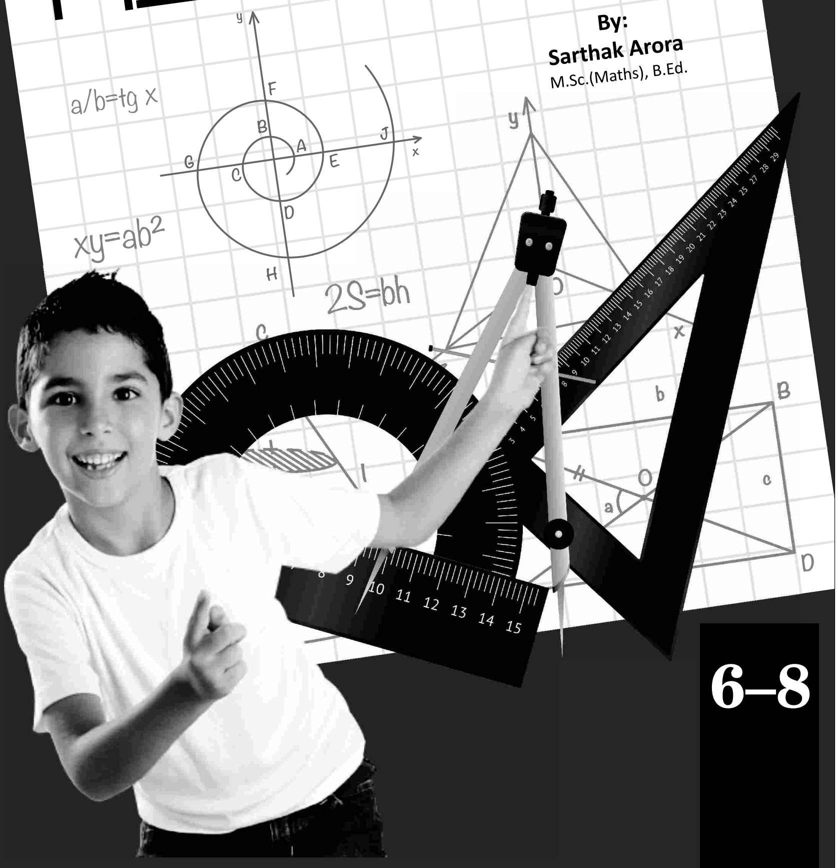
SHARVIL BOOKS

N.E.P. 2020

Essential Aspects of MATHEMATICS

By:
Sarthak Arora
M.Sc.(Maths), B.Ed.



6–8

1 Knowing Our Numbers

Exercise 1.1

1. Write the following numbers in words, in the Indian system of numeration :
   (a) 19,40,308 - Nineteen lakh forty thousand three hundred eight.
   (b) 3,35,007 - Three lakh thirty-five thousand seven.
   (c) 1,70,01,003 - One crore seventy lakh one thousand three.
   (d) 5,00,73,45,012 - Five arab seventy-three lakh forty-five thousand twelve.

2. Write the following numbers in words, in the International system of numeration :
   (a) 7,405, 316 - Seven million four hundred five thousand three hundred sixteen
   (b) 435,002 - Four hundred thirty-five thousand two
   (c) 1,509,463,112 - One billion five hundred nine million four hundred sixty-three thousand one hundred twelve
   (d) 397,051,008 - Three hundred ninety-seven million fifty-one thousand eight

3. 84235
Place value of 2 in 84235 = 200
Face value of 2 in 84235 = 2
difference = 198

4. 98378234
Place value of first '8' = 8000000
Place value of second '8' = 8000
Difference = 7992000

5. 16234507
Place value of 3 = 30000
Place value of 5 = × 500
their Product = 15000000

6. Digits - 5, 4, 0
Posible no are 540, 504, 405 and 450

7. 10 millions make 1 crore.

8. Required no. will be = 7805

9. No. = 543
No. made by reversing the digits = − 345
So, Difference = 198

10. No. = 4485
According to questions the no will be = 4845

$$\begin{array}{r} 4845 \\ -\,4485 \\ \hline 360 \end{array}$$

Yes, No will be increased by 360.

11. Consider the number 78654325. Name the values of the digits at :
- (a) digit at hundred's place = 3
- (b) digits at ten thousand's place = 5
- (c) digits at hundred thousand's place = 6
- (d) digit at crore's place = 7
- (e) digit at million's place = 8
- (f) digit at ten million's place = 7

12. Write the following numbers in expanded form :
- (a) 540803015 = 500000000 + 40000000 + 800000 + 3000 + 10 + 5
- (b) 31234560 = 30000000 + 1000000 + 200000 + 30000 + 4000 + 500 + 60
- (c) 789507 = 700000 + 80000 + 9000 + 500 + 7
- (d) 5700005 = 5000000 + 700000 + 5

13. Write in the short form :
- (a) $3 \times 1000 + 7 \times 100 + 2 \times 10 = 3720$
- (b) $9 \times 10000000 + 6 \times 100000 + 3 \times 1000 + 5 \times 10 + 5 = 90603055$
- (c) $11 \times 100000 + 7 \times 100 + 5 \times 10 + 9 = 1100759$

14. Fill in the blanks :
- (a) Thirty six, forty four, six
- (b) 200110005
- (c) Two hundred seventy eight

15. Find the greatest and the smallest numbers in each of the following cases :
- (a) greatest no. = 27,09,835
  smallest no. = 7,63,048
- (b) greatest no. = 3,68,92,173
  smallest no. = 12,37,689

Exercise 1.2

1. Round off each of the following numbers to nearest ten :
- (a) 3425
  In 3425, digit at ones place is 5, so estimated to nearest tens will give 3430.
- (b) 353
  In 353, digit at ones place is 3, so estimated to nearest tens will give 350.
- (c) 157
  In 157, digit at ones place is 7, so estimated to nearest tens will give 160.
- (d) 6428
  In 6428, digit at ones place is 8, so estimated to nearest tens will give 6430.
- (e) 7439
  In 7439, digit at ones place is 9, so estimated to nearest tens will give 7440.

2. Round off each of the following numbers to nearest hundreds :
- (a) 24693

In 24693, digit at tens palce is 9, so estimated to nearest hundreds will give 24700.

(b) 30925

In 30925, digit at tens palce is 2, so estimated to nearest hundreds will give 30900.

(c) 27563

In 27563, digit at tens palce is 6, so estimated to nearest hundreds will give 27600.

(d) 14675

In 14675, digit at tens palce is 7, so estimated to nearest hundreds will give 14700.

(e) 10392

In 10392, digit at tens palce is 9, so estimated to nearest hundreds will give 10400.

3. Round off each of the following numbers to nearest thousands :

(a) 4452

In 4452, digit at hundreds place is 4, so estimated to nearest thousands will give 4000.

(b) 2656

In 2656, digit at hundreds place is 6, so estimated to nearest thousands will give 3000.

(c) 26575

In 26575, digit at hundreds place is 5, so estimated to nearest thousands will give 27000.

(d) 14567

In 14567, digit at hundreds place is 5, so estimated to nearest thousands will give 15000.

(e) 32222

In 32222, digit at hundreds place is 2, so estimated to nearest thousands will give 32000.

4. Round off each of the following numbers to nearest ten thousands :

(a) 845625

In 845625, digit at thousands place is 5, so estimated to nearest ten thousands will give 850000.

(b) 243925

In 243925, digit at thousands place is 3, so estimated to nearest ten thousands will give 240000.

(c) 129875

In 129875, digit at thousands place is 9, so estimated to nearest ten thousands will give 130000.

(d) 124356

In 124356, digit at thousands place is 4, so estimated to nearest ten thousands will give 120000.

(e) 10952

In 10952, digit at thousands place is 0, so estimated to nearest ten thousands will give 10000.

5. Estimate the sum by rounding off to nearest ten :

(a) 16472 + 21434 + 65556

Estimating all numbers to the nearest tens. We have,

$$16470 + 21430 + 65560$$

So, estimated sum = 103460

(b) 21470 + 12437 + 230

Estimating all numbers to the nearest tens. We have,

$$21470 + 12440 + 230$$

So, estimated sum = 34140

(c) 74635 + 82960 + 1245

Estimating all numbers to the nearest tens. We have,

$$74640 + 82960 + 1250$$

So, estimated sum = 158850

6. Estimate the difference by rounding off to nearest hundreds :

(a) 7531 − 1916

Estimating these numbers to nearest hundreds

$$7500 - 1900$$

So, estimated difference = 5600

(b) 53045 − 1456

Estimating these numbers to nearest hundreds

$$53000 - 1500$$

So, estimated difference = 51500

(c) 9525 − 3542

Estimating these numbers to nearest hundreds

$$9500 - 3500$$

So, estimated difference = 6000

(d) 8260 − 4919

Estimating these numbers to nearest hundreds

$$8300 - 4900$$

So, estimated difference = 3400

7.

		Nearest 10
Mathematics book has page	= 492	490
Science book has page	= 368	− 370
So, estimated difference =		120

8. Estimate the product to nearest tens.

(a)	39	$\xrightarrow{\text{estimating nearest 10}}$	40
	× 42	$\xrightarrow{\text{estimating nearest 10}}$	× 40
Actual product	1638	So, estimated product	1600

(b) 86 $\xrightarrow{\text{estimating nearest 10}}$ 90

$\times$ 21 $\xrightarrow{\text{estimating nearest 10}}$ $\times$ 20

Actual product 1806 So, estimated product 1800

(c) 115 $\xrightarrow{\text{estimating nearest 10}}$ 120

$\times$ 232 $\xrightarrow{\text{estimating nearest 10}}$ $\times$ 230

Actual product 26680 So, estimated product 27600

(d) 1456 $\xrightarrow{\text{estimating nearest 10}}$ 1460

$\times$ 230 $\xrightarrow{\text{estimating nearest 10}}$ $\times$ 230

Actual product 334880 So, estimated product 335800

9. Tony walks everyday = 365 m

Distance covered in 130 days = 365

$\times$ 130

47450

In 47450, digit at hundreds place is 4, so estimated to nearest thousands will give 47000.

10. Find the estimated quotient of the following :

(a) 638 ÷ 23

638 $\xrightarrow{\text{estimating nearest 10}}$ 640

23 $\xrightarrow{\text{estimating nearest 10}}$ 20

So, 640 ÷ 20

= 32

```
20 ) 640 ( 32
     60
     --
      40
      40
      --
       ×
```

(b) 751 ÷ 32

751 $\xrightarrow{\text{estimating nearest 10}}$ 750

32 $\xrightarrow{\text{estimating nearest 10}}$ 30

So, 750 ÷ 30

= 25

```
30 ) 750 ( 25
     60
     ---
     150
     150
     ---
      ×
```

(c) 7098 ÷ 52

7098 $\xrightarrow{\text{estimating nearest 10}}$ 7100

52 $\xrightarrow{\text{estimating nearest 10}}$ 50

So, 7100 ÷ 50

= 142

```
50 ) 7100 ( 142
     50
     ---
     210
     200
     ---
      100
      100
      ---
       ×
```

(d) 2432 ÷ 55

2432 $\xrightarrow{\text{estimating nearest 10}}$ 2400

55 $\xrightarrow{\text{estimating nearest 10}}$ 60

So, 2400 ÷ 60

= 40

```
60 ) 2400 ( 40
     240
     ---
       0
       0
      --
       ×
```

(e) $2660 \div 19$

$2660 \xrightarrow{\text{estimating nearest 10}} 2660$

$19 \xrightarrow{\text{estimating nearest 10}} 20$

So, $2660 \div 20$

$= 133$

$$\begin{array}{l} 20\,)\,2660\,(\,133 \\ \quad\;\; 20 \\ \quad\;\; \overline{\;\;66} \\ \quad\;\;\;\; 60 \\ \quad\;\; \overline{\;\;\;\;60} \\ \quad\;\;\;\;\; 60 \\ \quad\;\; \overline{\;\;\;\;\;\times} \end{array}$$

Exercise 1.3

1. Express each of the following as a Roman numeral :

(a) 9 = 10 − 1 = IX
(b) 19 = 10 + 9 = XIX
(c) 35 = 10 + 10 + 10 + 5 = XXXV
(d) 39 = 10 + 10 + 10 + 9 = XXXIX
(e) 40 = 50 − 10 = XL
(f) 59 = 50 + 9 = LIX
(g) 84 = 50 + 10 + 10 + 10 + 4 = LXXXIV
(h) 79 = 50 + 10 + 10 + 9 = LXXIX
(i) 66 = 50 + 10 + 6 = LXVI
(j) 69 = 50 + 10 + 9 = LXIX
(k) 75 = 50 + 10 + 10 + 5 = LXXV
(l) 85 = 50 + 10 + 10 + 10 + 5 = LXXXV
(m) 44 = 40 + 4 = XLIV
(n) 23 = 10 + 10 + 3 = XXIII
(o) 62 = 50 + 10 + 2 = LXII

2. Express each of the following as a Roman numeral :

(a) 341 = 100 + 100 + 100 + 40 + 1 = CCCXLI
(b) 226 = 100 + 100 + 20 + 6 = CCXXVI
(c) 195 = 100 + 90 + 5 = CXCV
(d) 164 = 100 + 50 + 10 + 4 = CLXIV
(e) 759 = 500 + 100 + 100 + 50 + 9 = DCCLIX
(f) 611 = 500 + 100 + 10 + 1 = DCXI
(g) 596 = 500 + 90 + 6 = DXCVI
(h) 475 = 500 − 100 + 70 + 5 = CDLXXV

3. Write each of the following as a Hindu-Arabic numeral :

(a) V = 5
(b) X = 10
(c) XV = 10 + 5 = 15
(d) XX = 10 + 10 = 20
(e) XXV = 10 + 10 + 5 = 25
(f) XXIX = 10 + 10 + 10 − 1 = 29
(g) XXX = 10 + 10 + 10 = 30
(h) XXXV = 10 + 10 + 10 + 5 = 35
(i) XL = 50 − 10 = 40
(j) L = 50
(k) LX = 50 + 10 = 60
(l) XC = 100 − 10 = 90
(m) C = 100
(n) CI = 100 + 1 = 101
(o) CIX = 100 + 10 − 1 = 109
(p) CL = 100 + 50 = 150
(q) CC = 100 + 100 = 200
(r) CCXLIX = 100 + 100 + 40 + 9 = 249

(s) CCCL $=100+100+100+50=350$

(t) CD $=500-100=400$ (u) DCL $=500+100+50=650$

(v) DCCLXVIII $=500+100+100+50+10+8=768$

(w) CM $=1000-100=900$ (x) M $=1000$

(y) MCCL $=1000+100+100+50=1250$

Multiple Choice Questions

Tick (3) the correct option :

1. (b) **2.** (b) **3.** (a) **4.** (c) **5.** (c) **6.** (a) **7.** (c) **8.** (d)

Higher Order Thinking Skills (HOTS)

1. Greatest four digit no. using 2 different digits $=9998$

2. Zero (o) :

3. Greatest no. which on rounding off gives 5400 $=5449$

smallest no which no rounding off gives 5400 $=5350$

So difference $=5449-5350=99$

1,329,854,134

4. (a) one billion three hundred twenty-nine million eight hundred fifty-four thousand one hundred thirty-four.

(b) One arab thirty-two crore ninety-eight lakh fifty-four thousand one hundred thirty-four.

5. Largest no formed by digits 0, 2, 5 and 7 = 7520

smallest no. formed by digits 0, 2, 5 and 7 = -2057

Difference = 5463

2 Playing With Numbers

Exercise 2.1

1. Fill in the blanks :

(a) **2** is the smallest even number.

(b) **4** is the smallest composite number.

(c) **2** is the smallest prime number.

(d) A number which having more than two factors is called **composite** number.

(e) Every number is a **factor** and **multiples** of itself.

(f) 1 is neither a **prime** nor a **composite** number.

(g) A number which has only two factors is called a **prime number.**

2. Write all factors of the following numbers :

(a) $120 = (1\times 120); (2\times 60); (3\times 40); (40\times 30);$
$(5\times 24); (6\times 20); (8\times 15); (10\times 12)$

Factors of 120 is 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60 and 120.

(b) $76 = (1 \times 76); (2 \times 38); (4 \times 19)$
Factors of 76 is 76 is 1, 2, 4, 19, 38 and 76

(c) $27 = (3 \times 9); (9 \times 3); (27 \times 1)$
Factors of 27 is 1, 3, 9 and 27.

3. Give the first four multiples of each :

(a) First multiples of 5 are :
$5 \times 1 = 5; 5 \times 2 = 10; 5 \times 3 = 15.$; and $5 \times 4 = 20$
Thus, 5, 10, 15 and 20 are firs four multiples of 5.

(b) First four multiples of 13 are :
$13 \times 1 = 13; 13 \times 2 \times 2 = 26; 13 \times 3 = 39$ and $13 \times 4 = 52$
Thus, 13, 26, 39 and 52 are first four multiples of 13.

(c) First four multiples of 17 are :
$17 \times 1 = 17; 17 \times 2 = 34; 17 \times 3 = 51$ and
Thus, 17, 34, 51 and 68 are first four multiples of 17.

4. Find the common factors of :

(a) Factors of 45 = 1, 3, 5, 9, 15, 45
Factors of 60 = 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30
Factors of 105 = 1, 3, 5, 7, 15, 21, 105
Common factors = 1, 3, 5, 15

(b) Factors of 21 = 1, 3, 7, 21 Factors of 35 = 1, 5, 7, 35
Common factors = 1, 7

(c) Factors of 16 = 1, 2, 4, 8, 16 Factors of 20 = 1, 2, 4, 5, 10, 20
Common factors = 1, 2, 4

(d) Factors of 8 = 1, 2, 4, 8
Factors of 12 = 1, 2, 3, 4, 6, 12
Factors of 20 = 1, 2, 4, 5, 10, 20
Common factors = 1, 2, 4

(e) Factors of 3 = 1, 3 Factors of 6 = 1, 2, 3, 6
Factors of 9 = 1, 3, 9 Common factors = 1, 3

(f) Factors of 10 = 1, 2, 5, 10 Factors of 15 = 1, 3, 5, 15
Common factors = 1, 5

5. Find the first three common multiples of :

(a) Multiples of 8 = 8, 16, 24, 32, 40, 48, 56, 64, 72, 80
Multiples of 12 = 12, 24, 36, 48, 60, 72, 84
common multiples of 8 and 12 = 24, 48, 72

(b) Multiples of 6 = 6, 12, 18, 24, 30, 36, 42, 48,
Multiples of 9 = 9, 18, 27, 36, 45, 54, 63
common multiples of 6 and 9 = 18, 36, 54

(c) Multiples of 10 = 10, 20, 30, 40, 50 , 60, 70, 80, 90, 100 , 110, 120, 130, 140, 150

Multiples of 25 = 25, 50 , 75, 100 , 125, 150, 175

common multiples of 10 and 25 = 50, 100

6. Write down the prime numbers between :

(a) Prime number between 1 and 20 = 2, 3, 5, 7, 11, 13, 17, 19

(b) Prime number between 28 and 44 = 29, 31, 37, 41, 43

(c) Prime number between 90 and 120 = 97, 101, 103, 107, 109, 113

7. Write all the numbers less than 90 which are common multiples of 5 and 6.

Multiples of 5 = 5, 10, 15, 20, 25, 30 , 35, 40, 45, 50, 55, 60 , 65, 70, 75, 80, 85, 90 , 95

Multiples of 6 = 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90

Common multiples of 5 and 6 is 30, 60 and 90.

8. Express each of the following as a sum of two odd primes :

(a) Sum of 13 and 17 prime number, we get 30.

$$13 + 17 = 30$$

(b) Sum of 23 and 41 prime number, we get 64.

$$23 + 41 = 64$$

(c) Sum of 31 and 67 prime number, we get 98.

$$31 + 67 = 98$$

9. A number is divisible by 15. By what other numbers will that number be divisible?

A number is divisible by 15.

Factors of 15 = 1, 3, 5, 15

So, we say that is number is divisible by 15, then it will be divisible by 1, 3 and 5 too.

10. A number is divisible by 5 and 8 both. By which other number will that number be always divisible?

Multiplying 5 by 8 = $8 \times 5 = 40$

We can say that a number is divisible by 5 and 8 both, it must always be divisible by 40.

11. Write all the even numbers between 40 and 60.

(**Note :** which number is divisible by 2 is called an even number).

Then, the even number between 40 and 60 = 42, 44, 46, 48, 50, 52, 54, 56 and 58

12. Write all the odd numbers less than 20.

(**Note :** Which number is not divisible by 2 is called an odd number)

Then, the odd numbers less than 20 :

1, 3, 5, 7, 9, 11, 13, 15, 17, 19

Exercise 2.2

1. Check divisibility of the following numbers by 2, 4, 8, 5 and 10. Put a tick (3) for divisible and cross (7) for not divisible :

Number	2	4	8	5	10
(a) 990	3	7	7	3	3
(b) 464	3	3	3	7	7
(c) 572	3	3	7	7	7
(d) 4995	7	7	7	3	7
(e) 1586	3	7	7	7	7

2. Check divisibility of the following numbers by 3, 6, 9 and 11. Put a (3) for divisible and a (7) for not divisible.

Number	3	6	9	11
(a) 1258	7	7	7	7
(b) 5335	7	7	7	3
(c) 21084	3	3	7	7
(d) 71232	3	3	7	7

3. If a number is divisible by 2 and 7, will it be divisible by 14 ?
Give an example.
Yes, If number is divisible by 2 and 7, it will be divisible by 14.
Because 2 and 7 are factors of 14.
For example :
938 = As units place is even digit so, 938 is divisible by 2.
$[938 - (8 \times 2)] = 93 - 16 = 77$
77 is divisible 7.
Thus, 938 is also divisible by 14.

4. If a number is divisible by 4 and 6, is it necessary that it will be divisible by 24? If not, write one such number.
No, it is not necessary that a number divisible by 4 and 6, will be divisible by 24 also. For example, 12 is divisible by both 4 and 6 but it cannot be divided by 24 as it is smaller than it.

5. Is 2430780 divisible by 7?
Number $= 2430780$
Rule of divisible by 7 = A number is divisible by 7 if the difference of twice the digit at ones place and the number is formed by. The digits at remaining places is divisible by 7.
Digit at ones place $= 0$
Twice the one place $= 0 \times 2 = 0$

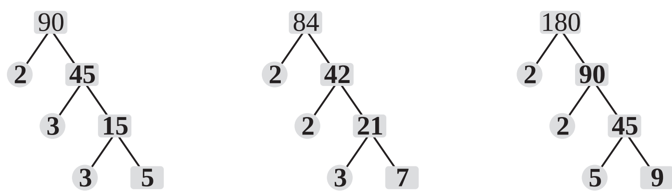
Remaining places $= 243078 - 0 = 243078$
243078 is not divisible by 7.
So, we say that 2430780 is not divisible by 7 too.

6. A number is divisible by 12. By what other numbers will that number be divisible?
Factor of 12 = 1, 2, 3, 4, 6, 12
A number is divisible by 12. It is also divisible by 1, 2, 3, 4, 6 and 12.

7. A number is divisible by both 5 and 12. By which other number will that number be always divisible?
Multiplying 5 by 12 $= 5 \times 12 = 60$
Factors of 60 = 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
A number is divisible by both 5 and 12. It is also divisible by 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

Exercise 2.3

1. Complete the following factor trees and write down the prime factors of each number :



2. Write the prime factorization of each of the following number :

(a) 36

2	36
2	18
3	9
3	3
	1

$36 = 2 \times 2 \times 3 \times 3$

(b) 24

2	24
2	12
2	6
3	3
	1

$24 = 2 \times 2 \times 2 \times 3$

(c) 28

2	28
2	14
7	7
	1

$28 = 2 \times 2 \times 7$

(d) 54

2	54
3	27
3	9
3	3
	1

$54 = 2 \times 3 \times 3 \times 3$

(e) 96

2	96
2	48
2	24
2	12
2	6
3	3
	1

$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$

(f) 180

2	180
2	90
3	45
3	15
5	5
	1

$180 = 2 \times 2 \times 3 \times 3 \times 5$

(g) 120

2	120
2	60
2	30
3	15
5	5
	1

$120 = 2 \times 2 \times 2 \times 3 \times 5$

(h) 256

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

3. Find the HCF of :

(a) 18 and 48

The prime factorization of 18 and 48 are :

$$18 = 2 \times 3 \times 3$$
$$48 = 2 \times 2 \times 2 \times 2 \times 3$$

2	18
3	9
3	3
	1

2	48
2	24
2	12
2	6
3	3
	1

Common factors are 2 and 3.

The product of these factors $= 2 \times 3 = 6$

Thus, 6 is HCF of 18 and 48.

(b) 35 and 45

The prime factorization 35 and 45 are :

$$35 = 5 \times 7$$
$$45 = 5 \times 3 \times 9$$

5	35
7	7
	1

3	45
3	15
5	5
	1

Common factors are 5.

Thus, 5 is HCF of 35 and 45.

(c) 30 and 42

The prime factorization 30 and 42 are :

$$30 = 2 \times 3 \times 5$$
$$42 = 2 \times 3 \times 7$$

2	30
3	15
5	5
	1

2	42
3	21
7	7
	1

Common factors are 2 and 3.

The product of these factors = 2 × 3 = 6

Thus, 6 is HCF of 30 and 42.

(d) 60 and 72

The prime factorization of 60 and 72 are :

$60 = 2 \times 2 \times 3 \times 5$

$72 = 2 \times 2 \times 2 \times 3 \times 3$

2	60
2	30
3	15
5	5
	1

2	72
2	36
2	18
3	9
3	3
	1

Common factors of 60 and 72 = 2 × 2 × 3

The product of these factors = 2 × 2 × 3 = 12

Thus, 12 is HCF of 60 and 72.

(e) 18 and 60

Prime factorization of 18 and 60 are :

$18 = 2 \times 3 \times 3$

$60 = 2 \times 3 \times 3 \times 5$

2	18
3	9
3	3
	1

2	60
2	30
3	15
5	5
	1

Common factors of 18 and 60 = 23

Product of these factors = 2 × 3 = 6

HCF of 18 and 60 = 6

(f) 38 and 25

Prime factorization of 38 and 25.

$38 = 2 \times 19 \times 1$

$25 = 5 \times 5 \times 1$

2	38
19	19
	1

5	25
5	5
	1

Common factors of 38 and 25 = 1

HCF of 38 and 25 = 1

4. Write the smallest and the largest 4-digit numbers and determine the prime factorization of each.

The smallest 4-digit number = 1000

2	1000
2	500
2	250
5	125
5	25
5	5
	1

3	9999
3	3333
11	1111
101	101
	1

Prime factors of 1000 = 2 × 2 × 2 × 5 × 5 × 5

The largest 4-digit number = 9999

Prime factors of 9999 = 3 × 3 × 11 × 101

5. Find the HCF of :

(a) 15, 30 and 75

The prime factorization of 15, 30 and 75 are :

3	15
5	5
	1

2	30
3	15
5	5
	1

3	75
5	25
5	5
	1

$15 = 3 \times 5$

$30 = 2 \times 3 \times 5$
$75 = 3 \times 5 \times 5$

Common factors are 3,5

The product of these factor is $= 3 \times 5 = 15$

(b) 12, 45 and 75

The prime factorization of 12, 45 and 75 are :

3	12
4	4
	1

3	45
3	15
5	5
	1

3	75
5	25
5	5
	1

$12 = 3 \times 4$
$45 = 3 \times 3 \times 5$
$75 = 3 \times 5 \times 5$

Common factors is 3.

Thus 3 is the HCF of 12, 45 and 75.

(c) 16 48 and 60

The prime factorization of 16, 48 and 60 are :

2	16
2	8
2	4
2	2
	1

2	48
2	24
2	12
2	6
3	3
	1

2	60
2	30
3	15
5	5
	1

$16 = 2 \times 2 \times 2 \times 2$
$48 = 2 \times 2 \times 2 \times 2 \times 3$
$60 = 2 \times 2 \times 3 \times 5$

Common factors of 16, 48 and 60 = 2 × 2 = 4.

Thus 4 is the HCF of 16, 48 and 60.

(d) 18, 54 and 81

Prime factorization of 18, 54 and 81

2	18
3	9
3	3
	1

2	54
3	27
3	9
3	3
	1

3	81
3	27
3	9
3	3
	1

$18 = 2 \times 3 \times 3$
$54 = 2 \times 3 \times 3 \times 3$
$81 = 3 \times 3 \times 3 \times 3$

Common factors of 18, 54 and $81 = 3 \times 3 = 9$

Thus, 9 is HCF of 18, 54 and 81.

(e) 49, 91 and 112

Prime factorization of 49, 91 and 112

7	49
7	7
	1

7	91
13	13
	1

2	112
2	56
2	28
2	14
7	7
	1

$49 = 7 \times 7$
$91 = 7 \times 13$
$112 = 2 \times 2 \times 2 \times 2 \times 7$

Common factors of 49, 91 and $112 = 7$

Thus, 7 is HCF of 49, 91, 112.

(f) 36, 126 and 180

Prime factorization of 36, 126 and 180

$36 = 2 \times 2 \times 3 \times 3$

$126 = 2 \times 3 \times 3 \times 7$

$180 = 2 \times 2 \times 3 \times 3 \times 5$

2	36
2	18
3	9
3	3
	1

2	126
3	63
3	21
7	7
	1

2	180
2	90
3	45
3	15
5	5
	1

Common factors of 36, 126 and 180 $= 2, 3, 3$

Product of common factors $= 2 \times 3 \times 3$

Thus, HCF of 36, 126 and $180 = 18$

6. Find the prime factors of 1729.

The prime factors of 1729

7	1729
13	247
19	19
	1

Prime factors of $1729 = 7 \times 13 \times 19$

Exercise 2.4

1. Find the LCM of :

(a) 12 and 18

The prime factorizations of 12 and 18 are :

$12 = 2 \times 3 \times 2$

$98 = 2 \times 3 \times 3$

LCM of 12 and 18

$= 2 \times 2 \times 3 \times 3 = 36$

(b) 24 and 80

The prime factorization of 24 and 80 are :

$24 = 2 \times 2 \times 2 \times 3$

$80 = 2 \times 2 \times 2 \times 2 \times 5$

LCM of 24 and 80

$= 2 \times 2 \times 2 \times 2 \times 5 \times 3 = 240$

(c) 45 and 75

The prime factorization of 45 and 75 are :

$45 = 3 \times 3 \times 5$

$75 = 3 \times 5 \times 5$

LCM of 45 and 75

$= 3 \times 3 \times 5 \times 5 = 225$

(d) 24 and 100

The prime factorization of 24 and 100 are :

$24 = 2 \times 2 \times 3 \times 3$

$100 = 2 \times 2 \times 5 \times 5$

LCM of 24 and 100

$= 2 \times 2 \times 2 \times 3 \times 5 \times 5 = 600$

(e) 40, 48 and 45

The prime factorization of 48 and 45

$48 = 2 \times 2 \times 2 \times 2 \times 3$

$45 = 3 \times 3 \times 5$

LCM of 40, 48 and 45

$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5$

$= 720$

(f) 20, 25 and 30

The prime factorization of 20, 25 and 30

$20 = 2 \times 2 \times 5$

$25 = 5 \times 5$

$30 = 2 \times 3 \times 5$

LCM of 20, 25 and 30

$= 2 \times 2 \times 3 \times 5 \times 5 = 300$

2. Find the LCM of :

(a) 28, 36, 45, 60

2	28
2	14
7	7
	1

2	36
2	18
3	9
3	3
	1

3	45
3	15
5	5
	1

2	60
2	30
3	15
5	5
	1

Prime factorization of 28, 36, 45 and 60

$28 = 2 \times 2 \times 7$ $\qquad 36 = 2 \times 2 \times 3 \times 3$

$45 = 3 \times 3 \times 5$ $\qquad 60 = 2 \times 2 \times 3 \times 5$

LCM of 38, 36, 45 and $60 = 2 \times 2 \times 3 \times 3 \times 7 \times 5 = 1260$

(b) 144, 180, 384

2	144
2	72
2	36
2	18
3	9
3	3
	1

2	180
2	90
3	45
3	15
5	5
	1

2	384
2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

Prime factorizations of 144, 180 and 384

$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$180 = 2 \times 2 \times 3 \times 3 \times 5$

$384 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$

LCM of 144, 180 and $384 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 = 5760$

3. Find the HCF and LCM of :

(a) 186, 403

2	186
3	93
31	31
	1

13	403
31	31
	1

Prime factorization of 186 and 403

$186 = 2 \times 3 \times 31$

$403 = 13 \times 31$

HCF of 186 and $403 = 31$

One number $= 186$, other number $= 403$

Product of two number $=$ Product of HCF and LCM

$186 \times 403 = 31 \times \text{LCM}$ $\qquad$ $\text{LCM} = \dfrac{186 \times 403}{31} = 2418$

(b) 490, 1155

$$\begin{array}{r|l} 2 & 490 \\ \hline 5 & 245 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array} \qquad \begin{array}{r|l} 3 & 1155 \\ \hline 5 & 385 \\ \hline 7 & 77 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

Prime factorization of 490 and 1155.

$490 = 2 \times 5 \times 7 \times 7$ $\qquad$ $1155 = 3 \times 5 \times 7 \times 11$

HCF of 490 and 1155 $= 5 \times 7 = 35$

HCF of 490 and 1155 $= 35$

one number $= 490$, other number $= 1155$

Prodcut of two numbers $=$ Product of HCF and LCM

$$490 \times 1155 = 35 \times \text{LCM}$$

$$\text{LCM} = \frac{490 \times 1155}{35} = 16170$$

4. The HCF of two numbers is 145 and their LCM is 2175. If one of the numbers is 725, find the other.

HCF of two numbers $= 145$ $\qquad$ LCM of two numbers $= 2175$

One number $= 725$

One number × the other number = HCF × LCM

Required other number $= \dfrac{145 \times 2175}{725} = 435$

5. Can two numbers have 16 as their HCF and 204 as their LCM? Give reasons in support of your answer.

No, two numbers cannot have 16 as their HCF and 204 as their LCM this is so, because 16 is not a factor of 204 and in such a case HCF should be a factor of LCM.

6. Is the product of three numbers always equal to the product of their HCF and LCM? Give reasons in support of your answer.

No; for the three numbers 5, 10 and 15, the HCF is 5 and LCM is 30.

Here, $\qquad$ HCF × LCM $= 5 \times 30 = 150$

Product of numbers $= 5 \times 10 \times 15 = 750$

Exercise 2.5

1. Three boxes of books contain 24, 40 and 56 books. These books are to be packed in small packets which will contain equal number of books. What is the largest number of books that can be packed in each of the small packets?

Number of books in first box $= 24$

Number of books in second box $= 40$

Number of books in third box $= 56$

Number of books pack in small packet $=$ HCF of 24, 40 and 50

$$24 = 2 \times 2 \times 2 \times 3$$
$$40 = 2 \times 2 \times 2 \times 5$$
$$56 = 2 \times 2 \times 2 \times 7$$

Common factors of 24, 40 and 56 $= 2 \times 2 \times 2 = 8$

8 books that can be packed in each of the small packets.

2. In a morning walk, three boys step off together from the same spot. Their steps measure 63 cm, 70 cm and 77 cm respectively. What is the minimum distance each should cover so that all can cover the distance in complete steps?

Distance covered by first boy $= 630$ cm

Distance covered by second boy $= 70$ cm

Distance covered by third boy $= 77$ cm

LCM of 63, 70, 77

Prime factors of 63, 70, 77 :

$$63 = 7 \times 9$$
$$70 = 7 \times 10$$
$$77 = 7 \times 11$$

LCM of 63, 70, 77 $= 7 \times 9 \times 10 \times 11$

$= 6930$ cm or 69.30 m

$= 69$ m 30 cm

3. The circumference of the wheels of a carrier are 3 m 25 cm and 5 m. What is the least distance in which both wheels make an exact number of revolutions?

Circumference of wheel $= 3$ m 25 cm $= 325$ cm and 500 cm

Prime factorization of 325 and 500 :

$$325 = 5 \times 5 \times 13$$
$$500 = 2 \times 2 \times 5 \times 5 \times 5$$

LCM of 325 and 500 $= 5 \times 5 \times 5 \times 2 \times 2 \times 13 = 6500$ cm

The least distance revolutions of wheels is 6500 cm.

Or $(6500 \div 1000)$ km $= 6.5$ km.

4. A rectangular court yard is 20 m 16 cm long and 15 m 60 cm broad. It is to be paved with square-shaped tiles of the same size. Find the number of tiles required to pave the court yard.

Length of a rectangular court yard $= 20$ m 16 cm $= 2016$ cm

Breadth of a rectangular court yard $= 15$ m 60 cm $= 1560$ cm

HCF of 2016 and 1560

2	2016
2	1008
2	504
2	252
2	126
3	63

2	1560
2	780
2	390
3	195
5	65
13	13

3	21
7	7
	1

	1

Prime factors of 2016 and 1560 :

$$2016 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 7$$
$$1560 = 2 \times 2 \times 2 \times 3 \times 5 \times 13$$

Common factors of 2016 and $1560 = 2, 2, 2, 3$

HCF of 2016 and $1560 = 8 \times 3 = 24$

$$\text{Required tiles} = \frac{\text{Area of flour}}{\text{Area of tile}} = \frac{2016 \times 1560}{24 \times 24} = \frac{3144960}{576} = 5460$$

Required tiles 5460 to covered the flour.

5. Find the greatest number which exactly divides 40 and 87 leaving remainders 4 and 3 respectively.

When 40 is divided by the required number a remainder is left $= 40 - 4 = 36$

Similarly $87 - 3 = 84$ must be completely divisible by the required number

HCF of 36 and 84

2	36
2	18
3	9
3	3
	1

2	84
2	42
3	21
7	7
	1

$$36 = 2 \times 2 \times 3 \times 3$$
$$84 = 2 \times 2 \times 3 \times 7$$

HCF of 36 and $84 = 2 \times 2 \times 3 = 12$

Hence, the required number $= 12$.

6. There are 312, 260 and 156 students in class VI, VII and VIII respectively. Buses are to be hired to take the students to a picnic. Find the maximum number of students who can sit in a bus if each bus takes equal number of students. Also, find the number of buses required.

Number of students in each class VII $= 312$

Number of students in class VII $= 260$

Number of students in class VIII $= 156$

Number of students sit in each bus $=$ HCF of 312, 260 and 156

2	312
2	156
2	78
3	39
13	13
	1

2	260
2	130
5	65
13	13
	1

2	156
2	78
3	39
13	13
	1

Prime factorization of 312, 260 and 156 are :

$312 = 2 \times 2 \times 2 \times 3 \times 13$ $\qquad$ $260 = 2 \times 2 \times 5 \times 13$

$156 = 2 \times 2 \times 3 \times 13$

Common factors of 312, 260 and 156 $= 2 \times 2 \times 13$

Product of common factor $= 2 \times 2 \times 13 = 52$

Number of students in each bus $= 52$

Total number of students $= 312 + 260 + 156 = 728$

Required buses $= 728 \div 52 = 14$

Thus, the number of buses required $= 14$.

7. Two tankers contain 700 and 750 litres of milk respectively. Find the maximum capacity of a container which can measure the milk of each tanker in exact number of times.

Quality of one tankers $= 700\,l$

Quantity of second tankers $= 750\,l$

HCF of 700 and 750

2	700
2	350
5	175
5	35
7	7
	1

2	750
3	375
5	125
5	25
5	5
	1

Prime factorization of 700 and 750

$700 = 2 \times 2 \times 5 \times 5 \times 7$

$750 = 2 \times 3 \times 5 \times 5 \times 5$

Common factors of 700 and 750 $= 2, 5, 5$

Product of common factors $= 2 \times 5 \times 5 = 50$

Thus, the maximum capacity of a container is 50 *l*.

8. The length, breadth and height of a room are 6 m 30 cm, 5 m 85 cm and 3 m 60 cm respectively. What will be the greatest length of a tape which can measure the dimensions of the room in exact number of times.

Length of a room $= 6$ m 30 cm $= 630$ cm

Breadth of a room $= 5$ m 85 cm $= 585$ cm

Height of a room $= 3$ m 60 cm $= 360$ cm

HCF of 630; 585 and 360 :

2	630
3	315
3	105
5	35
7	7

3	585
3	195
5	65
13	13
	1

2	360
2	180
2	90
3	45
3	15

	1

5	5
	1

$630 = 2 \times 3 \times 3 \times 5 \times 7$

$585 = 3 \times 3 \times 5 \times 13$

$360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$

Common factors of 630, 585 and 360 $= 3, 3, 5$

Product of common factors $= 3 \times 3 \times 5 = 45$

Thus the greatest length of a tape is 45 cm.

9. Find the smallest number which when divided by 25, 40, 60 leaves a remainder of 7 in each case.

The required number is 7 added to the LCM of 25, 40 and 60

Now, $25 = 5 \times 5$

$40 = 2 \times 2 \times 2 \times 5$

$60 = 2 \times 2 \times 3 \times 5$

LCM $= 2 \times 2 \times 2 \times 3 \times 5 \times 5 = 600$

Hence, the required number is $600 + 7 = 607$.

10. Determine the greatest 5-digit number which is exactly divisible by each of 8, 15 and 21.

By common diision method :

2	8, 15, 21
2	4, 15, 21
2	2, 15, 21
3	1, 15, 21
5	1, 5, 7
7	1, 1, 7
	1, 1, 1

LCM of 8, 15 and 21 $= 2 \times 2 \times 2 \times 3 \times 5 \times 7 = 840$

The greatest 5-digit number $= 99999$

We find that when 99999 is divided by 840 the remainder $= 39$.

$$\begin{array}{r} 119 \\ 840\overline{)99999} \\ -840 \\ \hline 1599 \\ -840 \\ \hline 7599 \\ -7560 \\ \hline 39 \\ \hline \end{array}$$

So, the number exactly divisible by 8, 15 and 21

$= 99999 - 39$

$= 99960$

11. Determine the two numbers nearest to 10000 which are exactly divisible by each of 2, 3, 4, 5, 6 and 7.

First we will find the LCM of 2, 3, 4, 5 and 7

2	2, 3, 4, 5, 6, 7
2	1, 3, 2, 5, 3, 7
3	1, 3, 1, 5, 3, 7
5	1, 1, 1, 5, 1, 7
7	1, 1, 1, 1, 1, 7
	1, 1, 1, 1, 1, 1

$$\begin{array}{r} 23 \\ 420\overline{)10000} \\ -840 \\ \hline 1600 \\ -1260 \\ \hline 340 \\ \hline \end{array}$$

$LCM = 2 \times 2 \times 3 \times 5 \times 7 = 420$

We find that when 10000 is divided by 420, the remainder is 340.

So, the number exactly divisible by 2, 3, 4, 5, 6 and 7

$= 10000 - 340 = 9660$

Next number which is divisible by 2, 3, 4, 5, and 7

$= 9660 \times 420 = 10080.$

12. A boy saves ` 4.65 daily. Find the least number of days in which he will be able to save an exact number of rupees.

(Saving in 1 day = ` 4.65)

Saving in 100 days = ` 4.65 × 100 = ` 465

Now, to find least number of days for exact rupees, we will find LCM of 465 and 100.

Prime factorization of 465 and 100

$465 = 3 \times 5 \times 31$ $\qquad$ $100 = 2 \times 2 \times 5 \times 5$

LCM of 465 and $100 = 2 \times 2 \times 3 \times 5 \times 5 \times 31 = 9300$

3	465
5	155
31	31
	1

2	100
2	50
25	25
5	5
	1

Exact number of days $= LCM \div 465$

$= 9300 \div 465 = 20$ days

Multiple Choice Questions

Tick (3) the correct options :

1. (b) **2.** (a) **3.** (d) **4.** (d) **5.** (c) **6.** (d) **7.** (b)

3 Whole Numbers

Exercise 3.1

1. In each of the following pairs of the numbers, state which whole number is on the left of the other number on the number line :

(a) Clearly, $2221 < 2251$ $\qquad$ 2221 lies to the left of 2251

(b) Clearly, $9521 > 5921$ $\qquad$ 5921 lies to the left of 9521

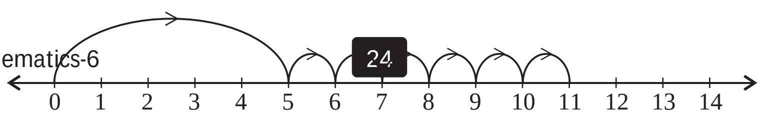
(c) The largest 2-digit number $= 99$

The smallest 3-digit number $= 100$

Clearly, $99 < 100$

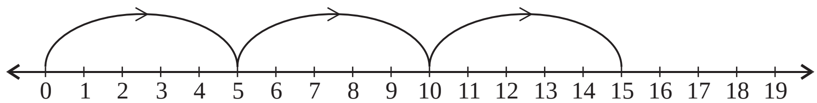
99 lies to the left of 100

2. Add 5 and 6 using the number line. $(5 + 6 = 11)$



5 + 6 = 11

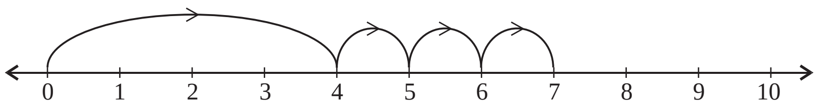
3. Multiply 5 by 3 using the number line.



$5 \times 3 = 15$

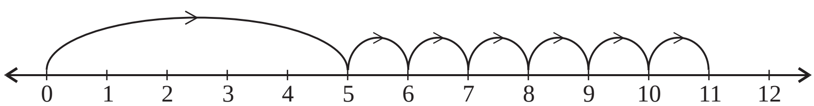
4. Using number line find the following :

(a) $4 + 3 = 7$



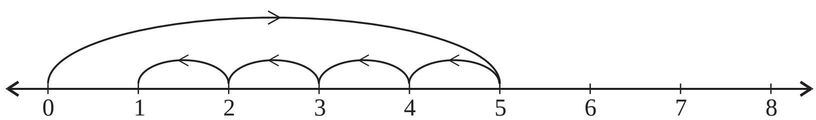
4+3=7

(b) $5 + 6$



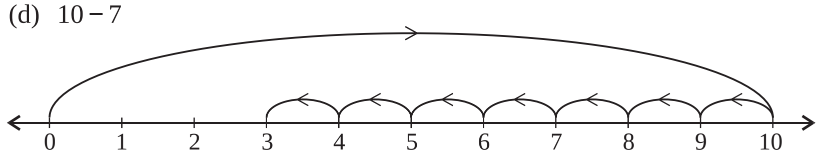
5+6=1 1

(c) $5 - 4 = 1$



5 – 4 = 1

(d) $10 - 7$



10–7=3

5. Say True (T) or False (F) :

(a) F (b) F (c) T (d) F (e) F

Exercise 3.2

1. Find the sum using suitable rearrangement of numbers :

(a) $266 + 508 + 234$
$= (266 + 234) + 508$
$= 500 + 508$
$= 1008$

(b) $521 + 378 + 79 + 122$
$= (521 + 79) + (378 + 122)$
$= 600 + 500$
$= 1100$

(c) $205 + 196 + 104 + 95$
$= (196 + 104) + (205 + 95)$
$= 300 + 300 = 600$

2. Verify the associative property of addition for the following numbers :

(a) 3, 5, 7 $(3 + 5) + 7 = 8 + 7 = 15$
$3 + (5 + 7) = 3 + 12 = 15$
$(3 + 5) + 7 = 3 + (5 + 7)$

(b) 2, 4, 6 $= (2 + 4) + 6 = 6 + 6 = 12$
$= 2 + (4 + 6) = 2 + 10 = 12$
$= (2 + 4) + 6 = 2 + (4 + 6)$

3. Find the product using associative property of numbers :

(a) $4 \times 572 \times 50 = (4 \times 50) \times 572 = 200 \times 572 = 11400$

(b) $625 \times 777 \times 16 = (625 \times 16) \times 777 = 10000 \times 777 = 7770000$

(c) $125 \times 799 \times 4 = (125 \times 4) \times 799 = 500 \times 799 = 399500$

(d) $50 \times 29 \times 80 = (50 \times 80) \times 29 = 4000 \times 29 = 116000$

4. If $a = 256$ and $b = 175$, show that $a - b \neq b - a$.

$a = 256, b = 175$
$(a - b) \neq (b - a)$
$(a - b) = 256 - 175 = 81$
$(b - a) = 175 - 256 = -81$
$\because$ $81 \neq -81$
$(a - b) \neq (b - a)$

5. Simplify the following :

(a) $1008 \times 8 + 1008 \times 92$
$= 1008 \times (8 + 92)$
$= 1008 \times 100$
$= 100800$

(b) $562 \times 4 \times 80 + 281 \times 20 \times 8 \times 4$
$= 2248 \times 80 + 2248 \times 80$
$= 2248 \times (80 + 80)$
$= 2248 \times 160 = 359680$

(c) $952 \times 15 - 5 \times 952$
$= 952 \times (15 - 5)$
$= 952 \times 10$
$= 9520$

(d) $697 \times 25 \times 282 + 3485 \times 5 \times 718$
$= 17425 \times 282 + 17425 \times 718$
$= 17425 \times (282 + 718)$
$= 17425 \times 1000 = 17425000$

6. If a = 12, b = 8 and c = 5, show that a – (b – c) ≠ (a – b) – c.

$a = 12, b = 8, c = 5$
$a - (b - c) \neq (a - b) - c$
$a - (b - c) = 12 - (8 - 5) = 12 - 3 = 9$
$(a - b) - c = (12 - 8) - 5 = 4 - 5 = -1$
$\because$ $9 = -1$
$a - (b - c) \neq (a - b) - c$

7. If $a = 10$ and $b = 6$, show that $a - b \neq b - a$

$a = 10, b = 6$
$(a - b) \neq (b - a)$
$(a - b) = (10 - 6) = 4$
$(b - a) = (6 - 10) = -4$
$\because$ $4 \neq -4$

$$(a-b) \neq (b-a)$$

8. If $a = 256$, $b = 362$ and $c = 182$, show that $a - (b - c) \neq (a - b) - c$.

$a = 256, b = 362, c = 182$

$$a - (b - c) \neq (a - b) - c$$
$$256 - (362 - 182) = 256 - 180 = 76$$
$$(256 - 362) - 182 = -106 - 362 = 468$$
$$\because \quad 76 \neq -468$$
$$a - (b - c) \neq (a - b) - c$$

9. If $a = 4$, $b = 3$ and $c = 6$, find the following :

(a) $a \times (b + c) = 4 \times (3 + 6) = 4 \times 9 = 36$

(b) $ab + bc = 4 \times 3 + 4 \times 6 = 12 + 24 = 36$

10. Verify that $b + c = a$ if $a - b = c$ for

(a) $a = 5, b = 3$
$c = a - b$
$c = 5 - 3 = 2$
$3 + 2 = 5$

(b) $a = 23, b = 9$
$c = a - b$
$c = 23 - 9 = 14$
$9 + 14 = 23$

11. If $a = 8$, $b = 5$ and $c = 2$, find the following :

(a) $a \times (b - c) = 8 \times (5 - 2)$
$= 8 \times 3 = 24$

(b) $ab - bc = 8 \times 5 - 8 \times 2$
$= 40 - 16 = 24$

12. If $a = 84$ and $b = 4$, verify whether $a \div b \neq b \div a$.

$a = 84, b = 4$

$$a \div b \neq b \div a$$
$$a \div b = 84 \div 4 = 21$$
$$b \div a = 4 \div 84 = 0.048$$
$$\because \quad 21 \neq 0.048$$
$$a \div b \neq b \div a$$

13. Find the difference between the largest 5 digit number and smallest 3 digit number.

The largest 5-digit number $= 99999$
The smallest 3 digit number $= 1000$
Difference $= 99999 - 1000 = 99899$

14. A shopkeeper sold 7 bedsheets for ` 350 each and 13 pillow covers for ` 50 each. Find the amount he earned by selling the bedsheets and pillow covers.

Cost of 1 bed sheets = ` 350
Cost of 7 bed sheets = ` $350 \times 7$ = ` 2450
Cost of 1 pillow cover = ` 30
Cost of 13 pillow cover = ` $30 \times 13$ = ` 390
Total spelling price of bed sheets and pillow covers = ` $(2450 + 390)$
= ` 2840

15. Fill in the blanks :

(a) $751 \div 751 = \mathbf{1}$

(b) $128 \times (100 - 2) = 128 \times \mathbf{100} - 128 \times \mathbf{2}$

(c) $195 \times \mathbf{405} = 405 \times \mathbf{195}$ (d) $7 \times 0 = \mathbf{0} = 0 \times \mathbf{7}$

(e) $1275 \div 1 = \mathbf{1275}$ (f) $5 \times 92 \times 20 = \mathbf{100} \times 92$

(g) $5 + (105 + 2) = (5 + \mathbf{105}\ ) + 2$ (h) $\mathbf{0} + 515 = 515$

Exercise 3.3

Study each of the following patterns. Write the next two steps for each :

a. $37 \times 3 = 111$
$37 \times 6 = 222$
$37 \times 9 = 333$
$37 \times 12 = 444$
37 × 15 = 555
37 × 18 = 666

b. $1 + 2 = 3$
$1 + 2 + 3 = 6$
$1 + 2 + 3 + 4 = 10$
$1 + 2 + 3 + 4 + 5 = 15$
1 + 2 + 3 + 4 + 5 + 6 = 21
1 + 2 + 3 + 4 + 5 + 6 + 7 = 28

c. $9 \times 9 + 7 = 88$
$9 \times 98 + 6 = 888$
$9 \times 987 + 5 = 8888$
$9 \times 9876 + 4 = 88888$
9 × 98765 + 3 = 888888
9 × 987654 + 2 = 8888888

d. $46 \times 9 = 460 - 46$
$46 \times 99 = 4600 - 46$
$46 \times 999 = 46000 - 46$
$46 \times 9999 = 460000 - 46$
46 × 99999 = 4600000 – 46
46 × 999999 = 46000000 – 46

Multiple Choice Questions

Tick (3) the correct answer :

1. (d) **2.** (a) **3.** (a) **4.** (c) **5.** (a) **6.** (b) **7.** (a) **8.** (c) **9.** (b) **10.** (a) **11.** (b) **12.** (a)

High Order Thinking Skills (HOTS)

Fill in the boxes with +, −, × or ÷ sign.

$71{,}234 \boxed{+} 0 = 71{,}234$ $45{,}638 \boxed{\times} 0 = 0$

$6815 \boxed{\div} 6815 = 1$ $3636 \boxed{-} 3636 = 0$

$0 \boxed{\times} 65{,}329 = 0$ $53{,}817 \boxed{\div} 1 = 53{,}817$

$2963 \boxed{-} 1 = 2962$ $79{,}643 \boxed{+} 1 = 79{,}644$

4 Negative Numbers and Integers

Exercise 4.1

1. Give opposite of :

(a) + 34 (b) A with drawn of ` 100

(c) A profit of ` 7. (d) Going west

(e) Loosing a weight of 5 kg (f) Decrease in population

2. Find :

(a) $|-3-2| = |-5| = 5$ (b) $|-10| - |5| = 10 - 5 = 5$

(c) $|5| + |-12| = 5 + 12 = 17$ (d) $|5| + |-3| = 5 + 3 = 8$

(e) $|7| - |-3|\ 7 - 3 = 4$ (f) $|5| - |0| = 5 - 0 = 5$

3. Replace * in each by < or > so that the statement is true :

(a) $0 < 5$ (b) $-17 > -18$ (c) $-5 < -2$ (d) $-100 < -98$

4. Write all integers between :

(a) –5 and 0

Integers between -5 and $0 = -4, -3, -2, -1$

(b) –3 and 3

Integers between -3 and $3 = -2, -1, 0, 1, 2$

(c) 0 and 8

Integers between 0 and 8 $= 1, 2, 3, 4, 5, 6, 7$

(d) (-7) and 0

Integers between -7 and $0 = -6, -5, -4, -3, -2, -1$

5. Which number in each of the following is smaller?

(a) $(0, -2)$ Since, $0 > -2$

-2 is smaller than 0.

(b) $(-3, -5)$ Since, $-3 > -5$

-5 is smaller than -3.

(c) $(-5, 2)$ Since, $-5 < 2$

-5 is smaller than 2.

(d) $(-12,\ 9)$ Since, $-12 < 9$

-12 is smaller than 9.

(e) $(0, 3)$ Since, $0 < 3$

0 is smaller than 3.

6. Which number in each of the following pairs is to the right of the other on the number line?

(a) $(1, 7) = 1 < 7$ 7 lies to right to 1

(b) $(-2, -5) = -2 > -5$ lies to right to -5

(c) $(0, -3) = 0 > -3$ 0 lies to right to -3

(d) $(-5, 8) = -5 < 8$ 8 lies to the right of -5.

7. Indicate the following by '+' or '–' sign :

(a) A loss of ` 800 = – ` 800 (b) 3 km below sea level $= -3$ km

(c) A gain of ` 500 = + ` 500 (d) 3°C above zero = + 3°C

(e) Decrease of 9 $= -9$(f) A deposit of ` 200 = + ` 200

Exercise 4.2

1. Classify the following statements as true (T) or false (F) :

(a) T (b) T (c) F (d) T (e) T

2. Fill in the blanks :

(a) – 6 + **6** = 0 (b) – 40 + 40 = **0**

(c) 15 + **(– 15)** = 0 (d) 0 + **0** = 0

3. Find :

(a) The successor of $-100 = -100 + 1 = -99$

(b) The predecessor of $0 = 0 - 1 = -1$
(c) The negative of $-50 = -(-50) = (50)$
(d) The additive inverse of $254 = -254$

4. Find :

(a) $200 + (-174) + (-26)$
$= 200 - 174 - 26$
$= 200 - 200 = 0$

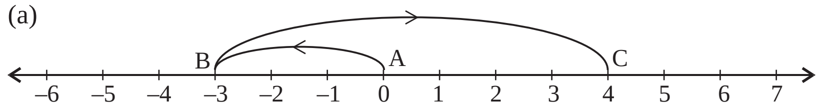
(b) $4 + (-99) + (-101) + 96$
$= 4 + 96 - 99 - 101$
$= 100 - 200 = -100$

(c) $(-18) + (+25) + (-37) = -18 + 25 - 37$
$= 25 - 55 = -30$

(d) $(-100) + (-99) + (-98) + ...98 + 99 + 100$
$(-)$ and $(+)$ added
$(-) + (+) = 0$
$(-100) + (-99) + (-98)......98 + 99 + 100 = 0$

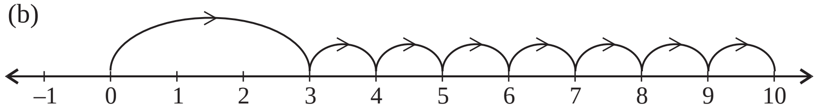
5. Represent the following on a number line :

(a)



$(-3) + (+7) = +4$

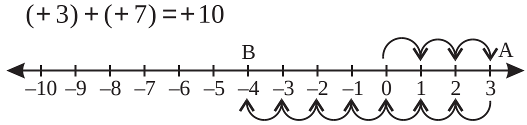
(b)



(+3) + (+7) = 10

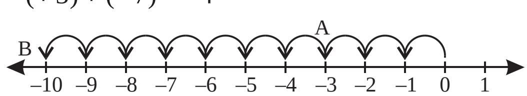
$(+3) + (+7) = +10$

(c)



$(+3) + (-7) = -4$

(d)



$(-3) + (-7) = -10$

6. In a Math quiz, 1 mark is gained for each correct answer. 1 mark is lost for each wrong answer. There are 20 questions. If all questions are answered correctly, a student's score will be 20; If all questions are answered incorrectly, a student's score will be -20.

Number of question $= 20$
If 20 questions correct; score will be $= 20$
If 20 questions incorrect; score will be $= -20$
Present score of Suraj $= 4$

(a) Score after answering all the five question correctly $= 4 + 5 \times 1 = 9$
(b) Score after answering all the five question along $= 4 - 5 \times 1 = 4 - 5 = -1$
(c) Score after answering 2 questions correctly and 3 question incorrectly

$= 4 + 2 \times 1 - 1 \times 3 = 4 + 2 - 3 = 4 - 1 = 3$

7. At 5 am., the temperature at a place was $-5°C$. It rose by 7° after three hours and stayed constant for two hours. What were the temperatures at 8 a.m. and at 9 a.m.?

Temperature at 5 a.m. $= -5°C$

Increase in temperature $= 7°C$

Temperature at 8 am $= (-5 + 7) = 2°C$

Time period for which the temperature is remaining constent $= 3$ hrs after 8 am.

temperature at 9 am = temperature at 8 am $= 2°C$

8. Find the sum of -21, -9, 63, -22 and -28.

$$(-21) + (-9) + 63 + (-22) + (-28) = -21 - 9 - 22 - 28 + 63$$
$$= -80 + 63 = -17$$

9. A diver is 10 m below sea level. His position is given as -10 m. Give his new position as integer, if he :

(a) He goes further by 10 m

New position $= -10 - 10 = -20$ m

(b) He comes up by 5 m

New position $= -10 + 5 = -5$ m

10. Add the successor of -99 and the predecessor of 9, and find the sum.

Sucessor of $-99 = -99 + 1 = -98$

Predecessor of $9 = 9 - 1 = 8$

Sum of -98 and $8 = -98 + 8 = -90$

Exercise 4.3

1. Which of the following statements are true?

(b) $-4 + (-2) < 2$, the statemnts are true.

2. Calculate the sum :

$3 + (-3) + 3 + (-3) + 3 + (-3) + ...$

(a) If the number of terms is 40.

$$[3 + (-3)] \times 20 = 0 \times 20 = 0$$

(b) If the number of terms is 71,

$$[3 + (-3))] \times 35 + 3$$
$$0 \times 35 + 3 = 3$$

3. From the sum of -38 and -12 subtract -18.

Sum of -38 and $-12 = -38 + (-12) = -38 - 12 = -50$

Subtract $-18 = -50 - (-18) = -50 + 18 = -32$

4. Subtract the sum of -8 and -28 from the sum of -13 and 31.

Sum of -8 and -28

$$-8 + (-28) = -8 - 28 = -36$$

Sum of -13 and 31

$$= -13 + 31 = 18$$

Subtract the sum of -8 and -28 from the sum of -13 and 31.

$18-(-36)=18+36=54$

5. Simplify :

(a) $-12+18-15+3$
$=-12-15+18+3$
$=-27+21=-6$

(b) $-8+(-6)+(-11)$
$=-8-6-11$
$=-25$

(c) $7-(-9)+(-3)$
$=7+9-3$
$=7+6=13$

(d) $-6-8(-5)$
$=-6-8+15$
$=-14+15=1$

6. A place is 37 m above sea level and another is 35 m below sea level. What is the difference of levels between the two places?

A place is Sea level above 37 m $=+37$ m
A place is sea level below 35 m $=-35$ m
Difference $=37-(-35)=37+35=72$ cm

7. p and q are two integers such that p is the predecessor of q.

Find the value of $p-q$.

If p is the predecessor of q

Then,
$$p<q$$
$$p+1=q$$
$$p-q=-1$$

Value of $p-q=-1$

8. Fill in the blanks :

(a) $13+(-13)=\mathbf{(0)}$ (b) $-3+\mathbf{(-9)}=-12$

(c) $11-\mathbf{(-11)}=22$ (d) $-6+\mathbf{(6)}=0$

9. Subtract -5 from 7. Subtract 7 from -5. Are the two results the same?

Subtract -5 from 7
$7-(-5)=7+5=12$
Subtract 7 from -5
$=-5-7=-12$
No, $7-(-5)\neq-5-7$

10. Subtract :

(a) Subtract : -340 from -370
$=-370-(-340)$
$=-370+340=-30$

(b) Subtract : 2 from -7
$=-7-2=-9$

(c) Subtract : -62 from 0
$=0-(-62)=62$

(d) Subtract : 0 from -52
$=-52-0=-52$

11. The sum of two integers is -50. If one of them is 78, what is the other integer?

Sum of two integers $=-50$
One of them $=78$
Other number $=x$
$$78+x=-50$$
$$x=-50-78$$

$$x = -128$$

The other number is -128.

12. Two cars started from the same point. First car went towods the east and covered 64 km in one hour. The second car went towards the west and covered 58 km in one hour. Find the distance between the two cars after one hour.

Speed of first car = 64 km/hours
Distance covered in 1 hr = 64 km
Speed of second car = 58 km/hrs
Distance covered in 1 hrs = 58 km
Difference = 64 + 58 = 122
Distance between two cars after 1 hr = 122 km.

Multiple Choice Questions

Tick (3) the correct answer :

1. (c) **2.** (b) **3.** (a) **4.** (c) **5.** (a) **6.** (c) **7.** (b) **8.** (c)

Higher Order Thinking Skills (HOTS)

1. The required x and y are 32 and 3125 as $32 \times 3125 = 100000$ and both of these do not contain 0 as a digit.
2. To get a successor of an integer we add 1 in it. To get predecessor an integer we subtract 1 in it.
   No, the sum of a successor and a predecessor of an integer cannot be odd.

5 Fractions

Exercise 5.1

1. Write the natural numbers from 12 to 21. What fraction of them are prime numbers?

The natural number from 12 to 21 = 12, 13, 14, 15, 16, 17, 18, 19, 20, 21
Total numbers are 10.
Prime number between 12 to 21 = 13,17,19
Total numbers of prime number is 3
Fraction of prime number = $\frac{3}{10}$.

2. Kajal invited 30 friends on her birthday. Only 20 friends turned up. What fraction of friends did not atend her party?

Number of friends invited on birthday = 30
Number of friends turned the party = 20
Number of friends did not attended the party = $30 - 20 = 10$
Fraction of friends did not attend her party = $\frac{10}{30} = \frac{1}{3}$

3. The number of students playing in the ground were 25. There were 15 boys.

What fraction of the students in the playground are girls?

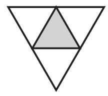
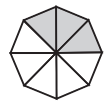
Number of students playing in the ground $= 25$

Number of boys $= 15$

Number of girls $= 25 - 15 = 10$

Fraction of the students in playground are girls $= \frac{10}{25}$ or $\frac{2}{5}$

4. Shade the portion according to the fraction given :

(a) $\frac{2}{3}$  (b) $\frac{1}{4}$  (c) $\frac{5}{6}$  (d) $\frac{3}{8}$ 

5. Write the fraction representing the shaded portion :

(a) Fraction $= \frac{5}{12}$ (b) Fraction $= \frac{28}{100} = \frac{7}{25}$ (c) Fraction $= \frac{4}{6}$ or $\frac{2}{3}$

(d) Fraction $= \frac{9}{16}$ (e) Fraction $= \frac{4}{6}$ or $\frac{2}{3}$ (f) Fraction $= \frac{5}{7}$

(g) Fraction $= \frac{3}{4}$ (h) Fraction $= \frac{4}{5}$

Exercise 5.2

1. Which of the following figures represent equivalent fractions?

(a) $\frac{4}{18}$ (b) $\frac{3}{12} = \frac{1}{4}$ (c) $\frac{1}{4}$ (d) $\frac{2}{8} = \frac{1}{4}$

(b), (c), (d) are equivalent fractions.

2. Give a proper fraction :

Proper fraction : In, proper fraction, numerator is less than denominator.

(a) Sum of numerator and denominator $= 12$

$N + D = 12$

Proper fractions $= \frac{1}{11}, \frac{3}{9}, \frac{4}{8}, \frac{5}{7}$

(b) Numerator $= 9$ and denominator $= 9 \times 2 - 1 = 17$

Proper fraction $= \frac{9}{17}$

(c) Numerator $= 15$ and denominator 17

Proper fraction $= \frac{15}{17}$

3. Fill in the blanks to make the following fractions equivalent :

(a) $\frac{35}{28} = \frac{5}{4} = \frac{45}{36}$ (b) $\frac{20}{58} = \frac{60}{174} = \frac{10}{29}$ (c) $\frac{100}{500} = \frac{200}{1000} = \frac{50}{250}$

4. Write two improper fractions with :

(a) numerator 11

In improper fraction numerator is greater than the denominator.

So, denominator is < 11

Denominator $11 - 1 = 10$ and $11 - 2 = 9$

Fraction $= \frac{11}{10}, \frac{11}{9}$

(b) denominator 11

In improper fraction numerator is greater than the denominator.

So, Numerator is > 11

numerator $11 + 1 = 12$ and $12 + 1 = 13$

Fraction $\frac{12}{11}$ and $\frac{13}{11}$

(c) numerator 5

In improper fraction numerator is greater than the denominator.

So, denominator is < 5

Denominator $5 - 2 = 3$ and $5 - 3 = 2$

Fraction $= \frac{5}{3}$ and $\frac{5}{2}$

(d) denominator 9

In improper fraction numerator is greater than the denominator.

So, numerator is > 9

So, Numerator $= 9 + 1 = 10$ and $10 + 1 = 11$

Fractions $= \frac{10}{9}$ and $\frac{11}{9}$

5. (a) $2\frac{1}{2} = \frac{5}{2}$

$\frac{5}{2} \div \frac{1}{2} = \frac{5}{2} \times 2 = 5$

5 halves can be made in $2\frac{1}{2}$.

(b) $4\frac{1}{2} = \frac{9}{2}; \frac{9}{2} \div \frac{1}{2}$

$\frac{9}{2} \times 2 = 9$

9 halves can be made in fraction $4\frac{1}{2}$.

(c) $7\frac{1}{2} = \frac{15}{2}; \frac{15}{2} \div \frac{1}{2}\ \frac{15}{2} \times 2 = 15$

15 halves can be made in fraction $7\frac{1}{2}$.

6. Number of students in class VI A $= 36$

Number of boys $= 18$

Number of girls $= 36 - 18 = 18$

fraction of girls in section VI A $= \frac{18}{36}$ or $\frac{1}{2}$

Number of students in class VI B $= 30$

Number of boys $= 15$
Number of girls $= 30 - 15 = 15$
Fraction of girls in section VI B $= \frac{15}{30}$ or $\frac{1}{2}$
Number of students in class VI C $= 32$
Number of boys $= 16$
Number of girls $= 32 - 16 = 16$
Fraction of girls in section VI C $= \frac{16}{32}$ or $\frac{1}{2}$
Thus, yes, each section have equal fraction of girls students?

7. Reduce the following fractions to the simplest form :

(a) $\frac{2}{28} = \frac{2 \div 2}{28 \div 2} = \frac{1}{14}$

(b) $\frac{56}{24} = \frac{56 \div 8}{24 \div 8} = \frac{7}{3}$

(c) $\frac{42}{66} = \frac{42 \div 6}{66 \div 6} = \frac{7}{11}$

(d) $\frac{120}{180} = \frac{120 \div 60}{180 \div 60} = \frac{2}{3}$

8. Check whether the given fractions are equivalent :

(a) $\frac{45}{65}, \frac{18}{26}$

$\frac{45}{65} \quad \frac{18}{26}$

$45 \times 26, 18 \times 25$

Since, $1170 = 1170$

So, $\frac{45}{65}$ and $\frac{18}{26}$ are equivalent fractions.

(b) $\frac{6}{5}, 1\frac{2}{10}$ or $\frac{12}{10}$

$\frac{6}{5} \quad \frac{12}{10}$

$6 \times 10, 12 \times 5$

Since, $60 = 60$

So, $\frac{6}{5}$ and $1\frac{12}{10}$ are equivalent fractions.

(c) $\frac{12}{25}, \frac{6}{5}$

$\frac{12}{25} \quad \frac{6}{5}$

$12 \times 5, 6 \times 25$

Since, $60 \neq 150$

So, $\frac{12}{25}$ and $\frac{6}{5}$ are equivalent fractions.

(d) $\frac{5}{4}, \frac{125}{100}$

$\frac{5}{4} \quad \frac{125}{100}$

$5 \times 100, 125 \times 4$

Since, $500 = 500$

So, $\frac{5}{4}$ and $\frac{125}{100}$ are equivalent fractions.

9. Find the equivalent fraction of $\frac{5}{8}$ having :

(a) numerator $= 55$

$\frac{5}{8} = \frac{5 \times 11}{8 \times 11} = \frac{55}{88}$

(b) denominator $= 80$

$\frac{5}{8} = \frac{5 \times 10}{8 \times 10} = \frac{50}{80}$

(c) numerator $= 45$

$\frac{5}{8} = \frac{5 \times 9}{8 \times 9} = \frac{45}{72}$

(d) denominator $= 24$

$\frac{5}{8} = \frac{5 \times 3}{8 \times 3} = \frac{15}{24}$

10. Express the following as improper fractions :

(a) $1\frac{1}{9} = \frac{9 \times 1 + 1}{9} = \frac{9+1}{9} = \frac{10}{9}$ (b) $4\frac{1}{3} = \frac{4 \times 3 + 1}{7} = \frac{12+1}{3} = \frac{13}{3}$

(c) $3\frac{2}{5} = \frac{3 \times 5 + 2}{5} = \frac{15+2}{5} = \frac{17}{5}$ (d) $1\frac{2}{7} = \frac{1 \times 7 + 2}{7} = \frac{7+2}{7} = \frac{9}{7}$

11. Express the following as mixed fractions :

(a) $\frac{64}{5} = 64 \div 5$

$= 12\frac{4}{5}$

$$\begin{array}{r} 12 \\ 5\overline{)64} \\ -5 \\ \hline 14 \\ -10 \\ \hline 4 \\ \hline \end{array}$$

(b) $\frac{43}{8} = 43 \div 8$

$= 5\frac{3}{8}$

$$\begin{array}{r} 5 \\ 8\overline{)43} \\ -40 \\ \hline 3 \\ \hline \end{array}$$

(c) $\frac{19}{3} = 19 \div 3$

$= 6\frac{1}{3}$

$$\begin{array}{r} 6 \\ 3\overline{)19} \\ -18 \\ \hline 1 \\ \hline \end{array}$$

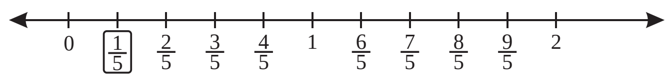
(d) $\frac{23}{4} = 23 \div 4$

$= 5\frac{3}{4}$

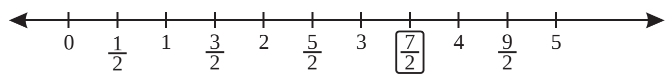
$$\begin{array}{r} 5 \\ 4\overline{)23} \\ -20 \\ \hline 3 \\ \hline \end{array}$$

12. Draw number lines and locate following fractions on them :

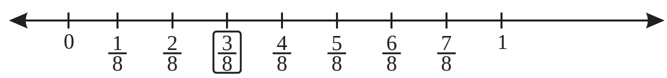
$\frac{1}{5}$ =



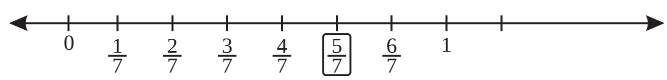
$\frac{7}{2}$ =



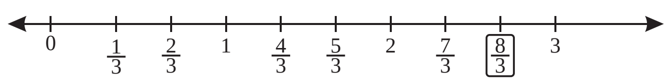
$\frac{3}{8}$ =



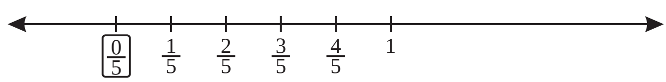
$\frac{5}{7}$ =



$2\frac{2}{3} = \frac{8}{3}$ =



$\frac{0}{5}$ =



Exercise 5.3

1. Write three like fractions with denominator :

Like fractions : The fractions that have same denominator are called like fractions.

(a) Denominator $= 13$

Like fractions $= \frac{1}{13}, \frac{2}{13}, \frac{3}{13}$

(b) Denominator $= 11$

Like fractions $= \frac{1}{11}, \frac{2}{11}, \frac{3}{11}$

(c) Denominator $= 7$

Like fractions $= \frac{1}{7}, \frac{2}{7}, \frac{3}{7}$

(d) Denominator $= 5$

Like fractions $= \frac{1}{5}, \frac{2}{5}, \frac{3}{5}$

2. Compare the following fractions and write the greater fraction :

(a) $\frac{5}{7}, \frac{9}{11}$

The given fractions are unlike, so, let us take the LCM of 7 and $11 = 77$

$$\frac{5}{7} = \frac{5 \times 11}{7 \times 11} = \frac{55}{77} \text{ and } \frac{9}{11} = \frac{9 \times 7}{11 \times 7} = \frac{63}{77}$$

Clearly $\frac{55}{77} < \frac{63}{77}$ therefore, $\frac{5}{7} < \frac{9}{11}$

So, $\frac{9}{11}$ is greater than $\frac{5}{7}$.

(b) $\frac{26}{32}, \frac{1}{16}$

The given fractions are unlike, so let us take the LCM of 32 and $16 = 16$

$$\frac{26 \div 2}{32 \div 2} = \frac{13}{16}; \frac{1 \div 1}{16 \div 1} = \frac{1}{16}$$

Clearly, $\frac{13}{16} > \frac{1}{16}$ therefore, $\frac{26}{32} > \frac{1}{16}$

(c) $2\frac{1}{5}, 1\frac{7}{9}$ or $\frac{11}{5}, \frac{16}{9}$

LCM of 5 and $9 = 45$

$$\frac{11 \times 9}{5 \times 9} = \frac{99}{45}; \quad \frac{16 \times 5}{9 \times 5} = \frac{80}{45}$$

Clearly, $\frac{99}{45} > \frac{80}{45}$

So, $2\frac{1}{5}$ is greater than $1\frac{7}{9}$.

(d) $\frac{4}{17}, \frac{3}{22}$

LCM of 17 and $22 = 374$

$$\frac{4 \times 22}{17 \times 22} = \frac{88}{374}; \quad \frac{3 \times 17}{22 \times 17} = \frac{51}{374}$$

Clearly, $\frac{88}{374} > \frac{51}{374}$

So, $\frac{4}{17}$ is greater than $\frac{3}{22}$.

(e) $\frac{1}{8}, \frac{1}{10}$

LCM of 8 and 10 = 40

$$\frac{1\times 5}{8\times 5} = \frac{5}{40}; \qquad \frac{1\times 4}{10\times 4} = \frac{4}{40}$$

Clearly, $\frac{5}{40} > \frac{4}{40}$

So, $\frac{1}{8}$ is greater than $\frac{1}{10}$.

(f) Compare : $\frac{2}{15}, \frac{2}{25}$

LCM of 15 and 25 = 75

$$\frac{2\times 5}{15\times 5} = \frac{10}{75}; \qquad \frac{2\times 3}{25\times 3} = \frac{6}{75}$$

Clearly, $\frac{10}{75} > \frac{6}{75}$

So, $\frac{2}{15}$ is greater than $\frac{2}{25}$.

3. Add the following fractions :

(a) Add $\frac{1}{3}$ and $\frac{1}{4}$

$$= \frac{1}{3} + \frac{1}{4} = \frac{1\times 4 + 3\times 1}{12} = \frac{4+3}{12} = \frac{7}{12}$$

(b) Add $\frac{2}{5}, \frac{3}{2}$ and $\frac{1}{7}$

$$= \frac{2}{5} + \frac{3}{2} + \frac{1}{7} = \frac{2\times 14 + 3\times 35 + 1\times 10}{70} = \frac{28 + 105 + 10}{70} = \frac{143}{70} \text{ or } 2\frac{3}{70}$$

(c) Add $\frac{1}{3}$ and $\frac{3}{8}$

$$= \frac{1}{3} + \frac{3}{8} = \frac{1\times 8 + 3\times 3}{24} = \frac{8+9}{24} = \frac{17}{24}$$

(d) Add $2\frac{1}{2}$ and $3\frac{7}{4}$ or $2\frac{1}{2} = \frac{5}{2}$ and $3\frac{7}{4} = \frac{19}{4}$

$$= \frac{5}{2} + \frac{19}{4} = \frac{5\times 2 + 19}{4} = \frac{10+19}{4} = \frac{29}{4} \text{ or } 7\frac{1}{4}$$

(e) Add : $\frac{5}{11}, \frac{12}{11}$ and $\frac{1}{22}$ or $\frac{5}{11} + \frac{12}{11} + \frac{1}{22}$

$$= \frac{5\times 2 + 12\times 2 + 1}{22} = \frac{10 + 24 + 1}{22} = \frac{35}{22} \text{ or } 1\frac{13}{22}$$

(f) Add : $5\frac{1}{6}$ and $6\frac{1}{5}$ or $5\frac{1}{6} = \frac{31}{6}$ and $6\frac{1}{5} = \frac{31}{5}$

$= \frac{31}{6} + \frac{31}{5} = \frac{31\times 5 + 31\times 6}{30} = \frac{155+186}{30} = \frac{341}{30}$ or $11\frac{11}{30}$

4. Subtract the first fraction from the second :

(a) Subtract $\frac{1}{6}$ from $\frac{1}{2}$

$= \frac{1}{2} - \frac{1}{6} = \frac{3-1}{6} = \frac{2}{6}$ or $\frac{1}{3}$

(b) Subtract $\frac{2}{9}$ from $\frac{4}{7}$

$= \frac{4}{7} - \frac{2}{9} = \frac{4\times 9 - 2\times 7}{63}$

$= \frac{36-14}{63}$

$= \frac{22}{63}$

(c) Subtract $\frac{2}{7}$ from $\frac{7}{2}$

$= \frac{7}{2} - \frac{2}{7} = \frac{7\times 7 - 2\times 2}{14} = \frac{49-4}{14} = \frac{45}{14}$

(d) Subtract $2\frac{1}{5}$ from $12\frac{1}{2}$ $\qquad 2\frac{1}{5} = \frac{11}{5}$ or $12\frac{1}{2} = \frac{25}{2}$

$= \frac{25}{2} - \frac{11}{5} = \frac{25\times 5 - 11\times 2}{10} = \frac{125-22}{10} = \frac{103}{10}$

(e) Subtract $\frac{4}{11}$ from $\frac{9}{11}$

$= \frac{9}{11} - \frac{4}{11} = \frac{9-4}{11} = \frac{5}{11}$

(f) Subtract $\frac{1}{7}$ from $\frac{11}{7}$

$= \frac{11}{7} - \frac{1}{7} = \frac{11-1}{7} = \frac{10}{7}$

5. Arrange the followinog fractions in ascending order :

(**Note :** When we compare two fractions with the same denominator the fraction with the greater numerator is greater.)

(a) $\frac{1}{2}, \frac{3}{2}, \frac{13}{2}, \frac{7}{2}, \frac{9}{2}, \frac{10}{2}$

Compare the numerator $1 < 3 < 7 < 9 < 10 < 13$

or, Ascending order $= \frac{1}{2} < \frac{3}{2} < \frac{7}{2} < \frac{9}{2} < \frac{10}{2} < \frac{13}{2}$

(b) $\frac{11}{7}, \frac{17}{7}, \frac{3}{7}, \frac{4}{7}, \frac{9}{7}, \frac{10}{7}$

Compare the numerations $3 < 4 < 9 < 10 < 11 < 17$

or, Ascending order $= \frac{3}{7} < \frac{4}{7} < \frac{9}{7} < \frac{10}{7} < \frac{11}{7} < \frac{17}{7}$

6. Simplify :

(a) $6\frac{3}{5} + 2\frac{1}{5}$

$= \frac{33}{5} + \frac{11}{5} = \frac{33+11}{5}$

(b) $4\frac{1}{3} - 3\frac{1}{3}$

$= \frac{13}{3} - \frac{10}{3} = \frac{13-10}{3}$

$= \frac{44}{5}$ or $8\frac{4}{5}$

$= \frac{3}{3} = 1$

(c) $3\frac{2}{7} - 2\frac{1}{7}$

$= \frac{23}{7} - \frac{15}{7} = \frac{23-15}{7}$

$= \frac{8}{7}$ or $1\frac{1}{7}$

(d) $1\frac{1}{3} + 2\frac{3}{8}$

$= \frac{4}{3} + \frac{19}{8} = \frac{4 \times 8 + 19 \times 3}{24}$

$= \frac{24 + 57}{24} = \frac{81}{24}$ or $3\frac{3}{8}$

7. Pallavi bought of cloth $= 3\frac{2}{3}$ m $= \frac{11}{3}$ m

Deepa bought of cloth $= 2\frac{1}{3}$ m or $\frac{7}{3}$ m

Since, $\frac{11}{3} > \frac{7}{3}$

Difference $= \frac{11}{3} - \frac{7}{3} = \frac{11-7}{3} = \frac{4}{3}$ m or $1\frac{1}{3}$ m

Thus, Pallavi bought more cloth. She bought $1\frac{1}{3}$ m cloth extra.

8. Time spend on Friday $= \frac{1}{2}$ hours

Time spend on Saturday $= \frac{7}{4}$ hours

Time spend on Sunday $= \frac{1}{3}$ hours

Total time spend for study over the weekend $= \frac{1}{2} + \frac{7}{4} + \frac{1}{3}$

$= \frac{1 \times 6 + 7 \times 3 + 1 \times 4}{12}$

$= \frac{6 + 21 + 4}{12} = \frac{31}{12}$ or $2\frac{7}{12}$

Thus, she studied $2\frac{7}{12}$ hours over the weekend.

9. **For Dev :**

Number of pages $= 40$

Number of coloured pages $= 4$

Fraction of coloured pages $= \frac{4}{40} = \frac{1}{10}$

For Raman :

Fraction of coloured pages $= \frac{1}{3}$

Compare $\frac{1}{10}$ and $\frac{1}{3}$

$$\frac{1\times 3}{10\times 3}, \frac{10\times 1}{10\times 3} = \frac{3}{30} \qquad \text{Clearly, } \frac{10}{30}$$

Thus, Dev coloured less pages.

10. Fraction of collection by students $= \frac{2}{3}$

Fraction of collection by school staff $= \frac{1}{6}$

Total collection $= \frac{2}{3} + \frac{1}{6} = \frac{2\times 2+1}{6} = \frac{4+1}{6} = \frac{5}{6}$

Fraction of collection from donations $= 1 - \frac{5}{6} = \frac{6-5}{6} = \frac{1}{6}$

Thus, $\frac{1}{6}$ of funds collected from donations.

11. Mahi takes time to cross the bride by car $= 4\frac{1}{2}$ min $= \frac{9}{2}$ min

Tarun, takes time to cross the bride by car $= 3\frac{1}{3}$ min $= \frac{10}{3}$ min

Comparison $= \frac{9}{2}$ and $\frac{10}{3}$

Now, $\frac{9\times 3}{2\times 3} = \frac{27}{6}$ and $\frac{10\times 2}{3\times 2} = \frac{20}{6}$

Clearly, $\frac{27}{6} > \frac{20}{6}$

Difference $= \frac{27}{6} - \frac{20}{6} = \frac{27-20}{6} = \frac{7}{6}$

Thus, Mahi takes $1\frac{1}{6}$ min more than Tarun.

12. Fraction of pots sold on Monday $= \frac{1}{3}$

Fraction of pots sold on Tuesday $= \frac{1}{4}$

Fraction of pots sold on Wednesday $= \frac{1}{5}$

Fraction of pots sold on Thursday $= \frac{1}{6}$

Total pots sold $= \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} = \frac{20+15+12+10}{60} = \frac{57}{60}$

Remaining pots sold in weekened $= 1 - \frac{57}{60} = \frac{60-57}{60} = \frac{3}{60}$ or $\frac{1}{20}$

13. Rahul gives oranges $= \frac{5}{7}$

Oranges left in basket $= 1 - \frac{5}{7} = \frac{7-5}{7} = \frac{2}{7}$

$\frac{2}{7}$ oranges were left in the basket.

14. Weight of potatoes $= 3\frac{1}{2}$ or $\frac{7}{2}$ kg

Weight of tomatoes $= 1\frac{3}{4}$ or $\frac{7}{4}$ kg

Weight of carrots $= 1\frac{1}{4}$ or $\frac{5}{4}$ kg

Total weight of vegetable purchased by Mrs Sharma $= \frac{7}{2} + \frac{7}{4} + \frac{5}{4}$

$$= \frac{7 \times 2 + 7 + 5}{4} = \frac{14 + 7 + 5}{7}$$

$$= \frac{26}{4} \text{ or } \frac{13}{2} = 6\frac{1}{2} \text{ kg}$$

Mrs Sharma purchased $6\frac{1}{2}$ kg vegetable.

15. Quantity of milk bought $= 5\frac{3}{4}\ l$ or $\frac{23}{4}\ l$

Quantity of milk consumed $= 2\frac{1}{4}\ l$ or $\frac{9}{4}\ l$

Milk is left with Seema $= \left(\frac{23}{4} - \frac{9}{4}\right) l = \frac{23-9}{4}\ l = \frac{14}{4}\ l$ or $\frac{7}{2}\ l$

Thus, $3\frac{1}{2}\ l$ milk is left with Seema.

16. Money earned in a day = ₹ $87\frac{1}{2}$ or ₹ $\frac{175}{2}$

Money spent on food = ₹ $37\frac{3}{4}$ or ₹ $\frac{151}{4}$

Money left with Krishan = ₹ $\left(\frac{175}{2} - \frac{151}{4}\right)$ = ₹ $\frac{175 \times 2 - 151}{4}$

= ₹ $\frac{350 - 151}{4}$ = ₹ $\frac{199}{4}$ or $49\frac{3}{4}$

Thus, ₹ $49\frac{3}{4}$ money is left with him.

17. Total oil contained in a tin $= 15\frac{3}{4}\ l$ or $\frac{63}{4}\ l$

Leaked oil $= 2\frac{1}{2}\ l$ or $\frac{5}{2}\ l$

Oil is left in tin $= \frac{63}{4} - \frac{5}{2}\ l = \frac{63 - 5 \times 2}{4}\ l = \frac{63-10}{4}\ l = \frac{53}{4}\ l$ or $13\frac{1}{4}\ l$

18. Sum of two numbers $= \frac{7}{8}$

One numbers $= \frac{3}{4}$

Other number $= \frac{7}{8} - \frac{3}{4} = \frac{7 - 3 \times 2}{8} = \frac{7-6}{8} = \frac{1}{8}$

19. Length of a wire $= 2\frac{1}{3}$ m or $\frac{7}{3}$ m

Length of one piece $= \frac{1}{4}$ m

Length of other piece $= \left(\frac{7}{3} - \frac{1}{4}\right) \text{m} = \frac{7 \times 4 - 1 \times 3}{12}$ m

$= \frac{28-3}{12} = \frac{25}{12}$ m or $2\frac{1}{12}$ m

20. Write the shaded portion as fraction and arrange them in ascending order :

(a) Descending order $= \frac{4}{5} > \frac{3}{5} > \frac{2}{5} > \frac{1}{5}$

(b) Desceding order $= \frac{6}{8} > \frac{5}{8} > \frac{3}{8} > \frac{1}{8}$

Multiple Choice Questions

Tick (3) the correct answer :

1. (b) **2.** (c) **3.** (a) **4.** (a) **5.** (d) **6.** (a) **7.** (d) **8.** (a) **9.** (d) **10.** (b)

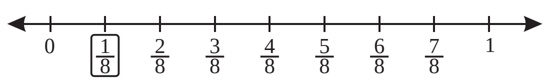
High Order Thinking Skills (HOTS)

1. Proper fraction $= \frac{5}{9}$. Infinite fractions can be written in this way.

2. (a) $\frac{1}{2} > \frac{1}{3}$ (b) $\frac{3}{7} > \frac{2}{7}$

3. $\frac{3}{7} + \frac{5}{9} = \frac{9 \times 3 + 5 \times 7}{63} = \frac{27+35}{63} = \frac{62}{63}$

4. $\frac{55}{100}$ is the different fraction of given fraction.

5. 

6. Total parts of bread $= 16$

I ate $= \frac{4}{16}$ part of bread

My brother ate $= \frac{7}{16}$ part of bread

Since, $= \frac{4}{16} < \frac{7}{16}$ Difference $= \frac{7}{16} - \frac{4}{16} = \frac{3}{16}$

So, my brother ate $\frac{3}{16}$ parts more than me

Fraction of bread left $= 1 - \frac{4}{16} - \frac{7}{16} = \frac{16-4-7}{16} = \frac{16-11}{16} = \frac{5}{16}$

6 Decimals

Exercise 6.1

1. Write the following decimals into place value table :

	Thous -ands	**Hundreds**	**Tens**	**Ones**	**Tenths**	**Hundredt hs**	**Thousan dths**
(a)		3	3	6	4	5	
(b)			4	6	5	6	
(c)		7	8	0	2		
(d)	1	2	6	4	5	0	9

2. Write each as decimal :

(a) six tenths = **0.6**

(b) two tens three ones and five tenths = **23.5**

(c) two hundred and six tenths = **200.6**

(d) four and seven tenths = **4.7**

(e) fourteen and eight tenths = **14.8**

(f) ninety two and six tenths = **92.6**

3. Write the following as decimals :

(a) 200 + 40 + 0.7 + 0.009 = 240.709

(b) 30 + 4 + 0.5 + 0.06 = 34.56 (c) 600 + 7 + 9 + 0.4 = 679.4

(d) 100 + 5 + 0.3 + 0.04 + 0.005 = 105.345

(e) 700 + 4 + 0.2 = 704.2 (f) 700 + 50 + 6 = 756.0

4. Express the following decimals as fractions in lowest form :

(a) $\frac{7}{10}$ (b) $\frac{47}{2}$ (c) $\frac{73}{5}$ (d) $\frac{237}{10}$

(e) $\frac{128}{5}$ (f) $\frac{19}{5}$

5. Express the following as cm using decimal :

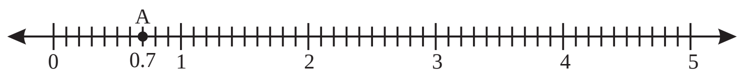
(a) 2 mm $= \frac{2}{10} = 0.2$ cm (b) 175 mm $= \frac{175}{10} = 17.5$ cm

(c) 14 cm 2 mm = 14 cm + $\frac{2}{10}$ cm = 14 + 0.2 cm = 14.2 cm

(d) 20 cm 6 mm = 20 cm + $\frac{6}{10}$ cm = 20 cm + 0.6 cm = 20.6 cm

6. Between which two whole numbers on the number line does the given number lie. Which of these whole number is nearer to the number given?

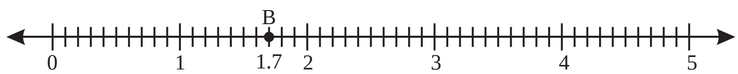
(a) 0.7



0.7 is present in between 0 and 1

0.7 is nearer to 1.

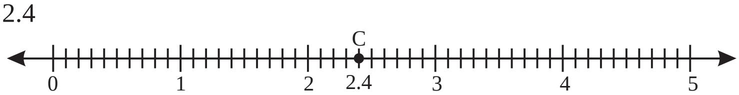
(b) 1.7



1.7 is present in between 1 and 2.

1.7 is nearer to 2.

(c) 2.4



2.4 is present in between 2 and 3.

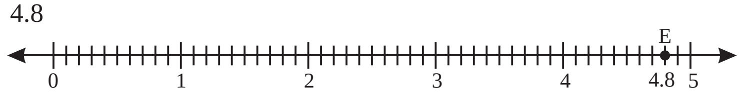
2.4 is nearer to 2.

(d) 3.9

3.9 is present in between 3 and 4.

3.9 is nearer to 4.

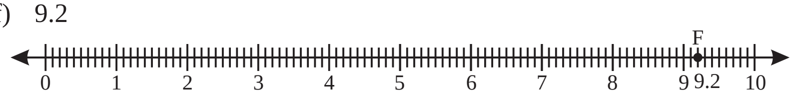
(e) 4.8



4.8 is present in between 4 and 5.

4.8 is nearer to 5.

(f) 9.2

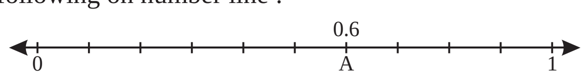


9.2 is present in between 9 and 10.

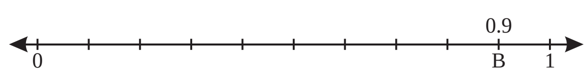
9.2 is nearer to 9.

7. Represent the following on number line :

(a) 0.6 =



(b) 0.9 =



(c) 2.3 =

(d) 4.7 =

(e) 3.5 =

(f) 4.2 =

8. Write the following as decimal :

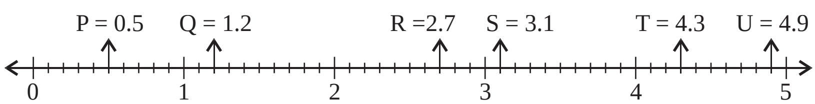
(a) $\frac{27}{10} = 2.7$ (b) $\frac{131}{10} = 13.1$ (c) $\frac{36}{10} = 3.6$

(d) $\frac{125}{10} = 125$ (e) $\frac{246}{10} = 24.6$ (f) $70\frac{4}{10} = \frac{704}{10} = 70.4$

(g) $20 + 6 + \frac{5}{10} = 20 + 6 + 0.5 = 26.5$ (h) $40\frac{3}{10} = \frac{403}{10} = 40.3$

(i) $100 + 5 + \frac{6}{10} = 100 + 5 + 0.6 = 105.6$

9. Write the decimals that are represented by the points P, Q, R, S, T and U on given number line.



Exercise 6.2

1. Convert as cm using decimals : $\left(\frac{1}{10} \text{ mm} = 1\text{cm}\right)$

(a) $5 \text{ mm} = \frac{5}{10} \text{ cm} = 0.5 \text{ cm}$

(b) $124 \text{ mm} = \frac{124}{10} \text{ cm} = 12.4 \text{ cm}$

(c) $9 \text{ cm } 5 \text{ mm} = 9 \text{ cm} + \frac{5}{10} \text{ cm} = 9 \text{ cm} + 0.5 \text{ cm} = 9.5 \text{ cm}.$

(d) $3 \text{ cm } 3 \text{ mm} = 3 \text{ cm} + \frac{3}{10} \text{ cm} = 3 + 0.3 \text{ cm} = 3.3 \text{ cm}$

2. Convert :

(a) 14.2 cm into mm (1 cm = 10 mm)

$14.2 \text{ cm} = 14.2 \times 10 \text{ mm} = 142 \text{ mm}$

(b) 3.4 m into cm (1 m = 100 cm)

$3.4 \text{ m} = 3.4 \times 100 \text{ cm} = 340 \text{ cm}$

(c) 164 cm into m $\quad\quad (1 \text{ m} = \frac{1}{100} \text{ cm})$

$164 \text{ cm} = \frac{164}{100} = 1.64 \text{ m}$

(d) 2500 m into km $\quad\quad \left(1 \text{m} = \frac{1}{1000} \text{ km}\right)$

$2500 \text{ m} = \frac{2500}{1000} = 2.5 \text{ km}$

3. Express as km using decimals :

(a) $8 \text{ m} = \frac{8}{1000} \text{ km}$
$= 0.008 \text{ km}$

(b) $80 \text{ m} = \frac{80}{1000} \text{ km}$
$= 0.08 \text{ km}$

(c) $808 \text{ m} = \frac{808}{1000} \text{ km}$
$= 0.008 \text{ km}$

(d) $17 \text{ km } 70 \text{ m} = 17 \text{ km} + \frac{70}{1000} \text{ km}$
$= 17 \text{ km} + 0.070 \text{ km}$
$= 17.07 \text{ km}$

4. Express as kg using decimals : $\left(\frac{1}{1000} \text{ kg} = 1 \text{g}\right)$

(a) 2 gm
$= \frac{2}{1000} \text{ kg} = 0.002 \text{ kg}$

(b) 100 gm
$= \frac{100}{1000} \text{ kg} = 0.1 \text{ kg}$

(c) 4250 gm
$= \frac{4250}{1000} \text{ kg} = 4.250 \text{ kg}$

(d) $5 \text{ kg } 8 \text{ gm} = 5 \text{ kg} + \frac{8}{1000} \text{ kg}$
$= 5 \text{ kg} + 0.008 \text{ kg} = 5.008 \text{ kg}$

(e) 26 kg 50 gm
$= 26 \text{ kg} + \frac{50}{1000} \text{ kg} = 26 \text{ kg} + 0.05 \text{ kg} = 26.05 \text{ kg}$

5. Convert as rupees using decimals : $\left(\frac{1}{100} = 1 \text{paise}\right)$

(a) 125 paise
$= ₹\,\frac{125}{100} = ₹\, 1.25$

(b) 80 paise
$= ₹\,\frac{80}{100} = ₹\, 0.8$

(c) 50 rupees 90 paise
$= ₹\, 50 + ₹\,\frac{90}{100} = ₹\, 50 + ₹\, 0.9$
$= ₹\, 50.90$

(d) 725 paise
$= ₹\,\frac{725}{100} = ₹\, 7.25$

6. Convert the following into paise :

(a) $₹\, 18.75 = 18 \times 100 \text{ p} + 0.75 \times 100 \text{ p} = 1800 \text{ p} + 75 \text{ p} = 1875 \text{ p}$

(b) $₹\, 20.50 = 20 \times 100 \text{ p} + 0.50 \times 100 \text{ p} = 2000 \text{ p} + 50 \text{ p} = 2050 \text{ p}$

(c) ` $3.01 = 3 \times 100\,p + 0.01 \times 100\ p = 300\,p + 1\,p = 301\,p$

(d) ` $100.00 = 100 \times 100\,p = 10000\,p$

7. Express as metres using decimals :

(a) 15 cm

$= \frac{15}{100}\ m = 0.15\ m$

(b) 60 cm

$= \frac{60}{100} = 0.60\ m$

(c) $2m\ 45\ cm = 2\,m + \frac{45}{100}\ m$

$= 2\,m + 0.45\ m = 2.45\ m$

(d) 4 m 15 cm

$= 4\,m + \frac{15}{100}\ m$

$= 4\,m + 0.15\ m = 4.15\ m$

8. Add the following amount :

(a) Add : ` 435.00 and ` 43.20

` 435.00
+ ` 43.20
` 478.20

(b) Add : ` 49.45 and ` 100.42

` 49.45
+ ` 100.42
` 149.87

(c) Add : ` 150.40 and ` 234.50

` 150.40
+ ` 234.50
` 384.90

(d) Add : ` 270.50 and ` 130.46

` 270.50
+ ` 130.46
` 400.96

9. Subtract :

(a) Subtract ` 27.85 from ` 30.81

` 30.81 – ` 27.85

` 30.81
– ` 27.85
` 2.96

(b) Subtract ` 50.45 from ` 80.30

` 80.30 – ` 50.45

` 80.30
– ` 50.45
` 29.85

(c) Subtract ` 59.05 from ` 70.00

` 70.00
– ` 59.05
` 10.95

(d) Subtract ` 355.62 from ` 395.00

` 395.00
– ` 355.62
` 39.38

10. Subtract :

(a) Subtract : 10 km 200 m from 20 km 435 m

10 km 200 m = 10.200 km

20 km 435 m = 20.435 m

20.435 km – 10.200 km = 10.235 km

20.435 km
– 10.200 km
10.235 km   or   10 km 235 m

(b) Subtract : 15 kg 280 gm from 20 kg 400 gm

15 kg 280 gm = 15.280 kg

20 kg 400 gm = 20.400 kg

20.400 kg – 15.280 kg

$$\begin{array}{r} 20.400 \text{ kg} \\ -\ 15.280 \text{ kg} \\ \hline 5.120 \text{ kg} \end{array}$$

or 5.120 kg = 5 kg 120 g

(c) Subtract : 15 km 300 m from 30 km

15 km 300 m = 15.300 km

30 km = 30 km

$$\begin{array}{r} 30.000 \text{ km} \\ -\ 15.300 \text{ km} \\ \hline 14.700 \text{ km} \end{array}$$

or 14 km 700 m

(d) Subtract : 6 cm 5 mm from 8 cm 2 mm

6 cm 5 mm = 6.5 cm

8 cm 2 m = 8.2 cm

8.2 cm – 6.5 cm = 1.7

$$\begin{array}{r} 8.2 \text{ cm} \\ -\ 6.5 \text{ cm} \\ \hline 1.7 \text{ cm} \end{array}$$

or 1 cm 7 mm

Exercise 6.3

1. Find the sum in each of the following :

(a) 0.009 + 3.142 + 30.08

$$\begin{array}{r} 0.009 \\ 3.142 \\ +\ 30.080 \\ \hline 33.231 \end{array}$$

(b) 15.06 + 1.45 + 6.723

$$\begin{array}{r} 15.060 \\ 1.450 \\ +\ 6.723 \\ \hline 23.233 \end{array}$$

(c) 27.067 + 2.45 + 1.38

$$\begin{array}{r} 27.067 \\ 2.450 \\ +\ 1.380 \\ \hline 30.897 \end{array}$$

(d) 0.75 + 10.425 + 3.4

$$\begin{array}{r} 0.750 \\ 10.425 \\ +\ 3.400 \\ \hline 14.575 \end{array}$$

2. Subtract the following :

(a) 9.892 – 6.56

$$\begin{array}{r} 9.892 \\ -\ 6.560 \\ \hline 3.332 \end{array}$$

(b) 21.751 – 12.45

$$\begin{array}{r} 21.751 \\ -\ 12.450 \\ \hline 9.301 \end{array}$$

(c) 18.52 – 6.79

$$\begin{array}{r} 18.52 \\ -\ 6.79 \\ \hline 11.73 \end{array}$$

(d) 11.6 – 9.847

$$\begin{array}{r} 11.600 \\ -\ 9.847 \\ \hline 1.753 \end{array}$$

3. Subtract :

(a) Subtract : 81.45 from 112

$$\begin{array}{rr} & 112.00 \\ - & 81.45 \\ \hline & 30.55 \\ \hline \end{array}$$

(b) Subtract : 6.12 from 81.42

$$\begin{array}{rr} & 81.42 \\ - & 6.12 \\ \hline & 75.30 \\ \hline \end{array}$$

(c) Subtract : 6.79 from 20.32

20.32 – 6.79

$$\begin{array}{rr} & 20.32 \\ - & 6.79 \\ \hline & 13.53 \\ \hline \end{array}$$

(d) Subtract : 9.847 from 11.6

11.6 – 9.847

$$\begin{array}{rr} & 11.600 \\ - & 9.847 \\ \hline & 1.753 \\ \hline \end{array}$$

(e) Subtract : 48.06 from 70

70 – 48.06

$$\begin{array}{rr} & 70.00 \\ - & 48.06 \\ \hline & 21.94 \\ \hline \end{array}$$

(f) Subtract : 19.01 from 45.67

$$\begin{array}{rr} & 45.67 \\ - & 19.01 \\ \hline & 26.66 \\ \hline \end{array}$$

4. Rakhi's mother gave her money = ₹ 110.50

Rakhi's father gave her money = ₹ 115.80

Total money = ₹ 110.50 + ₹ 115.80 = ₹ 226.30

$$\begin{array}{rr} & ₹\ 110.50 \\ + & ₹\ 115.80 \\ \hline & ₹\ 226.30 \\ \hline \end{array}$$

Thus, ₹ 226.30 is given to Rakhi by her parents.

5. Length of cloth for shirt = 3 m 20 cm = 3.20 cm

Length of cloth for trouser = 2 m 15 cm = 2.15 cm

Total length = 3.20 m + 2.15 m = 5.35 m

Thus, Ankita bought 5 m 35 cm cloth.

$$\begin{array}{rr} & 3.20\text{ m} \\ + & 2.15\text{ m} \\ \hline & 5.35\text{ m} \\ \hline \end{array}$$

6. Sum of 182.38 and 132.91

$$\begin{array}{rr} & 182.38 \\ + & 132.91 \\ \hline & 315.29 \\ \hline \end{array}$$

Subtract 315.29 from 998.45

$$\begin{array}{rr} & 998.45 \\ + & 315.29 \\ \hline & 683.16 \\ \hline \end{array}$$

7. Cost of a school bag = ₹ 275

Cost of a lunh box = ₹ 95

Total cost = ₹ 275 + ₹ 95 = ₹ 370

$$\begin{array}{rr} & ₹\ 275 \\ + & ₹\ 95 \\ \hline & ₹\ 370 \\ \hline \end{array}$$

Total money had = ₹ 1000

Money spent = ₹ 370

Money left = ₹ (1000 – 370) = ₹ 630

Thus, ₹ 630 is left with her.

$$\begin{array}{rr} & ₹\ 1000 \\ - & ₹\ 370 \\ \hline & ₹\ 630 \\ \hline \end{array}$$

8. Let x should be added to 20.75 to get 25.5

$$x + 20.75 = 25.50$$
$$x = 25.50 - 20.75 = 4.75$$

$$\begin{array}{r} 25.00 \\ -\ 20.75 \\ \hline 4.75 \\ \hline \end{array}$$

Thus, required number 4.75 to added to get 25.5.

9. Money spent by Aman = ₹ 900.50

Money spent by Pracheta = ₹ 675.25

Clearly, 900.50 > 675.25

Difference = ₹ 900.50 – ₹ 675.25 = ₹ 225.25

$$\begin{array}{r} ₹\ 900.50 \\ -\ \ ₹\ 675.25 \\ \hline ₹\ 225.25 \\ \hline \end{array}$$

Aman spent ₹ 225.25 more than Pracheta.

10. In the sum, decimal point comes directly below the decimal point of the number which are added.

Sum of 10001.0001 and 0.00001

$$\begin{array}{r} 10001.001 \\ +\quad 0.00001 \\ \hline 10001.00101 \\ \hline \end{array}$$

11. This is so because decimals combine with whole numbers to give another number greater than a particular number. For example, if we add 0.4 to 1.0 we get 1.4 which is greater than 1.

$$0.4 + 1 = 1.4$$
$$1.4 > 1$$

Multiple Choice Questions

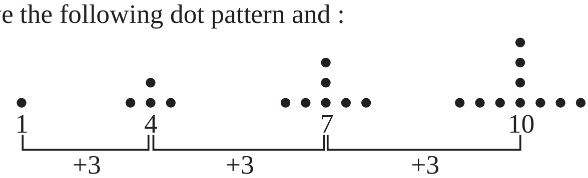
Tick (✓) the correct answer :

1. (c) **2.** (c) **3.** (a) **4.** (b) **5.** (c) **6.** (b) **7.** (a) **8.** (a) **9.** (b)

7 Introduction to Algebra

Exercise 7.1

1. Observe the following dot pattern and :

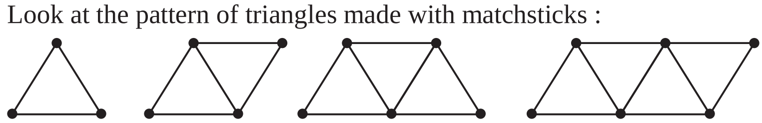


(a) The generalize statement for the dots of the nth shape = $3n - 2$

(b) Rule = Adding 3

(c) The pattern numbers = 1, 4, 7, 10, 13.....

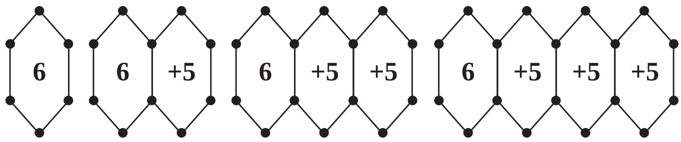
2. Look at the pattern of triangles made with matchsticks :



1 2 3 4

Number of triangles	1	2	3	5	6	11	n
Number of matchsticks	3	5	7	11	13	23	$(n \times 2 + 1)$

3. Look at the pattern of shapes made with matchsticks.



1 2 3 4

Number of Figure	1	2	3	4
Use matchsticks	6	11 $(6 \times 2 - 1)$	16 $(6 \times 3 - 2)$	21 $(6 \times 4 - 3)$

(a) Required matchsticks for 6th shapes :

$$= 6 \times 6 - 5 = 36 - 5 = 31$$

(b) Required matchsticks for 21st shapes :

$$= 6 \times 21 - 20 = 126 - 20 = 106$$

(c) Required matchsticks for nth shapes :

$$= 6 \times n - (n - 1)$$
$$= 6n - n + 1 = 5n + 1$$

4. Find the formula which gives the number of matchsticks required to make the *n*th pattern of each of the following :

(a) Required matchsticks $= 2$
Required matchsticks for nth shapers $= 2n$

(b) Required matchsticks $= 4$
Required matchsticks for nth shapes $= 4n$

(c) Required matchsticks $= 2$
Required matchsticks for nth shapes $= 2n$

(d) Required matchstick $= 3$
Required matchsticks for nth shape $= 3n$

5. Look at the pattern and complete the table :

Four matchsticks $= 1 \times 4 = 4,\ 2 \times 4 = 8,\ 3 \times 4 = 12,\ 4 \times 4 = 16$
For dots $= 1 \times 4 - 0 = 4,\quad 2 \times 4 - 1 = 7,$
$3 \times 4 - 2 = 10,\quad 4 \times 4 - 3 = 13$

Number of squares	1	2	3	4	7	15	n
Number of matchsticks	4	8	12	16	28	$15 \times 4 = 60$	$n \times 4 = 4n$
Number of dots	4	7	10	13	$4 \times 7 - 6 = 22$	$15 \times 4 - 14 = 46$	$(3n + 1)$ $3n + 1$

6. Using the given formula, complete the table :

	Series	Formula	Term to be bind
(a)	16, 19, 22, 25...	$3n + 13$	25th term $= 3 \times 25 + 13 = 88$
(b)	5, 12, 19, 26,...	$7n - 2$	100th term $= 7 \times 100 - 2 = 698$
(c)	-1, 2, 5, 8, ...	$3n - 4$	31th term $= 3 \times 31 - 4 = 89$

Exercise 7.2

1. Which out the following are expressions with numbers only?

(a), (b) and (e) are exressions with number only.

2. Write the following in the form of algebraic expressions :

(a) $xy + x + y$ (b) $x - y$ (c) $\frac{x}{4} + y + z$

(d) $2y + 11$ (e) $x - 10$

3. For the value of x given in the boxes, find the value of the expression in each table :

(a)

x	expression
3	$3x - 1 = 3 \times 3 - 1 = 9 - 1 = 8$
2	$3x + 1 = 3 \times 2 + 1 = 6 + 1 = 7$
0	$4x + 5 = 4 \times 0 + 5 = 0 + 5 = 5$
-1	$x + 5 = -1 + 5 = 4$
-4	$7x + 29 = -7 \times 4 + 29 = -28 + 29 = 1$

(b)

x	expression
8	$6x - 46 = 6 \times 8 - 46 = 48 - 46 = 2$
10	$x - 10 = 10 - 10 = 0$
-1	$4 - 7x = 4 - 7(-1) = 4 + 7 = 11$
9	$x - 8 = 9 - 8 = 1$
2	$3x + 2 = 3 \times 2 + 2 = 6 + 2 = 8$

4. Translate into algebraic expression :

(a) $5x + 3$ (b) $6n - 5$

5. $x + x + x$, $3x$ **6.** $10m + n$

7. $(k + 5)$ years **8.** $(k - m)$ years

9. State in words the meaning of the following algebraic expressions :

(a) 7 more than a number x (b) y subtracted from 2 times x

(c) 3 times the product of a and b (d) x divided by y

Exercise 7.3

1. $\frac{m^2}{3n}$; put $m=6$ and $n=3$

$$\frac{(6)^2}{3\times 3}=\frac{36}{9}=4$$

Value of $\frac{m^2}{3n}=4$

2. $\frac{xy}{w}-(x+w)$

(Putting $x=25;\ y=36$ and $w=20$)

$$=\frac{25\times 36}{20}-(25+20)$$
$$=\frac{900}{20}-45$$
$$=\frac{900-45\times 20}{20}=\frac{900-900}{20}=\frac{0}{20}=0$$

3. Value of $3x+(2y\times z)$

Putting $x=7,\ y=6$ and $z=4$

$$=3\times 7+(2\times 6\times 4)=21+(12\times 4)=21+48=69$$

4. Find the value of the following expressions for the given values of variables :

(a) Substituting the values of $x=3$ and $a=5$ in the given expression, we get

$$5+4x^3-4x+2a=5+4(3)^3-4(3)+2\times 5$$
$$=5+4\times 27-4\times 3+10$$
$$=5+108-12+10$$
$$=123-12$$
$$=111$$

(b) Substituting the values of $x=-1,\ y=2$ and $z=1$ in the given expression, we get

$$4xyz-2xy+3xyz=4\times(-1)\times 2\times 1-2\times(-1)\times 2+3\times(-1)\times 2\times 1$$
$$=-8+4-6$$
$$=-14+4=-10$$

(c) Substituting the value of $x=1,\ y=-2$ and $z=3$ given expression, we get

$x^2-y^2-z^2$

$$(1)^2-(-2)^2-(3)^2=1-4-9$$
$$=1-13=-12$$

(d) Substituting the value of $a=0,\ b=1$ and $c=1$ in the given expression, we get

$$a^2-2b^2+3c^2=(0)^2-2(1)^2+3(1)^2$$
$$0-2\times 1+3\times 1=3-2=1$$

(e) Substituting the value of $a = 2, b = 3$ and $c = 5$ in the given expression, we get

$$4a - 3b + c = 4 \times 2 - 3 \times 3 + 5$$
$$= 8 - 9 + 5$$
$$= 13 - 9 = 4$$

(f) Substituting the value of $x = 1$ and $y = 2$ in the given expression, we get

$$x^2 y + x^2 y^2 - xy^2 = (1)^2 \times 2 + (1)^2 (2)^2 - 1 \times (2)^2$$
$$= 1 \times 2 + 1 \times 4 - 1 \times 4$$
$$= 2 + 4 - 4$$
$$= 6 - 4 = 2$$

Multiple Choice Questions

Tick (3) the correct answers :

1. (c) **2.** (b) **3.** (a) **4.** (d) **5.** (c) 6. (a) **7.** (b) **8.** (c) **9.** (a) **10.** (c)

Higher Order Thinking Skills (HOTS)

Complete the table given below, based on the pattern of dots and line segments. Also generalize and find the expression for the number of dots and segments used in case of *n* squares.

Number of squares	1	2	3	4	5	10	n
Number of dots	4	8	$3 \times 4 = 12$	$4 \times 4 = 16$	20	$10 \times 4 = 40$	$n \times 4 = 4n$
Number of line segments	$5 \times 1 - 1 = 4$	$5 \times 2 - 1 = 9$	$5 \times 3 - 1 = 14$	$5 \times 4 - 1 = 19$	$5 \times 5 - 1 = 24$	$5 \times 10 - 1 = 49$	$(4n + n - 1) = 5n - 1$

8 Algebraic Equations (Linear Equation)

Exercise 8.1

1. Solve each of the following equations by the trial-and-error method :

We make a guess and try serval values of x and find the values of the LHS and RHS.

(a) $2x + 3 = 3x$

x	**LHS**	**RHS**
1	$2 \times 1 + 3 = 5$	$3 \times 1 = 3$
2	$2 \times 2 + 3 = 7$	$3 \times 2 = 6$
3	$2 \times 3 + 3 = 9$	$3 \times 3 = 9$

Hence, $x = 3$ is solution of the equation.

(b) $x - 4 = 2x - 6$

x	LHS	RHS
1	$1-4=-3$	$2\times1-6=-4$
2	$2-4=-2$	$2\times2-6=-2$

Hence, $x = 2$ is the solution of the equation.

(c) $10 - x = 6$

x	LHS	RHS
1	$10-1=9$	6
2	$10-2=8$	6
3	$10-3=7$	6
4	$10-4=6$	6

Hence, $x = 4$ is the solution of the equation.

(d) $x + 7 = 7$

x	LHS	RHS
0	$0+7=7$	7

Hence, $x = 0$ is the solution of the equation.

(e) $x + 5 = 8$

x	LHS	RHS
1	$1+5=6$	8
2	$2+5=7$	8
3	$3+5=8$	8

Hence, $x = 3$ is the solution of the equation.

(f) $x - 3 = 7$

x	LHS	RHS
1	$1-3=-2$	7
2	$2-3=-1$	7
3	$3-0=0$	7
4	$4-3=1$	7
5	$5-3=2$	7
6	$6-3=3$	7
7	$7-3=4$	7

8	$8-3=5$	7
9	$9-3=6$	7
10	$10-3=7$	7

Hence, $x=10$ is the solution of the equation.

(g) $\frac{x}{2}=3$

x	LHS	RHS
1	$\frac{1}{2}$	3
2	$\frac{2}{2}=1$	3
3	$\frac{3}{2}$	3
4	$\frac{4}{2}=2$	3
5	$\frac{5}{2}$	3
6	$\frac{6}{2}=3$	3

Hence, $x=6$ is the solution of the equation.

(h) $2x+4=3x$

x	LHS	RHS
1	$2\times1+4=6$	$3\times1=3$
2	$2\times2+4=8$	$3\times2=6$
3	$2\times3+4=10$	$3\times3=9$
4	$2\times4+4=12$	$3\times4=12$

Hence, $x=4$ is the solution of the equation.

(i) $3x=9$

x	LHS	RHS
1	$3\times1=3$	9
2	$3\times2=6$	9
3	$3\times3=9$	9

Hence, $x=3$ is the solution of the equation.

2. Verify by substitution that :

(a) The root of $3x-5=7$ is $x=4$

Value of $x=4$ putting in $3x-5$

$$3\times 4-5=7$$
$$12-5=7$$
$$7=7$$

LHS = RHS

(b) The root of $3+2x=9$ is $x=3$

Value of $x=3$ putting in $3+2x=9$

$$3+2\times 3=9$$
$$3+6=9$$
$$9=9$$

LHS = RHS

(c) The root of $5x-8=2x-2$ is $x=2$

Value of $x=2$ putting in $5x-8=2x-2$

$$\text{LHS}=5\times 2-8=10-8=2$$
$$\text{RHS}=2\times 2-2=4-2=2$$
$$2=2$$

LHS = RHS

(d) The root of $8-7y=1$ is $y=1$

Value of $y=1$, putting in $8-7y=1$

$$8-7\times 1=8-7=1$$

LHS = RHS

(e) The root of $\frac{z}{7}=8$ is $z=56$

Value of $z=56$, putting in $\frac{z}{7}=8$

$$\frac{56}{7}=8$$
$$8=8$$

LHS = RHS

3. Write a statement for each of the equations, given below :

(a) 7 less than x is 5
(b) x less than 3 is 7
(c) 7 more than x is 10
(d) x divided by 5 is 7
(e) 4 more than twice x is 10
(f) 11 more than x is 17

4. Write each of the following statements as an equation :

(a) $4x-3=17$
(b) $5x=40$
(c) $x+8=15$
(d) $25-x=1$
(e) $x-5=3$
(f) $3x-5=16$
(g) $x-12=24$
(h) $19-2x=11$
(i) $6x=x+5$
(j) $\frac{x}{8}=7$

Exercise 8.2

1. Solve each of following equation and verify answer :

(a) $\frac{3x}{10} - 4 = 14$

$$\frac{3x - 4 \times 10}{10} = 14$$
$$3x - 40 = 14 \times 10$$
$$3x - 40 = 140$$
$$3x = 140 + 40$$
$$3x = 180$$
$$x = \frac{180}{3} = 60$$
$$x = 60$$

Verification : $x = 60$ putting in $\frac{3x}{10} - 4 = 14$

$$\frac{3 \times 60}{10} - 4 = 14$$
$$\frac{180}{10} - 4 = 14$$
$$18 - 4 = 14$$
$$14 = 14$$
$$\text{RHS} = \text{LHS}$$

(b) $\frac{x-3}{5} - 2 = \frac{2x}{5}$

$$\frac{x - 3 - 2 \times 5}{5} = \frac{2x}{5}$$
$$\frac{x - 3 - 10}{5} = \frac{2x}{5}$$
$$\frac{x - 13}{5} = \frac{2x}{5}$$
$$5(x - 13) = 2x \times 5 \quad \text{(cross multiplication)}$$
$$5x - 13 \times 5 = 10x$$
$$5x - 65 = 10x$$
$$-65 = 10x - 5x$$
$$-65 = 5x$$
$$x = \frac{-65}{5} = -13$$
$$x = -13$$

Verification : $x = -13$ putting in $\frac{x-3}{5} - 2 = \frac{2x}{5}$

$$\frac{-13 - 3}{5} - 2 = \frac{2 \times (-13)}{5}$$

$$\frac{-16}{5} - 2 = \frac{-26}{5}$$
$$\frac{-16 - 2 \times 5}{5} = \frac{-26}{5}$$
$$\frac{-16 - 10}{5} = \frac{-26}{5}$$
$$\frac{-26}{5} = \frac{-26}{5}$$
$$\text{RHS} = \text{LHS}$$

(c) $\frac{2x}{5} - \frac{3}{2} = \frac{x}{2} + 1$

$$\frac{2x \times 2 - 3 \times 5}{10} = \frac{x + 2}{2}$$
$$\frac{4x - 15}{10} = \frac{x + 2}{2} \quad \text{(Cross multiplication)}$$
$$2(4x - 15) = 10(x + 2)$$
$$8x - 30 = 10x + 20$$
$$8x - 10x = 20 + 30$$
$$-2x = 50$$
$$x = \frac{50}{-2} = -25$$
$$x = -25$$

Verification : $(x = -25)$ putting in $\frac{2x}{5} - \frac{3}{2} = \frac{x}{2} + 1$

$$\frac{2 \times (-25)}{5} - \frac{3}{2} = \frac{-25}{2} + 1$$
$$\frac{-50}{5} - \frac{3}{2} = \frac{-25 + 2}{2}$$
$$\frac{-50 \times 2 - 3 \times 5}{10} = \frac{-23}{2}$$
$$\frac{-100 - 15}{10} = \frac{-23}{2}$$
$$\frac{-115}{10} \text{ or } \frac{-23}{2} = \frac{-23}{2}$$
$$\text{LHS} = \text{RHS}$$

(d) $\frac{2m}{3} + 8 = \frac{m}{2} - 1$

$$\frac{2m + 8 \times 3}{3} = \frac{m - 1 \times 2}{2}$$
$$\frac{2m + 24}{3} = \frac{m - 2}{2}$$
$$2(2m + 24) = 3(m - 2) \text{(Cross multiplication)}$$

$$4m + 48 = 3m - 6$$
$$4m - 3m = -6 - 48$$
$$m = -54$$
$$m = -54$$

Verification : $(m = -54)$ putting in $\frac{2m}{3} + 8 = \frac{m}{2} - 1$

$$\frac{2 \times (-54)}{3} + 8 = \frac{-54}{2} - 1$$
$$\frac{-108}{3} + 8 = -27 - 1$$
$$-36 + 8 = -28$$
$$-28 = -28 \qquad \text{LHS} = \text{RHS}$$

(e) $\frac{n}{4} - 5 = \frac{n}{6} + \frac{1}{2}$

$$\frac{n - 5 \times 4}{4} = \frac{n + 3}{6} \qquad\qquad \frac{n - 20}{4} \quad \frac{n + 3}{6}$$
$$6(n - 20) = 4(n + 3) \qquad\qquad 6n - 120 = 4n + 12$$
$$6n - 4n = 120 + 12 \qquad\qquad 2n = 132$$
$$n = \frac{132}{2} = 66 \qquad\qquad n = 66$$

Verification : $(n = 66)$ putting in $\frac{n}{4} - 5 = \frac{n}{6} + \frac{1}{2}$

$$\frac{66}{4} - 5 = \frac{66}{6} + \frac{1}{2}$$
$$\frac{66 - 5 \times 4}{4} = \frac{66 + 3}{6}$$
$$\frac{66 - 20}{4} = \frac{69}{6} \qquad\qquad \frac{46}{4} = \frac{69}{6}$$
$$\frac{23}{2} = \frac{23}{2} \qquad\qquad \text{LHS} = \text{RHS}$$

(f) $3(2 - 5x) - 2(1 - 6x) = 1$

$$(6 - 15x) - (2 - 12x) = 1$$
$$6 - 15x - 2 + 12x = 1$$
$$6 - 2 - 15x + 12x = 1$$
$$4 - 3x = 1$$
$$-3x = 1 - 4$$
$$x = -3 \div -3 = 1$$
$$x = 1$$

Verification : $(x = 1)$ putting in $3(2 - 5x) - 2(1 - 6x) = 1$

$$= 3(2 - 5 \times 1) - 2(1 - 6 \times 1) = 1$$
$$= (3 \times 2 - 5 \times 3) - 2 \times 1 + 12 = 1$$
$$= -9 + 10 = 1$$
$$1 = 1$$
$$\text{RHS} = \text{LHS}$$

2. Solve the following equation and check the result in each case :

(a) $3x - 3 = 12$ (Adding 3 in both sides)

$$3x - 3 + 3 = 12 + 3$$
$$3x = 15$$
$$x = \frac{15}{3} = 5$$
$$x = 5$$

Check : Value of x put in $3x - 3$

$$3 \times 5 - 3 = 15 - 3 = 12$$
$$12 = 12$$
$$\text{LHS} = \text{RHS}$$

(b) $3 - x = 1$ (Subtracting 3 in both sides)

$$3 - 3 - x = 1 - 3$$
$$-x = -2$$
$$x = 2$$

Check : x's value putting in $(3 - x)$

$$3 - 2 = 1$$
$$1 = 1$$
$$\text{RHS} = \text{LHS}$$

(c) $x + 2 = 7$ (Subtracting 2 in both sides)

$$x + 2 - 2 = 7 - 2$$
$$x = 5$$

Check : x's value putting in $(x + 2)$

$$5 + 2 = 7$$
$$7 = 7$$
$$\text{RHS} = \text{LHS}$$

(d) $x + 5 = -7$ (Subtracting 5 in both sides)

$$x + 5 - 5 = -7 - 5$$
$$x = -12$$

Check : x's value putting in $(x + 5)$

$$-12 + 5 = -7$$
$$\text{RHS} = \text{LHS}$$

(e) $\frac{3x}{5} = 18$ (Dividing $\frac{3}{5}$ in both sides)

$$\frac{3x}{5} \div \frac{3}{5} = 18 \div \frac{3}{5}$$
$$x\left(\frac{3}{5} \times \frac{5}{3}\right) = 18 \times \frac{5}{3}$$
$$x = 30$$

Check : Value of $x = 30$ putting in $\frac{3x}{5}$

$$\frac{3 \times 30}{5} = 18$$

$$18 = 18$$
$$\text{LHS} = \text{RHS}$$

(f) $x - 2 = -5$ (Adding 2 in both sides)

$$x - 2 + 2 = -5 + 2$$
$$x = -3$$

Check : Value of $x = -3$ putting in $(x - 2)$

$$-3 - 2 = -5$$
$$-5 = -5$$
$$\text{LHS} = \text{RHS}$$

(g) $4x - 4 = 16$ (Adding 4 in both sides)

$$4x - 4 + 4 = 16 + 4$$
$$4x = 20$$
$$x = \frac{20}{4} = 5$$
$$x = 5$$

Check : Value of $x = 5$ putting in $(4x - 4)$

$$4 \times 5 - 4 = 20 - 4 = 16$$
$$16 = 16$$
$$\text{LHS} = \text{RHS}$$

(h) $\frac{x}{2} = \frac{x}{3} + 5$

$$\frac{x}{2} + 5 = \frac{x}{3} + 5 + 5 \quad \text{(Adding 5 in both sides)}$$
$$\frac{x + 10}{2} = \frac{x + 10 \times 3}{3}$$
$$3(x + 10) = 2(x + 30) \quad \text{(Cross multiplication)}$$
$$3x + 30 = 2x + 60$$
$$3x - 2x = 60 - 30$$
$$x = 30$$
$$x = 30$$

Value of $x = 30$ putting in $\frac{x}{2} = \frac{x}{3} + 5$

$$\frac{30}{2} = \frac{30}{3} + 5$$
$$15 = 10 + 5$$
$$15 = 15$$
$$\text{LHS} = \text{RHS}$$

(i) $6x - 5 = 2x + 11$ (Adding 5 in both sides)

$$6x + 5 - 5 = 2x + 11 + 5$$
$$6x = 2x + 16$$
$$6x - 2x = 16 \quad \text{(By transposing } 2x \text{ to LHS)}$$
$$4x = 16$$
$$x = \frac{16}{4} = 4$$

$$x = 4$$

Check : x's value $(x = 4)$ putting in $6x - 5 = 2x + 11$

$$\text{LHS} = 6 \times 4 - 5 = 24 - 5 = 19$$
$$\text{RHS} = 2 \times 4 + 11 = 8 + 11 = 19$$
$$19 = 19$$
$$\text{LHS} = \text{RHS}$$

3. Solve the following :

(a) $3(x+2) - 2(x-3) = 5$

$$3x + 6 - 2x + 6 = 5$$
$$3x - 2x + 6 + 6 = 5$$
$$x + 12 = 5$$
$$x = -7$$

(b) $\frac{3y}{10} - 4 = 11$

$$\frac{3y - 4 \times 10}{10} = 11 \qquad \frac{3y - 40}{10} = 11$$
$$3y - 40 = 11 \times 10 \qquad 3y = 150$$
$$y = \frac{150}{3} = 50 \qquad y = 50$$

(c) $\frac{m}{4} - \frac{1}{2} = \frac{m}{3} + 1$

$$\frac{m}{4} - \frac{m}{3} = 1 + \frac{1}{2} \qquad \frac{3m - 4m}{12} = \frac{2+1}{2}$$
$$\frac{-m}{12} = \frac{3}{2} \qquad -2m = 12 \times 3$$
$$m = \frac{36}{-2} = -18$$
$$m = -18$$

(d) $3(x+6) + 2(x+3) = 54$

$$3x + 18 + 2x + 6 = 54$$
$$3x + 2x + 18 + 6 = 54$$
$$5x + 24 = 54$$
$$5x = 54 - 24$$
$$5x = 30$$
$$x = \frac{30}{5}$$
$$x = 6$$

(e) $\frac{2x}{3} + 8 = \frac{x}{2} - 1$

$$\frac{2x}{3} + 8 + 1 = \frac{x}{2} \qquad \frac{2x}{3} + 9 = \frac{x}{2}$$

$$\frac{2x+27}{3} = \frac{x}{2}$$ (Cross-multiplication)

$$2(2x+27) = 3x$$
$$4x + 54 = 3x$$
$$x = -54$$

(f) $(12m-3) = 5(2m+1)$

$$12m - 3 = 10m + 5$$
$$12m - 10m = 5 + 3$$
$$2m = 8$$
$$m = \frac{8}{2} = 4$$
$$m = 4$$

(g) $\frac{m}{4} + 8 = 12$

$$\frac{m}{4} = 12 - 8$$
$$\frac{m}{4} = 4$$
$$m = 4 \times 4 = 16$$
$$m = 16$$

(h) $6x + 5 = 3x + 20$

$$6x - 3x = 20 - 5$$
$$3x = 15$$
$$x = \frac{15}{3} = 5$$
$$x = 5$$

(i) $2(x-2) - 3(x-3) = 5(x-5)$

$$2x - 4 - 3x + 9 = 5x - 25$$
$$2x - 3x + 9 - 4 = 5x - 25$$
$$-x + 5 = 5x - 25$$
$$-x - 5x = -25 - 5$$
$$-6x = -30$$
$$x = 5$$

Exercise 8.3

1. Let a number be x.

According to question,

$$x + 80 = 2x$$
$$80 = 2x - x$$
$$80 = x$$

So, required number is 80.

2. Let one natural number $= x$

Second number $= x + 1$

Third number $= x + 2$

Sum of these numbers $= x + x + 1 + x + 2 = 3x + 3$

According to question,

Sum of these numbers $= 114$

$$3x + 3 = 114$$
$$3x = 114 - 3$$
$$3x = 111$$
$$x = \frac{111}{3} = 37$$

$$x = 37$$

The numbers are : $x, x+1, x+2$

$37, (37+1), (37+2)$

$37, 38, 39$

3. Let the number be x

x multiply by 17 and add 4 $= x \times 17 + 4 = 17x + 4$

According the question,

$$17x + 4 = 225$$
$$17x = 225 - 4$$
$$x = \frac{221}{17} = 13$$
$$x = 13$$

Thus, the number is 13.

4. Let Rekha's present age be x years

Then, her mother's present age $= (x + 27)$ years

Rekha's age after 8 years $= (x + 8)$ years

Her mother's age after 8 year $= (x + 27 + 8) = (x + 35)$ years

According to question,

$$x + 35 = 2(x + 8)$$
$$x + 35 = 2x + 16$$
$$2x - x = 35 - 16$$
$$x = 19$$

Rekha's present age $= 19$ years

And, her mother's present age $= (19 + 27)$ years $= 46$ years.

5. Let breadth of a wire x cm.

Length of a wire $= (x + 7)$ cm

Perimeter of rectangle $= 2(l + b) = 2(x + x + 7)$

$= 2(2x + 7) = (4x + 14)$ cm

According question,

$$4x + 14 = 86$$
$$4x = (86 - 14) \text{ cm}$$
$$4x = 72 \text{ cm}$$
$$x = \frac{72}{4} \text{ cm} = 18 \text{ cm}$$

So, breadth of a wire $= 18$ cm, length of a wire $(18 + 7)$ cm $= 25$ cm.

6. Let breadth of a park be x m.

So, length of a park $= (x + 5)$ m

Perimeter of a park $= 2(l + b) = 2(x + x + 5)$ m

$= 2(2x + 5) = (4x + 10)$ m

According to question,

$$4x + 10 = 74$$
$$4x = 74 - 10$$

$$x = \frac{64}{4} = 16\,\text{m}$$

$$x = 16\,\text{m}$$

So, length $= (16 + 5)\,\text{m} = 21\,\text{m}$; breadth $= 16\,\text{m}$.

7. Let breadth of a rectangular field be x m.

Length of a rectangular field $= 3x$ m

Perimeter of a field $= 2(l + b) = 2(x + 3x)$ m

$= 2 \times 4x = 8x$ m

According to question :

$$8x = 168$$

$$x = \frac{168}{8}\,\text{m} = 21\,\text{m}$$

$$x = 21\,\text{m}$$

So, breadth $= 21\,\text{m}$, length $= 3 \times 21 = 63\,\text{m}$.

8. Let one number be x.

And, second number be $(x + 18)$.

Sum of their number

$$x + x + 18 = 2x + 18$$

According to question,

$$2x + 18 = 92$$

$$2x = 92 - 18$$

$$x = \frac{74}{2} = 37$$

So, the one number is 37 and the second number is $37 + 18 = 55$.

9. Let the present age of Mr. Sharma's son be x years.

Then, Mr Sharma's age $= 3 \times x$ years $= 3x$ years

Mr Sharma son's age before 3 years $= (x - 3)$ years

Then, his age before 3 years $= (3x - 3)$ years

According to question,

$$4(x - 3) = (3x - 3)$$

$$4x - 12 = 3x - 3$$

$$4x - 3x = -3 + 12$$

$$x = 9$$

The present age of son $= 9$ years.

Mr Sharma's age $= 9 \times 3$ years $= 27$ years.

10. Number of girls $= x$

Number of boys $= x + 334$

Total strength $= 572$

$$x + x + 334 = 572$$

$$2x = 572 - 334$$

$$x = \frac{238}{2} = 119$$

Thus, 119 girls in the school.

11. In ΔABC,

$$A + \quad B + \quad C = 180°$$
$$2x° + x° + 3x° = 180°$$
$$6x° = 180°$$
$$x° = \frac{180°}{6} = 30°$$

Thus, The magnitude of $A = 2 \times 30° = 60°$
The magnitude of $B = 30° = 30°$
The magnitude of $C = 3 \times 30° = 90°$

12. Let number of coins of 50 paise be x

Number of coins of 25 paise $= 4x$

Value of 50 paise coin $= x \times 0.50 =$ ` $0.50\,x$

Value of 25 paise coins $= 4x \times 0.25 =$ ` $1.0\,x$

According to question,

Total money = ` 30

` $1.00\,x$ + ` $0.50\,x$ = ` 30

` $1.50\,x$ = ` 30

x = ` $\dfrac{\text{` } 30}{\text{` } 1.50} = 20$

Number of coins of 50 paise is 20

And number of coin of 25 paise $= 20 \times 4 = 80$.

13. Let, the present age of Mr. Bhaskar's son be x years.

Mr Bhaskar's present age $= 4x$ years

After 16 year,

His son's age $= (x + 16)$ years

His age $= (4x + 16)$ years

According to question $(x + 16)\,2 = 4x + 16$

$$2x + 32 = 4x + 16$$
$$32 - 16 = 4x - 2x$$
$$16 = 2x$$
$$x = \frac{16}{2} = 8 \text{ years}$$

His son's age $= 8$ years and his age $= 32$ years.

14. Let Vikram's age be x years

Then, Manav's age $= 2x$ years

Difference of their ages $= 11$ years

$$2x - x = 11$$
$$x = 11 \text{ years}$$

Vikram's age $= 11$ years, Manav's age
$= 22$ years

15. Let Akash's age be x years
Kamal's age $= (x + 6)$ years
Sum of their age $= 28$ years

$$x + (x + 6) = 28$$
$$2x + 6 = 28$$
$$2x = 28 - 6 \qquad x = \frac{22}{2} = 11 \text{ years}$$

Akash's age $= 11$ years and Kamal's age $= 17$ years.

16. In square $ABCD$,

$$DC = (3x - 8)\text{ cm}; \; BC = (x + 4)\text{ cm}$$

We know that, sides of a square is equal in length.

$$DC = BC$$
$$3x - 8 = x + 14$$
$$3x - x = (14 + 8)\text{ cm}$$
$$2x = 22\text{ cm} \qquad x = \frac{22}{2}\text{ cm} = 11\text{ cm}$$

$DC = (3 \times 11 - 8)\text{ cm} = 33 - 8\text{ cm} = 25\text{ cm}$

Perimeter of square $= 4 \times$ side
Perimeter of square $= 4 \times 25 = 100$ cm

17. Since, $ABCD$ is a rectangle

$$DC = (4a + 3)\text{ cm}; \; BC = (2a + 1)\text{ cm}$$

Perimeter $= 2(BC + DC) = 2\{(4a + 3) + (2a + 1)\}$ cm

$$= 2\{4a + 3 + 2a + 1\}$$
$$= 2\{6a + 4\} = 12a + 8$$

According to question, $(10a + 12)$ m is the perimeter.

$$10a + 12 = 12a + 8$$
$$10a - 12a = 8 - 12$$
$$-2a = -4$$
$$a = 2$$

Value of $a = 2$ cm.

MCQs

Tick (3) the correct answer :

1. (a) **2.** (c) **3.** (b) **4.** (d) **5.** (c) **6.** (c) **7.** (b) **8.** (a) **9.** (d) **10.** (c)

Higher Order Thinking Skills (HOTS)

1. (a) In square $ABCD$,

$$AB = 2K + 7$$
$$BC = 3K - 7$$
$$AB = BC$$
$$2K + 7 = 3K - 7$$
$$7 + 7 = 3K - 2K$$
$$14 = K$$

(b) In Triangle ΔABC,

$$AB = BC = AC$$

$$AB = 3K - 4,\ BC = 2K + 1;\ AC = K + 6$$

$$AB = BC$$

$$3K - 4 = 2K + 1$$

$$3K - 2K = 1 + 4$$

$$K = 5$$

Value of $K = 5$ cm

2. In triangle ΔABC,

$AB = x + 1;$ $AC = 2x + 1,$ $BC = 5x + 7$

Perimeter of triangle $= AB + AC + BC$

$$= x + 1 + 2x + 1 + 5x + 7$$

$$= 8x + 9$$

According to question,

Perimeter of triangle $= 4x + 25$

$$8x + 9 = 4x + 25$$

$$8x - 4x = 25 - 9$$

$$4x = 16$$

$$x = \frac{16}{4} = 4$$

Value of $x = 4$.

9 Ratio, Proportion and Unitary Method

Exercise 9.1

1. Express each one of the following ratios in its simplest form :

(a) 500 : 1000

$$= \frac{500 \div 500}{1000 \div 500} = \frac{1}{2} \text{ or } 1 : 2$$

(b) $450 : 270$

$$= \frac{450 \div 90}{270 \div 90} = \frac{5}{3} \text{ or } 5 : 3$$

(c) $17 : 34$

$$= \frac{17 \div 17}{34 \div 17} = \frac{1}{2} \text{ or } 1 : 2$$

(d) $65 : 91$

$$= \frac{65 \div 13}{91 \div 13} = \frac{5}{7} \text{ or } 5 : 7$$

(e) $50 : 225$

$$= \frac{50 \div 25}{225 \div 25} = \frac{2}{9} \text{ or } 2 : 9$$

(f) $70 : 42$

$$= \frac{70 \div 14}{42 \div 14} = \frac{5}{3} \text{ or } 5 : 3$$

(g) $100 : 150$

$$= \frac{100 \div 50}{150 \div 50} = \frac{2}{3} \text{ or } 2 : 3$$

(h) $33 : 99$

$$= \frac{33 \div 33}{99 \div 33} = \frac{1}{3} \text{ or } 1 : 3$$

(i) $25 : 45$

$$= \frac{25 \div 5}{45 \div 5} = \frac{5}{9} \text{ or } 5 : 9$$

(j) $16 : 18$

$$= \frac{16 \div 2}{18 \div 2} = \frac{8}{9} \text{ or } 8 : 9$$

2. Find the ratio of the following :

(a) Ratio of 400 mL to 1.6 L

Ratio of 400 mL to $1.6 \times 1000\,\text{mL}$ $\quad$ (1 L $= 1000\,\text{mL}$)

Ratio of 400 mL to 1600 mL

$$400 : 1600$$

Ratio $= 1 : 4$

(b) Ratio of 60 paise to ` 1

Ratio of 60 paise to 100 paise $\quad$ (` $1 = 100\,\text{p}$)

$$60 : 100$$

Ratio $= 3 : 5$

(c) Ratio of 25 cm to 2.5 m

Ratio of 25 cm to $2.5 \times 100\,\text{cm}$ $\quad$ (1 m $= 100\,\text{cm}$)

Ratio of 25 cm to 250 cm

Ratio $= 25 : 250 = 1 : 10$

(d) Ratio of 15 min to 1.5 hrs

Ratio of 15 min to $1.5 \times 60\,\text{min}$ $\quad$ (1 hrs $= 60\,\text{min}$)

Ratio 15 min to 90 min

$$15 : 90 = 1 : 6$$

3. Which ratio is greater?

(a) 3 : 4 or 5 : 6

Compare the ratio 3 : 4 and 5 : 6

$$3 : 4 = \frac{3}{4} \text{ and } 5 : 6 = \frac{5}{6}$$

Now, LCM of 4 and $6 = 12$

Making the denominator of each fraction equal to 12.

We have, $\dfrac{3 \times 3}{4 \times 3} = \dfrac{9}{12}$ and $\dfrac{5 \times 2}{6 \times 2} = \dfrac{10}{12}$

Since, $\quad \dfrac{9}{12} < \dfrac{10}{12}$

So, $\quad 3 : 4 < 5 : 6$

Thus, $5 : 6$ is greater than 3 : 4.

(b) 9 : 11 or 7 : 3

Compare the ratio 9 : 11 and 7 : 3

$$9 : 11 = \frac{9}{11} \text{ and } 7 : 3 = \frac{7}{3}$$

LCM of 11 and $3 = 33$

Making denominator of each fraction equal to 33.

$$\frac{9 \times 3}{11 \times 3} = \frac{27}{33};\ \frac{7 \times 11}{3 \times 11} = \frac{77}{33}$$

Since, $\quad \dfrac{27}{33} < \dfrac{77}{33}$

Hence $\qquad 9:11 < 7:3$

Thus, 7 : 3 is greater than 9 : 11.

(c) 1 : 2 or 3 : 7

Compare the ratio 1 : 2 and 3 : 7

$$1:2 = \frac{1}{2} \text{ and } 3:7 = \frac{3}{7}$$

LCM of 2 and $7 = 14$

Making denominator of each fraction equal to 14.

$$\frac{1\times 7}{2\times 7} = \frac{7}{14} \text{ and } \frac{3\times 2}{7\times 2} = \frac{6}{14}$$

Since, $\qquad \frac{7}{14} > \frac{6}{14}$

So, $\qquad 1:2 > 3:7$

Thus 1 : 2 is greater than 3 : 7.

(d) 5 : 13 or 2 : 5

Compare the ratio $= 5:13$ and 2 : 5

$$5:13 = \frac{5}{13} \text{ or } 2:5 = \frac{2}{5}$$

LCM of 13 and $5 = 65$

Making denominator of each fraction equal to 65

$$\frac{5\times 5}{13\times 5} = \frac{25}{65} \text{ and } \frac{2\times 13}{5\times 13} = \frac{26}{65}$$

Since, $\qquad \frac{25}{65} < \frac{26}{65}$ $\qquad$ So, $\quad 5:13 < 2:5$

Thus, $2:5$ is greater than 5 : 13.

4. Number of girls $= 16$

Number of boys $= 24$

Ratio of boys to number of girls $= 24:16$ or 3 : 2

5. Number of pairs of white earrings $= 4$

Number of pairs of red earrings $= 5$

Total number of pairs $= 4 + 5 = 9$

Ratio of while earrings to total number of earrings $= \frac{4}{9} = 4:9$

6. Speed of Krishna's car $= 60$ km per hours

Speed of Ravi's car $= 45$ km per hours

Ratio of the speed of Ravi's car to Krishna's car $= 45:60$ or $3:4$

7. A tempo, covered distance in 2 hrs $= 60$ km

Distance covered in 1 hrs $= 60 \div 2$ km $= 30$ km

So, tempo's speed $= 30$ km/hr

Car, covered distance in 1 hr $= 80$ km

Car's speed $= 80$ km/hr

Ratio of speed $= \frac{30}{80} = \frac{3}{8}$ or $3:8$

8. Somiya has 24 cups and 18 saucers. Find the ratio of the following in the simplest form :

Number of cups $= 24$

Number of saucers $= 18$

Total crockery $= 24 + 18 = 42$

(a) Ratio of cups to saucers $= 24:18 = 4:3$

(b) Ratio of saucers to cups $= 18:24 = 3:4$

(c) Ratio of cups to whole crockery $= 24:42 = 4:7$

(d) Ratio of saucers to whole crockery $= 18:42 = 3:7$

9. The present age of a father is 36 years and that of his son is 8 years. Find the ratio of :

Present age of the father $= 36$ years

Present age of his son $= 8$ years

(a) Ratio present age of father to the present age of son $= 36:8 = 9:2$

(b) His son's age $= 6$ years

Then, father's age $= 36 - 2 = 34$ years

Ratio $= 34:6 = 17:3$

(c) After 10 year his son age $= 8 + 10 = 18$ years

After 10 year his father age $= 36 + 10 = 46$ years

Ratio $= 46:18$ or $23:9$

(d) If father's age $= 30$ years

Son's age $= 8 - 6 = 2$ years

Ratio $= 30:2 = 15:1$

10. In class VI of a school having 50 students, 20 play cricket, 10 play table tennis and 15 play badminton. The remaining students do not play any game. No student is allowed to play more than one game. Find the ratio of the number of students :

The total number of students $= 50$

Number of students play cricket $= 20$

Number of students play table tennis $= 10$

Number of students play badminton $= 15$

Number of students do not play $= 50 - (20 + 10 + 15)$

$= 50 - 45 = 5$

(a) Ratio of who play some game to total number of students $= 45:50$ or $9:10$

(b) Ratio of who, play some game to who do not play any game $= 45:5$ or $9:1$

(c) Ratio of who play table tennis to play badminton $= 10:15$ or $2:3$

(d) Ratio of who play cricket to play table tennis $= 20:10 = 2:1$

11. Mr Sonu earns ` 18,000 per month. He spends ` 12,000 and saves the rest. Find the ratio of the following in the simplest form :

Mr Sonu earns = ` 18000
He spend money = ` 12000
His saving = ` 18000 − ` 12000 = ` 6000
(a) Ratio of his income to expenditure $= 18000 : 12000 = 3 : 2$
(b) Ratio of his expenditure to saving $= 12000 : 6000 = 2 : 1$
(c) Ratio of his saving to total income $= 6000 : 18000 = 1 : 3$
(d) Ratio of his earnings to saving $= 18000 : 6000 = 3 : 1$

12. In a Rawat academy there are 30 cricket players and 20 football player setting training. Find the ratio of the following in the simplest form :
Number of cricket player $= 30$
Number of football player $= 20$
Total player $= 30 + 20 = 50$
(a) Ratio of football player to cricket player $= 20 : 30 = 2 : 3$
(b) Ratio of cricket player to football $= 30 : 20 = 3 : 2$
(c) Ratio of football player to all player $= 20 : 50 = 2 : 5$
(d) Ratio of cricket player to all player $= 30 : 50$ or $3 : 5$

Exercise 9.2

1. Write the extremes in the following :
(a) 4 : 5 : 20 : 25 — Extremes $= 4, 25$
(b) 22 : 11 : : 88 : 44 — Extremes $= 22, 44$
(c) 1 : 2 :: 3 : 6 — Extremes $= 1, 6$
(d) 3 : 4 :: 6 : 8 — Extremes $= 3, 8$
(e) 16 : 24 :: 24 : 36 — Extremes $= 16, 36$
(f) 5 : 7 :: 25 : 35 — Extremes $= 5, 35$
(g) 1 : 6 :: 4 : 24 — Extremes $= 1, 24$
(h) 50 : 150 :: 100 : 300 — Extremes $= 50, 300$

2. Which of the following are true by the rule of proportion :
(**Rule :** If $a : b :: c : d$ are in proportion. Then, product of extremes is equal to product of means $a \times d = b \times c$)

(a) 10 : 15 :: 20 : 25
$10 \times 25 \neq 15 \times 20$
$250 \neq 300$
It is not in true proportion.

(b) 24 : 96 :: 16 : 54
$24 \times 54 \neq 96 \times 16$
$1296 \neq 1536$
It is not in true proportion.

(c) 1 : 2 :: 3 : 6
$1 \times 6 = 2 \times 3$
$6 = 6$
It is in true proportion.

(d) 75 : 150 :: 3 : 18
$75 \times 18 \neq 150 \times 3$
$1350 \neq 450$
It is not in true proportion.

(e) 63 : 105 :: 18 : 30
$63 \times 30 = 105 \times 18$
$1890 = 1890$
It is in true proportion.

(f) 5 : 25 :: 30 : 150
$5 \times 150 = 25 \times 30$
$750 = 750$
It is in true proportion.

(g) 66 : 22 :: 22 : 66
$66 \times 66 \neq 22 \times 22$
$4356 \neq 484$
It is not true proportion.

(h) 18 : 24 :: 15 : 20
$24 \times 15 = 18 \times 20$
$360 = 360$
It is in true proportion.

3. Write the mean in the following :

(a) 25 : 5 :: 20 : 4
Mean $= 5, 20$

(b) 1 : 4 :: 8 : 32
Mean $= 4, 8$

(c) 4 : 12 :: 12 : 36
Mean $= 12, 12$

(d) 2 : 5 : : 16 : 40
Mean $= 5, 16$

(e) 2 : 3 :: 24 : 36
Mean $= 3, 24$

(f) 4 : 5 :: 16 : 20
Mean $= 5, 16$

(g) 25 : 30 :: 16 : 36
Mean $= 30, 16$

(h) 15 : 32 : 135 : 288
Mean $= 32, 135$

4. Find x in the following proportions :
(To find x; product of extremes = product of means)

(a) $169 : x :: x : 1$
$169 \times 1 = x \times x$
$169 = x^2$
$13 = x$
or, $x = 13$

(b) $80 : 32 :: x : 16$
$80 \times 16 = 32 \times x$
$x = \frac{80 \times 16}{32}$
$x = 40$

(c) $x : 3 :: 57 : 19$
$19 \times x = 3 \times 57$
$x = \frac{3 \times 57}{19} = 9$
$x = 9$

(d) $18 : x :: 27 : 3$
$18 \times 3 = 27 \times x$
$x = \frac{18 \times 3}{27} = 2$
$x = 2$

(e) $125 : x :: x : 5$
$125 \times 5 = x \times x$
$625 = x^2$
$25 = x$
or, $x = 25$

(f) $10 : 15 :: 12 : x$
$10 \times x = 15 \times 12$
$x = \frac{15 \times 12}{10} = \frac{180}{10} = 18$
$x = 18$

(g) $60 : x :: 52 : 39$
$60 \times 39 = 52 \times x$
$x = \frac{60 \times 39}{52} = 45$
$x = 45$

(h) $11 : 121 :: x : 231$
$11 \times 231 = 121 \times x$
$x = \frac{11 \times 231}{121} = 21$
$x = 21$

5. Prove that the four numbers in each of the following are in proportion :

(a) 4, 1, 8 and 2
Ratio of 4 to $1 = 4 : 1$
Ratio of 8 to $2 = 8 : 2 = 4 : 1$
Since, $4 : 1 = 8 : 4$
4, 1, 8 and 2 are in proportion.

(b) 4, 8, 16 and 32
Ratio of 4 to $8 = 4 : 8 = \frac{4}{8} = \frac{1}{2}$

Ratio of 16 to 32 $= 16 : 32 = \frac{16}{32} = \frac{1}{2}$

Since, $4 : 8 = 16 : 32$

4, 8, 16 are and 32 in proportion.

(c) 7, 42, 5 and 30

Ratio of 7 to 42 $= 7 : 42 \quad \frac{7}{42} = \frac{1}{6} = 1 : 6$

Ratio of 5 to 30 $= 5 : 30 \quad \frac{5}{30} = \frac{1}{6} = 1 : 6$

Since, $7 : 42 = 5 : 30$

7, 42, 5 and 30 are in proportion.

(d) 9, 6, 15 and 10

Ratio of 9 to 6 $= 9 : 6 = \frac{9}{6} = \frac{3}{2}$

Ratio of 15 to 10 $= 15 : 10 = \frac{15}{10} = \frac{3}{2}$

Since, $9 : 6 = 15 : 10$

9, 6, 15 and 10 are in proportion.

(e) 5, 7, 25 and 35

Ratio of 5 to 7 $= 5 : 7 = \frac{5}{7}$

Ratio of 25 to 35 $= 25 : 35 = \frac{5}{7}$

Since, $5 : 7 = 25 : 35$

5, 7, 25 and 35 are in proportion.

(f) 24, 30, 12 and 15

Ratio of 24 to 30 $= 24 : 30 \quad \frac{24}{30} = \frac{4}{5} = 4 : 5$

Ratio of 12 to 15 $= 12 : 15 \quad \frac{12}{15} = \frac{4}{5} = 4 : 5$

Since, $24 : 30 = 12 : 15$

24, 30, 12 and 15 are in proportion.

(g) 35, 21, 10 and 6

Ratio 35 to 21 $= 35 : 21 = \frac{35}{21} = \frac{5}{3}$

Ratio of 10 to 6 $= 10 : 6 = \frac{5}{3}$

Since, $35 : 21 = 10 : 6$

35, 21, 10 and 6 are in proportion.

(h) 60, 45, 40 and 30

Ratio of 60 to 45 $= 60 : 45 = \frac{60}{45} = \frac{4}{3}$ or 4 : 3

Ratio of 40 to 30 $= 40:30 = \frac{40}{30} = \frac{4}{3}$ or 4 : 3

Since, $60:45::40:30$

60, 45, 40 and 30 are in proportion.

6. Find the fourth term of the following proportions :

(a) Let fourth term be x.

Since, 21, 27, 14, x are in proportion

So, $21:27::14:x$

$$21x = 27 \times 14$$

$$x = \frac{27 \times 14}{21} = 18$$

$$x = 18$$

Thus, fourth term is 18.

(b) Let fourth term be x

Since, 57, 76, 108, x are in proportion

So, $57:76::108:x$

$$57 \times x = 76 \times 108$$

$$x = \frac{76 \times 108}{57} = 144$$

$$x = 144$$

Thus, fourth term is 144.

(c) Let fourth term be x.

Since, 3, 9, 27, x are in proportion

So, $3:9::27:x$

$$3x = 9 \times 27$$

$$x = \frac{9 \times 27}{3} = 81$$

$$x = 81$$

Thus, fourth term is 81.

(d) Let fourth term be x.

Since, 1, 10, 100, x are in proportion

So, $1:10::100:x$

$$1 \times x = 100 \times 10$$

$$x = 1000$$

Thus, fourth term $= 1000$.

7. Find the mean proportion between the numbers :

(a) 36, 16

$36:x::x:16$

$x^2 = 36 \times 16$

$x = \sqrt{36 \times 16}$

$= 6 \times 4 = 24$

(b) 4, 9

$4:x::x:9$

$x^2 = 4 \times 9$

$x = \sqrt{4 \times 9}$

$= 2 \times 3 = 6$

$x = 24$

Mean proportion $= 24$

$x = 6$

Mean proportion $= 6$

(c) 4, 16

$4 : x :: x : 16$

$x^2 = 4 \times 16$

$x^2 = 4 \times 16$

$x = \sqrt{4 \times 16}$

$= 2 \times 4 = 8$

$x = 8$

Mean proportion $= 6$

(d) 125, 5

$125 : x :: x : 5$

$x^2 = 125 \times 5$

$x^2 = 625$

$x = \sqrt{625}$

$= 25$

$x = 25$

Mean proportion $= 25$

(e) 121, 100

$121 : x :: x : 100$

$x^2 = 121 \times 100$

$x = \sqrt{121 \times 100}$

$x = 11 \times 10$

$x = 110$

Mean proportion $= 110$

(f) 32, 50

$32 : x :: x : 50$

$x^2 = 32 \times 50$

$x^2 = 1600$

$x = \sqrt{1600}$

$x = 40$

Mean proportion $= 40$

(g) 4, 36

$4 : x :: x : 36$

$x^2 = 4 \times 36$

$x = \sqrt{4 \times 36}$

$x = 2 \times 6$

$x = 12$

Mean proportion $= 12$

(h) 25, 36

$25 : x :: x : 36$

$x^2 = 25 \times 36$

$x = \sqrt{25 \times 36}$

$x = 5 \times 6$

$x = 30$

Mean proportion $= 30$

8. Let the number be x.

$x : 32 :: 18 : 24$

$$\frac{x}{32} = \frac{18}{24}$$

$$x = \frac{18 \times 32}{24}$$

$$x = 3 \times 8$$

$$x = 24$$

Hence the number is 24.

9. Let the fourth term be x

15, 20, 30 and x are in proportion.

$$15 : 20 :: 30 : x$$

$$15 \times x = 20 \times 30 \qquad x = \frac{20 \times 30}{15} = 40$$

Thus, the fourth term $= 40$.

10. Height of tin $= 8\,\text{cm}$

Quantity of oil $= 352\,l$

New height $= 12.5$ cm

Quantity of oil $= x$

$$8 : 12.5 :: 352 : x \qquad x = \frac{12.5 \times 352}{8}\,l = 550\,l$$

Thus, after increase the height the tin 550 l oil.

11. Mean proportion 9 and 4

$$9 : x :: x : 4$$

$$x^2 = 9 \times 4 \qquad x = \sqrt{9 \times 4} = 3 \times 2 = 6$$

Thus, mean proportion $= 6$

12. Scale $= 1 : 90$

Actual length of the field $= 270\,\text{m}$

$$1 : 90 :: x : 270$$

$$90x = 270 \times 1 \qquad x = \frac{270}{90} = 3\,\text{cm}$$

We take 3 cm as a scale on the map.

13. Let breadth of rectangle be x cm

Length of rectangle $= 80\,\text{cm}$

Ratio of length to breadth $= 80 : x$

given Ratio $= 6 : 3$

$$80 : x = 6 : 3$$

$$6x = 80 \times 3 \qquad x = \frac{80 \times 3}{6} = 40\,\text{cm}$$

Thus, breadth of rectangle $= 40\,\text{cm}$.

14. Let second term be x

1st term : 2nd term :: 3rd term : 4th term

$$42 : x :: 70 : 35$$

$$42 \times 35 = 70 \times x$$

$$x = \frac{42 \times 35}{70}$$

$$x = 21$$

Value of second term $= 21$.

15. x, y, z are in continued proportion

$$x : y :: y : z$$

$$x : 6 :: 6 : 12 \qquad \text{(given; } y = 6,\ z = 12\text{)}$$

$$12x = 6 \times 6$$

$$x = \frac{6 \times 6}{12} = 3$$

$$x = 3$$

Value of x is 3.

Exercise 9.3

1. Cost of 10 kg rice = ` 245

Cost of 1 kg rice = ` $245 \div 10$ = ` 24.50

Cost of 3 kg rice = ` $24.50 \times 3$ = ` 73.50

Cost of 3 kg rice is ` 73.50.

2. Cost of 35 inland letters = ` 105

Cost of 1 inland letter = ` $105 \div 35$ = ` 3

Cost of 60 inland letters = ` $3 \times 60$ = ` 180

Thus, the cost of 60 inland letter is ` 180.

3. Weight of 12 tables $= 132\text{ kg}$

Weight of 1 table $= 132 \div 12 = 11\text{ kg}$

Weight of t tables $= 11\text{ kg} \times 5 = 55\text{ kg}$

Thus, weight of 5 tables is 55 kg.

4. Length of cloths produces in 4 hrs $= 240\text{ m}$

Length of cloth produces in 1 hr $= \frac{240}{4}\text{ m}$

Length of cloth produces in 18 hrs $= \frac{240}{4} \times 18\text{ m} = 1080\text{ m}$

Length of cloth produces in 1 day $= 1080\text{ m}$

Length of cloth produces in 6 days $= 1080 \times 6\text{ m} = 6480\text{ m}$

5. Required diesel for covered 594 km $= 108\,l$

Required diesel for covered 1650 km $= \frac{108}{594} \times 1650\,l = 300\,l$

6. Charges to carry 24 boxes = ` 1800

Charges to carry 1 box = ` $\frac{1800}{24}$

Charges to carry 18 boxes = ` $\frac{1800}{24} \times 18$ = ` 1350

Thus, charges to carry 18 boxes is ` 1350.

7. Distance covered in 3 hrs $= 2550\text{ km}$

Distance covered in 1 hr $= \frac{2550}{3}\text{ km}$

Distance covered in 7 hrs $= \frac{2550}{3} \times 7\text{ km} = 5950\text{ km}$

An aeroplane covered 5950 km in 7 hrs.

8. Quantity of petrol required in cover 256 km $= 16\,l$

Quantity of petrol required to cover 1 km $= \frac{16}{256}\,l$

Quantity of petrol required to cover 400 km $= \frac{16}{256} \times 400\,l = 25\,l$

Thus, we need 25 *l* petrol to cover 400 km distance.

9. Cost of 7 pens = ` 91

Cost of 1 pen = ` 91 ÷ 7 = ` 13

Cost of 9 pens = ` 108

Cost of 1 pen = ` 108 ÷ 9 = ` 12

Thus, Shubham bought 9 pens of the cost ` 108.

Shubham bought the pens at a cheaper rate.

10. Cost of a dozen eggs = ` 30

Cost of 12 eggs = ` 30

Cost of 1 egg = ` 30 ÷ 12 = ` 2.5

Cost of 15 eggs = ` 2.5 × 15 = ` 37.5

Cost of 15 eggs is ` 37.5.

11. Average of rainfall in last 4 days = 366 mm

Average of rainfall in last 1 day = 366 ÷ 4 = 91.5 mm

Average of rainfall in last 7 days = 91.5 × 7 = 640.5 mm

MCQs

Tick (3) the correct answer :

1. (b) **2.** (a) **3.** (c) **4.** (c) **5.** (b) **6.** (a) **7.** (d) **8.** (d) **9.** (c) **10.** (a)

Higher Order Thinking Skills (HOTS)

1. Ratio of weight on earth and weight on moon = $84:14$ or $6:1$

If weight on earth = 9 kg

$$6:1::9:x$$
$$6x = 14 \times 9$$
$$x = \frac{1 \times 9}{6} = 1.5 \text{ kg}$$

2. **Section A;**

Ratio of boys to girls = $2:3$

Section B;

Ratio of boys to girls = $2:3$

If number of boys = 18

Let number of girls be x

Ratio of boys to girls = $18:x$

So, $$2:3::18:x$$
$$2x = 18 \times 3$$
$$x = \frac{18 \times 3}{2} = 27$$

So, Number of girls is 27.

3. Time taken by 3 men to complete the work = 8 days

Time taken by 1 man to complete the work = 8 × 3 days

Time taken by 4 men to complete the work $= \frac{8 \times 3}{4} = 6$ days

4. Cost of 15 pens = ` 60

Cost of 1 pen = ` $= 60 \div 15 =$ ` 4

Number of pen purchased = ` $156 \div 4 = 39$.

5. $\frac{p}{q} = \frac{p}{r}$

$q = r$ It must be true.

6. Vani's earn $= x$

Nikhil earn $= 5x$

Ratio of Vani's earn to Nikhil's earn $= x : 5x = 1 : 5$

7. No, it is not necessary that Sam's expenditure is more than Tony's. Because salaries may be different.

8. Amount = ` 1800

The given ratio $= 2 : 3 : 5$

Sum of ratios $= 2 + 3 + 5 = 10$

Rohit's part = ` $1800 \times \frac{2}{10} =$ ` 360

Bholanath's part = ` $1800 \times \frac{3}{10} =$ ` 540

Chameli's part = ` $1800 \times \frac{5}{10} =$ ` 900

10 Basic Geometrical Ideas (2-D)

Exercise 10.1

1. Identify each of the following figure given below as a ray, a line segment or a line :

(a) A line segment (b) A ray

(c) Line (d) A ray

(e) A line segment

2. In each of the figures given below, name all the points and the line segments.

(a) A, B, C, D, E and F are points and $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, $\overline{DE}$, $\overline{EF}$ and $\overline{FA}$ are line segments.

(b) P, Q, R, S and T are points and $\overline{PQ}$, $\overline{QR}$, $\overline{RS}$, $\overline{SP}$, $\overline{ST}$, $\overline{TQ}$, $\overline{PT}$, $\overline{TR}$, $\overline{PR}$, $\overline{SQ}$ are line segments.

(c) A, B, C, D, E, F, G and H are points and $\overline{AB}$, $\overline{BF}$, $\overline{AE}$, $\overline{EF}$, $\overline{DC}$, $\overline{CG}$, $\overline{DH}$, $\overline{HG}$, $\overline{AD}$, $\overline{BC}$, $\overline{EH}$ and $\overline{FG}$ are line segments.

3. How many line segments are there in each of the following figures :

(a) Seven (b) Four (c) Seven (d) Twelve

4. Name the line(s), shown in each of the following figures :

(a) Line l (b) Line AB

(c) Line P (d) Line AB and CD

5. (a) 

(b) 

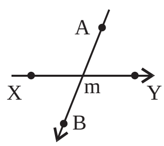
6. Yes; countless number of lines passing through O can be drawn.

7. No, we cannot draw more than one line passing through P and Q.

8. $(\overline{AB},\overline{DC})$, $(\overline{AD},\overline{BC})$, $(\overline{JK},\overline{DB})$, $(\overline{DB},\overline{EF})$, $(\overline{JK},\overline{EF})$, are pairs of parallel lines; and $(\overline{AC},\overline{JK})$, $(\overline{AC},\overline{DB})$, $(\overline{AC},\overline{EF})$, $(\overline{AD},\overline{JK})$, $(\overline{AB},\overline{JK})$, $(\overline{AD},\overline{DB})$ $(\overline{AB},\overline{DB})$, $(\overline{DC},\overline{EF})$, $(\overline{BC},\overline{EF})$ are pair of intersecting lines.

9. Eight points, twelve line segments and six planes

10. (a)

(b) 

(c) 

11. (a) False (b) True (c) True (d) True

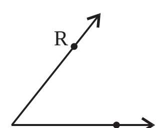
12. (a) Lines l and q (b) Lines l and p (c) Lines m, q and r

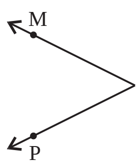
Exercise 10.2

1. Name the angles given in the following figure :

(a) AOB (b) XZY (c) PQR (d) DEF

2.





3. AOB, AOC, AOD, BOC, BOD, COD

4. (a) Interior of $AOC = P, T, Z$

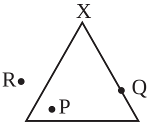
(b) Exterior of $AOC = X, Y, R, B$

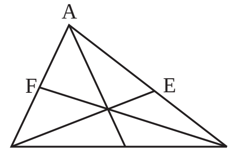
5. Triangles $= \Delta AEB$, ΔBEC, ΔCED, ΔDEA, ΔABC, ΔADB, ΔBCD, ΔCDA

6. (a) Point on $\Delta ABC = A, B, C, M, N$

(b) Interior of $\Delta ABC = P, R$ and Z.

(c) Exterior of $\Delta ABC = S, Q, T$

7. 

8. 

Exercise 10.3

1. Which of the following figures are quadrilaterals?
(a), (b) and (f) are quadrilateral.

2. In quadrilateral $ABCD = \overline{AB}, \overline{BC}, \overline{CD}, \overline{DA}$ are the four sides; A, B, C, D are the four angles; $\overline{AC}$, $\overline{BD}$ are the two diagonals.

3. (a) Adjacent sides $= \overline{AB}, \overline{BC}$ (b) Adjacent angle $= A$, B
(c) Opposite angle $= A$, C (d) Opposite side $= \overline{AB}$, $\overline{DC}$

4. (a) Exterior point of quadrilateral $= F, H$
(b) Point on quadrilateral $= A, B, C, D, I, M, Y$
(c) Interior point of quadrilateral $= E, U, G$

5. $\because$ The circumference $= 132$ cm

$$2\pi r = 132 \qquad 2 \times \frac{22}{7} \times r = 132 \qquad 2r = \frac{132 \times 7}{22} = 42 \text{ cm}$$

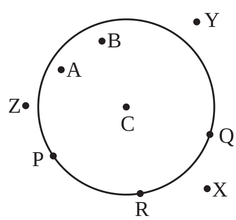
Length of diameter $= 42$ cm.

6. The given, $r = 7$

Circumference $= 2\pi r = 2 \times \dfrac{22}{7} \times 7 = 44$ cm

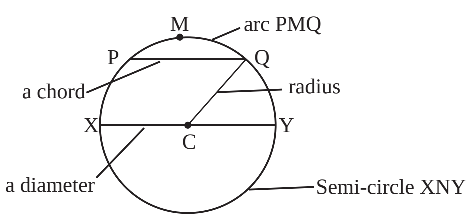
7. (a) a minor arc $= AXB$
(b) A major arc $= AYB$
(c) a semi circle $= PYQ$
(d) a minor segment $=$ Region AXB
(e) a minor sector $=$ Region OBQ

8. Draw a circle. Mark :



9. In the adjoining figure, name the following :
(a) Point $O =$ The centre (b) $\overline{AB}$ is largest chord and $\overline{PQ}$ is chord.
(c) $\overline{OC} =$ Radius (d) $\overline{AB}$ Diameter

10. Draw circle mark in it :



11. Fill in the blanks, using the words (always, sometimes or never) :
   (a) A radius is **Never** a chord.
   (b) A chord is **sometime** a diameter.
   (c) A diameter divides a circle **always** into two equal parts.
   (d) A diameter is **always** the longest chord in a circle.

Multiple Choice Questions

Tick (3) the correct answer :

1. (c) **2.** (b) **3.** (d) **4.** (d) **5.** (d) **6.** (c) **7.** (b) **8.** (d) **9.** (b) **10.** (c)

Higher Order Thinking Skills (HOTS)

Look at the figure and answer the following :

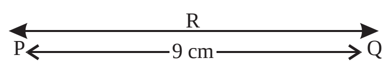
(a) 8 triangles.
(b) Name of diagonals are AC and DB.
(c) Yes; point G in the interior of $ABCD$.
(d) The point interior is E in ΔAOB.

11 Understanding Geometrical Shapes

Exercise 11.1

1. $PQ = 9$ cm

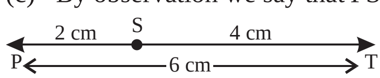
$PR = PQ \times \frac{1}{2} = \frac{9}{2} = 4.5$ cm



$PR = RQ = 4.5$ cm.

2. Identify the longest side in the following triangles using the method of observation.
   (a) By observation we say that $\overline{PR}$ is longest side.
   (b) By observation we say that $\overline{AC}$ is longest side.
   (c) By observation we say that $\overline{PS}$ is longest side.

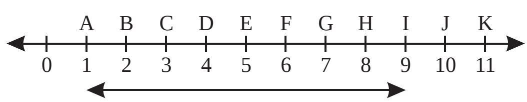
3.



$\overline{PT} = 6$ cm, $\overline{ST} = 4$ cm

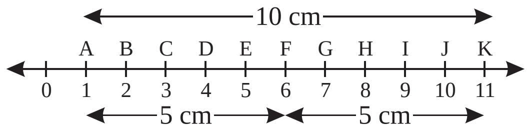
$\overline{PS} = 6 - 4 = 2$ cm

4. Using the number line (drawn above). Verify :
   (a)



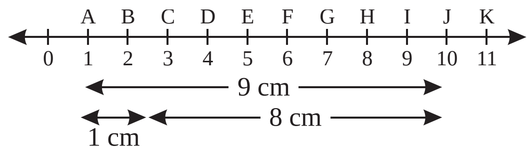
$AI = 8$ cm
Mid point $= 4$ cm
E is the mid point as it lies at a distance of AI.

(b)



$AF = 5\,\text{cm}$; $FK = 5\,\text{cm}$
$AK = 5\,\text{cm} + 5\text{ cm} = 10\,\text{cm}$

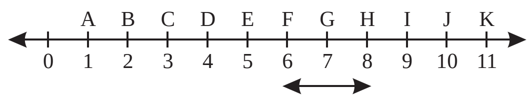
(c)



$\overline{AJ} = 9\,\text{cm}$ $\overline{BJ} = 8\,\text{cm}$

$\overleftrightarrow{AB} = (9-8)\,\text{cm} = 1\,\text{cm}$

(d)



$FH = 2\,\text{cm}$
$FG = 1\,\text{cm}$; $GH = 1\,\text{cm}$
G is the mid point as it lies at a distance of FH.

Exercise 11.2

1. Match the following :

(a) $1\frac{1}{2}$ right angles (iii) 135°

(b) more than $\frac{3}{4}$th revolution (i) 285°

(c) half of the revolution (ii) 180°

(d) less than $\frac{1}{4}$th of revolution (v) 52°

(e) between $\frac{1}{4}$ th and $\frac{1}{2}$ of revolution (iv) 115°

2. How many right angles are made if you start facing :

(a) We will start from south and will end at south itself. Hence right angles can be made = Four

(b) We will start from west and will end at east itself.
Hence right angle can be made = Two

(c) We will start from north and will end at west itself. Hence right angle can be made = Three

3. Where will the hour hand of a clock stop if it starts from :

(a) Start at 8 and turns 3 right angles thus we will reach at 5.

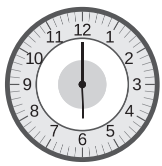
$8 \xrightarrow[\text{1 right angle}]{} 11 \xrightarrow[\text{2 right angle}]{} 2 \xrightarrow[\text{3 right angle}]{} 5$

(b) Start at 9 and turns 1 right angle
Thus, we will reach at 12

$9 \xrightarrow[\text{1 rightangle}]{} 12$

(c) Start at 6 and turns 2 right angle thus we will reach at 12

$6 \xrightarrow[\text{1 right angle}]{} 9 \xrightarrow[\text{2 right angle}]{} 12$



4. Classify the following angles :

(a) Acute (b) Reflex (c) Obtuse (d) Reflex (e) Right

5. Measure the following angles in the given figure using the protractor and classify them :

$COE = 25°$ (Acute)

$BOE = BOC + COE = 50° + 25° = 75°$ (acute)

$AOB = AOF + FOB = 45° + 40° = 85°$ (acute)

$AOC = AOF + FOB + BOC$

$= 45° + 40° + 50° = 135°$ (obtuse)

$AOE = AOF + FOB + BOC + COE$

$= 45° + 40° + 50° + 25° = 160°$ (obtuse)

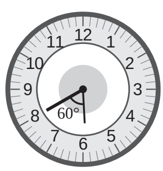
$FOC = FOB + BOC = 40° + 50° = 90°$ (Right)

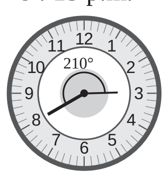
$DOC = DOA + AOF + FOB + LOC$

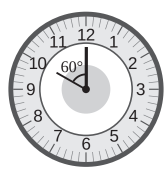
$= 45° + 45° + 40° + 50° = 180°$ (Straight)

6. Find the angles formed by the two hands of clock at :

(a) 5.05 p.m. (b) 6 : 40 a.m. (c) 8 : 15 p.m. (d) 10 : 00 a.m.







7. Find the degree measure of :

(a) $2\frac{1}{2}$ right angles $= 90° + 90° + 90° \times \frac{1}{2} = 90° + 90° + 45° = 225°$

(b) $\frac{3}{5}$ of complete angle $= \frac{3}{5} \times 360° = 216°$

(c) $\frac{1}{2}$ of straight angle $= 180° \times \frac{1}{2} = 90°$

(d) $\frac{4}{5}$ of straight angle $= 180° \times \frac{4}{5} = 144°$

8. Find x in the following figures :

(a) $ACB + \quad ACD = 180°$ (Linear pair angles)

$60° + x = 180°$ $\qquad x = 180° - 60° = 120°$

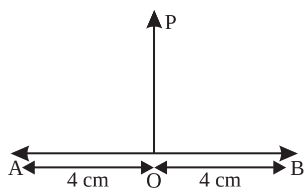
(b) In ΔABC $x° + 20° = 90°$ (Right angles]

$x° = 90° - 20°$ $\qquad x° = 70°$

Exercise 11.3

1. Mark a line AB and intesect OP of AB.

$PO \quad AB$



2. From the given figure, answer the following :

(a) Yes, $BC = DC = 1$ cm (b) Yes, $LCD = \quad LCF = 90°$

(c) $\overline{LM}$ is perpendicular bisector of three line segments $= \overline{BD}, \overline{AE}, \overline{PF}$

(d) $BCM = 90°$

(e) $DQ = 4$ cm mid point $= 2$ cm

Mid point $= OF$

Exercise 11.4

1. Classify the following triangles on the basis of their angles :

(a) Obtuse angled triangle (b) Right angled triangle

(c) Acute angled triangle (d) Obtuse angled triangle

2. Name the following triangles in two different ways :

(a) Right angled triangle, isosceles triangle

(b) Acute angled triangle, equilateral triangle

(c) Obtuse angled triangle, scalene triangle

(d) Acute angled triangle, isosceles triangle

3. ΔABC isosceles triangle

$B = 130°$

Let $A = \quad C = x°$

Sum of angle of a triangle $= 180°$

$$x + x = 130° = 180°$$
$$2x = 180° - 130°$$
$$x = 50° \div 2 = 25°$$

Other angles are 25° and 25°.

4. In ΔPRQ

$$PRQ + \quad PQR + \quad RPQ = 180°$$
$$PRQ + 45° + 45° = 180°$$
$$PRQ = 180° - 90°$$
$$PRQ = 90°$$

5. **Equilateral triangle** Three sides of an equilateral triangle are equal and three angles are also equal.

So, each angle of triangle is 60°.

Let one angle of triangle be $x°$

Then, sum of angle of a triangle $= 180°$

$$x + x + x = 180°$$
$$3x = 180°$$
$$x = \frac{180°}{3} = 60°$$

6. Since, the sum of three angles of a triangle can not exceed 180°, but here a triangle have two right angles, which is equal to 180°, therefore such a triangle is not possible.

7. Find the measure of the angles marked by x in the following :

(a) In ΔABD,

$$ABD = \quad DBC + \quad CBA = 90°$$
$$x° + 75° = 90°$$
$$x = 90° - 75° = 15°$$

(b) In ΔABD, [Linear pair angles]

$$BCD = \quad ACB + \quad ACD$$
$$180° = 60° + x°$$
$$x = 180° - 60° = 120°$$

Exercise 11.5

1. State whether the following statements are true or false. Correct and rewrite the false statements.

(a) True (b) False, every rectangle is a parallelogram.

(c) True (d) True

(e) False, A square is a special form of rectangle.

2. Classify the following figures as parallelogram, square, rectangles, rhombus, trapezium, isosceles trapezium or a kite.

(a) Kite (b) Rectangles

(c) Square (d) Trapezium

3. Match the columns :

	Column A		Column B
(a)	Opposite sides are paralle and equal	(iii)	Parallelogram
(b)	All angles are equal	(ii)	Rectangle
(c)	Diagonals bisect each other at right angles	(i)	Rhombus

4. Equilateral triangle = ΔABC

Right triangle = ΔACD, ΔGEF

Rectangle = *ACEG*

Trapezium = *ADEG*

Parallelogram = *AGFD*

5. Do it yourself.

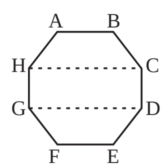
6. Write the similarities between :

(a) **Squares and rhombus :** Both have two pairs of parallels sides and both have four equal sides.

(b) **Rectangle and Square :** Both are quadrilaterals with all four angles are right angle.

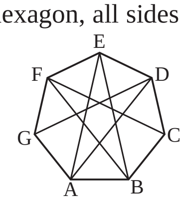
(c) **Paralellogram, rectangle and rhombus :** All of these are quadrilaterals and opposite side are paraller to each other and the opposite angles are also equal.

7. Draw, regular octagon *ABCDEFGH*.
The *CDGH* as rectangle.



8. Irregular hexagon has unequal sides whereas in a regular hexagon, all sides and angles are equal.

9. Draw heptagon make diagonals.
Than, we see that four diagonals in one heptagon.



Exercise 11.6

1. Match the following :

	Shapes		Objects
(a)	Sphere	(ii)	A cricketk ball
(b)	Cylinder	(i)	A coke can
(c)	Cuboid	(iv)	A chalk duster
(d)	Cube	(iii)	A dice

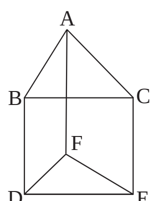
2. Complete the following table :

	Shape	Edges	Vertices	Faces
(a)	Cuboid	12	8	6
(b)	Cube	12	8	6
(c)	Cylinder	2	0	3
(d)	Cone	1	1	2
(e)	Sphere	0	0	1
(f)	Triangular prism	9	6	5
(g)	Triangular pyramid	6	4	4
(h)	Square pyramid	8	5	5

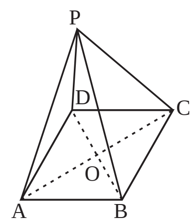
3. Write the number of triangles in the nets of :

(a) Triangles in triangles prism
$= 2(\Delta ABC, \Delta DEF)$

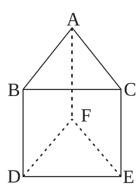
(b) Triangle in square pyramid
$= 3(\Delta ABP, \Delta ADP, \Delta PBC)$



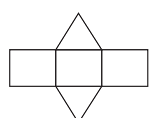
Triangular Prism



4. Trinagular prism. Net of triangular prism



Triangular prism


Net of triangular prism

MCQs

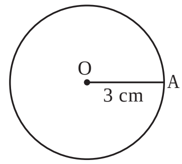
Tick (3) the correct answer :

1. (a) **2.** (d) **3.** (c) **4.** (c) **5.** (d) **6.** (b) **7.** (a) **8.** (c) **9.** (a) **10.** (b)

Exercise 12.1

1. Draw the circle of the following radii :

(a) **Steps of construction :**

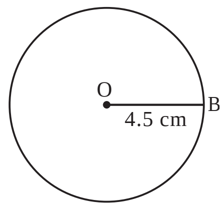


(i) Mark a point O on a sheet of paper, where a circle is to be drawn.

(ii) Take a pair of compasses and measure 3 cm using a ruler.

(iii) Without disturbing the opening of the compasses, keep the needle at mark O and draw complete arc holding the compasses from its knob. After completing one complete round, we get the desired cirlce.

(b) **Steps of Construction :**



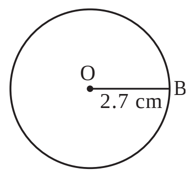
(i) Mark a point O on a sheet of paper, where a circle is to be drawn.

(ii) Take a pair of compasses and measure 4.5 cm using a ruler.

(iii) Without disturbing the opening of the compasses. Keep the needle at mark O and draw complete arc holding the compasses from its knob.

After completing one complete round, we get the desired circle.

(c) **Steps of Construction :**



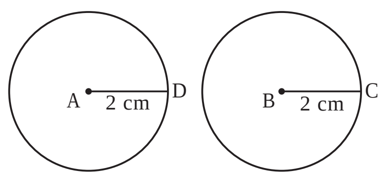
(i) Mark a point O on a sheet of paper, where a circle is to be drawn.

(ii) Take a pair of compasses and measure 2.7 cm using a ruler.

(iii) Without disturbing the opening of the compasses, keep the needle at mark O and draw complete arc holding the comasses from its knob.

After completing one complete round, we get the desired circle.

2. Steps of Construction :



(i) Open the compasses for the required radius of 2 cm.

(ii) Mark a point A.

(iii) Place the pointer of the compasses on A.

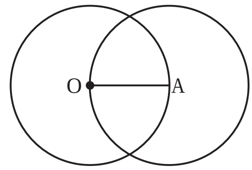
(iv) Turn the compasses slowly to draw the circle.

(v) Repeat steps (i) to (iv) and again draw a circle with centre at B.

$AD = 2\,\text{cm}$; $BC = 2\,\text{cm}$

radii of two circles = equal.

3. **Steps of Construction :**

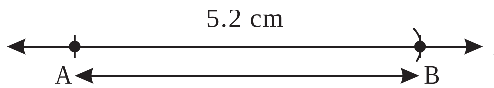


(i) Open the compass for radius of 2 cm.
(ii) Make point *O*.
(iii) Place the pointer of the compasses on *O*. Draw a cirlce.
(iv) Draw *OA*.
(v) With *A* as centre take *OA* as radius.
(vi) Place the pointer of the compasses on *A*.
(vii) Turn the compasses slowly to draw the circle.

4. **Using a ruler and a pair of compasses, draw the line segments of the following lengths :**

(a) Length = 5.2 m

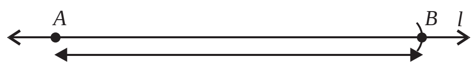
Steps of Construction :



(i) Draw a line *l* and mark a point *A* on it.
(ii) Open the arms of the compass so that the end points of the open arms equal to 5.2 cm.
(iii) Without disturbing the opening of the compasses, place its needle at the point *A* and draw an arc to cut the line *l* at the point *B*.
(iv) *AB* is the required line segment of length 5.2 cm.

(b) Length 7.7 cm

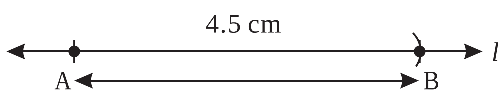
Steps of Construction :



(i) Draw a line *l* and mark a point *A* on it.
(ii) Open the arms of the compass so that the end points of the open arms equal to 7.7 cm.
(iii) Without disturbing the opening of the compasses, place its needle at the point *A* and draw an arc to cut the line *l* at the point *B*.
(iv) *AB* is the required line segment of length 7.7 cm.

(c) Length = 4.5 cm

Steps of Construction :



(i) Draw a line *l* and mark a point *A* on it.
(ii) Open the arms of the compass so that the end points of the open arms equal to 4.5 cm.
(iii) Without disturbing the opening of the compasses, place its needle at the point *A* and draw an arc to cut the line *l* at the point *B*.
(iv) *AB* is the required line segment of length 4.5 cm.

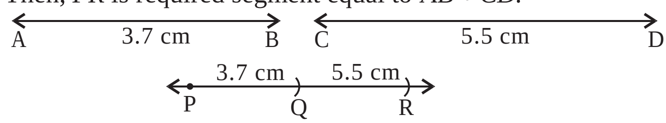
5. **Draw two line segments *AB* and *CD* of lengths 3.7 cm and 5.5 cm respectively. Construct the line segment of the following lengths :**

(a) **Steps of Construction :**

(i) Draw any line *l* and mark a point *A* on it.
(ii) Construct a segment *PQ* on *l* equal in length to *AB* = 3.7 cm starting from *P*.

(iii) Now construct another segment QR on l of length (5.5 cm) starting from Q.

(iv) Then, PR is required segment equal to $AB + CD$.



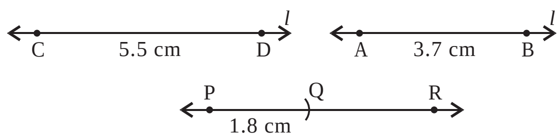
$PR = AB + CD = 3.7 \text{ cm} + 5.5 \text{ cm} = 9.2 \text{ cm}$

(b) Steps of Construction :

(i) Draw any line l and mark a point D on it.

(ii) Starting from P construct a segment PR on l equal in length to $CD = 5.5$ cm.

(iii) Now, construct an other segment QR on l equal in length to $AB = 3.7$ cm starting from Q.



The PQ is required segment equal to $CD - AD = (5.5 - 3.7) \text{ cm} = 1.8 \text{ cm}$

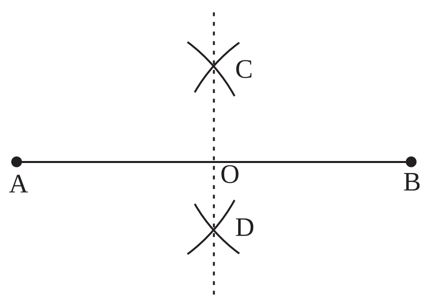
6. Steps of Construction :

(i) Draw a line segment AB of lengths 6.2 cm.

(ii) Taking A as the centre and with any radius more than half of AB, draw an arc on either side of AB.

(iii) Similarly, taking B as the centre and radius as in step (ii), draw another arc on either side of AB intersecting the previous arcs at C and D.

(iv) Join C and D crosing AB at O.



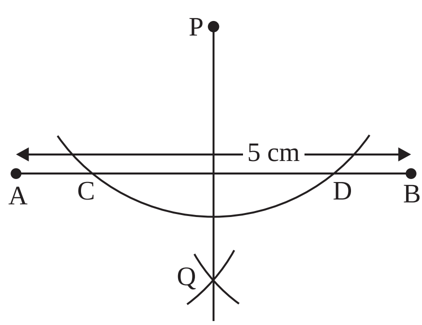
Hence, CD is the required perpendicular bisector of line segment AB.

7. Steps of Construction :

(i) Draw a line segment $\overline{AB}$ of length 5 cm and mark point P outside the line segment AB.

(ii) Taking P as the centre and with any suitable radius, draw an arc cutting AB at C and D.

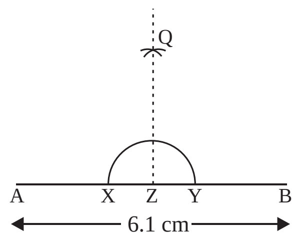
(iii) Taking C and D as centres and with radius more than half of CD, draw arcs below AB intersecting each other at Q.



(iv) Join P and Q.

Hence, PQ is the required perpendicular to the line segment $\overline{AB}$ from point P lying outside the line segment AB.

8. Steps of Construction :



(i) Draw a line segment $\overline{AB}$ of length 6.1 cm and take a point Z on it.

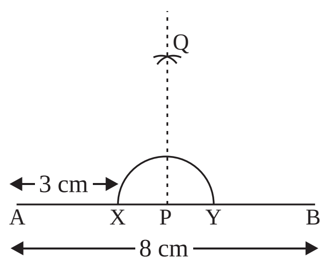
(ii) Taking Z as the centre and with any convenient radius, draw an arc cutting $\overline{AB}$ at X and Y.

(iii) Taking X and Y as centres and with any suitable radius draw arcs cutting each other at Q.

(iv) Join Z and Q.

Then, ZQ is perpendicular to AB passing through the point Z.

9. Steps of Construction :



(i) Draw a line segment $\overline{AB}$ of length 8 cm.

(ii) With A as centre and radius 3 cm cut the line of AB take point P on it.

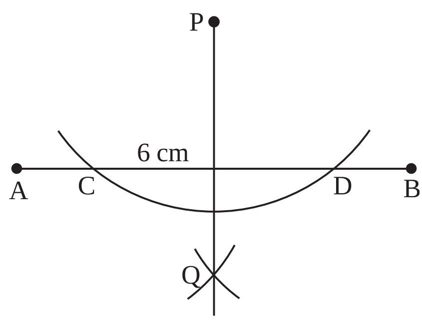
(iii) Taking P as the centre and with any convenient radius draw an arc cutting $\overline{AB}$ at X and Y.

(iv) Taking X and Y as centres and with any suitable radius draw arcs cutting each at Q.

(v) Join P and Q.

Then, PQ is perpendicular to AB passing through the point P.

10. Steps of Construction :



(i) Draw a line segment $\overline{AB}$ of length 6 cm and mark point P outside the line segment AB.

(ii) Taking P as the centre and with any suitable radius, draw an arc cutting AB at C and D.

(iii) Taking C and D as centres and with radius more than half of CD, draw arcs below AB intersecting each other at Q.

(iv) Join P and Q.

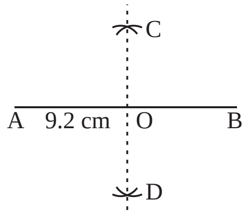
Hence, PQ is the required perpendicular to the line segment $\overline{AB}$ from point P lying outside the line segment AB.

11. Steps of Construction :

(i) Draw a line segment AB of length 9.2 cm.

(ii) Taking A as the centre and with any radius more than half of AB, draw an arc on either side of AB.

(iii) Similarly, taking B as the centre and radius as in step (ii) draw another arc on either side of AB intersecting the previous arcs at C and D.



(iv) Join C and D crossing AB at O.

Hence, CD is the required perpendicular bisector of the line segment AB.

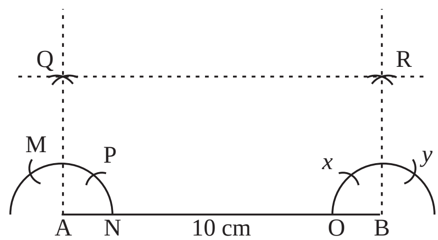
Verification : Measure AO and OB. We find the measurement of $AO = OB$.

12. Steps of Construction :

(i) Draw $AB = 10$ cm.

(ii) Taking A as centre and any convenient radius draw an arc M and N.

(iii) Taking M and P as centres and with any suitable radius draw arcs cutting each other at Q.



(iv) Again, taking B as centre and taking some radius draw an arc O and y.

(v) Taking x and y as centres and with any suitable radius draw arcs cutting each other at P.

(vi) Join Q and P. Then, $PQ \parallel AB$.

Exercise 12.2

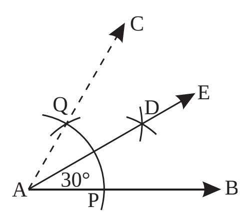
1. Using ruler and a pair of compasses, construct angles of the following measures :

(a) 30°

Steps of Construction :

(i) Draw an angle of 60° as explained before.

(ii) Taking A as the centre and with any suitable radius, draw as arc $\overset{\frown}{PQ}$ that cuts AB at P and AC at Q.



(iii) Taking P as the centre and radius greater than half of PQ, draw an arc. Taking Q as the centre and with the same radius draw another arc, cutting the previous arc at D.

(iv) Join A and D to get the line segment $\overline{AD}$ and produce it to get $\overrightarrow{AE}$.

(v) $\overrightarrow{AE}$ is the angular bisector of CAB. Therefore, $CAD = DAB = 30°$, is the required angle.

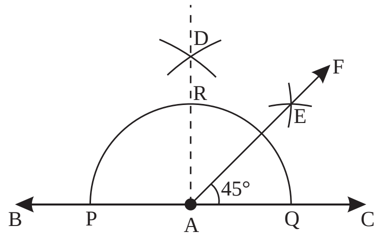
(b) 45°

Steps of Construction :

(i) Draw an angle of 90° as explained before.

(ii) Taking Q as a centre and a radius more than half of QR, draw an arc.

(iii) Taking R as the centre and the same radius, draw an arc cutting the previous arc at E.



(iv) Join A and E to get the line segment $\overline{AE}$.

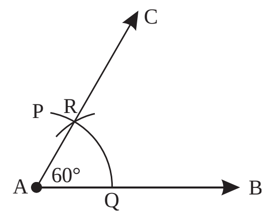
(v) AF is the angular bisector of DAC. Therefore, $DAE = EAC = 45°$ is the required angle.

(c) 60°

Steps of Construction :

(i) Draw any ray $\overrightarrow{AB}$.

(ii) Taking A as the centre and with any suitable radius, draw an arc $\overrightarrow{PQ}$ that cuts AB at Q.



(iii) Taking Q as the centre and radius equal to $\overline{AQ}$, draw an arc cutting the previous arc PQ at R.

(iv) Join $\overline{AR}$ and produce it to get $\overrightarrow{AC}$.

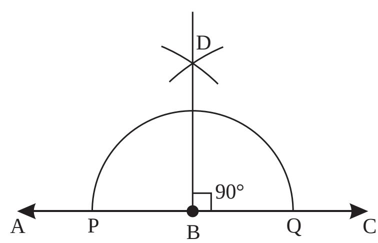
(v) BAC is the required angle equal to 60°.

(d) 90°

Steps of Construction :

(i) Draw a line AC and mark a point B on it.

(ii) Taking B as the centre and with any suitable radius, draw an arc PQ cutting $\overleftrightarrow{AC}$ at P and Q.



(iii) Taking P and Q as the centres and with any convenient radius, draw arcs interesting each other at D.

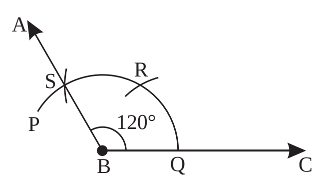
(iv) Join B and D to get the $\overline{BD}$.

Then, $ABD = DBC = 90°$ is the required angle.

(e) 120°

Steps of Construction :

(i) Draw a ray BC.



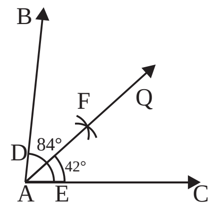
(ii) Taking B as the centre and with any suitable radius, draw an arc PQ cutting $\overrightarrow{BC}$ at Q.

(iii) Taking Q as the centre and $\overline{BQ}$ as a radius draw an arc cutting arc PQ at R. Taking R as the centre and with the same radius, cut and arc PQ at another point S.

(iv) Join $\overline{BS}$ and produce it to get $\overrightarrow{BA}$.

(v) ABC is the required angle of measuring 120°.

2. Steps of Construction :



(i) Draw an angle $BAC = 84°$.

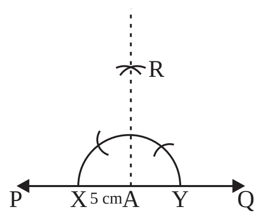
(ii) Taking A as centre and with any suitable radius, draw an arc cutting $\overrightarrow{AB}$ and $\overrightarrow{AC}$ of CAB at D and E respectively.

(iii) Taking D as the centre and any radius more an half $\overline{DE}$ draw an arc.

(iv) Similarly, taking E as the centre and with the same radius draw an arc intersecting previous arc at P. Join $\overline{AF}$ and produce it to get $\overrightarrow{AQ}$.

Thus, ray $\overrightarrow{AQ}$ is the required bisector of CAB or BAC.

3. Steps of Construction :



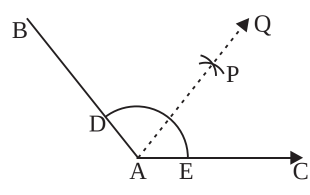
(i) Draw a line $PQ = 5$ cm and mark a point A on it such that $PA = 3$ cm.

(ii) Taking A as the centre an with any suitable radius draw an arc XY cutting $\overleftrightarrow{PQ}$ at X and Y.

(iii) Taking X and Y as the centres and with any convenient radius draw arcs intersecting each other R. Join A and R to get the $\overline{AR}$.

$PAR = RAQ = 90°$ is the required angle.

4. Steps of Construction :



(i) Draw $BAC = 140°$.

(ii) Taking A as the centre and with any suitable radius, draw an arc cutting the arms $\overrightarrow{AB}$ and $\overrightarrow{AC}$ of CAB at D and E respectively.

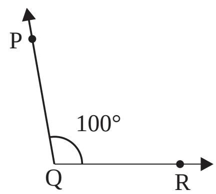
(iii) Taking D as the centre and radius more than half of DE, draw an arc.

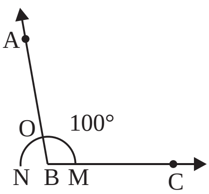
(iv) Similarly, taking E as the centre and with the same radius (as in step (iii) draw an arc intersecting the previous arc at P. Join $\overline{AP}$ and produce it to get $\overrightarrow{AQ}$.

Thus, ray $\overrightarrow{AQ}$ is the required bisector of $CAB = 70°$ or $BAC = 70°$.

5. Draw an angle $PQR = 100°$ by protractor.

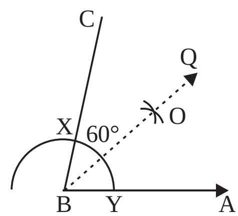
Draw an angle $ABC = 100°$





(i) We will open the compass of the required length.
(ii) By taking B as centre we will draw a semicircle.
(iii) The point where this semi-circle cuts. B, we will make this point as M.
(iv) Now taking M as centre, we will draw an arc. Thus, we will be marked as O.
(v) Now, we will extend a line from B through O. This is the required angle of 100°.

6. Steps of Construction :



(i) Draw an angle of 60° using a protractor.
(ii) Take B as the centre and draw an arc of convenient length cutting $\overrightarrow{BC}$ and $\overrightarrow{BA}$ at X and Y respetively with the compass.
(iii) With Y as the centre for the compass and more than half of XY as the length, draw an arc from Y to the exterior of XY. With the same radius and X as the centre cut the previous arc at O.
(iv) Join OB.

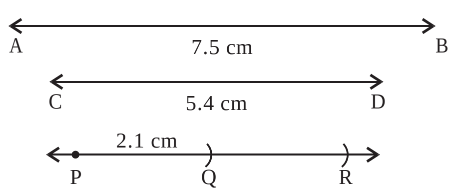
Now, line BO is the bisector of Angle ABC

$CBO = ABO = 30°$.

7. $AB = 7.5$ cm; $CD = 5.4$ cm

$PQ = AB - CD$

$PQ = (7.5 - 5.4)$ cm $= 2.1$ cm

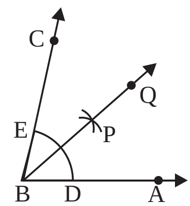


Steps of Construction :

(i) Draw any line l and mark a point P on it.
(ii) Starting from P construct a segment PR on l equal in length to AB.
(iii) Now, construct on other segment QR on l equal in length to CD starting from Q as shown.

Then, PQ is required segment equal to difference of AB and CD.

8. Steps of Construction :



(i) Draw $ABC = B = 75°$.

(ii) Taking B as the centre and with any suitable radius, draw an arc cutting the arms $\overrightarrow{BA}$ and $\overrightarrow{CB}$ of CBA at D and E respectively.

(iii) Taking D as the centre and any radius more than half of DE, draw an arc.

(iv) Similarly, taking E as the centre and with the same radius (as in step (iii). draw an arc intersecting the previous arc at P. Join $\overline{BP}$ and produce it go get $\overrightarrow{BQ}$.

Thus, ray $\overrightarrow{BQ}$ is the required bisector of $CBA = 37.5°$ or $QBA = 37.5°$.

9. First diagonal = 5.5 cm, second diagonal = (5.5 + 2.5) cm = 8.0 cm

Area of the kite $= \frac{1}{2}$ the product of diagonal

$$= \frac{1}{2} \times 5.5 \times 8$$

$$= 5.5 \times 4 = 22\,\text{cm}^2$$

Area of the kite $= 22\,\text{cm}^2$

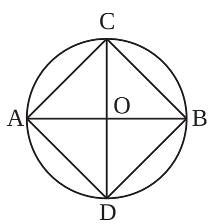
Multiple Choice Questions

Tick (3) the correct answer :

1. (b) **2.** (c) **3.** (a) **4** (c) **5.** (d) **6.** (c)

Higher Order Thinking Skills (HOTS)

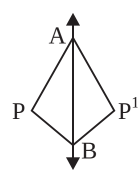
1.



2. $AP = \overline{AP}$

$BP = \overline{BP}$

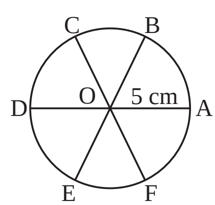
Yes, $AP = \overline{AP}$ & $BP = \overline{BP}'$



3. A circle of radius = 5 cm.

radius = 5 cm

We make a circle with the radius of 5 m cm and draw an arc cutting the circle with the opening of a compass equal to its radius = 5 cm

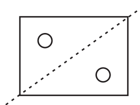


13 Symmetry

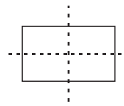
Exercise 13.1

1. Take a piece of paper and fold it in half. Open it and spill a few drops of ink or water colour on one-half side. Now press the two halves together and open it again. What do you observe?

(a) Yes, there is any symmetry in the pattern formed.



(b)

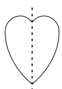


(c) No, there is not any other line of symmetry in the figure.

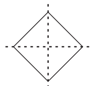
2. Door, leaf, books, table and scale are symmetrical objects from our surroundings.

3. (a) 1 Symmetry (b) 4 Symmetry

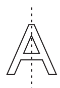
4.



(a)

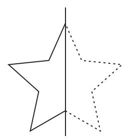


(b)

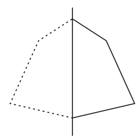


(c)

5. (a)



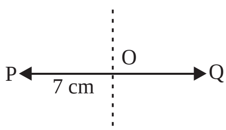
(b)



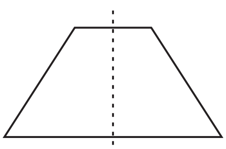
6. Fill in the blanks :

(a) A square has **4** lines of symmetry.
(b) A **circle** has unlimited number of lines of symmetry.
(c) A **scalene** triangle has no line of symmetry.
(d) The letter 'X' has **2** lines of symmetry.

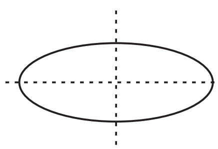
7.



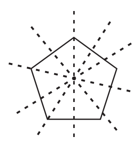
8.



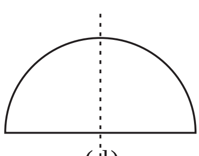
(a)



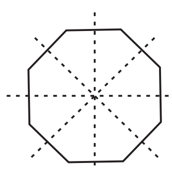
(b)



(c)

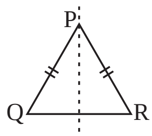


(d)



(e)

9.

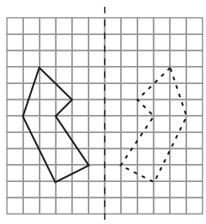


10. B, M, S, W

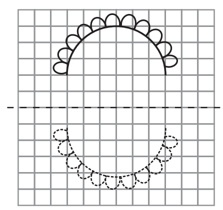
No Symmetry.

11. Dart board, rangoli, design creations and textile, architecture etc.

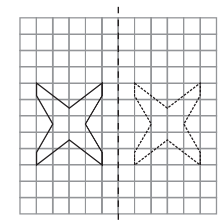
12. (a)



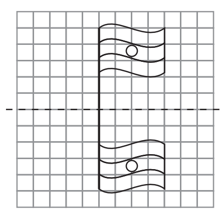
(b)



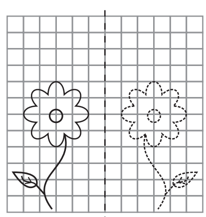
(c)



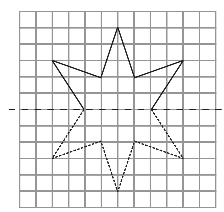
(d)



(e)



(f)



Multiple Choice Questions

1. (d) **2.** (b) **3.** (a) **4.** (c)
5. (d) **6.** (d)

14 Mensuration (Perimeter and Area)

Exercise 14.1

1. Find the perimeter of the following figures :

(a) Perimeter $= (2+3+5+3+2+8+2+3+5+5+2+8)$ cm $= 46$ cm
(b) Perimeter $= (6+3+2+8+2+8+2+3)$ cm $= 34$ cm
(c) Perimeter $= (10+4+20+4+15+12)$ cm $= 65$ cm
(d) Perimeter $= (2+2+2+2+2+2+2+2+2+2+2+2)$ cm
$= 24$ cm
(e) Perimeter $= (4+4+6+6+6)$ cm $= 26$ cm
(f) Perimeter $= (2+9+8+9+2+6+4+6)$ cm $= 46$ cm
(g) Perimeter $= (10+10+10+10+10+10+10+10)$ cm $= 80$ cm
(h) Perimeter $= (15+10+12+24)$ m $= 61$ cm
(i) Perimeter of rectangle $= 2$ (length + breadth)
length $= 10$ cm; breadth $= 15$ cm
Perimeter $= 2(10+15)$ cm $= 2 \times 25$ cm $= 50$ cm
(j) Perimeter of square $= 4$ side $= 4 \times 40$ cm $= 160$ cm
(k) Perimeter $= (5+6+7)$ cm $= 18$ cm
(l) Perimeter = sum of all sides
Perimeter $= (12+12+15)$ cm $= 39$ cm

2. Find the perimeter of the rectangle whose dimensions are given as :

Since, perimeter of rectangle $= 2(l+b)$

(a) length $= 65$ cm, breadth $= 40$ cm
Perimeter $= 2(65+40) = 2(105) = 210$ cm
(b) length $= 40$ cm, breadth $= 12$ cm
Perimeter $= 2(40+12) = 2 \times 52 = 104$ cm
(c) length $= 185$ m, breadth $= 80$ m
Perimeter $= 2(185+80) = 2 \times 265 = 530$ m
(d) length $= 10$ m 25 cm or 10.25 m   breadth $= 5$ m 75 cm or 5.75 m
Perimeter $= 2(10.25+5.75)$ m $= 2 \times 16$ m $= 32$ m

3. Find the perimeter of a square with one side as :

Since, perimeter of square $= 4 \times$ side

(a) Side $= 15$ cm   Perimeter $= 4 \times 15$ cm $= 60$ cm
(b) Side $= 24$ cm   Perimeter $= 24 \times 4$ m $= 96$ cm
(c) Side $= 195$ cm   Perimeter $= 4 \times 195$ cm $= 780$ cm
(d) Side $= 1$ m 25 cm or 1.25 m   Perimeter $= 4 \times 1.25$ cm $= 5.0$ m

4. Determine the perimeter of a triangle whose sides are :

(a) Sides $= 15$ cm, 12 cm, 7 cm   Perimeter $= (15+12+7)$ cm $= 34$ cm
(b) Sides $= 4$ cm, 3 cm, 6 cm   Perimeter $= (4+3+6)$ cm $= 13$ cm
(c) Sides $= 15$ cm, 20 cm, 25 cm   Perimeter $= (15+20+25)$ cm $= 60$ cm
(d) Sides $= 25$ cm, 26 cm, 27 cm   Perimeter $= (25+26+27)$ cm $= 78$ cm

5. Length of a plot $= 0.6$ km $= 600$ m   Breadth of a plot $= 0.5$ km $= 500$ m

Perimeter $= 2(l+b)$

Perimeter $= 2(600 + 500) = 2 \times 1100 = 2200\,\text{m}$
Required wires $= 2200 \times 5 = 11000\,\text{m} = 11\text{ km}$
Cost of wire required for fencing = ` $11000 \times 9 =$ ` 99000

6. Length of rectangular park $= 150\,\text{m}$ Breadth of rectangular park $= 100\,\text{m}$
Perimeter $= 2(150 + 100) = 2 \times 250\,\text{m} = 500\,\text{m}$
Total distance covered by an athlete in 12 rounds $= 12 \times 500\,\text{m} = 6000\,\text{m}$

7. Length of rectangular park $= 60\,\text{m}$ Breadth of rectangular park $= 40\,\text{cm}$
Perimeter $= 2 \times (60 + 40)\,\text{m} = 200\,\text{m}$
Total distance covered by Mayank $= 200\,\text{m} \times 3 = 600\,\text{m}$
Side of square $= 55\,\text{m}$ Perimeter $= 4 \times 55 = 220\,\text{m}$
Total distance covered by Roma $= 220\,\text{m} \times 3 = 660$
Roma walk more distance by 60 m.

8. Perimeter $= 2$ (length + breadth)
$600 = 2$ (length + 90) $600 = 2$ length $+ 90 \times 2$
length $= \dfrac{600 - 180}{2} = 210\,\text{m}$, So, length $= 210\,\text{m}$

9. Ratio of length and breadth $= 2:1$
Length of rectangular field $= 2x$
Breadth of rectangular field $= x$
Perimeter of rectangular field $= 2(2x + x) = 2 \times 3x = 6x$
Total distance $= 2\,\text{km} = 2000$ m
Number of times around this field $= 5$ times
Distance covered in 1 time $= \dfrac{2000}{5} = 400\,\text{m}$
Perimeter of field is 400 m
According to question;

$$400 = 6x$$
$$x = \frac{400}{6} = \frac{200}{3}$$

length of field $= \left(2 \times \dfrac{200}{3}\right)\text{m} = \dfrac{400}{3}$ m, Breadth of this field $= \dfrac{200}{3}$ m

Perimeter $= 600\,\text{m}$; breadth $= 90\,\text{m}$

10. Side of square garden $= 25\,\text{m}$
Perimeter of garden $= 4 \times 25\,\text{m} = 100\,\text{m}$
Cost of fencing $= 100 \times 10 =$ ` 1000

11. Length of rectangular of park $= 50\,\text{m}$
Breadth of rectangular of park $= 30\,\text{m}$
Perimeter $= 2(l + b) = 2(50 + 30) = 2 \times 80 = 160\,\text{m}$
Cost of fence around a rectangular play ground = ` $160 \times 50 =$ ` 8000

12. Side of square park $= 80\,\text{m}$
Perimeter of square $= 4 \times$ side $= 4 \times 80 = 320\,\text{m}$
Distance covered by Lalit $= 2 \times 320\,\text{m} = 640\,\text{m}$
length of rectangular park $= 100\,\text{m}$

Breadth of rectangular park $= 75\,\text{m}$
Perimeter of rectangle $= 2(l + b) = 2(100 + 75)\,\text{cm} = 2 \times 175\,\text{cm}$
Distance covered by Rohan $= 350 \times 3 = 1050\,\text{cm}$
Lalit covers less distance.

13. Ratio of length and breadth $= 4 : 1$

Let length of a rectangular playground $= 4x$
breadth of a rectangular playground $= x$
Perimeter $= 2(4x + x) \;= 2 \times 5x = 10x$
Total cost fencing the playground = ₹ 5000
Cost of fencing per metre = ₹ 50
Perimeter of playground $= \dfrac{5000}{50} = 100\,\text{cm}$
According to question $\quad 10x = 100 \qquad x = 10\,\text{cm}$
length of rectangular park $= 4 \times 10 = 40\,\text{cm}$
breadth of rectangular park $= 10\,\text{cm}$

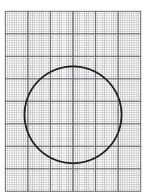
14. Length of rectangular box $= 75\,\text{cm}$

Breadth of rectangular box $= 25\,\text{cm}$
Perimeter of rectangular $= 2(l + b)$
Perimeter of box $= 2(75 + 25)\,\text{cm} = 2 \times 100\,\text{cm} = 200\,\text{cm}$
length of the tape required is 200 cm.

Exercise 14.2

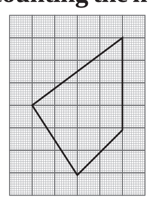
1. Find the area of the following figures by counting the number of squares :

(a)



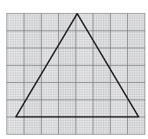
Number of full squares $= 10$
Number of half squares $= 6$
Area $= 10 + 6 \times \dfrac{1}{2}\,\text{cm}^2 = 13\,\text{cm}^2$

(b)



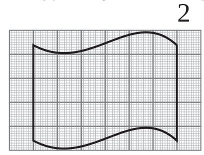
Number of full squares $= 10$
Number of half squares $= 4$
Area $= 10 + 4 \times \dfrac{1}{2}\,\text{cm}^2 = 12\,\text{cm}^2$

(c)



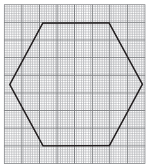
Number of full squares $= 14$
Number of half squares $= 4$
Area $= \left(14 + 4 \times \dfrac{1}{2}\right)\text{cm}^2 = 16\,\text{cm}^2$

(d)



Number of full square $= 20$
Number of half squares $= 4$
Area $= \left(20 + 4 \times \dfrac{1}{2}\right)\text{cm}^2 = 22\,\text{cm}^2$

(e)

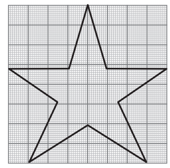


Number of full squares $= 28$

Number of half squares $= 6$

Area $= \left(28 + 6 \times \frac{1}{2}\right) cm^2 = 31 cm^2$

(f)



Number of full squares $= 8$

Number of half squares $= 12 \times \frac{1}{2}$

$= 6$

Area $= (8 + 6)$ cm^2 $= 14$ cm^2

Exercise 14.3

1. Find the area of rectangle whose length and breadth are :

(a) length $= 12$ cm, breadth $= 8$ cm
Area of rectangle $= (12 \times 8)$ cm^2 $= 96$ cm^2

(b) length $= 14$ cm, breadth $= 8$ cm
Area of rectangle $= (14 \times 8)$ cm^2 $= 112$ cm^2

(c) length $= 25$ cm, breadth $= 16$ cm
Area of rectangle $= (25 \times 16)$ cm^2 $= 400$ cm^2

(d) length $= 12.6$ m, breadth $= 9$ m
Area of rectangle $= (12.6 \times 9)$ m^2 $= 113.4$ m^2

2. Find the area of a square whose side is :

(a) Side $= 13$ cm — Area of square $= (13 \times 13)$ cm^2 $= 169$ cm^2

(b) Side $= 25$ cm — Area of square $= (25 \times 25)$ cm^2 $= 625$ cm^2

(c) Side $= 10\frac{1}{2}$ m $= \frac{21}{2}$ m $= 10.5$ m
Area of square $= (10.5)^2$ m^2 $= 110.25$ m^2

(d) Side $= 4$ m 50 cm or 4.50 m
Area of square $= (4.5 \times 4.5)$ m^2 $= 20.25$ m^2

3. Find the area of rectangles with following dimensions and see which one has the greater area.

(a) $l = 10$ m 10 cm or 10.10 m — $b = 3$ m 30 cm or 3.3 m
Area $= (10.10 \times 3.3)$ m^2 $= 33.33$ m^2

(b) $l = 14$ m 25 cm or 14.25 m — $b = 2$ m 30 cm or 2.30 m
Area $= (14.25 \times 2.30)$ m^2 $= 32.775$ m^2

(c) $l = 8$ m 45 cm or 8.45 m — $b = 6$ m 25 cm or 6.25 m
Area $= (6.45 \times 6.25)$ m^2 $= 52.8125$ m^2

So, area of rectangle C is greater.

4. Area of rectangle $= 900\,m^2$ Length $= 50\,m$

Area $=$ length $\times$ breadth $900\,m^2 = 50\,m \times$ breadth

breadth $= \dfrac{900\,m^2}{50\,m} = 18\,m$ Perimeter $= 2(50+18) = 2 \times 68 = 136\,cm$

5. Length of room $= 10\,m$ Breadth of room $= 8\,m$

Area $= 10 \times 8\,m^2 = 80\,m^2$

Cost of carpeting the room = ` $80 \times 135 =$ ` 10800

6. Length of a paper sheet $= 300\,cm$ Breadth of a paper sheet $= 150\,cm$

Area $= 300 \times 150 = 45000\,cm^2$

Length of envelopes from small sheets $= 10\,cm$

Breadth of envelopes from small sheets $= 3\,cm$

Area $= 10 \times 3\,cm^2 = 30\,cm^2$

Number of envelopes made from big sheet $= \dfrac{45000}{30} = 1500$

7. Length of a stick $= 1\,m = 100$ cm Area of square $= 625\,m^2$

New length of stick $= 90\,cm$

Let length of stick 100 cm Original area $= 625$

Let length of stick 1 cm original area $= \dfrac{625}{100}$

Length of stick 90 cm of original area $= \dfrac{625}{100} \times 90 = 562.5\ m^2$

8. Length of a room $= 17\,m$ Breadth of a room $= 10\,m$

Area of a room $= 17 \times 10 = 170\,m^2$ Side of square carpet $= 12\,m$

Area of carpet $= 12 \times 12\,m^2 = 144\ m^2$

Area of the floor which will remain bare $= (170 - 144)\,m^2 = 26\,m^2$

9. Length of a field $= 60\,m$ Breadth of a field $= 40\,m$

Area $= (60 \times 40)\,m^2 = 2400\,m^2$

Cost of ploughing = ` $2400 \times 25 =$ ` 60000

10. Length of drawing room $= 5\,m$ 40 cm $= 5.40$ m

breadth of drawing room $= 4$ m 10 cm or 4.10 m

Area of room $= (5.40 \times 4.10)\,m^2 = 22.14\,m^2$

Cost of carpet = ` $22.14 \times 325 =$ ` 7195.5

11. Side of the square $= 24\,m$ Area of square $= (24 \times 24)\,m^2 = 576\,m^2$

A rectangle and a square are equal in area.

Area of rectangle $= 576\,m^2$ length $\times$ breadth $= 576$

$36 \times$ breadth $= 576$ breadth $= \dfrac{576}{36} = 16$

breadth of rectangle $= 16\,m$ given, length of rectangle $= 36\,m$

Perimeter of rectangle $= 2(16 + 36) = 104$ m.

Perimeter of square $= 4 \times 24$ m $= 96$ m

12. Length of rectangular field $= 34$ m 20 cm $= 34.20$ m

Breadth of rectangular field $= 16$ m 30 cm $= 16.30$ m

Perimeter $= 2(34.20 + 16.30) = 2 \times 50.50$ cm $= 101$ m

Area $= (34.20 \times 16.30)\ m^2 = 557.46\ m^2$

Cost of fencing $=$ ₹ $101 \times 40 =$ ₹ 4040

Cost of turfing $=$ ₹ $557.46 \times 21 =$ ₹ 11706.66

13. Let side of square be x cm

Area of square $= x \times x = x^2\ cm^2$

Now, new side of square will be $= 2x$ cm

and new area $= (2x)^2\ cm^2 = 4x^2\ cm^2 = 4 \times x^2\ cm^2$

We can say that area becomes 4 times.

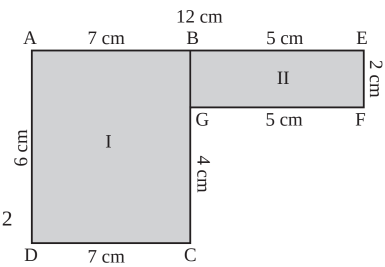
14. Length of a ground $= 45$ m Breadth of a ground $= 30$ m

Area $= l \times b = 45 \times 30 = 1350\ m^2$

Cost of leveling a ground $=$ ₹ $1350 \times 12 =$ ₹ 16200

15. **Calculate the area of each one of the shaded regions split into rectangles :**

(a) Two rectangle in the figure $ABCD$ and $BGFE$



Area of $ABCD = 7 \times 6\ cm^2$

$= 42\ cm^2$

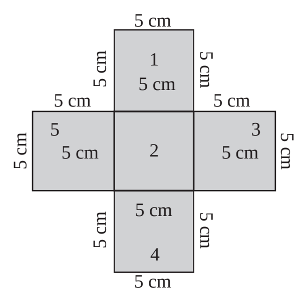
Area $BGFE = 5 \times 2\ cm^2$

$= 10\ cm^2$

Total Area $= (42 + 10)\ cm^2 = 52\ cm^2$

(b) 5 square in the figure

all sides are equal in 5 squares



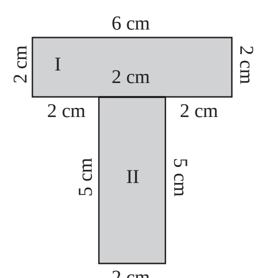
The area of first square $= 5 \times 5\ cm^2$

$= 25\ cm^2$

Area of figure $= 25 \times 5$

$= 625\ cm^2$

(c) 2 rectangle in the figure



Area of I rectangle $= 6 \times 2\ cm^2$

$= 12\ cm^2$

Area of II rectangle $= 5 \times 2\ cm^2$

$= 10\ cm^2$

Area of figure $= 12 + 10\ cm^2$

$= 22\ cm^2$

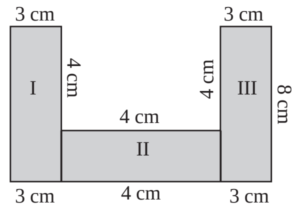
(d) 2 rectangle and 1 square in the figure

Area of I rectangle $= 3 \times 8\ \text{cm}^2 = 24\ \text{cm}^2$

Area of II square $= 4 \times 4\ \text{cm}^2 = 16\ \text{cm}^2$

Area of III rectangle $= 3 \times 8\ \text{cm}^2 = 24\ \text{cm}^2$

Area of figure $= 24 + 16 + 24 = 64\ \text{cm}^2$



MCQs

1.	(d)	**2.**	(d)	**3.**	(c)	**4.**	(a)
5.	(c)	**6.**	(b)	**7.**	(b)	**8.**	(c)

Higher Order Thinking Skills (HOTS)

1. As *B* square is covering more space than that covered by *A*. So, area of square *A* is less than the area of square *B*.

2. Number of side of pentagon = 5

Perimeter of pentagon $= 9 \times 5 = 45\ \text{m}$

Speed = 7 m per min

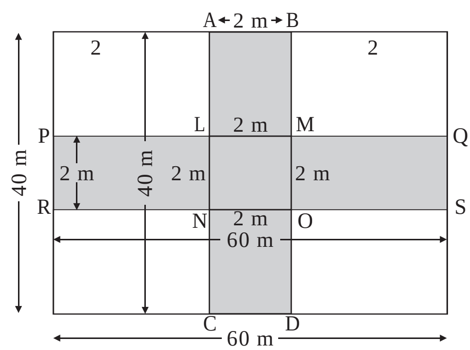
Time taken to complete one round of pentagon $= 45 \div 7 = 6.428$ minute

3. A farmer ploughed field in 1 day = 1 acres or $100\ \text{m}^2$

or he ploughed $100\ \text{m}^2$ field = in 1 day

or he ploughed $300\ \text{m}^2$ field = in $1 \times \frac{1}{100} \times 300 = 3$ days

4.



Area of $ABCD = AB \times AC \quad (AB = CD;\ AC = BD)$

$= 40 \times 2 = 80\ \text{m}^2$

Area of $PQRS = PQ \times PR \quad (PR = QS;\ PQ = RS)$

$= 60 \times 2 = 120\ \text{m}^2$

Area of *LMNO* square $= 2\ \text{m} \times 2\text{m} = (LM = MO = ON = NL)$

$= 4\ \text{m}^2$

Area of path $= (80 + 120 - 4)\ \text{m}^2$

$= 200 - 4\ \text{m}^2 = 196\ \text{m}^2$

Area of remaining part $= (2400 - 196)\ \text{m}^2 = 2204\ \text{m}^2$

15 Data Handling

Exercise 15.1

1. The final marks in English test of 30 students are as follows :

(a)

Group	Tally marks	Number of students
30 − 39	||	2
40 − 49	|||	3
50 − 59	~~||||~~ ||	8
60 − 69	~~||||~~ |||	8
70 − 79	||||	4
80 − 89	||	2
90 − 99	||	2
100 − 109	|	1
		30

(b) The highest score = 100

(c) The lowest score = 37

(d) 2 student failed.

(e) 5 students marks in less than 50.

2. Following are the number of children in 20 families of a colony :

No. of students	Tally marks	Frequency
1	~~||||~~ |	6
2	~~||||~~ |||	8
3	||||	4
4	||	2

(a) The minimum number of children in a family is 1.

(b) The maximum number of children in a family is 4.

(c) The most common number of children in a family of the colony is 2.

(d) 8 families have 2 children.

3. The height of 20 students (in cm) is recorded as under :

Height of students (in cm)	Tally marks	Frequency
114	|	1
115	||	2
116	|	1
117	~~||||~~ ||	7
118	||	2

119	$\mid$	1
120	$\mid\mid$	2
125	$\mid\mid\mid\mid$	4

4. The monthly electricity bill (in `) of 30 houses in a locality of Delhi are given below :

Electricity bill	Tally marks	Number of houses
1055	$\cancel{\mid\mid\mid\mid}\ \mid\mid\mid$	8
1056	$\cancel{\mid\mid\mid\mid}$	5
1476	$\mid$	1
1578	$\mid$	1
2001	$\mid$	1
2033	$\mid$	1
2044	$\cancel{\mid\mid\mid\mid}$	5
2046	$\mid\mid\mid$	3
2048	$\mid\mid\mid$	3
2218	$\mid$	1
2255	$\mid$	1
		30

(a) $15\,(1+1+5+3+3+1+1)$ houses had electricity bill more than ` 2000.

(b) $15\,(8+5+1+1)$ houses had bill more than ` 1000 but less than ` 2000.

(c) The maximum bill amount is ` 2255.

(d) The range of above data $= 2255 - 1055 = 1200$.

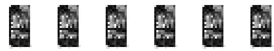
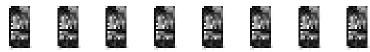
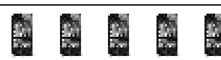
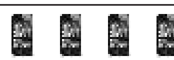
5. In a ready made garments store, on a particular day the following size of shirts were sold.

Size of shirts	Tally marks	Frequency
32	$\mid\mid\mid$	3
34	$\mid\mid\mid$	3
36	$\mid\mid$	2
38	$\mid\mid\mid\mid$	4
40	$\cancel{\mid\mid\mid\mid}\ \cancel{\mid\mid\mid\mid}\ \mid\mid$	12
42	$\mid\mid\mid$	3
44	$\mid\mid\mid$	3

(a) Size 36 had min. sale

(b) Size 40 had max. sale

6. **The number CFL made in a factory in 7 days of a week is given below :**
   (a) The factory made **200** CFL on Tuesday.
   (b) The factory made maximum number of CFL on **Wednesday.**
   (c) The factory made minimum number of CFL on **Friday.**
   (d) **300** CFL were made on Saturday.
   (e) 200 CFL are made on **Tuesday** and **Thursday.**
7. **The following table shows the daily production mobile sets in an industry for 7 days of a week :**

Days	Number of Mobile Sets
Mon	
Tue	
Wed	
Thu	
Fri	
Sat	
Sun	

Mobile set  = 50 mobiles

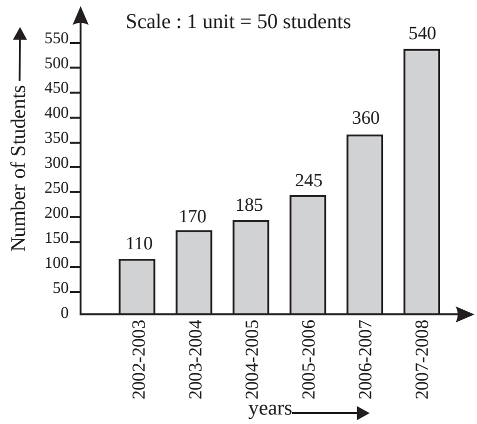
8. **The following table shows the number of cars sold by five dealers in a particular month.**

Dealer	Bike sold
Saya	
Bagga Links	
Ajay automobiles	
Bhasin automobiles	
Competent automobile	

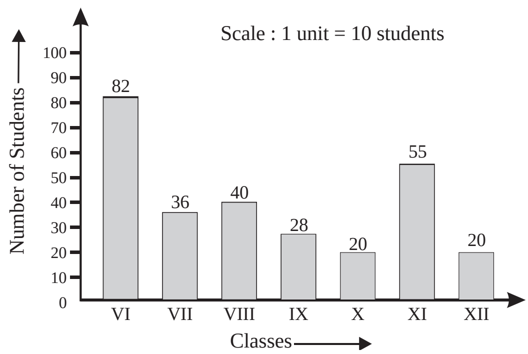
 = 5 Cars sold.

Exercise 15.2

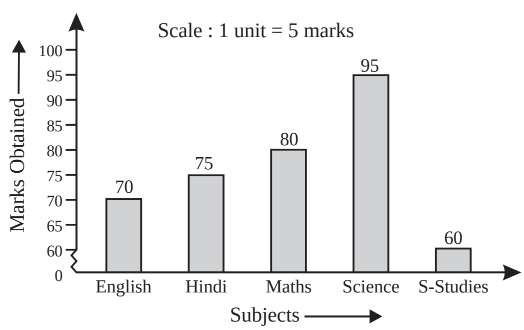
1. **The year-wise growth of a little stars school is shown below :**



2. **The number of students admitted in a year in a school in different classes is given below. Represent the data by a bar graph.**



3. **The marks obtained by a student in various subjects are given below :**



4. Read the bar graph given below shows the productions of wheat in 8 states and answer the following questions :

(a) Bar graph shows the total production of wheat (in tonnes) in 8 different states.

(b) MP is the largest produces of wheat.

(c) WB state has the minimum production of wheat.

(d) The total production of UP and MP $= 13000$.

5. The bar-graph shows the number of goals scored by a football team per match. Read the graph and answer the questions given :

(a) 68 matches were played in all $(12 + 20 + 16 + 6 + 12 + 2)$.

(b) 4 goals were scored in 12 matches.

(c) No goal was scored in 12 matches.

6. The graph given below indicates the number of books issued by a library during a week.

(a) The bar graph shows the number of books issued by a library during a week.

(b) 40 books were issued on Monday.

(c) 50 books were issued on Thursday.

(d) 220 total number of books were issued. $(40 + 60 + 30 + 50 + 25 + 15)$

(e) 45 more books were issued on Tuesday than Saturday. $(60 - 15)$

7. The given bar graph represents the circulation of newspapers in different languages. Study the graph and answer the following questions :

(a) The total circulation of newspapers in Hindi, Marathi and Tamil is 220000. $(160000 + 40000 + 20000)$

(b) The circulation is least language in Tamil.

(c) The circulation is highest language in Hindi.

MCQs

1.	(b)	**2.**	(c)	**3.**	(a)	**4.**	(c)
5.	(b)	**6.**	(c)	**7.**	(b)	**8.**	(a)

1 Integers

Exercise 1.1

1. Subtract the following.

(a) -68 from -30
$= -30 - (-68)$
$= -30 + 68$
$= 38$

(b) -42 from 8
$= 8 - (-42)$
$= 8 + 42$
$= 50$

(c) 591 from 1091
$= 1091 - 591$
$= 500$

(d) 5700 from -5700
$= -5700 - 5700$
$= -11400$

(e) -2009 from -1009
$= -1009 - (-2009)$
$= -1009 + 2009$
$= 1000$

(f) 0 from -67
$= -67 - 0$
$= -67$

(g) -48 from 0
$= 0 - (-48)$
$= 0 + 48$
$= 48$

(h) 17 from -38
$= -38 - 17$
$= -55$

(i) -17 from 57
$= 57 - (-17) = 57 + 17 = 74$

2. Evaluate.

(a) $15 - (-25)$
$= 15 + 25$
$= 40$

(b) $9 + 23 - (-25) - 40$
$= 9 + 23 + 25 - 40$
$= 57 - 40 = 17$

(c) $-42 - [(-30) + (-50)]$
$= -42 - [-30 - 50]$
$= -42 - [-80]$
$= -42 + 48$
$= 38$

(d) $(-30 + 10) - (40 - 20)$
$= -20 - (20)$
$= -20 - 20$
$= -40$

(e) $[-437 - 1 + 8] + [234 - (-10)] - [15 + (-17)]$
$= (-430) + (234 + 10) - (15 - 17)$
$= -430 + 244 + 2$
$= -184$

(f) $509 - (-19) + (-19) + 20 + (-20)$
$= 509 + 19 - 19 + 20 - 20 = 509$

3. Subtract the sum of 38 and 97 from 237
$= 237 - (38 + 97)$
$= 237 - 135 = 102$

4. Subtract -48 from the sum of -34 and -49.

$= [(-34)+(-49)]-(-48)$
$= (-34-49)+48$
$= -83+48$
$= -35$

5. Find the additive inverse of the following numbers :

(a) Additive inverse of $90 = -90$
(b) Additive inverse of $-37 = +37$
(c) Additive inverse of $0 = 0$
(d) Additive inverse of $-1908 = +1908$
(e) Additive inverse of $11801 = -11801$
(f) Additive inverse of $-600100 = +600100$

6. Find the product of each of the following :

(a) $(-9)\times 4$
$= -36$

(b) $0\times(-52)$
$= 0$

(c) $7\times(-35)$
$= -245$

(d) $(-17)\times(-2)$
$= +(17\times 2) = +34$

(e) $(-7)\times(-49)$
$= +(7\times 49)$
$= +343$

(f) $(-18)\times(-13)$
$= +(18\times 13)$
$= +234$

(g) $(-1)\times(-3)\times(6)$
$= +(1\times 3\times 6) = +18$

(h) $(-5)\times(-5)\times(-5)$
$= -(5\times 5\times 5) = -125$

(i) $(-10)\times 0\times(-18)$
$= 0\times(-18) = 0$

(j) $10\times(-9)\times(-9)$
$= (-90)\times(-9) = +810$

(k) $2\times(-3)\times 4\times(-5)$
$= (-6)\times 4\times(-5)$
$= (-24)\times(-5) = +120$

(l) $(-3)\times(-3)\times 0\times(-6)$
$= 9\times 0\times(-6)$
$= 0\times(-6) = 0$

7. Fill in the blanks :

(a) $+13$ (b) -32 (c) $+42$ (d) $+9$
(e) -16 (f) $+13$

8. No, collection of integers is not associative under subtraction.

9. No, collection of integers is not associative under division.

e.g., $24\div(12\div 2)\neq(24\div 12)\div 2$
$24\div 6\neq 2\div 2$
$4\neq 1$

10. Verify and name the property used :

(a) $(-202)\times(-142) = (-142)\times(-202)$
$+28684 = +28684$
LHS = RHS
(commotative property over multiplication)

(b) $-1210+265 = 265+(-1210)$
$-945 = -945$

$$\text{LHS} = \text{RHS}$$

(commotative property over addition)

(c) $[-15+135]+(-250) = -15+[135+(-250)]$

$$[+120]-(250) = -15+[135-250]$$
$$120-250 = -15+(-115)$$
$$-130 = -15-115$$
$$-130 = -130 \text{ (Associative property over addition)}$$
$$\text{L.H.S} = \text{R.H.S}$$

(d) $(-20\times 5)\times(-356) = -20\times[5\times(-356)$

$$(-100)\times(-356) = -20\times[5\times(-356)]$$
$$(-100)\times(-356) = (-20)\times(-1780)$$
$$+35600 = +35600$$
$$\text{L.H.S} = \text{R.H.S}$$

(Associative property over addition)

11. Fill in the blanks

(a) $-19\div \boxed{-1} = 19$

(b) $(23)\div \boxed{-23} = -1$

(c) $(-602)\div \boxed{1} = -602$

(d) $\boxed{-93} \div 1 = -93$

(e) $\boxed{-1} \div 1 = -1$

(f) $121\div \boxed{-11} = -11$

(g) $\boxed{-35} \div (7) = -5$

12. $a\div 5 = -b$

Such pairs are $= (-10,-2)\,(-15,-3)\,(-20,-4)\;\; (-25,-5),\;\; (-30,-6),$ $(-35,-7)$ etc.

13. (a) Let Ankit attempts x questions incorrect

Marks scored by Ankit $= 80$

$$20\times(+5)+x\times(-2) = 80$$
$$100-2x = 80$$
$$2x = 100-80$$
$$2x = 20$$
$$x = \frac{20}{2}$$
$$x = 10$$

So, Ankit attempted 10 questions incorrect.

(b) Let Bhavna attempted x questions incorrect.

Marks scored by Bhavna $= 0$

$$10\times(+5)+x\times(-2) = 0$$
$$50-2x = 0$$
$$2x = 50$$
$$x = \frac{50}{2}$$
$$x = 25$$

So, Bhavna attempted 25 questions incorrect.

(c) Let Chavi attempted x questions correct and $(13-x)$ questions incorrect

So, marks scored by Chavi $= -5$

$$x \times (+5) + (13 - x) \times (-2) = -5$$
$$5x - 26 + 2x = -5$$
$$7x = -5 + 26$$
$$7x = 21$$
$$x = \frac{21}{7}$$
$$x = 3$$

So, Chavi attempted 3 questions correct and $(13-3) = 10$ questions incorrect.

14. Speed $= 6$ m/min

total distance $= 10 - (-350)$ m

$= 10 + 350$ m

$= 360$ m

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{360}{6} = 60 \text{ min or } 1 \text{ hr}$$

15. Product of two number $= -153$

one no. $= 9$

othe no. $= -153 \div 9$

$$= \frac{-153}{9} = -17$$

16. For each of the following statements, write true or false :

(a) False (b) True (c) False (d) True

(e) False (f) False

Exercise 1.2

1. Find the value of :

(a) $28 + 8 \div 4$
$= 28 + 2$
$= 30$

(b) $120 - 45 \div 15$
$= 120 - 3$
$= 117$

(c) $15 - (3 \times 2) - 4$
$= 15 - 6 - 4$
$= 9 - 4$
$= 5$

(d) $5 - (5 + 3 - 2)$
$= 5 - (8 - 2)$
$= 5 - (6)$
$= -1$

(e) $(-21) + 8 \div [6 - (4)]$
$= -21 + 8 \div 2$
$= -21 + 4$
$= -17$

(f) $28 \div \overline{10 - 9}$
$= 28 \div 1$
$= 28$

(g) $15 + (-4) \times (-5) - 8$
$= 15 + 20 - 8$
$= 35 - 8$
$= 27$

(h) $(-4) - (-30) \div (-12 - 3) \times 5$
$= (-4) - (-30) \div (-15) \times 5$
$= -4 - (2) \times 5$
$= -4 - 10$
$= -14$

2. Simplify :

(a) $12-[7-\{16-(18-\overline{6+3-1})\}]$

$=12-[7-\{16-(18-8)\}]$
$=12-[7-\{16-10\}]$
$=12-[7-6]$
$=12-1=11$

(b) $75-\{35\times 2-(14\times 4+6)\}$

$=75-\{35\times 2-(56+6)\}$
$=75-\{70-62\}$
$=75-\{8\}=67$

(c) $15+3\times 3-[14-2-\{9-(7-\overline{9-4})\}]$

$=15+3\times 3-[14-2-\{9-(7-5)\}]$
$=15+9-[14-2-\{9-2\}]$
$=15+9-[14-2-7]$
$=15+9-[14-9]$
$=24-5=19$

(d) $12+5-[9-\{6\div 2-(6-12\div 3)\div 2\}]-5$

$=12+5-[9-\{6\div 2-(6-4)\div 2\}]-5$
$=12+5-[9-\{6\div 2-2\div 2\}]-5$
$=12+5-[9-\{3-1\}]-5$
$=12+5-[9-2]-5$
$=12+5-7-5$
$=17-12=5$

(e) $(21-4)\times[20+\{18+\overline{10-5}\}]$

$=17\times[20+\{18+5\}]$
$=17\times[20+23]$
$=17\times 43=731$

(f) $100-[18-\{16\div 2-(16-12\div 3)\div 3\}]$

$=100-[18-\{16\div 2-(16-4)\div 3\}]$
$=100-[18-\{16\div 2-12\div 3\}]$
$=100-[18-\{8-4\}]$
$=100-[18-4]$
$=100-14=86$

(g) $-25+12\div(9-3)$

$=-25+12\div 6$
$=-25+2=-23$

(h) $29-[38-\{40\div 2-(6-9\div 3)\div 3\}]$

$=29-[38-\{40\div 2-(6-3)\div 3\}]$
$=29-[38-\{40\div 2-3\div 3\}]$
$=29-[38-\{40\div 2-1\}]$
$=29-[38-\{20-1\}]$

$$= 29 - [38 - 19] = 29 - 19 = 10$$

(i) $14 - \frac{1}{2}\{13 + 2 - (7 + 5 - \overline{2 + 3})\}$

$$= 14 - \frac{1}{2}\{13 + 2 - (7 + 5 - 5)\}$$

$$= 14 - \frac{1}{2}\{13 + 2 - 7\}$$

$$= 14 - \frac{1}{2}\{15 - 7\}$$

$$= 14 - \frac{1}{2} \times 8 = 14 - 4 = 10$$

(j) $14 + \frac{1}{5}[\{-10 \times (25 - \overline{13 - 3})\} \div (-5)]$

$$= 14 + \frac{1}{5}[\{-10 \times (25 - 10)\} \div (-5)]$$

$$= 14 + \frac{1}{5}[\{-10 \times 15\} \div (-5)]$$

$$= 14 + \frac{1}{5}[\{-150\} \div (-5)]$$

$$= 14 + \frac{1}{5}[30]$$

$$= 14 + \frac{1}{5} \times 30 = 14 + 6 = 20$$

(k) $-30 + \{\overline{(-1) - (-2)} \times 3 \div \overline{6 - 3}\}$

$$= -30 + \{1 \times 3 \div 3\}$$
$$= -30 + \{3 \div 3\}$$
$$= -30 + 1 = -29$$

(l) $(-4) \times (-5)[3 \times (-6) + 3 \times (\overline{2 \times 6} - 4 - 4)]$

$$= (-4) \times (-5) \times [3 \times (-6) + 3 \times (12 - 4 - 4)]$$
$$= (-4) \times (-5) \times [3 \times (-6) + 3 \times 4]$$
$$= (-4) \times (-5) \times (-18 + 12)$$
$$= 20 \times (-6) = -120$$

3. Express the following statements in mathematical terms making use of brackets :

(a) $36 \div (8 - 2)$

(b) $21 + 15 \div 3$

(c) $(-15) \times [12 + (-35)]$

(d) $5 \times [(32 - 7) - 1]$

(e) $-21 \div 7 + 7$

(f) $(8 \times 5) - [(-6) \times (-10)]$

Multiple Choice Questions

Tick (3) the correct option :

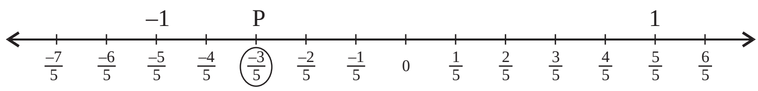
1. (b) **2.** (a) **3.** (d) **4.** (a) **5.** (b)

2 Rational Numbers

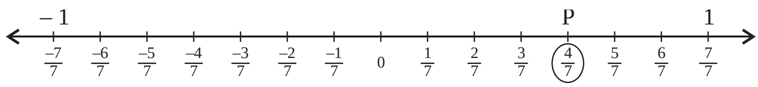
Exercise 2.1

1. Draw number lines and mark the following :

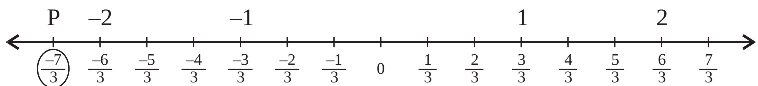
(a)



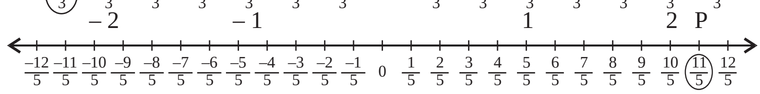
(b)



(c)



(d)



2. Fill in the blanks with symbol >, < or = :

(a) $\frac{-3}{4}$ < $\frac{-1}{4}$

(b) $\frac{5}{6}$ = $\frac{10}{12}$

$\frac{5}{6}\ \frac{10}{12}$ (cross multiplication)

$5 \times 12 = 10 \times 6$

$60 = 60$

(c) $\frac{-2}{3}$ < $\frac{1}{3}$

(d) 0 < $\frac{5}{6}$

(e) -6 < $\frac{-26}{5}$

$\frac{-6}{1}\ \frac{-26}{5}$ (cross multiplication)

$-6 \times 5 < -26 \times 1$

$-30 < -26$

(f) $\frac{4}{-5}$ < $\frac{-7}{10}$

$\frac{(-4)}{5}\ \frac{(-7)}{10}$ (cross multiplication)

$-4 \times 10 < -7 \times 5$

$-40 < -35$

3. Express the following as rational numbers in the form of $\frac{p}{q}$.

(a) $-9 = \frac{-9}{1}$

(b) $0 = \frac{0}{1}$

(c) $1.8 = \frac{18}{10}$ or $\frac{9}{5}$ (d) $-0.7 = \frac{-7}{10}$

4. Express the following rational numbers in their standard form.

(a) $\frac{-12}{16} = \frac{-12 \div 4}{16 \div 4} = \frac{-3}{4}$ (H.C.F. of 12 and 16 is 4)

(b) $\frac{-84}{-120} = \frac{-84 \div -12}{-120 \div 12} = \frac{7}{10}$ (H.C.F. of – 84 and – 120 is –12)

(c) $\frac{39}{-49} = \frac{39 \times -1}{-49 \times -1} = \frac{-39}{49}$

(d) $\frac{-32}{-96} = \frac{-32 \times -1}{-96 \times -1} = \frac{32}{96} = \frac{32 \div 32}{96 \div 32} = \frac{1}{3}$

5. Check if the following pairs of rational numbers are equivalent :

(a) $\frac{2}{3}$ and $\frac{8}{9}$ $\quad \frac{2}{3} = \frac{2 \times 3}{3 \times 3} = \frac{6}{9}$

$\frac{6}{9} \neq \frac{8}{9}$ No, pair is not equivalent

(b) $\frac{-5}{6} = \frac{-5 \times 5}{6 \times 5} = \frac{-25}{30}$

$\frac{25}{-30} = \frac{25 \times -1}{-30 \times -1} = \frac{-25}{30}$

$\frac{-25}{30} = \frac{-25}{30}$ Yes, Pair is equivalent.

(c) $\frac{-1}{-3}$ and $\frac{5}{15}$

$\frac{-1}{3} = \frac{-1 \times -5}{-3 \times -5} = \frac{5}{15}$

$\frac{5}{15} = \frac{5}{15}$ Yes, pair is equivalent

(d) $\frac{-4}{11}$ and $\frac{-12}{22}$

$\frac{-4 \times 2}{11 \times 2} = \frac{-8}{22}$; $\frac{-12}{22}$; $\frac{-8}{22} \neq \frac{-12}{22}$ No, pair is not equalvalent.

6. Find four rational numbers equivalent to :

(a) $\frac{3}{7} = \frac{3 \times 2}{7 \times 2} = \frac{6}{14}$; $\frac{3 \times -2}{7 \times -2} = \frac{-6}{-14}$; $\frac{3}{7} = \frac{3 \times 3}{7 \times 3} = \frac{9}{21}$; $\frac{3}{7} \times \frac{-3}{-3} = \frac{-9}{-21}$

$\frac{6}{14}, \frac{-6}{-14}, \frac{9}{21}, \frac{-9}{21}$ are equavalent fractional number of $\frac{3}{7}$.

(b) $\frac{-4}{9} = \frac{-4 \times -2}{9 \times -2} = \frac{8}{-18}$; $\frac{-4 \times 3}{9 \times 3} = \frac{-12}{27}$; $\frac{-4 \times 4}{9 \times 4} = \frac{-16}{36}$; $\frac{-4 \times -5}{9 \times -5} = \frac{20}{-45}$

$\frac{8}{-18}, \frac{-12}{27}, \frac{-16}{36}$ and $\frac{20}{-45}$ are equalvalent fractional number of $\frac{-4}{9}$.

(c) $\frac{-5}{11} = \frac{-5\times-2}{11\times-2} = \frac{10}{-22}; \frac{-5\times-3}{11\times-3} = \frac{15}{-33}; \frac{-5\times-4}{11\times-4} = \frac{20}{-44};$
$\frac{-5\times-5}{11\times-5} = \frac{25}{-55}$
$\frac{10}{-22}; \frac{15}{-33}; \frac{20}{-44}$ and $\frac{25}{-55}$ are equalaned fractional number $\frac{5}{4}$.

7. Write each of the following with a positive denominator.

(a) $\frac{4}{-13} = \frac{4\times-1}{-13\times-1} = \frac{-4}{13}$

(b) $\frac{-3}{-5} = \frac{-3\times-1}{-5\times-1} = \frac{3}{5}$

(c) $\frac{1}{-9} = \frac{1\times-1}{-9\times-1} = \frac{-1}{9}$

(d) $\frac{-7}{-15} = \frac{-7\times-1}{-15\times-1} = \frac{7}{15}$

8. Express $\frac{12}{-5}$ as a rational numbers with :

(a) numerator $= 48$
$\frac{12\times4}{-5\times4} = \frac{48}{-20}$

(b) numerator $= -84$
$\frac{12\times-7}{-5\times-7} = \frac{-84}{35}$

(c) denominator $= -25$
$\frac{12\times5}{-5\times5} = \frac{60}{-25}$

(d) denominator $= 30$
$\frac{12\times-6}{-5\times-6} = \frac{-72}{30}$

9. Arrange the following in ascending order.

(a) $\frac{4}{-9}, \frac{-5}{6}, \frac{-2}{3}, \frac{11}{18}$

First, on changing the denominator of $\frac{4}{-9}$ into positive number, we have

$\frac{4}{-9} = \frac{-4}{9}$

Now, compare $\frac{-4}{9}, \frac{-5}{6}, \frac{-2}{3}, \frac{11}{18}$ by converting them into equivalent rational number.

$\frac{11}{18}$ is positive rational number which is largest.

(LCM of 9, 6, 3 is 18)

$\frac{-4}{9} = \frac{-4\times2}{9\times2} = \frac{-8}{18}; \frac{-5}{6} = \frac{-5\times3}{6\times3} = \frac{-15}{18}; \frac{-2}{3} = \frac{-2\times6}{3\times6} = \frac{-12}{18}$

Now, $\frac{-8}{18}, \frac{-15}{18}, \frac{-12}{18}$

Since $-8 > -12 > -15$

or Ascending order $\frac{-15}{18} < \frac{-12}{18} < \frac{-8}{18}$

or $\frac{-5}{6} < \frac{-2}{3} < \frac{-4}{9} < \frac{11}{18}$

(b) $\frac{-7}{5}, \frac{-19}{-30}, \frac{3}{10}, \frac{8}{-15}$

First, on changing the denominator of $\frac{-19}{-30}$ and $\frac{8}{-15}$ into positive number, we have $\frac{-19}{-30} = \frac{19}{30}; \frac{8}{-15} = \frac{-8}{15}$

Now, we have $\frac{19}{30}$ and $\frac{3}{10}$ are positive rational number.

We campare $\frac{19}{30}$ and $\frac{3}{10}$

$$19 \times 10 = 190 > 3 \times 30$$

$$\frac{19}{30} \;\; \frac{3}{10} \qquad \text{(By cross multiplication)}$$

$\frac{19}{30}$ is greater than $\frac{3}{10}$.

Now, compare $\frac{-7}{5}$ and $\frac{-8}{15}$

$$\frac{-7}{5} \;\; \frac{-8}{15} \qquad \text{(By cross multiplication)}$$

$-7 \times 15 < -8 \times 5 = -105 < -40$

or $\frac{-7}{5} < \frac{-8}{15}$

Now, Ascending order

$$\frac{-7}{5} < \frac{-8}{15} < \frac{3}{10} < \frac{19}{30}$$

or $\frac{-7}{5} < \frac{8}{-15} < \frac{3}{10} < \frac{-19}{-30}$

10. Find four rational numbers between :

(a) $\frac{-3}{5}$ and -2

Reduce both of them of equivalent rational number having denominator equal to the LCM of 5 and 1 that is 5.

$$\frac{-3}{5} = \frac{-3 \times 1}{5 \times 1} = \frac{-3}{5}$$

$$\frac{-2}{1} = \frac{-2 \times 5}{1 \times 5} = \frac{-10}{5}$$

Thus, rational numbers between $\frac{-3}{5}$ and $\frac{-10}{5}$ are

$\frac{-4}{5}, \frac{-6}{5}, \frac{-7}{5}, \frac{-8}{5}, \frac{-9}{5}, \frac{-10}{5}$ (choice any four rational number)

Rational numbers are $\frac{-4}{5}, \frac{-6}{5}, \frac{-7}{5}, \frac{-8}{5}$

(b) – 2 and – 1

– 2 and – 1 may be shown as rational numbers with a common denominator 10. Let us say

$$\frac{-2}{1} \times \frac{10}{10} = \frac{-20}{10}; \frac{-1}{1} \times \frac{10}{10} = \frac{-10}{10}$$

Thus, rational no. between $\frac{-20}{10}$ and $\frac{-10}{10}$ are $\frac{-19}{10}, \frac{-18}{10}, \frac{-17}{10}, \frac{-16}{10}, \frac{-15}{10}$ … $\frac{-11}{10}$ (choice any four)

Rational numbers are $\frac{-19}{10}, \frac{-18}{10}, \frac{-17}{10}, \frac{-16}{10}$

(c) $\frac{-4}{5}$ and $\frac{-3}{4}$

$\frac{-4}{5}$ and $\frac{-3}{4}$ may be shown as equalivent rational number having denominator equal to the LCM of 5 and 4 multipled by 10 ; 200

$\frac{-4}{5} \times \frac{40}{40} = \frac{-160}{200}; \frac{-3}{4} \times \frac{50}{50} = \frac{-150}{200}$

Thus rational numbers between $\frac{-150}{200}$ and $\frac{-160}{200}$ are

$\frac{-159}{200}, \frac{-158}{200}, \frac{-157}{200}, \frac{-156}{200}$ … $\frac{-151}{200}$ (choice any four)

Rational numbers are $\frac{-159}{200}, \frac{-158}{200}, \frac{-157}{200}, \frac{-156}{200}$.

(d) $\frac{1}{4}$ and $\frac{6}{7}$

$\frac{1}{4}$ and $\frac{6}{7}$ may be shown as equalivent rational number having denominator equal to the LCM of 4 and 7 are 28.

$\frac{1 \times 7}{4 \times 7} = \frac{7}{28}; \frac{6 \times 4}{7 \times 4} = \frac{24}{28}$

Thus, rational numbers between $\frac{7}{28}$ and $\frac{24}{28}$ are

$\frac{7}{28}, \frac{8}{28}, \frac{9}{28}, \frac{10}{28}$ … $\frac{12}{28}, \frac{14}{28}$ … $\frac{20}{28}$, (choice any four)

Rational numbers are $\frac{10}{28}, \frac{12}{28}, \frac{14}{28}, \frac{20}{28}$

11. Which of the following pairs of rational number is greater?

(a) $\frac{-3}{7}, \frac{3}{7}$ As $\frac{3}{7}$ is positive rational numbers

So, $\frac{3}{7}$ is greater than $\frac{-3}{7}$

(b) $\frac{-11}{15}, 0$ 0 is greater that all negative rational numbers

So, 0 is greater than $\frac{-11}{15}$

(c) $\frac{-4}{9}, \frac{-7}{9}$ $\frac{-4}{9}$ is greater than $\frac{-7}{9}$.

(d) $\frac{3}{-8}, \frac{-8}{12}$ By cross multiplication

$$\frac{-3}{8} \qquad \frac{-8}{12}$$

$$-3\times 12 > -8\times 8$$

$$-36 > -64$$

or $$\frac{3}{-8} > \frac{-8}{12}$$

$\frac{3}{-8}$ is greater than $\frac{-8}{12}$

12. Find two rational numbers between :

(a) $\frac{1}{2}$ and $\frac{3}{4}$

Reduce both of them of equivalent national numbers having denominator equal to the LCM of 2 and 4 multiplied by 20. *i.e.*, 80

$\frac{1}{2} = \frac{1\times 40}{2\times 40} = \frac{40}{80}$ and $\frac{3}{4} = \frac{3\times 20}{4\times 20} = \frac{60}{80}$

Now, we say that $\frac{41}{80}, \frac{42}{80}, \frac{42}{80}, \frac{44}{80}, \frac{45}{80}$...... all these rational number between $\frac{1}{2}$ and $\frac{3}{4}$

So, $\frac{41}{80}, \frac{42}{80}$ are two rational number between $\frac{1}{2}$ and $\frac{3}{4}$.

(b) $\frac{-1}{2}$ and $\frac{1}{2}$

First rational no. $= \frac{1}{2}\left[\frac{-1}{2} + \frac{1}{2}\right] = \frac{1}{2} \times 0 = 0$

Now, second rational number between 0 and $-\frac{1}{2}$

$$= \frac{1}{2}\left[0 - \frac{1}{2}\right] = \frac{1}{2} \times \frac{-1}{2} = \frac{-1}{4}$$

So, Two rational number between $\frac{-1}{2}$ and $\frac{1}{2}$ are $= 0$ and $\frac{-1}{4}$

Exercise 2.2

1. Add the following :

(a) $\frac{-4}{5}$ and $\frac{-1}{5} = \frac{-4}{5} + \left(\frac{-1}{5}\right) = \frac{-4-1}{5} = \frac{-5}{5} = -1$

(b) $\frac{-5}{7}$ and $\frac{-6}{-7}$

$$\frac{-6}{-7} = \frac{-6 \times (-1)}{-7 \times (-1)} = \frac{6}{7}$$

Now, $\frac{-5}{7} + \frac{6}{7} = \frac{-5+6}{7} = \frac{1}{7}$

(c) $\frac{3}{9}$ and $\frac{1}{-9}$

$$\frac{1}{-9} = \frac{1 \times (-1)}{-9 \times (-1)} = \frac{-1}{9}$$

Now, $\frac{3}{9} + \left(\frac{-1}{9}\right) = \frac{3-1}{9} = \frac{2}{9}$

(d) $\frac{-3}{8}$ and $\frac{-5}{8}$

$$\frac{-3}{8} + \left(\frac{-5}{8}\right) = \frac{-3-5}{8} = \frac{-8}{8} = -1$$

2. Add and express the sum in the lowest terms.

(a) $\frac{7}{25} + \frac{3}{5} = \frac{7 + (3 \times 5)}{25} = \frac{7+15}{25} = \frac{22}{25}$

(b) $\frac{-5}{12} + \frac{-1}{4} = \frac{-5}{12} - \frac{1}{4} = \frac{-5-(1 \times 3)}{12} = \frac{-5-3}{12} = \frac{-8}{12}$ or $= \frac{-2}{3}$

(c) $\frac{-3}{10} + \frac{9}{5} = \frac{-3 + (9 \times 2)}{10} = \frac{-3+18}{10} = \frac{15}{10}$ or $\frac{3}{2}$ or $1\frac{1}{2}$

(d) $\frac{11}{12} + \frac{-1}{4} = \frac{11}{12} - \frac{1}{4} = \frac{11-3}{12} = \frac{8}{12}$ or $\frac{2}{3}$

3. Write the additive inverse of :

(a) The additive inverse of $\frac{2}{9} = \frac{-2}{9}$

(b) The additive inverse of $\frac{-5}{11} = \frac{+5}{11}$

(c) The additive inverse of $\dfrac{8}{-9} = \dfrac{8}{9}$

(d) The additive inverse of $\dfrac{-11}{-61} = \dfrac{-11}{61}$

4. Fill in the blanks so as to make the given statements true :

(a) $\dfrac{3}{11} + \dfrac{-2}{11} = + \mathbf{\dfrac{1}{11}}$ (b) $\dfrac{2}{3} + \mathbf{1} = \dfrac{5}{3}$ (c) $\dfrac{5}{9} + \mathbf{\dfrac{-5}{9}} = 0$

(d) $\mathbf{\dfrac{13}{14}} - \dfrac{5}{7} = \dfrac{3}{14}$ (e) $\mathbf{\dfrac{-13}{17}} - \dfrac{-13}{17} = 0$ (f) $0 + \mathbf{\dfrac{4}{7}} = \dfrac{4}{7}$

5. Evaluate the following :

(a) $\dfrac{7}{12} - \dfrac{1}{12} = \dfrac{7-1}{12} = \dfrac{6}{12}$ or $\dfrac{1}{2}$ (b) $\dfrac{-3}{7} - \dfrac{5}{7} = \dfrac{-3-5}{7} = \dfrac{-8}{7}$

(c) $\dfrac{1}{3} - \left(\dfrac{-5}{3}\right) = \dfrac{1-(-5)}{3} = \dfrac{1+5}{3} = \dfrac{6}{3}$ or 2

(d) $\dfrac{-5}{21} - \left(\dfrac{-3}{21}\right) = \dfrac{-5+3}{21} = \dfrac{-2}{21}$

6. Simplify :

(a) $\dfrac{16}{9} + \dfrac{5}{-12} + \dfrac{-7}{18}$

Writing $\dfrac{5}{-12}$ as a rational number with a positive denominator

$$\frac{5}{-12} \times \frac{-1}{-1} = \frac{-5}{12}$$

$$\frac{16}{9} + \left(\frac{-5}{12}\right) + \left(\frac{-7}{18}\right) = \frac{16}{9} - \frac{5}{12} - \frac{7}{18}$$

$$= \frac{(16 \times 4) - (5 \times 3) - (7 \times 2)}{36} \text{ (LCM of 9, 12, 18} = 36)$$

$$= \frac{64 - 15 - 14}{36}$$

$$= \frac{64 - 29}{36} = \frac{35}{36}$$

(b) $\dfrac{-11}{3} + \dfrac{-3}{4} + \dfrac{-11}{6} + \dfrac{3}{8}$ (LCM of 3, 4, 6 and 8 $= 24$)

$$= \frac{(-11 \times 8) - (3 \times 6) - (11 \times 4) + (3 \times 3)}{24}$$

$$= \frac{-88 - 18 - 44 + 9}{24} = \frac{-150 + 9}{24} = \frac{-141}{24} \text{ or } \frac{-47}{8}$$

(c) $\dfrac{5}{7} + \dfrac{-11}{14} + \dfrac{16}{21}$

$= \frac{5\times 6+(-11\times 3)+(16\times 2)}{42}$ (LCM of 7, 14 and 21 = 42)

$= \frac{30+(-33)+32}{42} = \frac{62-33}{42} = \frac{29}{42}$

(d) $\frac{-8}{7} + \frac{-4}{9} + \frac{-11}{7} + \frac{5}{6}$

$= \frac{(-8\times 18)+(-4\times 14)+(-11\times 18)+(5\times 21)}{126}$

(LCM of 7, 9, 7 and 6 = 126)

$= \frac{-144+(-56)+(-198)+105}{126}$

$= \frac{-144-56-198+105}{126} = \frac{-398+105}{126} = \frac{-293}{126}$

7. Sum of two rational number $= -4$

one rational number $= \frac{-11}{5}$

other number $= -4 - \left(\frac{-11}{5}\right)$

$= \frac{-4\times 5+11}{5} = \frac{-20+11}{5} = \frac{-9}{5}$

8. One rational number $\frac{-3}{11}$

According to questions $\frac{-3}{11}$ more than $\frac{4}{7}$

$= \frac{-3}{11} + \frac{4}{7} = \frac{(-3\times 7)+(4\times 11)}{77} = \frac{-21+44}{77} = \frac{23}{77}$

Thus, required number $= \frac{23}{77}$.

9. Let required number $= x$

According to question;

$$x + \frac{-5}{7} = \frac{13}{21}$$

$$x = \frac{13}{21} - \left(\frac{-5}{7}\right)$$

$$= \frac{13}{21} + \frac{5}{7} = \frac{13+5\times 3}{21}$$

$$= \frac{13+15}{21} = \frac{28}{21} = \frac{4}{3}$$

Thus, if $\frac{4}{3}$ added to $\frac{-5}{7}$ to get $\frac{13}{21}$

10. Sum of $\frac{-5}{7}$ and $\frac{15}{14}$

$$\frac{-5}{7}+\frac{15}{14}=\frac{-5\times 2+15}{14}=\frac{-10+15}{14}=\frac{5}{14}$$

Subtract $\frac{5}{14}$ from $\frac{9}{28}$

$$\frac{9}{28}-\left(\frac{5}{14}\right)=\frac{9-5\times 2}{28}=\frac{9-10}{28}=\frac{-1}{28}$$

11. The difference of two rational numbers is $\frac{-6}{25}$.

$$\text{The greatest number } =\frac{-4}{6}$$

$$\text{So, the smallest number } =\frac{-6}{25}-\left(\frac{-4}{6}\right)$$

$$=\frac{-36+100}{150}$$

$$=\frac{64}{150} \text{ or } \frac{32}{75}$$

Thus, the smallest number is $\frac{32}{75}$.

12.

$$\text{Quantity of apples } =\frac{1}{3}$$

$$\text{Quantity of oranges } =\frac{1}{4}$$

$$\text{Quantity of bananas } =\frac{1}{5}$$

Let total quantity of fruits in basket $=1$

$$\text{Quantity of mangoes } =1-\left(\frac{1}{3}+\frac{1}{4}+\frac{1}{5}\right)$$

$$=1-\left(\frac{(1\times 20)+(1\times 15)+(1\times 12)}{60}\right)$$

$$=1-\left(\frac{20+15+12}{60}\right)$$

$$=1-\frac{47}{60}=\frac{60-47}{60}=\frac{13}{60}$$

$$\text{Total number of fruits } =240$$

$$\text{Number of apples } =240\times\frac{1}{3}=80$$

$$\text{Number of oranges } =240\times\frac{1}{4}=60$$

$$\text{Number of bananas } = 240 \times \frac{1}{5} = 48$$

$$\text{Number of mangoes } = 240 \times \frac{13}{60} = 52$$

Thus, $\frac{13}{60}$ mangoes put in baskets and 80 apples, 60 oranges, 49 bananas, 52 mangoes in a basket.

Exercise 2.3

1. Find the product of the following :

(a) $\frac{-5}{3} \times \frac{-7}{15}$ $\qquad$ $\frac{-5}{3} \times \frac{-7}{15} = \frac{7}{9}$

(b) $\frac{2}{-3} \times \frac{4}{5}$ $\qquad$ $\frac{2 \times 4}{-3 \times 5} = \frac{8}{-15}$

(c) $\frac{15}{2} \times \frac{17}{-5}$ $\qquad$ $\frac{15}{2} \times \frac{17}{-5} = \frac{51}{-2}$

(d) $\frac{10}{-19} \times 57$ $\qquad$ $\frac{10}{-19} \times 57 = \frac{570}{-19} = -30$

2. Divide :

(a) $\frac{-2}{9} \div \frac{1}{9} = \frac{-2}{9} \times \frac{9}{1} = -2$

(b) $\frac{-3}{13} \div \frac{-5}{39} = \frac{-3}{13} \times \frac{39}{-5} = \frac{-3 \times 3}{-5} = \frac{9}{5}$

(c) $\frac{56}{7} \div \frac{-8}{14} \quad = \frac{56}{7} \times \frac{14}{-8} = \frac{7 \times 2}{-1} = -14$

(d) $\frac{-105}{11} \div \frac{-15}{121} = \frac{-105}{11} \times \frac{121}{-15} = 7 \times 11 = 77$

3. Find the reciprocal of :

(a) Reciporal of $\frac{-6}{11} = \frac{11}{-6}$ $\qquad$ (b) Reciporal of $\frac{9}{-5} = \frac{-5}{9}$

(c) Reciporal of $\frac{-1}{10} = -10$ $\qquad$ (d) Reciporal of $-5 = \frac{1}{-5}$

4. Write in the standard form :

(a) $\left(\frac{1}{3}\right)^{-1} = (3)^{1} = 3$ $\qquad$ (b) $(-1)^{-1} = \frac{1}{-1} = -1$

(c) $\left(\frac{5}{-8}\right)^{-1} = \left(\frac{-8}{5}\right)$ $\qquad$ (d) $\left[\frac{5}{2} \times \frac{-2}{5}\right]^{-1} = (-1)^{-1} = \frac{1}{-1} = -1$

5. Simplify :

(a) $\left(\frac{1}{2}\times\frac{1}{4}\right)+\left(\frac{1}{2}\times 6\right)=\left(\frac{1}{8}+1\times 3\right)=\frac{1}{8}+3=\frac{1+3\times 8}{8}=\frac{1+24}{8}=\frac{25}{8}$

(b) $\left(-5\times\frac{2}{15}\right)-\left(-6\times\frac{2}{9}\right)=\left(\frac{-1\times 2}{3}\right)-\left(-2\times\frac{2}{3}\right)$

$$=\frac{-2}{3}-\left(\frac{-4}{3}\right)=\frac{-2+4}{3}=\frac{2}{3}$$

(c) $\left(\frac{-5}{18}\times\frac{15}{-7}\right)-\left(1\times\frac{1}{4}\right)+\left(\frac{1}{2}\times\frac{1}{4}\right)=\left(\frac{-5}{6}\times\frac{5}{-7}\right)-\frac{1}{4}+\frac{1}{8}$

$$=\frac{25}{42}-\frac{1}{4}+\frac{1}{8}=\frac{25}{42}+\frac{1}{8}-\frac{1}{4}$$

$$=\frac{(25\times 4)+21-42}{168}$$

$$=\frac{100+21-42}{168}=\frac{79}{168}$$

(d) $\left(\frac{2}{13}\div\frac{1}{7}\right)\times\frac{26}{14}=\left(\frac{2}{13}\times 7\right)\times\frac{26}{14}=\frac{14}{13}\times\frac{26}{14}=2$

6. $$\text{Product }=\frac{7}{2}$$

Let required number x

$$\frac{-5}{4}\times x=\frac{7}{2}$$

$$x=\frac{7}{2}\div\frac{-5}{4}$$

$$=\frac{7}{2}\times\frac{4}{-5}$$

$$=\frac{7\times 2}{-5}=\frac{14}{-5}\text{ or }\frac{-14}{5}$$

Thus, required number $-\frac{14}{5}$.

7. Sum of $\frac{1}{3}$ and $\frac{2}{5}$

$$=\frac{1}{3}+\frac{2}{5}=\frac{5+2\times 3}{15}=\frac{5+6}{15}=\frac{11}{15}$$

Divide $\frac{11}{15}$ by $\frac{3}{5}$

$$=\frac{11}{15}\div\frac{3}{5}=\frac{11}{15}\times\frac{5}{3}=\frac{11}{9}$$

8. $$\text{Length of rope }=20\text{ m}$$

$$\text{Size of each piece }=\frac{5}{4}\text{ m}$$

$$\text{Number of pieces cut } = 20 \div \frac{5}{4} = 20 \times \frac{1}{5} = 16$$

Thus, 16 pieces are cut off and no rope is left..

9. Simplify the following :

(a) $\left(\frac{13}{15} - \frac{3}{5}\right) \div \left(\frac{13}{15} + \frac{3}{5}\right)$

$$\left(\frac{13 - 3 \times 3}{15}\right) \div \left(\frac{13 + 3 \times 3}{15}\right) = \left(\frac{13 - 9}{15}\right) \div \left(\frac{13 + 9}{15}\right)$$

$$= \frac{4}{15} \div \frac{22}{15} = \frac{4}{15} \times \frac{15}{22} = \frac{2}{11}$$

(b) $$\left(\frac{3}{7} \times \frac{-5}{9}\right) \div \left(\frac{-5}{12} \times \frac{12}{49}\right) = \left(\frac{3}{7} \times \frac{-5}{9}\right) \div \left(\frac{-5}{12} \times \frac{12}{49}\right)$$

$$= \frac{-5}{21} \div \frac{-5}{49} = \frac{-5}{21} \times \frac{49}{-5} = \frac{49}{21} \text{ or } \frac{7}{3}$$

10. Fill in the blanks :

(a) $\frac{2}{3} \times \mathbf{1} = \frac{2}{3}$ (b) $\frac{2}{3} \div \mathbf{-1} = \frac{-2}{3}$ (c) $\frac{7}{5} \div \mathbf{\frac{7}{5}} = 1$ (d) $\mathbf{\frac{5}{14}} \div \frac{2}{7} = \frac{5}{4}$

Exercise 2.4

1. Without performing actual division, state which of the following have a terminating decimals or non-terminating decimals :

(a) $\frac{19}{29}$

Here denominator $= 29$, which cannot be expressed as a factor of 2 or 5 or both.

Hence, it is non-terminating.

(b) $-\frac{8}{10}$

Here denominator $10 = 2 \times 5$, since the prime factors are 2 and 5.

$\frac{-8}{10}$ is terminating decimal.

(c) $\frac{17}{90}$

Here denominator $= 90$

Prime factors of $90 = 2 \times 3 \times 3 \times 5$

Here the prime factors are other than 2 and 5.

So, $\frac{17}{90}$ is a non-terminating repeating decimal.

(d) $-\frac{33}{20}$

Here denominator $= 20$

Prime factors of $20 = 2 \times 2 \times 5$

Here, the prime factors are 2 and 5.

So, $\frac{-33}{20}$ is terminating decimal

(e) $-\frac{13}{27}$

Here, denominator $= 27$

Prime factors of $27 = 3 \times 3 \times 3$

Since, prime factors are other than 2 or 5

So, $\frac{-13}{27}$ is terminating repeating decimal.

(f) $\frac{438}{900}$

Here, denominator $= 900$

Prime factors of $900 = 2 \times 2 \times 5 \times 3 \times 3 \times 5$

Here, prime factors are other than 2 or 5.

So, $\frac{438}{900}$ is non-terminating decimal.

(g) $\frac{71}{75}$

Here, denominator 75 Prime factors of $75 = 3 \times 5 \times 5$

Here, prime factors are other than 2 or 5.

So, $\frac{71}{75}$ is non-terminating decimal.

(h) $\frac{19}{45}$

Here, denominator $= 45$

Prime factors of $45 = 3 \times 3 \times 5$

Here, prime factors are other than 2 or 5

So, $\frac{19}{43}$ is non-terminating decimal.

2. Convert the following rational numbers into decimal numbers :

(a) $\frac{26}{25} = 26 \div 25$

$$\begin{array}{l} 25\overline{)26(}\ 1.04 \\ \underline{-25} \\ \quad 100 \\ \quad \underline{-100} \\ \quad\quad 0 \end{array}$$

$\frac{26}{25} = 1.04$

(b) $\frac{85}{12} = 85 \div 2$

$$\begin{array}{l} 12\overline{)85(}\ 7.08333 \\ \underline{-84} \\ \quad 100 \\ \quad \underline{-96} \\ \quad\quad 40 \\ \quad\quad \underline{-36} \\ \quad\quad\quad 40 \end{array}$$

$$
\begin{array}{r}
-36 \\
\hline
40 \\
-36 \\
\hline
4 \\
\hline
\end{array}
$$

$\frac{85}{12} = 7.08333$

(c) $\frac{2}{11} = 2 \div 11$

$$
\begin{array}{l}
11\overline{)20}(\ 0.181818 \\
\quad\underline{-11} \\
\quad\quad 90 \\
\quad\underline{-88} \\
\quad\quad 20 \\
\quad\underline{-11} \\
\quad\quad 90 \\
\quad\underline{-88} \\
\quad\quad 20 \\
\quad\underline{-11} \\
\quad\quad 90 \\
\quad\underline{-88} \\
\quad\quad\underline{2}
\end{array}
$$

$\frac{2}{11} = 0.181818$

(d) $\frac{16}{32} = 16 \div 32$

$$
\begin{array}{l}
32\overline{)160}(\ 0.5 \\
\quad\underline{-160} \\
\quad\quad\underline{0}
\end{array}
$$

$16 \div 32 = 0.5$

(e) $\frac{49}{15} = 49 \div 15$

$$
\begin{array}{l}
15\overline{)49}(\ 3.2666 \\
\quad\underline{-45} \\
\quad\quad 40 \\
\quad\underline{-30} \\
\quad\quad 100 \\
\quad\underline{-90} \\
\quad\quad 100 \\
\quad\underline{-90} \\
\quad\quad 100 \\
\quad\underline{-90} \\
\quad\quad\underline{10}
\end{array}
$$

$\frac{49}{15} = 3.2666$

(f) $\frac{11}{8}$

$$
\begin{array}{l}
8\overline{)11}(\ 1.375 \\
\quad\underline{-8} \\
\quad\quad 30 \\
\quad\underline{-24} \\
\quad\quad 60 \\
\quad\underline{-56} \\
\quad\quad 40 \\
\quad\underline{-40} \\
\quad\quad\underline{0}
\end{array}
$$

$\frac{11}{8} = 1.375$

(g) $\frac{26}{500}$

(h) $\frac{303}{125}$

$$500\overline{)2600}(0.052$$
$$\begin{array}{r} -2500 \\ \hline 1000 \\ -1000 \\ \hline 0 \\ \hline \end{array}$$
$$\frac{26}{500} = 0.052$$

$$125\overline{)303}(2.424$$
$$\begin{array}{r} -250 \\ \hline 530 \\ -500 \\ \hline 300 \\ -250 \\ \hline 500 \\ -500 \\ \hline 0 \end{array}$$
$$\frac{303}{125} = 2.424$$

3. Express each of the following decimals in rational form :

(a) Let $x = 0.1\overline{3}$

Here, we have two digits in the decimal part out of which one digit is repeated.

First, we multiply it by 10. So that only repeating decimal is left on the right side the decimal point

$$10x = 1.\overline{3} \qquad \ldots(i)$$

Now, only one digit is repeating, so again we multiply it by 10.

$$100x = 13.\overline{3} \qquad \ldots(ii)$$

Subtracting equation (ii) from (i)

$$100x - 10x = 13.\overline{3} - 1.\overline{3}$$
$$90x = 12$$
$$x = \frac{12}{90} \text{ or } \frac{2}{15}$$

(b) Let $x = 0.8\overline{3}$

Here, we have two digits in the decimal part out of which one digit is repeated.

First, we multiply it by 10. So that only repeating decimal is left on the right side the decimal point

$$10x = 8.\overline{3} \qquad \ldots(i)$$

Now, only one digit is repeating, so again we multiply it by 10.

$$100x = 83.\overline{3} \qquad \ldots(ii)$$

Subtracting equation (ii) from (i)

$$100x - 10x = 83.\overline{3} - 8.\overline{3}$$
$$90x = 75$$
$$x = \frac{75}{90} \text{ or } \frac{25}{30} \text{ or } \frac{5}{6}$$

(c) Let $x = 2.\overline{3}$ $\qquad \ldots(i)$

Here, only one digit in decimal part is repeating, so we multiply it by 10

$$10x = 23.\overline{3} \qquad \ldots(ii)$$

Subtracting (i) from (ii)

$$10x - x = 23.\overline{3} - 2.\overline{3}$$
$$9x = 21$$
$$x = \frac{21}{3} \text{ or } \frac{7}{3} \text{ or } 2\frac{1}{3}$$

(d) $12.68 = \frac{1268}{100} = \frac{317}{25} \text{ or } 12\frac{17}{25}$

(e) $3.125 = \frac{3.125}{1000} = \frac{25}{8} \text{ or } 3\frac{1}{8}$

(f) $5.005 = \frac{5005}{1000} = \frac{1001}{200} \text{ or } 5\frac{1}{200}$

(g) Let $x = 1.4\overline{3}$

Here, we have two digits in the decimal part of which one digit is repeated First, we multiply it by 10. So that only repeating decimal is left on right side that decimal part.

$$10x = 14.\overline{3} \qquad \ldots(i)$$

Now only one digit is repeating so again we multiply it by 10.

$$100x = 143.\overline{3} \qquad \ldots(ii)$$

Subtracting (ii) form (i)

$$100x - 10x = 143.\overline{3} - 14.\overline{3}$$
$$90x = 129x = \frac{129}{90} \text{ or } \frac{43}{30} 1\frac{13}{30}$$

(h) Let $x = 3.\overline{185} \ldots(i)$

Here we have three digits in the decimal part is repeating, so we multiply is by 1000

$$1000x = 3185.\overline{185} \qquad \ldots(ii)$$

Subtracting eq. (ii) form (i)

$$1000x - x = 3185.\overline{185} - 3.\overline{185}$$
$$999x = 3182$$
$$= \frac{3182}{999} \text{ or } 3\frac{185}{999}$$

4. Which of the following decimals can be expressed as rational numbers?

Ans. As only those number can be expressed as national numbers whose decimals recurr in a definite pattern.

As only (a) and (b) full fills this condition thus, only 0.66666… and 0.217217217… can be expressed as rational number.

5. Find the value of the following as a rational number :

(a) $0.\overline{2} + 0.1\overline{3}$

First convert each of the decimals into rational numbers. Then, add them

Let $a = 0.\overline{2} \qquad \ldots(i)$

$$10a = 2.\overline{2} \qquad \text{(multiply by 10)} \qquad \ldots(ii)$$

Now, on subtracting (ii) from (i) we get

$$\begin{aligned} 10a &= 2.\overline{2} \\ -a &= 0.2 \\ \hline 9a &= 2 \end{aligned} \qquad a = \frac{2}{9}$$

And, Let $b = 0.1\overline{3}$

$10b = 1.\overline{3}$ (multiply by 10) …(iii)

$100b = 13.\overline{3}$ (multiply by 100) …(iv)

Now, subtracting (iv) from (iii) we get

$$\begin{aligned} 100b &= 13.\overline{3} \\ -10b &= 1.\overline{3} \\ \hline 90b &= 12 \end{aligned}$$

$b = \frac{12}{90}$ or $\frac{2}{15}$ $\quad b = \frac{2}{15}$

Here, $0.\overline{2} + 0.1\overline{3} = \frac{2}{9} + \frac{2}{15}$

$$= \frac{2 \times 5 + 2 \times 3}{45}$$

$$= \frac{10 + 6}{45} = \frac{16}{45}$$

So, $0.\overline{2} + 0.1\overline{3} = \frac{16}{45}$

(b) $0.\overline{2} + 0.\overline{3} + 0.\overline{4}$

First convert each of the decimals into rational number. Then, add them

Let $a = 0.\overline{2}$ …(i)

$10a = 2.\overline{2}$ (multiply by 10) …(ii)

Now, on subtracting (ii) from (i) we get

$$\begin{aligned} 10a &= 2.\overline{2} \\ -a &= 0.2 \\ \hline 9a &= 2 \end{aligned} \qquad \boxed{a = \frac{2}{9}}$$

And, let $b = 0.\overline{3}$ …(iii)

$10b = 3.\overline{3}$ …(iv)

subtracting eq. (iii) from (iv)

$$\begin{aligned} 10b &= 3.\overline{3} \\ -b &= 0.\overline{3} \\ \hline 9b &= 3 \\ b &= \frac{3}{9} = \frac{1}{3} \end{aligned} \qquad \boxed{b = \frac{1}{3}}$$

Again, let $c = 0.\overline{4}$ …(v)

$10c = 4.\overline{4}$ …(vi)

subtracting eq. (v) from (vi)

$$\begin{aligned} 10c &= 4.\overline{4} \\ -c &= 0.\overline{4} \\ \hline 9c &= 4 \end{aligned} \qquad \boxed{c = \frac{4}{9}}$$

$$c = \frac{4}{9}$$

Here, $0.\overline{2} + 0.\overline{3} + 0.\overline{4}$

$\frac{2}{9} + \frac{1}{3} + \frac{4}{9}$

$$\frac{2+3+4}{9} = \frac{9}{9} \text{ or } 1$$

so, $0.\overline{2} + 0.\overline{3} + 0.\overline{4} = 1$

(c) $5.\overline{1} - 4.\overline{7}$

First, convert each of the decimals into rational numbers. Then subtract them

Let $x = 5.\overline{1}$ …(i)

$10x = 51.\overline{1}$ (multiply by 10) …(ii)

Subtracting eq. (i) from (ii)

$$\begin{aligned} 10x &= 51.\overline{1} \\ -x &= 5.\overline{1} \\ \hline 9x &= 46 \end{aligned} \qquad x = \frac{46}{9}$$

$$x = \frac{46}{9}$$

And, let $y = 4.\overline{7}$ …(iii)

$10y = 47.\overline{7}$ …(iv)

Subtracting eq. (iii) from (iv)

$$10y - y = 47.\overline{7} - 4.\overline{7}$$

$$9y = 43$$

$$y = \frac{43}{9}$$

Here, $5.\overline{1} - 4.\overline{7} = \frac{46}{9} - \frac{43}{9} = \frac{46-43}{9} = \frac{3}{9}$ or $\frac{1}{3}$

$$5.\overline{1} - 4.\overline{7} = \frac{1}{3}$$

Multiple Choice Questions

Tick (3) the correct answer :

1. (d) **2.** (c) **3.** (b) **4.** (c) **5.** (b) **6.** (c)

Mental Task

Fill in the blanks :

1. Express $\frac{-8}{3}$ with denominator 15 $\mathbf{-\frac{40}{15}}$.
2. 1.23040040004 is a **Irrational number** number.
3. Which is greater $\frac{-2}{5}$ or $\frac{-1}{5}$? $\mathbf{\frac{-1}{5}}$ is greater.
4. A rational number which is neither positive nor negative is **0**.
5. 1.476547654765 can be written as $\mathbf{1.\overline{4765}}$.
6. Additive inverse of 0 is **0** and (– 1) is **+1**.

High Order Thinking Skills

1. Multiplicative inverse of $\frac{-7}{5} = \frac{5}{-7}$ or $= \frac{-5}{7}$

   Multiplicative inverse of $-2 = \frac{1}{-2}$ or $\frac{-1}{2}$

   LCM of 7 and 2 = 14

$$\frac{-5}{7} = \frac{-5\times 2}{7\times 2} = \frac{-10}{14}$$

$$\frac{-1}{2} = \frac{-1\times 7}{2\times 7} = \frac{-7}{14}$$

$$\frac{-10}{14} < \frac{-9}{14} < \frac{-8}{14} < \frac{-7}{14}$$

   Here we find only two rational numbers we have to find 4 rational numbers.

   So,
$$\frac{-5}{7} = \frac{-5\times 4}{7\times 4} = \frac{-20}{28}$$

$$\frac{-1}{2} = \frac{-1\times 14}{2\times 14} = \frac{-14}{28}$$

   Here $= \frac{-20}{28} < \frac{-19}{28} < \frac{-18}{28} < \frac{-17}{28} < \frac{-16}{28} < \frac{-15}{28} < \frac{-14}{28}$ (choice any four)

   four rational numbers are $\frac{-19}{28} < \frac{-18}{28} < \frac{-17}{28} < \frac{-16}{28}$

2. Find the following :

   (a) $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \ldots\ldots + 50$ times $\qquad \frac{1}{5} \times 50 = 10$

   (b) $\left(-2\frac{1}{4}\right) + \left(-2\frac{1}{4}\right) + \ldots\ldots + 100$ times $\qquad -2\frac{1}{4} \times 100$

$$= \frac{-9}{4} \times 100 = -9\times 25 = -225$$

Exercise-3.1

1. Write four equivalent fractions for the following :

(a) $\frac{2}{3} = \frac{2\times2}{3\times2} = \frac{4}{6}$; $\frac{2\times3}{3\times3} = \frac{6}{9}$; $\frac{2\times4}{3\times4} = \frac{8}{12}$; $\frac{2\times5}{3\times5} = \frac{10}{15}$

$\frac{4}{6}, \frac{6}{9}, \frac{8}{12}$ and $\frac{10}{15}$ are the equivalent fractions of $\frac{2}{3}$.

(b) $\frac{2}{7} = \frac{2\times2}{7\times2} = \frac{4}{14}$; $\frac{2\times3}{7\times3} = \frac{6}{21}$; $\frac{2\times4}{7\times4} = \frac{8}{28}$; $\frac{2\times5}{7\times5} = \frac{10}{35}$

$\frac{4}{14}; \frac{6}{21}; \frac{8}{28}$ and $\frac{10}{35}$ are the equivalent fractions of $\frac{2}{7}$.

(c) $\frac{1}{5} = \frac{1\times2}{5\times2} = \frac{2}{10}$; $\frac{1\times3}{5\times3} = \frac{3}{15}$; $\frac{1\times4}{5\times4} = \frac{4}{20}$; $\frac{1\times5}{5\times5} = \frac{5}{25}$

$\frac{2}{10}; \frac{3}{15}; \frac{4}{20}; \frac{5}{25}$ are the equivalent fractions of $\frac{1}{5}$.

2. Compare the following fractions :

(a) $\frac{6}{7}$ and $\frac{7}{6}$

$\frac{6}{7} \times \frac{7}{6}$

$6\times6 < 7\times7$

$36 < 49$

$\frac{6}{7} < \frac{7}{6}$

(b) $\frac{7}{15}$ and $\frac{9}{20}$

$\frac{7}{15} \times \frac{9}{20}$

$20\times7 > 15\times9$

$140 > 135$

$\frac{7}{15} > \frac{9}{20}$

3. Arrange the following in descending order :

(a) $\frac{1}{2}, \frac{1}{4}, \frac{3}{7}, \frac{2}{7}$

(LCM of 2, 4, 7 and 7 = 28)

$\frac{1}{2}\times\frac{14}{14} = \frac{14}{28}$; $\frac{1}{4}\times\frac{7}{7} = \frac{7}{28}$; $\frac{3}{7}\times\frac{4}{4} = \frac{12}{28}$; $\frac{2}{7}\times\frac{4}{4} = \frac{8}{28}$

$\because$ $14 > 12 > 8 > 7$

So, $\frac{14}{28} > \frac{12}{28} > \frac{8}{28} > \frac{7}{28}$

So, Descending order $= \frac{1}{2} > \frac{3}{7} > \frac{2}{7} > \frac{1}{4}$

(b) $\frac{1}{4}, \frac{1}{9}, \frac{1}{7}, \frac{1}{3}, \frac{1}{11}$

(LCM of 4, 9, 7, 3 and $11 = 2772$)

$$\frac{1}{4}\times\frac{693}{693}=\frac{693}{2772}\,;\ \frac{1}{9}\times\frac{308}{308}=\frac{308}{2772}\,;$$

$$\frac{1}{7}\times\frac{396}{396}=\frac{396}{2772}\,;\ \frac{1}{3}\times\frac{924}{924}=\frac{924}{2772}\,;\ \frac{1}{11}\times\frac{252}{252}=\frac{252}{2772}$$

$\because$ $924>693>396>308>252$

So, $\frac{924}{2772}>\frac{693}{2772}>\frac{396}{2772}>\frac{308}{2772}>\frac{252}{2772}$

So, Descending order $\frac{1}{3}>\frac{1}{4}>\frac{1}{7}>\frac{1}{9}>\frac{1}{11}$

4. Simplify :

(a) $7\frac{1}{2}+3\frac{1}{3}$

$=\frac{15}{2}+\frac{10}{3}$

$=\frac{15\times3+10\times2}{6}$

$=\frac{45+20}{6}$

$=\frac{65}{6}$ or $10\frac{5}{6}$

(b) $4\frac{1}{5}-2\frac{1}{3}$

$=\frac{21}{5}-\frac{7}{3}$

$=\frac{21\times3-7\times5}{15}$

$=\frac{63-35}{15}$

$=\frac{28}{15}$ or $1\frac{13}{15}$

(c) $2\frac{1}{4}-1\frac{1}{2}+4$

$=\frac{9}{4}-\frac{3}{2}+4$

$=\frac{9-3\times2+4\times4}{4}$

$=\frac{9-6+16}{4}$

$=\frac{9+16-6}{4}$

$=\frac{25-6}{4}=\frac{19}{4}$ or $4\frac{3}{4}$

(d) $4\frac{1}{2}-1\frac{1}{5}+\frac{2}{5}$

$\frac{9}{2}-\frac{6}{5}+\frac{2}{5}$

$\frac{9\times5-6\times2+2\times2}{10}$

$$\frac{9\times5-6\times2+2\times2}{10}=\frac{45-12+4}{10}=\frac{45+4-12}{10}=\frac{49-12}{10}=\frac{37}{10}\text{ or }3\frac{7}{10}$$

5. Number of parts of pizza with Sunny $=\frac{8}{8}$

He gave to Vikas $=\frac{2}{8}$

He gave to Khalid $=\frac{3}{8}$

He gave to Wasim $=\frac{1}{8}$

He has pizza left $=\frac{8}{8}-\left[\frac{2}{8}+\frac{3}{8}+\frac{1}{8}\right]$

$$= \frac{8}{8} - \frac{6}{8} = \frac{8-6}{8} = \frac{2}{8}$$

Difference of Khalid and Sunny pizza $= \frac{3}{8} - \frac{2}{8} = \frac{1}{8}$

So, Khalid got $\frac{1}{8}$ pizza more than Sunny.

6. Manu finish work in one hour $= \frac{2}{3}$

Priti finished work in one hour $= \frac{3}{4}$

We compare $\frac{2}{3}$ and $\frac{3}{4}$

(LCM of 3 and 4 = 12)

$\frac{2 \times 4}{3 \times 4} = \frac{8}{12}$; $\frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

$$\frac{8}{12} < \frac{9}{12}$$

Priti finished the work earlier.

7. (a) Fraction of money spend on bag and books and total money $= \frac{500}{1000} = \frac{1}{2}$

(b) Fraction of money give to her brother and total money $= \frac{250}{1000} = \frac{1}{4}$

(c) Money left with Ruchi = ` $1000 - (500 + 100 + 250) =$ ` $1000 - 850 = 150$

Fraction of money left with her and total money $= \frac{150}{1000} = \frac{3}{20}$

Exercise 3.2

1. Find the value of :

(a) $\frac{1}{4}$ of 200

$= \frac{1}{4} \times 200 = 50$

(b) $\frac{2}{7}$ of 63

$= \frac{2}{7} \times 63 = 2 \times 9 = 18$

(c) $\frac{3}{4}$ of 62

$= \frac{3}{4} \times 62 = \frac{3}{2} \times 31 = \frac{93}{2}$ or $46\frac{1}{2}$

(d) $\frac{1}{6}$ of $2\frac{3}{4}$

$= \frac{1}{6} \times \frac{11}{4} = \frac{11}{24}$

2. Find the product and express as a mixed fraction :

(a) $3\frac{1}{7} \times 2$

$= \frac{22}{7} \times 2 = \frac{44}{7}$ or $6\frac{2}{7}$

(b) $\frac{3}{4}$ of $5\frac{1}{7}$

$= \frac{3}{4} \times \frac{36}{7} = \frac{108}{28}$

$$= \frac{27}{7} \text{ or } 3\frac{6}{7}$$

(c) $2 \times 3\frac{1}{3}$

$= 2 \times \frac{10}{3} = \frac{20}{3} \text{ or } 6\frac{2}{3}$

(d) $\frac{4}{7}$ of $2\frac{3}{4}$

$= \frac{4}{7} \times \frac{11}{4} = \frac{11}{7} \text{ or } 1\frac{4}{7}$

3. Distance covered by using 1 litre $= 26$ km

Distance covered by using $5\frac{3}{4}$ litre or $\frac{23}{4}$ L $= \frac{23}{4} \times 26$

$$= \frac{23 \times 13}{2}$$

$$= \frac{299}{2} = 149\frac{1}{2} \text{ km}$$

Thus, bus wil cover $149\frac{1}{2}$ km distance with $5\frac{3}{4}$ litres of diesel.

4. Total number of marbles in bag $= 240$

(a) Number of white marbles $= \frac{1}{4} \times 240 = 60$

Number of black marbles $= \frac{1}{3} \times 240 = 80$

Number of red marbles $= \frac{1}{5} \times 240 = 48$

(b) Number of blue marbles $= 240 - (60 + 80 + 48)$

$240 - 188 = 52$

Fraction of blue marbles $= \frac{52}{240}$ or $\frac{13}{60}$

5. One third of $\frac{33}{4} = \frac{33}{4} \times \frac{1}{3} = \frac{11}{4}$

half of $\frac{11}{2} = \frac{11}{2} \times \frac{1}{2} = \frac{11}{4}$

$$\frac{11}{4} = \frac{11}{4}$$

Yes, these are equal.

6. Evaluate :

(a) $\left(\frac{3}{11} + \frac{5}{22}\right) \times \left(\frac{14}{9} + \frac{5}{6}\right) = \left(\frac{3 \times 2 + 5}{22}\right) \times \left(\frac{14 \times 2 + 5 \times 3}{18}\right)$

$$= \left(\frac{6 + 5}{22}\right) \times \left(\frac{28 + 15}{18}\right)$$

$$= \left(\frac{11}{22}\right) \times \left(\frac{43}{18}\right)$$

$$= \frac{11}{22} \times \frac{43}{18}$$

$$= \frac{43}{36} \text{ or } 1\frac{7}{36}$$

(b) $\left[\frac{6}{25} \times \frac{50}{24}\right] - \left[\frac{5}{9} \times \frac{1}{25}\right] = \frac{1}{2} - \frac{1}{9 \times 5}$

$$\frac{1}{2} - \frac{1}{45} = \frac{45-2}{90} = \frac{43}{90}$$

(c) $\left(3\frac{1}{4} \times 3\frac{1}{5}\right) - \left(\frac{2}{3} - \frac{3}{7}\right) = \left(\frac{13}{4} \times \frac{16}{5}\right) - \left(\frac{2 \times 7 - 3 \times 3}{21}\right)$

$$= \left(\frac{13 \times 4}{5}\right) - \left(\frac{14-9}{21}\right)$$

$$= \frac{52}{5} - \frac{5}{21} = \frac{52 \times 21 - 5 \times 5}{105}$$

$$= \frac{1092-25}{105}$$

$$= \frac{1067}{105} = 10\frac{17}{105}$$

(d) $\left[4\frac{1}{2} \times 2\frac{1}{5} \times 2\frac{2}{3}\right] - \left[\frac{3}{5} \times 2\frac{2}{3} \times 3\frac{3}{4}\right] = \left[\frac{9}{2} \times \frac{11}{5} \times \frac{8}{3}\right] - \left[\frac{3}{5} \times \frac{8}{3} \times \frac{15}{4}\right]$

$$= \frac{3 \times 11 \times 4}{5} - 1 \times 2 \times 3$$

$$= \frac{132}{5} - 6 = \frac{132 - 6 \times 5}{5}$$

$$= \frac{132-30}{5} = \frac{102}{5} \text{ or } 20\frac{2}{5}$$

Exercise 3.3

1. Find the reciprocal of the following :

(a) reciprocal of 1 $= 1$

(b) reciprocal of $\frac{7}{3}$ $= \frac{3}{7}$

(c) reciprocal of 8 $= \frac{1}{8}$

(d) reciprocal of $\frac{21}{4}$ $= \frac{4}{21}$

2. Find the following :

(a) $\frac{6}{11} \div 15 = \frac{6}{11} \times \frac{1}{15} = \frac{2}{11 \times 5} = \frac{2}{55}$

(b) $5 \div \frac{2}{11} = 5 \times \frac{11}{2} = \frac{55}{2} \text{ or } 27\frac{1}{2}$

(c) $36\frac{1}{4} \div 8\frac{2}{4} = \frac{145}{4} \div \frac{34}{4} = \frac{145}{4} \times \frac{4}{34} = \frac{145}{34}$ or $4\frac{9}{34}$

(d) $\frac{343}{64} \div \frac{7}{8} = \frac{343}{64} \times \frac{8}{7} = \frac{49}{8}$ or $6\frac{1}{8}$

3. Simplify :

(a) $\left[\frac{4}{15} \times \frac{6}{28}\right] \times \frac{9}{2} = \left[\frac{4}{15} \times \frac{6}{28}\right] \times \frac{9}{2} = \frac{2}{5 \times 7} \times \frac{9}{2} = \frac{9}{35}$

(b) $\left(24 \div 2\frac{2}{3}\right) \div 3\frac{1}{9} = \left(24 \div \frac{8}{3}\right) \div \frac{28}{9} = \left(24 \times \frac{3}{8}\right) \div \frac{28}{9}$

$$= 9 \div \frac{28}{9} = \frac{9 \times 9}{28} = \frac{81}{28} = 2\frac{25}{28}$$

(c) $\left(2\frac{1}{7} \times 2\frac{4}{5}\right) \div \frac{1}{10} = \left(\frac{15}{7} \times \frac{14}{5}\right) \div \frac{1}{10} = 6 \times 10 = 60$

(d) $\left[7 \div 2\frac{2}{5}\right] \times \left[\frac{5}{9} \div 9\frac{4}{9}\right] = \left[7 \div \frac{12}{5}\right] \times \left[\frac{5}{9} \div \frac{85}{9}\right]$

$$= \left[7 \times \frac{5}{12}\right] \times \left[\frac{5}{9} \times \frac{9}{85}\right] = \frac{35}{12} \times \frac{1}{17} = \frac{35}{204}$$

Exercise 3.4

1. Distance covered in 1 hour $= 5\frac{1}{3}$ km or $\frac{16}{3}$ km

Distance covered in $2\frac{1}{4}$ or $\frac{9}{4}$ hours $= \frac{16}{3} \times \frac{9}{4} = 12$ km

Thus, Amar can walk 12 km in $2\frac{1}{4}$ hours

2. Weight of one cement bag $= 15\frac{2}{3}$ kg $= \frac{47}{3}$ kg

Number of bags $= 22\frac{4}{7} = \frac{158}{7}$

Weight of $\frac{158}{7}$ bags $= \frac{47}{3} \times \frac{158}{7}$

$$= \frac{47 \times 158}{3 \times 7} = \frac{7426}{21} = 353\frac{13}{21} \text{ kg}$$

Thus, the weight of $22\frac{4}{7}$ bags is $353\frac{13}{21}$ kg.

3. Product of two numbers $= 15\frac{5}{6} = \frac{95}{6}$

One number $= 6\frac{1}{3} = \frac{19}{3}$

$$\text{Other number } = \frac{95}{6} \div \frac{19}{3}$$

$$= \frac{95}{6} \times \frac{3}{19} = \frac{5}{2} \text{ or } 2\frac{1}{2}$$

4. $$\text{Rocky has toffees } = 30\frac{3}{8} \text{ kg} = \frac{243}{8} \text{ kg}$$

$$\text{Quantity of each packet } = 2\frac{1}{40} \text{ kg} = \frac{81}{40} \text{ kg}$$

$$\text{Number of packet filled by Rocky} = \frac{243}{8} \div \frac{81}{40}$$

$$= \frac{243}{8} \times \frac{40}{81} = 15$$

Rocky made 15 packets.

5. $$\text{Total length of a rope } = 58\frac{13}{20} \text{ m} = \frac{1173}{20} \text{ m}$$

$$\text{Number of pieces } = 17$$

$$\text{Length of each piece } = \frac{1173}{20} \div 17$$

$$= \frac{1173}{20} \times \frac{1}{17} = \frac{69}{20} = 3\frac{9}{20}$$

Thus, length of each piece is $3\frac{9}{20}$ m.

6. $$\text{Side of square } = 16\frac{3}{4} \text{ m} = \frac{67}{4} \text{ m}$$

$$\text{Perimeter of a square } = 4 \times \text{side} = 4 \times \frac{67}{4} = 67 \text{ m}$$

$$\text{Area of a square } = \frac{67}{4} \times \frac{67}{4} \text{ m}^2$$

$$= \frac{4489}{16} = 280\frac{9}{16} \text{ m}^2.$$

7. $$\text{Let total number of students } = x$$

$$\text{Number of boys } = \frac{x \times 4}{7} = \frac{4x}{7}$$

$$\text{Number of girls } = x - \frac{4x}{7} = \frac{3x}{7}$$

According to questions;

$$\text{Number of girls } = \frac{3x}{7} = 210$$

$$x = \frac{210 \times 7}{3} = 490$$

$$\text{Number of boys in the school } = 490 \times \frac{4}{7} = 280$$

Thus, 280 boys in the school.

8. $$\text{The duration of one period } = \frac{2}{3} \text{ hour}$$

$$\text{The duration of 9 periods } = \frac{2}{3} \times 9 \text{ hour} = 6 \text{ hours}$$

Multiple Choice Questions

Tick (3) the correct answer :

1. (d) **2.** (c) **3.** (c) **4.** (c) **5.** (b)

High Order Thinking Skills (HOTS)

1. Let one rational be x and second number be $(10.5 - x)$

Let greater number be x and smaller number well be $(10.5 - x)$

According to the question, $\dfrac{(10.5-x)}{x} \quad \dfrac{2}{3}$

$$\begin{aligned}
31.5 - 3x &= 2x \\
31.5 &= 2x + 3x \\
31.5 &= 5x \\
x &= \frac{31.5}{5} = 6.3 \\
6.3 &= \frac{63}{10}
\end{aligned}$$

Now, $$10.5 - \frac{63}{10} = \frac{10.5 \times 10 - 63}{10}$$

$$= \frac{105 - 63}{10}$$

$$= \frac{42}{10} = \frac{21}{5}$$

$$\frac{21}{5} \div \frac{63}{10} \qquad \frac{21}{5} \times \frac{10}{63} = \frac{2}{3}$$

So, fractions are $\frac{21}{5}$ and $\frac{63}{10}$.

2. $$\text{The largest fraction } = \frac{10}{11}$$

$$\text{The smallest fraction} = \frac{3}{11}$$

$$\text{Product } = \frac{10}{11} \times \frac{3}{11} = \frac{30}{121}$$

4 Decimals

Exercise 4.1

1. If 1257 × 5 = 6285, then find the product :

(a) $1.257 \times 5 =$ **6.285**

(b) $12.57 \times 0.5 =$ **6.285**

(c) $125.7 \times 0.05 =$ **6.285**

2. Write the product in the blank space :

(a) $8.6 \times 100 =$ **860** (b) $40.04 \times 10 =$ **400.4**

(c) $609.75 \times 1000 =$ **609750** (d) $3.756 \times 10 =$ **37.56**

(e) $2.103 \times 100 =$ **210.3** (f) $2389.05 \times 1000 =$ **2389050**

3. Find the product :

(a) 1.1×1.01

Number of decimal paces $= 1 + 2 = 3$

So, $1.1 \times 1.01 = 1.111$

(b) 1.9×5

Number of decimal places $= 1$

So; $1.9 \times 5 = 9.5$

(c) 0.9×0.09

Number of decimal places $= 1 + 2 = 3$

So, $0.9 \times 0.09 = 0.081$

(d) 0.8×0.7

Number of decimal places $= 1 + 1 = 2$

So, $0.8 \times 0.7 = 0.56$

(e) 2.01×0.4

Number of decimal places $= 2 + 1 = 3$

So, $2.01 \times 0.4 = 0.804$

(f) 0.111×0.003

Number of decimal places $= 3 + 3 = 6$

So, $0.111 \times 0.003 = 0.000333$

4. Multiply :

(a) 26.42 by 3.2

$$\begin{array}{r} 2\,6\,4\,2 \\ \times\,3\,2 \\ \hline 5\,2\,8\,4 \\ 7\,9\,2\,6\,0 \\ \hline 8\,4\,5\,4\,4 \\ \hline \end{array}$$

Number of decimal-places $= 2 + 1 = 3$

$26.42 \times 3.2 = 84.544$

(b) 94.13 by 2.5

$$\begin{array}{r} 9\,4\,1\,3 \\ \times\,2\,5 \\ \hline 4\,7\,0\,6\,5 \\ 1\,8\,8\,2\,6\,0 \\ \hline 2\,3\,5\,3\,2\,5 \\ \hline \end{array}$$

Number of decimals-places $= 2 + 1 = 3$

$94.13 \times 2.5 = 235.325$

(c) 895.17 by 1.01

$$\begin{array}{r} 8\,9\,5\,1\,7 \\ \times 1\,0\,1 \\ \hline 8\,9\,5\,1\,7 \\ 0\,0\,0\,0\,0\,0 \\ \underline{8\,9\,5\,1\,7\,0\,0} \\ \underline{9\,0\,4\,1\,2\,1\,7} \end{array}$$

Number of decimal-places $= 2 + 2 = 4$

$895.17 \times 1.01 = 904.1217$

(d) 183.8 by 31.12

$$\begin{array}{r} 1\,8\,3\,8 \\ \times 3\,1\,1\,2 \\ \hline 3\,6\,7\,6 \\ 1\,8\,3\,8\,0 \\ 1\,8\,3\,8\,0\,0 \\ \underline{5\,5\,1\,4\,0\,0\,0} \\ \underline{5\,7\,1\,9\,8\,5\,6} \end{array}$$

Number of decimal-places $= 1 + 2 = 3$

$183.8 \times 31.12 = 5719.856$

(e) 501.03 by 3.3

$$\begin{array}{r} 5\,0\,1\,0\,3 \\ \times 3\,3 \\ \hline 1\,5\,0\,3\,0\,9 \\ \underline{1\,5\,0\,3\,0\,9\,0} \\ \underline{1\,6\,5\,3\,3\,9\,9} \end{array}$$

Number of decimal-places $= 2 + 1 = 3$

$501.03 \times 3.3 = 1653.399$

(f) 307.12 by 12.6

$$\begin{array}{r} 3\,0\,7\,1\,2 \\ \times 1\,2\,6 \\ \hline 1\,8\,4\,2\,7\,2 \\ 6\,1\,4\,2\,4\,0 \\ \underline{3\,0\,7\,1\,2\,0\,0} \\ \underline{3\,8\,6\,9\,7\,1\,2} \end{array}$$

Number of decimal $= 2 + 1 = 3$

$307.12 \times 12.6 = 3869.712$

5. Cost of 1 kg wheat = ` 24.25

Cost of 15.1 kg wheat = ` $24.25 \times 15.1$ = ` 366.175

$$\begin{array}{r} 2\,4\,.\,2\,5 \\ \times\ 1\,5.1 \\ \hline 2\,4\,2\,5 \\ 1\,2\,1\,2\,5\,0 \\ \underline{2\,4\,2\,5\,0\,0} \\ \underline{3\,6\,6.1\,7\,5} \end{array}$$

Thus cost of 15 kg wheat is ` 366.175.

6. Distance covered in 1 litre of petrol = 16.5 km

Distance covered in 5.5 litre of petrol $= (16.5 \times 5.5)$ km $= 90.75$ km

$$\begin{array}{r} 1\,6\,.\,5 \\ \times\ 5\,.\,5 \\ \hline 8\,2\ \ 5 \\ \underline{8\,2\,5\ \ 0} \\ \underline{9\,0.7\ \ 5} \end{array}$$

So, taxi covered 90.75 km distance in 5.5 liters.

7. Side of squares = 6.25 m

Area of squares $= (\text{side})^2$

$= 6.25 \times 6.25\ m^2$

$$\begin{array}{r} 6\,.\,2\,5 \\ \times 6\,.\,2\,5 \\ \hline 3\,1\,2\,5 \\ 1\,2\,5\,0\,0 \\ \underline{3\,7\,5\,0\,0\,0} \\ \underline{3\,9.0\,6\,2\,5} \end{array}$$

$= 39.0625 \text{ m}^2$

Thus, area of squares is 39.0625 m^2

Exercise 4.2

1. Write the quotient :

(a) $15.5 \div 10 = 1.55$

(b) $430.75 \div 100 = 4.3075$

(c) $122.5 \div 1000 = 0.1225$

(d) $323.8 \div 1000 = 0.3238$

(e) $84.84 \div 10 = 8.484$(f) $0.5 \div 100 = 0.005$

2. Find the quotient :

(a) $3.12 \div 8$

$8\overline{)3.12}($ 0.39

$\underline{2\ 4}$

7 2

$\underline{7\ 2}$

0

Quotient $= 0.39$

(b) $12.675 \div 3$

$3\overline{)12.675}($ 4.225

$\underline{12}$

0 6

$\underline{-6}$

07

$\underline{-6}$

15

$\underline{-15}$

$\underline{0}$

Quotient $= 4.225$

(c) $0.077 \div 7$

$7\overline{)0.077}($ 0.011

$\underline{-7}$

07

$\underline{-7}$

$\underline{0}$

Quotient $= 0.011$

(d) $125.375 \div 25$

$25\overline{)125.375}($ 5.015

$\underline{-125}$

0 37

$\underline{-25}$

125

$\underline{-125}$

$\underline{0}$

Quotient $= 5.015$

(e) $88.88 \div 22$

$22\overline{)88.88}($ 4.04

$\underline{-88}$

88

$\underline{88}$

0

Quotient $= 4.04$

(f) $37.986 \div 39$

$39\overline{)37.986}($ 0.974

$\underline{-35\ 1}$

2 88

$\underline{-2\ 73}$

156

$\underline{-156}$

$\underline{0}$

Quotient $= 0.974$

3. Divide :

(a) Divide : 3.204 by 36

$3.204 \div 36$

$$
\begin{array}{r}
36\overline{)3.204}(0.089 \\
-2\;88 \\ \hline
324 \\
-324 \\ \hline
0 \\ \hline
\end{array}
$$

Quotient $= 0.089$

(b) Divide 0.192 by 12

$0.192 \div 12$

$$
\begin{array}{r}
12\overline{)0.192}(0.016 \\
-12 \\ \hline
72 \\
-72 \\ \hline
0 \\ \hline
\end{array}
$$

Quotient $= 0.016$

(c) Divide $=$ 125.086 by 26

$125.086 \div 26$

$$
\begin{array}{r}
26\overline{)125.086}(4.811 \\
-104 \\ \hline
210 \\
-208 \\ \hline
28 \\
-26 \\ \hline
26 \\
-26 \\ \hline
0 \\ \hline
\end{array}
$$

Quotient $= 4.811$

(d) Divide 4.23 by 15

$4.23 \div 15$

$$
\begin{array}{r}
15\overline{)4.23}(0.282 \\
-30 \\ \hline
123 \\
-120 \\ \hline
30 \\
-30 \\ \hline
0 \\ \hline
\end{array}
$$

Quotient $= 0.282$

4. Divide :

(a) Divide 1.28 by 0.8

$1.28 \div 0.8 = 1.28 \times 10 \div 0.8 \times 10$

$= 12.8 \div 8 = 1.6$

(b) Divide 0.027 by 0.03

$0.027 \div 0.03 = 0.027 \times 100 \div 0.03 \times 100$

$= 2.7 \div 3 = 0.9$

(c) Divide 0.75 by 0.025

$0.75 \div 0.025 = 0.75 \times 1000 \div 0.025 \times 1000$

$= 750 \div 25 = 30$

(d) Divide 8.64 by 0.24

$8.64 \div 0.24 = 8.64 \times 100 \div 0.24 \times 100$

$= 864 \div 24 = 36$

(e) Divide 337.5 by 1.125

$337.5 \div 1.125 = 337.5 \times 1000 \div 1.125 \times 1000$

$= 337500 \div 1125 = 300$

(f) Divide 0.993 by 0.331

$0.993 \div 0.331 = 0.993 \times 1000 \div 0.331 \times 1000$

$= 993 \div 331 = 3$

5. Find :

(a) $0.216 \div 0.6 = 0.216 \times 10 \div 0.6 \times 10$
$= 2.16 \div 6$
$= 0.36$

$$\begin{array}{r} 6\overline{)2.16}(\ 0.36 \\ -1\,8 \\ \hline 36 \\ -36 \\ \hline 0 \\ \hline \end{array}$$

(b) $0.0102 \div 0.17 = 0.0102 \times 100 \div 0.17 \times 100$
$= 1.02 \div 17$
$= 0.06$

$$\begin{array}{r} 17\overline{)1.02}(\ 0.06 \\ -1\,02 \\ \hline 0 \\ \hline \end{array}$$

(c) $99.36 \div 2.3 = 99.36 \times 10 \div 2.3 \times 10$
$= 993.6 \div 23$
$= 43.2$

$$\begin{array}{r} 23\overline{)993.6}(\ 43.2 \\ -92 \\ \hline 73 \\ -69 \\ \hline 46 \\ -46 \\ \hline 0 \\ \hline \end{array}$$

(d) $3.48 \div 0.003 = 3.48 \times 1000 \div 0.003 \times 1000$
$= 3480 \div 3$
$= 1160$

$$\begin{array}{r} 3\overline{)3480}(\ 1160 \\ -3 \\ \hline 04 \\ -3 \\ \hline 18 \\ -18 \\ \hline 0 \\ \hline \end{array}$$

(e) $0.4288 \div 0.134 = 0.4288 \times 1000 \div 0.134 \times 1000$
$= 428.8 \div 134$
$= 3.2$

$$\begin{array}{r} 34\overline{)428.8}(\ 3.2 \\ -414 \\ \hline 148 \\ -148 \\ \hline 0 \\ \hline \end{array}$$

(f) $1.296 \div 0.108$
$= 1.296 \times 1000 \div 0.108 \times 1000$
$= 1296 \div 108$
$= 12$

$$\begin{array}{r} 108\overline{)1296}(\ 12 \\ -108 \\ \hline 216 \\ -216 \\ \hline 0 \\ \hline \end{array}$$

6. If 3250 ÷ 26 = 125, find the quotient orally :

(a) $32.50 \div 26 = 1.25$ (b) $3.250 \div 26 = 0.125$

(c) $325.0 \div 26 = 12.5$

7. Find :

(a) $1 \div 0.005 = 1 \times 1000 \div 0.005 \times 1000 = 1000 \div 5 = 200$

(b) $8 \div 0.04 = 8 \times 100 \div 0.04 \times 100 = 800 \div 4 = 200$

(c) $72 \div 0.144 = 72 \times 1000 \div 0.144 \times 1000$
$= 72000 \div 144 = 500$

(d) $5 \div 0.125 = 5 \times 1000 \div 0.125 \times 1000 = 5000 \div 125 = 40$

(e) $822 \div 16.44 = 822 \times 100 \div 16.44 \times 100 = 82200 \div 1644 = 50$

(f) $365 \div 9.125 = 365 \times 1000 \div 9.125 \times 1000 = 365000 \div 9125 = 40$

8. Divide :

(a) Divide 18 by 1.2 $= 18 \times 10 \div 1.2 \times 10 = 180 \div 12 = 15$

(b) Divide 26 by 3.25 $= 26 \times 100 \div 3.25 \times 100 = 2600 \div 325 = 8$

(c) Divide 21 by 0.42 $= 21 \times 100 \div 0.42 \times 100 = 2100 \div 42 = 50$

(d) Divide 9 by 0.15 $= 9 \times 100 \div 0.15 \times 100 = 900 \div 15 = 60$

(e) Divide by 99 by 0.09 $= 99 \times 100 \div 0.09 \times 100 = 9900 \div 9 = 1100$

(f) Divide 76 by 0.019 $= 76 \times 1000 \div 0.019 \times 1000 = 76000 \div 19 = 4000$

Exercise 4.3

Solve the following word problems :

1. Cost of 1 metre of cloth = ` 67.25

Cost of 18 metres of cloth = ` 67.25×18

= ` 1210.50

$$\begin{array}{r} 67.25 \\ \times\ 18 \\ \hline 53800 \\ 67250 \\ \hline 1210.50 \end{array}$$

Thus, cost of 18 metres cloth is ` 1210.50.

2. Cloth required for making a shirt = 1.85 m

Total cloth = 22.2 m

Number of shirts can be made $= 22.2 \div 1.85$

$$= \frac{22.2 \times 100}{1.85 \times 100}$$

$$= \frac{2220}{185} = 12$$

$$\begin{array}{l} 185)\,2220\,(12 \\ \underline{-185} \\ \quad 370 \\ \underline{-370} \\ \quad\ \ 0 \end{array}$$

Thus, 12 shirts can be made from 22.2 m cloth.

3. Weight of 13 slabs = 6.682 kg

Weight of 1 slab $= \frac{6.682}{13}$ kg

$$\begin{array}{l} 13)\,6.682\,(0.514 \\ \underline{-6\,5} \\ \quad 18 \\ \underline{-13} \\ \quad\ 52 \\ \underline{-52} \\ \quad\ \ 0 \end{array}$$

Weight of 8 slabs $= 0.514 \times 8 = 4.112$ kg.

$$\begin{array}{r} 0.514 \\ \times\ 8 \\ \hline 4.112 \end{array}$$

Thus, weight of 8 slabs is 4.112 kg

4. Cost of one kg mangoes = ` 28.70

Cost of 3.5 kg mangoes = ` 28.70×3.5

= ` 100.45

$$\begin{array}{r} 28.70 \\ \times\ 3.\ 5 \\ \hline 14350 \\ 186100 \\ \hline 100.450 \end{array}$$

Thus, cost of 3.5 kg mangoes is ` 100.45.

5. Quantity of vegetables bought in 7 days = 21.7 kg

Quantity of vegetables bought in 1 day = 21.7 ÷ 7 = 3.1 kg

$$\begin{array}{r} 7\overline{)21.7}(3.1 \\ \underline{-21} \\ 07 \\ \underline{-7} \\ 0 \end{array}$$

Thus, Aurna brought 3.1 kg vegetables in each day.

6. Weight of 1 gold chain = 22.725 g

Number of chains = 5

Total weight of 5 chains = 22.725 × 5g

= 113.625 g

$$\begin{array}{r} 22.725\text{ g} \\ \underline{\times 5} \\ \underline{113.625\text{ g}} \end{array}$$

Thus, weight of 5 gold chains is 113.625 g.

7. Quantity of ink in a one bottle = 0.375 lit

Quantity of total ink = 13.5 litres

Number of bottle required = 13.5 ÷ 0.375

$= \dfrac{13.5 \times 1000}{0.375 \times 1000}$

$= \dfrac{13500}{375} = 36$

$$\begin{array}{r} 375\overline{)13500}(36 \\ \underline{-1125} \\ 2250 \\ \underline{-2250} \\ \underline{0} \end{array}$$

So, 36 bottles are required.

8. Cost of 1 litre milk = ` 15.50

Cost of 5 litres milk = ` 15.50 × 5

= ` 77.50

$$\begin{array}{r} \text{` } 15.50 \\ \underline{\times 5} \\ \underline{\text{` } 77.50} \end{array}$$

Thus, my mother spent ` 77.50 for bought 5 litres of milk.

9. Number of vessels = 81

Quantity of water = 283.5 litres

Capacity of each vessel = 283.5 L ÷ 81

= 3.5 L

$$\begin{array}{r} 81\overline{)283.5}(3.5 \\ \underline{-243} \\ 405 \\ \underline{-405} \\ \underline{0} \end{array}$$

The capacity of each vessel is 3.5 L.

10. Cost of 8.75 m cloth = ` 420

Cost of 1 m cloth = ` $\dfrac{420}{8.75}$ = ` 48

Cost of 3.5 m cloth = ` $\dfrac{420}{8.75} \times 3.5$

$$\begin{array}{r} 875\overline{)147000}(168 \\ \underline{-875} \\ 5950 \\ \underline{-5250} \\ \underline{700} \end{array}$$

$$= ` \frac{1470}{8.75}$$

$$= \frac{1470 \times 100}{8.75 \times 100}$$

$$= \frac{147000}{875}$$

Thus, the cost of 3.5 m cloth is ` 168.

Exercise 4.4

Simplify :

1. $9 + 2.5 \div 0.5 - 1 = 9 + 5 - 1 = 14 - 1 = 13$

2. $2.5 \div 0.5 + 4 \times 2.5 = 5 + 4 \times 2.5 = 5 + 10 = 15$

3. $1.1 \times 0.1 + 3.01 - 0.01 = 0.11 + 3.01 - 0.01 = 3.12 - 0.01 = 3.11$

4. $14 + 2 \div 4 - 0.5 \times 3 = 14 + 0.5 - 1.5 = 14.5 - 1.5 = 13$

5. $8.5 \div 1.7 + 1.2 - 0.9 \text{ of } 1.2$

$$= 8.5 \div 1.7 + 1.2 - 0.9 \times 1.2$$
$$= 5 + 1.2 - 0.9 \times 1.2$$
$$= 5 + 1.2 - 1.08 = 6.2 - 1.08 = 5.12$$

6. $4 \div 3.2 + 37.8 - 6.5 \text{ of } 3$

$$= 4 \div 3.2 + 37.8 - 6.5 \times 3$$
$$= 1.25 + 37.8 - 6.5 \times 3$$
$$= 1.25 + 37.8 - 19.5 = 19.55$$

7. $1.4 \times 3.2 + 2 \times 2.1 - 0.8 = 4.48 + 4.2 - 0.8 = 8.68 - 0.8 = 7.88$

8. $13 \div 5.2 + 0.024 \text{ of } 8 + 0.3$

$$= 13 \div 5.2 + 0.024 \times 8 + 0.3$$
$$= 2.5 + 0.192 + 0.3 = 2.992$$

9. $2.5 \times 4 - 25.5 \div 2.5 \text{ of } 2$

$$= 2.5 \times 4 - 25.5 \div 2.5 \times 2$$
$$= 2.5 \times 4 - 25.5 \div 5$$
$$= 2.5 \times 4 - 5.1 = 10 - 5.1 = 4.9$$

10. $12 \div \frac{1}{2} + 0.5 \times \frac{5}{2} - 2 = 12 \times 2 + 0.5 \times 2.5 - 2$

$$= 24 + 1.25 - 2$$
$$= 25.25 - 2$$
$$= 23.25$$

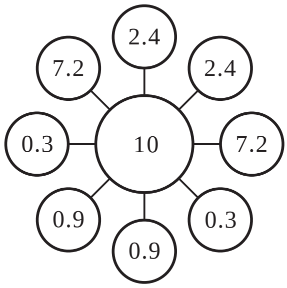
Multiple Choice Questions

Tick (3) the correct answer :

1. (a)	**2.** (b)	**3.** (c)	**4.** (d)	**5.** (b)
6. (c)	**7.** (a)	**8.** (c)	**9.** (a)	**10.** (c)

High Order Thinking Skills (HOTS)

$(7.2 \times 10 \times 0.3 = 21.6;\ 2.4 \times 10 \times 0.9 = 21.6)$



5 Exponents and Powers

Exercise 5.1

1. Write the base and exponent in each of the following :

(a) $\left(\frac{2}{3}\right)^5$ Base $= \frac{2}{3}$ exponent $= 5$

(b) 4^7 Base $= 4$ exponent $= 7$

(c) $\left(\frac{-3}{5}\right)^6$ Base $= \frac{-3}{5}$ exponent $= 6$

(d) $\frac{5}{11}$ Base $= \frac{5}{11}$ exponent $= 1$

2. Express the following in exponential form :

(a) $10000000 = (10)^7$

(b) $y \times y \times y \times y$ ...... x times $= (y)^x$

(c) $9 \times 9 \times 9 \times 9$ (2 ways) $= 9^4$ or 3^8

(d) $\left(\frac{-2}{7}\right) \times \left(\frac{-2}{7}\right) \times \left(\frac{-2}{7}\right) \times \left(\frac{-2}{7}\right) \times \left(\frac{-2}{7}\right) = \left(\frac{-2}{7}\right)^5$

3. Find the value of each of the following numbers using exponential notation :

(a) $(-7)^3 = (-7) \times (-7) \times (-7) = -343$

(b) $(-4)^2 = (-4) \times (-4) = 16$

(c) $\left(\frac{-1}{2}\right)^6 = \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} = \frac{1}{64}$

(d) $-\left(\frac{1}{10}\right)^4 = \frac{-1}{10} \times \frac{-1}{10} \times \frac{-1}{10} \times \frac{-1}{10} = \frac{1}{10000}$

4. Write the exponential notation :

(a) $\frac{16}{625}=\frac{2\times2\times2\times2}{5\times5\times5\times5}=\frac{(2)^4}{(5)^4}=\left(\frac{2}{5}\right)^4$

(b) $\frac{-1}{27}=\frac{-1\times-1\times-1}{3\times3\times3}=\frac{(-1)^3}{(3)^3}=\left(\frac{-1}{3}\right)^3$

(c) $\frac{-32}{243}=\frac{-2\times-2\times-2\times-2\times-2}{3\times3\times3\times3\times3}=\frac{(-2)^5}{(3)^5}=\left(\frac{-2}{3}\right)^5$

(d) $\frac{16}{169}=\frac{4\times4}{13\times13}=\left(\frac{4}{13}\right)^2$

5. Expand and write as a rational number :

(a) $(-5)^3=-5\times-5\times-5=-125$

(b) $\left(\frac{-1}{3}\right)^4=\frac{-1}{3}\times\frac{-1}{3}\times\frac{-1}{3}\times\frac{-1}{3}=\frac{1}{81}$

(c) $\left(\frac{-2}{7}\right)^3=\frac{-2}{7}\times\frac{-2}{7}\times\frac{-2}{7}=\frac{-8}{343}$

(d) $\left(\frac{3}{4}\right)^2=\frac{3}{4}\times\frac{3}{4}=\frac{9}{16}$

6. Write the reciprocal of the following :

(a) $(-3)^5$ reciprocal of $(-3)^5=\left(\frac{1}{-3}\right)^5$

(b) $\left(\frac{2}{5}\right)^4$ reciprocal of $\left(\frac{2}{5}\right)^4=\left(\frac{5}{2}\right)^4$

(c) $\left(\frac{-5}{11}\right)^2$ reciprocal of $\left(\frac{-5}{11}\right)^2=\left(\frac{-11}{5}\right)^2$

(d) $(-8)^5$ reciprocal of $(-8)^5=\left(\frac{1}{-8}\right)^5$

7. Which is greater?

(a) 3^2 or 2^3

$3^2=9$

$2^3=8$

$9>8$

or 3^2 is greater than 2^3

(b) 5^3 or 3^5

$5^3=125$

$3^5=243$

$125<243$

3^5 is greater than 5^3

(c) 2^8 or 8^2

$2^8=256$

(d) 4.2×10^8 or 2.4×10^9

$4.2\times10^8=4.2\times100000000$

$8^2 = 64$

$256 > 64$

2^8 is greater than 8^2

$= 4200000000$

$2.4 \times 10^9 = 2.4 \times 1000000000$

$4200000000 < 2400000000$

2.4×10^9 is greater than 4.2×10^8

(e) 5×10^{12} or 4×10^{13}

$5 \times 10^{12} = 5 \times 1000000000000 = 5000000000000$

$4 \times 10^{13} = 4 \times 10000000000000 = 40000000000000$

$500000000000 < 4000000000000$

4×10^{13} is greater than 5×10^{12}

8. Evaluate.

(a) $30 - 3^3 = 30 - 27 = 3$

(b) $51 + 2^3 = 51 + 8 = 59$

(c) $3^4 + 2 \times (-17) = 81 + (-34) = 81 - 34 = 47$

(d) $2^5 - (5).(5) = 32 - 5 \times 5 = 32 - 25 = 7$

(e) $(-4)^2 + (-1)^3 = 16 + (-1) = 16 - 1 = 15$

(f) $(3)^4 + (4)^3 = 81 + 64 = 145$

9. Find the number which makes the given expressions true.

(a) $2^x = 32$

$2^x = (2)^5$

$x = 5$

(b) $(-4)^x = -64$

$(-4)^x = (-4)^3$

$x = 3$

(c) $(0.5)^y = 0.25$

$(0.5)^y = (0.5)^2$

$y = 2$

(d) $10^y = 10000$

$10^y = (10)^4$

$y = 4$

(e) $1^3 + 2^3 + 3^3 + 4^3 = 10^x$

$1 + 8 + 27 + 64 = 10^x$

$100 = 10^x$

$10^2 = 10^x$

$x = 2$

Exercise 5.2

1. Using the laws of exponents. Simplify in the exponential form :

(a) $3^9 \times 3^2 = (3)^{9+2} = 3^{11}$

(b) $6^3 \times 6^4 \times 6^2 = (6)^{3+4+2} = 6^9$

(c) $m \times m^2 \times m^3 = (m)^{1+2+3} = m^6$

(d) $\left(\frac{1}{4}\right)^6 \times \left(\frac{1}{4}\right)^2 = \left(\frac{1}{4}\right)^{6+2} = \left(\frac{1}{4}\right)^8$

(e) $\left(-\frac{3}{5}\right)^6 \times \left(-\frac{3}{5}\right)^3 \times \left(-\frac{3}{5}\right)^5 = \left(\frac{-3}{5}\right)^{6+3+5} = \left(\frac{-3}{5}\right)^{14}$

(f) $\left(-\frac{2}{3}\right) \times \left(-\frac{2}{3}\right)^4 \times \left(-\frac{2}{3}\right)^6 = \left(\frac{-2}{3}\right)^{1+4+6} = \left(\frac{-2}{3}\right)^{11}$

(g) $(-4)^2 \times (-4)^3 \times (-4)^6 = (-4)^{2+3+6} = (-4)^{11}$

(h) $n^6 \times n^2 \times n^{10} = (n)^{6+2+10} = n^{18}$

(i) $(-7) \times (-7)^3 \times (-7)^4 = (-7)^{1+3+4} = (-7)^8$

2. Expand :

(a) $(3a)^5 = 3^5 \times a^5$

(b) $(4 \times 3)^6 = 4^6 \times 3^6$

(c) $(2 \times b)^4 = 2^4 \times b^4$

(d) $(7 \times 3)^{10} = 7^{10} \times 3^{10}$

(e) $(-6a)^3 = (-6)^3 \times a^3$

(f) $(a \times b)^{10} = a^{10} \times b^{10}$

(g) $(8 \times -b)^{11} = 8^{11} \times -b^{11}$

(h) $(-8 \times x)^{15} = -8^{15} \times x^{15}$

3. Which one is greater?

(a) $(3^2)^4$ or $(3^2) \times 4$

$(3^2)^4 = 3^{2\times4} = 3^8 = 6561$

$3^2 \times 4 = 9 \times 4 = 36$

$6561 > 36$

$(3^2)^4$ is greater

(b) $(4^3)^5$ or $(4^3) \times 5$

$(4^3)^5 = 4^{3\times5} = 4^{15}$

$4^3 \times 5 = 64 \times 5 = 320$

$4^{15} > 320$

$(4^3)^5$ is greater

4. Write the following in exponential form assuming the denominators not equal to zero :

$(x^a \div x^b = x^{a-b})$

(a) $\frac{4^6}{4^3} = 4^6 \div 4^3 = 4^{6-3} = 4^3$

(b) $\frac{10^{12}}{10^5} = 10^{12} \div 10^5 = 10^{12-5} = 10^7$

(c) $\frac{(-2)^8}{(-2)^6} = (-2)^8 \div (-2)^6 = (-2)^{8-6} = (-2)^2$

(d) $\frac{(-5)^{10}}{(-5)^4} = (-5)^{10} \div (-5)^4 = (-5)^{10-4} = (-5)^6$

(e) $\left(-\frac{1}{2}\right)^{11} \div \left(-\frac{1}{2}\right)^6 = \left(\frac{-1}{2}\right)^{11-6} = \left(\frac{-1}{2}\right)^5$

(f) $(0.5)^7 \div (0.5)^3 = (0.5)^{7-3} = (0.5)^4$

(g) $(6.8)^{10} \div (6.8)^4 = (6.8)^{10-4} = (6.8)^6$

(h) $\left(\frac{x}{y}\right)^6 \div \left(\frac{x}{y}\right)^4 = \left(\frac{x}{y}\right)^{6-4} = \left(\frac{x}{y}\right)^2$

5. Express the following with a single power :

$(x^{ap} = x^{a \times b}; x^a \times x^b = x^{a+b})$

(a) $(3^3)^5 \times (3^4)^2 = (3)^{3\times5} \times (3)^{4\times2} = (3)^{15} \times (3)^8 = (3)^{15+8} = (3)^{23}$

(b) $(7^2)^5 \times (7^3)^6 = (7)^{2\times5} \times (7)^{3\times6} = (7)^{10} \times (7)^{18} = (7)^{10+18} = (7)^{28}$

(c) $(5^3)^6 \times (5^2)^4 = (5)^{3\times6} \times (5)^{2\times4} = (5)^{18} \times (5)^8 = (5)^{18+8} = (5)^{26}$

(d) $(2^{10})^3 \times (2^5)^4 = (2)^{10\times3} \times (2)^{5\times4}$

$= (2)^{30} \times (2)^{20} = (2)^{30+20} = (2)^{50}$

(e) $(9^2)^3 \times (9^3)^4 = (9)^{2\times3} \times (9)^{3\times4} = (9)^6 \times (9)^{12} = (9)^{6+12} = (9)^{18}$

(f) $(10^3)^4 \times (10^5)^3 = (10)^{3\times4} \times (10)^{5\times3}$

$= (10)^{12} \times (10)^{15} = (10)^{12+15} = (10)^{27}$

(g) $(2)^{4\times3} \times (2)^{3\times2} \times (2)^{2\times4} = (2)^{12} \times (2)^6 \times (2)^8$

$= (2)^{12+6+8} = (2)^{26}$

(h) $(3^2)^3 \times (3^3)^2 \times (3^4)^3 = (3)^{2\times3} \times (3)^{3\times2} \times (3)^{4\times3}$

$= (3)^6 \times (3)^6 \times (3)^{12} = (3)^{6+6+12} = 3^{24}$

6. Simplify and answer in the exponential :

(a) $(2^3 \times 2)^2 = (2^{3+1})^2 = (2^4)^2 = 2^{4\times2} = 2^8$

(b) $\left(\frac{4^6 \times a^8 b^5}{4^3 \times a^5 b^2}\right) = \frac{4^6}{4^3} \times \frac{a^8 b^5}{a^5 b^2}$

$= (4)^{6-3} \times (a)^{8-5} \times (b)^{5-2} = 4^3 \times a^3 \times b^3 = (4ab)^3$

(c) $\frac{2^8 \times a^5}{4^3 \times a^3} = \frac{2^8 \times a^5}{2^6 \times a^3} = (2)^{8-6} \times (a)^{5-3} = (2)^2 (a)^2 = (2a)^2$

(d) $2^3 \times 2^2 \times 5^5 = (2)^{3+2} \times (5)^5 = (2)^5 \times (5)^5 = (2\times5)^5 = 10^5$

(e) $\frac{3^8 \times 3^2}{3^4 \times 3^3} = \frac{(3)^{8+2}}{(3)^{4+5}} = \frac{(3)^{10}}{(3)^9} = (3)^{10-9} = (3)^1$

(f) $(6^2 \times 6^4) \div 6^3 = (6)^{2+4} \div (6)^3 = (6)^6 \div 6^3 = (6)^{6-3} = 6^3$

(g) $\left(\frac{3^7}{3^2}\right) \times 3^5 = (3)^{7-2} \times (3)^5 = (3)^5 \times (3)^5 = (3)^{5+5} = 3^{10}$

(h) $\left(\frac{a^5}{a^3}\right) \times a^8 = (a)^{5-3} \times (a)^8 = (a)^2 \times (a)^8 = (a)^{2+8} = a^{10}$

Multiple Choice Questions

Tick (3) the correct answer :

1.	(d)	**2.**	(b)	**3.**	(d)	**4.**	(a)
5.	(c)	**6.**	(b)	**7.**	(c)	**8.**	(b).

High Order Thinking Skills (HOTS)

1. Value of $4^3 = 4 \times 4 \times 4 = 64$

Value of `$3^4 = 3 \times 3 \times 3 \times 3 = 81$

Difference $= 3^4 - 4^3 = 81 - 64 = 17$

2. Value of $5^4 = 5 \times 5 \times 5 \times 5 = 625$

Value of $4^5 = 4 \times 4 \times 4 \times 4 \times 4 = 1024$ Difference $= 1024 - 625 = 399$

3. (b) $x^{2a} \times x^b = x^{2a+b}$

6 Algebraic Expressions

Exercise 6.1

1. Write an algebraic expression for the following :

(a) $2y - 3x$ (b) z^2 (c) $\frac{1}{2}(x + y)$

(d) $\frac{pq}{4}$ (e) $x^2 + y^2$ (f) $3mn + 5$

2. Write the numerical co-efficient of each of the following expressions:

(a) The numerical co-efficient $= \frac{-15}{2}, -30, 6, 4$

(b) The numerical co-efficient $= 9, -10, -11, -1$

(c) The numerical co-efficient $= 7, -2, -16, 18$

(d) The numerical co-efficient $= \frac{-3}{5}, 9, -18$

3. Write the co-efficient of y^2 in the following :

(a) Co-efficient of y^2 in $10y^2z = 10z$

(b) Co-efficient of y^2 in $-14xy^3z = -14\,yzx$

(c) Co-efficient of y^2 in $8y^2 = 8$

(d) Co-efficient of y^2 in $\frac{5}{6}y^2x^2z = \frac{5}{6}x^2z$

(e) Co-efficient of y^2 in $11x^2y^2z^2 = 11x^2z^2$

(f) Co-efficient of y^2 in $32x^2y^4z = 32x^2y^2z$

4. Classify the following expressions as monomials, binomials and trinomials :

(a) $x^2 + y^2 + z^2 =$ trinomial (b) $14xyz =$ monomial

(c) $-10 =$ monomial (d) $y + 2z =$ binomial

(e) $pq + qr - 4 =$ trinomial (f) $15z^2 - 2 =$ binomial

5. Identify the like terms from each of the following expressions :

(Like terms : All the terms containing the same literal numbers (or variables) with the same degrees are called like terms.)

Thus, the like terms are :

(a) $9a^2, -4a^2; 3b^2, 2b^2$ (b) $2yz, -4yz, 9yz, -\frac{19}{2}yz$

(c) $a^2b^2c, -9a^2cb^2$ (d) $pqr, -32pqr$

(e) $x^2y, yx^2, 4x^2y$ (f) $-xy^2, 2xy^2$

6. Write the co-efficient of :

(a) Co-efficient of y in $-5y = -5$

(b) Co-efficient of a in $2ab = 2b$

(c) Co-efficient of y in $-7xy = -7x$

(d) Co-efficient of p in $-3pq = -3q$

(e) Co-efficient of y^2 in $9xy^2 = 9x$

(f) Co-efficient of x^3 in $x^3 + 1 = 1$

(g) Co-efficient of x^2 in $-x^2 = -1$

(h) Co-efficient of x^2 in $\frac{-5}{7}x^2y = \frac{-5}{7}y$

7. Write the factors of each term of the following :

(a) $-16xyz + 4yz$

We write all the values separately to know all the factors. Thus, factors are

$-16xyz = -16, x, y, z$ and $+4yz = 4, y, z$

(b) $32y^2z - 8xy - 4$

We write all the values separately to know all the factors. Thus, factors are

$32y^2z = 32, y, y, z$; $-8xy = -8, x, y$; $-4 = -4$

(c) $a^2b^2c - ab + 9$

We write all the values separately to know all the factors. Thus, factors are

$a^2b^2c = a \times a \times b \times b \times c$; $-ab = -a, b$; $9 = 9$

(d) $x^2y - y^2z$

We write all the values separately to know all the factors Thus, factors are $x^2y = x \times x \times y$; $-y^2z = -y \times y \times z$

8. Write down the degree of each term and degree of the algebraic expressions given in Q. 7.

(a) $-16xyz + 4yz$

Degree of $-16xyz = 3$

$$\text{Degree of } +4yz = 2$$
$$\text{Highest degree is } = 3$$
$$\text{The degree of } -16xyz + 4yz = 3$$

(b) $32y^2z - 8xy - 4$

$$\text{Degree of } 32y^2z = 3$$
$$\text{Degree of } -8xy = 2$$
$$\text{Degree of } -4 = 0$$
$$\text{Highest degree is } = 3$$
$$\text{The degree of } 3y^2z - 8xy - 4 = 3$$

(c) $a^2b^2c - ab + 9$

$$\text{Degree of } a^2b^2c = 5$$
$$\text{Degree of } -ab = 2$$
$$\text{Degree of } 9 = 0$$
$$\text{Highest of degree is } = 5$$
$$\text{The degree of } a^2b^2c - ab + 9 = 5$$

(d) $x^2y - y^2z$

$$\text{Degree of } x^2y = 3$$
$$\text{Degree of } y^2z = 3$$
$$\text{Highest of degree is } = 3$$
$$\text{The degrees of } x^2y - y^2z = 3$$

9. What's the degree of each term of the following expressions. Hence, state the degree of the expression.

(a) $4 + y^2$

$$\text{Degree of } 4 = 0$$
$$\text{Degree of } y^2 = 2$$
$$\text{Highest degree is } 2$$
$$\text{The degree of } 4 + y^2 = 2$$

(b) $4 - y^3$

$$\text{Degree of } 4 = 0$$
$$\text{Degree of } y^3 = 3$$
$$\text{Highest degree is } 3$$
$$\text{The degree of } 4 - y^3 = 3$$

(c) $1 - 2t + t^2 - 3t^3$

$$\text{Degree of } 1 = 0$$
$$\text{Degree of } -2t = 1$$
$$\text{Degree of } t^2 = 2$$
$$\text{Degree of } -3t^3 = 3$$

Highest degree is 3

Degree of $1-2t+t^2-3t^3=3$

(d) x^2+xy

Degree of $x^2=2$

Degree of $xy=2$

Highest degree is 2

Degree of $x^2+xy=2$

(e) $4x^3-3x^2+5x-6$

Degree of $4x^3=3$

Degree of $-3x^2=2$

Degree of $5x=1$

Degree of $6=0$

Highest degree $=3$

Degree of $4x^3-3x^2+5x-6=3$

(f) $x^2y-xy^2+7xy-3$

Degree of $x^2y=3$

Degree of $-xy^2=3$

Degree of $7xy=2$

Degree of $-3=0$

Highest degree is $=3$

Degree of $x^2y-xy^2+7xy-3=3$

Exercise 6.2

1. Add the following :

(a) Add :

$$24xy,\ 19xy,\ -4xy=24xy+19xy+(-4xy)$$
$$=24xy+19xy-4xy$$
$$=43xy-4xy=39xy$$

(b) Add :

$$3x^2,\ -10x^2,\ 4x^2=3x^2+(-10x^2)+4x^2$$
$$=3x^2-10x^2+4x^2$$
$$=7x^2-10x^2=-3x^2$$

(c) Add :

$$5y^3,\ 26y^3,\ 10y^3,\ -3y^3=5y^3+26y^3+10y^3+(-3y^3)$$
$$=5y^3+26y^3+10y^3-3y^3$$
$$=41y^3-3y^3=38y^3$$

(d) Add :

$$4x^2y,\ -3xy^2,\ -5xy^2,\ 5x^2y=4x^2y+(-3xy^2)+(-5xy^2)+5x^2y$$

$= 4x^2 y + 5x^2 y - 3xy^2 - 5xy^2$

$= 9x^2 y - 8xy^2$

(e) Add :

$-10ab^2 c, - ab^2 c, 15ab^2 c, ab^2 c$

$= -10ab^2 c + (-ab^2 c) + 15ab^2 c + ab^2 c$

$= -10ab^2 c - ab^2 c + 15ab^2 c + ab^2 c$

$= -11ab^2 c + 16ab^2 c$

$= 16ab^2 c - 11ab^2 c$

$= 5ab^2 c$

(f) Add :

$8x^2 y, -11x^2 y, -8x^2 y = 8x^2 y + (-11x^2 y) + (-8x^2 y)$

$= 8x^2 y - 11x^2 y - 8x^2 y$

$= 8x^2 y - 19x^2 y$

$= -11x^2 y$

2. Add the following expressions :

(a) Add : $x^2 + y^2 + 2xy,\ 3x^2 + y^2 - 4xy, x^2 + y^2$

$$\begin{array}{r}
x^2 + y^2 + 2xy \\
3x^2 + y^2 - 4xy \\
(+)\quad \underline{x^2 + y^2 \qquad} \\
\underline{5x^2 + 3y^2 - 2xy}
\end{array}$$

(b) Add : $x^2 y + xy^2,\ -11x^2 y + 10xy^2,\ -10x^2 y - 11xy^2$

$$\begin{array}{r}
x^2 y + xy^2 \\
-11x^2 y + 10xy^2 \\
(+)\underline{-10x^2 y - 11xy^2} \\
\underline{-20x^2 y \qquad\quad}
\end{array}$$

(c) Add : $4abc + 6a^2 + 7b, 10a^2 + 14b, -2abc - 3a^2$

$$\begin{array}{r}
4abc + 6a^2 + 7b \\
+10a^2 + 14b \\
(+)\underline{-2abc - 3a^2 \qquad\quad} \\
\underline{2abc + 13a^2 + 21b}
\end{array}$$

(d) Add : $2x^2 + 4y^2 + 5,\ -x^2 + 3y^2 + 10,\ -2x^2 - 4y^2 - 10$

$$\begin{array}{r}
2x^2 + 4y^2 + 5 \\
-x^2 + 3y^2 + 10 \\
(+)\quad \underline{-2x^2 - 4y^2 - 10} \\
\underline{-x^2 + 3y^2 + 5}
\end{array}$$

3. Subtract :

(a) Subtract : $18ab$ from $-6ab$

$= -6ab - 18ab$

$= -24ab$

(b) Subtract : $-a^2b$ from $9a^2b$

$= 9a^2b - (-a^2b)$

$= 9a^2b + a^2b = 10a^2b$

(c) Subtract : $19pq$ from $6pq$

$= 6pq - 19pq = -13pq$

(d) Subtract : $10xy$ from $-14xy$

$= -14xy - 10xy = -24xy$

(e) Subtract : $14x^2$ from $3x^2$

$= 3x^2 - 14x^2$

$= -11x^2$

(f) Subtract : $-5x^3y$ from $-10x^3y$

$= -10x^3y - (-5x^3y)$

$= -10x^3y + 5x^3y = -5x^3y$

4. Subtract the first expression from the second :

(a) $5a - 3b + 15,\ 6a - 8b - 10$

$$\begin{array}{rrrr} & 6a & -8b & -10 \\ (-) & 5a & -3b & +15 \\ & (-) & (+) & (-) \\ \hline & 1a & -5b & -25 \end{array}$$

(b) $7 - 2x - x^2,\ 3x^2 - 4x + 2$

$$\begin{array}{rrrr} & 3x^2 & -4x & +2 \\ (-) & -x^2 & -2x & +7 \\ & (+) & (+) & (-) \\ \hline & 4x^2 & -2x & -5 \end{array}$$

(c) $3x^2 - 5y + 7,\ 10y + 14$

$$\begin{array}{rrr} & 10y & +14 \\ 3x^2 & -5y & +7 \\ (-) & (+) & (-) \\ \hline -3x^2 & +15y & +7 \end{array}$$

(d) $x^2 - xy + y^2,\ -x^2 - 2xy + y^2$

$$\begin{array}{rrr} -x^2 & -2xy & +y^2 \\ x^2 & -xy & +y^2 \\ (-) & (+) & (-) \\ \hline -2x^2 & -xy & \end{array}$$

(e) $ab^2 + b^2 - a^2b,\ -2ab^2 + 3b^2$

$$\begin{array}{rrr} -2ab^2 & +3b^2 & \\ ab^2 & +b^2 & -a^2b \\ (-) & (-) & (+) \\ \hline -3ab^2 & +2b^2 & +a^2b \end{array}$$

(f) $4p^3 + 3p^2 - 2p,\ 6p^3 - 4p$

$$\begin{array}{rrr} 6p^3 & -4p & \\ 4p^3 & -2p & +3p^2 \\ (-) & (+) & (-) \\ \hline 2p^3 & -2p & -3p^2 \end{array}$$

(g) $8y - 6x^2 + 9,\ 2x^2$

$$\begin{array}{rrr} 2x^2 & & \\ -6x^2 & +8y & +9 \\ (+) & (-) & (-) \\ \hline 8x^2 & -8y & -9 \end{array}$$

(h) $5a^2 - 7ab + 5b^2,\ 3ab - 2a^2 - 2b^2$

$$\begin{array}{rrr} 3ab & -2a^2 & -2b^2 \\ -7ab & +5a^2 & +5b^2 \\ (+) & (-) & (-) \\ \hline 10ab & -7a^2 & -7b^2 \end{array}$$

5. What should be added to $5x^3 - 11x^2 - 4$ to get $10x^3 - 4x^2 + 6$?

$$\begin{array}{rrr} 10x^3 & -4x^2 & +6 \\ 5x^3 & -11x^2 & -4 \\ (-) & (+) & (+) \\ \hline 5x^3 & +7x^2 & +10 \\ \hline \end{array}$$

Thus, $5x^3 + 7x^2 + 10$ should be added to $5x^3 - 11x^2 - 4$ to get $10x^3 - 4x^2 + 6$.

6. What should be subtracted from $14xyz + 6xy$ to get $- xyz + 7xy$?

$$\begin{array}{rr} 14xyz & +6xy \\ -xyz & +7xy \\ -\ (+) & (-) \\ \hline 15xyz & -xy \\ \hline \end{array}$$

Thus, $15xyz - xy$ should be subtract to get $-xyz + 7xy$.

7. How much is $x^3 - 2x^2 + x + 4$ greater than $2x^3 - 7x^2 - 5x + 6$?

$$\begin{array}{rrrr} x^3 & -2x^2 & +x & +4 \\ 2x^3 & -7x^2 & -5x & +6 \\ (-) & (+) & (+) & (-) \\ \hline -x^3 & +5x^2 & +6x & -2 \\ \hline \end{array}$$

Thus, $x^3 - 2x^2 + x + 4$ is $-x^3 + 5x^2 + 6x - 2$ greater than $2x^3 - 7x^2 - 5x + 6$.

8. From the sum of $pq + p^2 - q^2$ and $2p^2 + 4q^2$ subtract $2pq - p^2$.

Add : $pq + p^2 - q^2$ and $2p^2 + 4q^2$

Add :

$$\begin{array}{rrr} pq & +p^2 & -q^2 \\ & +2p^2 & +4q^2 \\ \hline pq & +3p^2 & +3q^2 \\ \hline \end{array}$$

Subtract $2pq - p^2$ from $pq + 3p^2 - 3q^2$

Subtract :

$$\begin{array}{rrr} pq & +3p^2 & +3q^2 \\ +2pq & -p^2 & \\ (-) & (+) & (+) \\ \hline -pq & +4p^2 & +3q^2 \\ \hline \end{array}$$

9. Subtract $10a^2b + 4ab^2$ from the sum of $-7a^2b + 9$ and $-3ab^2 + 2$.

Sum of $-7a^2b + 9$ and $-3ab^2 + 2$

Add :

$$\begin{array}{rrr} -7a^2b & +9 & \\ & +2 & -3ab^2 \\ \hline -7a^2b & +11 & -3ab^2 \\ \hline \end{array}$$

Subtract $10a^2b + 4ab^2$ from $-7a^2b + 11 - 3ab^2$

Subtract :

$$\begin{array}{r} -7a^2b + 11 - 3ab^2 \\ 10a^2b \quad + 4ab^2 \\ (-) \quad (-) \quad (-) \\ \hline -17a^2b + 11 - 7ab^2 \\ \hline \end{array}$$

10. If P = $2x^2 + 3xy - 5y^2$, Q = $-5x^2 + 2xy + 3y^2$, and R = $-3x^2 + 5xy - 2y^2$, show that P + Q – R = 0.

P = $2x^2 + 3xy - 5y^2$, Q = $-5x^2 + 2xy + 3y^2$,

$P + Q =$

$$\begin{array}{r} 2x^2 + 3xy - 5y^2 \\ -5x^2 + 2xy + 3y^2 \\ \hline -3x^2 + 5xy - 2y^2 \\ \hline \end{array}$$

$P + Q - R =$

$$\begin{array}{r} -3x^2 + 5xy - 2y^2 \\ -3x^2 + 5xy - 2y^2 \\ (+) \quad (-) \quad (+) \\ \hline 0 \\ \hline \end{array}$$

$P + Q - R = 0$

Hence proved.

11. The sum of two expression is $x^2 - y^2 + 3y - 5$, if one of them is $2y^2 + 2x - y - 10$, find the other.

Sum of the two expressions $= x^2 - y^2 + 3y - 5$

One expression $= 2y^2 + 2x - y - 10$

Other expression

$$\begin{array}{r} x^2 - y^2 + 3y - 5 \\ 2y^2 - y + 2x - 10 \\ (-) \ (+) \ (-) \ (+) \\ \hline +x^2 - 3y^2 + 4y - 2x + 5 \\ \hline \end{array}$$

12. Add $15xy + x^2 + 2$ to the sum of $11xy - x^2 - 4$ and $-14xy + 5x^2$.

Add : $11xy - x^2 - 4$ and $-14xy + 5x^2$

Add :

$$\begin{array}{r} 11xy - x^2 - 4 \\ -14xy + 5x^2 \\ \hline -3xy + 4x^2 - 4 \\ \hline \end{array}$$

Add : $15\,xy + x^2 + 2$ and $-3xy + 4x^2 - 4$

Add :

$$\begin{array}{r} 15xy + x^2 + 2 \\ -3xy + 4x^2 - 4 \\ \hline 12xy + 5x^2 - 2 \\ \hline \end{array}$$

Exercise 6.3

1. If $x = 2$, $y = 1$, find the value of each of the following expressions :

(a) $2x + 3 = 2 \times 2 + 3 = 4 + 3 = 7$

(b) $4y - 6 = 4 \times 1 - 6 = 4 - 6 = -2$

(c) $4x^2 - 5 = 4(2)^2 - 5 = 4 \times 4 - 5 = 16 - 5 = 11$

(d) $y^2 - 2y = (1)^2 - 2 \times 1 = 1 - 2 = -1$

(e) $x^2 + y^2 - xy = (2)^2 + (1)^2 - 2 \times 1 = 5 - 2 = 3$

(f) $x^2 - y^2 = (2)^2 - (1)^2 = 4 - 1 = 3$

2. Find the value of the expressions, if $a = 2$, $b = -2$, $c = 1$:

(a) $a^2b + ab^2 = (2)^2 \times -2 + 2 \times (-2)^2 = 4 \times -2 + 2 \times 4 = -8 + 8 = 0$

(b) $a^3 + b^3 + c^3 = (2)^3 + (-2)^3 + (1)^3 = 8 - 8 + 1 = 1$

(c) $2abc + 1 = 2 \times 2 \times -2 \times 1 + 1 = -8 + 1 = -7$

(d) $ab + bc + ac = (2 \times -2) + (-2 \times 1) + (2 \times 1)$
$= -4 + (-2) + 2 = -4 - 2 + 2 = -6 + 2 = -4$

(e) $a^3 + b^3 + c^3 - 3abc = (2)^3 + (-2)^3 + (1)^3 - 3 \times 2 \times (-2) \times 1$
$= 8 - 8 + 1 - (-12) = 0 + 1 + 12 \quad = 13$

(f) $-a^2b - a^2c - 2a^2 = -(2)^2 \times -2 - (2)^2 \times 1 - 2(2)^2$
$= -4 \times -2 - 4 \times 1 - 2 \times 4 = +8 - 4 - 8 = -4$

(g) $-ab^2c + a^2bc - abc^2$
$= -2 \times (-2)^2 \times 1 + (2)^2 \times -2 \times 1 - (2 \times -2 \times (1)^2)$
$= -2 \times 4 \times 1 + 4 \times -2 \times 1 - (-4)$
$= -8 - 8 + 4 = -12$

(h) $a^2 - b^2 - c^2 - 2ab - 2bc - 2ac$
$= (2)^2 - (-2)^2 - (1)^2 - (2 \times 2 \times -2) - (2 \times -2 \times 1) - (2 \times 2 \times 1)$
$= 4 - 4 - 1 - (-8) - (-4) - 4$
$= 4 - 4 - 1 + 8 + 4 - 4 = 7$

3. (a) Find the value of $x^3 - 3(x - 10)$, if $x = 10$.
Putting $x = 10$ expression we get
$x^3 - 3(x - 10) = (10)^3 - 3(10 - 10) = 1000 - 3 \times 0 = 1000$

(b) Find the value of $y^2 - 2y - 100$, if $y = -10$
Putting $y = -10$ in expression we get
$y^2 - 2y - 100 = (-10)^2 - 2 \times (-10) - 100 = 100 + 20 - 100 = 20$

4. Simplify the expressions and find their values, if $x = 2$:

(a) $x + 7 + 4(x - 5) = x + 7 + 4x - 20 = 5x + 7 - 20 = 5x - 13$
Putting $x = 2$ we get
$5 \times 2 - 13 = 10 - 13 = -3$

(b) $3(x + 2) + 5x - 7 = 3x + 6 + 5x - 7 = 3x + 5x + 6 - 7 = 8x - 1$
Putting $x = 2$ we get
$8 \times 2 - 1 = 16 - 1 = 15$

(c) $4(2x-1)+3x+11 = 8x-4+3x+11 = 8x+3x-4+11 = 11x+7$

Putting $x=2$ we get

$11\times 2+7 = 22+7 = 29$

5. Simplify the expressions and find their values if $p = -1$, $q = 1$, $r = 2$:

(a) $4p+q-6p+q = 4\times(-1)+1-6(-1)+1 = -4+1+6+1 = -4+8 = 4$

(b) $7p^2+q^2-8p^2-q^2 = 7(-1)^2+(1)^2-8(-1)^2-(1)^2$

$= 7+1-8-1 = 8-8-1 = -1$

(c) $10pq-2qr-6pr+4pq = 10(-1\times 1)-2(1\times 2)-6(-1\times 2)+4(-1\times 1)$

$= -10-4+12-4$

$= -18+12$

$= -6$

(d) $pqr-6pqr+7q^2-4p^2$

$= (-1\times 1\times 2)-6(-1\times 1\times 2)+7(1)^2-4(-1)^2$

$= -2-6(-2)+7-4$

$= -2+12+7-4$

$= 12+7-4-2$

$= 19-6 = 13$

(e) $5p^2-6q^2-7r^2+6p^2-5q^2+2r^2$

$= 5(-1)^2-6(1)^2-7(2)^2+6(-1)^2-5(1)^2+2(2)^2$

$= 5-6-7\times 4+6-5+2\times 4$

$= 5-6-28+6-5+8 = 5+6+8-6-28-5 = 19-39 = -20$

(f) $5(p+q)-3p-2q = 5(-1+1)-3\times(-1)-2\times 1$

$= 5\times 0+3-2$

$= 0+3-2$

$= +1$

Multiple Choice Questions

Tick (3) the correct answer :

1.	(a)	**2.**	(c)	**3.**	(b)	**4.**	(b)	**5.**	(c)
6.	(b)	**7.**	(a)	**8.**	(c)	**9.**	(d)	**10.**	(a)

High Order Thinking Skills (HOTS)

1. Addition of $3x^2y$, $6xy^2$ and $9x^2y^2$

$3x^2y+6xy^2+9x^2y^2 = 3x^2y+6xy^2+9x^2y^2$

Thus, Tom is wrong. This is so because he added the unlike terms as like terms.

2. Khalid added $= a^2+2b^2+3c^2$ and $3a^2+2b^2+c^2$

$$\begin{array}{r} a^2+2b^2+3c^2 \\ 3a^2+2b^2+c^2 \\ \hline 4a^2+4b^2+4c^2 \\ \hline \end{array}$$

Add :

Vikky subtracts : $a^2+2b^2+3c^2$ from $3a^2+2b^2+c^2$

$$\begin{array}{l} 3a^2 + 2b^2 + c^2 \\ a^2 + 2b^2 + 3c^2 \\ (-)\quad(-)\quad(-) \\ \hline 2a^2 \qquad\quad -2c^2 \\ \hline \end{array}$$

$(3a^2 + 2b^2 + c^2 - a^2 - 2b^2 - 3c^2) = 2a^2 - 2c^2$

Difference $= 4a^2 + 4b^2 + 4c^2 - (2a^2 - 2c^2)$

Subtract

$$\begin{array}{l} 4a^2 + 4b^2 + 4c^2 \\ 2a^2 \quad - 3c^2 \\ (-)\quad(+) \\ \hline 2a^2 + 4b^2 + 6c^2 \\ \hline \end{array}$$

7 Linear Equation in one variable

Exercise 7.1

1. Write equations for the following statements :

(a) $5b - 3 = 12$ (b) $\frac{t}{7} + 13 = 20$ (c) $5x + 3 = 18$

(d) $7m = 84$ (e) $\frac{P}{4} + 4 = 40$ (f) $n + 10 = 25$

(g) $\frac{y}{2} = 33$ (h) $d - 11 = 40$ (i) $\frac{c}{6} - 2 = 8$

(j) $8y - 8 = 80$

2. Write the following equations in statement forms :

(a) 3 less than quotient of b and 7 is 8
(b) Sum of x and 3 is 14
(c) Quotient of q and 9 is 9
(d) Negative quotient of p and 7 is 7
(e) Difference between 5 and y is -3
(f) Three-fourth of a number p is 15
(g) 6 times x added to 11 gives 35
(h) 7 subtracted from one-fifth of y is 8
(i) 16 times m is 96
(j) 14 less than 3 times x results is 4
(k) 5 subtracted from y gives -12

3. Form an equation for the following cases :

(a) $\frac{2x}{5} + x = 35$ (where x is the number of boys in class)

(b) $2(l + b) = 240$, where $l = 2b - 6$

(c) $x + \frac{x}{2} = 33$

(d) $2x + 6 = 24$. (where Isha's age is x years)

(e) $A + \frac{A}{3} + \frac{A}{3} = 180° \left(B = C = \frac{A}{3} \to \text{given} \right)$

(f) $2x \pm 1 = 51 [x + (x + 1) \text{ or } (x - 1) + x]$

(g) $3x = 195$ (where x is the number of runs scored by Gautam)

(h) $3x + 4 = 43$ (where x is Monu's age)

Exercise 7.2

1. Solve the following equations by transposition method :

(a)
$$2m + \frac{5}{2} = \frac{37}{2}$$
$$2m = \frac{37}{2} - \frac{5}{2}$$
$$2m = \frac{37-5}{2}$$
$$2m = \frac{32}{2} = 16$$
$$m = 16 \div 2 = 8$$
$$m = 8$$

(b)
$$0 = 18 + 9(m - 2)$$
$$0 = 18 + 9m - 18$$
$$0 = 9m$$
$$m = \frac{0}{9} = 0$$
$$m = 0$$

(c)
$$\frac{x}{4} = \frac{x}{5} + 1$$
$$\frac{x}{4} - \frac{x}{5} = 1$$
$$\frac{5x - 4x}{20} = 1$$
$$\frac{x}{20} = 1$$
$$x = 20$$
$$x = 20$$

(d)
$$23 - 4x = -25 + 4x$$
$$23 + 25 = 4x + 4x$$
$$48 = 8x$$

$$x = \frac{48}{8} = 6$$

$$x = 6$$

(e)

$$-3(4-x) = 2x + 5$$

$$-12 + 3x = 2x + 5$$

$$3x - 2x = 5 + 12$$

$$x = 17$$

(f)

$$\frac{y}{5} - \frac{y}{6} = \frac{1}{30}$$

$$\frac{6y - 5y}{30} = \frac{1}{30}$$

$$\frac{y}{30} = \frac{1}{30}$$

$$30y = 30$$

$$y = \frac{30}{30}$$

$$y = 1$$

(g)

$$4x - \frac{1}{3} = \frac{1}{5} + 3x$$

$$4x - 3x = \frac{1}{5} + \frac{1}{3}$$

$$x = \frac{3+5}{15}$$

$$x = \frac{8}{15}$$

$$x = \frac{8}{15}$$

(h)

$$3p - 2(2p - 5) = 2(p + 3) - 8$$

$$3p - 4p + 10 = 2p + 6 - 8$$

$$-1p + 10 = 2p - 2$$

$$-1p - 2p = -2 - 10$$

$$-3p = -12$$

$$p = \frac{-12}{-3} = 4$$

$$p = 4$$

(i)

$$7x + 2(x + 2) = 20 - (2x - 5)$$

$$7x + 2x + 4 = 20 - 2x + 5$$

$$9x + 4 = 25 - 2x$$

$$9x + 2x = 25 - 4$$

$$11x = 21$$

$$x = \frac{21}{11}$$

$$x = \frac{21}{11}$$

2. Check whether or not the value given in the bracket is a solution to the given equation :

(a) $4s = 80 \quad (s = 76)$

Putting the value of s the equation

$$7 \times 76 = 304$$

$$304 \neq 80$$

So, the given value is not a solution to the given equation.

(b) $2b + 5 = 17 \;\; (b = 6)$

Putting the value of 'b' in the equal to $2 \times 6 + 5 = 12 + 5 = 17$

$$17 = 17$$

So, the given value is a solution to the equation.

(c) $8 – 7n = – 20\ (n = 2)$

putting the value of n in eq.

$$8 - 7 \times 2 = 8 - 14 = -7$$

$$-7 \neq -20$$

So, the given value is not a solution to the given equation.

(d) $9q – 3 = 15\, (q = 2)$

Putting the value of 'q' in the equation

$$9 \times 2 - 3 = 18 - 3 = 15$$

$$15 = 15$$

So, the given value is a solution to the equation.

(e) $\frac{a}{20} = 4 \quad (a = 60)$

Putting the value of 'a' in the equation

$$\frac{60}{20} = 3$$

$$3 \neq 4$$

So, the given value is not a solution the to equation.

(f) $13b = 169 \quad (b = 13)$

Putting the value of 'b' in the equation

$$13 \times 13 = 169$$

$$169 = 169$$

So, the given value is a solution to the equation.

(g) $2x + 1 = x + 3\, (x = 1)$

Putting the value of 'x' in the equation

$$2 \times 1 + 1 = 2 + 1 = 3$$

$$1 + 3 = 4$$

$$3 \neq 4$$

So, the given value is not a solution to the equation.

(h) $\frac{y}{2} - 4 = 0\ (y = 8)$

Putting the value of 'y' in the equation

$$\frac{8}{2} - 4 = 4 - 4 = 0$$

$$0 = 0$$

So, the given value is a solution to the equation.

(i) $-12 + 23x = 11\ \ (x = 1)$

Putting the value of 'x' in the equation

$$-12 + 23 \times 1 = -12 + 23$$

$$11 = 11$$

So, the given value is a solution to the equation.

3. Solve the following equation and check your result :

(a)
$$8z + 20 = 52$$
$$8z = 52 - 20$$
$$z = \frac{32}{8} = 4$$
$$z = 4$$

Check : $8z + 20 = 8 \times 4 + 20 = 32 + 20 = 52$

$$\text{L.H.S} = \text{R.H.S}$$

(b)
$$\frac{x}{13} + 6 = 5$$
$$\frac{x}{13} = 5 - 6$$
$$\frac{x}{13} = -1$$
$$x = -13$$

Check : $\frac{x}{13} + 6 = \frac{-13}{13} + 6 = -1 + 6 = 5$

$$\text{L.H.S} = \text{R.H.S}$$

(c)
$$\frac{5}{2}y = 60$$
$$\frac{5y}{2} = 60$$
$$5y = 60 \times 2$$
$$y = \frac{120}{5} = 24$$
$$y = 24$$

Check : $\frac{5y}{2} = 60$

$$\frac{5 \times 24}{2} = 60$$

$$60 = 60$$
$$\text{L.H.S} = \text{R.H.S}$$

(d)
$$\begin{aligned} -2(y+3) &= 7 \\ -2y + 3 \times (-2) &= 7 \\ -2y - 6 &= 7 \\ -2y &= 7 + 6 \\ y &= \frac{-13}{2} \end{aligned}$$

Check :
$$\begin{aligned} -2(y+3) &= -2\left(\frac{-13}{2} + 3\right) \\ &= -2\left(\frac{-13+6}{2}\right) \\ &= -2 \times \frac{-7}{2} \\ &= -1 \times -7 = 7 \\ \text{L.H.S} &= \text{R.H.S} \end{aligned}$$

(e)
$$\begin{aligned} 12t + 1 &= 37 \\ 12t &= 37 - 1 \\ 12t &= 36 \\ t &= \frac{36}{12} = 3 \\ t &= 3 \end{aligned}$$

Check : $12t + 1 = 12 \times 3 + 1 = 36 + 1 = 37$
$$\text{L.H.S} = \text{R.H.S}$$

(f)
$$\begin{aligned} \frac{x}{4} + 9 &= 7 \\ \frac{x + 9 \times 4}{4} &= 7 \\ x + 36 &= 7 \times 4 \\ x + 36 &= 28 \\ x &= 28 - 36 = -8 \\ x &= -8 \end{aligned}$$

Check : $\frac{x}{4} + 9 = 7$

$\frac{-8}{4} + 9$

$-2 + 9 = 7$

L.H.S $=$ R.H.S

(g)
$$\begin{aligned} 5(n-3) &= -45 \\ 5n - 15 &= -45 \\ 5n &= -45 + 15 \end{aligned}$$

$$5n = -30$$

$$n = \frac{-30}{5} = -6$$

$$n = -6$$

Check : $5(n - 3) = 5(-6 - 3)$

$$= 5 \times -9 = -45$$

L.H.S = R.H.S

(h) $$34 - 5(n - 1) = 4$$

$$34 - (5n - 5) = 4$$

$$34 - 5n + 5 = 4$$

$$39 - 5n = 4$$

$$-5n = -39 + 4$$

$$n = \frac{-35}{-5} = 7$$

$$n = 7$$

Check : $34 - 5(7 - 1) = 34 - 5 \times 6 = 34 - 30 = 4$

L.H.S = R.H.S

(i) $$4(5x - 4) + 3(2x - 1) = 7$$

$$20x - 16 + 6x - 3 = 7$$

$$26x - 19 = 7$$

$$26x = 7 + 19$$

$$x = \frac{26}{26} = 1$$

$$x = 1$$

Check : $4(5x - 4) + 3(2x - 1) = 4(5 \times 1 - 4) + 3(2 \times 1 - 1)$

$$= 4(5 - 4) + 3(2 - 1)$$

$$= 4 \times 1 + 3 \times 1 = 4 + 3 = 7$$

L.H.S = R.H.S

Exercise 7.3

1. Let one of the even number be x.

Then next consecutive even number $= x + 2$

Sum of 2 connective even number $= 502$

$$x + (x + 2) = 502$$

$$2x + 2 = 502$$

$$2x = 502 - 2$$

$$2x = 500$$

$$x = 500 \div 2 = 250$$

Hence, one even number $= 250$ and

Then, second even number $= 250 + 2$

$$= 252$$

2. Let one number be x

$$\text{Three-fourth of number } = x \times \frac{3}{4} = \frac{3x}{4}$$

Sum of number and three-fourth number is 91.

$$x + \frac{3x}{4} = 91$$

$$\frac{4x + 3x}{4} = 91$$

$$\frac{7x}{4} = 91$$

$$x = \frac{91 \times 4}{7} = 52$$

Hence, one number is 52 and other number is $39 = \left(52 \times \frac{3}{4}\right)$

3.

$$\text{Let one number } = x$$

$$\text{Second number } = \frac{x}{2}$$

$$\text{According to question; } x + \frac{x}{2} = 45$$

$$\frac{2x + x}{2} = 45$$

$$\frac{3x}{2} = 45$$

$$3x = 45 \times 2$$

$$x = 90 \div 3 = 30$$

Thus,one number is 30, second number is $15 = \left(30 \times \frac{1}{2}\right)$

4. Let one of the numbers be x.

The second number will be $x + 1$

Then,

$$x + (x + 1) = 203$$

$$2x + 1 = 203$$

$$2x = 203 - 1$$

$$x = \frac{202}{2} = 101$$

$$x + 1 = 101 + 1 = 102$$

Then, the numbers are 101, 102.

5. Let one of number be $= x$

It is multiplied by $\frac{5}{6}$ gives 60 $\qquad x \times \frac{5}{6} = 60$

$$\frac{5x}{6} = 60$$

$$x = \frac{60 \times 6}{5} = 72$$

Thus, required number is 72.

6. Let the required number be x, 5 times the number $= 5x$

Subtracting 3 from it, to get $5x - 3$,

So, the following equation is obtained

$$5x - 3 = 42$$
$$5x = 42 + 3$$
$$x = \frac{45}{5} = 9$$
$$x = 9$$

Required number is 9.

7. Let one of the number be x

Let second number will be $(x+1)$

Let third number will be$(x+2)$

Then $$x + (x+1) + (x+2) = 24$$
$$3x + 3 = 24$$
$$3x = 24 - 3$$
$$x = \frac{21}{3}$$
$$x = 7$$

Hence, one of the number is 7, second number $= 8\,(7+1)$, and third number $= 9\,(7+2)$.

8. Let one number be $= x$

Then, the next consecutive odd number $= x + 2$

Sum of 2 consecutive odd number $= 136$

$$x + (x+2) = 136$$
$$2x + 2 = 136$$
$$2x = 136 - 2$$
$$x = \frac{134}{2} = 67$$

Hence, one odd number $= 67$, second odd number$= 67 + 2 = 69$.

9. Let one of the number be $= x$

35 added it then we get $= x + 35$

According to questions, $x + 35 = 217$

$$x = 217 - 35 = 182.$$

Thus, required number is 182.

10. Let first angle of triangle $= x$

Second angle of triangle $= 2x$

Third angle of triangle $= 3x$

Sum of three and of triangle $= 180°$

$$x + 2x + 3x = 180°$$

$$6x = 180°$$
$$x = 180 \div 6 = 30°$$

$x = 30°$; $2x = 60°$; $3x = 90°$

Angles of triangles is 30°, 60° and 90°.

11. Let required number $= x$

$$\text{Two third of number} = x \times \frac{2}{3} = \frac{2x}{3}$$
$$\text{One-third of number} = \frac{x}{3}$$

According to question $\frac{2x}{3} > \frac{x}{3}$

$$\text{If added 3 in } \frac{x}{3} = \frac{2x}{3}$$
$$3 + \frac{x}{3} = \frac{2x}{3}$$
$$\frac{x+9}{3} = \frac{2x}{3}$$
$$3x + 27 = 6x$$
$$27 = 6x - 3x$$
$$27 = 3x$$
$$x = \frac{27}{3} = 9$$

Thus, required number is 9.

12. Let required number $= x$; twice a number $= 2x$

If 7 added to $2x$ gives 59

$$2x + 7 = 59$$
$$2x = 59 - 7$$
$$x = 52 \div 2$$
$$x = 26$$

Thus, required number is 26.

13. Let Mayank's present age $= x$ years

According to the question

$$x + 15 = 4x$$
$$15 = 4x - x$$
$$15 = 3x$$
$$x = \frac{15}{3} = 5$$

Mayank's present age $= 5$ years.

14. Let Sahil's age $= x$ years

His mother's age $= 5x$

Sum of their ages $= x + 5x = 48$

$$6x = 48$$

$$x = \frac{48}{6} = 8$$

Thus Sahil's age $= 8$ years

his mother age $= 8 \times 5 = 40$ years.

15. Let Isha's present age $= x$ year

Then brother's present age $= (x+5)$ year

After 4 year

Isha's age $= (x+4)$ year

Her brother's age $= (x+5)+4$ year

$= x+9$ year

According to questions

Their age Ratio $= 2:3$

$$\frac{x+4}{x+9} = \frac{2}{3} \text{ (cross multiply)}$$

$$3(x+4) = 2(x+9)$$

$$3x+12 = 2x+18$$

$$3x-2x = 18-12$$

$$x = 6$$

Thus, Isha's present age is 6 year and her brother's age $6+5=11$ years.

16. Let Sony's present age $= x$ years

Sony's mother age $= 3 \times x = 3$ years

Sum of both ages $= x+3x$

According to question

Sum of ages $= 72$

$$x+3x = 72$$

$$4x = 72$$

$$x = \frac{72}{4} 18;\ x = 18$$

Thus, Sony's age $= 18$ years; and her mother's age $= 18 \times 3 = 54$ years

17. Let of the breath of rectangle $= x$ m

Length of rectangle $= (4x-3)$ m

Perimeter $= 2(l+b)$

According to question; $94 = 2(x+(4x-3))$ m

$$94 = 2(x+4x-3) \text{ m}$$

$$94 = 2(5x-3)$$

$$94 = 10x-6$$

$$10x = 94+6$$

$$10x = 100$$

$$x = 10$$

Breath $= 10$ m

Length $= (4 \times 10 - 3)$ m

$= (40-3)$ m $= 37$ m

18. In isosceles triangle two angle are equal

Let one angle of triangle $= x$

other angle are also $= x$

According to question, third angle of triangle $= 3x$

We know that the sum of three angles of triangle is 180°

$$\begin{aligned} x + x + 3x &= 180° \\ 5x &= 180° \\ x &= \frac{180°}{5} = 36° \end{aligned}$$

One angle of triangle is 36°

Other angle of triangle is 36° and third angle of the triangle $= 3 \times 36° = 108°$

Value of angles are 36°, 36°, 108°.

19.

$$\begin{aligned} \text{Let the runs second by '}B\text{'} &= x \\ \text{run scored by '}A\text{'} &= 2x \end{aligned}$$

According to the question;

$$\begin{aligned} (2x + x) &= 200 - 5 \\ 3x &= 195 \\ x &= \frac{195}{3} = 65 \end{aligned}$$

$$\begin{aligned} \text{Thus, Runs scored by '}A\text{'} &= 2 \times 65 = 130 \\ \text{Run scored by '}B\text{'} &= 65 \end{aligned}$$

20.

$$\begin{aligned} \text{Number of 2-rupee coins} &= x \\ \text{Number of 1-rupee coins} &= 3x \\ \text{Value of 2 rupees coin} &= 2 \times x = \text{` } 2x \\ \text{Value of 1 rupee coin} &= 1 \times 3x = \text{` } 3x \end{aligned}$$

Total value 2 rupees and 1-rupees coin

$$\begin{aligned} &= \text{` } 50 \\ \text{` }(2x + 3x) &= 50 \\ 5x &= 50 \\ x &= \frac{50}{5} = 10 \\ x &= 10 \end{aligned}$$

$$\begin{aligned} \text{Thus, Number of 2 rupees coins} &= 10 \\ \text{Number of 1 rupees coins} &= 3 \times 10 \\ &= 30 \end{aligned}$$

Multiple Choice Questions

Tick (3) the correct answer :

1. (a)	**2.** (d)	**3.** (d)
4. (c)	**5.** (c)	**6.** (c)

8 Ratio, Proportion and Percentage

Exercise 8.1

1. Find the ratio of the following :

(a) 60 minutes to 3 hours

$$\begin{aligned} 1 \text{ hours} &= 60 \text{ min} \\ 3 \text{ hrs} &= 180 \text{ min} \\ \text{Ratio of 60 min to 180 min} &= 60:180 \\ &= 1:3 \end{aligned}$$

(b) 32 cm to 4 m

$$\begin{aligned} 1 \text{ m} &= 100 \text{ cm} \\ 4 \text{ m} &= 400 \text{ cm} \\ \text{Ratio of 32 cm to 400 cm} &= 32:400 \\ &= 2:25 \end{aligned}$$

(c) 800 ml to 4.8 litres

$$\begin{aligned} 1 \text{ L} &= 1000 \text{ mL} \\ 4.8 \text{ L} &= 4.8 \times 1000 = 4800 \\ \text{Ratio of 800 mL to 4800 mL} &= 800:4800 = 1:6 \end{aligned}$$

2.

$$\begin{aligned} \text{Number of books in a library} &= 90 \\ \text{Number of Social Science books} &= 10 \\ \text{Number of Hindi books} &= 18 \\ \text{Number of English books} &= 27 \\ \text{Number of Science} &= 90-(10+18+27) \\ &= 90-55 \\ &= 35 \end{aligned}$$

(a) Ratio of Social Science books to science books = 10 : 35 or 2 : 7

(b) Ratio of Hindi books to English books = 18 : 27 = 2 : 3

(c) Ratio of social science books to total books = 10 : 90 or 1 : 9

3. Fill in the following blanks making them equivalent ratios :

(a) $\frac{15}{75} = \frac{\mathbf{60}}{300} = \frac{75}{\mathbf{375}} = \frac{\mathbf{1}}{5}$ (b) $\frac{32}{\mathbf{48}} = \frac{4}{6} = \frac{\mathbf{2}}{3} = \frac{48}{\mathbf{72}}$

4.

$$\begin{aligned} \text{Total number of animals} &= 95 \\ \text{Number of horses} &= 5 \\ \text{Number of rabbits} &= 20 \\ \text{Number of hens} &= 95-(5+20) \\ &= 95-25 = 70 \end{aligned}$$

(a) Ratio of horses and total number of animals = 5 : 95 or 1 : 19

(b) Ratio of rabbits to number of houres = 20 : 5 = 4 : 1

(c) Ratio of hens to number of hourses = 70 : 5 = 14 : 1

(d) Ratio of hens to the number of rabbits = 70 : 20 = 7 : 2

5. Compare ratio = 3 : 4 or 2 : 3

$3:4 = \frac{3}{4}$; $\quad 2:3 = \frac{2}{3}$

$$\frac{3\times 3}{4\times 3} = \frac{9}{12} \quad \text{or} \quad \frac{2\times 4}{3\times 4} \quad \text{or} \quad \frac{8}{12}$$

Clearly, $\frac{9}{12} > \frac{8}{12}$

So, $\frac{3}{4} > \frac{2}{3}$

or $3 : 4 > 2 : 3$

6. Total Amount $= \text{`}\ 900$

The two parts are 5 and 4

The sum of $5+4 = 9$

Therefore A's share $= \text{`}\ 900 \times \frac{5}{9} = \text{`}\ 500$

B's share $= \text{`}\ 900 \times \frac{4}{9} = \text{`}\ 400$

7. Total amount $= \text{`}\ 324$

Ratio of A, B and C $= 3 : 4 : 5$

Sum of ratio $= 3+4+5 = 12$

Share of A $= \text{`}\ 324 \times \frac{3}{12} = \text{`}\ 27\times 3 = \text{`}\ 81$

Share of B $= \text{`}\ 324 \times \frac{4}{12} = \text{`}\ 27\times 4 = \text{`}\ 108$

Share of C $= \text{`}\ 324 \times \frac{5}{12} = \text{`}\ 27\times 5 = \text{`}\ 135$

8. A : B = 2 : 3 … (i) $\times 4 = 8:12$

B : C = 4 : 5 … (ii) $\times 3 = 12:15$

So, A : B : C = 8 : 12 : 15

(a) A : C = 8 : 15 ;

(b) A : B : C = 8 : 12 : 15

9. $x : y = 1 : 2 \qquad \frac{x}{y} = \frac{1}{2} \qquad y = 2x$

Consider, $\frac{2x+y}{y-x} = \frac{2x+2x}{2x-x}$

$= \frac{4x}{x}$

$= 4$

10. $a : b = 4 : 5$,

$\frac{a}{b} = \frac{4}{5} \qquad a = \frac{4b}{5}$

consider, $\dfrac{5a+b}{5a-b} = \dfrac{5\times\dfrac{4b}{5}+b}{5\times\dfrac{4b}{5}-b} = \dfrac{4b+b}{4b-b} = \dfrac{5b}{3b} = \dfrac{5}{3}$

$$\frac{5a+b}{5a-b} = \frac{5}{3}$$

11. Ratio of two number $= 4 : 7$

Let one number $= 4x$

Then, second number $= 7x$

According to questions

$$\frac{4x+3}{7x+3} \quad \frac{5}{8}$$

$$(4x+3)8 = (7x+3)5 \text{ (cross multiplication)}$$

$$32x+24 = 35x+15$$

$$24-15 = 35x-32x$$

$$9 = 3x$$

or $\quad x = \dfrac{9}{3} = 3$

$$x = 3$$

Thus one number is $= 4\times 3 = 12$ and

second number is $= 7\times 3 = 21$

12. Perimeter of triangle $= 54$ cm

Ratio of triangle $= 2 : 3 : 4$

Sum of ratio $= 2+3+4 = 9$

One side of triangle $= 54\times\dfrac{2}{9} = 6\times 2 = 12$ cm

Second side of triangle $= 54\times\dfrac{3}{9} = 6\times 3 = 18$ cm

Third side of triangle $= 54\times\dfrac{4}{9} = 6\times 4 = 24$ cm

Thus, side are 12 cm, 18 cm, 24 cm of triangle.

13. $\dfrac{2x+3y}{x-8y} = \dfrac{1}{2}$

$$(2x+3y)2 = (x-8y) \text{ (cross multiplication)}$$

$$4x+6y = x-8y$$

$$4x-x = -8y-6y$$

$$3x = -14y$$

$$\frac{x}{y} = \frac{-14}{3}$$

14. $\dfrac{5m+n}{n-m} = \dfrac{9}{7}.$

$$\begin{aligned}(5m+n)7 &= 9(n-m)\\ 35m+7n &= 9n-9m\\ 35m+9m &= 9n-7n\\ 44m &= 2n\\ \frac{m}{n} &= \frac{2}{44} \text{ or } \frac{1}{22}\end{aligned}$$

Exercise 8.2

1. Are the following in proportion?

(a) 30, 35, 40, 45

$$\begin{aligned}\text{Product of extremes} &= \text{Product of means}\\ 30\times 45 &= 35\times 40\\ 1350 &\neq 1400\end{aligned}$$

Thus, it is not in proportion.

(b) 2, 4, 3, 6

$$\begin{aligned}\text{Product of extremes} &= \text{Product of means}\\ 2\times 6 &= 4\times 3\\ 12 &= 12\end{aligned}$$

Thus, It is in proportion.

(c) 14, 18, 21, 27

$$\begin{aligned}\text{Product of extremes} &= \text{Product of means}\\ 14\times 27 &= 18\times 21\\ 378 &= 378\end{aligned}$$

Thus, It is in proportion.

2. Are the following in continued proportion?

(a) 4, 6, 9

$$\begin{aligned}b^2 &= ac\\ (6)^2 &= 4\times 9\\ 36 &= 36\end{aligned}$$

They are in continued proportion.

(b) 2, 4, 6

$$\begin{aligned}b^2 &= ac\\ (4)^2 &= 2\times 6\\ 16 &\neq 12\end{aligned}$$

They are not in continued proportion.

(c) 4, 12, 36

$$\begin{aligned}b^2 &= ac\\ (12)^2 &= 4\times 36\\ 144 &= 144\end{aligned}$$

They are in continued proportion.

(d) 3, 9, 27

$$b^2 = ac$$
$$(9)^2 = 3 \times 27$$
$$81 = 81$$

They are in continued proportion.

3. Find the fourth proportion to :

(a) 8, 12, 16

Let the fourth proportion to 8, 12 and 16 be x.

8 : 12 : : 16 : x

$$8x = 12 \times 16$$
$$(\text{Product of extremes} = \text{Product of mean})$$
$$x = \frac{12 \times 16}{8} = 24$$

Thus, $x = 24$ is fourth proportion to 8, 12 and 16

(b) 4, 7, 8

Let the fourth proportion to 4, 7 and 8 be x

4 : 7 : : 8 : x

$$4x = 7 \times 8$$
$$(\text{Product of extremes} = \text{Product of means})$$
$$x = \frac{56}{4} = 14$$

Thus, $x = 14$ is fourth proportion to 4, 7 and 8

(c) 1, 6, 10

Let the fourth proportion 1, 6 and 10 be x

1 : 6 : : 10 : x

$$1 \times x = 6 \times 10$$
$$(\text{Product of extreme} = \text{Product of mean})$$

Thus, $x = 60$ is fourth proportion to 1, 6 and 10.

(d) 30,40, 45

Let the fourth proportion 30, 40 and 45 be x

30 : 40 : : 45 : x

$$30 \times x = 40 \times 45$$
$$(\text{Product of extremes} = \text{Product of mean})$$
$$x = \frac{40 \times 45}{30} = 60$$

Thus, $x = 60$ is fourth proportion to 30, 40 and 45.

4. Find the value of x :

(a) 21 : 28 :: x : 52

$$\text{Product of extremes} = \text{Product of means.}$$
$$21 \times 52 = 28 \times x$$
$$x = \frac{21 \times 52}{28} = 39$$

(b) 11 : x :: 12 : 72

$$\text{Product of extremes} = \text{Product of means}$$
$$11 \times 72 = x \times 12$$
$$x = \frac{11 \times 12}{12} = 66$$

(c) $x : 45 :: 24 : 60$

$$\text{Product of extremes} = \text{Product of means}$$
$$x \times 60 = 45 \times 24$$
$$x = \frac{45 \times 24}{60} = 18$$

5. Find the third proportion to :

(a) 9 and 4 Let third proportion be x

In continued proportion

$$x^2 = a \times c$$
$$x^2 = 9 \times 4$$
$$x = \sqrt{36} = 6$$

Thus, third proportion is 6.

(b) 2 and 8 Let third proportion be x

In continued proportion

$$x^2 = a \times c$$
$$x^2 = 2 \times 8$$
$$x = \sqrt{16} = 4$$

Thus, third proportion is 4.

(c) 25 and 4 Let third proportion be x

In continued proportion

$$b^2 = a \times c$$
$$x^2 = 25 \times 4$$
$$x = \sqrt{100} = 10$$

Thus, third proportion is 10.

(d) 9 and 16 Let third proportion be x

In continued proportion

$$b^2 = a \times c$$
$$x^2 = 9 \times 16$$
$$x = \sqrt{144} = 12$$

Thus, third proportion is 12.

6. Let x should be added to numbers 1, 3, 10 and 18

Than numbers $= (1+x), (3+x), (10+x)$ and $(18+x)$

Now, they are in proportion :

So, product of extremes $=$ product of mean

$(1+x) : (3+x) :: (10+x) : (18+x)$

$$
\begin{aligned}
(1+x)(18+x) &= (3+x)(10+x) \\
18+x+18x+x^2 &= 30+3x+10x+x^2 \\
18+19x+x^2 &= 30+13x+x^2 \\
19x-13x &= 30-18 \\
6x &= 12 \\
x &= \frac{12}{6} \\
x &= 2
\end{aligned}
$$

Thus, required number is 2.

7.

$$
\begin{aligned}
\text{Number of bulbs} &= 12 \\
\text{Number of defective} &= 3 \\
\text{Ratio} &= 12:3 \\
\text{If number of bulbs} &= 100 \\
\text{Let assumed defective bulbs} &= x \\
\text{Ratio} &= 100:x \\
12:3::100:x & \\
12\times x &= 3\times 100 \\
x &= \frac{3\times 100}{12} = 25
\end{aligned}
$$

Thus, 25 defective bulbs will be there in 100 bulbs.

8.

$$
\begin{aligned}
\text{Distance covered by train} &= 180\,\text{km} \\
\text{Time taken} &= 3\,\text{hrs} \\
\text{Speed} &= \frac{\text{Distance}}{\text{Time}} = \frac{180}{3} = 60 \text{ hrs/km} \\
\text{If distance covered} &= 240\,\text{km} \\
\text{Time taken} &= \frac{\text{Distance}}{\text{Speed}} = \frac{240}{60} = 4 \text{ hrs.}
\end{aligned}
$$

9.

$$
\begin{aligned}
\text{Ratio of present ages of two girls} &= 3:5 \\
\text{Let, Present age of first girl} &= 3x \\
\text{Present age of second girl} &= 5x
\end{aligned}
$$

5 years ago :

$$
\begin{aligned}
\text{Age of first girl} &= 3x-5 \\
\text{Age of second girl} &= 5x-5 \\
\text{Ratio} &= (3x-5):(5x-5)
\end{aligned}
$$

According to question

$$
\begin{aligned}
\text{5 years ago their ratio} &= 1:2 \\
\frac{3x-5}{5x-5} &\;\; \frac{1}{2} \text{ (cross multiplication)} \\
(3x-5)2 &= 5x-5 \\
6x-10 &= 5x-5 \\
6x-5x &= -5+10
\end{aligned}
$$

$$x = 5$$

First girl present age is $3 \times 5 = 15$ years.

Second girl present age is $5 \times 5 = 25$ years.

10. Let actual distance will be x

than, 1 : 50,00,000 : : 2 : x

or $$\frac{1}{50,00,000} = \frac{2}{x}$$

$$x = 1,00,00,000 \text{ cm}$$

or $$x = 100 \text{ km}$$

Exercise 8.3

1. Cost of 30 metre of cloth = ` 1800

Cost of 1 metre of cloth = ` $\frac{1800}{30}$

Cost of 35 metre of cloth = ` $\frac{1800}{30} \times 35 =$ ` 2100

Thus, cost of 35 m cloth is ` 2100.

2. Number of books purchased in ` 606 $= 12$

Number of books purchase `1 $= \frac{12}{606}$

Number of books purchase ` 1010 $= \frac{12}{606} \times 1010$

$= 20$

Thus, 20 books are purchased in ` 1010.

3. 4 month's income = ` 24000

1 month's income = ` $\frac{24000}{4}$

Thus, annual income = ` $\frac{24000}{4} \times 12 =$ ` 72000

4. Cost of 5 litre milk = ` 112.50

Cost of 1 litre milk = ` $\frac{112.50}{5}$

Cost of 2 litre milk = ` $\frac{112.50}{5} \times 2 =$ ` 45

Thus, the cost of 2 litre milk is ` 45.

5. Cost of a doll = ` 625

Tax on doll = ` 62.50

Tax on ` 625 = ` 62.50

Tax on ` 1 = ` $\frac{62.50}{625}$

Tax on ` 300 = ` $\frac{62.50}{625} \times 300 =$ ` 30

6. Distance covered by plane in 8 hrs $= 4800\,\text{km}$

Distance covered by plane in 1 hrs $= \dfrac{4800}{8} = 600\,\text{km}$

Time taken to cover 600 km $= 1\,\text{hr}$

Time taken to cover 1 km $= \dfrac{1}{600}$ hrs

Time taken to cover 1800 km $= \dfrac{1}{600} \times 1800 = 3\,\text{hrs}$

Thus, 3 hrs will be taken to cover 1800 km.

7. Number of boxes required for 900 chocolates $= 15$

Number of boxes required for 1 chocolates $= \dfrac{15}{900}$

Number of boxes required for 1500 chocolates $= \dfrac{15}{900} \times 1500 = 25$

Thus, 25 boxes are required to pack 1500 chocolate.

8. Number of tank required for 1.2 kL or 1200 L $= 1$

Number of tank required for 1 L $= \dfrac{1}{1200}$

Number of tank required for 180000 L $= \dfrac{1}{1200} \times 180000 = 150$

Thus, 150 tank required for 180000 L.

Exercise 8.4

1. Express the following fractions as percentages :

(a) $\dfrac{3}{4} = \left(\dfrac{3}{4} \times 100\right)\% = 75\%$

(b) $\dfrac{5}{8} = \left(\dfrac{5}{8} \times 100\right)\% = 62\dfrac{1}{2}\%$

(c) $1\dfrac{7}{8} = \left(\dfrac{15}{8} \times 100\right)\% = 187\dfrac{1}{2}\%$

(d) $\dfrac{11}{20} = \left(\dfrac{11}{20} \times 100\right)\% = 55\%$

2. Express the following decimals as per cent :

(a) $0.02 = (0.02 \times 100)\% = 2\%$

(b) $1.05 = (1.05 \times 100)\% = 105\%$

(c) $0.250 = (0.250 \times 100)\% = 25\%$

(d) $12.25 = (12.25 \times 100)\% = 1225\%$

3. Express the following ratios as per cent :

(a) $1 : 2 = \left(\dfrac{1}{2} \times 100\right)\% = 50\%$

(b) $3 : 4 = \left(\dfrac{3}{4} \times 100\right)\% = 75\%$

(c) $5 : 12 = \left(\dfrac{5}{12} \times 100\right)\% = 41\dfrac{2}{3}\%$

(d) $27 : 50 = \left(\dfrac{27}{50} \times 100\right)\% = 54\%$

4. Express the following per cents as fractions :

(a) $26\% = \dfrac{26}{100} = \dfrac{13}{50}$

(b) $3\dfrac{1}{4}\% = \dfrac{13}{4} \times \dfrac{1}{100} = \dfrac{13}{400}$

(c) $35\frac{1}{2}\% = \frac{71}{2} \times \frac{1}{100} = \frac{71}{200}$ (d) $105\% = \frac{105}{100} = \frac{21}{20}$

5. Express the following per cents as decimals :

(a) $3\% = \frac{3}{100} = 0.03$ (b) $29\% = \frac{29}{100} = 0.29$

(c) $25.6\% = \frac{25.6}{100} = 0.256$ (d) $212\% = \frac{212}{100} = 2.12$

6. Express the following per cents as ratios in simplest form :

(a) $1.2\% = \frac{12}{1000} = \frac{3}{500} = 3 : 500$ (b) $20\% = \frac{20}{100} = 1 : 5$

(c) $15\frac{1}{2}\% = \frac{31}{200} = 31 : 200$ (d) $72\% = \frac{72}{100} = 18 : 25$

7. Calculate the following :

(a) 15% of $200\text{ m} = 200 \times \frac{15}{100} = 30\text{ m}$

(b) 24% of $500\text{ kg} = 500 \times \frac{24}{100} = 120\text{ kg}$

(c) $5\frac{1}{2}\%$ of ` 1200 = ` $1200 \times \frac{11}{2 \times 100}$ = ` 66

(d) 30% of 1.5 litres $= 1.5 \times \frac{30}{100} = 0.45$ L or 450 ml

8. Find the number whose :

(a) 12% is 60

$$\text{Let } 12\% \text{ of } x = 60 = x \times \frac{12}{100} = 60$$

$$x = \frac{60 \times 100}{12} = 500$$

(b) 25% is 70

$$\text{Let } 25\% \text{ of } x = 70$$

$$x \times \frac{25}{100} = 70$$

$$x = \frac{70 \times 100}{25} = 280$$

(c) 65% is 221

$$\text{Let } 65\% \text{ of } x = 221$$

$$x \times \frac{65}{100} = 221$$

$$x = \frac{221 \times 100}{65} = 340$$

(d) 12.5% is 1000

$$\text{Let } 12.5\% \text{ of } x = 1000$$

$$x \times \frac{12.5}{100} = 1000$$

$$x = \frac{1000 \times 100}{12.5} = 8000$$

9. What per cent of :

(a) 60 is 600? $= \frac{60}{600} \times 100 = 10\%$

(b) ₹ 50 is ₹ 250? $= \frac{50}{250} \times 100 = 20\%$

(c) 8 hrs is 2 days? $= \frac{8}{2 \times 24} \times 100 = 16\frac{2}{3}\%$

(d) 125 g is 2.5 kg? $= \frac{125}{2500} \times 100 = 5\%$

10.

$$\begin{aligned}
\text{Percentage of passed} &= 90\% \\
\text{Percentage of fail candidates} &= 100\% - 90\% \\
&= 10\% \\
\text{Let Number of candidates} &= x \\
10\% \text{ of } x &= 80 \\
\frac{10 \times x}{100} &= 80 \\
x &= \frac{80 \times 100}{10} = 800
\end{aligned}$$

Thus, number of candidates is 800.

11.

$$\begin{aligned}
\text{Percentage of Tanu} &= \frac{630}{900} \times 100 = 70\% \\
\text{Percentage of Anu} &= \frac{650}{1000} \times 100 = 65\%
\end{aligned}$$

Thus, Tanu's performance is better.

12.

$$\begin{aligned}
\text{Let original price of saree} &= ₹\ x \\
\text{increase price} &= ₹\ x \times 15\% = ₹\ \frac{15x}{100} \\
\text{Total price of saree} &= ₹\left(x + \frac{15x}{100}\right) = ₹\ \frac{115x}{100}
\end{aligned}$$

According to question;

Price of saree

$$\frac{115x}{100} = 115$$

$$x = \frac{100 \times 115}{115} = ₹\ 100$$

So, original price as saree = ₹100

13.

$$\begin{aligned}
\text{Distance covered by bus} &= 50\,\text{km} \\
\text{Distance covered by train} &= 200\,\text{km} \\
\text{Total distance covered} &= 200+50\,\text{km} = 250\,\text{km} \\
\text{Distance percentage by bus} &= \frac{50}{250}\times 100 = 20\% \\
\text{Distance Percentage by train} &= \frac{200}{250}\times 100 = 80\%
\end{aligned}$$

14.

Cost of a railway ticket = ` 720

Percentage of tax = 2%

Tax = ` $720 \times \frac{2}{100}$ = ` 14.4

Total cost of ticket ` 720 + 14.4 = ` 734.4

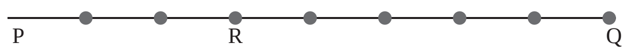
Multiple Choice Questions

Tick (3) the correct answer :

1. (b) **2.** (b) **3.** (d) **4.** (d) **5.** (a) **6.** (a) **7.** (b)

High Order Thinking Skills (HOTS)

- **What fraction of PQ is RQ ?**

(a) 

$= \frac{5}{8}$

(b) 

$= \frac{4}{5}$

- Jenny has more sweets because $\frac{3}{2} > \frac{2}{3}$.

- Let x should be added to numbers
  14, 22, 32 and 49
  Than numbers
  $(14+x), (22+x), (32+x), (49+x)$
  Now they are in proportion
  So, product of extremes = product of means

$(14+x) : (22+x) :: (32+x)(49+x)$

$$\begin{aligned}
(14+x)(49+x) &= (22+x)(32+x) \\
14(49+x)+x(49+x) &= 22(32+x)+x(32+x) \\
686+14x+49x+x^2 &= 704+22x+32x+x^2 \\
686+63x+x^2 &= 704+54x+x^2 \\
63x-54x &= 704-686 \\
9x &= 18 \\
x &= 2
\end{aligned}$$

So, 2 should be added to 14, 22, 32 and 49

9 Lines and Angles

Exercise 9.1

1. Write the complementary angles of the following :

(Complementary angle : Two angles whose sum is 90° are called complementary angle)

(a) $\frac{1}{3}$ of $90° = 90 \times \frac{1}{3} = 30°$

Complementary angle of $30° = 90° - 30° = 60°$

(b) $x° =$ Complementary angle of $x = 90° - x°$

(c) $\frac{2}{5}$ of $70° = 70° \times \frac{2}{5} = 28°$

Complementary angle of $28° = 90° - 28° = 62°$

(d) $10° + y° =$ complement angle of $10° + y°$

$= 90° - (10° + y°) = 90° - 10° - y° = 80° - y°$

2. Write the supplementary angles of the following :

(Supplementary angle : Two angles whose sum is 180° is called supplementary angle)

(a) $20 + y° =$ supplementary angle of $20 + y° = 180 - (20 + y)$

$= 180 - 20 - y = 160° - y°$

(b) $\frac{1}{2}$ of $120° = \frac{1}{2} \times 120° = 60$

Supplementary angle of $60° = 180° - 60° = 120°$

(c) $135° =$ Supplementary angle of $135° = 180 - 135 = 45°$

(d) $\frac{3}{5}$ of $100° = \frac{3}{5} \times 100 = 3 \times 20 = 60°$

Supplementary angle of $60° = 180° - 120° = 60°$

3. Ratio of angles $= 7 : 8$

Sum of two complementary angles $= 90°$

Let one angle $= 7x$

second angle $= 8x$

$$7x + 8x = 90$$
$$15x = 90$$
$$x = \frac{90}{15} = 6$$
$$x = 6$$

Value of one angle $= 7 \times 6 = 42°$

Value of second angle $= 8 \times 6 = 48°$

4. Ratio of angle $= 7 : 11$

Sum of supplementary angles $= 180°$

Let one angle $= 7x$

$$\text{Second angle} = 11x$$
$$\text{Sum} = 7x + 11x = 180°$$
$$18x = 180°$$
$$x = \frac{180}{18} = 10$$
$$\text{Value of one angle} = 7 \times 10 = 70°$$
$$\text{Value second angle} = 11 \times 10 = 110°$$

5. $$\text{Given ; one angle} = (3x + 15)°$$
$$\text{Second angle} = (2x + 5)°$$

We know that,

$$\text{Sum of supplementary angle} = 180°$$
$$(3x + 15)° + (2x + 5)° = 180°$$
$$3x + 15 + 2x + 5 = 180°$$
$$5x + 20 = 180°$$
$$5x = 180° - 20°$$
$$x = \frac{160°}{5} = 32°$$
$$\text{Thus, value of } x \text{ is} = 32°$$

6. $$\text{Given : one angle} = (2x - 7)°$$
$$\text{Second angle} = (x + 4)°$$

We know that

$$\text{Sum of complementary angle} = 90$$
$$(2x - 7)° + (x + 4)° = 90°$$
$$2x - 7 + x + 4 = 90°$$
$$3x - 3 = 90°$$
$$3x = 90° + 3$$
$$x = \frac{93}{3} = 31°$$

Thus, value of x is 31°

- For questions 7 to 10 refer to the given diagram in which ABC is a straight line.

7. $$\text{Given; } x = 45°$$
$$\text{straight line angle} = 180°$$
$$45 + y° = 180°$$
$$y° = 180° - 45° = 135°$$

8. $$\text{Given, Value of } y = 2x$$
$$\text{straight line angle} = 180°$$
$$x + y = 180°$$
$$x + 2x = 180°$$
$$3x = 180°$$

$$x = \frac{180}{3} = 60°$$

$$\text{Thus, value of } x = 60°$$

$$\text{Value of } y = 60° \times 2 = 120°$$

9. Given,

$$x = \frac{1}{2} y$$

$$\text{straight line angle} = 180°$$

$$x + y = 180°$$

$$y + \frac{1}{2} y = 180°$$

$$\frac{2y + 1y}{2} = 180°$$

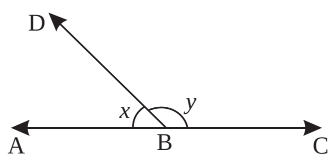
$$\frac{3y}{2} = 180°$$

$$y = \frac{180° \times 2}{3}$$

$$= \frac{360°}{3} = 120°$$

$$\text{Thus, Value of } y = 120°$$

10. If $y = 1\frac{1}{2}$ right angle, find x



$$y = \frac{3}{2} \times 90° = 135°$$

$$\text{straight line angle} = 180°$$

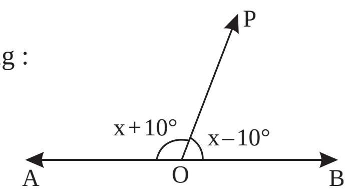
$$x + 135° = 180°$$

$$x = 180° - 135°$$

$$= 45°$$

$$\text{Value of } x = 45°$$

11. From the adjoining figure, find x; if AOB is a straight line. Hence complete the following :



(a) We know that,

$$\text{sum of the angles at a point on a straight line} = 180°$$

$$(x+10)° + (x-10)° = 180°$$

$$2x + 10 - 10 = 180°$$

$$2x = 180°$$

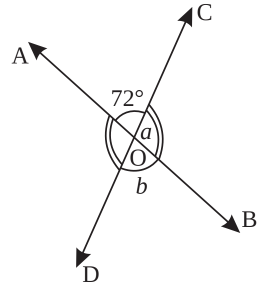
$$x = \frac{180°}{2} = 90°$$

$$AOP = (x+10)°$$

$= 90° + 10°$
$= 100°$

(b) $BOP = (x - 10)° = 90 - 10 = 80°$
(c) BOP is acute angle.
(d) AOP is obtuse angle.

12. In the figure given along side, the lines AB and CD intersect at O.



(a) AB is straight line

Sum of the angles on a straight line $= 180°$

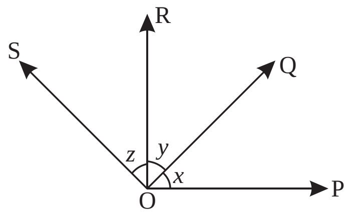
$72° + a = 180°$
$a = 180° - 72$
$a = 108°$

(b) The adjacent angle = AOD and DOB; BOC and COA; COA and AOD; DOB and BOC

(c) The vertically opposite angles AOD and BOC; AOC and BOD

(d) Yes; figure shows clearly that the vertically opposite angles are equal.

13. Express the given angles in terms of x, y, z:



(a) In POR; According to the figure, $POQ = x$ and $QOR = y$
$POR = x + y$

(b) $POR - QOR$
Here, we shall take out the value of QOR
∵ $QOR = y$
$POR - QOR$
$x + y - y = x$

(c) $QOS - SOR$
Here, we shall take out the value of SOR
∵ $SOR = 2$
$QOS - SOR$
$y + z - z = y$

(d) $POS - QOR - POQ$
Here, we shall take out the value of QOR and $POQ = y$ and x
$POS - QOR - POQ = z$
$x + y + z - x - y = z$

14. Express the given angles in the form of a single angle in capital letters:

(a) $x + y = POQ + ROQ = POR$
(b) $x + y + z = POQ + ROQ + SOR = POS$

(c) $y + z = ROQ + SOR = SOQ$

(d) $x + y + z - z = POS - SOR = POR$

15. $x = 25°,\ y = 60°$

$$POR = POQ + ROQ$$
$$= x + y = 25° + 60° = 85°.$$

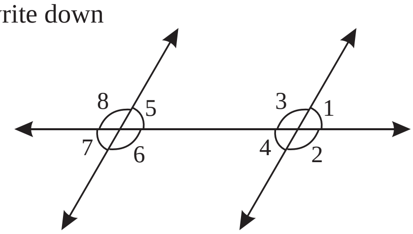
16. $SOQ = 100°,\quad QOR = 55$

$$SOR = SOQ - QOR$$
$$= 100° - 55° = 45°.$$

17. Value of right angle $= 90°$

$$x = \frac{1}{3}\text{ right angle} = \frac{1}{3} \times 90° = 30°$$
$$y = \frac{2}{3}\text{ right angle} = \frac{2}{3} \times 90° = 60°$$
$$z = \frac{1}{2}\text{ right angle} = \frac{1}{2} \times 90° = 45°$$
$$POS = x + y + z$$
$$= 30° + 60° + 45° = 135°.$$

18. In the figure, write down

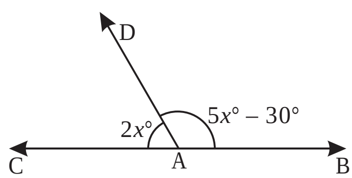


(a) Linear pair = 1, 2; 2, 4; 3, 1; 3, 4; 5, 6; 6, 7; 7, 8, 8, 5

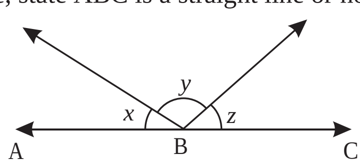
(b) Vertically opposite angle 1, 4; 2, 3; 5, 7; 8, 6;

19. $BAD = 5x° - 30°,\quad CAD = 2x°$

$$\text{Sum of straight line angle} = 180°$$
$$5x° - 30° + 2x° = 180°$$
$$7x - 30° = 180°$$
$$7x° = 180° + 30°$$
$$x = \frac{210}{7}$$
$$= 30°$$
$$\text{value of } x = 30°.$$



20. In the given figure, state ABC is a straight line or not, if :



Sum of straight line angle $= 180^\circ$

(a) $x = y = 80^\circ$; $z = 30^\circ$

Sum of angle x, y, z

$$80^\circ + 80^\circ + 30^\circ = 190^\circ$$

No, it is not straight line.

(b) $x = y = z = \frac{2}{3}$ right angle.

$$\text{right angle} = 90^\circ$$

$$z = \frac{2}{3} \times 90 = 60^\circ$$

sum of angle x, y and z

$$60^\circ + 60^\circ + 60^\circ = 180^\circ$$

So, it is straight line.

(c) $x = \frac{2}{3}$ right angle, $y = 1$ right angle, $z = \frac{1}{2}$ right angle.

$x = \frac{2}{3}$ right angle $= \frac{2}{3} \times 90^\circ = 60^\circ$

$y = 1$ right angle $= 90^\circ$

$z = \frac{1}{2}$ right angle $= \frac{1}{2} \times 90^\circ = 45^\circ$

sum of angle x, y and z

$$60^\circ + 90^\circ + 45^\circ = 195^\circ$$

So, it is not straight line.

(d) $z = 1\frac{1}{2}$ right angle, $x = y = 30^\circ$.

$z = \frac{3}{2}$ right angle $= \frac{3}{2} \times 90^\circ = 135^\circ$

Sum of x, y and z

$$30^\circ + 30^\circ + 135^\circ = 195^\circ$$

No, it is not straight line.

Exercise 9.2

1. Fill in the blanks :

(a) A pair of vertically opposite angles is always **equal** in measure.

(b) If the sum of the measures of two angles is 180°, they are called **supplementary angles**.

(c) A pair of **adjacent** angles always have a common vertex.

(d) A line which intersects two or more lines at different points is called a **transversal**.

(e) The distance between two parallel lines is the **same** everywhere.

2. $FCD + CFE = 180^\circ$

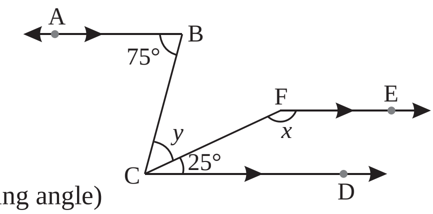
(consecutive interior angles)

$25° + x = 180°$

$x = 180° - 25°$

$x = 155°$

$x = 155°$



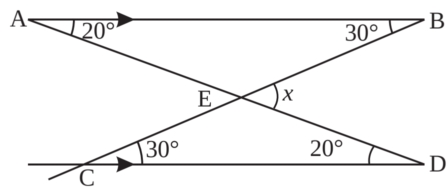
$ABC = \quad BCD$

$= $ (corresponding angle)

$75° = y + 25°$

$y = 75° - 25°$ $\qquad y = 50°$

3. $AB \| CD$



Extending A and B, we get two triangles.

ΔAEB and ΔCED

$B = \quad C$

$= 30°$

(alternate angle)

$D = 20°$ (given)

In ΔEDC; $\quad D = 20°, \quad C = 30° = \quad E = ?$

Sum of angle of triangle $= 180°$

$D + \quad C + \quad E = 180°$

$20° + 30° + \quad E = 180°$

$E = 180° - 50° = 130°$

Now, $\qquad AEB = \quad CED$ (Vertically opposite sides)

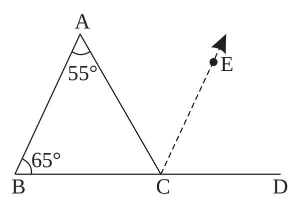
AED is straight line

Sum of straight line is 180°

$x = 180° - 130° = 50°$

Then; $x = 50°$

4. $AB \| CE$



$ABC = 65°$

$BAC = 55°$

$ABC = \quad DCE$

$= 65°$

(corresponding angle)

In ABC, Triangle

$BAC + \quad ABC + \quad ACB = 180°$

$55° + 65° + \quad ACB = 180°$

$120° + \quad ACB = 180°$

$120° + \quad ACB = 180°$

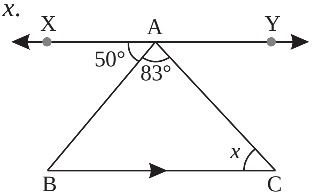
$ACB = 180° - 120° = 60°$

BCD is straight line

Sum of straight angle $= 180°$

$$ACB + \quad ACE + \quad ECD = 180°$$
$$60° + \quad ACE + 65° = 180°$$
$$ACE + 125° = 180°$$
$$ACE = 180° - 125° = 55°$$
$$ACD = \quad ACE + \quad ECD$$
$$= 55° + 65° = 120°$$
$$ACE = 55° \; ; \quad ECD = 65° \; ; \quad ACD = 120°.$$

5. In the given figure, $XY \,||\, BC$. Find the value of x.

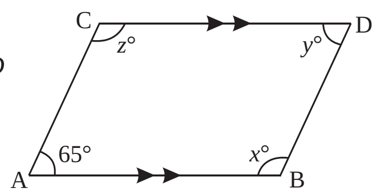


XAY is straight line

$$\text{Sum of angles of straight line} = 180°$$
$$XAB + \quad BAC + \quad YAC = 180°$$
$$50° + 83° + \quad YAC = 180°$$
$$133° + \quad YAC = 180°$$
$$YAC = 180° - 133°$$
$$YAC = 47°$$
$$YAC = \quad ACB = x \text{ (alternate angles)}$$
$$47° = 47° = x$$

Value of x is 47°.

6. (a) $AB \,||\, CD$, $AC \,||\, BD$



$$A = \quad D$$

(opposite angle of $\square$ gm)

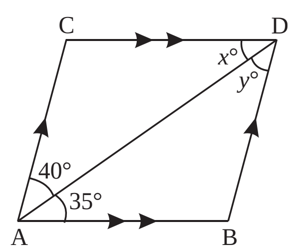
$$D = y°$$
$$= 65°$$

AB straight line,

$$\text{Sum of angle of straight line} = 180°$$
$$B = 180° - 65° = 115°$$
$$B = \quad C = z° = x° \text{ (oppoosite angles of } \square \text{ gm)}$$
$$z° = 115°$$

$x° = 115°$, $y° = 65°$, $z° = 115°$.

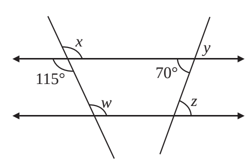
(b) $x° = 40°$, $y° = 35°$



(corresponding angles are equal)

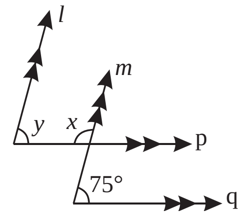
$x = 40°$, $y = 35°$

7. In the given figure, find x, y, z and w. Give reasons.



$$x = 115° \text{ (vertically opposite angles)}$$
$$y = 70° \text{ (vertically opposite angles)}$$
$$x = \quad w = 15° \text{ (corresponding angles)}$$
$$y = \quad z = 70° \text{ (corresponding angles)}$$
$$x = 115°, \quad y = 70°, \quad z = 70°; \quad w = 115°.$$

8. Given $l \,||\, m$ and $p \,||\, q$. Find x and y.



$$y = 75°$$

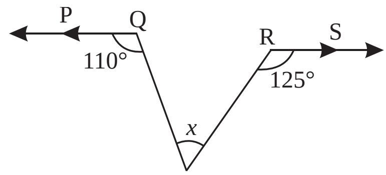
(corresponding angles are equal)

x and y in a straight line

so, sum of these angle $= 180°$

$$x + y = 180°$$
$$x + 75° = 180°$$
$$x = 180° - 75° = 105°$$

9. $PQ \,||\, RS$



Extending the lines PQ and RS we get,

$180° - 110° = 70°$ and $180 - 125° = 55°$

$PQ \,||\, RS$

$Q = y = 70°$ (corresponding angle)

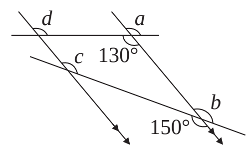
Here, ARY is triangle.

Sum of angle of triangle $= 180°$

$$70° + 55° + x = 180°$$
$$125° + x = 180°$$
$$x = 180° - 125° = 55°$$

Value of $x = 55°$.

10. $E = 130°$ (given)



$F = 150°$ (given)

$b = 150°$ (vertically opposite angles)

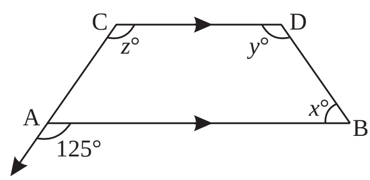
$a = 130°$ (vertically opposite angle)

$b = c = 150°$ (corresponding angle)

$a = d = 130°$ (corresponding angle)

$a = 130°$, $b = 150°$, $c = 150°$, $d = 130°$.

11. $A = C = 125°$ (corresponding angle)



$$z° = 125°$$
$$D = C$$
$$= 125°$$

(corresponding angle)

$$z° = y° = 125°$$

BD is straight angle,

Sum of angle of straight line $= 180°$

$$x° + y° = 180°$$
$$x + 125° = 180°$$
$$x = 180° - 125°$$
$$= 55°$$

Thus, $x° = 55°$, $y° = 125°$, $z = 125°$.

Multiple Choice Questions

Tick (3) the correct option :

1. (b) **2.** (a) **3.** (b) **4.** (c) **5.** (b)

High Order Thinking Skills (HOTS)

$$\begin{aligned} \text{Sum of supplementary angle } &= 180° \\ \text{Let value of } x &= A \\ \text{Value of } y &= (180 - A)° \end{aligned}$$

putting the value of x and y

$$(A+25)°;\ (180° - A + 15°) = (195° - A)° \text{ (given)}$$

Vertically opposite angle is equal

$$\begin{aligned} (A+25)° &= (195 - A)° \\ A + A &= 195° - 25° \\ 2A &= 170° \\ A &= \frac{170}{2} = 85° \\ \text{Angles } &= (85° + 25°) = 110° \\ &= (180° - 85° + 15°) = (195 - 85)° = 110° \end{aligned}$$

10 Properties of Triangles

Exercise 10.1

1. State in which cases the angles can possibly be those of a triangle :

(We know that; Sum of three angles of triangle is 180°)

(a) Sum of angles $= 70° + 60° + 70° = 20°$
Triangle is not possible.

(b) Sum of angles $= 90° + 30° + 60° = 180°$
Yes, triangle is possible.

(c) Sum of angles $= 50° + 45° + 85° = 180°$
Yes, triangle is possible.

(d) Sum of angles $= 45° + 90° + 45° = 180°$
Yes, triangle is possible.

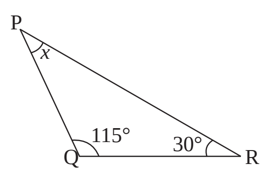
(e) Sum of angles $= 60° + 30° + 100° = 190°$
Triangle is not possible

(f) Sum of angles $= 105° + 30° + 35° = 170°$
Triangle is not possible

2. Find the value of the unknown angles in the following figures :

(a) In sum of three angles of a triangle $= 180°$

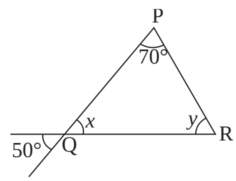
ΔPQR



$$\begin{aligned} P + \quad R + \quad Q &= 180° \\ x + 30 + 115 &= 180° \\ x + 145 &= 180° \\ x &= 180° - 145° \\ &= 35° \end{aligned}$$

(b) $x = 50°$ (vertical opposite angles)

In $x = 50°$



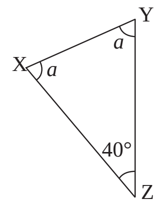
$$P + \quad Q + \quad R = 180°$$

(sum of three angle of a triangle $= 180°$)

$$70° + 50° + y° = 180°$$
$$120° + y° = 180°$$
$$y = 180° - 120°$$
$$= 60°.$$

(c) Sum of three angle of a triangle $= 180°$

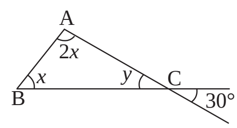
In $\Delta\, XYZ$



$$X + \quad Y + \quad Z = 180°$$
$$a + a + 40° = 180°$$
$$2a + 40° = 180°$$
$$2a = 180° - 40°$$
$$2a = 140°$$
$$a = 70°$$

$x = 70°$; $y = 70°$.

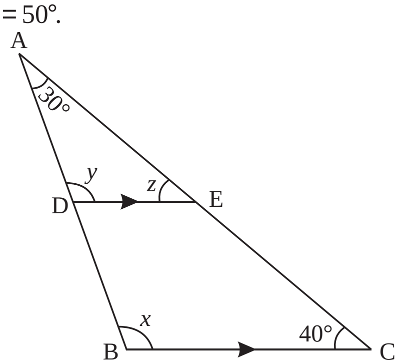
(d) $y = 30°$ (vertical opposite angles)



In ΔABC, $A + \quad B + \quad C = 180°$

$$2x + x + 30° = 180°$$
$$3x = 180° - 30°$$
$$3x = 150°$$
$$x = 50°$$
$$A = 2x = 50 \times 2 = 100°$$
$$B = x = 50°.$$

3. $DE \,||\, BC$



$$C = \quad E$$

(corresponding angle)

$$C = \quad E = 40°$$

$\Delta\, ADE$,

$$A + \quad D + \quad E = 180°$$
$$30° + y + 40° = 180°$$
$$y = 180°$$
$$y = 180° - 70°$$
$$y = 110°$$

$D = \quad B$ (corresponding angle)

$$D = \quad B = 110°$$

Thus, $x = 110°$, $y = 110°$, $z = 40°$.

4. Number of angle in pentagon value of each angle $= 108°$

Sum of angles of a pentagon $= 108° \times 5 = 540°$.

5. Number of angle in quadrilateral $= 4$

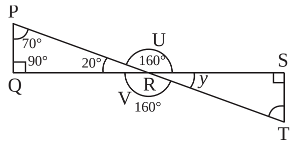
Value of each angle $= 90°$

$$\text{Sum of all angles of a quadrilateral} = 90° \times 4 = 360°.$$

6.
$$\begin{aligned}
\text{One angle of the triangle} &= 75° \\
\text{Sum of angles in triangle} &= 180° \\
\text{Sum of other two angles} &= 180° - 75° = 105°.
\end{aligned}$$

7. Find the unknown angles in the following figures :

(a) In ΔPQR,

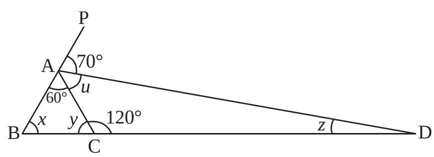


$$\begin{aligned}
P + \quad Q + \quad R &= 180° \\
x + 90° + 20° &= 180° \\
x + 110° &= 180° \\
x &= 180° - 110° \\
&= 70° \\
P &= 70° \\
20° &= y \qquad \text{(vertical opposite angles)}
\end{aligned}$$

In ΔTSR;
$$\begin{aligned}
R + \quad S + \quad T &= 180° \\
20 + 90° + \quad T &= 180° \\
T &= 180° - 110° = 70° \\
T &= 70°
\end{aligned}$$

PRT straight line
$$\begin{aligned}
v + 20° &= 180° \\
v &= 180° - 20° \\
&= 160° \\
v &= 160° \\
u &= v = 160° \text{ (vertical opposite angles)}
\end{aligned}$$

(b) *ABP* is straight line



$$\begin{aligned}
60° + u + 70° &= 180° \\
130° + u &= 180° \\
u &= 180° - 130° \\
u &= 50° \\
u &= 50°
\end{aligned}$$

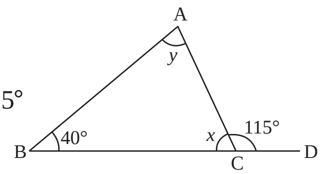
In *ACD*
$$\begin{aligned}
DAC + \quad ACD + \quad CDA &= 180° \\
50° + 120° + \quad CDA &= 180° \\
z &= 180° - 170° \\
z &= 10° \\
z &= 10°
\end{aligned}$$

BCD is straight line
$$\begin{aligned}
ACD + \quad ACB &= 180° \\
120° + y &= 180° \\
y &= 180° - 120° = 60° \\
y &= 60°
\end{aligned}$$

ΔABC ;
$$BAC + \quad ABC + \quad BCA = 180°$$

$$
\begin{aligned}
60^\circ + x + y &= 180^\circ \\
60^\circ + x + 60^\circ &= 180^\circ \\
x + 120^\circ &= 180^\circ \\
x &= 180^\circ - 120^\circ \\
x &= 60^\circ
\end{aligned}
$$

(c) *BCD* is straight line

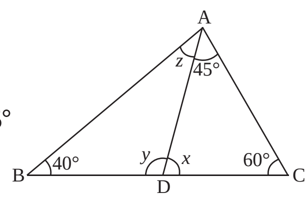


$$
\begin{aligned}
ACB + \quad ACD &= 180^\circ \\
x + 115^\circ &= 180^\circ \\
x &= 180^\circ - 115^\circ \\
&= 65^\circ \\
x &= 65^\circ
\end{aligned}
$$

ΔABC,

$$
\begin{aligned}
ABC + \quad BAC + \quad BCA &= 180^\circ \\
40^\circ + y + x &= 180^\circ \\
40^\circ + y + 65^\circ &= 180^\circ \\
y + 105^\circ &= 180^\circ \\
y &= 180^\circ - 105^\circ = 75^\circ \\
y &= 75^\circ
\end{aligned}
$$

(d) In ΔADC ;



$$
\begin{aligned}
DAC + \quad ADC + \quad DCA &= 180^\circ \\
45^\circ + x + 60^\circ &= 180^\circ \\
x + 105^\circ &= 180^\circ \\
x &= 180^\circ - 105^\circ \\
&= 75^\circ \\
x &= 75^\circ
\end{aligned}
$$

BDC straight line

$$
\begin{aligned}
BDC + \quad ADB &= 180^\circ \\
x + y &= 180^\circ \\
75^\circ + y &= 180^\circ \\
y &= 180^\circ - 75^\circ = 105^\circ \\
y &= 105^\circ
\end{aligned}
$$

In ΔADB

$$
\begin{aligned}
BAD + \quad DBA + \quad BDA &= 180^\circ \\
40^\circ + z + y &= 180^\circ \\
40^\circ + z + 105^\circ &= 180^\circ \\
z + 145^\circ &= 180^\circ \\
z &= 180^\circ - 145^\circ \\
z &= 35^\circ
\end{aligned}
$$

8. Sum of angle of triangle is 180°

Let,

$$
\begin{aligned}
\text{Value of first angle} &= x \\
\text{Value of second angle} &= 2x \\
\text{Value of third angle} &= 3x
\end{aligned}
$$

$$x + 2x + 3x = 180°$$
$$6x = 180°$$
$$x = \frac{180°}{6} = 30°$$
$$\text{Value of first angle} = 30°$$
$$\text{Value second angle} = 2 \times 30° = 60°$$
$$\text{Value third angle} = 3 \times 30° = 90°$$

Angle of triangle is 30°, 60° and 90°.

9. In right angled triangle one angle is 90°.

Ratio of other angle in triangle 2 : 3

Let, Value of second angle $= 2x$

third angle $= 3x$

Sum of angle of triangle is 180°

$$90° + 2x + 3x = 180°$$
$$5x = 180° - 90°$$
$$x = 90° \div 5$$
$$x = 18$$
$$\text{Value of second angle} = 2 \times 18° = 36°$$
$$\text{Value of third angle} = 3 \times 18° = 54°$$

10. (a) Yes, sum of three angles of a triangle is 180°, if one of the angle is obtuse then the other two are less than 90°

(b) No, obtuse angle > 90° and sum of three angles is equal to 180°. Therefore, two angles can never be $\geq 90°$

(c) No, same as above

(d) No, as sum of three angles = 180° and sum of angle > 60° is greater than 180°. Therefore, it is not possible to have all angles > 60°

(e) No, if all angles < 60°, their sum will be < 180°

(f) Yes

Exercise 10.2

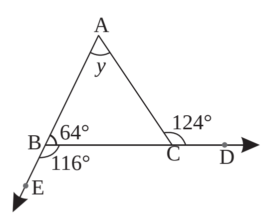
1. (a) Yes, external angle = Sum of the interior remote angles

(b) Yes, same as above

(c) No, external angles ≠ Sum of interior angles

(d) Yes

2. Find the value of y in the following figure.



(a) $$DBE + CBA = 180°$$
$$CBA = 180° - 116° = 64°$$
$$B + A = C$$

Exterior angle property

$$64° + y = 124°$$
$$y = 124° - 64° = 60°$$

(b) $TQP + \quad RQP = 180°$

(linear pair)

$RQP = 180° - 110°$

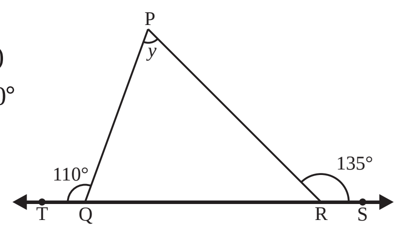
$= 70°$

$Q + \quad P = \quad R$

(Exterior angle property)

$70° + y° = 135°$

$y° \quad = 135° - 70 = 65°$



3. Find angle x in the following figures :

(a) Since, the sum of interior opposite angles = exterior angle

$B + \quad B = \quad C$

$50° + 60° = 110°$

$C = 110°$

In ΔECD; Sum of triangle's angle = 180°

$E + \quad C + \quad D = 180°$

$E + 110° + 40° = 180°$

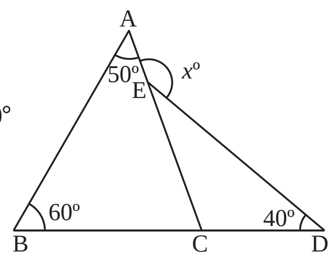
$E = 180° - 150° = 30°$

$AED + \quad AEC = 180°$ (linear pair)

$x + 30° = 180°$

$x = 180° - 30° = 150°$

$x = 150°$

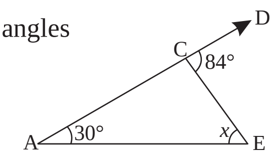


(b) Sum of interior opposite angles = exterior angles

$30° + x° = 84°$

$x = 84° – 30°$

$x = 54°$



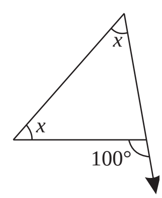
(c) Sum interior opposite angle = exterior angle

$x + x = 100°$

$2x = 100°$

$x = \frac{100}{2} = 50°$

$x = 50°$



4. QSR is a straight line

So, $z + 105° = 180°$ (Linear pair)

$z = 180° - 105°$

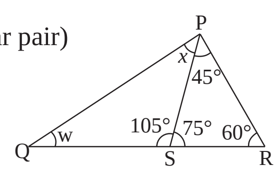
$z = 75°$

Now in ΔPSR, $P + \quad S + \quad R = 180°$

$y + 75° + 60° = 180°$

$y + 135° = 180°$

$y = 45°$



Now ΔQPR

RS in the bisector of $\quad QPR$

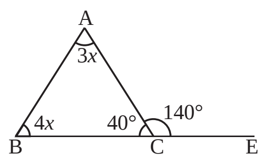
So, $x = \ y° = 45°$

In ΔPQS

$$\begin{aligned} P + \quad Q + \quad S &= 180° \\ x + w + 105° &= 180° \\ 45° + w + 105° &= 180° \\ w + 150° &= 180° \\ w &= 180° - 150° \\ &= 30° \end{aligned}$$

So, $x = 45°$, $y = 45°$, $z° = 75°$ and $w = 30°$.

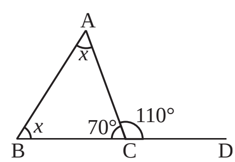
5. Let ΔABC; $A = 3x$; $B = 4x$



$$\begin{aligned} ACE &= 140° \\ \text{Sum of interior opposite angles} &= \text{exterior angle} \\ 3x + 4x &= 140 \\ 7x &= 140° \\ x &= \frac{140°}{7} = 20° \\ \text{Value of angle } A &= 3x = 3 \times 20° = 60° \\ \text{Value of angle } B &= 4 \times x = 4 \times 20° = 80° \\ ACE + \quad ACB &= 180° \text{ (linear pair)} \\ 140° + \quad ACB &= 180° \\ ACB &= 180° - 140° \\ &= 40° \end{aligned}$$

$A = 60°$, $B = 80°$, $C = 40°$

6. Let interior opposite angle $= x$

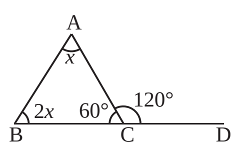


$$\begin{aligned} \text{Sum of interior opposite angles} &= \text{Exterior angle} \\ x + x &= 110° \\ 2x &= 110° \\ x &= 110° \div 2 = 55° \\ BCA + \quad ACD &= 180° \\ BCA + 110° &= 180° \\ BCA &= 180° - 110° = 70° \end{aligned}$$

$A = 55°$,
$B = 55°$,
$C = 70°$

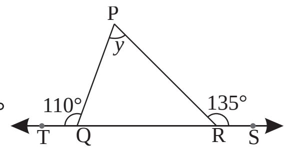
7. Let ABC is triangle

$A = x$, $B = 2x$



$$\begin{aligned} \text{Sum of interior opposite angles} &= \text{Exteriors angle} \\ x + 2x &= 120° \\ 3x &= 120° \\ x &= 120° \div 3 = 40° \\ BCA + \quad ACB &= 180° \\ 120° + \quad ACB &= 180° \end{aligned}$$

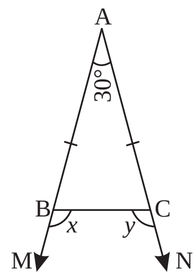
$$ACB = 180° - 120°$$
$$= 60°$$
$$A = 40°,$$
$$B = 40 \times 2 = 80°$$
$$C = 60°.$$



8. Here, $AB = AC$

$$B = \quad C$$

(Angles opposite to equal side of a triangle are equal)



Let $B = \quad C = P$

$$B + \quad C + \quad A = 180°$$
$$P + P + 30° = 180°$$

(Sum of angles of a triangle)

$$2P = 180° - 30°$$
$$P = \frac{150°}{2} = 75°$$
$$BAC + \quad BCA = \quad CBM$$

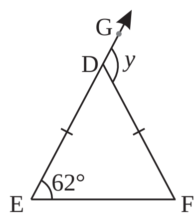
(Sum of interior opposite angles = exterior angle)

$$30° + 75° = x$$
$$105° = x$$
$$x = 105°$$
$$BAC + \quad ABC = \quad BCN$$

(Sum of interior opposite angles = exterior angle)

$$30° + 75° = 105° = y$$
$$y = 105°$$

9. Find the unknown angle in the following figure.



(a) Given $DEF = \quad EFD$

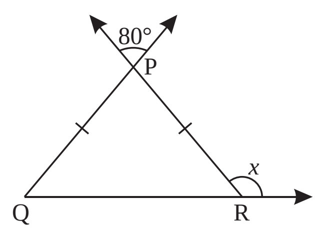
∵ $DEF = 62°$

$$EFD = 62°$$
$$DEF + \quad FED = \quad GDF$$
$$62° + 62° = \quad GDF$$
$$124° = \quad GDF$$
$$y = 124°$$ (Exterior angle property)

(b) $P = 80°$

$PQ = PR = \quad Q = \quad R$

(Angles opposite to equal sides of a triangle are equal)



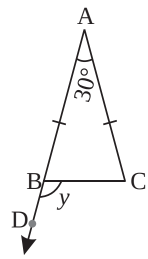
Let $Q = \quad R = A$

(Angle sum of triangle property)

$$A + A + 80° = 180°$$
$$2A = 180° - 80°$$
$$A = 100° \div 2$$
$$= 50°$$

$$P + \quad Q = \quad R \text{ (Exterior angle property)}$$
$$80^\circ + 50^\circ = 130^\circ$$
$$R = 130^\circ$$
$$x = 130^\circ$$

(c) $A = 30^\circ$



$AB = BC; \quad B = \quad C$

Let $B = \quad C = A$

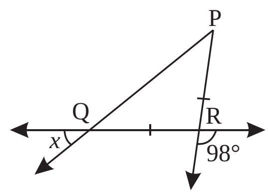
$$B + \quad C + \quad A = 180^\circ$$

(Angle sum of Triangle property)

$$30^\circ + A + A = 180^\circ$$
$$A = \frac{180^\circ - 30^\circ}{2}$$
$$= \frac{150^\circ}{2} = 75^\circ$$
$$B = \quad C = 75$$
$$A + \quad C = \quad CBD \text{ (Exterior angle property)}$$
$$30^\circ + 75 = y$$
$$y = 105^\circ$$

(d) $R = 98^\circ$ (vertical opposite angles)

$$PR = QR$$



(Angles opposite to equal sides of a triangle are equal)

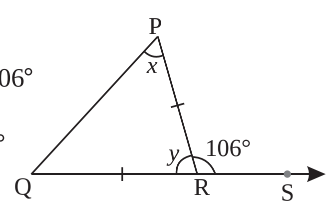
$$Q = \quad P$$

Let $Q = \quad P = A$

$$A + A + 98^\circ = 180^\circ \text{ (sum of angle triangle property)}$$
$$2A + 98 = 180^\circ$$
$$A = \frac{180 - 98}{2}$$
$$A = 41$$
$$Q = 41$$
$$x = 41 \text{ (vertically opposite angle)}$$

(e) QRS in straight angle

$$QRP + \quad SRP = 180^\circ$$
$$QRP + 106^\circ = 180^\circ$$
$$QRP = 180^\circ - 106^\circ$$
$$= 74^\circ$$
$$R = y^\circ = 74^\circ$$



ΔPQR ; $PR = QR$

$$P = \quad Q$$

(Angles opposite to equal sides of a triangle are equal.)

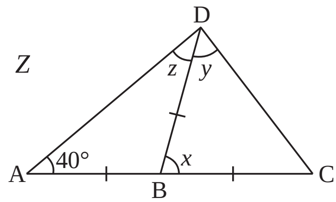
Let $\quad P = \quad Q = x$

$$x + x + 74 = 180°$$
$$2x = 180° - 74°$$
$$x = \frac{180° - 74°}{2} = 53°$$

So, $\quad P = x$ then $x = 53°$ and $y = 74°$

(f) Here, $\quad AB = BD$

$$A = \quad D = \quad Z$$



(Angles opposite to equal sides of a triangle are equal)

so $\quad z = 40°$

In ΔABD

$$BAD + \quad ABD + \quad ADB = 180° \text{ (sum of angle of triangle)}$$
$$40° + 40° + \quad ABD = 180°$$
$$ABD = 180° - 80° = 100°$$

ABC is straight line

$$ABD + \quad CBD = 180°$$
$$CBD = 180° - 100° = 80°$$
$$x = 80°$$

And $\quad BC = BD$

$$D = \quad C$$

Let $\quad D$ is y

In ΔDBC, $\quad BDC + \quad DBC + \quad BCD = 180°$

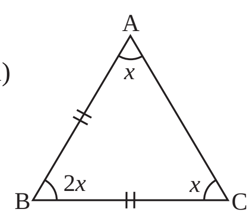
$$y + y + 180° = 180°$$
$$2y + 80 = 180°$$
$$2y = 180° - 80°$$
$$y = \frac{100°}{2} = 50$$
$$y° = 50°$$

So, $x = 80°$, $y = 50°$, $z` = 40°$

10. $\quad AB = BC$

Let $\quad A = x$

then $\quad C = x$



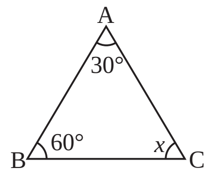
(Angles opposite to equal side of a triangle are equal)

$$B = 2x$$
$$A + \quad B + \quad C = 180°$$
$$x + 2x + x = 180°$$
$$4x = 180°$$
$$x = \frac{180°}{4} = 45°$$

$A = 45°$; $\quad C = 45°$ $\qquad$ And $\quad B = 45° \times 2 = 90°$

Exercise 10.3

1. In ΔABC



$$A + \quad B + \quad C = 180°$$
$$30° + 60° + \quad C = 180°$$
$$C = 180° - 90°$$
$$= 90°$$

Side opposite to $\quad C$ its hypotenuse and hence ($AB^2 - BC^2 = AC^2$)

So, (a) true.

2. Find the unknown length x in the following figures.

(a) ΔPQS, $PQ = 24$ cm, $QS = 7$ cm, $PS = x$ cm

$$(PS)^2 = (PQ)^2 + (QS)^2 \text{(Pythagoras property)}$$
$$(PS)^2 = (24)^2 + (7)^2$$
$$= 576 + 49$$
$$= 625$$
$$PS = \sqrt{625} = 25$$
$$PS = 25 \text{ cm}$$

or $\quad x = 25$ cm

(b) ΔPQR, $PQ = 6$ m, $QR = 8$ m, $PR = x$ cm

$$(PR)^2 = (QP)^2 + (QR)^2 \text{ (Pythagoras property)}$$
$$(PR)^2 = (8)^2 + (6)^2$$
$$= 64 + 36$$
$$= 100$$
$$PR = \sqrt{100} = 10 \text{ cm}$$
$$PR = 10 \text{ cm}$$

or $\quad x = 10$ cm

(c) ΔABD; $AB = 5$ m, $AD = 3$ m ; $BD = y$ cm

$$(AB)^2 = (BD)^2 + (AD)^2 \text{(Pythagoras property)}$$
$$(BD)^2 = (AB)^2 - (AD)^2$$
$$= (5)^2 - (3)^2$$
$$= 25 - 9 = 16$$
$$BD = \sqrt{16} = 4 \text{ m}$$
$$BD = 4 \text{ m}$$

ΔACD; $AC = 12$ m; $AD = 3$ cm, $DC = z$ cm

$$DC^2 = (AC)^2 - (AD)^2 \text{(Pythagoras property)}$$
$$DC^2 = (12)^2 - (3)^2$$
$$= 144 - 9 = 135$$
$$DC = \sqrt{135} = z$$
$$BC = BD + CD$$

$$x = y + z$$
$$x = 4 + \sqrt{135}$$
$$BC = (4 + \sqrt{135})\,\text{m}$$

(d) In ΔABC

$BC = 5\,\text{m}$, $AB = CB = 5\,\text{m}$, $AC = x$

$$(AC)^2 = (AB)^2 + (BC)^2$$
$$= (5)^2 + (5)^2 = 25 + 25 = 50$$
$$AC = \sqrt{50}$$

3. Which of the following can be the sides of a right triangle?

(a) 8 cm, 15 cm, 17 cm

In this Hypotenuse is 17 cm

$$(17)^2 = (8)^2 + (15)^2$$
$$289 = 64 + 225$$
$$289 = 289$$

So, with these dimesions, right triangle is possible.

(b) 3 cm, 3 cm, 9 cm

In this Hypotenuse is 9 cm ^{2}

$$(9)^2 \neq (3)^2 + (3)^2$$
$$81 \neq 9 + 9$$
$$81 \neq 18$$

So, with these dimensions, right triangle is not possible.

(c) 2.5 cm, 6.5 cm, 6 cm

In this Hypotenuse is 6.5 cm

$$(6.5)^2 = (2.5)^2 + (6)^3$$
$$42.25 = 6.25 + 36$$
$$42.25 = 42.25$$

So, with these dimensions, right triangle is possible.

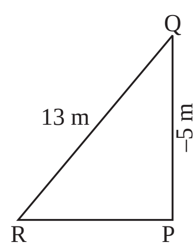
(d) 16 cm, 30 cm, 34 cm

In this Hypotenuse is 34 cm

$$(34)^2 = (16)^2 + (30)^2$$
$$1156 = 256 + 900$$
$$1156 = 1156$$

So, these dimensions, right triangle is possible.

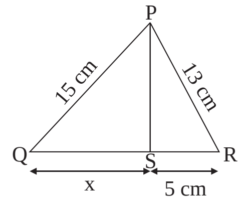
4. ΔPQR,



$$RP^2 = QR^2 - QP^2$$
$$RP^2 = (13)^2 - (5)^2$$
$$= 169 - 25$$
$$= 144$$
$$RP = \sqrt{144} = 12$$

Value of $RP = 12\,\text{cm}$.

5. In ΔPSR;



$$\begin{aligned} PR^2 &= PS^2 + SR^2 \\ PS^2 &= PR^2 - SR^2 \\ PS^2 &= (13)^2 - (5)^2 \\ &= 169 - 25 = 144 \\ PS &= \sqrt{144} = 12 \\ PS &= 12\,\text{cm} \end{aligned}$$

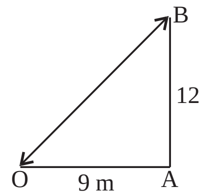
In PQS;

$$\begin{aligned} PQ^2 &= QS^2 + PS^2 \\ QS^2 &= PQ^2 - PS^2 \\ &= (15)^2 - (12)^2 \\ &= 225 - 144 \\ &= 81 \\ QS &= \sqrt{81} \\ &= 9 \\ QS &= 9\,\text{cm} \end{aligned}$$

or $\quad x = 9\,\text{cm}$.

6. Let O be the initial position of Kajal

$OA = 9\,\text{m},\ AB = 12\,\text{cm},\ OB = ?$



$$OB^2 = OA^2 + AB^2$$

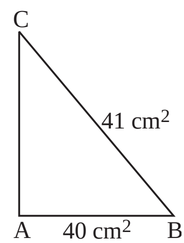
(phythagorast theorem)

$$\begin{aligned} OB^2 &= (9)^2 + (12)^2 \\ &= 81 + 144 = 225 \\ OB &= \sqrt{225} = 15 \end{aligned}$$

Hence, Kajal is at distance of 15 m from her initial position.

7. In right-angled triangle,

hypotenuse $= 41\,\text{cm}$; one side $= 40\,\text{cm}$



$$\begin{aligned} CB^2 &= AB^2 + AC^2 \\ CA^2 &= CB^2 - AB^2 \\ &= 41^2 - 40^2 \\ &= 1681 - 1600 \\ &= 81 \\ CA &= \sqrt{81} = 9\,\text{cm} \end{aligned}$$

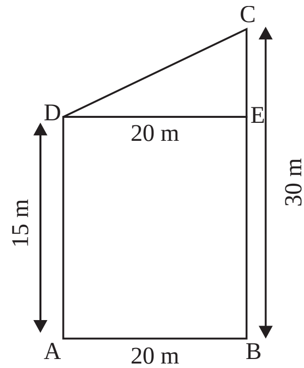
Other side of triangle is 9 cm.

8. The height of two poles are 30 m and 15 m

$AD = 15\,\text{m},\ BC = 30\,\text{cm}$

$$\begin{aligned} AB &= DE \\ &= 20\,\text{m} \end{aligned}$$

$$CE = BC - BE$$
$$= BC - AD$$
$$= 30 - 15 = 15m \; [BE = AD]$$



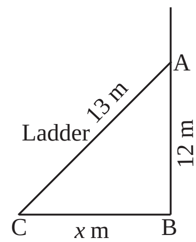
In right ΔDCE,

$$CD^2 = CE^2 + DE^2$$
$$= (15)^2 + (20)^2$$
$$= 225 + 400 = 625$$
$$CD = \sqrt{625} = 25$$

Hence, distance between their top most points is 25 m.

9. In ΔABC,

$$AC^2 = AB^2 + CB^2$$
$$CB^2 = AC^2 - AB^2$$
$$= (13)^2 - (12)^2$$
$$= 169 - 144 = 25$$
$$CB = \sqrt{25} = 5$$

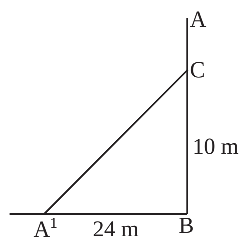


Thus, Distance of the foot of ladder from the wall is 5 m.

10. Let AB be the height of the tree before it broken. Let C be point from where it broke and the broken tree touches the ground at point A'.

Then, BCA' is a right angle triangle

$$A'C^2 = BC^2 + (BA^1)^2$$
$$= (10)^2 + (24)^2$$
$$= 100 + 576 = 676$$
$$A'C = 26$$



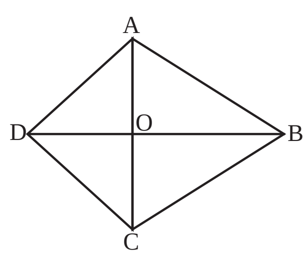
So, height of the tree

$$AB = AC + BC$$
$$= A'C + BC$$
$$= 26 + 10 = 36\,\text{m}$$

11. $ABCD$ is a rhombus AC and BD are its diagonal CA rhombus has all sides equal and its diagonals bisect each other at right angle.

So, AOB is right angle triangle

$$AO = \frac{1}{2} AC$$
$$AO = \frac{1}{2} \times 24 = 12\,\text{cm}$$
$$BO = \frac{1}{2} \times 10$$
$$BO = 5\,\text{cm}$$



Thus using pythagoras property we have

$$AB^2 = AO^2 + OB^2$$

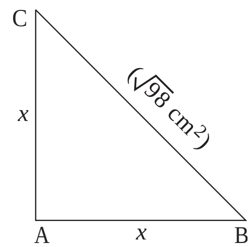
$$= (12)^2 + (5)^2$$
$$= 144 + 25 = 169$$
$$AB = \sqrt{169} = 13 \text{ cm}$$
$$AB = BC = CD = DC = 13 \text{ cm}$$
$$\text{Perimeter of rhombus} = 4 \times \text{side} = 4 \times 13 \text{ cm} = 52 \text{ cm}$$

Hence, perimeter of rhombus is 52 cm.

12. In anclsoscies right triangle two sides are equal.

equal side $= x$ cm

By pythogorean theorem



$$(AB)^2 + (CA)^2 = (CB)^2$$
$$(x)^2 + (x)^2 = \sqrt{98}$$
$$x^2 + x^2 = 98$$
$$2x^2 = 98$$
$$x^2 = 49$$
$$x = \sqrt{49} = 7 \text{ cm}$$

Length of side $= 7$ cm

So, length of each side $=$ 7 cm, 7 cm and 9.89 cm.

Exercise 10.4

1. Fill in the blanks :

(a) The altitude of a triangle is the **perpendicular** from vertex to the **opposite** side.

(b) Median of a triangle is a line segment that joins a **vertex** to the **middle point** of the opposite side.

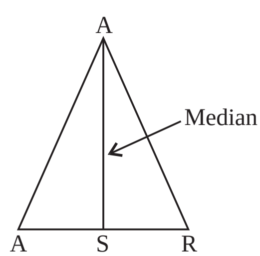
(c) If ΔABC is right angled at C, then $\boldsymbol{BC}$ and $\boldsymbol{AC}$ are two of the altitudes of the triangle.

(d) In ΔDEF, P is the mid-point of EF

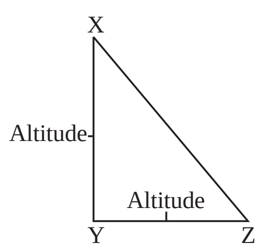
DP is **Median**; DQ is **Altitude** ; EP is $\mathbf{\frac{1}{2}} \boldsymbol{EF}$.

2. Draw diagrams which represent the following :

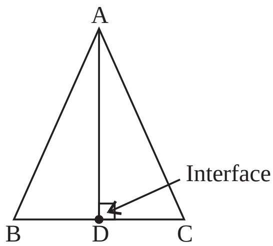
(a)



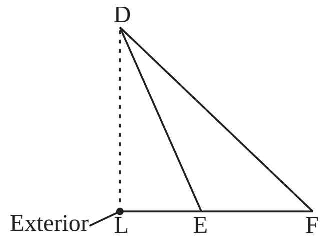
(b)



(c)



(d)



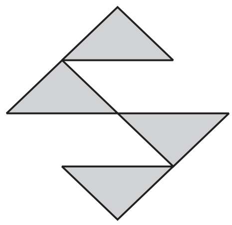
Multiple Choice Questions

Tick (3) the correct option :

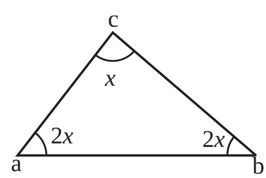
1.	(a)	**2.**	(c)	**3.**	(c)	**4.**	(d)
5.	(a)	**6.**	(a)	**7.**	(b)	**8.**	(d).

Higher Order Thinking Skills (HOTS)

1.



2. Let ΔABC is triangle,



$$\begin{aligned} \text{Let angle of } A &= 2x \\ b &= 2x \\ \text{and} \quad c &= x \\ \text{Sum of angle} &= 180^\circ \\ x + 2x + 2x &= 180^\circ \\ 5x &= 180^\circ \\ x &= \frac{180^\circ}{5} \\ &= 36^\circ \end{aligned}$$

Then, $A = 72^\circ$, $b = 72^\circ$, $C = 36^\circ$.

11 Congruence of Triangles

Exercise 11.1

1. Fill in the blanks :

(a) Two circles are congruent, if they have the same **radius**.

(b) Two angles are congruent, if they are equal in **degree** measure.

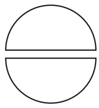
(c) If two figures have the same **shape** and **dimension**, they are congruent.

(d) Two rectangles will be **congruent**, if their respective lengths and breadths are equal.

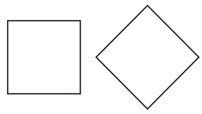
(e) If ΔABC is superimposed over ΔDEF and ΔDEF is covered completely, then the two triangles are **congruent**.

2. Which of the following pair of figures are congruent? If you are not sure, trace one figure and see if the tracing will fit over the other figure.

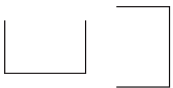
(b)



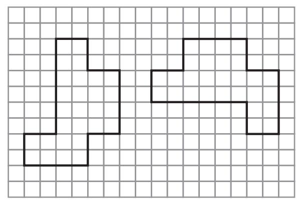
(c)



(e)



(f)

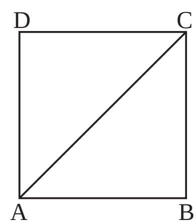


3. Square $ABCD$

$\Delta ABC \cong ACD$

$AB = DC = AD = BC$

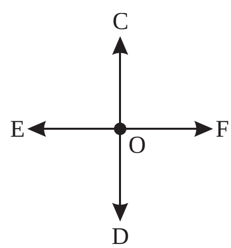
AC is diagonal



4. $COF = DOF$;

$COE = DOE$

All angles are equal.



5.

$\overline{XY} = 4.2$ cm

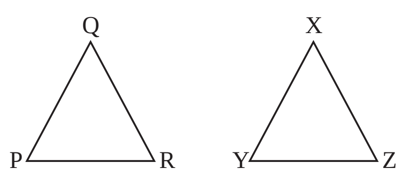
$MN \cong XY$

$MN = 4.2$ cm

Length is of $\overline{MN} = 4.2$ cm

6. They are congruent triangle

Yes, $\overline{PQ} = \overline{XY}$

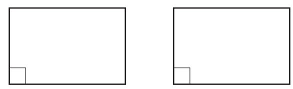


7. $\overline{PQ}$

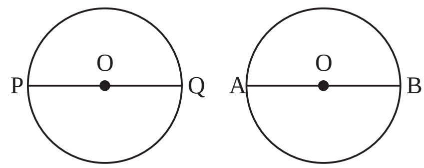
$$\overline{PR} = \overline{RQ}$$

Yes, $\overline{PR}$ will be congruent to $\overline{RQ}$.

8. Yes, the two angles of a rectangle congruent.
Rectangle both of 90°.

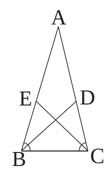


9. The diameter divide the circle in two
congruent parts. Each part is called semi circle.



Exercise 11.2

1.



$$\Delta BDC = \Delta CEB$$

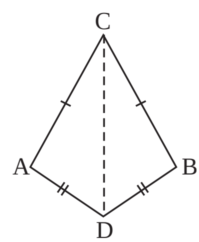
$$BC = BC \text{ (Base)}$$

$$DBC = \quad ECB\ ; \quad DBE = \quad ECD \text{ (Bisect angle are equal)}$$

$$BE = DC$$

$$\Delta BDC \cong \Delta CEB$$

2.



$$\Delta ACD = \Delta BCD$$

$$AD = DB \text{ (given)}$$

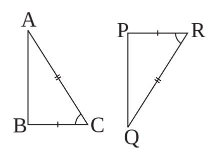
$$AC = CB \text{ (given)}$$

$$DC = DC \text{ (common)}$$

$A \leftrightarrow C, D \leftrightarrow D, B \leftrightarrow B$

$\Delta ACD \cong BCD$

3. In $\Delta ABC \cong \Delta QPR$



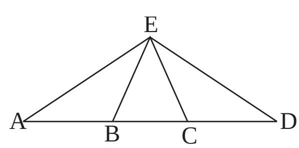
$$AC = RQ \text{ (given)}$$

$$BC = PR \text{ (given)}$$

$$BCA = \quad PRQ \text{ (given)}$$

$$\Delta ABC \quad \Delta PQR$$

4.



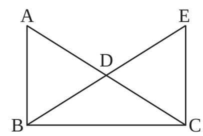
$$AB = CD$$

$$AE = ED$$

$$BE = CE$$

EBC is also an isosceles triangle.

5. (a) ΔADB and ΔCDE $\quad AD = DC$ (Given)



$BD = DE$ (given)

$ADB = \quad CDE$

(vertical opposite angle)

So, $\Delta ADB \cong \Delta CDE$

(b) $AB = EC$

$\Delta ABC \cong \Delta ECB$

$BC = BC$ (common line)

$AB = CE$ (proved above)

$AC = BE$ (given)

$\Delta ABC \cong \Delta ECB$

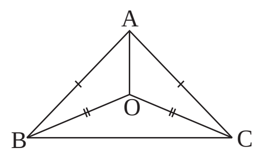
(c) We have proed that,

$\Delta ABC \quad \Delta ECD$

So, $CBA = \quad BCE$

So, $ECB = 90°$ (given)

6. In ΔABO and ΔACO



$AB = CA$ (given)

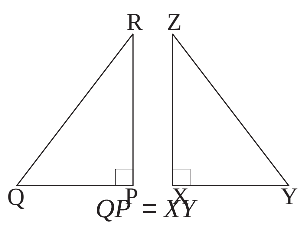
$BO = OC$ (given)

$OA = OA$ (common line)

So, $\Delta ABO \cong \Delta ACO$

So, $ABO = \quad ACO$

7.



$QP = XY$

$P = \quad X$

$= 90°$

Either $PQ = XY$ or $PR = XZ$

8. (a) $\Delta ABC \cong \Delta PQR$, SAS congruence.

(b) $\Delta ABC \cong \Delta DEF$, ASA congruence.

(c) ΔPQR and ΔLMN are not congruent.

Multiple Choice Questions

Tick (3) the correct option :

1. (c) **2.** (d) **3.** (d) **4.** (a) **5.** (b)

Higher Order Thinking Skills (HOTS)

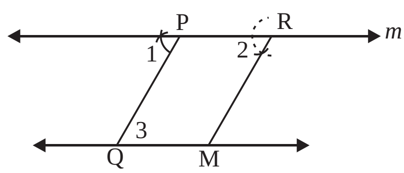
1. ΔABC and ΔDEF are congruent tring

$$\begin{aligned} AC &= DF \\ BC &= EF \\ AB &= BE \\ B &= \quad E \\ E &= 45° \\ 45° &= (x-5) \\ x &= 45+5=50° \\ C &= \quad F \\ 27° &= (y+5)° \\ y &= (27-5)° = 22° \\ \text{Value of } x &= 50° \\ \text{and} \qquad y° &= 22° \end{aligned}$$

12 Constructions

Exercise 12.1

1. Steps :



(i) Let l be any line and P be any point not lying on l.

(ii) Draw a line m parallel to l as explained in steps (iii) to (v) of the previous solution.

(iii) Now, take a point R on m.

Then with P as centre draw an arc of some sufficient measure. With the same radius draw arc from the point R then make equal arc such that.

$$1 = \quad 2 (\text{as } PQ \,||\, RM)$$

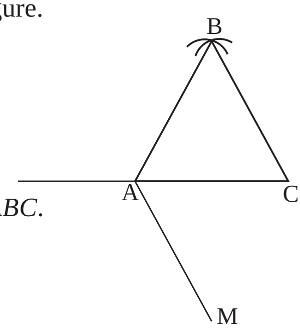
Also $\quad 1 = \quad 3 \quad (\text{as } m \,||\, l)$

Thus, the figure obtained is the required figure.

2. $\Delta ABC, AB = CB$

$BC = AM$

Step :



(i) Draw a line AC.

(ii) Cut an arc from A and C.

(iii) Join both the points at B. Thus gives us ΔABC.

(iv) Cut an arc from A and C, down wards it m.

(v) Join M to A. It is parallel to BC.

$AB = BC$

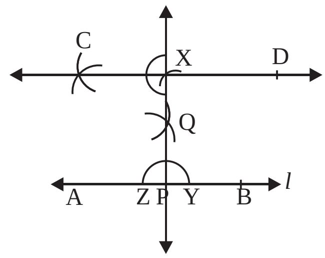
3. Steps :

(i) Draw $\overleftrightarrow{AB}$

(ii) Take any point P on AB.

(iii) With P as centre and any sufficient measure draw semicircle. Let this semicircle cut the line AB at Z and Y.

(iv) With Z and Y as centre and radius more than half of semicircle drawn in previous step, put two arcs intersecting each other at Q. as shown above.



(v) Join PQ

(vi) With P as centre and radius equal to 4 cm cut an arc on the line PQ. Let X be a point on PQ such that $PX = 4$ cm.

(vii) Now to draw a line CD parallel to AB through X we will repeat the steps (iii) to (v) with X.

Here, CD is the line drawn parallel to AB through the point X which is at a distance of 4 cm from the line AB.

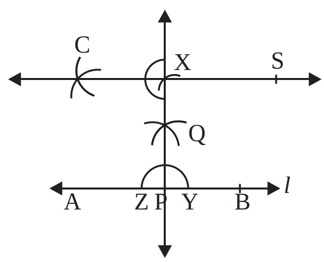
4. Steps :

(i) Draw $\overleftrightarrow{AB}$ of any measure name it as l.

(ii) Take any point P on l.

(iii) With P as centre and any sufficient measure draw a semicircle. Let this semicircle cut the line AB on l at Z and Y.

(iv) With Z and Y as centre and radius more than half of semicircle drawn in previous step, put two arcs intersecting each other at Q. as shown above.



(v) Join PQ

(vi) With P as centre and radius equal to 3 cm cut an arc on the line PQ. Let X be a point on PQ such that $PX = 3$ cm.

(vii) Now to draw a line m parallel to l through X we will repeat the steps (iii) to (v) with X.

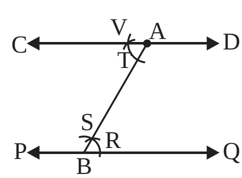
Here, XS is the line drawn parallel to l through the point X which is at a distance of 3 cm from the line l.

5. Step :

(i) Draw a line PQ using a ruler and mark a point A outside PQ.

(ii) Take any point B on PQ. Join AB.

(iii) With B as centre and a suitable radius draw an arc using compass to cut PQ at R and AB at S.



(iv) With A as centre and the same radius draw an arc, cutting AB.

(v) Now place the pointed tip of the compass at R and adjust the opening so that the pencil tip is at S.
(vi) With T as centre and the same radius RS, draw an arc cutting the previous arc at V.
(vii) Join AV and produce it on both sides to get the required line parallel to PQ.

(b) only one

(c) only one

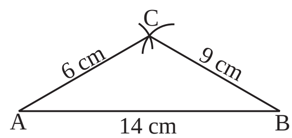
Exercise 12.2

1. Which of the following triangles can be constructed?

(a) We can not construct triangle for sides of 8 cm, 4 cm, 3 cm.

(b) We can not construct triangle for side of 7 cm, 15 cm, 5 cm.

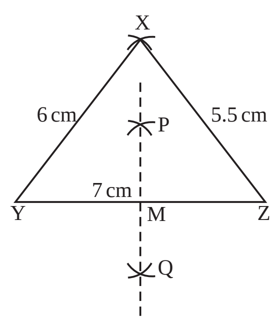
(c) We can make construe triangle as follow the step.



(i) Draw a line segment AB 14 cm
(ii) With A as centre and radius 6 cm, draw an arc using a compass.
(iii) With B as centre and radius 9 cm draw another arc cutting previous and at C.
Join CA and CD

(d) We can not construct triangle for sides OP 10 cm, 10 cm and 20 cm.
Then, ΔABC are required triangle.

2. (a) **Step :**



(i) Draw a line segment $YZ = 7\,\text{cm}$
(ii) With Y as centre and radius 6 cm, draw an arc a compass.
(iii) With z as centre and radius 5.5 cm draw an arc crossing a compass. Cutting previous are at X .
(iv) Join XY and XZ. Then, ΔXYZ is the triangle.
(v) With Y as centre and radius more than $\frac{1}{2}$ of YZ drawn arcs both side of YZ.
(vi) With z as centre and radius more than $\frac{1}{2}$ of YZ. Draw arcs cutting the previously drawn arcs at P and Q respectively.
(vi) Join PQ meeting at M. Then PM is particular bisector YZ.
Ray PQ bisects YZ.

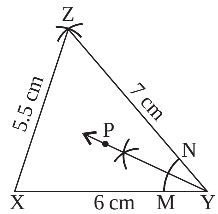
(b) **Step**
(i) Draw a line segment $XY = 6\,\text{cm}$.
(ii) With X as centre and radius 5.5 cm draw angle crossing a compass.

(iii) With Z as centre and radius 7 cm drawn arc cutting previous at at Z.

(iv) Join XZ and YZ.

(v) With Y as a centre and taking any suitable radius, draw an arc which cut XY and YZ at M and N respectively.

(vi) With centre M and radius more than half at MN draw an arc.



(v) With centre N and some radius more than half at MN draw an arc cutting at .

(vi) Join Y and produce it any point X.

Then, ray PY bisects XYZ.

3. Step :

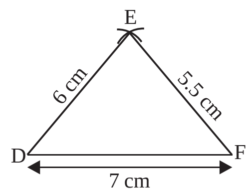
(i) Draw a line segment DF of length 7 cm.

(ii) With D as centre and radius 6 cm, draw an arc using compass.

(iii) With F as centre and radius 5.5 cm draw an another arc, cutting the preview arc at E.

(iv) Join DE 6 cm and FE.

Then, ΔDEF is the required triangle.



4. Step :

(i) Draw a line segment length 6.5 cm.

(ii) With P as centre and radius 6.5 cm, draw an arc using compass.

(iii) With Q as centre and radius 6.5 cm draw an another arc, cutting the previous arc at R.

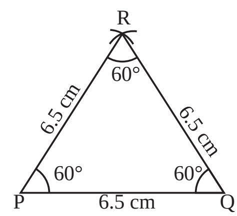
(iv) Join PR and QR

Then, ΔPQR is the required triangle

We conclose that, $P = 60°$,

$Q = 60°$,

$R = 60°$.



5. Step :

(i) Draw a line segment PQ length 5.5 cm.

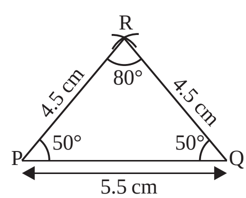
(ii) With P as centre and radius 4.5 cm, draw an arc using compass.

(iii) With Q as centre and radius 4.5 cm draw an another arc, cutting the previous arc at R.

(iv) Join PR and QR.

Then, ΔPQR is the required triangle.

$P = 50°$, $Q = 50°$ and $R = 80°$.



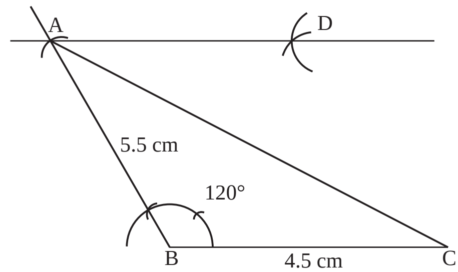
6. Step :

(i) Draw a line segment *BC* of measurement 4.5 cm.

(ii) Make an angle of 120° at *B*.

(iii) Taking *B* as centre make an arc at *A* of length 5.5 cm. Join *A* with *B*.

(iv) Join *A* to *C*.



(v) Taking *C* as centre, mark an arc parallel to *A* of 5.5 cm.

(vi) Make another arc from *A* of the same radius.

(vii) Join *A* to *D*. *AD* is parallel to *BC*.

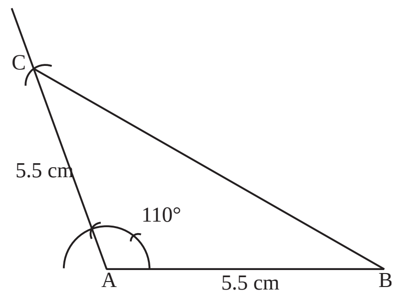
7. Step :

(i) Draw a line segment $AB = 5.5$ cm.

(ii) At *A* construct *XAB* 110°.

(iii) With *A* as center and radius 5.5 cm draw an arc cutting *AX* at *C* Join *CB*.

(iv) Then, *ABC* is a required triangle.



8. Step :

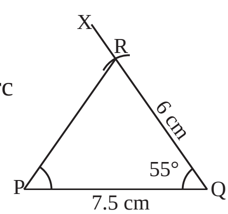
(i) Draw a line segment $PQ = 7.5$ cm.

(ii) At *Q* constract $XQP = 55°$.

(iii) With *Q* as centre and radius 6 cm, draw an arc cutting *QX* at *R*.

(iv) Join *PR*.

Then, ΔPRQ is the required triangle.



9. Step :

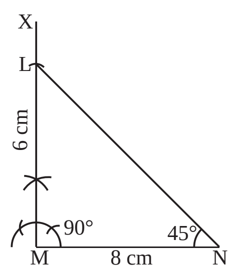
(i) Draw a line segment $MN = 8$ cm.

(ii) At *M* construct *XMN* 90°.

(iii) With *M* as centre and radius 6 cm draw an arc cutting *MX* at *L*.

(iv) Join *NL*.

Then, ΔMNL is the required triangle.



Exercise 12.3

1. Step :

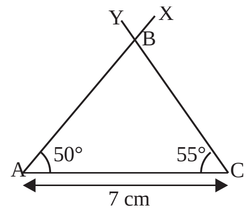
(i) Draw AC of length 7 cm.

(ii) At A construct $XAB = 50°$.

(iii) At Q construct $YCA = 55°$.

(iv) Let AX and CY intersect at B.

Then, ΔABC is the required triangle.



2. Step :

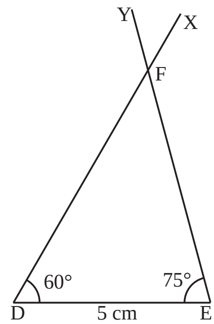
(i) Draw DE of length 5 cm.

(ii) At D construct $XDE = 60°$.

(iii) At E construct $YED = 75°$

(iv) Let DX and EY intersect at F.

Then, ΔDEF is the required triangle.



3. Given : $QR = 5.5$ cm

$P = 45°$, $Q = 30°$

You know that $P + Q + R = 180°$ (angle sun property of triangle)

$$45° + 30° + R = 180°$$
$$75° + R = 180°$$
$$R = 180° - 75°$$
$$= 105°$$

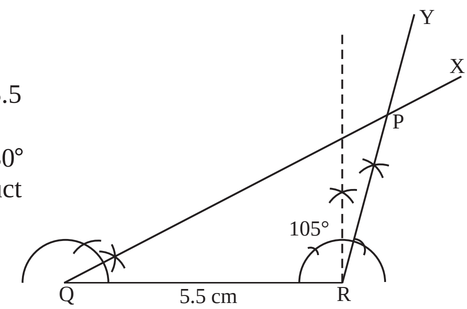
Step :

(i) Draw line segment $QR = 5.5$ cm.

(ii) At Q constant $XQR = 30°$ cut at R construct $YRQ = 105°$.

(iii) QX and RY at the dot of P.

(iv) ΔQRP is triangle.



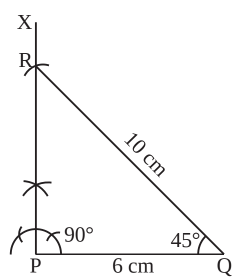
4. Step

(i) Draw PQ of length 6 cm.

(ii) At P construct $XPQ = 90°$.

(iii) With Q as a center and radius 10 cm cutting PX in 10 cm.

Then, ΔPQR is required.



5. Step :

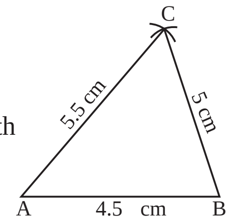
(i) Draw AB length of 4.5 cm.

(ii) With A as center and radius 5.5 cm cut an arc.

(iii) With B as center and radius 5 cm cut an arc with previous arc at C.

(iv) Join AC and BC

Then, ΔABC is required triangle.



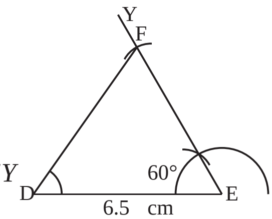
6. Step :

(i) Draw DE length 6.5 cm.

(ii) At point of E construct = $YED = 60°$.

(iii) With E as a center and radius 4.5 cm cutting EY in 4.5 cm at F join FD.

Now, ΔDEF is required triangle.



7. Step :

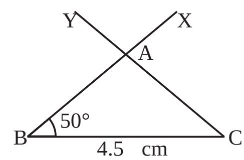
(i) Draw BC of length 4.5 cm.

(ii) At B construct $XBC = 50°$.

(iii) At C construct $YCB = 50°$

(iv) Let BX and CY intersect at A.

Then, ΔABC is the required triangle.



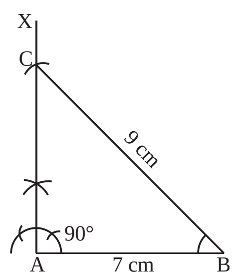
8. Step :

(i) Draw AB length of 7 cm.

(ii) At A construct $XAB = 90°$.

(iii) With B as a center and radius 9 cm cutting previous line AY as C point.

(iv) Then, ΔABC is required right angled triangle.



9. Step :

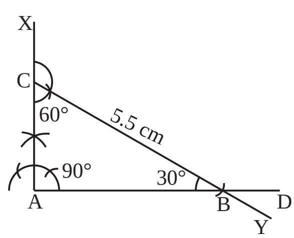
(i) Draw AD.

(ii) At A construct $XAB = 90°$.

(iii) At point of C construct $YCA = 60°$.

(iv) With C as a center and radius 5.5 cm. cutting previous like CY at the point of B.

(v) Now, ΔABC is required right angled triangle.



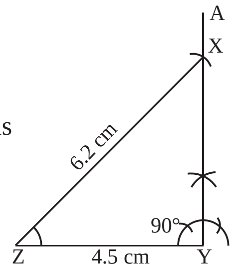
10. Step :

(i) Draw YZ length 4.5 cm.

(ii) At Y construct $AYZ = 90°$.

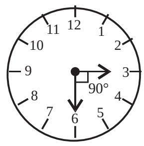
(iii) With Z as center and radius 6.2 cm cutting pervious line AZ.

Now, ΔXYZ is required triangle.



High Order Thinking Skills (HOTS)

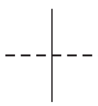
Angle $= 90°$



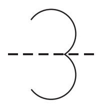
13 Symmetry

Exercise 13.1

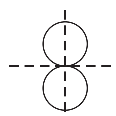
1. (a)



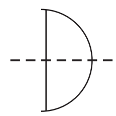
(b)



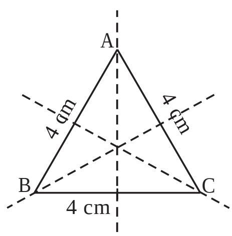
(c)



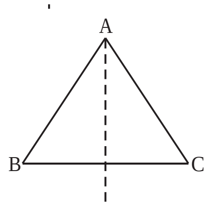
(d)



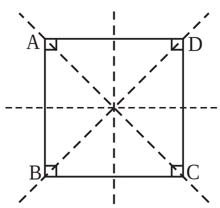
2. (a)



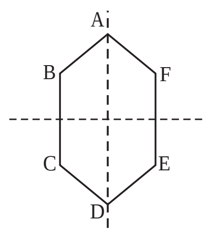
(b)



(c)

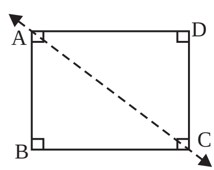


(d)

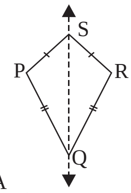


3. (a) corresponding sides $= AB, CD; AD, BC$

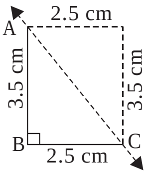
corresponding angles $= A, \quad C; \quad B, \quad D.$



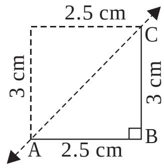
(b) corresponding sides $= PS, SR; PQ, RQ$
corresponding angles $= \quad R, \quad P; \quad S, \quad Q$



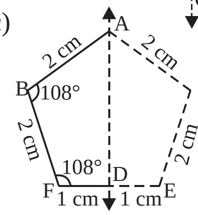
4. (a)



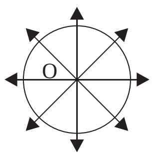
(b)



(c)

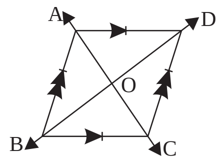


5. (a)



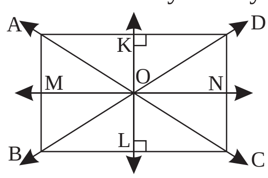
Number of lines of symmetry = infinite

(b)



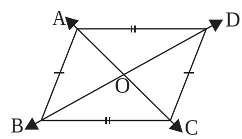
Number of lines of symmetry = 2

(c)



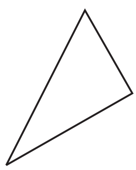
Number of lines of symmetry = 2

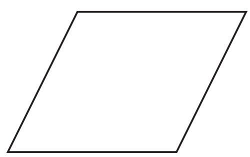
(d)

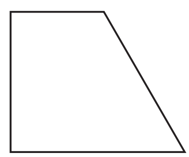


Number of lines of symmetry = 0

6.



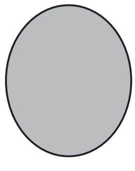




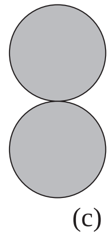
A scalene triangle, a parallelogram and a trapezium do not have any lines of symmetry.

Exercise 13.2

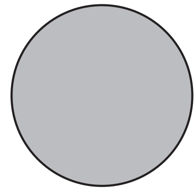
1. (b)



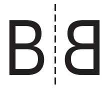
(e)



(f)

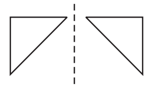


2. (a)

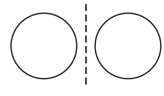


(b)

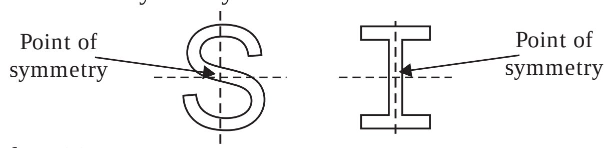
(c)



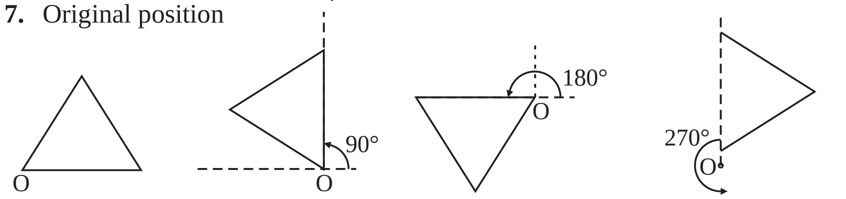
(d)



3. The pentagon shown above matches itself 5 times as it is rotated, it is said to have rotational symmetry of order 5.
4. H, I, O are three letters which have both line of symmetry and rotational symmetry.
5. A, B, C are three letters which have line symmetry but have no rotational symmetry.
6. Oder of rotational symmetry is 2.



7. Original position



Original position | Rotated at an angle 90° | Rotated at an angle 180° | Rotated at an angle 270°

Rotated at an angle 90°.
Rotated at an angle 180°.
Rotated at an angle 270°.

8. Parallelogram, no line of symmetry but has rotational symmetry of order 2.
9. No, Trapezium has no rational symmetry.

Multiple Choice Questions

Tick (3) the correct option :

1. (c) **2.** (c) **3.** (a) **4.** (a) **5.** (a).

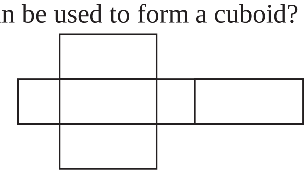
High Order Thinking Skills (HOTS)

1. 3 o'clock, 6 o'clock, 9 o'clock.
2. The alphabet having both type of symmetries are *H*, *I*, *O* and *X*.

14 Representing 3-D in 2-D

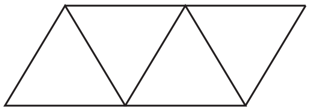
Exercise 14.1

1. Identify the solids whose nets are given below :
   (a) Cylinder (b) Cone (c) Cube
2. Identify the nets which can be used to form a cuboid?
   (c)

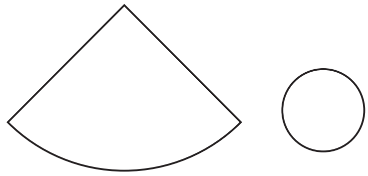


3. A dice is cube, each face marked with a number between 1 and 6. Number of faces of dice a different from each other. The sum of two number on the opposite is always 7. In this way we make a net of dice. On this basis we can say that the given figure is not a net of dice.

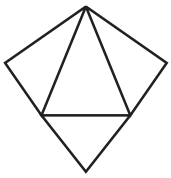
4. (a)



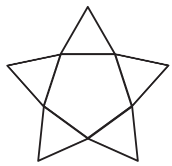
(b)



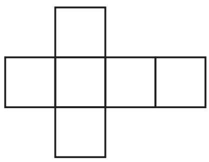
(c)



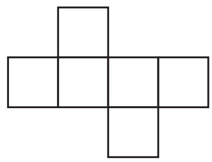
(d)



5. (c)

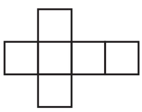


(d)

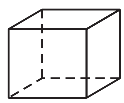


6.

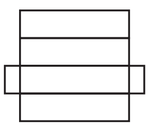
(a)



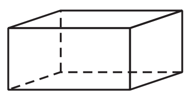
(iii)



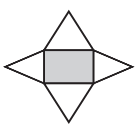
(b)



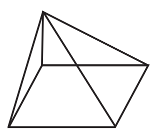
(iv)



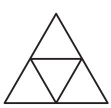
(c)



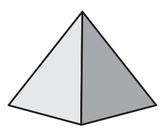
(i)



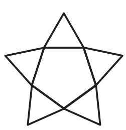
(d)



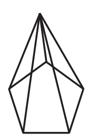
(ii)

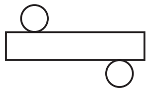
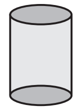


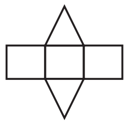
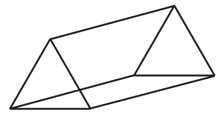
(e)



(vi)



(f)  (vii) 

(g)  (v) 

7. Volume of the cuboid $= 8 \times 5 \times 6\,\text{cm} = 240\,\text{cm}^3$

Edge of the cube to be fit $= 1\,\text{cm}$

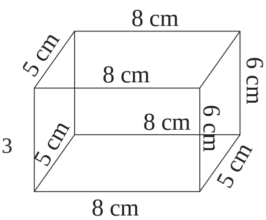
Volume of the cube $= 1 \times 1 \times 1\,\text{cm}$

$= 1\,\text{cm}^3$

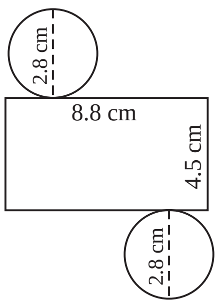
Number of cubes can be fit $= 240\,\text{cm}^3 \div 1\,\text{cm}^3$

$= 240$

240 cubes can be fit in the cuboid.



8.



2 circular, 1 curved

9. (a) Cone (b) Cylinder

(c) Triangular Prism (d) Square pyramid

10. (a) Triangular prism

$V = 6, F = 5, E = 9$

$6 + 5 - 9 = 2$

(b) A cube

$V = 8, F = 6, E = 12$

$8 + 6 - 12 = 2$

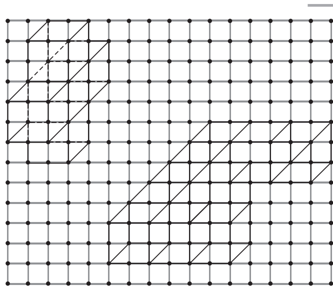
(c) A hexagonal pyramid

$V = 7, F = 7, E = 12$

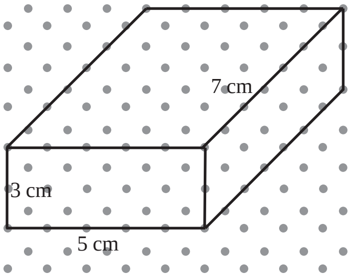
$7 + 7 - 12 = 2$

Exercise 14.2

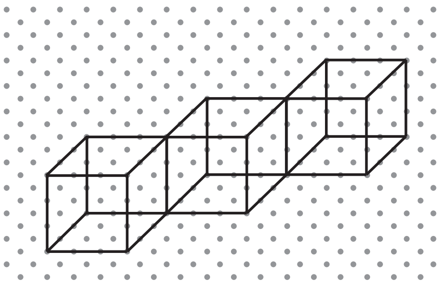
1.



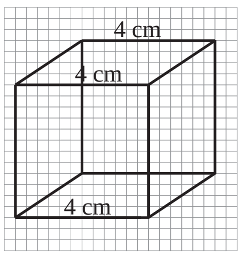
2.



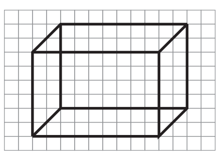
3.



4.

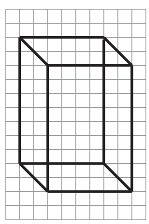


5. (i)



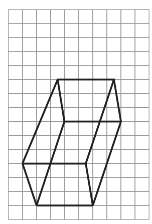
2 × 3 × 5 cm

(ii)



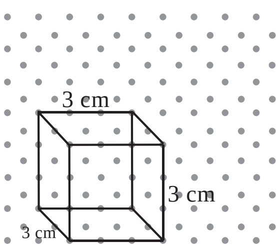
2 × 3 × 5 cm

(iii)

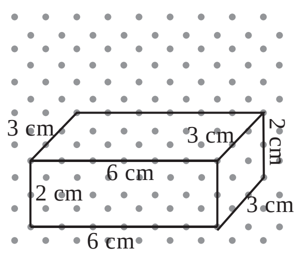


2 × 3 × 5 cm

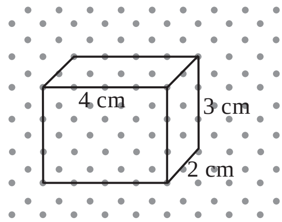
6. (a)



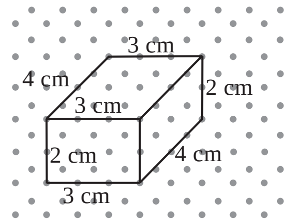
(b)



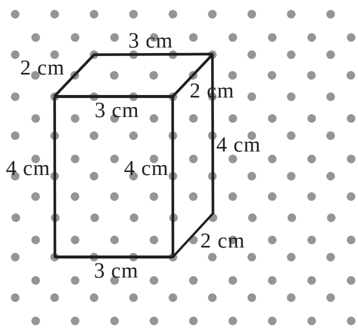
7. (i)



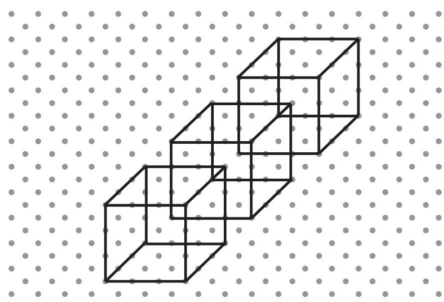
(ii)



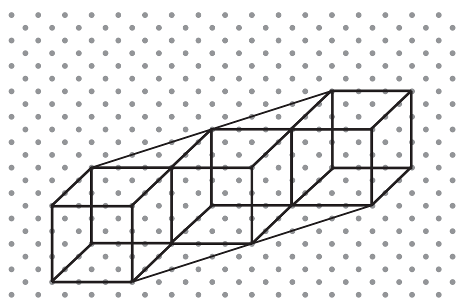
(iii)



8.



9.



10. Do it yourself

Multiple Choice Questions

Tick (3) the correct option :

1. (c) **2.** (a) **3.** (a) **4.** (a)

15 Perimeter and Area

Exercise 15.1

1. Find the area of a square whose side is given below. Also find its perimeter :

(a) side 4.8 cm

$$\text{Perimeter of square} = 4 \times \text{side}$$
$$= 4 \times 4.8 \text{ cm} = 19.2 \text{ cm}$$
$$\text{Area} = (\text{side})^2$$
$$= 4.8 \times 4.8 \text{ cm}^2 = 23.04 \text{ cm}^2$$

(b) side 35 m

$$\text{Perimeter of square} = 4 \times \text{side}$$
$$= 4 \times 35 \text{ m}$$
$$= 140 \text{ m}$$
$$\text{Area} = (\text{side})^2$$
$$= 35 \times 35 \text{ m}^2$$
$$= 1225 \text{ m}^2$$

(c) 44 mm

$$\text{Perimeter of square} = 4 \times \text{side}$$
$$= 4 \times 44 \text{ mm} = 176 \text{ mm or } 17.6 \text{ cm}$$
$$\text{Area} = (\text{side})^2 = (44)^2 = 1936 \text{ mm}^2 \text{ or } 19.36 \text{ cm}^2$$

(d) 2 m 50 cm.

$$\text{Perimeter of square} = 4 \times \text{side}$$
$$= 4 \times 2.5 \text{ m} = 10 \text{ m}$$
$$\text{Area} = (\text{side})^2$$
$$= 2.5 \text{ m}^2 = 6.25 \text{ m}^2$$

2.

$$\text{Length of a room} = 5.6 \text{ m or } 560 \text{ cm}$$
$$\text{Wide of a room} = 3.6 \text{ m or } 360 \text{ cm}$$
$$\text{Area of a room} = 560 \text{ cm} \times 360 \text{ cm} = 201600 \text{ cm}^2$$
$$\text{Length of square marble} = 10 \text{ cm}$$
$$\text{Weight of square marble} = 10 \text{ cm}$$
$$\text{Area of square marble} = 10 \times 10 \text{ cm}^2 = 100 \text{ cm}^2$$
$$\text{Required marble} = \frac{201600}{100} = 2016$$
$$\text{Cost of 2 tiles} = ` \ 5$$
$$\text{Cost of 1 tile} = ` \ \frac{5}{2}$$
$$\text{Cost of 2016 tiles} = ` \ \frac{5}{2} \times 2016 = ` \ 5040$$

Thus, cost of required titles is ` 5040.

3. Area of rectangle $= 24\,\text{cm}^2$

breadth $= 6\,\text{cm}$

length $= \dfrac{24}{6} = 4$ m.

4. Area of square $= 18050\,\text{m}^2$

length of diagonal $= \sqrt{2 \times \text{Area}}$

$= \sqrt{2 \times 18050}$

$= \sqrt{36100}$

$= \sqrt{190 \times 190}$

$= 190$

Thus, length of diagonal is 190 m.

5. Original length $= l$

Original breadth $= b$

Area $= l \times b$

New length $= 2l$

New breadth $= 2b$

Area $= 2l \times 2b = 4\,(l \times b)$

The area has quadrupled (increased 4 time).

6. Length of a door $= 2.6$ m

breadth of a door $= 1.1$ m

Area of door $= 2.6 \times 1.1\ \text{m}^2$

$= 2.86\ \text{m}^2$

Paining shall be done both sides

So , Area to be painted $= 2.86 \times 2$

$= 5.72\ \text{m}^2$

cost of painting per square metre = ` 20

cost of painting 5.72 m^2 = ` $20 \times 5.72$ = ` 114.40

7. Area of a square plot $= 400 \times 400\,\text{m}^2$

$= 160000\,\text{m}^2$

Area of 9 hectares $= 90000\,\text{m}^2$

Remaining plot $= 160000 - 90000 = 70000$

Cost of plot = ` 900 per metre square

= ` 70000×900

= ` 63000000

So, he will get 6 corre 30 lakh rupees.

8. Let breadth of room $= x$ m

Then, length of room $= 3 \times x = 3x$ m

Height of room $= 3$ m

Area of 4 walls of room $= 2\,(l + b) \times h$

$$= 2(x + 3x) \times 3\,\text{m}^2$$
$$= 2 \times 4x \times 3\,\text{m}^2$$
$$= 8x \times 3\,\text{m}^2 = 24x\,\text{m}^2$$

According to question; $144\,\text{m}^2 = 24x\,\text{m}^2$

$$x = \frac{144}{24} = 6$$

$l = 3 \times 6 = 18\,\text{m},\; b = 6\,\text{m}$

Area of flour $= l \times b$

$$= 18 \times 6 = 108\,\text{m}^2$$

9. length of a room $= 9.5$ m

breadth of a room $= 7.5$ m

height of a room $= 2.5$ m

Area of a room $= 2 \times (l + b) \times h$

$$= 2 \times (9.5 + 7.5) \times 2.5\,\text{m}^2$$
$$= 2 \times 17 \times 2.5\, m^2$$
$$= 85\,\text{m}^2$$

Area of a door $= 2 \times 3\,\text{m}^2 = 6\,\text{m}^2$

Area of two window $= 3.5 \times 2 \times 2 = 14\,\text{m}^2$

Area of wall $= 85 - (6 + 14)\,\text{m}^2$

$$= (85 - 20)\,\text{m}^2$$
$$= 65\,\text{m}^2$$

Cost of paining your wall $= 65 \times 5.60 =$ ` 364

10. Size of greeting card $= 10\,\text{cm} \times 6$ cm

Area of greeting card $= 10 \times 6 = 60\,\text{cm}^2$

Size of paper $= 1\,\text{m} \times 0.96$ m

$$= 100 \text{ cm} \times 96 \text{ cm}$$

Area of paper $= 9600\,\text{cm}^2$

Number of greeting card made by paper

$$= \frac{9600\,\text{cm}^2}{60\,\text{cm}^2}$$
$$= 160$$

Exercise 15.2

1. Calculate the area of the shaded region in each of the following figures.

(a) Area of $ABCD = 60 \times 50\,\text{m}^2 = 3000\,\text{m}^2$

Area of (i) square $= 8 \times 8\,\text{m}^2 = 64\,\text{m}^2$

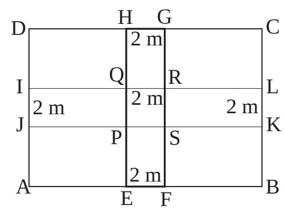
Area of (ii) square $= 64\,\text{m}^2$

$$\text{Area of (iii) square} = 64\ m^2$$
$$\text{Area of (iv) square} = 64\ m^2$$
$$\text{Area of shaded part} = 3000-(64+64+64+64)$$
$$= 3000-256\ m^2$$
$$= 2744\ m^2$$

(b) In this figure have two recentangle,

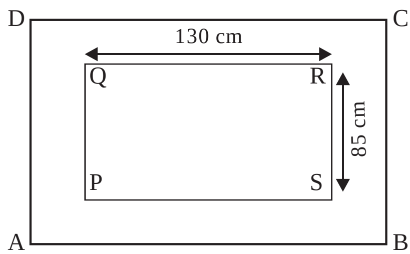
$$\text{Area of } ABCD = 7\times 2\ m^2 = 14\ m^2$$
$$\text{Area of } DEFG = 6\times 2\ m^2 = 12\ m^2$$
$$\text{Total Area} = (14+12)\ m^2$$
$$= 26\ m^2$$

2. *ABCD* represents the park and *EFGH* and *IJLK* represent the two cross roads.



$$\text{Area of road } EFGH = 2\times 30\ cm^2$$
$$= 60\ cm$$
$$\text{Area of } IJKL = 2\times 58\ cm^2$$
$$= 116\ cm^2$$
$$\text{Area of } PQRS = 2\times 2 = 4\ cm^2$$
$$\text{Area of road} = \text{Area of } EFGH + IJKL - PQRS$$
$$= 60+116-4$$
$$= 176-4 = 172\ cm^2$$

3. Area of $PQRS = 130\times 85\ m^2 = 11050\ m^2$



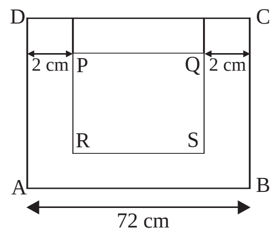
Area of *ABCD*

$$\text{Length of } AB = 130+4\times 2 = 138\ cm$$
$$\text{Length of } AD = 85+4\times 2 = 93\ cm$$
$$\text{Area of } ABCD = 138\times 93\ m^2 = 12834\ m^2$$
$$\text{Area of path} = 12834-11050\ m^2$$
$$= 1784\ m^2$$

4.
$$\text{Length of a rectangular park} = 100\ m$$
$$\text{Breadth of a rectangular park} = 65\ m$$
$$\text{Area of park} = 100\times 65\ m^2 = 6500\ m^2$$

Length of one flower bed $= 20\,\text{m}$
Breadth one flower bed $= 10\,\text{m}$
Area of one flower bed $= 20 \times 10\,\text{m}^2 = 200\,\text{m}^2$
Area of 6 flower bed $= 200 \times 6 = 1200\,\text{m}^2$
The remaining portion of park $= 6500 - 1200\,\text{m}^2$
$= 5300\,\text{m}^2$
Cost of laying the paths $=$ ` 5300×20
$=$ ` 10600

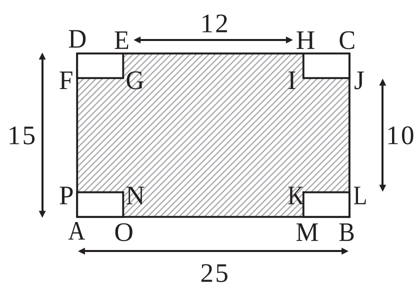
5. Area of *ABCD* $= 72 \times 72\,\text{m}^2$



$= 5184\,\text{m}^2$
Area of *PQRS* $= (72 - 2 \times 2) \times (72 - 2 \times 2)$
$= 68 \times 68\,\text{m}^2 = 4624\,\text{m}^2$
Area of path $=$ Area of *ABCD*
– Area of *PQRS*
$= 5184 - 4624\,\text{m}^2$
$= 560\,\text{m}^2$

6. Length of cardboard $= 12\,\text{cm}$
breadth of cardboard $= 10\,\text{cm}$
Area of cardboard $= 12 \times 10\,\text{cm}^2$
$= 120\,\text{cm}^2$
Length of photo $= 8\,\text{cm}$
breadth of photo $= 6\,\text{cm}$
Area of photo $= 8 \times 6\,\text{cm}^2$
$= 48\,\text{cm}^2$
Area of cardboard that is visible outside the photo $= 120 - 48\,\text{cm}^2$
$= 72\,\text{cm}^2$

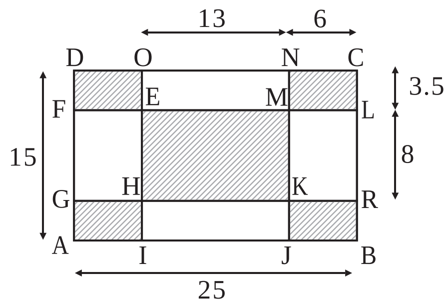
7. Area of *ABCD* $= 15 \times 25\ \text{m}^2 = 375\,\text{m}^2$



All the unshaded parts are equal
Length of one unshaded part $= (25 - 12) \div 2 = 6.5\ \text{m}$

$$\text{breadth of unshaded part} = (15-10)\div 2$$
$$= 2.5\text{ m}$$
$$\text{Area of}DEFG = 6.5\times 2.5$$
$$= 16.25\text{ m}^2$$
$$\text{Area of } HCIJ = 16.25\text{ m}^2$$
$$\text{Area of } PNAO = 16.25\text{ m}^2$$
$$\text{Area of } BLMK = 16.25\text{ m}^2$$
$$\text{Total Area of un shaded parts} = 16.25\times 4 = 65\text{ m}^2$$
$$\text{Area of shaded part} = 375-65\text{ m}^2 = 310\text{ m}^2$$

(b)

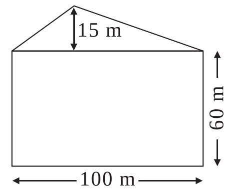


$$\text{Length of } AB = 25$$
$$\text{Length of } AD = 15$$
$$\text{Area of } ABCD = 25\times 15\text{ m}^2 = 375\text{ m}^2$$
$$\text{Area of } ONEM = \text{Area of } HKIJ$$
$$\text{Length} = 13\text{ m}$$
$$\text{breadth} = 3.5\text{ m}$$
$$\text{Area} = 13\times 3.5 = 45.5\text{ m}^2$$
$$\text{Area of two rectangle} = 45.5\times 2$$
$$= 91\text{ m}^2$$
$$\text{Area of } GHEF = \text{Area of } LRKM$$
$$\text{Length} = 8\text{ m}$$
$$\text{breadth} = 6\text{ cm}$$
$$\text{Area} = 8\times 6\text{ m}^2$$
$$= 48\text{ m}^2$$
$$\text{Area of two rectangle} = 48\times 2$$
$$= 96\text{ m}^2$$
$$\text{Total Area of unshaded part} = 91+96\text{ m}^2$$
$$= 187\text{ m}^2$$
$$\text{Area of shaded part} = 375-187\text{ m}^2$$
$$= 188\text{ m}^2$$

Exercise 15.3

1.

$$\text{Area of rectangle} = L \times b = 100 \times 60\,\text{m}^2 = 6000\,\text{m}^2$$



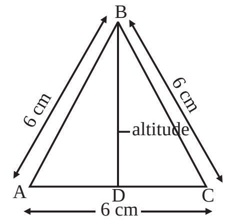
$$\text{Area of triangle} = \frac{1}{2}\,\text{base} \times \text{altitude} = \frac{1}{2} \times 100 \times 15 = 750\,\text{m}^2$$

$$\text{Area of figures} = (6000 + 750)\,\text{m}^2 = 6750\,\text{m}^2$$

2.

$$\text{Area of an equilateral triangle} = 9\sqrt{3}\,\text{cm}^2$$

$$\text{Length of each side} = 6\,\text{cm}$$



$$\because \quad \text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$9\sqrt{3}\,\text{cm}^2 = \frac{1}{2} \times AC \times BD$$

$$9\sqrt{3}\,\text{cm}^2 = \frac{1}{2} \times 6\,\text{cm} \times BD$$

$$\frac{9\sqrt{3}}{3}\,\text{cm} = BD$$

$$3\sqrt{3}\,\text{cm} = BD$$

$$BD = 3\sqrt{3}\,\text{cm}$$

3. Calculate the base of the triangle whose :

(a) Area $= 4.83\,\text{cm}^2$ and altitude = 2.3 cm.

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{altitude}$$

$$4.83 = \frac{1}{2} \times \text{base} \times 2.3\,\text{cm}$$

$$\text{base} = \frac{4.83 \times 2}{2.3}\,\text{cm} = 4.2\,\text{cm}$$

(b) Area = 9.38 m^2 and altitude = 2.8 m.

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{altitude}$$

$$9.38 = \frac{1}{2} \times \text{base} \times 2.8$$

$$\text{base} = \frac{9.38 \times 2}{2.8} = 6.7\,\text{cm}$$

(c) Area = 11.4 cm^2 and altitude = 4 cm.

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{Altitude}$$

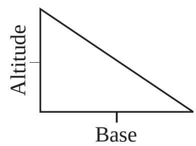
$$11.4 = \frac{1}{2} \times \text{base} \times 4$$

$$\text{base} = \frac{11.4 \times 2}{4} = 5.7 \text{ cm}$$

4. $$\text{Area of a right triangle} = 6\,\text{cm}^2$$

$$\text{Base} = 3\,\text{cm}$$

$$\text{Area} = \frac{1}{2} \times \text{Base} \times \text{Altitude}$$



$$6 = \frac{1}{2} \times 3 \times \text{Altitude}$$

$$\text{Altitude} = \frac{6 \times 2}{3} = 4 \text{ cm}$$

By Pythogoras;

$$\begin{aligned}(\text{Hypotenuse})^2 &= (\text{Base})^2 + (\text{Altitude})^2 \\ &= (3\,\text{cm})^2 + (4\,\text{cm})^2 \\ &= (9+16)\,\text{cm}^2 \\ &= 25\,\text{cm}^2 \\ \text{Hypotenuse} &= \sqrt{25} = 5\,\text{cm}\end{aligned}$$

So, one side is 4 cm and other is 5 cm.

5. Calculate the area of each :

(a) $$\begin{aligned}\text{Area of triangle} &= \frac{1}{2} BC \times AD \\ &= \frac{1}{2} \times 2.2 \times 4.9 \text{ cm}^2 \\ &= 1.1 \times 4.9 \text{ cm}^2 \\ &= 5.39 \text{ cm}^2\end{aligned}$$

(b) $$\begin{aligned}\text{Area of triangle} &= \frac{1}{2} PQ \times QR \\ &= \frac{1}{2} \times 2.7 \times 5.8 \text{ cm}^2 \\ &= 7.83 \text{ cm}^2\end{aligned}$$

6. $$\begin{aligned}\text{Length of right triangle} &= 90\,\text{m} \\ \text{Breadth of right triangle} &= 120\,\text{m} \\ \text{Area of right triangle} &= \frac{1}{2} \times 90\,\text{cm} \times 120\,\text{cm} \\ &= 5400\,\text{m}^2 \\ \text{Cost of levelling} &= \text{\` } 5400 \times 12 \\ &= \text{\` } 64800.\end{aligned}$$

7. Side of triangle $= 17\,\text{cm}$, 10 cm, 9 cm

$a = 17\,\text{cm},\ b = 10\,\text{cm},\ c = 9\,\text{cm}$

$$S = \frac{a+b+c}{2}$$

$$S = \frac{17+10+9}{2}$$

$$= \frac{36}{2} = 18$$

$$\text{Area of triangle} = \sqrt{S\,(S-a)(S-b)(S-c)}$$

$$= \sqrt{18(18-17)(18-10)(18-9)}\ \text{cm}^2$$

$$= \sqrt{18\times 1\times 8\times 9}\ \text{cm}^2$$

$$= \sqrt{1296}\ \text{cm}^2$$

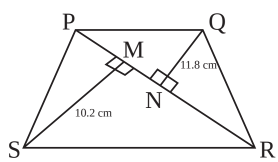
$$= 36\,\text{cm}^2$$

Area of triangle is 36 cm^2

8. Let $PQRS$ be the given quadrilateral. PR is the given diagonal SM PR and QN PR.

$PR = 28$ cm, $SM = 10.2\,\text{cm}$ and $QN = 11.8\,\text{cm}$

Area of quadrilateral $PQRS$ = area of ΔPQR + area of ΔPRS



$$= \frac{1}{2}\times PR\times NQ + \frac{1}{2}\times PR\times SM$$

$$= \frac{1}{2}\times PR\times (SM + QN)$$

$$= \frac{1}{2}\times 28\times [10.2 + 11.8]$$

$$= \frac{1}{2}\times 28\times 22\,\text{cm}^2$$

$$= 14\times 22\ \text{cm}^2 = 308\,\text{cm}^2$$

Hence, the area of the quadrilateral is 308 cm^2.

9. Sides of triangle $= 40\,\text{m}$, 37 m, 13 m

$a = 40\,\text{m},\ b = 37\,\text{m},\ c = 13\,\text{m}$

$$S = \frac{a+b+c}{2} = \frac{40+37+13}{2} = \frac{90}{2} = 45$$

$$\text{Area or triangle} = \sqrt{S\,(S-a)(S-b)(S-c)}$$

$$= \sqrt{45(45-40)(45-37)(45-13)}\ \text{m}^2$$

$$= \sqrt{45\times 5\times 8\times 32}\ \text{m}^2$$

$$= \sqrt{57600}\ \text{m}^2$$

$$= 240\,\text{m}^2$$

Area of plot is 240 m^2.

10. Ratio of a triangle side $= 3 : 4 : 5$

Sides are $3x$, $4x$, $5x$

Perimeter $= 24$ cm

(sum of sides)

$$(3x + 4x + 5x) = 24$$
$$12x = 24$$
$$x = 24 \div 12 = 2$$

one side $= 3 \times 2 = 6$ cm; second side $4 \times 2 = 8$ cm

Third side $= 5 \times 2 = 10$ cm

$$S = \frac{a+b+c}{2}$$
$$= \frac{6+8+10}{2}$$
$$= \frac{24}{2} = 12 \text{ cm}$$

Area of triangle $= \sqrt{S\,(S-a)(S-b)(S-c)}$

$$= \sqrt{12(12-6)(12-8)(12-10)}$$
$$= \sqrt{12 \times 6 \times 4 \times 2}$$
$$= \sqrt{576} = 24$$

Area of triangle 24 cm^2.

Exercise 15.4

1. Find the area of the parallelogram whose :

(a) Base = 5.6 cm and height = 4.2 cm.

Area $= 5.6 \times 4.2$

$= 23.52 \text{ cm}^2$

(b) Base = 6.4 cm and height = 3.6 cm.

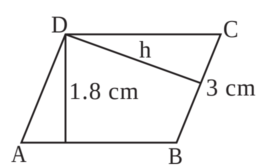
Area $= 6.4 \times 3.6 \text{ cm}^2$

$= 23.04 \text{ cm}^2$

2. Area of parallelelogram $=$ base $\times$ altitude

$= 1.8 \times 4$

$= 7.2 \text{ cm}^2$



Area of parallelelogram $=$ base $\times$ altitude

$$7.2 = 3 \times h$$
$$h = \frac{7.2}{3} = 2.4$$

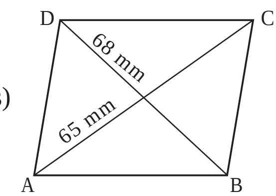
height $= 2.4$ cm.

3. Area of a rhombus $= 202.4 \text{ cm}^2$

$$\text{One diagonals} = 18.4 \text{ cm}$$
$$\text{Let other diagonals} = x$$
$$\text{Area of rhombus} = \frac{1}{2} \times \text{product of diagonals}$$
$$202.4 = \frac{1}{2} \times 18.4 \times x$$
$$x = \frac{202.4 \times 2}{18.4}$$
$$= 22 \text{ cm}$$

Other side of rhombus is 22 cm.

4.
$$\text{Diagonals} = 8 \text{ cm } 8 \text{ mm} = 88 \text{ mm}$$
$$= 6 \text{ cm } 5 \text{ mm or } 65 \text{ mm}$$



$$\text{Area of rhombus} = \frac{1}{2} (\text{product of diagonals})$$
$$= \frac{1}{2} \times 88 \times 65 \text{ mm}^2$$
$$= 44 \times 65 \text{ mm}^2$$
$$= 2860 \text{ mm}^2.$$

5.
$$\text{Side of a parallelogram} = 8.2 \text{ cm}$$
$$\text{corresponding altitude} = 6.2 \text{ cm}$$
$$\text{Area of the parallelogram} = \text{base} \times \text{altitude}$$
$$= 8.2 \times 6.2 \text{ cm}^2$$
$$= 50.84 \text{ cm}^2$$

Divided into 3 parts

$$\text{Area of each parallelogram} = 50.84 \div 3 = 16.95 \text{ cm}^2.$$

6.
$$\text{Area of a parallelogram} = 6.25 \text{ m}^2$$
$$\text{Altitude} = 5.0 \text{ m}$$
$$\text{Corresponding} = \frac{\text{Area}}{\text{Altitude}}$$
$$= \frac{6.25}{5.0} = 1.25 \text{ m}$$

Corresponding base is 1.25 m.

7. Find the area of each of the following parallelograms :

(a)
$$\text{Base } (PQ) = 2 \text{ cm}$$
$$\text{Altitude} = 4.5 \text{ cm}$$
$$\text{Area of parallelogram} = \text{Base} \times \text{Altitude}$$
$$= 2 \times 4.5$$
$$= 9 \text{ cm}^2$$

(b)
$$\text{Base} = 5.8 \text{ cm}$$

$$\text{Altitude} = 6.5 \text{ cm}$$
$$\begin{aligned}\text{Area of parallelogram} &= \text{Base} \times \text{Altitude}\\ &= 5.8 \times 6.5 \text{ cm}^2\\ &= 37.7 \text{ cm}^2\end{aligned}$$

(c)
$$\begin{aligned}\text{Base} &= 5.2 \text{ cm}\\ \text{Altitude} &= 3 \text{ cm}\\ \text{Area of parallelogram} &= \text{Base} \times \text{Altitude}\\ &= 5.2 \times 3 \text{ cm}^2\\ &= 15.6 \text{ cm}^2\end{aligned}$$

Exercise 15.5

1. Find the circumference of a circle whose diameter is :

$$\textbf{circumference} = \boldsymbol{2\pi r}$$

or $\pi \times d$ (Where d = diameter)

(a)
$$\begin{aligned}\text{Diameter} &= 2.8 \text{ m}\\ \text{circumference} &= \pi \times d\\ &= \frac{22}{7} \times 2.8 \text{ m}\\ &= 8.8 \text{ m}\end{aligned}$$

(b)
$$\begin{aligned}\text{Diameter} &= 35 \text{ cm}\\ c &= \pi \times d\\ c &= \frac{22}{7} \times 35 = 110 \text{ cm}\end{aligned}$$

(c)
$$\begin{aligned}\text{Diameter} &= 4.2 \text{ cm}\\ c &= \pi \times d\\ &= \frac{22}{7} \times 4.2 \text{ cm} = 13.2 \text{ cm}\end{aligned}$$

2.
$$\begin{aligned}\text{Circumference} &= 26.4 \text{ m}\\ \text{Circumference} &= 2\pi r\\ 26.4 \text{ m} &= 2 \times \frac{22}{7} \times r\\ r &= \frac{26.4 \times 7}{2 \times 22} = 4.2\\ \text{Radius} &= 4.2 \text{ cm}\\ \text{Diameter} &= 4.2 \times 2 = 8.4 \text{ cm}\end{aligned}$$

3.
$$\begin{aligned}\text{Diameter of the park} &= 700 \text{ m}\\ \text{Circumference} &= \pi \times d\\ &= \frac{22}{7} \times 700 \text{ m} = 2200 \text{ m}\\ \text{Distance cover in 1 times daily} &= 2200 \text{ m}\\ \text{distance cover in 5 times} &= 2200 \times 5\end{aligned}$$

$$= 11000 \text{ m or } 11 \text{ km.}$$

4.
$$\begin{aligned}
\text{Ratio of two radii} &= 8 : 10 \\
\text{Length of one radius} &= 8x \\
\text{Length of second radius} &= 10x
\end{aligned}$$

For one circle :

$$\begin{aligned}
\text{circumference} &= 2\pi r \\
\text{circumference} &= 2 \times \pi \times 8x = 16x\pi
\end{aligned}$$

For second circle :

$$\begin{aligned}
\text{circumference} &= 2\pi \times 10x = 20x\pi \\
\text{Ratio of circumference} &= 16x\pi : 20x\pi \\
&= 4 : 5
\end{aligned}$$

5.
$$\begin{aligned}
\text{Circumference of one circle} &= 121 \text{ cm} \\
2\pi r &= 121 \\
2 \times \frac{22}{7} \times r &= 121 \\
r &= \frac{121 \times 7}{2 \times 22} \\
&= 19.25 \text{ cm} \\
\text{Circumference of second circle} &= 154 \text{ cm} \\
2\pi r &= 154 \\
2 \times \frac{22}{7} \times r &= 154 \\
r &= \frac{154 \times 7}{2 \times 22} \\
&= 24.5 \text{ cm} \\
\text{Difference} &= 24.5 \text{ cm} - 19.25 \text{ cm} \\
&= 5.25 \text{ cm}
\end{aligned}$$

6.
$$\begin{aligned}
\text{Length of radius of one circle} &= 84 \text{ cm} \\
\text{circumference} &= 2\pi r = 2 \times \frac{22}{7} \times 84 = 528 \text{ cm} \\
\text{Length of radius of second circle} &= 98 \text{ cm} \\
\text{circumference} &= 2 \times \frac{22}{7} \times 98 = 616 \text{ cm} \\
\text{Difference} &= 616 - 528 = 88 \text{ cm}
\end{aligned}$$

So, second circle has more circumference by 88 cm.

7.
$$\begin{aligned}
\text{Diameter of circle} &= 5.6 \text{ m} \\
\text{Radius} &= \frac{5.6}{2} = 2.8 \text{ cm} \\
\text{Circumference} &= 2\pi r = 2 \times \frac{22}{7} \times 2.8 = 17.6 \text{ m}
\end{aligned}$$

8. Length of rectangle $= 35$ cm

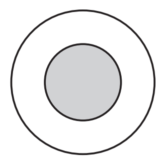
$$
\begin{aligned}
\text{Breadth of rectangle} &= 20\,\text{cm}\\
\text{Perimeter of rectangle} &= 2(l+b)\\
&= 2(35+20) = 2\times 55 = 110\,\text{cm}\\
\text{Circumference of circle} &= \text{perimeter of rectangle}\\
\text{Circumference of circle} &= 2\pi r\\
110\,\text{cm} &= \frac{2\times 22}{7}\times r\\
r &= \frac{7\times 110}{2\times 22}\\
&= 17.5\text{ cm}\\
\text{Diameter} &= 2r\\
&= 2\times 17.5\\
&= 35\,\text{cm.}
\end{aligned}
$$

9.

$$
\begin{aligned}
\text{Diameter of the wheel truck} &= 98\,\text{cm}\\
\text{circumference} &= \pi\times d\\
&= 98\times\frac{22}{7}\text{ cm}\\
&= 308\,\text{cm}\\
\text{Distance covered by wheel in 25 revolutions} &= 25\times 308\,\text{cm}\\
&= 7700\,\text{cm or 77 m.}
\end{aligned}
$$

10.

$$
\begin{aligned}
\text{Circumference of inner track} &= 200\text{ m}\\
2\pi r &= 200\,\text{m}\\
2\times\frac{22}{7}\times r &= 200\,\text{m}\\
r &= \frac{200\times 7}{22\times 2}\\
&= 31.82\text{ m}\\
\text{circumference of outer track} &= 220\,\text{m}\\
2\pi r &= 220\,\text{m}\\
2\times\frac{22}{7}\times r &= 220\,\text{m}\\
r &= \frac{220\times 7}{2\times 22}\\
&= 35\,\text{m}\\
\text{width of track} &= (35-31.82)\text{ m}\\
&= 3.18\text{ m}
\end{aligned}
$$



200 m

Exercise 15.6

1. Find the radius of a circle whose area is :

(a) Area $= 616\text{ m}^2$

Area $= \pi r^2$

(b) Area $= 2\pi\text{cm}^2$

Area $= \pi r^2$

$616\,m^2 = \frac{22}{7} \times r^2$ $\quad 2\pi cm^2 = \pi r^2$

$r^2 = \frac{616 \times 7}{22} m^2 = 196\,m^2$ $\quad r^2 = \frac{2\pi}{\pi} cm^2$

$r = \sqrt{196}\,m = 14\,m$ $\quad r = \sqrt{2}\,cm$

2. Find the diameter of a circle whose area is :

(a) Area $= 50.24\ m^2$

$$\text{Area } m^2 = \pi r^2$$
$$50.24\ m^2 = 3.14 \times r^2$$
$$r^2 = \frac{50.24}{3.14} m^2$$
$$r^2 = 16\,m^2$$
$$= 4\,m$$
$$d = 2r = 4 \times 2 = 8\,m$$

(b) Area $= 314\ m^2$

$$\text{Area} = \pi r^2$$
$$314 = 3.14 \times r^2$$
$$r^2 = \frac{314}{3.14} m^2$$
$$r^2 = 100\ m^2$$
$$r = 10\,m$$
$$d = 2r = 2 \times 10 = 20\,m$$

3.

$$\text{Area of circle} = 6.16\ cm^2$$
$$\pi r^2 = 6.16\ cm^2$$
$$r^2 = \frac{6.16 \times 7}{22}$$
$$= 1.96\ cm^2$$
$$r = \sqrt{1.96}\,cm$$
$$= 1.4\ cm$$
$$\text{Circumference of circle} = 2\pi r$$
$$= \frac{2 \times 22}{7} \times 1.4$$
$$= 8.8\ cm$$

4.

$$\text{Radius of outer circle} = 11\,m$$
$$\text{Radius of inner circle} = 4\ m$$
$$\text{Area of outer circle} = \pi r^2$$
$$= \frac{22}{7} \times 11 \times 11\,m^2$$
$$\text{Area of inner cirlce} = \pi r^2$$
$$= \frac{22}{7} \times 4 \times 4\ m^2$$
$$\text{Area of the ring} = \text{outer circle} - \text{inner circle}$$
$$= \frac{22}{7} \times 11 \times 11 - \frac{22}{7} \times 4 \times 4$$
$$= \frac{22}{7}(121 - 16)\,m^2$$
$$= \frac{22}{7} \times 105\,m^2$$

$= 330\text{ m}^2$

So, Area of ring $= 330\text{ m}^2$

Cost of painting per m^2 $=$ ₹ 21

cost of painting of ring $=$ ₹ 330×21

$=$ ₹ 6930.

5. Let radius $= r$ cm

Thus, circumference $= 2\pi r$ cm

Circumference $-$ radius $= 37$ cm

$$2\pi r - r = 37$$

$$2 \times \frac{22}{7} \times r - r = 37$$

$$\frac{44r - 7r}{7} = 37$$

$$\frac{37r}{7} = 37$$

$$r = \frac{37 \times 7}{37}$$

$$= 7$$

$$r = 7\text{ cm}$$

Thus, Area of circle $= \pi \times r^2 = 7 \times 7 \times \frac{22}{7} = 154\text{ cm}^2$.

6. Area of rectangle $ABCD$ $= AB \times BC$

$= 60\text{ cm} \times 28\text{ cm}$

$= 1680\text{ cm}^2$

Diameter of cemicircle $= CB = 28$ cm

Radius $= 14$ cm $(28 \div 2 = 14\text{ cm})$

Area of circle $= \pi r^2$

$= \frac{22}{7} \times 14 \times 14\text{ cm}^2$

$= 616\text{ cm}^2$

Area of semi circle $= \frac{1}{2} \times$ Area of circle

$= \frac{1}{2} \times 616$

$= 308\text{ cm}^2$

Area of plot with out grass $=$ Area of $ABCD$ $-$ Area of semi circle

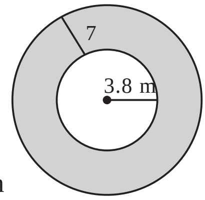
$= 1680 - 308$

$= 1372\text{ cm}^2$.

7. Inner circumference $= 242$ m

$$2\pi r = 242\text{ m}$$

$$2 \times \frac{22 \times r}{7} = 242$$



$$r = \frac{242 \times 7}{22 \times 2}$$

$$= 38.5 \text{ m}$$

Outer radius $= 38.5 + 7 \text{ m} = 45.5 \text{ m}$

Area of inner circle $= \pi r^2$

$$= \frac{22}{7} \times 38.5 \times 38.5 = 4658.5 \text{ m}^2$$

Area of outer circle $= \pi r^2$

$$= \frac{22}{7} \times 45.5 \times 45.5$$

$$= 6506.5 \text{ m}^2$$

Area of track = Outer area of track − inner area of track

Area of track $= 6506.5 \text{ m}^2 - 4658.5 \text{ m}^2 = 1848 \text{ m}^2$.

8. Area of outer part $= 1886.5 \text{ cm}^2$

Area of inner part $= 1386 \text{ cm}^2$

Let raidus of outer part $= r_1$

and radius of inner part $= r_2$

than, $\pi r_1^2 = 1886.5 \text{ cm}$

$$\frac{22}{7} \times r_1^2 = 1886.5$$

$$r_1^2 = \frac{1886.5 \times 7}{22}$$

$$r_1^2 = 600.25$$

$$r_1 = \sqrt{600.25}$$

$$r_1 = 24.5 \text{ cm}$$

$$\pi r_2^2 = 1368 \text{ cm}$$

$$\frac{22}{7} \times r_2^2 = 1386$$

$$r_2^2 = \frac{1386 \times 7}{22}$$

$$r_2^2 = \frac{1386 \times 7}{22}$$

$$r_2 = \sqrt{441}$$

$$r_2 = 21 \text{ cm}$$

So, width of the ring $= r_1 - r_2$

$$= 24.5 \text{ cm} - 21 \text{ cm}$$

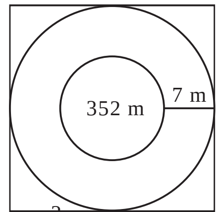
$= 3.5 \text{ cm}$

9. Circumference of circular park $= 352 \text{ m}$

$2\pi r_1 = 352 \text{ m}$

$2 \times \frac{22}{7} \times r_1 = 352 \text{ m}$

$r_1 = \frac{352 \times 7}{2 \times 22} = 56 \text{ m}$



Area of outer ring $= \pi r_1^{\,2}$

outer radius $= 56 + 7 = 63 \text{ m}$

Area of outer ring $= \frac{22}{7} \times 63 \times 63 = 12474 \text{ m}^2$

Area of inner ring $= \pi r_1^{\,2}$

$\frac{22}{7} \times 56 \times 56 = 9856 \text{ m}^2$

Area of road $= 12474 \text{ m}^2 - 9856 \text{ m}^2 = 2618 \text{ m}^2$.

10. Perimeter of square $= 4 \text{ side}$

$132 = 4 \times \text{side}$

$\text{side} = \frac{132}{4} = 33$

Area of square $= (\text{side})^2 = 33 \times 33 = 1089 \text{ cm}^2$

Circumference of circle $= 132 \text{ cm} = 2\pi r$

$132 \text{ cm} = 2 \times \frac{22}{7} \times r$

$r = \frac{132 \times 7}{2 \times 22} = 21 \text{ cm}$

Area of circle $= \pi r^2$

$= \frac{22}{7} \times 21 \times 21$

$= 1386 \text{ cm}^2$

Difference $= 1386 \text{ cm}^2 - 1089 \text{ cm}^2 = 297 \text{ cm}^2$

So, area of circle is greater by 297 cm^2.

11. Side of equilateral triangle $= 12 \text{ cm}$

Area of equilateral triangle $= \frac{\sqrt{3}}{4} \times (\text{side})^2$

$= \frac{\sqrt{3}}{4} \times 12 \times 12$

$= \frac{1.732}{4} \times 12 \times 12 = 62.352 \text{ cm}^2$

$$\text{Area of circle} = \pi r^2 = \frac{22}{7} \times 3.5 \times 3.5 = 38.5 \text{ cm}^2$$

$$\text{Area of shaded part} = 62.352 \text{ cm}^2 - 38.5 \text{ cm}^2 = 23.852 \text{ cm.}$$

12.

$$\text{Side of squares} = 21 \text{cm}$$

$$\text{Area of squares} = 21 \times 21 = 441 \text{cm}^2$$

$$4 \times \frac{1}{4} \text{ circle} = 1 \text{circle}$$

$$\text{diameter} = 21 \text{cm}$$

$$\text{radius} = 21 \div 2 = 10.5 \text{ cm}$$

$$\text{Area of circle} = 10.5 \times 10.5 \times \frac{22}{7} = 346.5 \text{ cm}^2$$

$$\text{Area of shaded part} = 441 - 346.5 \text{ cm}^2 = 94.5 \text{ cm}^2$$

Multiple Choice Questions

Tick (3) the correct option :

1. (c) **2.** (c) **3.** (b) **4.** (b) **5.** (b)

High Order Thinking Skills (HOTS)

1.

$$\text{Let side of square} = 7 \text{cm}$$

$$\text{Perimeter of equre} = 4 \times 7 \text{ cm}$$

$$= 28 \text{cm}$$

$$\text{Radius of circle} = 7 \text{cm}$$

$$\text{Perimeter of circle} = 2 \times \frac{22}{7} \times 7 \text{cm} = 44 \text{cm}$$

Here, we see that the perimeter of circle is greater than sequare.

2. In first figure :

$$\text{side of square} = 16 \text{cm}$$

$$\text{Area} = 16 \times 16 \text{cm}^2 = 256 \text{cm}^2$$

$$\text{Area of circle} = \pi r^2$$

$$r = 16 \div 2 = 8$$

$$= 3.14 \times 8 \times 8 = 200.96 \text{ cm}^2$$

Area of shaded part

$$(256 - 200.96) \text{ cm}^2 = 55.04 \text{ cm}^2$$

In second figure :

$$\text{Radius of one circle} = \frac{1}{2} \times 4 \text{ cm} = 2 \text{cm}$$

$$\text{Area} = \pi r^2 = \frac{22}{7} \times 2 \times 2 \text{ cm}$$

$$= 3.14 \times 2 \times 2 = 12.56 \text{ cm}^2$$

$$\text{Area of 16 circle } = 12.56 \times 16 = 200.96 \text{ cm}^2$$
$$\text{Area of square } = 16 \times 16 = 256 \text{ cm}^2$$
$$\text{Area of shaded part } = 256 - 200.96 \text{ cm}^2 = 55.04 \text{ cm}^2$$

16 Data Handing

Exercise 16.1

1. Ten odd number $= 1, 3, 5, 7, 9, 11, 13, 15, 17, 19$

$$\text{mean} = \frac{\text{sum of odd number}}{\text{Number}}$$

$$\text{mean} = \frac{1+3+5+9+11+13+15+17+19}{10}$$

$$= \frac{100}{10} = 10$$

$$\text{mean} = 10$$

2. Mean $= 75$, Number $= 35$

$$\text{Sum of Numbers } = 75 \times 35$$
$$= 2625$$
$$\text{Every number multiplied by 4 } = 2625 \times 4$$
$$= 10500$$
$$\text{New mean } = \frac{10500}{75} = 140$$

$$\text{Mean } = 140.$$

3. The scores 13, 9, 10, 12, 1, 3, 4, 4

$$\text{Arithmetic mean} = \frac{\text{Sum of all observations}}{\text{Number of obscrvations}}$$

$$= \frac{13+9+10+12+1+3+4+4}{8}$$

$$= \frac{56}{8} = 7$$

$$\text{mean } = 7$$

4. First 11 prime number $= 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31$

$$\text{mean} = \frac{2+3+5+7+11+13+17+19+23+29+31}{11}$$

$$= \frac{160}{11} = 14.54$$

5. Frequency distribution table :

Members of families	Tally mark	Frequency
2	|	1

3	|	1
5	||||	4
6	~~||||~~ |	6
7	~~||||~~	5
8	|||	3
Total		20

(a) The smallest family size is 1.
2 families are of the smallest size.

(b) 6 is the most common family size.

6. Calculate the arithmetic of mean the following scores :

(a) Scores : 10, 32, 14, 42, 20, 22, 38, 34, 27, 16, 9, 18, 17, 25, 36

$$\text{Arithmetic mean} = \frac{\text{Sum of scores}}{\text{Number of scores}}$$

$$= \frac{10+32+14+42+20+22+38+34+27+16+9+18+17+25+36}{15}$$

$$= \frac{360}{15} = 24$$

(b) Scores : 3.8, 4.2, 3.3, 3.7, 4, 3.7, 4.6, 3.9, 4.4, 4.4

$$\text{Arithmetic mean} = \frac{\text{Sum of scores}}{\text{Number of scores}}$$

$$= \frac{3.8+4.2+3.3+3.7+4+3.7+4.6+3.9+4.4+4.4}{10}$$

$$= \frac{40}{10} = 4$$

7.

$$\text{Mean} = 9$$

$$\text{number} = 6$$

$$\text{Mean} = \frac{\text{Sum of number}}{\text{number}}$$

$$9 = \frac{5+7+a+8+10+11}{6}$$

$$9 \times 6 = 41 + a$$

$$54 = 41 + a$$

$$-a = 41 - 54$$

$$-a = -13$$

$$a = 13$$

8. Number of player $= 11$

scores of players $= 18, 5, 20, 61, 35, 16, 50, 0, 3, 20, 14$

$$\text{Average score} = \frac{\text{Sum of scores}}{\text{Number of players}}$$

$$= \frac{18+5+20+61+35+16+50+0+3+20+14}{11}$$

$$= \frac{242}{11} = 22$$

Thus, average score is 22.

9. Frequency distribution table.

Members of Families	Tally mark	Frequency
9	$\cancel{||||}$ |	6
12	||||	4
17	||||	4
18	||	2
19	||||	4
20	|||	3
25	||	2
	Total Students	25

(a) Range of marks $= 25 - 9 = 16$

(b) 25 is the highest mark. (c) 9 marks.

10. If mean $= 27$, number $= 5$

Sum of number $= 27 \times 5 = 135$

Let x be added,

$$\text{New sum} = 135 + x$$

$$\text{Mean} = 25$$

$$\text{Mean} = \frac{\text{Sum of mean}}{\text{Number}}$$

$$25 = \frac{135 + x}{6}$$

$$25 \times 6 = 135 + x$$

$$150 = 135 + x$$

$$x = 150 - 135 = 15$$

Thus, 15 is added.

11.

$$\text{Mean} = 8$$

$$\text{Mean} = \frac{\text{Sum of number}}{\text{Number}}$$

$$8 = \frac{5+9+6+x+3}{5}$$

$$40 = 23 + x$$

$$-x = 23 - 40$$

$$-x = -17$$

$$x = 17$$

12.

Weekly wages	Tally marks	Workers
150	|||	3
200	$\cancel{\|\|\|\|}$	5
250	||||	4
300	||	2
350	|	1
	Total workers	15

(a) Range $350-150=200$.
(b) 1 worker is getting ` 350.
(c) 3 workers are getting the minimum wages.

Exercise 16.2

1. Ascending Order
49, 60, 70, 75, 78, 78

$$n = 6$$

Now, the two middle items are 3th and 4th and their value are 70 and 75.

Median $=$ mean of 70 and 75 $= \dfrac{70+75}{2} = 72.5$

Mode $= 78$.

2. Number arrange in ascending order 1, 2, 3, 4, 5, 6, 6.

$$N = 7$$

$$\text{Median} = \frac{n+1}{2} \text{ th term}$$

$$\frac{7+1}{2} \text{ th term } \frac{8}{2} \text{ th term} = 4 \text{ th term}$$

$$\text{Median} = 4$$

And, $\quad \text{Mode} = 6$

3. Ascending order of marks
5, 9, 10, 12, 15, 16, 19, 20, 20, 20, 20, 20, 23, 24, 25

$$n = 15$$

$$\text{Median} = \frac{n+1}{2}\text{th term} = \frac{15+1}{2}\text{th term}$$

$$= \frac{16}{2}\text{th term} = 8 \text{ th term} = 20$$

$$\text{Median} = 20$$

$$\text{Mode} = 20$$

4. Ascending Order $=$ 12, 12, 13, 13, 14, 14, 14, 16, 19

$$n = 9$$

$$\text{median} = \frac{n+1}{2}\text{th term}$$

$$= \frac{9+1}{2}\text{ th term} = \frac{10}{2}\text{th term} = 5\text{ th term}$$

$$\text{Median} = 14$$

$$\text{Mode} = 14.$$

5. (a) Mode $= 7$ (b) Mode $= 6$ and 3

Exercise 16.3

1. (a) Bar graph shows the number of news paper published in 8 languages.

(b) Total number of newspapers published in English, Hindi, Bengali and Punjabi.

$4500 + 3000 + 3200 + 1000 = 11700.$

(c) The excess number of newspapers published in English over these published in Bengali $4500 - 3200 = 1300.$

(d) Percent is the number of newspapers published in English of the total number of newspaper.

$$\frac{4500}{21500} \times 100 = \frac{900}{43}$$

$$= 20\frac{40}{43}\%$$

2. (a) Bar graph shows the number of vehicles passing through a particular crossing.

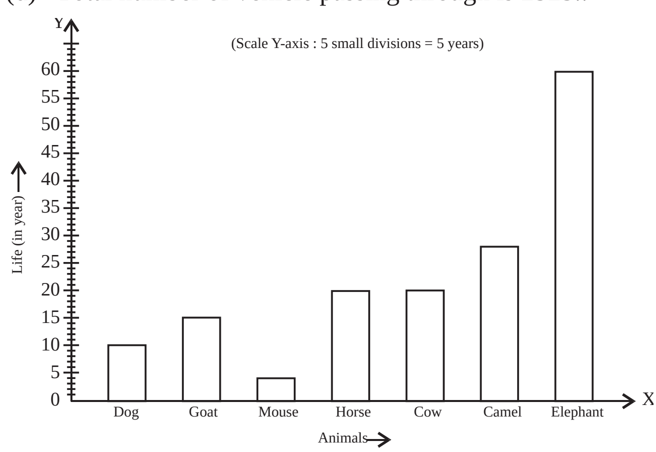
(b) The hourly traffic is maximum between 9-10 am. The maximum number of vehicles passed in this period is 400.

(c) The hourly traffic is minimum between 12 noon-1 pm.

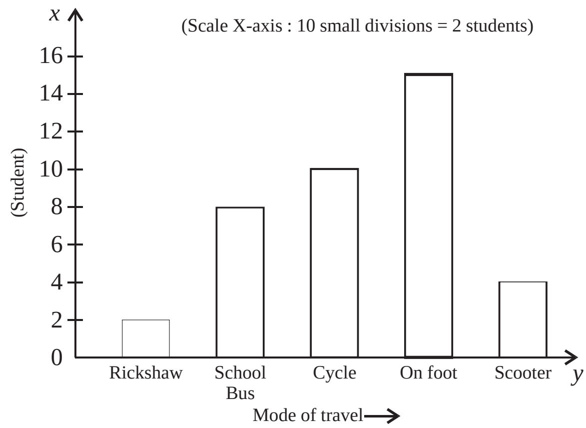
The minimum number of vehicles passed in this period is 150.

(d) Total number of vehicle passing through is 2525..

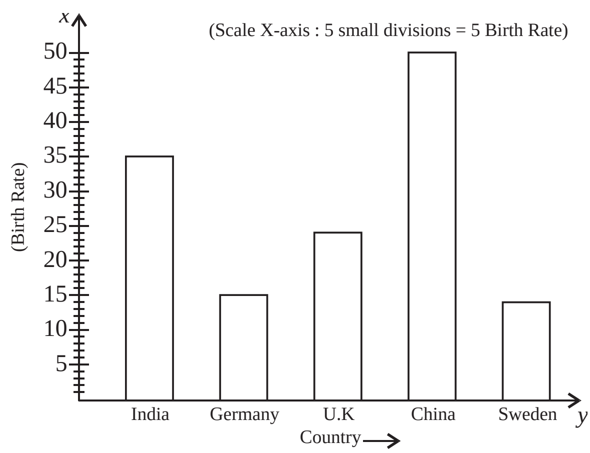
3.



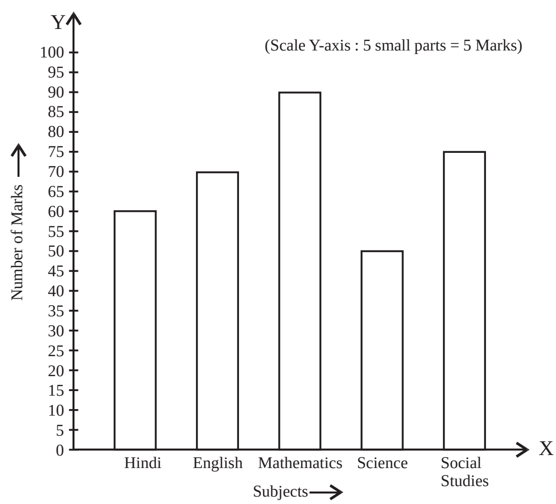
4.


(Scale X-axis : 10 small divisions = 2 students)
x
(Student)
16
14
12
10
8
6
4
2
0
Rickshaw
School Bus
Cycle
On foot
Scooter
y
Mode of travel

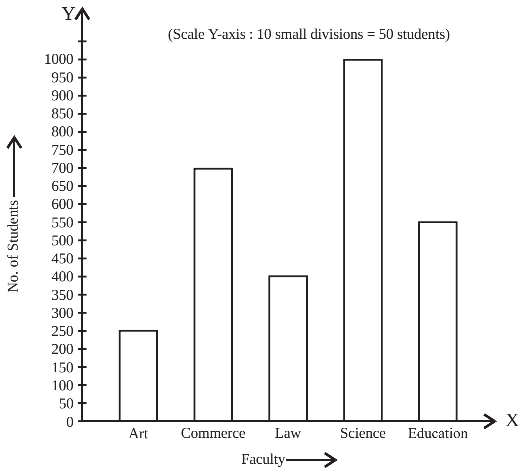
5.


(Scale X-axis : 5 small divisions = 5 Birth Rate)
x
(Birth Rate)
50
45
40
35
30
25
20
15
10
5
India
Germany
U.K
China
Sweden
y
Country

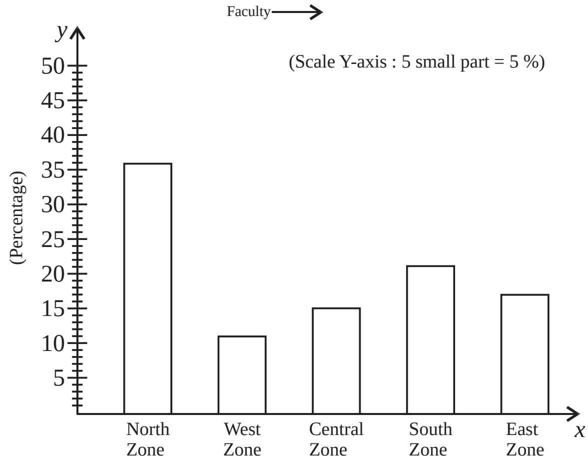
6.


(Scale Y-axis : 5 small parts = 5 Marks)
Y
Number of Marks
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Hindi
English
Mathematics
Science
Social Studies
X
Subjects

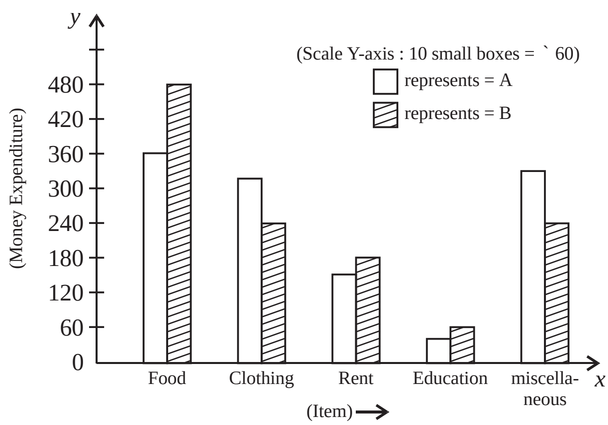
7.



8.



High Order Thinking Skills



Exercise 16.4

S. No.	Number of Total outcomes	Possible Outcomes	Probability of each outcome
1.	5	a, e, i, o, u	$\frac{1}{5}$
2.	6	1, 2, 3, 4, 5, 6	$\frac{1}{6}$
3.	5	M, A, R, C, H	$\frac{1}{5}$
4.	$2+2+3=7$	W, W, R, R, B, B, B	$\frac{1}{7}$
5.	4	K_1, K_2, K_3, K_4	$\frac{1}{4}$
6.	4	HH, H T, TH, TT	$\frac{1}{4}$

Exercise 16.5

1. The number of face of dice (Total outcome) $= 6$

(a) Getting upper face $= 3$

Favourable out come $= 1$

Probability $= \frac{1}{6}$

(b) Less than 3 getting 1, 2

Favourable outcomes $= 2$

Probability $= \frac{2}{6} = \frac{1}{3}$

(c) More than 3 getting 4, 5, 6

Favourable out comes $= 3$

Probability $= \frac{3}{6} = \frac{1}{2}$

(d) 8 No possible $= 0$

2. Total out comes $= 300$ times

(a) Number of time head appeared $= 120$

Probability $= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{120}{300} = \frac{2}{5}$

(b) Number of time tail appeared $= 300 - 120 = 180$

Probability $= \frac{180}{300} = \frac{3}{5}$

3. Total balls $= 2+3+4+5 = 14$

Total outcomes $= 14$

(a) Favourable outcomes $= 2$

Probability $= \frac{2}{14} = \frac{1}{7}$

(b) Favourable outcome $= 3$

Probability $= \frac{3}{14}$

(c) Favourable outcomes $= 4$

Probability $= \frac{4}{14} = \frac{2}{7}$

(d) Favourable outcomes $= 5$

Probability $= \frac{5}{14}$

4. The number of face of dice (Total outcome) $= 6$

(a) Getting upper face $= 2$

Favourable outcome $= 1$

Probability $= \frac{1}{6}$

(b) Getting upper face less than 4 $= 1, 2, 3$

Probability $= \frac{3}{6} = \frac{1}{2}$

(c) Getting upper face $=$ an odd number $= 1, 3, 5$

Probability $= \frac{3}{6} = \frac{1}{2}$

5. The number of faces of the dice (Total outcome) $= 6$

(a) an odd number $= 1, 3, 5$

Fovourable out comes $= 3$

Probability $= \frac{\text{Favourable outcome}}{\text{Total outcome}} = \frac{3}{6} = \frac{1}{2}$

(b) an even number $= 2, 4, 6$

Favourable outcomes $= 3$

Probability $= \frac{3}{6} = \frac{1}{2}$

6. Total out come $= (H, T) = 2$

Favourable out come $= 1$

Probability $= \frac{1}{2}$

7. Total out comes $3+4+5+2 = 14$

(a) Masala chips $= 5$

Favourable outcomes $= 5$

Probability $= \frac{5}{14}$

(b) Pudina chips $= 2$

Favourable outcomes $= 2$

Probability $= \frac{2}{14} = \frac{1}{7}$

(c) Plain Salted chips $= 4$

Favourable outcomes $= 4$

Probability $= \frac{4}{14} = \frac{2}{7}$

(d) Cheese and onion chips $= 3$

Probability $= \frac{3}{14}$

8. Total balls $(2+3+4) = 9$ (Total out come)

(a) Favourable outcome

(red ball) $= 2$

Probability $= \frac{2}{9}$

(b) Favourable outcome

(black ball) $= 3$

Probability $= \frac{3}{9} = \frac{1}{3}$

(c) Favourable outcome

(blue ball) $= 4$

Probability $= \frac{4}{9}$

9. Total outcome $= 2$

Favourable outcome $= 1$

Probability $= \frac{1}{2}$

Multiple Choice Questions

Tick (3) the correct option :

1.	(b)	**2.**	(a)	**3.**	(d)	**4.**	(b)
5.	(d)	**6.**	(c)	**7.**	(b)	**8.**	(b)

High Order Thinking Skills

Average of three numbers $= 20$

Sum of number $= 20 \times 3 = 60$

One number $= 14$

Sum of remaining two numbers $= 46 = (60 - 14)$

Average of two numbers $= \frac{46}{2} = \mathbf{23}$

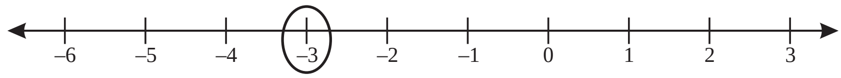
- Do it yourself.
- Do it yourself.

1 Rational Numbers

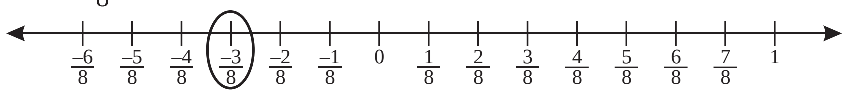
Exercise 1.1

1. Represent the following on the number line :

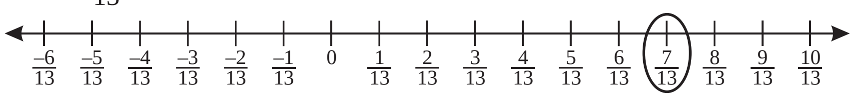
(a) -3



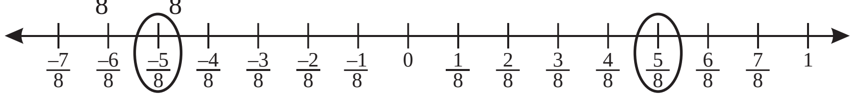
(b) $\frac{-3}{8}$



(c) $\frac{7}{13}$



(d) $\frac{5}{8}$ and $\frac{-5}{8}$



2. Which of the following rational numbers are on the left of *O* and which are on the right of *O*?

(a) $\frac{5}{2}$ is right of the 0.

(b) $\frac{7}{-5} = \frac{-7}{5}$ is left of the 0.

(c) $\frac{-8}{-5} = \frac{8}{5}$ is right of the 0.

(d) $\frac{-9}{2}$ is left of 0.

3. Write the absolute value of :

(a) $|-3| = 3$

(b) $\left|\frac{-3}{8}\right| = \frac{3}{8}$

(c) $\left|\frac{7}{13}\right| = \frac{7}{13}$

(d) $\left|\frac{9}{11}\right| = \frac{9}{11}$

4. Find the sum of the following :

(a) $\frac{3}{5}$ and $\frac{1}{5} = \frac{3}{5} + \frac{1}{5} = \frac{3+1}{5} = \frac{4}{5}$

(b) $\frac{7}{10}$ and $\frac{3}{10} = \frac{7}{10} + \frac{3}{10} = \frac{7+3}{10} = \frac{10}{10} = 1$

(c) $\frac{1}{2}$ and $\frac{3}{5}$

(d) $\frac{-2}{7}$ and $\frac{11}{21}$

$= \frac{1}{2} + \frac{3}{5} = \frac{5+6}{10} = \frac{11}{10}$

$= \frac{-2}{7} + \frac{11}{21}$

$= \frac{-2 \times 3 + 11 \times 1}{21} = \frac{-6+11}{21} = \frac{5}{21}$

5. Find the difference of the following :

(a) $\frac{12}{13} - \frac{7}{13} = \frac{12-7}{13} = \frac{5}{13}$

(b) $\frac{70}{100} - \frac{23}{100} = \frac{70-23}{100} = \frac{47}{100}$

(c) $\frac{-6}{13} - \frac{-7}{15} = \frac{-6 \times 15 + 13 \times 7}{195} = \frac{-90+91}{195} = \frac{1}{195}$

(d) $\frac{12}{35} - \frac{23}{105} = \frac{12 \times 3 - 23 \times 1}{105} = \frac{36-23}{105} = \frac{13}{105}$

6. Find the product of the following :

(a) $\frac{2}{3}$ and $\frac{5}{6} = \frac{2}{3} \times \frac{5}{6} = \frac{5}{9}$

(b) $\frac{3}{7}$ and $\frac{21}{35} = \frac{3}{7} \times \frac{21}{35} = \frac{9}{35}$

(c) $1\frac{3}{7}$ and $2\frac{5}{8}$

$= \frac{10}{7}$ and $\frac{21}{8}$

$= \frac{10}{7} \times \frac{21}{8} = \frac{15}{4}$

(d) $3\frac{1}{5}$ and $\frac{25}{64} = \frac{16}{5} \times \frac{25}{64} = \frac{5}{4}$

7. Divide the following :

(a) $\frac{3}{4} \div \frac{6}{9} = \frac{3}{4} \times \frac{9}{6} = \frac{9}{8}$

(b) $\frac{5}{9} \div \frac{12}{27} = \frac{5}{9} \times \frac{27}{12} = \frac{5}{4}$

(c) $\frac{10}{11} \div 1\frac{2}{3} = \frac{10}{11} \div \frac{5}{3} = \frac{10}{11} \times \frac{3}{5} = \frac{6}{11}$

(d) $5\frac{6}{7} \div 1\frac{2}{3} = \frac{41}{7} \div \frac{5}{3} = \frac{41}{7} \times \frac{3}{5} = \frac{123}{35}$

8. Write in standard form :

(a) $\frac{-44}{99} = \frac{-44 \div 11}{99 \div 11} = \frac{-4}{9}$

(b) $\frac{-36}{120} = \frac{-36 \div 12}{120 \div 12} = \frac{-3}{10}$

(c) $\frac{-30}{100} = \frac{-30 \div 10}{100 \div 10} = \frac{-3}{10}$

(d) $\frac{144}{240} = \frac{144 \div 48}{240 \div 48} = \frac{3}{5}$

9. Which of the following statement are true or false?

(a) False (b) True (c) True (d) False (e) True

10. Are the rational number $\frac{8}{12}$ and $\frac{16}{-24}$ are equal?

$\frac{8}{12}, \frac{16}{-24}$

$\frac{2}{3}, \frac{2}{-3}$

No, they are not equal because they have opposite sign.

11. Sum of rational no $= \frac{1}{2}$, one no. $= \frac{3}{4}$

$$\text{Other no.} = \frac{1}{2} - \frac{3}{4} = \frac{2-3}{4} = \frac{-1}{4}$$

12. Product of two numbers $= \frac{-15}{7}$

$$\text{one no} = \frac{-10}{21}$$

$$\text{other no} = \frac{-15}{7} \div \frac{-10}{21} = \frac{-15}{7} \times \frac{21}{-10} = \frac{9}{2}$$

Exercise 1.2

1. Write the additive inverse of each of the following :

(a) $\frac{5}{8}$ additive inverse of $\frac{5}{8} = \frac{-5}{8}$

(b) $\frac{-5}{9}$ additive inverse of $\frac{-5}{9} = \frac{5}{9}$

(c) $\frac{19}{-20}$ additive inverse of $\frac{19}{-20} = \frac{19}{20}$

(d) $\frac{15}{-37}$ additive inverse of $\frac{15}{-37} = \frac{15}{37}$

2. Add :

(a) $\frac{7}{13}$ and $\frac{-9}{15}$

$$= \frac{7}{13} + \frac{-9}{15} = \frac{105-117}{195} = \frac{-12}{195} = \frac{-4}{65}$$

(b) $\frac{-5}{19}$ and $\frac{-6}{57} = \frac{-5}{19} + \frac{-6}{57}$

$$= \frac{-5 \times 3 + -6 \times 1}{57} = \frac{-15-6}{57} = \frac{-21}{57} = \frac{-7}{19}$$

(c) $\frac{4}{37}$ and $\frac{19}{105}$

$$= \frac{4}{37} + \frac{19}{105} = \frac{420+703}{3885} = \frac{1123}{3885}$$

(d) $\frac{11}{17}$ and $\frac{6}{23}$

$$= \frac{11}{17} + \frac{6}{23} = \frac{253+102}{391} = \frac{355}{391}$$

(e) $\frac{8}{-9}$ and $\frac{10}{3}$

$$= \frac{-8}{9} + \frac{10}{3} = \frac{-8+30}{9} = \frac{22}{9}$$

(f) $\frac{-15}{7}$ and $\frac{3}{19}$

$$=\frac{-15}{7}+\frac{3}{19}=\frac{-285+21}{133}=\frac{-264}{133}$$

3. Subtract :

(a) $\frac{-13}{14}$ from $\frac{-5}{7}=\frac{-5}{7}-\frac{-13}{14}=\frac{-5}{7}+\frac{13}{14}=\frac{-10+13}{14}=\frac{3}{14}$

(b) $\frac{-8}{22}$ from $\frac{-3}{55}=\frac{-3}{55}-\left(\frac{-8}{22}\right)=\frac{-3}{55}+\frac{8}{22}=\frac{-6+40}{110}=\frac{34}{110}=\frac{17}{55}$

(c) $\frac{3}{5}$ from $\frac{1}{9}=\frac{1}{9}-\frac{3}{5}=\frac{5-27}{45}=\frac{-22}{45}$

(d) $\frac{19}{15}$ from $\frac{7}{12}=\frac{7}{12}-\frac{19}{15}=\frac{35-76}{60}=\frac{-41}{60}$

(e) $\frac{7}{8}$ from $\frac{2}{3}=\frac{2}{3}-\frac{7}{8}=\frac{16-21}{24}=\frac{-5}{24}$

(f) $\frac{5}{12}$ from $\frac{13}{20}=\frac{13}{20}-\frac{5}{12}=\frac{39-25}{60}=\frac{14}{60}=\frac{-7}{30}$

4. Multiply :

(a) $\frac{4}{7}$ by $\frac{-2}{5}=\frac{4}{7}\times\frac{-2}{5}=\frac{-8}{35}$

(b) $\frac{-9}{25}$ by $\frac{-5}{8}=\frac{-9}{25}\times\frac{-5}{8}=\frac{9}{40}$

(c) $\frac{-5}{9}$ by $\frac{81}{35}=\frac{-5}{9}\times\frac{81}{35}=\frac{-9}{7}$

(d) $\frac{6}{7}$ by $\frac{-19}{18}=\frac{6}{7}\times\frac{-19}{18}=\frac{-19}{21}$

(e) $\frac{8}{-11}$ by $\frac{33}{-24}=\frac{8}{-11}\times\frac{33}{-24}=1$

(f) $\frac{-17}{3}$ by $\frac{-21}{85}=\frac{-17}{3}\times\frac{-21}{85}=\frac{7}{5}$

5. Simplify :

(a) $\frac{-2}{3}+\frac{4}{9}-\frac{-5}{6}=\frac{-2}{3}+\frac{4}{9}+\frac{5}{6}=\frac{-12+8+15}{18}=\frac{11}{18}$

(b) $\frac{7}{8}-\frac{11}{12}+\frac{4}{15}=\frac{7}{8}-\frac{11}{12}+\frac{4}{15}=\frac{105-110+32}{120}=\frac{137-110}{120}=\frac{27}{120}=\frac{9}{40}$

(c) $\frac{-1}{5}-\frac{4}{7}-\frac{5}{21}=\frac{-21-60-25}{105}=\frac{-106}{105}$

(d) $\frac{5}{12}+\frac{-7}{18}-\frac{11}{24}=\frac{30-28-33}{72}=\frac{30-61}{72}=\frac{-31}{72}$

(e) $\frac{4}{3}+\frac{3}{5}+\frac{-2}{3}+\frac{-11}{5}=\frac{20+9-10-33}{15}=\frac{29-43}{15}=\frac{-14}{15}$

(f) $\frac{7}{6}+\frac{1}{2}-\frac{5}{4}+\frac{4}{3}=\frac{14+6-15+16}{12}=\frac{36-15}{12}=\frac{21}{12}=\frac{7}{4}$

6. Simplify :

(a) $\left(\frac{-3}{7}\times\frac{7}{5}\right)+\left(\frac{17}{15}\times\frac{3}{-34}\right)=\frac{-3}{7}\times\frac{7}{5}+\left(\frac{17}{15}\times\frac{3}{-34}\right)$

$$= \frac{-3}{5} + \left(\frac{1}{-10}\right) = \frac{-3}{5} - \frac{1}{10} = \frac{-6-1}{10} = \frac{-7}{10}$$

(b) $\left(\frac{-7}{21} \times \frac{-3}{14}\right) \times \left(\frac{5}{14} \times \frac{-4}{15}\right) = \frac{1}{14} \times \frac{-2}{21} = \frac{-1}{147}$

(c) $\left(\frac{3}{2} \times \frac{-7}{4}\right) - \left(\frac{-5}{2} \times \frac{3}{4}\right) = \frac{-21}{8} - \left(\frac{-15}{8}\right)$

$$= \frac{-21}{8} + \frac{15}{8} = \frac{-21+15}{8} = \frac{-6}{8} = \frac{-3}{4}$$

(d) $\left(\frac{9}{2} \times \frac{8}{3}\right) + \left(\frac{4}{3} \times \frac{5}{24}\right) - \left(\frac{3}{-5} \times \frac{-7}{6}\right)$

$$= \frac{12}{1} + \frac{5}{18} - \frac{7}{10} = \frac{1080+25-63}{90} = \frac{1105-63}{90} = \frac{1042}{90} = \frac{521}{45}$$

7. Simplify :

(a) $\frac{4}{13} + \frac{-5}{8} + \frac{-8}{13} + \frac{9}{13} = \frac{32-65-64+72}{104} = \frac{104-129}{104} = \frac{-25}{104}$

(b) $\frac{5}{3} + \frac{3}{-2} + \frac{-7}{3} + \frac{3}{1} = \frac{10-9-14+18}{6} = \frac{28-23}{6} = \frac{5}{6}$

(c) $\frac{3}{8} + \frac{7}{2} + \frac{-3}{5} + \frac{9}{8} + \frac{-3}{2} + \frac{6}{5} = \frac{15+140-24+45-60+48}{40}$

$$= \frac{248-84}{40} = \frac{164}{40} = \frac{41}{10}$$

(d) $\frac{1}{8} + \frac{5}{12} + \frac{2}{7} + \frac{7}{12} + \frac{9}{7} + \frac{-5}{16} = \frac{42+140+96+196+432-105}{336}$

$$= \frac{906-105}{336} = \frac{801}{336} = \frac{267}{112}$$

(e) $\frac{-3}{10} + \frac{7}{15} + \frac{3}{-20} + \frac{-9}{10} + \frac{13}{15} + \frac{13}{-20}$

$$= \frac{-3}{10} + \frac{7}{15} - \frac{3}{20} - \frac{9}{10} + \frac{13}{15} - \frac{13}{20}$$

$$= \frac{-18+28-9-54+52-39}{60} = \frac{-120+80}{60} = \frac{-40}{60} = \frac{-2}{3}$$

8. Verify that $x + y = y + x$, for each of the following :

(a) $x = \frac{-3}{5}$ and $y = \frac{-7}{10}$

Now, $x + y = y + x$

$$\frac{-3}{5} + \frac{-7}{10} = \frac{-7}{10} + \frac{-3}{5}$$

$$\frac{-3}{5} - \frac{7}{10} = \frac{-7}{10} - \frac{3}{5}$$

$$\frac{-6-7}{10} = \frac{-7-6}{10}$$

$$\frac{-13}{10} = \frac{-13}{10}$$

$$\text{LHS} = \text{RHS} \qquad \text{Verified}$$

(b) $x = \frac{6}{7}$ and $y = \frac{-11}{14}$

Now, $$x + y = y + x$$

$$\frac{6}{7} + \frac{-11}{14} = \frac{-11}{14} + \frac{6}{7}$$

$$\frac{6}{7} - \frac{11}{14} = \frac{-11}{14} + \frac{6}{7}$$

$$\frac{12-11}{14} = \frac{-11+12}{14}$$

$$\frac{1}{14} = \frac{1}{14}$$

$$\text{LHS} = \text{RHS Verified}$$

9. For each of the following, check that $x - y \neq y - x$:

(a) $x = \frac{-3}{2}$ and $y = \frac{4}{5}$

Now, $x - y \neq y - x$

$$\frac{-3}{2} - \frac{4}{5}, \qquad \frac{4}{5} - \left(\frac{-3}{2}\right)$$

$$\frac{-3}{2} - \frac{4}{5}, \qquad \frac{4}{5} + \frac{3}{2}$$

$$\frac{-15-8}{10} \neq \frac{8+15}{10}$$

$$\frac{-23}{10} \neq \frac{23}{10} \qquad \text{Verified}$$

(b) $x = \frac{5}{7}$ and $y = \frac{-8}{12}$

Now, $$x - y \neq y - x$$

$$\frac{5}{7} - \frac{-8}{12} \neq \frac{-8}{12} - \frac{5}{7}$$

$$\frac{5}{7} + \frac{8}{12} \neq \frac{-56-60}{84}$$

$$\frac{60+56}{84} \neq \frac{-116}{84}$$

$$\frac{116}{84} \neq \frac{-116}{84} \qquad \text{Verified}$$

10. Verified the associative property of addition for the following rational numbers :

(a) $\frac{-2}{3}, \frac{5}{4}, \frac{7}{12}$

Now,
$$\left(\frac{-2}{3}+\frac{5}{4}\right)+\frac{7}{12}=\frac{-2}{3}+\left(\frac{5}{4}+\frac{7}{12}\right)$$
$$\left(\frac{-8+15}{12}\right)+\frac{7}{12}=\frac{-2}{3}+\left(\frac{15+7}{12}\right)$$
$$\left(\frac{7}{12}+\frac{7}{12}\right)=\frac{-2}{3}+\left(\frac{22}{12}\right)$$
$$\frac{7+7}{12}=\frac{-8+22}{12}$$
$$\frac{14}{12}=\frac{14}{12}$$
$$\text{LHS}=\text{RHS} \qquad \text{verified}$$

(b) $\frac{3}{5}, \frac{3}{10}, \frac{7}{15}$

Now,
$$\left(\frac{3}{5}+\frac{3}{10}\right)+\frac{7}{15}=\frac{3}{5}+\left(\frac{3}{10}+\frac{7}{15}\right)$$
$$\left(\frac{6+3}{10}\right)+\frac{7}{15}=\frac{3}{5}+\left(\frac{9+14}{30}\right)$$
$$\frac{9}{10}+\frac{7}{15}=\frac{3}{5}+\frac{23}{30}$$
$$\frac{27+14}{30}=\frac{18+23}{30}$$
$$\frac{41}{30}=\frac{41}{30}$$
$$\text{LHS}=\text{RHS} \qquad \text{verified}$$

11. $x=\frac{-9}{11}$ and $y=\frac{5}{7}$

$$(-x)+(-y)=(-x+y)$$
$$-\left(\frac{-9}{11}\right)+\left(\frac{-5}{7}\right)=-\left(\frac{-9}{11}+\frac{5}{7}\right)$$
$$\frac{9}{11}-\frac{5}{7}=-\left(\frac{-63+55}{77}\right)$$
$$\frac{63-55}{77}=-\left(\frac{-8}{77}\right)$$
$$\frac{8}{77}=\frac{8}{77} \text{ proved}$$

12. Rearrange suitably and find the sum :

(a) $\frac{3}{7}+\frac{-5}{11}+\frac{-5}{14}+\frac{3}{11}$

$$=\left(\frac{3}{7}+\frac{-5}{14}\right)+\frac{-5}{11}+\frac{3}{11}$$
$$=\left(\frac{3}{7}-\frac{5}{14}\right)+\left(\frac{3}{11}-\frac{5}{11}\right)$$
$$=\left(\frac{6-5}{14}\right)+\left(\frac{3-5}{11}\right)$$
$$=\frac{1}{14}+\left(\frac{-2}{11}\right)$$
$$=\frac{11-28}{154}=\frac{-17}{154}$$

(b) $-5+\frac{3}{10}+\frac{3}{7}+(-3)+\frac{5}{14}+\frac{7}{20}$

$$=(-5)+(-3)+\left(\frac{3}{10}+\frac{7}{20}\right)+\left(\frac{3}{7}+\frac{5}{14}\right)$$
$$=-8+\left(\frac{6+7}{20}\right)+\left(\frac{6+5}{14}\right)$$
$$=\frac{-8}{1}+\frac{13}{20}+\frac{11}{14}$$
$$=\frac{-1120+91+110}{140}$$
$$=\frac{-1120+201}{140}$$
$$=\frac{-919}{140}$$

13. If $x=\frac{2}{3}, y=\frac{13}{21}$ and $z=\frac{5}{7}$

Then, $(x-y)-z \neq x-(y-z)$

$$=\left(\frac{2}{3}-\frac{13}{21}\right)-\frac{5}{7}\neq\frac{2}{3}-\left(\frac{13}{21}-\frac{5}{7}\right)$$
$$=\left(\frac{14-13}{21}\right)-\frac{5}{7}\neq\frac{2}{3}-\left(\frac{13-15}{21}\right)$$
$$=\frac{1}{21}-\frac{5}{7}\neq\frac{2}{3}-\left(\frac{-2}{21}\right)$$
$$=\frac{1}{21}-\frac{5}{7}\neq\frac{2}{3}+\frac{2}{21}$$

$$\frac{1-15}{21} \neq \frac{14+2}{21}$$

$$\frac{-14}{21} \neq \frac{16}{21}$$

No, it is not equal.

14. Fill in the blanks, using commutative property for addition of rational numbers :

(a) $\frac{-5}{9}+\frac{2}{7}=\frac{-35+18}{63}=\frac{-17}{63}$

(b) $\frac{-15}{19}+\frac{18}{23}=\frac{-345+342}{437}=\frac{-3}{437}$

(c) $\frac{5}{6}+\left(\frac{-4}{9}\right)=\frac{15+(-8)}{18}=\frac{15-8}{18}=\frac{7}{18}$

(d) $\frac{1}{3}+\left(\frac{-6}{5}\right)=\frac{1}{3}-\frac{6}{5}=\frac{5-18}{15}=\frac{-13}{15}$

(e) $\frac{-7}{26}+\frac{16}{39}=\frac{-21+32}{78}=\frac{11}{78}$

(f) $\left(\frac{-11}{29}\right)+\left(\frac{-6}{31}\right)=\frac{-11\times 31+(-6\times 29)}{899}=\frac{-341-174}{899}=\frac{-515}{899}$

15. Fill in the blanks, using associative property for addition of rational numbers :

(a) $\left(\frac{1}{11}+\frac{1}{3}\right)+\frac{5}{6}=\left(\frac{3+11}{33}\right)+\frac{5}{6}=\frac{14}{33}+\frac{5}{6}=\frac{28+55}{66}=\frac{83}{66}$

(b) $\left(\frac{-2}{5}\right)+\left(\frac{11}{5}+\frac{-3}{4}\right)=\frac{-2}{5}+\left(\frac{44-15}{20}\right)=\frac{-2}{5}+\left(\frac{29}{20}\right)=\frac{-8+29}{20}=\frac{21}{20}$

(c) $\left(\frac{3}{11}+\frac{1}{7}\right)+\left(\frac{-5}{13}\right)=\left(\frac{21+11}{77}\right)+\left(\frac{-5}{13}\right)$

$$=\left(\frac{32}{77}\right)+\left(\frac{-5}{13}\right)$$

$$=\frac{416+(-385)}{1001}=\frac{416-385}{1001}=\frac{31}{1001}$$

(d) $\frac{-11}{38}+\left(\frac{9}{14}+\frac{6}{19}\right)=\frac{-11}{38}+\left(\frac{171+84}{266}\right)$

$$=\frac{-11}{38}+\left(\frac{255}{266}\right)$$

$$=\frac{-77+255}{266}=\frac{178}{266}=\frac{89}{133}$$

(e) $\left(\frac{-3}{4}\right)+\left[\frac{5}{6}+\left(\frac{-4}{9}\right)\right]=\left(\frac{-3}{4}\right)+\left[\frac{45+(-24)}{54}\right]$

$$= \frac{-3}{4} + \left[\frac{21}{54}\right]$$

$$= \frac{-3}{4} + \frac{21}{54} = \frac{-81+42}{108} = \frac{-39}{108} = \frac{-13}{36}$$

(f) $\frac{11}{29} + \left[\left(\frac{-6}{19}\right) + \frac{8}{11}\right] = \frac{11}{29} + \left[\frac{-66+152}{209}\right]$

$$= \frac{11}{29} + \frac{86}{209} = \frac{2299+2494}{6061} = \frac{4793}{6061}$$

Exercise 1.3

1. Name the property of multiplication illustrated by the following statements :

(a) Commutative property over multiplication.

(b) Property of 1

(c) Distributive property of multiplication.

(d) Multiplicative inverse property.

(e) Property of zero.

(f) Associative property over multiplication.

(g) Distributive property.

2. Fill in the blanks :

(a) $\left(\frac{-23}{17}\right)\times\left(\frac{18}{35}\right) = \left(\frac{18}{35}\right)\times\left(\mathbf{\frac{-23}{17}}\right)$ (b) $-38\times\left(\frac{-7}{19}\right) = \left(\frac{-7}{19}\right)\times\left(\mathbf{\frac{-38}{1}}\right)$

(c) $\left(\frac{15}{7}\times\frac{-21}{10}\right)\times\left(\frac{-5}{6}\right) = \left(\mathbf{\frac{15}{7}}\right)\times\left[\left(\frac{-21}{10}\right)\times\left(\frac{-5}{6}\right)\right]$

(d) $\frac{-12}{15}\times\left(\frac{4}{15}\times\frac{25}{-16}\right) = \left(\frac{-12}{15}\times\frac{25}{-16}\right)\times\left(\mathbf{\frac{4}{15}}\right)$

(e) $\frac{-4}{5}\times\left(\frac{5}{7}\times\frac{-8}{9}\right) = \left(\frac{-4}{5}\times\mathbf{\frac{5}{7}}\right)\times\frac{-8}{9}$

(f) $\frac{2}{5}\div\frac{2}{5} = \mathbf{1}$ (g) $\frac{4}{11}\div\left(\mathbf{\frac{4}{-11}}\right) = -1$

(h) $\left(\mathbf{\frac{23}{16}}\right) + (-1) = \frac{7}{16}$ (i) $\frac{-11}{15}\div\left(\mathbf{\frac{11}{15}}\right) = -1$

(j) $\frac{4}{9}\div\mathbf{1} = \frac{4}{9}$

3. For each of the following, check that $x \div y \neq y \div x$:

(a) $x = \frac{2}{5}$ and $y = \frac{26}{15}$

Check : $x \div y \neq y \div x$

$$\frac{2}{5} \div \frac{26}{15} \neq \frac{26}{15} \div \frac{2}{5}$$
$$\frac{2}{5} \times \frac{15}{26} \neq \frac{26}{15} \times \frac{5}{2}$$
$$\frac{3}{13} \neq \frac{13}{3}$$ verified

(b) $x = \frac{40}{99}$ and $y = 20$

Check : $$x \div y \neq y \div x$$
$$\frac{40}{99} \div \frac{20}{1} \neq \frac{20}{1} \div \frac{40}{99}$$
$$\frac{40}{99} \times \frac{1}{20} \neq \frac{20}{1} \times \frac{99}{40}$$
$$\frac{2}{99} \neq \frac{99}{2}$$ verified

4. Verify the property, $x \times (y \times z) = (x \times y) \times z$, for each of the following :

(a) $x = \frac{1}{2}$, $y = \frac{5}{4}$ and $z = \frac{-7}{5}$

Check : $$x \times (y \times z) = (x \times y) \times z$$
$$\left(\frac{1}{2}\right) \times \left(\frac{5}{4} \times \frac{-7}{5}\right) = \left(\frac{1}{2} \times \frac{5}{4}\right) \times \left(\frac{-7}{5}\right)$$
$$\frac{1}{2} \times \left(\frac{-7}{4}\right) = \left(\frac{5}{8}\right) \times \left(\frac{-7}{5}\right)$$
$$\frac{-7}{8} = \frac{-7}{8}$$ verified

(b) $x = \frac{-5}{7}$, $y = \frac{5}{2}$ and $z = \frac{7}{5}$
$$x \times (y \times z) = (x \times y) \times z$$
$$\left(\frac{-5}{7}\right) \times \left(\frac{5}{2} \times \frac{7}{5}\right) = \left(\frac{-5}{7} \times \frac{5}{2}\right) \times \frac{7}{5}$$
$$\left(\frac{-5}{7}\right) \times \left(\frac{7}{2}\right) = \left(\frac{-25}{14}\right) \times \left(\frac{7}{5}\right)$$
$$\frac{-5}{2} = \frac{-5}{2}$$ verified

5. Verify the property, $x \times (y + z) = x \times y + x \times z$, for each of the following :

(a) $x = \frac{-8}{3}$, $y = \frac{5}{6}$ and $z = \frac{-7}{12}$

Prove that :
$$x \times (y + z) = (x \times y) + x \times z$$

$$\left(\frac{-8}{3}\right)\times\left[\frac{5}{6}+\left(\frac{-7}{12}\right)\right]=\left(\frac{-8}{3}\times\frac{5}{6}\right)+\left(\frac{-8}{3}\times\frac{-7}{12}\right)$$

$$\left(\frac{-8}{3}\right)\times\left[\frac{10-7}{12}\right]=\left(\frac{-20}{9}\right)+\frac{14}{9}$$

$$\frac{-8}{3}\times\frac{3}{12}=\frac{-20}{9}+\frac{14}{9}$$

$$\frac{-2}{3}=\frac{-6}{9}$$

$$\frac{-2}{3}=\frac{-2}{3}$$

$$\text{LHS}=\text{RHS}$$

(b) $x=\frac{-3}{4}$, $y=\frac{-15}{4}$ and $z=\frac{8}{12}$

Prove that :

$x\times(y+z)=x\times y+x\times z$

$$\frac{-3}{4}\times\left(\frac{-15}{4}+\frac{8}{12}\right)=\left(\frac{-3}{4}\times\frac{-15}{4}\right)+\left(\frac{-3}{4}\times\frac{8}{12}\right)$$

$$\left(\frac{-3}{4}\right)\times\left(\frac{-45+8}{12}\right)=\frac{+45}{16}+\frac{-1}{2}$$

$$\left(\frac{-3}{4}\right)\times\left(\frac{-37}{12}\right)=\left(\frac{45-8}{16}\right)$$

$$\frac{37}{16}=\frac{37}{16}$$

$$\text{LHS}=\text{RHS Proved}$$

6. Use distributive property of multiplication of rational numbers over addition to simplify the following :

(a) $\frac{2}{7}\times\left(\frac{7}{16}+\frac{21}{4}\right)=\left(\frac{2}{7}\times\frac{7}{16}\right)+\left(\frac{2}{7}\times\frac{21}{4}\right)=\frac{1}{8}+\frac{3}{2}$

$$=\frac{1+12}{8}=\frac{13}{8}$$

(b) $\frac{-5}{4}\times\left(\frac{8}{5}+\frac{16}{5}\right)=\left(\frac{-5}{4}\times\frac{8}{5}\right)+\left(\frac{-5}{4}\times\frac{16}{5}\right)$

$=(-2)+(-4)$

$=-2-4$

$=-6$

7. Find $(x+y)\div(x-y)$, for each of the following :

(a) $x=\frac{2}{7}$ and $y=\frac{4}{3}$

$=(x+y)\div(x-y)$

$$= \left(\frac{2}{7} + \frac{4}{3}\right) \div \left(\frac{2}{7} - \frac{4}{3}\right)$$

$$= \left(\frac{6+28}{21}\right) \div \left(\frac{6-28}{21}\right)$$

$$= \frac{34}{21} \div \left(\frac{-22}{21}\right)$$

$$= \frac{34}{21} \times \frac{21}{-22}$$

$$= \frac{34}{-22}$$

$$= \frac{-17}{11}$$

(b) $x = \frac{5}{4}$ and $y = \frac{3}{2}$

Now, $(x + y) \div (x - y)$

$$= \left(\frac{5}{4} + \frac{3}{2}\right) \div \left(\frac{5}{4} - \frac{3}{2}\right)$$

$$= \left(\frac{5+6}{4}\right) \div \left(\frac{5-6}{4}\right)$$

$$= \frac{11}{4} \div \frac{-1}{4}$$

$$= \frac{11}{4} \times \frac{4}{-1}$$

$$= -11$$

8. Simplify :

(a) $\frac{-3}{5} \times \frac{-10}{9} \times \frac{21}{-4} \times (-6)$

$$= \frac{-3}{5} \times \frac{-10}{9} \times \frac{21}{-4} \times -6 = \frac{(-3)\times(-10)\times 21\times(-6)}{5\times 9\times(-4)\times 1}$$

$$= \frac{2\times 7\times 6}{4}$$

$$= 7 \times 3$$

$$= 21$$

(b) $\frac{3}{11} \times \frac{-5}{6} \times \frac{-22}{9} \times \frac{-9}{5}$

$$= \frac{3}{11} \times \left(\frac{-5}{6}\right) \times \left(\frac{-22}{9}\right) \times \left(\frac{-9}{5}\right)$$

$$= \frac{3\times(-5)\times(-22)\times(-9)}{11\times 6\times 9\times 5}$$

$$= \frac{-(3) \times 2}{6}$$
$$= -1$$

Exercise 1.4

1. $\frac{-1}{2}$ and $\frac{-3}{4}$

or $\frac{-2}{4}$ and $\frac{-3}{4}$

or $\frac{-10}{20}$ and $\frac{-15}{20}$

Now, two, rational be between $\frac{-10}{20}$ and $\frac{-15}{20}$ are= $\frac{-11}{20}, \frac{-12}{20} \ldots$

2. -1 and $\frac{-1}{2}$

$\frac{-2}{2}$ and $\frac{-1}{2}$

or $\frac{-10}{10}$ and $\frac{-5}{10}$

So, four rational numbers between $\frac{-10}{10}$ and $\frac{-5}{10}$ are :

$$\frac{-9}{10}, \frac{-8}{10}, \frac{-7}{10} \text{ and } \frac{-6}{10}$$

3. $\frac{3}{8}$ and $\frac{-1}{2}$

$\frac{3}{8}$ and $\frac{-4}{8}$

So, six rational number between $\frac{3}{8}$ and $\frac{-4}{8}$ are $= \frac{2}{8}, \frac{1}{8}, 0, \frac{-1}{8}, \frac{-2}{8}, \frac{-3}{8}$

4. $\frac{-5}{6}$ and $\frac{4}{6}$

So, five rational number between $\frac{-5}{6}$ and $\frac{4}{6}$ are :

$\frac{-4}{6}, \frac{-3}{6}, \frac{-2}{6}, \frac{-1}{6}$ and $\frac{1}{6}$

5. $\frac{-1}{2}$ and $\frac{1}{4}$

or $\frac{-2}{4}$ and $\frac{1}{4}$

or $\frac{-8}{16}$ and $\frac{4}{16}$

So, four rational number between $\frac{-8}{16}$ and $\frac{4}{16}$ are $\frac{-7}{16}, \frac{-5}{16}, \frac{-1}{16}$ and $\frac{2}{16}$.

6. $\frac{1}{3}$ and $\frac{1}{5}$

$\frac{1}{3}$ and $\frac{1}{5}$

or $\frac{5}{15}$ and $\frac{3}{15}$

or $\frac{20}{60}$ and $\frac{12}{60}$

So three rational number between $\frac{20}{60}$ and $\frac{12}{60}$ are $= \frac{19}{60}, \frac{18}{60}, \frac{17}{60}$.

7. $\frac{1}{3}$ and $\frac{1}{2}$

Rational No. $= \frac{1}{2}\left[\frac{1}{3} + \frac{1}{2}\right]$

$= \frac{1}{2}\left[\frac{2+3}{6}\right]$

$= \frac{1}{2}\left[\frac{5}{6}\right]$

$= \frac{5}{12}$

8. $\frac{3}{4}$ and $\frac{2}{3}$

or $\frac{9}{12}$ and $\frac{8}{12}$

$= \frac{45}{60}$ and $\frac{40}{60}$

So, four rational numbers between $\frac{45}{60}$ and $\frac{40}{60}$ are :

$\frac{44}{60}, \frac{43}{60}, \frac{42}{60}, \frac{41}{60}$

9. $\frac{7}{11}$ and $\frac{-4}{11}$

Ten rational number between $\frac{7}{11}$ and $\frac{-4}{11}$ are :

$\frac{6}{11}, \frac{5}{11}, \frac{4}{11}, \frac{3}{11}, \frac{2}{11}, \frac{1}{11}, 0, \frac{-1}{11}, \frac{-2}{11}, \frac{-3}{11}$

Exercise 1.5

1.
$$\begin{aligned}
\text{Cost of 1 m of cloth} &= ₹\ 25\frac{1}{4} \\
\text{Cost of } 5\frac{3}{4} \text{ m of cloth} &= ₹\ 25\frac{1}{4} \times 5\frac{3}{4} \\
&= \frac{101}{4} \times \frac{23}{4} \\
&= ₹\ \frac{2323}{16}
\end{aligned}$$

So, $\text{cost of } 5\frac{3}{4} \text{ m of cloth} = ₹\ 145\frac{3}{16}$

2.
$$\begin{aligned}
\text{Distance covered by cyclist} &= 14\frac{2}{5} \text{ km} \\
\text{time taken} &= 2\frac{1}{4} \text{ hrs}
\end{aligned}$$

So,
$$\begin{aligned}
\text{speed} &= \frac{\text{Distance}}{\text{time}} \\
&= 14\frac{2}{5} \div 2\frac{1}{4} \\
&= \frac{72}{5} \div \frac{9}{4} \\
&= \frac{72}{5} \times \frac{4}{9} \\
&= \frac{32}{5} \\
&= 6\frac{2}{5} \text{ km/hr}
\end{aligned}$$

3. Divide the sum of $\frac{65}{12}$ and $\frac{8}{3}$ by their difference.
$$\begin{aligned}
&= \left(\frac{65}{12} + \frac{8}{3}\right) \div \left(\frac{65}{12} - \frac{8}{3}\right) \\
&= \left(\frac{65 + 32}{12}\right) \div \left(\frac{65 - 32}{12}\right) \\
&= \frac{97}{12} \div \frac{33}{12} \\
&= \frac{97}{12} \times \frac{12}{33} = \frac{97}{33} = 2\frac{31}{33}
\end{aligned}$$

4.
$$\text{length of the park} = 45\frac{1}{2} \text{ m}$$

$$\text{breadth of the park} = 34\frac{3}{4}\text{ m}$$

$$\text{perimeter of the park} = 2(l+b)$$

$$= 2\left(45\frac{1}{2} + 34\frac{3}{4}\right)$$

$$= 2\left(\frac{91}{2} + \frac{139}{4}\right)$$

$$= 2\left(\frac{321}{4}\right)$$

$$= \frac{321}{2} = 160\frac{1}{2}$$

$$\text{Area of the park} = l \times b$$

$$= 45\frac{1}{2} \times 34\frac{3}{4}$$

$$= \frac{91}{2} \times \frac{139}{4} = \frac{12649}{8} = 1581\frac{1}{8}$$

5. $$\text{Length of floor} = 2\frac{1}{4}\text{ m}$$

$$\text{Breadth of floor} = 1\frac{3}{4}\text{ m}$$

$$\text{Area of floor} = 2\frac{1}{4} \times 1\frac{3}{4} = \frac{9}{4} \times \frac{7}{4} = \frac{63}{16}\text{ m}^2$$

$$\text{Side of carpet} = 1\frac{1}{2}\text{ m}$$

$$\text{Area of carpet} = 1\frac{1}{2}\text{ m} \times 1\frac{1}{2}\text{ m} = \frac{3}{2}\text{ m} \times \frac{3}{2}\text{ m} = \frac{9}{4}\text{ m}^2$$

$$\text{Area of floor that is not carpeted} = \frac{63}{16} - \frac{9}{4} = \frac{63-36}{16} = \frac{27}{16} = 1\frac{11}{16}\text{ m}^2$$

6. $$\text{Suresh walks in a day} = 4\frac{3}{5}\text{ km}$$

$$\text{Suresh will walk in } 5\frac{1}{2}\text{ days} = 4\frac{3}{5} \times 5\frac{1}{2}\text{ km}$$

$$= \frac{23}{5} \times \frac{11}{2}\text{ km} = \frac{253}{10}\text{ km} = 25\frac{3}{10}\text{ km}$$

7. $$\text{Cost of one metre of cloths} = ₹\ 36\frac{2}{3}$$

$$\text{Cost of } 3\frac{3}{4}\text{ metres of cloth} = ₹\ 36\frac{2}{3} \times 3\frac{3}{4}$$

$$= ₹\ \frac{110}{3} \times \frac{15}{4} = ₹\ \frac{275}{2} = ₹\ 137\frac{1}{2}$$

8.

$$\text{Speed of car} = 40\frac{2}{5}\text{ m/hr}$$

$$\text{time} = 7\frac{1}{2}\text{ hours}$$

$$\text{Distance covered by car} = \text{speed} \times \text{time} = 40\frac{2}{5} \times 7\frac{1}{2}$$

$$= \frac{202}{5} \times \frac{15}{2} = 303\text{ km}$$

9. Product of two rational number $= \frac{-16}{9}$

$$\text{one number} = \frac{-4}{3}$$

So, $\text{other number} = \frac{-16}{9} \div \frac{-4}{3} = \frac{-16}{9} \times \frac{3}{-4} = \frac{4}{3}$

10. Let, $\frac{-33}{8}$ should be divided by x to get $\frac{-11}{2}$

So, $\frac{-33}{8} \div x = \frac{-11}{2}$

or $\frac{-33}{8} \div \frac{-11}{2} = x$

or $x = \frac{-33}{8} \times \frac{2}{-11}$

$$x = \frac{3}{4}$$

So, $\frac{-33}{8}$ should be divided by $\frac{3}{4}$ to get $\frac{-11}{2}$.

11. Cloth required for 24 pair of trousers = 54 m

So, average length of trousers will be $= \frac{54}{24} = \frac{9}{4} = 2\frac{1}{4}$ m

12.

$$\text{Length of rope} = 30\text{ m}$$

$$\text{Length of each piece} = 3\frac{3}{4}\text{ m}$$

So, $\text{No. of pieces of rope} = 30 \div 3\frac{3}{4} = 30 \div \frac{15}{4} = 30 \times \frac{4}{15} = 8\text{ pieces}$

Multiple Choice Questions

Tick (3) the correct option :

1.	(b)	2.	(b)	3.	(c)	4.	(c)	5.	(b)
6.	(d)	7.	(a)	8.	(a)	9.	(b)	10.	(d)

2 Square and Square Roots

Exercise 2.1

1. Select the numbers which are squares of even numbers and odd numbers :
(The squares of an even number is even and the squares of an odd number is odd.)

169 : $\because$ Digit at ones place is odd.
225 :
625 :
121 : All these numbers are square of odd numbers.
1225 :

36 : $\because$ Digit at ones place is even.
64 :
144 :
100 : All these numbers are square of even numbers.
196 :

2. Find the squares of the following numbers :
(a) 39 square of $39 = 39 \times 39 = 1521$
(b) 103 square of $103 = 103 \times 103 = 10609$
(c) 115 square of $115 = 115 \times 115 = 13225$
(d) 209 square of $209 = 209 \times 209 = 43681$

3. Select the numbers which are not perfect squares?

- **418**

2	418
	209

Prime factors of $418 = 2 \times 209$
418 is not perfect square.

- **900**

2	900
2	450
3	225
3	75
5	25
5	5
	1

Prime factors of $900 = \overline{2 \times 2} \times \overline{3 \times 3} \times \overline{5 \times 5}$
900 is a perfect square

- **563**

563	563
	1

Prime factors of $563 = 563 \times 1$
563 is not prefect square

- **1000**

2	1000
2	500
2	250
5	125
5	25
5	5
	1

Prime factors of 1000 $= \overline{2\times 2}\times 2\times \overline{5\times 5}\times 5$

1000 is not perfect square.

- **289**

17	289
17	17
	1

Prime factors of 289 $= \overline{17\times 17}$

289 is a perfect square.

- **612**

2	612
2	306
3	153
3	51
17	17
	1

Prime factors of 612 $= \overline{2\times 2}\times \overline{3\times 3}\times 17$

612 is not perfect square.

- **256**

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factors of 256 $= \overline{2\times 2}\times \overline{2\times 2}\times \overline{2\times 2}\times \overline{2\times 2}$

256 is a perfect square

- **697**

17	697
	41

Prime factors of 697 $= 17\times 41$

697 is not perfect square

4. The greatest 3-digit number $= 999$

Now, we need to find the least number, when subtracted from 999 gives a perfect square.

Thus, the required number $= 999 - 38$

$= 961$

Also, $\sqrt{961} = 31$

	31
3	$\overline{9}\ \overline{99}$
+3	−9
61	99
	−61
	38

5. The greatest 4-digit number $= 9999$

Now, we need to find the least number, when subtracted from 9999 gives a perfect square.

Thus, the required number

$9999 - 198 = 9801$

Also, $\sqrt{9801} = 99$

	99
9	$\overline{99}\ \overline{99}$
+9	−81
189	1899
	−1701
	198

6. Find the smallest number by which the given number must be divided to make it a perfect square.

- **8112**

Prime factors of 8112

$= (\overline{2\times 2})\times(\overline{2\times 2})\times 3\times(\overline{13\times 13})$

In the prime factors 3 is left unpaired.

If 8112 is divided by 3 then we will be left with a perfect square.

The required number $= 3$.

2	8112
2	4056
2	2028
2	1014
3	507
13	169
13	13
	1

- **3920**

Prime factors of 3920

$$= (\overline{2 \times 2}) \times (\overline{2 \times 2}) \times 5 \times (\overline{7 \times 7})$$

In prime factorisation, 5 is left unpaired.

If 3920 is divided by 5 then we will be left with a perfect square.

The required number $= 5$

2	3920
2	1960
2	980
2	490
5	245
7	49
7	7
	1

- **3971**

Prime factors of $3971 = (\overline{19 \times 19}) \times 11$

In prime factorisation, 11 is left unpaired.

If 3971 is divided by 11 then we will be left with a perfect square.

The required number $= 11$

19	3971
19	209
11	11
	1

- **10368**

Prime factors of 10368

$= (\overline{2 \times 2}) \times (\overline{2 \times 2}) \times (\overline{2 \times 2}) \times 2$
$\times (\overline{3 \times 3}) \times (\overline{3 \times 3})$

In prime factorisation, 2 is left unpaired.

If 10368 is divided by 2 then we will be left with a perfect square.

The required number $= 2$

2	10368
2	5184
2	2592
2	1296
2	648
2	324
2	162

3	81
3	27
3	9
3	3
	1

- **141148**

Prime factors of 141148

$$= (\overline{2 \times 2}) \times (\overline{71 \times 71}) \times 7$$

In prime factorisation, 7 is left unpaired.

If 141148 is divided by 7 then we will be left with a perfect square.

The required number $= 7$.

2	141148
2	70574
7	35287
71	5041
71	71
	1

- **1568**

Prime factors of 1568

$$= (2\times 2)\times(2\times 2)\times 2\times(\overline{7\times 7})$$

In prime factorization, 2 is left unpaired.
1568 is divided by 2 we will but left with a perfect square.
The required number is 2.

2	1568
2	784
2	392
2	196
2	98
7	49
7	7
	1

- **5184**

Prime factors of 5184

$$= (\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{3\times 3})\times(\overline{3\times 3})$$

5184 is already perfect square
If 5184 is divided by 4 we will be left again perfect square.
The required number is 4.

2	5184
2	2592
2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

- **27378**

Prime factors of 27378

$$= 2\times(\overline{3\times 3})\times(\overline{3\times 3})\times(\overline{13\times 13})$$

In prime factorization, 2 is left unpaired.
If 27378 is divided by 2, we will be left with a perfect square.
The required number is 2.

2	27378
3	13689
3	4563
3	1521
3	507
13	169
13	13
	1

7. Find the smallest number by which the given number must be multiplied to make it a perfect square.

- **156**

Prime factors of 156 $= (\overline{2\times 2})\times 3\times 13$

In the prime factors 3 and 13 are left unpaired.
Multiply 156 with 3×13, the ungrouped 3 and 13 will also be grouped in pair.
So, the required number is 39.

2	156
2	78
3	39
13	13
	1

- **1331**

Prime factors of 1331 $= (\overline{11\times 11})\times 11$

In the prime factors 11 is left ungrouped.
Multiply 1331 with 11 the ungrouped 11 will also be grouped in pair.

11	1331
11	121
11	11
	1

So, the required number is 11.

- **432**

Prime factors of 432

$$= (\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{3\times 3})\times 3$$

In the prime factors 3 is left in unpaired.
Multiply 432 by 3, the ungrouped 3 will also be grouped in pairs.
So, the required number is 3.

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

- **700**

Prime factors of 700

$$= (\overline{2\times 2})\times(\overline{5\times 5})\times 7$$

In the prime factors 7 is left in unpaired.
Multiply 700 by 7, the ungrouped 7 will also be grouped in pair.
So, the required number is 7.

2	700
2	350
5	175
5	35
7	7
	1

- **882**

Prime factors of 882

$$= 2\times(\overline{3\times 3})\times(\overline{7\times 7})$$

In the prime factor 2 is left in unpaired.
Multiply 882 with 2, the ungrouped 2 will be also in grouped in pairs.

2	882
3	441
3	147
7	49
7	7
	1

- **3698**

Prime factors of 3698 $= 2\times(\overline{43\times 43})$

In the prime factor 2 is left in unpaired.
Multiply 3698 with 2, the ungrouped 2 will be also in grouped in pairs.

2	3698
43	1849
43	43
	1

- **76800**

Prime factors of 76800

$$= (\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{2\times 2})$$
$$\times(\overline{2\times 2})\times 3\times(\overline{5\times 5})$$

In the prime factors 3 is left in unpaired.
Multiply 76800 with 3, the ungrouped 3 will be also in grouped in pairs.

2	76800
2	38400
2	19200
2	9600
2	4800
2	2400
2	1200
2	600
2	300

2	150
3	75
5	25
5	5
	1

845

Prime factors of 845

$= 5 \times \overline{(13 \times 13)}$

5	845
13	169
13	13
	1

In the prime factors, 5 is left unpaired.

Multiply with 5, the ungrouped 5 will be also in pairs.

8. Find the value of :

(a) $(-0.03)^2 = -0.03 \times -0.03 = 0.0009$

(b) $\left(\frac{-2}{3}\right)^2 = \left(\frac{-2}{3}\right) \times \left(\frac{-2}{3}\right) = \frac{4}{9}$

(c) $\left(\frac{-17}{105}\right)^2 = \left(\frac{-17}{105}\right) \times \left(\frac{-17}{105}\right) = \frac{289}{11025}$

(d) $\left(\frac{-39}{93}\right)^2 = \left(\frac{-39}{93}\right) \times \left(\frac{-39}{93}\right) = \frac{1521}{8649}$

Exercise 2.2

1. Find the squares of the following numbers :

(a) 25; $25 \times 25 = 625$ — 625 is the square of 25

(b) 39; $39 \times 39 = 1521$ — 1521 is the square of 39

(c) 45; $45 \times 45 = 2025$ — 2025 is the square of 45

(d) 103; $103 \times 103 = 10609$ — 10609 is the square of 103

(e) 115; $115 \times 115 = 13225$ — 13225 is the square of 115

(f) 123; $123 \times 123 = 15129$ — 15129 is the square of 12

2. Which of the following numbers are not perfect squares?

(By using property 2. All the perfect square are ending with an even number of zeros.)

Thus, 100, 10000, 16900, 22500, 640000 are perfect square.

So, 16000, 2500000, 1000, 9000, 81000 are not perfect square.

3. Select the numbers which are squares of even numbers and odd numbers :

(The squares of even numbers are even. Squares of odd numbers are odd.)

Squares of even numbers = 36, 64, 144, 100, 196.

Squares of odd numbers = 225, 169, 625, 121, 1225.

4. Show that the numbers :

90 = 90 with odd number of zero. 90 is not perfect square.

122 = 122 ending 2 can not perfect square. 122 is not perfect squeal.

124 = Prime factors of 124 is $2 \times 2 \times 31$.

The factors of 124 can not be grouped into pair of identical factors.

So, 124 is not a perfect square.

366 = Prime factor 366, we get $2 \times 3 \times 61$.

So, 366 is not a perfect square.

5. Check out which of the following numbers are perfect squares using prime factorization method : .

- **256**

Prime factor of 256

$= \overline{2\times 2}\times \overline{2\times 2}\times \overline{2\times 2}\times \overline{2\times 2}$

$= 16$

Thus, 256 is a perfect square of 16.

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

- **169**

13	169
13	13
	1

Prime factors of 169 $= \overline{13\times 13}$

Thus, 169 is a perfect square of 13.

- **226**

2	226
	113

Prime factors of 226 $= 2\times 113$

Thus, 226 is not a perfect square.

- **100**

2	100
2	50
5	25
5	5
	1

Prime factors of 100 $= \overline{2\times 2}\times \overline{5\times 5}$

$= 2\times 5$

$= 10$

Thus, 100 is perfect square of 10.

- **121**

11	121
11	11
	1

Prime factors of 121 $= \overline{11\times 11}$

Thus, 121 is a prefect square of 11.

- **299**

13	299
23	23
	1

Prime factors of 299 $= 13\times 23$

Thus, 299 is not perfect square.

- **324**

2	324
2	162
3	81
3	27
3	9
3	3
	1

Prime factors of 324 $= \overline{2\times 2}\times \overline{3\times 3}\times \overline{3\times 3}$

$= 2\times 3\times 3$

$= 18$

Thus, 324 is a perfect square of 18.

ı **1024**

4	1024
4	256
4	64
4	16
2	4
2	2
	1

ı **2027**

2027	2027
	1

Prime factors of 2027 $= 2027 \times 1$

Thus 2027 is not a prefect squares.

Prime factors of 1024 $= \overline{4\times 4}\times\overline{4\times 4}\times\overline{2\times 2}$

$$= 4\times 4\times 2 = 32$$

Thus, 1024 is a prefect square of 32..

ı **10404**

Prime factors of 10404

$$= (\overline{2\times 2})\times(\overline{3\times 3})\times(\overline{17\times 17})$$

$$= 2\times 3\times 17$$

Thus, 10404 is a perfect square of 102.

2	10404
2	5202
3	2601
3	867
17	289
17	17
	1

6. Check out which of the following numbers are not perfect squares, using the property of perfect squares :

(By using property 1. A number ending with 2, 3, 7 and 8 can never be a perfect square)

Thus, 137, 188, 697, 228, 233 are not perfect square.

$$125 = 5\times 5\times 5$$

ı 125 is cube of 5 so it is not a perfect square.

$$2205 = 5\times 21\times 21$$

ı 2205 is not a perfect square. As factors are not paired.

7. Which of the following are Pythagorean triplets?

(a) (4, 6, 8)

$$2m = 4 \qquad m = 2$$

$$(m^2 - 1) = 2^2 - 1 = 4 - 1 = 3$$

$$(m^2 + 1) = 2^2 + 1 = 4 + 1 = 5$$

4, 6, 8 are not pythagorean triplets.

(b) (6, 8, 10)

$$2m = 6 \qquad m = 3$$

$$(m^2 - 1) = 3^2 - 1 = 9 - 1 = 8$$

$$(m^2 + 1) = 3^2 + 1 = 9 + 1 = 10$$

6, 8, 10 are pythagorean triplets.

(c) (9, 81, 82)

$$2m = 9 \qquad m = 4.5$$
$$(m^2 - 1) = 4.5^2 - 1 = 20.25 - 1 = 19.25$$
$$(m^2 + 1) = 4.5^2 + 1 = 20.25 + 1 = 21.25$$

9, 81, 82 are not pythagorean triples.

(d) (10, 24, 26) $= 2m = 10 \qquad m = 5$

$$(m^2 - 1) = 5^2 - 1 = 25 - 1 = 24$$
$$(m^2 + 1) = (5^2 + 1) = 25 + 1 = 26$$

10, 24, 26 are pythagorean triplets.

(e) (15, 85, 87) $= 2m = 15 \qquad m = 7.5$

$$(m^2 - 1) = 7.5^2 - 1 = 56.25 - 1 = 55.25$$
$$(m^2 + 1) = 7.5^2 + 1 = 56.25 + 1 = 57.25$$

15, 85, 87 are not pythagorean triplets

(f) (26, 168, 170) $= 2m = 26 \qquad m = 13$

$$(m^2 - 1) = 13^2 - 1 = 169 - 1 = 168$$
$$(m^2 + 1) = 13^2 + 1 = 169 + 1 = 170$$

26, 168, 170 are pythagorean triplets

(g) (30, 224, 226) $= 2m = 30\,;\ m = 15$

$$(m^2 - 1) = 15^2 - 1 = 225 - 1 = 224$$
$$(m^2 + 1) = 15^2 + 1 = 225 + 1 = 226$$

30, 224, 226 are phythagorean triplets.

(h) (42, 440, 442) $= 2m = 42\,;\ m = 21$

$$(m^2 - 1) = 21^2 - 1 = 441 - 1 = 440$$
$$(m^2 + 1) = 21^2 + 1 = 441 + 1 = 442$$

42, 440, 442 are phythagorean triplets.

8. Find the values using the properties of squares :

$$\boxed{(n+1)^2 - n^2 = (n+1) + n}$$

(a) $105^2 - 104^2 = 105 + 104 = 209$

(b) $147^2 - 146^2 = 147 + 146 = 293$

(c) $238^2 - 237^2 = 238 + 237 = 475$

(d) $269^2 - 268^2 = 269 + 268 = 537$

9. Fill in the blanks :

(a) $1 + 3 + 5 + 7 + \mathbf{9} = \mathbf{25} = 5^2$

(b) $1 + 3 + 5 + 7 + 9 + \mathbf{11} = \mathbf{36} = 6^2$

(c) $1 + 3 + 5 + 7 + 9 + 11 + \mathbf{13} = \mathbf{49} = 7^2$

(d) $1 + 3 + 5 + 7 + 9 + 11 + 13 + \mathbf{15} = \mathbf{64} = 8^2$

Exercise 2.3

1. Find the square root of the following by prime factorization method.

(a) 1521

3	1521
3	507
13	169
13	13
	1

Prime factorization of $\overline{3\times 3}\times\overline{13\times 13}$

Square root of 1521 $=3\times 13=39$

(b) 1600

2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

Prime factorization of 1600 $=\overline{2\times 2}\times\overline{2\times 2}\times\overline{2\times 2}\times\overline{5\times 5}$

$=2\times 2\times 2\times 5=8\times 5=40$

Square root of 1600 $=40$

(c) 9604

2	9604
2	4802
7	2401
7	343
7	49
7	7
	1

Prime factorization of 9604

$=\overline{2\times 2}\times\overline{7\times 7}\times\overline{7\times 7}=2\times 7\times 7$

Square root of 9604 $=98$

(d) 11025

5	11025
5	2205
3	441
3	147
7	49
7	7
	1

Prime factorization of 11025

$=\overline{5\times 5}\times\overline{3\times 3}\times\overline{7\times 7}$

Square root of 11025 $=5\times 3\times 7=105$

2. Find the square root of the following by division method.

(a) 15376

	124
1	$\overline{1}\ \overline{53}\ \overline{76}$
+1	−1
22	53
+2	44
244	976
	−976
	0

$\sqrt{15376}=124$

(b) 974169

	987
9	$\overline{97}\ \overline{41}\ \overline{69}$
+9	−81
188	1641
+8	−1504
1967	13769
	13769
	0

$\sqrt{974169}=987$

(c) 4004001

	2001
2	$\overline{4}\ \overline{00}\ \overline{40}\ \overline{01}$
	−4
40	00
	00
4001	4001
	−4001
	×

$\sqrt{4004001} = 2001$

(d) 7033104

	2652
2	$\overline{7}\ \overline{03}\ \overline{31}\ \overline{04}$
+2	4
46	303
+6	−276
525	2731
+5	2625
5302	10604
	10604
	0

$\sqrt{7033104} = 2652$

3. The least number which will be divisible by 8, 12, 15 and 20 is the L.C.M. of 8,12,15 and 20.

2	8, 12, 15, 20
2	4, 6, 15, 10
2	2, 3, 15, 5
3	1, 3, 15, 5
5	1, 1, 5, 5
	1, 1, 1, 1

LCM of 8, 12, 15 and 20 $= 2 \times 2 \times 3 \times 5 \times 2 = 120$

To make 120 a perfect square $120 = 2 \times \overline{2 \times 2} \times 3 \times 5$

It must be multiplied by 30.

Hence, the required the least number $120 \times 30 = 3600$.

2	120
2	60
2	30
3	15
5	5
	1

4. The greatest 4-digit number $= 9999$

We observe that

$$99^2 = 9801$$

Now, we need to find the least number when subtracted from 9999 gives a perfect squares.

Thus, the required number is $9999 - 198 = 9801$

$$\sqrt{9801} = 99^2$$

	99
9	9999
+9	81
189	1899
	−1701
	198

5. The least number of 6 digits $= 100000$

We observe that

$$316^2 < 100000 < 317^2$$

Now, the number to be added

$$= 317^2 - 100000$$
$$= 100489 - 100000$$
$$= 489$$

Required prefect square

$$= 100000 + 489 = 100489$$

$\sqrt{100489} = 317$

	316
3	$\overline{10}\ \overline{00}\ \overline{00}$
+3	−9
61	100
+1	−61
626	3900
	3756
	144

6. Find the smallest number by which each of the following numbers should be multiplied so as to get a perfect squares.

(a) 126

Prime factors of 126 $= 2 \times \overline{3 \times 3} \times 7$

This prime factorisation 2 and 7 are left unpaired.

By multiples 126 with 14 the ungrouped 2 and 7 will also be grouped in pairs.

So, the required number is 14.

2	126
3	63
3	21
7	7
	1

(b) 180

Prime factor of 180 $= \overline{2 \times 2} \times \overline{3 \times 3} \times 5$

In, This prime factorization 5 is left unpaired

By multiplied 180 with 5 the ungrouped 5 will also be grouped in pairs.

So, required number = 5.

2	180
2	90
3	45
3	15
5	5
	1

(c) 1458

Prime factor of 1458

$= 2 \times \overline{3 \times 3} \times \overline{3 \times 3} \times \overline{3 \times 3}$

In this, prime factorization 2 is left unpaired.

By multiplied 1458 with 2 the ungrouped 2 will also be grouped paired.

So, required number = 2.

2	1458
3	729
3	243
3	81
3	27
3	9
	3
	1

(d) 2028

Prime factor of 2028

$= \overline{2 \times 2} \times 3 \times \overline{13 \times 13}$

In this, prime factorization 3 is left unpaired.

By multiplied 2028 with 3 the ungrouped 3 will also be grouped paired.

So, required number = 3.

2	2028
2	1014
3	507
13	169
13	13
	1

7. In each of the following find the least number which must be added to make the following a perfect square.

(a) 5678

We observe that $75^2 < 5678 < 76^2$

Now, the number to be added $76^2 - 5678$

$= 5776 - 5678 = 98$

Required number is 98.

98 is added to 5678 $= 5678 + 98 = 5776$

5776 is the perfect square of 76.

	75
7	56 78
+7	−49
145	778
	−725
	53

(b) 9991

We observe that

$$99^2 < 9991 < 100^2$$

Now, the number to be added

$$10000 - 9991 = 9$$

If 9 is added to 9991 $= 9991 + 9 = 10000$

10000 is perfect square of 100.

	99
9	9991
+9	−81
189	1891
	1701
	190

(c) 4215

We observe that $64^2 < 4215 < 65^2$

Now, the number to be added

$65^2 - 4215 = 4225 - 4215 = 10$

Required number $= 10$

If 10 is added to 4215 $= 4215 + 10 = 4225$

4225 is perfect square of 65.

	64
6	$\overline{42}\ \overline{15}$
+6	−36
124	615
	496
	119

(d) 306452

We observe that

$$553^2 < 306452 < 554^2$$

Now, the number to be added

$$554^2 - 306452$$

$306916 - 306452 = 464$

Required number $= 464$

If 464 is added to 306452 $= 306452 + 464$

$= 306916$

306916 is perfect square of 554.

	553
5	$\overline{30}\ \overline{64}\ \overline{52}$
+5	25
105	564
+5	−525
1103	3952
	3309
	643

(e) 92700

We observe that $304^2 < 92700 < 305^2$

Now, the number to be added

$305^2 - 92700 = 93025 - 92700 = 325$

Required number $= 325$

If 325 is added to 92700 $= 92700 + 325$

$= 93025$

93025 is perfect square of 305.

	304
3	$\overline{9}\ \overline{27}\ \overline{00}$
+3	−3
604	2700
	−2416
	284

8. The greatest 5-digit number $= 99999$

We observe that

$$316^2 = 99856$$

Now, we need to find the least number when subtracted from 99999 we gives a perfect square.

Thus, the required number

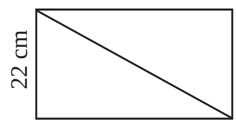
$$99999 - 143 = 99856$$

Square root

$$99856 = \sqrt{99856} = 316$$

	316
3	99999
+3	−9
61	099
+1	−61
626	3899
	3756
	143

	316
3	$\overline{9}\ \overline{98}\ \overline{56}$
$+3$	9
61	098
$+2$	-61
626	3856
	-3856
	0



9. Length of recentangle $= 22\,\text{cm}$
Breadth of recentangle $= 120\,\text{cm}$
By using phythagorash theorem

$$d^2 = l^2 + b^2 = 22^2 + 120^2 = 484 + 14400 = 14884$$

$$d = \sqrt{14884} = 122$$

	122
1	1 48 84
$+1$	-1
22	48
$+2$	-44
242	484
	484
	0

Diagonal of rectangle is 122 cm.

10. We observe that $245^2 < 60509 < 246^2$
Now, the number to be added

$$246^2 - 60509$$

$$60516 - 10509 = 7$$

Required number $= 7$
If 7 is added to $60509 = 60516$

$$\sqrt{60516} = 246.$$

	245
2	$\overline{6}\ \overline{05}\ \overline{09}$
$+2$	-4
44	205
$+4$	-176
485	2909
	-2425
	484

Exercise 2.4

1. Find the Square root of the following :

(a) $\dfrac{1296}{1936} = \sqrt{\dfrac{1296}{1936}} = \dfrac{\sqrt{1296}}{\sqrt{1936}} = \dfrac{36}{44}$

	36
3	1296
$+3$	-9
66	396
	-396
	0

	44
4	1936
$+4$	-16
84	336
	-336
	0

Square root of $\frac{1296}{1936} = \frac{36}{44}$

(b) $57\frac{19}{25} = \frac{1444}{24}$

$= \sqrt{\frac{1444}{25}}$

$= \frac{\sqrt{1444}}{\sqrt{25}} = \frac{38}{5}$

	38
3	14 44
	−9
68	544
	−544
	0

	5
5	25
	−25
	0

Square root of $\frac{1444}{25} = \frac{38}{5}$

(c) $6\frac{115}{289} = \sqrt{\frac{1849}{289}}$

$= \frac{\sqrt{1849}}{\sqrt{289}} = \frac{43}{17}$

Square root of $\frac{1849}{289} = \frac{43}{17}$

	43
4	$\overline{18}\ \overline{49}$
+4	−16
83	249
	249
	0

	17
1	$\overline{2}\ \overline{89}$
+1	−1
27	189
	189
	0

(d) $3\frac{16}{256} = \frac{784}{256} = \sqrt{\frac{784}{256}} = \frac{\sqrt{784}}{\sqrt{256}} = \frac{28}{16}$

	28
2	$\overline{7}\ \overline{84}$
+2	−4
48	384
	384
	0

	16
1	$\overline{2}\ \overline{56}$
+1	−1
26	156
	156
	0

square root of $\frac{784}{256} = \frac{28}{16}$

2. Find the value of the following numbers correct upto 3 decimal places.

(a) $\sqrt{145.38}$

	12.057
1	1 45.38 00 00
+1	−1
22	45
+2	−44
2405	13800
+5	−12025
24107	177500
	−168749
	8751

(b) $\sqrt{35.35}$

	5.945
5	$\overline{35}.\overline{35}\ \overline{00}\ \overline{00}$
+5	−25
109	1035
+9	−981
1184	5400
+4	−4736
11885	66400
	−59425
	6975

$\sqrt{145.38} = 12.057\ \ldots$ $\sqrt{35.35} = 5.945$

(c) $\sqrt{19}$

	4.358
4	$\overline{19}.\overline{00}\ \overline{00}\ \overline{00}$
+4	16
83	300
+3	243
865	5100
+5	4325
8708	77500
	−69664
	7836

$\sqrt{19} = 4.358$

(d) $\sqrt{15525.28}$

	124.600
1	$\overline{1}\ \overline{55}\ \overline{25}.\overline{28}\ \overline{00}\ \overline{00}$
+1	−1
22	055
+2	−44
244	1125
+4	−976
2486	14928
+6	–14916
249200	120000
	000000
	1200000

$\sqrt{15525.28} = 124.600$

3. Simplify :

(a) $\dfrac{\sqrt{72.25} - \sqrt{5.76}}{\sqrt{72.25} + \sqrt{5.76}}$

	8.5
8	$\overline{72}.\overline{25}$
+8	−64
165	825
	−825
	0

$\sqrt{72.25} = 8.5$

	2.4
2	$\overline{5}.\overline{76}$
+2	−4
44	176
	−176
	0

$\sqrt{5.76} = 2.4$

value put in $\dfrac{\sqrt{72.25} - \sqrt{5.76}}{\sqrt{72.25} + \sqrt{5.76}}$

$$\frac{8.5 - 2.4}{8.5 + 2.4} = \frac{6.1}{10.9} \text{ or } \frac{61}{109}$$

(b) $\dfrac{\sqrt{0.2209} + \sqrt{0.1681}}{\sqrt{0.2209} - \sqrt{0.1681}}$

	0.47
4	$\overline{0}.\overline{22}\ \overline{09}$
+4	−16
87	609
	−609
	0

	0.41
4	$\overline{0}.\overline{16}\ \overline{81}$
+4	−16
81	081
	81
	0

$\sqrt{0.2209} = 0.47$; $\sqrt{0.1681} = 0.41$

Value put in $\dfrac{\sqrt{0.2209}+\sqrt{0.1681}}{\sqrt{0.2209}-\sqrt{0.1681}}$

$\dfrac{0.47+0.41}{0.47-0.41} = \dfrac{0.88}{0.06} = \dfrac{88}{6}$ or $\dfrac{44}{3}$

4. Find the square root of the following numbers

(a) $3 =$ square root $3 = \sqrt{3}$

	1.732
1	$\overline{3}.\overline{00}\ \overline{00}\ \overline{00}$
+1	−1
27	200
+7	−189
343	1100
+3	−1029
3462	7100
	6924
	176

$\sqrt{3} = 1.732$

(b) 11 Square root of $11 = \sqrt{11}$

	3.316
3	$\overline{11}.\overline{00}\ \overline{00}\ \overline{00}$
+3	−9
63	200
+3	−189
661	1100
+1	−661
6626	43900
	−39756
	4144

$\sqrt{11} = 3.316$

(c) 125 Square root of $125 = \sqrt{125}$

	11.180
1	$\overline{1}\ \overline{25}.00\ 00\ \ 00$
+1	1
21	25
+1	21
221	400
+1	221
2228	17900
+8	−17824
22360	7600
	0000
	07600

(d) 3460 ; Square root of $3460 = \sqrt{3460}$

	58.821
5	$\overline{34}\ \overline{60}.\overline{00}\ \overline{00}\ \overline{00}$
+5	−25
108	960
+8	−864
1168	9600
+8	−9344
11762	25600
+2	−23524
11761	207600
	−11761
	195839

$\sqrt{3460} = 58.821$

5. Evaluate the following :

(a) $\sqrt{25 \times 169} = \sqrt{25} \times \sqrt{169}$

$= 5 \times 13 = 65$

(b) $\sqrt{45}\times\sqrt{20}=\sqrt{45\times 20}=\sqrt{900}=30$

(c) $\sqrt{25.6\times 52.9}=\sqrt{1354.24}=36.8$

	36.8
3	$\overline{13}\ \overline{54}.\overline{24}$
+3	−9
66	454
+6	−396
728	5824
	5824
	0

(d) $\sqrt{\dfrac{0.4225}{0.0169}}$

	0.65
6	$0.\overline{42}\ \overline{25}$
+6	−36
125	625
	−625
	0

	0.13
1	$0.\overline{01}\ \overline{69}$
+1	−1
23	69
	69
	0

$$=\frac{\sqrt{0.4225}}{\sqrt{0.0169}}=\frac{0.65}{0.13}=5$$

6. $\sqrt{19044}$ by using division method

$\sqrt{190.44}\div\sqrt{1.9044}$

$$=\sqrt{\frac{19044}{100}}\div\sqrt{\frac{19044}{10000}}$$

$$=\frac{\sqrt{19044}}{\sqrt{100}}\div\frac{\sqrt{19044}}{\sqrt{10000}}$$

$$=\frac{138}{10}\div\frac{138}{100}$$

$$=\frac{138}{10}\times\frac{100}{138}=10.$$

	138
1	$\overline{1}\ \overline{90}\ \overline{44}$
+1	1
23	90
+3	−69
268	2144
	2144
	0

7. $\sqrt{25921}$ by using division method

$\sqrt{259.21}-\sqrt{2.5921}$

$$\frac{\sqrt{25921}}{\sqrt{100}}-\frac{\sqrt{25921}}{\sqrt{10000}}$$

$$=\frac{161}{10}-\frac{161}{100}$$

$$=\frac{1610-161}{100}$$

$$=\frac{1449}{100}$$

$$=14.49$$

	161
1	$\overline{2}\ \overline{59}\ \overline{21}$
+1	−1
26	159
+6	156
321	321
	−321
	0

8. Find the square root of the following.

(a) $\sqrt{20.8849}$

	4.57
4	20.88 49
+4	−16
85	488
+5	−425
907	6349
	−6349
	0

Square root of 20.8849 = 4.57

(b) $\sqrt{180.0964}$

	13.42
1	$\overline{1}\ \overline{80}.\overline{09}\ \overline{64}$
+1	–1
23	80
+3	−69
264	1109
+4	−1056
2682	5364
	−5364
	0

Square root of 180.0964 = 13.42

(c) $0.\overline{00}\ \overline{01}\ \overline{10}\ \overline{25}$

$$= \frac{11025}{1000000000}$$

$$\frac{\sqrt{11025}}{\sqrt{\overline{00}\,\overline{00}\,\overline{00}}} = \frac{105}{10000}$$

$$\frac{105}{10000} = 0.0105$$

square root of 0.00011025 = 0.0105

	105
1	$\overline{1}\ \overline{10}\ \overline{25}$
+1	−1
205	01025
	−1025
	0

(d) 0.104976

$$= \frac{104976}{100000}$$

$$= \frac{\sqrt{104976}}{\sqrt{100000}}$$

$$= \frac{324}{1000}$$

$$\frac{324}{1000} = 0.324$$

Square root of 0.104976 = 0.324

	324
3	$\overline{10}\ \overline{49}\ \overline{76}$
+3	−9
62	149
−2	−124
644	2576
	−2576
	0

Multiple Choice Questions

Tick (3) correct answer :

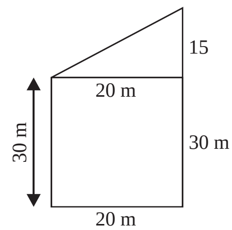
1.	(c)	**2.**	(d)	**3.**	(a)	**4.**	(b)	**5.**	(a)
6.	(d)	**7.**	(b)	**8.**	(a)	**9.**	(b)	**10.**	(c)

High Order Thinking Skills (HOTS)

1. Heights of first minar $= 30\,\text{m}$

Height of second minar $= 45\,\text{m}$

$$\begin{aligned} l^2 &= b^2 + h^2 \\ &= (20)^2 + (15)^2 \\ &= 400 + 225 \\ &= 625 \\ l &= \sqrt{625} \\ &= 25 \end{aligned}$$



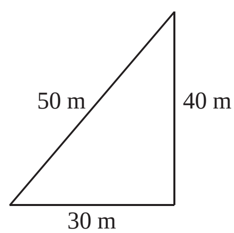
The distance between their tops 25 cm

2. Height of kite $= 40\,\text{m}$

Length of string $= 50\,\text{m}^2$

Distance between Raju and tree

$$\begin{aligned} l^2 &= b^2 + h^2 \\ b^2 &= l^2 - h^2 \\ &= (50)^2 - (40)^2 \\ &= 2500 - 1600 \\ &= 900 \\ b &= \sqrt{900} = 30\,\text{m} \end{aligned}$$



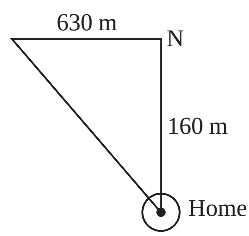
3. $h = 160\,\text{m},\ b = 630\,\text{m},\ l = x$

$$x^2 = (630)^2 + (160)^2 = 396900 + 25600 = 422500$$

$$x = \sqrt{422500} = 650\,\text{m}$$

She covered the distance while returning $= 650\,\text{m}$

	650
6	$\overline{42}\ \overline{25}\ \overline{00}$
+6	36
125	625
0	625
1250	000
	000
	0



3 Cube and Cube Roots

Exercise 3.1

1. Find the cubes of following numbers :

(a) $0.9 = 0.9 \times 0.9 \times 0.9 = 0.729$

(b) $1.7 = 1.7 \times 1.7 \times 1.7 = 4.913$

(c) $0.05 = 0.05 \times 0.05 \times 0.05 = 0.000125$

(d) $25.1 = 25.1 \times 25.1 \times 25.1 = 15813.251$

2. Which of the following are cubes of even natural numbers?

(The cube of an even number is even)

(a) 13,824 is cube of even natural number.

(b) 42,875 is not cube of even natural number

(c) 8,000 is cube of even natural number.

(d) 6,36,056 is cube of even natural number.

(e) 9,261 is not cube of even natural number.

(f) 32,768 is cube of even natural number.

3. Which of the following are cubes of odd natural numbers?

(The cube of an odd number are odd)

(a) 6,859 is cube of odd natural number.

(b) 4,913 is cube of odd natural number.

(c) 10,648 is not cube of odd natural number.

(d) 2,197 is cube of odd natural number.

(e) 2,744 is not cube of odd natural number.

(f) 35,937 is cube of odd natural number.

4. Which of the following are perfect cubes?

(a) 1,728

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

$$\sqrt[3]{1728} = (\overline{2\times 2\times 2})\times(\overline{2\times 2\times 2})\times(\overline{3\times 3\times 3})$$

(b) 3,840

2	3840
2	1920
2	960
2	480
2	240
2	120
2	60
2	30
3	15
5	5
	1

$$3840 = (\overline{2\times 2\times 2})\times(\overline{2\times 2\times 2})\times 2\times 2\times 3\times 5$$

$= 2 \times 2 \times 3 = 12$

1728 is a perfect cube

After grouping 2, 2, 5 and 3 are left.

3840 is not perfect cube.

(c) 12,167

23	12167
23	529
23	23
	1

$12167 = 23 \times 23 \times 23$

After grouping no factor is left.

12167 is a perfect cube.

(d) 11,109

3	11109
7	3703
23	529
23	23
	1

$11109 = 3 \times 7 \times 23$

Here we can not make any triplet

So, 11109 is not a perfect cube.

(e) 85,184

2	85184
2	42592
2	21296
2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

85184

$= \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{11 \times 11 \times 11}$

After grouping no factor is left.

85184 is a perfect cube.

(f) 20,48,383

127	2048383
127	16129
127	127
	1

$2048383 = \overline{127 \times 127 \times 127}$

After grouping no factor is left

2048383 is a perfect cube.

5. Find the smallest number which should be multiplied to the given number so that the product is a perfect cube.

(a) 392 Prime factor of 392

$392 = \overline{2 \times 2 \times 2} \times 7 \times 7$

2	392
2	196
2	98
7	49
7	7
	1

After grouping together, the triplets of 2 are left with factors 7×7.

If we multiply 392 by 7 the product will be a perfect cube.

$392 \times 7 = 2744$

2744 is cube of 14.

(b) 675

Prime factor of 675 $= \overline{3\times 3\times 3}\times 5\times 5$

After grouping together, the triplets of 3 are left with factors 5×5

If we multiply 675 by 5. The product will be a perfect cube.

$$675\times 5 = 3375$$

3375 is cube of 15.

3	675
3	225
3	75
5	25
5	5
	1

(c) 2560

Prime factors of 2560

$= \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times 5$

After grouping together the triples of $2\times 2\times 2$ are left with factor 5.

If we multiply 2560 by 5×5 the product will be perfect cube.

$2560\times 25 = 64000$

64000 is cube of 40.

2	2560
2	1280
2	640
2	320
2	160
2	80
2	40
2	20
2	10
5	5
	1

(d) 8788

Prime factors 8788 $= 2\times 2\times \overline{13\times 13\times 13}$

After grouping together the triplets of 13 are left with factor 2×2.

2	8788
2	4394
13	2197
13	169
13	13
	1

If we multiply 8788 by 2.

The product will be perfect cube.

6. Find the smallest number by which the following may be divided to obtain a perfect cube.

(a) 540

Prime factors of 540

$= 2\times 2\times \overline{3\times 3\times 3}\times 5$

After grouping together the triplets of 3 are left with factor $2\times 2\times 5$.

If we divided 540 by 20 the quotient will be a prefect cube.

$$540 \div 20 = 27$$

2	540
2	270
3	135
3	45
3	15
5	5
	1

27 is cube of 3.

(b) 2000

Prime factors of 2000

$$= \overline{2\times 2\times 2}\times 2\times \overline{5\times 5\times 5}$$

After grouping together the triplets of 2 and 5 left with factor 2.

If we divided 2000 by 2 the quotient will be a perfect cube

$$2000 \div 2 = 1000$$

1000 is cube of 10.

2	2000
2	1000
2	500
2	250
5	125
5	25
5	5
	1

(c) 8640

Prime factor of 8640

$$= \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times \overline{3\times 3\times 3}\times 5$$

After grouping together, the triplets of 2, 3 and 2 are left with factor 5.

If we divide 8640 by 5. Then also the quotient will be perfect cube

$$8640 \div 5 = 1728$$

1728 is perfect cube of 12.

2	8640
2	4320
2	2160
2	1080
2	540
2	270
3	135
3	45
3	15
5	5

(d) 27648

Prime factor of 27648

$$= \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}$$

$$\times 2\times \overline{3\times 3\times 3}$$

After grouping together the triplets of 2, 2, 3 are left with 2.

If we divide 27648 by 2.

Then also the quotient will be perfect cube.

$$27648 \div 2 = 13824$$

13224 is perfect cube of 24.

2	27648
2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

<u>Exercise 3.2</u>

1. Find the cube root of the following :

(a) 42875

5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

Prime factors of 42875

$$= \overline{5\times 5\times 5}\times \overline{7\times 7\times 7}$$

$$= 35$$

(b) 10^6

10	1000000
10	100000
10	10000
10	1000
10	100
10	10
	1

Prime factors of 1000000

$$= \overline{10\times 10\times 10}\times \overline{10\times 10\times 10}$$

$$= 10\times 10 = 100$$

(c) 35937

3	35937
3	11979
3	3993
11	1331
11	121
11	11
	1

Prime factors of 35937

$$= \overline{3\times 3\times 3}\times \overline{11\times 11\times 11}$$

$$= 3\times 11 = 33$$

$$= \sqrt[3]{35937} = 33$$

(d) 74088

2	74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

Prime factors of 74088

$$= \overline{2\times 2\times 2}\times \overline{3\times 3\times 3}\times \overline{7\times 7\times 7}$$

$$= 2\times 3\times 7 = 42$$

$$= \sqrt[3]{74088}$$

2. Find the cube root of the following :

(a) $\dfrac{-343}{729} = \dfrac{343\times -1}{729}$

$$= (-1)\sqrt[3]{\frac{343}{729}} = \frac{(-1)\sqrt[3]{343}}{\sqrt[3]{729}}$$

$$= \frac{\sqrt[3]{\overline{7\times 7\times 7}}}{\sqrt[3]{\overline{3\times 3\times 3}\times \overline{3\times 3\times 3}}}$$

$$= \frac{-7}{3\times 3} = \frac{7}{9} = \frac{-343}{729} = \frac{-7}{9}$$

7	343
7	49
7	7
	1

3	729
3	243
3	81
3	27
3	9
3	3
	1

(b) $\dfrac{3375}{5832}$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

Cube root of $\dfrac{3375}{5832} = \sqrt[3]{\dfrac{3375}{5832}}$

$$\frac{\sqrt[3]{3375}}{\sqrt[3]{5832}} = \frac{\sqrt[3]{\overline{3\times3\times3}\times\overline{5\times5\times5}}}{\sqrt{\overline{2\times2\times2}\times\overline{3\times3\times3}\times\overline{3\times3\times3}}}$$

$$= \frac{3\times5}{2\times3\times3} = \frac{15}{18}$$

(c) $\dfrac{-4913}{-2197}$

Cube root of $\dfrac{-4913}{-2197}$

$$\sqrt[3]{\frac{4913}{2197}} = \frac{\sqrt[3]{\overline{17\times17\times17}}}{\sqrt[3]{\overline{13\times13\times13}}} = \frac{17}{13}$$

17	4913
17	289
17	17
	1

13	2197
13	169
13	13
	1

$$\frac{-4913}{-2197} = \frac{-17}{-13} = \frac{17}{13}$$

(d) $10\dfrac{81}{125} = \dfrac{125\times10+81}{125} = \dfrac{1331}{125}$

Cube root of $\dfrac{1331}{125}$

$$\sqrt[3]{\frac{1331}{125}} = \frac{\sqrt[3]{1331}}{\sqrt[3]{125}} = \frac{\sqrt[3]{11 \times 11 \times 11}}{\sqrt[3]{\overline{5 \times 5 \times 5}}} = \frac{11}{5}$$

$$\frac{1331}{125} = \frac{11}{5}$$

3. Find the cube root of the following :

(a) $-29791 = -1 \times \overline{29791}$

$= -1 \times \overline{31 \times 31 \times 31}$

31	29791
31	961
31	31
	1

(b) $0.000512 = \dfrac{512}{1000000}$

10	1000000
10	100000
10	10000
10	1000
10	100
10	10
	1

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factor of $\dfrac{512}{100000} = \dfrac{\overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2}}{\overline{10 \times 10 \times 10} \times \overline{10 \times 10 \times 10}}$

$$= \sqrt[3]{0.000512}\ \sqrt[3]{\frac{512}{1000000}}$$

$$= \frac{\sqrt[3]{512}}{\sqrt[3]{1000000}} = \frac{2 \times 2 \times 2}{10 \times 10} = \frac{8}{100} = 0.08$$

(c) $(-6)^3 \times (-3)^3$

$(-6 \times -6 \times -6) \times (-3 \times -3 \times -3)$

$-216 \times -27 = 5832$

Cube root of 5822

Prime factor of 5832

$= \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}$

$= \sqrt[3]{5832}$

$= 2 \times 3 \times 3 = 18$

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

(d) 0.002197

13	2197
13	169
13	13
	1

2	1000000
2	500000
2	250000
2	125000
2	62500
2	31250
5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$$\sqrt[3]{0.002197} = \sqrt[3]{\frac{2197}{1000000}} = \frac{\sqrt[3]{2197}}{\sqrt[3]{1000000}}$$

$$= \frac{\sqrt[3]{\underline{13 \times 13 \times 13}}}{(\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}) \times (\underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5})}$$

$$= \frac{13}{(2 \times 2) \times (5 \times 5)} = \frac{13}{100} = 0.13$$

4. (a) Value of cubical box $= 13824 \text{ cm}^3$

Edge $= \sqrt[3]{13824}$

$= \sqrt{\overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3}}$

$= 2 \times 2 \times 2 \times 3$

$= 24$

Edge of cubical box is 24 cm.

2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

(b) Volume of cubical box $= 32.768 \text{ m}^3$

$$\text{Edge} = \sqrt[3]{32.768}$$

2	32768
2	16384
2	8192
2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64

2	32
2	16
2	8
2	4
2	2
	1

10	1000
10	100
10	10
	1

$$\text{Edge of cubical box is} = \frac{\overline{2\times 2\times 2}\times\overline{2\times 2\times 2}\times\overline{2\times 2\times 2}\times\overline{2\times 2\times 2}\times\overline{2\times 2\times 2}}{10\times 10\times 10}$$

$$= \frac{2\times 2\times 2\times 2\times 2}{10} = \frac{32}{10} = 3.2 \text{ m}$$

5. Volumes two cubes $= 125 : 729$

Ratio of edges $= \sqrt[3]{125} : \sqrt[3]{729} = 5 : 9$

Area of cube $= (\text{side})^2 = (5)^2 : (9)^2 = 25 : 81$

MCQs

Tick (3) the correct answer :

1. (d) **2.** (c) **3.** (b) **4.** (c) **5.** (c) **6.** (b) **7.** (b)

Higher Order Thinking Skills (HOTS)

Ratio of three number 1 : 2 : 3

Let one number is x

Second number is $2x$

Third number is $3x$

Sum of their cubes $= 62208$

$$x^3 + (2x)^3 + (3x)^3 = 62208$$

$$x^3 + 8x^3 + 27x^3 = 62208$$

$$36x^3 = 62208$$

$$x^3 = 62208 \div 36$$

$$x^3 = 1728$$

$$x = \sqrt[3]{1728}$$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

Cube of 1728 $= \overline{2\times 2\times 2}\times\overline{2\times 2\times 2}\times\overline{3\times 3\times 3}$

$$\sqrt[3]{1728} = \sqrt[3]{\overline{2\times 2\times 2}\times\overline{2\times 2\times 2}\times\overline{3\times 3\times 3}} = 2\times 2\times 3 = 12$$

Thus value of one number is 12.
Value of second number is 24 (12×2).
Value of third number is 36 (12×3).

4 Playing with Numbers

Exercise 4.1

1. Write the following number in generalized form.

(a) $231 = 200 + 30 + 1 = 2 \times 100 + 3 \times 10 + 1 \times 1$

(b) $80 = 8 \times 10$

(c) $999 = 9 \times 100 + 9 \times 10 + 9 \times 1$

(d) $54 = 5 \times 10 + 4 \times 1$

2. Let the unit digit and tenth digits be y and x respectively.

According to the questions

$$(10x + y) + (10y + x) = 110$$
$$10x + y + 10y + x = 110$$
$$11x + 11y = 110$$
$$x + y = 10 \qquad \ldots(i)$$

And their difference is 6.

So, $$x - y = 6 \qquad \ldots(ii)$$

We added eq. (i) and (ii)

$$\begin{array}{rl} x + y &= 10 \\ x - y &= 6 \\ (-) \quad (+) & \;\; (-) \\ \hline 2x &= 16 \end{array}$$

$$x = \frac{16}{2} = 8$$
$$x = 8$$

x's value put in eq. (i)

$$8 + y = 10$$
$$y = 10 - 8 = 2$$

Now, we get $x = 8$ and $y = 2$.

Hence, the required two digits number is 82.

3. Let the two digits number be $10x + y$.

So, according to the questions,

$$(10x + y) = 8 \times (x + y)$$
$$10x + y = 8x + 8y$$
$$10x - 8x + y - 8y = 0$$
$$2x - 7y = 0 \qquad \ldots(i)$$

Similarly, when we subtract 45 from it then the digit is changed.

$$(10x + y) - 45 = (10y + x)$$
$$10x + y - 45 - 10y - x = 0$$
$$9x - 9y = 45$$

$$x - y = 5 \quad \ldots(ii)$$

Solving equation (i) and (ii), we get

$$2x - 7y = 0 \quad \ldots(i)$$

$$x - y = 5 \quad \ldots(ii) \times 2$$

Eq. (i) subtract from eq. (iii)

$$\begin{aligned} 2x - 2y &= 10 \\ 2x - 7y &= 0 \\ (-) \quad (+) \quad &(-) \\ \hline 5y &= 10 \\ y &= 2 \end{aligned}$$

y's value put in eq. (ii)

$$x - 2 = 5$$

$$x = 5 + 2 = 7$$

Now, we get $x = 7$ and $y = 2.$

Hence, the required two digits number is 72.

4. Original number $= (10a + b)$

Number formed by reversing the digits $= 10b + a$

According to questions,

The new number is increased by 54

Given; Sum of the digits $= 12$

$$a + b = 12 \text{ and } b = 12 - a \quad \ldots(i)$$

$$10a + b < 10b + a$$

The difference between the old number and new number $= 54$

$$\begin{aligned} 10b + a - 10a - b &= 54 \\ 9b - 9a &= 54 \\ 9(b - a) &= 54 \\ (b - a) &= \frac{54}{9} = 6 \quad \ldots(ii) \end{aligned}$$

Substituting in (ii) $b = 12 - a$ we have

$$(12 - a) - a = 6 \qquad 12 - 2a = 6$$

$$-2a = 6 - 12 \qquad -2a = -6$$

$$a = 3$$

form (i) $\quad b = 12 - 3 = 9$

Hence the original number $= (10a + b)$

$$= 10 \times 3 + a = 30 + 9 = 39$$

5. Let original number $= 10a + b$

New number by reversing $= 10b + a$

The difference between the old number and new number is 45.

So, $\quad (10a + b) - (10b + a) = 45$

$$\begin{aligned} 10a + b - 10b - a &= 45 \\ 9a - 9b &= 45 \\ 9(a - b) &= 45 \\ (a - b) &= 45 \div 9 = 5 \end{aligned}$$

The difference between two digits $= 5.$

Exercise 4.2

1. Which of the following are divisible by 2?
(A number is divisible by 2. If its units digit is even.)
(a) 350 = In 350, 0 is even number.
So, 350 is divisible by 2.
(b) 4015 = In 4015, 5 is not even number.
So, 4015 is not divisible by 2.
(c) 461 = In 461, 1 is not even number.
So, 461 is not divisible by 2.
(d) 298 = In 298, 8 is even number.
So, 298 is divisible by 2.

2. Which of the following are divisible by 3?
(We know that a number is divisible by 3. If the sum of its digits is divided by 3.)
(a) 9261 = Sum of the digit of 9261 $= 9+2+6+1=18$
Which is divisible by 3, So, 9261 is divisible by 3.
(b) 3310 = Sum of the digit of 3310 $= 3+3+1+0=7$
Which is not divisible by 3. So, 3310 is not divisible by 3.
(c) 2561= Sum of digits of 2561 $= 2+5+6+1=14$
Which is not divisible by 3. So, 2561 is not divisible by 3.
(d) 1296 = Sum of the digits $= 1+2+9+6=18$
Which is divisible by 3.
So, 1296 is divisible by 3.

3. Which of the following are divisible by 5?
(A number is divisible by 5 if it units is 0 and 5)
(a) 4015 = Its unit digit is 5, So, 4015 is divisible by 5.
(b) 298 = Its unit digit is 8, So, 298 is not divisible by 5.
(c) 350 = Its unit digit is 0, So, 350 is divisible by 5.
(d) 461 = Its unit digit is 1, So, 461 is not divisible by 5.

4. Which of the following are divisible by 9?
We know that a number is divisible by 9 if sum of its digits is divisible by 9.
(a) 1769
Sum of digits $= 1+7+6+9=23$.
Which is not divisible by 9.
So, 1769 is not divisible by 9.
(b) 3915
Sum of digits $= 3+9+1+5=18$
Which is divisible by 9.
So, 3915 is divisible by 9.
(c) 6831
Sum of digits $= 6+8+3+1=18$
Which is divisible by 9.
So, 6831 is divisible by 9.

(d) 6618

Sum of its digits $= 6 + 6 + 1 + 8 = 21$

Which is not divisible by 9.

So, 6618 is not divisible by 9.

5. Which of the following are divisible by 10?

(A number is divisible by 10 if its units digit is 0.)

(a) 1709

Its unit digit is 9. So, 1709 is not divisible by 10.

(b) 2655

Its units digit is 5. So, 2655 is not divisible by 10.

(c) 1819

Its unit digit is 9. So, 1819 is not divisible by 10.

(d) 1400

Its unit digit is 0, So, 1400 is divisible by 10.

6. A number is divisible by 3 if it sum of its digit is divisible by 3.

A number is divisible by 9. If it sum of its digit is divisible by 9.

Now, as $9 > 3$ this implies that a number that is divisible by 3 may not be divisible by 9.

For example, $12 (1 + 2 = 3)$ and 15 $(1 + 5 = 6)$ are divisible by 3 but not by 9.

7. Replace x by the smallest digit so that the number is divisible by (i) 3 (ii) 9.

(a) (i) Divisible by 3

$41x6 =$ Sum of digits should be divisible by 3.

Sum of digits $= 4 + 1 + x + 6 = 11 + x$

We know that $3 \times 3 = 9$, $3 \times 4 = 12$

$$9 < 11 < 12$$

So the sum should be 12

$$11 + x = 12$$

$$x = 12 - 11 = 1$$

Thus, $41\underline{1}6$ is divisible by 3.

(ii) $41x6$ is divisible by 9

Sum of digits should be divisible by 9.

Sum of digits $= 4 + 1 + x + 6 = 11 + x$

We know that $9 \times 1 = 9$, $9 \times 2 = 18$

$$9 < 11 < 18$$

So, sum should be 18

$$11 + x = 18$$

$$x = 18 - 11 = 7$$

Thus, $41\underline{7}6$ is divisible 9.

(b) (i) $x284$ is divisible by 3 : Sum of digits should be divisible by 3.

$x + 2 + 8 + 4 = 14 + x$

We know that $3 \times 4 = 12$, $3 \times 5 = 15$

$$12 < 14 < 15$$

So, the sum should be $= 15$

$$14 + x = 15$$

$$x = 15 - 14 = 1$$

Thus, $\underline{1}284$ is divisible by 3.

(ii) $x\,284$ is divisible by 9.

Sum of digit should be divisible by 9.

$$x + 2 + 8 + 4 = 14 + x$$

We know that $9 \times 2 = 18$

$$9 < 14 < 18$$

So the sum should be $= 18$

$$14 + x = 18 \qquad x = 18 - 14 = 4$$

Thus $\underline{4}284$ is divisible by 9.

(c) (i) $5\,x\,02$ is divisible by 3 :

Sum of digit should be divisible by 3.

$$5 + x + 0 + 2 = 7 + x$$

We know that $= 2 \times 3 = 6,\ 3 \times 3 = 9$

So, the sum should be 9.

$$7 + x = 9 \qquad x = 9 - 7 = 2$$

Thus $5\underline{2}02$ is divisible by 3.

(ii) $5\,x\,02$ divisible by 9.

Sum of digits should be divided by 9.

Sum of digits $5 + x + 0 + 2 = 7 + x$

We know that $9 > 7$

The sum should be 9.

$$7 + x = 9$$

$$x = 9 - 7 = 2$$

Thus, $5\underline{2}02$ is divisible by 9.

(d) (i) $448\,x$ is divisible by 3.

Sum of digits should be divided by 3.

Sum of digits $= 4 + 4 + 8 + x = 16 + x$

We know that $3 \times 5 = 15,\ 3 \times 6 = 18$

$$16 + x = 18$$

$$x = 18 - 16 = 2$$

Thus, $448\underline{2}$ is divisible by 3.

(ii) $448x$ is divisible by 9.

Sum of digits should by divide 9.

Sum of digits $= 4 + 4 + 8 + x = 16 + x$

We know that, $9 \times 1 = 9,\ 18 = 2 \times 9$

$$9 < 16 < 18$$

The sum should be 18.

$$16 + x = 18 \qquad x = 18 - 16 = 2$$

$448\underline{2}$ is divisible by 9.

(e) (i) $5\,x\,21$ is divisible by 3.

Sum of digits should be divide by 3.

Sum of digits $5 + x + 2 + 1 = 8 + x$

we know that, $3 \times 2 = 6 \qquad 3 \times 3 = 9$

$$6 < 3 < 9$$

Sum should be 9

$$8+x=9 \qquad x=9-8=1$$

$5\underline{1}21$ is divisible by 3.

(ii) $5x21$ is divisible by 9.

Sum digits should be divided by 9.

Sum of digits $=5+x+2+1=8+x$

We know that, $9\times 1=9 \qquad 8<9$

Sum should be 9.

$$8+x=9 \qquad x=9-8=1$$

$5\underline{1}21$ is divisible by 9.

Exercise 4.3

1. As. $10\times 10=100$. As ; $100\div 10=10$

We can subtract 10 from 100 in 10 time.

2. Find the value of unknowns :

(a) (i) Starting from ones column we have

$$\begin{array}{r} 4\ 3\ 5 \\ 8\ 2\ 6 \\ +\ 1\ 4\ 7 \\ \hline 1\ 4\ 0\ 8 \\ \hline \end{array}$$

$$5+6+C=11+C$$
$$11+C=8$$
$$11+C=18$$

(8 will remain at the ones place and 1 is carried over.)

$$C=18-11=7$$

(ii) Tens column

We have; $3+B+4=0$

$7+B=10=$ (0 will remain at the one's place and 1 is carried over)

$$B=10-1-7=10-8=2$$

(iii) Hundred column

We have; $A+8+1=14$

$$A+9=14$$
$$A=14-9=5$$

Sum $5+8+1=14$

$$D=1$$

(b) As ones digit as 2.

$$\begin{array}{r} 6\ 6\ 8 \\ \times\ 4 \\ \hline 2\ 6\ 7\ 2 \\ \hline \end{array}$$

The B can either 3 or 8.

(As $4\times 3=12$, $4\times 8=32$)

As; $7-4=3 \quad B=8$

In ten's digit the place the number is same as that in the hundreds place in product.

As the digit thousands place in product is 2.

The required digit is 6 as $4\times \underline{6}=24$ and $24+2=2\underline{6}$

(c) Starting from ones column

$$\begin{array}{r} 2\ 4\ 7 \\ +\ 4\ 7\ 1 \\ \hline 7\ 1\ 8 \\ \hline \end{array}$$

$$B+1=8$$
$$B=8-1=7$$
$$B=7$$

Tens columns

$7+A=1$(1 will be remain at tens place and 1 is carried over)

$$7 + A = 11 \qquad A = 11 - 7$$
$$A = 4$$

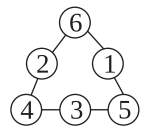
3. (a) Here a one digit is to be added to a 3-digit number. Who all are similar. Also, the result obtained is a 4-digit number, where ones, tens and hundreds digit is same. By this we conclude that $P = \underline{9}$, $A = \underline{1}$ and $B = \underline{0}$.

$$\begin{array}{r} 9\,9\,9 \\ +\;\;1 \\ \hline 1\,0\,0\,0 \\ \hline \end{array}$$

(b) Here, the digits are reversed by adding the digit at ones place and the digit at tens place is obtained as $9 + 9 = 18$.
Thus, $X = 8$, and $Y = 9$.

$$\begin{array}{r} 8\,9 \\ +\,9 \\ \hline 9\,8 \\ \hline \end{array}$$

4. We use the lowest three values on the points 1, 2, 3.
From there we put the values biggest to smallest in the middle of each section from low total to high total.



So, $1 + 2 = 3$, $1 + 3 = 4$ and $2 + 3 = 5$
So, 6 goes between 1 and 2, 5 between 1 and 3, 4 between 2 and 3.

5.

	29	
83	23	17
	71	

Given total $= 123$
Given number $= 83 = 123 - 83 = 40$
Sum of two prime number whose total is $40 = 23$ and 17

Again $123 = 23 + 29 - x$
$x = 123 - 52 = 71$.

6. Complete the magic squares given below :

(a)

I	II	III
6	**1**	8
7	5	**3**
2	**1**	4

Sum of diagonals $= 6 + 5 + 4 = 15$
In third column $15 - (8 + 4) = 3$
In second diagonal $15 - (8 + 5) = 2$
In third row $15 - (4 + 2) = 9$
In second column $= 15 - (5 + 9) = 1$
In third column $= 15 - (6 + 2) = 7$

(b)

	C-I	C-II	C-III	C-IV
R-I	6	$H\boxed{12}$	$G\boxed{6+B}$	9
R-II	B	15	$C\boxed{-4}$	14
R-III	11	$F\boxed{B+4}$	10	E_8
R-IV	16	$D\boxed{2}$	13	$A\boxed{B+2}$

We know that in magic squares sum of all sides and diagonals are equal.
Let the missing numbers be A, B, C, D, E, F, G, H respectively as shown in box
Now, Sum of diagonal and sum of column I are equal.

$$6+15+10+A=6+B+11+16$$
$$31+A=33+B$$
$$A-B=33-31=2$$
$$A=B+2$$

• Sum of diagonal and Sum of row II are equal

$$B+15+C+14=6+15+10+A$$
$$B+29+C=31+B+2 \qquad \text{(putting A's value)}$$
$$C=3-29+B-B$$
$$C=4$$

• Sum of diagonal and row IV are equal.

$$16+D+13+A=6+15+10+A$$
$$16+D+B+B+2=6+15+10+B+2$$
$$31+D+B=33+B$$
$$D=33-31+B-B$$
$$D=2$$

- **Sum of diagonal and sum of column are equal**

$$6+15+10+A=9+E+14+A$$
$$31+A+2=23+B+2+E$$
$$33+B=25+B+E$$
$$E=33-25+B-B$$
$$E=8$$

- **Sum of both the diagonals are equal**

$$9+4+F+16=6+15+10+A$$
$$29+F=31+B+2$$
$$F=33+B$$
$$F=33-29+B$$
$$F=4+B$$
$$F=B+4$$

- **Sum of diagonals and sum of column II are equal :**

$$6+15+10+A=H+15+F$$
$$31+B+2=H+15+B+4+2$$
$$33+B=H+B+21$$
$$H=33-21+B-B$$
$$H=12$$

- **Sum of diagonals and sum of row I are equal :**

$$6+H+G+9=6+15+10+A$$
$$6+12+G+9=31+B+2$$
$$27+G=33+B$$
$$G=33-27+B$$
$$G=6+B$$
$$G=B+6$$

We assumed the smallest value that is 1 as the value of B to make all the total equal.

Now $B = 1$

$F = 1 + 4 = 5;$ $A = 1 + 2 = 3;$ $G = 1 + 6 = 7$

Hence, the solved magical square is as follows :

6	12	7	9
1	15	4	14
11	5	10	8
16	2	13	3

Exercise 4.4

1. Fill in the blanks :

(a) 163 182 220 277 353 448 562

(+19) (+19 × 2) (+19 × 3) (+19 × 4) (+19 × 5) (+19 × 6)

(b) 17 17 51 255 1785 16065 176715

(17 × 1) (17 × 3) (51 × 5) (255 × 7) (1785 × 9) (16065 × 11)

2. Observe the following pattern and write the missing numbers :

$11^2 = 121$ $101^2 = 10201$

$1001^2 = 1002001$ $10001^2 = 100020001$

$10001^2 = \mathbf{10000200001}$ $\mathbf{1000001^2} = 1000002000001$

3. Using the pattern, find the missing numbers :

$1^2 + 2^2 + 2^2 = 3^2$ $2^2 + 3^2 + 6^2 = 7^2$

$3^2 + 4^2 + 12^2 = 13^3$ $4^2 + 5^2 + 20^2 = 21^2$

$5^2 + 6^2 + \mathbf{30^2} = 31^2$ $6^2 + 7^2 + \mathbf{42^2} = \mathbf{43^2}$

4. Study the number pattern given below :

$0 \times 9 + 1 = 1$
$1 \times 9 + 2 = 11$
$12 \times 9 + 3 = 111$
$123 \times 9 + 4 = 1111$
$1234 \times 9 + 5 = 11111$
$12345 \times 9 + 6 = 111111$
$123456 \times 9 + 7 = 1111111$
$1234567 \times 9 + 8 = 11111111$
$12345678 \times 9 + 9 = 111111111$
$123456789 \times 9 + 10 = 1111111111$

Investigate a similar number pattern where the first two lines are :

$1 \times 8 + 1 = 9$
$12 \times 8 + 2 = 98$

MCQs

Tick (3) the correct answer :

1. (c) **2.** (c) **3.** (a) **4.** (d) **5.** (d)

High Order Thinking Skills (HOTS)

1.

4	14	12	$\rightarrow 12+10+8=30$
18	10	2	
8	6	16	$\rightarrow 4+10+16=30$

2. $6x5$ divisible by 3 and 9.

Sum of digits are divisible by 9 or 3.

$$6+5+x=11+x$$
$$11+x=18$$
$$x=7$$

The 675 is divisible by 3 and 9.

5 Exponents

Exercise 5.1

1. Simplify and write the answer in exponential form :

$$x^m \times x^n = x^{m+n}$$

(a) $6^4 \times 6^{-5} = (6)^{4+(-5)} = 6^{4-5} = 6^{-1}$

(b) $12^{-7} \times 12^3 = 12^{-7+3} = 12^{-4}$

(c) $\left(\frac{3}{7}\right)^{-5} \times \left(\frac{3}{7}\right)^{-5} = \left(\frac{3}{7}\right)^{-5+(-5)} = \left(\frac{3}{7}\right)^{-5-5} = \left(\frac{3}{7}\right)^{-10}$

(d) $\left(\frac{-8}{11}\right)^{-12} \times \left(\frac{-8}{11}\right)^{6} = \left(\frac{-8}{11}\right)^{-12+6} = \left(\frac{-8}{11}\right)^{-6}$

2. Simplify and write the answer with positive exponents :

$$\boxed{x^m \div x^n = x^{m-n};\ x^{-m} = \frac{1}{x^m};\ x^{\circ} = 1}$$

(a) $\left(\frac{21}{23}\right)^{-4} \div \left(\frac{21}{23}\right)^{-6} = \left(\frac{21}{23}\right)^{-4-(-6)} = \left(\frac{21}{23}\right)^{-4+6} = \left(\frac{21}{23}\right)^{2}$

(b) $10^{-5} \div 10^{-2} = (-10)^{-5-(-2)} = (-10)^{-5+2} = (-10)^{-3} = \left(\frac{-1}{10}\right)^3$

(c) $\left(\frac{b^4}{b^2}\right) = b^4 \div b^2 = b^{4-2} = b^2$

(d) $\left(\frac{6}{7}\right)^{8} \div \left[\left(\frac{6}{7}\right)^{5} \times \left(\frac{6}{7}\right)^{3}\right] = \left(\frac{6}{7}\right)^{8} \div \left[\left(\frac{6}{7}\right)^{5+3}\right]$

$$= \left(\frac{6}{7}\right)^{8} \div \left(\frac{6}{7}\right)^{8} = \left(\frac{6}{7}\right)^{8-8} = \left(\frac{6}{7}\right)^{0} = 1$$

3. Find the value of the following :

$$\boxed{x^{-m} = \frac{1}{x^m}}$$

(a) $\left(\frac{1}{9}\right)^{-\frac{1}{2}} = (9)^{\frac{1}{2}} = (3)^{2\times\frac{1}{2}} = (3)^1 = 3$

(b) $\left(\frac{625}{81}\right)^{-\frac{1}{4}} = \left(\frac{81}{625}\right)^{\frac{1}{4}} = \frac{(3)^{4\times\frac{1}{4}}}{(5)^{4\times\frac{1}{4}}} = \frac{3}{5}$

(c) $\left(\frac{25}{49}\right)^{\frac{7}{2}} = \left(\frac{5}{7}\right)^{2\times\frac{7}{2}} = \left(\frac{5}{7}\right)^7 = \frac{78125}{823543}$

(d) $\left(\frac{32}{243}\right)^{\frac{4}{5}} = \left(\frac{(2)^5}{(3)^5}\right)^{\frac{4}{5}} = \left(\frac{2}{3}\right)^{5\times\frac{4}{5}} = \left(\frac{2}{3}\right)^4 = \frac{16}{81}$

4. Find the value of the following :

(a) $(343)^{\frac{2}{3}} = (7\times 7\times 7)^{\frac{2}{3}} = (7)^{3\times\frac{2}{3}} = (7)^2 = 49$

(b) $(32768)^{\left(\frac{1}{15}\right)} = 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2)^{1/15}$

$= (2)^{15\times\frac{1}{15}} = 2$

(c) $(279936)^{\frac{1}{7}} = (6\times 6\times 6\times 6\times 6\times 6\times 6)^{1/7} = (6)^{7\times\frac{1}{7}} = 6$

(d) $(343)^{-\frac{1}{3}} = \left(\frac{1}{343}\right)^{\frac{1}{3}} = \left(\frac{1}{7\times 7\times 7}\right)^{\frac{1}{3}} = \left(\frac{1}{7}\right)^{3\times\frac{1}{3}} = \left(\frac{1}{7}\right)^{3\times\frac{1}{3}} = \frac{1}{7}$

5. Find the value of the following :

(a) $(0.04)^{\frac{5}{2}} = (0.2\times 0.2)^{\frac{5}{2}} = (0.2)^{2\times\frac{5}{2}} = (0.2)^5$

$= 0.2\times 0.2\times 0.2\times 0.2\times 0.2 = 0.00032$

(b) $(0.000729)^{\frac{5}{6}} = (0.3\times 0.3\times 0.3\times 0.3\times 0.3\times 0.3)^{5/6} = (0.3)^{6\times\frac{5}{6}}$

$= (0.3)^5 = 0.3\times 0.3\times 0.3\times 0.3\times 0.3 = .00243$

(c) $(0.125)^{\frac{2}{3}} = (0.5\times 0.5\times 0.5)^{\frac{2}{3}} = (0.5)^{3\times\frac{2}{3}}$

$= (0.5)^2 = 0.5\times 0.5 = 0.25$

(d) $(0.000064)^{\frac{5}{6}} = (0.2\times 0.2\times 0.2\times 0.2\times 0.2\times 0.2)^{\frac{5}{6}}$

$= (0.2)^{6\times\frac{5}{6}} = (0.2)^5$

$$= 0.2 \times 0.2 \times 0.2 \times 0.2 \times 0.2 = 0.00032$$

6. Simplify the following :

(a) $4^{-4} \times 5^{-4} = (4 \times 5)^{-4} = (20)^{-4}$ (b) $7^{-5} \times 8^{-5} = (7 \times 8)^{-5} = (56)^{-5}$

(c) $\left(\frac{-3}{8}\right)^{-6} \times \left(\frac{-4}{9}\right)^{-6} = \left(\frac{\overset{-1}{\cancel{-3}}}{\underset{2}{\cancel{8}}} \times \frac{\overset{-1}{\cancel{-4}}}{\underset{3}{\cancel{9}}}\right)^{-6} = \left(\frac{1}{6}\right)^{-6}$

(d) $(1^3 + 2^3 + 3^3 + 4^3)^{\frac{-3}{2}} = (100)^{\frac{-3}{2}}$

$$= (10)^{2 \times \frac{-3}{2}} = (10)^{-3} = \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} = \frac{1}{1000}$$

7. Simplify the following :

(a) $\left[(729)^{\frac{-5}{3}}\right]^{\frac{-1}{2}} = [((3)^6)^{-\frac{5}{3}}]^{-\frac{1}{2}}$

$$= \left[\left(\frac{1}{(3)^6}\right)^{\frac{5}{3}}\right]^{-\frac{1}{2}} = \left[\frac{1}{(3)^{6 \times \frac{5}{3}}}\right]^{-\frac{1}{2}} = \left[\frac{1}{(3)^{10}}\right]^{-\frac{1}{2}}$$

$$= (3)^{10 \times \frac{1}{2}} = (3)^{\frac{10}{2}} = (3)^5 = 243$$

(b) $\left(\frac{2}{13}\right)^{\frac{4}{3}} \left(\frac{2}{13}\right)^{\frac{5}{3}} = \left(\frac{2}{13}\right)^{\frac{4}{3} + \frac{5}{3}} = \left(\frac{2}{13}\right)^{\frac{9}{3}} = \left(\frac{2}{13}\right)^{3} = \frac{8}{2197}$

Exercise 5.2

1. Write the following as radicals :

(a) $17^{1/2} = \sqrt{17}$ (b) $112^{1/7} = \sqrt[7]{112}$

(c) $\left(\frac{7}{12}\right)^{\frac{1}{9}} = \sqrt[9]{\frac{7}{12}}$ (d) $\left(\frac{516}{63}\right)^{\frac{-1}{14}} = \sqrt[14]{\frac{63}{516}}$

2. Write the following as a mixed radicals :

(a) $\sqrt{108} = \sqrt{2 \times 2 \times 3 \times 3 \times 3}$
$= 2 \times 3\sqrt{3} = 6\sqrt{3}$

(b) $\sqrt{99} = \sqrt{3 \times 3 \times 11}$
$= 3\sqrt{11}$

(c) $\sqrt{405} = \sqrt{3 \times 3 \times 3 \times 3 \times 5}$
$= 3^2 \times 3^2 \sqrt{5} = 9\sqrt{5}$

(d) $\sqrt{162} = \sqrt{2 \times 3 \times 3 \times 3 \times 3}$
$= 3 \times 3 \times \sqrt{2} = 9\sqrt{2}$

3. Write the following as a pure radicals :

(a) $2\sqrt{6} = \sqrt{(2)^2 \times 6}$
$= \sqrt{4 \times 6} = \sqrt{24}$

(b) $7\sqrt{6} = \sqrt{(7)^2 \times 6}$
$= \sqrt{49 \times 6} = \sqrt{294}$

(c) $10\sqrt{5} = \sqrt{(10)^2 \times 5}$

$= \sqrt{100 \times 5} = \sqrt{500}$

(d) $\frac{2}{3}\sqrt{40} = \sqrt{\frac{2}{3} \times \frac{2}{3} \times 40}$

$= \sqrt{\frac{4}{9} \times 40} = \sqrt{\frac{160}{9}}$

4. Write in standard form :

(a) $0.000000478 = 4.78 \times 10^{-7}$

(b) $606.239 = 606239 \times 10^{2}$

(c) $5230000000000 = (5.23) \times 10^{12}$

(d) $\frac{9}{100000000} = 9 \times 10^{-8}$

(e) $4603 \times (10)^{-5}$

$= 4.603 \times 10^3 \times 10^{-5}$

$= 4.603 \times 10^{3-5} = 4.603 \times 10^{-2}$

(f) $0.0000478 \times (10)^4$

$= 0.478 = 4.78 \times 10^{-1}$

5. Write in usual form :

(a) $1.29 \times (10)^{-8} = 0.0000000129$

(b) $6.083 \times (10)^4 = 60830$

(c) $7.17 \times (10)^{-5} = 0.0000717$

(d) $2.0001 \times (10)^9 = 2000100000$

(e) $8 \times (10)^{-9} = 0.000000008$

(f) $3.9 \times (10)^3 = 3900$

6. Write each of the following in scientific notation.

(a) $573 = 5.73 \times 10^{2}$

(b) $88450 = 8.845 \times 10^{4}$

(c) $959731452 = 9.59731452 \times 10^{8}$

(d) $0.37 = 3.7 \times 10^{-1}$

(e) $0.00000129 = 1.29 \times 10^{-6}$

(f) $0.000000000009 = 9 \times 10^{-12}$

7. Speed of light $= 300000000$ m/s $= 3 \times 10^8$ m/s.

8. Speed of aircraft $= 2.012 \times 10^3$ km/h $= 2.012 \times 10 \times 10 \times 10$ km/h $= 2012$ km/h

Time taken $= 3$ hrs 30 min $= 3 + \frac{1}{2}$ hrs $= \frac{7}{2}$ hrs

Distance $= 2012 \times \frac{7}{2} = 1006 \times 7 = 7042$

Distance $= 7.042 \times 10^3$ km.

9. Find x if :

(a) $3^x = 243$

$(3)^x = (3)^5$

$x = 5$

(b) $(-2)^x \times (-2)^{2x} = (-2)^{-9}$

$(-2)^{3x} = (-2)^{-9}$

$x = \frac{-9}{3} = -3 \qquad x = -3$

(c) $5^x . 5^{x+1} = 125$

$(5)^{2x+1} = (5)^3$

$2x + 1 = 3$

$2x = 2$

$x = 1$

(d) $\frac{7^{5x}}{7^{7x}} = \frac{1}{2401}$

$\frac{(7)^{5x}}{(7)^{7x}} = \frac{1}{(7)^4}$

$5x - 7x = -4$

$-2x = -4$

$x = 2$

(e) $2^x = \left(\frac{1}{32}\right)^{-3}$

$2^x = \left(\frac{1}{(2)^5}\right)^{-3}$

$2^x = ((2)^5)^3$

$2^x = 2^{15}$

$x = 15$

(f) $3^x = \frac{1}{81}$

$3^x = \left(\frac{1}{3}\right)^4$

$3^x = 3^{-4}$

$x = -4$

Multiple Choice Questions

Tick (✓) the correct answer

1. (d) **2.** (a) **3.** (d) **4.** (c) **5.** (b) **6.** (d) **7.** (a)

High Order Thinking Skills

1. Evaluate the following :

(a) $(0.000125)^{\frac{-4}{3}} = (0.05 \times 0.05 \times 0.05)^{-\frac{4}{3}}$

$= (0.05)^{3 \times \frac{-4}{3}} = (0.05)^{-4} = \left(\frac{1}{0.05}\right)^4 = 20^4$

(b) $\left[\left\{\left(\left(\frac{4}{5}\right)^{-1}\right)^{-2}\right\}^{\frac{1}{5}}\right]^{-10} = \left[\left\{\left(\frac{4}{5}\right)^{2}\right\}^{\frac{1}{5}}\right]^{-10}$

$= \left[\left(\frac{4}{5}\right)^{\frac{2}{5}}\right]^{-10} = \left(\frac{4}{5}\right)^{\frac{-2}{5} \times 10}$

$= \left(\frac{4}{5}\right)^{-4} = \left(\frac{5}{4}\right)^{4} = \frac{625}{256}$

2. $a^{x^2-y^2} \times a^{y^2-z^2} \times a^{z^2-x^2} = 1$

$a^m \times a^n = a^{m+n}$

$a^{x^2-y^2+y^2-z^2+z^2-x^2} = 1$ $\qquad a^0 = 1$

3. Solve : $5^{3x-5} = \frac{1}{25^x}$

$5^{3x-5} = \frac{1}{(5)^{2x}}$ $\qquad 5^{3x-5} = (5)^{-2x}$

$3x - 5 = -2x$ $\qquad 3x + 2x = 5$

$5x = 5$ $\qquad x = 1$

6 Commercial Mathematics

Exercise 6.1

1. Express the following :

(a) 83% into a simple fraction

$$83\% = \frac{83}{100}$$

(b) 38% into a decimal

$$38\% = \frac{38}{100} = 0.38$$

(c) 45% into a simple ratio

$$45\% = \frac{45}{100} = \frac{9}{20} = \text{Ratio} = 9 : 20$$

2. Find x, if :

(a) 5% of x is 20

$$x \times \frac{5}{100} = 20$$

$$x = \frac{20 \times 100}{5} = 400$$

x's value $= 400$

(b) 8.5% of x is 1.615

$$x \times \frac{85}{1000} = 1.615$$

$$x = \frac{1.615 \times 1000}{85} = 19$$

x's value $= 19$

3. % of men in town $= 45\%$

% of women in town $= 30\%$

% of children in town $= 100 - (45 + 30)\% = (100 - 75)\% = 25\%$

Thus, the percent age of children is 25%.

4. If 8.5% of a number is 51, find the number.

8.5% of $x = 51$

$$x \times \frac{8.5}{100} = 51 \qquad x = \frac{51 \times 100}{8.5} = 600$$

Thus, required number is 600.

5. The maximum marks $= x$

Bharti Scored $= 410$

She got 82% mark

So, $$x \times \frac{82}{100} = 410 \qquad x = \frac{410 \times 100}{82} = 500$$

Thus, maximum mark is 500.

6. Jagan's income = ` 18000

Spend for rent = ` 18000 × 14% = ` 18000 × $\frac{14}{100}$ = ` 2520

Spend for other things = ` 18000 × 54% = ` 18000× $\frac{54}{100}$ = ` 9720

Total money spend = ` 2520 + ` 9720 = ` 12240

His saving = ` 18000 − ` 12240 = ` 5760

7. Let number of days school open $= x$

Rajant attendance $= 80\%$

He went to school $= \frac{80x}{100}$

According to question;

Rajant went to school $= 260$

$$\frac{80x}{100} = 260 \qquad x = \frac{260 \times 100}{80} = 325$$

Thus, school is open for 325 days.

8. Total number of students $= x$

Number of boys $= x \times \frac{60}{100}$

Number of girls $= x - \frac{60x}{100} = \frac{100x - 60x}{100} = \frac{40x}{100}$

According to question; Number of girls $= 120$

$$\frac{40x}{100} = 120 \qquad x = \frac{120 \times 100}{40} = 300$$

Total number of students is 300.

9. Percentage of copper $= 20\%$; Percentage of zinc $= 35\%$

Percentage of nickel $= 100 - (20 + 35)\% = (100 - 55)\% = 45\%$

Quantity of alloy $= 1.5$ kg or 1500 g

Quantity of nickel$= 1500 \times 45\% = 1500 \times \frac{45}{100}$ g $= 675$ g.

10. Original cost of a article = ` 100

Reduced price $= 5\%$

Cost of price after reduce = ` $\left(100 - \frac{100 \times 5}{100}\right)$ = ` $100 - 5$ = ` 95

Increase price article by retailer = ` $100 - 95$ = ` 5

Increase percentage of old price $= \frac{5 \times 100}{95} = \frac{100}{19}\%$ or $5\frac{5}{19}\%$

11. Let share of third person $= x$

Share of second person $= x \times 50\% = x \times \frac{50}{100} = \frac{x}{2}$

Share of first person $= \frac{x}{2} \times \frac{50}{100} = \frac{x}{4}$

Total amount, $x + \frac{x}{2} + \frac{x}{4} = 3500 \qquad \frac{4x + 2x + x}{4} = 3500$

$$7x = 3500 \times 4 \qquad x = \frac{3500 \times 4}{7} = 500 \times 4 = 2000$$

Share of third person = ` 2000

Share of second person = ` $2000 \times 50\%$ = ` $2000 \times \frac{50}{100}$ = ` 1000

Share of first person = ` $1000 \times \frac{50}{100}$ = ` 500

Thus, first person gets ` 500, second person ` 1000, and third person gets ` 2000.

12. Suppose Bharat's income = ` 100

$$20\% \text{ of } 100 = \frac{20}{100} \times 100 = \text{` } 20$$

Amar's income = ` (100 – 20) = ` 80

If Amar's income is ` 80, then Bharat's income = ` 100

If Amar's income is ` 1, then Bharat's income = ` $\frac{100}{80}$

If Amar's income is ` 100, then Bharat's income = ` $\frac{100}{80} \times 100 =$ ` 125.

Bharat's income is ` $(125-100)$ or `25 *i.e.*, 25% more than Amar's

13. Let Number of votes $= x$

$$31\% \text{ votes} = \frac{x}{100} \times 31$$

According to questions;

$$\frac{31x}{100} = 31000 \qquad x = \frac{31000 \times 100}{31} = 100000$$

(a) Total votes $= 100000$

(b) Winning margin

$= \text{Number of votes got by winner} - \text{Number of votes got by loser}$

$= 53000 - 31000 = 22000$

14. Let the number be 180.

Increase $= 40\% = 100 \times 40\% = 40$

Number $= 100 + 40 = 140$

Decrease $= 40\% \text{ fo } 140 = 140 \times \frac{40}{100} = 56$

Number $= 140 - 56 = 84$

Net decrease $= 100 - 84 = 16$ or 16%

Exercise 6.2

1. Cost of car = ` 60000

Repairing = ` 10000

Sale value = ` 77000

Profit $=$ Sale Value $-$ Cost Price

Profit = ` 77000 $-$ (60000 + 10000) = ` 7000

$$\% \text{ Gain} = \frac{\text{Profit} \times 100}{\text{C.P.}} = \frac{7000}{70000} \times 100 = 10\%.$$

2. Cost of TV ` 6000

Loss % $= 15\%$

Loss on TV = ` 6000 × 15% = ` 6000 × $\frac{15}{100}$ = ` 900

Sales price $=$ Cost Price $-$ Loss

Sales price = ` $(6000 - 900) =$ ` 5100

Thus, sales price of the TV set is ` 5100.

3. Let cost price of article = ` x

$$\text{Loss in article} = \text{` } x \times \frac{1}{20} = \text{` } \frac{x}{20}$$

$$\text{Sale Price} = \text{Cost Price} - \text{Loss}$$

$$= \text{` } x - \text{` } \frac{x}{20} = \frac{20x - x}{20} = \text{` } \frac{19}{20}$$

If sales price ` $\frac{19x}{20}$ than cost price = ` x

If sales price ` 6270 than cost price $= x \times \frac{20}{19x} \times 6270 =$ ` 6600

Thus, cost price of article = ` 6600.

4. C.P. of 1 pen = ` 1

C.P. of 12 pen = ` 12

C.P. of 15 pens = ` 15

Cost of 12 pens = S.P of 15 pens

S.P. of 15 pens = ` 12

$$\text{Loss} = \text{` } 15 - \text{` } 12 = 3$$

$$\text{Loss \%} = \frac{\text{Loss} \times 100}{\text{C.P.}} = \frac{3}{15} \times 100 = 20\%$$

Percentage of loss is 20%.

5. Cost of 10 books = ` 10

Cost of 16 books = ` 16

Cost of 17 books = ` 17

S.P. of 16 books = C.P. of 17 books

S.P. of 16 books = ` 17

$$\text{Profit} = \text{` } (17 - 16) = \text{` } 1$$

$$\text{Profit \%} = \frac{1}{16} \times 100\% = \frac{100}{16}\% = 6.25\%$$

6. Let cost price of fan = ` x

$$\text{gain} = \text{` } x \times \frac{1}{8} = \text{` } \frac{x}{8}$$

$$\text{Selling price} = \text{` } x + \text{` } \frac{x}{8} = \text{` } \frac{9x}{8}$$

According to question,

sales price of fan = ` 1152

$$\text{` } \frac{9x}{8} = \text{` } 1152 \qquad x = \frac{1152 \times 8}{9} = \text{` } 1024.$$

7. Cost of 1 banana = ` 1

Cost of 6 bananas = ` 6

Cost of 5 bananas = ` 5

S.P. of 6 bananas = C.P. of 5 bananas

Loss = ` $(6 - 5)$ = ` 1

$$\text{loss }\% = \frac{\text{Loss}}{\text{C. P}} \times 100 = \frac{1}{6} \times 100 = \frac{100}{6}\% \text{ or } 16\frac{2}{3}\%$$

8. Cost price of 5 fans = ₹ 4050
Transportation exp… = ₹ 50
Total cost price = ₹ 4050 + ₹ 50 = ₹ 4100
Gain % = 15%

$$\text{Gain} = ₹\ 4100 \times \frac{15}{100} = ₹\ 615$$

Sales price = ₹ 4100 + ₹ 615 = ₹ 4715
Sale price of a fan = ₹ 4715 ÷ 5 = ₹ 943.

9. Cost price of total wheat = ₹ 35000

$$\text{Cost price of spoiled wheat} = ₹\ 35000 \times \frac{1}{7} = 5{,}000$$

Then cost price of good wheat = ₹ 35000 – ₹ 5000 = ₹ 30000
Sold price of good wheat :
gain = 10%
C.P. = ₹ 30000

$$\text{Profit} = ₹\ 30000 \times \frac{10}{100} = ₹\ 3000$$

S.P. = C.P. + Profit = ₹ (30000 + 3000) = ₹ 33000
Sold price of spoiled wheat :
Loss = 25% ; C.P. = ₹ 5000

$$\text{Loss} = ₹\ 5000 \times \frac{25}{100} = ₹\ 1250$$

S.P. = ₹ (5000 − 1250) = ₹ 3750
Total sales price = ₹ 33000 + ₹ 3750 = ₹ 367500
Total cost price = ₹ 35000
Gain = ₹ 36750 − 35000 = ₹ 1750

$$\text{Gain }\% = \frac{\text{Gain} \times 100}{\text{C. P.}} = \frac{1750 \times 100}{35000} = 5\%.$$

10. Cost price of one kg mangoes = ₹ 30
Cost price of 75 kg mangoes = ₹ 30 × 75 = ₹ 2250

Cost price of $\left(75 \times \frac{1}{3}\right)$ 25 kg mangoes = ₹ 30 × 25 = ₹ 750

Loss = 5%

$$\text{Loss} = ₹\ 750 \times \frac{5}{100} = ₹\ 37.5$$

Sales price = C.P. − Loss = ₹ (750 – 37.5) = ₹ 712.5
Total cost = ₹ 2250
Overall gain = 10%

$$\text{gain} = ₹\ 2250 \times \frac{10}{100} = ₹\ 225$$

Total sale price = ₹ (2250 + 225) = ₹ 2475
Sales price of 50 kg mangoes = ₹ 2475 − ₹ 712.5 = ₹ 1762.50

Sales price of 1 kg mangoes = ₹ $\frac{1762.50}{50}$ = ₹ 35.25

11. We have

Gain = S.P. of 100 toys − C.P. of 100 toys = S.P. of 20 toys.

C.P. of 100 toys = S.P. of 100 toys − S.P. of 20 toys

C.P. of 100 toys = S.P. of 80 toys

C.P. of 5 toys = S.P. of 4 toys

Let C.P. of 1 toy = ₹ 1

Cost of 5 toys = ₹ 5 = S.P. of 4 toys

S.P. of 4 toys = ₹ 5

S.P. of 1 toys = ₹ $\frac{5}{4}$

Gain = S.P. of 1 toys − C.P. of 1 toys = ₹ $\frac{5}{4} - 1 =$ ₹ $\frac{1}{4}$

$$\text{Gain\%} = \frac{\text{Gain}}{\text{C.P.}} \times 100 = \frac{1}{4} \times 100 = 25\%$$

Thus, Gain% is 25%.

12. Cost of 1 kg rice of Ist variety = ₹ 35

Let quantity of first variety rice = $3x$

Cost of 1 kg rice of 2nd variety = ₹ 45

Let quantity of second variety rice = $2x$

Total quantity of rice = $3x + 2x = 5x$

Total cost of rice = $3x \times 35 + 2x \times 45 = 105x + 90x = 195x$

Total selling price = $5x \times 41.60$ = ₹ $208x$

Profit = S.P. – C.P. = $208x - 195x = 13x$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{C.P.}} \times 100 = \frac{13x}{195x} \times 100 = 6.67\%$$

Gain percent = 6.67%.

13. Let cost price of article = ₹ x

If gain = 10%; gain = ₹ $x \times \frac{10}{100}$ = ₹ $\frac{10x}{100}$

S.P. = $x + \frac{10x}{100} = \frac{110x}{100}$

If gain = 14% ; gain = ₹ $x \times \frac{14}{100}$ = ₹ $\frac{14x}{100}$

S.P. = $x + \frac{14x}{100} = \frac{114x}{100}$

Difference of both S.P.

$$\frac{114x}{100} - \frac{110x}{100} = \frac{4x}{100}$$

According to question = Difference; $\frac{4x}{100} = 65$

$$x = \frac{65 \times 100}{4} = ₹\ 1625$$

So, the cost price = ₹ 1625.

14. Number of eggs = 200

Number of broken eggs = 38

Number of remaining eggs = 200 − 38 = 162

Sale price of 12 eggs = ₹ 48

Sale price of an egg = ₹ 48 ÷ 12 = ₹ 4

Sales price of 162 eggs = ₹ 162 × 4 = ₹ 648

Let cost price of 200 eggs be x

Over all profit = 8%

$$\text{profit} = x \times \frac{8}{100} = \frac{8x}{100}$$

$$\text{S.P.} = \frac{8x}{100} + x = \frac{108x}{100}$$

According to question, total investment $\frac{108x}{100} = 648$

$$x = \frac{648 \times 100}{108} = 600$$

So, Total investment = ₹ 600.

15. Let the original rate be ₹ x per kg.

Reduced rate = (80% of ₹ x) per kg = ₹ $\left(\frac{80}{100} \times x\right)$ per kg = ₹ $\frac{4x}{5}$ per kg

Quantity of sugar for ₹ 160 at original rate = $\frac{160}{x}$ kg.

Quantity of sugar for ₹ 160 at new price = $\frac{160}{\left(\frac{4x}{5}\right)}$ kg = $\frac{160 \times 5}{4x} = \frac{200}{x}$ kg

$$\frac{200}{x} - \frac{160}{x} = 5 \qquad 5x = (200 - 160)$$

$$5x = 40 \qquad x = 8$$

(a) Original rate = ₹ 8 per kg.

(b) Reduced rate = ₹ $\left(\frac{4}{5} \times 8\right)$ per kg = ₹ $\frac{32}{5}$ per kg = ₹ 6.40 per kg.

16. Cost price of wrist watch = ₹ x

$$\text{profit} = x \times \frac{1}{8} = ₹\ \frac{x}{8}$$

$$\text{Selling price} = ₹\ x + \frac{x}{8} = ₹\ \frac{9x}{8}$$

According to question;

Selling price of wrist watch = ₹ 990

$$\frac{9x}{8} = 990 \qquad x = \frac{990 \times 8}{9} = ` \ 880$$

So, cost price of wrist watch = ` 880

$$\text{Profit} = ` \ 880 \times \frac{1}{8} = ` \ 110$$

$$\text{Profit \%} = \frac{110}{880} \times 100 = 12.5\%$$

Percent profit is 12.5%.

17. Let cost price of laptop = ` x

$$\text{Selling price} = ` \ x \times \frac{6}{5} = ` \ \frac{6x}{5}$$

$$\text{Profit} = \frac{6x}{5} - x = \frac{6x - 5x}{5} = \frac{x}{5}$$

$$\text{profit \%} = \frac{x}{5x} \times 100\% = 20\%$$

Thus, percent profit is 20%.

18. Cost price of two fans = ` 3120

Let cost price of one fan = x

Cost price other fan = ` $(3120 - x)$

For one fan, $\quad \text{profit} = 36\% \text{ or } x \times \frac{36}{100} = \frac{36x}{100}$

$$\text{S.P.} = x + \frac{36x}{100} = \frac{136x}{100}$$

For other fan, $\quad \text{Loss} = 15\% \text{ or } (3120 - x) \times \frac{15}{100} = \frac{46800 - 15x}{100}$

$$\text{S.P.} = \text{C.P.} - \text{Loss} = (3120 - x) - \frac{(46800 - 15x)}{100}$$

$$= \frac{(3120 - x) \times 100 - 46800 + 15x}{100}$$

$$= \frac{312000 - 100x - 46800 + 15x}{100} = \frac{265200 - 85x}{100}$$

According to question; both fans selling price are equal.

$$\frac{136x}{100} = \frac{265200 - 85x}{100}$$

$$136x \times 100 = (265200 - 85x)100$$

$$13600x = 26520000 - 8500x$$

$$13600x + 8500x = 26520000$$

$$22100x = 26520000$$

$$x = \frac{26520000}{22100} = 1200$$

So, cost price of first fane = ` 1200

Cost price of second fan = ` $(3120 - 1200)$ = ` 1920.

19. According to question;

Loss = C.P. of 45 apples − S.P. of 45 apples = S.P. of 3 apples

C.P. of 45 apples = S.P. of 3 apples + S.P. of 45 apples

C.P. of 45 apples = S.P. of 48 apples

C.P. of 15 apples = S.P. of 16 apples

Let C.P. of apple = ` 15

C.P. of 15 apples = ` 15 = S.P. of 16 apples

S.P. of 16 apples = ` 15

S.P. of 1 apple = ` $\frac{15}{16}$

Loss = C.P. of 1 apple − S.P. of 1 apple = ` $1 - \frac{15}{16} = \frac{16-15}{16} = \frac{1}{16}$

$$\% \text{ Loss} = \frac{\text{Loss}}{\text{C.P.}} \times 100 = \frac{1}{16} \times 100 = \frac{100}{16}\% = 6.25\%$$

Loss percent = 6.25%.

20. S.P. of 1 kg or 1000 g = C.P. of 900 gm ∵ S.P. > C.P. (profit)

$$\text{Gain} = 1000 - 900\,\text{gm} = 100\,\text{gm}$$

$$\text{Gain\%} = \frac{100}{900} \times 100 = \frac{100}{9} = 11.1\%$$

21. Cost price of article = ` 200

Loss = 10%

Loss = 10% of ` 200 = ` 20

S.P. = ` (200 − 20) = ` 180

Reduced price = 5%

Now selling price = ` 180 − ` 180 × 5%

= ` 180 – ` 9 = ` 171

Thus, selling price ` 171 on article.

22. S.P. of one quintal rice = ` 896

Let C.P. of rice = ` 100

Profit = 12%

S.P. = ` 100 + 12 = ` 112

If, S.P. = ` 112 then C.P. = ` 100

If, S.P. = ` 1 then C.P. = ` $\frac{100}{112}$

` 896 = ` $\frac{100}{112} \times 896$ = ` 800

C.P. = ` 800

Cost price of one quintal rice = ` 800

Cost price of 1 kg rice = ` 800 ÷ 100 = ` 8

S.P. of one quantital sugar = ` 896

Let, C.P. of sugar = ` 100

Loss = 44% S.P. = ` 100 − 44 = ` 56

If, S.P. = ` 56 then C.P. = ` 100

$$\text{S.P.} = ` \ 1 \text{ then C.P.} = ` \ \frac{100}{56}$$

$$\text{S.P.} = ` \ 896 \text{ then C.P.} = ` \ \frac{100}{56} \times 896 = ` \ 1600$$

Cost price of one quantial sugar = ` 1600

Cost price of 1 kg sugar = ` 1600 ÷ 100 = ` 16

Total cost price sugar and rice ` $(800+1600) =$ ` 2400

Total selling price = ` $(896+896) =$ ` 1792

Loss = ` $(2400-1792) =$ ` 608

$$\text{Loss \%} = \frac{608}{2400} \times 100 = \frac{76}{3}\% \text{ or } 25.33\%.$$

Exercise 6.3

1. Let cost price of sugar $= x$

$$\text{Loss} = 10\% \text{ of } x = \frac{10x}{100}$$

$$\text{Selling price} = x - \frac{10x}{100} = \frac{90x}{100}$$

According to question ; S.P. of sugars = 5.4 kg

$$\frac{90x}{100} = 5.4 \qquad x = \frac{5.4 \times 100}{90} = ` \ 6$$

If profit percentage = 20%

$$\text{profit} = ` \ 6.00 \times \frac{20}{100} = ` \ 1.2$$

selling price = ` 6.00 + 1.20 = ` 7.2.

2. Let the C.P. be ` 100

M.P. = ` 100 + 20% of ` 100

$$= ` \ 100 + \frac{20}{100} \times 100 = 100 + 20 = ` \ 120$$

$$\text{Discount} = 10\% \text{ of M.P.} = ` \ 120 \times \frac{10}{100} = ` \ 12$$

S.P. = M.P. − Discount = ` 120 − ` 12 = ` 108

Gain = S.P. – C.P. = ` 108 − 100 = ` 8.

3. Let market price = ` x

discount = 5%

$$\text{selling price} = x - \frac{x \times 5}{100} = \frac{100x - 5x}{100} = \frac{95x}{100}$$

selling price of pen = Surbhi bought price.

$$\frac{95x}{100} = ` \ 23.75 \qquad x = ` \ \frac{23.75 \times 100}{95} = ` \ 25.$$

4. Let the C.P. be ` 100.

M.P. = ` 100 + 20% of ` 100

$$= ₹\ 100 + ₹\ \frac{20}{100} \times 100 = ₹\ 100 + ₹\ 20 = ₹\ 120$$

$$\text{Discount} = 15\% \text{ of M.P.} = ₹\ 120 \times \frac{15}{100} = ₹\ 18$$

$$\text{S.P.} = \text{M.P.} - \text{Discount} = ₹\ 120 - ₹\ 18 = 102$$

$$\text{Gain} = \text{S.P.} - \text{C.P.} = ₹\ 102 - ₹\ 100 = ₹\ 2$$

$$\text{Gain } \% = \frac{\text{Gain}}{\text{C.P.}} \times 100 = \frac{2}{100} \times 100 = 2\ \%.$$

5. discount $= 10\%$; profit $\% = 26\%$

So, increased percentage of C.P. $= \left(\frac{d+p}{100-d}\right) \times 100\% = \left(\frac{10+26}{100-10}\right) \times 100\%$

$$= \left(\frac{36}{90} \times 100\right)\% = (4 \times 10)\% = 40\%$$

Hence, 40% is the required percentage of C.P.

6. Marked price of the book = ₹ 100

$$\text{Discount} = 10\% \text{ or } ₹\ 100 \times \frac{10}{100} = ₹\ 10$$

$$\text{Selling price} = ₹\ 100 - ₹\ 10 = ₹\ 90$$

Let the C.P. is ₹ x

Profit $= 20\%$

$$\text{profit} = ₹\ 20 \times \frac{x}{100} = ₹\ \frac{20x}{100}$$

$$\text{Selling price} = \text{C.P.} + \text{profit} = ₹\ x + \frac{20x}{100}$$

$$= ₹\ \frac{100x + 20x}{100} = ₹\ \frac{120x}{100}$$

$$\text{Selling price} = ₹\ \frac{120x}{100} = ₹\ 90 \qquad x = ₹\ \frac{90 \times 100}{120} = ₹\ 75$$

$$\text{Cost price} = ₹\ 75$$

Discount given second time $= 15\%$

Now, discount $= 100 \times 15\% = ₹\ 15$

$$\text{S.P.} = ₹\ 100 - ₹\ 15 = ₹\ 85$$

Now, Gain $= ₹\ 85 - ₹\ 75 = ₹\ 10$

$$\text{Gain } \% = \frac{10}{75} \times 100 = \frac{100}{75}\% \text{ or } 13.33\%.$$

7. Let M.P. of the sofa set = ₹ 100

Discount $= 20\%$

S.P. of the sofa set = ₹ 100 – ₹ 20 = ₹ 80

If discount $= 25\%$

S.P. of the book = ₹ 100 – ₹ 25 = ₹ 75

Saving = ₹ 80 – ₹ 75 = ₹ 5

In saving is ₹ 5, than M.P. = ₹ 100

If saving is ` 1, than M..P = ` $\frac{100}{5}$

Saving ` 500 then M.P. = ` $\frac{100}{5} \times 500 =$ ` 10000

M.P. = ` 10000; discount $=$ 20% of ` 10000 = ` 2000

S.P. = ` 10000 – 2000 = ` 8000

Vijay purchase 'Sofa set' for ` 8000.

8. Marked price of table = ` 625

Cost of the soap given free by shopkeeper is equal to discount ` 25

Net selling price = ` 625 – ` 25 = ` 600

Gain $= 20\%$

$$\text{C.P.} = \frac{100 \times \text{S.P.}}{100 + \text{Gain}} = \frac{100 \times 600}{100 + 20} = \frac{60000}{120} = \text{` } 500$$

Cost price of a table is ` 500.

9. Cost price of stationary is ` 900

$$\text{Sales tax} = 6\% = \text{` } 900 + \frac{900 \times 6}{100} = \text{` } 900 + 54 = \text{` } 954.$$

10. Let selling price of fan = ` 100; tax $= 8\%$

Selling price of fan without included tax = ` 100 – ` 8 = ` 92

If S.P. without included tax ` 92 than S.P. of fan ` 100

If S.P. without included tax ` 1 than S.P. of fan = ` $\frac{100}{92}$

If S.P. without included tax ` 1242 than S.P. of fan = ` $\frac{100}{92} \times 1242 =$ ` 1350

The selling price (with out tax) of the fan is ` 1350.

11. Cost price of book = ` 100; Profit 12%

$$\text{S.P.} = \text{` } 100 + 100 \times \frac{12}{100} = \text{` } (100 + 12) = \text{` } 112$$

Discount $= 10\%$

M.P. $= 112 + 10\%$ of $112 =$ ` 112 + ` 12 = ` 124

Ratio $=$ Cost price : M.P. $= 100 : 124 = 25 : 31$.

12. Marked price of two set of bowl = ` 399

$$\text{Marked price} = 50\% \text{ of ` } 399 = 399 \times \frac{50}{100} = \text{` } 199.50$$

$$\text{S.P.} = \text{M.P.} - \text{Discount} = \text{` } (399 - 199.5) = \text{` } 199.50$$

Profit $= 4\%$

$$\text{C.P.} = \frac{100 \times \text{S.P.}}{100 + \text{Profit}} = \text{` } \left(\frac{100 \times 199.50}{100 + 4}\right) = \text{` } \left(\frac{100 \times 199.50}{104}\right) = \text{` } 191.82$$

He pays ` 191.82 for one set of bowl.

13. Market price = ` 80

Cost of the tooth brush given free by shopkeeper is equal to discount ` 11

Net selling price = ` 80 – ` 11 = ` 69

Gain $= 15\%$

If cost price is ` 100

$$\text{profit} = \text{` } 15 \times \frac{100}{100} = \text{` } 15$$

S.P. = ` 100 + 15 = ` 115

If selling price is ` 115 then cost price = ` 100

If selling price is ` 1 then cost price = ` $\frac{100}{115}$

If selling price is ` 69 then cost price = ` $\frac{100}{115} \times 69 =$ ` 60.

14. **In First case :** Marked price of article = ` 100

Discount $= 5\%$, Discount = ` 5

Selling price = ` 100 – 5 = ` 95

In second case :

Marked price of article = ` 100

Discount $= 7\% =$ Discount ` 7

Selling price = ` $(100-7) =$ ` 93.

Difference in both of the S.P. $= 95 - 93 = 2$

If Difference is ` 2 then M.P. = ` 100

If difference is ` 1 then M.P. = ` $\frac{100}{2}$

If difference is ` 15 then M.P. = ` $\frac{100}{2} \times 15 =$ ` 750

Thus, the M.P. of the article is ` 750.

15. C.P. of Saree = ` 950; gain $= 10\%$

S.P. = ` $(950 + 95) =$ ` 1045

Let marked price = ` 100

Discount $= 5\%$

Profit = ` $(100 - 5) =$ ` 95

If selling price ` 95 then marked price is ` 100

If ` 1 then marked price $= \frac{100}{95}$

If selling price ` 1045 then marked price = ` $\frac{100}{95} \times 1045 =$ ` 1100.

Exercise 6.4

1. In which of the following is x in direct variation with y?

(a) $\frac{x}{y} = \frac{5}{15} = \frac{1}{3};\ \frac{8}{24} = \frac{1}{3};\ \frac{9}{27} = \frac{1}{3};\ \frac{11}{33} = \frac{1}{3};\ \frac{x}{y}$ is constant and is equal to $\frac{1}{3}$.

Thus, no of x and no of y are in direct variation.

(b) $\frac{x}{y} = \frac{3}{5} \neq \frac{5}{3} \neq \frac{6}{10} \neq \frac{9}{15} \neq \frac{10}{6}$

$\frac{x}{y}$ is not equal.

Thus, number of x and number of y is not direct variation.

(c) $\frac{x}{y} = \frac{8}{2} = 4$; $\frac{16}{4} = 4$; $\frac{20}{5} = 4$; $\frac{32}{8} = 4$; $\frac{60}{15} = 4$.

2. Complete the following tables assuming that x is in direct variation with y:

(a)

x	60	x_1	180	x_2	x_3	x_4
y	4	8	12	15	20	25

Here x and y vary directly

So, $\frac{x}{y} = K$ (constant) $\qquad \frac{60}{4} = K$

Now, $\frac{x_1}{8} = \frac{60}{4} \qquad x_1 = \frac{60 \times 8}{4} = 120$

$\frac{x_2}{15} = \frac{60}{4} \qquad x_2 = \frac{15 \times 60}{4} = 225$

$\frac{x_3}{20} = \frac{60}{4} \qquad x_3 = \frac{20 \times 60}{4} = 300$

$\frac{x_4}{25} = \frac{60}{4} \qquad x_4 = \frac{60 \times 25}{4} = 375$

Here, $x_1 = 120, x_2 = 225, x_3 = 300, x_4 = 375$

(b)

x	x_1	9	x_2	15	x_3	26.5
y	3.5	4.5	6.5	y_1	9.25	y_2

Here x and y are vary directly

So, $\frac{x}{y} = K$ (constant)

$\frac{x}{y} = \frac{9}{4.5} = \frac{x_1}{3.5} \qquad x_1 = \frac{9 \times 3.5}{4.5} = 7$

$\frac{9}{4.5} = \frac{x_2}{6.5} \qquad x_2 = \frac{9 \times 6.5}{4.5} = 13$

$\frac{9}{4.5} = \frac{15}{y_1} \qquad y_1 = \frac{15 \times 4.5}{9} = 7.5$

$\frac{9}{4.5} = \frac{x_3}{9.25} \qquad x_3 = \frac{9 \times 9.25}{4.5} = 18.5$

$\frac{9}{4.5} = \frac{26.5}{y^2} \qquad y_2 = \frac{26.5 \times 4.5}{9} = 13.25$

Here $x_1 = 7, x_2 = 13, y_1 = 7.5, x_3 = 18.5, y_2 = 13.25$.

3. Which of the following show direct variation?

(a) When the height of a child increase, his weight also increase. That means $(x \times 2) = y \times 2$.

Direct variation

(b) If car is not moving a uniform speed than the distance covered will not change according to time taken.
It is not a direct variation.
(c) With the number of hours of works wages of worker also increase also increase. It is direct variation.
(d) Number of students increase fee paid them also increase.
Direct variation.
(e) Number of rainy day not the amount of not rainfall on depend on the those day not direct variation.

4. Let number of note book be x for cost ` 240

Number of note books	15	x
Cost	` 240	` 160

$$\frac{15}{x} = \frac{240}{160} \qquad x = \frac{15 \times 160}{240} = 10$$

Thus, Vicky bought 10 note books for ` 160.

5. Here present us dollars equallent Indian currency.
Let the worth of 250 used dollars be x

Us dollars	150	250
Indian currency	7425	x

$$\frac{150}{7425} = \frac{250}{x} \qquad x = \frac{7425 \times 250}{150} = \text{` } 12375$$

6. Let the distance covered in 25 min be x.

Distance (km)	70	x
Time (in min)	60	25

$$\frac{70}{60} = \frac{x}{25} \qquad x = \frac{70 \times 25}{60} = 29.16 \text{ km}$$

7. Let petrol will be needed xl.

Distance (in km)	115	345
Petrol (l)	20	x

$$\frac{115}{20} = \frac{345}{x} \qquad x = \frac{345 \times 20}{115} = 60$$

A car used 60 l of petrol for 345 km.

8. Let Kapil take x time to walk 275 m.

Distance (m)	110	275
Time (min)	130	x

$$\frac{110}{130} = \frac{275}{x} \qquad x = \frac{275 \times 130}{110} = 325 \text{ min}$$

9. 5 men $= 8$ women $\qquad$ 1 man $= \frac{8}{5}$ woman

8 men $= \frac{8 \times 8}{5}$ women $= \frac{64}{5}$ women

8 men and 12 women $= \frac{64}{5} + 12 = \frac{64 + 60}{5} = \frac{124}{5}$ women

Let ` x be the earning of $\frac{124}{5}$ women in one day.

Number of women	8	$\frac{124}{5}$
Earning in a day	` 625	x

$$\frac{8}{124/5} = \frac{625}{x} \qquad \frac{8 \times 5}{124} = \frac{625}{x}$$

$$\frac{40}{124} = \frac{625}{x} \qquad x = \frac{625 \times 124}{40} = 1937.5$$

Thus, earning of 12 women and 8 men = ` 1937.50.

10. Let number of bottles required to be x make 32 serving.

Number of bottles	5	x
Servings	8	32

$$\frac{5}{8} = \frac{x}{32} \qquad x = \frac{5 \times 32}{8} = 20$$

Thus 20 bottles required.

Exercise 6.5

1. (a) As x and y are not changing in a set pattern in such a way that with decrease in x there in a increa in y. It is not an inverse variation.

(b) In all cases, the product xy is constant for any two pairs of x an y.

$x_1 y_1 = 6 \times 10 = 60$; $x_2 y_2 = 4 \times 15 = 60$; $x_3 y_3 = 12 \times 5 = 60$;

$x_4 y_4 = 30 \times 2 = 60$; $x_5 y_5 = 15 \times 4 = 60$

So, in this case of inverse variation.

(c) In all case the product xy is constant for any two pairs of x and y.

$x_1 y_1 = 42 \times 2 = 84$; $x_2 y_2 = 4 \times 21 = 84$; $x_3 y_3 = 14 \times 6 = 84$;

$x_4 y_4 = 8 \times 12 = 96$; $x_5 y_5 = 28 \times 3 = 84$

All are not equal

It is not inverse.

2. Which of the following are in inverse variation with each other?

(a) Since on increasing the cost (c), the number of burgers (n) one can buy would decrease, therefore x and y vary inversely.

(b) When we increase the number of men employed, the time taken to finish these work clarets in a similar ratio. Therefore it is in inverse variation.

(c) The distance travelled by a car increases with the increase in amount of petrol used. Thus, it is a direct variation and not an inverse variation.

(d) As with the increase in number of children attending the party, the food consumed also increases, therefore it in not an inverse variation.

(e) When the speed of a car increases, the time taken decreases. Therefore it is an inverse variation.

3.

Time taken (hrs)	24	6
Pump filled	5	x

Time taken = Inverse ratio Pump filling the tank

$24 : 6 = x : 5$ $\qquad \frac{24}{6} = \frac{x}{5}$

$4 = \frac{x}{5}$ $\qquad x = 20$

Required pump are 20.

4.

Number of children	8	10
Number of chocolate	5	x

Number of children = Inverse ratio of number of chocolate

$8 : 10 = x : 5$

$\frac{8}{10} = \frac{x}{5}$ $\qquad 10x = 8 \times 5$

$10x = 40$ $\qquad x = 40 \div 40 = 4$

So, each child will get 4 chcolates.

5. Number of spraying machines = 5

Break machine = 2

Now, Number of machine used = $5 - 2 = 3$

Number of machine	5	3
Time taken	36	x

Number of machine = Inverse ratio of time

$5 : 3 = x : 36$ $\qquad \frac{5}{3} = \frac{x}{36}$

$x \times 3 = 5 \times 36$ $\qquad x = \frac{5 \times 36}{3} = 60$

Time taken 60 min for painting house.

6. Number of students = 200

100 students increase in hostel

Now, total student = $200 + 100 = 300$

Number of days	30	x
Number of students	200	300

The ratio of the number of student = inverse ratio of the number of days

$$200 : 300 = x : 30 = \frac{200}{300} = \frac{x}{30}$$

$$300 \times x = 30 \times 200$$

$$x = \frac{30 \times 200}{300} = 20$$

A hotel mess has provisions for 300 students for 20 days.

7.

Number of pages	8	x
Number of days	15	10

Number of days finish a book = Inverse ratio of the number of days.

$$15 : 10 = x : 8$$

$$\frac{x}{8} = \frac{15}{10} \qquad 10 \times x = 15 \times 8$$

$$x = \frac{15 \times 8}{10} = 12$$

Thus, Kajal reads 12 pages daily.

8.

Quantity of potatoes	10	x
Cost (per/kg)	18	20

Quantity of potatoes = Inverse ratio cost per kg.

$$x : 10 = 18 : 20 \qquad \frac{x}{10} = \frac{18}{20}$$

$$20 \times x = 18 \times 10 \qquad x = \frac{18 \times 10}{20} = 9$$

9.

Speed (km/h)	60	54
Time taken	9	x

Speed = (Time taken = Inverse ratio)

$$60 : 54 = x : 9$$

$$\frac{60}{54} = \frac{x}{9} \qquad 60 \times 9 = 54x \qquad x = \frac{540}{54} = 10$$

Time taken = 10 hrs.

10.

Number of boxes	25	x
Number of bottles	12	20

Number of bottles = Inverse ratio of number of boxes

$12 : 20 = x : 25 \qquad \frac{x}{25} = \frac{12}{20}$

$20 \times x = 12 \times 25 \qquad x = \frac{12 \times 25}{20} = 15$

Required boxes are 15.

11. If x is in inverse variation with y and :

(a) $x = 4,\ y = 6$, find x, when $y = 12$

$$x_1 : x_2 = y_2 : y_1$$

$$4 : A = 12 : 6 = \frac{4}{A} = \frac{12}{6}$$

$$12A = 4 \times 6 \qquad 12 = 24$$

$$A = \frac{24}{12} = 2$$

(b) $x = 7,\ y = 4$ find y when $x = 2$.

$$x_1 : x_2 = y_2 : y_1 \qquad 7 : 2 = A : 4$$

$$\frac{7}{2} = \frac{A}{4} \qquad 2 \times A = 4 \times 7$$

$$A = \frac{4 \times 7}{2} = 14 \qquad y = 14$$

(c) $x = 20,\ y = ?$

Constant of variation is 300.

$$y = \frac{300}{20} = 15$$

(d) $y = 16,\ x$

Constant of variation $= 176 \qquad x = \frac{176}{16} = 11$

Exercise 6.6

1. A can finish a work in 18 days

$$A\text{'s 1 day work} = \frac{1}{18}$$

B can finish a work in 9 days

$$B\text{'s 1 day work} = \frac{1}{9}$$

A's and B's 1 day work $= \frac{1}{18} + \frac{1}{9} = \frac{1+2}{18} = \frac{3}{18}$ or $\frac{1}{6}$

If A and B work together $\frac{1}{6}$ of the work is completed in 1 day.

2. A can do work in 10 days

$$A\text{'s 1 day work} = \frac{1}{10}$$

B can do work in 15 days

B's 1 day work $= \frac{1}{15}$

A's and B's 1 day work $= \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30}$ or $\frac{1}{6}$

If A's and B's work together, $\frac{1}{6}$ of the work is completed in 1 day.

1 work will be completed in $1 \div \frac{1}{6}$ day

$$1 \times \frac{6}{1} \text{ days} = 6 \text{ day} = 6 \text{ days}$$

Hence, $A + B$ can together work completed in 6 days.

3. A can do a job in 16 days.

A's 1 day work $= \frac{1}{16}$

B can do a job in 12 days

B's 1 day work $= \frac{1}{12}$

$A + B + C$ can do a job in 4 days.

$(A + B + C)$'s 1 day work $= \frac{1}{4}$

C's 1 day work $= \frac{1}{4} - \left(\frac{1}{16} + \frac{1}{12}\right) = \frac{1}{4} - \left(\frac{3+4}{48}\right) = \frac{1}{4} - \frac{7}{48}$

$= \frac{12-7}{48} = \frac{5}{48}$

C do $\frac{5}{48}$ work in 1 day.

C can do 1 work in $1 \div \frac{5}{48}$ days $= \frac{1 \times 48}{5}$ days

Hence, C's can alone complete the work in $9\frac{3}{5}$ days.

4. A man can do a work in 5 days.

Man's 1 day work $= \frac{1}{5}$

A man and his son do work in 3 days

both 1 day work $= \frac{1}{3}$

His son's one day work $= \frac{1}{3} - \frac{1}{5} = \frac{5-3}{15} = \frac{2}{15}$

Son do $\frac{2}{15}$ work in 1 day.

Son can do 1 work in $1 \div \frac{2}{15}$ days $= 1 \times \frac{15}{2}$ days $= 7\frac{1}{2}$ days

Hence, his son can alone complete the work in $7\frac{1}{2}$ days.

5. A and B do work in 72 days

$$A\text{'s} + B\text{'s work in 1 day} = \frac{1}{72}$$

B and C do work in 120 days

$$B\text{'s} + C\text{'s work in 1 day} = \frac{1}{120}$$

C and A do work in 90 days

$$C\text{'s} + A\text{'s work in 1 day} = \frac{1}{90}$$

$$2(A+B+C)\text{ work in 1 day} = \frac{1}{72} + \frac{1}{120} + \frac{1}{90}$$

$$= \frac{10+6+8}{720} = \frac{24}{720} \text{ or } \frac{1}{30}$$

$$2(A+B+C)\text{ work in 1 day} = \frac{1}{30} \div 2 = \frac{1}{30} \times \frac{1}{2} = \frac{1}{60}$$

$$(A+B+C)\text{ can do 1 work in } = 1 \div \frac{1}{60}\text{ days} = 1 \times \frac{60}{1} = 60\text{ days}$$

A's work in 1 days $= (A+B+C)$ work in 1 day $-(B+C)$ work in 1 day

$$= \frac{1}{60} - \frac{1}{120} = \frac{2-1}{120} = \frac{1}{120}$$

A's can do 1 work in $1 \div \frac{1}{120}$ days $= 1 \times \frac{120}{1} = 120$ days.

B's work in 1 day $= (A+B+C)$ work in 1 day $-(A+C)$ work in day

$$= \frac{1}{60} - \frac{1}{90} = \frac{3-2}{180} = \frac{1}{180}$$

B's can do 1 work $1 \div \frac{1}{180}$ days $= 1 \times \frac{180}{1} = 180$ days.

C's work in 1 days $= (A+B+C)$ work in 1 day $-(A+B)$ work in 1 day.

$$= \frac{1}{60} - \frac{1}{72} = \frac{6-5}{360} = \frac{1}{360}$$

C's can do 1 work $1 \div \frac{1}{360}$ days $= 1 \times \frac{360}{1} = 360$ days.

6. A can do work in 15 days

$$A\text{'s 1 day work} = \frac{1}{15}$$

B can do work in 20 days

$$B\text{'s 1 day work} = \frac{1}{20}$$

$$(A+B)\text{'s 1 day work} = \frac{1}{15} + \frac{1}{20} = \frac{4+3}{60} = \frac{7}{60}$$

$(A+B)$'s 4 day work $= \frac{7}{60} \times 4 = \frac{28}{60}$ or $\frac{7}{15}$

Now, work is left $= 1 - \frac{7}{15} = \frac{15-7}{15} = \frac{8}{15}$

7. A can do $\frac{1}{3}$ of a work in 5 days

A complete work in $= 5 \div \frac{1}{3} = 5 \times 3 = 15$ days.

A's 1 day work $= \frac{1}{15}$

B can do $\frac{2}{3}$ of a work in 10 days

B complete work in $= 10 \div \frac{2}{3} = 10 \times \frac{3}{2} = 15$ day

B's 1 day work $= \frac{1}{15}$

$(A+B)$'s 1 day work $= \frac{1}{15} + \frac{1}{15} = \frac{2}{15}$

$(A+B)$'s can do 1 work $1 \div \frac{2}{15}$ days

$1 \times \frac{15}{2} = \frac{15}{2}$ days or $7\frac{1}{2}$ days.

8. P can do $\frac{1}{4}$ of work in 10 days.

1 work will be completed in $4 \times 10 = 40$ days.

Q can do 40% or $\frac{40}{100}$ or $\frac{2}{5}$ of work in 15 days

1 work will be completed in $5 \times \frac{15}{2} = \frac{75}{2}$ days

R can do $\frac{1}{3}$ of work in 13 days

1 work will be completed in $3 \times 15 = 39$ days

comparison of work 40, $\frac{75}{2}$, 39

$$\frac{40 \times 2}{1 \times 2} = \frac{80}{2}\ ;\ \frac{75}{2}\ ;\ \frac{39 \times 2}{1 \times 2} = \frac{39}{2}$$

So, Q will complete the work first.

9. Mohan : Number of pages type in 6 hrs $= 32$ pages

Number of pages type in 1 hr $= \frac{32}{6}$ pages $= \frac{16}{3}$ pages

Sohan : Number of pages type in 5 hrs $= 40$ pages

Number of pages type in 1 hrs $= 40 \div 5 = 8$ pages

Mohan and Sohan work together in 1 hrs $= \frac{16}{3} + 8$ pages

$$= \frac{16+24}{3} = \frac{40}{3} \text{ pages}$$

Mohan + Sohan type $\frac{40}{3}$ pages in 1 hrs.

They type 110 page in $110 \div \frac{40}{3} = 110 \times \frac{3}{40} = \frac{33}{4}$ or $8\frac{1}{4}$ hrs.

10. Time taken to fill the tank $= 16$ hrs.

Tank can be filled in 1 hrs $= \frac{1}{16}$ part

Due to Leakage in the bottom

Time taken to fill the tank $= 24$ hr.

Tank can be fill in 1 hrs $= \frac{1}{24}$ part

Time taken to leak take to empty it $\frac{1}{16} - \frac{1}{24} = \frac{3-2}{48} = \frac{1}{48}$

Time taken to empty tank $1 \div \frac{1}{48} = 48$ hrs.

11. Time taken to fill the tank $= 6$ hours.

Tank can be filled in 1 hour $= \frac{1}{6}$ part

Tank filled $= \frac{1}{2}$

Tank remained to fill $= 1 - \frac{1}{2}$

Number of others similar taps $= 3$

Rate of filling the tanks $= 6$ hours.

Tank can be filled in $\frac{1}{2}$ hours $= \frac{1}{3}$

Time taken to fill the remaining tank $= \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3}$ hours $= 1$ hour

Multiple Choice Questions

Tick (3) the correct answer :

1. (a) **2.** (c) **3.** (a) **4.** (b) **5.** (d) **6.** (a) **7.** (a)

7 Compound Interest

Exercise 7.1

1. Principal for the first year = ` 7000

Rate $= 12\%$

Interest for first year ₹ $\frac{7000 \times 12 \times 1}{100}$ = ₹ 840

Amount at end of first year = ₹ 7000 + ₹ 840 = ₹ 7840

Rate = 12%

Interest for second year = ₹ $\frac{7840 \times 12 \times 1}{100}$ = ₹ 940.80

Amount at end of second year = ₹ 7840 + 940.80 = ₹ 8780.80

Compound Interest = ₹ (8780.80 – 7000) = ₹ 1780.80

2. Principal for first six months (first half year) = ₹ 20,000

Rate for the first half year = $\left(\frac{4}{2}\right)\% = 2\%$

Time = 1 half year

Interest = $\frac{20{,}000 \times 2 \times 1}{100}$ = ₹ 400 (for 1st half year)

Amount at the end of 1st half year = ₹ 20,000 + ₹ 400 = ₹ 20400

Principal for the second six months (second half year) = ₹ 20400

Rate for the second half year = $\left(\frac{4}{2}\right)\% = 2\%$

Time = 1 half year

Interest for the second year $\frac{20400 \times 2 \times 1}{100}$ = ₹ 408

Amount at the end of second half year = ₹ 20400 + ₹ 408 = ₹ 20808

Principal for the third six months (third half year) = ₹ 20808

Rate = $\left(\frac{4}{2}\right)\% = 2\%$

Time = 1 half year

Interest = $\frac{20808 \times 2 \times 1}{100}$ = ₹ 416.16

Amount at the end of third half year = ₹ (20808 + 416.16) = ₹ 21224.16

Final amount to be paid = ₹ 21224.16

C.I. = ₹ 211224.16 – 20000 = ₹ 11224.16

3. 9 months = three quarters

$R = 12\%$ p.a. $= \left(\frac{12}{4}\right)\%$ per quarter = 3% per quarter

Principal for 1st quarter = ₹ 8500

Interest for 1st quarter = $\frac{8500 \times 3 \times 1}{100}$ = ₹ 255

Amount at the end of 1st quarter = ₹ 8500 + ₹ 255 = ₹ 8755

Principal for the 2nd quarter = ₹ 8755; $R = 3\%$

Interest for the 2nd quarter = ₹ $\frac{8755 \times 3 \times 1}{100}$ = ₹ 262.65

Amount at the end of 2nd quarter = ₹ 8755 + ₹ 262.65 = ₹ 9017.65

Principal for 3rd quarter = ` 9017.65; $R = 3\%$

Interest for the 3rd quarter = ` $\dfrac{9017.05 \times 3 \times 1}{100}$ = ` 270.53

Amount at the end of 3rd quarter = ` 9017.65 + 270.53 = ` 9288.18

C.I. = ` 9288.18 – 8500 = ` 788.18

4. 9 months = Three quarters

$R = 6\%$ p.a. $= \left(\dfrac{6}{4}\right)\%$ per quarter $= \dfrac{6}{4}\%$ per quarter

Principal for 1st quarter = ` 4000

Interest for 1st quarter = $\dfrac{4000 \times 6 \times 1}{100 \times 4}$ = ` 60

Amount at the end of 1st quarter = ` 4000 + ` 60 = ` 4060

Principal for the 2nd quarter = ` 4060; $R = \dfrac{6}{4}\%$

Interest for the 2nd quarter = ` $\dfrac{4060 \times 6 \times 1}{100 \times 4}$ = ` 60.90

Amount at the end of 2nd quarter = ` 4060 + ` 60.90 = ` 4120.9

Principal for the 3rd quarter = ` 4120.9, $R = \dfrac{6}{4}\%$

Interest for 3rd quarter = ` $\dfrac{4120.9 \times 6}{4 \times 100}$ = ` 61.81

Amount at the end of 3rd quarter = ` 4120.90 + ` 61.81 = ` 4182.71

Compound Interest = Amount – Principal = ` 4182.71 – 4000 = ` 182.71

5. Principal for the first year = ` 2000

Rate = 10%

Interest for first year = ` $\dfrac{2000 \times 10 \times 1}{100}$ = ` 200

Amount at end of first year = ` 2000 + ` 200 = ` 2200

Rate = 10%

Interest for second year = ` $\dfrac{2200 \times 10 \times 1}{100}$ = ` 220

Amount at end of second year = ` 2200 + ` 220 = ` 2420.

Compound Interest = ` 2420 – 2000 = ` 420.

6. Principal = ` 32768

Rate $= 12\dfrac{1}{2}\% = \dfrac{25}{2}\%$ p.a. $= \left(\dfrac{25}{2 \times 4}\right)\%$ per quarter $= \dfrac{25}{8}\%$ per quarter

Nine month = 3 quarter.

Principal for 1st quarter = ` 32768 ; $R = \dfrac{25}{8}\%$

Interest for 1st quarter = ` $\dfrac{32768 \times 25 \times 1}{8 \times 100}$ = ` 1024

Amount for 1st quarter = ` (32768 + 1024) = ` 33792

Principal for 2nd quarter $= ` \ 33792 \ ; R = \frac{25}{8}\%$

Interest for 2nd quarter $= \frac{33792 \times 25 \times 1}{8 \times 100} = ` \ 1056$

Amount for 2nd quarter $= ` \ (33792 + 1056) = ` \ 34848$

Principal for 3rd quarter $= ` \ 34848 \ ; R = \frac{25}{8}\%$

Interest for 3rd quarter $= ` \ \frac{34848 \times 25 \times 1}{8 \times 100} = ` \ 1089$

Amount for 3rd quarter $= ` \ 1089 + ` \ 34848 = ` \ 35937.$

7. Principal $= ` \ 3000$; Rate $= 6\%$ per annum

Time $= 1\frac{1}{2}$ year or $\frac{3}{2}$ year $= \frac{3}{2} \times 2 = 3$ half year

Principal for first six months (first half year) $= ` \ 3000$

Rate for the first half year $= \left(\frac{6}{2}\%\right) = 3\%$

Time 1 half year

$$\text{Interest} = \frac{3000 \times 3 \times 1}{100} = ` \ 90$$

Amount at the end of 1st half year $= ` \ 3000 + ` \ 90 = ` \ 3090$

Principal for the second six months (second half year) $= ` \ 3090$

Rate for the second half year $= \left(\frac{6}{2}\right)\% = 3\%$

Time $= 1$ half for

$$\text{Interest for second year} = ` \ \frac{3090 \times 3 \times 1}{100} = ` \ 92.70$$

Amount at the end of 2nd half year $= ` \ 3090 + 92.70 = ` \ 3182.70$

Principal for the third six months (third half year) $= ` \ 3182.70$

$$\text{Rate} = \left(\frac{6}{2}\right)\% = 3\%; \text{ Time} = 1 \text{ half year}$$

$$\text{Interest} = ` \ \frac{3182.70 \times 3 \times 1}{100} = ` \ 95.481$$

Amount at the end of third half year $= ` \ (3182.70 + 95.481) = ` \ 3278.181$

Final amount to be paid $= ` \ 3278.181$

C.I. $= ` \ (3278.81 - 3000) = ` \ 278.181.$

8. Simple Interest

Principal $= ` \ 18000$, $R = 12\%$ Time $= 2$ year

$$\text{S.I.} = \frac{P \times R \times T}{100} = ` \ \frac{18000 \times 12 \times 2}{100} = ` \ 4320$$

Compound Interest

Principal $= ` \ 18000$; $R = 12\%$

Interest for 1 year = ₹ $\frac{18000 \times 12 \times 1}{100}$ = ₹ 2160

Amount of 1 year = ₹ 18000 + ₹ 2160 = ₹ 20160

Principal for 2 year = ₹ 20160

Interest for 2 year = ₹ $\frac{20160 \times 12 \times 1}{100}$ = ₹ 2419.20

Amount of 2 year = ₹ 20160 + ₹ 2419.20 = ₹ 22579.20

Compound Interest = ₹ 22579.20 − ₹ 18000 = ₹ 4579.20

Sonam earn profit = ₹ (4579.20 – 4320) = ₹ 259.20

9. 1 year = 4 quarters

$R = 8\%$ p.a. $= \left(\frac{8}{4}\right)\%$ per quarter $= 2\%$ per quarter

Principal for 1st quarter = ₹ 12000

Interest for 1st quarter = $\frac{12000 \times 2 \times 1}{100}$ = ₹ 240

Amount at the end of 1st quarter = ₹ 12000 + ₹ 240 = ₹ 12240

Principal for the 2nd quarter = ₹ 12240; R = 2%

Interest for the 2nd quarter = ₹ $\frac{12240 \times 2 \times 1}{100}$ = ₹ 244.8

Amount at the end of 2nd quarter = ₹ 12240 + ₹ 244.8 = ₹ 12484.8

Principal for 3rd quarter = ₹ 12484.8

Interest for 3rd quarter = $\frac{12484.8 \times 2 \times 1}{100}$ = ₹ 249.696

Amount at the end of 3rd quarter = ₹ 12484.8 + ₹ 249.696 = ₹ 12734.496

Principal for the 4th quarter = ₹ 12734.500; $R = 2\%$

Interest for the 4th quarter = ₹ $\frac{12734.500 \times 2 \times 1}{100}$ = ₹ 65×4 = ₹ 254.69

Amount at the end of 4th quarter = ₹ 12734.500 + ₹ 254.69 = ₹ 12989.19

C.I. = Final amount − Original principal = ₹ 12989.19 – ₹ 12000 = ₹ 989.19

10. Nine months = three quarters

$R = 10\%$ p.a. $= \left(\frac{10}{4}\right)\%$ per quarter $= \frac{25}{10}\%$ per quarter

Principal for 1st quarter = ₹ 25600

Interest for 1st quarter = $\frac{25600 \times 25 \times 1}{100 \times 10}$ = ₹ 640

Amount at the end of 1st quarter = ₹ 25600 + ₹ 640 = ₹ 26240

Principal for the 2nd quarter = ₹ 26240 ; $R = \frac{25}{10}\%$

Interest for the 2nd quarter = ₹ $\frac{26240 \times 25 \times 1}{100 \times 10}$ = ₹ 656

Amount at the end of 2nd quarter = ₹ 26240 + ₹ 656 = ₹ 26896

Principal for the 3rd quarter = ` 26896, $R = \frac{25}{10}\%$

Interest for the 3rd quarter = ` $\frac{26896 \times 25 \times 1}{10 \times 100}$ = ` 672.40

Amount at the end of 3rd quarter = ` (26896 + 672.40) = ` 27568.40

C.I. = Amount − Principal = ` 27568.40 − 25600 = ` 1968.40

11. Principal = ` 24000

Nine months = 3 quater

Rate = 20 paisa and rupee per annum 20%

Rate $= \frac{20}{4} = 5\%$

Principal for 1 quater = ` 24000 ; Rate = 5%

Interest fo 1st quater = ` $\frac{24000 \times 5 \times 1}{100}$ = ` 1200

Amount for Ist quater = ` 24000 + ` 1200 = ` 25200

Principal for 2nd quater = ` 25200 ; Rate = 5%

Interest fo 2nd quater = ` $\frac{25200 \times 5 \times 1}{100}$ = ` 1260

Amount for 2nd quater = ` 25200 + ` 1260 = ` 26460

Interest fo 3rd quater = ` $\frac{26460 \times 5 \times 1}{100}$ = ` 1323

Amount for 3rd quater = ` 26460 + ` 1323 = ` 27783

Compound Interest = Amount – Princpal = ` 27783 – ` 24000 = ` 3783

12. Principal for first six months (first half year) = ` 64000

Rate for the first half year $= \left(\frac{5}{2}\right)\%$

Time = 1 half year

Interest $= \frac{64{,}000 \times 5 \times 1}{100 \times 2}$ = ` 1600 (for 1st half year)

Amount at the end of 1st half year = ` 64,000 + ` 1600 = ` 65600

Principal for the second six months (second half year) = ` 65,600

Rate for the second half year $= \left(\frac{5}{2}\right)\%$

Time = 1 half year

Interest for the second year $= \frac{65600 \times 5 \times 1}{100 \times 2}$ = ` 1640

Amount at the end of second half year = ` 65600 + ` 1640 = ` 67240

Principal for the third six months (third half year) = ` 67240

Rate $= \left(\frac{5}{2}\right)\%$

Time = 1 half year

$$\text{Interest} = \frac{67240 \times 5 \times 1}{100 \times 2} ` \ 1681$$

Amount at the end of third half year = ` 67240 + ` 1681 = ` 68921

Final amount to be paid = ` 68921

C.I. = ` 68921 − ` 64,000 = ` 4921

13. Principal for the first year = ` 15000

$R = 5\%$

$$\text{Interest the first year} = \frac{15000 \times 5 \times 1}{100} = ` \ 750$$

Amount of the end of first year = ` 15000 + ` 750 = ` 15750

Principal for the second year = ` 15750

$R = 5\%$

$$\text{Interest for the second year} = \frac{15750 \times 5 \times 1}{100} = ` \ 787.50$$

Amount at the end of second year = ` 15750 + ` 787.50 = ` 16537.50

Compound interest = $A - P$ = ` (16537.50 – 15000) = ` 1537.50

Exercise 7.2

1. Find the compound interest in each of the following using the formulae :

(a) Principal = ` 4,000, Rate = 6%, Time = 3 years

$$A = P\left(1 + \frac{R}{100}\right)^T$$

$$A = ` \ 4000\left(1 + \frac{6}{100}\right)^3 = ` \ 4000 \times \left(1 + \frac{3}{50}\right)^3 = ` \ 4000\left(\frac{53}{50}\right)^3$$

$$= ` \ 4000 \times \frac{53}{50} \times \frac{53}{50} \times \frac{53}{50} = ` \ 4764.06$$

C.I. = $A - P$ = ` 4764.06 – ` 4000 = ` 764.06

(b) Principal = ` 5,000, Rate = 5 paise per rupee per annum, Time = 3 years

$$A = P\left(1 + \frac{R}{100}\right)^T$$

$$A = ` \ 5000\left(1 + \frac{5}{100}\right)^3 = ` \ 5000\left(\frac{21}{20}\right)^3$$

$$= ` \ 5000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} = ` \ 5788.13$$

C.I. = $A - P$ C.I. = ` 5788.13 – ` 5000 = ` 788.13

(c) Principal = ` 3,000, Rate = 10% per annum compounded half-yearly, Time = 2 years

$$r = \frac{10}{2}\% = 5\%$$

Time = 2 years = $2 \times 2 = 4$ half yearly

$$A = P\left(1+\frac{R}{100}\right)^{T}$$

$$A = 3000\left(1+\frac{5}{100}\right)^{4} = 3000\left(\frac{21}{20}\right)^{4}$$

$$= 3000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20} = ₹\ 3646.52$$

C.I. $= A-P$ ₹ $(3646.52-3000) =$ ₹ 646.52

(d) Principal = ₹ 20,000, Rate = 20% per annum compounded quarterly, Time $=1$ years

$$r = \frac{20}{4}\%\text{ or }5\%$$

Time $=1$ year $=4$ quarterly

$$A = ₹\ P\left(1+\frac{r}{100}\right)^{T} = ₹\ 20000\left(1+\frac{5}{100}\right)^{4} = ₹\ 20000\left(\frac{105}{100}\right)^{4}$$

$$= ₹\ 20000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20} = ₹\ 24310.13$$

C.I. $= A-P =$ ₹ 24310.13 – ₹ 20000 = ₹ 4310.13

2. $P =$ ₹ 12500, $R = 8\%$ p.a. and $n = 1\frac{1}{4}$ years

$$\text{Amount of } 1\frac{1}{4}\text{ years} = ₹\ P\left(1+\frac{R}{100}\right)^{1}\left(1+\frac{\frac{1}{4}R}{100}\right)$$

$$= ₹\ 12500\left(1+\frac{8}{100}\right)^{1}\left(1+\frac{\frac{1}{4}\times 8}{100}\right)$$

$$= ₹\ 12500\times\frac{108}{100}\times\frac{102}{100} = ₹\ 13770$$

C.I. $A-P$ ₹ 13770 – ₹ 12500 = ₹ 1270

3. $P =$ ₹ 12800; $T = 3$ year; $R = 6\frac{1}{2}\%$ p.a. or $\frac{13}{2}\%$

$$A = P\left(1+\frac{R}{100}\right)^{T}$$

$$A = ₹\ 12800\left(1+\frac{13}{2\times 100}\right)^{3}$$

$$A = ₹\ 12800\left(\frac{213}{200}\right)^{3} = ₹\ 12800\times\frac{213}{200}\times\frac{213}{200}\times\frac{213}{200} = ₹\ 15461.76$$

C.I. $= A-P$; C.I. = ₹ (15461.76 – 12800) = ₹ 2661.76

4. S.I. = ₹ 2400; $R = 5\%$, $T = 3$ years

$$\text{S.I.} = \frac{P \times R \times T}{100} \qquad 2400 = \frac{P \times 5 \times 3}{100} \qquad P = ₹\ \frac{2400 \times 100}{5 \times 3} = ₹\ 16000$$

Compound interest :

$$A = P\left(1 + \frac{R}{100}\right)^T$$

$$A = ₹\ 16000\left(1 + \frac{5}{100}\right)^3 = ₹\ 16000\left(\frac{21}{20}\right)^3$$

$$= ₹\ 16000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} = ₹\ 18522$$

C.I. $= A - P =$ ₹ $(18522 - 16000) =$ ₹ 2522

5. $P =$ ₹ 2000 ; $R = 10\%$ p.a. (half yearly)$= \frac{10}{2}\% = 5\%$

Time $(n) = 1\frac{1}{2}$ year $= \frac{3}{2} \times 2 = 3$ (half yearly)

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$A = ₹\ 2000\left(1 + \frac{5}{100}\right)^3$$

$$A = ₹\ 2000 \times \left(\frac{105}{100}\right)^3 = ₹\ 2000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} = ₹\ 2315.25$$

C.I. $= A - P$ ₹ (2315.25 – 2000) = ₹ 315.25

6. Principal = ₹ 1625 ; rate $= 12$ p.a. and $n = 1\frac{1}{4}$ years

$$\text{Amount of } 1\frac{1}{4} \text{ years} = ₹\ p\left(1 + \frac{R}{100}\right)^1\left(1 + \frac{\frac{1}{4}R}{100}\right)$$

$$= ₹\ 1625\left(1 + \frac{12}{100}\right)\left(1 + \frac{\frac{1}{4} \times 12}{100}\right) = ₹\ 1625\left(\frac{112}{100}\right)\left(\frac{103}{100}\right)$$

$$= ₹\ 1625 \times \frac{112}{100} \times \frac{103}{100} = ₹\ \frac{18746000}{10000} = ₹\ 1874.6$$

C.I. $= A - P =$ ₹ 1874.6 − ₹ 1625 = ₹ 249.60

7. $P =$ ₹ 50000; $r = 10\%$ $n = 1\frac{1}{2}$ year $= \frac{3}{2} \times 2 = 3$ (half yearly) $= \frac{10}{2}\% = 5\%$

$$A = P\left(1 + \frac{R}{100}\right)^n = ₹\ 50000\left(1 + \frac{10}{100}\right)^3$$

$$= ₹\ 50000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} = ₹\ 66550$$

C.I. $= A - P =$ ₹ (66550 – 50000) = ₹ 16550.

8. Principal = ₹ 1600, Time $= 2$ years, $r = 7\frac{1}{4}\%$ or $\frac{29}{4}\%$

$$A = P\left(1 + \frac{r}{100}\right)^T \qquad A = ₹\ 1600\left(1 + \frac{29}{4 \times 100}\right)^2$$

$$A = ₹\ 1600 \times \frac{429}{400} \times \frac{429}{400} = ₹\ 1840.400$$

C.I. $= A - P =$ ₹ $(1840.400 - 1600) =$ ₹ 240.40

9. Principal = ₹ 25000; Time $= 3$ years

$a = 10\%,\ b = 12\%\ c = 15\%$

$$A = ₹\ P\left(1 + \frac{a}{100}\right)\left(1 + \frac{b}{100}\right)\left(1 + \frac{c}{100}\right)$$

$$= ₹\ 25000\left(1 + \frac{10}{100}\right)\left(1 + \frac{12}{100}\right)\left(1 + \frac{15}{100}\right)$$

$$= ₹\ 25000\left(\frac{11}{10}\right)\left(\frac{112}{100}\right)\left(\frac{115}{100}\right)$$

$$= ₹\ 25000 \times \frac{11}{10} \times \frac{112}{100} \times \frac{115}{100} = ₹\ 35420$$

C.I. $= A - P$ ₹ 35420 – 25000 = ₹ 10420

10. $P =$ ₹ 57600; $R = 12\frac{1}{2}\%$ or $\frac{25}{2}\%$ p.a. half year $= \left(\frac{25}{2} \div 2\right) = \frac{25}{4}\%$

Time $= 1\frac{1}{2}$ year $= \frac{3}{2} \times 2$ half year $= 3$ half year

$$A = P\left(1 + \frac{R}{100}\right)^T$$

$$A = ₹\ 57600\left(1 + \frac{25}{100 \times 4}\right)^3$$

$$= ₹\ 57600\left(\frac{17}{16}\right)^3 = ₹\ 57600 \times \frac{17}{16} \times \frac{17}{16} \times \frac{17}{16} = ₹\ 69089.06$$

C.I. $= A - P$; C.I.

= ₹ (69089.06 – 57600) = ₹ 11489.06

11. $P =$ ₹ 15000; $R = 8\% = \frac{8}{4} = 2\%$ quarterly,

$T = 9$ months; $\frac{9}{12}$ year $= \frac{9}{12} \times 4 = 3$ (quarters)

$$A = P\left(1 + \frac{R}{100}\right)^T$$

$$A = ₹\ 15000\left(1+\frac{2}{100}\right)^3 = ₹\ 15000\times\left(\frac{51}{50}\right)^3$$

$$= ₹\ 15000\times\frac{51}{50}\times\frac{51}{50}\times\frac{51}{50} = ₹\ 15918.12$$

$$\text{C.I.} = A-P;\ \text{C.I.} = ₹\ 15918.12-15000 = ₹\ 918.12$$

12. Principal = ₹ 5000; $n = 3$ year; $a = 10\%$, $b = 12\%$, $c = 14\%$

$$A = P\left(1+\frac{a}{100}\right)\left(1+\frac{b}{100}\right)\left(1+\frac{c}{100}\right)$$

$$A = ₹\ 5000\left(1+\frac{10}{100}\right)\left(1+\frac{12}{100}\right)\left(1+\frac{14}{100}\right)$$

$$= ₹\ 5000\times\frac{110}{100}\times\frac{112}{100}\times\frac{114}{100} = ₹\ 7022.4$$

$$\text{C.I.} = A-P = ₹\ (7022.4-5000) = ₹\ 2022.4$$

Exerciser 7.3

1. Let, the sum be ₹ 100

Rate $= 15\%$ Time $= 2$ year

$$\text{S.I. on ₹ } 100 = ₹\ \frac{100\times15\times2}{100} = ₹\ 30$$

$$\text{C.I. on ₹ } 100; \quad A = P\left(1+\frac{r}{100}\right)^n$$

$$A = ₹\ 100\left(1+\frac{15}{100}\right)^2$$

$$= ₹\ 100\times\frac{115}{100}\times\frac{115}{100} = ₹\ 132.25$$

$$\text{C.I.} = A-P \quad ₹\ (132.25-100) = ₹\ 32.25$$

Difference between C.I. and S.I. ₹ 32.25 – ₹ 30 = ₹ 2.25

If difference is ₹ 144 the sum will be $= \frac{100}{2.25}\times144 = ₹\ 6400.$

2. Let, the sum be ₹ 100

Rate $= 5\%$ Time $= 2$ year

$$\text{Sum of ₹ } 100 = ₹\ \frac{100\times5\times2}{100} = ₹\ 10$$

$$\text{C.I. of ₹ } 100; \quad A = P\left(1+\frac{r}{100}\right)^n$$

$$A = 100\left(1+\frac{5}{100}\right)^2 = 100\left(\frac{21}{20}\right)^2$$

$$A = 100\times\frac{21}{20}\times\frac{21}{20} = ₹\ 110.25$$

$$\text{C.I.} = A-P$$

$$\text{C.I.} = 110.25 - 100 = ₹\ 10.25$$

Difference of S.I. and C.I. ₹ (10.25 – 10.00) = ₹ 0.25

If difference is ₹ 0.25 then sum = ₹ 100

$$\text{Difference is ₹ 1 then sum} = ₹\ \frac{100}{0.25}$$

$$\text{Difference is ₹ 1.50 then sum} = ₹\ \frac{100}{0.25} \times 1.50 = ₹\ 600$$

$$\text{Principal} = ₹\ 600.$$

3. Let the original principal be ₹ x

It amount to ₹ 12100 in 2 years at C.I. of Rate $= 10\%$

$$A = P\left(1 + \frac{R}{100}\right)^n \qquad 12100 = x\left(1 + \frac{10}{100}\right)^2$$

$$12100 = x\left(\frac{11}{10}\right)^2 \qquad 12100 = x \times \frac{11}{10} \times \frac{11}{10}$$

$$x = 12100 \times \frac{10 \times 10}{11 \times 11} = 10000$$

Principal = ₹ 10000.

4. $P =$ ₹ 20,000; $R_1 = 5\%$; $R_2 = 6\%$; $R_3 = 8\%$

$$A = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right)$$

$$= ₹\ 20000\left(1 + \frac{5}{100}\right)\left(1 + \frac{6}{100}\right)\left(1 + \frac{8}{100}\right)$$

$$= ₹\ 20000 \times \frac{105}{100} \times \frac{106}{100} \times \frac{108}{100} = ₹\ 24040.8$$

5. Let the original principal = ₹ x then, amount = ₹ $\frac{9}{4} \times x =$ ₹ $\frac{9}{4}x$

Time $= 2$ year and Suppose Rate $= R$

$$A = P\left(1 + \frac{R}{100}\right)^n \qquad \frac{9x}{4} = x\left(1 + \frac{R}{100}\right)^2$$

$$\frac{9x}{4} \div x = \left(1 + \frac{R}{100}\right)^2 \qquad \frac{9x}{4} \times \frac{1}{x} = \left(1 + \frac{R}{100}\right)^2$$

$$\left(\frac{3}{2}\right)^2 = \left(1 + \frac{R}{100}\right)^2$$

Comparison the equation; $\frac{3}{2} = 1 + \frac{R}{100}$

$$\frac{R}{100} = \frac{3}{2} - 1 \qquad \frac{R}{100} = \frac{3-2}{2}$$

$$\frac{R}{100} = \frac{1}{2} \qquad R = \frac{1}{2} \times 100 = 50\%$$

Rate $= 50\%$.

6. S.I. for 2 years = ₹ 100

S.I for 1 years = ₹ 50

C.I. for 2 years = ₹ 104

For Ist year C.I and S.I. will be same.

So, C.I. for Ist year = ₹ 50

S.I. means

₹ 4 is the C.I. of ₹ 50 for 1 year

So, C.I. = 4, P = 50, T = 1, R = ?

Now, $$R = \frac{C.I. \times 100}{P \times T}$$

$$= \frac{4 \times 100}{50 \times 1} = 8\%.$$

7. C.I. = ₹ 6781.25; P = ₹ 16000, $T = 3$ year

$A = \text{C.I.} + P$ $\quad A$ = ₹ 6781.25 + ₹ 16000 = ₹ 22781.25

$$A = P\left(1 + \frac{r}{100}\right)^n \qquad 22781.25 = 16000\left(1 + \frac{r}{100}\right)^3$$

$$\frac{2278125}{1600000} = \left(1 + \frac{r}{100}\right)^3 \qquad \frac{729}{512} = \left(1 + \frac{r}{100}\right)^3$$

$$\left(\frac{9}{8}\right)^3 = \left(1 + \frac{r}{100}\right)^3 \qquad \frac{r}{100} = \frac{9}{8} - 1$$

$$\frac{r}{100} = \frac{9-8}{8} \qquad r = \frac{1}{8} \times 100 = 12.5$$

So, Rate = 12.5%.

Multiple Choice Questions

Tick (✓) the correct answer :

1. (b); **2.** (b); **3.** (a); **4.** (d); **5.** (a); **6.** (d) **7.** (d); **8.** (c); **9.** (c); **10.** (a)

High Order thinking Skills (HOTS)

1. Let the principal and rate be P and r respectively.

Then, For 2 years, $$1210 = P\left(1 + \frac{r}{100}\right)^2 \quad \ldots\text{(i)}$$

For 5 years, $$1610.51 = P\left(1 + \frac{r}{100}\right)^5 \quad \ldots\text{(ii)}$$

Divide equation (ii) by (i), we get

$$\frac{1610.51}{1210} = \frac{P\left(1 + \frac{r}{100}\right)^5}{P\left(1 + \frac{r}{100}\right)^2} \quad \text{or} \quad \left(1 + \frac{r}{100}\right)^3 = \frac{161051}{121000}$$

$$\left(1+\frac{r}{100}\right)^3 = \frac{1331}{1000} \qquad \left(1+\frac{r}{100}\right) = \sqrt[3]{\frac{1331}{1000}}$$

$$1+\frac{r}{100} = \frac{11}{10} \qquad 10+\frac{10r}{100} = 11$$

$$\frac{r}{10} = 11-10 \qquad r = 1\times 10$$

$$r = 10\%$$

Putting the value of r in equation (i), we get

$$1210 = P\left(1+\frac{10}{100}\right)^2 \qquad 1210 = P\left(1+\frac{1}{10}\right)^2$$

$$1210 = P\times\frac{11\times 11}{100} \qquad P = \frac{1210\times 100}{11\times 11} = 10\times 100 = \text{`}\ 1000.$$

2. Amount in 1 year = ` 8820
Amount in 1 year 6 months = ` 9261
Interest in 6 month = ` 9261 – ` 8820 = ` 441
Interest in 1 year = ` 441 × 2 = ` 882
One year compound Interest equal to one year

Simple interest ` 882 = ` $\frac{8820\times R\times 1}{100}$ (For 6 month $P = A$ of 1 year)

$$R = \frac{88200}{8820} = 10\%$$

Let original principal = ` x
Amount ` 8820 in 1 year at C.I. half year

$$8820 = x\left(1+\frac{10}{100\times 2}\right)^{1\times 2} \qquad r = 10\% \div 2 = 5\%$$

$$n = 1\times 2 = 2 \qquad 8820 = x\left(1+\frac{5}{100}\right)^2$$

$$8820 = x\times\frac{105}{100}\times\frac{105}{100}$$

$$x = 8820\times\frac{100}{105}\times\frac{100}{105} = \text{`}\ 8000.$$

8 Algebraic Expressions and Factorization

Exercise 8.1

1. Find the following products :

(a) $2x\times 7x = 14x^2$ (b) $3x^2\times 6x^3 = 18x^5$

(c) $(-7x^2)\times 2y = -14x^2y$

(d) $\left(-\frac{3}{2}x^2y^2\right)\times\left(-\frac{6}{7}xy^2\right)=\left(\frac{-3}{2}\times\frac{-6}{7}\right)(x^2\times x)(y^2\times y^2)=\frac{9}{7}x^3y^4$

2. Multiply the monomials :

(a) Multiply : $3x$, $-4x^2$ and $7x^3$

$$3x^2\times -4x^2\times 7x^3=3\times -4\times 7\times x\times x^2\times x^3=-84x^6$$

(b) Multiply : a^3, $-6a^2b$ and $2b^3$

$$a^3\times -6a^2b\times 2b^3=-6\times 2\times(a^3\times a^2)\times(b\times b^3)$$
$$=-12a^5\times b^4=-12a^5b^4$$

(c) Multiply : $16x^6$, $-10xy^2$ and $\frac{3}{5}x^2y^2$

$$16x^6\times -10xy^2\times\frac{3}{5}x^2y^2=\left(16\times -10\times\frac{3}{5}\right)\times(x^6\times x\times x^2)\times(y^2\times y^2)$$
$$=-96\times x^9\times y^4=-96x^9y^4$$

(d) Multiply : $-2p^4$ $-4p^2q^2$ and $\frac{3}{8}pq^2$

$$=-2p^4\times -4p^2q^2\times\frac{3}{8}pq^2$$
$$=-2\times -4\times\frac{3}{8}\times p^4\times p^2\times p\times q^2\times q^2$$
$$=-1\times 3\times p^7\times q^4=-3p^7q^4$$

3. Find the following products :

(a) $(-3x)(2x^2+6x-7)=-3x\times 2x^2+(-3x\times 6x)+(-7\times -3x)$
$$=-6x^3+(-18x^2)+(+21x)$$
$$=-6x^3-18x^2+21x$$

(b) $\frac{1}{2}xy\,(x^2-2xy+y^2)$

$$=\frac{1}{2}xy\times x^2-\frac{1}{2}xy\times 2xy+\frac{1}{2}xy\times y^2=\frac{1}{2}x^3y-x^2y^2+\frac{1}{2}xy^3$$

(c) $a^2(a^3+3a^2b+b^3+3ab^2)$
$$=a^2\times a^3+a^2\times 3a^2b+a^2b^3+a^2\times 3ab^2$$
$$=a^5+3a^4b+a^2b^3+3a^3b^2$$

(d) $\left(-\frac{3}{5}p^2q\right)(p^4+q^4+2p^2q^2)$

$$=\frac{-3}{5}p^2q\times p^4+\left(\frac{-3}{5}p^2q\times q^4\right)+\left(\frac{-3}{5}p^2q\times\frac{2}{1}p^2q^2\right)$$
$$=\frac{-3}{5}p^6q+\left(\frac{-3}{5}p^2q^5\right)+\left(\frac{-6}{5}p^4q^3\right)$$

$$= \frac{-3}{5} p^6 q - \frac{3}{5} p^2 q^5 - \frac{6}{5} p^4 q^3$$

4. Find the following products :

(a) Multiply : $(2x - y)(3x - 5y)$

$$(2x - y) \times (3x - 5y) = 2x(3x - 5y) - y(3x - 5y)$$
$$= 6x^2 - 10xy - 3xy + 5y^2$$
$$= 6x^2 - 13xy + 5y^2$$

(b) $(3a + 2)(2a - 5) = 3a(2a - 5) + 2(2a - 5) = 6a^2 - 15a + 4a - 10$
$$= 6a^2 - 11a - 10 = 6a^2 - 11a - 10$$

(c) $(p + q)(p - q) = p(p - q) + q(p - q)$
$$= p^2 - pq + pq - q^2 = p^2 - q^2$$

(d) $\left(\frac{1}{2}x^2 + y^2\right)\left(x^2 - \frac{1}{2}y^2\right) = \frac{1}{2}x^2\left(x^2 - \frac{1}{2}y^2\right) + y^2\left(x^2 - \frac{1}{2}y^2\right)$

$$= \left(\frac{1}{2}x^2 \times x^2 - \frac{1}{2}y^2 \times \frac{1}{2}x^2\right) + \left(y^2 \times x^2 - \frac{1}{2}y^2 \times y^2\right)$$
$$= \frac{1}{2}x^4 - \frac{1}{4}x^2y^2 + 1x^2y^2 - \frac{1}{2}y^4$$
$$= \frac{1}{2}x^4 + \frac{-1x^2y^2 + 4x^2y^2}{4} - \frac{1}{2}y^4 = \frac{1}{2}x^4 + \frac{3x^2y^2}{4} - \frac{1}{2}y^4$$

5. Find the following products :

(a) $(a + b)(a^2 + b^2) = a(a^2 + b^2) + b(a^2 + b^2)$
$$= a^3 + ab^2 + ba^2 + b^3$$

(b) $(2x - 1)(x^2 + 2x + 7)$
$$= 2x(x^2 + 2x + 7) - 1(x^2 + 2x + 7)$$
$$= 2x^3 + 4x^2 + 14x - x^2 - 2x - 7$$
$$= 2x^3 + (4x^2 - x^2) + (14x - 2x) - 7$$
$$= 2x^3 + 3x^2 + 12x - 7$$

(c) $(3y^2 + 5)(5y^2 + 3y + 1) = 3y^2(5y^2 + 3y + 1) + 5(5y^2 + 3y + 1)$
$$= 15y^4 + 9y^3 + 3y^2 + 25y^2 + 15y + 5$$
$$= 15y^4 + (13y^2 + 25y^2) + 9y^3 + 15y + 5$$
$$= 15y^4 + 28y^2 + 9y^3 + 15y + 5$$

(d) $(p^2 + q^2)(p^2 - pq + q^2)$
$$= p^2(p^2 - pq + q^2) + q^2(p^2 - pq + q^2)$$
$$= (p^4 - p^3q + p^2q^2) + (p^2q^2 - pq^3 + q^4)$$
$$= p^4 - p^3q + p^2q^2 + p^2q^2 - pq^3 + q^4$$
$$= p^4 - p^3q + 2p^2q^2 - pq^3 + q^4$$

6. Multiply and verify the result by taking $x=1,\ y=2$ and $z=3$.

(a) $6x^2y(z^2 - y^2) = 6x^2y \times z^2 - 6x^2y \times y^2$

$= 6x^2yz^2 - 6x^2y^3$

Verification : $6x^2y(z^2 - y^2) = 6x^2yz^2 - 6x^2y^3 \quad (x=1,\ y=2,\ z=3)$

L.H.S.

$= 6x^2y(z^2 - y^2) = 6(1)^2 \times 2((3)^2 - (2)^2)$

$= 6 \times 1 \times 2(9-4) = 12 \times 5 = 60$

R.H.S.

$6x^2yz^2 - 6x^2y^3 = 6(1)^2 \times (2)(3)^2 - 6(1)^2(2)^3$

$= 6 \times 1 \times 2 \times 9 - 6 \times 1 \times 8 = 108 - 48 = 60$

Hence, L.H.S. = R.H.S.

(b) $(4y+z)(z-4y) = 4y(z-4y) + z(z-4y)$

$= 4yz - 16y^2 + z^2 - 4yz$

$= -16y^2 + z^2$ or $z^2 - 16y^2$

Verification : $(4y+z)(z-4y) = z^2 - 16y^2 \ (y=2, z=3)$

L.H.S. : $(4y+z)(z-4y) = (4 \times 2 + 3)(3 - 4 \times 2)$

$= (8+3)(3-8)$

$= 11 \times -5 = -55$

R.H.S. $z^2 - 16y^2 = (3)^2 - 16(2)^2$

$= 9 - 16 \times 4$

$= 9 - 64 = -55$

Hence, L.H.S. = R.H.S.

(c) $(2x - 2y)^2$

$(a-b)^2 = a^2 - 2ab + b^2$

$(2x-2y)^2 = (2x)^2 - 2 \times 2x \times 2y + (2y)^2$

$= 4x^2 - 8xy + 4y^2$

or $= 4x^2 + 4y^2 - 8xy$

Verification $(2x-2y)^2 = 4x^2 + 4y^2 - 8xy \quad (x=1, y=2)$

L.H.S; $(2x-2y)^2 = (2 \times 1 - 2 \times 2)^2$

$= (2-4)^2 = (-2)^2 = 4$

R.H.S.; $4x^2 + 4y^2 - 8xy = 4(1)^2 + 4(2)^2 - 8 \times 1 \times 2$

$= 4 + 4 \times 4 - 8 \times 2$

$= 20 - 16 = 4$

L.H.S. = R.H.S.

(d) $(x+y+z)(x+y+z) = (x+y+z)^2$

$= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

Verification

$(x+y+z)(x+y+z) = x^2 + y^2 + z^2 + 2xy + 2yz$

$$\text{L.H.S.} = (x+y+z)(x+y+z) = (x+y+z)^2 = (1+2+3)^2 = 36$$

$$\text{R.H.S.} = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$$

$$= 1^2 + 2^2 + 3^2 + 2\times 1\times 2 + 2\times 2\times 3 + 2\times 3\times 1$$

$$= 1+4+9+4+12+6 = 36$$

L.H.S. = R.H.S

7. Use the column method to find the following products :

(a) $(a+2b)(2a+b)$

$$\begin{array}{r} (a+2b) \\ \times\,(2a+b) \\ \hline ab+2b^2 \\ 2a^2+4ab \qquad\quad \\ \hline 2a^2+5ab+2b^2 \end{array}$$

(Multiply by $2a$)

(multiply by b)

(b) $(p^2+q^2)(p^2-q^2)$

$$\begin{array}{r} (p^2+q^2) \\ \times\,(p^2-q^2) \\ \hline p^4+p^2q^2 \qquad \\ -p^2q^2-q^4 \\ \hline p^4 \qquad\quad -q^4 \end{array}$$

(Multiply by p^2)

(Multiply by $-q^2$)

$$(p^2+q^2)(p^2-q^2) = (p^4-q^4)$$

(c) $\left(\frac{3}{5}x - \frac{1}{3}y\right)\left(\frac{3}{5}x + \frac{1}{3}y\right)$

$$\begin{array}{r} \frac{3}{5}x - \frac{1}{3}y \\ \times\,\frac{3}{5}x + \frac{1}{3}y \\ \hline \frac{3}{5}x\times\frac{3}{5}x - \frac{1}{3}y\times\frac{3}{5}x \qquad\qquad \\ + \frac{3}{5}x\times\frac{1}{3}y - \frac{1}{3}y\times\frac{1}{3}y \\ \hline \end{array}$$

$\left(\text{Multiply by } \frac{3}{5}x\right)$

$\left(\text{Multiply by } \frac{1}{3}y\right)$

$$\frac{9}{25}x^2 - \left(\frac{-1}{5}xy + \frac{1}{5}xy\right) - \frac{1}{9}y^2$$

$$= \frac{9}{25}x^2 - (0xy) - \frac{1}{9}y^2$$

$$\frac{9}{25}x^2 + 0 - \frac{1}{9}y^2$$

$$\left(\frac{3}{5}x - \frac{1}{5}y\right)\left(\frac{3}{5}x + \frac{1}{3}y\right) = \frac{9}{25}x^2 - \frac{1}{9}y^2$$

(d) $(x-y)(x^2+y^2+xy)$

$$\begin{array}{rl} x^2+y^2+xy & \\ \times\ \ x-y & \\ \hline x^3+xy^2+x^2y & \text{(Multiply by } x\text{)} \\ -xy^2-x^2y-y^3 & \text{(Multiply by } y\text{)} \\ \hline x^3+0+0-y^3 & \\ \hline \end{array}$$

$(x-y)(x^2+y^2+xy)=x^3-y^3$

8. Simplify :

(a) $c(b-a)+b(a-c)-a(b-c)$

$bc-ac+ba-bc-ab+ac=0$

(b) $x(x+y^2+z)+y^2(x+y+z)-z(x+y^2)$

$=x^2+xy^2+zx+y^2x+y^3+zy^2-zx-y^2z$

$=x^2+xy^2+y^2x+y^3=x^2+2xy^2+y^3$

9. Product of (x^3+2x^2-5x+1) and (x^2+7x+1)

$$\begin{array}{r} x^3+2x^2-5x+1 \\ x^2+7x+1 \\ \hline x^5+2x^4-5x^3+x^2 \\ 7x^4+14x^3-35x^2+7x \\ x^3+2x^2-5x+1 \\ \hline x^5+9x^4+10x^3-32x^2+2x+1 \\ \hline \end{array}$$

$(x^3+2x^2-5x+1)(x^2+7x+1)=x^5+9x^4+10x^3-32x^2+2x+1$

10. Product of $(2x+3y)$ and $(x^2+2xy+y^2)$

$(2x+3y)(x^2+2xy+y^2)$

$=2x(x^2+2xy+y^2)+3y(x^2+2xy+y^2)$

$=2x^3+4x^2y+2xy^2+3x^2y+6xy^2+3y^3$

$=2x^3+7x^2y+8xy^2+3y^3$

Verification :

$(2x+3y)(x^2+2xy+y^2)=(x=-1,\ y=2)$

$=2x^3+7x^2y+8xy^2+3y^2$

L.H.S.; $(2x+3y)(x^2+2xy+y^2)$

$=((2\times-1)+3\times2)((-1)^2+2\times-1\times2+(2)^2)$

$=(-2+6)(1-4+4)=4\times1=4$

R.H.S.; $=2x^3+7x^2y+8xy^2+3y^3$

$=2(-1)^3+7(1)^2\times2+8\times-1\times(2)^2+3(2)^3$

$=2\times-1+7\times2+(-8\times4)+3\times8$

$=-2+14-32+24=-34+38=4$

R.H.S. = L.H.S.

Exercise 8.2

1. Divide :

(a) Divide : $12x^2y^3$ by $3xy$

$$12x^2y^3 \div 3xy \qquad \frac{12x^2y^3}{3xy} = 4xy^2$$

(b) Divide : $36abc^2$ by $(-9ac)$

$$36abc^2 \div -9ac \qquad \frac{36abc^2}{-9ac} = -4bc$$

(c) Divide : $(-60p^2q^2r^2)$ by $(-12pqr^2)$

$$-60p^2q^2r^2 \div -12pqr^2 \qquad \frac{-60p^2q^2r^2}{-12pqr^2} = 5pq$$

(d) Divide : $25x^2yz$ by $3xyz$

$$25x^2yz \div 3xyz \qquad \frac{25x^2yz}{3xyz} = \frac{25}{3}x$$

2. Divide :

(a) $5x^3 - 30x^2 + 45x$ by $5x$

$$\frac{5x^3 - 30x^2 + 45x}{5x} = \frac{5x^3}{5x} - \frac{30x^2}{5x} + \frac{45x}{5x} = x^2 - 6x + 9$$

(b) $8x^2y^2 - 6xy^2 + 10x^2y^3$ by $2xy$

$$\frac{8x^2y^2 - 6xy^2 + 10x^2y^3}{2xy}$$

$$= \frac{8x^2y^2}{2xy} - \frac{6xy^2}{2xy} + \frac{10x^2y^3}{2xy} = 4xy - 3y + 5xy^3.$$

(c) $4x^3 + 8x^2 - x$ by $(-2x)$

$$= \frac{4x^3 + 8x^2 - x}{-2x} = \frac{4x^3}{-2x} + \frac{8x^2}{-2x} - \frac{x}{-2x} = -2x^2 - 4x + \frac{1}{2}$$

(d) $10a^2b - 6ab + 12ab^2$ by $3ab$

$$= \frac{10a^2b - 6ab + 12ab^2}{3ab} = \frac{10a^2b}{3ab} - \frac{6ab}{3ab} + \frac{12ab^2}{3ab} = \frac{10}{3}a - 2 + 4b$$

3. Which of the following expressions are not polynomials :

(Any algebraic expression with more than one term is called a polynomial. A polynomial is an algebraic expression in which the exponents of the variable are always non-negative integers.)

According to rules

(b) $\sqrt{2x}+x^2+x^3$, (c) $\frac{2}{3}x^2-4x+12$ are polynomials.

Similarly, (a) $3\sqrt{y}+4y+7y^2$, (d) $2x^{-2}+3x^{-1}+5+4x$,

(e) $\sqrt{a}x^{\frac{1}{2}}+ax+7x^2+5$, (f) x^3+x^{-3} are not polynomials.

4. Divide by long division method :

(a) $(x^2+12x+35)$ divide by $(x+7)$

$$
\begin{array}{r|l}
 & x+5 \\
\hline
x+7 & x^2+12x+35 \\
 & x^2+7x \\
 & (-)\quad(-) \\
\hline
 & 5x+35 \\
 & 5x+35 \\
 & (-)\quad(-) \\
\hline
 & 0
\end{array}
$$

$(x^2+12x+35)\div(x+7)=(x+5)$

(b) $6x^2-13x+6$ by $(2x-3)$

$$
\begin{array}{r|l}
 & 3x-2 \\
\hline
(2x-3) & 6x^2-13x+6 \\
 & 6x^2-9x \\
 & (-)\quad(+) \\
\hline
 & -4x+6 \\
 & -4x+6 \\
 & (+)\quad(-) \\
\hline
 & 0
\end{array}
$$

$(6x^3-13x+6)\div(2x-3)=(3x-2)$

(c) $12x^3-20x^2-9x+15$ by $(3x-5)$

$$
\begin{array}{r|l}
 & 4x^2-3 \\
\hline
(3x-5) & 12x^3-20x^2-9x+15 \\
 & 12x^3-20x^2 \\
 & (-)\quad(+) \\
\hline
 & -9x+15 \\
 & -9x+15 \\
 & (-)\quad(+) \\
\hline
 & 0
\end{array}
$$

$(12x^3-20x^2-9x+15)\div(3x-5)=4x^2-3$

(d) $a^3-6a^2+11a-6$ by (a^2-5a+6)

$$\begin{array}{r|l} & a-1 \\ \hline a^2-5a+6 & a^3-6a^2+11a-6 \\ & a^3-5a^2+6a \\ & (-)\quad(+)\quad(-) \\ \hline & -a^2+5a-6 \\ & -a^2+5a-6 \\ & (+)\quad(-)\quad(+) \\ \hline & 0 \\ \hline \end{array}$$

$$a^3-6a^2+11a-6 \div a^2-5a+6 = (a-1)$$

(e) (p^4+p^2+1) by (p^2+p+1)

$$\begin{array}{r|l} & p^2-p+1 \\ \hline p^2+p+1 & p^4 \qquad +p^2+1 \\ & p^4+p^3+p^2 \\ & (-)\quad(-)\quad(-) \\ \hline & -p^3 \qquad\qquad +1 \\ & -p^3-p^2-p \\ & (+)\quad(+)\quad(+) \\ \hline & p^2+p+1 \\ & p^2+p+1 \\ & (-)\quad(-)\quad(-) \\ \hline & 0 \\ \hline \end{array}$$

$$p^4+p^4+1 \div p^2+p+1 = p^2-p+1$$

(f) $6y^5+4y^4-3y^3-1$ by $(3y^2-y+1)$

$$\begin{array}{r|l} & 2y^3+2y^2-y-1 \\ \hline 3y^2-y+1 & 6y^5+4y^4-3y^3-1 \\ & 6y^5-2y^4+2y^3 \\ & (-)\quad(+)\quad(-) \\ \hline & 6y^4-5y^3-1 \\ & 6y^4-2y^3+2y^2 \\ & (-)\quad(+)\quad(-)\quad(+) \\ \hline & -3y^3-2y^2-1 \\ & -3y^3+y^2-y \\ & (+)\quad(-)\quad(+)\quad(-) \\ \hline & -3y^2+y-1 \\ & -3y^2+y-1 \end{array}$$

$$6y^5+4y^4-3y^3-1 \div (3y^2-y+1) = 2y^3+2y^2-y-1$$

$$\underline{(+)\quad(-)\quad(+)}$$
$$\underline{0}$$

5. Divide and verify the result :

(a) $m^4 + m^3 + m^2$ divide by $m + 1$

$$m^3 + m - 1$$
$$m+1 \overline{\big)\, m^4 + m^3 + m^2}$$
$$m^4 + m^3$$
$$\underline{(-)\quad(-)}$$
$$m^2$$
$$m^2 + m$$
$$\underline{(-)\quad(-)}$$
$$-m$$
$$-m-1$$
$$\underline{(+)\ (+)}$$
$$\underline{1}$$

Quotient $= m^3 + m - 1$, Remainder $= 1$

Verification : Dividend = Quotient × Division + Remainder

$$m^4 + m^3 + m^2 = (m+1)(m^3 + m - 1) + 1$$
$$= m(m^3 + m - 1) + 1(m^3 + m - 1) + 1$$
$$= m^4 + m^2 - m + m^3 + m - 1 + 1$$
$$= m^4 + m^2 + m^3$$

(b) $x^4 + 1$ divide by $(x - 1)$

$$x^3 + x^2 + x + 1$$
$$x-1 \overline{\big)\, x^4 \qquad\qquad +1}$$
$$x^4 - x^3$$
$$\underline{(-)\quad(+)}$$
$$+x^3 \qquad +1$$
$$x^3 - x^2$$
$$\underline{(-)\quad(+)}$$
$$x^2 \qquad +1$$
$$x^2 - x$$
$$\underline{(-)\quad(+)}$$
$$x+1$$
$$x-1$$
$$\underline{(-)\ (+)}$$
$$\underline{2}$$

Quotient $= x^3 + x^2 + x + 1$; Remainder $= 2$

Verification :

Dividend = Quotient × Division + Remainder

$$x^4 + 1 = (x^3 + x^2 + x + 1) \times (x - 1) + 2$$
$$= x(x^3 + x^2 + x + 1) - 1(x^3 + x^2 + x + 1) + 2$$

$$= x^4 + x^3 + x^2 + x - x^3 - x^2 - x - 1 + 2 = x^4 - 1 + 2 = x^4 + 1$$

6. Find the quotient and the remainder in each of the following :

(a) Divide $4x^3 - x + 1$ by $(2x - 1)$

$$\begin{array}{r|l}
 & 2x^2 + x \\
2x - 1 & 4x^3 \qquad - x + 1 \\
 & 4x^3 - 2x^2 \\
 & (-) \quad (+) \\ \hline
 & 2x^2 - x + 1 \\
 & 2x^2 - x \\
 & (-) \quad (+) \\ \hline
 & 1
\end{array}$$

Quotient $= 2x^2 + x$, Remainder $= 1$

(b) Divide $2a^3 + 5a^2 + 8a + 4$ by $(2a + 1)$

$$\begin{array}{r|l}
 & a^2 + 2a + 3 \\
2a + 1 & 2a^3 + 5a^2 + 8a + 4 \\
 & 2a^3 + a^2 \\
 & (-) \quad (-) \\ \hline
 & 4a^2 + 8a \\
 & 4a^2 + 2a \\
 & (-) \quad (-) \\ \hline
 & 6a + 4 \\
 & 6a + 3 \\
 & (-) \quad (-) \\ \hline
 & 1
\end{array}$$

Quotient $= a^2 + 2a + 3$, Remainder $= 1$

7.
$$\begin{array}{r|l}
 & x^2 + x + 7 \\
(x^2 + 1) & x^4 + x^3 + 8x^2 + ax + b \\
 & x^4 + x^2 \\
 & (-) \quad (-) \\ \hline
 & x^3 + 7x^2 + ax + b \\
 & x^3 + x \\
 & (-) \quad (-) \\ \hline
 & 7x^2 + (a - 1)x + b \\
 & 7x^2 \qquad + 7 \\
 & (-) \qquad (-) \\ \hline
 & (a - 1)x + (b - 7)
\end{array}$$

Since, it is divisible by $(x^2 + 1)$. So the remainder must be zero.

Therefore, comparing the coefficient of x and constant value with zero.

So, $(a - 1) = 0$ Similarly,

or $a = 1$ $\qquad b - 7 = 0$ $\qquad b = 7$

8. $t^3 - 2t^2 + 3t - 18$ divisible by $(t - 3)$

$$
\begin{array}{r|l}
 & t^2 + t + 6 \\
t-3 & t^3 - 2t^2 + 3t - 18 \\
 & t^3 - 3t^2 \\
 & (-)\quad (+) \\ \hline
 & \qquad t^2 + 3t \\
 & \qquad t^2 - 3t \\
 & \qquad (-)\quad (+) \\ \hline
 & \qquad\qquad 6t - 18 \\
 & \qquad\qquad -6t - 18 \\
 & \qquad\qquad (-)\quad (+) \\ \hline
 & \qquad\qquad\quad 0
\end{array}
$$

Quotient $= t^2 + t + 6$.

9. Divide $4x^4 - 2x^3 - 6x^2 + x - 5$ by $2x^2 + x - 2$ and subtract the remainder which you get from the dividend

So,

$$
\begin{array}{r|l}
 & 2x^2 - 2x \\
2x^2 + x - 2 & 4x^4 - 2x^3 - 6x^2 + x - 5 \\
 & 4x^4 + 2x^3 - 4x^2 \\
 & (-)\quad (-)\quad (+) \\ \hline
 & \qquad -4x^3 - 2x^2 + x - 5 \\
 & \qquad -4x^3 - 2x^2 + 4x \\
 & \qquad (+)\quad (+)\quad (-) \\ \hline
 & \qquad\qquad\qquad -3x - 5
\end{array}
$$

Hence, $(-3x - 5)$ must be subtracted from $4x^4 - 2x^3 - 6x^2 + x - 5$, so that the result is exactly divisible by $2x^2 + x - 2$.

Exercise 8.3

1. Find the value of the following :

(a) $9x^2 + 49y^2 + 42xy = (3x)^2 + (7y)^2 + 2 \times 3x \times 7y$

$= (3x + 7y)^2$ when $x = 3$ and $y = 1$

$= (3 \times 3 + 7 \times 1)^2 = (9 + 7)^2 = (16)^2 = 256$

(b) $25x^2 + 64y^2 - 80xy = (5x)^2 + (8y)^2 - 2 \times 5x \times 8y$

$= (5x - 8y)^2$ When $x = 4$ and $y = 2$

$= (5 \times 4 - 8 \times 2)^2 = (20 - 16)^2 = (4)^2 = 16$

2. (a) $2x + 3y = 8$

squaring on both side

$$(2x + 3y)^2 = (8)^2$$

$$(2x)^2 + 2 \times 2x \times 3y + (3y)^2 = 64$$

$$4x^2 + 12xy + 9y^2 = 64$$

$$4x^2 + 9y^2 + 12 \times 2 = 64 \qquad (xy = 2)$$
$$4x^2 + 9y^2 + 24 = 64$$
$$4x^2 + 9y^2 = 64 - 24 = 40$$

(b) $3x - 7y = 8$

squaring on both side,

$$(3x - 7y)^2 = (8)^2$$
$$9x^2 + 49y^2 - 42xy = 64$$
$$9x^2 + 49y^2 - 42 \times (-1) = 64 \qquad (xy = -1)$$
$$9x^2 + 49y^2 + 42 = 64$$
$$9x^2 + 49y^2 = 64 - 42$$
$$9x^2 + 49y^2 = 22$$

Thus, $\qquad 9x^2 + 49y^2 = 22$

3. Expand the following :

(a) $(5x + 3y)^2 \qquad [\ (a+b)^2 = a^2 + 2ab + b^2]$

$$(5x+3y)^2 = (5x)^2 + 2 \times 5x \times 3y + (3y)^2 = 25x^2 + 30xy + 9y^2$$

(b) $(5 + 12x^2)^2 \qquad [\ (a+b)^2 = a^2 + 2ab + b^2]$

$$= (5)^2 + 2 \times 5 \times 12x^2 + (12x^2)^2 = 25 + 120x^2 + 144x^4$$

(c) $\left(5x + \frac{1}{5y}\right)^2 \qquad [\ (a+b)^2 = a^2 + 2ab + b^2]$

$$= 5x^2 + 2 \times 5x \times \frac{1}{5y} + \left(\frac{1}{5y}\right)^2 = 25x^2 + \frac{2x}{y} + \frac{1}{25y^2}$$

(d) $(3x - 4y)^2 \qquad [\ (a-b)^2 = a^2 - 2ab + b^2]$

$$(3x - 4y)^2 = (3x)^2 - 2 \times 3x \times 4y + (4y)^2 = 9x^2 - 24xy + 16y^2$$

(e) $\left(\sqrt{3}x - \frac{1}{5}y\right)^2 \qquad [\ (a-b)^2 = a^2 - 2ab + b^2]$

$$\left(\sqrt{3x} - \frac{1}{5}y\right)^2 = (\sqrt{3x})^2 - 2 \times \sqrt{3} \times \frac{1}{5}xy + \left(\frac{1}{5}y\right)^2$$
$$= (3x^2) - \frac{2\sqrt{3}}{5}xy + \frac{1}{25}y^2$$

(f) $(x - 3y) \times (x - 3y) = x(x - 3y) - 3y(x - 3y)$

$$= x^2 - 3xy - 3xy + 9y^2 = x^2 - 6xy + 9y^2$$

4. Find the product of the following :

(a) $(4x + 5y)(4x - 5y) \qquad [\because (a+b)(a-b) = a^2 - b^2]$

$$= (4x)^2 - (5y)^2 = (16x^2 - 25y)^2$$

(b) $(ab + cd)(ab - cd) \qquad [\because (a+b)(a-b) = a^2 - b]$

$$= (ab)^2 - (cd)^2 = a^2b^2 - c^2d^2$$

(c) $(x-1)(x+1)(x^2+1)(x^4+1)$

$$=[(x)^2-(1)^2](x^2+1)(x^4+1)=(x^2-1)(x^2+1)(x^4+1)$$
$$=[(x^2)^2-(1)^2][x^4+1]=(x^4-1)(x^4+1)$$
$$=(x^4)^2-(1)^2=x^8-1^2=x^8-1$$

(d) $\left(x+\frac{y}{5}-1\right)\left(x+\frac{y}{5}+1\right)$ $[\because (a+b)(a-b)=a^2+b^2]$

$$=\left(x+\frac{y}{5}\right)^2-(1)^2 \quad [\ (a+b)^2=a^2+b^2+2ab]$$
$$=\left(x^2+\left(\frac{y}{5}\right)^2+2\times x\frac{y}{5}\right)-1=x^2+\frac{y^2}{25}+\frac{2xy}{5}-1$$

5. (a) $x^2+\frac{1}{x^2}$

$\left(\text{We have } x+\frac{1}{x}=6 \text{ squaring on both sides}\right)$

$$\left(x+\frac{1}{x}\right)^2=(6)^2 \qquad x^2+\frac{1}{x^2}+2\times x\times\frac{1}{x}=36$$
$$x^2+\frac{1}{x^2}+2=36 \qquad x^2+\frac{1}{x^2}=36-2$$
$$x^2+\frac{1}{x^2}=34$$

Thus, $x^2+\frac{1}{x^2}=34$

(b) $x^4+\frac{1}{x^4}=34$

$\left(\text{We have } x^2+\frac{1}{x^2}=34 \text{ from part (a) squaring on both sides again}\right)$

$$\left(x^2+\frac{1}{x^2}\right)^2=(34)^2 \qquad x^4+\frac{1}{x^4}+2\times x^2\times\frac{1}{x^2}=1156$$
$$x^4+\frac{1}{x^4}+2=1156 \qquad x^4+\frac{1}{x^4}=1156-2$$
$$x^4+\frac{1}{x^4}=1154$$

Thus, $x^4+\frac{1}{x^4}=1154.$

6. (a) $x-\frac{1}{x}=5$ (squaring both sides)

(a) $\left(x-\frac{1}{x}\right)^2=(5)^2 \qquad x^2+\frac{1}{x^2}-2\times x\times\frac{1}{x}=25$

$$x^2 + \frac{1}{x^2} - 2 = 25 \qquad x^2 + \frac{1}{x^2} = 25 + 2$$

$$x^2 + \frac{1}{x^2} = 27$$

Thus, $x^2 + \frac{1}{x^2} = 27$

(b) Now, we have $x^2 + \frac{1}{x^2} = 27,$ squaring on both side

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (27)^2 \qquad x^4 + \frac{1}{x^4} + 2 \times x^2 \times \frac{1}{x^2} = 729$$

$$x^4 + \frac{1}{x^4} = 729 - 2 \qquad x^4 + \frac{1}{x^4} = 727$$

Thus, $x^4 + \frac{1}{x^4} = 727$

7. Simplify the following by using identities :

(a) $(103)^2 = (100+3)^2$ $\quad [\ (a+b)^2 = a^2 + b^2 + 2ab)]$

$= (100)^2 + (3)^2 + 2 \times 3 \times 100 \ = 10000 + 9 + 600 = 10609$

(b) $(91)^2 \ = (100-9)^2$ $\quad [\ (a-b)^2 = a^2 + b^2 - 2ab]$

$= (100)^2 + (9)^2 - 2 \times 100 \times 9$

$= 10000 + 81 - 1800 = 10081 - 1800 = 8281$

(c) $(0.98)^2 = (1-0.02)^2 = (1)^2 - 2 \times 1 \times 0.02 + (0.02)^2$

$= 1 – 0.04 + 0.0004 = 1.0004 - 0.04 = 0.9604$

(d) $(97)^2 = (100-3)^2$ $\quad [\ (a-b)^2 = a^2 + b^2 - 2ab]$

$= (100)^2 + (3)^2 - 2 \times 3 \times 100 = 10000 + 9 - 600$

$= 10009 - 600 = 9409$

(e) 103 × 97

$= (100+3)(100-3)$ $\quad [(a+b)(a-b) = a^2 - b^2]$

$= (100)^2 - (3)^2 = 10000 - 9 = 9991$

(f) 104 × 104 $= (104)^2$

$= (100+4)^2$ $\quad [\ (a+b)^2 = a^2 + b^2 + 2ab]$

$= (100)^2 + (4)^2 + 2 \times 100 \times 4 = 10000 + 16 + 800 = 10816$

(g) 166 × 166 – 134 × 134

$= (166)^2 - (134)^2$ $\quad [\ (a^2 - b^2) = (a+b)(a-b)]$

$= (166+134)(166-134) = 300 \times 32 = 9600$

(h) 0.78 × 0.78 – 0.22 × 0.22

$= (0.78)^2 - (0.22)^2$ $\quad [\ (a^2 - b^2) = (a+b)(a-b)]$

$= (0.78 + 0.22)\ (0.78 - 0.22) = (1.00)\ (0.56) = 0.56$

(i) 0.54 × 0.54 – 0.46 × 0.46

$= (0.54)^2 - (0.46)^2$ $\quad [\ (a^2 - b^2) = (a+b)(a-b)]$

$= (0.54 + 0.46)\ (0.54 - 0.46) = 1 \times 0.08 = 0.08$

Exercise 8.4

1. $x^2 + 4y^2 + 9z^2 + 4xy + 12yz + 6xz$

$= (x)^2 + (2y)^2 + (3z)^2 + 2 \times x \times 2y + 2 \times 2y \times 3z + 2 \times x \times 3z$

$= (x + 2y + 3z)^2$ (Putting value of $x = 8,\ y = 7,\ z = 6$)

$= (8 + 2 \times 7 + 3 \times 6)^2 = (8 + 14 + 18)^2 = (40)^2 = 40 \times 40 = 1600$

2. Find the value of :

$x^2 + 4y^2 + 25z^2 - 4xy + 20yz - 10xz$

$= (x)^2 + (2y)^2 + (5z)^2 - 2 \times x \times 2y + 2 \times 2y \times 5z - 2 \times x \times 5z$

$a^2 + b^2 + c^2 - 2ab + 2bc - 2ca = (-a + b + c)^2 = (-x + 2y + 5z)^2$

Putting value of $x = 9,\ y = 2$ and $z = 1$

$= (-9 + 2 \times 2 + 5 \times 1)^2 = (-9 + 4 + 5)^2 = (-9 + 9)^2 = 0$

3. Expand each of the following :

(a) $(x - 2y - 5z)^2$ $\quad (\ (a - b - c)^2 = a^2 + b^2 + c^2 - 2ab + 2bc - 2ca)$

$(x - 2y - 5z)^2 = x^2 + (2y)^2 + (5z)^2 - 2 \times x \times 2y + 2 \times 2y \times 5z - 2 \times 5z \times x$

$= x^2 + 4y^2 + 25z^2 - 4xy + 20zy - 10zx$

(b) $\left(\frac{1}{4}x - \frac{1}{2}y + 16\right)^2$ $\quad [\ (a - b + c)^2 = a^2 + b^2 + c^2 - 2ab - 2bc + 2ca]$

$\left[\frac{1}{4}x - \frac{1}{2}y + 16\right]^2$

$= \left(\frac{1}{4}x\right)^2 + \left(\frac{1}{2}y\right)^2 + (16)^2 - 2 \times \frac{1}{4} \times \frac{1}{2}xy - 2 \times \frac{1}{2} \times 16 \times y + 2 \times 16 \times \frac{1}{4}x\ \Big]$

$= \frac{1}{16}x^2 + \frac{1}{4}y^2 + 256 - \frac{xy}{4} - 16y + 8x$

(c) $\left(\frac{a}{b} + \frac{b}{c} + \frac{c}{d}\right)^2$ $\quad [(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca]$

$\left(\frac{a}{b} + \frac{b}{c} + \frac{c}{d}\right)^2 = \left[\left(\frac{a}{b}\right)^2 + \left(\frac{b}{c}\right)^2 + \left(\frac{c}{a}\right)^2 + 2 \times \frac{a}{b} \times \frac{b}{c} + 2 \times \frac{b}{c} \times \frac{c}{d} + 2\frac{c}{d} \times \frac{a}{b}\right]$

$\left(\frac{a}{b} + \frac{b}{c} + \frac{c}{d}\right)^2 = \left[\frac{a^2}{b^2} + \frac{b^2}{c^2} + \frac{c^2}{d^2} + \frac{2a}{c} + \frac{2b}{d} + \frac{2ac}{bd}\right]$

4. $x + y + z = 8$ (square in both side)

$(x + y + z)^2 = (8)^2$

$x^2 + y^2 + z^2 + 2xy + 2yz + 2zx = 64$

$x^2 + y^2 + z^2 + 2(xy + yz + zx) = 64$

$x^2 + y^2 + z^2 + 2 \times 13 = 64 \quad \because \ (xy + yz + zx = 13)$

$$x^2 + y^2 + z^2 = 64 - 26$$
$$x^2 + y^2 + z^2 = 38$$

5. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab+bc+ca)$

In $\quad (x+y+z)^2 = x^2 + y^2 + z^2 + 2(xy+yz+zx)$

$$(x+y+z)^2 = 35 + 2 \times 23 = 35 + 46 = 81$$
$$(x+y+z) = \sqrt{81} \qquad x+y+z = 9$$

6. $x + y + z = 12$ (square in both side)

$$(x+y+z)^2 = (12)^2$$
$$x^2 + y^2 + z^2 + 2xy + 2yz + 2xz = 144$$
$$(x^2 + y^2 + z^2) + 2(xy + yz + xz) = 144$$
$$64 + 2(xy + yz + zx) = 144$$
$$2(xy + yz + zx) = 144 - 64$$
$$(xy + yz + zx) = \frac{80}{2} = 40$$

Thus, $\quad xy + yz + zx = 40$

7. Simplify the following :

(a) $(2x + p - c)^2 - (2x - p + c)^2$

$$((2x)^2 + (p)^2 + (c)^2 + 2 \times 2x \times p - 2 \times p \times c - 2 \times 2x \times c)$$
$$-((2x)^2 + (p)^2 + (c)^2 - 2 \times 2x \times p - 2 \times p \times c + 2 \times 2x \times c)$$
$$= (4x^2 + p^2 + c^2 + 4xp - 2pc - 4xc) - (4x^2 + p^2 + c^2 - 4xp - 2pc + 4cx)$$
$$= (\cancel{4x^2} + \cancel{p^2} + \cancel{c^2} + 4xp - \cancel{2pc} - 4xc - \cancel{4x^2} - \cancel{p^2} - \cancel{c^2} + 4xp + \cancel{2pc} - 4cx)$$
$$= 4xp + 4xp - 4cx - 4cx$$
$$= 8px - 8cx = 8x(p - c)$$

(b) $(x^2 + y^2 - z^2)^2 - (x^2 - y^2 + z^2)^2$

$$= ((x^2)^2 + (y^2)^2 + (z^2)^2 + 2x^2y^2 - 2y^2z^2 - 2x^2z^2)$$
$$-((x^2)^2 + (y^2)^2 + (z^2)^2 - 2x^2y^2 - 2y^2z^2 + 2x^2z^2)$$
$$= \cancel{x^4} + \cancel{y^4} + \cancel{z^4} + 2x^2y^2 - 2y^2z^2 - 2x^2z^2 - \cancel{x^4} - \cancel{y^4} - \cancel{z^4}$$
$$+ 2x^2y^2 + 2y^2\cancel{z^2} - 2x^2z^2$$
$$= 2x^2y^2 + 2x^2y^2 - 2x^2z^2 - 2x^2z^2$$
$$= 4x^2y^2 - 4x^2z^2 = 4x^2(y^2 - z^2) = 4x^2(y+z)(y-z)$$

(c) $(a + b + c)^2 + (a - b + c)^2 + (a + b - c)^2$

$$= (a^2 + b^2 + c^2 + 2ab + 2bc + 2ca) + (a^2 + b^2 + c^2 - 2ba - 2bc + 2ca)$$
$$+ (a^2 + b^2 + c^2 + 2ba - 2bc - 2ca)$$
$$= a^2 + b^2 + c^2 + \cancel{2ab} + \cancel{2bc} + \cancel{2ca} + a^2 + b^2 + c^2 - \cancel{2ba} - \cancel{2bc} + 2ca +$$
$$a^2 + b^2 + c^2 + 2ba - 2bc - \cancel{2ca}$$
$$= a^2 + b^2 + c^2 + a^2 + b^2 + c^2 + 2ca + a^2 + b^2 + c^2 + 2ba - 2bc$$
$$= 3a^2 + 3b^2 + 3c^2 + 2ca + 2ba - 2bc$$

$$= 3(a^2 + b^2 + c^2) + 2ab - 2bc + 2ac$$

Exercise 8.5

1. Expand the following :

(a) $(3x - 2y)^3$ $\quad [\because (a-b)^3 = a^3 - b^3 - 3ab(a-b)]$

$$(3x-2y)^3 = (3x)^3 - (2y)^3 - 3 \times 3x \times 2y(3x-2y)$$
$$= 27x^3 - 8y^3 - 18xy(3x-2y)$$
$$= 27x^3 - 8y^3 - 54x^2y + 36xy^2$$

(b) $\left(\frac{1}{3}x + \frac{5}{3}y\right)^3$ $\quad [\because (a+b)^3 = a^3 + b^3 + 3ab(a+b)]$

$$\left(\frac{1}{3}x + \frac{5}{3}y\right)^3 = \left(\frac{1}{3}x\right)^3 + \left(\frac{5}{3}y\right)^3 + 3 \times \frac{1}{3} \times \frac{5}{3} \times xy\left(\frac{1}{3}x + \frac{5}{3}y\right)$$
$$= \frac{1}{27}x^3 + \frac{125}{27}y^3 + \frac{5}{3}xy\left(\frac{1}{3}x + \frac{5}{3}y\right)$$
$$= \frac{1}{27}x^3 + \frac{125}{27}y^3 + \frac{5}{9}x^2y + \frac{25}{9}xy^2$$
$$= \frac{1}{27}x^3 + \frac{5}{9}x^2y + \frac{25}{9}xy^2 + \frac{125}{27}y^3$$

(c) $\left(\frac{1}{3x} - \frac{2}{5y}\right)^3$ $\quad [\because (a-b)^3 = a^3 - b^3 - 3ab(a-b)]$

$$= \left(\frac{1}{3x}\right)^3 - \left(\frac{2}{5y}\right)^3 - 3 \times \frac{1}{3x} \times \frac{2}{5y}\left(\frac{1}{3x} - \frac{2}{5y}\right)$$
$$= \frac{1}{27x^3} - \frac{8}{125y^3} - \frac{1}{x} \times \frac{2}{5y}\left(\frac{1}{3x} - \frac{2}{5y}\right)$$
$$= \frac{1}{27x^3} - \frac{8}{125y^3} - \frac{2}{5xy}\left(\frac{1}{3x} - \frac{2}{5y}\right)$$
$$= \frac{1}{27x^3} - \frac{8}{125y^3} - \frac{2}{15x^2y} + \frac{4}{25xy^2}$$

2. Solve the following :

(a) $(a - 3b)^3 + (a + 3b)^3$ $= (a-3b)^3$

$$= a^3 - (3b)^3 - 3 \times a \times 3b(a-3b)$$
$$= a^3 - 27b^3 - 9ab(a-3b)$$
$$= a^3 - 27b^3 - 9a^2b + 27ab^2 \qquad \ldots\text{(i)}$$
$$(a+3b)^3 = a^3 + (3b)^3 + 3 \times a \times 3b(a+3b)$$
$$= a^3 + 27b^3 + 9ab(a+3b)$$
$$= a^3 + 27b^3 + 9a^2b + 27ab^2 \qquad \ldots\text{(ii)}$$

On adding equation (i) and (ii) we get

$(a-3b)^3+(a+3b)^3$

$$= a^3-27b^3-9a^2b+27ab^2+a^3+27b^3+9a^2b+27ab^2$$

$$= a^3+a^3+27ab^2+27ab^2 = 2a^3+54ab^2$$

3. Solve the following by using identity :

(a) $(1004)^3 = (1000+4)^3$

By using identity $[\quad (a+b)^3 = a^3+b^3+3ab(a+b)]$

$(1000+4)^3 = (1000)^3+(4)^3+3\times1000\times4(1000+4)$

$$= 1000000000+64+12000\times1004$$

$$= 1000000000+64+12048000 = 1012048064$$

(b) $(599)^3 = (600-1)^3$

By using identity $[\quad (a-b)^3 = a^3-b^3-3ab(a-b)]$

$(600-1)^3 = (600)^3-(1)^3-3\times600\times1(600-1)$

$$= 216000000-1-1800\times599 = 216000000-1-1078200$$

$$= 216000000-1078201 = 214921799$$

(c) $(9.8)^3 = (10-0.2)^3$

By using identity $[\quad (a-b)^3 = a^3-b^3-3ab(a-b)]$

$(10-0.2)^3 = (10)^3-(0.2)^3-3\times10\times0.2\,(10-0.2)$

$$= 1000-0.008-6\times9.8 = 1000-0.008-58.8$$

$$= 1000-58.808 = 941.192$$

(d) $(8.01)^3 = (8+0.01)^3$

By using identity; $[\quad (a+b)^3 = a^3+b^3+3ab(a+b)]$

$(8+0.01)^3 = (8)^3+(0.01)^3+3\times8\times0.01\,(8+0.01)$

$$= 512+0.000001+0.24\times8.01$$

$$= 512+0.000001+1.9224 = 513.922401$$

4. $x+y=5$ (cube in both side)

$$(x+y)^3 = (5)^3$$

$$x^3+y^3+3xy(x+y) = 125$$

$$x^3+y^3+3\times6(x+y) = 125 \qquad (xy=6)$$

$$x^3+y^3+18\times5 = 125 \qquad (x+y=5)$$

$$x^3+y^3+90 = 125$$

$$x^3+y^3 = 125-90$$

$$x^3+y^3 = 35$$

5. $x-y=4$ (cube in both side)

$$(x-y)^3 = (4)^3$$

$$x^3-y^3-3xy(x-y) = 64$$

$$x^3-y^3-3\times21(x-y) = 64 \qquad (xy=21)$$

$$x^3-y^3-63(x-y) = 64$$

$$x^3 - y^3 - 63 \times 4 = 64 \qquad (x - y = 4)$$
$$x^3 - y^3 - 252 = 64$$
$$x^3 - y^3 = 64 + 252 = 316$$
Thus, $$x^3 - y^3 = 316$$

6. $x + y = 12$ (cube in both side)
$$(x + y)^3 = (12)^3$$
$$x^3 + y^3 + 3xy(x + y) = 1728 \qquad (xy = 27)$$
$$x^3 + y^3 + 3 \times 27(x + y) = 1728$$
$$x^3 + y^3 + 81 \times 12 = 1728 \qquad (x + y = 12)$$
$$x^3 + y^3 + 972 = 1728$$
$$x^3 + y^3 = 1728 - 972$$
$$x^3 + y^3 = 756$$

7. $3x - 2y = 11$ (cube in both side)
$$(3x - 2y)^3 = (11)^3$$
$$(3x)^3 - (2y)^3 - 3 \times 3x \times 2y(3x - 2y) = 1331$$
$$27x^3 - 8y^3 - 18xy(3x - 2y) = 1331$$
$$27x^3 - 8y^3 - 18 \times 12(3x - 2y) = 1331 \qquad (xy = 12)$$
$$27x^3 - 8y^3 - 216 \times 11 = 1331 \qquad ((3x - 2y) = 11)$$
$$27x^3 - 8xy^3 - 2376 = 1331$$
$$27x^3 - 8y^3 = 1331 + 2376 = 3707$$

8. $x + \frac{1}{x} = 7$ (cube of both side)
$$\left(x + \frac{1}{x}\right)^3 = (7)^3$$
$$x^3 + \frac{1}{x^3} + 3 \times x \times \frac{1}{x}\left(x + \frac{1}{x}\right) = 343$$
$$x^3 + \frac{1}{x^3} + 3 \times 7 = 343 \qquad \left(x + \frac{1}{x} = 7\right)$$
$$x^3 + \frac{1}{x^3} + 21 = 343$$
$$x^3 + \frac{1}{x^3} = 343 - 21$$
$$x^3 + \frac{1}{x^3} = 322$$

9. $x - \frac{1}{x} = 5$ (cube of both side)

$$\left(x-\frac{1}{x}\right)^3 = (5)^3 \qquad x^3-\frac{1}{x^3}-3\times x\times\frac{1}{x}\left(x-\frac{1}{x}\right)=125$$

$$x^3-\frac{1}{x^3}-3\times 5=125 \qquad \left(x-\frac{1}{x}=5\right)$$

$$x^3-\frac{1}{x^3}=125+15 \qquad x^3-\frac{1}{x^3}=140$$

10. We know that $\qquad (\because (a+b)^2=a^2+b^2+2ab)$

$$\left(x+\frac{1}{x}\right)^2 = x^2+\frac{1}{x^2}+2$$

On putting $\qquad x^2+\frac{1}{x^2}=7$

$$\left(x+\frac{1}{x}\right)^2 = 7+2=9 \qquad \left(x+\frac{1}{x}\right)=3 \qquad \ldots(\text{i})$$

On cubing both the sides $\quad ((a+b)^3=a^3+b^3+3ab(a+b))$

$$\left(x+\frac{1}{x}\right)^3 = 3^3 \qquad x^3+\frac{1}{x^3}+3\times x\times\frac{1}{x}\left(x+\frac{1}{x}\right)=27$$

$$x^3+\frac{1}{x^3}+3\times 3=27 \quad \left\{\because x+\frac{1}{x}=3, \text{ by equation (i)}\right\}$$

$$x^3+\frac{1}{x^3}=27-9$$

Thus, $\qquad x^3+\frac{1}{x^3}=18$

11. We know that $\qquad [\because (a-b)^2=a^2+b^2-2ab]$

$$\left(x-\frac{1}{x}\right)^2 = x^2+\frac{1}{x^2}-2$$

On putting $\qquad x^2+\frac{1}{x^2}=27$

$$\left(x-\frac{1}{x}\right)^2 = 27-2=25=5^2 \qquad \left(x-\frac{1}{x}\right)=5 \qquad \ldots(\text{i})$$

On cubing both the sides $\quad (\because (a-b)^3=a^3-b^3-3ab(a-b))$

$$\left(x-\frac{1}{x}\right)^3 = 5^3$$

$$x^3-\frac{1}{x^3}-3\times x\times\frac{1}{x}\left(x-\frac{1}{x}\right)=125$$

$$x^3-\frac{1}{x^3}-3\times 5=125 \quad \left\{\because x-\frac{1}{x}=5, \text{ by equation (i)}\right\}$$

$$x^3 - \frac{1}{x^3} = 125 + 15 = 140$$

Thus, $$x^3 - \frac{1}{x^3} = 140$$

Exercise 8.6

1. Find all possible factors of the following ;

(a) $12p^2q = 2 \times 2 \times 3 \times p \times p \times q$

(b) $16xy^2z = 2 \times 2 \times 2 \times 2 \times x \times y \times y \times z$

(c) $20a^2b^2c^2 = 2 \times 2 \times 5 \times a \times a \times b \times b \times c \times c$

(d) $21m^2np^2 = 3 \times 7 \times m \times m \times n \times p \times p$

2. Find the common factors of the following monomials :

(a) $2xy, 12x^2y = 2xy(1, 6x)$

Common factors of $2xy$ and $12x^2y = 2xy$

(b) $3m^2, 15m^4 = 3m^2(1, 5m^2)$

Common factors of $3m^2$ and $15m^4 = 3m^2$

(c) $3ax^2y, 18axy = 3axy(x, 6)$

Common factors of $3ax^2y$ and $18axy = 3axy$.

(d) $25p^2q^4, 15pq^2 = 5pq^2(5pq^2, 3)$

Common factors of $25p^2q^4$ and $15pq^2 = 5pq^2$

3. Find the common factors of the following expressions :

(a) $6x^2 + 15x^3 + 21x^4 = 3x^2(2 + 3x^1 + 7x^2)$

Common factors $= 3x^2$

(b) $9x^2y^3 + 18x^3y^2 - 36x^2y^2 = 9x^2y^2(y + 2x - 4)$

Common factors $= 9x^2y^2$

(c) $5a^3bc + 15ab^3 + 25a^3 = 5a(a^2bc + 3b^3 + 5a^2)$

Common factors $= 5a$

(d) $8p^3 - 16q^3 + 32r^3 = 8(p^3 - 2q^3 + 4r^3)$

Common factors $= 8$.

4. Factorize the following :

By using $x^2 - y^2 = (x + y)(x - y)$

(a) $x^2 - 16 = (x)^2 - (4)^2 = (x + 4)(x - 4)$

(b) $4 - 36y^2 = (2)^2 - (6y)^2 = (2 + 6y)(2 - 6y)$

(c) $a^4b^4 - c^4 = (a^2b^2)^2 - (c^2)^2$

$= (a^2b^2 + c^2)(a^2b^2 - c^2)$

$= (a^2b^2 + c^2)(ab + c)(ab - c)$

(d) $m^2 - (n + p)^2 = (m)^2 - (n + p)^2 = (m + n + p)(m - n - p)$

(e) $8p^3 - 2p = 2p(4p^2 - 1) = 2p((2p)^2 - (1)^2) = 2p(2p + 1)(2p - 1)$

(f) $16x^4 - (z-x)^4 = (4x^2)^2 - ((z-x)^2)^2$

$$= (4x^2 - (z-x)^2)(4x^2 + (z-x)^2)$$
$$= ((2x)^2 - (z-x)^2)(4x^2 + (z-x)^2)$$
$$= (2x + z - x)(2x - (z-x))(4x^2 + (z-x)^2)$$
$$= (x+z)(2x - z + x)(4x^2 + (z^2 + x^2 - 2zx))$$
$$= (x+z)(3x-z)(4x^2 + x^2 + z^2 - 2zx)$$
$$= (x+z)(3x-z)(5x^2 + z^2 - 2zx)$$

5. Factorize :

(a) $(x+3)\,x + (x+3)\,y = (x+3)(x+y)$

(b) $3a\,(x-4y) - 2b\,(x-4y) = (3a-2b)(x-4y)$

(c) $-4\,(a-2b) + 8\,(a-2b)^2 = 4\,(a-2b)\,(-1 + 2\,(a-2b))$

$$= 4\,(a-2b)(-1 + 2a - 4b)$$

(d) $5\,(m-n)^2 - 6\,(m-n) = (m-n)(5(m-n)-6) = (m-n)(5m-5n-6)$

6. Factorize using suitable grouping :

(a) $abc - ab - c + 1 = abc - c - ab + 1$

$$= c\,(ab-1) - 1(ab-1)$$
$$= (c-1)(ab-1)$$

(b) $p^2q - pr^2 - pq + r^2 = p^2q - pq - pr^2 + r^2$

$$= pq\,(p-1) - r^2\,(p-1)$$
$$= (p-1)(pq - r^2)$$

(c) $4x^2 + 2y^2 + x^2y^2 + 8 = 4x^2 + x^2y^2 + 2y^2 + 8$

$$= x^2\,(4 + y^2) + 2\,(y^2 + 4)$$
$$= (y^2 + 4)(x^2 + 2)$$

(d) $ax^2 + by^2 + bx^2 + ay^2 = ax^2 + ay^2 + bx^2 + by^2$

$$= a\,(x^2 + y^2) + b\,(x^2 + y^2)$$
$$= (a+b)\,(x^2 + y^2)$$

7. Factorize by splitting the middle term :

(a) $x^2 + 9x + 20 = x^2 + 5x + 4x + 20$

$$= x\,(x+5) + 4\,(x+5)$$
$$= (x+5)(x+4)$$

(b) $x^2 - 14x + 13 = x^2 - 13x - 1x + 13$

$$= x\,(x-13) - 1(x-13)$$
$$= (x-13)(x-1)$$

(c) $p^2 + 2p - 15 = p^2 + 3p - 5p - 15$

$$= p\,(p+3) - 5\,(p+3)$$
$$= (p+3)(p-5)$$

(d) $m^2 + 11mn + 18n^2 = m^2 + 9nm + 2mn + 18m^2$

$$= m\,(m+9n) + 2n\,(m+9n)$$

$$= (m + 9n)(m + 2n)$$

(e) $m^2 - 3m - 70 = m^2 - 10m + 7m - 70$
$$= m(m - 10) + 7(m - 10)$$
$$= (m - 10)(m + 7)$$

(f) $3x^2 - 10x + 8 = 3x^2 - 6x - 4x + 8$
$$= 3x(x - 2) - 4(x - 2)$$
$$= (3x - 4)(x - 2)$$

(g) $10p^2 + 11p + 3 = 10p^2 + 6p + 5p + 3$
$$= 2p(5p + 3) + 1(5p + 3)$$
$$= (5p + 3)(2p + 1)$$

(h) $11a^2 + 54a + 63 = 11a^2 + 21a + 33a + 63$
$$= a(11a + 21) + 3(11 + 21)$$
$$= (11a + 21)(a + 3)$$

(i) $12y^2 + 28y - 5 = 12y^2 - 2y + 30y - 5$
$$= 2y(6y - 1) + 5(6y - 1)$$
$$= (2y + 5)(6y - 1)$$

8. Factorize the following expressions :

(a) $y^2 - 18y + 81 = (y)^2 - 2 \times 9 \times y + (9)^2 = (y - 9)^2$

(b) $x^4 + 22x^2 + 121 = (x^2)^2 + 2 \times 11 \times x^2 + (11)^2 = (x^2 + 11)^2$

(c) $p^6 - 4p^3 + 4 = (p^3)^2 - 2 \times p^3 \times 2 + (2)^2 = (p^3 - 2)^2$

(d) $a^2 + 2ab + b^2 - 16 = (a + b)^2 - 16$
$$= (a + b)^2 - (4)^2$$
$$= (a + b + 4)(a + b - 4)$$

(e) $9z^2 - x^2 - 4y^2 + 4xy = 9z^2 - (x^2 + 4y^2 - 4xy) = 9z^2 - (x - 2y)^2$
$$= (3z)^2 - (x - 2y)^2$$
$$= (3z - x + 2y)(3z + x - 2y)$$

(f) $x^8 - y^8 + x^4 - y^4$
$$= (x^4)^2 - (y^4)^2 + (x^2)^2 - (y^2)^2$$
$$= (x^4 + y^4)(x^4 - y^4) + (x^2 + y^2)(x^2 - y^2)$$
$$= (x^4 + y^4)(x^2 - y^2)(x^2 + y^2) + (x^2 + y^2)(x + y)(x - y)$$
$$(x^4 + y^4)(x + y)(x - y)(x^2 + y^2) + (x^2 + y^2)(x + y)(x - y)$$
$$= (x^4 + y^4 + 1)(x^2 + y^2)(x + y)(x - y)$$

Multiple Choice Questions

Tick (3) the correct answer :

1. (b)	**2.** (c)	**3.** (a)	**4.** (b)
5. (a)	**6.** (d)	**7.** (d)	**8.** (d)

9 Quadrilaterals

Exercise 9.1

1. Ratio of four angles of a quadrilateral $= 2:3:4:1$

Let first angle $= 2x$; second angle $= 3x$; third angle $= 4x$ and fourth angle $= 1x$

The sum of the angles of a quadrilateral is 360°

$$2x + 3x + 4x + 1x = 360° \qquad 10x = 360°$$

$$x = 360° \div 10 = 36°$$

Value of first angle $= 2 \times 36 = 72°$; value of second angle $3 \times 36 = 108°$;

third angle $= 4 \times 36 = 144°$; fourth angle $= 36°$

2. Ratio of a quadrilateral $= 1:3:7:9$

Let first angle $= x$, second angle $= 3x$

Third angle $= 7x$, fourth angle $= 9x$

Sum of the quadrilateral $= 360°$

$$x + 3x + 7x + 9x = 360° \qquad 20x° = 360°$$

$$x = 360° \div 20 = 18°$$

Thus, first angle $= 18°$ second angle $= 3 \times 18 = 54°$

Third angle $= 7 \times 18 = 126°$ fourth angle $= 9 \times 18 = 162°$

3. Let, the fourth angle of the quadrilateral $= x°$

The Sum of the angles of a quadrilateral is 360°

$$20° + 90° + 90° + x° = 360°$$

$$200° + x° = 360° \qquad x = 360° - 200° = 160°$$

So, the fourth angle is 160°.

4. (a) Adjacent sides $= (AB$ and $BC)$ or $(BC$ and $CD)$ or $(CD$ and $DA)$ or $(DA$ and $AB)$

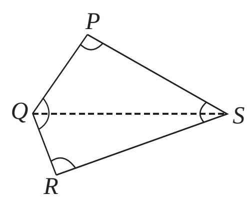
(b) Opposite sides $= (AB$ and $CD)$ or $(BC$ and $AD)$

(c) Adjacent angle $= ($ A and $B)$ or $($ B and $C)$ or $($ C and $D)$ or $($ D and $A)$

(d) Opposite angle $= ($ A and $C)$ or $($ B and $D)$

(e) Diagonals AC and BD

5. $PQRS$ is a quadrilateral and diagonal QS divides it into two triangles, *i.e.*, ΔPQS and ΔQRS



In ΔPQS;

$$QPS + PQS + QSP = 180° \quad \ldots(i)$$

In ΔQRS;

$$SQR + QRS + QSR = 180° \quad \ldots(ii)$$

Adding (i) and (ii), we get

$$QPS + QRS + (PQS + RQS) + (PSQ + QSR) = 180° + 180°$$

$$QPS + PSR + SRQ + RQP = 360°$$

6. Sum of two angle $= 150°$

Let one angle $= x$ and other angle $= (150 - x)°$

Ratio of other angle $= 2:3$

Third angle $= 2x$ Fourth angle $= 3x$

Sum of quadrilateral $= 360°$

$x + (150 - x)° + 2x + 3x = 360°$

$(150 - x)° + 6x = 360°$ $\qquad$ $150 + 5x = 360°$

$5x = 360° - 150° = 210°$ $\qquad$ $x = 42°$

First angle $= 42°$,

Second angle $= 150° - 42° = 108°$,

Third angle $= 2 \times 42° = 84°$,

Fourth angle $= 3 \times 42° = 126°$.

7. If *ODEC* is a quadrilateral

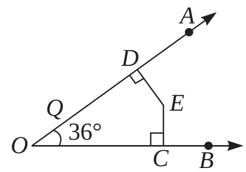
$DOC + \quad OCE + \quad CED + \quad EDO = 360°$

$36° + 90° + x° \; 90° = 360°$

$216° + x = 360°$

$x = 360° - 216° = 144°$

$CED = 144°$.



8. Ratio of angles of quadrilateral $= 1 : 2 : 3 : 4$

Let first angle of quadrilateral $= x$

Second angle of quadrilateral $= 2x$

Third angle of quadrilateral $= 3x$

Fourth angle of quadrilateral $= 4x$

Sum of angles of quadrilateral $= 360°$

$x + 2x + 3x + 4x = 360°$ $\qquad$ $10x = 360°$

$x = 360° \div 10 = 36$

Thus, value of first angle $= 36°$

Value of second angle $= 36° \times 2 = 72°$

Value of third angle $= 36° \times 3 = 108°$

Value of fourth angle $= 36° \times 4 = 144°$.

9. Let fourth angle $= x$

Other three angle are $= 100°, 50°, 50°$

Sum of angle of quadrilateral $= 360°$

$100° + 50° + 50° + x = 360°$ $\qquad$ $200° + x° = 360°$

$x = 360° - 200° = 160°$.

10. Let, equal angle $= x$

Sum of the quadrilateral $= 360°$

$x \times 3 + 120 = 360°$ $\qquad$ $3x + 120 = 360°$

$3x = 360° - 120°$ $\qquad$ $x = 240° \div 3 = 80°$

So, equal angle $= 80°$.

11. Ratio of angles of a quadrilateral $= 3 : 5 : 7 : 9$

Let, first angle $= 3x$ $\qquad$ second angle $= 5x$

third angle $= 7x$, $\qquad$ fourth angle $= 9x$

Sum of quadrilateral $= 360°$

$3x + 5x + 7x + 9x = 360°$ $\qquad$ $24x = 360°$

$x = 360° \div 24 = 15°$

Thus, first angle is $3 \times 15 = 45°$,

second angle is $5 \times 15 = 75°$,

third angle is $7 \times 15 = 105°$,

fourth angle is $9 \times 15 = 135°$.

12. Let equal angles be x

The sum of the angles of a quadrilateral is 360°

$$75° + x° + x° + 75° = 360° \qquad 150° + 2x = 360°$$

$$2x = 360° - 150° \qquad x = \frac{210°}{2} = 105°$$

So, equal angles of quadrilateral are $= 105°$.

13. Let equal angles $= x$

Sum of four angle of quadrilateral $= 360°$

$$130° + 30° + x + x = 360°$$

$$160° + 2x = 360°$$

$$x = \frac{360° - 160°}{2} = \frac{200°}{2} = 100°.$$

14. Let equal angles $= x$

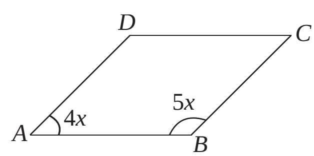
Sum of four angle of quadrilateral $= 360°$

$$85° + 115° + x + x = 360° \qquad 200° + 2x = 360°$$

$$2x = 360° - 200 \qquad x = \frac{160}{2} = 80°.$$

Exercise 9.2

1. Suppose $ABCD$ is a parallelogram and measure of A and B are in the ratio 4 : 5



Let $A = 4x$ then $B = 5x$

Now, $A + B = 180°$

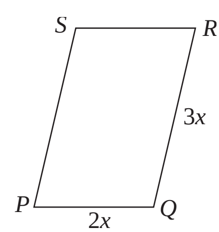
[∵ Sum of the interior angles on one side of parallel line is 180°]

$$4x + 5x = 180° \qquad 9x = 180°$$

$$x = 20° \qquad A = C = 20° \times 4 = 80°$$

$$D = B = 20° \times 5 = 100°.$$

2. Suppose $ABCD$ be a parallelogram with



$$AB = 2x \text{ and } BC = 3x$$

Since, opposite sides of a parallelogram are equal

$$AB = DC = 2x \text{ and } BC = AD = 3x.$$

Now, the perimeter of $ABCD$ is given by

$$AB + BC + CD + DA = 40 \text{ cm}$$

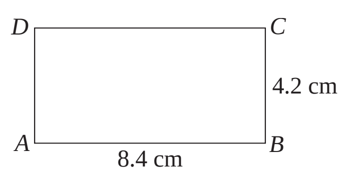
$$2x + 3x + 2x + 3x = 40 \text{ cm}$$

$$10x = 40 \text{ cm} \qquad x = 4 \text{ cm}$$

Hence, $AB = CD = 2x = 2 \times 4 = 8$ cm

Also, $BC = DA = 3x = 4 \times 3 = 12$ cm.

3. Longer side $= 8.4$ cm



Shorter Sider $= 4.2$ cm

Suppose $ABCD$ be a parallelogram with

$$AB = 8.4 \text{ cm}, BC = 4.2 \text{ cm}$$

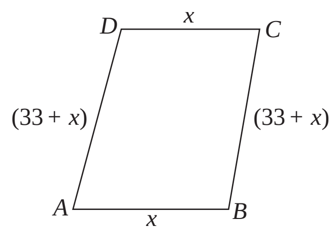
Since, opposite sides of a parallelogram are equal.

$AB = DC = 8.4$ cm; $AD = BC = 4.2$ cm

Now, the perimeter of $ABCD$ is given by $AB + BC + CD + DA$

$8.4 + 4.2 + 8.4 + 4.2 = 25.2$ cm.

4. Perimeter of a parallelogram $= 150$ cm



Let one side is x. other side is $(33 + x)$

If $ABCD$ is parallelogram

$AB = DC;\ AD + BC$

Perimeter of a parallelogram $= 150$

$x + (33 + x) + x + (33 + x) = 150$

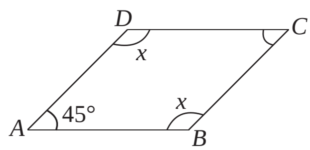
$66 + 4x = 150$

$4x = 150 - 66$

$x = \frac{84}{4} = 21$

one side is 21 cm, other side is $(21 + 33)$ cm $= 54$ cm.

5. $ABCD$ is a parallelogram



$A = 45°, \quad C = 45°$

Let $\quad B = x \quad$ and $\quad D = x$

Sum of $\quad A + \ B + \ C + \ D = 360°$

$45° + x + 45° + x = 360°$

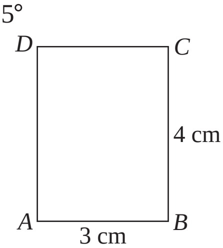
$90° + 2x = 360° \qquad 2x = 360° - 90°$

$2x = 270° \qquad x = \frac{270°}{2} = 135°$

$B = 135°$; so $= \ D = 135°$

$A = 45°, \quad B = 135°, \quad C = 45°, \quad D = 135°$

6. $AB = 3$ cm, $BC = 4$ cm



Suppose $ABCD$ be a parallelogram with,

$AB = 3$ cm, $CB = 4$ cm

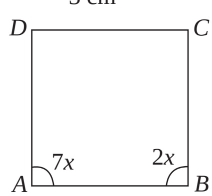
Since, opposite sides of a parallelogram are equal

3 cm $= AB = DC$; $AD = CB = 4$ cm

perimeter of $ABCD$ is given by

$= AB + CD + AD + CB = 3 + 4 + 3 + 4$ cm $= 14$ cm

7. Suppose $ABCD$ is a parallelogram and measure of $\ A$ and $\ B$ are in the ratio 7 : 2.



it $\qquad A = 7x$ then $\ B = 2x$

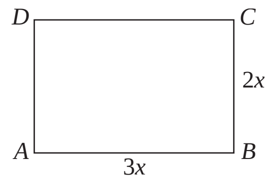
Now, $\qquad A + \ B = 180°$

[∵ Sum of the interior angles on one side of parallel line is 180°]

$7x + 2x = 180° \qquad 9x = 180°$

$x = 20° \qquad A = \ C = 20° \times 7 = 140°$

$D = \quad B = 20° \times 2 = 40°.$



8. Suppose $ABCD$ be parallelogram with $AB = 3x$ and $BC = 2x$

Since, opposite sides of parallelogram are equal

$AB = DC = 3x$ and $AD = BC = 2x$

Now, the perimeter of $ABCD$ is given by

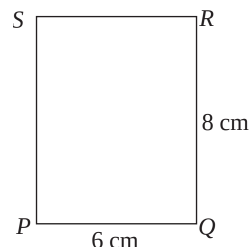
$AB + BC + CD + DA = 60$ cm

$3x + 2x + 3x + 2x = 60$

$10x = 60 \qquad x = 6$

$AB = CD = 3 \times 6 = 18$ cm

$AD = BC = 2 \times 6 = 12$ cm.



9. Long side of a parallelogram $= 8$ cm

Shorter side $= 8 \times \frac{3}{4} = 6$ cm

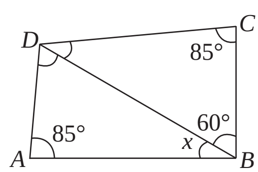
If $PQRS$ is parallelogram

$PQ = RS = 6$ cm; $PS = RQ = 8$ cm

Sum of all sides

$= PQ + RQ + RS + PS$

$= 6 + 8 + 6 + 8 = 28$ cm.



10. $AB = DC = 21$ cm; $AD = BC = 54$ cm

$DAB = 85° \quad DBC = 60°$

$AB \,||\, DC$ and AB is traversal $\quad A + \quad B = 180°$

(Sum of the interior angles on one side of parallel line 180°)

$85° + x + 60° = 180°$

$145° + x = 180°$

$x = 180° - 145° = 35°$

(a) $\quad CDB = \quad ABD = 35°$ (alternate angle)

(b) $\quad ABD = 35°.$

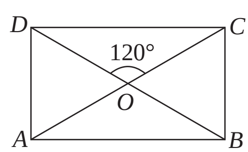
Exercise 9.3

1. In the given rectangle $\quad DOC = \quad AOB = 120°$

$\Delta AOB, OA = OB$ (Diagonals of a rectangle are equal and bisect each other)

$OBA = \quad OAB = x$

(Angles opposite to equal sides are equal)



In ΔAOB, $\quad AOB + \quad OAB + \quad ABO = 180°$

$120° + x + x = 180°$

$2x = 180° - 120°$

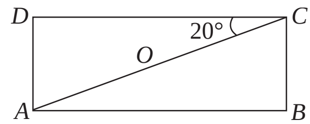
$x = 60° \div 2 = 30°$

So, $\quad OBA = 30°.$

2. In ΔACD, $\quad ACD = 20°$ (Given)

and $\quad AD = DC$ (Sides of a rhombus)

$ACD = DAC$



(Angles opposite to equal sides)

Therefore, $\quad DAC = \quad ACD = 20°$

So, $\quad DAC = 20°$

Now, In ΔACD

$$ADC + \quad DAC + \quad ACD = 180°$$
$$ADC + 20° + 20° = 180°$$
$$ADC = 180° - 40° = 140°$$

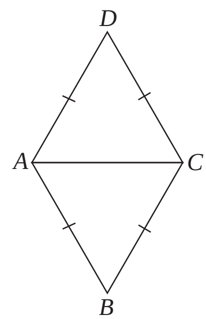
We know that opposite angles of rhombus are equal.

So, $\quad ABC = \quad ADC = 140°$

Therefore, $\quad ABC = 140°$

$$DCB = \quad DCA + \quad ACB = 20° + 20° = 40°$$
$$DCB = \quad DAB = 40°$$
$$A = 40°, \quad B = 140°, \quad C = 40°, \quad D = 140°.$$

3. Let diagonal $AC =$ side AB



Now in ΔABC,

$$AB = BC = AC.$$

ΔABC is an equilateral triangle.

$$ABC = 60°$$

Also, $\quad BAC = \quad BCA = 60°$

Similarly ΔADC is an equilateral triangle.

$$ADC \quad = \quad DAC = \quad DCA = 60°$$

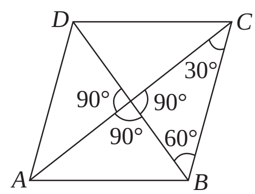
Now, $\quad DAB$

$= \quad DAC + \quad CAB = 60° + 60° = 120°$

Similarly, $\quad DCB = 120°$

Angles of rhombus are 60°, 120°, 60° and 120°.

4. In the adjoining, $ABCD$ is a rhombus.



Find the measure of the following angles,

if $\quad ACB = 30°$

(a) $\quad BOC = 90°$

(Diagonals of rhombus bisect, each other 90°)

(b) $\quad CBO =$ In, $\Delta BOC, \quad B + \quad C + \quad O = 180°$

$$B + 90° + 30° = 180° \quad B = 180° - 120° = 60°$$

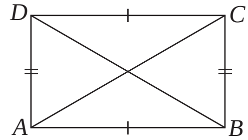
(c) $\quad OAD = 30°$ (alternate angles)

(d) $\quad ABO = \quad CBO = 60°.$

5. The diagonals of a parallelogram are not perpendicular to each other. It is not rhombus, because to be a rhombus, it is essential that diagonals of a parallelogram should be perpendicular.

6. (a) Rhombus (b) Rectangle (c) Square.

7. Let, us look at the rectangle once more.



Let, us prove that the diagonals are equal.

In triangles ABD and BAC,

$AB = BA$ (common side)

$A = \quad B = 90°$(already proved)

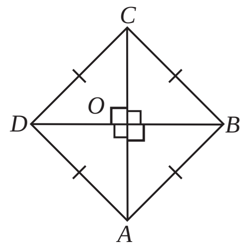
$AD = BC$ (opposite sides of a parallelogram are equal.)

Two sides and the included angle of ΔABD are respectively equal to two sides and the included angle of ΔBAC.

By S.A.S. property $\Delta ABD \cong \Delta BAC$.

Hence, $BD = AC$, *i.e.*, the diagonals of a rectangle are equal.

8. We will prove that the diagonals bisect at right angles.



Consider ΔABO and ΔBCO

$AB = BC$ (by defination of a rhombus)

BO is common.

$AO = CO$

(dagonals of a parallelogram bisect each other)

So, the two trangles are congruent (S.S.S. condition for congruence of trangles).

So, $AOB = BOC$

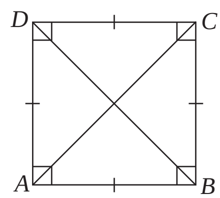
But, $AOB + BOC = 180°$ (straight angle)

$AOB = BOC = 90°$

COD and DOA are vertcally opposte angles of AOB and BOC. So they are also 90° each.

So, the diagonals of a rhombus bisect each other at right angles.

9. Take a rhombus $ABCD$,



where $AB = BC = CD = AD$

and $A = B = C = D = 90°$

To Prove :

A rhombus wth one angle 90° is a square.

Proof : Since, in the rhombus $ABCD$,

Hence, AC and BD bisect each other. (property of parallelogram)

Hence proved (ii).

$AB = BC = CD = AD$,

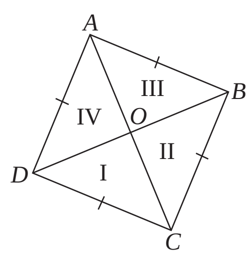
Hence, $AC \quad BD$ (Property of rhombus)

As here Rhombus; opposite sides are parallel.

All sides equal opposite angles are equal.

So, a rhombus with one angle 90° is square.

10. In figure $\Delta AOD, \Delta AOB, \Delta DOC, \Delta BOC$



Here $AB = BC = CD = AD$

$CA = DB$ common side

$AOD = AOB = BOC = DOC = 90°$

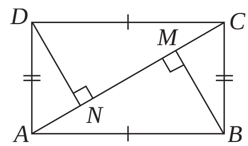
(Diagonals bisect each other at right angle)

In the rhombus $ABCD$ shown above

$AB \,||\, CD$; $BC \,||\, AD$

$AB = BC = CD = AD$

$AO = BO$ and $CO = DO$ (diagonals bisect each other in a parallelogram)
So, we can say that four triangle found by dagonals and sides of rohombus are congruent.



11. In ΔAND and ΔCMB , we have

$$AD = BC$$

Opposite sides of the rectangle $ABCD$

$$DNC = \quad BMC \text{ (90° each)}$$

$$DAN = \quad BCM$$

($AD \| BC$ and AC is transversely and these angles are alternate interior angles)

Therefore, $\Delta AND \cong \Delta CMB$

$$AN = CM$$

Hence proved,

12. Which of the following statements is True (T) or False (F) :

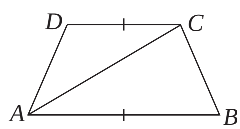
(a) F (b) F (c) F (d) T
(e) T (f) F (g) T (h) F
(i) T (j) F

Multiple Choice Questions

Tick (3) the correct answer :

1. (b), **2.** (a), **3.** (a), **4.** (c),
5. (a), **6.** (c), **7.** (d)

High Order Thinking Skills



1. $AB \| DC$

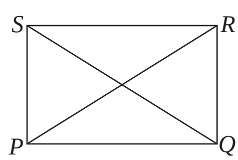
In the figure alongside quadrilateral $ABCD$ is a trapezium in which $AB \| DC$, AC is Diagonal

ΔADC and ΔABC are equal sum of one triangle $= 180°$

Then, Sum of $\Delta ADC + \Delta ABC = 180° + 180°$

$$= 360°$$

Sum of trapezium is 360°.



2. If $PQRS$, $PQ \| RS$

$$PQ = RS \; ; \; PR = QS$$

$$2x + 4 = 3x + 1$$

$$4 - 1 = 3x - 2x$$

$$3 = x$$

Value of x is 3.

10 Construction of Quadrilaterals

Exercise 10.1

1. Steps of construction :

Step 1. Draw AB 5 cm.

Step 2. Draw an angle of 80° at B.

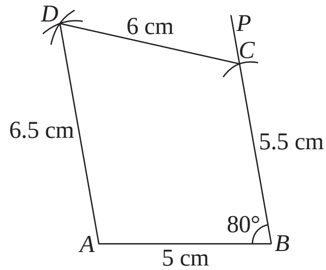
Step 3. With B as centre and radius 5.5 cm, draw an arc intersecting BP at C.

Step 4. With C as centre and radius 6 cm draw an arc on one side of BC.

Step 5. With A as centre and radius 6.5 cm, draw an arc intersecting the previous arc at D.

Join D to C and A to D.

The figure of $ABCD$, thus drawn, is the required quadrilateral.



2. Steps of construction :

Step 1. Draw diagonal $PR = 10$ cm.

Step 2. With P as centre and radius 5 cm.

Step 3. With R as centre and radius 7.5 cm.

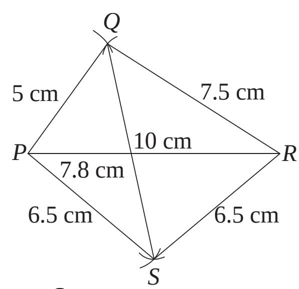
Step 4. Join P to Q and R to Q.

Step 5. With P as centre and radius 6.5 cm, an arc.

Step 6. With R as centre and radius 6.5 cm, draw an arc intersecting the previous arc at S.

Step 7. Join P to Q and R to S.

The figure $PQRS$, thus drawn, is the required quadrilateral.



3. Steps of constructions :

Step 1. Draw diagonal $BD = 6$ cm.

Step 2. With B as centre and radius 5 cm.

Step 3. With D as centre and radius 5 cm.

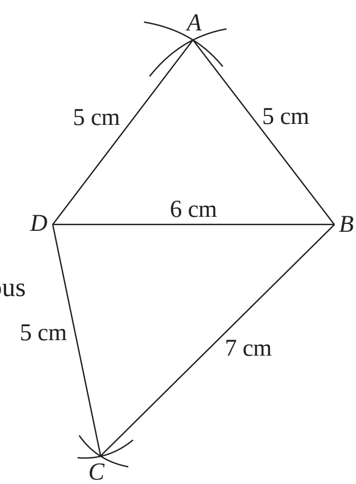
Step 4. Join A to B and A to D.

Step 5. With B as centre and radius 5 cm draw an arc on the other side of BD.

Step 6. With D as centre and radius 7 cm, draw an arc intersecting the previous arc at C.

Step 7. Join B to C and D to C.

The $ABCD$ thus drawn, is the required quadrilateral.



4. Steps of construction :

Step 1. Draw diagonal $PR = 4.5$ cm.

Step 2. With P as centre and radius 3.5 cm.

Step 3. With R as centre and radius 4 cm.

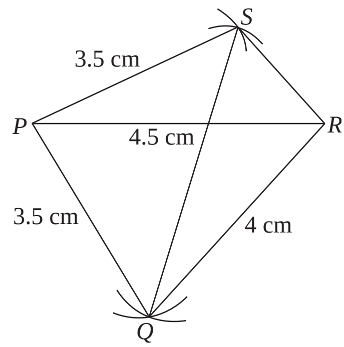
Step 4. Join P to Q and R to Q.

Step 5. With P as centre and radius 3.5 cm draw an arc on the other side of PR.

Step 6. With Q as centre and radius 5 cm, drawn an arc at S.

Step 7. Join P to S and Q to S.

Step 8. Join S to R ; $SR = 2.5$ cm.



The figure $PQRS$, thus drawn, is the require quadrilateral.

5. Steps of construction :

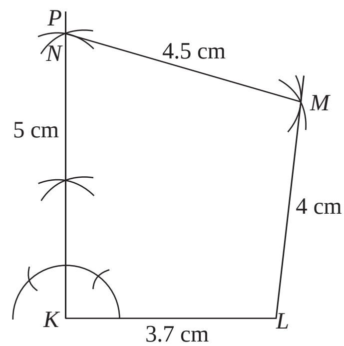
Step 1. Draw KL 3.7 cm.

Step 2. Draw an angle of 90° at K.

Step 3. With K as centre and radius 5 cm, draw an arc intersecting KP at N.

Step 4. With N as centre and radius 4. cm draw an arc on one side of KN.

Step 5. With L as centre and radius 4 cm, draw an arc intersecting the previous arc at M.



Join M to N and M to L.

The figure of $KLMN$, thus drawn, is the required quadrilateral.

6. Steps of construction :

Step 1. Draw diagonal $AC = 7$ cm.

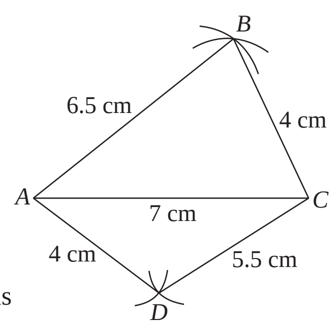
Step 2. With A as center and radius 6.5 cm.

Step 3. With C as center and radius 4 cm and cut previous arc of B.

Step 4. Join AB and BC.

Step 5. With A as center and radius 4 cm draw an arc another side of AC.

Step 6. With C as center and radius 5.5 cm draw an arc intersecting the previous arc at D.



Step 7. Join A to D and C to D.

The figure of $ABCD$ thus drawn is the required quadrilateral.

Exercise 10.2

1. **Steps of construction :**

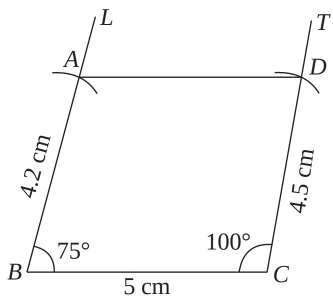
Step 1. Draw $BC = 5$ cm.

Step 2. Taking B and C a centres, draw angles of 75° and 100° respectively.

Step 3. With B as centre and radius 4.2 cm, draw an arc intersecting BL at A.

Step 4. With C as centre and radius 4.5 cm, draw an arc intersecting at CT at D.

Step 5. Join A to D.



The figure $ABCD$, thus drawn is the required quadrilateral.

2. **Steps of construction :**

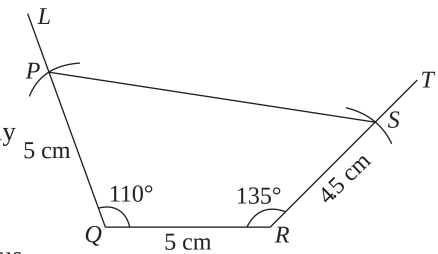
Step 1. Draw $QR = 5$ cm.

Step 2. Taking Q and R as centres, draw angles of 110° and 135° respectively

Step 3. With Q as centre and radius 5 cm, draw an arc intersecting QL at P.

Step 4. With R as centre and radius 4.5 cm, draw an arc intersecting at RT at S.

Step 5. Join P to S.



The figure $PQRS$, thus drawn, is the required quadrilateral.

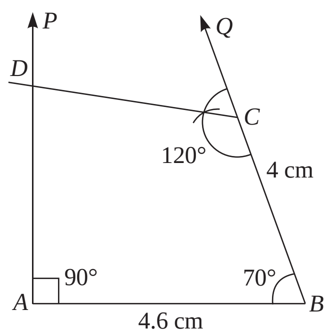
3. **Steps of construction :**

Step 1. Draw $AB = 4.6$ cm.

Step 2. With A and B as centres, draw angles of 90° and 70° respectively.

Step 3. With B as centre and radius 4 cm, draw an arc intersecting BQ at C.

Step 4. With C as centre, draw an angle of 120° intersecting AP at D.



Thus $ABCD$ drawn is the required quadrilateral.

4. **Steps of construction :**

(Find the A, $B = 135°$,

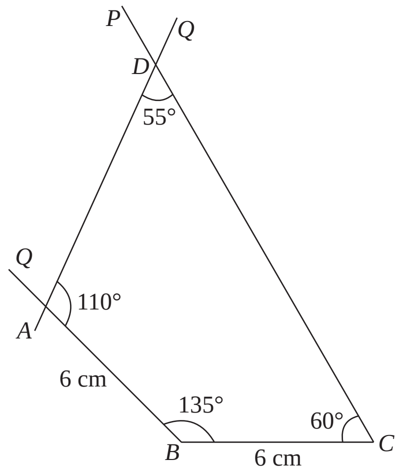
$C = 60°$, $C = 55°$

Sum of quadrilateral $= 360°$

$135° + 60° + 55° + A = 360°$

$250° + A = 360°$

$A = 360° - 250° = 110°$)



Step 1. Draw $BC = 6$ cm.

Step 2. With B and C as centres draw angles of 135° and 60° respectively.

Step 3. With B as centre and radius 6 cm draw an arc intersection BQ at A.

Step 4. With A as centre, draw an angle 110° intersecting CP at D; $D = 55°$.

Thus, $ABCD$ drawn is the required quadrilaterals.

5. **Steps of construction :**

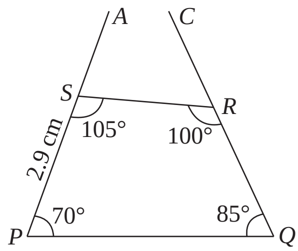
(Sum of quadrilateral $= 360°$

$P = 70°$, $Q = 85°$, $R = 100°$

$P + Q + R + S = 360°$

$70° + 85° + 100° + S = 360°$

$S = 360° - 255° = 105°$)



Step 1. Draw $PQ = 5.3$ cm.

Step 2. With P an Q as centres, drawn angle 70° and 85° respectively.

Step 3. With P as centre and radius 2.9 cm draw arc intersecting PA at S.

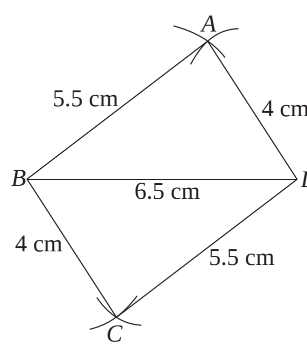
Step 4. With S as centre and draw $S = 105°$ intersecting QS at R.

$R = 100°$

The figure $PQRS$ thus drawn is required quadrilateral.

Exercise 10.3

1. **Steps of construction :**



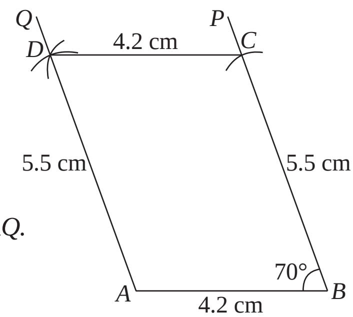
Step 1. Draw $BD = 6.5$ cm.

Step2. With B and D as centres, and radii 5.5 cm and 4 cm respectively, draw two arcs on one side of BD intersecting each other at A. Join A to B and A to D.

Step 3. Again, with D and B as centres and radii 4 cm and 5.5 cm respectively, draw two arcs on the other side of BD intersecting each other at C. Join C to B and C to D.

The figure $ABCD$, thus drawn, is the required parallelogram.

2. Steps of construction :



Step 1. Draw $AB = 4.2$ cm.

Step 2. With B as center draw angle 70°.

Step 3. With B as centers and radius 5.5 cm draw an arc intersecting BP at C.

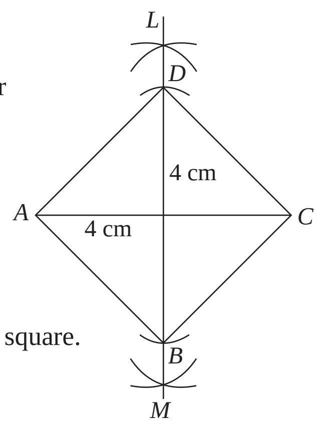
Step 4. With A as center and radius 5.5 cm draw an arc intersecting AQ.

Step 5. With C as center and radius 4.2 cm draw an arc which the cut pervious arc as D.

Step 6. Join A to D and B to C.

Thus, $ABCD$ is required parallelogram.

3. Steps of construction :



Step 1. Draw $AC = 8$ cm.

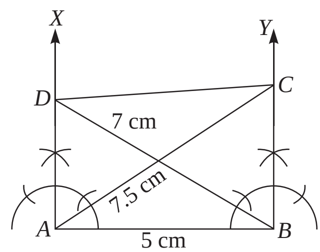
Step 2. Draw LM, the perpendicular bisector of AC, intersecting AC at O.

Step 3. With O as centre and radius 4 cm ($i.e.$, half of 8 cm), draw two arcs on either side of AC intersecting LM at B and D respectively.

Step 4. Join AB, CB, CD and DA.

The figure $ABCD$, thus drawn, is the required square.

4. Steps of construction :



Step 1. Draw $AB = 5$ cm.

Step 2. With A and B as centres, draw angles of 90° at each point.

Step 3. With A and B as centres and radius 7 cm, draw two arcs intersecting BY and AX at C and D respectively.

Step 4. Join C and D.

The figure $ABCD$, thus drawn, is the required rectangle.

5. Steps of construction :

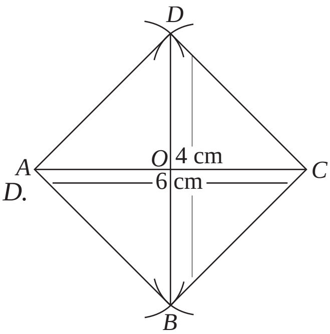
Step 1. Draw $AC = 6$ cm.

Step 2. Draw a perpendicular bisector of AC which cuts AC at O.

Step 3. With O as centre take a radius 2 cm draw two arc which cuts the perpendicular bisector on B and D.

Step 4. Join, AB, BC, CD and DA.

$ABCD$ is the required rhombus.



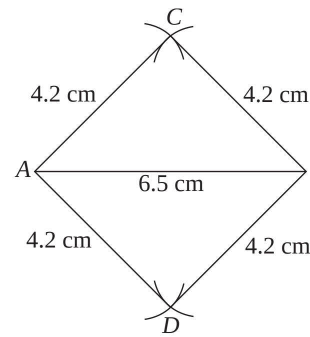
6. Steps of construction :

Step 1. Draw $AC = 6.5$ cm.

Step 2. With A and B as centres, and radius 4.2 cm, draw two arcs on the same side of AB, intersecting each other at C. Join A to C and C to B.

Step 3. With A and B as centres, and radius 4.2 cm, draw two arcs on the other side of AB intersecting each other at D. Join A to DB and C to D.

The figure $ABCD$, thus drawn, is the required rhombus.



7. Steps of construction :

Step 1. Draw $AB = 5$ cm.

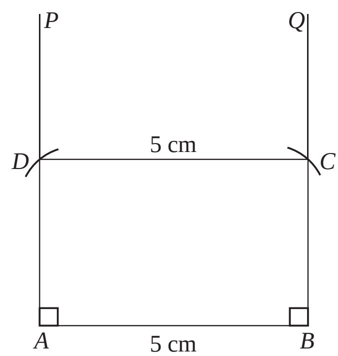
Step 2. Draw an angle of 90° at A.

Step 3. Draw another angle of 90° at B.

Step 4. With A as centre draw on arc of radius 5 cm which cuts AP at D.

Step 5. With B as centre, draw an arc of raidus 5 cm which cuts BQ at C. Join C to D.

The figure $ABCD$, thus drawn, is the required square.



11 Representing 3-D in 2-D

Exerciser 11

1. Identity the given solid shapes :

(a) Square pyramid (b) Sphere (c) Cuboid

(d) Cube (e) Cone

2. Which of the following shapes is not a polyhedron?
(a) Yes (b) Yes (c) No

3. Which of these solids is an example of a regular polyhedron?
(a) regular polyhedron.

4. Look at the following polyhedrons and fill in the given table to verify the Euler's formula.

	Solid	V	F	E	$V+F-E$
(a)	Triangular Prism	6	5	9	2
(b)	Hexagonal Prism	12	8	18	2
(c)	Hexagonal Pyramid	7	7	12	2
(d)	Pentagonal pyramid	6	6	10	2
(e)	Cube	8	6	12	2
(f)	Rectangular pyramid	5	5	8	2

5. Number of vertices $(V) = 8$;
Number of faces $(F) = 6$
Let number of edges $(E) = x$;

$$V + F - E = 2$$

As $8 + 6 - x = 2$

$$14 - x = 2 \qquad x = 14 - 2 = 12$$

Number of edges $= 12$.

6. Number of vertices $(V) = 20$
Let number of faces $(F) = x$
Number of edges $(E) = 30$

$$V + F - E = 2$$
$$20 + x - 30 = 2$$
$$x - 10 = 2$$
$$x = 10 + 2$$
$$x = 12$$

Number of faces $= 12$.

7. Let number of vertices $(V) = x$
Number of faces $(F) = 40$
Number of edges $(E) = 60$

$$V + F - E = 2$$

As $x + 40 - 60 = 2$

$$x = 2 + 60 - 40$$
$$x = 62 - 40 = 22$$

Number of vertices $= 22$.

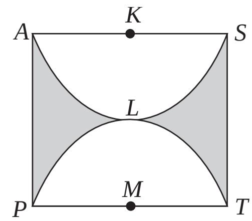
Multiple Choice Questions

Tick (3) the correct option :

1. (b) **2.** (b) **3.** (c) **4.** (a) **5.** (d) **6.** (c) **7.** (c) **8.** (a)

12 Area of Rectilinear Figures

Exercise 12.1



1. *PAST* is a square

In *PAST*; side = 14 cm

Area of square = $(\text{side})^2 = 14\,\text{cm} \times 14\,\text{cm} = 196\,\text{cm}^2$

ALS and *PLT* are semi circles.

Area of *ALS*;

Diameter of circular = 14 cm

$$\text{radius} = \frac{14}{2} = 7\,\text{cm}$$

Area of semi circle = $\frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 = 77\,\text{cm}^2$

Area of semicircle *PLT* = $77\,\text{cm}^2$

Area of shaded region = Area of square − Area of semicircle

$$= 196 - 77 \times 2\,\text{cm}^2 = 196 - 154\,\text{cm}^2 = 42\,\text{cm}^2$$

2. Let old length of a rectangular field = x cm

Area of rectangular field = $x \times y = xy\,\text{cm}^2$

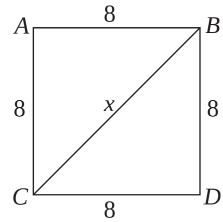
New length of rectangular field = $x + x \times \frac{50}{100} = \frac{3x}{2}$ cm

breadth of rectangular field = $y - y \times \frac{50}{100} = \frac{y}{2}$ cm

Area of new rectangular field = $\frac{3x}{2} \times \frac{y}{2} = \frac{3xy}{4}\,\text{cm}^2$

Difference = $xy - \frac{3xy}{4}\,\text{cm}^2 = \frac{4xy - 3xy}{4}\,\text{cm}^2 = \frac{xy}{4}\,\text{cm}^2$

Area decrease = $\frac{xy \times 100}{4 \times xy} = 25\%$.

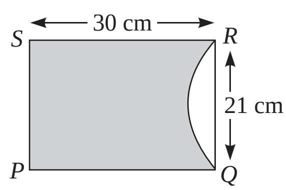


3. Side of a square = 8 cm

Diagonal of a square = $\sqrt{2} \times \text{side}$

$= \sqrt{2} \times 8\,\text{cm}$

$= 8\sqrt{2}$ cm or 11.31 cm.



4. In Rectangle *PQRS*

$PQ = 30\,\text{cm}, QR = 21\,\text{cm}$

Area of rectangle = length × breadth

$= 30 \times 21\,\text{cm}^2 = 630\,\text{cm}^2$

Diameter of semi circular end = 21 cm

radius semi circular $= \frac{21}{2} = 10.5$

Area of semi circular $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 10.5 \times 10.5 = 173.25 \text{ cm}^2$

The area of remaining part = Area of rectangle $PQRS$ − Area of semi circular

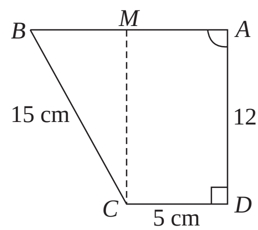
$$= (630 - 173.25) \text{ cm}^2 = 456.75 \text{ cm}^2$$

Thus, Area of remaining part is 456.75 cm^2.

5. In the given figure $ABCD$ is quadrilateral in which

$AB \parallel DC$, $DC = 5$ cm, $AB = 14$ cm, $CB = 15$ cm and $DA \quad AB$.

Let $CM \quad AB$



$$MB = AB - AM = AB - DC$$
$$= 14 - 5 = 9$$

Now in ΔCMB

$$CM^2 = CB^2 - MB^2$$
$$= 15^2 - 9^2 = 225 - 81 = 144$$
$$CM = \sqrt{144} = 12 \text{ cm}$$

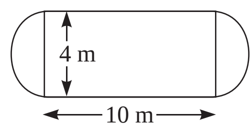
Now, Area of quadrilateral

Area of rectangle $AMCD$ and Area of triangle BMC

$$= 12 \times 5 \text{ cm}^2 + \frac{1}{2} \times 12 \times 9 \text{ cm}^2$$

$60 \text{ cm}^2 + 54 \text{ cm}^2 = 114 \text{ cm}^2$.

6. Area of rectangle;



length = 10 m, breadth = 4 m

Area of rectangle = length × breadth

$$= 10 \times 4 \text{ m}^2 = 40 \text{ m}^2$$

Area of semicircular;

Diameter of circular end = 4 m

Radius of circular ends $(r) = 4 \times \frac{1}{2} = 2$ m

Area of first semicircular ends $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 2 \times 2 = \frac{44}{7} \text{ cm}^2$

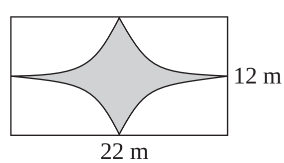
Area of second semicircular $= \frac{1}{2} \times \frac{22}{7} \times \frac{2}{1} \times 2 = \frac{44}{7} \text{ cm}^2$

Area of figure = Area of rectangular part + Area of semicircular part

$$= 40 \text{ m}^2 + \frac{44}{7} \text{ cm}^2 + \frac{44}{7} \text{ m}^2$$

$\frac{280 + 44 + 44}{7} \text{ m}^2 = \frac{368}{7} \text{ m}^2$ or $52\frac{4}{7} \text{ m}^2$ or 52.57 m^2.

7. Length of rectangular field = 22 m



Breadth of rectangular field = 12 m

Area of rectangular field $= 22 \times 12 \text{ m}^2 = 264 \text{ m}^2$

4 quadrants circles = one circle

radius $= 2.5$ m

Area of circle $= \pi r^2 = \frac{22}{7} \times 2.5 \times 2.5 = \frac{137.5}{7}$

Area of shaded part $= 264 + \frac{1375}{70}$

$$= \frac{18480 + 1375}{70} = \frac{19855}{70} \text{ or } \frac{3971}{14} \text{ m}^2 = 283\frac{9}{14} \text{ m}^2$$

8. Ratio of side of both the squares $= 4 : 5$

Let length of first square $= 4x$ cm

Area of first square $= 4x \times 4x = 16x^2 \text{ cm}^2$

Length of second square $= 5x$ cm

Area of second square $= 25x^2 \text{ cm}^2$

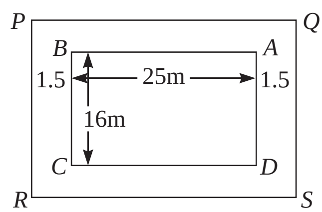
Ratio of both squares $= 16x^2 : 25x^2 = 16 : 25.$

9. Area of *ABCD* plot

Length of *ABCD* $= 25$ m

Breadth of *ABCE* $= 16$ m

Area of *ABCD* $= 25 \times 16 \text{ m} = 400 \text{ m}^2$



Area of *PQRS*

Length of *PQRS* $= 25 + (1.5 \times 2)$ m $= 28$ m

Breadth of *PQRS* $= 16 + (1.5 \times 2)$ m $= 19$ m

Area of *PQRS* $= 28 \times 19 \text{ m}^2 = 532 \text{ m}^2$

Area of foot path

$=$ Area of *PQRS* $-$ Area of *ABCD*

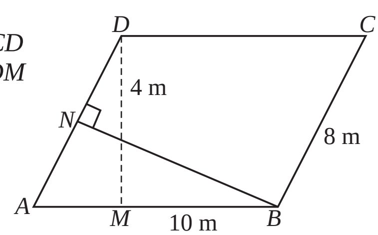
$= 532 \text{ m}^2 - 400 \text{ m}^2 = 132 \text{ m}^2$

Side of square tiles $= 20$ cm or 0.2 m

Area of square tiles $= 0.2 \text{ m} \times 0.2 \text{ m} = 0.04 \text{ m}^2$

Number of required tiles $= \frac{132}{0.04} = 3300.$

10. Since $AB \parallel DC$



We know that area of parallelogram *ABCD*

$= \text{base} \times \text{height} = AB \times DM$

$= 10 \times 4 \text{ m}^2 = 40 \text{ m}^2$

Also, area of parallelogram $= 40 \text{ m}^2$

$BN \times BC = 40$

$8 \times BN = 40$

$BN = \frac{40}{8} = 5$ m

Required distance between longer sides is 5 cm.

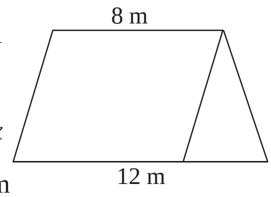
Exercise 12.2

1. Length of canal the bottom $= 8$ m

Length of canal at the top $= 12$ m

Let the depth between them $= x$ cm

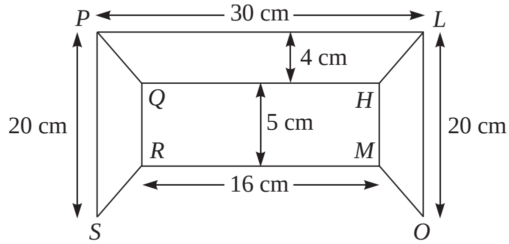
Area of trapezium $= \frac{1}{2}$ (sum of length of parallel sides distance between them)



$84 = \frac{1}{2}(8+12) \times x$ $84 = \frac{20}{2}x$

$84 = 10x$ $x = 8.4$ cm

2. In this figure,
PQRS is trapezium, *PQLH* and *LHMO* is are trapezium and *MNQR* is rectangle.



Area of trapezium $= \frac{1}{2}$ (Sum of parallel side) × distance

Area of *PQLH* $= \frac{1}{2} \times (30+16) \times 4 = \frac{1}{2} \times 46 \times 4 = 92 \text{ cm}^2$

Area of *PQRS* $= \frac{1}{2}(20+5) \times \frac{(30-16)}{2} = \frac{1}{2} \times 25 \times \frac{14}{2} = 87.5$

Area of *LHMO* $= \frac{1}{2}(20+5) \times \frac{(30-16)}{2} = 87.5 \text{ cm}^2$

Area of *QRMH* $= l \times b = 5 \times 16 = 80 \text{ cm}^2$

Area of given figure $= (92 + 87.5 + 87.5 + 80) \text{ cm}^2 = 347 \text{ cm}^2$.

3. Find the area of the trapezium whose :

(a) Bases $= 15$ cm and 20 cm; altitude $= 8$ cm

Area of trapezium $= \frac{1}{2}$ (sum of lengths of parallel sides) × altitude

Area of trapezium $= \frac{1}{2}(15+20) \times 8 = \frac{1}{2} \times 35 \times 8 = 140 \text{ cm}^2$

(b) Bases $= 10$ cm and 12 cm; altitude $= 5$ cm

Area of trapezium $= \frac{1}{2}$ (Sum of lengths of parallel sides) × altitude.

Area of trapezium $= \frac{1}{2}(10+12) \times 5 = \frac{1}{2} \times 22 \times 5 = 55 \text{ cm}^2$.

4. Ratio of parallel side of trapezium $= 3 : 5$

Let one side is $3x$ cm

Other side is $5x$ cm

Distance between them $= 12$ cm

Area of the trapezium $= 720\,\text{cm}^2$

We know that,

Area of trapezium $= \frac{1}{2}$ (sum of parallel sides) × Distance between them

$$720 = \frac{1}{2}(3x + 5x) \times 12 \qquad 720 = 8x \times 6$$

$$720 = 48x \qquad x = \frac{720}{48} = 15$$

Now parallel sides of trapezium =

one side $= 3 \times 15 = 45\,\text{cm}$

and other side $= 5 \times 15 = 75\,\text{cm}$.

5. Parallel sides $= 1.5$ m and 2 m

perpendicular distance $= 1.2$ cm

Area of trapezium $= \frac{1}{2}$ (sum of parallel sides + Distance)

$$= \frac{1}{2}(1.5 + 2) \times 1.2 = 2.1\ \text{m}^2.$$

6. Parallel side $= 100\,\text{m}$ and 150 m

Distance between them $= 125\,\text{m}$

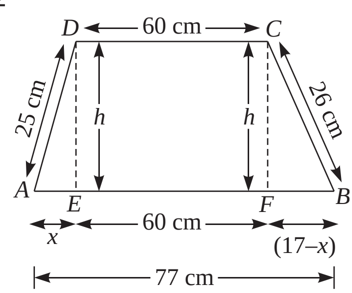
Area of trapezium $= \frac{1}{2}$ (sum of parallel side distance between them)

$$= \frac{1}{2}(100 + 150) \times 125 = \frac{1}{2} \times 250 \times 125 = 15625\,\text{m}^2.$$

7. Let $DE = CF = h$ (Because $AB \parallel DC$)

and $AE = x$ cm, $FB = (17 - x)$ cm

In ΔAED,



$AD^2 = AE^2 + DE^2$ (Pythagoras theorem)

$$25^2 = x^2 + h^2$$

$$x^2 + h^2 = 625 \quad \ldots\text{(i)}$$

Similarly,

In ΔBFC,

$$BC^2 = CF^2 + FB^2$$

$$26^2 = h^2 + (17 - x)^2$$

$$676 = h^2 + 289 + x^2 - 34x$$

$$676 - 289 = x^2 + h^2 - 34x$$

$$387 = x^2 + h^2 - 34x$$

$$34x = 625 - 387 \qquad \text{(From equation (i))}$$

$$34x = 238 \qquad x = 7\,\text{cm}$$

putting the value of x in equation (i), we get

$$7^2 + h^2 = 625 \qquad h^2 = 625 - 49$$

$$h^2 = 576 \qquad h = 24\,\text{cm}$$

So, the area of a trapezium $= \frac{1}{2} \times h \times$ (sum of parallel side)

$$= \frac{1}{2} \times 24 \times (77 + 60)\, cm^2$$

$$= 12 \times 137\, cm^2 = 1644\, cm^2.$$

8. The area of a trapezium $= 105\, cm^2$

One of the parallel sides $= 28\, cm$

Distance the parallel sides $= 5\, cm$

Let, length of the other parallel side $= x\, cm$

Area of a trapezium $= \frac{1}{2}$ (sum of length of parallel sides)

× Distance between then

$$105 = \frac{1}{2}(28 + x) \times 5\, cm \qquad 105 \times 2 = 140 + 5x$$

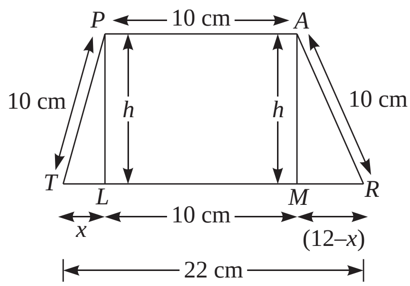
$$210 = 140 + 5x \qquad 210 - 140 = 5x$$

$$x = \frac{70}{5} = 14\, cm.$$

Thus, other parallel sides $= 14$ cm.

9. Let $PART$ be the given trapezium in which

$RT = 25\, cm$, $PA = 13\, cm = LM$, $PT = RA = 10\, cm$



Let TL be x cm and the height of the trapezium be h cm.

From the figure,

$$MR = 22 - (LM + TL) = 22 - 10 - x = 12 - x$$

In ΔPTL

$$PL^2 = PT^2 - TL^3 \qquad h^2 = 10^2 - x^2$$

$$h^2 = 100 - x^2 \qquad \ldots(i)$$

In ΔAMR

$$AM^2 = AR^2 - AM^2$$

$$h^2 = 10^2 - (12 - x)^2 = 100 - (144 - 24x + x^2) = 100 - 144 + 24x - x^2$$

$$h^2 = 24x - x^2 - 44 \qquad \ldots(ii)$$

Form (i) and (ii), we have

$$24x - x^2 - 44 = 100 - x^2 \qquad 24x - x^2 + x^2 = 100 + 44$$

$$24x = 144 \qquad x = \frac{144}{24} = 6\, cm$$

Substituting the value of x in (i) we get

$$h^2 = 100 - 6^2 = 100 - 36 = 64$$

$$h = \sqrt{64} = 8 \qquad h = 8\,\text{cm}$$

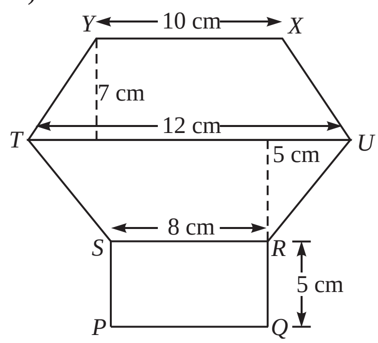
Now, Area of trapezium $= \frac{1}{2} \times$ height $\times$ sum of parallel side

$$= \frac{1}{2} \times 8 \times (22 + 10)\,\text{cm}^2$$

$$= 4 \times 32\,\text{cm}^2 = 128\,\text{cm}^2.$$

10. In the figure, $YXTU$ is trapezium

Area of trapezium $= \frac{1}{2}$ (sum of parallel side) $\times$ Distance between then



$$= \frac{1}{2}(10 + 12) \times 7$$

$$= \frac{1}{2} \times 22 \times 7 = 77\,\text{cm}^2$$

Second trapezium is $TUSR$

$$\text{Area} = \frac{1}{2}(12 + 8) \times 5$$

$$= \frac{1}{2} \times 20 \times 5 = 50\,\text{cm}^2$$

$PQRS$ is a rectangle

Area of rectangle $=$ length $\times$ breadth $= 8 \times 5\,\text{cm}^2 = 40\,\text{cm}^2$

Now Area of given fiver $YXURQPSTV = 77 + 50 + 40\,\text{cm}^2 = 167\,\text{cm}^2$.

Exercise 12.3

1. In quadrilaterals $PQRS$

Diagonals $QS = 18\,\text{cm}$;

Sum of off sets $= 15\,\text{cm}$

Area of quadrilateral $PQRS = \frac{1}{2}$ Diagonal $\times$ sum of off sets

$$= \frac{1}{2} \times 18 \times 15 = 135\,\text{cm}^2.$$

2. Find the are of given quadrilaterals.

(a) Area of quadrilaterals $= \frac{1}{2}$ (sum of parallel sides) $\times$ Distance

Area of quadrilaterals $= \frac{1}{2}(11 + 15) \times 4 = 52\,\text{cm}^2$

(b) Area of quadrilaterals $= \frac{1}{2}$ (sum of parallel sides) $\times$ distance

Area of quadrilaterals $= \frac{1}{2}(0.6 + 2) \times 2 = 2.6\,\text{cm}^2$

(c) Area of quadrilateral $= \frac{1}{2}$ (sum of off sets) diagonal

Area a of quadrilateral $= \frac{1}{2}(3+4)\times 8 = 28\,\text{cm}^2$

(d) Area of quadrilaterals $= \frac{1}{2}$ Sum of off sets $\times$ diagonal

Area of a quadrilaterals $= \frac{1}{2}(4.5 + 2.5)\times 9 = 31.5\ \text{cm}^2$.

3. Area of rhombus $= 216\,\text{cm}^2$
Length of one diagonal $= 18\,\text{cm}$
Length of other diagonal $= x$

Area of rhombus $= \frac{1}{2}\times d_1 \times d_2$

$$216 = \frac{1}{2}\times 18\times x = \frac{216\times 2}{18} = x \qquad x = 24$$

Length of other diagonal is 24 cm.

4. Area of triangle $= \frac{1}{2}\times$ base $\times$ height

Area of I triangle $DCE = \frac{1}{2}\times CE\times DE$

Area of $\Delta DCE = \frac{1}{2}\times 10\times 27 = 135\,\text{cm}^2$

Area II rectangle $DEFG =$ length $\times$ breadth

Area of $\square DGEF = DH\times HF = 27\times(28-10-6) = 27\times 12 = 324\ \text{m}^2$

Area II triangle $\Delta EFG = \frac{1}{2} FA\times EF$

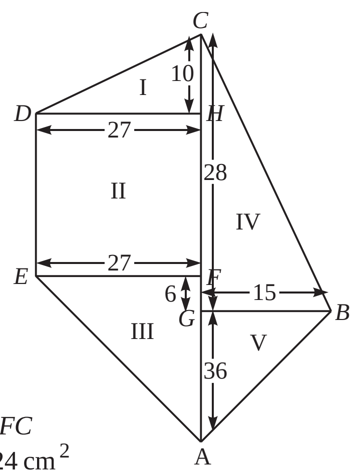
Area of $\Delta EFG = \frac{1}{2}(6+36)\times 27 = 567\,\text{m}^2$

Area of $\Delta CGB = \frac{1}{2} CG\times GB$

$= \frac{1}{2}\times 28\times 15 = 210\,\text{m}^2$

Area of $\Delta AGB = \frac{1}{2}\times GA\times GB$

$= \frac{1}{2}\times 15\times 36 = 270\,\text{m}^2$

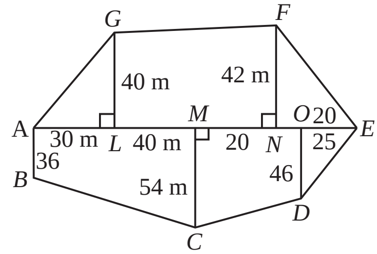


Area of field $\Delta ABCDE =$ Sum of Area of
$\Delta CDH + \square DBFH + \Delta EFA + \Delta AGB + \Delta BFC$

$= 135 + 210 + 270 + 567 + 324\ \text{cm}^2$

$= 1506\,\text{m}^2$.

5. Area of the field $ABCDEFG$



Area of $\Delta AGL = \frac{1}{2} \times GL \times AL$

$= \frac{1}{2} \times 40 \times 30 = 600\,m^2$

Area of $GFLN$ trapezium

$= \frac{1}{2}(GF + LN)(LM + MN)$

$= \frac{1}{2}(40 + 42)(40 + 20) = \frac{1}{2} 82 \times 60 = 2460\,m^2$

Area of $\Delta FNE = \frac{1}{2} FO \times NE = \frac{1}{2} \times 42 \times (20 + 25) = 945\,m^2$

Area of $\Delta OED = \frac{1}{2} \times OE \times ND = \frac{1}{2} \times 25 \times 46 = 575\,m^2$

Area of trapezium $MOCD = \frac{1}{2}(MC + OD) \times (MN + ON)$

$= \frac{1}{2}(54 + 46) \times (20 + 20) = 2000\,m^2$

Area of trapezium $AMBC = \frac{1}{2}(AB + MC)(AL + LM) = \frac{1}{2}(36 + 54)(30 + 40)$

$= \frac{1}{2} \times 90 \times 70$

$= 3150\,m^2$

Area of field $ABCDEG$ $= (600 + 2460 + 945 + 2000 + 575 + 3150)\,m^2$

$= 9730\,m^2$.

6. In $ABCD$; AC is diagonal 48 cm

off set $= DP = 17.5$ cm and $BQ = 12$ cm

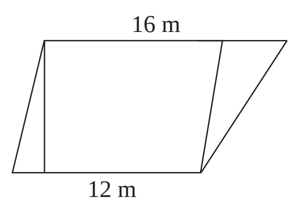
Area of quadrilateral $ABCD = \frac{1}{2} \times AC\,(DP + BQ)$

$= \frac{1}{2} \times 48 \times (17.5 + 12) = 708\,cm^2$.

7. Diagonals of rhombus $= 18$ cm and 30 cm

Area of rhombus $= \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 18 \times 30 = 270\,cm^2$.

8. Area of cross section 112 m^2



Length of top $= 16$ m

Length of bottom $= 12$ m

$h = ?$

Let distance between them $= x$

Area $= \frac{1}{2} \times$ sum of parallel side $\times$ distance

$$112 = \frac{1}{2}(16+12)\times x \qquad 112 = \frac{28}{2}\times x$$

$$112 = 14x \qquad x = \frac{112}{4} = 8\,\text{cm}$$

The depth of the pool is 8 cm.

9. Side of a regular hexagon $= 10\,\text{m}$

Area of regular hexagon $= \dfrac{3\sqrt{3}a^2}{2} = \dfrac{3\sqrt{3}\times 10\times 10}{2} = 150\sqrt{3}\ \text{m}^2$

$= 150 \times 1.732\ \text{m}^2 = 259.807\ \text{m}^2$.

10. Length of one diagonal $= 20\,\text{cm}$ or 0.2 m

Length of other diagonal $= 28\,\text{cm}$ or 0.28 m

Area of diagonal $= \dfrac{1}{2}\times d_1 \times d_2 = \dfrac{1}{2}\times 0.2 \times 0.28$

$= 0.028\ \text{m}^2$

Number of tiles $= 2550$

Area of total tiles $= 2550\times 0.0280$

$= 71.4\ \text{cm}^2$ or $71.4\ \text{m}^2$

Cot of polishing = ` 25 per m^2

Cost of total area polishing = ` $71.4 \times 25$ = ` 1785.

Multiple Choice Questions

Tick (3) the correct answer :

1. (b) **2.** (c) **3.** (c) **4.** (c) **5.** (d) **6.** (b) **7.** (c)

13 Surface Area and Volume

Exercise 13.1

1. Length of rectangular hall $= 30\,\text{m}$

breadth of rectangular hall $= 25\,\text{m}$

Height of rectangular hall $= 18\,\text{m}$

Surface area of rectangular hall $= 2(lb + bh + lh)$

$2(30\times 25 + 25\times 18 + 18\times 30)\,\text{m}^2$

$2\times(750+450+540)\,\text{m}^2 \qquad 2\times 1740\,\text{m}^2 = 3480\,\text{m}^2$

Cost of painting outer surface $= 3480\times 12 =$ ` 41760.

2. Diameter of the cylindrical wheel of road roller

$= 98\,\text{cm}$ or 0.98 m

Radius $= (0.98 \div 2) = 0.49$ m

Length of the cylindrical wheel of road roller $= 1.25$ m

Surface area of wheel of road roller $= 2\pi r h$

$= 2\times \dfrac{22}{7}\times 0.49 \times 1.25 = 3.85\ \text{m}^2$

Number of revolutions to more one to level of a road $= 900$

The area of road $= 3.85 \times 900 \text{ m}^2 = 3465 \text{ m}^2$.

3. Total surface area $= 3750 \text{ m}^2$

We know that; total surface area of a cube $= 6l^2$

$$3750 = 6l^2 \qquad l^2 = \frac{3750}{6}$$

$$l^2 = 625 \qquad l = 25$$

Thus, side of a cube is 35 m.

4. Dimensions of a cuboidal box $= 8m \times 7.5 \text{ m} \times 6 \text{ m}$

$$l = 8 \text{ m},\ b = 7.5 \text{ m},\ h = 6 \text{ m}$$

Total surface area $= 2(lb + bh + lh)$

$$= 2(8 \times 7.5 + 7.5 \times 6 + 8 \times 6) \text{ m}^2$$

$$= 2 \times (60 + 45 + 48) \text{ m}^2 = 2 \times 153 \text{ m}^2 = 306 \text{ m}^2$$

Area of bottom of the box $= 8 \times 7.5 = 60 \text{ m}^2$

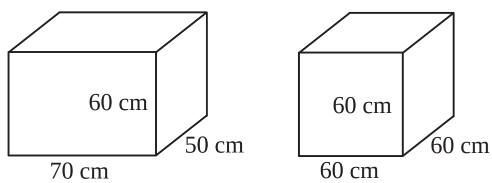
He painted the box $= (306 - 60) \text{ m}^2 = 246 \text{ m}^2$.

5. Surface area of first box $= 2(lb + bh + hl)$

$$= 2(70 \times 50 + 50 \times 60 + 60 \times 70)$$

$$= 2(3500 + 3000 + 4200)$$

$$= 2 \times 10700 = 21400 \text{ cm}^2$$



Surface are of a second box $= 6 \times \text{side}^2 = 6 \times (60)^2$

$$= 6 \times 3600 = 21600 \text{ cm}^2$$

Thus, cube required more materials to make.

6. Diameter of a circular well $= 3.5$ m; radius $= \frac{3.5}{2} = 1.75$ m

Depth of the well $(h) = 15$ m

Area of circular well $= 2\pi rh = 2 \times \frac{22}{7} \times 1.75 \times 15 \text{ m}^2 = 165 \text{ m}^2$

Cost of plastering inner curved surface = ` 165 × 25 = ` 4125.

7. (i) figure is cylinder and (ii) figure is cube.

Area of cylinder $= 2\pi rh = 2 \times \frac{22}{7} \times \frac{9}{2} \times 9 \text{ m}^2 = 254.54 \text{ m}^2$

Area of surface area of cube $= 4 \times \text{side}^2 = 4 \times 9^2 = 4 \times 81 = 324 \text{ m}^2$

No, the lateral surface areas not same.

8. Height of a cylindrical tank $= 8$ m

radius of a cylindrical tank $= 3.5$ m

Area of required material sheet $(2\pi r^2 + h\ (2\pi r))$

$$= 2\times\frac{22}{7}\times(3.5)^2 + 8\left(2\times\frac{22}{7}\times 3.5\right)$$

$$= 2\times\frac{22}{7}\times 12.25 + 8\times 44\times 0.5 = \frac{539}{7} + 176$$

$$= 77 + 176\,\text{m}^2 = 253\,\text{m}^2$$

Cost of required material sheet = ` $(253\times 130)$ = ` 32890.

9. Length of a chocolate box $= 50$ cm or 0.5 m

Breadth of a chocolate box $= 35$ cm or 0.35

Height of a chocolate box $= 10$ cm or 0.1 m

Surface area of chocolate box $= 2(lb + bh + hl)$

$$= 2(0.5\times 0.35 + 0.35\times 0.1 + 0.1\times 0.5)$$
$$= 2\times(0.175 + 0.035 + 0.05)$$
$$= 2\times 0.26 = 0.52\ \text{m}^2$$

Number of boxes $= 60$

Required wrapping material $= 60\times 0.52 = 31.2\ \text{m}^2$.

10. length of a room $= 150$ m, breadth of a room $= 25$ m, height of a room $= 6$ m

Area of a roof $= l\times b = 150\times 25 = 3750\,\text{m}^2$

Area of the four walls of a room $= 2(l+b)\times h = 2(150+25)\times 6$

$$= 2\times 175\times 6 = 2100\,\text{m}^2$$

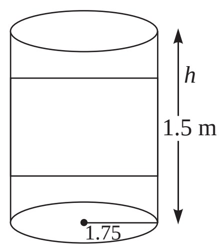
Area of roof and walls $= 3750 + 2100\,\text{m}^2 = 5850\,\text{m}^2$

Cost paint roof and walls = ` $5850\times 20$ = ` 117000

Area of flour $= l\times b = 150\times 25 = 3750\,\text{m}^2$

Cost of polishing floor = ` $3750\times 40$ = ` 150000.

11. Area of cylindrical pillar whose height $= 7.5$ m



Height $= 7.5 - (0.25\times 2) = 7$ m

Diameter $= 3.5$ m

Radius $= 1.75$ m

Surface area of cylindrical pillar $= 2\pi rh$

$$= 2\times\frac{22}{7}\times 1.75\times 7 = 77\,\text{m}^2.$$

12. Length of a class room $= 7$ m

Breadth of a class room $= 6$ m

Height of class room $= 4$ m

Area of roof $= l\times b = 7\times 6 = 42\,\text{m}^2$

Area of 4 walls $= 2(l+b)\times h$

$$= 2(7+6)\times 4 = 2\times 13\times 4 = 104\,\text{m}^2$$

Total area of roof and walls $= (42+104)\,\text{m}^2 = 146\,\text{m}^2$

Area of doors and windows $= 7\,\text{m}^2$

Remaining area $= 146 - 7\,\text{m}^2 = 139\,\text{m}^2$

Cost of white washing = ` $139\times 15\,\text{m}^2$ = ` 2085.

Exercise 13.2

1. Let length of cube II $= x$ cm; cube I $= 2x$ cm

volume of cube II $= x^3 \text{ cm}^3$

volume of cube I $= 8x^3 \text{ cm}^2$

Ratio of volume cube I to cube II $= \dfrac{8x^3}{x^3} = 8 : 1.$

2. Length of first cube $= 18$ cm

Volume of first cube $= 18 \times 18 \times 18 \text{ cm}^3 = 5832 \text{ cm}^3$

Length of second cube $= 24$ cm

Volume of second cube $= 24 \times 24 \times 24 \text{ cm}^3 = 13824 \text{ cm}^3$

Length of third cube $= 30$ cm

Volume of third cube $= 30 \times 30 \times 30 \text{ cm}^3 = 27000 \text{ cm}^3$

Sum of volume $= 5832 + 13824 + 27000 \text{ cm}^3 = 46656 \text{ cm}^3$

Side of cube $= \sqrt[3]{\text{Volume}} = \sqrt[3]{46656} = 36$ cm.

3. Diameter of well $= 7$ m; radius of well $= 7 \div 2 = 3.5$ m

Height of well $= 20$ m

Volume of well $= \pi r^2 h = \dfrac{22}{7} \times (3.5)^2 \times 20 = \dfrac{22}{7} \times 3.5 \times 3.5 \times 20$

$= 22 \times 0.5 \times 3.5 \times 20 = 770 \text{ m}^3$

Length of rectangular plot $= 14$ m

Breadth of rectangular plot $= 11$ m

Let height of rectangular plot $= x$ m

volume $= l \times b \times h$ $\quad 770 = 14 \times 11 \times x$

$x = \dfrac{770}{14 \times 11} = 5$ m.

4. Water flows out of a pie in 1 sec $= 30$ cm

Area of cross section the tap $= 5 \text{ cm}^2$

Water flows out in 1 hrs $= 30 \times 5 \times 3600 = 540000 \text{ cm}^3$ $\quad$ (1000 cm $= 1L$)

$\dfrac{540000}{1000} = 540$ L.

5. Volume of hall $= l \times b \times h = 150 \times 85 \times 12 \text{ m}^3 = 153000 \text{ m}^3$

Number of people can sit in the hall $= 153000 \div 50 = 3060.$

6. Volume of external cuboid box $= 36 \times 25 \times 16.5 \text{ cm}^3 = 14850 \text{ cm}^3$

length of internal box $= 36 - 1.5 \times 2 = 33$ cm

breadth of internal box $= 25 - 1.5 \times 2 = 22$ cm

height of internal box $= 16.5 - 1.5 \times 2 = 13.5$ cm

Volume $= 33 \times 22 \times 13.5 \text{ cm}^2 = 9801 \text{ cm}^3$

Volume of aluminium required $= 14850 \text{ cm}^2 - 9801 \text{ cm}^3$

$= 5049 \text{ cm}^2$

So, weight of aluminium $= 5049 \times 4.5$ g

$$= 22720.5 \text{ g}$$
$$= 22.7205 \text{ kg.}$$

7. Dimensions of a water tank $= 10\,\text{m} \times 7.5\text{ m} \times 4\text{ m}$

$$\text{Volume of a water tank} = l \times b \times h = 10 \times 7.5 \times 4\text{ m}^3 = 300\,\text{m}^3$$
$$\text{Convert into } l = 300 \times 1000 = 300000\,l$$
$$\text{rate of fill the tank} = 400\,l \text{ per min}$$
$$\text{Time} = \frac{300000}{400}$$
$$= 750\,\text{min or } 12\,\text{hrs } \frac{1}{2} \text{ min or } 12\frac{1}{2} \text{ hrs.}$$

8. Find the volume of a cube of.

(a) Side $= 15\,\text{cm}$

Volume of a cube $= (\text{side})^3 = 15 \times 15 \times 15\,\text{cm}^3 = 3375\,\text{cm}^3$.

(b) Side $= 9.5\,\text{m}$

Volume of cube $= (\text{side})^3 = 9.5 \times 9.5 \times 9.5\text{ cm}^3 = 857.375\text{ cm}^3$.

9. Side of one cube $= 6\,\text{cm}$

Volume of cube $= (\text{side})^3 = 6 \times 6 \times 6\,\text{cm}^3 = 216\,\text{cm}^3$

Number of cubes $= 6$

Volume of New solid $= 6 \times 216\,\text{cm}^3 = 1296\,\text{cm}^3$.

10. Clocks size $= 5\,\text{cm} \times 10\text{ cm} \times 10\text{ cm}$

Volume of clock $= 0.05 \times 0.1 \times 0.1\text{ m}^3 = 0.0005\text{ m}^3$

$$\text{volume of box} = 1\,\text{m} \times \frac{1}{2}m \times \frac{3}{4}m = \frac{3}{8} = 0.375\text{ m}^3$$

$$\text{Number of clock put in box} = \frac{0.375}{0.0005} = 750\,\text{clock.}$$

11. Volume of well $= 594\,\text{m}^3$; Diameter of well $= 6\,\text{m}$

Radius of well $(r) = 3\,\text{m}$; Depth of well $(h) = x$

Volume of well $= \pi r^2 h$

$$594 = \frac{22}{7} \times 3 \times 3 \times h \qquad 594 = \frac{198}{7} \times h$$
$$h = \frac{594 \times 7}{198} = 21$$

Depth of well is 21 cm.

12. Height of cylinder $= 22\,\text{cm}$

Circumference of cylinder $= 44\text{ cm}$

$$2\pi r = 44$$
$$2 \times \frac{22}{7} \times r = 44 \qquad r = \frac{44 \times 7}{44} = 7\,\text{cm}$$
$$\text{Volume} = \pi r^2 h = \frac{22}{7}(7)^2 \times 22$$

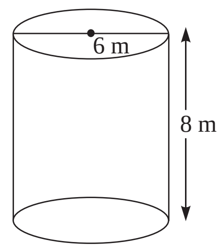
$$= \frac{22}{7} \times 7 \times 7 \times 22 = 3388 \text{ cm}^3$$

$$\text{Total surface area} = 2\pi r(h + r) = 2 \times \frac{22}{7} \times 7(22 + 7)$$

$$= 2 \times 22 \times 29$$

$$= 44 \times (29) = 1276 \text{ cm}^2.$$

13. Radius of each coin $= 0.75$ cm



Thickness of coin $(h) = 0.2$ cm

$$\text{Volume of each coin} = \pi r^2 h$$

$$= \frac{22}{7} \times 0.75 \times 0.75 \times 0.2 \text{ cm}^3$$

$$= 0.3536 \text{ cm}^3$$

Height of cylinder $= 8$ cm

Diameter of base $= 6$ cm

Radius $= 3$ cm

$$\text{Volume of cylinder} = \pi r^2 h = \frac{22}{7} \times 3 \times 3 \times 8 = 226.29 \text{ cm}^3 \text{ or } 226.30$$

$$\text{Number of coins required} = \frac{226.29}{0.3536} = 639.96 \text{ or } 640 \text{ coins.}$$

14. Find the total surface area curved surface area and volume of a cylinder of dimension.

(a) $r = 7$ cm and $h = 40$ cm

The total surface area $= 2\pi r(h + r)$

$$\text{Total surface area} = 2 \times \frac{22}{7} \times 7(40 + 7) = 2068 \text{ cm}^2$$

$$\text{Curved surface area} = 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 40 \text{ cm}^2 = 1760 \text{ cm}^2$$

$$\text{Volume of cylinder} = \pi r^2 h = \frac{22}{7} \times (7)^2 \times 40$$

$$= \frac{22}{7} \times 7 \times 7 \times 40 = 6160 \text{ cm}^3.$$

(b) $r = 2.8$ m and $h = 1.5$ m

$$\text{The total surface area} = 2\pi r(h + r) = 2 \times \frac{22}{7} \times 2.8\ (2.8 + 1.5)$$

$$= 2 \times 22 \times 0.4 \times 4.3 = 75.68 \text{ cm}^2$$

$$\text{Curved surface area} = 2\pi rh = 2 \times \frac{22}{7} \times 2.8 \times 1.5$$

$$= 2 \times 22 \times 0.4 \times 1.5 = 26.4 \text{ cm}^2$$

$$\text{Volume of cylinder} = \pi r^2 h = \frac{22}{7} \times (2.8)^2 \times 1.5$$

$$= \frac{22}{7} \times 2.8 \times 2.8 \times 1.5 = 36.96 \text{ cm}^3.$$

15. Find the volume of a cuboid of dimensions :

(a) $l = 30\,\text{cm}$, $b = 15\,\text{cm}$ and $h = 12\,\text{cm}$

Volume $= l \times b \times h$

Volume $= 30 \times 15 \times 12\,\text{cm}^3 = 5400\,\text{cm}^3$

(b) $l = 1.5$ cm, $b = 95$ cm or 0.95 m

$h = 0.5$ cm or 0.05

Volume $= l \times b \times h$

Volume $= 0.95 \times 0.5 \times 1.5 = 0.007125\ \text{m}^3$.

Multiple Choice Questions

Tick (3) the correct answer :

1. (d) **2.** (c) **3.** (d) **4.** (d) **5.** (b) **6.** (c) **7.** (b) **8.** (a)

High Order Thinking Skills

1. Dimensions of cuboid $= a \times b \times c\ (l = a, b = b, c = h)$

volume $= a \times b \times c = abc\ \text{cm}^3$

$$\frac{1}{V} = \frac{2}{S}\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right) \qquad V = l \times b \times h;\quad S = 2(lb + bh + lh)$$

$$\frac{1}{V} = \frac{2}{S}\left(\frac{bc + ac + ba}{abc}\right) = \frac{2(bc + ac + ba)}{S \times abc} = \frac{2(bc + ac + ba)}{2(bc + ac + ca) \times abc} = \frac{1}{abc} = \frac{1}{V}.$$

2. Dimensions of Box I $= 4\,\text{cm} \times 9\,\text{cm} \times 15\,\text{cm} = 540\,\text{cm}^3$

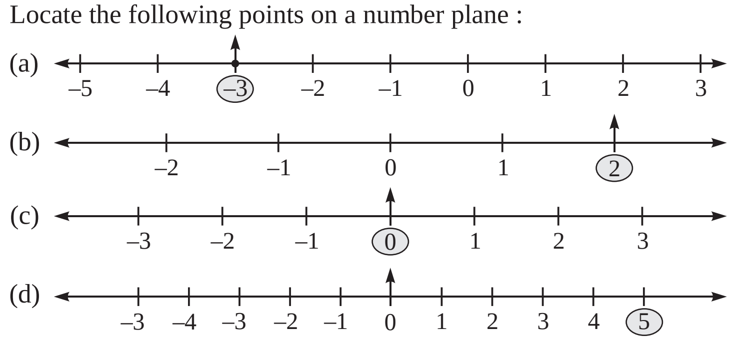
Dimensions of Box II $= 6\,\text{cm} \times 6\,\text{cm} \times 11.25\ \text{cm} = 405\,\text{cm}^3$

Box I is more for economical because more chocolates put in it.

14 Introduction to Line Graphs

Exercise 14.1

1. Locate the following points on a number plane :



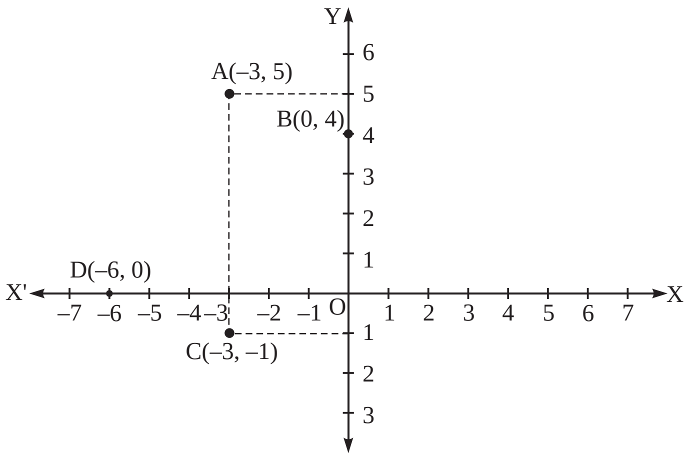
2. (a) The ordinate of $(1, -2) = -2$ (b) The ordinate of $(-3, -4) = -4$

(c) The ordinate of $(6, 2) = 2$ (d) The ordinate of $(4, -3) = -3$

3. Determine the quadrants in which is the following points lie :

(a) $P(-3, 4)$: coordinate of $(-, +)$ lie in the II quadrant.
(b) $Q(3, -4)$ coordinate of $(+, -)$ line in the IV quadrant.
(c) $R(-1, -2)$ coordinate of $(-, -)$ line in the III quadrant.
(d) S (1, 1) coordinate of $(+, +)$ lie in the I quadrant.

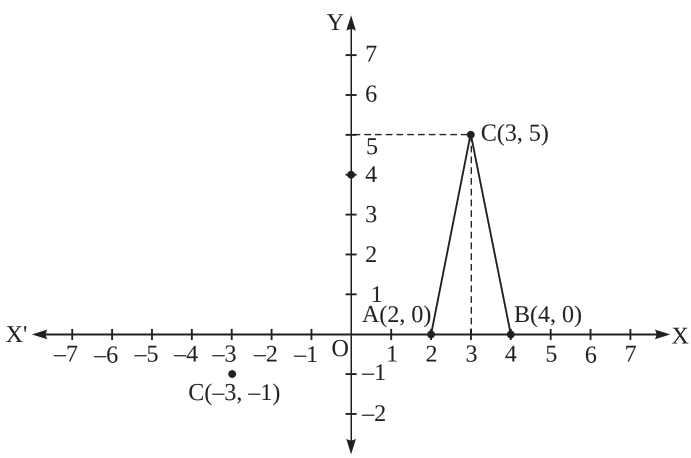
4.



5. (a) Ordered pair : $(-2, 0)$ (b) Ordered pair : $(4, -6)$.

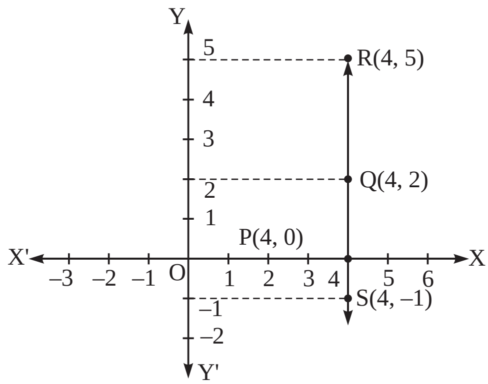
6. (b) (4, 0) points lie on the X-axis.

7.



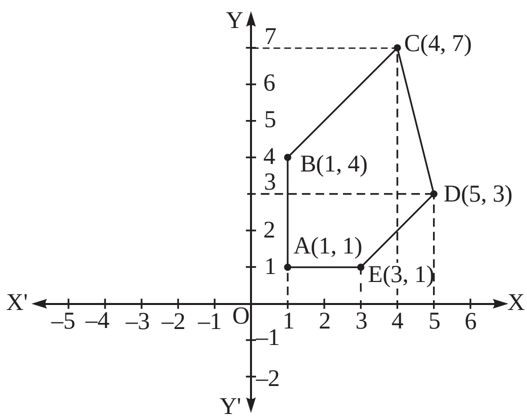
8. The co-ordinates of point $L(3, 1)$
The co-ordinates of point M $(-3, 2)$
The co-ordinates of point N $(-3, -3)$
The co-ordinates of point P $(4, -2)$.

9.

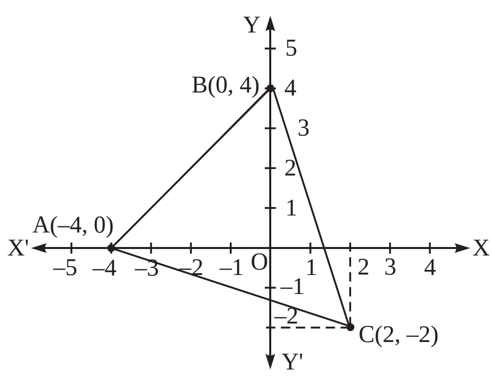


Yes, They are collinear.

10.

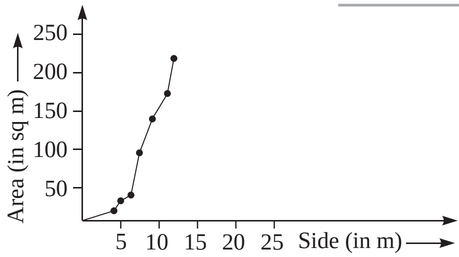


11.

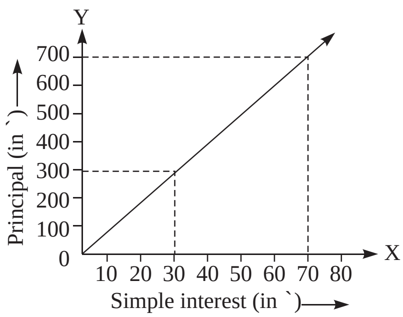


Exercise 14.2

1.



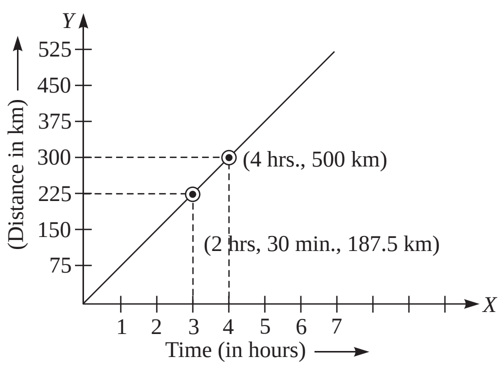
2.



(a) If investment = ` 300 then interest = ` 30.

(b) If interest = ` 70 then investment ` 700.

3. Speed = 75 km/h



We know the you a moving object

Distance (d) = Speed (s) × time (t)

Train speed = 75 km/hr

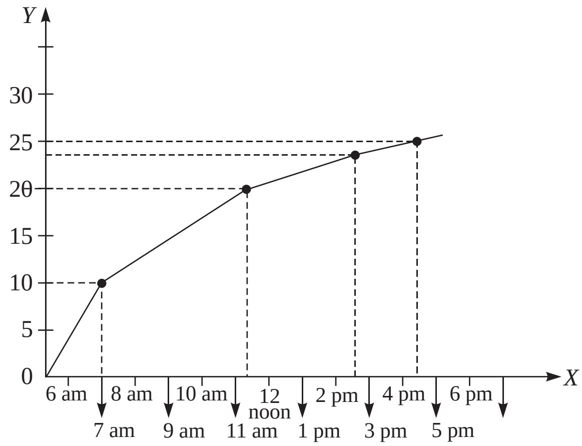
Time hours	1	2	3	4	5
distance (d)	75	150	225	300	375

(a) Distance covered in 2 hrs = 150 km

Distance covered in 2 hrs 30 min = 150 + 37.5 = 187.5 km

(b) Time take to covered 300 km = 4 hrs.

4.

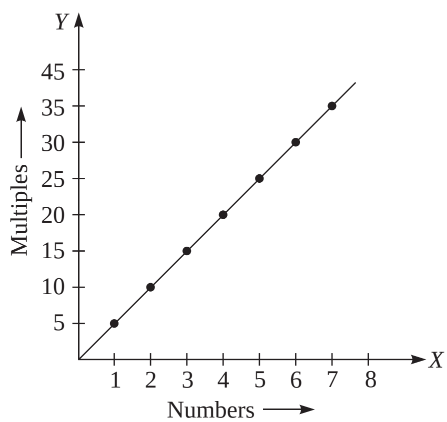


(a) Temperature at 7 am = 10°C.
(b) Temperature at 1 pm = 24°C.
(c) 11 : 24 am when temperature was 20°C.
(d) 2 : 24 pm when temperature was 25°C.

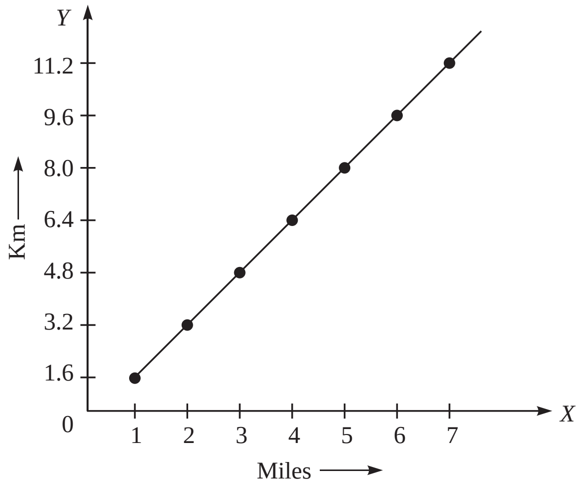
5. Draw table of multiples of 5 :

1	2	3	4	5	6	7
5	10	15	20	25	30	35

Line graph :

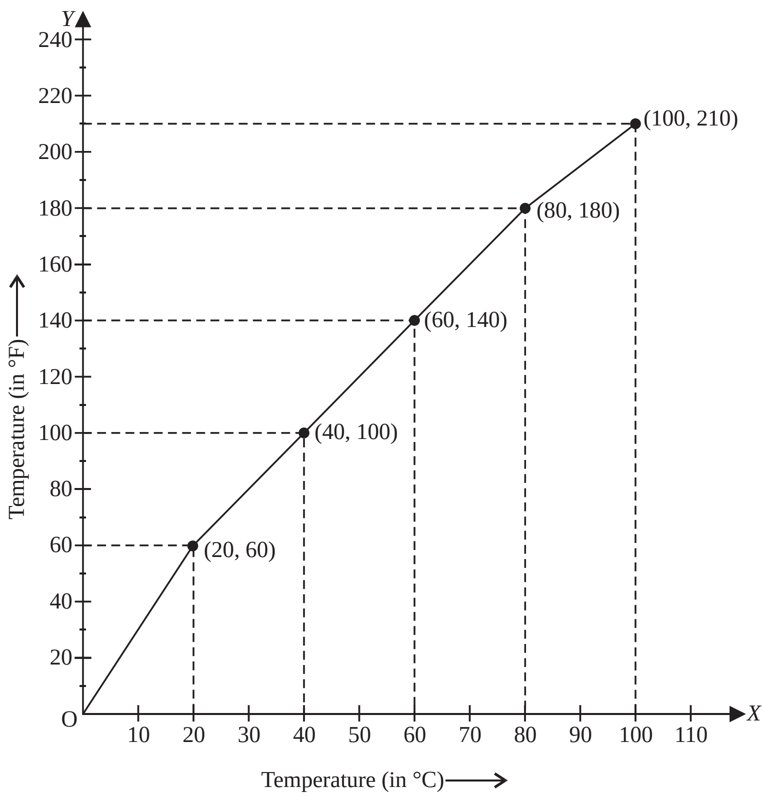


6.

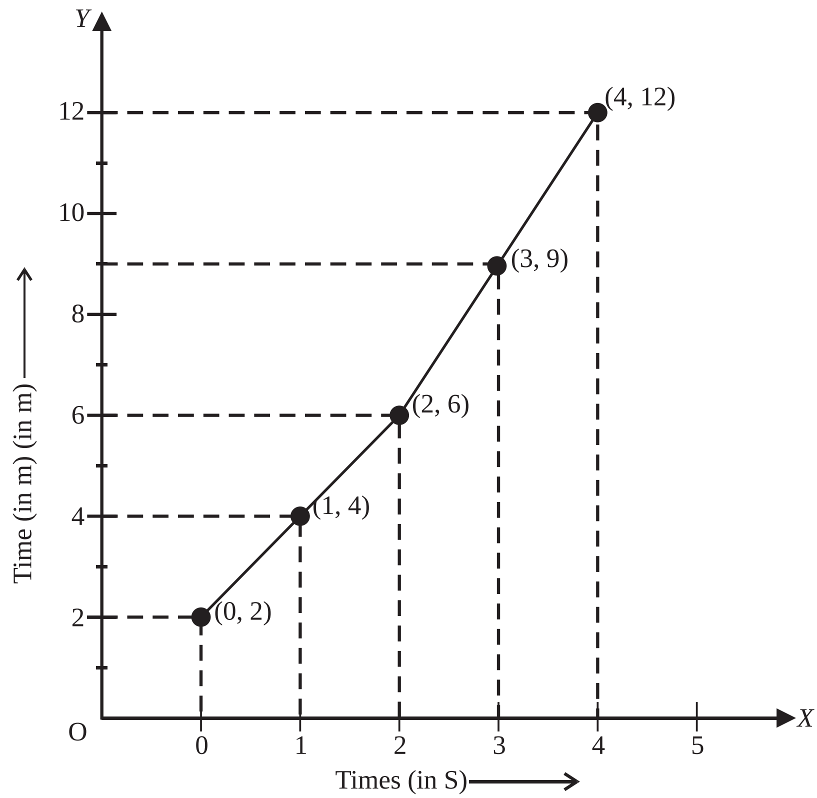


Mile : 1	2	3	4	5	6	7
Km : 1.6	3.2	4.8	6.4	8.0	9.16	11.2

7.



8.



Multiple Choice Questions

Tick (3) the correct answer.

1. (a)
2. (c)
3. (d)
4. (b)
5. (b)

15 Data Handing

Exercise 15.1

1.

No. of Paper Mills	Tally Marks	Frequency
1	$\cancel{||||}$ ||||	9
2	$\cancel{||||}$ $\cancel{||||}$ |||	13
3	|||	3

2. (a) Ascending order.
2, 5, 8, 10, 10, 10, 11, 12, 14, 15, 16, 16, 17 19, 19, 20, 20, 20, 20, 21, 21, 22, 23, 23, 24, 25, 25, 25, 25, 28, 28, 29, 30, 30, 30

(b) The highest marks $= 30$ (c) The lowest marks $= 2$

(d) Range $= 30 - 2 = 28$

(e) Number of failed student $= 7$

(f) Number of student scored above 25 marks $= 6$ students.

3.

Ages of patient	Tally marks	Number of patients
3	|	1
4	|	1
5	|	1
8	|	1
9	|	1
12	$\cancel{||||}$	5
13	|	1
14	|	1
15	|	1
16	|	1
21	|	1
24	|	1
25	|	1
26	|	1
30	|	1
32	|	1
34	|	1
35	|	1
38	|	1
39	||	2

(a) The age of youngest patient is 3 year.

(b) 12 age. (c) Number of patients $= 6$

4.

Marks	Tally Marks	Frequency
0-20	𝍸 |	6
20-40	𝍸𝍸 ||||	14
40-60	𝍸𝍸𝍸	15
60-80	𝍸𝍸𝍸	15
80-100	𝍸𝍸	10`

(a) Class Mark $= \frac{80+100}{2} = \frac{180}{2} = 90.$ (b) Class size $= 80-60 = 20.$

(c) 40 upper limit of class $20-40.$

(d) 15 is the frequency of class $40-60.$

5.

Heights (in cm)	Tally Marks	Frequency(No. of Workers)
125-130		0
130-135	||||	4
135-140	𝍸 |	6
140-145	𝍸 |||	8
145-150		0
150-155	𝍸	5
155-160	𝍸	5
160-165	||	2

Rage $= 162 - 130 = 32$

6. (a) Sale of cars in year 2011. (b) The sale was least in April.

(c) The sale was highest in July.

(d) In the month of January, June, September and December 15 cars were sold.

(e) Total cars sold in the last quarter of the year $= 35 + 10 + 15 = 60.$

7. (a) Cheetah runs the fastest.

(b) Cheetah 20 km/h $(90-70)$ faster then a horse.

(c) Speed of animal of represent vertical axis.

(d) Speed of dog $= 60$ km/h

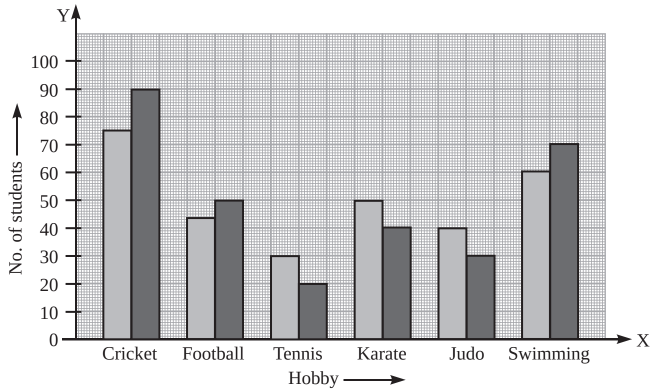
Speed of cat $= 50$ km/h Ratio $= 60 : 50 = 6 : 5.$

8. (a) The performance of the student is better than the class average in English, Sanskrit and Maths.

(b) In Hindi and Social Studies, the performance of the student is worse than the class average.

(c) In Science, the performance of the student is equal to the class average.

9.



(a) Cricket is more popular in school B.
(b) Karate is more popular in school *A*.
(c) Tennis is least popular in school *B*.
(d) Total number of students in school *A*.

$$= 75 + 45 + 30 + 50 + 40 + 60 = 300$$

Total number of students in school *B*.

$$= 90 + 50 + 20 + 40 + 30 + 70 = 300$$

Student % prefer swinging in school $A = \frac{60}{300} \times 100 = 20\%$.

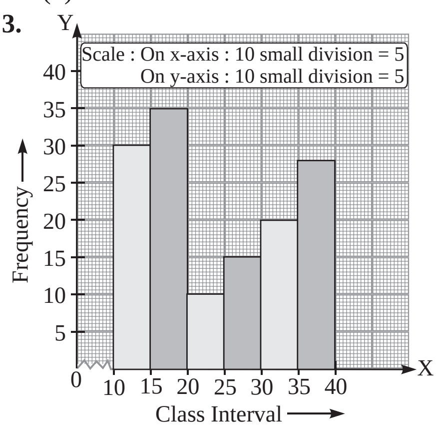
Student % perefer swinging in school $B = \frac{70}{300} \times 700 = 23.33\%$.

Exercise 15.2

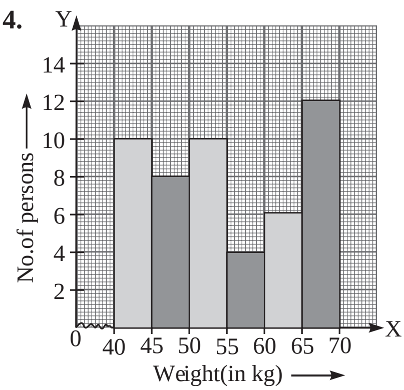
1. (a) 2 students scored less than 10 marks. (b) class size $= 20 - 10 = 10$.
(c) Number of failures $= 2 + 6 + 10 + 3 = 21$.

2. (a) Class size $= 40 - 20 = 20$.
(b) Maximum earning group is 60-80 (in `).
(c) Minimum earning group is 0-20 (in `).
(d) 18.

3.



4.



(a) 65-70 (b) 5 (c) 55-60.

5. (a) Kapil spends the largest amount of his pocket money in Enterainment.

(b) Fraction of his pocket money does he save $= \frac{1}{4}$.

(c) 25% percentage of his money is spent on books and stationery.

(d) Saving = ` $360 \times \frac{1}{4}$ = ` 90

Expenditure = ` $(360 - 90)$ = ` 270

Ratio $= 270 : 90 = 3 : 1$.

6. (a) The most scored subject is Maths.

(b) The least scored subject is Hindi.

(c) The central angle of the subject s.st $= \frac{20}{100}$ of $360° = \frac{20}{100} \times 360 = 72°$.

(d) For English $= 25\%$ of x

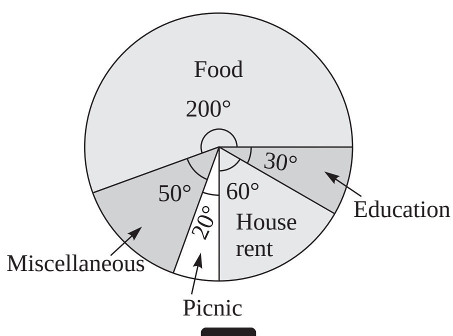
$$x \times \frac{25}{100} = 270 \qquad x = \frac{270 \times 100}{25} = 1080.$$

In Maths students $= 1080 \times 30\% = 324$.

7. We first have to find out the central angle of each sector.

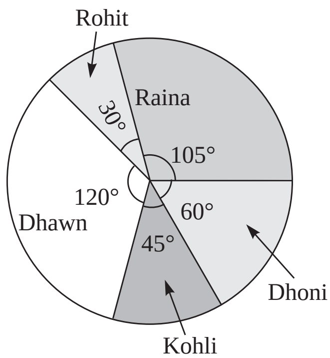
The total sale is ` 7200

Item	Amount spent	Fraction of the Total	Angle of the sector
Education	600	$\frac{600}{7200} = \frac{1}{12}$	$\frac{1}{12} \times 360° = 30°$
Food	4000	$\frac{4000}{7200} = \frac{5}{9}$	$\frac{5}{9} \times 360° = 200°$
House rent	1200	$\frac{1200}{7200} = \frac{1}{6}$	$\frac{1}{6} \times 360° = 60°$
Picnic	400	$\frac{400}{7200} = \frac{1}{18}$	$\frac{1}{18} \times 360° = 20°$
Miscellaneous items	1000	$\frac{1000}{7200} = \frac{5}{36}$	$\frac{5}{36} \times 360° = 50°$



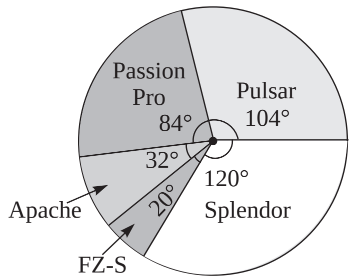
8.

Player	Number of Students	Fraction of the Total	Angle of the sector
Raina	7	$\frac{7}{24}$	$\frac{7}{24} \times 360° = 105°$
Dhoni	4	$\frac{4}{24}$	$\frac{4}{24} \times 360° = 60°$
Kohli	3	$\frac{3}{24}$	$\frac{3}{24} \times 360° = 45°$
Dhawan	8	$\frac{8}{24}$	$\frac{8}{24} \times 360° = 120°$
Rohit	2	$\frac{2}{24}$	$\frac{2}{24} \times 360° = 30°$
	24		360°



9.

Type of bikes	Number of Bikes	Fraction of the Total	Angle of the Sector
Pulsar	26	$\frac{26}{90}$	$\frac{26}{90}$ of 360° = 104°
Splendor	30	$\frac{30}{90}$	$\frac{30}{90}$ of 360° = 120°
FZ-S	5	$\frac{5}{90}$	$\frac{5}{90}$ of 360° = 20°
Apache	8	$\frac{8}{90}$	$\frac{8}{90}$ of 360° = 32°
Passion Pro	21	$\frac{21}{90}$	$\frac{21}{90}$ of 360° = 84°
Total	90		360°



Multiple Choice Questions

1. (a) 2. (d) 3. (d) 4. (b) 5. (a) 6. (d)

16 Probability

Exercise 16

1. Words : CHEMISTRY

Number of words $= 9$ choose letter $= Y$

Probability $= \frac{1}{9}$

2. Total Number of family $= 100$

Favourabe out come $= 35$

Probability $= \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{35}{100}$ or $\frac{7}{20}$

3. (c) buying a bread is not an experiment.

4. (a) When two dice are rolled out together, then sample space

(S) = {(1, 1), (1, 2), (1, 3),(1, 4), (1, 5), (1, 6)
(2, 1), (2, 2), (2, 3), (2, 4), (2, 5) (2, 6),
(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

Total possible outcomes = 36

Favourable outcomes (i.e. sum of both the numbers is 10)

$$= \{(4,6), (5,5), (6,4)\} = 3$$

Probability of getting sum of 10, say $P(A)$,

$$P(A) = \frac{\text{Favourable outcomes}}{\text{Total number of outcomes}} = \frac{3}{36} = \frac{1}{12}$$

Hence, the probability of getting the sum 10 is $\frac{1}{12}$.

(b) Total possible outcomes $= 36$

Favourable Outcome $=$ (sum of both more than 6 and multiple of 3)

$= \{(6, 6) (6, 3), (3, 6), (5, 4) (4, 5)\} = 5$

$$\text{Probability} = \frac{\text{Favourable outcome}}{\text{Total number of outcome}} = \frac{5}{36}.$$

5. Total balls $= 4 + 6 + 5 = 15$

(a) Getting red balls

Red balls $= 6$ Probability $= \frac{6}{15}$ or $\frac{2}{5}$

(b) Getting blue balls; blue balls $= 5$

Probability balls $= \frac{5}{15}$ or $\frac{1}{3}$.

6. (a) Picking a green ball from a bag containing green is not a random experiment.

7. Total number of family $= 400$

(a) Favourable outcome (3 children) $= 74$

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{74}{400} \text{ or } \frac{37}{200}$$

(b) Favourabnle out come (2 children) $= 182$

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{182}{400} \text{ or } \frac{91}{200}.$$

8. Number $= 1, 2, 3, 4, 5, 6, 7, 8$

Odd number $= 1, 3, 5, 7$

Favourable outcomes $= 4$; total outcomes $= 8$

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{4}{8} = \frac{1}{2}.$$

9. Number $= 1, 2, 3, 4, 5$

Total outcomes $= 5$

Favourable outcome $= 1$

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{1}{5}.$$

10. Number days in week $= 7$

Monday $= 1$

Probability of selecting Monday $= \frac{1}{7}$.

11. Number of blocks $= 9$

Red block $= 4$, black block $= 3$, while block $= 2$

(a) Probability of red block $= \frac{4}{9}$

(b) Probability of black block $= \frac{3}{9}$ or $\frac{1}{3}$

(c) Probability of while block $= \frac{2}{9}$

=

(d) Probability of red, white or black blocks

$$\text{Probability} = \frac{9}{9} = 1.$$

Multiple Choice Questions

Tick (3) the correct answer :

1. (d) **2.** (a) **3.** (a) **4.** (d) **5.** (d).

High Order Thinking Skills (HOTS)

1. 3 purple sectors and 2 movie sectors

$$\text{Total sectors} = 3 + 2 = 5$$

$$\text{Probability of purple sectors} = \frac{3}{5}.$$

2. In a single throw of a coin, there are only two possible outcomes, *i.e.*, *heads or tails.*

Sample space (S) = {heads, tails}

When a dice is rolled, there are six possible outcomes, *i.e.*, 1, 2, 3, 4, 5 and 6.

Sample space (S) = {1, 2, 3, 4, 5, 6}

3. Since three coins are tossed, the total number of possible outcomes will be 2^3, *i.e.*, 8. The tree diagram of the sample space is as follows.

(1st coin) (2nd coin) (3rd coin) Sample Space (S)