CBSE NCERT Solutions for Class 8 Mathematics Chapter 1

Back of Chapter Questions

Exercise 1.1

1. Using appropriate properties find.

(i) $-\frac{2}{3}\times\frac{3}{5}+\frac{5}{2}-\frac{3}{5}\times\frac{1}{6}$

(ii) $\frac{2}{5}\times\left(\frac{-3}{7}\right)-\frac{1}{6}\times\frac{3}{2}+\frac{1}{14}\times\frac{2}{5}$

Solution:

(i) $\frac{-2}{3}\times\frac{3}{5}+\frac{5}{2}-\frac{3}{5}\times\frac{1}{6}=\frac{-2}{3}\times\frac{3}{5}-\frac{3}{5}\times\frac{1}{6}+\frac{5}{2}$ (by commutativity)

$=\frac{2}{3}\times\left(\frac{-3}{5}\right)+\left(\frac{-3}{5}\right)\times\frac{1}{6}+\frac{5}{2}$

$=\left(\frac{-3}{5}\right)\left(\frac{2}{3}+\frac{1}{6}\right)+\frac{5}{2}$ (by distributivity)

$=\frac{-3}{5}\times\frac{5}{6}+\frac{5}{2}$

$=\frac{-1}{2}+\frac{5}{2}$

$=\frac{-1+5}{2}$

$=\frac{4}{2}$

$=2$

Hence, $-\frac{2}{3}\times\frac{3}{5}+\frac{5}{2}-\frac{3}{5}\times\frac{1}{6}=2$

(ii) $\frac{2}{5}\times\left(\frac{-3}{7}\right)-\frac{1}{6}\times\frac{3}{2}+\frac{1}{14}\times\frac{2}{5}=\frac{2}{5}\times\left(\frac{-3}{7}\right)+\frac{2}{14}\times\frac{2}{5}-\frac{1}{6}\times\frac{3}{2}$ (by commutativity)

$=\frac{2}{5}\left(\frac{-3}{7}+\frac{1}{14}\right)-\frac{1}{6}\times\frac{3}{2}$ (by distributivity)

$=\frac{2}{5}\left(\frac{-6+1}{14}\right)-\frac{1}{6}\times\frac{3}{2}$

$=\frac{2}{5}\left(\frac{-5}{14}\right)-\frac{1}{2}\times\frac{1}{2}$

$=\frac{2}{5}\times\frac{(-5)}{14}-\frac{1}{4}$

$= \frac{-2}{14} - \frac{1}{4}$

$= \frac{-11}{28}$

Hence, $\frac{2}{5} \times \left(\frac{-3}{7}\right) - \frac{1}{6} \times \frac{3}{2} + \frac{1}{14} \times \frac{2}{5} = \frac{-11}{28}$

2. Write the additive inverse of each of the following

(i) $\frac{2}{8}$

(ii) $\frac{-5}{9}$

(iii) $\frac{-6}{-5}$

(iv) $\frac{2}{-9}$

(v) $\frac{19}{-6}$

Solution:

We know that for any number $a, a + (-a) = 0$, So, $-a$ is called the additive inverse of a.

(i) Additive inverse of $\frac{2}{8}$ is $\frac{-2}{8}$

(ii) Additive inverse of $\frac{-5}{9}$ is $\frac{5}{9}$

(iii) $\frac{-6}{-5} = \frac{6}{5}$

Hence, additive inverse of $\frac{-6}{-5}$ is $\frac{-6}{5}$

(iv) Additive inverse of $\frac{2}{-9}$ is $\frac{2}{9}$

(v) Additive inverse of $\frac{19}{-6}$ is $\frac{19}{6}$

3. Verify that $-(-x) = x$ for

(i) $x = \frac{11}{15}$

(ii) $x = -\frac{13}{17}$

Solution:

(i) The additive inverse of $\frac{11}{15}$ is $-\frac{11}{15}$

Since $\frac{11}{15}+\left(-\frac{11}{15}\right)=0$

$\Rightarrow \frac{11}{15}=-\left(-\frac{11}{15}\right)$

Hence verified.

(ii) The additive inverse of $-\frac{13}{17}$ is $\frac{13}{17}$

Since $-\frac{13}{17}+\left(\frac{13}{17}\right)=0$

$\Rightarrow \frac{13}{17}=-\left(-\frac{13}{17}\right)$

Hence verified.

4. Find the multiplicative inverse of the following.

(i) -13

(ii) $-\frac{13}{19}$

(iii) $\frac{1}{5}$

(iv) $\frac{-5}{8}\times\frac{-3}{7}$

(v) $-1\times\frac{-2}{5}$

(vi) -1

Solution:

As we know that a rational number $\frac{c}{d}$ is the multiplicative inverse of another rational number $\frac{a}{b}$ if $\frac{a}{b}\times\frac{c}{d}=1$

So, $\frac{c}{d}=\frac{b}{a}$

Or we can say that multiplicative inverse of $\frac{a}{b}$ is $\frac{b}{a}$

(i) Multiplicative inverse of -13 is $\frac{-1}{13}$

Since $-13\ \times\frac{-1}{13}=1$

(ii) Multiplicative inverse of $\frac{-13}{19}=\frac{-19}{13}$

Since $\frac{-13}{19}\times\frac{-19}{13}=1$

(ii) Multiplicative inverse of $\frac{1}{5}$ is 5

Since $\frac{1}{5} \times 5 = 1$

(iv) Multiplicative inverse of $\frac{-5}{8} \times \frac{-3}{7} = \frac{15}{56}$ is $\frac{56}{15}$

Since $\frac{15}{56} \times \frac{56}{15} = 1$

(v) Multiplicative inverse of $-1 \times \frac{-2}{5} = \frac{2}{5}$ is $\frac{5}{2}$

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

(vi) Multiplicative inverse of -1 is -1

Since $-1 \times -1 = 1$

5. Name the property under multiplication used in each of the following

(i) $\frac{-4}{5} \times 1 = 1 \times \frac{-4}{5} = \frac{-4}{5}$

(ii) $\frac{-13}{17} \times \frac{-2}{7} = \frac{-2}{7} \times \frac{-13}{17}$

(iii) $\frac{-19}{29} \times \frac{29}{-19} = 1$

Solution:

(i) Multiplicative identity

(ii) Commutative property

(iii) Multiplicative inverse property

6. Multiply $\frac{6}{13}$ by the reciprocal of $\frac{-7}{16}$.

Solution:

The reciprocal of $\frac{-7}{16}$ is $\frac{-16}{7}$

According to the question,

$\frac{-16}{7} \times \frac{6}{13} = \frac{-96}{91}$

Hence, Multiplication of $\frac{6}{13}$ by the reciprocal of $\frac{-7}{16}$

7. Tell what property allows you to compute $\frac{1}{3} \times \left(6 \times \frac{4}{3}\right)$ as $\left(\frac{1}{3} \times 6\right) \times \frac{4}{3}$.

Solution:

By using associative property of multiplication,

$a \times (b \times c) = (a \times b) \times c$

8. Is $\frac{8}{9}$ the multiplicative inverse of $-1\frac{1}{8}$? Why or why not?

Solution:

$-1\frac{1}{8}$ is eqaul to $\frac{-9}{8}$

So, multiplicative inverse of $\frac{-9}{8}$ is $\frac{-8}{9}$

Since, $\frac{-9}{8} \times \frac{-8}{9} = 1$

Hence, $\frac{8}{9}$ is not the multiplicative inverse of $-1\frac{1}{8}$

9. Is 0.3 the multiplicative inverse of $3\frac{1}{3}$? Why or why not?

Solution:

$0.3 = \frac{3}{10}$

As we know, multiplicative inverse of $\frac{a}{b}$ is $\frac{b}{a}$

So multiplicative inverse of $\frac{3}{10}$ is $\frac{10}{3}$

Which is equal to $3\frac{1}{3}$

10. Write.

(i) The rational number that does not have a reciprocal.

(ii) The rational numbers that are equal to their reciprocals.

(iii) The rational number that is equal to its negative.

Solution:

(i) 0

(ii) $1, -1$

(iii) 0

11. Fill in the blanks.

(i) Zero has ________ reciprocal.

(ii) The numbers ________ and ________ are their own reciprocals

(iii) The reciprocal of – 5 is ________.

(iv) Reciprocal of $\frac{1}{x}$, where $x \neq 0$ is ________.

(v) The product of two rational numbers is always a _______.

(vi) The reciprocal of a positive rational number is ________.

Solution:

(i) Zero has no reciprocal

(ii) The numbers 1 and -1 are their own reciprocals

(iii) The reciprocal of -5 is $\frac{1}{-5}$

(iv) Reciprocal of $\frac{1}{x}$, where $x \neq 0$ is x

(v) The product of two rational number is always a rational number.

(vi) The reciprocal of a positive rational number is positive.

Exercise 1.2

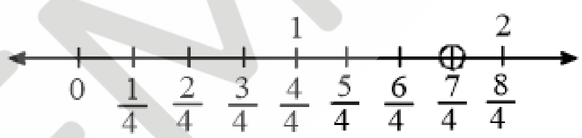
1. Represent these numbers on the number line

(i) $\frac{7}{4}$

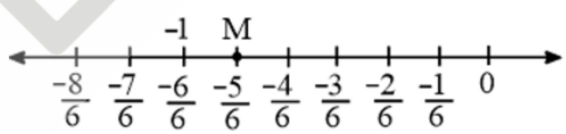
(ii) $\frac{-5}{6}$

Solution:

(i) $\frac{7}{4} = 1\frac{3}{4}$



(ii) Let M $= \frac{-5}{6}$



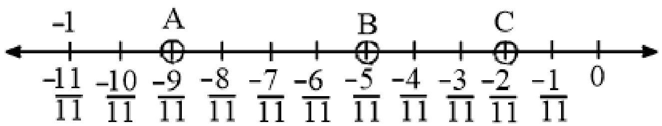
2. Represent $\frac{-2}{11}, \frac{-5}{11}, \frac{-9}{11}$ on the number line.

Solution:

Let $\frac{-2}{11} = C$,

$\frac{-5}{11} = B$ and

$\frac{-9}{11} = A$



3. Write five rational numbers which are smaller than 2.

Solution:

The rational numbers smaller than 2 are

(i) $\frac{1}{3}$

(ii) $\frac{2}{3}$

(iii) $\frac{5}{3}$

(iv) $\frac{4}{3}$

(v) $\frac{1}{2}$

4. Find ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$.

Solution:

Rational numbers are $\frac{-2}{5}$ and $\frac{1}{2}$

Here, L.C.M of 5 and 2 is 10.

So, $\frac{-2}{5} = \frac{-2}{5} \times \frac{2}{2} = \frac{-4}{10}$

Also, $\frac{1}{2} = \frac{1}{2} \times \frac{5}{5} = \frac{5}{10}$

Again, $\frac{-4}{10} = \frac{-4}{10} \times \frac{2}{2} = \frac{-8}{20}$

and, $\frac{5}{10} = \frac{5}{10} \times \frac{2}{2} = \frac{10}{20}$

Hence, $\frac{-2}{5} = \frac{-8}{20}$ and $\frac{1}{2} = \frac{10}{20}$

$\therefore$ Ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$ are $\frac{-7}{20}, \frac{-6}{20}, \frac{-5}{20}, \frac{-4}{20}, \frac{-3}{20}, \frac{-2}{20}, \frac{-1}{20}, 0, \frac{1}{20}, \frac{2}{20}$

5. Find five rational numbers between

(i) $\frac{2}{3}$ and $\frac{4}{5}$

(ii) $\frac{-3}{2}$ and $\frac{5}{3}$.

(iii) $\frac{1}{4}$ and $\frac{1}{2}$

Solution:

(i) $\frac{2}{3}$ and $\frac{4}{5}$

L.C.M. of 3 and 5 is 15

So, $\frac{2}{3} = \frac{2}{3} \times \frac{5}{5} = \frac{10}{15}$

and $\frac{4}{5} = \frac{4}{5} \times \frac{3}{3} = \frac{12}{15}$

Again, $\frac{10}{15} = \frac{10}{15} \times \frac{4}{4} = \frac{40}{60}$

and $\frac{12}{15} = \frac{12}{15} \times \frac{4}{4} = \frac{48}{60}$

Hence, $\frac{2}{3} = \frac{40}{60}$ and $\frac{4}{5} = \frac{48}{60}$

$\therefore$ Five rational numbers bewteen $\frac{2}{3}$ and $\frac{4}{5}$ are $\frac{41}{60}, \frac{42}{60}, \frac{43}{60}, \frac{44}{60}, \frac{45}{60}$

(ii) $\frac{-3}{2}$ and $\frac{5}{3}$

LCM of 2 and 3 is 6

So, $\frac{-3}{2} = \frac{-3}{2} \times \frac{3}{3} = \frac{-9}{6}$

and $\frac{5}{3} = \frac{5}{3} \times \frac{2}{2} = \frac{10}{6}$

Hence, $\frac{-3}{2} = -\frac{9}{6}$ and $\frac{5}{3} = \frac{10}{6}$

$\therefore$ Five rational numbers bewteen $\frac{-3}{2}$ and $\frac{5}{3}$ are $\frac{-2}{6}, \frac{-1}{6}, 0, \frac{1}{6}, \frac{2}{6}$

(iii) $\frac{1}{4}$ and $\frac{1}{2}$

LCM of 4 and 2 is 4

So, $\frac{1}{4} = \frac{1}{4} \times \frac{1}{1} = \frac{1}{4}$

& $\frac{1}{2} = \frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$

Again, $\frac{1}{4} = \frac{1}{4} \times \frac{8}{8} = \frac{8}{32}$

and $\frac{2}{4} = \frac{2}{4} \times \frac{8}{8} = \frac{16}{32}$

Hence, $\frac{1}{4} = \frac{8}{32}$ and $\frac{1}{2} = \frac{16}{32}$

$\therefore$ Five rational numbers bewteen $\frac{1}{4}$ and $\frac{1}{2}$ are $\frac{9}{32}, \frac{10}{32}, \frac{11}{32}, \frac{12}{32}, \frac{13}{32}$.

6. Write five rational numbers greater than – 2

Solution:

The rational numbers greater than -2 are

(i) $\frac{1}{3}$

(ii) $\frac{2}{3}$

(iii) $\frac{5}{3}$

(iv) $\frac{4}{3}$

(v) $\frac{1}{2}$

7. Find ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$.

Solution:

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

LCM of 5 and 4 $= 20$

So, $\frac{3}{5} = \frac{3}{5} \times \frac{4}{4} = \frac{12}{20}$

and $\frac{3}{4} = \frac{3}{4} \times \frac{5}{5} = \frac{15}{20}$

Again, $\frac{12}{20} = \frac{12}{20} \times \frac{8}{8} = \frac{96}{160}$

& $\frac{15}{20} = \frac{15}{20} \times \frac{8}{8} = \frac{120}{160}$

$\therefore$ 10 Rational numbers bewteen $\frac{3}{5}$ and $\frac{3}{4}$ are

$\frac{97}{160}, \frac{98}{160}, \frac{99}{160}, \frac{100}{160}, \frac{101}{160}, \frac{102}{160}, \frac{103}{160}, \frac{104}{160}, \frac{105}{160}, \frac{106}{160}$

♦♦♦

CBSE NCERT Solutions for Class 8 Mathematics Chapter 2

Back of Chapter Questions

Exercise 2.1

1. Solve the equation x – 2 = 7

Solution:

Given $x - 2 = 7$

Add 2 to both sides

$\Rightarrow x - 2 + 2 = 7 + 2$

$\Rightarrow x = 9$

2. Solve the equation y + 3 = 10

Solution:

Given $y + 3 = 10$

Subtract 3 from both sides

$\Rightarrow y + 3 - 3 = 10 - 3$

$\Rightarrow y = 7$

3. Solve the equation 6 = z + 2

Solution:

Given $6 = z + 2$

Subtract 2 from both sides

$\Rightarrow 6 - 2 = z + 2 - 2$

$\Rightarrow 4 = z + 0$

$\Rightarrow z = 4$

4. Solve the equation $\frac{3}{7} + x = \frac{17}{7}$

Solution:

Given $\frac{3}{7} + x = \frac{17}{7}$

Subtract $\frac{3}{7}$ from both sides

$$\Rightarrow \frac{3}{7} + x - \frac{3}{7} = \frac{17}{7} - \frac{3}{7}$$

$$\Rightarrow x + \frac{3}{7} - \frac{3}{7} = \frac{14}{7}$$

$\Rightarrow x + 0 = 2$

$\Rightarrow \ x = 2$

5. Solve the equation 6x $=$ 12

Solution:

Given $6x = 12$

Dividing both sides by 6

$\Rightarrow \frac{6x}{6} = \frac{12}{6}$

$\Rightarrow \ x = 2$

6. Solve the equation $\frac{t}{5} = 10$

Solution:

Given $\frac{t}{5} = 10$

Multiplying both sides by 5

$\Rightarrow 5 \times \frac{t}{5} = 5 \times 10$

$\Rightarrow \ t = 50$

7. Solve the equation $\frac{2x}{3} = 18$

Solution:

Given $\frac{2x}{3} = 18$

Multiplying both sides by 3

$\Rightarrow 3 \times \left(\frac{2x}{3}\right) = 3 \times 18$

$\Rightarrow 2x = 54$

Dividing both sides by 2

$\Rightarrow \frac{2x}{2} = \frac{54}{2}$

$\Rightarrow \ x = 27$

8. Solve the equation $1.6 = \frac{y}{1.5}$

Solution:

Given $1.6 = \frac{y}{1.5}$

Multiplying both sides by 1.5

$\Rightarrow 1.5 \times 1.6 = 1.5 \times \left(\frac{y}{1.5}\right)$

$\Rightarrow 2.4 = y$

$\Rightarrow y = 2.4$

9. Solve the equation 7x – 9 = 16

Solution:

Given $7x - 9 = 16$

Adding 9 on both sides

$\Rightarrow 7x = 16 + 9$

$\Rightarrow 7x = 25$

Dividing both sides by 7

$\Rightarrow x = \frac{25}{7}$

10. Solve the equation 14y – 8 = 13

Solution:

Given $14y - 8 = 13$

Transposing 8 to RHS

$\Rightarrow 14y = 8 + 13$

$\Rightarrow 14y = 21$

Divide by 14 on both sides

$\Rightarrow \frac{14y}{14} = \frac{21}{14}$

$\Rightarrow y = \frac{3}{2}$

11. Solve the equation 17 + 6p = 9

Solution:

Given $17 + 6p = 9$

Transposing 17 to RHS

$\Rightarrow 6p = 9 - 17$

$\Rightarrow 6p = -8$

Dividing both sides by 6

$\Rightarrow \frac{6p}{6} = \frac{-8}{6}$

$$\Rightarrow \ p = -\frac{4}{3}$$

12. Solve the equation $\frac{x}{3} + 1 = \frac{7}{15}$

Solution:

Given $\frac{x}{3} + 1 = \frac{7}{15}$

Transposing 1 to RHS

$$\Rightarrow \frac{x}{3} = \frac{7}{15} - 1$$

$$\Rightarrow \frac{x}{3} = \frac{7}{15} - \frac{15}{15}$$

$$\Rightarrow \frac{x}{3} = \frac{-8}{15}$$

Multiplying both sides by 3

$$\Rightarrow 3 \times \left(\frac{x}{3}\right) = 3 \times \left(\frac{-8}{15}\right)$$

$$\Rightarrow x = \frac{-8}{5}$$

Exercise 2.2

1. If you subtract $\frac{1}{2}$ from a number and multiply the result by $\frac{1}{2}$, you get $\frac{1}{8}$. What is the number?

Solution:

Let the number be x

According to question,

$$\left(x - \frac{1}{2}\right) \times \frac{1}{2} = \frac{1}{8}$$

Multiplying 2 to both sides

$$\Rightarrow \left(x - \frac{1}{2}\right) \times \frac{1}{2} \times 2 = \frac{1}{8} \times 2$$

$$\Rightarrow \left(x - \frac{1}{2}\right) = \frac{1}{4}$$

Adding $\frac{1}{2}$ on both sides.

$$\Rightarrow \ x = \frac{1}{2} + \frac{1}{4}$$

$$\Rightarrow \ x = \frac{3}{4}$$

Hence the number is $\frac{3}{4}$.

2. The perimeter of a rectangular swimming pool is 154 m. Its length is 2 m more than twice its breadth. What are the length and the breadth of the pool?

Solution:

Let the breadth be x m

The length will be $(2x + 2)$m

We know that Perimeter $= 2(l + b)$

Given perimeter of a pool $= 154$ m.

$\Rightarrow 2(2x + 2 + x) = 154$

$\Rightarrow 2(3x + 2) = 154$

$\Rightarrow 3x + 2 = \dfrac{154}{2}$

$\Rightarrow 3x + 2 = 77$

$\Rightarrow 3x = 77 - 2$ [transposing 2 to RHS]

$\Rightarrow 3x = 75$

$\Rightarrow x = \dfrac{75}{3}$

$\Rightarrow x = 25$

Breadth $= 25$m.

Length $= 2 \times 25 + 2 = 52$m.

Hence, length is 52m and breadth is 25m

3. The base of an isosceles triangle is $\frac{4}{3}$ cm. The perimeter of the triangle is $4\frac{2}{15}$ cm. What is the length of either of the remaining equal sides?

Solution:

Given, Base of triangle $= \frac{4}{3}$ cm.

Perimeter of the triangle $= 4\frac{2}{15}$ cm.

Let the length of equal sides be x cm

Perimeter $= x + x +$ base

$= 2x + \dfrac{4}{3}$

$\Rightarrow 2x + \dfrac{4}{3} = 4\dfrac{2}{15}$

$\Rightarrow\ 2x + \frac{4}{3} = \frac{62}{15}$ (given)

Transposing $\frac{4}{3}$ to RHS

$$\Rightarrow\ 2x = \frac{62}{15} - \frac{4}{3}$$

$$\Rightarrow\ 2x = \frac{62 - 20}{15} = \frac{42}{15}$$

$$\Rightarrow\ 2x = \frac{14}{5}$$

On dividing both sides by 2

$$\Rightarrow\ x = \frac{14}{2 \times 5}$$

$$\Rightarrow\ x = \frac{7}{5}$$

Hence, length of remaining equal sides is $\frac{7}{5}$ cm.

4. Sum of two numbers is 95. If one exceeds the other by 15, find the numbers.

Solution:

Let the smaller number be x

Therefore, other number will be x + 15

Given, Sum of two numbers = 95.

According to question,

$x + (x + 15) = 95$

$\Rightarrow\ 2x + 15 = 95$

Transposing 15 to RHS

$\Rightarrow\ 2x = 95 - 15$

$\Rightarrow\ 2x = 80$

Dividing 2 on both sides

$$\Rightarrow\ \frac{2x}{2} = \frac{80}{2}$$

$\Rightarrow x = 40$

Therefore, the numbers are 40 and 55.

5. Two numbers are in the ratio 5: 3. If they differ by 18, what are the numbers?

Solution:

Let the numbers be 5x and 3x respectively.

Given, $5x - 3x = 18$

$\Rightarrow 2x = 18$

Dividing both sides by 2.

$\Rightarrow \frac{2x}{2} = \frac{18}{2}$

$\Rightarrow x = 9$

First number $= 5x$

$= 5 \times 9 = 45$

Second number $= 3x$

$= 3 \times 9 = 27$

6. Three consecutive integers add up to 51. What are these integers?

Solution:

Given sum of three consecutive integers $= 51$.

Let the three consecutive integer be $x, x + 1$, and $x + 2$.

Sum of these integers $= x + (x + 1) + (x + 2) = 51$

$\Rightarrow 3x + 3 = 51$

Transposing 3 to RHS

$\Rightarrow 3x = 51 - 3$

$\Rightarrow 3x = 48$

On dividing both sides by 3

$\Rightarrow \frac{3x}{3} = \frac{48}{3}$

$\Rightarrow x = 16$

Other numbers are

$x + 1 = 17$

$x + 2 = 18$

Therefore, the consecutive integers are $16, 17$ and 18.

7. The sum of three consecutive multiples of 8 is 888. Find the multiples.

Solution:

Given sum of three consecutive multiples of 8 is 888

Let the three consecutive multiples of 8 be $8x, 8(x + 1), 8(x + 2)$.

Sum of these numbers $= 8x + 8(x + 1) + 8(x + 2) = 888$

$\Rightarrow\ 8(x + x + 1 + x + 2) = 888$

On dividing both sides by 8

$\Rightarrow\ \frac{8(3x + 3)}{8} = \frac{888}{8}$

$\Rightarrow\ 3x + 3 = 111$

$\Rightarrow\ 3x = 111 - 3$

$\Rightarrow\ 3x = 108$

$\Rightarrow\ \frac{3x}{3} = \frac{108}{3}$ [On dividing both sides by 3]

$\Rightarrow\ x = 36$

Smallest multiple $= 8x = 8 \times 36$

$= 288$

Next consecutive multiple $= 8(x + 1) = 8(36 + 1)$

$= 8 \times 37 = 296$

Second next consecutive multiple $= 8(x + 2) = 8(36 + 2)$

$= 8 \times 38 = 304$

Therefore, multiples are $288, 296$ and 304

8. Three consecutive integers are such that when they are taken in increasing order and multiplied by $2, 3$ and 4 respectively, they add up to 74. Find these numbers.

Solution:

Let the three consecutive integers be $x, x + 1$ and $x + 2$

Given, Consecutive integer when multiplied by 2,3,4 respectively, they add up to 74.

According to question,

$2x + 3(x + 1) + 4(x + 2) = 74$

$\Rightarrow\ 2x + 3x + 3 + 4x + 8 = 74$

$\Rightarrow\ 9x + 11 = 74$

On transposing 11 to to RHS,

$\Rightarrow\ 9x = 74 - 11$

$\Rightarrow\ 9x = 63$

On dividing both sides by 9, we get

$\frac{9x}{9} = \frac{63}{9}$

$\Rightarrow x = 7$

Other numbers are

$x + 1 = 8$

$x + 2 = 9$

Therefore, the numbers are $7, 8$ and 9.

9. The ages of Rahul and Haroon are in the ratio $5: 7$. Four years later the sum of their ages will be 56 years. What are their present ages?

Solution:

Given ages of Rahul and Haroon are in ratio $5: 4$.

Let age of Rahul and Haroon will be $5x$ years and $7x$ years respectively.

After 4 Years, the age of Rahul and Haroon will be $(5x + 4)$ and $(7x + 4)$ years respectively.

According to question,

$(5x + 4 + 7x + 4) = 56$

$\Rightarrow\ 12x + 8 = 56$

Transposing 8 to RHS

$\Rightarrow\ 12x = 56 - 8$

$\Rightarrow\ 12x = 48$

Dividing both sides by 12

$$\Rightarrow \frac{12x}{12} = \frac{48}{12}$$

$\Rightarrow x = 4$

Rahul's age $= 5x$

$= 5 \times 4$

$= 20$ years

Haroon's age$= 7x$

$= 7 \times 4$

$= 28$ years

Therefore, Rahul and Haroon's present ages are
20 years and 28 years respectively.

10. The number of boys and girls in a class are in the ratio $7: 5$. The number of boys is 8 more than the number of girls. What is the total class strength?

Solution:

Given ratio of boys and girls in a class $= 7:5$

Let, Number of boys $= 7x$

Number of girls $= 5x$

Given Number of boys = Number of girls $+8$

$\therefore 7x = 5x + 8$

On transposing 5x to LHS

$\Rightarrow 7x - 5x = 8$

$\Rightarrow 2x = 8$

On dividing both sides by 2, we get

$\Rightarrow \frac{2x}{2} = \frac{8}{2}$

$\Rightarrow x = 4$

Number of boys $= 7x = 7 \times 4 = 28$

Number of girls $= 5x = 5 \times 4 = 20$

Total class strength $= 28 + 20$

$= 48$

Therefore, total class strength = 48.

11. Baichung's father is 26 years younger than Baichung's grandfather and 29 years older than Baichung. The sum of the ages of all the three is 135 years. What is the age of each one of them?

Solution:

Let Baichung's father age be x years.

According to question, Baichung's age and his grandfather's age will be $(x - 29)$ and $(x + 26)$ years respectively.

Given sum of ages of all the three = 135 years

$\Rightarrow (x - 29) + x + (x + 26) = 135$

$\Rightarrow 3x - 3 = 135$

On transposing 3 to RHS, we get

$\Rightarrow 3x = 135 + 3$

$\Rightarrow 3x = 138$

On dividing both sides by 3

$\Rightarrow \frac{3x}{3} = \frac{138}{3}$

$\Rightarrow\ x = 46$

Baichung age $= x - 29$

$= 46 - 29$

$= 17$ years

Baichung's father age $= x = 46$ years

Baichung's grandfather's age $= x + 26 = 46 + 26$

$= 72$ years

12. Fifteen years from now Ravi's age will be four times his present age. What is Ravi's present age?

Solution:

Let Ravi's present age be x years.

Fifteen years later, Ravi's age $= (x + 15)$ years

Given,

$x + 15 = 4x$

On transposing x to RHS, we get

$\Rightarrow 15 = 4x - x$

$\Rightarrow 15 = 3x$

Dividing 3 on both sides, we get

$\Rightarrow \frac{15}{3} = \frac{3x}{3}$

$\Rightarrow 5 = x$

Therefore, Ravi's present age $= 5$ years

13. A rational number is such that when you multiply it by $\frac{5}{2}$ and add $\frac{2}{3}$ to the product, you get $-\frac{7}{12}$. What is the number?

Solution:

Let the number be x

According to question,

$\frac{5}{2}x + \frac{2}{3} = \frac{-7}{12}$

on transposing $\frac{2}{3}$ to RHS, we get

$\Rightarrow \frac{5}{2}x = \frac{-7}{12} - \frac{2}{3}$

$\Rightarrow \frac{5}{2}x = \frac{-15}{12}$

On multiplying $\frac{2}{5}$ to both sides, we get

$\Rightarrow x = \frac{-15}{12} \times \frac{2}{5}$

$\Rightarrow x = \frac{-1}{2}$

Therefore, the rational number is $\frac{-1}{2}$

14. Lakshmi is a cashier in a bank. She has currency notes of denominations ₹ 100, ₹ 50 and ₹ 10, respectively. The ratio of the number of these notes is $2:3:5$. The total cash will Lakshmi is ₹ 4,00,000. How many notes of each denomination does she have?

Solution:

Given currency notes are in the ratio $2:3:5$

Let numbers of ₹ 100 notes, ₹ 50 notes, ₹ 10, notes will be $2x, 3x$ and $5x$ respectively.

Amount of ₹ 100 notes = ₹ $(100 \times 2x)$

= ₹ $200x$

Amount of ₹ 50 notes = ₹ $(50 \times 3x)$ = ₹ $150x$

Amount of ₹ 10 notes = ₹ $(10 \times 5x)$ = ₹ $50\,x$

It is given that total amount is ₹ 400000

$\Rightarrow 200x + 150x + 50x = 400000$

$\Rightarrow 400x = 400000$

Dividing 400 to both sides, we get

$\Rightarrow x = 1000$

Number of ₹ 100 notes $= 2x$

$= 2 \times 1000$

$= 2000$

Number of ₹ 50 notes $= 3x$

$= 3 \times 1000$

$= 3000$

Number of ₹ 10 notes $= 5x$

$= 5 \times 1000$

$= 5000$

15. I have a total of ₹ 300 in coins of denomination ₹ 1, ₹ 2 and ₹ 5. The number of ₹ 2 coins is 3 times the number of ₹ 5 coins. The total number of coins is 160. How many coins of each denomination are with me?

Solution:

Given total number of coins are 160.

Let the number of ₹ 5 coins be x.

Given Number of ₹ 2 coins = $3 \times$ number of ₹ 5 coins

$= 3x$

Number of ₹ 1 coins = $160 -$ (number of coins of ₹ 5 and of ₹ 2)

$= 160 - (3x + x)$

$= 160 - 4x$

Amount of ₹ 1 coins = $1 \times (160 - 4x)$

= ₹ $(160 - 4x)$

Amount of ₹ 2 coins = ₹ $(2 \times 3x)$

= ₹ $6x$

Amount of ₹ 5 coins = ₹ $(5 \times x)$

= ₹ $5x$

Given, $(160 - 4x) + 6x + 5x = 300$

$160 + 7x = 300$

on transposing 160 to RHS, we get

$\Rightarrow\ 7x = 300 - 160$

$\Rightarrow\ 7x = 140$

On dividing both sides by 7, we get

$\Rightarrow\ x = \frac{140}{7}$

$\Rightarrow\ x = 20$

Number of ₹ 5 coins = 20

Number of ₹ 1 coins = $160 - 4x = 160 - 4 \times 20$

$= 160 - 80$

$= 80$

Number of ₹ 2 coins = $3x = 3 \times 20 = 60$

16. The organisers of an essay competition decide that a winner in the competition gets a prize of ₹ 100 and a participant who does not win gets a prize of ₹ 25. The total prize money distributed is ₹ 3000. Find the number of winners, if the total number of participants is 63.

Solution:

Given total number of participants are 63

Let the number of winners be x

Therefore, the number of participants who did not win will be $63 - x$

Amount given to the winners $= ₹\ (100 \times x)$

$= ₹\ 100x$

Amount given to the participants who did not win $= ₹\ \left(25(63 - x)\right)$

$= ₹\ (1575 - 25x)$

Given, $100x + (1575 - 25x) = 3000$

$\Rightarrow\ 75x + 1575 = 3000$

On transposing 1575 to RHS, we get

$\Rightarrow\ 75x = 3000 - 1575$

$\Rightarrow\ 75x = 1425$

On dividing both sides by 75, we get

$\Rightarrow\ x = \dfrac{1425}{75}$

$\Rightarrow\ x = 19$

Therefore, the number of winners $= 19$

Exercise 2.3

1. Solve $3x = 2x + 18$ and check your results

Solution:

Given $3x = 2x + 18$

Transposing 2x to LHS

$\Rightarrow 3x - 2x = 18$

$\Rightarrow x = 18$

Verification:

L.H.S: R.H.S:

3x 2x + 18

Substituting $x = 18$,

$3(18) = 54\ 2(18) + 18 = 54$

Hence verified.

2. Solve $5t - 3 = 3t - 5$ and check your results

Solution:

Given $5t - 3 = 3t - 5$

Transposing 3t to LHS

$\Rightarrow 5t - 3 - 3t = -5$

$\Rightarrow (5t - 3t) - 3 = -5$

$\Rightarrow 2t - 3 = -5$

Transposing 3 to RHS

$\Rightarrow 2t = -5 + 3$

$\Rightarrow 2t = -2$

Divide by 2 on both sides

$\Rightarrow \frac{2t}{2} = -\frac{2}{2}$

$\Rightarrow t = -1$

Verification:

L.H.S:

$5t - 3$

$= 5(-1) - 3$

$= -8$

R.H.S:

$3t - 5$

$= 3(-1) - 5$

$= -8$

L.H.S=R.H.S

Hence verified.

3. Solve $5x + 9 = 5 + 3x$ and check your results

Solution:

Given $5x + 9 = 5 + 3x$

Transposing 3x to LHS

$\Rightarrow 5x - 3x + 9 = 5$

$\Rightarrow 2x + 9 = 5$

Transposing 9 to RHS

$\Rightarrow 2x = 5 - 9$

$\Rightarrow 2x = -4$

Dividing both sides by 2

$\Rightarrow x = \frac{-4}{2}$

$\Rightarrow x = -2$

Verification:

L.H.S:

$5x + 9$

$= 5(-2) + 1$

$= -1$

R.H.S:

$5 + 3x$

$= 5 + 3(-2)$

$= -1$

L.H.S=R.H.S

Hence verified.

4. Solve $4z + 3 = 6 + 2z$ and check your results

Solution:

Given $4z + 3 = 6 + 2z$

Transposing 2z to LHS

$\Rightarrow 4z - 2z + 3 = 6$

$\Rightarrow 2z + 3 = 6$

Transposing 3 to RHS

$\Rightarrow 2z = 6 - 3$

$\Rightarrow 2z = 3$

Dividing both sides by 2

$\Rightarrow z = \frac{3}{2}$

Verification:

L.H.S:

$4z + 3$

$= 4\left(\frac{3}{2}\right) + 3$

$= 6 + 3$

$= 9$

R.H.S:

$6 + 2z$

$= 6 + 2\left(\frac{3}{2}\right)$

$= 6 + 3$

$= 9$

L.H.S=R.H.S

Hence verified.

5. Solve $2x - 1 = 14 - x$ and check your results

Solution:

Given $2x - 1 = 14 - x$

Adding x to both sides

$\Rightarrow 2x + x - 1 = 14 - x + x$

$\Rightarrow 3x - 1 = 14$

Adding 1 to both sides

$\Rightarrow 3x - 1 + 1 = 14 + 1$

$\Rightarrow 3x = 15$

Dividing both sides by 3

$\Rightarrow x = \frac{15}{3}$

$\Rightarrow x = 5$

Verification:

L.H.S:

$2x - 1$

$= 2(5) - 1$

$= 9$

R.H.S:

$14 - x$

$= 14 - 5$

$= 9$

L.H.S=R.H.S

Hence verified.

6. Solve $8x + 4 = 3(x - 1) + 7$ and check your results

Solution:

Given $8x + 4 = 3(x - 1) + 7$

$\Rightarrow 8x + 4 = 3x - 3 + 7$

$\Rightarrow 8x + 4 = 3x + 4$

Transposing 3x to LHS

$\Rightarrow 8x - 3x + 4 = 4$

$\Rightarrow 5x + 4 = 4$

Transposing 4 to RHS

$\Rightarrow 5x = 4 - 4$

$\Rightarrow 5x = 0$

$\Rightarrow x = 0$

Verification:

L.H.S:

$8x + 4$

$= 8(0) + 4$

$= 4$

R.H.S:

$3(x - 1) + 7$

$= 3(0 - 1) + 7$

$= -3 + 7$

$= 4$

L.H.S = R.H.S

Hence verified.

7. Solve $x = \frac{4}{5}(x + 10)$ and check your results

Solution:

Given $x = \frac{4}{5}(x + 10)$.

Multiplying both sides by 5

$\Rightarrow 5x = 5 \times \frac{4}{5}(x + 10)$

$\Rightarrow 5x = 4(x + 10)$

$\Rightarrow 5x = 4x + 40$

Transposing 4x to LHS

$\Rightarrow 5x - 4x = 40$

$\Rightarrow \ x = 40$

Verification:

L.H.S:

$x = 40$

R.H.S:

$\frac{4}{5}(x + 10)$

$= \frac{4}{5}(40 + 10)$

$= \frac{4}{5}(50)$

$= 40$

L.H.S = R.H.S

Hence verified.

8. Solve $\frac{2x}{3} + 1 = \frac{7x}{15} + 3$ and check your results

Solution:

Given $\frac{2x}{3} + 1 = \frac{7x}{15} + 3$

Multiply both sides by 15

$\Rightarrow 15 \times \frac{2x}{3} + 15 = 15 \times \frac{7x}{15} + 3 \times 15$

$\Rightarrow 10x + 15 = 7x + 45$

Transposing 7x to LHS

$\Rightarrow 10x - 7x + 15 = 45$

$\Rightarrow \ 3x + 15 = 45$

Subtract 15 from both sides

$\Rightarrow\ 3x + 15 - 15 = 45 - 15$

$\Rightarrow\ 3x = 30$

Divide by 3 on both sides

$\Rightarrow \frac{3x}{3} = \frac{30}{3}$

$\Rightarrow x = 10$

Verification:

L.H.S:

$\frac{2x}{3} + 1$

$= \frac{2(10)}{3} + 1$

$= \frac{23}{3}$

R.H.S:

$\frac{7x}{15} + 3$

$= \frac{7(10)}{15} + 3$

$= \frac{14}{3} + 3$

$= \frac{23}{3}$

L.H.S =R.H.S

Hence verified.

9. Solve $2y + \frac{5}{3} = \frac{26}{3} - y$ and check your results

Solution:

Given $2y + \frac{5}{3} = \frac{26}{3} - y$

Adding y to both sides

$\Rightarrow 2y + y + \frac{5}{3} = \frac{26}{3} - y + y$

$\Rightarrow 3y + \frac{5}{3} = \frac{26}{3}$

Multiplying both sides by 3

$\Rightarrow 3 \times 3y + 5 = 26$

$\Rightarrow 9y + 5 = 26$

Transposing 5 to RHS

$\Rightarrow 9y = 26 - 5$

$\Rightarrow 9y = 21$

Dividing both sides by 9

$\Rightarrow y = \frac{21}{9}$

$\Rightarrow\ y = \frac{7}{3}$

Verification:

L.H.S:

$2y + \frac{5}{3}$

$= 2\left(\frac{7}{3}\right) + \frac{5}{3}$

$= \frac{19}{3}$

R.H.S:

$\frac{26}{3} - y$

$= \frac{26}{3} - \frac{7}{3}$

$= \frac{19}{3}$

L.H.S=R.H.S

Hence verified.

10. Solve $3m = 5m - \frac{8}{5}$ and check your results

Solution:

Given $3m = 5m - \frac{8}{5}$

Transposing 3m to RHS

$\Rightarrow 0 = 5m - 3m - \frac{8}{5}$

$\Rightarrow 0 = 2m - \frac{8}{5}$

Adding $\frac{8}{5}$ to both sides

$\Rightarrow \frac{8}{5} = 2m - \frac{8}{5} + \frac{8}{5}$

$\Rightarrow \frac{8}{5} = 2m$

$\Rightarrow\ 2m = \frac{8}{5}$

Dividing both sides by 2

$\Rightarrow m = \frac{8}{10}$

$\Rightarrow m = \frac{4}{5}$

Verification:

L.H.S:

3m

$= 3\left(\frac{4}{5}\right)$

$= \frac{12}{5}$

R.H.S:

$5m - \frac{8}{5}$

$= 5\left(\frac{4}{5}\right) - \frac{8}{5}$

$= \frac{12}{5}$

L.H.S =R.H.S

Hence verified.

Exercise 2.4

1. Amina thinks of a number and subtract $\frac{5}{2}$ from it. She multiplies the result by 8. The result now obtained is 3 times the same number she thought of. What is the number?

Solution:

Let the number be x

According to given question,

$8\left(x - \frac{5}{2}\right) = 3x$

$\Rightarrow 8x - 20 = 3x$

$\Rightarrow 8x - 3x = 20$

$\Rightarrow 5x = 20$

$\Rightarrow x = \frac{20}{5}$

$\Rightarrow x = 4$

Therefore, the number she thought is 4.

2. A positive number is 5 times another number. If 21 is added to both the numbers, then one of the new numbers become twice the other new number. What are the numbers?

Solution:

Let the number be x, and 5x

According to question,

$21 + 5x = 2(x + 21)$

$\Rightarrow 21 + 5x = 2x + 42$

Transposing 2x to LHS and 21 to RHS, we get

$\Rightarrow 5x - 2x = 42 - 21$

$\Rightarrow 3x = 21$

$\Rightarrow x = \frac{21}{3}$

$\Rightarrow x = 7$

Greater number $= 5x$

$= 5 \times 7$

$= 35$

Therefore, the numbers are 7 and 35.

3. Sum of the digits of a two -digit number is 9. When we interchange the digits, it is found that the resulting new number is greater than the original number by 27. What is the two-digit number?

Solution:

Let the digits at tens place and ones place be x and $9 - x$ respectively.

Therefore, the original number $= 10x + (9 - x)$

$= 9x + 9$

On interchanging the digits, the digits at ones place and tens place be x and $9 - x$ respectively.

Therefore, new number $= 10(9 - x) + x$

$= 90 - 9x$

Given, new number $=$ original number $+ 27$

$90 - 9x = 9x + 9 + 27$

$\Rightarrow 90 - 9x = 9x + 36$

Transposing 9x to RHS and 36 to LHS, we get

$\Rightarrow\ 90 - 36 = 9x + 9x$

$\Rightarrow\ 54 = 18x$

$\Rightarrow x = \frac{54}{18}$

$\Rightarrow\ x = 3$

Digits at ones place $= 9 - x$

$= 9 - 3$

$= 6$

Digit at tens place $= x$

$= 3$

Hence, two digit number $= 36$

4. One of the two digits of a two-digit number is three times the other digit. If you interchange the digits of this two digit number and add the resulting number to the original number, you get 88. What is the original number?

Solution:

Let the digits at tens place and ones place be x and 3x respectively.

Therefore, original number $= 10x + 3x$

$= 13x$

On interchanging the digits, the digits at ones place and tens place will be x and 3x respectively.

New number $= 10 \times 3x + x$

$= 31x$

Given, original number $+$ new number $= 88$

$\Rightarrow\ 13x + 31x = 88$

$\Rightarrow\ 44x = 88$

On dividing both sides by 44

$\Rightarrow x = \frac{88}{44}$

$\Rightarrow x = 2$

Therefore, original number $= 13x$

$= 13 \times 2 = 26$

By considering, the tens place and ones place be 3x and x respectively, the two digit number = 62.

Therefore, the two digit number may be 26 or 62.

5. Shobo's mother's present age is six times shobo's present age. Shobo's age five years from now will be one third of his mother's present age. What are their present ages?

Solution:

Let shobo's present age be x years.

And shobo's mother present age $= 6x$ years

According to question,

$x + 5 = \frac{1}{3} \times 6x$

$\Rightarrow x + 5 = 2x$

$\Rightarrow 2x = x + 5$

$\Rightarrow 2x - x = 5$

$\Rightarrow x = 5$

shobo's mother present age $= 6x$ years

$= 6 \times 5 = 30$ years.

Hence, Shobo present age = 5 years and Shobo's mother present age = 30 years.

6. There is a narrow rectangular plot, reserved for a school, in Mahuli village. The length and breadth of the plot are in the ratio 11: 4. At the rate ₹ 100 per meter it will cost the village panchayat ₹ 75000 to fence the plot. What are the dimensions of the plot?

Solution:

Let the length and breadth of the rectangular plot be 11x and 4x respectively.

Perimeter of the plot$= \frac{\text{Total cost}}{\text{cost of 1 meter}}$

$= \frac{75000}{100} = 750\text{m}$

We know that, perimeter of rectangle $= 2(l + b)$

$\Rightarrow\ 2(11x + 4x) = 750$

$\Rightarrow\ 30x = 750$

$\Rightarrow x = \dfrac{750}{30}$

$\Rightarrow x = 25$

Hence, length of rectangular plot $= 11 \times 25$

$= 275$ m

Breadth of rectangular plot $= 4x$

$= 4 \times 25$

$= 100$ m

Therefore, the length and breadth of the plot are 275m and 100m respectively.

7. Hasan buys two kinds of cloth materials for school uniforms, shirt materials that costs him ₹ 50 per meter and trouser material that costs him ₹ 90 per metre. For every 3 meters of the shirt material he buys 2 meters of the trouser material. He sells the materials at 12% and 10% profit respectively. His total sell is ₹ 36600 . How much trouser material did he buy?

Solution:

Let the shirt material and trouser material he bought be 3x, 2x respectively.

The cost of shirt material $= 50 \times 3x$

$= ₹150x$

The selling price at 12% gain $= \frac{100+p\%}{100} \times \text{C. P.}$

$= \dfrac{100 + 12}{100} \times 150x$

$= \dfrac{112}{100} \times 150x = ₹168x$

The cost of trouser material $= 90 \times 2x$

$= ₹180x$

The selling price at 12% gain $= \frac{100+p\%}{100} \times \text{C. P.}$

$= \dfrac{100 + 10}{100} \times 180x$

$= \dfrac{110}{100} \times 180x = ₹198x$

According to question,

$168x + 198x = 36600$

$366x = 36600$

$x = \frac{36600}{366} = 100$

Now, trouser material $= 2x = 2 \times 100$

$= 200$ meters

Hence, Hasan bought 200m trouser material.

8. Half of a herd of deer are grazing in the field and three fourths of the remaining are playing nearby. The rest 9 are drinking water from the pond. Find the number of deer in the herd.

Solution:

Let the total number of deer in the herd be x.

According to question,

$x = \frac{x}{2} + \frac{3}{4} \times \left(x - \frac{x}{2}\right) + 9$

$\Rightarrow x = \frac{x}{2} + \frac{3x}{8} + 9$

$\Rightarrow x = \frac{7x}{8} + 9$

$\Rightarrow x - \frac{7x}{8} = 9$

$\Rightarrow \frac{x}{8} = 9$

$\Rightarrow x = 9 \times 8$

$\Rightarrow x = 72$

Hence, the total number of deer in the herd is 72.

9. A grandfather is ten times older than his granddaughter. He is also 54 years older than her. Find their present ages.

Solution:

Let present age of granddaughter be x years.

Therefore, grandfather's age $= 10x$ years.

According to question.

$10x = x + 54$

$\Rightarrow 9x = 54$

$\Rightarrow\ x = \frac{54}{9}$

$\Rightarrow\ x = 6$

Granddaughter's present age = 6 years.

And Grandfather's present age = 10x = 10 × 6 = 60 years.

Hence, granddaughter's present age is 6 years and Grandfather's present age is 60 years.

10. Aman's age is three times his son's age. Ten years ago he was five times his son's age. Find their present ages.

Solution:

Let the present age of Aman's son's be x years.

Therefore, Aman's age = 3x years

According to question,

$\Rightarrow\ 3x - 10 = 5(x - 10)$

$\Rightarrow\ 3x - 10 = 5x - 50$

$\Rightarrow\ 50 - 10 = 5x - 3x$

$\Rightarrow\ 40 = 2x$

$\Rightarrow\ x = \frac{40}{2} = 20$ years.

Hence, Aman's son's age = 20 years and Aman's age = 3x = 3 × 20 = 60 years.

Exercise 2.5

1. Solve the linear equation $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$

Solution:

Given $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$

Multiplying both sides of the equations by 6

$\Rightarrow\ 6 \times \frac{x}{2} - 6 \times \frac{1}{5} = 6 \times \frac{x}{3} + 6 \times \frac{1}{4}$

$\Rightarrow\ 3x - \frac{6}{5} = 2x + \frac{3}{2}$

Transposing 2x to LHS

$\Rightarrow\ 3x - 2x - \frac{6}{5} = \frac{3}{2}$

$\Rightarrow x - \frac{6}{5} = \frac{3}{2}$

Adding $\frac{6}{5}$ to both sides

$\Rightarrow x - \frac{6}{5} + \frac{6}{5} = \frac{3}{2} + \frac{6}{5}$

$\Rightarrow x = \frac{15 + 12}{10}$

$\Rightarrow x = \frac{27}{10}$

2. Solve the linear equation $\frac{n}{2} - \frac{3n}{4} + \frac{5n}{6} = 21$

Solution:

Given $\frac{n}{2} - \frac{3n}{4} + \frac{5n}{6} = 21$

Multiplying both sides by 12.

$\Rightarrow 12 \times \frac{n}{2} - 12 \times \frac{3n}{4} + 12 \times \frac{5n}{6} = 12 \times 21$

$\Rightarrow 6n - 9n + 10n = 252$

$\Rightarrow 7n = 252$

$\Rightarrow n = \frac{252}{7}$

$n = 36$

3. Solve the linear equation $x + 7 - \frac{8x}{3} = \frac{17}{6} - \frac{5x}{2}$

Solution:

Given $x + 7 - \frac{8x}{3} = \frac{17}{6} - \frac{5x}{2}$

Multiplying both side by 6.

$\Rightarrow 6(x + 7) - 6 \times \frac{8x}{3} = 6 \times \frac{17}{6} - 6 \times \frac{5x}{2}$

$\Rightarrow 6x + 42 - 16x = 17 - 15x$

$\Rightarrow 42 - 10x = 17 - 15x$

Adding 15x to both sides

$\Rightarrow 42 - 10x + 15x = 17 - 15x + 15x$

$\Rightarrow 5x + 42 = 17$

Transposing 42 to RHS

$\Rightarrow 5x = 17 - 42$

$\Rightarrow 5x = -25$

Dividing both sides by 5

$\Rightarrow x = \frac{-25}{5}$

$x = -5$

4. Solve the linear equation $\frac{x-5}{3} = \frac{x-3}{5}$

Solution:

Given $\frac{x-5}{3} = \frac{x-3}{5}$

Multiplying both sides by 15

$\Rightarrow \frac{15(x-5)}{3} = \frac{15(x-3)}{5}$

$\Rightarrow 5(x-5) = 3(x-3)$

$\Rightarrow 5x - 25 = 3x - 9$

Transposing 3x to LHS

$\Rightarrow 5x - 3x - 25 = -9$

$\Rightarrow 2x - 25 = -9$

Adding 25 to both sides

$\Rightarrow 2x - 25 + 25 = -9 + 25$

$\Rightarrow 2x = 16$

Dividing both sides by 2

$\Rightarrow x = \frac{16}{2}$

$\Rightarrow x = 8$

5. Solve the linear equation $\frac{3t-2}{4} - \frac{2t+3}{3} = \frac{2}{3} - t$

Solution:

Given $\frac{3t-2}{4} - \frac{2t+3}{3} = \frac{2}{3} - t$

Multiplying both sides by 12

$\Rightarrow 12\left(\frac{3t-2}{4}\right) - 12\left(\frac{2t+3}{3}\right) = 12 \times \frac{2}{3} - 12t$

$\Rightarrow 3(3t-2) - 4(2t+3) = 4 \times 2 - 12t$

$\Rightarrow 9t - 6 - 8t - 12 = 8 - 12t$

$\Rightarrow t - 18 = 8 - 12t$

Adding 12t to both sides

$\Rightarrow t + 12t - 18 = 8 - 12t + 12t$

$\Rightarrow 13t - 18 = 8$

Adding 18 to both sides

$\Rightarrow 13t - 18 + 18 = 8 + 18$

$\Rightarrow 13t = 26$

$\Rightarrow t = \frac{26}{13} = 2$

6. Solve the linear equation $m - \frac{m-1}{2} = 1 - \frac{m-2}{3}$

Solution:

Given $m - \frac{m-1}{2} = 1 - \frac{m-2}{3}$

Multiplying both sides by 6

$\Rightarrow 6m - \frac{6(m-1)}{2} = 6 - 6\frac{(m-2)}{3}$

$\Rightarrow 6m - 3(m-1) = 6 - 2(m-2)$

$\Rightarrow 6m - 3m + 3 = 6 - 2m + 4$

$\Rightarrow 3m + 3 = 10 - 2m$

Adding 2m to both sides

$\Rightarrow 3m + 2m + 3 = 10 - 2m + 2m$

$\Rightarrow 5m + 3 = 10$

Transposing 3 to RHS

$\Rightarrow 5m = 10 - 3$

$\Rightarrow 5m = 7$

$\Rightarrow m = \frac{7}{5}$

7. Simplify and solve the linear equation $3(t-3) = 5(2t+1)$

Solution:

Given $3(t-3) = 5(2t+1)$

$\Rightarrow 3t - 9 = 10t + 5$

Transposing 3t to RHS

$\Rightarrow -9 = 10t - 3t + 5$

$\Rightarrow 7t + 5 = -9$

Transposing 5 to RHS

$\Rightarrow\ 7t = -9 - 5$

$\Rightarrow\ 7t = -14$

$\Rightarrow\ t = \frac{-14}{7}$

$\Rightarrow\ t = -2$

8. Simplify and solve the linear equation $15(y-4) - 2(y-9) + 5(y+6) = 0$

Solution:

Given $15(y-4) - 2(y-9) + 5(y+6) = 0$

$\Rightarrow 15y - 60 - 2y + 18 + 5y + 30 = 0$

$\Rightarrow 18y - 12 = 0$

Adding 12 to both sides

$\Rightarrow 18y - 12 + 12 = 12$

$\Rightarrow\ 18y = 12$

$\Rightarrow y = \frac{12}{18}$

$\Rightarrow\ y = \frac{2}{3}$

9. Simplify and solve the linear equation $3(5z-7) - 2(9z-11) = 4(8z-13) - 17$

Solution:

Given $3(5z-7) - 2(9z-11) = 4(8z-13) - 17$

$\Rightarrow 15z - 21 - 18z + 22 = 32z - 52 - 17$

$\Rightarrow -3z + 1 = 32z - 69$

Adding 3z to both sides

$\Rightarrow -3z + 3z + 1 = 32z + 3z - 69$

$\Rightarrow 1 = 35z - 69$

Adding 69 to both sides

$\Rightarrow 1 + 69 = 35z - 69 + 69$

$\Rightarrow 70 = 35z$

Diving 35 to both sides

$\Rightarrow \frac{70}{35} = z$

$\Rightarrow\ z = 2$

10. Simplify and solve the linear equation $0.25(4f - 3) = 0.05(10f - 9)$

Solution:

Given $0.25(4f - 3) = 0.05(10f - 9)$

$\Rightarrow f - 0.75 = 0.5f - 0.45$

On transposing 0.5f to LHS

$\Rightarrow f - 0.5f - 0.75 = -0.45$

$\Rightarrow 0.5f - 0.75 = -0.45$

Adding 0.75 to both sides

$\Rightarrow 0.5f - 0.75 + 0.75 = -0.45 + 0.75$

$\Rightarrow 0.5f = 0.30$

$\Rightarrow f = \frac{0.30}{0.50}$

$\Rightarrow f = \frac{3}{5}$

Exercise 2.6

1. Solve the equation $\frac{8x-3}{3x} = 2$

Solution:

Given $\frac{8x-3}{3x} = 2$

Multiplying 3x to both sides

$\Rightarrow \left(\frac{8x - 3}{3x}\right) \times 3x = 2 \times 3x$

$\Rightarrow 8x - 3 = 6x$

Transposing 6x to LHS

$\Rightarrow 8x - 6x - 3 = 0$

$\Rightarrow 2x - 3 = 0$

Adding 3 to both sides

$\Rightarrow 2x = 3$

$\Rightarrow x = \frac{3}{2}$

2. Solve the equation $\frac{9x}{7-6x} = 15$

Solution:

Given $\frac{9x}{7-6x} = 15$

Multiplying both sides by $7-6x$

$\Rightarrow \left(\frac{9x}{7-6x}\right) \times (7-6x) = 15 \times (7-6x)$

$\Rightarrow 9x = 105 - 90x$

$\Rightarrow 9x + 90x = 105$

$\Rightarrow 99x = 105$

$\Rightarrow x = \frac{105}{99}$

$\Rightarrow x = \frac{35}{33}$

3. Solve the equation $\frac{z}{z+15} = \frac{4}{9}$

Solution:

Given $\frac{z}{z+15} = \frac{4}{9}$

Multiplying $(z+15)$ to both sides

$\Rightarrow \left(\frac{z}{z+15}\right) \times (z+15) = \frac{4}{9}(z+15)$

$\Rightarrow z = \frac{4}{9}(z+15)$

Multiplying 9 to both sides

$\Rightarrow 9z = 4(z+15)$

$\Rightarrow 9z = 4z + 60$

Transposing 4z to LHS

$\Rightarrow 9z - 4z = 60$

$\Rightarrow 5z = 60$

$\Rightarrow z = 12$

4. Solve the equation $\frac{3y+4}{2-6y} = \frac{-2}{5}$

Solution:

Given $\frac{3y+4}{2-6y} = \frac{-2}{5}$

Multiplying $(2-6y)$ to both sides

$\Rightarrow \left(\frac{3y+4}{2-6y}\right) \times (2-6y) = \frac{-2}{5}(2-6y)$

$\Rightarrow 3y + 4 = \frac{-2}{5}(2-6y)$

$\Rightarrow 5(3y + 4) = -2(2 - 6y)$

$\Rightarrow 15y + 20 = -4 + 12y$

$\Rightarrow 15y - 12y + 20 = -4$

$\Rightarrow 3y + 20 = -4$

$\Rightarrow 3y = -24$

$\Rightarrow y = \frac{-24}{3}$

$\Rightarrow y = -8$

5. Solve the equation $\frac{7y+4}{y+2} = \frac{-4}{3}$

Solution:

Given $\frac{7y+4}{y+2} = \frac{-4}{3}$

Multiplying $(y + 2)$ to both sides

$\Rightarrow \left(\frac{7y + 4}{y + 2}\right) \times (y + 2) = \frac{-4}{3} \times (y + 2)$

$\Rightarrow 7y + 4 = \frac{-4}{3}(y + 2)$

Multiplying 3 to both sides

$\Rightarrow 3(7y + 4) = -4(y + 2)$

$\Rightarrow 21y + 12 = -4y - 8$

$\Rightarrow 21y + 4y = -8 - 12$

$\Rightarrow 25y = -20$

$\Rightarrow y = \frac{-20}{25}$

$\Rightarrow y = \frac{-4}{5}$

6. The ages of Hari and harry are in the ratio $5: 7$. Four years from now the ratio of their ages will be $3: 4$. Find their present ages

Solution:

Let the present ages of Hari and harry be 5x and 7x respectively.

After 4 years,

Hari's age $= 5x + 4$

Harry's age $= 7x + 4$

Given $\frac{5x+4}{7x+4} = \frac{3}{4}$

Cross multiplication gives $4(5x + 4) = 3(7x + 4)$

$\Rightarrow\ 20x + 16 = 21x + 12$

$\Rightarrow\ 16 - 12 = 21x - 20x$

$\Rightarrow\ 4 = x$

Therefore, Hari's present age $= 5x = 20$ years

Harry's present age $= 7x = 28$ years

7. The denominator of a rational number is greater than its numerator by 8. If the numerator is increased by 17 and denominator is decreased by 1, the number obtained is $\frac{3}{2}$. Find the rational number

Solution:

Let the numerator of rational number be x

Given Denominator is greater than numerator by 8 .

Then, denominator $= x + 8$

If numerator $= x + 17$,

Then denominator $= x + 8 - 1$

$= x + 7$

Given Number $= \frac{3}{2}$

i.e., $\frac{x+17}{x+7} = \frac{3}{2}$

on cross multiplying

$\Rightarrow 2(x + 17) = 3(x + 7)$

$\Rightarrow 2x + 34 = 3x + 21$

$\Rightarrow 34 - 21 = 3x - 2x$

$\Rightarrow\ 13 = x$

Hence, numerator $= 13$

Denominator $= 13 + 8$

$= 21$

Therefore, Number is $\frac{13}{21}$

♦♦♦

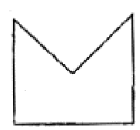
CBSE NCERT Solutions for Class 8 Mathematics Chapter 3

Back of Chapter Questions

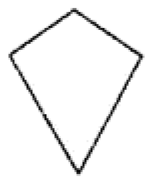
Exercise 3.1

1. Given here are some figure:

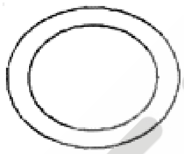
(A)



(B)

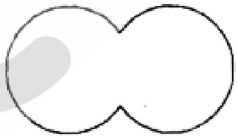


(C)

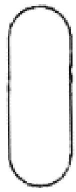


(D)

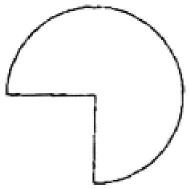
(E)



(F)



(G)



(H)

Classify each them on the basis of the following:

(i) Simple curve

(ii) Simple closed curve

(iii) polygon

(iv) Convex polygon

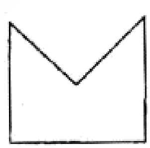
(v) Concave polygon

Solution:

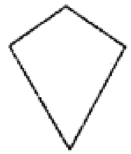
(i) **Simple curve:** A simple curve is a curve that does not cross itself.

The following are the simple curves.

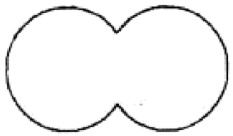
(A)



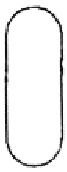
(B)



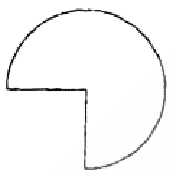
(E)



(F)



(G)

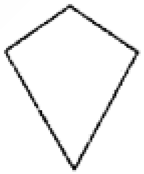


(ii) **Simple closed curve:** A connected curve that does not cross itself and ends at the same point where it begins is called a simple closed curve.

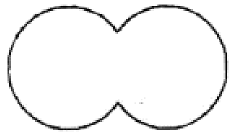
The following are the simple closed curves.

(A)

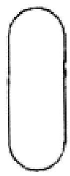
(B)



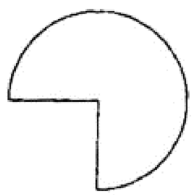
(E)



(F)



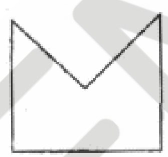
(G)



(iii) **Polygon:** A polygon is a plane figure enclosed by three or more line segments.

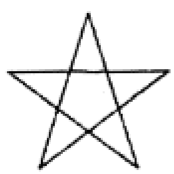
The following are the polygons

(A)



(B)

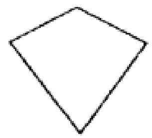
(D)



(iv) **Convex polygon:** A convex polygon is defined as a polygon with all its interior angles less than 180^{o}. This means that all the vertices of the polygon will point outwards, away from the interior of the shape.

The following is the convex polygon.

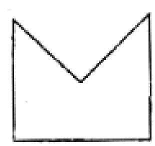
(A)



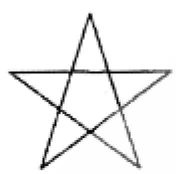
(v) **Concave polygon:** A concave polygon is defined as a polygon with one or more interior angles greater than 180°.

The following are the concave polygons.

(A)



(D)



2. How many diagonals does each of the following have?

(A) A convex quadrilateral

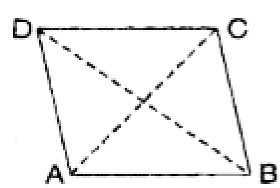
(B) A regular hexagon

(C) A triangle

Solution:

(A) A convex quadrilateral has two diagonals.

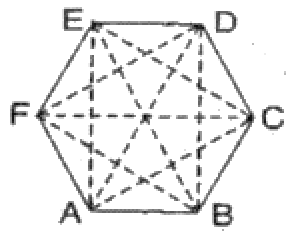
For e.g.



In above convex quadrilateral, AC and BD are only two diagonals.

(B) A regular hexagon has 9 diagonals.

For e.g.



In above hexagon, diagonals are AD, AE, BD, BE, FC, FB, AC, EC and FD.

So, there are total 9 diagonals in regular hexagon.

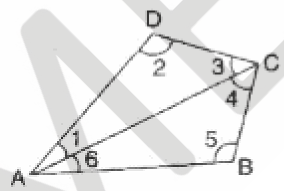
(C) In a triangle, there is no diagonal.

3. What is the sum of the measures of the angles of a convex quadrilateral? Will this property hold if the quadrilateral is not convex? (Make a non-convex quadrilateral and try)

Solution:

Let ABCD is a convex quadrilateral.

Now, draw a diagonal AC which divided the quadrilateral in two triangles.



$\angle A + B + \angle C + \angle D = \angle 1 + \angle 6 + \angle 5 + \angle 4 + \angle 3 + \angle 2$

$= (\angle 1 + \angle 2 + \angle 3) + (\angle 4 + \angle 5 + \angle 6)$

$= 180^o + 180^o$ (By Angle sum property of triangle)

$= 360^o$

Hence, the sum of measures of the triangles of a convex quadrilateral is 360^o.

And this property still holds even if the quadrilateral is not convex.

E.g.

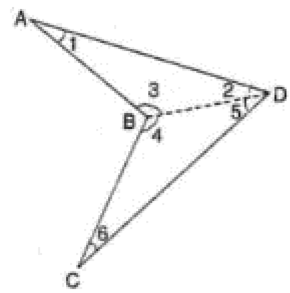
Let ABCD be a non-convex quadrilateral.

Now, join BD, which also divides the quadrilateral ABCD in two triangles.

Using angle sum property of triangle,

In $\Delta ABD, \angle 1 + \angle 2 + \angle 3 = 180^o$ ………. (i)

In $\Delta BDC, \angle 4 + \angle 5 + \angle 6 = 180^o$ ………. (ii)



Adding equation (i) and (ii), we get

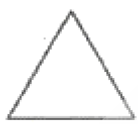
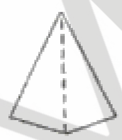
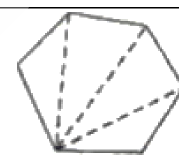
$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 360^o$

$\Rightarrow \angle 1 + (\angle 3 + \angle 4) + \angle 6 + (\angle 2 + \angle 5) = 360^o$

$\Rightarrow \angle A + \angle B + \angle C + \angle D = 360^o$

Hence, the sum of measures of the triangles of a non-convex quadrilateral is also 360^o.

4. Examine the table. (Each figure is divided into triangles and the sum of the angles deduced from that.)

Figure				
Side	3	4	5	6
Angle	$1 \times 180^o = (3 - 2) \times 180^o$	$2 \times 180^o = (4 - 2) \times 180^o$	$3 \times 180^o = (5 - 2) \times 180^o$	$4 \times 180^o = (6 - 2) \times 180^o$

What can you say about angle sum of a convex polygon with number of sides?

Solution:

(A) When $n = 7$, then

Angle sum of a polygon $= (n - 2) \times 180^o = (7 - 2) \times 180^o = 5 \times 180^o = 900^o$

(B) When $n = 8$, then

Angle sum of a polygon $= (n - 2) \times 180^o = (8 - 2) \times 180^o = 6 \times 180^o = 1080^o$

(C) When $n = 10$, then

Angle sum of a polygon $= (n-2) \times 180^o = (10-2) \times 180^o = 8 \times 180^o = 1440^o$

(D) When $n = n$, then, angle sum of polygon $= (n-2) \times 180^o$

5. What is a regular polygon? State the name of a regular polygon of:

(A) 3 sides

(B) 4 sides

(C) 6 sides

Solution:

A regular polygon is a polygon which have all sides of equal length and the interior angles of equal size.

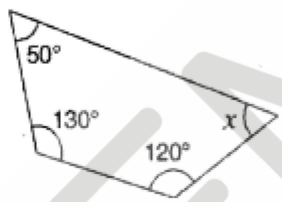
(i) 3 sides. Polygon having three sides is called a triangle.

(ii) 4 sides. Polygon having four sides is called a quadrilateral.

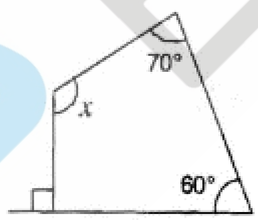
(iii) 6 sides. Polygon having six sides is called a hexagon.

6. Find the angle measures x in the following figures:

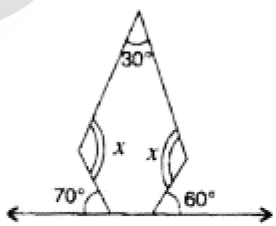
(A)



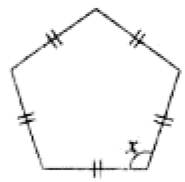
(B)



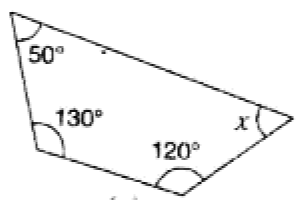
(C)



(D)



Solution:



We know in any quadrilateral, sum of interior angles will be 180^o

$50^o + 130^o + 120^o + x = 360^o$ (Angle sum Property of a quadrilateral)

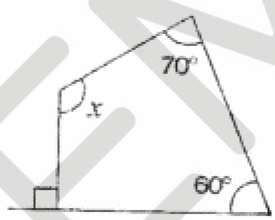
$\Rightarrow 300^o + x = 360^o$

$\Rightarrow x = 360^o - 300^o$

$\Rightarrow x = 60^o$

Therefore, the value of x is 60^o.

(B)



We know in any quadrilateral, sum of interior angles will be 180^o

$90^o + 60^o + 70^o + x = 360^o$ (Angle sum Property of a quadrilateral)

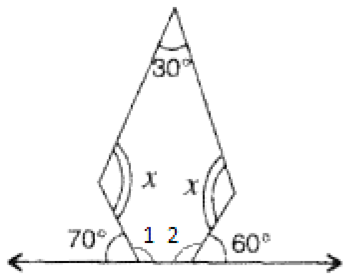
$\Rightarrow 220^o + x = 360^o$

$\Rightarrow x = 360^o - 220^o$

$\Rightarrow x = 140^o$

Therefore, the value of x is 140^o.

(C)



First base interior angle $\angle 1 = 180^o - 70^o = 110^o$

Second base interior angle $\angle 2 = 180^o - 60^o = 120^o$

Since, there are 5 sides.

Therefore, n = 5

We know that Angle sum of a polygon $= (n-2) \times 180^o$

$= (5-2) \times 180^o = 3 \times 180^o = 540^o$

$\therefore\ 30^o + x + 110^o + 120^o + x = 540^o$ (Angle sum property)

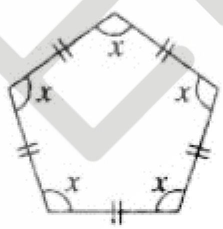
$\Rightarrow 260^o + 2x = 540^o \Rightarrow 2x = 540^o - 260^o$

$\Rightarrow 2x = 280^o$

$\Rightarrow x = 140^o$

Therefore, the value of x is 140^o.

(D)



Since, there are 5 sides.

Therefore, n = 5.

We know that Angle sum of a polygon $= (n-2) \times 180^o$

$= (5-2) \times 180^o = 3 \times 180^o = 540^o$

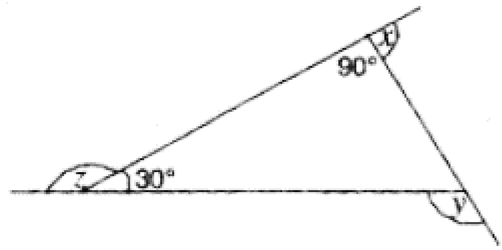
$\therefore x + x + x + x + x = 540^o$ (Angle sum property)

$\Rightarrow 5x = 540^o$

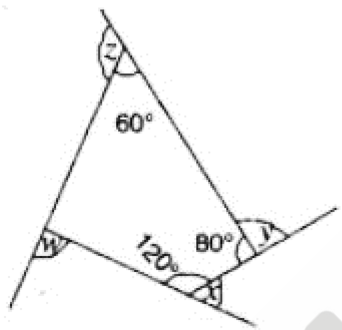
$\Rightarrow x = 108^o$

Hence each interior angle of the given polygon is 108^o.

7. (A) Find x + y + z

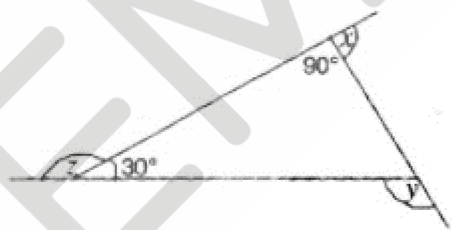


(B) Find x + y + z + w



Solution:

(A)



$90^o + x = 180^o$ ($\because$ sum of linear pair angles is 180^o)

$\Rightarrow x = 180^o - 90^o = 90^o$

And $z + 30^o = 180^o$ ($\because$ sum of linear pair angles is 180^o)

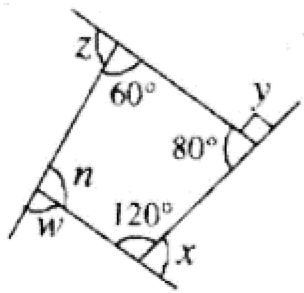
$\Rightarrow z = 180^o - 30^o = 150^o$

Also $y = 90^o + 30^o = 120^o$ [$\because$ Exterior angle property]

$x + y + z = 90^o + 120^o + 150^o = 360^o$

Hence, $x + y + z = 90^o + 120^o + 150^o = 360^o$

(B)



$60^o + 80^o + 120^o + n = 360^o$ ($\because$ Angle sum property of a quadrilateral)

$\Rightarrow 260^o + n = 360^o$

$\Rightarrow n = 360^o - 260^o$

$\Rightarrow n = 100^o$

$w + n = 180°$ ($\because$ Sum of linear pair angles is 180^o)

$\therefore w + 100° = 180^o$ ....(i)

Similarly, $x + 120^o = 180^o$ .... (ii)

And $y + 80^o = 180^o$. (iii)

And $z + 60^o = 180^o$ .... (iv)

Adding eq. (i), (ii), (iii) and (iv),

$\Rightarrow x + y + z + w + 100^o + 120^o + 80^o + 60^o$

$= 180^o + 180^o + 180^o + 180^o$

$\Rightarrow x + y + z + w + 360^o = 720^o$

$\Rightarrow x + y + z + w = 720^o - 360^o$

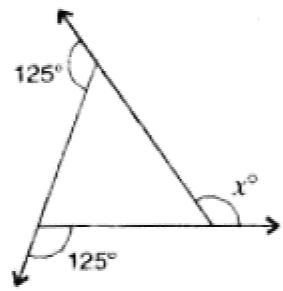
$\Rightarrow x + y + z + w = 360^o$

Hence, $x + y + z + w = 360^o$

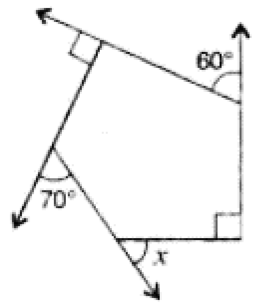
Exercise 3.2

1. Find x in the following figures:

(A)

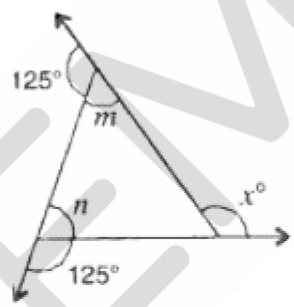


(B)



Solution:

(A)



Here, $125^o + m = 180^o$ [∵ Sum of linear pair angles is 180^o]

$\Rightarrow m = 180^o - 125^o = 55^o$

And similarly, $125^o + n = 180^o$

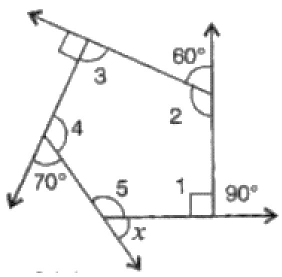
$\Rightarrow n = 180^o - 125^o = 55^o$

Now, $x° = m + n$ (∵ Exterior angle property)

$\therefore x^o = 55^o + 55^o = 110^o$

Therefore, the value of x is 110^o.

(B)



Since, in the given polygon, there are 5 sides.

Therefore, number of sides, n = 5

We know that sum of angles of a pentagon $= (n - 2) \times 180^o$

$= (5 - 2) \times 180^o$

$= 3 \times 180^o = 540^o$

Now, $\angle 1 + 90^o = 180^o$. (i) ($\because$ Sum of linear pair of angle is 180^o)

$\angle 2 + 60^o = 180^o$………………. (ii) ($\because$ Sum of linear pair of angle is 180^o)

$\angle 3 + 90^o = 180^o$………………. (iii) (Sum of linear pair of angle is $180°$)

$\angle 4 + 70^o = 180^o$ …………… (iv) (Sum of linear pair of angle is 180^o)

$\angle 5 + x = 180^o$ …………………(v) (Sum of linear pair of angle is 180^o)

On adding eq. (i), (ii), (iii), (iv) and (v), we get

$x + (\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5) + 310^o = 900^o$

$\Rightarrow x + 540^o + 310^o = 900^o$

$\Rightarrow x + 850^o = 900^o$

$\Rightarrow x = 900^o - 850^o = 50^o$

Therefore, the value of x is $50°$.

2. Find the measure of each exterior angle of a regular polygon of:

(A) 9 sides

(B) 15 sides

Solution:

(i) It is given that number of sides, n = 9.

We know that sum of angles of a regular polygon $= (n - 2) \times 180^o$

$= (9 - 2) \times 180^o = 7 \times 180^o = 1260^o$

Each interior angle $= \frac{\text{Sum of interior angles}}{\text{Number of sides}} = \frac{1260^o}{9} = 140^o$

Each exterior angle $= 180^o - 140^o = 40^o$

Hence, each exterior angle of a regular polygon of 9 sides is equal to 40^o .

(ii) It is given that number of sides, $n = 15$.

We know that sum of exterior angle of a regular polygon $= 360^o$

Each interior angle $= \frac{\text{Sum of interior angles}}{\text{Number of sides}} = \frac{360^o}{15} = 24^o$

Each exterior angle $= 180^o - 24^o = 156^o$

Hence, each exterior angle of a regular polygon of 15 sides is equal to 156^o .

3. How many sides does a regular polygon have, if the measure of an exterior angle is 24^o?

Solution:

We know that sum of exterior angles of a regular polygon $= 360^o$

Number of sides $= \frac{\text{Sum of exterior angles}}{\text{Each exterior angle}} = \frac{360^o}{24^o} = 15$

Hence, the regular polygon has 15 sides.

4. How many sides does a regular polygon have if each of its interior angles is 165^o?

Solution:

Given interior angle is 165^o

Exterior angle $= 180^o - 165^o = 15^o$

We know that sum of exterior angles of a regular polygon $= 360^o$

Number of sides $\frac{\text{Sum of exterior angles}}{\text{Each exterior angle}} = \frac{360^o}{15^o} = 24$

Hence, the regular polygon has 24 sides.

5. (A) Is it possible to have a regular polygon with of each exterior angle as 22^o?

(B) Can it be an interior angle of a regular polygon? Why?

Solution:

(A) Since 22 is not a divisor of 360^o.

Therefore, it is not possible to have a regular polygon with of each exterior angles as 22^o

(B) It is given that interior angle $= 22^o$

We know that exterior angle $= 180^o - \text{Interior angle}$

Exterior angle $= 180^o - 22^o = 158^o$, which is not a divisor of 360^o.

Hence, it is not possible to have a regular polygon with of each interior angles as 22^o.

6. (A) What is the minimum interior angle possible for a regular polygon? Why?

(B) What is the maximum exterior angle possible for a regular polygon?

Solution:

(A) The equilateral triangle being a regular polygon of 3 sides have the least measure of an interior angle equal to 60^o

Let each side of equilateral triangle = x

$\therefore x + x + x = 180^o$ (By angle sum Property)

$\Rightarrow 3x = 180^o$

$\Rightarrow x = 60^o$

(B) We know that equilateral triangle has least measure of an interior angle equal to 60^o.

Also, Exterior angle $= 180^o - \text{Interior angle}$

Therefore, greatest exterior angles = $180^o - 60^o = 120^o$.

Exercise 3.3

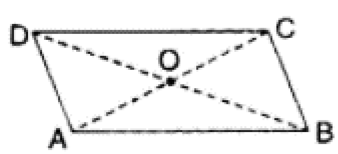
1. Give a parallelogram ABCD. Complete each statement along with the definition or property used.

(A) AD = ______________

(B) ∠DCB =______________

(C) OC = ______________

(D) m∠DAB + m∠CDA =______________



Solution:

(A) We know that opposite sides of a parallelogram are equal

Therefore, AD = BC

(B) We know that opposite angles of a parallelogram are equal.

Therefore, $\angle DCB = \angle DAB$

(C) We know that diagonals of a parallelogram bisect each other

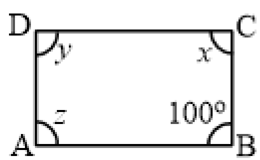
Therefore, For diagonal AC, $OC = OA$

(D) Since, $\angle DAB$ and $\angle CDA$ are adjacent angles and we know that Adjacent angles in a parallelogram are supplementary

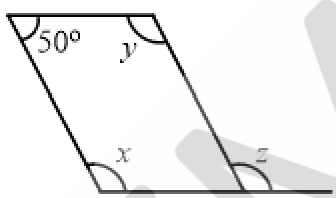
Therefore, $\angle DAB + \angle CDA = 180^{o}$

2. Consider the following parallelograms. Find the values of the unknowns x, y, z.

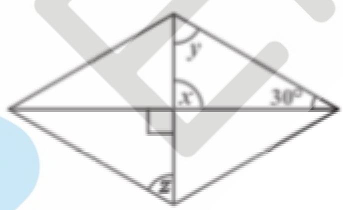
(A)



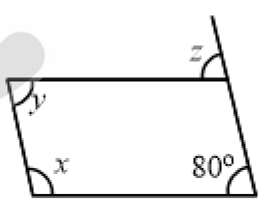
(B)



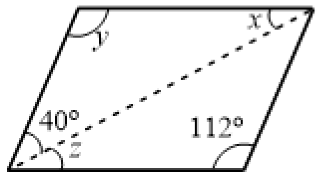
(C)



(D)

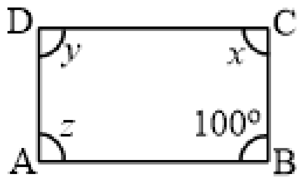


(E)



Solution:

(A)



Given that $\angle B = 100^o$.

In parallelogram ABCD

Now, $\angle B + \angle C = 180^o$ ($\because$ Adjacent angles in a parallelogram are supplementary)

$\Rightarrow 100^o + x = 180^o$

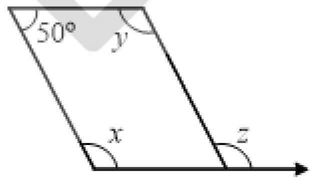
$\Rightarrow x = 180^o - 100^o = 80^o$

and $z = x = 80^o$ ($\because$ Opposite angles of a parallelogram are equal)

and $y = \angle B = 100^o$ ($\because$ Opposite angles of a parallelogram are equal)

Hence $x = z = 80^o$ and $y = 100^o$

(B)



$x + 50^o = 180^o$ ($\because$ Sum of adjacent angles in a parallelogram is 180°)

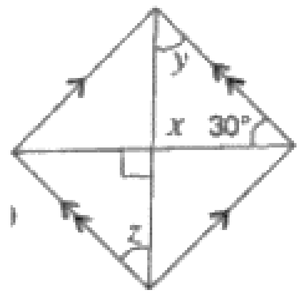
$\Rightarrow x = 180^o - 50^o = 130^o$

And $x = y = 130^o$ ($\because$ Opposite angles of a parallelogram are equal)

and $z = x = 130^o$ ($\because$ Corresponding angles are equal)

Hence, $x = z = y = 130^o$

(C)



$x = 90^{o}$ ($\because$ Vertically opposite angles are equal)

And $y + x + 30^{o} = 180^{o}$ (Angle sum property of a triangle)

$\Rightarrow y + 90^{o} + 30^{o} = 180^{o}$

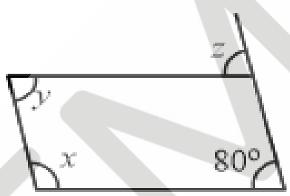
$\Rightarrow y + 120^{o} = 180^{o}$

$\Rightarrow y = 180^{o} - 120^{o} = 60^{o}$

and $z = y = 60^{o}$ ($\because$ Alternate angles are equal)

Hence, $x = 90^{o}$ and $z = y = 60^{o}$

(D)



$z = 80^{o}$ ($\because$ Corresponding angles are equal)

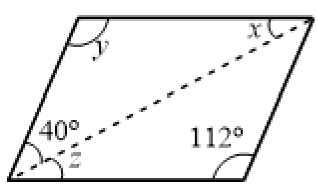
And now $x + 80^{o} = 180^{o}$ ($\because$ Sum of adjacent angles in a parallelogram is 180°)

$\Rightarrow x = 180^{o} - 80^{o} = 100^{o}$

and $y = 80^{o}$ ($\because$ Opposite angles of a parallelogram are equal)

Hence, $x = 100^{o}, y = z = 80^{o}$

(E)



$y = 112^{o}$ ($\because$ Opposite angles of a parallelogram are equal)

$40^o + y + x = 180^o$ ($\because$ Angle sum property of a triangle)

$\Rightarrow 40° + 112^o + x = 180^o$

$\Rightarrow 152^o + x = 180^o$

$\Rightarrow x = 180^o - 152^o = 28^o$

and $z = x = 28^o$ ($\because$ Alternate angles are equal)

Hence, $x = z = 28^o$ and $y = 112^o$

3. Can a quadrilateral ABCD be a parallelogram, if:

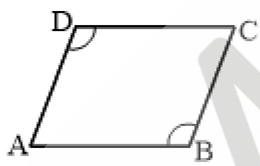
(A) $\angle D + \angle B = 180^o$?

(B) $AB = DC = 8$ cm, $AD = 4$ cm and $BC = 4.4$ cm ?

(C) $\angle A = 70^o$ and $\angle C = 65^o$?

Solution:

(A)



Given quadrilateral ABCD where $\angle D + \angle B = 180^o$

If ABCD is a parallelogram then opposite angles are equal.

$\therefore \angle D = \angle B$

But given $\angle D + \angle B = 180^o$

$\Rightarrow \angle B + \angle B = 180^o$

$\Rightarrow 2\angle B = 180^o$

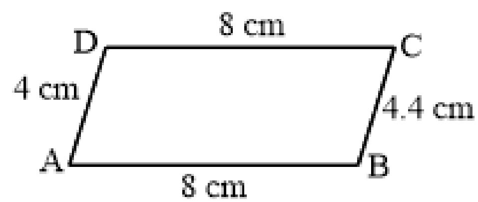
$\Rightarrow \angle B = 90^o$

$\therefore \angle D = \angle B = 90^o$

So, ABCD is a parallelogram where $\angle D = \angle B = 90^o$ which is possible only if ABCD is a square or rectangle.

Hence, may be parallelogram, but in all cases

(B)



Given quadrilateral ABCD where $AB = DC = 8$ cm, $AD = 4$ cm and $BC = 4.4$ cm

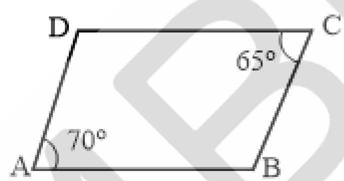
We know opposite sides of parallelogram are equal.

$\therefore AB = DC$ and $AD = BC$

But here $AD \neq BC$

Hence, ABCD is not a parallelogram.

(C)



Given quadrilateral ABCD where $\angle A = 70^o$ and $\angle C = 65^o$

We know, opposite angles of parallelogram are equal.

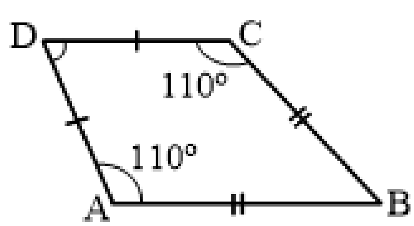
$\therefore \angle A = \angle C$

But here $\angle A \neq \angle C$

Hence, ABCD is not a parallelogram.

4. Draw a rough figure of a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measures.

Solution:

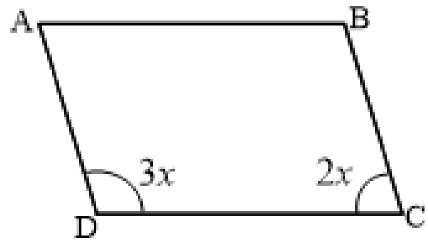


ABCD is quadrilateral in which angles $\angle A = \angle C = 110^o$

Hence, ABCD is a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measures.

5. The measure of two adjacent of a parallelogram are in the ratio $3:2$. Find the measure of each of the angles of the parallelogram.

Solution:



Let ABCD be the given parallelogram and $\angle C = 3x$ and $\angle D = 2x$.

Since the adjacent angles in a parallelogram are supplementary.

$\therefore 3x + 2x = 180^o$

$\Rightarrow 5x = 180^o$

$\Rightarrow x = \dfrac{180^o}{5} = 36^o$

Hence, $\angle C = 3x = 3 \times 36^o = 10^o$

and $\angle D = 2x = 2 \times 36^o = 72^o$

Hence, the two required adjacent angles are 108^o and 72^o.

Now, opposite angles of a parallelogram are equal

Hence, $\angle C = \angle A = 72^o$ and $\angle D = \angle B = 108^o$

6. Two adjacent angles of a parallelogram have equal measure. Find the measure of the angles of the parallelogram.

Solution:

Let each adjacent angle be x.

Since the adjacent angles in a parallelogram are supplementary.

$\therefore \mathrm{x} + \mathrm{x} = 180^o$

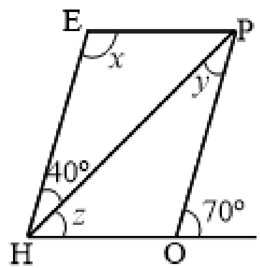
$\Rightarrow 2\mathrm{x} = 180^o$

$\Rightarrow \mathrm{x} = \dfrac{180^o}{2} = 90^o$

Hence, each adjacent angle is 90^o.

7. The adjacent figure HOPE is a parallelogram. Find the angle measures x, y and z. State the properties you use to find them.

Solution:



Here $\angle HOP + 70^o = 180^o$ ($\because$ sum of angles of linear pair is $180°$)

$\Rightarrow \angle HOP = 180^o - 70^o = 110^o$

and $\angle E = \angle HOP$ ($\because$ Opposite angles of a parallelogram are equal)

$\Rightarrow x = 110^o$

Now, $\angle PHE = \angle HPO$ ($\because$ Alternate angles are equal)

$\therefore\ y = 40^o$

Since, $OP || HE$

Therefore, $\angle EHO = \angle O = 70^o$ (Corresponding angles)

Since, $\angle EHO = 70^o$

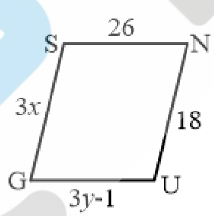
$\Rightarrow 40^o + z = 70^o$

$\Rightarrow z = 70^o - 40^o = 30^o$

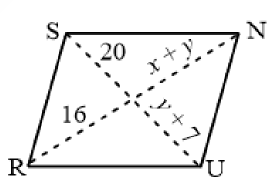
Hence, $x = 110^o, y = 40^o$ and $z = 30^o$

8. The following figures GUNS and RUNS are parallelogram, Find x and y. (Length are in cm)

(A)

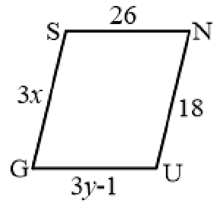


(B)



Solution:

(A)



In parallelogram GUNS,

GS = UN (∵ Opposite sides of parallelogram are equal)

$\Rightarrow 3x = 18$

$\Rightarrow x = \frac{18}{3} = 6$ cm

Also GU = SN (∵ Opposite sides of parallelogram are equal)

$\Rightarrow 3y - 1 = 26$

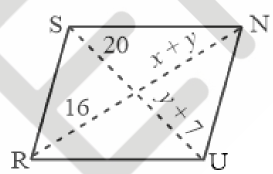
$\Rightarrow 3y = 26 + 1$

$\Rightarrow 3y = 27$

$\Rightarrow y = \frac{27}{3} = 9$ cm

Hence, x = 6 cm and y = 9 cm

(B)



In parallelogram RUNS,

$y + 7 = 20$ (∵ Diagonals of a parallelogram bisects each other)

$\Rightarrow y = 20 - 7 = 13$ cm

Similarly, $x + y = 16$

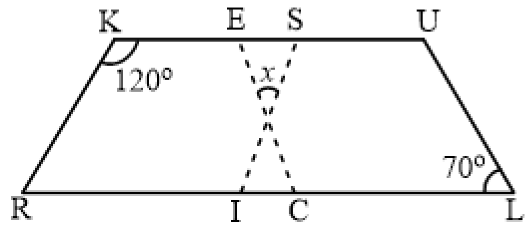
$\Rightarrow x + 13 = 16$

$\Rightarrow x = 16 - 13$

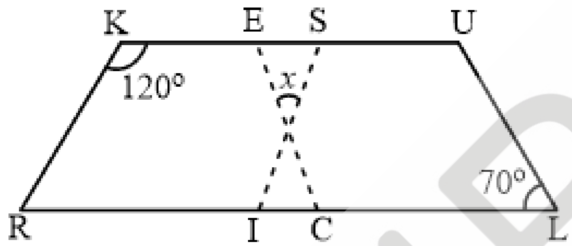
$\Rightarrow x = 3$ cm

Hence, x = 3 cm and y = 13 cm

9. In the figure, both RISK and CLUE are parallelograms. Find the value of x.



Solution:



Let angle vertically opposite to x be n

In parallelogram RISK,

$\angle RIS = \angle K = 120^o$ ($\because$ Opposite angles of a parallelogram are equal)

$\angle SIC + \angle RIS = 180^o$ ($\because$ Sum of linear pair of angle is 180°)

$\Rightarrow \angle SIC + 120^o = 180^o$

$\Rightarrow \angle SIC = 180^o - 120^o = 60^o$

and $\angle ECl = \angle L = 70^o$ ($\because$ Corresponding angles are equal)

$\angle SIC + n + \angle ECI = 180^o$ ($\because$ Angle sum property of a triangle)

$\Rightarrow 60^o + n + 70^o = 180^o$

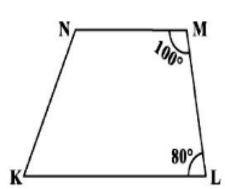
$\Rightarrow 130^o + n = 180^o$

$\Rightarrow n = 180^o - 130^o = 50^o$

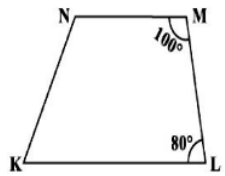
also $x = n = 50^o$ ($\because$ Vertically opposite angles are equal)

Hence, the value of x is 50°.

10. Explain how this figure is a trapezium. Which of its two sides are parallel?

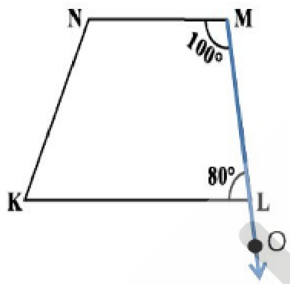


Solution:



Given a quadrilateral KLMN having $\angle L = 80^o$ and $\angle M = 100^o$

Now extent the line LM to O as shown in figure



For the line segment NM and KL, with MO is a transversal.

Now $\angle L + \angle M = 180^o$

Thus, sum of interior angles on the same side of transversal is 180^o which is only possible

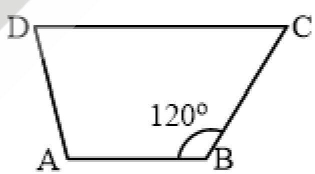
If NM and KL are parallel lines

Therefore, NM | |KL

Since, KLMN is quadrilateral with KL | |NM

$\therefore$ KLMN is a trapezium

11. Find $m\angle C$ in figure, if $\overline{AB}||\overline{DC}$,



Solution:

In quadrilateral ABCD

Since, it is given that $\overline{AB}||\overline{DC}$

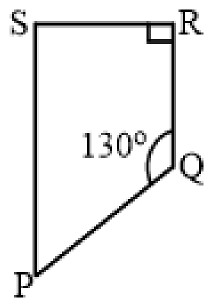
Therefore, $\angle B + \angle C = 180^o$

$\Rightarrow 120^o + m\angle C = 180^o$

$\Rightarrow m\angle C = 180^o - 120^o = 60^o$

Hence, $m\angle C = 60°$

12. Find the measure of $\angle P$ and $\angle S$ if $\overline{SP} || \overline{QR}$ in given figure. (If you find $m\angle R$, is there more than one method to find $m\angle P$)



Solution:

$\angle P + \angle Q = 180^o$ [$\because$ Sum of co-interior angles is 180^o]

$\Rightarrow \angle P + 130^o = 180^o$

$\Rightarrow \angle P = 180^o - 130^o$

$\Rightarrow \angle P = 50^o$

And $\angle S + \angle R = 180^o$ ($\because$ Sum of co-interior angles is 180^o)

$\Rightarrow \angle S + 90^o = 180^o$ ($\angle R = 90°$ (given))

$\Rightarrow \angle S = 180^o - 90^o$

$\Rightarrow \angle S = 90^o$

Yes, there is one more method to find $\angle P$.

In quadrilateral SRQP

$\angle S + \angle R + \angle Q + \angle P = 360^o$ [Angle sum property of quadrilateral]

$\Rightarrow 90^o + 90^o + 130^o + \angle P = 360^o$

$\Rightarrow 310^o + \angle P = 360^o$

$\Rightarrow \angle P = 360^o - 310^o$

$\Rightarrow \angle P = 50^o$

Exercise 3.4

1. State whether true or false:

(A) All rectangles are squares.

(B) All rhombuses are parallelograms.

(C) All squares are rhombuses and also rectangles

(D) All squares are not parallelograms

(E) All kites are rhombuses.

(F) All rhombuses are kites.

(G) All parallelograms are trapeziums

(H) All squares are trapeziums.

Solution:

(A) False.

In the rectangle all sides may not be equal but in the case of square all sides are equal.

Hence, all rectangles are not squares

(B) True.

In a parallelogram, opposite angles are equal and also diagonal intersect at the mid- point.

And Since, in rhombus, opposite angles are equal and diagonals intersect at mid-point.

Hence, all rhombuses are parallelograms.

(C) True.

We know that a rectangle become square when all sides of a rectangle are equal. Hence square is a special case of rectangle. And since, square has same property as that of rhombus.

Hence, all squares are rhombuses and also rectangles

(D) False.

Since, all squares have the same property as that of parallelogram.

Hence, all squares are parallelograms

(E) False.

In the rhombus, all sides are equal, but all kites do not have equal sides.

Hence, all kites are rhombuses

(F) True.

Since, all rhombuses have equal sides and diagonals bisect each other and, in the kite,, all sides may be equal and their diagonal can also bisect each other.

Hence, all rhombuses are kites.

(G) True.

We know that trapezium has only two parallel sides and Since, in the parallelogram two sides are parallel to each other.

Hence, all parallelograms are trapeziums

(H) True.

We know that a trapezium has two sides parallel to each other and Since, in the square two sides are parallel.

Hence, all squares are trapeziums

2. Identify all the quadrilaterals that have:

(A) four sides of equal lengths.

(B) four right angles.

Solution:

(A) Rhombus and square have sides of equal length.

(B) Square and rectangle have four right angles.

3. Explain how a square is:

(A) a quadrilateral

(B) a parallelogram

(C) a rhombus

(D) a rectangle

Solution:

(A) A quadrilateral has 4 sides and a square has 4 sides, hence it is a quadrilateral

(B) A square is a parallelogram, since it contains both pairs of opposite sides are parallel.

(C) A rhombus is a parallelogram where all sides are equal and a square is a parallelogram where all sides are of equal length. Hence it is a rhombus.

(D) A rectangle is a parallel 90° and a square is a parallelogram where all angles are 90°. Hence it is a rectangle.

4. Name the quadrilateral whose diagonals:

(A) bisect each other.

(B) are perpendicular bisectors of each other.

(C) are equal.

Solution:

(A) If diagonals of a quadrilateral bisect each other then it may be a rhombus, parallelogram, rectangle or square.

(B) If diagonals of a quadrilateral are perpendicular bisector of each other, then it may be a rhombus or square.

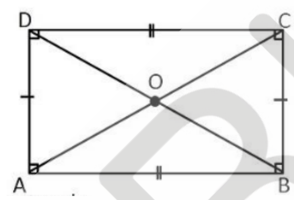
(C) If diagonals are equal, then it may be a square or rectangle.

5. Explain why a rectangle is a convex quadrilateral.

Solution:

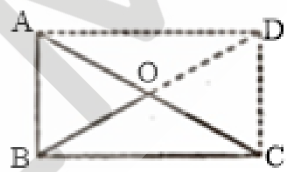
In convex quadrilateral, all the diagonals lie inside the quadrilateral.

Consider a rectangle ABCD, Its diagonal AC and BD lie inside the rectangle



Hence rectangle is a convex quadrilateral.

6. ABC is a right-angled triangle and O is the mid-point of the side opposite to the right angle. Explain why O is equidistant from A, B and C. (The dotted lines are drawn additionally to help you.)



Solution:

Given a right-angled triangle ABC and O is the mid-point of AC.

Now draw a line from A parallel to BC and from C parallel to BA.

Let the point of intersection of these lines be D. Now Join OD.

Now in quadrilateral ABCD

AB ∥ DC and BC ∥ AD

⇒ opposite sides are parallel

∴ ABCD is a parallelogram

We know that

Adjacent angles of a parallelogram are supplementary

$\angle B + \angle C = 180^o$

$\Rightarrow 90^o + \angle C = 180^o$

$\Rightarrow \angle C = 180^o - 90^o$

$\Rightarrow \angle C = 90^o$

Also,

Opposite angles of a parallelogram are equal.

$\angle A = \angle C$

$\Rightarrow \angle A = 90^o$

And $\angle D = \angle B$

$\Rightarrow \angle D = 90^o$

Therefore,

$\angle A = \angle B = \angle C = \angle D = 90^o$

$\Rightarrow$ Each angle of ABCD is a right angle.

So, ABCD is a parallelogram with all angles 90^o

$\therefore$ ABCD is a rectangle

We know that

The diagonals of a rectangle bisect each other

$OA = OC = \frac{1}{2}AC \ldots (1)$

$OB = OD = \frac{1}{2}BD \ldots (2)$

Also,

The diagonals of a rectangle are equal in length.

$BD = AC$

Dividing both sides by 2

$\Rightarrow \frac{1}{2}BD = \frac{1}{2}AC$

$\Rightarrow OB = OA$ (from (1) and (2))

$\therefore OA = OB = OC$

Hence, O is equidistant from A, B and C.

♦♦♦

CBSE NCERT Solutions for Class 8 Mathematics Chapter 4

Back of Chapter Questions

1. Construct the following quadrilaterals.

(i) Quadrilateral ABCD

$AB = 4.5$ cm

$BC = 5.5$ cm

$CD = 4$ cm

$AD = 6$ cm

$AC = 7$ cm

(ii) Quadrilateral JUMP

$JU = 3.5$ cm

$UM = 4$ cm

$MP = 5$ cm

$PJ = 4.5$ cm

$PU = 6.5$ cm

(iii) Parallelogram MORE

$OR = 6$ cm

$RE = 4.5$ cm

$EO = 7.5$ cm

(iv) Rhombus BEST

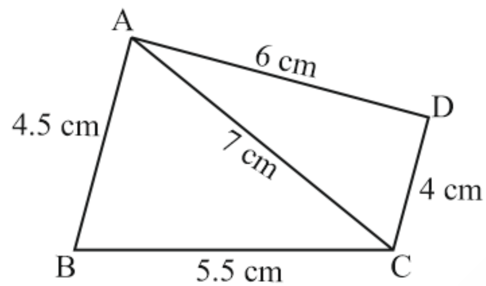
$BE = 4.5$ cm

$ET = 6$ cm

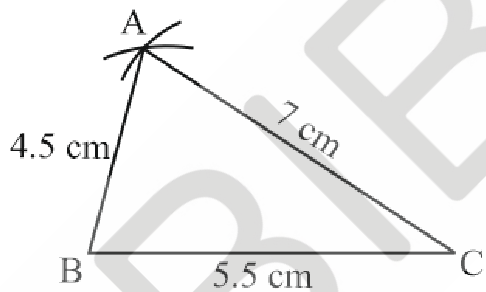
Solution:

(i) Given, $AB = 4.5$ cm, $BC = 5.5$ cm, $CD = 4$ cm, $AD = 6$ cm and $AC = 7$ cm

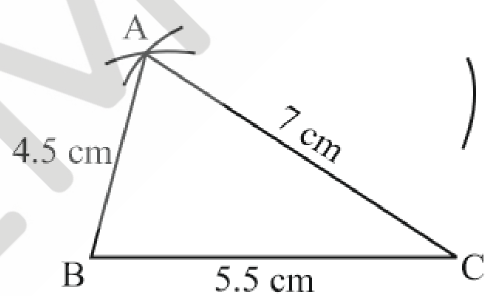
(a) Draw a rough sketch which will help us to visualize the quadrilateral. We draw this first and mark measurements:



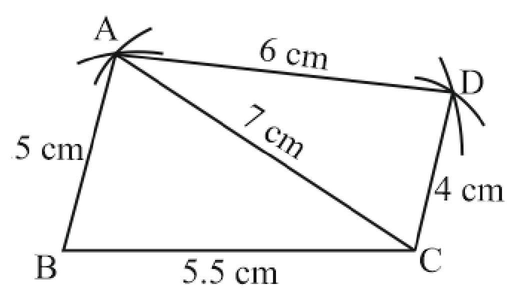
(b) Draw BC = 5.5 cm. Now with B as the center draw an arc of 4.5 cm and with C as the center draw an arc of 7 cm. Mark the point of intersection as A.



(c) Given that AD is 6 cm, draw an arc of radius 6 cm from point A as the center.



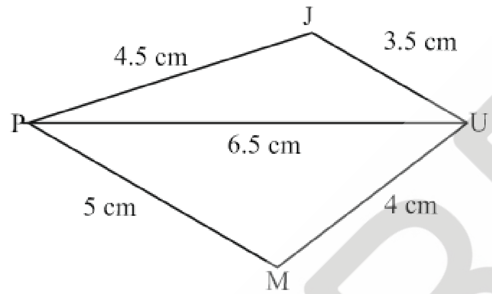
(d) Now with C as the center draw an arc of radius 4 cm such that it cuts the previous arc. Call this point of intersection as D.



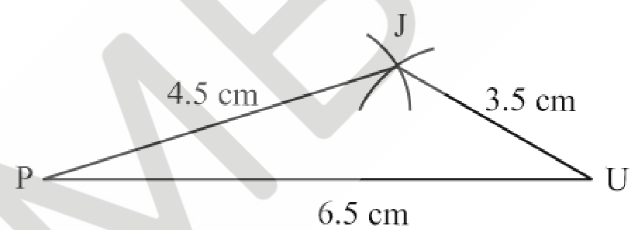
Hence, ABCD is the required quadrilateral.

(ii) Given, $JU = 3.5$ cm, $UM = 4$ cm, $MP = 5$ cm, $PJ = 4.5$ cm and $PU = 6.5$ cm

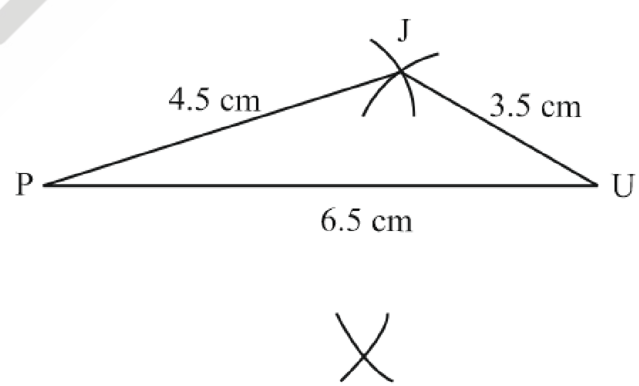
(a) Draw a rough sketch which will help us to visualize the quadrilateral. We draw this first and mark measurements



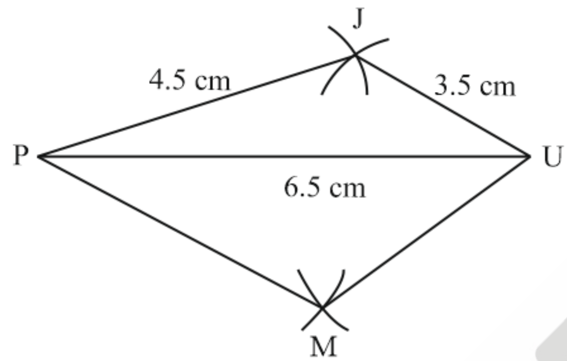
(b) Draw the base line $PU = 6.5$cm. Now with P as the center draw an arc of radius 4.5 cm and with U as the center draw an arc of radius 3.5 cm such that it cuts the previously drawn arc. Name this point of intersection as J.



(c) Given that the point M is at a distance of 4 cm and 5 cm from U and P respectively, draw arcs of radius 4 cm and 5 cm from U and P. The point of intersection is M.



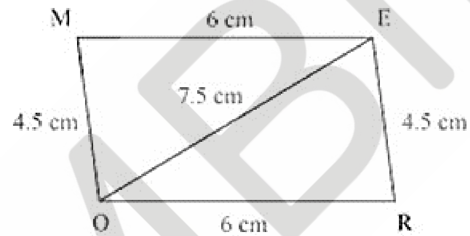
(d) Join PM and UM



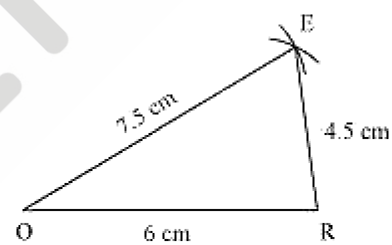
JUMP is the required quadrilateral.

(iii) Given, OR $= 6$ cm, RE $= 4.5$ cm and EO $= 7.5$ cm

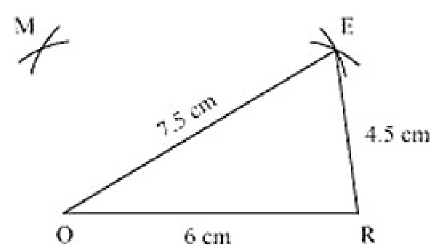
(a) The opposite sides of a parallelogram are equal and parallel. Therefore, ME = OR and MO = ER. Draw a rough sketch which will help us to visualize the parallelogram:



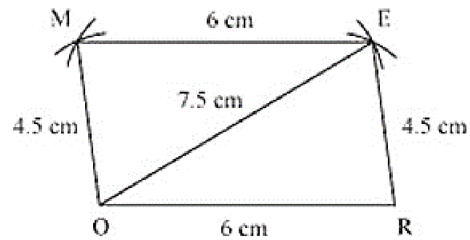
(b) Construct OR = 6cm. Now with O and R as centers draw arcs of radius 7.5cm and 4.5cm respectively. Name the point of intersection as E.



(c) Construct arcs of radius 4.5 cm and 6 cm from O and E respectively. The point of intersection is named as M.



(d) Join OM and EM

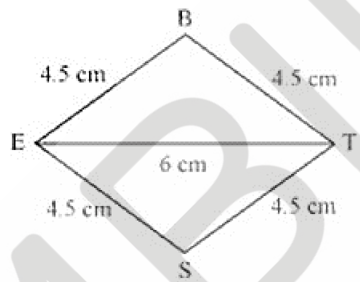


Therefore, MORE is the required parallelogram.

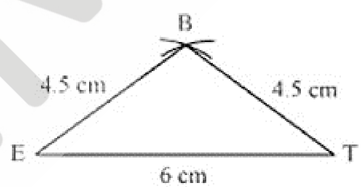
(iv) Given, BE = 4.5 cm and ET = 6 cm

(a) Since all the sides of a rhombus measure the same, BE = ES = ST = TB.

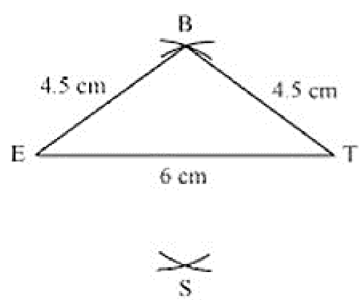
Draw a rough sketch which will help us to visualize the rhombus.



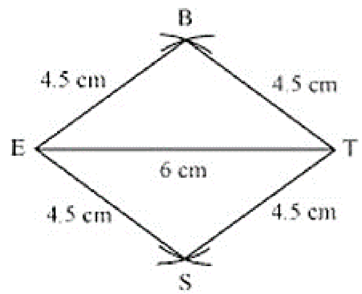
(b) Construct ET = 6cm. Now with E and F as the centers construct arcs of radius 4.5 cm from each respectively. The point of intersection is named as B.



(c) Since point S is 4.5 cm away from E and T respectively, construct arcs of 4.5 cm from E and T and the point of intersection gives S.



(d) Join ES and TS



Hence, BEST is the required rhombus.

EXERCISE 4.2

1. Construct the following quadrilaterals.

(i) quadrilateral LIFT

$LI = 4$ cm

$IF = 3$ cm

$TL = 2.5$ cm

$LF = 4.5$ cm

$IT = 4$ cm

(ii) Quadrilateral GOLD

$OL = 7.5$ cm

$GL = 6$ cm

$GD = 6$ cm

$LD = 5$ cm

$OD = 10$ cm

(iii) Rhombus BEND

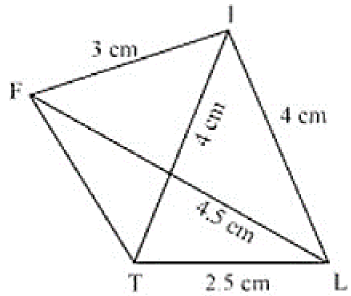
$BN = 5.6$ cm

$DE = 6.5$ cm

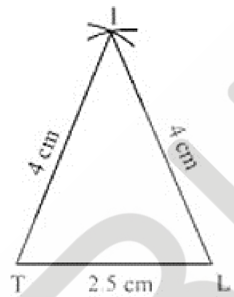
Solution:

(i) Given, $LI = 4$ cm, $IF = 3$ cm, $TL = 2.5$ cm, $LF = 4.5$ cm and $IT = 4$ cm

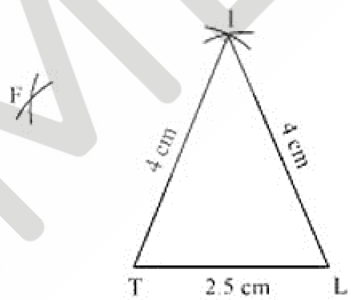
(a) Draw the rough sketch of the quadrilateral LIFT. Now we can easily see that it is possible to draw ΔLTI first.



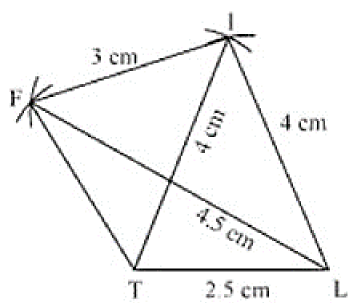
(b) Draw ΔLTI using SSS construction. So ΔLTI is constructed with the given measurements as shown.



(c) Construct arcs of radius 4.5 cm and 3 cm with centers L and I respectively. The point of intersection is F.



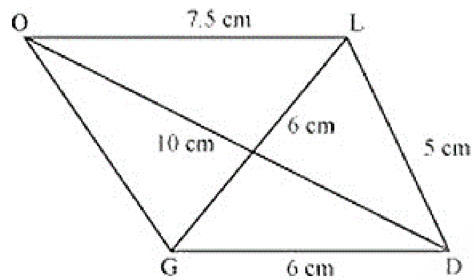
(d) Join FT and IF to obtain the required quadrilateral.



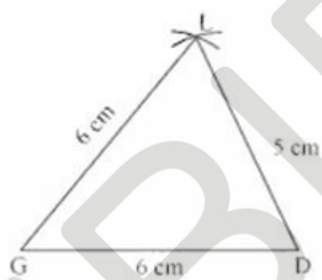
Hence, LIFT is the required quadrilateral.

(ii) Given, $OL = 7.5$ cm, $GL = 6$ cm, $GD = 6$ cm, $LD = 5$ cm and $OD = 10$ cm

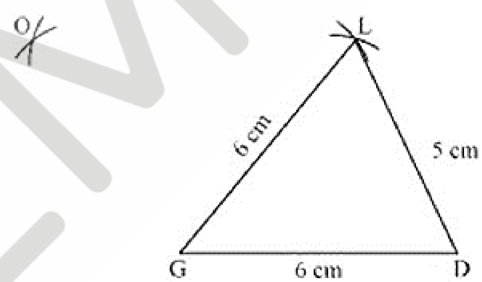
(a) Draw the rough sketch of the quadrilateral LIFT. Now we can easily see that it is possible to draw ΔDGL first.



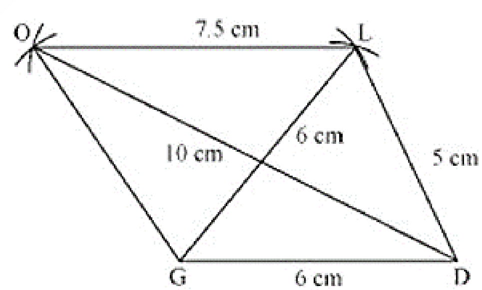
(b) Draw ΔDGL using SSS construction. So ΔDGL is constructed with the given measurements as shown.



(c) With D and L as the centers construct arcs of 10 cm and 7.5 cm respectively. The point of intersection is named as O.



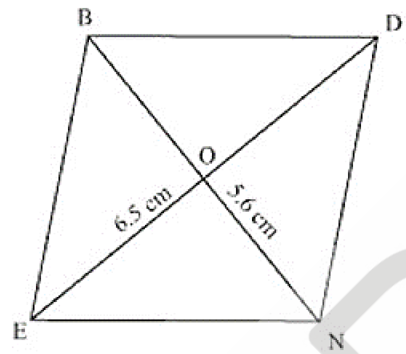
(d) Join O to G, D and L to obtain the required quadrilateral.



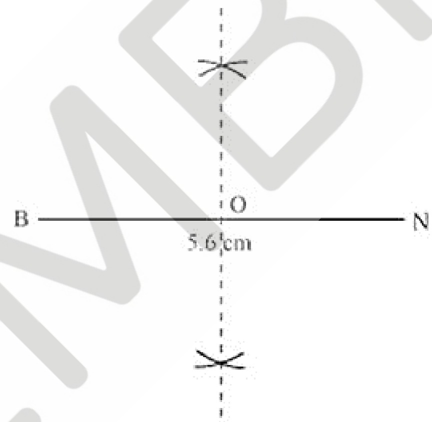
Therefore, GOLD is the required quadrilateral.

(iii) Given, BN = 5.6 cm and DE = 6.5 cm

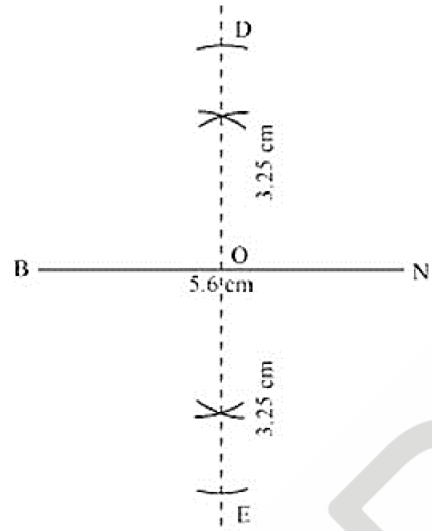
(a) The diagonals of a rhombus bisect each other at 90^0. Let us assume O to be the point of intersection. Then EO = OD = 3.25cm. the rough sketch is as shown below:



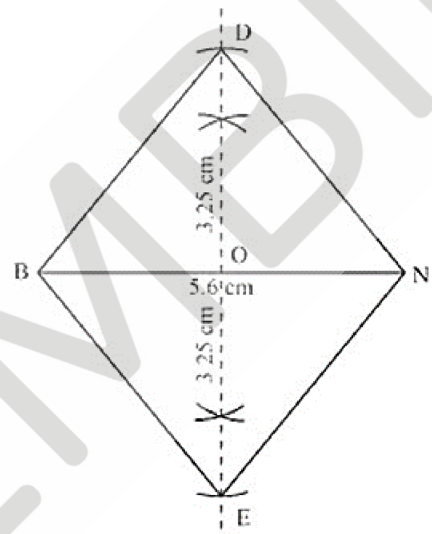
(b) Draw BN = 5.6 cm and construct its perpendicular bisectors. Name the point at which it intersects BN to be O.



(c) With O as the center draw arcs of 3.25 cm such that they intersect the perpendicular bisector at point D and E respectively.



(d) Join BD, DN, BE and EN to obtain the required rhombus BEND.



Hence, the above figure is the required rhombus.

EXERCISE 4.3

1. Construct the following quadrilaterals.

(i) Quadrilateral MORE

$MO = 6$ cm

$OR = 4.5$ cm

$\angle M = 60°$

$\angle O = 105°$

$\angle R = 105°$

(ii) Quadrilateral PLAN

$PL = 4$ cm

$LA = 6.5$ cm

$\angle P = 90°$

$\angle A = 110°$

$\angle N = 85°$

(iii) Parallelogram HEAR

$\angle R = 85°$

$EA = 6$ cm

$HE = 5$ cm

(iv) Rectangle OKAY

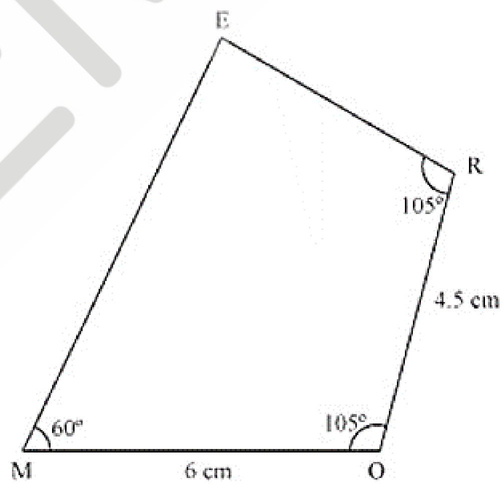
$OK = 7$ cm

$KA = 5$ cm

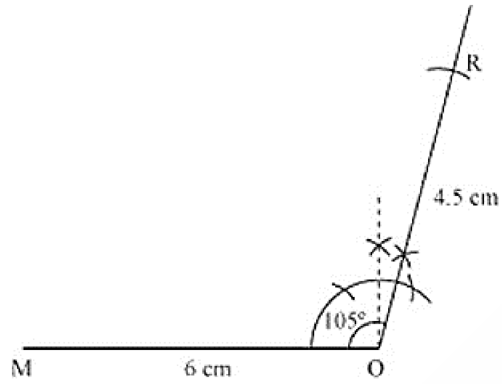
Solution:

(i) Given, $MO = 6$ cm, $OR = 4.5$ cm, $\angle M = 60°, \angle O = 105°$ and $\angle R = 105°$

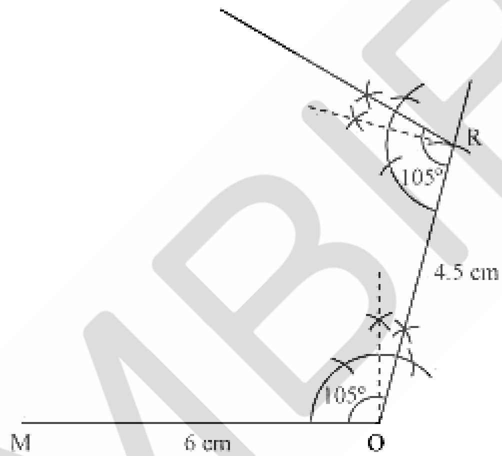
(a) Draw a rough sketch which will help us to visualize the quadrilateral.



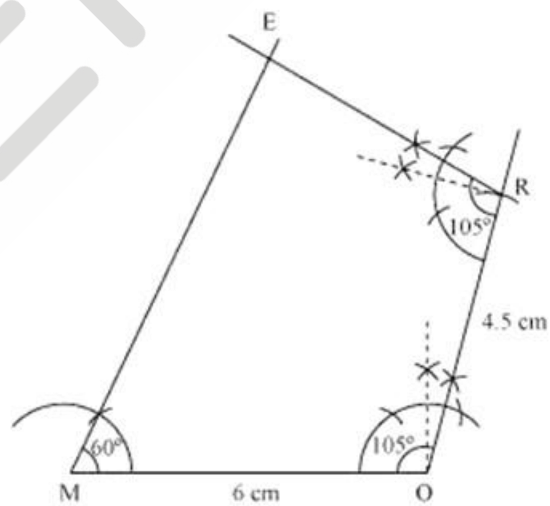
(b) Start with taking $MO = 6$cm on O and a line segment of 105 degrees from O. Given that $OR = 4.5$cm, cut an arc of 4.5 cm and locate R with O as the center.



(c) Draw an angle of 105° from R and draw a line.



(d) Draw a ray of 60° from M and extend it to meet the ray starting from R. The point of intersection gives E.



Hence, MORE is the required quadrilateral.

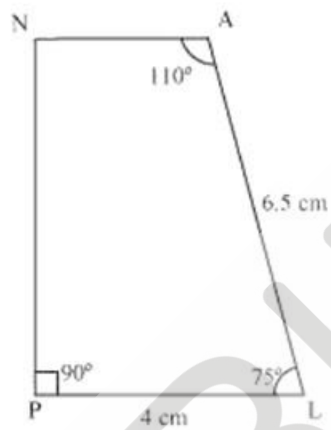
(ii) Given, PL = 4 cm, LA = 6.5 cm, $\angle P = 90°$, $\angle A = 110°$ and $\angle N = 85°$

Using angle sum property of a quadrilateral,

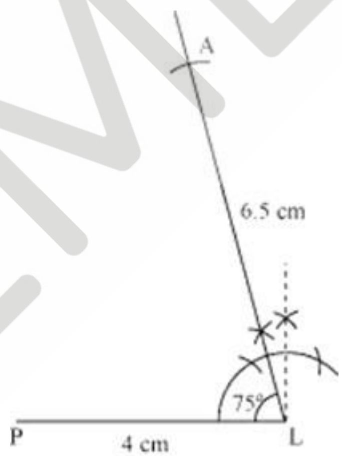
$\angle P + \angle L + \angle A + \angle N = 360°$

Which gives $\angle L = 75°$

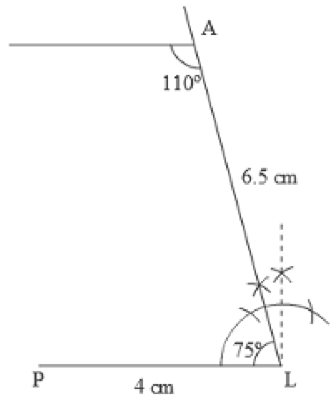
(a) Draw a rough sketch which will help us to visualize the quadrilateral.



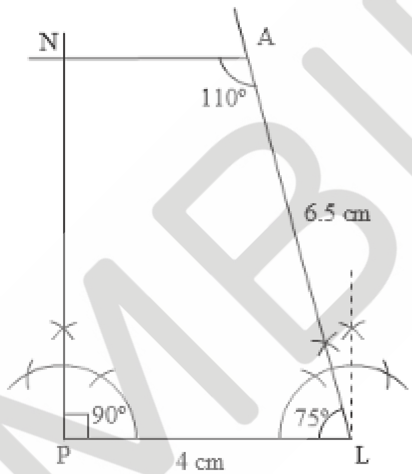
(b) Draw PL = 4cm and construct an angle of 75° from point L. Cut an arc of 6.5 cm on the ray and name the point as A.



(c) Draw an angle of 110 degrees at point A and draw a line.



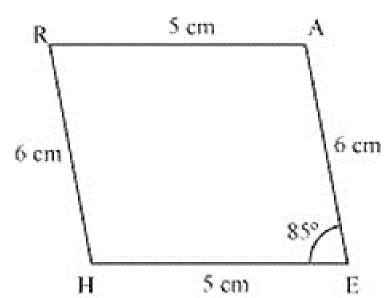
(d) Draw a ray at an angle of 90^0 from P and let it meet the ray from A at N



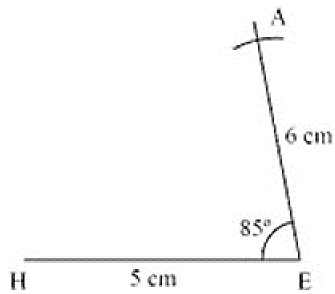
Hence, PLAN is the required quadrilateral.

(iii) Given, $\angle R = 85°$, $EA = 6$ cm and $HE = 5$ cm

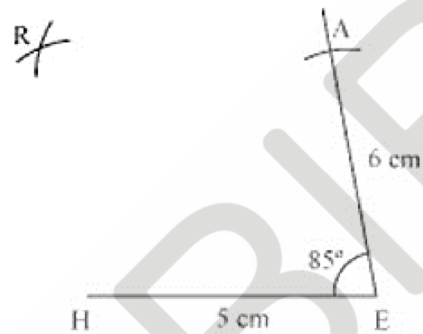
(a) Draw a rough sketch which will help us to visualize the parallelogram.



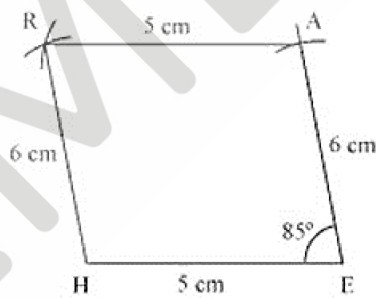
(b) Construct HE = 5cm and an angle of 85^0 at E. Since AE is given to be 6 cm, cut an arc of 6 cm on the ray from E and the point obtained will be named as A.



(c) Draw arcs of radius 6 cm and 5 cm from H and A respectively. Name the point of intersection as R



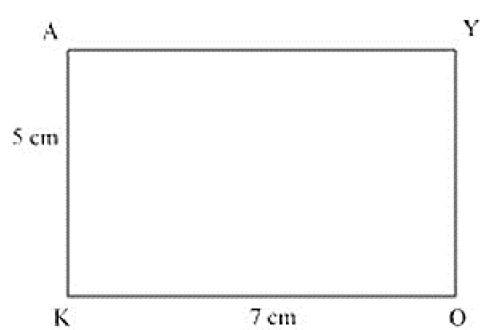
Join R to H and A to obtain the required parallelogram HEAR.



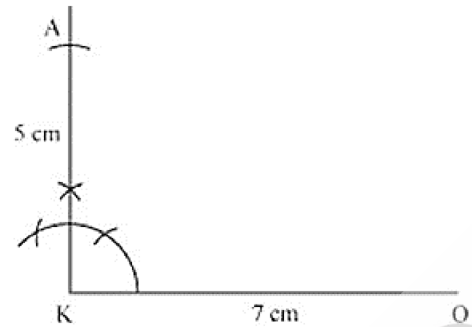
Hence, the above figure is the required parallelogram.

(iv) Given, OK = 7 cm and KA = 5 cm

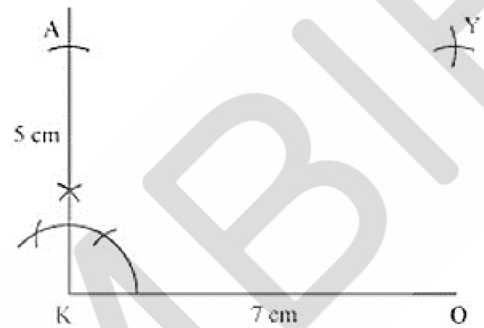
(a) Draw a rough sketch which will help us to visualize the rectangle OKAY.



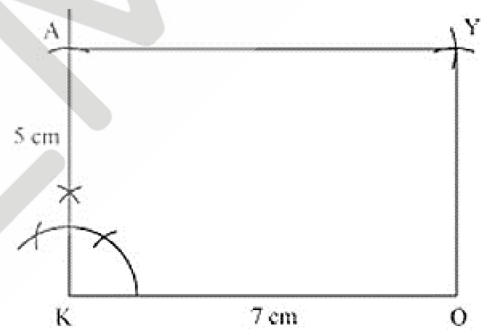
(b) Draw KO = 7cm and an angle of 90^0 at K. Given that AK is 5 cm, cut an arc of 5 cm on the ray drawn from K and name the point A.



(c) Draw arcs of radius 5 cm and 7 cm from O and A respectively. The point of intersection gives Y



Join AY and OY to obtain the required rectangle OKAY.



Therefore, the above figure is the required rectangle.

EXERCISE 4.4

1. Construct the following quadrilaterals.

(i) Quadrilateral DEAR

DE = 4 cm

EA = 5 cm

AR = 4.5 cm

$\angle E = 60°$

$\angle A = 90°$

(ii) Quadrilateral TRUE

$TR = 3.5$ cm

$RU = 3$ cm

$UE = 4$ cm

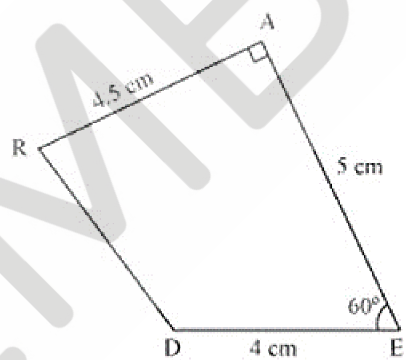
$\angle R = 75°$

$\angle U = 120°$

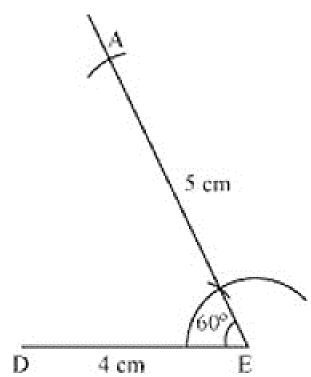
Solution:

(i) Given, $DE = 4$ cm, $EA = 5$ cm, $AR = 4.5$ cm, $\angle E = 60°$ and $\angle A = 90°$

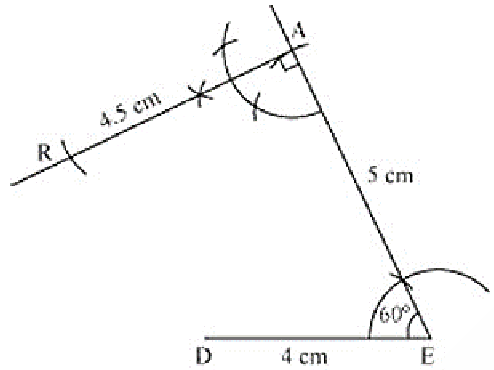
(a) Draw a rough sketch which will help us to visualize the quadrilateral DEAR.



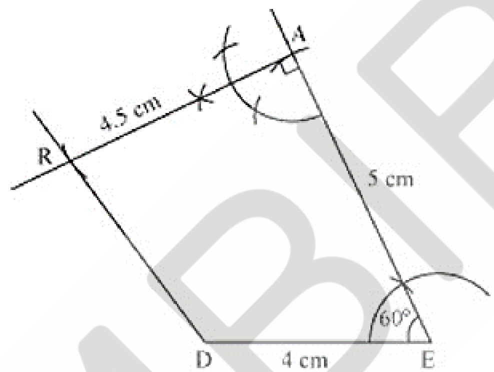
(b) Draw $DE = 4$cm and an angle of 60^0 at E. Cut an arc of 5 cm on the ray extended from E and name this point as A.



(c) Draw an angle of 90^0 at A and cut an arc of 4.5 cm on the ray extended from A. Name this point as R.



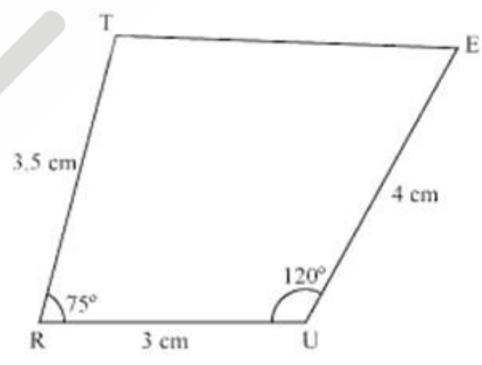
(d) Join RD to obtain the required quadrilateral DEAR.



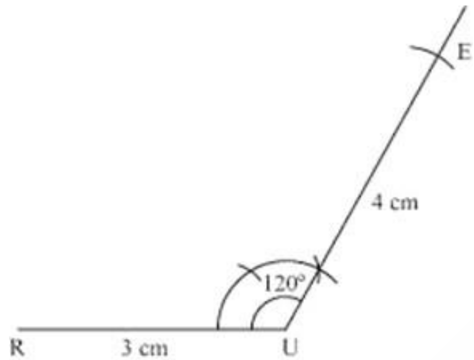
Hence, DEAR is the required quadrilateral.

(ii) Given, $TR = 3.5$ cm, $RU = 3$ cm, $UE = 4$ cm, $\angle R = 75°$ and $\angle U = 120°$

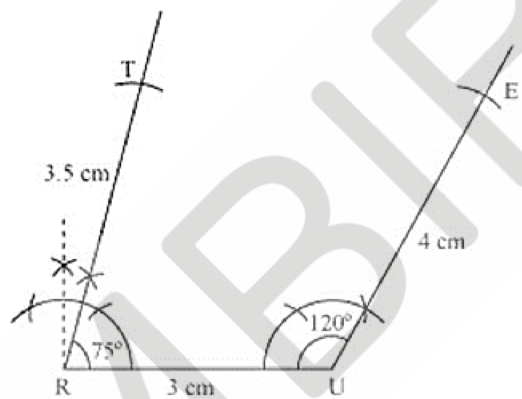
(a) Draw a rough sketch which will help us to visualize the quadrilateral TRUE.



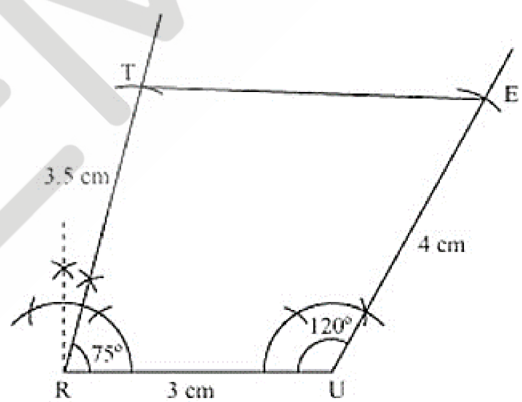
(b) Draw $RU = 3$cm and an angle of 120^0 at U. Cut an arc of 4 cm on the ray extending from U and name this point as E.



(c) Next draw an angle of 75^0 at R and cut an arc of 3.5 cm on the ray extending from this and name this point as T.



(d) Join TE to obtain the required quadrilateral TRUE.



Hence, the above figure is the required quadrilateral.

EXERCISE 4.5

1. Draw the following.

(i) The square READ with RE = 5.1 cm.

(ii) A rhombus whose diagonals are 5.2 cm and 6.4 cm long.

(iii) A rectangle with adjacent sides of lengths 5 cm and 4 cm

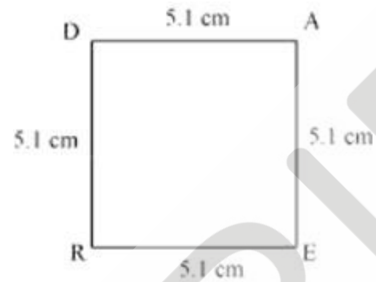
(iv) A parallelogram OKAY where OK = 5.5 cm and KA = 4.2 cm. Is it unique?

Solution:

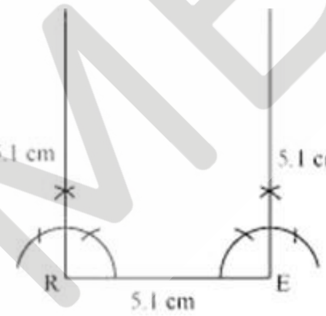
(i) Given, RE = 5.1 cm

All the sides of a square measure the same and each of the angle measure 90^0.

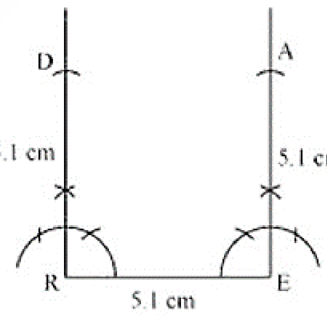
(a) Draw a rough sketch which will help us to visualize the square read.



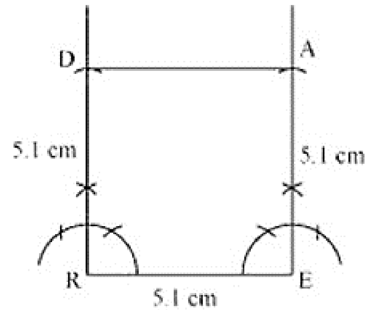
(b) Draw RE = 5.1 cm and an angle of 90^0 at R and E respectively.



Cut arcs of 5.1 cm from R and E such that they intersect the ray extending from them at D and A respectively.



Join DA to obtain the required square READ.



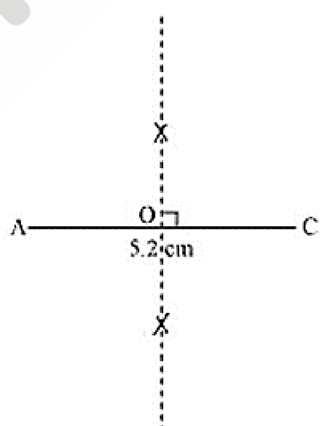
Hence, the above figure is the required square.

(ii) Given, diagonals are 5.2 cm and 6.4 cm long

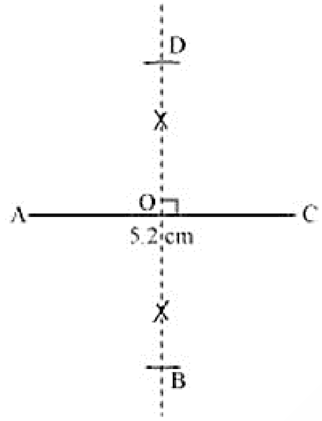
In a rhombus, the diagonals bisect each other at 90^0.

(a) Draw a rough sketch which will help us to visualize the rhombus ABCD.

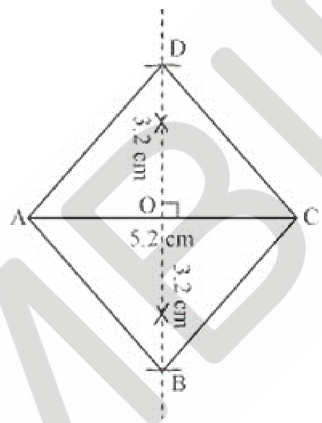
(b) Draw AC = 5.2 cm and construct the perpendicular bisectors. Let it intersect AC at point O.



(c) Draw arcs of 3.2 cm on both the sides of this perpendicular bisector and name it D and B as shown.



Join B and D to A and C to obtain the required rhombus ABCD.

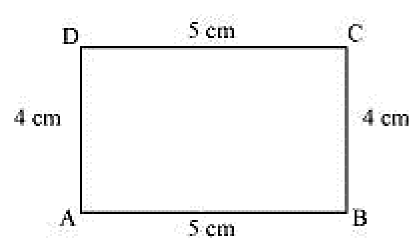


Hence, the above figure is the required rhombus.

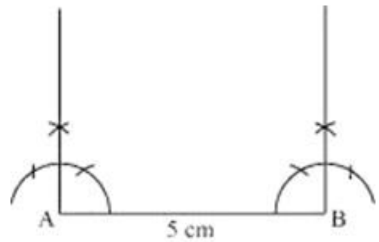
(iii) Given, adjacent sides of lengths are 5 cm and 4 cm.

In a rectangle, the opposite sides measure the same and each interior angle is equal to 90^0.

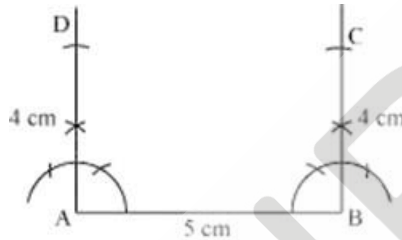
(a) Draw a rough sketch which will help us to visualize the rectangle ABCD.



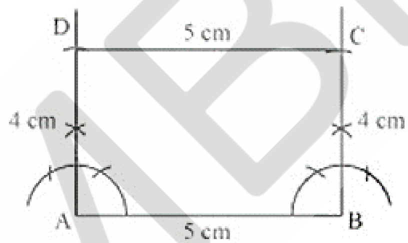
(b) Draw a line segment AB of 5cm and an angle of 90^0 at A and B respectively.



(c) Cut arcs of 4 cm on the rays extending from A and B respectively and name the points of intersection as D and C respectively.



(d) Join DC.

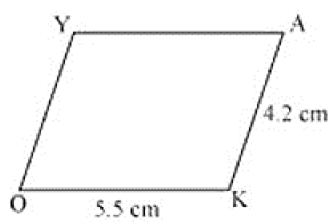


Hence, the above figure is the required rectangle.

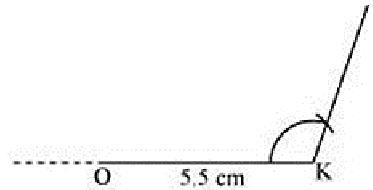
(iv) Given, $OK = 5.5$ cm and $KA = 4.2$ cm

Opposite sides of a parallelogram are equal and parallel to each other.

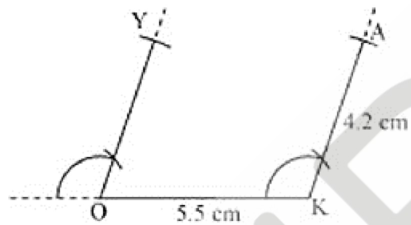
(a) Draw a rough sketch which will help us to visualize the parallelogram OKAY.



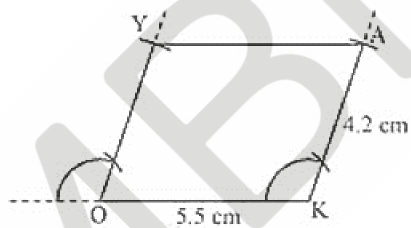
(b) Draw a line segment OK of 5.5cm and any convenient angle at point A.



(c) Draw a ray from O such that it is parallel to the one at K. Cut arcs of 4.2 cm from O and K such that they intersect the rays at Y and A respectively.



Join AY to obtain the required parallelogram OKAY



Hence, the above figure is the required parallelogram.

♦♦♦

CBSE NCERT Solutions for Class 8 Mathematics Chapter 5

Back of Chapter Questions

Exercise 5.1

1. For which of these would you use a histogram to show the data?

(A) The number of letters for different areas in a postman's bag.

(B) The height of competitors in athletics meet.

(C) The number of cassettes produced by 5 companies.

(D) The number of passengers boarding trains from 7:00 a.m. to 7:00 p.m. at a station.

Give reasons for each.

Solution:

If data can be represented in manner of class interval, then histogram can be used to show the data.

(A) In this case, data cannot be divided into class interval. So, we cannot use a histogram to show the data.

(B) In this case, data can be divided into class interval. So, we cannot use a histogram to show the data.

(C) In this case, data cannot be divided into class interval. So, we cannot use a histogram to show the data.

(D) In this case, data can be divided into class interval. So, we cannot use a histogram to show the data.

2. The shoppers who come to a departmental store are marked as: man(M), woman (W), boy (B) or girl (G). The following list gives the shoppers who came in the first hour in the morning:

WWWGBWWMGGMMWWWWGBMWBGGMWWMMWWWMWBWG MWWWWGWMMWWMWGWMGWMMBGGW

Make a frequency distribution table using tally marks. Draw a bar graph to illustrate it.

Solution:

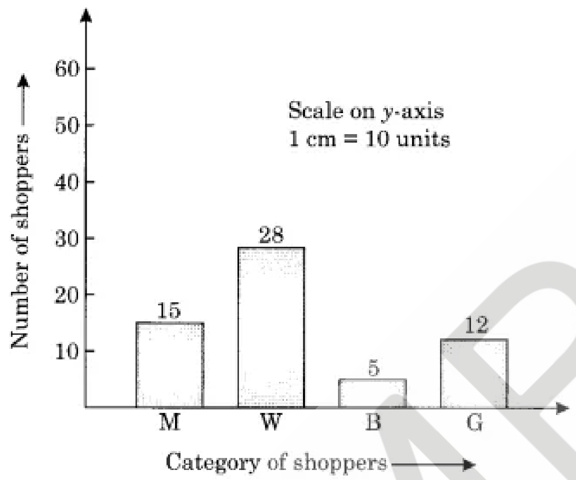
The frequency distribution table is as follows.

Shopper	Tally Marks	Number
W	卌 卌 卌 卌 卌 III	28

M	卌 卌 卌	15
B	卌	5
G	卌 卌 ||	12

The illustration of data by bar graph is as follows.

Bar Graph



3. The weekly wages (in rs) of 30 workers in a factory are.

830, 835, 890, 810, 835, 836, 869, 845, 898, 890, 820, 860, 832, 833, 855, 845, 804, 808, 812, 840, 885, 835, 835, 836, 878, 840, 868, 890, 806, 840

Using tally marks make a frequency table with intervals as 800-810, 810-820 and so on.

Solution:

The representation of data by frequency distribution table using tally marks is as follows.

Interval	Tally marks	Frequency
800 – 810	|||	3
810 – 820	||	2
820 – 830	|	1
830 – 840	卌 ||||	9
840 – 850	卌	5

850 – 860	|	1
860 – 870	|||	3
870 – 880	|	1
880 – 890	|	1
890 – 900	||||	4
	Total	30

4. Draw a histogram for the frequency table made for the data in Question 3, and answer the following questions.

(i) Which group has the maximum number of workers?

(ii) How many workers earn rs 850 and more?

(iii) How many workers earn less than rs 850?

Solution:

The representation of data by frequency distribution table using tally marks is as follows

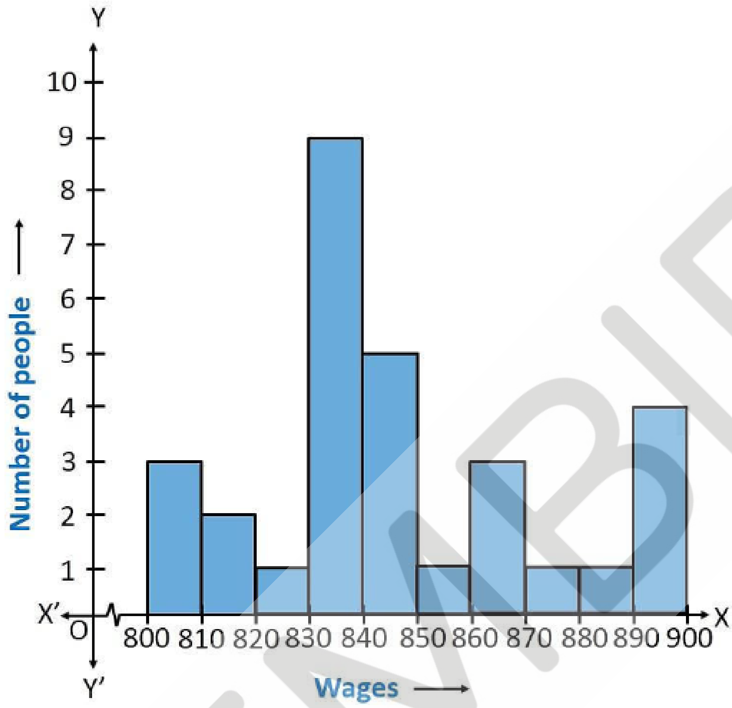
Interval	Tally marks	Frequency
800 – 810	|||	3
810 – 820	||	2
820 – 830	|	1
830 – 840	~~||||~~ ||||	9
840 – 850	~~||||~~	5
850 – 860	|	1
860 – 870	|||	3
870 – 880	|	1
880 – 890	|	1
890 – 900	||||	4

	Total	30

(i) 830-840 group has the maximum number of workers

(ii) 10 workers earn more than 850

(iii) 20 workers earn less than 850



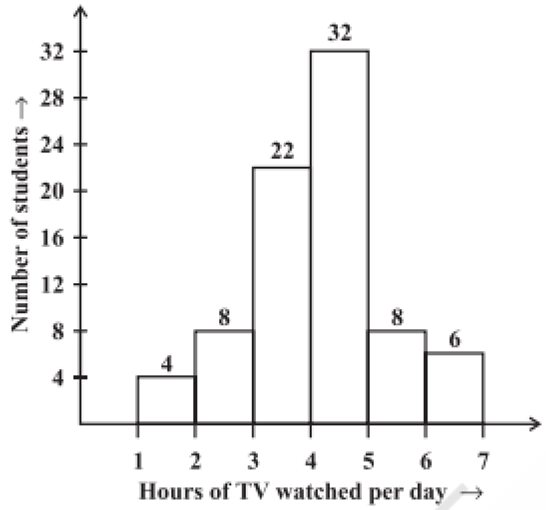
5. The number of hours for which students of a particular class watched television during holidays is shown through the given graph.

Answer the following.

(i) For how many hours did the maximum number of students watch TV?

(ii) How many students watched TV for less than 4 hours?

(iii) How many students spent more than 5 hours in watching TV?



Solution:

(i) The maximum number of students watched TV for 4-5 hours.

(ii) 34 students watched TV for less than 4 hours.

(iii) 14 students spend more than 5 hours in watching TV.

Exercise 5.2

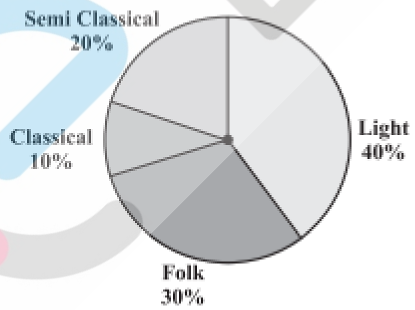
1. A survey was made to find the type of music that a certain group of young people liked in a city. Adjoining pie chart shows the findings of this survey.

From this pie chart answer the following:

If twenty people liked classical music, how many young people get surveyed?

Which type of music is liked by the maximum number of people?

If a cassette company were to make 1000 CD's, how many of each type would they make?



Solution:

(i) Let the total number of people surveyed be x.

It is given that 10% of them like classical music.

10% of $x = 20$

$$\Rightarrow x \times \frac{10}{100} = 20$$

$\Rightarrow \frac{x}{10} = 20$

which gives $x = 200$

Hence, 200 people were surveyed.

(ii) From the pie chart, it is clear that 40% people like light music.

Hence, light music is liked by the maximum number of people.

(iii) CD's of classical music $= 1000 \times \frac{10}{100} = 100$

CD's of semi classical music $= 1000 \times \frac{20}{100} = 200$

CD's of light music $= 1000 \times \frac{40}{100} = 400$

CD's of folk music $= 1000 \times \frac{30}{100} = 300$

2. A group of 360 people were asked to vote for their favourite season from the three seasons, rainy, winter and summer.

Season	No. of votes
Summer 	90
Rainy 	120
Winter 	150

(i) which season got the most votes?

(ii) Find the central angle of each sector?

(iii) Draw a pie chart to show this information.

Solution:

(i) From the given table it is clear that winter season got the maximum votes.

(ii) Total number of votes $= 90 + 120 + 150$

$= 360$

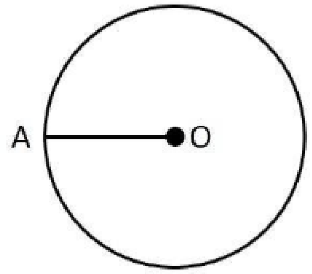
Central angle of summer season $= \left(\frac{90}{360}\right) \times 360^{o} = 90^{o}$

Central angle of winter season $= \left(\frac{150}{360}\right) \times 360^{o} = 150^{o}$

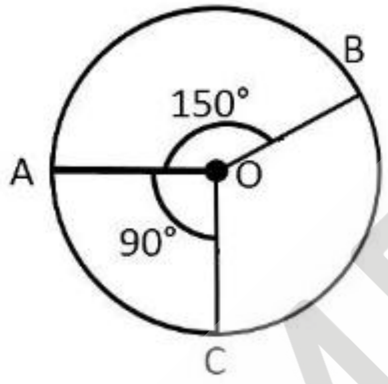
Central angle of rainy season $= \left(\frac{120}{360}\right) \times 360^{o} = 120^{o}$

(iii) Steps to draw a pie chart:

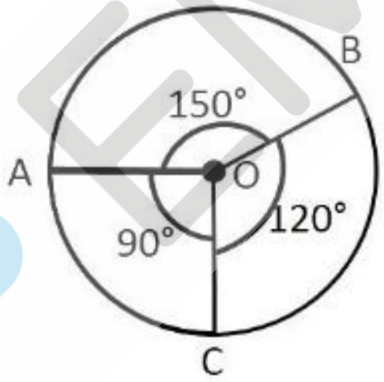
Draw a circle of any radius. Mark radius as OA.



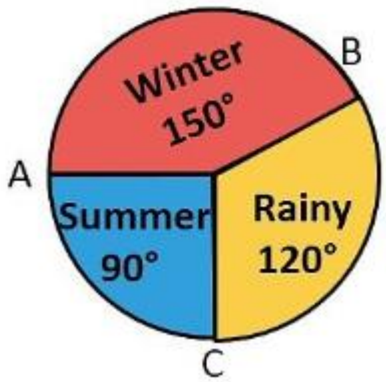
Now, using protractor draw OC 90^o to OA and OB 150^o to OA as shown.



The remaining portion will be 120^o



Now label the pie chart as shown.



3. Draw a pie chart showing the following information. The table shows the colours preferred by a group of people.

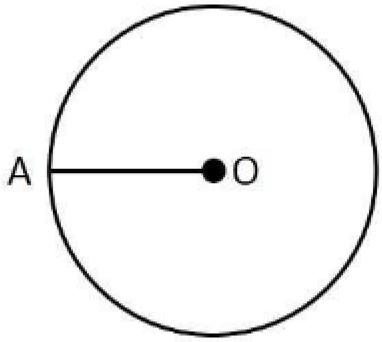
Colours	Number of people
Blue	18
Green	9
Red	6
Yellow	3
Total	36

Solution:

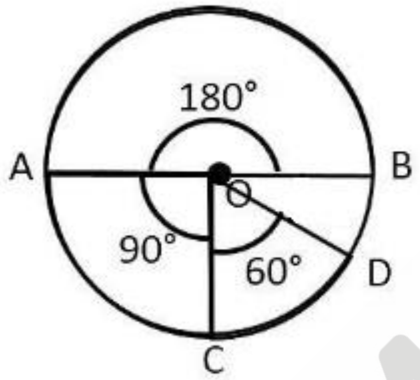
Colours	Number of people	In fraction	Central Angle
Blue	18	$\frac{18}{36} = \frac{1}{2}$	$\left(\frac{1}{2}\right) \times 360^o = 180^o$
Green	9	$\frac{9}{36} = \frac{1}{4}$	$\left(\frac{1}{4}\right) \times 360^o = 90^o$
Red	6	$\frac{6}{36} = \frac{1}{6}$	$\left(\frac{1}{6}\right) \times 360^o = 60^o$
Yellow	3	$\frac{3}{36} = \frac{1}{12}$	$\left(\frac{1}{12}\right) \times 360^o = 30^o$

Steps to draw a pie chart:

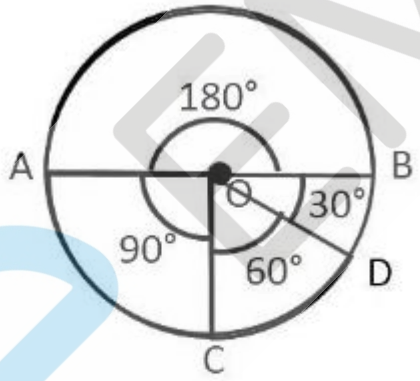
Draw a circle of any radius. Mark radius as OA.



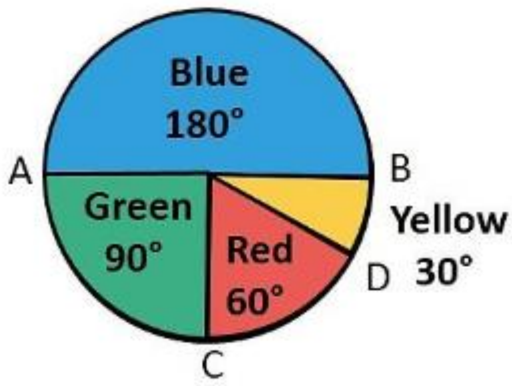
Now, using protractor draw OB 180^{o} to OA, OC 90^{o} to OA and OD 60^{o} to OC as shown.



The remaining portion will be 30^{o}



Now the label the pie chart

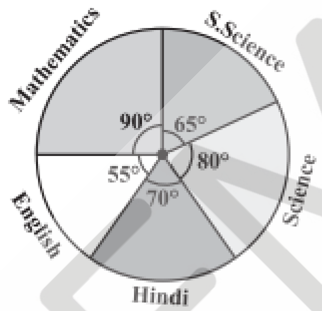


4. The adjoining pie chart gives the marks scored in an examination by a student in Hindi, English, Mathematics, Social Science and Science. If the total marks obtained by the student is 540, answer the following questions.

(i) In which subject did the student score 105 marks?

(ii) How many more marks were obtained by the student in mathematics than in hindi?

(iii) Examine whether the sum of the marks obtained in Social Science and Mathematics is more than that in Science and Hindi.



Solution:

Subject	Central Angle	Marks Obtained
Mathematics	90^o	$(90^o/360^o) \times 540 = 135$
Social Science	65^o	$(65^o/360^o) \times 540 = 97.5$
Science	80^o	$(80^o/360^o) \times 540 = 120$
Hindi	70^o	$(70^o/360^o) \times 540 = 105$
English	55^o	$(55^o/360^o) \times 540 = 82.5$

(i) The student scored 105 marks in Hindi.

(ii) Marks obtained in Mathematics $= 135$

Marks obtained in Hindi $= 105$

Difference $= 135 - 105$

$= 30$

Thus, 30 more marks were obtained by the student in Mathematics than in Hindi.

(iii) The sum of marks in Social Science and Mathematics $= 97.5 + 135 = 232.5$

The sum of marks in Science and Hindi $= 120 + 105 = 225$

Yes, the sum of marks in Social Science and Mathematics is more than that in Science and Hindi.

5. The number of students in a hostel, speaking different languages is given below.

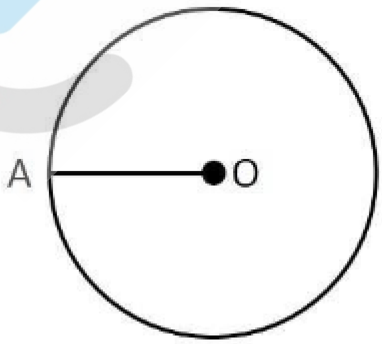
Display the data in a pie chart.

Language	**Hindi**	**English**	**Marathi**	**Tamil**	**Bengali**	**Total**
Number of students	40	12	9	7	4	72

Solution:

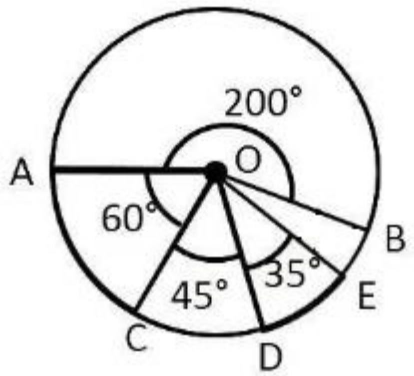
Language	**Number of students**	**In fraction**	**Central Angle**
Hindi	40	$40/72 = 5/9$	$(5/9) \times 360^o = 200^o$
English	12	$12/72 = 1/6$	$(1/6) \times 360^o = 60^o$
Marathi	9	$9/72 = 1/8$	$(1/8) \times 360^o = 45^o$
Tamil	7	$7/72 = 7/72$	$(7/72) \times 360^o = 35^o$
Bengali	4	$4/72 = 1/18$	$(1/18) \times 360^o = 20^o$
Total	72		

Steps to draw a pie chart:

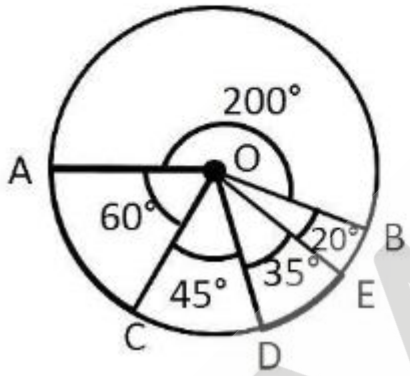


Draw a circle of any radius. Mark radius as OA.

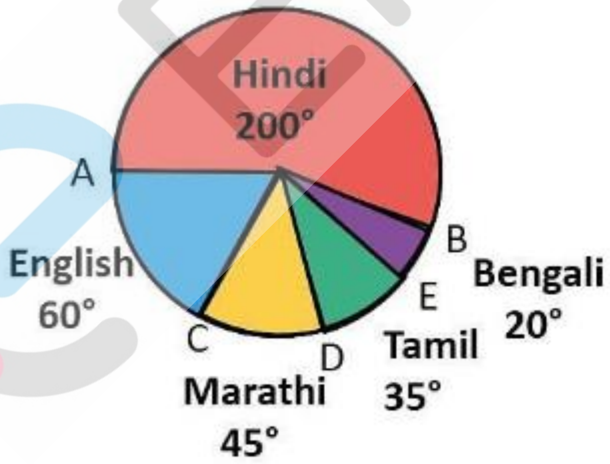
Now, using protractor draw OB 200^o with OA, OC 60^o with OA, OD 45^o with OC and OE 35^o with OD as shown.



The remaining portion will be 20^o.



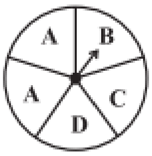
Now label the pie chart



Exercise 5.3

1. list the outcomes you can see in these experiments

Spinning a wheel (B) Tossing two coins together



Solution:

1 (A): There are four letters A, B, C, D in the spinning wheel. So, there are four outcomes.

1 (B): When two coins are tossed together, there are four possible outcomes HH, HT, TH, TT.

2. When a die is thrown, list the outcomes of an event of getting

1 (A) a prime number (B) not a prime number

2 (A) a number greater than 5 (B) a number not greater than 5.

Solution:

When a die is thrown, the possible outcomes are 1, 2, 3, 4, 5 and 6.

1(A) When a die is thrown, outcomes of the event of getting a prime number are 2, 3 and 5.

1(B) When a die is thrown, outcomes of event of not getting a prime number are 1, 4 and 6.

2(A) When a die is thrown, outcomes of event of getting a number greater than 5 is 6.

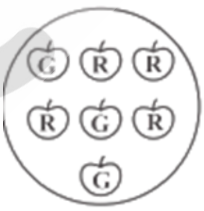
2(B) When a die is thrown, outcomes of event of getting a number not greater than 5 are 1, 2, 3, 4 and 5.

3. Find the.

(A) Probability of the pointer stopping on D in (Question 1 − (A))?

(B) Probability of getting an ace from a well shuffled deck of 52 playing cards?

(C) Probability of getting a red apple. (see figure below)



Solution:

3(A) In the given spinning wheel, There are five pointers A, A, B, C and D. So, there are five outcomes. Pointer stops at D is an outcome.

Hence, the probability of the pointer stopping on D is $\frac{1}{5}$.

3(B) Total numbers of aces in a well shuffled deck of 52 playing cards is 4. So, there are four events of getting an ace.

So, the probability of getting an ace $= \frac{4}{52} = \frac{1}{13}$

3(C) Total number of apples $= 7$

Total number of red apples $= 4$

Probability of getting a red apple $= \frac{4}{7}$

4. Numbers 1 to 10 are written on ten separate slips (one number on one slip), kept in a box and mixed well. One slip is chosen from the box without looking into it. What is the probability of.

Getting a number 6?

Getting a number less than 6?

Getting a number greater than 6?

Getting a 1-digit number?

Solution:

4(1) Outcome of getting a number 6 from 10 separate slips is one.

Therefore, probability of getting a number 6 is $\frac{1}{10}$.

4(2) $1, 2, 3, 4$ and 5 are the numbers which are less than 6. So, there are five outcomes.

Therefore, probability of getting a number less than 6 $= \frac{5}{10} = \frac{1}{2}$.

4(3) $7, 8, 9$ and 10 are the four numbers which are greater than 6. So, there are four outcomes.

Therefore, probability of getting a number greater than 6 $= \frac{4}{10} = \frac{2}{5}$

4(4) $1, 2, 3, 4, 5, 6, 7, 8$ and 9 are the nine one digit numbers out of ten.

Therefore, probability of getting a one digit number $= \frac{9}{10}$.

5. If you have a spinning wheel with 3 green sectors, 1 blue sector and 1 red sector, what is the probability of getting a green sector? What is the probability of getting a non blue sector?

Solution:

There are five sectors. Three sectors are green out of five sectors.

Therefore, probability of getting a green sector $= \frac{3}{5}$

There is one blue sector out of five sectors.

Number of non blue sectors $= 5 - 1$ sectors

$= 4$ sectors

Therefore, probability of getting a non blue sector $= \frac{4}{5}$

6. Find the probabilities of the events given in question 2.

Solution:

1(A): When a die is thrown, there are total six outcomes, i.e, $1, 2, 3, 4, 5$ and 6.

Out of all possible outcomes $2, 3$ and 5 are the prime numbers. So, there are three outcomes out of six.

Therefore, probability of getting a prime number $= \frac{3}{6} = \frac{1}{2}$

1(B): Out of all possible outcomes $1, 4$ and 6 are not prime numbers. So, there are three outcomes out of six.

Therefore, probability of not getting a prime number $= \frac{3}{6} = \frac{1}{2}$

2(A) Only 6 is greater than 5 out of all possible outcomes. So, there is one outcome out of six.

Therefore, probability of getting a number greater than $5 = \frac{1}{6}$

2(B) $1, 2, 3, 4$ and 5 are the numbers not greater than 5. So, there are 5 outcomes out of 6.

Therefore, probability of not getting a number greater than $5 = \frac{5}{6}$

CBSE NCERT Solutions for Class 8 Mathematics Chapter 6

Back of Chapter Questions

Exercise 6.1:

1. What will be the unit digit of the squares of the following numbers?

(i) 81

(ii) 272

(iii) 799

(iv) 3853

(v) 1234

(vi) 26387

(vii) 52698

(viii) 99880

(ix) 12796

(x) 55555

Solution:

We know that if a number has its unit's place digit as m, then its square will end with the unit digit of the multiplication $m \times m$.

(i) 81

As the given number has its unit's place digit as 1, its square will end with the unit digit of the multiplication $(1 \times 1 = 1)$ i.e., 1.

(ii) 272

As the given number has its unit's place digit as 2, its square will end with the unit digit of the multiplication $(2 \times 2 = 4)$ i.e., 4.

(iii) 799

As the given number has its unit's place digit as 9, its square will end with the unit digit of the multiplication $(9 \times 9 = 81)$ i.e., 1.

(iv) 3853

As the given number has its unit's place digit as 3, its square will end with the unit digit of the multiplication $(3 \times 3 = 9)$ i.e., 9.

(v) 1234

As the given number has its unit's place digit as 4, its square will end with the unit digit of the multiplication $(4 \times 4 = 16)$ i.e., 6.

(vi) 26387

As the given number has its unit's place digit as 7, its square will end with the unit digit of the multiplication $(7 \times 7 = 49)$ i.e., 9.

(vii) 52698

As the given number has its unit's place digit as 8, its square will end with the unit digit of the multiplication $(8 \times 8 = 64)$ i.e., 4.

(viii) 99880

As the given number has its unit's place digit as 0, its square will have two zeroes at the end. Therefore, the unit digit of the square of the given number is 0.

(xi) 12796

As the given number has its unit's place digit as 6, its square will end with the unit digit of the multiplication $(6 \times 6 = 36)$ i.e., 6.

(x) 55555

As the given number has its unit's place digit as 5, its square will end with the unit digit of the multiplication $(5 \times 5 = 25)$ i.e., 5.

2. The following numbers are obviously not perfect squares. Give reason.

(i) 1057

(ii) 23453

(iii) 7928

(iv) 222222

(v) 64000

(vi) 89722

(vii) 222000

(viii) 505050

Solution:

We know that the square of numbers may end with any one of the digits: 0, 1, 5, 6, or 9. Also, a perfect square has only even number of zeroes at the end of it.

(i) 1057

Has its unit place digit as 7. Hence, it cannot be a perfect square.

(ii) 23453

Has its unit place digit as 3. Hence, it cannot be a perfect square.

(iii) 7928

Has its unit place digit as 8. Hence, it cannot be a perfect square.

(iv) 222222

Has its unit place digit as 2. Hence, it cannot be a perfect square.

(v) 64000

Has three zeros at the end of it. However, since a perfect square cannot end with odd number of zeroes, it is not a perfect square.

(vi) 89722

Has its unit place digit as 2. Hence, it cannot be a perfect square.

(vii) 222000

Has three zeroes at the end of it. Therefore, since a perfect square cannot end with odd number of zeroes, it is not a perfect square.

(viii) 505050

Has one zero at the end of it. Therefore, since a perfect square cannot end with odd number of zeroes, it is not a perfect square.

3. The squares of which of the following would be odd numbers?

(i) 431

(ii) 2826

(iii) 7779

(iv) 82004

Solution:

We observe, that the square of an odd number is odd and the square of an even number is even.

(i) 431^2 is an odd number

(ii) 2826^2 is an even number

(iii) 7779^2 is an odd number

(iv) 82004^2 is an even number

4. Observe the following pattern and find the missing digits.

$11^2 = 121$

$101^2 = 10201$

$1001^2 = 1002001$

$100001^2 = 1\_2\_1$

$10000001^2 = \cdots$

Solution:

From the given pattern, it can be observed that the squares of the given numbers have the same number of zeroes before and after the digit 2 as it was in the original number. Therefore,

$100001^2 = 10000200001$

$10000001^2 = 100000020000001$

5. Observe the following pattern and supply the missing number.

$11^2 = 121$

$101^2 = 10201$

$10101^2 = 102030201$

$1010101^2 = \ldots\ldots$

$\ldots^2 = 10203040504030201$

Solution:

From the above pattern, we obtain

$1010101^2 = 1020304030201$

$101010101^2 = 10203040504030201$

6. Using the given pattern, find the missing numbers.

$1^2 + 2^2 + 2^2 = 3^2$

$2^2 + 3^2 + 6^2 = 7^2$

$3^2 + 4^2 + 12^2 = 13^2$

$4^2 + 5^2 + \_^2 = 21^2$

$5^2 + \_^2 + 30^2 = 31^2$

$6^2 + 7^2 + \_^2 = \_^2$

Solution:

From the given pattern, it can be observed that,

(i) The third number is the product of the first two numbers.

(ii) The fourth number can be obtained by adding 1 to the third number.

Thus, the missing numbers in the pattern will be:

$4^2 + 5^2 + \underline{20}^2 = 21^2$

$5^2 + \underline{6}^2 + 30^2 = 31^2$

$6^2 + 7^2 + \underline{42}^2 = \underline{43}^2$

7. Without adding find the sum

(i) $1 + 3 + 5 + 7 + 9$

(ii) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19$

(iii) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23$

Solution:

We know that the sum of first n odd natural numbers is n^2.

(i) Now, we have to find the sum of first five odd natural numbers.

Hence, $1 + 3 + 5 + 7 + 9 = (5)^2 = 25$

(ii) Now, we have to find the sum of first ten odd natural numbers.

Hence, $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = (10)^2 = 100$

(iii) Now, we have to find the sum of first twelve odd natural numbers.

Hence, $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 = (12)^2 = 144$

8. (i) Express 49 as the sum of 7 odd numbers.

(ii) Express 121 as the sum of 11 odd numbers.

Solution:

We know that the sum of first n odd natural numbers is n^2.

(i) $49 = (7)^2$

Therefore, 49 is the sum of first 7 odd natural numbers.

$49 = 1 + 3 + 5 + 7 + 9 + 11 + 13$

(ii) $121 = (11)^2$

Therefore, 121 is the sum of first 11 odd natural numbers.

$121 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21$

9. How many numbers lie between squares of the following numbers?

(i) 12 and 13

(ii) 25 and 26

(iii) 99 and 100

Solution:

We know that there will be $2n$ numbers in between the squares of the numbers n and $(n+1)$.

(i) Between 12^2 and 13^2, there will be $2 \times 12 = 24$ numbers

(ii) Between 25^2 and 26^2, there will be $2 \times 25 = 50$ numbers

(iii) Between 99^2 and 100^2, there will be $2 \times 99 = 198$ numbers

Exercise 6.2:

1. Find the square of the following numbers

(i) 32

(ii) 35

(iii) 86

(iv) 93

(v) 71

(vi) 46

Solution:

(i) $32^2 = (30+2)^2$

$= 30\,(30+2) + 2\,(30+2)$

$= 30^2 + 30 \times 2 + 2 \times 30 + 2^2$

$= 900 + 60 + 60 + 4$

$= 1024$

(ii) $35^2 = (30+5)^2$

$= 30(30+5) + 5(30+5)$

$= 30^2 + 30 \times 5 + 5 \times 30 + 5^2$

$= 900 + 150 + 150 + 25$

$= 1225$

(iii) $86^2 = (80+6)^2$

$= 80(80+6) + 6(80+6)$

$= 80^2 + 80 \times 6 + 6 \times 80 + 6^2$

$= 6400 + 480 + 480 + 36$

$= 7396$

(iv) $93^2 = (90 + 3)^2$

$= 90(90 + 3) + 3(90 + 3)$

$= 90^2 + 90 \times 3 + 3 \times 90 + 3^2$

$= 8100 + 270 + 270 + 9$

$= 8649$

(v) $71^2 = (70 + 1)^2$

$= 70(70 + 1) + 1(70 + 1)$

$= 70^2 + 70 \times 1 + 1 \times 70 + 1^2$

$= 4900 + 70 + 70 + 1$

$= 5041$

(vi) $46^2 = (40 + 6)^2$

$= 40(40 + 6) + 6(40 + 6)$

$= 40^2 + 40 \times 6 + 6 \times 40 + 6^2$

$= 1600 + 240 + 240 + 36$

$= 2116$

2. Write a Pythagorean triplet whose one member is

(i) 6

(ii) 14

(iii) 16

(iv) 18

Solution:

For any natural number $m > 1; 2m, m^2 - 1, m^2 + 1$ forms a Pythagorean triplet.

(i) If we take $m^2 + 1 = 6$, then $m^2 = 5$

The value of m will not be an integer.

If we take $m^2 - 1 = 6$, then $m^2 = 7$

Again the value of m is not an integer.

Let $2m = 6$,

$m = 3$

$2 \times \mathrm{m} = 2 \times 3 = 6$

$\mathrm{m}^2 - 1 = 3^2 - 1 = 8$

$\mathrm{m}^2 + 1 = 3^2 + 1 = 10.$

Therefore, the Pythagorean triplets are: $6, 8$, and 10.

(ii) If we take $\mathrm{m}^2 + 1 = 14$, then $\mathrm{m}^2 = 13$

The value of m will not be an integer.

If we take $\mathrm{m}^2 - 1 = 14$, then $\mathrm{m}^2 = 15$

Again the value of m is not an integer.

Let $2\mathrm{m} = 14$

$\mathrm{m} = 7$

Thus, $\mathrm{m}^2 - 1 = 49 - 1 = 48$ and $\mathrm{m}^2 + 1 = 49 + 1 = 50$

Therefore, the required triplet is $14, 48$, and 50.

(iii) If we take $\mathrm{m}^2 + 1 = 16$, then $\mathrm{m}^2 = 15$

The value of m will not be an integer.

If we take $\mathrm{m}^2 - 1 = 16$, then $\mathrm{m}^2 = 17$

Again the value of m is not an integer.

Let $2\mathrm{m} = 16$

$\mathrm{m} = 8$

Thus, $\mathrm{m}^2 - 1 = 64 - 1 = 63$ and $\mathrm{m}^2 + 1 = 64 + 1 = 65$

Therefore, the Pythagorean triplet is $16, 63$, and 65.

(iv) If we take $\mathrm{m}^2 + 1 = 18$,

$\mathrm{m}^2 = 17$

The value of m will not be an integer.

If we take $\mathrm{m}^2 - 1 = 18$, then $\mathrm{m}^2 = 19$

Again the value of m is not an integer.

Let $2\mathrm{m} = 18$

$\mathrm{m} = 9$

Thus, $m^2 - 1 = 81 - 1 = 80$ and $m^2 + 1 = 81 + 1 = 82$

Therefore, the Pythagorean triplet is $18, 80$, and 82.

Exercise 6.3:

1. What could be the possible 'one's' digits of the square root of each of the following numbers?

(i) 9801

(ii) 99856

(iii) 998001

(iv) 657666025

Solution:

(i) If the number ends with 1, then the one's digit of the square root of that number may be 1 or 9. Hence, one's digit of the square root of 9801 is either 1 or 9.

(ii) If the number ends with 6, then the one's digit of the square root of that number may be 4 or 6. Hence, one's digit of the square root of 99856 is either 4 or 6.

(iii) If the number ends with 1, then the one's digit of the square root of that number may be 1 or 9. Hence, one's digit of the square root of 998001 is either 1 or 9.

(iv) If the number ends with 5, then the one's digit of the square root of that number will be 5. Hence, the one's digit of the square root of 657666025 is 5.

2. Without doing any calculation, find the numbers which are surely not perfect squares.

(i) 153

(ii) 257

(iii) 408

(iv) 441

Solution:

The perfect squares of a number can end with any of the digits 0, 1, 4, 5, 6, or 9 at unit's place. Also, a perfect square will end with even number of zeroes.

(i) Since the number 153 has its unit's place digit as 3, it is not a perfect square.

(ii) Since the number 257 has its unit's place digit as 7, it is not a perfect square.

(iii) Since the number 408 has its unit's place digit as 8, it is not a perfect square.

(iv) Since the number 441 has its unit's place digit as 1, it is a perfect square.

3. Find the square roots of 100 and 169 by the method of repeated subtraction.

Solution:

We know that the sum of the first n odd natural numbers is n^2.

Consider $\sqrt{100}$.

(i) $100 - 1 = 99$

(ii) $99 - 3 = 96$

(iii) $96 - 5 = 91$

(iv) $91 - 7 = 84$

(v) $84 - 9 = 75$

(vi) $75 - 11 = 64$

(vii) $64 - 13 = 51$

(viii) $51 - 15 = 36$

(ix) $36 - 17 = 19$

(x) $19 - 19 = 0$

We see that we have subtracted successive odd numbers starting from 1 to 100, and obtained 0 at 10^{th} step.

Therefore, $\sqrt{100} = 10$

The square root of 169 can be obtained by the method of repeated subtraction as follows.

(i) $169 - 1 = 168$

(ii) $168 - 3 = 165$

(iii) $165 - 5 = 160$

(iv) $160 - 7 = 153$

(v) $153 - 9 = 144$

(vi) $144 - 11 = 133$

(vii) $133 - 13 = 120$

(viii) $120 - 15 = 105$

(ix) $105 - 17 = 88$

(x) $88 - 19 = 69$

(xi) $69 - 21 = 48$

(xii) $48 - 23 = 25$

(xiii) $25 - 25 = 0$

We have subtracted successive odd numbers starting from 1 to 169, and obtained 0 at 13^{th} step.

Therefore, $\sqrt{169} = 13$

4. Find the square roots of the following numbers by the Prime Factorization Method.

(i) 729

(ii) 400

(iii) 1764

(iv) 4096

(v) 7744

(vi) 9604

(vii) 5929

(viii) 9216

(ix) 529

(x) 8100

Solution:

(i) After performing the prime factorization, we obtain the factors as,

$729 = \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$

$\sqrt{729} = 3 \times 3 \times 3 = 27$

(ii) After performing the prime factorization, we obtain the factors as,

$400 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5}$

$\sqrt{400} = 2 \times 2 \times 5 = 20$

(iii) After performing the prime factorization, we obtain the factors as,

$1764 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

$\sqrt{1764} = 2 \times 3 \times 7 = 42$

(iv) After performing the prime factorization, we obtain the factors as

$4096 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}$

$\sqrt{4096} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$

(v) After performing the prime factorization, we obtain the factors as,

$7744 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{11 \times 11}$

$\sqrt{7744} = 2 \times 2 \times 2 \times 11 = 88$

(vi) After performing the prime factorization, we obtain the factors as,

$9604 = \underline{2 \times 2} \times \underline{7 \times 7} \times \underline{7 \times 7}$

$\sqrt{9604} = 2 \times 7 \times 7 = 98$

(vii) After performing the prime factorization, we obtain the factors as,

$5929 = \underline{7 \times 7} \times \underline{11 \times 11}$

$\sqrt{5929} = 7 \times 11 = 77$

(viii) After performing the prime factorization, we obtain the factors as,

$9216 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3}$

$\sqrt{5929} = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 96$

(ix) After performing the prime factorization, we obtain the factors as,

$529 = \underline{23 \times 23}$

$\sqrt{529} = 23$

(x) After performing the division, we obtain the factors as,

$8100 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{5 \times 5}$

$\sqrt{8100} = 2 \times 3 \times 3 \times 5 = 90$

5. For each of the following numbers, find the smallest whole number by which it should be multiplied so as to get a perfect square number. Also find the square root of the square number so obtained.

(i) 252

(ii) 180

(iii) 1008

(iv) 2028

(v) 1458

(vi) 768

Solution:

(i) $252 = \underline{2 \times 2} \times \underline{3 \times 3} \times 7$

Here, prime factor 7 does not have its pair.

If 7 gets a pair, then the number will become a perfect square.

Therefore, 252 must be multiplied with 7 to obtain a perfect square.

$252 \times 7 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

Therefore, $252 \times 7 = 1764$ is a perfect square

$\therefore \sqrt{1764} = 2 \times 3 \times 7 = 42$

(ii) $180 = \underline{2 \times 2} \times \underline{3 \times 3} \times 5$

Here, prime factor 5 does not have its pair. If 5 gets a pair, then the number will become a perfect square.

Therefore, 180 must be multiplied with 5 to obtain a perfect square.

$180 \times 5 = 900 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5}$

Therefore, $180 \times 5 = 900$ is a perfect square.

$\therefore \sqrt{900} = 2 \times 3 \times 5 = 30$

(iii) $1008 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 7$

Here, prime factor 7 does not have its pair. If 7 gets a pair, then the number will become a perfect square.

Therefore, 1008 can be multiplied with 7 to obtain a perfect square.

$1008 \times 7 = 7056 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7}$

Therefore, $1008 \times 7 = 7056$ is a perfect square.

$\therefore \sqrt{7056} = 2 \times 2 \times 3 \times 7 = 84$

(iv) $2028 = \underline{2 \times 2} \times 3 \times \underline{13 \times 13}$

Here, prime factor 3 does not have its pair. If 3 gets a pair, then the number will become a perfect square.

Therefore, 2028 has to be multiplied with 3 to obtain a perfect square.

Therefore, $2028 \times 3 = 6084$ is a perfect square.

$2028 \times 3 = 6084 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{13 \times 13}$

$\therefore \sqrt{6084} = 2 \times 3 \times 13 = 78$

(v) $1458 = 2 \times \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$

Here, prime factor 2 does not have its pair. If 2 gets a pair, then the number will become a perfect square.

Therefore, 1458 has to be multiplied with 2 to obtain a perfect square.

Therefore, $1458 \times 2 = 2916$ is a perfect square.

$1458 \times 2 = 2916 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$

$\therefore \sqrt{2916} = 2 \times 3 \times 3 \times 3 = 54$

(vi) $768 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times 3$

Here, prime factor 3 does not have its pair. If 3 gets a pair, then the number will become a perfect square.

Therefore, 768 must be multiplied with 3 to obtain a perfect square.

Therefore, $768 \times 3 = 2304$ is a perfect square.

$768 \times 3 = 2304 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3}$

$\therefore \sqrt{2304} = 2 \times 2 \times 2 \times 2 \times 3 = 48$

6. For each of the following numbers, find the smallest whole number by which it should be divided so as to get a perfect square number. Also find the square root of the square number so obtained.

(i) 252

(ii) 2925

(iii) 396

(iv) 2645

(v) 2800

(vi) 1620

Solution:

(i) 252 can be factorized as follows.

$252 = \underline{2 \times 2} \times \underline{3 \times 3} \times 7$

Here, prime factor 7 does not have its pair.

If we divide this number by 7, then the number will become a perfect square. Therefore, 252 must be divided by 7 to obtain a perfect square.

$252 \div 7 = 36$ is a perfect square.

$36 = \underline{2 \times 2} \times \underline{3 \times 3}$

$\therefore \sqrt{36} = 2 \times 3 = 6$

(ii) 2925 can be factorized as follows.

$2925 = \underline{3 \times 3} \times \underline{5 \times 5} \times 13$

Here, prime factor 13 does not have its pair.

If we divide this number by 13, then the number will become a perfect square.

Therefore, 2925 has to be divided by 13 to obtain a perfect square.

$2925 \div 13 = 225$ is a perfect square.

$225 = \underline{3 \times 3} \times \underline{5 \times 5}$

$\therefore \sqrt{225} = 3 \times 5 = 15$

(iii) 396 can be factorized as follows.

$396 = \underline{2 \times 2} \times \underline{3 \times 3} \times 11$

Here, prime factor 11 does not have its pair.

If we divide this number by 11, then the number will become a perfect square.

Therefore, 396 must be divided by 11 to obtain a perfect square.

$396 \div 11 = 36$ is a perfect square.

$36 = \underline{2 \times 2} \times \underline{3 \times 3}$

$\therefore \sqrt{36} = 2 \times 3 = 6$

(iv) 2645 can be factorized as follows.

$2645 = 5 \times \underline{23 \times 23}$

Here, prime factor 5 does not have its pair.

If we divide this number by 5, then the number will become a perfect square.

Therefore, 2645 has to be divided by 5 to obtain a perfect square.

$2645 \div 5 = 529$ is a perfect square.

$529 = 23 \times 23$

$\therefore \sqrt{529} = 23$

(v) 2800 can be factorized as follows.

$2800 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5} \times 7$

Here, prime factor 7 does not have its pair.

If we divide this number by 7, then the number will become a perfect square.

Therefore, 2800 has to be divided by 7 to obtain a perfect square.

$2800 \div 7 = 400$ is a perfect square.

$400 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5}$

$\therefore \sqrt{400} = 2 \times 2 \times 5 = 20$

(vi) 1620 can be factorized as follows.

$1620 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3} \times 5$

Here, prime factor 5 does not have its pair.

If we divide this number by 5, then the number will become a perfect square.

Therefore, 1620 has to be divided by 5 to obtain a perfect square.

$1620 \div 5 = 324$ is a perfect square

$324 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3}$

$\therefore \sqrt{324} = 2 \times 3 \times 3 = 18$

7. The students of Class VIII of a school donated Rs 2401 in all, for Prime Minister's National Relief Fund. Each student donated as many rupees as the number of students in the class. Find the number of students in the class.

Solution:

It is given that each student donated as many rupees as the number of students of the class.

Number of students in the class will be the square root of the amount donated by the students of the class.

The total amount of donation is Rs 2401.

Number of students in the class $= \sqrt{2401}$

$2401 = \underline{7 \times 7} \times \underline{7 \times 7}$

$\therefore \sqrt{2401} = 7 \times 7 = 49$

Hence, the number of students in the class is 49.

8. 2025 plants are to be planted in a garden in such a way that each row contains as many plants as the number of rows. Find the number of rows and the number of plants in each row.

Solution:

It is given that in the garden, each row contains as many plants as the number of rows.

Hence,

Number of rows = Number of plants in each row

Total number of plants = Number of rows × Number of plants in each row

Number of rows × Number of plants in each row = 2025

$(\text{Number of rows})^2 = 2025$

2	4, 9, 10
2	2, 9, 5
3	1, 9, 5
3	1, 3, 5
5	1, 1, 5
	1, 1, 1

Number of rows = $\sqrt{2025}$

$2025 = \underline{5 \times 5} \times \underline{3 \times 3} \times \underline{3 \times 3}$

$\therefore \sqrt{2025} = 5 \times 3 \times 3 = 45$

Thus, the number of rows and the number of plants in each row is 45.

9. Find the smallest square number that is divisible by each of the numbers 4, 9, and 10.

Solution:

The number that will be perfectly divisible by each one of 4, 9, and 10 is the LCM of these numbers. The LCM of these numbers is as follows.

LCM of $4, 9, 10 = \underline{2 \times 2} \times \underline{3 \times 3} \times 5 = 180$

Here, prime factor 5 does not have its pair. Therefore, 180 is not a perfect square. If we multiply 180 with 5, then the number will become a perfect square.

Therefore, 180 should be multiplied with 5 to obtain a perfect square.

Hence, the required square number is $180 \times 5 = 900$.

10. Find the smallest square number that is divisible by each of the numbers 8, 15, and 20.

Solution:

The number that is perfectly divisible by each of the numbers $8, 15$, and 20 is their LCM.

2	8, 15, 20
2	4, 15, 10
2	2, 15, 5
3	1, 15, 5
5	1, 5, 5
	1, 1, 1

LCM of $8, 15$, and $20 = \underline{2 \times 2} \times 2 \times 3 \times 5 = 120$

Here, prime factors $2, 3$, and 5 do not have their respective pairs. Therefore, 120 is not a perfect square.

Therefore, 120 should be multiplied by $2 \times 3 \times 5$, i.e. 30, to obtain a perfect square. Hence, the required square number is $120 \times 2 \times 3 \times 5 = 3600$.

Exercise 6.2:

1. Find the square root of each of the following numbers by division method.

(i) 2304

(ii) 4489

(iii) 3481

(iv) 529

(v) 3249

(vi) 1369

(vii) 5776

(viii) 7921

(ix) 576

(x) 1024

(xi) 3136

(xii) 900

Solution:

(i) The square root of 2304 can be calculated as follows.

	48

4	$\overline{23}\,\overline{04}$ -16
88	704 704
	0

$\therefore \sqrt{2304} = 48$

(ii) The square root of 4489 can be calculated as follows.

	67
6	$\overline{44}\,\overline{89}$ -36
127	889 889
	0

$\therefore \sqrt{4489} = 67$

(iii) The square root of 3481 can be calculated as follows.

	59
5	$\overline{34}\,\overline{81}$ -25
109	981 981
	0

Therefore, $\sqrt{3481} = 59$

(iv) The square root of 529 can be calculated as follows.

	23
2	$\overline{5}\,\overline{29}$ -4
43	129 129

	0

$\therefore \sqrt{529} = 23$

(v) The square root of 3249 can be calculated as follows.

	57
5	$\overline{32}\,\overline{49}$ -25
107	749 749
	0

$\therefore \sqrt{3249} = 57$

(vi) The square root of 1369 can be calculated as follows.

	37
3	$\overline{13}\,\overline{69}$ -9
67	469 469
	0

$\therefore \sqrt{1369} = 37$

(vii) The square root of 5776 can be calculated as follows.

	76
7	$\overline{57}\,\overline{76}$ -49
146	876 876
	0

$\therefore \sqrt{5776} = 76$

(viii) The square root of 7921 can be calculated as follows.

	89

8	$\overline{79}\,\overline{21}$ -64
169	1521 1521
	0

$\therefore \sqrt{7921} = 89$

(ix) The square root of 576 can be calculated as follows.

	24
2	$\overline{5}\,\overline{76}$ -4
44	176 176
	0

$\therefore \sqrt{576} = 24$

(x) The square root of 1024 can be calculated as follows.

	32
3	$\overline{10}\,\overline{24}$ -9
62	124 124
	0

$\therefore \sqrt{1024} = 32$

(xi) The square root of 3136 can be calculated as follows.

	56
5	$\overline{31}\,\overline{36}$ -25
106	636 636

	0

$\therefore \sqrt{3136} = 56$

(xii) The square root of 900 can be calculated as follows.

	30
3	$\overline{9}\,\overline{00}$ -9
60	00 00
	0

$\therefore \sqrt{900} = 30$

2. Find the number of digits in the square root of each of the following numbers (without any calculation).

(i) 64

(ii) 144

(iii) 4489

(iv) 27225

(v) 390625

Solution:

(i) By placing bars, we obtain

$64 = \overline{64}$

Since there is only one bar, the square root of 64 will have only one digit in it.

(ii) By placing bars, we obtain

$144 = \overline{1}\,\overline{44}$

Since there are two bars, the square root of 144 will have 2 digits in it.

(iii) By placing bars, we obtain

$4489 = \overline{44}\,\overline{89}$

Since there are two bars, the square root of 4489 will have 2 digits in it.

(iv) By placing bars, we obtain

$27225 = \overline{2}\,\overline{72}\,\overline{25}$

Since there are three bars, the square root of 27225 will have three digits in it.

(v) By placing the bars, we obtain

$390625 = \overline{39}\,\overline{06}\,\overline{25}$

Since there are three bars, the square root of 390625 will have 3 digits in it.

3. Find the square root of the following decimal numbers.

(i) 2.56

(ii) 7.29

(iii) 51.84

(iv) 42.25

(v) 31.36

Solution:

(i) The square root of 2.56 can be calculated as follows.

	1.6
1	$\overline{2}\,\overline{56}$ -1
26	156 156
	0

$\therefore \sqrt{2.56} = 1.6$

(ii) The square root of 7.29 can be calculated as follows.

	2.7
2	$\overline{7}.\overline{29}$ -4
47	329 329
	0

$\therefore \sqrt{7.29} = 2.7$

(iii) The square root of 51.84 can be calculated as follows.

	7.2
7	$\overline{51}.\overline{84}$ -49
142	284 284
	0

$\therefore \sqrt{51.84} = 7.2$

(iv) The square root of 42.25 can be calculated as follows.

	6.5
6	$\overline{42}.\overline{25}$ -36
125	625 625
	0

$\therefore \sqrt{42.25} = 6.5$

(v) The square root of 31.36 can be calculated as follows.

	5.6
5	$\overline{31}.\overline{36}$ -25
106	636 636
	0

$\therefore \sqrt{31.36} = 5.6$

4. Find the least number which must be subtracted from each of the following numbers so as to get a perfect square. Also find the square root of the perfect square so obtained.

(i) 402

(ii) 1989

(iii) 3250

(iv) 825

(v) 4000

Solution:

(i) The square root of 402 can be calculated by long division method as follows.

	20
2	$\overline{4}\,\overline{02}$ -4
40	02 00
	2

The remainder is 2. It represents that the square of 20 is less than 402 by 2. Therefore, a perfect square will be obtained by subtracting 2 from the given number 402.

Therefore, required perfect square $= 402 - 2 = 400$

And, $\sqrt{400} = 20$

(ii) The square root of 1989 can be calculated by long division method as follows.

	44
4	$\overline{19}\,\overline{89}$ -16
84	389 336
	53

The remainder is 53. It represents that the square of 44 is less than 1989 by 53. Therefore, a perfect square will be obtained by subtracting 53 from the given number 1989.

Therefore, required perfect square $= 1989 - 53 = 1936$

And, $\sqrt{1936} = 44$

(iii) The square root of 3250 can be calculated by long division method as follows.

	57
5	$\overline{32}\,\overline{50}$ -25
107	750 749
	1

The remainder is 1. It represents that the square of 57 is less than 3250 by 1. Therefore, a perfect square can be obtained by subtracting 1 from the given number 3250.

Therefore, required perfect square $= 3250 - 1 = 3249$

And, $\sqrt{3249} = 57$

(iv) The square root of 825 can be calculated by long division method as follows.

	28
2	$\overline{8}\,\overline{25}$ -4
48	425 384
	41

The remainder is 41. It represents that the square of 28 is less than 825 by 41. Therefore, a perfect square can be calculated by subtracting 41 from the given number 825.

Therefore, required perfect square $= 825 - 41 = 784$

And, $\sqrt{784} = 28$

(v) The square root of 4000 can be calculated by long division method as follows.

	63
6	$\overline{40}\,\overline{00}$ -36

123	400 369
	31

The remainder is 31. It represents that the square of 63 is less than 4000 by 31. Therefore, a perfect square can be obtained by subtracting 31 from the given number 4000.

Therefore, required perfect square $= 4000 - 31 = 3969$

And, $\sqrt{3969} = 63$

5. Find the least number which must be added to each of the following numbers so as to get a perfect square. Also find the square root of the perfect square so obtained.

(i) 525

(ii) 1750

(iii) 252

(iv) 1825

(v) 6412

Solution:

(i) The square root of 525 can be calculated by long division method as follows.

	22
2	$\overline{5}\ \overline{25}$ -4
42	125 84
	41

The remainder is 41. It represents that the square of 22 is less than 525. Next number is 23 and $23^2 = 529$

Hence, number to be added to $525 = 232 - 525 = 529 - 525 = 4$

The required perfect square is 529 and $\sqrt{529} = 23$

(ii) The square root of 1750 can be calculated by long division method as follows.

	41

4	$\overline{17}\,\overline{50}$ -16
81	150 81
	69

The remainder is 69.

It represents that the square of 41 is less than 1750.

The next number is 42 and $42^2 = 1764$

Hence, number to be added to $1750 = 42^2 - 1750 = 1764 - 1750 = 14$

The required perfect square is 1764 and $\sqrt{1764} = 42$

(iii) The square root of 252 can be calculated by long division method as follows.

	15
1	$\overline{2}\,\overline{52}$ -1
25	152 125
	27

The remainder is 27. It represents that the square of 15 is less than 252.

The next number is 16 and $16^2 = 256$

Hence, number to be added to $252 = 16^2 - 252 = 256 - 252 = 4$

The required perfect square is 256 and $\sqrt{256} = 16$

(iv) The square root of 1825 can be calculated by long division method as follows.

	42
4	$\overline{18}\,\overline{25}$ -16
82	225

	164
	61

The remainder is 61. It represents that the square of 42 is less than 1825.

The next number is 43 and $43^2 = 1849$

Hence, number to be added to $1825 = 43^2 - 1825 = 1849 - 1825 = 24$

The required perfect square is 1849 and $\sqrt{1849} = 43$

(v) The square root of 6412 can be calculated by long division method as follows.

	80
8	$\overline{64}\ \overline{12}$ -64
160	012 0
	12

The remainder is 12. It represents that the square of 80 is less than 6412.

The next number is 81 and $81^2 = 6561$

Hence, number to be added to $6412 = 81^2 - 6412 = 6561 - 6412 = 149$

The required perfect square is 6561 and $\sqrt{6561} = 81$

6. Find the length of the side of a square whose area is 441 m^2.

Solution:

Let the length of the side of the square be x m.

Area of square $= (x)^2 = 441\ m^2$

$x = \sqrt{441}$

The square root of 441 can be calculated as follows.

	21
2	$\overline{4}\ \overline{41}$ -4

41	041 41
	0

$\therefore x = 21$ m

Hence, the length of the side of the square is 21 m.

7. In a right triangle ABC, $\angle B = 90^o$.

(A) If $AB = 6$ cm, $BC = 8$ cm, find AC

(B) If $AC = 13$ cm, $BC = 5$ cm, find AB

Solution:

(A) ΔABC is right-angled at B.

Therefore, by applying Pythagoras theorem, we obtain

$AC^2 = AB^2 + BC^2$

$AC^2 = (6 \text{ cm})^2 + (8 \text{ cm})^2$

$AC^2 = (36 + 64) \text{ cm}^2 = 100 \text{ cm}^2$

$AC = (\sqrt{100})\text{cm} = (\sqrt{10 \times 10}) \text{ cm}$

$AC = 10$ cm

(B) ΔABC is right-angled at B.

Therefore, by applying Pythagoras theorem, we obtain

$AC^2 = AB^2 + BC^2$

$(13 \text{ cm})^2 = (AB)^2 + (5 \text{ cm})^2$

$AB^2 = (13 \text{ cm})^2 - (5 \text{ cm})^2 = (169 - 25)\text{cm}^2 = 144 \text{ cm}^2$

$AB = (\sqrt{144})\text{cm} = (\sqrt{12 \times 12})\text{cm}$

$AB = 12$ cm

8. A gardener has 1000 plants. He wants to plant these in such a way that the number of rows and the number of columns remain same. Find the minimum number of plants he needs more for this.

Solution:

It is given that the gardener has 1000 plants. The number of rows and the number of columns is the same.

We have to find the number of more plants that should be there, so that when the gardener plants them, the number of rows and columns are same.

That is, the number which should be added to 1000 to make it a perfect square has to be calculated.

The square root of 1000 can be calculated by long division method as follows.

	31
3	$\overline{10}\ \overline{00}$ -9
61	100 61
	39

The remainder is 39. It represents that the square of 31 is less than 1000.

The next number is 32 and $32^2 = 1024$

Hence, number to be added to 1000 to make it a perfect square

$= 32^2 - 1000 = 1024 - 1000 = 24$

Thus, the required number of plants is 24.

9. These are 500 children in a school. For a P.T. drill they have to stand in such a manner that the number of rows is equal to number of columns. How many children would be left out in this arrangement?

Solution:

It is given that there are 500 children in the school. They have to stand for a P.T. drill such that the number of rows is equal to the number of columns.

The number of children who will be left out in this arrangement has to be calculated. That is, the number which should be subtracted from 500 to make it a perfect square has to be calculated.

The square root of 500 can be calculated by long division method as follows.

	22
2	$\overline{5}\ \overline{00}$ -4
42	100 84

	16

The remainder is 16.

It shows that the square of 22 is less than 500 by 16. Therefore, if we subtract 16 from 500, we will obtain a perfect square.

Required perfect square $= 500 - 16 = 484$

Thus, the number of children who will be left out is 16.

CBSE NCERT Solutions for Class 8 Mathematics Chapter 7

Back of Chapter Questions

Exercise 7.1

1. Which of the following numbers are not perfect cubes?

(i) 216

(ii) 128

(iii) 1000

(iv) 100

(v) 46656

Solution:

(i) Given number is 216

216 can be factorised as follows.

2	216
2	108
2	54
3	27
3	9
3	3
	1

$216 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^3 \times 3^3$

$= (2 \times 3)^3 = 6^3$

Here, in factorization of 216, each factor appears 3 times.

Therefore, 216 is a perfect cube.

(ii) Given number is 128

128 can be factorised a s follows

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

$218 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6 \times 2 = 2^{2\times3} \times 2 = 4^3 \times 2$

Here, One 2 is remaining after grouping the triplets of 2.

Therefore, 128 is not a perfect cube.

(iii) Given number is 1000.

1000 can be factorised as follows

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

$1000 = 2 \times 2 \times 2 \times 5 \times 5 \times 5 = 2^3 \times 5^3$

$= (2 \times 5)^3 = 10^3$

Here, in factorisation of 1000, each factor appears 3 times.

Therefore, 1000 is a perfect cube.

(iv) Given number is 100.

100 can be factorised as follows

2	100
5	50
5	25
5	5
	1

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

Here, Two 2 and two 5 are remaining after grouping the triples.

Therefore, 100 is not a perfect

(v) Given number is 46656

46656 can be factorised as follows.

2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

$46656 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

$= 2^3 \times 2^3 \times 3^3 \times 3^3$

$= (2 \times 2 \times 3 \times 3)^3$

$= (36)^3$

Here, in factorisation of 46656, each prime factor is appearing as many times as a perfect multiple of 3.

Therefore, 46656 is a perfect cube.

2. Find the smallest number by which each of the following numbers must be multiplied to obtain a perfect cube.

(i) 243

(ii) 256

(iii) 72

(iv) 675

(v) 100

Solution:

(i) Given number is 243

243 can be factorised as follows

3	243
3	81
3	27
3	9
3	3
	1

$243 = 3 \times 3 \times 3 \times 3 \times 3$

Here, two $3'$s are not in triplet. To make 243 a cube, one more 3 is required.

In this case, $243 \times 3 = 929$ is a perfect cube.

Hence the smallest number by which 243 should be multiplied to obtain a perfect cube is 3.

(ii) Given number is 256

256 can be factorised as follows

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

So, $256 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2)$

Here, two $2'$s are not in triplet. To make 256 a cube, one more 2 is required.

In this case, $256 \times 2 = 512$ is a perfect cube.

Hence, the smallest number by which 256 should be multiplied to obtain a perfect cube is 2.

(iii) Given number is 72.

72 can be factorised as follows.

2	72
2	36
2	18
3	9
3	3
	1

So, $72 = (2 \times 2 \times 2) \times (3 \times 3)$

Here, two $3's$ are not in triplet. To make 72 a cube, one more 3 is required.

In this case, $72 \times 3 = 216$ is a perfect cube.

Hence, the smallest number by which 72 must be multiplied to obtain a perfect cube is 3

(iv) Given number is 675.

675 can be factorised as follows

3	675
3	225
3	75
5	25
5	5
	1

So, $675 = (3 \times 3 \times 3) \times (5 \times 5)$

Here, two $5's$ are not in triplet. To make 675 a cube, one more 5 is required.

In this case, $675 \times 5 = 3375$ is a perfect cube.

Hence, the smallest number by which 675 should be multiplied to obtain a perfect cube is 5.

(v) 100 can be factorised as follows

2	100
2	50
5	25
5	5
	1

So, $100 = (2 \times 2) \times (5 \times 5)$

Here, two $2's$ and two $5's$ are not in triplet. To make 100 a cube, one more 2 and one more 5 is required.

In this case, $100 \times 2 \times 5 = 1000$ is a perfect cube.

Hence, the smallest number by which 100 should be multiplied to obtain a perfect cube is 10.

3. Find the smallest number by which each of the following numbers must be divided to obtain a perfect cube.

(i) 81

(ii) 128

(iii) 135

(iv) 192

(v) 704

Solution:

(i) 81 can be factorised as follows

$81 = (3 \times 3 \times 3) \times 3$

Here, one 3 is left which is not in triplet.

If we divided 81 by 3, then it will become a perfect cube.

Thus, $81 \div 3 = 27 = 3 \times 3 \times 3$ is a perfect cube

Hence, the smallest number by which 81 should be divided to make it a perfect cube is 3.

(ii) 128 can be factorised as follows

$128 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times 2$

Here, one 2 is left which is not in triplet.

If we divided 128 by 2, then it will become a perfect cube.

Thus, $128 \div 2 = 64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$ is a perfect cube.

Here, the smallest number by which 128 must be divided to make it a perfect cube is 2.

(iii) 135 can be factorised as follows

$135 = (3 \times 3 \times 3) \times 5$

Here, one 5 is left which is not in triplet.

If we divided 135 by 5, then it will become a perfect cube.

Thus, $135 \div 5 = 27 = 3 \times 3 \times 3$ is a perfect cube.

Hence, smallest number by which 135 should be divided to make it a perfect cube is 5.

(iv) 192 can be factorised as follows

$192 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times 3$

Here, one 3 is left which is not in triplet.

If we divided 192 by 3, then it will become a perfect cube.

Thus, $192 \div 3 = 64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$ is a perfect cube.

Hence, smallest number by which 192 should be divided to make it a perfect cube is 3.

(v) 704 can be factorised as follows

$704 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times 11$

Here, one 11 is left which is not in a triplet.

If we divided 704 by 11, then it will become a perfect cube.

Thus $704 \div 11 = 64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$ is a perfect cube.

Hence, smallest number by which 704 should be divided to make it a perfect cube is 11.

4. Parikshit makes a cuboid of plasticine of sides 5 cm, 2 cm, 5 cm. How many such cuboids will he need to form a cube?

Solution:

Volume of the cuboid of sides 5 cm, 2 cm, 5 cm $= 5\text{ cm} \times 2\text{ cm} \times 5\text{ cm} = 50\text{ cm}^3$

Now, $50 = 2 \times 5 \times 5$

Here, two 5′s and one 2′s are left which are not in triplet.

If we multiply this expression by $2 \times 2 \times 5 = 20$, then it will become a perfect cube.

Thus, $2 \times 5 \times 5 \times 2 \times 2 \times 5 = 5 \times 5 \times 5 \times 2 \times 2 \times 2 = 1000$ is a perfect cube.

Hence, 20 cuboids of 5 cm, 2 cm, 5 cm are required to form a cube.

Exercise 7.2

1. Find the cube root of each of the following numbers by prime factorisation method.

(i) 64

(ii) 512

(iii) 10648

(iv) 27000

(v) 15625

(vi) 13824

(vii) 110592

(viii) 46656

(ix) 175616

(x) 91125

Solution:

(i) 64 can be factorised as follows.

2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factorization of 64 $= 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$\therefore \sqrt[3]{64} = \sqrt[3]{4^3} = 4$

(ii) 512 can be factorized as follows.

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factorization of 512 $= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$\therefore \sqrt[3]{512} = 2 \times 2 \times 2 = 8$

(iii) 10648 can be factorised as follows

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

Prime factorization of 10648 $= 2 \times 2 \times 2 \times 11 \times 11 \times 11$

$\therefore \sqrt[3]{10648} = 2 \times 11 = 22$

(iv) 27000 can be follows as follows

2	27000
2	13500
2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

Prime factorization of 27000 $= 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5$

$\therefore \sqrt[3]{27000} = 2 \times 3 \times 5 = 30$

(v) 15625 can be factorised as follows.

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

Prime factorisation of 15625 $= 5 \times 5 \times 5 \times 5 \times 5 \times 5$

$\therefore \sqrt[3]{15625} = 5 \times 5 = 25$

(vi) 13824 can be factorised as follows

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

Prime factorization of 13824 $= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$

$\therefore \sqrt[3]{13824} = 2 \times 2 \times 2 \times 3 = 24$

(vii) 110592 can be factorised as follows

2	110592
2	55296
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

Prime factorization of $110592 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$

$\therefore \sqrt[3]{110592} = 2 \times 2 \times 2 \times 2 \times 3 = 48$

(viii) 46656 can be factorised as follows

2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

Prime factorisation of $46656 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

$\therefore \sqrt[3]{46656} = 2 \times 2 \times 3 \times 3 = 36$

(ix) 175616 can be factorised as follows

2	175616
2	87808
2	43904
2	21952
2	10976
2	5488
2	2744
2	1372
2	686
7	343
7	49
7	7
	1

Prime factorisation of $175616 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 7 \times 7 \times 7$

$\therefore \sqrt[3]{175616} = 2 \times 2 \times 2 \times 7 = 56$

(x) 91125 can be factorised as follows

3	91125
3	30375
3	10125
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

Prime factorisation of $91125 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5$

$\therefore \sqrt[3]{91125} = 3 \times 3 \times 5 = 45$

2. State true or false.

(i) Cube of any odd number is even.

(ii) A perfect cube does not end with two zeros.

(iii) If square of a number ends with 5, then its cube ends with 25.

(iv) There is no perfect cube which ends with 8.

(v) The cube of a two-digit number may be a three-digit number.

(vi) The cube of a two-digit number may have seven or more digits.

(vii) The cube of a single digit number may be a single digit number.

Solution:

(i) False

Explanation:

The unit place digit of an odd number (say, a) is odd and the unit place digit of the cube is the unit place digit of a × a × a.

If a is odd, then a × a × a is also odd.

So unit place digit of a × a × a is odd.

Hence, unit place digit of the cube is odd.

Therefore, cube of any odd number is an odd number.

(ii) True

Explanation:

Perfect cube will end with a certain number of zeroes that are always a perfect multiple of 3.

(iii) False

Explanation:

It is not always necessary that if the square of a number ends with 5, then its cube will end with 25.

For example, the square of 35 is 1225 and also has its unit place digit as 5 but the cube of 35 is 42875 which doesnot end with 25.

(iv) False

Explanation:

The cubes of all the numbers having their unit place digit as 2 will ends with 8. In this way, There are many perfect cubes which ends with 8.

(v) True

Explanation:

The smallest two digit natural number is 10 and its cube is 1000 which is a four digit number.

(vi) False

Explanation:

The largest two digit natural is 99 and its cube is 970299 which is a 6 digit number. Therefore, the cube of any two digit number cannot have 7 or more digits in it.

(vii) True

Explanation:

The cube of 1 and 2 are 1 and 8 respectively.

Hence, the given statement is true.

3. You are told that 1,331 is a perfect cube. Can you guess without factorisation what is its cube root? Similarly, guess the cube roots of $4913, 12167, 32768$.

Solution:

1331 :

We know that $10^3 = 1000$

Possible cube of $11 = 1331$

Since, cube of unit digit is $= 1$

Therefore, cube root of 1331 is 11.

4913:

We know that $7^3 = 343$

Next number comes with 7 as unit place digit is 17.

So possible cube of $17 = 4913$.

Therefore, cube root of 4913 is 17.

12167:

We know that $3^3 = 27$

Here in cube, unit digit is 7

Now next number with 3 as its unit digit is 13

Also, $13^3 = 2197$

and next number with 3 as its unit digit is 23 and $23^3 = 12167$

Hence cube root of 12167 is 23.

32768 :

We know that $2^3 = 8$

Here in cube, unit's digit is 8

Now next number with 2 at its unit place digit is 12 and $12^3 = 1728$

And next number with 2 as its unit's place digit is 22

$22^3 = 10648$

And next number with 2 at its unit's place digit is 32

Also, $32^3 = 32768$

Hence cube root of 32768 is 32.

♦♦♦

CBSE NCERT Solutions for Class 8 Mathematics Chapter 8

Back of Chapter Questions

Exercise 8.1

1. Find the ratio of the following.

(a) Speed of a cycle 15 km per hour to the speed of scooter 30 km per hour.

(b) 5 m to 10 km

(c) 50 paise to ₹ 5

Solution:

(a) Given, Speed of a cycle is 15 km per hour

speed of scooter is 30 km per hour.

Hence, the ratio of the speed of cycle to the speed of scooter $= \frac{15}{30} = \frac{1}{2}$

$\frac{1}{2}$ is written as $1:2$

(b) Ratio of 5 m to 10 km $= \frac{5}{10000} = \frac{1}{2000}$

$\frac{1}{2000}$ is written as $1:2000$ [$\because$ 1 km $= 1000$ m]

(c) Ratio of 50 paise to ₹ 5 $= \frac{50}{500} = \frac{1}{10}$

$\frac{1}{10}$ Is written as $1:10$ [$\because$ 1 ₹ $= 100$ paise]

2. Convert the following ratios to percentages.

(a) $3:4$

(b) $2:3$

Solutions:

By unitary method:

(a) Required % $= \frac{3}{4} \times 100 = 75\%$

(b) Required % $= \frac{2}{3} \times 100 = \frac{200}{3}\% = 66\frac{2}{3}\%$

3. 72% of 25 students are interested in mathematics. How many are not interested in mathematics?

Solution:

Given, 72% of 25 students are good in mathematics.

Hence, the percentage of students who are not good in mathematics $= (100 - 72)\%$

$= 28\%$

Therefore, Number of students who are not good in mathematics $= \frac{28}{100} \times 25 = 7$

Thus, 7 students are not good in mathematics.

4. A football team won 10 matches out of the total number of matches they played. If their win percentage was 40, then how many matches did they play in all?

Solution:

Let the total number of matches played by the team be k.

It is given that the team won 10 matches and the winning percentage of the team was 40%.

Therefore, 40% of k is 10

$$\Rightarrow \frac{40}{100} \times k = 10$$

$$\Rightarrow k = 25$$

Hence, the team played 25 matches.

5. If Chameli had ₹ 600 left after spending 75% of her money, how much did she have in the beginning?

Solution:

Consider Chameli had total ₹ k in the beginning.

After spending 75%, she left with ₹ 600.

$\Rightarrow 25\%$ of $k = 600$

$$\Rightarrow \frac{25}{100} \times k = 600$$

$$\Rightarrow k = 2400$$

Thus, Chameli had ₹ 2400 in the beginning.

6. If 60% people in a city like cricket, 30% like football and the remaining like other games, then what per cent of the people like other games? If the total number of people is 50 lakh, find the exact number who like each type of game.

Solution:

Remaining $\% = 100 - (60 + 30)$

$= 10\%$

Therefore, 10% people like other games.

Since, total population is 50 lakhs,

Thus, number of people who like cricket is 60% of 50 lakh $= \frac{60}{100} \times$ 50 lakhs =30 lakhs

number of people who like football is 30% of 50 lakh $= \frac{30}{100} \times 50$ lakhs $=15$ lakhs

number of people who like other games is 10% of 50 lakh $= \frac{10}{100} \times 50$ lakhs $= 5$ lakhs.

Exercise 8.2

1. A man got a 10% increase in his salary. If his new salary is ₹ 1,54,000. Find his original salary.

Solution:

Let the original salary be x.

Given that the increment in salary is 10%.

Thus, original salary + increment = new salary

$$\Rightarrow x + \frac{10}{100} \times x = 154000$$

$$\Rightarrow \frac{110x}{100} = 154000$$

$$\Rightarrow x = 154000 \times \frac{100}{110}$$

$$\Rightarrow x = 140000$$

Hence, the original salary is ₹ 140000.

2. On Sunday 845 people went to the Zoo. On Monday only 169 people went. What is the per cent decrease in the people visiting the Zoo on Monday?

Solution:

We know that, % decrease $= \frac{\text{Number of decrement in peopele}}{\text{Original number of people went on Sunday}} \times 100$

Number of decrement in people on Monday$= 845 - 169 = 676$

Hence, % decrease $= \frac{676}{845} \times 100$

$= 80\%$

3. A shopkeeper buys 80 articles for ₹ 2,400 and sells them for a profit of 16%. Find the selling price of one article.

Solution:

We know that, Selling Price $=$ Cost Price $+$ profit

Total Cost Price for 1 article is $\frac{2400}{80} = 30$

Profit $= 16\%$ of 30

$= \frac{16}{100} \times 30$

$\Rightarrow$ Profit $=$ ₹ 4.8

Hence, Selling Price for one article is ₹$(30 + 4.8) =$ ₹ 34.80

4. The cost of an article was ₹ 15,500. ₹ 450 were spent on its repairs. If it is sold for a profit of 15%, find the selling price of the article.

Solution:

Given, the cost of an article was ₹ 15,500 and ₹ 450 were spent on its repairs.

So, Total Cost Price $=$ original cost $+$ repair cost

$= 15500 + 450$

$= 15950$

Given, profit of 15 %.

Thus, profit in ₹ $= 15\%$ of 15950

$= \frac{15}{100} \times 15950$

$=$ ₹ 2392.50

Thus, Selling Price $=$ Cost Price $+$ profit

$= 15950 + 2392.50$

$=$ ₹ 18342.50

Hence, the selling price of the article is ₹ 18342.50.

5. A VCR and TV were bought for ₹ 8,000 each. The shopkeeper made a loss of 4% on the VCR and a profit of 8% on the TV. Find the gain or loss percent on the whole transaction.

Solution:

Given Cost Price of a VCR = ₹ 8000

Loss on VCR= 4%

$\Rightarrow$ Selling price = 96% of Cost Price

$\Rightarrow$ Selling Price = ₹ $\left(\frac{96}{100} \times 8000\right)$

= ₹ 7680

Cost Price of a TV= ₹ 8000

Profit on TV= 8%

Selling Price of TV= 108% of Cost Price

$= \frac{108}{100} \times 8000 = 8640$

Therefore, total Cost Price= ₹ 16000

Total Selling Price = ₹ (8640 + 7680)

= 16320

Since Selling Price > Cost Price, thus it is a profit.

Profit = Selling Price − Cost Price

= ₹ 320

$\text{Gain\%} = \frac{\text{Gain}}{\text{Cost Price}} \times 100$

$= \frac{320}{16000} \times 100$

= 2%

Hence, the shopkeeper had a profit of 2% in whole transaction.

6. During a sale, a shop offered a discount of 10% on the marked prices of all the items. What would a customer have to pay for a pair of jeans marked at ₹ 1450 and two shirts marked at ₹ 850 each?

Solutions:

Total marked price = ₹(1,450 + 2 × 850)

= ₹(1,450 + 1,700)

= ₹ 3,150

Given that, discount % = 10%

$= ₹\left(\frac{10}{100} \times 3150\right) = ₹315$

Also, Discount = Marked price − Sale price

$\Rightarrow ₹\,315 = ₹\,3150 - \text{Sale price}$

$\therefore$ Sale price = ₹ (3150 − 315) = ₹ 2835

Hence, the customer will have to pay ₹ 2,835.

7. A milkman sold two of his buffaloes for ₹ 20,000 each. On one he made a gain of 5% and on the other a loss of 10%. Find his overall gain or loss.

Solution:

Given, Selling Price of each buffalo = ₹ 20000

Also, the milkman made a gain of 5% while selling one buffalo

$\Rightarrow$ Selling Price = 105% of Cost Price

$= ₹\left(20000 \times \frac{100}{105}\right)$

= ₹ 19,047.62

Now, second buffalo was sold at a loss of 10%.

$\Rightarrow$ Selling Price = 90% of Cost Price

$\therefore$Cost Price of other buffalo $= ₹\left(20000 \times \frac{100}{90}\right)$

= ₹ 22222.22

Total Cost Price = ₹ 19047.62 + ₹ 22222.22

= ₹ 41269.84

Total Selling Price = ₹ 20000 + ₹ 20000

= ₹ 40000

Loss = ₹ 41269.84 – ₹ 40000

= ₹ 1269.84

Hence, the overall loss of milkman was ₹ 1,269.84.

8. The price of a TV is ₹ 13,000. The sales tax charged on it is at the rate of 12%. Find the amount that Vinod will have to pay if he buys it.

Solution:

Given, tax charged at rate of 12%

On ₹ 13000, the tax to be paid will be $=$ ₹ $\left(\frac{12}{100} \times 13000\right)$

$=$ ₹ 1560

Required amount $=$ Cost $+$ Sales Tax $=$₹ $13000 +$ ₹ $1560 \;=$ ₹ 14560

Hence, Vinod will have to pay ₹ 14,560 for the T.V.

9. Arun bought a pair of skates at a sale where the discount given was 20%. If the amount he pays is ₹ 1,600, find the marked price.

Solution:

Let us assume that the marked price be x.

Discount Percent$=\frac{\text{Discount}}{\text{Marked Price}} \times 100$

$\Rightarrow 20 = \frac{\text{Discount}}{\text{x}} \times 100$

$\Rightarrow$ Discount$=\frac{20}{100} \times x \;=\; \frac{1}{5}x$

Also, we know that,

Discount $=$ Marked price $-$ Sale price

$$\Rightarrow \frac{1}{5}x = x - ₹1600$$

$$\Rightarrow x - \frac{1}{5}x = ₹1600$$

$$\Rightarrow \frac{4}{5}x = ₹1600$$

$$\Rightarrow x = ₹\left(1600 \times \frac{5}{4}\right) = ₹2000$$

Therefore, the marked price was ₹ 2000.

10. I purchased a hair-dryer for ₹ 5,400 including 8% VAT. Find the price before VAT was added.

Solution:

It is given that the price includes VAT.

Let the price before VAT was added be x.

Thus, total price $=$ price before VAT added $+$ VAT

$$\Rightarrow 5400 = \; x + 8\% \; of \; x$$

$$\Rightarrow 5400 = \frac{108}{100}x$$

$\Rightarrow x = \frac{100}{108} \times 5400$

$\Rightarrow x = ₹\, 5000$

Hence, price before VAT is added is ₹ 5000.

11. An article was purchased for ₹ 1239 including GST of 18%. Find the price of the article before GST was added?

Solution:

It is given that the price includes GST.

Let the price before GST was added be x.

Thus, total price= price before GST included + GST

$\Rightarrow 1239 = x + 18\%\ of\ x$

$\Rightarrow 1239 = \frac{118}{100}x$

$\Rightarrow x = \frac{100}{118} \times 1239$

$\Rightarrow x = ₹\, 1050$

Hence, price before GST is included is ₹ 1050.

Exercise 8.3

1. Calculate the amount and compound interest on

(a) ₹ 10,800 for 3 years at $12\frac{1}{2}\%$ per annum compounded annually.

(b) ₹ 18,000 for $2\frac{1}{2}$ years at 10% per annum compounded annually.

(c) ₹ 62,500 for $1\frac{1}{2}$ years at 8% per annum compounded half yearly.

(d) ₹ 8,000 for 1 year at 9% per annum compounded half yearly.

(You could use the year by year calculation using SI formula to verify).

(e) ₹ 10,000 for 1 year at 8% per annum compounded half yearly.

Solution:

(a) Given, $P = 10800$

Time = 3 yrs.

Rate $= \frac{25}{2}\%$

Thus, Amount is given by the formulae: - $P\left(1+\frac{R}{100}\right)^n$

$\Rightarrow A = ₹\left[10800\left(1+\frac{25}{200}\right)^3\right]$

$= ₹\left[10800\left(\frac{225}{200}\right)^3\right]$

$= ₹\ (10800 \times \frac{225}{200} \times \frac{225}{200} \times \frac{225}{200})$

$= ₹15377.34375$

$= ₹15377.34$

Hence, Compound Interest $= A - P$

$= ₹\ (15377.34\ - 10800)$

$= ₹\ 4{,}577.34$

Therefore, Compound Interest is ₹ 4,577.34

(b) Given, $P = 18000$

Rate $=\ 10\%$

Time $= 2\frac{1}{2}$ years

The amount obtained at the end of 2 years and 6 months can be calculated in two steps:

(i) Calculate the amount for 2 years using the compound interest formula,

(ii) Calculate the simple interest for 6 months on the amount obtained at the end of 2 years.

Amount at the end of two years is given by: $A = ₹\left[18000\left(1+\frac{1}{10}\right)^2\right]$

$= ₹\left(18000 \times \frac{11}{10} \times \frac{11}{10}\right)$

$= ₹21780$

Now take P=21780, the Simple Interest for the next $\frac{1}{2}$ year will be calculated.

$$\text{Simple Interest} = ₹\left(\frac{21780 \times \frac{1}{2} \times 10}{100}\right)$$

$= ₹\,1089$

$\therefore$ Interest for the first 2 years $=$ $₹\,(21780 - 18000) = ₹\,3780$

And interest for the next $\frac{1}{2}$ year $=$ $₹\,1089$

$\therefore$ Total Compound Interest $= ₹\,3780 + ₹\,1089 = ₹\,4{,}869.$

$A = P + \text{Compound Interest} = ₹\,18000 + ₹\,4869 = ₹\,22{,}869$

(c) Given, $P = 62500$

Rate $= 8\%$

Time $= 1\frac{1}{2}$ years

There will be 3 half years in $1\frac{1}{2}$ years.

We know that, $A = P\left(1 + \frac{R}{100}\right)^n$

$\Rightarrow A = [62500\left(1 + \frac{4}{100}\right)^3]$

$\Rightarrow A = ₹\left(62500 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25}\right)$

$\Rightarrow A = ₹\,70304$

Compound Interest $= A - P$

$= ₹\,70304 - ₹\,62500$

$= ₹\,7{,}804$

(d) Given, $P = 8000$

Rate $=$ 9%

Time $=$ 1 year

There are 2 half years in 1 year and rate would be $\frac{9}{2}$% for each half year.

We know that,

$A = P\left(1 + \frac{R}{100}\right)^n$

$\Rightarrow A = [8000\left(1 + \frac{9}{200}\right)^2$

$\Rightarrow A = [8000\left(\frac{209}{200}\right)^2$

$\Rightarrow A = ₹\ 8736.20$

Compound Interest $= A - P$

$= ₹\ 8736.20 - ₹\ 8000$

$= ₹\ 736.20$

(e) Given, $P = 8000$

Rate $= 8\%$

Time $= 1$ year

Rate $= 8\%$ per annum or 4% per half year

Number of years $= 1$ year

There are 2 half years in 1 year.

$A = P\left(1 + \frac{R}{100}\right)^n$

$\Rightarrow A = [10000\left(1 + \frac{4}{100}\right)^2$

$\Rightarrow A = \left[10000\left(1 + \frac{1}{25}\right)^2\right]$

$\Rightarrow A = ₹\left(10000 \times \frac{26}{25} \times \frac{26}{25}\right)$

$\Rightarrow A = ₹\ 10{,}816$

Now,

Compound Interest $= A - P$

$= ₹\ 10816 - ₹\ 10000$

$= ₹\ 816$

Hence, the Compound Interest is ₹ 816

2. Kamala borrowed ₹ 26,400 from a Bank to buy a scooter at a rate of 15% p.a. compounded yearly. What amount will she pay at the end of 2 years and 4 months to clear the loan?

Solution:

Given, $P = 26400$

Rate $=$ 15% p.a. compounded yearly

Time = 2 years and 4 months

The amount obtained for 2 years and 4 months can be calculated in two steps

(i) calculate the amount for 2 years using the compound interest formula,

(ii) calculate the simple interest for 4 months on the amount obtained at the end of 2 years.

The amount obtained at the end of two years is given by: -

$$A = P\left(1+\frac{R}{100}\right)^n$$

$$\Rightarrow A = ₹\left[26400\left(1+\frac{15}{100}\right)^2\right]$$

$$\Rightarrow A = ₹\left[26400\left(1+\frac{3}{20}\right)^2\right]$$

$$\Rightarrow A = ₹\left(26400\times\frac{23}{20}\times\frac{23}{20}\right)$$

$$\Rightarrow A = ₹\,34{,}914$$

Now take P=34919, the Simple Interest for the next $\frac{1}{3}$ years will be calculated.

$$\text{Simple Interest} = \frac{P\times R\times T}{100}$$

$$= ₹\left(\frac{34914\times\frac{1}{3}\times 15}{100}\right)$$

$$= ₹1{,}745.70$$

Interest at the end of first two years = ₹ (34914 − 26400) = ₹ 8,514

And interest for the next $\frac{1}{3}$ years =₹ 1,745.70

Total Compound Interest = ₹ (8514 + ₹ 1745.70) = ₹ 10,259.70

Amount = P + Compound Interest

= ₹ 26400 + ₹ 10259.70

= ₹ 36,659.70

3. Fabina borrows ₹ 12,500 at 12% per annum for 3 years at simple interest and Radha borrows the same amount for the same time period at 10% per annum, compounded annually. Who pays more interest and by how much?

Solution:

Simple interest is given by: -

$$\text{Simple Interest} = \frac{P \times R \times T}{100}$$

Interest paid by Fabina is given by: -

$$\text{Simple Interest} = \frac{P \times R \times T}{100}$$

$$= ₹\left(\frac{12500 \times 12 \times 3}{100}\right)$$

$$= ₹4{,}500$$

Amount paid by Radha at the end of 3 years is given by: -

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$\Rightarrow A = [12500\left(1 + \frac{10}{100}\right)^3$$

$$\Rightarrow A = ₹\,80000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100}$$

$$\Rightarrow A = ₹\,16{,}637.50$$

Compound Interest $= A - P = ₹\,16637.50 - ₹\,12500 = ₹\,4{,}137.50$

The total interest paid by Radha is ₹ 4,137.50 and by Fabina is ₹ 4,500.

Thus, Fabina pays more interest. ₹ 4500 − ₹ 4137.50 = ₹ 362.50

Hence, Fabina will have to pay ₹ 362.50 more.

4. I borrowed ₹ 12,000 from Jamshed at 6% per annum simple interest for 2 years. Had I borrowed this sum at 6% per annum compound interest, what extra amount would I have to pay?

Solution:

Principal =₹ 12000

Rate = 6% per annum

Time = 2 years

$$\text{Simple Interest} = \frac{P \times R \times T}{100}$$

$$= ₹\left(\frac{1200 \times 6 \times 2}{100}\right)$$

$= ₹1,440$

To find the compound interest, the amount (A) to be calculated is given by:

$A = P\left(1 + \frac{R}{100}\right)^n$

$= \left[12000\left(1 + \frac{6}{100}\right)^2\right]$

$= ₹13,483.20$

$\therefore$ Compound Interest $= A - P$

$= ₹\,13483.20 - ₹\,12000$

$= ₹\,1,483.20$

Compound Interest $-$ Simple Interest $= ₹\,1,483.20 - ₹\,1,440 = ₹\,43.20$

Thus, the extra amount to be paid is ₹ 43.20.

5. Vasudevan invested ₹ 60,000 at an interest rate of 12% per annum compounded half yearly. What amount would he get?

(i) after 6 months?

(ii) after 1 year?

Solution:

(i) Principal =₹ 60,000

Rate = 12% per annum = 6% per half year

Number of years $(n) =$ 6 months = 1 half year

We know that,

$A = P\left(1 + \frac{R}{100}\right)^n$

$= 60000\left(1 + \frac{6}{100}\right)^1$

$= ₹\,63,600$

(ii) Now, there are 2 half years in 1 year.

So, $n = 2$

$A = P\left(1 + \frac{R}{100}\right)^n$

$= \left[60000\left(1 + \frac{6}{100}\right)^2\right]$

$= ₹67,416$

6. Arif took a loan of ₹ 80,000 from a bank. If the rate of interest is 10% per annum, find the difference in amounts he would be paying after $1\frac{1}{2}$ years if the interest is

(i) compounded annually.

(ii) compounded half yearly.

Solution:

(i) Principal(P) =₹ 80,000

Rate = 10% per annum

Number of years $(n) = 1\frac{1}{2}$ years

The amount obtained for 1 year and 6 months can be calculated by first calculating the amount at the end of 1 year using the Compound Interest formula, and then calculating the Simple Interest for 6 months on the amount obtained at the end of 1 year.

The amount for 1 is given by: -

$$A = P\left(1+\frac{R}{100}\right)^n$$

$$\Rightarrow A = [80000\left(1+\frac{10}{100}\right)^1$$

$$\Rightarrow A = ₹\ 80000 \times \frac{11}{10}$$

$$\Rightarrow A = ₹\ 88,000$$

By taking ₹ 88,000 as principal, the Simple Interest for the next $\frac{1}{2}$ year will be obtained as

$$\text{Simple Interest} = \frac{P \times R \times T}{100} = ₹\left(\frac{88000 \times 10 \times \frac{1}{2}}{100}\right) = ₹4,400$$

Interest obtained for the first year = ₹ 88000 − ₹ 80000

= ₹ 8,000

Also, interest for the next $\frac{1}{2}$ year = ₹ 4,400

Total Compound Interest = ₹ 8000 + ₹ 4,400 = ₹ 1,2400

Amount = Principal + Compound Interest

= ₹ (80000 + 12400)

$= ₹\ 92{,}400$

(ii) The interest is compounded half yearly.

Rate $= 10\%$ per annum $= 5\%$ per half year

There will be three half years in $1\frac{1}{2}$ year

$A = P\left(1+\frac{R}{100}\right)^n$

$\Rightarrow A = [80000\left(1+\frac{5}{100}\right)^3$

$\Rightarrow A = ₹\ (80000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20})$

$\Rightarrow A = ₹\ 92{,}610$

The difference between the amounts $= ₹\ 92{,}610 - ₹\ 92{,}400 = ₹\ 210$

7. Maria invested ₹ 8,000 in a business. She would be paid interest at 5% per annum compounded annually. Find

(i) The amount credited against her name at the end of the second year

(ii) The interest for the 3rd year.

Solution:

(i) Given, Principal $(P) = ₹\ 8{,}000$

Rate $= 5\%$ per annum

Number of years $(n) = 2$ years

We know that,

$$A = P\left(1+\frac{R}{100}\right)^n$$

$$\Rightarrow A = ₹\left[8000\left(1+\frac{5}{100}\right)^2\right]$$

$$\Rightarrow A = ₹\left[8000\left(1+\frac{1}{20}\right)^2\right]$$

$$\Rightarrow A = ₹\left(8000 \times \frac{21}{20} \times \frac{21}{20}\right)$$

$$\Rightarrow A = ₹\ 8{,}820$$

(ii) The interest for the next one year, i.e. the third year, has to be calculated. By taking ₹ 8,820 as principal, the Simple Interest for the next year will be calculated.

$$\text{Simple Interest } = \frac{P \times R \times T}{100}$$

$$= ₹\left(\frac{8820 \times 5 \times 1}{100}\right)$$

$$= ₹\, 441$$

8. Find the amount and the compound interest on ₹ 10,000 for $1\frac{1}{2}$ years at 10% per annum, compounded half yearly. Would this interest be more than the interest he would get if it was compounded annually?

Solution:

Principal $(P) = ₹\, 10{,}000$

Rate = 10% per annum

= 5% per half year

Number of years $(n) = 1\frac{1}{2}$ years

There will be 3 half years in $1\frac{1}{2}$ years.

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$\Rightarrow A = ₹\left[10000\left(1 + \frac{5}{100}\right)^3\right]$$

$$\Rightarrow A = ₹\left[10000\left(1 + \frac{1}{20}\right)^3\right]$$

$$\Rightarrow A = ₹\left(10000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}\right)$$

$$\Rightarrow A = ₹\, 11576.25$$

Now, Compound Interest $= A - P$

$= ₹\, 11576.25 - ₹\, 10000$

$= ₹\, 1{,}576.25$

The amount obtained at the end of 1 year and 6 months is calculated by first calculating the amount for 1 year using the compound interest formula, and then calculating the simple interest for duration of 6 months on the amount obtained at the end of 1 year.

The amount obtained at the end of the first year is calculated as given below:

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$\Rightarrow A = ₹\left[10000\left(1 + \frac{10}{100}\right)^1\right]$$

$$\Rightarrow A = ₹\left[10000\left(1 + \frac{1}{10}\right)^1\right]$$

$$\Rightarrow A = ₹\left(10000 \times \frac{11}{10}\right)$$

$$\Rightarrow A = ₹\ 11000$$

By taking ₹ 11,000 as the principal, the Simple Interest for the next $\frac{1}{2}$ year will be calculated

$$\text{Simple Interest} = \frac{P \times R \times T}{100}$$

$$= ₹\left(\frac{11000 \times 10 \times \frac{1}{2}}{100}\right)$$

$$= ₹\ 550$$

∴ Interest for the first year = ₹ 11000 – ₹ 10000 = ₹ 1,000

∴ Total compound interest = ₹ 1000 + ₹ 550 = ₹ 1,550

Hence, the interest would be more when compounded half yearly than the interest when compounded annually.

9. Find the amount which Ram will get on ₹ 4,096, he gave it for 18 months at $12\frac{1}{2}$% per annum, interest being compounded half yearly.

Solution:

Given,

Principal (P) = ₹ 4,096

$$\text{Rate} = 12\frac{1}{2}\%\ \text{per annum} = \frac{25}{4}\%\ \text{per half year}$$

Number of years (n) = 18 months

There will be 3 half years in 18 months.

Therefore,

$$A = P\left(1+\frac{R}{100}\right)^n$$

$$\Rightarrow A = ₹\left[4096\left(1+\frac{25}{400}\right)^3\right]$$

$$\Rightarrow A = ₹\left[4096\left(1+\frac{1}{16}\right)^3\right]$$

$$\Rightarrow A = ₹\left(4096\times\frac{17}{16}\times\frac{17}{16}\times\frac{17}{16}\right)$$

$$\Rightarrow A = ₹4913$$

Hence, the required amount is ₹ 4,913.

10. The population of a place increased to 54,000 in 2003 at a rate of 5% per annum

(i) find the population in 2001

(ii) what would be its population in 2005?

Solution:

(i) It is given that, population in the year 2003 $= 54{,}000$

Therefore,

$$54000 = (\text{population in } 2001)\times\left(1+\frac{5}{100}\right)^2$$

Population in 2001 is given by: -

$$\text{Population in } 2001 = \frac{54000}{\left(1+\frac{5}{100}\right)^2}$$

$$\Rightarrow \text{Population in } 2001 = \left(54000\times\frac{20}{21}\times\frac{20}{21}\right)$$

$$\Rightarrow \text{Population in } 2001 = 48980$$

Hence, the population in 2001 is 48980.

(ii) Population in 2005 is given by: -

$$\text{Population in } 2005 = 54000\left(1+\frac{5}{100}\right)^2$$

$$\Rightarrow \text{Population in 2005} = 54000\left(1+\frac{1}{20}\right)^2$$

$$\Rightarrow \text{Population in 2005} = \left(54000 \times \frac{21}{20} \times \frac{21}{20}\right)$$

$$\Rightarrow \text{Population in 2005} = 59535$$

Hence, the population in the year 2005 would be 59,535.

11. In a laboratory, the count of bacteria in a certain experiment was increasing at the rate of 2.5% per hour. Find the bacteria at the end of 2 hours if the count was initially 5,06,000.

Solution:

Given, the initial count of bacteria is given as 5,06,000.

Count of bacteria at the end of 2 hours is given by: -

$$\text{Count of bacteria} = 506000\left(1+\frac{2.5}{100}\right)^2$$

$$\Rightarrow \text{Count of bacteria} = 506000\left(1+\frac{1}{40}\right)^2$$

$$\Rightarrow \text{Count of bacteria} = (506000 \times \frac{41}{40} \times \frac{41}{40})$$

$$\Rightarrow \text{Count of bacteria} = 531616 \text{ (approximately)}$$

Therefore, the count of bacteria at the end of 2 hours will be 5,31,616 (approximately).

12. A scooter was bought at ₹ 42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year.

Solution:

Given,

Principal = Cost Price of the scooter = ₹ 42,000

Depreciation = 8% of ₹ 42,000 per year

$= ₹ \left(\frac{42000\times8\times1}{100}\right) = ₹3,360$

Hence, Value after 1 year = ₹ 42000 − ₹ 3360 = ₹ 38,640.

♦♦♦

CBSE NCERT Solutions for Class 8 Mathematics Chapter 9

Back of Chapter Questions

Exercise 9.1

1. Identify the terms, their coefficients for each of the following expressions.

(i) $5xyz^2 - 3zy$

(ii) $1 + x + x^2$

(iii) $4x^2y^2 - 4x^2y^2z^2 + z^2$

(iv) $3 - pq + qr - rp$

(v) $\frac{x}{2} + \frac{y}{2} - xy$

(vi) $0.3a - 0.6ab + 0.5b$

Solution:

(i) Given expression is $5xyz^2 - 3zy$.

This expression contains two terms $5xyz^2$ and $-3zy$.

Here the coefficient of xyz^2 is 5 and of zy is -3.

(ii) Given expression is $1 + x + x^2$

This expression contains three terms $1, x$ and x^2.

Here the coefficient of x and x^2 is 1.

(iii) Given expression is $4x^2y^2 - 4x^2y^2z^2 + z^2$.

This expression contains three terms $4x^2y^2, -4x^2y^2z^2$ and z^2 .

Here the coefficient of x^2y^2 is 4, coefficient of $x^2y^2z^2$ is -4 and coefficient of z^2 is 1.

(iv) Given expression is $3 - pq + qr - rp$.

This expression contains four terms $3, -pq, qr$ and $-rp$

Here the coefficient of pq is -1, coefficient of qr is 1 and the coefficient of rp is -1.

(v) Given expression is $\frac{x}{2} + \frac{y}{2} - xy$

This expression contains three terms $\frac{x}{2}$, $\frac{y}{2}$ and $-xy$

Here the coefficient of x is $\frac{1}{2}$, coefficient of y is $\frac{1}{2}$ and the coefficient of xy is -1.

(vi) Given expression is $0.3a - 0.6ab + 0.5b$

This expression contains three terms $0.3a, -0.6ab$ and $0.5b$.

Here the coefficient of a is 0.3, coefficient of ab is -0.6 and the coefficient of b is 0.5.

2. Classify the following polynomials as monomials, binomials, trinomials. Which polynomials do not fit in any of these three categories?

$x + y, 1000, x + x^2 + x^3 + x^4, 7 + y + 5x, 2y - 3y^2, 2y - 3y^2 + 4y^3, 5x - 4y + 3xy, 4z - 15z^2, ab + bc + cd + da, pqr, p^2q + pq^2, 2p + 2q.$

Solution:

Given polynomial is $x + y$

Since $(x + y)$ contains two terms. Therefore, it is binomial.

Given polynomial is 1000

Since 1000 contains only one term. Therefore, it is monomial.

Given polynomial is $x + x^2 + x^3 + x^4$

Since $(x + x^2 + x^3 + x^4)$ contains four terms. Therefore, it is a polynomial and it does not fit in the above three categories.

Given polynomial is $7 + y + 5x$

Since $(7 + y + 5x)$ contains three terms. Therefore, it is trinomial.

Given polynomial is $2y - 3y^2$

Since $(2y - 3y^2)$ contains two terms. Therefore, it is binomial.

Given polynomial is $2y - 3y^2 + 4y^3$

Since $(2y - 3y^2 + 4y^3)$ contains three terms. Therefore, it is trinomial.

Given polynomial is $5x - 4y + 3xy$

Since $(5x - 4y + 3xy)$ contains three terms. Therefore, it is trinomial.

Given polynomial is $4x - 15z^2$

Since $(4x - 15z^2)$ contains two terms. Therefore, it is binomial.

Given polynomial is $ab + bc + cd + da$.

Since $(ab + bc + cd + da)$ contains four terms. Therefore, it is a polynomial and it does not fit in the above three categories.

Given polynomial is pqr.

Since pqr contains only one term. Therefore, it is monomial.

Given polynomial is $p^2q + pq^2$

Since $(p^2q + pq^2)$ contains two terms. Therefore, it is binomial.

Given polynomial is $2p + 2q$

Since $(2p + 2q)$ contains two terms. Therefore, it is binomial.

3. Add the following:

$ab - bc, bc - ca, ca - ab$

$a - b + ab, b - c + bc, c - a + ac$

$2p^2q^2 - 3pq + 4, 5 + 7pq - 3p^2q^2$

$l^2 + m^2, m^2 + n^2, n^2 + l^2, 2lm + 2mn + 2nl$

Solution:

$(ab - bc) + (bc - ca) + (ca - ab) = (ab - ab) + (bc - bc) + (ca - ca) = 0$

$(a - b + ab) + (b - c + bc) + (c - a + ac)$
$= a - a + b - b + c - c + ab + bc + ac$

$= ab + bc + ac$

$(2p^2q^2 - 3pq + 4) + (5 + 7pq - 3p^2q^2)$
$= (2 - 3)p^2q^2 + (-3 + 7)pq + (4 + 5)$

$= -p^2q^2 + 4pq + 9$

$(l^2 + m^2) + (m^2 + n^2) + (n^2 + l^2) + (2lm + 2mn + 2nl)$
$= 2(l^2 + m^2 + n^2 + lm + mn + nl)$

4. (a) Subtract $4a - 7ab + 3b + 12$ from $12a - 9ab + 5b - 3$

(b) Subtract $3xy + 5yz - 7zx$ from $5xy - 2yz - 2zx + 10xyz$

(c) Subtract $4p^2q - 3pq + 5pq^2 - 8p + 7q - 10$ from $18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q$.

Solution:

(a) Given polynomials are $4a - 7ab + 3b + 12$ and $12a - 9ab + 5b - 3$

Now, $(12a - 9ab + 5b - 3) - (4a - 7ab + 3b + 12) = (12a - 4a) + (-9ab - (-7ab)) + (5b - 3b) + (-3 - 12)$

$= 8a - 2ab + 2b - 15$

(b) Given polynomials are $3xy + 5yz - 7zx$ and $5xy - 2yz - 2zx + 10xyz$

Now, $(5xy - 2yz - 2zx + 10xyz) - (3xy + 5yz - 7zx) = (5xy - 3xy) + (-2yz - 5yz) + (-2zx + 7zx) + 10xyz$

$= 2xy - 7yz + 5zx + 10xyz$

(c) Given polynomials are $4p^2q - 3pq + 5pq^2 - 8p + 7q - 10$ from $18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q$

Now, $(18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q) - (4p^2q - 3pq + 5pq^2 - 8p + 7q - 10)$

$= (18 - 10) + \big(-3 - (-8)\big)p + (-11 - 7)q + \big(5 - (-3)\big)pq + (-2 - 5)pq^2 + (5 - 4)p^2q$

$= 28 + 5p - 18q + 8pq - 7pq^2 + p^2q$

Exercise 9.2

1. Find the product of the following pairs of monomials.

(i) $4, 7p$

(ii) $-4p, 7p$

(iii) $-4p, 7pq$

(iv) $4p^3, -3p$

(v) $4p, 0.$

Solution:

$4 \times 7p = 28p$

$(-4p) \times 7p = (-4 \times 7)(p \times p) = -28p^2$

$(-4p) \times 7pq = (-4 \times 7)(p \times p \times q) = -28p^2q$

$4p^3 \times (-3p) = \big(4 \times (-3)\big)(p^3 \times p) = -12p^4$

$4p \times 0 = 0$

2. Find the areas of rectangles with the following pairs of monomials as their lengths and breadths respectively.

(p, q); $(10m, 5n)$; $(20x^2, 5y^2)$; $(4x, 3x^2)$; $(3mn, 4np)$

Solution:

(i) Area of rectangle $=$ length $\times$ breadth $= p \times q = pq$ sq. units.

(ii) Area of rectangle $=$ length $\times$ breadth $= 10m \times 5n = 50mn$ sq. units.

(iii) Area of rectangle $=$ length $\times$ breadth $= 20x^2 \times 5y^2 = 100x^2y^2$ sq. units

(iv) Area of rectangle = length × breadth = $4x \times 3x^2 = 12x^3$ sq. units.

(v) Area of rectangle = length × breadth = $3mn \times 4np = 12mn^2p$ sq. units

3. Complete the table of products:

First Monomial → / Second monomial ↓	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
$2x$	$4x^2$					
$-5y$			$-15x^2y$			
$3x^2$						
$-4xy$						
$7x^2y$						
$-9x^2y^2$						

Solution:

First Monomial → / Second monomial ↓	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
$2x$	$4x^2$	$-10xy$	$6x^3$	$-8x^2y$	$14x^3y$	$-18x^3y^2$
$-5y$	$-10xy$	$25y^2$	$-15x^2y$	$20xy^2$	$-35x^2y^2$	$45x^2y^3$
$3x^2$	$6x^3$	$-15x^2y$	$9x^4$	$-12x^3y$	$21x^4y$	$-27x^4y^2$
$-4xy$	$-8x^2y$	$20xy^2$	$-12x^3y$	$16x^2y^2$	$-28x^3y^2$	$36x^3y^3$
$7x^2y$	$14x^3y$	$-35x^2y^2$	$21x^4y$	$-28x^3y^2$	$49x^4y^2$	$-63x^4y^3$
$-9x^2y^2$	$-18x^3y^2$	$45x^2y^3$	$-27x^4y^2$	$36x^3y^3$	$-63x^4y^3$	$81x^4y^4$

4. Obtain the volume of rectangular boxes with the following length, breadth and height respectively.

(i) $5a, 3a^2, 7a^4$

(ii) $2p, 4q, 8r$

(iii) $xy, 2x^2y, 2xy^2$

(iv) $a, 2b, 3c$.

Solution:

Volume of rectangular box = length × breadth × height

$= 5a \times 3a^2 \times 7a^4$

$= 105a^7$ cubic units

Volume of rectangular box = length × breadth × height

$= 2p \times 4q \times 8r$

$= 64pqr$ cubic units.

Volume of rectangular box = length × breadth × height

$= xy \times 2x^2y \times 2xy^2$

$= 4x^4 y^4$ cubic units.

Volume of rectangular box = length × breadth × height

$= a \times 2b \times 3c$

$= 6abc$ cubic units.

5. Obtain the product of

(i) xy, yz, zx

(ii) $a, -a^2, a^3$

(iii) $2, 4y, 8y^2, 16y^3$

(iv) $a, 2b, 3c, 6abc$

(v) $m, -mn, mnp$.

Solution:

$xy \times yz \times zx = x^2y^2z^2$

$a \times (-a^2) \times a^3 = -a^6$

$2 \times 4y \times 8y^2 \times 16y^3 = 1024y^6$

$a \times 2b \times 3c \times 6abc = 36a^2b^2c^2$

$m \times (-mn) \times mnp = -m^3n^2p$.

Exercise 9.3

1. Carry out the multiplication of the expression in each of the following pairs:

$4p, q + r$

$ab, a - b$

$a + b, 7a^2b^2$

$a^2 - 9, 4a$

$pq + qr + rp, 0$

Solution:

(i) $4p \times (q + r) = 4p \times q + 4p \times r$

$= 4pq + 4pr$

(ii) $ab \times (a - b) = (ab \times a) - (ab \times b)$

$= a^2b - ab^2$

(iii) $(a + b) \times (7a^2 b^2) = (7a^2b^2 \times a) + (7a^2b^2 \times b)$

$= 7a^3b^2 + 7a^2b^3$

(iv) $(a^2 - 9) \times 4a = (a^2 \times 4a) - (9 \times 4a)$

$= 4a^3 - 36a$

(v) $(pq + qr + rp) \times 0 = 0$

Complete the following table:

	First expression	**Second expression**	**Product**
(i)	a	$b + c + d$	…
(ii)	$x + y - 5$	$5xy$	…
(iii)	p	$6p^2 - 7p + 5$	…
(iv)	$4p^2q^2$	$p^2 - q^2$	…
(v)	$a + b + c$	abc	…

Solution:

	First expression	**Second expression**	**Product**
(i)	a	$b + c + d$	$a(b + c + d)$ $= (a \times b) + (a \times c) + (a \times d)$ $= ab + ac + ad$
(ii)	$x + y - 5$	$5xy$	$(x + y - 5)5xy$ $= x(5xy) + y(5xy) - 5(5xy)$ $= 5x^2y + 5xy^2 - 25xy$
(iii)	p	$6p^2 - 7p + 5$	$p(6p^2 - 7p + 5)$ $= (p \times 6p^2) - (p \times 7p) + (p \times 5)$ $= 6p^3 - 7p^2 + 5p$
(iv)	$4p^2q^2$	$p^2 - q^2$	$4p^2q^2(p^2 - q^2)$

			$= (4p^2q^2 \times p^2) - (4p^2q^2 \times q^2)$ $= 4p^4q^2 - 4p^2q^4$
(v)	$a + b + c$	abc	$abc(a + b + c)$ $= (abc \times a) + (abc \times b) + (abc \times c)$ $= a^2bc + ab^2c + abc^2$

2. Find the product:

(a) $(a^2) \times (2a^{22}) \times (4a^{26})$

(b) $\left(\frac{2}{3}xy\right) \times \left(-\frac{9}{10}x^2y^2\right)$

(c) $\left(-\frac{10}{3}pq^3\right) \times \left(\frac{6}{5}p^3q\right)$

(d) $x \times x^2 \times x^3 \times x^4$

Solution:

(a) $(a^2) \times (2a^{22}) \times (4a^{26}) = 2 \times 4(a^2 \times a^{22} \times a^{26})$

$= 8a^{2+22+26}$

$= 8a^{50}$

(b) $\left(\frac{2}{3}xy\right) \times \left(-\frac{9}{10}x^2y^2\right) = \left(\frac{2}{3} \times \frac{-9}{10}\right)(xy \times x^2y^2)$

$= \frac{-3}{5}x^3y^3$

(c) $\left(-\frac{10}{3}pq^3\right) \times \left(\frac{6}{5}p^3q\right) = \left(\frac{-10}{3} \times \frac{6}{5}\right) \times (pq^3 \times p^3q)$

$= -4p^4q^4$

(d) $x \times x^2 \times x^3 \times x^4 = x^{1+2+3+4} = x^{10}$

3. (a) Simplify: $3x(4x - 5) + 3$ and find the value for (i) $x = 3$ (ii) $x = \frac{1}{2}$

(b) Simplify: $a(a^2 + a + 1) + 5$ and find its value for (i) $a = 0$ (ii) $a = 1$ (iii) $a = -1$

Solution:

(a) $3x(4x - 5) + 3 = (3x \times 4x) - (3x \times 5) + 3 = 12x^2 - 15x + 3$

For $x = 3$, $12x^2 - 15x + 3 = 12(3)^2 - 15(3) + 3$

$= (12 \times 9) - 45 + 3$

$= 108 - 45 + 3$

$= 66$

For $x = \frac{1}{2}$, $12x^2 - 15x + 3 = 12\left(\frac{1}{2}\right)^2 - 15\left(\frac{1}{2}\right) + 3$

$= \left(12 \times \frac{1}{4}\right) - \frac{15}{2} + 3$

$= 3 - \frac{15}{2} + 3$

$= 6 - \frac{15}{2}$

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

(b) $a(a^2 + a + 1) + 5 = (a \times a^2) + (a \times a) + a + 5 = a^3 + a^2 + a + 5$

For $a = 0$, $a^3 + a^2 + a + 5 = (0)^3 + (0)^2 + 0 + 5$

$= 0 + 0 + 0 + 5$

$= 5$

For $a = 1$, $a^3 + a^2 + a + 5 = (1)^3 + (1)^2 + 1 + 5$

$= 1 + 1 + 1 + 5$

$= 8$

For $a = -1$, $a^3 + a^2 + a + 5 = (-1)^3 + (-1)^2 - 1 + 5$

$= -1 + 1 - 1 + 5$

$= 4$

4. (a) Add: $p(p - q), q(q - r)$ and $r(r - p)$

(b) Add: $2x(z - x - y)$ and $2y(z - y - x)$

(c) Subtract: $3l(l - 4m + 5n)$ from $4l(10n - 3m + 2l)$

(d) Subtract: $3a(a + b + c) - 2b(a - b + c)$ from $4c(-a + b + c)$

Solution:

(a) $p(p - q) + q(q - r) + r(r - p) = (p \times p) - (p \times q) + (q \times q) - (q \times r) + (r \times r) - (r \times p)$

$= p^2 - pq + q^2 - qr + r^2 - rp$

$= p^2 + q^2 + r^2 - pq - qr - rp$

(b) $2x(z - x - y) + 2y(z - y - x) = 2zx - 2x^2 - 2xy + 2yz - 2y^2 - 2xy$

$= -2x^2 - 2y^2 - 4xy + 2yz + 2zx$

(c) $4l(10n - 3m + 2l) - 3l(l - 4m + 5n) = 40ln - 12lm + 8l^2 - 3l^2 + 12lm - 15ln$

$= 5l^2 + 25ln$

(d) $4c(-a + b + c) - 3a(a + b + c) + 2b(a - b + c) = -4ac + 4bc + 4c^2 - 3a^2 - 3ab - 3ac + 2ab - 2b^2 + 2bc$

$= -3a^2 - 2b^2 + 4c^2 - ab + 6bc - 7ac$

Exercise 9.4

1. Multiply the binomials.

(a) $(2x + 5)$ and $(4x - 3)$

(b) $(y - 8)$ and $(3y - 4)$

(c) $(2.5l - 0.5m)$ and $(2.5l + 0.5m)$

(d) $(a + 3b)$ and $(x + 5)$

(e) $(2pq + 3q^2)$ and $(3pq - 2q^2)$

(f) $\left(\frac{3}{4}a^2 + 3b^2\right)$ and $4\left(a^2 - \frac{2}{3}b^2\right)$

Solution:

(a) $(2x + 5) \times (4x - 3) = (2x \times 4x) + (5 \times 4x) + (2x \times -3) + (5 \times -3)$

$= 8x^2 + 20x - 6x - 15$

$= 8x^2 + 14x - 15$

(b) $(y - 8) \times (3y - 4) = (y \times 3y) + (-8 \times 3y) + (y \times -4) + (-8 \times -4)$

$= 3y^2 - 24y - 4y + 32$

$= 3y^2 - 28y + 32$

(c) $(2.5l - 0.5m) \times (2.5l + 0.5m) = (2.5l \times 2.5l) + (-0.5m \times 2.5l) + (2.5l \times 0.5m) + (-0.5m \times 0.5m)$

$= 6.25l^2 - 1.25ml + 1.25ml - 0.25m^2$

$= 6.25l^2 - 0.25m^2$

(d) $(a + 3b) \times (x + 5) = (a \times x) + (3b \times x) + (a \times 5) + (3b \times 5)$

$= ax + 3bx + 5a + 15b$

(e) $(2pq + 3q^2) \times (3pq - 2q^2) = (2pq \times 3pq) + (3q^2 \times 3pq) + (2pq \times -2q^2) + (3q^2 \times -2q^2)$

$= 6p^2q^2 + 9pq^3 - 4pq^3 - 6q^4$

$= 6p^2q^2 + 5pq^3 - 6q^4$

(f) $\left(\frac{3}{4}a^2 + 3b^2\right) \times 4\left(a^2 - \frac{2}{3}b^2\right) = \left(\frac{3}{4}a^2 \times 4a^2\right) + (3b^2 \times 4a^2) + \left(\frac{3}{4}a^2 \times -\frac{8}{3}b^2\right) + (3b^2 \times -\frac{8}{3}b^2)$

$= 3a^4 + 12a^2b^2 - 2a^2b^2 - 8b^4$

$= 3a^4 + 10a^2b^2 - 8b^4$

2. Find the product.

(a) $(5 - 2x)(3 + x)$

(b) $(x + 7y)(7x - y)$

(c) $(a^2 + b)(a + b^2)$

(d) $(p^2 - q^2)(2p + q)$

Solution:

(a) $(5 - 2x)(3 + x) = (5 \times 3) + (-2x \times 3) + (5 \times x) + (-2x \times x)$

$= 15 - 6x + 5x - 2x^2$

$= 15 - x - 2x^2$

(b) $(x + 7y)(7x - y) = (x \times 7x) + (7y \times 7x) + (x \times -y) + (7y \times -y)$

$= 7x^2 + 49xy - xy - 7y^2$

$= 7x^2 + 48xy - 7y^2$

(c) $(a^2 + b)(a + b^2) = (a^2 \times a) + (b \times a) + (a^2 \times b^2) + (b \times b^2)$

$= a^3 + ab + a^2b^2 + b^3$

(d) $(p^2 - q^2)(2p + q) = (p^2 \times 2p) + (-q^2 \times 2p) + (p^2 \times q) + (-q^2 \times q)$

$= 2p^3 - 2pq^2 + p^2q - q^3$

3. Simplify.

(a) $(x^2 - 5)(x + 5) + 25$

(b) $(a^2 + 5)(b^3 + 3) + 5$

(c) $(t + s^2)(t^2 - s)$

(d) $(a + b)(c - d) + (a - b)(c + d) + 2(ac + bd)$

(e) $(x + y)(2x + y) + (x + 2y)(x - y)$

(f) $(x + y)(x^2 - xy + y^2)$

(g) $(1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y$

(h) $(a + b + c)(a + b - c)$

Solution:

(a) $(x^2 - 5)(x + 5) + 25 = (x^2 \times x) + (-5 \times x) + (x^2 \times 5) + (-5 \times 5) + 25$

$= x^3 - 5x + 5x^2 - 25 + 25$

$= x^3 + 5x^2 - 5x$

(b) $(a^2 + 5)(b^3 + 3) + 5 = (a^2 \times b^3) + (5 \times b^3) + (a^2 \times 3) + (5 \times 3) + 5$

$= a^2b^3 + 5b^3 + 3a^2 + 15 + 5$

$= a^2b^3 + 3a^2 + 5b^3 + 20$

(c) $(t + s^2)(t^2 - s) = (t \times t^2) + (s^2 \times t^2) + (t \times -s) + (s^2 \times -s)$

$= t^3 + s^2t^2 - st - s^3$

(d) $(a + b)(c - d) + (a - b)(c + d) + 2(ac + bd) = (a \times c) + (a \times -d) + (b \times c) + (b \times -d) + (a \times c) + (a \times d) + (-b \times c) + (-b \times d) + 2ac + 2bd$

$= ac - ad + bc - bd + ac + ad - bc - bd + 2ac + 2bd$

$= 4ac$

(e) $(x + y)(2x + y) + (x + 2y)(x - y) = (x \times 2x) + (y \times 2x) + (x \times y) + (y \times y) + (x \times x) + (2y \times x) + (x \times -y) + (2y \times -y)$

$= 2x^2 + 2xy + xy + y^2 + x^2 + 2xy - xy - 2y^2$

$= 3x^2 + 4xy - y^2$

(f) $(x + y)(x^2 - xy + y^2) = (x \times x^2) + (y \times x^2) + (x \times -xy) + (y \times -xy) + (x \times y^2) + (y \times y^2)$

$= x^3 + x^2y - x^2y - xy^2 + xy^2 + y^3$

$= x^3 + y^3$

(g) $(1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y = (1.5x \times 1.5x) + (1.5x \times 4y) + (1.5x \times 3) + (-4y \times 1.5x) + (-4y \times 4y) + (-4y \times 3) - 4.5x + 12y$

$= 2.25x^2 + 6xy + 4.5x - 6xy - 16y^2 - 12y - 4.5x + 12y$

$= 2.25x^2 - 16y^2$

(h) $(a+b+c)(a+b-c) = (a\times a) + (a\times b) + (a\times -c) + (b\times a) + (b\times b) + (b\times -c) + (c\times a) + (c\times b) + (c\times -c)$

$= a^2 + ab - ca + ab + b^2 - bc + ca + bc - c^2$

$= a^2 + b^2 - c^2 + 2ab$

Exercise 9.5

1. Use a suitable identity to get each of the following products.

(i) $(x + 3)(x + 3)$

(ii) $(2y + 5)(2y + 5)$

(iii) $(2a - 7)(2a - 7)$

(iv) $\left(3a - \frac{1}{2}\right)\left(3a - \frac{1}{2}\right)$

(v) $(1.1m - 0.4)(1.1m + 0.4)$

(vi) $(a^2 + b^2)(-a^2 + b^2)$

(vii) $(6x - 7)(6x + 7)$

(viii) $(-a + c)(-a + c)$

(ix) $\left(\frac{x}{2} + \frac{3y}{4}\right)\left(\frac{x}{2} + \frac{3y}{4}\right)$

(x) $(7a - 9b)(7a - 9b)$

Solution:

(i) $(x + 3)(x + 3) = (x+3)^2$

We know that $(a+b)^2 = a^2 + 2ab + b^2$

Here $a = x, b = 3$

Hence, $(x+3)^2 = x^2 + 2x(3) + 3^2$

$= x^2 + 6x + 9$

(ii) $(2y + 5)(2y + 5) = (2y+5)^2$

We know that $(a+b)^2 = a^2 + 2ab + b^2$

Here $a = 2y, b = 5$

Hence, $(2y+5)^2 = (2y)^2 + 2(2y)(5) + 5^2$

$= 4y^2 + 20y + 25$

(iii) $(2a - 7)(2a - 7) = (2a - 7)^2$

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = 2a, b = 7$

Hence, $(2a-7)^2 = (2a)^2 - 2(2a)(7) + 7^2$

$= 4a^2 - 28a + 49$

(iv) $\left(3a - \frac{1}{2}\right)\left(3a - \frac{1}{2}\right) = \left(3a - \frac{1}{2}\right)^2$

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = 3a, b = \frac{1}{2}$

Hence, $\left(3a - \frac{1}{2}\right)^2 = (3a)^2 - 2(3a)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)^2$

$= 9a^2 - 3a + \frac{1}{4}$

(v) $(1.1m - 0.4)(1.1m + 0.4)$

We know that $(a+b)(a-b) = a^2 - b^2$

Here $a = 1.1m, b = 0.4$

Hence, $(1.1m - 0.4)(1.1m + 0.4) = (1.1m)^2 - 0.4^2$

$= 1.21m^2 - 0.16$

(vi) $(a^2 + b^2)(-a^2 + b^2) = (b^2 + a^2)(b^2 - a^2)$

We know that $(a+b)(a-b) = a^2 - b^2$

Here $a = b^2, b = a^2$

Hence, $(b^2 + a^2)(b^2 - a^2) = (b^2)^2 - (a^2)^2$

$= b^4 - a^4$

(vii) We know that $(a+b)(a-b) = a^2 - b^2$

Here $a = 6x, b = 7$

Hence, $(6x-7)(6x+7) = (6x)^2 - 7^2$

$= 36x^2 - 49$

(viii) $(-a + c)(-a + c) = (c-a)^2$

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = c, b = a$

Hence, $(c-a)^2 = (c)^2 - 2(c)(a) + a^2$

$= c^2 - 2ca + a^2$

(ix) $\left(\frac{x}{2}+\frac{3y}{4}\right)\left(\frac{x}{2}+\frac{3y}{4}\right) = \left(\frac{x}{2}+\frac{3y}{4}\right)^2$

We know that $(a+b)^2 = a^2 + 2ab + b^2$

Here $a = \frac{x}{2}, b = \frac{3y}{4}$

Hence, $\left(\frac{x}{2}+\frac{3y}{4}\right)^2 = \left(\frac{x}{2}\right)^2 + 2\left(\frac{x}{2}\right)\left(\frac{3y}{4}\right) + \left(\frac{3y}{4}\right)^2$

$= \frac{x^2}{4} + \frac{3xy}{4} + \frac{9y^2}{16}$

(x) $(7a - 9b)(7a - 9b) = (7a - 9b)^2$

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = 7a, b = 9b$

Hence, $(7a - 9b)^2 = (7a)^2 - 2(7a)(9b) + (9b)^2$

$= 49a^2 - 126a + 81b^2$

2. Use the identity $(x + a)(x + b) = x^2 + (a + b)x + ab$ to find the following products.

(i) $(x + 3)(x + 7)$

(ii) $(4x + 5)(4x + 1)$

(iii) $(4x - 5)(4x - 1)$

(iv) $(4x + 5)(4x - 1)$

(v) $(2x + 5y)(2x + 3y)$

(vi) $(2a^2 + 9)(2a^2 + 5)$

(vii) $(xyz - 4)(xyz - 2)$

Solution:

(i) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $a = 3, b = 7$

Hence, $(x + 3)(x + 7) = x^2 + (3 + 7)x + 21$

$= x^2 + 10x + 21$

(ii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(4x + 5)(4x + 1) = 16\left(x + \frac{5}{4}\right)\left(x + \frac{1}{4}\right)$

$= 16(x^2 + \left(\frac{5}{4} + \frac{1}{4}\right)x + \frac{5}{16})$

$= 16x^2 + 24x + 5$

(iii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(4x - 5)(4x - 1) = 16\left(x - \frac{5}{4}\right)\left(x - \frac{1}{4}\right)$

$= 16\left(x^2 - \frac{6}{4}x + \frac{5}{16}\right)$

$= 16x^2 - 24x + 5$

(iv) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(4x + 5)(4x - 1) = 16\left(x + \frac{5}{4}\right)\left(x - \frac{1}{4}\right)$

$= 16\left(x^2 + x - \frac{5}{16}\right)$

$= 16x^2 + 16x - 5$

(v) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(2x + 5y)(2x + 3y) = 4\left(x + \frac{5}{2}y\right)\left(x + \frac{3}{2}y\right)$

$= 4\left(x^2 + 4xy + \frac{15}{4}\right)$

$= 4x^2 + 16xy + 15$

(vi) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Here $x = 2a^2, a = 9, b = 5$

$(2a^2 + 9)(2a^2 + 5) = (2a^2)^2 + (9 + 5)2a^2 + 45$

$= 4a^4 + 28a^2 + 45$

(vii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Here $x = xyz, a = -4, b = -2$

$(xyz - 4)(xyz - 2) = (xyz)^2 + (-4 - 2)xyz + 8$

$= x^2y^2z^2 - 6xyz + 8$

3. Find the following squares by using the identities.

(i) $(b - 7)^2$

(ii) $(xy + 3z)^2$

(iii) $(6x^2 - 5y)^2$

(iv) $\left(\frac{2}{3}m + \frac{3}{2}n\right)^2$

(v) $(0.4p - 0.5q)^2$

(vi) $(2xy + 5y)^2$

Solution:

(i) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = b, b = 7$

$(b - 7)^2 = b^2 - 2(b)(7) + 49$

$= b^2 - 14b + 49$

(ii) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = xy, b = 3z$

$(xy + 3z)^2 = (xy)^2 + 2(xy)(3z) + (3z)^2$

$= x^2y^2 + 6xyz + 9z^2$

(iii) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = 6x^2, b = 5y$

$(6x^2 - 5y)^2 = (6x^2)^2 - 2(6x^2)(5y) + (5y)^2$

$= 36x^4 - 60x^2y + 25y^2$

(iv) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = \frac{2}{3}m, b = \frac{3}{2}n$

$\left(\frac{2}{3}m + \frac{3}{2}n\right)^2 = \frac{4}{9}m^2 + 2\left(\frac{2}{3}m\right)\left(\frac{3}{2}n\right) + \frac{9}{4}n^2$

$= \frac{4}{9}m^2 + 2mn + \frac{9}{4}n^2$

(v) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = 0.4p, b = 0.5q$

$(0.4p - 0.5q)^2 = 0.16p^2 - 2(0.4p)(0.5q) + 0.25q^2$

$= 0.16p^2 - 0.4pq + 0.25q^2$

(vi) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = 2xy, b = 5y$

$(2xy + 5y)^2 = 4x^2y^2 + 2(2xy)(5y) + 25y^2$

$= 4x^2y^2 + 20xy^2 + 25y^2$

4. Simplify.

(i) $(a^2 - b^2)^2$

(ii) $(2x + 5)^2 - (2x - 5)^2$

(iii) $(7m - 8n)^2 + (7m + 8n)^2$

(iv) $(4m + 5n)^2 + (5m + 4n)^2$

(v) $(2.5p - 1.5q)^2 - (1.5p - 2.5q)^2$

(vi) $(ab + bc)^2 - 2ab^2c$

(vii) $(m^2 - n^2m)^2 + 2m^3n^2$

Solution:

(i) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = a^2, b = b^2$

$(a^2 - b^2)^2 = (a^2)^2 - 2(a^2)(b^2) + (b^2)^2$

$= a^4 - 2a^2b^2 + b^4$

(ii) We know that $(a + b)^2 - (a - b)^2 = 4ab$

Here $a = 2x, b = 5$

$(2x + 5)^2 - (2x - 5)^2 = 4(2x)5$

$= 40x$

(iii) We know that $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

Here $a = 7m, b = 8n$

$(7m - 8n)^2 + (7m + 8n)^2 = 2((7m)^2 + (8n)^2)$

$= 98m^2 + 128n^2$

(iv) We know that $(a + b)^2 = a^2 + 2ab + b^2$

$(4m + 5n)^2 + (5m + 4n)^2$

$= 16m^2 + 25n^2 + 2(4m)(5n) + 25m^2 + 16n^2 + 2(5m)(4n)$

$= 41m^2 + 41n^2 + 80mn$

(v) We know that $(a - b)^2 = a^2 - 2ab + b^2$

$(2.5p - 1.5q)^2 - (1.5p - 2.5q)^2$

$= 6.25p^2 + 2.25q^2 - 7.5pq - (2.25p^2 + 6.25q^2 - 7.5pq)$

$= 4p^2 - 4q^2$

(vi) We know that $(a + b)^2 = a^2 + 2ab + b^2$

$(ab + bc)^2 - 2ab^2c = (a^2b^2 + b^2c^2 + 2ab^2c) - 2ab^2c$

$= a^2b^2 + b^2c^2$

(vii) We know that $(a - b)^2 = a^2 - 2ab + b^2$

$(m^2 - n^2m)^2 + 2m^3n^2$

$= m^4 + n^4m^2 - 2m^3n^2 + 2m^3n^2$

$= m^4 + n^4m^2$

5. Show that

(i) $(3x + 7)^2 - 84x = (3x - 7)^2$

(ii) $(9p - 5q)^2 + 180pq = (9p + 5q)^2$

(iii) $\left(\frac{4}{3}m - \frac{3}{4}n\right)^2 + 2mn = \frac{16}{9}m^2 + \frac{9}{16}n^2$

(iv) $(4pq + 3q)^2 - (4pq - 3q)^2 = 48pq^2$

(v) $(a - b)(a + b) + (b - c)(b + c) + (c - a)(c + a) = 0$

Solution:

(i) We know that $(a + b)^2 = a^2 + 2ab + b^2$

$\Rightarrow (a + b)^2 - 4ab = a^2 + 2ab + b^2 - 4ab$

$\Rightarrow (a + b)^2 - 4ab = a^2 - 2ab + b^2$ ….. (i)

And $(a - b)^2 = a^2 - 2ab + b^2$ ……(ii)

From (i) and (ii)

$(a + b)^2 - 4ab = (a - b)^2$

Put $a = 3x, b = 7$

$(3x + 7)^2 - 4(3x)7 = (3x - 7)^2$

$\Rightarrow (3x + 7)^2 - 84x = (3x - 7)^2$

(ii) We know that $(a - b)^2 = a^2 - 2ab + b^2$

$\Rightarrow (a - b)^2 + 4ab = a^2 - 2ab + b^2 + 4ab$

$\Rightarrow (a - b)^2 + 4ab = a^2 + 2ab + b^2$ …..(i)

And $(a+b)^2 = a^2 + 2ab + b^2 \ldots\ldots$(ii)

From (i) and (ii)

$(a-b)^2 + 4ab = (a+b)^2$

Put $a = 9p, b = 5q$

$(9p-5q)^2 + 4(9p)(5q) = (9p+5q)^2$

$\Rightarrow (9p-5q)^2 + 180pq = (9p+5q)^2$

(iii) We know that $(a-b)^2 = a^2 - 2ab + b^2$

$\Rightarrow\ (a-b)^2 + 2ab = a^2 - 2ab + b^2 + 2ab$

$= a^2 + b^2$

Put $a = \frac{4}{3}m, b = \frac{3}{4}n$

$\Rightarrow \left(\frac{4}{3}m - \frac{3}{4}n\right)^2 + 2\left(\frac{4}{3}m\right)\left(\frac{3}{4}n\right) = (\frac{4}{3}m)^2 + (\frac{3}{4}n)^2$

$\Rightarrow \left(\frac{4}{3}m - \frac{3}{4}n\right)^2 + 2mn = \frac{16}{9}m^2 + \frac{9}{16}n^2$

(iv) We know that $(a+b)^2 = a^2 + 2ab + b^2 \ldots.$ (i)

$(a-b)^2 = a^2 - 2ab + b^2 \ldots.$ (ii)

Adding (i) and (ii)

$(a+b)^2 - (a-b)^2 = (a^2 + 2ab + b^2) - (a^2 - 2ab + b^2)$

$= 4ab$

Put $a = 4pq, b = 3q$

$(4pq + 3q)^2 - (4pq - 3q)^2 = 4(4pq)(3q)$

$= 48q^2p$

(v) We know that $(a-b)(a+b) = a^2 - b^2$

$(b-c)(b+c) = b^2 - c^2$

$(c-a)(c+a) = c^2 - a^2$

Hence, $(a-b)(a+b) + (b-c)(b+c) + (c-a)(c+a) = a^2 - b^2 + b^2 - c^2 + c^2 - a^2$

$= 0$

6. Using identities, evaluate

(i) 71^2

(ii) 99^2

(iii) 102^2

(iv) 998^2

(v) 5.2^2

(vi) 297×303

(vii) 78×82

(viii) 8.9^2

(ix) 1.05×9.5

Solution:

(i) We know that $(a+b)^2 = a^2 + 2ab + b^2$

Put $a = 70, b = 1$

$(70+1)^2 = (70)^2 + 2(70)(1) + 1$

$= 4900 + 140 + 1 = 5041$

(ii) We know that $(a-b)^2 = a^2 - 2ab + b^2$

Put $a = 100, b = 1$

$(100-1)^2 = (100)^2 - 2(100)(1) + 1$

$= 10000 - 200 + 1 = 9801$

(iii) We know that $(a+b)^2 = a^2 + 2ab + b^2$

Put $a = 100, b = 2$

$(102)^2 = 100^2 + 2(100)(2) + 4$

$= 10000 + 400 + 4 = 10404$

(iv) We know that $(a-b)^2 = a^2 - 2ab + b^2$

Put $a = 1000, b = 2$

$(1000-2)^2 = (1000)^2 - 2(1000)(2) + 2^2$

$= 1000000 - 4000 + 4$

$= 996004$

(v) We know that $(a+b)^2 = a^2 + 2ab + b^2$

Put $a = 5, b = 0.2$

$(5+0.2)^2 = 5^2 + 2(5)(0.2) + (0.2)^2$

$= 25 + 2 + 0.04 = 27.04$

(vi) We know that $(a+b)(a-b) = a^2 - b^2$

Put $a = 300, b = 3$

$(300+3)(300-3) = (300)^2 - (3)^2$

$= 90000 - 9 = 89991$

(vii) We know that $(a+b)(a-b) = a^2 - b^2$

Put $a = 80, b = 2$

$(80-2)(80+2) = (80)^2 - 4$

$= 6396$

(viii) We know that $(a-b)^2 = a^2 - 2ab + b^2$

Put $a = 9, b = 0.1$

$(9-0.1)^2 = 9^2 - 2(9)(0.1) + (0.1)^2$

$= 81 - 1.8 + 0.01 = 79.21$

(ix) $1.05 \times 9.5 = 1.05 \times 0.95 \times 10$

We know that $(a+b)(a-b) = a^2 - b^2$

$1.05 \times 0.95 \times 10 = (1+0.05)(1-0.05)(10)$

$= (1 - 0.0025)10$

$= 9.975$

7. Using $a^2 - b^2 = (a-b)(a+b)$,find

(i) $51^2 - 49^2$

(ii) $(1.02)^2 - (0.98)^2$

(iii) $153^2 - 147^2$

(iv) $12.1^2 - 7.9^2$

Solution:

(i) We know that $a^2 - b^2 = (a-b)(a+b)$

$51^2 - 49^2 = (51-49)(51+49)$

$= 2(100) = 200$

(ii) We know that $a^2 - b^2 = (a-b)(a+b)$

$(1.02)^2 - (0.98)^2 = (1.02 - 0.98)(1.02 + 0.98)$

$= (0.04)2 = 0.08$

(iii) We know that $a^2 - b^2 = (a - b)(a + b)$

$153^2 - 147^2 = (153 - 147)(153 + 147)$

$= 6(300) = 1800$

(iv) We know that $a^2 - b^2 = (a - b)(a + b)$

$12.1^2 - 7.9^2 = (12.1 - 7.9)(12.1 + 7.9)$

$= 4.2(20) = 84$

8. Using $(x + a)(x + b) = x^2 + (a + b)x + ab$, find

(i) 103×104

(ii) 5.1×5.2

(iii) 103×98

(iv) 9.7×9.8

Solution:

(i) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 100, a = 3, b = 4$

$(100 + 3)(100 + 4) = 100^2 + (3 + 4)100 + 12$

$= 10000 + 700 + 12$

$= 10712$

(ii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 5, a = 0.1, b = 0.2$

$(5 + 0.1)(5 + 0.2) = 25 + 1.5 + 0.02$

$= 26.52$

(iii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 100, a = 3, b = -2$

$(100 + 3)(100 - 2) = 10000 + 100 - 6$

$= 10094$

(iv) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 10, a = -0.2, b = -0.3$

$(10 - 0.2)(10 - 0.3) = 100 - 5 + 0.06$

$= 95.06$

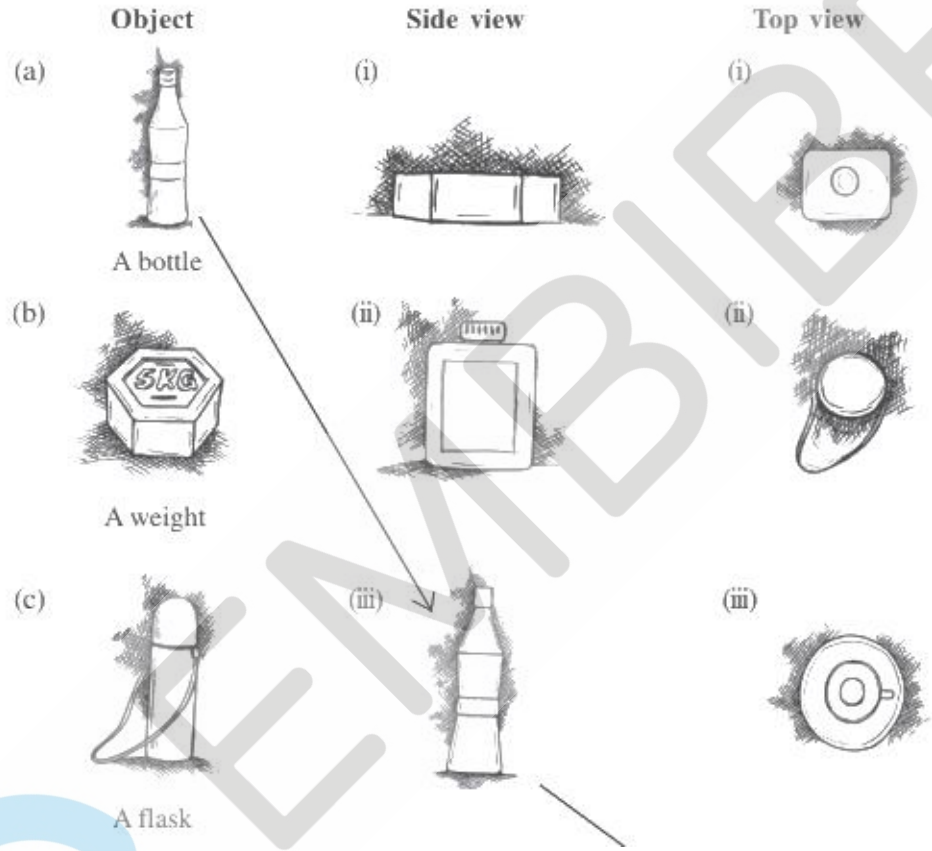
♦♦♦

CBSE NCERT Solutions for Class 8 Mathematics Chapter 10

Back of Chapter Questions

Exercise 10.1

1. For each of the given solid, the two views are given. Match for each solid the corresponding top and front views. The first one is done for you.

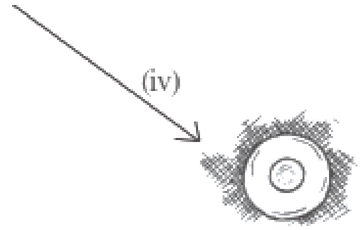


(d)

Cup and Saucer

(iv)

(iv)



(e)

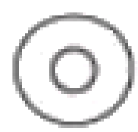
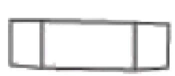
Container

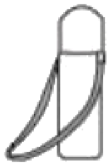
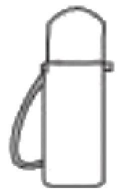
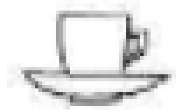
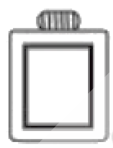
(v)

(v)

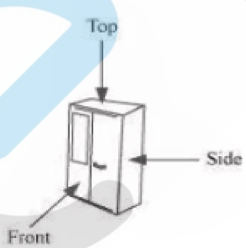
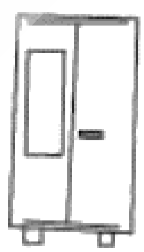
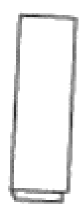
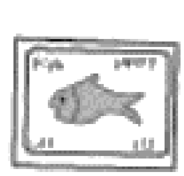
Solution:

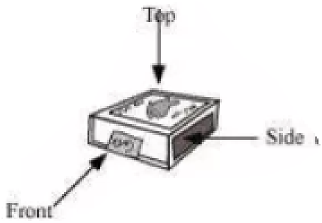
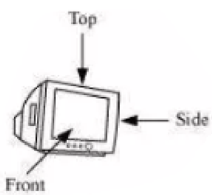
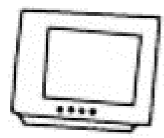
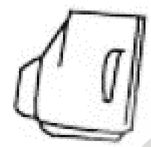
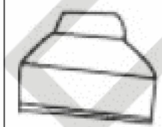
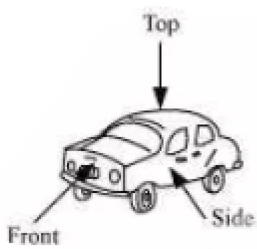
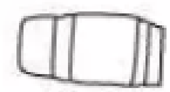
The following tables shows the objects matched with their top view and front views:

OBJECT	FRONT VIEW	TOP VIEW
(a)  A bottle	(i) 	(i) 
(b)  A weight	(ii) 	(ii) 

(c)  A flask	(iii) 	(iii) 
(d)  Cup and Saucer	(iv) 	(iv) 
(e)  Container	(v) 	(v) 

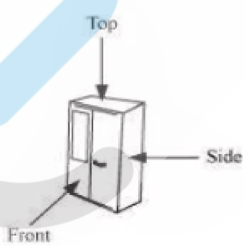
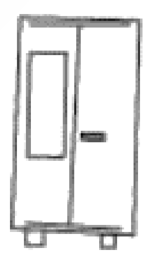
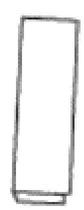
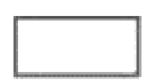
2. For each of the given solid, the three views are given. Identify for each solid the corresponding top, front and side views.

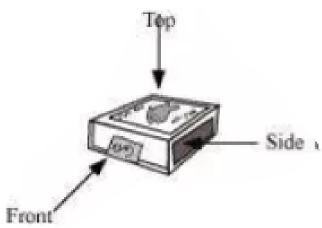
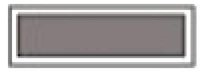
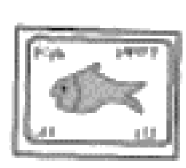
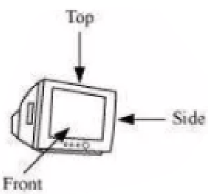
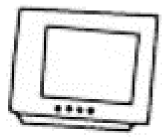
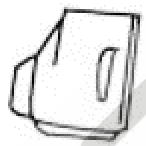
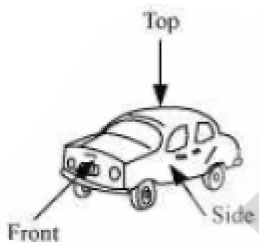
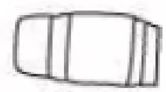
(a) 			
(b)			

			
(c) 			
(d) 			

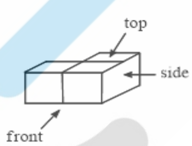
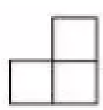
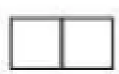
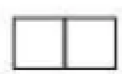
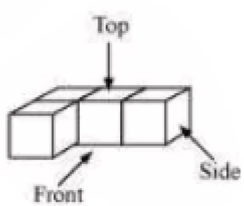
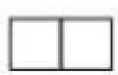
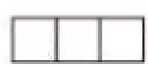
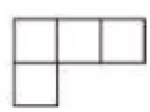
Solution:

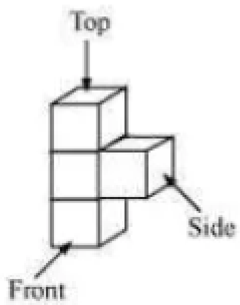
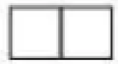
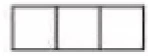
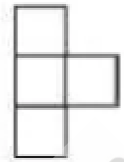
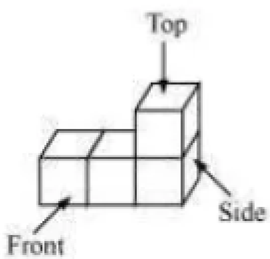
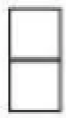
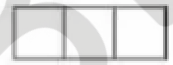
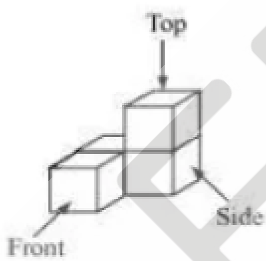
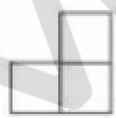
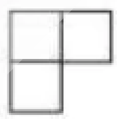
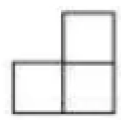
The front, top and side views of the object are as shown below:

(a) 	 Front view	 Side view	 Top view

(b) 	 Side view	 Front view	 Top view
(c) 	 Front view	 Side view	 Top view
(d) 	 Front view	 Side view	 Top view

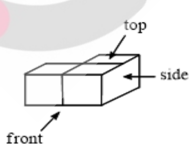
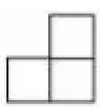
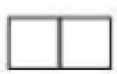
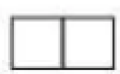
3. For the given solid, identify the top view, front view and the side view.

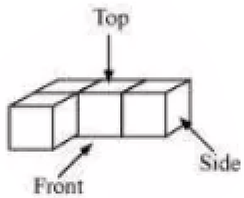
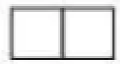
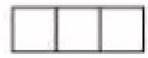
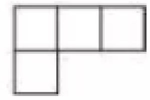
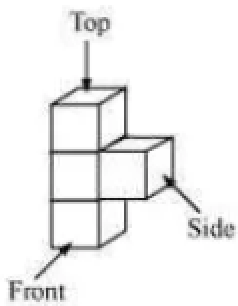
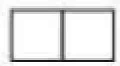
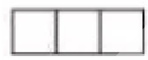
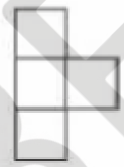
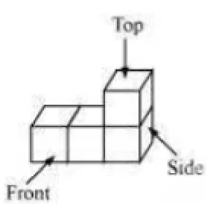
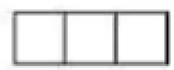
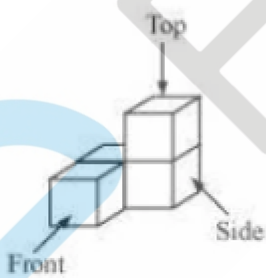
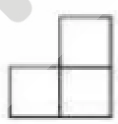
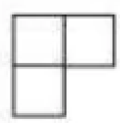
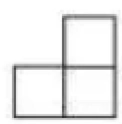
(a) 			
(b) 			

<table>
<tr><td>(c)
</td><td></td><td></td><td></td></tr>
<tr><td>(d)
</td><td></td><td></td><td></td></tr>
<tr><td>(e)
</td><td></td><td></td><td></td></tr>
</table>

Solution:

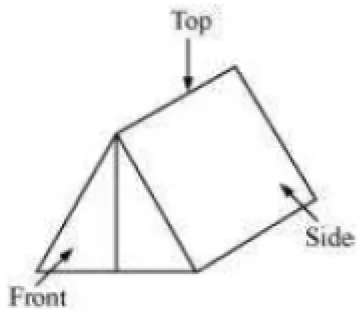
The objects and their labeled side, top and front views are as shown below:

<table>
<tr><td>(a)
</td><td>
Top view</td><td>
Front view</td><td>
Side view</td></tr>
<tr><td>(b)</td><td></td><td></td><td></td></tr>
</table>

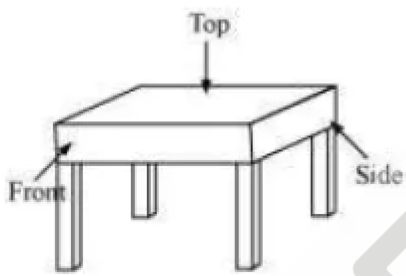
	 Side view	 Front view	 Top view
(c) 	 Top view	 Side view	 Front view
(d) 	 Side view	 Front view	 Top view
(e) 	 Front view	 Top view	 Side view

4. Draw the front view, side view and the top view of the given objects:

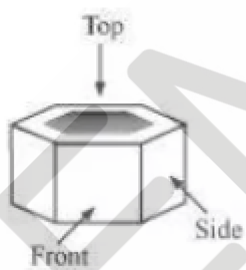
(a) A military tent



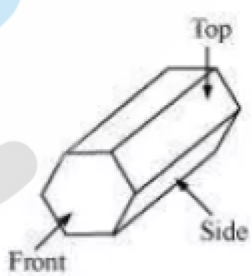
(b) A table



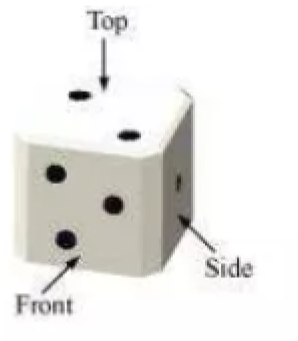
(c) A nut



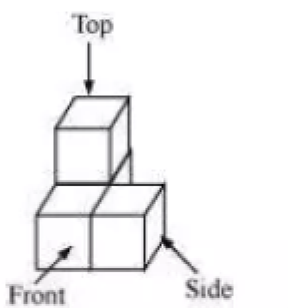
(d) A hexagonal block



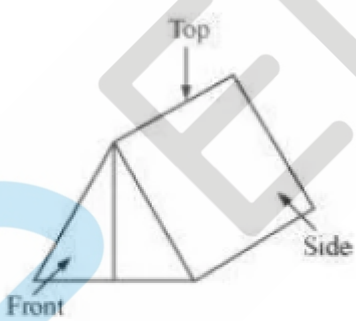
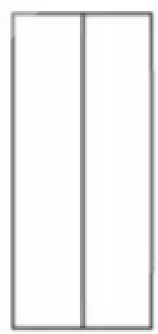
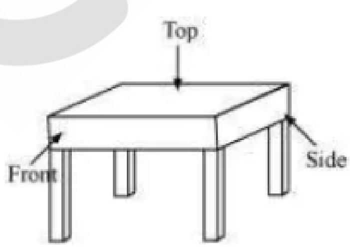
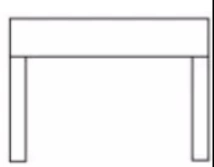
(e) A dice

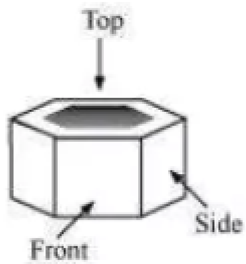
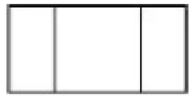
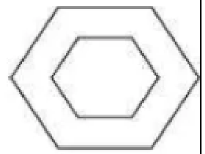
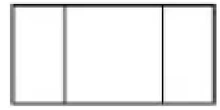
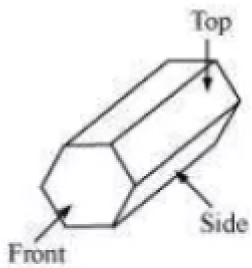
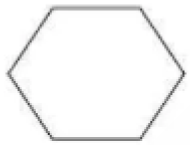
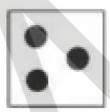
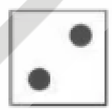
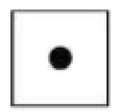
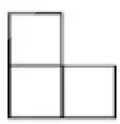
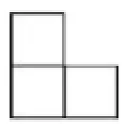
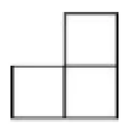


(f) A solid



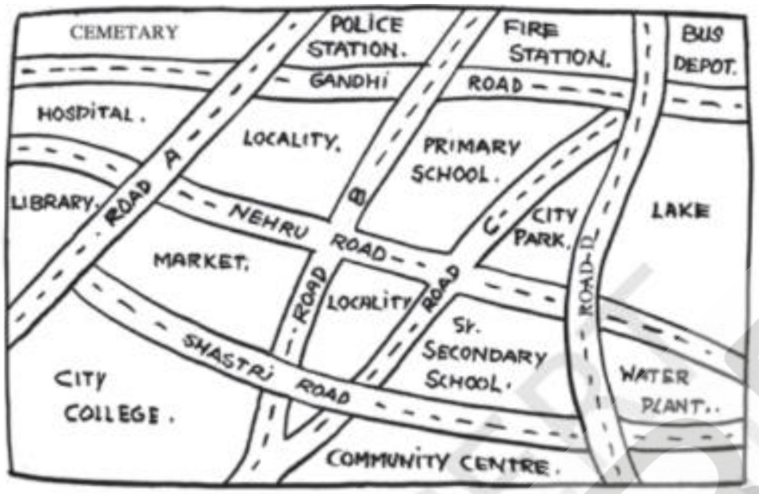
Solution:

Object	**Front view**	**Top view**	**Side view**
(a) A military tent 			
(b) A table 			
(c) A nut			

			
(d) A hexagonal block 			
(e) A dice 			
(f) A solid 			

Exercise 10.2

1. Look at the given map of a city.



Answer the following:

(a) Colour the map as follows: Blue-water, red-fire station, orange-library, yellow - schools, Green - park, Pink - College, Purple - Hospital, Brown - Cemetery.

(b) Mark a green 'X' at the intersection of Road 'C' and Nehru Road, Green 'Y' at the intersection of Gandhi Road and Road A.

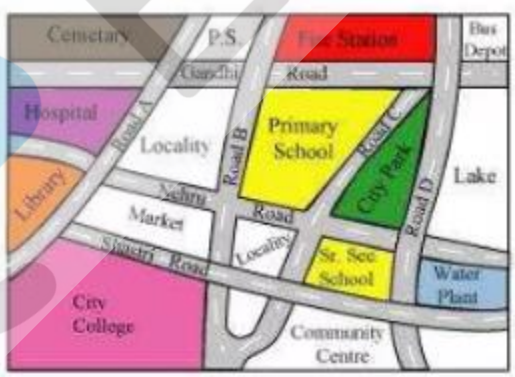
(c) In red, draw a short street route from Library to the bus depot.

(d) Which is further east, the city park or the market?

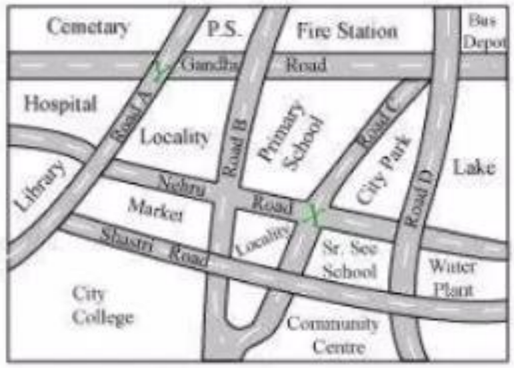
(e) Which is further south, the primary school or the Sr. Secondary School?

Solution:

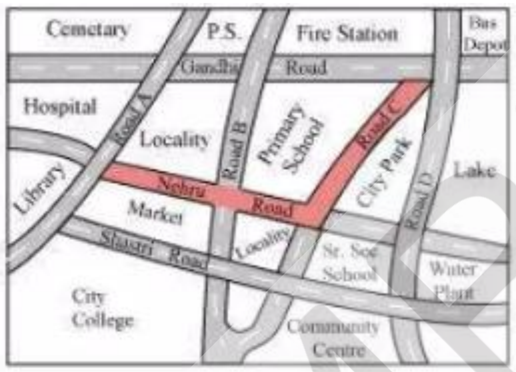
(a) The required coloured map is as shown:



(b) The marks X, C and Y at the required intersections are as shown:



(c) The shortest route between the required places is as shown:



(d) Amongst the city park and the market, the place that is further east is the city park.

(e) Amongst the Primary School and the Sr. Secondary School, the place that is further south is the Sr. Secondary School.

Exercise 10.3

1. Can a polyhedron have for its faces

(i) 3 triangles?

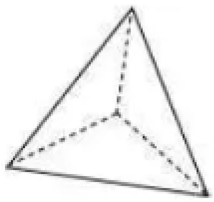
(ii) 4 triangles?

(iii) A square and four triangles?

Solution:

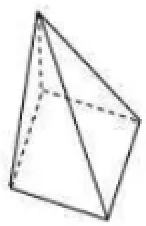
(i) No. The minimum number of faces a polyhedron can have is four. Therefore, a polyhedron with only three triangles is not possible.

(ii) Yes. A polyhedron with four triangles is possible. It is as shown below:



Such a polyhedron is called a triangular pyramid.

(iii) Yes. A polyhedron with a square and four triangles is possible. It is as shown below:



Such a polyhedron is called a square pyramid.

2. Is it possible to have a polyhedron with any given number of faces? (**Hint:** Think of a pyramid)

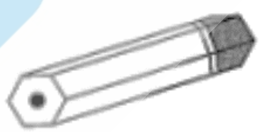
Solution:

No. The minimum number of faces a polyhedron can have is four. It is therefore not possible to have a polyhedron with less than four faces.

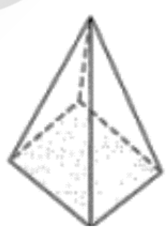
3. Which are prisms among the following?

(i) A nail

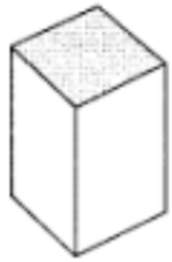
(ii) Unsharpened pencil



(iii) A table weight



(iv) A box



Solution:

(i) A nail has a curved surface. Hence, it is not a polyhedron. Therefore, it cannot be a prism also.

(ii) An unsharpened pencil has its base and top surfaces to be congruent and other lateral faces to be parallelograms. Therefore, it is a prism.

(iii) A table weight has a polygon for a base and the lateral surfaces are triangles. Therefore, the given figure is not a prism but a pyramid.

(iv) A box has its base and top surfaces to be congruent and other lateral faces to be parallelograms. Therefore, it is a prism.

Hence, an unsharpened pencil and a box are prisms.

4. (i) How are prisms and cylinders alike?

(ii) How are pyramids and cones alike?

Solution:

(i) A prism is a polyhedron which has a regular polygon for its base and parallelograms for its lateral sides. If the number of lateral sides are increased, the figure turns out to resemble a cylinder. Hence, a cylinder can be visualized as a prism with infinite number of faces or lateral sides. It can therefore be thought as a circular prism.

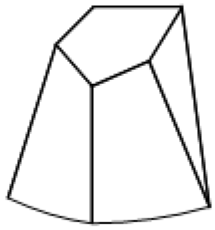
(ii) A pyramid is a polyhedron which has a regular polygon for its base and triangles for its lateral sides. If the number of lateral sides are increased, the figure turns out to resemble a cone. Hence, a cone can be visualized as a pyramid with infinite number of faces or lateral sides. It can therefore be thought as a circular pyramid.

5. Is a square prism same as a cube? Explain.

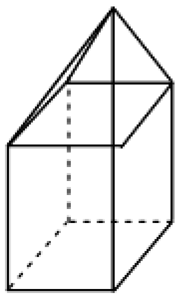
Solution:

No. A square prism need not be a cube. A square prism has a square for its base, but the lateral sides may or may not be squares, that is, the height of the sides can be different from the length of the side of the base. Hence, a square prism is not the same as a cube.

6. Verify Euler's formula for these solids:



(i)



Solution:

The Euler's formula is stated as follows:

$F + V - E = 2$

Where, F is the number of faces.

V is the number of vertices

E is the number of edges of a polyhedron.

(i) Here, number of faces $= F = 7$

Number of vertices $= V = 10$

Number of edges $= E = 15$

Substituting these values in Euler's formula:

$F + V - E = 2$

$\Rightarrow 7 + 10 - 15 = 2$

$\Rightarrow 2 = 2$

$LHS = RHS$

Therefore, the Euler's formula is verified.

(ii) Here, number of faces $= F = 9$

Number of vertices $= V = 9$

Number of edges $= E = 16$

Substituting these values in Euler's formula:

$F + V - E = 2$

$\Rightarrow 9 + 9 - 16 = 2$

$\Rightarrow 2 = 2$

LHS = RHS

Therefore, the Euler's formula is verified.

7. Using Euler's formula, find the unknowns:

Faces	?	5	20
Vertices	6	?	12
Edges	12	9	?

Solution:

Euler's formula is given by:

$F + V - E = 2$

Where, F is the number of faces.

V is the number of vertices

E is the number of edges of a polyhedron.

(i) Given, number of vertices = 6

Number of edges = 12

Substituting these values in the Euler's formula:

$F + V - E = 2$

$\Rightarrow F + 6 - 12 = 2$

$\Rightarrow F = 2 - 6 + 12$

$\Rightarrow F = 8$

Therefore, the number of faces = 8

(ii) Given, number of faces = 5

Number of edges = 9

Substituting these values in the Euler's formula:

$F + V - E = 2$

$\Rightarrow 5 + V - 9 = 2$

$\Rightarrow V = 2 - 5 + 9$

$\Rightarrow V = 6$

Therefore, the number of vertices $= 6$

(iii) Given, number of faces $= 20$

Number of vertices $= 12$

Substituting these values in the Euler's formula:

$F + V - E = 2$

$\Rightarrow 20 + 12 - E = 2$

$\Rightarrow E = 20 + 12 - 2$

$\Rightarrow E = 30$

Therefore, the number of edges $= 30$

Hence, the completed table is as follows:

Faces	8	5	20
Vertices	6	6	12
Edges	12	9	30

8. Can a polyhedron have 10 faces, 20 edges and 15 vertices?

Solution:

Given, number of faces $= F = 10$

Number of edges $= E = 20$

Number of vertices $= V = 15$

Substituting these values in Euler's formula:

$F + V - E = 2$

$\Rightarrow 10 + 15 - 20 = 2$

$\Rightarrow 25 - 20 = 2$

$\Rightarrow 5 = 2$

Clearly, $5 \neq 2$

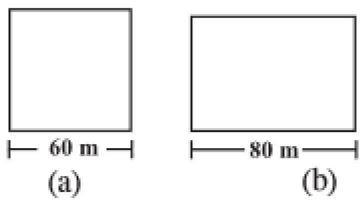
Hence, this is a violation of Euler's formula. Therefore, a polyhedron with the given number of faces, vertices and edges cannot exist.

CBSE NCERT Solutions for Class 8 Mathematics Chapter 11

Back of Chapter Questions

Exercise 11.1

1. A square and a rectangular field with measurements as given in the figure have the same perimeter. Which field has a larger area?



Solution:

Given, side of square = 60 m and length of rectangle = 80m

We know that, perimeter of square $= 4a$

And perimeter of rectangle$= 2(l + b)$

Perimeter of square $= 4 \times 60 = 240m$

Perimeter of rectangle $= 2[l + b]$

$= 2(80 + b)$

Given, Perimeter of Square = Perimeter of Rectangle

$\Rightarrow 240 = 2(80 + b)$

$\Rightarrow b = 40m$

We know that, Area of square$= a^2$

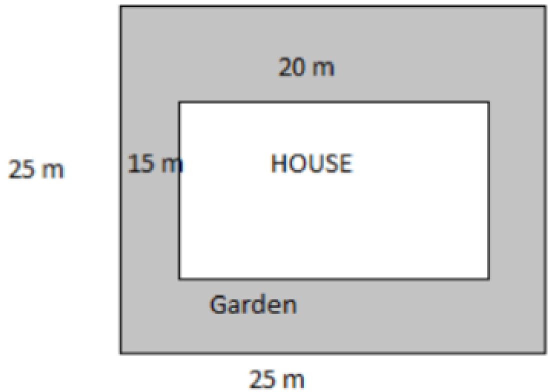
Area of rectangle $= lb$

Area of Square $= 60 \times 60 = 3600m^2$

Area of rectangle $= 80 \times 40 = 3200m^2$

Hence, area of square is greater than area of rectangle.

2. Mrs. Kaushik has a square plot with the measurement as shown in the figure. She wants to construct a house in the middle of the plot. A garden is developed around the house. Find the total cost of developing a garden around the house at the rate of ₹55 per m^2.



Solution:

Given, Side of square $= 25\text{m}$

Length of house $= 15\text{m}$

Breadth of house $= 20\text{m}$

We know that, Area of square $= \text{a}^2$

Area of rectangle $= \text{lb}$

Area of remaining portion $=$ Area of square plot $-$ Area of house

Now, area of Square $= 25 \times 25 = 625\ \text{m}^2$

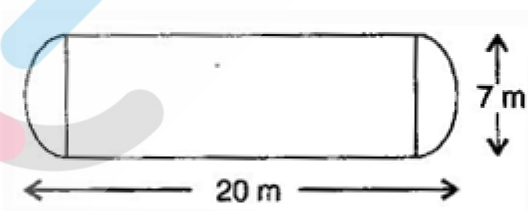
And area of house $= 15 \times 20 = 300\ \text{m}^2$

Hence, area of remaining portion $= 625\ \text{m}^2 - 300\ \text{m}^2 = 325\ \text{m}^2$

Total cost $=$ ₹ $(325 \times 55) =$ ₹ $17{,}875$.

Hence, the total cost for developing a garden is ₹17,875.

3. The shape of a garden is rectangular in the middle and semicircular at the ends as shown in the diagram. Find the area and the perimeter of this garden [Length of rectangle is $20 - (3.5 + 3.5)$ meters].



Solution:

Given total length $= 20$ m

And diameter of the semicircle $= 7$ m

$\Rightarrow$ Radius of the semicircle $= \frac{7}{2}\text{m} = 3.5\text{m}$

Length of rectangular field $= 20 - (3.5 + 3.5)$

$= 20 - 7 = 13$ m

Breadth of the rectangular field $= 7$m

Area of rectangular field $= l \times b$

$= 13 \times 7$

$= 91\text{m}^2$

Area of two semi circles $= 2 \times \frac{1}{2} \times \pi \times r^2$

$= 2 \times \frac{1}{2} \times \frac{22}{7} \times 3.5 \times 3.5$

$= 38.5\text{m}^2$

Therefore, area of garden $= 91 + 38.5 = 129.5\ \text{m}^2$

Perimeter of two semi circular arcs $= 2 \times \pi r$

$= 2 \times \frac{22}{7} \times 3.5$

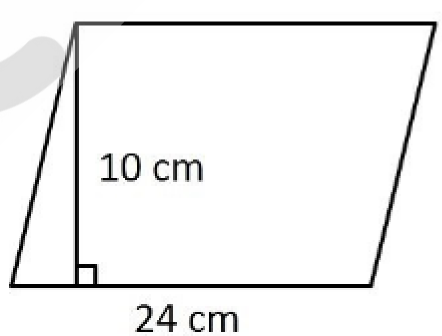
$= 22$ m

Hence, Perimeter of garden $= 22 + 13 + 13$

$= 48$ m

4. A flooring tile has the shape of a parallelogram whose base is 24 cm and the corresponding height is 10 cm. How many such tiles are required to cover a floor of area 1080 m^2 ? (If required you can split the tiles in whatever way you want to fill up the corners).

Solution:



Given, base of a parallelogram = 24 cm.

And height of a parallelogram= 10 cm.

Area of a parallelogram = bh

Area of one tile = $24\text{cm} \times 10\text{cm} = 240 \text{ cm}^2$

We know that 1m = 100cm

Total area = $1080 \times 10000 = 10800000\text{cm}^2$.

Hence,

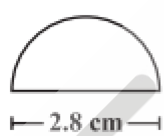
Total tiles required = $\frac{\text{Total area}}{\text{Area of one tile}}$

$= \frac{1080 \times 10000}{240}$

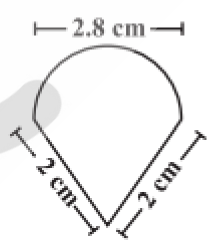
= 45000 Tiles

Therefore, 45000 tiles are required to cover area of 1080 m^2

5. An ant is moving around a few food pieces of different shapes scattered on the floor. For which food-piece would the ant have to take a longer round? Remember circumference of a circle can be obtained by using the expression $c = 2\pi r$, Where r is the radius of the circle.

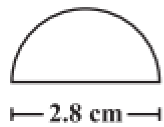
(a) 

(b) 

(c) 

Solution:

(a) Given figure



Given that diameter of a circle = 2.8 cm

Radius of circle = $\frac{\text{Diameter}}{2}$

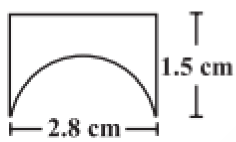
= 1.4 cm

Circumference of the semi-circle = πr

$= \frac{22}{7} \times 1.4$

= 4.4

Total distance covered =4.4cm + 2.8cm = 7.2cm



(b)

Given diameter of a semicircle = 2.8 cm

Radius of semicircle = $\frac{2.8}{2}$ = 1.4 cm

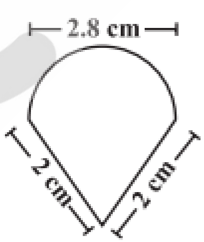
Circumference of the semi-circle = πr

$= \frac{22}{7} \times 1.4$

= 4.4

Total distance covered = 1.5 + 2.8 + 1.5 + 4.4

= 10.2 cm



(c)

Given diameter of a semicircle = 2.8 cm

Radius of semicircle $= \frac{2.8}{2} = 1.4$ cm

Circumference of the semi-circle $= \pi r$

$= \frac{22}{7} \times 1.4$

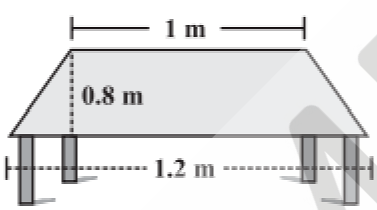
$= 4.4$

Total distance covered by the ant $= 2 + 2 + 4.4 = 8.4$ cm

Therefore, for food piece of shape (b), ant have to take a longer round.

Exercise 11.2

1. The shape of the top surface of a table is a trapezium. Find its area if its parallel sides are 1 m and 1.2 m and perpendicular distance between them is 0.8 m.



Solution:

Given, Length of parallel sides of trapezium are 1 m and 1.2 m

Perpendicular distance between parallel sides $= 0.8$ m

We know, Area of Trapezium $= \frac{1}{2}h(a + b)$

Area $= \frac{1}{2} \times (1 + 1.2) \times 0.8$

$= 0.88\ m^2$

Therefore, Area of top surface of table is $0.88\ m^2$

2. The area of a trapezium is $34\ cm^2$ and the length of one of the parallel sides is 10 cm and its height is 4 cm. Find the length of the other parallel side.

Solution:

Let the length of the unknown parallel side be x.

Given, Area of a trapezium is $34\ cm^2$.

And length of one of parallel sides of trapezium $= 10$ cm

We know, area of Trapezium $= \frac{1}{2}h(a + b)$

$\Rightarrow 34 = \frac{1}{2} \times 4 \times (10 + x)$

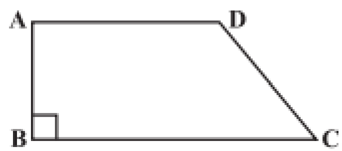
$\Rightarrow 34 = 2(10 + x)$

$\Rightarrow 17 = 10 + x$

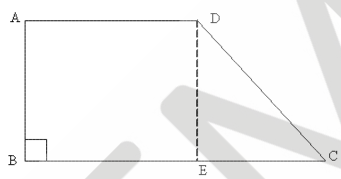
$\Rightarrow x = 17 - 10 = 7$ cm

Hence, length of the other parallel side = 7 cm

3. Length of the fence of a trapezium shaped field ABCD is 120 m. If BC = 48 m, CD = 17 m and AD = 40 m, find the area of this field. Side AB is perpendicular to the parallel sides AD and BC.



Solution:



Given, Length of the fence of a trapezium shaped field ABCD = 120 m

BC = 48 m

CD = 17 m

AD = 40 m

Now, AB= $120 - 48 - 17 - 40$

$= 15$ m

Draw a perpendicular from D on BC

AB = DE

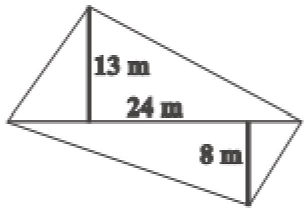
Area of Trapezium $= \frac{1}{2}h(a + b)$

$= \frac{1}{2} \times 15 \times (40 + 48)$

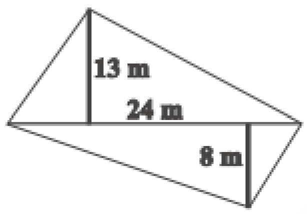
$= 660 \text{ m}^2$

Therefore, area of field $= 660\ \text{m}^2$

4. The diagonal of a quadrilateral shaped field is $24\ \text{m}$ and the perpendiculars dropped on it from the remaining opposite vertices are $8\ \text{m}$ and $13\ \text{m}$.Find the area of the field.



Solution:



Given, Length of base $= 24$ m.

Height of upper triangle $= 13$ m

Height of lower triangle $= 8$ m

We know, area of triangle $= \frac{1}{2} \times$ height $\times$ base

Hence, Area of upper triangle $= \frac{1}{2} \times 13 \times 24 = 156\ \text{m}^2$

And area of lower triangle $= \frac{1}{2} \times 8 \times 24 = 96\ \text{m}^2$

Therefore, Area of field $= 156 + 96 = 252\ \text{m}^2$

5. The diagonals of a rhombus are 7.5 cm and 12 cm. Find its area.

Solution:

We Area of rhombus $= \frac{1}{2} \times$ Diagonal $1 \times$ Diagonal 2

Given, Length of diagonal $1 = 7.5$ cm

Length of diagonal $2 = 12$ cm

Area of rhombus $= \frac{1}{2} \times 7.5 \times 12$

$= 45\ \text{cm}^2$

Therefore, area of given rhombus $= 45\ \text{cm}^2$

6. Find the area of a rhombus whose side is 5 cm and whose altitude is 4.8 cm. If one of its diagonals is 8 cm long, find the length of the other diagonal.

Solution:

We know that area of rhombus $= \frac{1}{2} \times$ product of its diagonals

Since, a rhombus is also a parallelogram

$\therefore$ Area of rhombus $= 5\text{cm} \times 4.8\text{cm} = 24\text{cm}^2$

Let the length of another diagonal be x.

Now, $24\text{cm}^2 = \frac{1}{2}(8\text{ cm} \times x)$

$$\Rightarrow x = \frac{24 \times 2}{8}\text{cm} = 6\text{ cm}$$

Thus, the length of other diagonal is 6 cm.

7. The floor of a building consists of 3000 tiles which are rhombus shaped and each of its diagonals are 45 cm and 30 cm in length. Find the total cost of polishing the floor, if the cost per m^2 is ₹ 4.

Solution:

Given length of diagonals are 45 cm and 30 cm.

We know that area of rhombus $= \frac{1}{2} \times$ product of its diagonals.

Area of rhombus (Each tile) $= \frac{1}{2} \times 45 \times 30 = 675\text{ cm}^2$

Now, area of 3000 tiles $= 3000 \times 675\text{ cm}^2$

$= 2025000\text{ cm}^2$

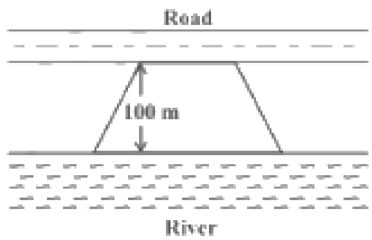
$= 202.5\text{ m}^2$

Given that the cost of polishing is 4m^2.

Cost of polishing 202.5 m^2 area $=$ ₹ (4×202.5)

$=$ ₹ 810

8. Mohan wants to buy a trapezium shaped field. Its side along the river is parallel to and twice the side along the road. If the area of this field is 10500 m^2 and the perpendicular distance between the two parallel sides is 100 m, find the length of the side along the river.



Solution:

Given, Perpendicular distance (Height) = 100 m .

Area of field = $10500\ \text{m}^2$.

Let the length of side alongside the road be x. Given that side along the river is twice the side along the road.

Hence, length of other side = $2x$.

We know that, Area of Trapezium = $\frac{1}{2} \times$ sum of parallel sides $\times$ perpendicular distance.

$\Rightarrow 10500 = \frac{1}{2} \times (x + 2x) \times 100$

$\Rightarrow 3x = 10500 \times \frac{2}{100}$

$\Rightarrow 3x = 210$

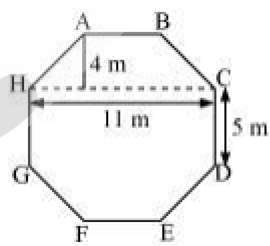
$\Rightarrow x = 70$

Therefore, length of side along the road = 70 m.

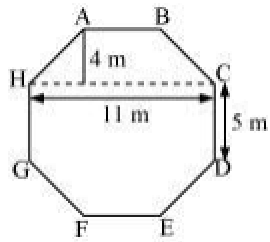
and length of side along the river = 140 m.

Hence, Length of side along the river = 140 m.

9. Top surface of a raised platform is in the shape of a regular octagon as shown in the figure. Find the area of the octagonal surface.



Solution:



From the given figure, Area of trapezium ABCH $=$ Area of trapezium DEFG

We know that, Area of Trapezium $= \frac{1}{2} \times$ sum of parallel sides $\times$ perpendicular distance.

Hence, area of Trapezium ABCH $= \left[\frac{1}{2}(4)(11+5)\right] \text{m}^2$

$= \left(\frac{1}{2} \times 4 \times 16\right) \text{m}^2$

$= 32\text{m}^2$

Area of rectangle HGDC $=$ length $\times$ breadth $= 11 \times 5 = 55 \text{ m}^2$

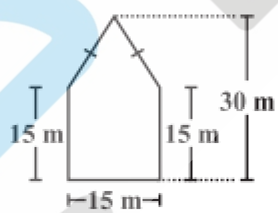
Therefore, Area of octagon $=$ Area of trapezium ABCH $+$ Area of trapezium DEFG $+$ Area of rectangle HGDC

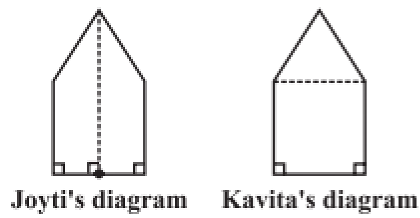
Area of Octagon $= 32 \text{ m}^2 + 32 \text{ m}^2 + 55 \text{ m}^2$

$= 119 \text{ m}^2$

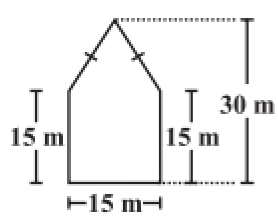
Hence, area of the octagon is 119 m^2

10. There is a pentagonal shaped park as shown in the figure. For finding its area Jyoti and Kavita divided it in two different ways. Find the area of this park using both ways. Can you suggest some other way of finding its area?



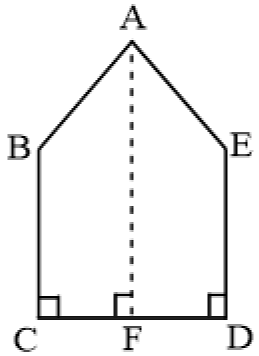


Solution:



(a) From the given figure, Area of pentagon = Area of trapezium AEDF + Area of trapezium ABCF

Area of pentagon = 2 (Area of trapezium ABCF)

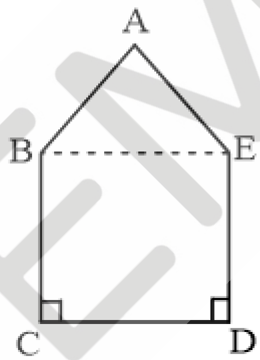


We know that, Area of Trapezium $= \frac{1}{2} \times$ sum of parallel sides $\times$ perpendicular distance.

Area of pentagon $= \left[2 \times \frac{1}{2}(15+30)\left(\frac{15}{2}\right)\right] \text{m}^2$

$= 337.5 \text{ m}^2$

(b) From the given diagram, Area of rectangle BCDE $= 15 \times 15 = 225 \text{ m}^2$



Area of triangle ABE $= \frac{1}{2} \times$ Base $\times$ Height

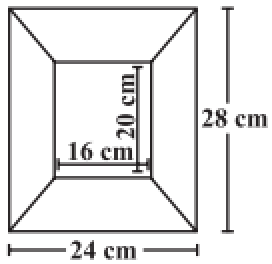
$= \frac{1}{2} \times 15 \times 15$

$= 112.5 \text{ m}^2$

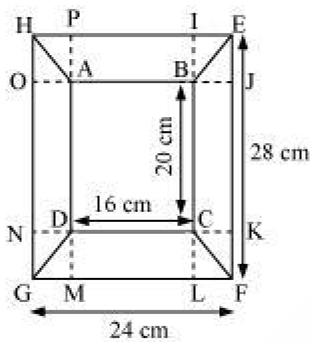
Area of pentagon ABCDE = Area of rectangle BCDE +Area of triangle ABE

$= 225 + 112.5 = 337.5 \text{ m}^2$.

11. Diagram of the adjacent picture frame has outer dimensions $= 24 \text{ cm} \times 28 \text{ cm}$ and inner dimensions $16 \text{ cm} \times 20 \text{ cm}$. Find the area of each section of the frame, if the width of each section is same.



Solution:



Given that width of each section is same.

$\therefore$ IB = BJ = CK = CL = DM = DN = AO = AP

And IL = IB + BC + CL

$\Rightarrow 28 = \text{IB} + 20 + \text{CL}$

$\Rightarrow \text{IB} + \text{CL} = 28 \text{ cm} - 20 \text{ cm} = 8 \text{ cm}$

$\Rightarrow \text{IB} = \text{CL} = 4 \text{ cm}$

Hence, IB = BJ = CK = CL = DM = DN = AO = AP = 4 cm

Area of section BEFC = Area of section DGHA

We know that, Area of Trapezium

$$= \frac{1}{2} \times \text{ sum of parallel sides} \times \text{perpendicular distance.}$$

Area of section BEFC $= \left[\frac{1}{2}(20 + 28)(4)\right] \text{cm}^2 = 96 \text{ cm}^2$

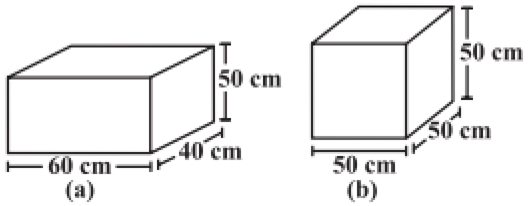
Area of section ABEH = Area of section CDGF

$= \left[\frac{1}{2}(16 + 24)(4)\right]$

$= 80\text{cm}^2$

EXERCISE 11.3

1. There are two cuboidal boxes as shown in the adjoining figure. Which box requires the lesser amount of material to make?



Solution:

We know, Total surface area of the cuboid $= 2 \times (L \times H + B \times H + L \times B)$

And total surface area of the cube $= 6\ L^2$

Given, Dimensions of cuboid are $60\text{ cm} \times 40\text{ cm} \times 50\text{ cm}$

And dimensions of cube are $50\text{ cm} \times 50\text{ cm} \times 50\text{ cm}$

Total surface area of cuboid $= [2\{(60)(40) + (40)(50) + (50)(60)\}]\text{ cm}^2$

$= (2 \times 7400)\text{cm}^2$

$= 14800\text{ cm}^2$

Total surface area of cube $= 6\ (50\text{ cm})^2$

$= 15000\text{ cm}^2$

Thus, the cuboidal box will require lesser amount of material than cube.

2. A suitcase with measures $80\text{ cm} \times 48\text{ cm} \times 24\text{ cm}$ is to be covered with a tarpaulin cloth. How many meters of tarpaulin of width 96 cm is required to cover 100 such suitcases?

Solution:

Given dimensions of suitcase are $80\text{ cm} \times 48\text{ cm} \times 24\text{ cm}$

We know that total surface area of the cuboid $= 2\ (L \times H + B \times H + L \times B)$

Total surface area of suitcase $= 2[(80)\ (48) + (48)\ (24) + (24)\ (80)]$

$= 2[3840 + 1152 + 1920]$

$= 13824\text{ cm}^2$

Total surface area of 100 suitcases $= (13824 \times 100)\text{cm}^2$

$= 1382400\text{ cm}^2$

Area of tarpaulin $=$ Length $\times$ Breadth

$\Rightarrow 1382400\ \text{cm}^2 = \text{Length} \times 96\ \text{cm}$

$\Rightarrow \text{Length} = \dfrac{1382400}{96}\ \text{cm}$

$= 14400\ \text{cm}$

$= 144\ \text{m}$

Therefore, 144 m of tarpaulin is required to cover 100 suitcases.

3. Find the side of a cube whose surface area is 600 cm^2.

Solution:

Given surface area of cube $= 600\ \text{cm}^2$

We know that Surface area of cube $= 6\ (\text{Side})^2$

Let side of cube be L cm.

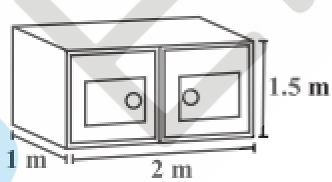
$\Rightarrow 600\ \text{cm}^2 = 6\text{L}^2$

$\Rightarrow \text{L}^2 = 100\ \text{cm}^2$

$\Rightarrow \text{L} = 10\ \text{cm}$

Therefore, the side of the cube is 10 cm.

4. Rukhsar painted the outside of the cabinet of measure $1\ \text{m} \times 2\ \text{m} \times 1.5\ \text{m}$. How much surface area did she cover if she painted all except the bottom of the cabinet?



Solution:

Given, Length of the cabinet $= 2\text{m}$

Breadth of the cabinet $= 1\text{m}$

Height of the cabinet $= 1.5\ \text{m}$

Area of the cabinet that was painted $= 2\text{H}\ (\text{L} + \text{B}) + \text{L} \times \text{B}$

$= [2 \times 1.5 \times (2 + 1) + (2)(1)]\text{m}^2$

$= (9 + 2)\text{m}^2$

$= 11\text{m}^2$

Therefore, area of the cabinet that was painted is $11\ m^2$.

5. Daniel is painting the walls and ceiling of a cuboidal hall with length, breadth and height of $15\ m, 10\ m$ and $7\ m$ respectively. From each can of paint $100\ m^2$ of area is painted. How many cans of paint will she need to paint the room?

Solution:

Given, Length of the cabinet= $15\ m$

Breadth of the cabinet $= 10\ m$

Height of the cabinet $= 7\ m$

Area of the cabinet that was painted $= 2H\ (L + B) + L \times B$

$= [2(7)(15 + 10) + 15 \times 10]\ m^2$

$= 500 m^2$

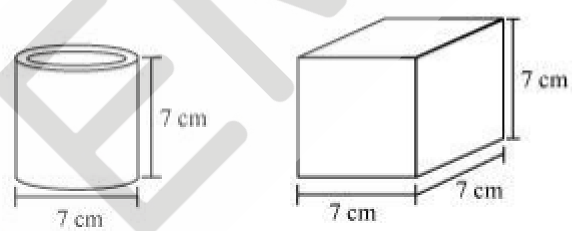
Given $100\ m^2$ can be painted from 1 can.

Number of cans required $= \frac{500}{100}$

$= 5$

Hence, number of cans required is 5.

6. Describe how the two figures at the right are alike and how they are different. Which box has larger lateral surface area?



Solution:

Given, side length of cube $= 7$ cm

Radius of cylinder $= 3.5$ cm

Height of cylinder $= 7$ cm.

We know, Lateral Surface area of the cube $= 4L^2$

$= 4\ (7\ )^2$

$= 196\ cm^2$

Lateral surface area of the cylinder $= 2\pi rh$

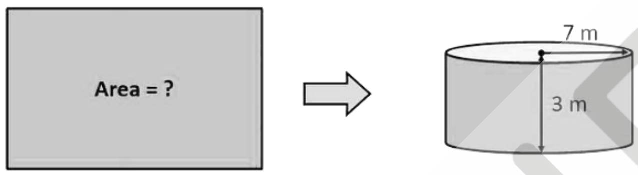
$= \left(2 \times \frac{22}{7} \times \frac{7}{2} \times 7\right) \text{cm}^2$

$= 154 \text{ cm}^2$

Hence, cube has the larger surface area than cylinder.

7. A closed cylindrical tank of radius 7 m and height 3 m is made from a sheet of metal. How much sheet of metal is required?

Solution:



Given, Radius of cylinder = 7m

Height of cylinder = 3m

We know surface area of cylinder = $2\pi r(r + h)$

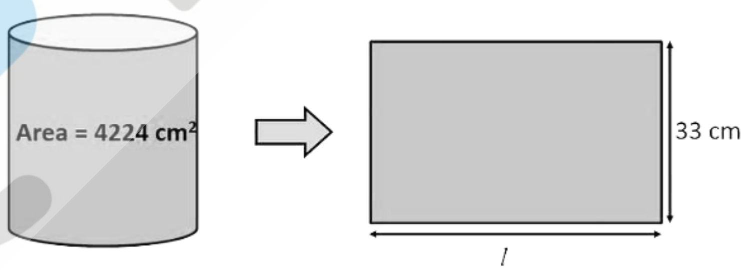
Surface area = $\left[2 \times \frac{22}{7} \times 7(7 + 3)\right] \text{m}^2$

$= 440 \text{m}^2$

Thus, 440m^2 sheet of metal is required.

8. The lateral surface area of a hollow cylinder is 4224 cm^2. It is cut along its height and formed a rectangular sheet of width 33 cm. Find the perimeter of rectangular sheet?

Solution:



Given

Lateral surface area of cylinder = 4224 cm^2

Clearly, Area of cylinder = Area of rectangular sheet

$\Rightarrow 4224 \text{ cm}^2 = 33 \text{ cm} \times \text{Length}$

$\Rightarrow \text{Length} = \dfrac{4224\text{cm}^2}{33\text{cm}}$

$= 128\text{cm}$

Now, perimeter of rectangular sheet= $2[L + B]$

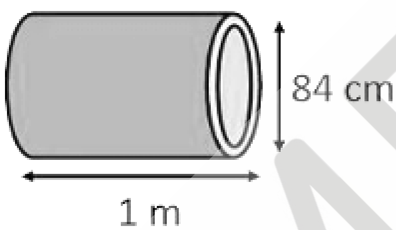
$= [2\,(128 + 33)]$ cm

$= (2 \times 161)$ cm

$= 322$ cm

9. A road roller takes 750 complete revolutions to move once over to level a road. Find the area of the road if the diameter of a road roller is 84 cm and length is 1 m.

Solution:



Given, Road roller takes 750 revolutions.

Length of road roller = 1 m

Diameter of a road roller = 84 cm

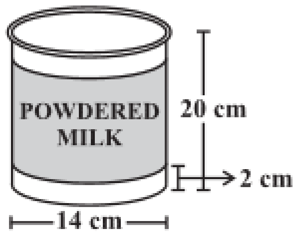
In 1 revolution, area of the road covered = $2\pi rh$

$= 2 \times \dfrac{22}{7} \times 42\text{cm} \times 1\text{m}$

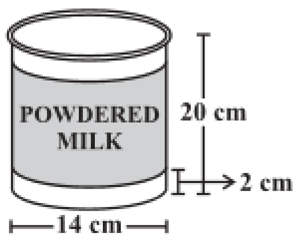
$= 2 \times \dfrac{22}{7} \times \dfrac{42}{100}\text{m} \times 1\text{m} = \dfrac{264}{100}\text{m}^2$

In 750 revolutions, area covered on the road = $750 \times \frac{264}{100}\text{m}^2 = 1980\text{m}^2$

10. A company packages its milk powder in cylindrical container whose base has a diameter of 14 cmand height 20 cm. Company places a label around the surface of the container (as shown in the figure). If the label is placed 2 cm from top and bottom, what is the area of the label.



Solution:



Given, Height of cylinder $= 20$ cm.

Diameter of cylinder $= 14$ cm.

Height of the label $= 20 \text{ cm} - 2 \text{ cm} - 2 \text{ cm}$

$= 16$ cm

Radius of the label $= \frac{14}{2}$ cm

$= 7$ cm

Area of the label $= 2\pi$ (Radius) (Height)

$$= \left(2 \times \frac{22}{7} \times 7 \times 16\right) \text{cm}^2$$

$= 704 \text{ cm}^2$

Hence, area of the label $= 704 \text{ cm}^2$.

Exercise 11.4

1. Given a cylindrical tank, in which situation will you find surface area and in which situation volume.

(a) To find how much it can hold.

(b) Number of cement bags required to plaster it.

(c) To find the number of smaller tanks that can be filled with water from it

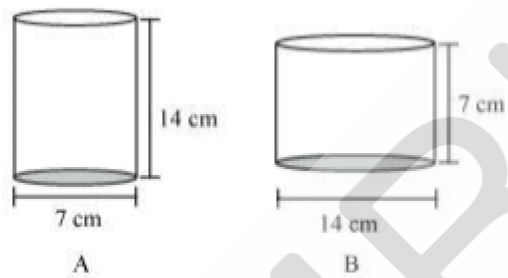
Solution:

In given situation, we will find its volume to know how much it can hold.

In given situation, we will find surface area to find number of cement bags required to plaster it.

In given situation, we will find volume to find number of smaller tanks that can be filled with water from it.

2. Diameter of cylinder A is 7 cm, and the height is 14 cm. Diameter of cylinder B is 14 cm and height is 7 cm. Without doing any calculations can you suggest whose volume is greater? Verify it by finding the volume of both the cylinders. Check whether the cylinder with greater volume also has greater surface area?



Solution:

We know that Volume of cylinder$= \pi r^2 h$

If measures of r and h are same, then the cylinder with greater radius will have greater area.

Given, Radius of cylinder A $= \frac{7}{2}$ cm $= 3.5$ cm

Radius of cylinder B $= \frac{14}{2}$ cm $= 7$cm

Height of cylinder A $= 14$ cm

Height of cylinder B $= 7$ cm.

Therefore, volume of cylinder B is greater.

Volume of cylinder A $= \pi r^2 h$

$= \frac{22}{7} \times 3.5 \times 3.5 \times 14$

$= 539\ \text{cm}^3$

Volume of cylinder B $= \pi r^2 h$

$= \frac{22}{7} \times 7 \times 7 \times 7$

$= 1078 \text{ cm}^3$

Surface area of cylinder A $= 2\pi r(r + h)$

$= 2 \times \frac{22}{7} \times 3.5(3.5 + 14)$

$= 385 \text{ cm}^2$

Surface area of cylinder B $= 2\pi r(r + h)$

$= 2 \times \frac{22}{7} \times 7(14)$

$= 616 \text{ cm}^2$

The cylinder with higher volume has higher surface area.

3. Find the height of a cuboid whose base area is 180 cm^2 and volume is 900 cm^3?

Solution:

Given, Base area of a cuboid $= 180 \text{ cm}^2$

Volume of a cuboid $= 900 \text{ cm}^3$

We know that, Volume = base area × height

$\Rightarrow$ Height $= \frac{\text{Volume}}{\text{Base area}}$

$= \frac{900\text{cm}^3}{180\text{cm}^2}$

$= 5$ cm

4. A cuboid is of dimensions 60 cm × 54 cm × 30 cm. How many small cubes with side 6 cm can be placed in the given cuboid?

Solution:

Given that the dimensions of cuboid are 60 cm × 54 cm × 30 cm

And side length of cube = 6 cm

We know that volume of cuboid = lbh

Volume of cuboid = 60 cm × 54 cm × 30 cm

$= 97200 \text{ cm}^3$

Side of the cube = 6 cm

Volume of cube $= a^3$

Volume of the cube $= 216 \text{ cm}^3$

Number of cubes $= \frac{\text{Volume of cuboid}}{\text{Volume of 1 cube}}$

$= \frac{97200\text{cm}^3}{216\text{cm}^3}$

$= 450$

Hence, 450 cubes can be placed in cuboid of given dimensions.

5. Find the height of the cylinder whose volume is 1.54 m^3 and diameter of the base is 140 cm?

Solution:

Given that the diameter of the base = 140 cm

Volume of the cylinder $= 1.54\text{ m}^3$

Also, radius (r) of the base $= \frac{140}{2}\text{cm} = 70\text{cm}$

$= \frac{70}{100}\text{m} = 0.7\text{m}$

We know, Volume of cylinder $= \pi r^2 h$

$\Rightarrow 1.54\text{m}^3 = \frac{22}{7} \times 0.7\text{m} \times 0.7\text{m} \times h$

$\Rightarrow h = 1\text{m}$

Hence, Height of cylinder = 1m

6. A milk tank is in the form of cylinder whose radius is 1.5 m and length is 7 m. Find the quantity of milk in litres that can be stored in the tank?

Solution:

Given, Radius of cylinder = 1.5 m

Length of cylinder = 7 m

Volume of cylinder $= \pi r^2 h$

$= \left(\frac{22}{7} \times 1.5 \times 1.5 \times 7\right)\text{m}^3$

$= 49.5\text{ m}^3$

$1\text{ m}^3 = 1000\text{ L}$

Required quantity $= (49.5 \times 1000)\text{L} = 49500\text{L}$

Hence, 49500 L milk can be stored in tank.

7. If each edge of a cube is doubled, How many times will its surface area increase?

How many times will its volume increase?

Solution:

Let initially the edge of the cube be L.

We know surface area of cube $= 6L^2$

If each edge of the cube is doubled, then it becomes 2L.

New surface area $= 6(2L)^2 = 4 \times 6L^2$

Clearly, the surface area will be increased by 4 times

Initial volume of the cube $= L^3$

When each edge of the cube is doubled, it becomes 2L.

New volume $= (2L)^3 = 8L^3 = 8\, x\, L^3$

Clearly, the volume of the cube will be increased by 8 times.

8. Water is pouring into a cuboidal reservoir at the rate of 60 liters per minute. If the volume of reservoir is $108\ \text{m}^3$, find the number of hours it will take to fill the reservoir.

Solution:

Given, Volume of cuboidal reservoir $= 108\ \text{m}^3$

$= (108 \times 1000)\text{L}$

$= 108000\ \text{L}$

Rate at which Water pouring $= (60 \times 60)\text{L}$

$= 3600\ \text{L}$ per hour

Required number of hours $= \frac{108000}{3600}$

$= 30$ hours .

Therefore, 30 hours are required to fill the reservoir.

CBSE NCERT Solutions for Class 8 Mathematics Chapter 12

Back of Chapter Questions

Exercise: 12.1

1. Evaluate:

(i) 3^{-2}

(ii) $(-4)^{-2}$

(iii) $\left(\frac{1}{2}\right)^{-5}$

Solution:

(i) $3^{-2} = \frac{1}{3^2}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \frac{1}{9}$

Hence, $3^{-2} = \frac{1}{9}$

(ii) $(-4)^{-2} = \frac{1}{(-4)^2}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \frac{1}{16}$

Hence, $(-4)^{-2} = \frac{1}{16}$

(iii) $\left(\frac{1}{2}\right)^{-5} = \left(\frac{2}{1}\right)^5$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= (2)^5 = 32$

Hence, $\left(\frac{1}{2}\right)^{-5} = 32$

2. Simplify and express the result in power notation with positive exponent:

(i) $(-4)^5 \div (-4)^8$

(ii) $\left(\frac{1}{2^3}\right)^2$

(iii) $(-3)^4 \times \left(\frac{5}{3}\right)^4$

(iv) $(3^{-7} \div 3^{-10}) \times 3^{-5}$

(v) $2^{-3} \times (-7)^{-3}$

Solution:

(i) $(-4)^5 \div (-4)^8 = (-4)^{5-8}$ $[\because a^m \div a^n = a^{m-n}]$

$= (-4)^{-3} = \frac{1}{(-4)^3}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

Hence, $(-4)^5 \div (-4)^8 = \frac{1}{(-4)^3}$

(ii) $\left(\frac{1}{2^2}\right)^2 = \frac{1^2}{(2^3)^2}$ $\left[\because \left(\frac{a}{b}\right)^m = \frac{a^m}{a^n}\right]$

$= \frac{1}{2^{3\times 2}} = \frac{1}{2^6}$ $[\because (a^m)^n = a^{m\times n}]$

Hence, $\left(\frac{1}{2^2}\right)^2 = \frac{1}{2^6}$

(iii) $(-3)^4 \times \left(\frac{5}{3}\right)^4 = (-3)^4 \times \frac{5^4}{3^4}$ $\left[\because \left(\frac{a}{b}\right)^m = \frac{a^m}{a^n}\right]$

$= \{(-1)^4 \times 3^4\} \times \frac{5^4}{3^4}$ $[\because (ab)^m = a^m b^m]$

$= 3^{4-4} \times 5^4$ $[\because a^m \div a^n = a^{m-n}]$

$= 3^0 \times 5^4 = 5^4$ $[\because a^0 = 1]$

Hence, $(-3)^4 \times \left(\frac{5}{3}\right)^4 = 5^4$

(iv) $(3^{-7} \div 3^{-10}) \times 3^{-5} = 3^{-7-(-10)} \times 3^{-5}$ $[\because a^m \div a^n = a^{m-n}]$

$= 3^{-7+10} \times 3^{-5} = 3^3 \times 3^{-5} = 3^{3+(-5)}$ $[\because a^m \times a^n = a^{m+n}]$

$= 3^{-2} = \frac{1}{3^2}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

Hence, $(3^{-7} \div 3^{-10}) \times 3^{-5} = \frac{1}{3^2}$

(v) $2^{-3} \times (-7)^{-3} = \frac{1}{2^3} \times \frac{1}{(-7)^3}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \frac{1}{\{2\times(-7)\}^3} = \frac{1}{(-14)^3}$ $[\because (ab)^m = a^m b^m]$

Hence, $2^{-3} \times (-7)^{-3} = \frac{1}{(-14)^3}$

3. Find the value of:

(i) $(3^0 + 4^{-1}) \times 2^2$

(ii) $(2^{-1} \times 4^{-1}) \div 2^{-2}$

(iii) $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$

(iv) $(3^{-1} + 4^{-1} + 5^{-1})^0$

(v) $\left\{\left(-\frac{2}{3}\right)^{-2}\right\}^2$

Solution:

(i) $(3^0+4^{-1})\times 2^2 = \left(1+\frac{1}{4}\right)\times 2^2$ $\left[\because a^{-m}=\frac{1}{a^m} \text{ and } a^0=1\right]$

$= \left(\frac{4+1}{4}\right)\times 2^2 = \frac{5}{4}\times 2^2 = \frac{5}{2^2}\times 2^2$

$= 5\times 2^{2-2}$ $[\because a^m \div a^n = a^{m-n}]$

$= 5\times 2^0 = 5\times 1 = 5$ $[\because a^0=1]$

Hence, $(3^0+4^{-1})\times 2^2 = 5$

(ii) $(2^{-1}\times 4^{-1})\div 2^{-2} = \left(\frac{1}{2^1}\times\frac{1}{4^1}\right)\div 2^{-2}$ $\left[\because a^{-m}=\frac{1}{a^m}\right]$

$= \left(\frac{1}{2}\times\frac{1}{2^2}\right)\div 2^{-2} = \frac{1}{2^3}\div 2^{-2}$ $[\because a^m\times a^n = a^{m+n}]$

$= 2^{-3}\div 2^{-2} = 2^{-3-(-2)} = 2^{-3+2} = 2^{-1}$ $[\because a^m \div a^n = a^{m-n}]$

$= \frac{1}{2}$ $\left[\because a^{-m}=\frac{1}{a^m}\right]$

Hence, $(2^{-1}\times 4^{-1})\div 2^{-2} = \frac{1}{2}$

(iii) $\left(\frac{1}{2}\right)^{-2}+\left(\frac{1}{3}\right)^{-2}+\left(\frac{1}{4}\right)^{-2} = (2^{-1})^{-2}+(3^{-1})^{-2}+(4^{-1})^{-2}$ $\left[\because a^{-m}=\frac{1}{a^m}\right]$

$= 2^{-1\times(-3)}+3^{-1\times(-2)}+4^{-1\times(-2)}$ $[\because (a^m)^n = a^{m\times n}]$

$= 2^2+3^2+4^2 = 4+9+16 = 29$

Hence, $\left(\frac{1}{2}\right)^{-2}+\left(\frac{1}{3}\right)^{-2}+\left(\frac{1}{4}\right)^{-2} = 29$

(iv) $(3^{-1}+4^{-1}+5^{-1})^0 = \left(\frac{1}{3}+\frac{1}{4}+\frac{1}{5}\right)^0$ $\left[\because a^{-m}=\frac{1}{a^m}\right]$

$= \left(\frac{20+15+12}{60}\right)^0 = \left(\frac{47}{60}\right)^0 = 1$ $[\because a^0=1]$

Hence, $(3^{-1}+4^{-1}+5^{-1})^0 = 1$

(v) $\left\{\left(-\frac{2}{3}\right)^{-2}\right\}^2 = \left(\frac{-2}{3}\right)^{-2\times 2}$ $[\because (a^m)^n = a^{m\times n}]$

$= \left(\frac{-2}{3}\right)^{-4} = \left(\frac{-3}{2}\right)^4$ $\left[\because a^{-m}=\frac{1}{a^m}\right]$

$= \frac{81}{16}$

Hence, $\left\{\left(-\frac{2}{3}\right)^{-2}\right\}^2 = \frac{81}{16}$

4. Evaluate:

(i) $\frac{8^{-1}\times 5^3}{2^{-4}}$

(ii) $(5^{-1}\times 2^{-1})\times 6^{-1}$

Solution:

(i) $\frac{8^{-1}\times 5^3}{2^{-4}} = \frac{(2^3)^{-1}\times 5^3}{2^{-4}} = \frac{2^{-3}\times 5^3}{2^{-4}}$ $[\because (a^m)^n = a^{m\times n}]$

$= 2^{-3-(-4)}\times 5^3 = 2^{-3+4}\times 5^3$ $[\because a^m \div a^n = a^{m-n}]$

$= 2\times 125 = 250$

Hence, $\frac{8^{-1}\times 5^3}{2^{-4}} = 250$

(ii) $(5^{-1}\times 2^{-1})\times 6^{-1} = \left(\frac{1}{5}\times\frac{1}{2}\right)\times\frac{1}{6}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \frac{1}{10}\times\frac{1}{6} = \frac{1}{60}$

Hence, $(5^{-1}\times 2^{-1})\times 6^{-1} = \frac{1}{60}$

5. Find the value of m for which $5^m \div 5^{-3} = 5^5$.

Solution:

Given $5^m \div 5^{-3} = 5^5$

$\Rightarrow$ $5^{m-(-3)} = 5^5$ $[\because a^m \div a^n = a^{m-n}]$

$\Rightarrow$ $5^{m+3} = 5^5$

Comparing exponents both sides, we get

$\Rightarrow$ $m + 3 = 5$

$\Rightarrow$ $m = 5 - 3$

$\Rightarrow$ $m = 2$

Therefore, the value of m is 2

6. Evaluate:

(i) $\left\{\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$

(ii) $\left(\frac{5}{8}\right)^{-7}\times\left(\frac{8}{5}\right)^{-4}$

Solution:

(i) $\left\{\left(\frac{1}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right\}^{-1}=\left\{\left(\frac{3}{1}\right)^{1}-\left(\frac{4}{1}\right)^{1}\right\}^{-1}$ $\left[\because a^{-m}=\frac{1}{a^m}\right]$

$=\{3-4\}^{-1}=-1$

Hence, $\left\{\left(\frac{1}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right\}^{-1}=-1$

(ii) $\left(\frac{5}{8}\right)^{-7}\times\left(\frac{8}{5}\right)^{-4}=\frac{5^{-7}}{8^{-7}}\times\frac{8^{-4}}{5^{-4}}$ $\left[\because \left(\frac{a}{b}\right)^{m}=\frac{a^m}{a^n}\right]$

$=5^{-7-(-4)}\times 8^{-4-(-7)}$ $[\because a^m\div a^n=a^{m-n}]$

$=5^{-7+4}\times 8^{-4+7}=5^{-3}\times 8^{3}=\frac{8^3}{5^3}$ $\left[\because a^{-m}=\frac{1}{a^m}\right]$

$=\frac{512}{125}$

Hence, $\left(\frac{5}{8}\right)^{-7}\times\left(\frac{8}{5}\right)^{-4}=\frac{512}{125}$

7. Simplify:

(i) $\frac{25\times t^{-4}}{5^{-3}\times 10\times t^{-8}}\,(t\neq 0)$

(ii) $\frac{3^{-5}\times 10^{-5}\times 125}{5^{-7}\times 6^{-5}}$

Solution:

(i) $\frac{25\times t^{-4}}{5^{-3}\times 10\times t^{-8}}=\frac{5^2\times t^{-4}}{5^{-3}\times 5\times 2\times t^{-8}}=\frac{5^{2-(-3)-1}\times t^{-4-(-8)}}{2}$ $[\because a^m\div a^n=a^{m-n}]$

$=\frac{5^{2+3-1}\times t^{-4+8}}{2}=\frac{5^4\times t^4}{2}=\frac{625}{2}t^4$

(ii) $\frac{3^{-5}\times 10^{-5}\times 125}{5^{-7}\times 6^{-5}}=\frac{3^{-5}\times(2\times 5)^{-5}\times 5^3}{5^{-7}\times(2\times 3)^{-5}}=\frac{3^{-5}\times 2^{-5}\times 5^{-5}\times 5^3}{5^{-7}\times 2^{-5}\times 3^{-5}}$ $[\because (ab)^m=a^mb^m]$

$=\frac{3^{-5}\times 2^{-5}\times 5^{-5+3}}{5^{-7}\times 2^{-5}\times 3^{-5}}=\frac{3^{-5}\times 2^{-5}\times 5^{-2}}{5^{-7}\times 2^{-5}\times 3^{-5}}$ $[\because a^m\times a^n=a^{m+n}]$

$=3^{-5-(-5)}\times 2^{-5-(-5)}\times 5^{-2-(-7)}$ $[\because a^m\div a^n=a^{m-n}]$

$=3^{-5+5}\times 2^{-5+5}\times 5^{-2+7}=3^0\times 2^0\times 5^5$

$=1\times 1\times 3125$ $[\because a^0=1]$

$=3125$

Exercise 12.2

1. Express the following numbers in standard from:

(i) 0.0000000000085

(ii) 0.00000000000942

(iii) 6020000000000000

(iv) 0.00000000837

(v) 31860000000

Solution:

(i) $0.0000000000085 = 0.0000000000085 \times \frac{10^{12}}{10^{12}} = 8.5 \times 10^{-12}$

(ii) $0.00000000000942 = 0.00000000000942 \times \frac{10^{12}}{10^{12}} = 9.42 \times 10^{-12}$

(iii) $6020000000000000 = 6020000000000000 \times \frac{10^{15}}{10^{15}} = 6.02 \times 10^{15}$

(iv) $0.00000000837 = 0.00000000837 \times \frac{10^{9}}{10^{9}} = 8.37 \times 10^{-9}$

(v) $31860000000 = 31860000000 \times \frac{10^{10}}{10^{10}} = 3.186 \times 10^{10}$

2. Express the following numbers in usual form:

(i) 3.02×10^{-6}

(ii) 4.5×10^{4}

(iii) 3×10^{-8}

(iv) 1.0001×10^{9}

(v) 5.8×10^{12}

(vi) 3.61492×10^{6}

Solution:

(i) $3.02 \times 10^{-6} = \frac{3.02}{10^{6}} = 0.00000302$

(ii) $4.5 \times 10^{4} = 4.5 \times 10000 = 45000$

(iii) $3 \times 10^{-8} = \frac{3}{10^{8}} = 0.00000003$

(iv) $1.0001 \times 10^{9} = 1000100000$

(v) $5.8 \times 10^{12} = 5.8 \times 1000000000000 = 5800000000000$

(vi) $3.61492 \times 10^{6} = 3.61492 \times 1000000 = 3614920$

3. Express the number appearing in the following statements in standard form:

(i) 1 micron is equal to $\frac{1}{1000000}$ m.

(ii) Charge of an electron is 0.000,000,000,000,000,000,16 coulomb

(iii) Size of a bacteria is 0.0000005 m.

(iv) Size of a plant cell is 0.00001275 m.

(v) Thickness if a thick paper is 0.07 mm.

Solution:

(i) 1 micron $= \frac{1}{1000000} = \frac{1}{10^6} = 1 \times 10^{-6}$ m.

(ii) Charge of an electron is 0.000,000,000,000,000,000,16 coulomb = $0.000,000,000,000,000,000,16 \times \frac{10^{19}}{10^{19}} = 1.6 \times 10^{-19}$ coulomb

(iii) Size of a bacteria $= 0.0000005 = \frac{5}{10000000} = \frac{5}{10^7} = 5 \times 10^{-7}$m.

(iv) Size of a plant cell is 0.00001275 m $= 0.00001275 \times \frac{10^5}{10^5} = 1.275 \times 10^{-5}$ m

(v) Thickness if a thick paper = 0.07 mm $= \frac{7}{100}$ mm $= \frac{7}{10^2} = 7 \times 10^{-2}$ mm.

4. In a stack there are 5 books each of thickness 20 mm and 5 paper sheets each of thickness 0.016 mm. What is the total thickness of the stack?

Solution:

Thickness of one book = 20 mm

Thickness of 5 books $= 20 \times 5 = 100$ mm

Thickness of one paper = 0.016 mm

Thickness of 5 papers $= 0.016 \times 5 = 0.08$ mm

Total thickness of stack $= 100 + 0.08$

$= 100.08$mm

$= 100.08 \times \frac{10^2}{10^2} = 1.0008 \times 10^2$ mm

♦♦♦

CBSE NCERT Solutions for Class 8 Mathematics Chapter 13

Back of Chapter Questions

EXERCISE 13.1

1. Following are the car parking charges near a railway station upto

4 hours	Rs. 60
8 hours	Rs. 100
12 hours	Rs. 140
24 hours	Rs 180

Check if the parking charges are in direct proportion to the parking time.

Solution:

We can observe that,

$$\frac{4}{60} \neq \frac{8}{100} \neq \frac{12}{140} \neq \frac{24}{180}$$

Hence, the parking charges are not directly proportional to the parking time.

2. A mixture of paint is prepared by mixing 1 part of red pigments with 8 parts of base. In the following table, find the parts of base that need to be added.

Parts of red pigment	1	4	7	12	20
Parts of base	8	….	….	….	….

Solution:

Let us assume the parts of red pigment to be x and the parts of base to be y.

Given that the paint is prepared by mixing 1 part of red pigments with 8 parts of base.

We can observe that $y = 8x$.

Therefore, the table can be filled as follows:

$$\frac{4}{32}, \frac{7}{56}, \frac{12}{96}, \frac{20}{160}$$

A mixture of paint is prepared by mixing 1 part of red pigments with 8 parts of base. If 1 part of a red pigment requires 75 mL of base, how much red pigment should we mix with 1800 mL of base?

Solution:

Let us assume the quantity of red pigment to be mixed with 1800mL of base to be x.

Parts of red pigment	1	x
Parts of be (in mL)	75	1800

Since these quantities are in direct proportion, the value of x can be found out as shown below:

$$x = \frac{1 \times 1800}{75}$$

Therefore, $x = 24$ mL.

3. A machine in a soft drink factory fills 840 bottles in six hours. How many bottles will it fill in five hours?

Solution:

Let the number of bottles filled in five hours be x.

The following information can be tabulated as follows:

Number of bottles	840	6
Time taken (In hours)	6	5

Since the number of bottles and the time taken to fill them are in direct proportion, the value of x can be calculated as follows:

$$x = \frac{840 \times 5}{6}$$

$$x = 700$$

Hence, 700 bottles can be filled in 5 hours.

4. A photograph of a bacteria enlarged 50,000 times attains a length of 5 cm as shown in the diagram. What is the actual length of the bacteria? If the photograph is enlarged 20,000 times only, what would be its enlarged length?

Solution:

The actual length of the bacteria $= \frac{5}{50000}$ cm $= 10^{-4}$ cm.

Let us assume the length of the bacteria when enlarged 20,000 times to be x.

The above information can be tabulated as follows:

Enlarged length (in cm)	5	x

Enlarged photograph	50 000	20 000

Since these values are directly proportional to each other, the value of x can be calculated as follows:

$$x = \frac{5 \times 20000}{50000} = 2$$

Hence the enlarged length is 2 cm.

5. In a model of a ship, the mast is 9 cm high, while the mast of the actual ship is 12 m high. If the length of the ship is 28 m, how long is the model ship?

Solution:

Let the length of the model ship be x. The given data can be tabulated as follows.

	Height of mast	**Length of ship**
Model ship	9 cm	x
Actual ship	12 m	28 m

Since, the heights of the model ship and the actual ship are directly proportional to each other, the value of x can be calculated as follows

$$x = \frac{9 \times 28}{12} = 21$$

Hence, the height of the model ship is 21 cm.

6. Suppose 2 kg of sugar contains 9×10^6 crystals. How many sugar crystals are there in (i) 5 kg of sugar? (ii) 1.2 kg of sugar?

Solution:

Let x and y be the number of crystals in 5 kg and 1.2 kg of sugar respectively. The given data can be tabulated as follows:

No. of crystals	9×10^5	x	y
Sugar (in kg)	2	5	1.2

Since these values are directly proportional to each other, x and y can be found as follows:

$$x = \frac{9 \times 10^5 \times 5}{2} = 2.25 \times 10^7$$

Hence, 5 kg of sugar contains 2.25×10^7 number of crystals.

$$y = \frac{9 \times 10^5 \times 1.2}{2} = 5.4 \times 10^6$$

Hence, 1.2 kg of sugar contains 5.4×10^6 number of crystals.

7. Rashmi has a road map with a scale of 1 cm representing 18 km. She drives on a road for 72 km. What would be her distance covered in the map?

Solution:

Let us assume the distance on map to be x. The given data can be tabulated as follows.

Distance covered on road in (in km)	18	72
Distance represented on map (in an)	1	x

Since, these values are directly proportional to each other, the value of x can be calculated as follows:

$$x = \frac{1 \times 72}{18} = 4$$

Hence, the distance represented on the map is 4cm.

8. A 5 m 60 cm high vertical pole casts a shadow 3 m 20 cm long. Find at the same time (i) the length of the shadow cast by another pole 10 m 50 cm high (ii) the height of a pole which casts a shadow 5 m long

Solution:

Let us consider x m to be the length of the pole whose shadow is of length 10 m 50 cm. Let us consider y m be the length of the pole whose shadow is 5 m long. The above data can be tabulated as follows.

Length of pole (in m)	5.6	10.5	y
Length of its shadow (in m)	3.2	x	5

Since, the tabulated values are directly proportional to each other, the values of x and y can be calculated as follows:

$$x = \frac{3.2 \times 10.5}{5.6} = 6$$

Hence, the length of the shadow cast by another pole 10 m 50 cm high is 6 m.

$$y = \frac{5 \times 5.6}{3.2} = 8.75$$

Hence, the height of a pole which casts a shadow 5 m long is 8.75 m.

9. A loaded truck travels 14 km in 25 minutes. If the speed remains the same, how far can it travel in 5 hours?

Solution:

Let us assume that the distance travelled by the truck in 5 hours to be x km.

We know that,1 hour = 60 minute

$\therefore\ 5 \text{ hours} = (5 \times 60) \text{ minutes} = 300 \text{ minutes}$

The given information can be tabulated as follows.

Distance travelled (in km)	14	x
Time (in min)	25	300

Since, the tabulated values are directly proportional to each other, the value of x can be calculated as follows:

$$x = \frac{14 \times 300}{25} = 168$$

Hence, the truck can travel 168 km in 300 min.

EXERCISE 13.2

10. Which of the following are in inverse proportion?

(i) The number of workers on a job and the time to complete the job.

(ii) The time taken for a journey and the distance travelled in a uniform speed.

(iii) Area of cultivated land and the crop harvested.

(iv) The time taken for a fixed journey and the speed of the vehicle.

(v) The population of a country and the area of land per person.

Solution:

(i) More the number of workers, less time it takes to complete the job. Hence, they are in inverse proportion.

(ii) With uniform speed, it is possible to cover more distance in more time.

Hence, they are in direct proportion.

(iii) More the area, more is the crop harvested.

Hence, they are in direct proportion.

(iv) More the speed, less is the time taken.

Hence, they are in inverse proportion.

(v) More the population, less is the area per person.

Hence, they are in inverse proportion.

11. In a Television game show, the prize money of rupees 1,00,000 is to be divided equally amongst the winners. Complete the following table and find whether the prize money given to an individual winner is directly or inversely proportional to the number of winners?

Number of winners	1	2	4	5	8	10	20
Prize for each winner (in ₹)	1,00,000	50,000	….	….	….	….	….

Solution:

As the number of winners increase, the prize amount per winner decreases. Hence, they are in inverse proportion.

The values are found as follows:

$\therefore\ 4 \times x = 1 \times 100000$

$$\Rightarrow\ x = \frac{100000}{4} = 25000$$

Thus, for 4 it is 25000

$5 \times y = 1 \times 100000$

$$\Rightarrow y = \frac{100000}{5} = 20000$$

Therefore, for 5 it is 20000.

$8 \times z = 1 \times 100000$

$$\Rightarrow\ z = \frac{100000}{8} = 12500$$

12. Rehman is making a wheel using spokes. He wants to fix equal spokes in such a way that the angles between any pair of consecutive spokes are equal. Help him by completing the following table.

Number of spokes	4	6	8	10	12
Angle between a pair of consecutive spokes	90^o	60^o	....	....	....

(i) Are the number of spokes and the angles formed between the pairs of consecutive spokes in inverse proportion?

(ii) Calculate the angle between a pair of consecutive spokes on a wheel with 15 spokes.

(iii) How many spokes would be needed, if the angle between a pair of consecutive spokes is 40^o?

Solution:

Let us assume the values to be determined to be as follows

Number of spokes	4	6	8	10	12
Angle between a pair of consecutive spokes	90^o	60^o	x_1	x_2	x_3

From the table, we can observe that

$4 \times 90^0 = 360^0 = 6 \times 60^0$

Hence, this is an inverse proportion.

The unknown values can be found as follows

$4 \times 90^o = x_1 \times 8$

$$x_1 = \frac{4 \times 90^o}{8} = 45^o$$

Similarly, $x_2 = \frac{4\times 90^o}{10} = 36^0$ and

$$x_3 = \frac{4 \times 90^o}{12} = 30^o$$

The updated table is as shown below

Number of spokes	4	6	8	10	12

Angle between a pair of consecutive spokes	90^o	60^o	45^o	36^o	30^o

Yes, the number of spokes and the angles formed between the pairs of consecutive spokes are in inverse proportion.

Let the angle between a pair of consecutive spokes on a wheel with 15 spokes be x, then

$$x = \frac{4 \times 90^o}{15} = 24^o$$

Let the number of spokes in a wheel which has 40^o angles between a pair of consecutive spokes be y, then

$$y = \frac{4 \times 90^o}{40} = 9^o$$

13. If a box of sweets is divided among 24 children, they will get 5 sweets each. How many would each get, if the number of the children is reduced by 4?

Solution:

Given, 1 box of sweet is divided among 24 children

Number of children after reducing by 4 is $24 - 4 = 20$

Let us assume each of them get x number of sweets.

The above can be tabulated as follows:

Number of students	24	20
Number of sweets	5	x

More the number of students, lesser the number of sweets each of them get.

Hence, they are in inverse proportion.

The value of x can be calculated as follows:

$$x = \frac{24 \times 5}{50} = 6$$

Hence, each of them will get 6 sweets.

14. A farmer has enough food to feed 20 animals in his cattle for 6 days. How long would the food last if there were 10 more animals in his cattle?

Solution:

Number of cattle $= 20 + 10 = 30$

Let x be the number of days the food lasts

Number of animals	20	30
Number of days	6	x

More the cattle, lesser the number of days the food will last, hence these are in inverse proportion.

The value of x is calculated as below:

$\therefore\ 20 \times 6 = 30 \times x$

$$\Rightarrow x = \frac{20 \times 6}{30} = 4$$

Hence, the food will last for 4 days.

15. A contractor estimates that 3 persons could rewire Jasminder's house in 4 days. If he uses 4 persons instead of three, how long should they take to complete the job?

Solution:

Assume the number of days as x.

The data is tabulated as follows:

Number of days	4	x
Number of persons	3	4

More the number of workers, less is the number of days required to complete the work.

Hence, they are in inverse proportion, and the value of x is calculated as follows:

$$x = \frac{4 \times 3}{4} = 3$$

Therefore, 4 workers will take 3 days to complete the job.

16. A batch of bottles were packed in 25 boxes with 12 bottles in each box. If the same batch is packed using 20 bottles in each box, how many boxes would be filled?

Solution:

If 20 bottles are packed together, let x be the number of boxes. The data is tabulated as follows:

Number of	25	x

boxes		
Number of bottles per box	12	20

If a greater number of bottles are packed in a box, lesser will be the number of boxes required.

Hence it is inverse proportion and the value of x is calculated as follows:

$$x = \frac{12 \times 25}{20} = 15$$

Hence, 15 boxes will be filled.

17. A factory requires 42 machines to produce a given number of articles in 63 days. How many machines would be required to produce the same number of articles in 54 days?

Solution:

Let x be the number of machines required.

The tabulated data is as below:

Number of machines	42	x
Number of days	63	54

More the number of machines, less is the number of days required.

Hence, they are in inverse proportion.

The value of x is calculated as follows:

$$x = \frac{42 \times 63}{54} = 49$$

Therefore, 49 machines are required to produce the same number of articles in 54 days.

18. A car takes 2 hours to reach a destination by travelling at the speed of 60 km/h. How long will it take when the car travels at the speed of 80 km/h?

Solution:

Let the time taken to reach a certain place at 80 km/h be x.

Speed (in km/hr)	60	80
Time (in hours)	2	x

More the speed, less it the time required.

Hence, they are in inverse proportion and the value of x can be calculated as shown:

$$x = \frac{2 \times 60}{80} = 1.5$$

Therefore, it takes 1.5 hours to reach at 80km/h.

19. Two persons could fit new windows in a house in 3 days.

(i) One of the persons fell ill before the work started. How long would the job take now?

(ii) How many persons would be needed to fit the windows in one day?

Solution:

(i) Let x be the number of days required

Number of persons	2	1
Number of days	3	x

Clearly, this is an inverse proportion.

$x = 2 \times 3 = 6$

Hence, it will take 6 days if one person works.

(ii) Let the number of people be y

Number of persons	2	Y
Number of days	3	1

Clearly, this is an inverse proportion.

$y = 2 \times 3 = 6$

Therefore, it will take 6 people to fit the window in one day.

20. A school has 8 periods a day each of 45 minutes duration. How long would each period be, if the school has 9 periods a day, assuming the number of school hours to be the same?

Solution:

Let the duration of a period be x.

The given data can be tabulated as follows:

Number of periods	8	9
Duration of periods (in minutes)	45	x

Assuming the number of school hours to be the same, more is the duration of each period, less is the number of periods.

Hence, they are in inverse proportion.

The value of x is calculated as shown:

$$x = \frac{8 \times 45}{9} = 40$$

Hence, each of the 9 periods will be for 40 minutes of duration.

CBSE NCERT Solutions for Class 8 Mathematics Chapter 14

Back of Chapter Questions

Exercise 14.1

1. Find the common factors of the given terms.

(i) $12x, 36$

(ii) $2y, 22xy$

(iii) $14\ pq, 28p^2q^2$

(iv) $2x, 3x^2, 4$

(v) $6abc, 24ab^2, 12a^2b$

(vi) $16x^3, -4x^2, 32x$

(vii) $10\ pq, 20qr, 30rp$

(viii) $3x^2y^3, 10x^3y^2, 6x^2y^2z$

Solution:

(i) $12x = 12 \times x$

2	12
2	6
3	3
	1

$\therefore\ 12x = 12 \times x = 2 \times 2 \times 3 \times x$

$36 \Rightarrow$

2	36
2	18
3	9
3	3
	1

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

Thus,

$12x = 2 \times 2 \times 3 \times x$

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

So, the common factors are 2, 2 and 3

And $2 \times 2 \times 3 = 12$

(ii) $2y, 22xy$

$2y = 2 \times y$

$22\ xy = 22 \times x \times y$

$= 2 \times 11 \times x \times y$

So, the common factors are 2 and y

And$2 \times y = 2y$

(iii) $14\ pq, 28p^2q^2$

$14pq = 14 \times p \times q$

2	14
7	7
	1

$= 2 \times 7 \times p \times q$

$28\ p^2q^2 = 28 \times p^2 \times q^2$

2	28
2	14
7	7
	1

$= 2 \times 2 \times 7 \times p^2 \times q^2$

$= 2 \times 2 \times 7 \times p \times q \times q \times q$

So,$14pq = 2 \times 7 \times p \times q$

$28p^2q^2 = 2 \times 2 \times 7 \times p \times p \times q \times q$

$\therefore$ the common factor are 2, 7, p and q

And $2 \times 7 \times p \times q = 14 \times pq$

$= 14pq$

(iv) $2x, 3x^2, 4$

$2x = 2 \times x$

$3x^2 = 3 \times x^2$

$= 3 \times x \times x$

$4 = 2 \times 2$

There is no common factor visible.

$\therefore$ 1 is the only common factor of the given terms.

(v) $6abc, 24ab^2, 12a^2b$

$6abc = 6 \times abc$

$= 2 \times 3 \times abc$

$= 2 \times 3 \times a \times b \times c$

$24ab^2 = 24 \times ab^2$

2	24
2	12
2	6
3	3
	1

$= 2 \times 2 \times 2 \times 3 \times ab^2$

$= 2 \times 2 \times 2 \times 3 \times a \times b \times b$

$12a^2b = 12 \times a^2b$

2	12
2	6
3	3
	1

$= 2 \times 2 \times 3 \times a^2 \times b$

$= 2 \times 2 \times 3 \times a \times a \times b$

So, $6\ abc = 2 \times 3 \times a \times b \times c$

$24ab^2 = 2 \times 2 \times 2 \times 3 \times a \times b \times c$

$12\ a^2b = 2 \times 2 \times 3 \times a \times a \times b$

$\therefore$ the common factor are 2, 3, a and b

And $2 \times 3 \times a \times b = 6 \times ab$

$= 6\ ab$

(vi) $16x^3, -4x^2, 32x$

$16x^3 = 16 \times x^3$

2	16
2	8
2	4
2	2
	1

$= 2 \times 2 \times 2 \times 2 \times x^3$

$= 2 \times 2 \times 2 \times 2 \times x \times x \times x$

$-4x^2 = -4 \times x^2$

$= -1 \times 4 \times x^2$

$= -1 \times 2 \times 2 \times x^2$

$= -1 \times 2 \times 2 \times x \times x$

$32x = 32 \times x$

2	32
2	16
2	8
2	4
2	2
	1

$= 2 \times 2 \times 2 \times 2 \times 2 \times x$

So, $16x^3 = 2 \times 2 \times 2 \times 2 \times x \times x \times x$

$-4x^2 = -1 \times 2 \times 2 \times x \times x$

$32x = 2 \times 2 \times 2 \times 2 \times x$

$\therefore$ the common factors are 2, 2 and x

And $2 \times 2 \times x = 4 \times x$

$= 4x$

(vii) $10\,pq, 20qr, 30rp$

$10pq = 10 \times pq$

$= 2 \times 5 \times pq$

$= 2 \times 5 \times p \times q$

$20qr = 20 \times qr$

2	20
2	10
5	5
	1

$= 2 \times 2 \times 5 \times qr$

$= 2 \times 2 \times 5 \times q \times r$

$30rp = 30 \times rp$

2	30
3	15
5	5
	1

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

$= 2 \times 2 \times 5 \times r \times p$

So, $10pq = 2 \times 5 \times p \times q$

$20qr = 2 \times 2 \times 5 \times q \times r$

$30rp = 2 \times 2 \times 5 \times r \times p$

$\therefore$ the common factors are 2 and 5

And $2 \times 5 = 10$

(viii) $3x^2y^3, 10x^3y^2, 6x^2y^2z$

$3x^2y^3 = 3 \times x^2 \times y^2$

$= 3 \times x \times x \times y \times y \times y$

$10x^3y^2 = 10 \times x^3 \times y^2$

$= 2 \times 5 \times x^3 \times y^2$

$= 2 \times 5 \times x \times x \times x \times y \times y$

$6x^2y^2z = 6 \times x^2 \times y^2 \times z$

$= 2 \times 3 \times x^2 \times y^2 \times z$

$= 2 \times 3 \times x \times x \times y \times y \times z$

So, $3x^2y^3 = 2 \times x \times x \times y \times y \times y$

$10x^3y^2 = 2 \times 5 \times x \times x \times x \times y \times y$

$6x^2y^2z = 2 \times 3 \times x \times x \times y \times y \times z$

$\therefore$ the common factors are x, x, y and y

And$x \times x \times y \times y = (x \times x) \times (y \times y)$

$= x^2 \times y^2$

$= x^2y^2$

2. Factorise the following expressions.

(i) $7x - 42$

(ii) $6p - 12q$

(iii) $7a^2 + 14a$

(iv) $-16z + 20z^3$

(v) $20l^2m + 30\ a/m$

(vi) $5x^2y - 15xy^2$

(vii) $10\ a^2 - 15\ b^2 + 20\ c^2$

(viii) $-4a^2 + 4ab - 4\ ca$

(ix) $x^2yz + xy^2z + xyz^2$

(x) $ax^2y + bxy^2 + cxyz$

Solution:

(i) $7x - 42$

Method 1:

$7x = 7 \times x$

$42 = 2 \times 3 \times 7$

2	42
3	21
7	7
	1

7 is the only common factor.

$7x - 42 = (7 \times x) - (2 \times 3 \times 7)$

$= 7\big(x - (2 \times 3)\big)$

$= 7(x - 6)$

Method 2:

$7x - 42$

$7x - 42$

$= (7 \times x) - (7 \times 6)$

$= 7(x - 6)$ (taking 7 as common)

(ii) $6p - 12q$

Method 1:

$6p = 6 \times p$

$= 2 \times 3 \times p$

$12q = 12 \times q$

2	12
2	6
3	3
	1

$= 2 \times 2 \times 3 \times q$

So, the common factors are 2 and 3.

$6p - 12q = (2 \times 3 \times p) - (2 \times 2 \times 3 \times q)$

$= 2 \times 3(p - (2 \times q))$

$= 6(p - 2q)$

Method 2:

$6p - 12q$

$= 6p - (6 \times 2)q$

$= 6(p - 2q)$(taking 6 as common)

(iii) $7a^2 + 14a$

Method 1:

$7a^2 = 7 \times a^2 = 7 \times a \times a$

$14a = 14 \times a = 7 \times 2 \times a \times a$

So, the common factors are 7 and a

$7a^2 + 14a = (7 \times a \times a) + (7 \times 2 \times a)$

$= (7 \times a)(a + 2)$

$= 7a(a + 2)$

Method 2:

$7a^2 + 14a$

$= 7a^2 + (7 \times 2)a$

$= (7a \times a) + (7a \times 2)$

$= 7a(a + 2)$(taking $7a$ common)

(iv) $-16z + 20z^3$

Method 1:

$-16z = -16 \times z$

$= -1 \times 2 \times 2 \times 2 \times 2 \times z$

$20z^3 = 20 \times z^3$

2	20
2	10
5	5
	1

$= 2 \times 2 \times 5 \times z \times z \times z$

So, the common factors are 2, 2 and z

$-16z + 20z^3$

$= (-1 \times 2 \times 2 \times 2 \times 2 \times z) + (2 \times 2 \times 5 \times z \times z \times z)$

Taking $2 \times 2 \times z$ common,

$= 2 \times 2 \times z\big((-1 \times 2 \times 2) + (5 \times z \times z)\big)$

$= 4z(-4 + 5z^2)$

Method 2:

$-16z + 20z^3$

$= (4 \times -4)z + (4 \times 5)z^3$

$= 4z(-4 + 5z^2)$(taking 4z as common)

(v) $20l^2m + 30\ a/m$

Method 1:

$20\ l^2\ m = 20 \times l^2 \times m$

2	20
2	10
5	5
	1

$= 2 \times 2 \times 5 \times l \times l \times m$

$30 \text{ alm} = 30 \times a \times l \times m$

2	30
3	15
5	5
	1

$= 2 \times 3 \times 5 \times a \times l \times m$

So, $20l^2\text{m} = 2 \times 2 \times 5 \times l \times l \times \text{m}$

$30 \text{ alm} = 2 \times 3 \times 5 \times \text{a} \times l \times \text{m}$

So, $2, 5, l$ and m are the common factors.

Now,

$20l^2\text{m} + 30 \text{ alm} = (2 \times 2 \times 5 \times l \times l \times \text{m}) + (2 \times 3 \times 5 \times \text{a} \times l \times \text{m})$

Taking $2 \times 5 \times l \times \text{m}$ common

$= 2 \times 5 \times l \times \text{m}\,[(2 \times 1) + (3 \times a)]$

$= 10l\text{m}(2l + 3\text{a})$

Method 2:

$20\, l^2\, m + 30 \text{ alm}$

$= (10 \times 2)l \times l \times m + (10 \times 3) \text{ a} \times l \times \text{m}$

Taking $10 \times l \times \text{m}$ as common,

$= 10 \times l \times \text{m}(2l + 3a)$

$= 10l\text{m}(2l + 3a)$

(vi) $5x^2y - 15xy^2$

Method 1:

$5x^2y = 5 \times x \times x \times y$

$15\, xy^2 = 15 \times x \times y^2$

$= 3 \times 5 \times x \times y \times y$

So, 5, x and y are the common factors.

Now,

$5x^2y - 15xy^2 = (5 \times x \times x \times y) - (3 \times 5 \times x \times y \times y)$

Taking $5 \times x \times y$ common

$= 5 \times x \times y(x - (3 \times y))$

$= 5xy(x - 3y)$

Method 2:

$5x^2y - 15xy^2 = 5x^2y - 5 \times 3 \times xy^2$

Taking 5 as common

$= 5(x^2y - 3xy^2)$

$= 5\big((xy \times x) - (xy \times 3y)\big)$

Taking xy as common

$= 5xy(x - 3y)$

(vii) $10\,a^2 - 15\,b^2 + 20\,c^2$

Method 1:

$10a^2 = 10 \times a^2 = 2 \times 5 \times a^2 = 2 \times 5 \times a \times a$

$15b^2 = 15 \times b^2 = 3 \times 5 \times b^2 = 3 \times 5 \times b \times b$

$20c^2 = 20 \times c^2 = 2 \times 2 \times 5 \times c^2 = 2 \times 2 \times 5 \times c \times c$

So, 5 is the common factor.

$10a^2 - 15b^2 + 20c^2$

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

$= 5 \times \big((2 \times a \times a) - (3 \times b \times b) + (2 \times 2 \times c \times c)\big)$

$= 5 \times (2a^2 - 3b^2 + 4c^2)$

$= 5(2a^2 - 3b^2 + 4c^2)$

Method 2:

$10\,a^2 - 15\,b^2 + 20\,c^2$

$= (5 \times 2)a^2 - (5 \times 3)b^2 + (5 \times 4)c^2$

Taking 5 common,

$= 5(2a^2 - 3b^2 + 4c^2)$

(viii) $-4a^2 + 4ab - 4\,ca$

Method 1:

$-4a^2 = -4 \times a^2 = -1 \times 4 \times a^2$

$= -1 \times 2 \times 2 \times a^2$

$= -1 \times 2 \times 2 \times a \times a$

$4ab = 4 \times a \times b = 2 \times 2 \times a \times b$

$4ca = 4 \times c \times a = 2 \times 2 \times c \times a$

So, $2, 2$ and a are the common factors.

$-4a^2 + 4ab - 4ca$

$= (-1 \times 2 \times 2 \times a \times a) + (2 \times 2 \times a \times b) - (2 \times 2 \times c \times a)$

$= 2 \times 2 \times a \times \left((-1 \times a) + b - c\right)$

$= 4a(-a + b - c)$

Method 2:

$-4a^2 + 4ab - 4\,ca$

Taking 4 common,

$= 4(-a^2 + ab - ca)$

$= 4\left((-a \times a) + (a \times b) - (c \times a)\right)$

Taking a common,

$= 4a(-a + b - c)$

(ix) $x^2yz + xy^2z + xyz^2$

Method 1:

$x^2yz = x^2 \times y \times z = x \times x \times y \times z$

$x^2yz = x \times y^2 \times\ z = x \times y \times y \times z$

$xyz^2 = x \times y \times z^2 = x \times y \times z \times z$

So, x, y and z are the common factors.

$x^2yz + xy^2z + xyz^2$
$= (x \times x \times y \times z) + (x \times y \times y \times z)(x \times y \times z \times z)$

Taking $x \times y \times z$ common,

$= x \times y \times z(x + y + z)$

$= xyz(x + y + z)$

Method 2:

$x^2yz + xy^2z + xyz^2$

$= (x \times xyz) + (y \times xyz) + (z \times xyz)$

Taking xyz common,

$= xyz(x + y + z)$

(x) $ax^2y + bxy^2 + cxyz$

Method 1:

$ax^2y = a \times x^2 \times y = a \times x \times x \times y$

$bxy^2 = b \times x \times y^2 = b \times x \times y \times y$

$cxyz = c \times x \times y \times z$

So, x and y are the common factors.

$ax^2y + bxy^2 + cxyz$

$= (a \times x \times x \times y) + (b \times x \times y \times y) + (c \times x \times y \times z)$

$= x \times y(a \times x) + (b \times y) + (c \times z)$

$= xy(ax + by + cz)$

Method 2:

$ax^2y + bxy^2 + cxyz$

$= (x \times axy) + (x \times by^2) + (x \times cyz)$

Taking x common,

$= x(axy + by^2 + cyz)$

$= x\big((ax \times y) + (by \times y) + (cz \times y)\big)$

Taking y common,

$= x \times y(ax + by + cz)$

$= xy(ax + by + cz)$

3. Factorise.

(i) $x^2 + xy + 8x + 8y$

(ii) $15xy - 6x + 5y - 2$

(iii) $ax + bx - ay - by$

(iv) $15pq + 15 + 9q + 25p$

(v) $z - 7 + 7xy - xyz$

Solution:

(i) $x^2 + xy + 8x + 8y$

$= \underbrace{(x^2 + xy)}_{\text{Both have x as common factor}} + \underbrace{(8x + 8y)}_{\text{Both have 8 as common factor}}$

$= x(x + y) + 8(x + y)$

Taking $(x + y)$ common

$= (x + y)(x + 8)$

(ii) $15xy - 6x + 5y - 2$

$15xy - 6x + 5y - 2$

$= \underbrace{(15xy - 6x)}_{\text{Both have 3 and } x \text{ as common factor}} + \underbrace{(5y - 2)}_{\text{Since nothing is common, we take 1 common}}$

$= 3x(5y - 2) + 1(5y - 2)$

Taking $(5y - 2)$ common

$= (5y - 2)(3x + 1)$

(iii) $ax + bx - ay - by$

$ax + bx - ay - by$

$\underbrace{(ax + bx)}_{\text{Both have x as common factor}} - \underbrace{(ay - by)}_{\text{Both have y as common factor}}$

$= x(a + b) - y(a + b)$

Taking $(a + b)$ common

$= (a + b)(x - y)$

(iv) $15pq + 15 + 9q + 25p$

$15pq + 15 + 9q + 25p$

$= \underbrace{(15pq + 25p)}_{\text{Both have 5 and p as common factor}} + \underbrace{(15 + 9q)}_{\text{Both have 3 as common factor}}$

$= 5p(3q + 5) + 3(5 + 3q)$

$= 5p(3q + 5) + 3(3q + 5)$

Taking $(3q + 5)$ Common,

$= (3q + 5)(5p + 3)$

(v) $z - 7 + 7xy - xyz$

$z - 7 + 7xy - xyz$

$(z - 7) + \underbrace{(7xy - xyz)}_{\text{Both have } x \text{ and } y \text{ as common factor}}$

$(z - 7) + xy(7 - z)$

$= (z - 7) + xy \times -(z - 7)$ (As $(7 - z) = -(z - 7)$)

$= (z - 7) - xy(z - 7)$

Taking $(z - 7)$ common

$= (z - 7)(1 - xy)$

Exercise 14.2

1. Factorise the following expressions.

(i) $a^2 + 8a + 16$

(ii) $p^2 - 10p + 25$

(iii) $25m^2 + 30m + 9$

(iv) $49y^2 + 84yz + 36z^2$

(v) $4x^2 - 8x + 4$

(vi) $121b^2 - 88bc + 16c^2$

(vii) $(l + m)^2 - 4lm$ (**Hint**: Expand $(l + m)^2$ first)

(viii) $a^4 + 2a^2b^2 + b^4$

Solution:

(i) $a^2 + 8a + 16$

$= a^2 + 8a + 4^2$

$= a^2 + (2 \times a \times 4) + 4^2$

$= a^2 + 4^2 + (2 \times a \times 4)$

Using $(x + y)^2 = x^2 + y^2 + 2xy$

Here, $x = a$ and $y = 4$

$= (a + 4)^2$

(ii) $p^2 - 10p + 25$

$p^2 - 10p + 25$

$= p^2 - 10p + 5^2$

$= p^2 - (2 \times p \times 5) + 5^2$

$= p^2 + 5^2 - (2 \times p \times 5)$

Using $(a - b)^2 = a^2 + b^2 - 2ab$

Here, $a = p$ and $b = 5$

$= (p - 5)^2$

(iii) $25m^2 + 30m + 9$

$25m^2 + 30m + 9$

$= (5m)^2 + 30m + 3^2$

$= (5m)^2 + (2 \times 5m \times 3) + 3^2$

$= (5m)^2 + 3^2 + (2 \times 5m \times 3)$

Using $(a + b)^2 = a^2 + b^2 + 2ab$

Here, $a = 5m$ and $b = 3$

$= (5m + 3)^2$

(iv) $49y^2 + 84yz + 36z^2$

$49y^2 + 84yz + 36z^2$

$= (7y)^2 + 84yz + (6z)^2$

$= (7y)^2 + 2 \times 7y \times 6z + (6z)^2$

$= (7y)^2 + (6z)^2 + 2 \times 7y \times 6z$

Using $(a + b)^2 = a^2 + b^2 + 2ab$

Here, $a = 7y$ and $b = 6z$

$= (7y + 6z)^2$

(v) $4x^2 - 8x + 4$

$4x^2 - 8x + 4$

$= 2x^2 - \big(2 \times 2x \times (-2)\big) + 2^2$

$= 2x^2 + 2^2 - \left(2 \times 2x \times (-2)\right)$

Using $(a-b)^2 = a^2 + b^2 - 2ab$

Here, $a = 2x$ and $b = 2$

$= (2x-2)^2$

(vi) $121b^2 - 88bc + 16c^2$

$121b^2 - 88bc + 16c^2 = (11b)^2 - 88bc + (4c)^2$

$= (11b)^2 - 2 \times 11b \times 4c + (4c)^2$

$= (11b)^2 + (4c)^2 - 2 \times 11b \times 4c$

Using $(x-y)^2 = x^2 + y^2 - 2xy$

Here, $x = 11b$ and $y = 4c$

$= (11b - 4c)^2$

(vii) $(l+m)^2 - 4lm$(**Hint**: Expand $(l+m)^2$ first)

Using $(a+b)^2 = a^2 + b^2 + 2ab$

Here, $a = l$ and $b = m$

$= l^2 + m^2 + 2lm - 4lm$

$= l^2 + m^2 + 2lm(1-2)$

$= l^2 + m^2 - 2lm$

Using $(a-b)^2 = a^2 + b^2 - 2ab$

Here, $a = l$ and $b = m$

$= (l-m)^2$

(viii) $a^4 + 2a^2b^2 + b^4$

$a^4 + 2a^2b^2 + b^4$

Using $(a^m)^n = a^{m \times n}$

$\therefore (a^2)^2 = a^{2\times 2} = a^4$

$= (a^2)^2 + 2a^2b^2 + (b^2)^2$

$= (a^2)^2 + 2(a^2 \times b^2) + (b^2)^2$

$= (a^2)^2 + (b^2)^2 + 2(a^2 \times b^2)$

Using $(x+y)^2 = x^2 + y^2 + 2xy$

Here, $x = a^2$ and $y = b^2$

$= (a^2 + b^2)^2$

2. Factorise

(i) $4p^2 - 9q^2$

(ii) $63a^2 - 112b^2$

(iii) $49x^2 - 36$

(iv) $16x^5 - 144x^3$

(v) $(l + m)^2 - (l - m)^2$

(vi) $9x^2y^2 - 16$

(vii) $(x^2 - 2xy + y^2) - z^2$

(viii) $25a^2 - 4b^2 + 28bc - 49c^2$

Solution:

(i) $4p^2 - 9q^2$

$= (2p)^2 - (3q)^2$

Using $a^2 - b^2 = (a + b)(a - b)$
Here $a = 2p$ and $b = 3q$

$= (2p + 3q)(2p - 3q)$

(ii) $63a^2 - 112b^2$

$63a^2 - 112b^2$

$= (7 \times 9)a^2 - (7 \times 16)b^2$

Taking 7 common,

$= 7(9a^2 - 16b^2)$

$= 7((3a)^2 - (4b)^2)$

Using $x^2 - y^2 = (x + y)(x - y)$
Here $x = 3a$ and $y = 4b$

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

(iii) $49x^2 - 36$

$49x^2 - 36$

$= (7x)^2 - (6)^2$

Using $a^2 - b^2 = (a + b)(a - b)$

Here $a = 7x$ and $b = 6$

$= (7x + 6)(7x - 6)$

(iv) $16x^5 - 144x^3$

$16x^5 - 144x^3$

$= 16x^2x^3 - 144x^3$

Taking x^3 common,

$= x^3(16x^2 - 144)$

$= x^3((4x)^2 - (12)^2)$

Using $a^2 - b^2 = (a + b)(a - b)$

Here $a = 4x$ and $b = 12$

$= x^3(4x + 12)(4x - 12)$

$= x^3 \underbrace{(4x + 12)}\ \underbrace{(4x - 12)}$

Both have 4 as common factor

$= x^3 \times 4(x + 3) \times 4(x - 3)$

$= x^3 \times 4 \times 4 \times (x + 3)(x - 3)$

$= 16x^3(x + 3)(x - 3)$

(v) $(l + m)^2 - (l - m)^2$

$(l + m)^2 - (l - m)^2$

Using $a^2 - b^2 = (a + b)(a - b)$

Here $a = (l + m)$ and $b = (l - m)$

$= [(l + m) + (l - m)][(l + m) - (l - m)]$

$= [l + m + l - m][l + m - l + m]$

$= (2l)(2m)$

$= 2 \times 2 \times l \times m$

$= 4lm$

(vi) $9x^2y^2 - 16$

$9x^2y^2 - 16$

$= (3xy)^2 - (4)^2$

Using $a^2 - b^2 = (a + b)(a - b)$

Here $a = 3xy$ and $b = 4$

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

(vii) $(x^2 - 2xy + y^2) - z^2$

$(x^2 - 2xy + y^2) - z^2$

$= (x^2 + y^2 - 2xy) - z^2$

Using $(a - b)^2 = a^2 + b^2 - 2ab$
Here $a = x$ and $b = y$

$= (x - y)^2 - z^2$

Using $a^2 - b^2 = (a + b)(a - b)$
Here $a = x - y$ and $b = z$

$= (x - y + z)(x - y - z)$

(viii) $25a^2 - 4b^2 + 28bc - 49c^2$

$25a^2 - \underbrace{4b^2 + 28bc - 49c^2}_{\text{Taking−common}}$

$= 25a^2 - (4b^2 - 28bc + 49c^2)$

$= 25a^2 - (4b^2 + 49c^2 - 28bc)$

$= 25a^2 - ((2b)^2 + (7c)^2 - 2 \times 2b \times 7c)$

Using $(x - y)^2 = x^2 + y^2 - 2xy$
Here $x = 2b$ and $y = 7c$

$= 25a^2 - (2b - 7c)^2$

$= (5a)^2 - (2b - 7c)^2$

Using $x^2 - y^2 = (x + y)(x - y)$
Here $x = 5a$ and $y = 2b - 7c$

$= \big(5a + (2b - 7c)\big)\big(5a - (2b - 7c)\big)$

$= (5a + 2b - 7c)(5a - 2b + 7c)$

3. Factorise the expressions:

(i) $ax^2 + bx$

(ii) $7p^2 + 21q^2$

(iii) $2x^3 + 2xy^2 + 2xz^2$

(iv) $am^2 + bm^2 + bn^2 + an^2$

(v) $(lm + l) + m + 1$

(vi) $y(y + z) + 9(y + z)$

(vii) $5y^2 - 20y - 8z + 2yz$

(viii) $10ab + 4a + 5b + 2$

(ix) $6xy - 4y + 6 - 9x$

Solution:

(i) $ax^2 + bx$

$ax^2 = a \times x \times x$

$bx = b \times x$

So, x is a common factor.

Taking x common,

$= x\big((a \times x) + b\big)$

$= x(ax + b)$

(ii) $7p^2 + 21q^2$

$7p^2 = 7 \times p^2 = 7 \times p \times p$

$21q^2 = 21 \times q^2 = 3 \times 7 \times q \times q$

So, 7 is the only common factor.

Taking 7 common,

$= 7 \times \big((p \times p) + (3 \times q \times q)\big)$

$= 7 \times (p^2 + 3q^2)$

$= 7(p^2 + 3q^2)$

Method 1:

(iii) $2x^3 + 2xy^2 + 2xz^2$

$2x^3 = 2 \times x^3 = 2 \times x \times x \times x$

$2x^3 = 2 \times x \times y^2 = 2 \times x \times y \times y$

$2xz^2 = 2 \times x \times z^2 = 2 \times x \times z \times z$

So, 2 and x are the common factors.

$2x^3 + 2xy^2 + 2xz^2$
$= (2 \times x \times x \times x) + (2 \times x \times y \times y) + (2 \times x \times z \times)$

Taking $2 \times x$ common,

$= 2 \times x\big((x \times x) + (y \times y) + (z \times z)\big)$

$= 2x\,(x^2 + y^2 + z^2)$

(iv) $am^2 + bm^2 + bn^2 + an^2$

$\underbrace{(am^2 + bm^2)}_{\substack{\text{Both have } m^2 \text{ as} \\ \text{common factor}}} + \underbrace{(bn^2 + an^2)}_{\substack{\text{Both have } n^2 \text{ as} \\ \text{common factor}}}$

$= m^2(a + b) + n^2(a + b)$

Taking $(a + b)$ common,

$= (a + b)(m^2 + n^2)$

(v) $(lm + l) + m + 1$

$(lm + l) + m + 1$

Taking l common,

$= l(m + 1) + 1(m + 1)$

Taking $(m + 1)$ common,

$= (m + 1)(l + 1)$

(vi) $y(y + z) + 9(y + z)$

$y(y + z) + 9(y + z)$

Taking $(y + z)$ common,

$= (y + z)(y + 9)$

(vii) $5y^2 - 20y - 8z + 2yz$

$5y^2 - 20y - 8z + 2yz$

$= \underbrace{(5y^2 - 20y)}_{\substack{\text{Both have 5 only } y \\ \text{as common factors}}} + \underbrace{(-8z + 2yz)}_{\substack{\text{Both have 2 only } z \\ \text{as common factors}}}$

$= 5y(y - 4) + 2z(-4 + y)$

$= 5y(y - 4) + 2z(y - 4)$

Taking $(y - 4)$ as common,

$= (y - 4)(5y + 2z)$

(viii) $10ab + 4a + 5b + 2$

$10ab + 4a + 5b + 2$

$\underbrace{(10ab + 4a)}_{\text{Both have 2 and as common factors}} + \underbrace{(5b + 2)}_{\text{Since nothing is common, we take 1 common}}$

$= 2a(5b + 2) + 1(5b + 2)$

Taking $(5b + 2)$ as common,

$= (5b + 2)(2a + 1)$

(ix) $6xy - 4y + 6 - 9x$

$\underbrace{(6xy - 4y)}_{\text{Both have 2 and } y \text{ as common factors}} + \underbrace{(6 - 9x)}_{\text{Both have 3 as common factors}}$

$= 2y(3x - 2) + 3(2 - 3x)$

$= 2y(3x - 2) + 3 \times -1(3x - 2)\big(As\ (2 - 3x) = -1 \times (3x - 2)\big)$

$= 2y\ (3x - 2) - 3(3x - 2)$

Taking $(3x - 2)$ as common,

$= (3x - 2)(2y - 3)$

4. Factorise:

(i) $a^4 - b^4$

(ii) $p^4 - 81$

(iii) $x^4 - (y + z)^4$

(iv) $x^4 - (x - z)^4$

(v) $a^4 - 2a^2b^2 + b^4$

Solution:

(i) $a^4 - b^4$

$= (a^2)^2 - (b^2)^2$

Using $x^2 - y^2 = (x + y)(x - y)$ Here $x = a^2$ and $y = b^2$

$= (a^2 + b^2)(a^2 - b^2)$

Using $x^2 - y^2 = (x + y)(x - y)$ Here $x = a$ and $y = b$

$= (a^2 + b^2)(a + b)(a - b)$

$= (a - b)(a + b)(a^2 + b^2)$

(ii) $p^4 - 81$

$= (p^2)^2 - (9)^2$

Using $a^2 - b^2 = (a + b)(a - b)$
Here $a = p^2$ and $b = 9$

$= (p^2 + 9)(p^2 - 9)$

$= (p^2 + 9)(p^2 - 3^2)$

Again Using $a^2 - b^2 = (a + b)(a - b)$
Here $a = p$ and $b = 3$

$= (p^2 + 9)(p + 3)(p - 3)$

$= (p - 3)(p + 3)(p^2 + 9)$

(iii) $x^4 - (y + z)^4$

$= (x^2)^2 - ((y + z)^2)^2$

Using $a^2 - b^2 = (a + b)(a - b)$
Here $a = x^2$ and $b = (y + z)^2$

$= [x^2 + (y + z)^2]\,[x^2 - (y + z)^2]$

Again Using $a^2 - b^2 =$ $(a + b)(a - b)$
Here $a = x$ and $b = (y + z)$

$= [x^2 + (y + z)^2]\big(x - (y + z)\big)\big(x + (y + z)\big)$

$= [x^2 + (y + z)^2](x - y - z)(x + y + z)$

(iv) $x^4 - (x - z)^4$

$= (x^2)^2 - [(x - z)^2]^2$

Using $a^2 - b^2 = (a + b)(a - b)$
Here $a = x^2$ and $b = (x - z)^2$

$= [x^2 + (x - z)^2]\,[x^2 - (x - z)^2]$

Again Using $a^2 - b^2 =$ $(a + b)(a - b)$

Here $a = x$ and $b = (x - z)$

$= [x^2 + (x - z)^2][x + (x - z)][x - (x - z)]$

$= [x^2 + (x - z)^2][x + x - z][x - x + z]$

$= [x^2 + (x - z)^2][2x - z][z]$

Using $(a - b)^2 = a^2 + b^2 - 2ab$

Here $a = x$ and $b = z$

$= [x^2 + (x^2 + z^2 - 2xz)][2x - z][z]$

$= [x^2 + x^2 + z^2 - 2xz][2x - z][z]$

$= [2x^2 + z^2 - 2xz][2x - z][z]$

$= z(2x - z)(2x^2 + z^2 - 2xz)$

(v) $a^4 - 2a^2b^2 + b^4$

$= (a^2)^2 - 2a^2b^2 + (b^2)^2$

$= (a^2)^2 + (b^2)^2 - 2(a^2 \times b^2)$

Using $(x - y)^2 = x^2 + y^2 - 2xy$

Here $x = a^2$ and $y = b^2$

$= (a^2 - b^2)^2$

Using $x^2 - y^2 = (x + y)(x - y)$

Here $x = a$ and $y = b$

$= [(a + b)(a - b)]^2$

$= (a + b)^2(a - b)^2$(Since $(ab)^m = a^m \times b^m$)

5. Factorise the following expressions:

(i) $p^2 + 6p + 8$

(ii) $q^2 - 10q + 21$

(iii) $p^2 + 6p - 16$

Solution:

(I) $p^2 + 6p + 8$

$= p^2 + 2p + 4p + 8$(here 6p can be written as 2p + 4p)

$= (p^2 + 2p) + (4p + 8)$

$= p(p + 2) + 4(p + 2)$

Taking $(p+2)$ common,

$= (p+2)(p+4)$

(ii) $q^2 - 10q + 21$

$= q^2 - 3q - 7q + 21$ (here -10q can be written as- 3q – 7q)

$= (q^2 - 3q) - (7q - 21)$

$= q(q-3) - 7(q-3)$

Taking $(q-3)$ common,

$= (q-3)(q-7)$

(iii) $p^2 + 6p - 16$

$= p^2 - 2p + 8p - 16$(here, 6p can be written as -2p + 8p)

$= (p^2 - 2p) + (8p - 16)$

$= p(p-2) + 8(p-2)$

Taking $(p-2)$ common

$= (p-2)(p+8)$

Exercise: 14.3

1. Carryout the following divisions.

(i) $28x^4 \div 56x$

(ii) $-36y^3 \div 9y^2$

(iii) $66pq^2r^3 \div 11qr^2$

(iv) $34x^3y^3z^3 \div 51xy^2z^3$

(v) $12a^8b^8 \div (-6a^6b^4)$

Solution:

(i) $28x^4 \div 56x$

$= \frac{28\,x^4}{56\,x}$

$= \frac{28}{56} \times \frac{x^4}{x}$

$= \frac{1}{2} \times x^{4-1} \left(\frac{a^m}{a^n} = a^{m-n}\right)$

$= \frac{1}{2} \times x^3$

$= \frac{1}{2}x^3$

(ii) $-36y^3 \div 9y^2$

$= \frac{-36y^3}{9y^2}$

$= \frac{-36}{9} \times \frac{y^3}{y^2}$

$= -4 \times y^{3-2} \left(\frac{a^m}{a^n} = a^{m-n}\right)$

$= -4y$

(iii) $66pq^2r^3 \div 11qr^2$

$= \frac{66pq^2r^3}{11qr^2}$

$= \frac{66}{11} \times p \times \frac{q^2}{q} \times \frac{r^3}{r^2}$

$= 6 \times p \times q^{2-1} \times r^{3-2} \left(\frac{a^m}{a^n} = a^{m-n}\right)$

$= 6 \times p \times q \times r$

$= 6pqr$

(iv) $34x^3y^3z^3 \div 51xy^2z^3$

$= \frac{34x^3y^3z^3}{51xy^2z^3}$

$= \frac{34}{51} \times \frac{x^3}{x} \times \frac{y^3}{y^2} \times \frac{z^3}{z^3}$

$= \frac{2}{3} \times x^{3-1} \times y^{3-2} \times z^{3-3} \left(\frac{a^m}{a^n} = a^{m-n}\right)$

$= \frac{2}{3} \times x^2 \times y \times z^0$

$= \frac{2}{3} \times x^2 \times y \times 1$

$= \frac{2}{3}x^2y$

(v) $12a^8b^8 \div (-6a^6b^4)$

$$= \frac{12a^8b^8}{-6a^6b^4}$$

$$= \frac{12}{-6} \times \frac{a^8}{a^6} \times \frac{b^8}{b^4}$$

$$= -2 \times a^{8-6} \times b^{8-4} \left(\frac{a^m}{a^n} = a^{m-n}\right)$$

$$= -2 \times a^2 \times b^4$$

$$= -2a^2b^4$$

2. (**Method 1:**) Separating each term

Divide the given polynomial by the given monomial.

(i) $(5x^2 - 6x) \div 3x$

Solution:

$5x^2 - 6x$

Taking x common,

$= x(5x - 6)$

$\Rightarrow \frac{5x^2-6x}{3x} = \frac{x(5x-6)}{3x}$

$$= \frac{x}{x} \times \frac{5x - 6}{3}$$

$$= \frac{5x - 6}{3}$$

(**Method 2:**) Cancelling the terms

Divide the given polynomial by the given monomial.

(i) $(5x^2 - 6x) \div 3x$

Solution:

$$\frac{5x^2 - 6x}{3x}$$

$$= \frac{5x^2}{3x} - \frac{6x}{3x}$$

$$= \left(\frac{5}{3} \times \frac{x^2}{x}\right) - \left(\frac{6}{3} \times \frac{x}{x}\right)$$

$$= \left(\frac{5}{3} \times x\right) - 2$$

$= \frac{5}{3}x - 2$

$= \frac{5x - (2 \times 3)}{3} = \frac{5x - 6}{3}$

(ii) (**Method 1:**)

Divide the given polynomial by the given monomial.

(ii) $(3y^8 - 4y^6 + 5y^4) \div y^4$

Solution:

$3y^8 - 4y^6 + 5y^4$

$= (3y^4 \times y^4) - (4y^2 \times y^4) + (5 \times y^4)$

Taking y^4 common

$= y^4(3y^4 - 4y^2 + 5)$

$\Rightarrow \frac{3y^8 - 4y^6 + 5y^4}{y^4}$

$= \frac{y^4(3y^4 - 4y^4 + 5)}{y^4}$

$= 3y^4 - 4y^2 + 5$

(**Method 2:**)

Divide the given polynomial by the given monomial.

(ii) $(3y^8 - 4y^6 + 5y^4) \div y^4$

Solution:

$\frac{3y^8 - 4y^6 + 5y^4}{y^4}$

$= \frac{3y^8}{y^4} - \frac{4y^6}{y^4} + \frac{5y^4}{y^4}$

$= 3 \times y^{8-4} - 4 \times y^{6-4} + 5 \times y^{4-4} \left(\frac{a^m}{a^n} = a^{m-n}\right)$

$= 3 \times y^4 - 4 \times y^2 + 5y^0$

$= 3y^4 - 4y^2 + 5(a^0 = 1)$

(iii) (**Method 1:**)

Divide the given polynomial by the given monomial.

$8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3) \div 4x^2y^2z^2$

Solution:

$8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3)$

$= 8(x \times x^2y^2z^2) + (y \times x^2y^2z^2) + (z \times x^2y^2z^2)$

Taking $x^2y^2z^2$ common

$= 8x^2y^2z^2(x + y + z)$

$\Rightarrow \frac{8(x^3y^2z^2+x^2y^3z^2+x^2y^2z^3)}{4x^2y^2z^2}$

$= \frac{8x^2y^2z^2(x + y + z)}{4x^2y^2z^2}$

$= \frac{8}{4} \times \frac{x^2y^2z^2}{x^2y^2z^2} \times (x + y + z)$

$= 2 \times (x + y + z)$

$= 2(x + y + z)$

(**Method 2:**)

Divide the given polynomial by the given monomial.

(iii) $8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3) \div 4x^2y^2z^2$

Solution:

$= \frac{8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3)}{4x^2y^2z^2}$

$= \frac{8x^3y^2z^2}{4x^2y^2z^2} + \frac{8x^2y^3z^2}{4x^2y^2z^2} + \frac{8x^2y^2z^3}{4x^2y^2z^2}$

$= 2x + 2y + 2z$

Taking 2 common

$= 2(x + y + z)$

(iv) (**Method 1:**)

Divide the given polynomial by the given monomial.

(iv) $(x^3 + 2x^2 + 3x) \div 2x$

Solution:

$x^3 + 2x^2 + 3x = (x^2 \times x) + (2x \times x) + (3 \times x)$

Taking x common,

$= x(x^2 + 2x + 3)$

$\Rightarrow \dfrac{x^3 + 2x^2 + 3x}{2x}$

$= \dfrac{x(x^2 + 2x + 3)}{2x}$

$= \dfrac{x}{x} \times \dfrac{x^2 + 2x + 3}{2}$

$= \dfrac{x^2 + 2x + 3}{2}$

$= \dfrac{1}{2}(x^2 + 2x + 3)$

(**Method 2:**)

Divide the given polynomial by the given monomial.

(iv) $(x^3 + 2x^2 + 3x) \div 2x$

Solution:

$\dfrac{x^2 + 2x + 3}{2x}$

$= \dfrac{x^3}{2x} + \dfrac{2x^2}{2x} + \dfrac{3x}{2x}$

$= \left(\dfrac{1}{2} \times \dfrac{x^3}{x}\right) + \left(\dfrac{2}{2} \times \dfrac{x^2}{x}\right) + \left(\dfrac{3}{2} \times \dfrac{x}{x}\right)$

$= \left(\dfrac{1}{2} \times x^2\right) + (1 \times x) + \left(\dfrac{3}{2} \times 1\right)$

$= \dfrac{1}{2}x^2 + x + \dfrac{3}{2}$

$= \dfrac{x^2 + 2x + 3}{2}$

$= \dfrac{1}{2}(x^2 + 2x + 3)$

(v) (**Method 1:**)

Divide the given polynomial by the given monomial.

$(p^3q^6 - p^6q^3) \div p^3q^3$

Solution:

$p^3q^6 - p^6q^3$

$= (p^3q^3 \times q^3) - (p^3q^3 \times p^3)$

Taking p^3q^3 common,

$= p^3q^3(q^3 - p^3)$

$\Rightarrow \dfrac{p^3q^6 - p^6q^3}{p^3q^3}$

$= \dfrac{p^3q^3(q^3 - p^3)}{p^3q^3}$

$= q^3 - p^3$

(**Method 2:**)

Divide the given polynomial by the given monomial.

(v) $(p^3q^6 - p^6q^3) \div p^3q^3$

Solution:

$\dfrac{p^3q^6 - p^6q^3}{p^3q^3}$

$= \dfrac{p^3q^6}{p^3q^3} - \dfrac{p^6q^3}{p^3q^3}$

$= \dfrac{q^6}{q^3} - \dfrac{p^6}{p^3}$

$= q^{6-3} - p^{6-3} \left(\dfrac{a^m}{a^n} = a^{m-n}\right)$

$= q^3 - p^3$

3. Work out the following divisions.

(i) $(10x - 25) \div 5$

Solution:

$10x - 25$

$= (5 \times 2)x - (5 \times 5)$

Taking 5 common,

$= 5(2x - 5)$

Dividing, $\frac{10x-25}{5}$

$=\dfrac{5(2x-5)}{5}$

$=(2x-5)$

(ii) $(10x-25)\div(2x-5)$

Solution:

$10x-25$

$=(5\times 2)x-(5\times 5)$

Taking 5 common,

$=5(2x-5)$

Dividing, $\frac{(10x-25)}{(2x-5)}$

$=\dfrac{5(2x-5)}{(2x-5)}$

$=5$

(iii) $10y(6y+21)\div 5(2y+7)$

Solution:

$10y(6y+21)$

$=10y[(3\times 2)y+(3\times 7)]$

Taking 3 common,

$=10y\times 3(2y+7)$

Dividing, $\frac{10y(6y+21)}{5(2y+7)}$

$=\dfrac{10y\times 3(2y+7)}{5\times(2y+7)}$

$=3\times\dfrac{10}{5}\times y\times\dfrac{(2y+7)}{(2y+7)}$

$=3\times 2\times y\times 1$

$=6y$

(iv) $9x^2y^2(3z-24)\div 27xy(z-8)$

Solution:

$9x^2y^2(3z - 24)$

$= 9x^2y^2 \times [3z - (3 \times 8)]$

Taking 3 common,

$= 9x^2y^2 \times 3(z - 8)$

$= 27x^2y^2(z - 8)$

Dividing, $\frac{9x^2y^2(3z-24)}{27xy(z-8)}$

$= \frac{27x^2y^2(z - 8)}{27xy(z - 8)}$

$= \frac{27}{27} \times \frac{x^2}{x} \times \frac{y^2}{y} \times \frac{(z - 8)}{(z - 8)}$

$= 1 \times x \times y \times 1 \left(\frac{a^m}{a^n} = a^{m-n}\right)$

$= xy$

(v) $96\, abc\, (3a - 12)(5b - 30) \div 144\, (a - 4)(b - 6)$

Solution:

$96\, abc\, (3a - 12)(5b - 30)$

$= 96\, abc\, \big(3a - (3 \times 4)\big)(5b - 30)$

Taking 3 common,

$= 96\, abc \times 3(a - 4)(5b - 30)$

$= 288\, abc\, (a - 4)(5b - 30)$

$= 288\, abc\, (a - 4)(5b - 5 \times 6)$

Taking 5 common,

$= 288\, abc(a - 4) \times 5(b - 6)$

$= 288 \times 5\, abc(a - 4)(b - 6)$

$= 1440\, abc\, (a - 4)(b - 6)$

Dividing,

$\frac{96\, abc\, (3a - 12)(5b - 30)}{144(a - 4)(b - 6)}$

$= \frac{1440\, abc\, (a - 4)(b - 6)}{144\, (a - 4)(b - 6)}$

$= \frac{1440}{144} \times abc \times \frac{(a-4)}{(a-4)} \times \frac{(b-6)}{(b-6)}$

$= 10 \times abc \times 1 \times 1$

$= 10\, abc$

4. Divide as directed

(i) $5(2x+1)(3x+5) \div (2x+1)$

Solution:

$5(2x+1)(3x+5) \div (2x+1)$

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

$= 5(3x+5)$

(ii) $26xy(x+5)(y-4) \div 13x(y-4)$

Solution:

$26xy(x+5)(y-4) \div 13x(y-4)$

$= \frac{26xy(x+5)(y-4)}{13x(y-4)}$

$= \frac{26y(x+5)}{13}$

$= \frac{26}{13} \times y(x+5)$

$= 2 \times y(x+5)$

$= 2y(x+5)$

(iii) $52pqr(p+q)(q+r)(r+p) \div 104pq(q+r)(r+p)$

Solution:

$52pqr(p+q)(q+r)(r+p) \div 104pq(q+r)(r+p)$

$= \frac{52pqr(p+q)(q+r)(r+p)}{104pq(q+r)(r+p)}$

$= \frac{52}{104} \times \frac{pqr}{pq} \times (p+q) \times \frac{(q+r)}{(q+r)} \times \frac{(r+p)}{(r+p)}$

$= \frac{1}{2} \times r \times (p+q) \times 1 \times 1$

$= \frac{1}{2} r(p+q)$

(iv) $20(y+4)(y^2+5y+3) \div 5(y+4)$

Solution:

$20(y+4)(y^2+5y+3) \div 5(y+4)$

$= \frac{20(y+4)(y^2+5y+3)}{5(y+4)}$

$\frac{20}{5} \times \frac{(y+4)}{(y+4)} \times (y^2+5y+3)$

$= 4 \times 1 \times (y^2+5y+3)$

$= 4(y^2+5y+3)$

(v) $x(x+1)(x+2)(x+3) \div x(x+1)$

Solution:

$x(x+1)(x+2)(x+3) \div x(x+1)$

$= \frac{x(x+1)(x+2)(x+3)}{x(x+1)}$

$= \frac{x}{x} \times \left(\frac{x+1}{x+1}\right) \times (x+2)(x+3)$

$= 1 \times 1 \times (x+2)(x+3)$

$= (x+2)(x+3)$

5. Factorise the expressions and divide them as directed.

(i) $(y^2+7y+10) \div (y+5)$

Solution:

$y^2+7y+10$

$= y^2+2y+5y+10$(here, the middle term can be split as7y = 2y + 5y)

$= (y^2+2y)+(5y+10)$

$= y(y+2)+5(y+2)$

Taking $(y+2)$ common,

$= (y+2)(y+5)$

Now, dividing

$(y^2 + 7y + 10) \div (y + 5)$

$= \dfrac{y^2 + 7y + 10}{(y + 5)}$

$= \dfrac{(y + 2)(y + 5)}{(y + 5)}$

$= (y + 2) \times \dfrac{(y + 5)}{(y + 5)}$

$= (y + 2)$

Hint: To split the middle term

We need to find two numbers whose

Sum $= 7$

Product $= 10$

	Sum	**Product**
1 and 10	11	10
2 and 5	7	10

So, we write $7y = 2y + 5y$

(ii) $(m^2 - 14m - 32) \div (m + 2)$

Solution:

$m^2 - 14m - 32$

$= m^2 + 2m - 16m - 32$(here, the middle term can be split as $-14m = 2m - 16m$)

$= (m^2 + 2m) - (16m + 32)$

$= m(m + 2) - 16(m + 2)$

Taking $(m + 2)$ common,

$= (m + 2)(m - 16)$

Now, dividing

$(m^2 - 14m - 32) \div (m + 2)$

$= \dfrac{m^2 - 14m - 32}{(m + 2)}$

$= \dfrac{(m + 2)(m - 16)}{(m + 2)}$

$= \frac{(m+2)}{(m+2)} \times (m-16)$

$= (m-16)$

Hint: To split the middle term

We need to find two numbers whose

Sum $= -14$

Product $= -32$

	Sum	Product
1 and -32	-31	-32
2 and -16	-14	-32

So, we write $-14m = 2m - 16m$

(iii) $(5p^2 - 25p + 20) \div (p-1)$

Solution:

$5p^2 - 25p + 20$

Taking 5 common,

$= 5(p^2 - 5p + 4)$

$= 5(p^2 - p - 4p + 4)$(here, the middle term can be split as- 5p = - p – 4p)

$= 5[(p^2 - p) - (4p - 4)]$

$5[p(p-1) - 4(p-1)]$

Taking $(p-1)$ common,

$= 5(p-1)(p-4)$

Now, dividing

$(5p^2 - 25p + 20) \div (p+1)$

$= \frac{5p^2 - 25p + 20}{(p-1)}$

$= \frac{5(p-1)(p-4)}{(p-1)}$

$= 5 \times \frac{(p-1)}{(p-1)} \times (p-4)$

$= 5(p-4)$

Hint: To split the middle term

We need to find two numbers whose

Sum $= -5$

Product $= 4$

	Sum	Product
-1 and -4	-5	4

So, we write $-5p = -p - 4p$

(iv) $4yz(z^2 + 6z - 16) \div 2y(z + 8)$

Solution:

$4yz(z^2 + 6z - 16)$

$= 4yz(z^2 - 2z + 8z - 16)$(here, the middle term can be split as6z = - 2z + 8z)

$= 4yz[(z^2 - 2z) + (8z - 16)]$

$= 4yz[z(z - 2) + 8(z - 2)]$

Taking $(z - 2)$ common,

$= 4yz(z - 2)(z + 8)$

Now, dividing

$4yz(z^2 + 6z - 16) \div 2y(z + 8)$

$= \frac{4yz(z - 2)(z + 8)}{2y(z + 8)}$

$= \frac{4}{2} \times \frac{y}{y} \times z \times (z - 2) \times \frac{(z + 8)}{(z + 8)}$

$= 2 \times z \times (z - 2)$

$= 2z(z - 2)$

Hint: To split the middle term

We need to find two numbers whose

Sum $= 6$

Product $= -16$

	Sum	Product
-1 and 16	15	-16
-2 and 8	-15	-16

-2 and 8	6	-16

So, we write $6z = -2z + 8z$

(v) $5pq(p^2 - q^2) \div 2p(p+q)$

Solution:

$5pq(p^2 - q^2)$

Using $a^2 - b^2 = (a+b)(a-b)$

Here $a = p$ and $b = q$

$= 5pq(p+q)(p-q)$

Now, dividing

$5pq(p^2 - q^2) \div 2p(p+q)$

$$= \frac{5pq(p^2 - q^2)}{2p(p+q)}$$

$$= \frac{5pq(p+q)(p-q)}{2p(p+q)}$$

$$= \frac{5}{2} \times \frac{p}{p} \times q \times \frac{(p+q)}{(p+q)} \times (p-q)$$

$$= \frac{5}{2} \times q \times (p-q)$$

$$= \frac{5}{2} q(p-q)$$

(vi) $12xy(9x^2 - 16y^2) \div 4xy(3x+4y)$

Solution:

$12xy(9x^2 - 16y^2)$

$= 12xy[(3x)^2 - (4y)^2]$

Using $a^2 - b^2 = (a+b)(a-b)$

Here $a = 3x$ and $b = 4y$

$= 12xy(3x+4y)(3x-4y)$

Now, dividing

$12xy(9x^2 - 16y^2) \div 4xy(3x+4y)$

$$= \frac{12xy(9x^2 - 16y^2)}{4xy(3x+4y)}$$

$= \frac{12xy(3x+4y)(3x-4y)}{4xy(3x+4y)}$

$= \frac{12}{4} \times \frac{xy}{xy} \times \frac{(3x+4y)}{(3x+4y)} \times (3x-4y)$

$= 3(3x-4y)$

(vii) $39y^3(50y^2-98) \div 26y^2(5y+7)$

Solution:

$39y^3(50y^2-98)$

$= 39y^3(2 \times 25y^2 - 2 \times 49)$

Taking 2 common,

$= 39y^3 \times 2(25y^2-49)$

$= 78y^3(25y^2-49)$

$= 78y^3[(5y)^2-(7)^2]$

Using $a^2 - b^2 = (a+b)(a-b)$

Here $a = 5y$ and $b = 7$

$= 78y^3(5y-7)(5y+7)$

Now, dividing

$39y^3(50y^2-98) \div 26y^2(5y+7)$

$= \frac{39y^3(50y^2-98)}{26y^2(5y+7)}$

$= \frac{78y^3(5y+7)(5y-7)}{26y^2(5y+7)}$

$= \frac{78}{26} \times \frac{y^3}{y^2} \times \frac{(5y+7)}{(5y+7)} \times (5y-7)$

$= 3 \times y \times (5y-7)$

$= 3y(5y-7)$

CBSE NCERT Solutions for Class 8 Mathematics Chapter 15

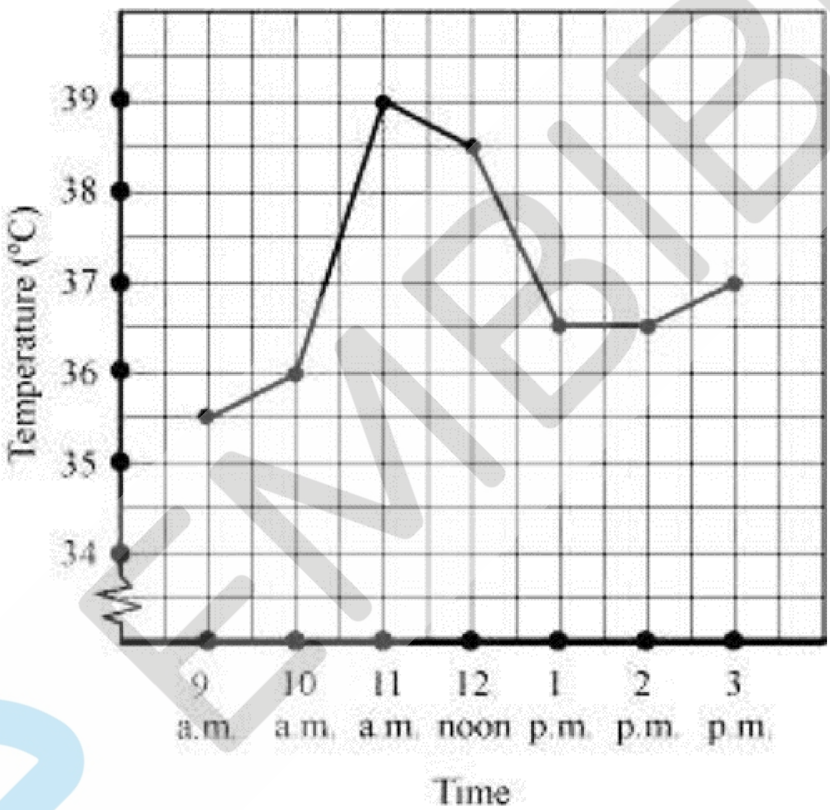
Back of Chapter Questions

Exercise 15.1

1. The following graph shows the temperature of a patient in a hospital, recorded every hour.

(a) What was the patient's temperature at 1 p.m.?

(b) When was the patient's temperature 38.5° C?



(c) The patient's temperature was the same two times during the period given. What were these two times?

(d) What was the temperature at 1.30 p.m.? How did you arrive at your answer?

(e) During which periods did the patients' temperature showed an upward trend?

Solution:

(a) From the given graph,

we can observe that at 1 p.m., the patient's temperature was 36.5^0C.

(b) From the given graph,

we can observe that the patient's temperature was 38.5^{0}C at 12 noon.

(c) From the given graph,

we can observe that the patient's temperature was same at 1 p.m. and 2 p.m.

(d) From the given graph,

we can see that the graph during the time 1 p.m. and 2 p.m. is parallel to x-axis which means the temperature is constant during 1 p.m. to 2 p.m.

The temperature at 1 p.m. and 2 p.m. is 36.5^{o}C.

So, the temperature at 1: 30 p.m. is also 36.5^{o}C.

(e) From the given graph. We can infer that during the following periods, the patient's temperature showed an upward trend.

9 a.m. to 10 a.m., 10 a.m. to 11 a.m., 2 p.m. to 3 p.m.

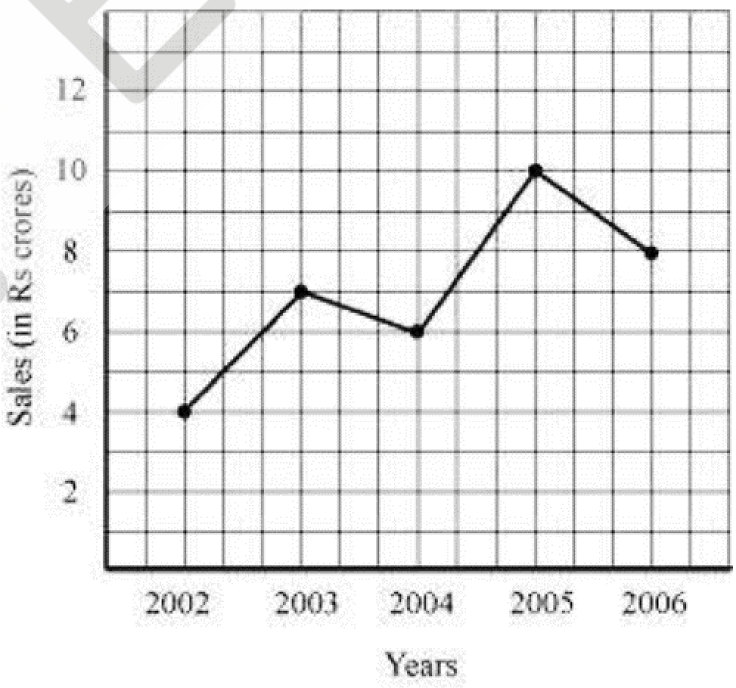
2. The following line graph shows the yearly sales figures for a manufacturing company.

(a) What were the sales in (i) 2002 (ii) 2006?

(b) What were the sales in (i) 2003 (ii) 2005?

(c) Compute the difference between the sales in 2002 and 2006.

(d) In which year was there the greatest difference between the sales as compared to its previous year?



Solution:

(a) From the given figure,

(i) In 2002, the sales were ₹4 crores.

(ii) In 2006, the sales were ₹8 crores.

(b) From the given figure,

(i) In 2003, the sales were ₹7 crores.

(ii) In 2005, the sales were ₹10 crores.

(c) From the given figure, we can observe

In 2002, the sales were ₹4 crores.

In 2006, the sales were ₹8 crores.

Difference between the sales in 2002 and 2006 $=$ ₹ $(8-4)$ crores.

$=$ ₹ 4 crores.

Hence, the difference between the sales in 2002 and 2006 is ₹4 crores

(d) From the figure,

In 2002, the sales were ₹4 crores.

In 2003, the sales were ₹7 crores.

In 2004, the sales were ₹6 crores.

In 2005, the sales were ₹10 crores

In 2006, the sales were ₹8 crores.

∴ Difference between the sales of the year $2006\ and\ 2005 =$ ₹$(10-8)$crores $= 2$ crores

Difference between the sales of the year $2005\ and\ 2004 =$ ₹$(10-6)$ crores $= 4$ crores.

Difference between the sales of the year $2004\ and\ 2003 =$ ₹$(7-6)$crores $= 1$ crore.

Difference between the sales of the year $2003\ and\ 2002 =$ ₹$(7-4)$crores $= 3$ crores.

Hence, the greatest difference was maximum in year 2005 as compared to its previous year 2004.

3. For an experiment in Botany, two different plants, plant A and plant B were grown under similar laboratory conditions. Their heights were measured at the end of each week for 3 weeks. The results are shown by the following graph.

(a) How high was Plant A after (i) 2 weeks (ii) 3 weeks?

(b) How high was Plant B after (i) 2 weeks (ii) 3 weeks?

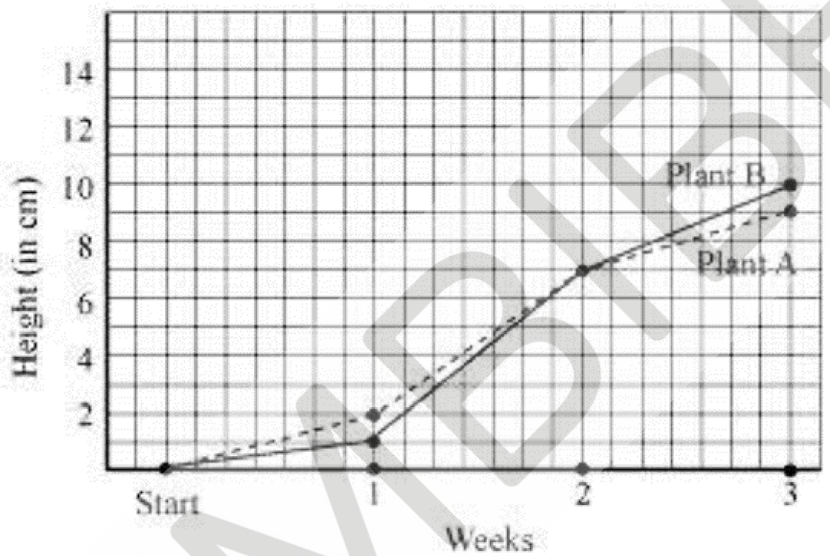
(c) How much did Plant A grow during the 3rd week?

(d) How much did Plant B grow from the end of the 2nd week to the end of the 3rd week?

(e) During which week did Plant A grow most?

(f) During which week did Plant B grow least?

(g) Were the two plants of the same height during any week shown here? Specify.



Solution:

(a)

(i) We can observe from the given graph that the height of plant A was 7 cm after 2 weeks.

(ii) We can observe from the given graph that the height of plant A was 9 cm after 3 weeks.

(b)

(i) We can observe from the given graph that the height of plant B was 7 cm after 2 weeks.

(ii) We can observe from the given graph that the height of plant B was 10 cm after 3 weeks.

(c) From the given figure,

Height of plant A after 2 weeks = 7 cm.

Height of plant A after 3 weeks = 9 cm.

∴ Growth of plant A during 3rd week = 9 − 7 cm = 2 cm.

Hence, plant A grew 2 cm during 3rd week

(d) From the given figure,

Height of plant B after 2 weeks = 7 cm.

Height of plant B after 3 weeks = 10 cm.

∴ Growth of plant B from the end of the 2nd week to the end of the 3rd week

$= 10 - 7$ cm

= 3 cm.

Hence, plant B grew 3 cm from the end of the 2nd week to the end of the 3rd week

(e) From the given figure,

Growth of plant A during 1st week = $2 - 0$ cm

= 2 cm

Growth of plant A during 2nd week = $7 - 2$ cm

= 5 cm.

Growth of plant A during 3rd week = $9 - 7$ cm

= 2 cm.

Thus, growth of plant A is maximum in 2nd week.

(f) From the given figure,

Growth of plant B during 1st week = $1 - 0$ cm

= 1 cm

Growth of plant B during 2nd week = $7 - 1$ cm

= 6 cm.

Growth of plant B during 3rd week = $10 - 7$ cm

= 3 cm.

Thus, growth of plant B is least in 1st week.

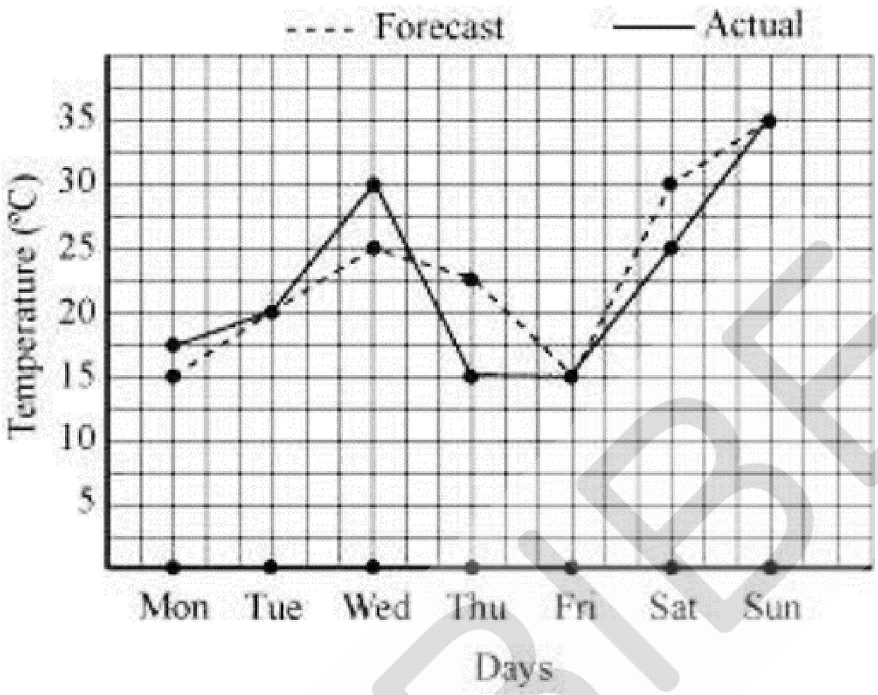
4. The following graph shows the temperature forecast and the actual temperature for each day of a week.

(a) On which days was the forecast temperature the same as the actual temperature?

(b) What was the maximum forecast temperature during the week?

(c) What was the minimum actual temperature during the week?

(d) On which day did the actual temperature differ the most from the forecast temperature?



Solution:

(a) From the given graph, we can observe that the forecast temperature is same as actual temperature on Tuesday, Friday and Sunday.

(b) We can observe from the given graph that maximum forecast temperature during the week is $35^{\circ}C$.

(c) We can observe from the given graph that minimum actual temperature during the week is $15^{\circ}C$.

(d) We can observe from the given graph that the actual temperature differs the most from the forecast temperature on Thursday which is $25^{\circ}C - 15^{\circ}C = 10^{\circ}C$

5. Use the tables below to draw linear graphs.

(a) The number of days a hill side city received snow in different years.

years	2003	2004	2005	2006
Days	8	10	5	12

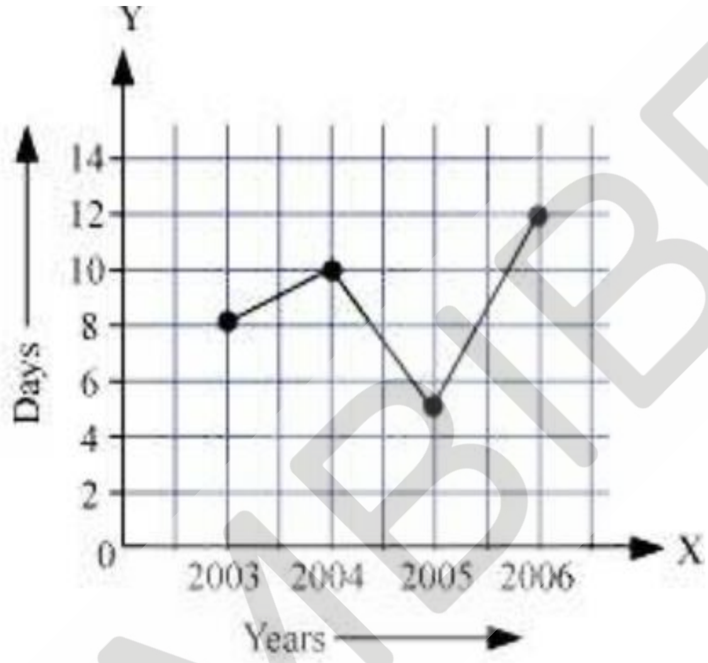
(b) Population (in thousands) of men and women in a village in different years.

Year	2003	2004	2005	2006	2007
Number of Men	12	12.5	13	13.2	13.5
Number of Women	11.3	11.9	13	13.6	12.8

Solution:

(a) Let us consider graph with scale of x-axis, 2 units = 1 year and for y-axis, 1 unit = 2 days.

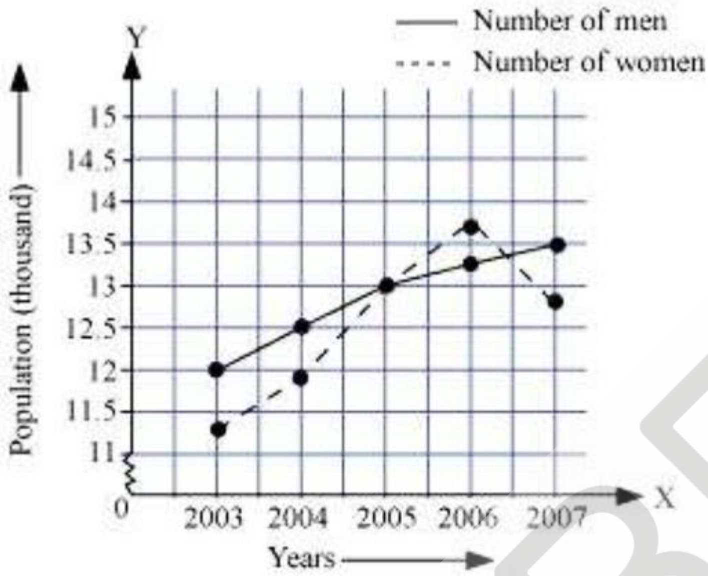
We can represent the years on x-axis and number of days on y-axis. The graph of the given data is given as below:



Hence, as per given information the linear graph is drawn as above.

(b) Let us consider graph with scale of x-axis, 2 unit = 1 year and for y-axis, 1 unit = 0.5 thousand.

We can represent the years on x-axis and population on y-axis. The graph of the given data is as follows



Hence, as per given information the linear graph is drawn as above.

6. A courier-person cycles from a town to a neighboring suburban area to deliver a parcel to a merchant. His distance from the town at different times is shown by the following graph.

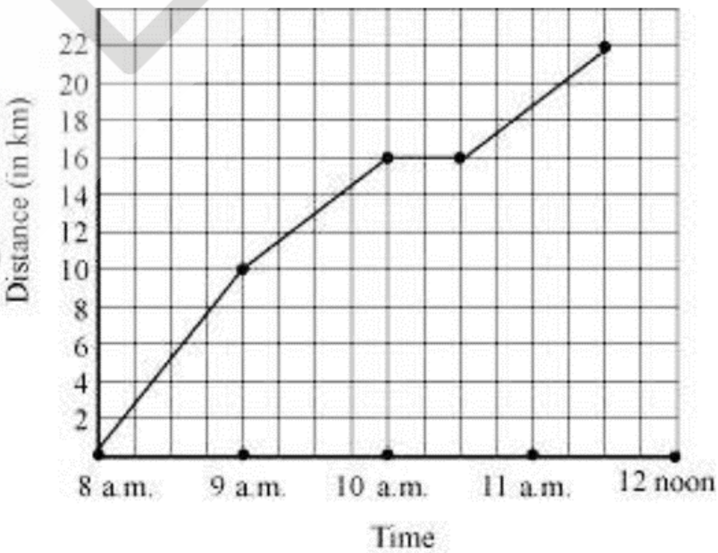
(a) What is the scale taken for the time axis?

(b) How much time did the person take for the travel?

(c) How far is the place of the merchant from the town?

(d) Did the person stop on his way? Explain.

(e) During which period did he ride fastest?



Solution:

(a) Scale taken for the time axis is 4 units= $9 - 8 = 10 - 9 = 11 - 10 = 1$ hour

Hence, the scale taken for the time x-axis is 1 hour= 4 units.

(b) He travelled from 8 a.m. to $11:30$ a. m.

Hence, the courier-person took 3.5 hours to travel.

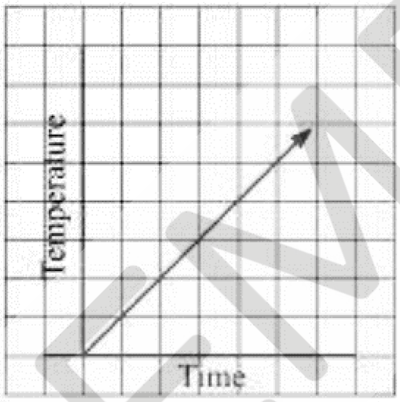
(c) We can observe from the graph that the merchant's place is 22 km far from the town.

(d) The graph is parallel to x-axis from 10 a.m. to $10:30$ a.m. which means the person did not travel any distance during this time period.

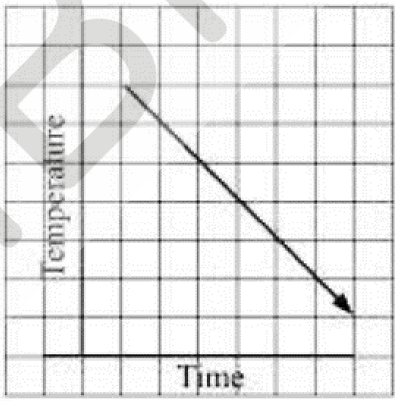
Hence, the person stopped on his way from 10 a.m. to $10:30$ a.m.

(e) From the given graph, we can observe that he rides fastest during 8 a.m. to 9 a.m.

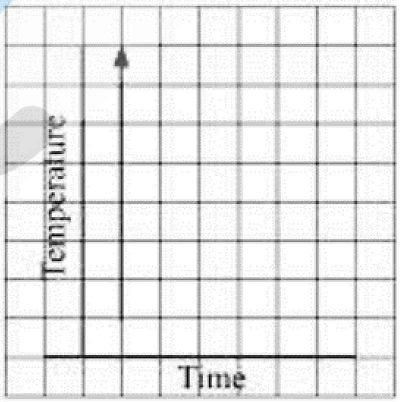
7. Can there be a time-temperature graph as follows? Justify your answer.



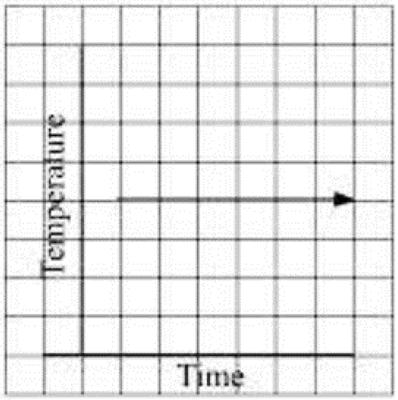
(i)



(ii)



(iii)



(iv)

Solution:

i. From the given figure, we can observe that it is a time –temperature graph.

Hence, we can infer that as the time increases, temperature also increases.

ii. From the given figure, we can observe that it is a time –temperature graph.

Hence, we can infer that as the time increases, temperature decreases.

iii. From the given graph, it shows different temperatures at the same time which is not possible.

Hence, this is not a valid time-temperature graph.

iv. From the given figure, this can be a time-temperature graph.

Hence, as the temperature increases, time remains constant which is possible.

EXERCISE 15.2

1. Plot the following points on a graph sheet. Verify if they lie on a line

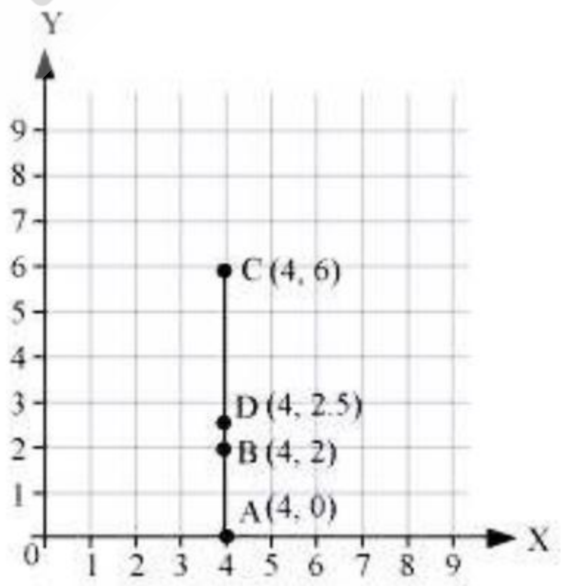
(a) $A(4, 0), B(4, 2), C(4, 6), D(4, 2.5)$

(b) $P(1, 1), Q(2, 2), R(3, 3), S(4, 4)$

(c) $K(2, 3), L(5, 3), M(5, 5), N(2, 5)$

Solution:

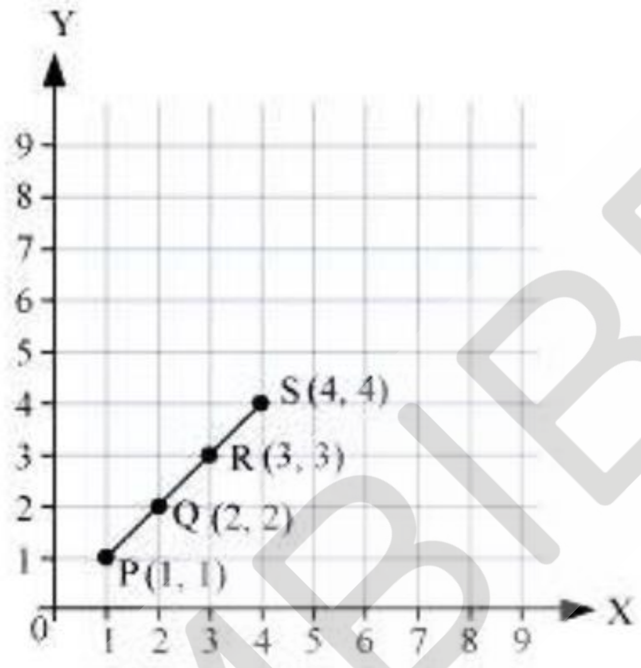
(a) The given points can be plotted as below:



From the above graph, it can be observed from the graph that the given points lie on the same line.

Hence, it is verified that the given points lie on same line.

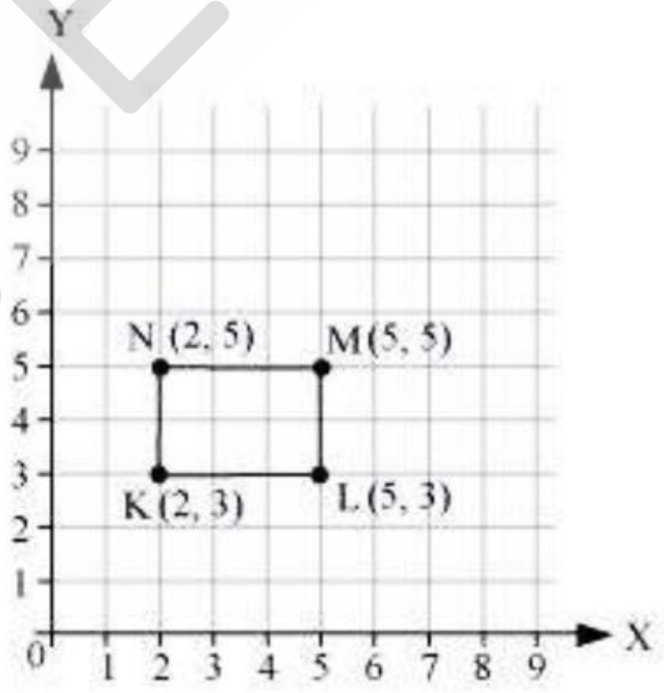
(b) The given points can be plotted as below:



From the above graph, it can be observed from the graph that the given points lie on the same line.

Hence, it is verified that the given points lie on same line.

(c) The given points can be plotted as below:



From the above graph, it can be observed from the graph that the given points do not lie on the same line.

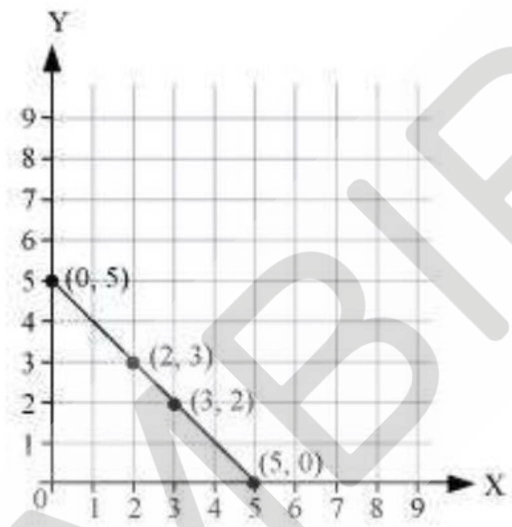
Hence, it is verified that the given points do not lie on same line.

2. Draw the line passing through $(2, 3)$ and $(3, 2)$. Find the coordinates of the points at which this line meets the x- axis and y-axis.

Solution:

Let us draw the graph and locate the points $(2, 3)$ and $(3, 2)$.

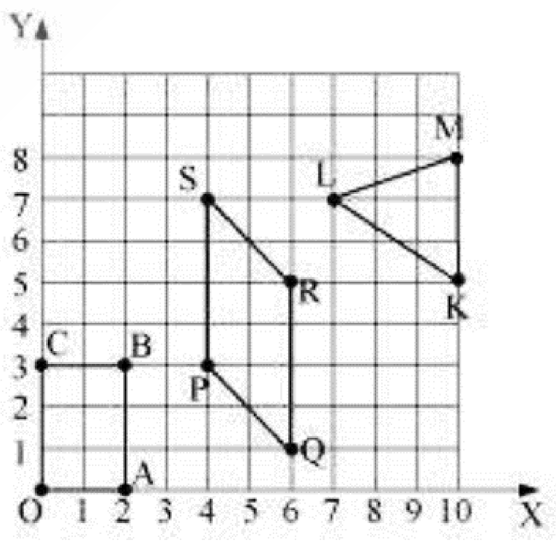
Now, extend the line which meets towards x- axis and y-axis.



We can observe from the graph, that the line passing through $(2, 3)$ and $(3, 2)$ meets the x-axis at $(5, 0)$ and the y-axis at $(0, 5)$.

Therefore, $(5, 0)$ and $(0, 5)$ are the required coordinates of the points at which the line meets the x- axis and y-axis.

3. Write the coordinates of the vertices of each of these adjoining figures.



Solution:

From the given graph,

The coordinates of the vertices are:

(i) O is at origin

Hence, the coordinates of O are $(0, 0)$.

(ii) A is at distance of 2 units from origin along x-axis and 0 units along y-axis.

Hence, the coordinates of A are $(2, 0)$.

(iii) B is at distance of 2 units along x-axis and 3 units along y-axis.

Hence, the coordinates of B are $(2, 3)$.

(iv) C is at distance of 0 units along x-axis and 3 units along y-axis.

Hence, the coordinates of C are (0,3)

(iv) P is at distance of 4 units along x-axis and 3 units along y-axis.

Hence, the coordinates of P are $(4, 3)$

(v) Q is at distance of 6 units along x-axis and 1 unit along y −axis.

Hence, the coordinates of Q are $(6, 1)$

(vi) R is at distance of 6 units along x-axis and 5 units along y-axis.

Hence, the coordinates of R are $(6, 5)$

(vii) S is at distance of 4 units along x-axis and 7 units along y-axis.

Hence, the coordinates of S are $(4, 7)$

(viii) K is at distance of 2 units along x-axis and 3 units along y-axis.

Hence, the coordinates of K are $(10, 5)$

(ix) L is at distance of 7 units along x-axis and 7 units along y-axis.

Hence, the coordinates of L are L $(7, 7)$

(x) M is at distance of 10 units along x-axis and 8 units along y-axis.

Hence, the coordinates of M are $(10, 8)$

Therefore, the coordinate points of the adjoining figures are given as above.

4. State whether True or False. Correct that are false

(i) A point whose x coordinate is zero and y-coordinate is non-zero will lie on the y-axis.

(ii) A point whose y coordinate is zero and x-coordinate is 5 will lie on y-axis.

(iii) The coordinates of the origin are $(0, 0)$.

Solution:

(i) True

As x coordinate is zero and y-coordinate is non-zero, point can be represented as $(0, y)$ which lies on y axis.

(ii) False

As y- coordinate is zero and x-coordinate is non-zero, point can be represented as $(x, 0)$ which lies on x axis.

(iii) True

EXERCISE 15.3

1. Draw the graphs of the following tables of values, with suitable scales on the axes.

(a) Cost of apples

Number of apples	1	2	3	4	5
Cost (in ₹)	5	10	15	20	25

(b) Distance travelled by a car

Time (in hours)	6 a.m.	7 a.m.	8 a.m.	9 a.m.
Distance (in km)	40	80	120	160

(i) How much distance did the car cover during the period 7.30 a.m. to 8 a.m.?

(ii) What was the time when the car had covered a distance of 100 km since its start?

(c) Interest on deposits for a year.

Deposit (in ₹)	1000	2000	3000	4000	5000
Simple Interest (in ₹)	80	160	240	320	400

(i) Does the graph pass through the origin?

(ii) Use the graph to find the interest on ₹ 2500 for a year.

(iii) To get an interest of ₹ 280 per year, how much money should be deposited?

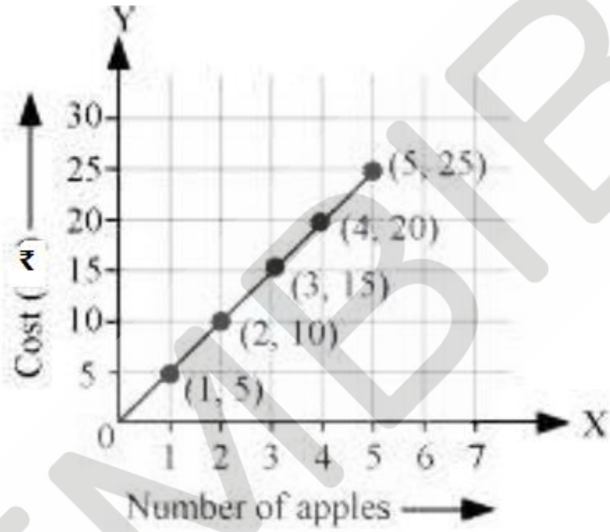
Solution:

(a) Let us draw the graph by taking number of apples on x-axis and cost in rupees on y-axis.

Now, for a suitable scale,

We take x-axis as 1 unit = 1 apple and y-axis as 1 unit = ₹ 5

From the given data, the graph is as follows



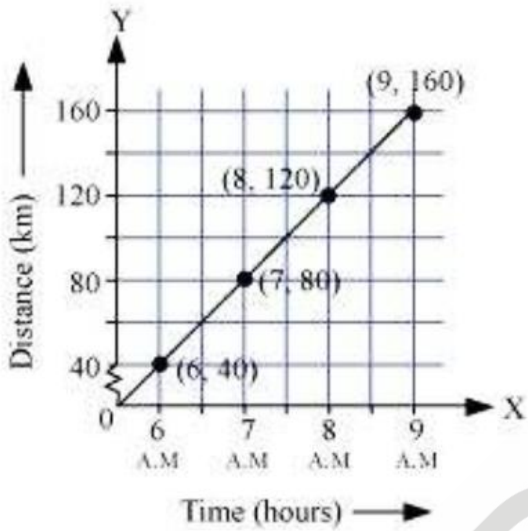
Hence, the above figure is the required graph.

(b) Let us draw the graph by taking Time (in hours) on x-axis and Distance (in km) on y-axis.

Now, for a suitable scale,

We take x-axis as 2 units = 1 hour and y-axis as 2 units = 40 kms

From the given data, the graph follows as below:



(i) We can observe from the above graph that the car covered a distance of 20 km during 7: 30 a.m. to 8 a.m.

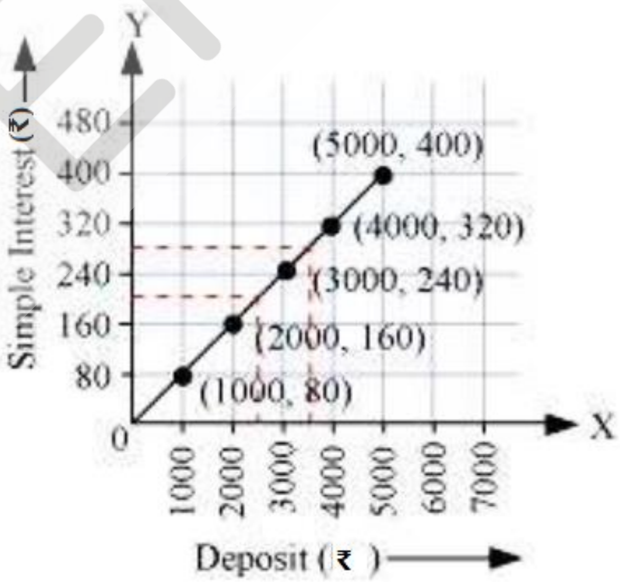
(ii) From the above graph, at 7: 30 a.m. the car covered a distance of 100 km.

(c) Let us draw the graph by taking Deposit (₹) on x-axis and Simple interest (₹) on y-axis.

Now, for a suitable scale,

We take x-axis as 1 unit = ₹1000 and y-axis as 1 unit = ₹80

From the given data, the graph follows as below:



We can observe the following points from the graph

(i) Yes, the graph passes through the origin $(0, 0)$.

(ii) The interest earned in a year on a deposit of ₹2500 is ₹200.

(iii) To get an interest of ₹ 280 per year, ₹ 3500 must be deposited.

2. Draw a graph for the following.

(i)

Side of square (in cm)	2	3	3.5	5	6
Perimeter (in cm)	8	12	14	20	24

Is it a linear graph?

(ii)

Side of square (in cm)	2	3	4	5	6
Area (in cm^2)	4	9	16	25	36

Is it a linear graph?

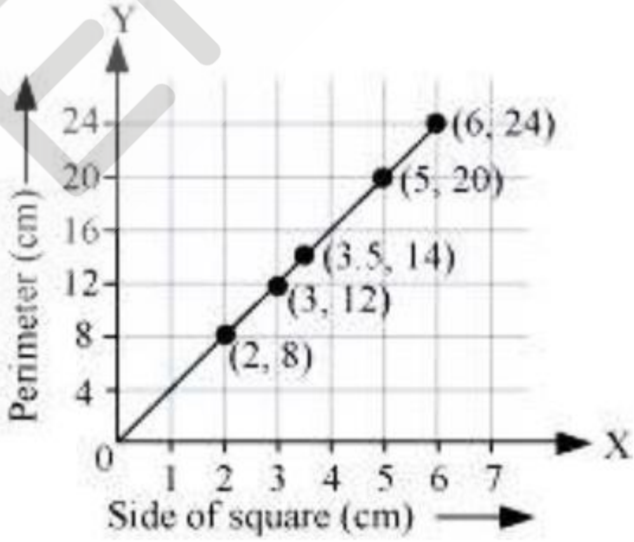
Solution:

(i) Let us draw the graph by taking side of a square (cm) on x-axis and perimeter (cm) on y-axis.

Now, for a suitable scale,

We take x-axis as 1 unit = 1 cm and y-axis as 1 unit= 4 cm.

From the given data, the graph follows as below:



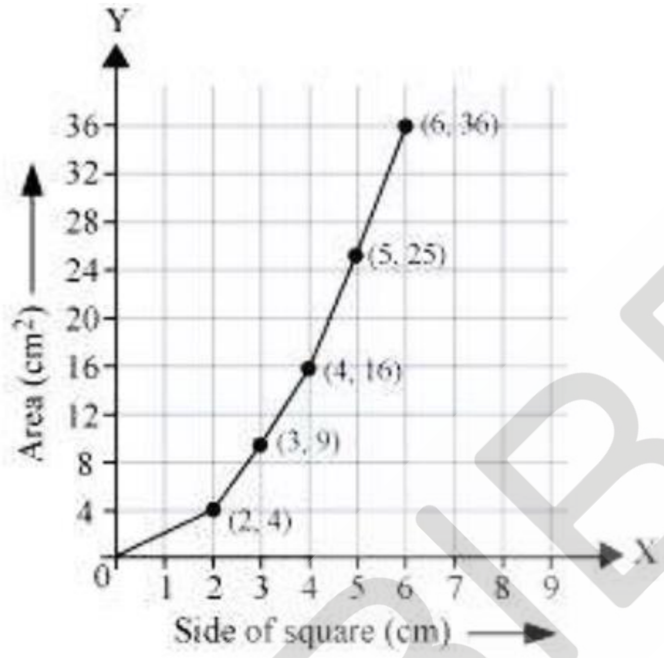
Hence, it is a linear graph.

(ii) Let us draw the graph by taking side of a square (cm) on x-axis and area (cm^2) on y-axis.

Now, for a suitable scale,

We take x-axis as 1 unit $=$ 1 cm and y-axis as 1 unit $=$ 4 cm^2.

From the given data, the graph follows as below:



Hence, it is not a linear graph.

CBSE NCERT Solutions for Class 8 Mathematics Chapter 16

Back of Chapter Questions

EXERCISE 16.1

1. Find the values of the letters in each of the following and give reasons for the steps involved

1\. 3 A

$+ 2\ 5$

B 2

Solution:

We can see that addition of A and 5 is 2 which means addition of A and 5 is a number whose one's digit is 2. This is possible when A is 7. In that case, the addition of A and 5 will give 12. Thus, we get a carry 1 for the next step.

In next step,

$1 + 3 + 2 = 6$

Therefore, the addition is as follows,

3 7

$+ 2\ 5$

----

6 2

Hence, the values of A and B are 7 and 6 respectively.

2. 4 A

$+ 9\ 8$

C B 3

Solution:

We can see that addition of A and 8 is 3 which means addition of A and 8 is a number whose one's digit is 3. This is possible when A is 5. In that case, the addition of A and 8 will give 13. Thus, we get a carry 1 for the next step.

In next step,

$1 + 4 + 9 = 14$

Therefore, the addition is as follows,

4 5

+ 9 8

----

1 4 3

Hence, the values of A, B and C are 5, 4 and 1 respectively.

3. 1 A

× A

----

9 A

Solution:

We can see that multiplication of A and A is a number whose one's digit is A again.

So, the possible values of A are 0, 1, 5, 6

If $A = 0$, then the product will be zero. Therefore, this value of A is not possible.

If $A = 1$, then $A \times A = 1 \times 1 = 1$

In next step,

$1 \times A = 9$

But, 1×1 is not equal to 9.

So, A cannot be 1

If $A = 5$, then $A \times A = 5 \times 5 = 25$ and 2 will be a carry for next step.

In next step,

$1 \times A + 2 = 9$

Which gives $A = 7$ which is not possible as we have already assumed A as 5

So, A cannot be 5.

If $A = 6$, then $A \times A = 6 \times 6 = 36$ and 3 will be a carry for next step.

In next step,

$1 \times A + 3 = 9$

Which gives $A = 6$.

Hence, the possible value of A is 6.

4. A B

+ 3 7

----

6 A

Solution:

The addition of A and 3 is 6. There can be 2 cases.

Case 1

When first step is not producing a carry.

In this case, A should be equal to 3 as $3 + 3 = 6$. Consider the first step in which addition of B and 7 is A, B should be a number such that unit digit of addition of B and 7 is 3. It is possible only when $B = 6$. But when $B = 6$, first step is producing 1 as a carry. So, A cannot be equal to 3.

Case 2:

When first step is producing a carry.

In this case, A should be equal to 2 as $1 + 2 + 3 = 6$. Consider the first step in which addition of B and 7 is A, B should be a number such that unit digit of addition of B and 7 is 2. It is possible only when $B = 5$.

So, the addition is as follows:

2 5

+ 3 7

----

6 2

Hence, the values of A and B are 2 and 5 respectively.

5. A B

× 3

C A B

Solution:

We can see that multiplication of B and 3 is a number whose one's digit is B again.

So, the possible values of B are 0 & 5

If $B = 5$, then $B \times 3 = 5 \times 3$.

$B \times 3 = 15$

1 will be a carry for next step.

In next step,

$3A + 1 = CA$.

This is not possible for any value of A.

Hence, B must be 0 only.

If $B = 0$, then $0 \times 3 = 0$

In next step,

$3A = CA$

i.e., the ones digit of $3 \times A$ should be A.

It is possible only when A is 0 or 5.

But A cannot be equal to 0 and AB is a two-digit number.

Therefore, A must be 5 only. The multiplication is as follows.

5 0

$\times$ 3

----

1 5 0

Hence, the values of A, B and C are 5, 0 and 1 respectively.

6. A B

$\times$ 5

C A B

Solution:

We can see that the multiplication of B and 5 is a number whose one's digit is B again. So, the possible values of B are 0 and 5.

If $B = 5$, then $B \times 5 = 5 \times 5$

$B \times 5 = 25$

2 will be a carry for next step.

In next step,

$5A + 2 = CA$.

Hence the possible values of A are 2 or 7. The multiplication is as follows:

2 5 7 5

× 5 × 5

--------- ---------

1 2 5 3 7 5

--------- ---------

If $B = 0$, then $B \times 5 = 0 \times 5$

$B \times 5 = 0$

In next step, $5 \times A = CA$

Hence, the possible values of A are 0 and 5.

But, A cannot be equal to 0 as AB is a two-digit number.

Hence, A can be 5 only.

The multiplication is as follows:

5 0

× 5

----

2 5 0

Hence, there are three possible values of A, B and C

(i) 5, 0 and 2 respectively.

(ii) 2, 5 and 1 respectively

(iii) 7, 5 and 3 respectively

7. A B

× 6

B B B

Solution:

We can see that multiplication 6 and B is a number whose ones digit is B again. So, the possible values of B are $0, 2, 4, 6$ & 8.

If $B = 0$, then the product will be 0. Therefore, this value of B is not possible.

If $B = 2$, then $B \times 6 = 12$ and 1 will be a carry for the next step.

In next step,

$6A + 1 = BB$

$6A + 1 = 22$

$6A = 21$

Hence, any integer value of A is not possible. So B cannot be 2.

If $B = 6$, then $B \times 6 = 36$ and 3 will be a carry for the next step.

In next step,

$6A + 3 = BB$

$6A + 3 = 66$

$6A = 63$

Hence, any integer value of A is not possible. So B cannot be 6.

If $B = 8$, then $B \times 6 = 48$ and 4 will be a carry for the next step.

In next step,

$6A + 4 = BB$

$6A + 4 = 88$

$6A = 84$

Hence, any integer value of A is not possible. So B cannot be 8.

If $B = 4$, then $B \times 6 = 24$ and 2 will be a carry for the next step.

In next step,

$6A + 2 = BB$

$6A + 2 = 44$

$6A = 42$

Hence, $A = 7$.

The multiplication is as follows

7 4

$\times\ 6$

----

4 4 4

Hence, the possible values of A and B are 7 and 4 respectively.

8. A 1

$+$ 1 B

B 0

Solution:

We can see that addition of 1 and B is 0 which means that addition of 1 and B is a number whose one's digit is 0. This is possible only when digit B is 9.

In this case, addition of 1 and B is 10 and thus, 1 will be the carry for the next step.

In next step,

$1 + A + 1 = 9$

$A = 9 - 1 - 1$

$A = 7$

Therefore, the addition is as follows

7 1

$+$1 9

----

9 0

Hence, the possible values of A and B are 7 and 9 respectively.

9. 2 A B

$+$ A B 1

B 1 8

Solution:

We can see that addition of B and 1 is 8 which means that addition of B and 1 is a number whose one's digit is 8. This is possible only when digit B is 7.

In next step,

$A + B = 1$

Clearly, A is equal to 4.

$4 + 7 = 11$ and 1 will be a carry for the next step.

In next step,

$1 + 2 + A = B$

$1 + 2 + 4 = 7$

Therefore, the addition is as follows

2 4 7

+4 7 1

----

7 1 8

The possible values of A and B are 4 and 7 respectively.

10. 1 2 A

+ 6 A B

A 0 9

Solution:

We can see that addition of A and B is 9 which means addition of A and B is a number whose one's digit is 9. But, the sum of two single digit numbers cannot be 19 so the sum can be 9 only. Therefore, there will not be any carry in this step.

In next step, $2 + A = 0$

It is possible only when $A = 8$.

$2 + 8 = 10$ and we get a carry 1 for the next step.

$1 + 1 + 6 = A$

Which gives $A = 8$

Also, $A + B = 9$

$8 + B = 9$

Which gives $B = 1$

Hence, the values of A and B are 8 and 1 respectively.

EXERCISE 16.2

1. If 21y5 is a multiple of 9, where y is a digit, what is the value of y?

Solution:

If a number is a multiple of 9, then the sum of its digits will be divisible by 9.

Sum of digits of $21y5 = 2 + 1 + y + 5$

$= 8 + y$

Hence, $8 + y$ should be a multiple of 9.

So, possible value of y is 1.

2. If 31z5 is a multiple of 9, where z is a digit, what is the value of z?

Solution:

If a number is a multiple of 9, then the sum of its digits will be divisible by 9.

Sum of digits of $31z5 = 3 + 1 + z + 5$

$= 9 + z$

Hence, $9 + z$ should be a multiple of 9.

So, possible values of z are 0 and 9.

3. If 24x is a multiple of 3, where x is a digit, what is the value of x?

Solution:

If a number is a multiple of 3, then the sum of its digits will be divisible by 3.

Sum of digits of $24x = 6 + x$

Hence, $6 + x$ should be a multiple of 3.

So, the possible values of x are $0, 3, 6, 9$.

4. If 31z5 is a multiple of 3, where z is a digit, what might be the values of z?

Solution:

If a number is a multiple of 3, then the sum of its digits will be divisible by 3.

Sum of digits of $31z5 = 3 + 1 + z + 5$

$= 9 + z$

Hence, $9 + z$ should be a multiple of 3.

So, the possible values of z are $0, 3, 6, 9$.