

Ch. 1 Rational Numbers

Exercise 1.1

Q1 :

Using appropriate properties find:

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

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

Answer :

(i)

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

(Using commutativity of rational numbers)

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

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

$$= \left(-\frac{3}{6}\right) + \frac{5}{2} = \left(\frac{-3 + 5 \times 3}{6}\right) = \left(\frac{-3 + 15}{6}\right)$$

$$= \frac{12}{6} = 2$$

(ii)

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

$$\begin{aligned}
&= \frac{2}{5} \times \left(-\frac{3}{7} + \frac{1}{14} \right) - \frac{1}{4} && \text{(By distributivity)} \\
&= \frac{2}{5} \times \left(\frac{-3 \times 2 + 1}{14} \right) - \frac{1}{4} \\
&= \frac{2}{5} \times \left(\frac{-5}{14} \right) - \frac{1}{4} \\
&= -\frac{1}{7} - \frac{1}{4} \\
&= \frac{-4 - 7}{28} = \frac{-11}{28}
\end{aligned}$$

Q2 :

Write the additive inverse of each of the following:

$$(i) \frac{2}{8} \quad (ii) \frac{-5}{9} \quad (iii) \frac{-6}{-5} \quad (iv) \frac{2}{-9} \quad (v) \frac{19}{-6}$$

Answer :

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

$$\text{Additive inverse} = -\frac{2}{8}$$

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

$$\text{Additive inverse} = \frac{5}{9}$$

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

$$\text{Additive inverse} = \frac{-6}{5}$$

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

$$\text{Additive inverse} = \frac{2}{9}$$

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

$$\text{Additive inverse} = \frac{19}{6}$$

Q3 :

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

$$(i) x = \frac{11}{15} \quad (ii) x = -\frac{13}{17}$$

Answer :

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

The additive inverse of $x = \frac{11}{15}$ is $-x = -\frac{11}{15}$ as $\frac{11}{15} + \left(-\frac{11}{15}\right) = 0$

This equality $\frac{11}{15} + \left(-\frac{11}{15}\right) = 0$ represents that the additive inverse of $-\frac{11}{15}$ is $\frac{11}{15}$ or it can be said that $-\left(-\frac{11}{15}\right) = \frac{11}{15}$ i.e., $-(-x) = x$

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

The additive inverse of $x = -\frac{13}{17}$ is $-x = \frac{13}{17}$ as $-\frac{13}{17} + \frac{13}{17} = 0$ This equality $-\frac{13}{17} + \frac{13}{17} = 0$ represents that the additive inverse of $\frac{13}{17}$ is $-\frac{13}{17}$ i.e., $-(-x) = x$

Q4 :

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

Answer :

(i) -13

Multiplicative inverse = $-\frac{1}{13}$

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

Multiplicative inverse = $-\frac{19}{13}$

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

Multiplicative inverse = 5

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

Multiplicative inverse = $\frac{56}{15}$

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

Multiplicative inverse = $\frac{5}{2}$

$$(vi) -1$$

Multiplicative inverse = -1

Q5 :

Name the property under multiplication used in each of the following:

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

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

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

Answer :

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

1 is the multiplicative identity.

(ii) Commutativity

(iii) Multiplicative inverse

Q6 :

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

$$\text{Answer : } \frac{6}{13} \times \left(\text{Reciprocal of } -\frac{7}{16} \right) = \frac{6}{13} \times -\frac{16}{7} = -\frac{96}{91}$$

Q7 :

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

Answer :

Associativity

Q8 :

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

Answer :

If it is the multiplicative inverse, then the product should be 1.

However, here, the product is not 1 as

$$\frac{8}{9} \times \left(-1\frac{1}{8} \right) = \frac{8}{9} \times \left(-\frac{9}{8} \right) = -1 \neq 1$$

Q9 : Is 0.3 the multiplicative inverse of $3\frac{1}{3}$? Why or why not?

Answer :

$$3\frac{1}{3} = \frac{10}{3}$$

$$0.3 \times 3\frac{1}{3} = 0.3 \times \frac{10}{3} = \frac{3}{10} \times \frac{10}{3} = 1$$

Here, the product is 1. Hence, 0.3 is the multiplicative inverse of $3\frac{1}{3}$.

Q10 :

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.

Answer :

- (i) 0 is a rational number but its reciprocal is not defined.
- (ii) 1 and -1 are the rational numbers that are equal to their reciprocals.
- (iii) 0 is the rational number that is equal to its negative.

Q11 :

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 _____.

Answer :

(i) No

(ii) 1, - 1

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

(iv) x

(v) Rational number

(vi) Positive rational number

Exercise 1.2 :

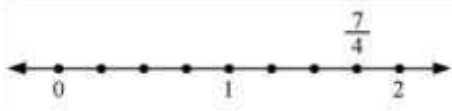
Q1 :

Represent these numbers on the number line.

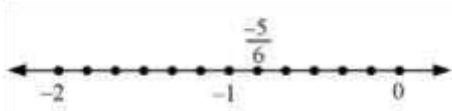
(i) $\frac{7}{4}$ (ii) $-\frac{5}{6}$

Answer :

(i) $\frac{7}{4}$ can be represented on the number line as follows.



(ii) $-\frac{5}{6}$ can be represented on the number line as follows.

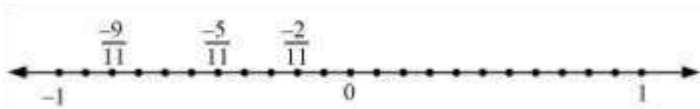


Q2 :

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

Answer :

$\frac{-2}{11}, \frac{-5}{11}, \frac{-9}{11}$ can be represented on the number line as follows.



Q3 :

Write five rational numbers which are smaller than 2.

Answer :

2 can be represented as $\frac{14}{7}$

Therefore, five rational numbers smaller than 2 are

$$\frac{13}{7}, \frac{12}{7}, \frac{11}{7}, \frac{10}{7}, \frac{9}{7}$$

Q4 :

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

Answer :

$\frac{-2}{5}$ and $\frac{1}{2}$ can be represented as $-\frac{8}{20}$ and $\frac{10}{20}$ respectively.

Therefore, ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$ are

$$-\frac{7}{20}, -\frac{6}{20}, -\frac{5}{20}, -\frac{4}{20}, -\frac{3}{20}, -\frac{2}{20}, -\frac{1}{20}, 0, \frac{1}{20}, \frac{2}{20}$$

Q5 : 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 $\frac{1}{2}$

Answer :

(i) $\frac{2}{3}$ and $\frac{4}{5}$ can be represented $\frac{30}{45}$ and $\frac{36}{45}$ as respectively.

Therefore, five rational numbers between $\frac{2}{3}$ and $\frac{4}{5}$ are

$$\frac{31}{45}, \frac{32}{45}, \frac{33}{45}, \frac{34}{45}, \frac{35}{45}$$

(ii) $-\frac{3}{2}$ and $\frac{5}{3}$ can be represented as $-\frac{9}{6}$ and $\frac{10}{6}$ respectively.

Therefore, five rational numbers between $-\frac{3}{2}$ and $\frac{5}{3}$ are $-\frac{8}{6}, -\frac{7}{6}, -1, -\frac{5}{6}, -\frac{4}{6}$

(iii) $\frac{1}{4}$ and $\frac{1}{2}$ can be represented as $\frac{8}{32}$ and $\frac{16}{32}$ respectively.

Therefore, five rational numbers between $\frac{1}{4}$ and $\frac{1}{2}$ are $\frac{9}{32}, \frac{10}{32}, \frac{11}{32}, \frac{12}{32}, \frac{13}{32}$

Q6 :

Write five rational numbers greater than - 2.

Answer :

- 2 can be represented as $-\frac{14}{7}$.

Therefore, five rational numbers greater than - 2 are $-\frac{13}{7}, -\frac{12}{7}, -\frac{11}{7}, -\frac{10}{7}, -\frac{9}{7}$

Q7 :

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

Answer :

$\frac{3}{5}$ and $\frac{3}{4}$ can be represented as $\frac{48}{80}$ and $\frac{60}{80}$ respectively.

Therefore, ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$ are

$\frac{49}{80}, \frac{50}{80}, \frac{51}{80}, \frac{52}{80}, \frac{53}{80}, \frac{54}{80}, \frac{55}{80}, \frac{56}{80}, \frac{57}{80}, \frac{58}{80}$

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MIND MAP

CH.: 1 RATIONAL NUMBERS

This chapter consists of three different topics. The most probable questions from examination point of view are given below.

TYPE:1 RATIONAL NUMBERS AND PROPERTIES

Q.1. Fill in the blanks. Also mention the property used.

a) $\frac{6}{13} + \left(\frac{4}{9} + \frac{7}{8}\right) = \left(\frac{6}{13} + \frac{4}{9}\right) + \text{---}$

b) $\frac{-3}{5} \left(\frac{3}{4} + \frac{-8}{9}\right) = \frac{-3}{5} \times \frac{3}{4} + \text{---} \times \frac{-8}{9}$

Q.2. Show that $\left(-\frac{2}{5} + \frac{4}{9}\right) + \left(-\frac{3}{4}\right) = -\frac{2}{5} + \left\{\frac{4}{9} + \left(-\frac{3}{4}\right)\right\}$

Q.3. Check if $-\frac{3}{5} \left(\frac{3}{4} + \frac{-8}{9}\right) = \left(\frac{-3}{5} \times \frac{3}{4}\right) + \left\{\frac{-3}{5} \times \left(\frac{-8}{9}\right)\right\}$

Q.4. Simplify using distributive property:

a) $273 \times 43 + 273 \times 57$

b) $\frac{3}{4} \times \frac{18}{31} + \frac{3}{4} \times \frac{13}{31}$

Q.5. Simplify:

a) $\left(\frac{-3}{4} \times \frac{8}{15}\right) - \left(\frac{2}{3} \times \frac{-3}{8}\right) - \left(\frac{-4}{7} \times \frac{-14}{15}\right)$

b) $-4 \div \left(\frac{-2}{5}\right) \times \frac{3}{4}$

TYPE:2 RATIONAL NUMBERS BETWEEN RATIONAL NUMBERS

Q.6. i) Find a rational number between $\frac{-8}{11}$ and $\frac{-7}{11}$

ii) Find five rational numbers between $\frac{4}{15}$ and $\frac{7}{15}$

TYPE:3 REAL LIFE APPLICATIONS

Q.7. A shirt can be stitched using $2\frac{1}{4}m$ of cloth. How much cloth is required for stitching 9 shirts.

Q.8. In a school $\frac{5}{8}$ of the students were girls. If the number of girls is 120 more than that of the boys, what is the strength of the school? How many boys are there?

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CH. 2 LINEAR EQUATIONS IN ONE VARIABLE
MIND MAP

This chapter consists of three different topics. The most probable questions from examination point of view are given below.

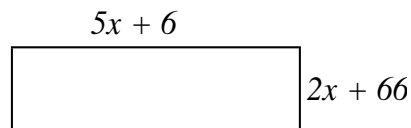
TYPE:1 SOLVING EQUATIONS WHICH HAVE LINEAR EXPRESSIONS ON ONE SIDE AND NUMBERS ON THE OTHER SIDE AND ITS APPLICATIONS

Q.1. Solve:

a) $0.4(3x - 1) - 0.5x = 1$

b) $\frac{2x+20}{25} = 4$

Q.2. For what value of x is the perimeter of shape 186 cm?



Q.3. Radha takes some flowers in a basket and visits three temples one-by-one. At each temple she offers one half of the flowers from the basket. If she is left with 3 flowers at the end, then find the number of flowers she had in the beginning.

TYPE:2 SOLVING EQUATIONS HAVING VARIABLES ON BOTH SIDES AND ITS APPLICATIONS

Q.1. Solve:

a) $m - \frac{m-1}{2} = 1 - \frac{m-2}{3}$

b) $0.25(4x - 5) = 0.75x + 8$

Q.2. Five years ago, a man was 7 times as old as his son. Five years hence, he will be three times as old as his son. Find their present ages.

Q.3. The digit in the tens place of a two digit number is three times the digit in the unit's place. If the digits are reversed, the new number will be 36 less than the original number. Find the number.

TYPE:3 REDUCING EQUATIONS TO SIMPLER FORMS

Q.1. Solve: (a) $\frac{2+3y}{1+5y} = \frac{4}{3}$ (b) $\frac{2}{x+9} = \frac{-7}{4x-3}$

Q.2. Distance between two places A and B is 210 km. Two cars start simultaneously from A and B in opposite directions and distance between them after 3 hours is 54 km. If speed of one car is less than that of other by 8 km/h, then find the speed of each.

Q.3. There are 40 passengers in a bus, some with ₹3 tickets and remaining with ₹10 tickets. The total collection from these passengers is ₹295. Find how many passengers have tickets worth ₹3?

Exercise 2.1

Solve the following equations.

1. $x - 2 = 7$

Solution:

$$x - 2 = 7$$

$$x = 7 + 2$$

$$x = 9$$

2. $y + 3 = 10$

Solution:

$$y + 3 = 10$$

$$y = 10 - 3$$

$$y = 7$$

3. $6 = z + 2$

Solution:

$$6 = z + 2$$

$$z + 2 = 6$$

$$z = 6 - 2$$

$$z = 4$$

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

Solution:

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

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

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

$$x = \frac{14}{7}$$

$$x = 2$$

5. $6x = 12$

Solution:

$$6x = 12$$

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

$$x = 2$$

6. $\frac{t}{5} = 10$

Solution:

$$t = 10 \times 5$$

$$t = 50$$

$$t = 10 \times 5$$
$$t = 50$$

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

Solution:

$$\frac{2x}{3} = 18$$
$$2x = 18 \times 3$$
$$2x = 54$$
$$x = \frac{54}{2}$$
$$x = 27$$

8. $1.6 = \frac{y}{1.5}$

Solution:

$$1.6 = \frac{y}{1.5}$$
$$\frac{y}{1.5} = 1.6$$
$$y = 1.6 \times 1.5$$
$$y = 2.4$$

9. $7x - 9 = 16$

Solution:

$$7x - 9 = 16$$
$$7x = 16 + 9$$
$$7x = 25$$
$$x = \frac{25}{7}$$

10. $14y - 8 = 13$

Solution:

$$14y - 8 = 13$$
$$14y = 13 + 8$$
$$14y = 21$$
$$y = \frac{21}{14}$$
$$y = \frac{3}{2}$$

11. $17 + 6p = 9$

Solution:

$$17 + 6p = 9$$
$$6p = 9 - 17$$
$$6p = -8$$

$$p = \frac{-8}{6}$$
$$p = \frac{-4}{3}$$

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

Solution:

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

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

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

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

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

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

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 the question,

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

$$\Rightarrow \frac{x}{2} - \frac{1}{4} = \frac{1}{8}$$

$$\Rightarrow \frac{x}{2} = \frac{1}{8} + \frac{1}{4}$$

$$\Rightarrow \frac{x}{2} = \frac{1}{8} + \frac{2}{8}$$

$$\Rightarrow \frac{x}{2} = \frac{1+2}{8}$$

$$\Rightarrow x = \frac{3}{8} \times 2$$

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

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

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:

Given that,

Perimeter of rectangular swimming pool = 154 m

Let the breadth of rectangle be = x

According to the question,

$$\text{Length of the rectangle} = 2x + 2$$

We know that,

$$\text{Perimeter} = 2(\text{length} + \text{breadth})$$

$$\Rightarrow 2(2x + 2 + x) = 154 \text{ m}$$

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

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

$$\Rightarrow 3x = 77 - 2$$

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

$$\Rightarrow x = 25 \text{ m}$$

$$\therefore \text{Breadth} = x = 25 \text{ m}$$

$$\text{Length} = 2x + 2$$

$$\begin{aligned}
 &= (2 \times 25) + 2 \\
 &= 50 + 2 \\
 &= 52 \text{ m}
 \end{aligned}$$

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:

$$\text{Base of isosceles triangle} = \frac{4}{3} \text{ cm}$$

$$\text{Perimeter of triangle} = 4\frac{2}{15} \text{ cm} = \frac{62}{15}$$

Let the length of equal sides of triangle be x .

According to the question,

$$\frac{4}{3} + x + x = \frac{62}{15} \text{ cm}$$

$$\Rightarrow 2x = \left(\frac{62}{15} - \frac{4}{3}\right) \text{ cm}$$

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

$$\Rightarrow 2x = \frac{42}{15} \text{ cm}$$

$$\Rightarrow x = \frac{42}{15} \times \frac{1}{2}$$

$$\Rightarrow x = \frac{14}{5} \text{ cm}$$

$$\Rightarrow x = \frac{30}{7} \text{ cm}$$

The length of either of the remaining equal sides are $\frac{7}{5}$ cm.

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

Solution:

Let one of the numbers be x .

Then, the other number becomes $x + 15$

According to the question,

$$x + x + 15 = 95$$

$$\Rightarrow 2x + 15 = 95$$

$$\Rightarrow 2x = 95 - 15$$

$$\Rightarrow 2x = 80$$

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

$$\Rightarrow x = 40$$

First number = $x = 40$

And, other number = $x + 15 = 40 + 15 = 55$

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

Solution:

Let the two numbers be $5x$ and $3x$.

According to the question,

$$5x - 3x = 18$$

$$\Rightarrow 2x = 18$$

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

$$\Rightarrow x = 9$$

Thus,

$$\text{the numbers are } 5x = 5 \times 9 = 45$$

$$\text{and } 3x = 3 \times 9 = 27.$$

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

Solution:

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

According to the question,

$$x + (x+1) + (x+2) = 51$$

$$\Rightarrow 3x + 3 = 51$$

$$\Rightarrow 3x = 51 - 3$$

$$\Rightarrow 3x = 48$$

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

$$\Rightarrow x = 16$$

Thus, the integers are

$$x = 16$$

$$x+1 = 17$$

$$x+2 = 18$$

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

Solution:

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

According to the question,

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

$$\Rightarrow 8(x + x+1 + x+2) = 888 \quad (\text{Taking 8 as common})$$

$$\Rightarrow 8(3x + 3) = 888$$

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

$$\Rightarrow 3x + 3 = 111$$

$$\Rightarrow 3x = 111 - 3$$

$$\Rightarrow 3x = 108$$

$$\Rightarrow x = \frac{108}{3}$$

$$\Rightarrow x = 36$$

Thus, the three consecutive multiples of 8 are:

$$8x = 8 \times 36 = 288$$

$$8(x+1) = 8 \times (36+1) = 8 \times 37 = 296$$

$$8(x+2) = 8 \times (36+2) = 8 \times 38 = 304$$

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 are x , $x+1$ and $x+2$.

According to the question,

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

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

$$\Rightarrow 9x + 11 = 74$$

$$\Rightarrow 9x = 74 - 11$$

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

$$\Rightarrow x = 7$$

Thus, the numbers are:

$$x = 7$$

$$x+1 = 8$$

$$x+2 = 9$$

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:

Let the ages of Rahul and Haroon be $5x$ and $7x$.

Four years later,

The ages of Rahul and Haroon will be $(5x + 4)$ and $(7x + 4)$ respectively.

According to the question,

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

$$\Rightarrow 5x + 4 + 7x + 4 = 56$$

$$\Rightarrow 12x + 8 = 56$$

$$\Rightarrow 12x = 56 - 8$$

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

$$\Rightarrow x = 4$$

$$\therefore, \text{Present age of Rahul} = 5x = 5 \times 4 = 20$$

$$\text{And, present age of Haroon} = 7x = 7 \times 4 = 28$$

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:

Let the number of boys be $7x$ and girls be $5x$.

According to the question,

$$7x = 5x + 8$$

$$\Rightarrow 7x - 5x = 8$$

$$\Rightarrow 2x = 8$$

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

$$\Rightarrow x = 4$$

\therefore , Number of boys = $7 \times 4 = 28$

And, Number of girls = $5 \times 4 = 20$

Total number of students = $20 + 28 = 48$

- 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 the age of Baichung's father be x .

Then, the age of Baichung's grandfather = $(x+26)$

and, Age of Baichung = $(x-29)$

According to the question,

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

$$\Rightarrow 3x + 26 - 29 = 135$$

$$\Rightarrow 3x - 3 = 135$$

$$\Rightarrow 3x = 135 + 3$$

$$\Rightarrow 3x = 138$$

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

$$\Rightarrow x = 46$$

Age of Baichung's father = $x = 46$

Age of Baichung's grandfather = $(x+26) = 46 + 26 = 72$

Age of Baichung = $(x-29) = 46 - 29 = 17$

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

Solution:

Let the present age of Ravi be x .

Fifteen years later, Ravi age will be $x+15$ years.

According to the question,

$$x + 15 = 4x$$

$$\Rightarrow 4x - x = 15$$

$$\Rightarrow 3x = 15$$

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

$$\Rightarrow x = 5$$

\therefore , Present age of Ravi = 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?

NCERT Solution For Class 8 Maths Chapter 2- Linear Equations in One Variable

Solution:

Let the rational be x.

According to the question,

$$x \times \left(\frac{5}{2}\right) + \frac{2}{3} = \frac{-7}{12}$$

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

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

$$\Rightarrow \frac{5x}{2} = \frac{-7-8}{12}$$

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

$$\Rightarrow \frac{5x}{2} = \frac{-5}{4}$$

$$\Rightarrow x = \frac{-10}{20}$$

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

∴, 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 with Lakshmi is ₹4,00,000. How many notes of each denomination does she have?

Solution:

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

$$\text{Value of ₹100} = 2x \times 100 = 200x$$

$$\text{Value of ₹50} = 3x \times 50 = 150x$$

$$\text{Value of ₹10} = 5x \times 10 = 50x$$

According to the question,

$$200x + 150x + 50x = 4,00,000$$

$$\Rightarrow 400x = 4,00,000$$

$$\Rightarrow x = \frac{400000}{400}$$

$$\Rightarrow x = 1000$$

$$\text{Numbers of ₹100 notes} = 2x = 2000$$

$$\text{Numbers of ₹50 notes} = 3x = 3000$$

$$\text{Numbers of ₹10 notes} = 5x = 5000$$

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:

Let the number of ₹5 coins be x.

Then,

$$\text{number ₹2 coins} = 3x$$

and, $\text{number of ₹1 coins} = (160 - 4x)$

Now,

$$\text{Value of ₹5 coins} = x \times 5 = 5x$$

$$\text{Value of ₹2 coins} = 3x \times 2 = 6x$$

$$\text{Value of ₹1 coins} = (160 - 4x) \times 1 = (160 - 4x)$$

According to the question,

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

$$\Rightarrow 11x + 160 - 4x = 300$$

$$\Rightarrow 7x = 140$$

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

$$\Rightarrow x = 20$$

$$\text{Number of ₹5 coins} = x = 20$$

$$\text{Number of ₹2 coins} = 3x = 60$$

$$\text{Number of ₹1 coins} = (160 - 4x) = 160 - 80 = 80$$

- 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 ₹3,000. Find the number of winners, if the total number of participants is 63.**

Solution:

Let the numbers of winner be x .

Then, the number of participants who didn't win = $63 - x$

Total money given to the winner = $x \times 100 = 100x$

Total money given to participant who didn't win = $25 \times (63 - x)$

According to the question,

$$100x + 25 \times (63 - x) = 3,000$$

$$\Rightarrow 100x + 1575 - 25x = 3,000$$

$$\Rightarrow 75x = 3,000 - 1575$$

$$\Rightarrow 75x = 1425$$

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

$$\Rightarrow x = 19$$

\therefore , the numbers of winners are 19.

Exercise 2.3

Solve the following equations and check your results.

1. $3x = 2x + 18$

Solution:

$$3x = 2x + 18$$

$$\Rightarrow 3x - 2x = 18$$

$$\Rightarrow x = 18$$

Putting the value of x in RHS and LHS we get,

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

$$\Rightarrow 54 = 54$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

2. $5t - 3 = 3t - 5$

Solution:

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

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

$$\Rightarrow 2t = -2$$

$$\Rightarrow t = -1$$

Putting the value of t in RHS and LHS we get,

$$5 \times (-1) - 3 = 3 \times (-1) - 5$$

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

$$\Rightarrow -8 = -8$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

3. $5x + 9 = 5 + 3x$

Solution:

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

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

$$\Rightarrow 2x = -4$$

$$\Rightarrow x = -2$$

Putting the value of x in RHS and LHS we get,

$$5 \times (-2) + 9 = 5 + 3 \times (-2)$$

$$\Rightarrow -10 + 9 = 5 + (-6)$$

$$\Rightarrow -1 = -1$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

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

Solution:

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

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

$$\Rightarrow 2z = 3$$

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

Putting the value of z in RHS and LHS we get,

$$(4 \times \frac{3}{2}) + 3 = 6 + (2 \times \frac{3}{2})$$

$$\Rightarrow 6 + 3 = 6 + 3$$

$$\Rightarrow 9 = 9$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

$$5. 2x - 1 = 14 - x$$

Solution:

$$2x - 1 = 14 - x$$

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

$$\Rightarrow 3x = 15$$

$$\Rightarrow x = 5$$

Putting the value of x in RHS and LHS we get,

$$(2 \times 5) - 1 = 14 - 5$$

$$\Rightarrow 10 - 1 = 9$$

$$\Rightarrow 9 = 9$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

$$6. 8x + 4 = 3(x - 1) + 7$$

Solution:

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

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

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

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

$$\Rightarrow 5x = 0$$

$$\Rightarrow x = 0$$

Putting the value of x in RHS and LHS we get,

$$(8 \times 0) + 4 = 3(0 - 1) + 7$$

$$\Rightarrow 0 + 4 = 0 - 3 + 7$$

$$\Rightarrow 4 = 4$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

$$7. x = \frac{4}{5}(x + 10)$$

Solution:

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

$$\Rightarrow x = \frac{4x}{5} + \frac{40}{5}$$

$$\Rightarrow x - \frac{4x}{5} = 8$$

$$\Rightarrow \frac{(5x - 4x)}{5} = 8$$

$$\Rightarrow x = 8 \times 5$$

$$\Rightarrow x = 40$$

Putting the value of x in RHS and LHS we get,

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

$$\Rightarrow 40 = \frac{4}{5} \times 50$$

$$\Rightarrow 40 = \frac{200}{5}$$

$$\Rightarrow 40 = 40$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

$$8. \frac{2x}{3} + 1 = \frac{7x}{15} + 3$$

Solution:

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

$$\Rightarrow \frac{2x}{3} - \frac{7x}{15} = 3 - 1$$

$$\Rightarrow \frac{(10x - 7x)}{15} = 2$$

$$\Rightarrow 3x = 2 \times 15$$

$$\Rightarrow 3x = 30$$

$$\Rightarrow x = 10$$

Putting the value of x in RHS and LHS we get,

$$\frac{(2 \times 10)}{3} + 1 = \frac{(7 \times 10)}{15} + 3$$

$$\Rightarrow \frac{20}{3} + 1 = \frac{70}{15} + 3$$

$$\Rightarrow \frac{(20+3)}{3} = \frac{(70+45)}{15}$$

$$\Rightarrow \frac{23}{3} = \frac{115}{15}$$

$$\Rightarrow \frac{23}{3} = \frac{23}{3}$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

$$9. 2y + \frac{5}{3} = \frac{26}{3} - y$$

Solution:

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

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

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

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

$$\Rightarrow 3y = 7$$

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

Putting the value of y in RHS and LHS we get,

$$(2 \times \frac{7}{3}) + \frac{5}{3} = \frac{26}{3} - \frac{7}{3}$$

$$\frac{14}{3} + \frac{5}{3} = \frac{26}{3} - \frac{7}{3}$$

$$\Rightarrow \frac{14+5}{3} = \frac{26-7}{3}$$

$$\Rightarrow \frac{19}{3} = \frac{19}{3}$$

$$\Rightarrow \text{LHS} = \text{RHS}$$

10. $3m = 5m - \frac{8}{5}$

Solution:

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

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

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

$$\Rightarrow 2m \times 5 = 8$$

$$\Rightarrow 10m = 8$$

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

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

Putting the value of m in RHS and LHS we get,

$$3 \times \frac{4}{5} = (5 \times \frac{4}{5}) - \frac{8}{5}$$

$$\Rightarrow \frac{12}{5} = 4 - \frac{8}{5}$$

$$\Rightarrow \frac{12}{5} = \frac{(20-8)}{5}$$

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

$$\Rightarrow \text{LHS} = \text{RHS}$$

Exercise 2.4

1. Amina thinks of a number and subtracts $\frac{5}{2}$ 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 the question,

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

$$\Rightarrow 8x - \frac{40}{2} = 3x$$

$$\Rightarrow 8x - 3x = \frac{40}{2}$$

$$\Rightarrow 5x = 20$$

$$\Rightarrow x = 4$$

Thus, the number 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 becomes twice the other new number. What are the numbers?

Solution:

Let one of the positive number be x then other number will be $5x$.

According to the question,

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

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

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

$$\Rightarrow 3x = 21$$

$$\Rightarrow x = 7$$

$$\text{One number} = x = 7$$

$$\text{Other number} = 5x = 5 \times 7 = 35$$

The two 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 digit at tens place be x then digit at ones place will be $(9-x)$.

Original two digit number = $10x + (9-x)$

After interchanging the digits, the new number = $10(9-x) + x$

According to the question,

$$10x + (9-x) + 27 = 10(9-x) + x$$

$$\Rightarrow 10x + 9 - x + 27 = 90 - 10x + x$$

$$\begin{aligned} &\Rightarrow 9x \\ &+ 36 = 90 - 9x \\ &\Rightarrow 9x + 9x = 90 - 36 \\ &\Rightarrow 18x = 54 \\ &\Rightarrow x = 3 \\ &\text{Original number} = 10x + (9-x) = (10 \times 3) + (9-3) = 30 + 6 = 36 \\ &\text{Thus, the number is 36.} \end{aligned}$$

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 digit at tens place be x then digit at ones place will be $3x$.
Original two digit number = $10x + 3x$
After interchanging the digits, the new number = $30x + x$
According to the question,
 $(30x + x) + (10x + 3x) = 88$
 $\Rightarrow 31x + 13x = 88$
 $\Rightarrow 44x = 88$
 $\Rightarrow x = 2$
Original number = $10x + 3x = 13x = 13 \times 2 = 26$

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 the present age of Shobo be x then age of her mother will be $6x$.
Shobo's age after 5 years = $x + 5$
According to the question,
 $(x + 5) = \frac{1}{3} 6x$
 $\Rightarrow x + 5 = 2x$
 $\Rightarrow 2x - x = 5$
 $\Rightarrow x = 5$
Present age of Shobo = $x = 5$ years
Present age of Shobo's mother = $6x = 30$ 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 metre it will cost the village panchayat ₹75000 to fence the plot. What are the dimensions of the plot?

Solution:

Let the length of the rectangular plot be $11x$ and breadth be $4x$.
Rate of fencing per metre = ₹100
Total cost of fencing = ₹75000
Perimeter of the plot = $2(l+b) = 2(11x + 4x) = 2 \times 15x = 30x$

Total amount
of fencing = $(30x \times 100)$

According to the question,

$$(30x \times 100) = 75000$$

$$\Rightarrow 3000x = 75000$$

$$\Rightarrow x = \frac{75000}{3000}$$

$$\Rightarrow x = 25$$

$$\text{Length of the plot} = 11x = 11 \times 25 = 275\text{m}$$

$$\text{Breadth of the plot} = 4x = 4 \times 25 = 100\text{m}$$

7. Hasan buys two kinds of cloth materials for school uniforms, shirt material that costs him ₹50 per metre and trouser material that costs him ₹90 per metre. For every 3 meters of the shirt material he buys 2 metres of the trouser material. He sells the materials at 12% and 10% profit respectively. His total sale is ₹36,600. How much trouser material did he buy?

Solution:

Let $2x$ m of trouser material and $3x$ m of shirt material be bought by him.

$$\text{Selling price of shirt material per metre} = ₹ 50 + 50 \times \left(\frac{12}{100}\right) = ₹ 56$$

$$\text{Selling price of trouser material per metre} = ₹ 90 + 90 \times \left(\frac{10}{100}\right) = ₹ 99$$

$$\text{Total amount of sale} = ₹ 36,600$$

According to the question,

$$(2x \times 99) + (3x \times 56) = 36600$$

$$\Rightarrow 198x + 168x = 36600$$

$$\Rightarrow 366x = 36600$$

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

$$\Rightarrow x = 100$$

$$\text{Total trouser material he bought} = 2x = 2 \times 100 = 200 \text{ m.}$$

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 be x .

$$\text{Deer grazing in the field} = \frac{x}{2}$$

$$\text{Deer playing nearby} = \frac{3}{4} \left(x - \frac{x}{2}\right) = \frac{3x}{4} - \frac{3x}{8}$$

$$\text{Deer drinking water} = 9$$

According to the question,

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

$$\Rightarrow \frac{4x+3x}{8} + 9 = x$$
$$\Rightarrow \frac{7x}{8} + 9 = x$$

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

$$\Rightarrow x = 72$$

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

Solution:

Let the age of granddaughter be x and grandfather be $10x$.

Also, he is 54 years older than her.

According to the question,

$$10x = x + 54$$

$$\Rightarrow 10x - x = 54$$

$$\Rightarrow 9x = 54$$

$$\Rightarrow x = 6$$

$$\text{Age of grandfather} = 10x = 10 \times 6 = 60 \text{ years.}$$

$$\text{Age of granddaughter} = x = 6 \text{ years.}$$

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 age of Aman's son be x then age of Aman will be $3x$.

According to the question,

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

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

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

$$\Rightarrow 2x = 40$$

$$\Rightarrow x = 20$$

$$\text{Aman's son age} = x = 20 \text{ years}$$

$$\text{Aman age} = 3x = 3 \times 20 = 60 \text{ years}$$

Exercise 2.5

Solve the following linear equations.

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

Solution:

$$\begin{aligned} \frac{x-1}{2} - \frac{x-1}{5} &= \frac{x-1}{3} + \frac{1}{4} \\ \Rightarrow \frac{x}{2} - \frac{x}{3} &= \frac{1}{4} + \frac{1}{5} \\ \Rightarrow \frac{(3x-2x)}{6} &= \frac{(5+4)}{20} \\ \Rightarrow 3x - 2x &= \frac{9}{20} \times 6 \\ \Rightarrow x &= \frac{54}{20} \\ \Rightarrow x &= \frac{27}{10} \end{aligned}$$

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

Solution:

$$\begin{aligned} \frac{n}{2} - \frac{3n}{4} + \frac{5n}{6} &= 21 \\ \Rightarrow \frac{(6n-9n+10n)}{12} &= 21 \\ \Rightarrow \frac{7n}{12} &= 21 \\ \Rightarrow 7n &= 21 \times 12 \\ \Rightarrow n &= \frac{252}{7} \\ \Rightarrow n &= 36 \end{aligned}$$

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

Solution:

$$\begin{aligned} x + 7 - \frac{8x}{3} &= \frac{17}{6} - \frac{5x}{2} \\ \Rightarrow x - \frac{8x}{3} + \frac{5x}{2} &= \frac{17}{6} - 7 \\ \Rightarrow \frac{6x-16x+15x}{6} &= \frac{17-42}{6} \end{aligned}$$

[Type text]

$$\begin{aligned}\Rightarrow \frac{5x}{6} &= \frac{-25}{6} \\ \Rightarrow 5x &= -25 \\ \Rightarrow x &= -5\end{aligned}$$

4. $\frac{x-5}{3} = \frac{x-3}{5}$

Solution:

$$\begin{aligned}\frac{x-5}{3} &= \frac{x-3}{5} \\ \Rightarrow 5(x-5) &= 3(x-3) \\ \Rightarrow 5x-25 &= 3x-9 \\ \Rightarrow 5x-3x &= -9+25 \\ \Rightarrow 2x &= 16 \\ \Rightarrow x &= 8\end{aligned}$$

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

Solution:

$$\begin{aligned}\frac{3t-2}{4} - \frac{2t+3}{3} &= \frac{2}{3} - t \\ \Rightarrow \frac{3t}{4} - \frac{2t}{3} - \left(\frac{1}{2} + 1\right) &= \frac{2}{3} - t \\ \Rightarrow \frac{3t}{4} - \frac{2t}{3} - \frac{3}{2} - 1 &= \frac{2}{3} - t \\ \Rightarrow \frac{3t}{4} - \frac{2t}{3} + t &= \frac{2}{3} + 1 + \frac{1}{2} \\ \Rightarrow \frac{(9t-8t+12t)}{12} &= \frac{2}{3} + \frac{3}{2} \\ \Rightarrow \frac{13t}{12} &= \frac{4+9}{6} \\ \Rightarrow \frac{13t}{12} &= \frac{13}{6} \\ \Rightarrow t &= \frac{12}{6} = 2\end{aligned}$$

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

Solution:

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

$$\begin{aligned} &\Rightarrow m - \left(\frac{m}{2}\right) \\ &= 1 - \left(\frac{m}{3} - \frac{m}{3}\right) \\ &\Rightarrow m - \frac{m}{2} + \frac{1}{2} = 1 - \frac{m}{3} + \frac{2}{3} \\ &\Rightarrow m - \frac{m}{2} + \frac{m}{3} = 1 + \frac{2}{3} - \frac{1}{2} \\ &\Rightarrow \frac{m}{2} + \frac{m}{3} = \frac{1}{2} + \frac{2}{3} \\ &\Rightarrow \frac{(3m+2m)}{6} = \frac{(3+4)}{6} \\ &\Rightarrow \frac{5m}{6} = \frac{7}{6} \\ &\Rightarrow m = \frac{7}{6} \times \frac{6}{5} \\ &\Rightarrow m = \frac{7}{5} \end{aligned}$$

Simplify and solve the following linear equations.

7. $3(t - 3) = 5(2t + 1)$

Solution:

$$\begin{aligned} 3(t - 3) &= 5(2t + 1) \\ \Rightarrow 3t - 9 &= 10t + 5 \\ \Rightarrow 3t - 10t &= 5 + 9 \\ \Rightarrow -7t &= 14 \\ \Rightarrow t &= \frac{14}{-7} \\ \Rightarrow t &= -2 \end{aligned}$$

8. $15(y - 4) - 2(y - 9) + 5(y + 6) = 0$

Solution:

$$\begin{aligned} 15(y - 4) - 2(y - 9) + 5(y + 6) &= 0 \\ \Rightarrow 15y - 60 - 2y + 18 + 5y + 30 &= 0 \\ \Rightarrow 15y - 2y + 5y &= 60 - 18 - 30 \\ \Rightarrow 18y &= 12 \\ \Rightarrow y &= \frac{12}{18} \\ \Rightarrow y &= \frac{2}{3} \end{aligned}$$

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

Solution:

$$\begin{aligned}3(5z - 7) - 2(9z - 11) &= 4(8z - 13) - 17 \\ \Rightarrow 15z - 21 - 18z + 22 &= 32z - 52 - 17 \\ \Rightarrow 15z - 18z - 32z &= -52 - 17 + 21 - 22 \\ \Rightarrow -35z &= -70 \\ \Rightarrow z &= \frac{-70}{-35} \\ \Rightarrow z &= 2\end{aligned}$$

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

Solution:

$$\begin{aligned}0.25(4f - 3) &= 0.05(10f - 9) \\ \Rightarrow f - 0.75 &= 0.5f - 0.45 \\ \Rightarrow f - 0.5f &= -0.45 + 0.75 \\ \Rightarrow 0.5f &= 0.30 \\ \Rightarrow f &= \frac{0.30}{0.5} \\ \Rightarrow f &= \frac{3}{5} = 0.6\end{aligned}$$

Exercise 2.6

Solve the following equations.

1. $\frac{(8x-3)}{3x} = 2$

Solution:

$$\begin{aligned}\frac{(8x-3)}{3x} &= 2 \\ \Rightarrow \frac{8x}{3x} - \frac{3}{3x} &= 2 \\ \Rightarrow \frac{8}{3} - \frac{1}{x} &= 2 \\ \Rightarrow \frac{8}{3} - 2 &= \frac{1}{x} \\ \Rightarrow \frac{(8-6)}{3} &= \frac{1}{x} \\ \Rightarrow \frac{2}{3} &= \frac{1}{x} \\ \Rightarrow x &= \frac{3}{2}\end{aligned}$$

2. $\frac{9x}{(7-6x)} = 15$

Solution:

$$\begin{aligned}\frac{9x}{(7-6x)} &= 15 \\ \Rightarrow 9x &= 15(7-6x) \\ \Rightarrow 9x &= 105-90x \\ \Rightarrow 9x+90x &= 105 \\ \Rightarrow 99x &= 105 \\ \Rightarrow x &= \frac{105}{99} = \frac{35}{33}\end{aligned}$$

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

Solution:

$$\begin{aligned}\frac{z}{z+15} &= \frac{4}{9} \\ \Rightarrow z &= \frac{4}{9}(z+15) \\ \Rightarrow 9z &= 4(z+15) \\ \Rightarrow 9z &= 4z+60 \\ \Rightarrow 9z-4z &= 60 \\ \Rightarrow 5z &= 60 \\ \Rightarrow z &= 12\end{aligned}$$

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

Solution:

$$\begin{aligned}\frac{3y+4}{2-6y} &= \frac{-2}{5} \\ \Rightarrow 3y + 4 &= \frac{-2}{5}(2 - 6y) \\ \Rightarrow 5(3y + 4) &= -2(2 - 6y) \\ \Rightarrow 15y + 20 &= -4 + 12y \\ \Rightarrow 15y - 12y &= -4 - 20 \\ \Rightarrow 3y &= -24 \\ \Rightarrow y &= -8\end{aligned}$$

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

Solution:

$$\begin{aligned}\frac{7y+4}{y+2} &= \frac{-4}{3} \\ \Rightarrow 7y + 4 &= \frac{-4}{3}(y + 2) \\ \Rightarrow 3(7y + 4) &= -4(y + 2) \\ \Rightarrow 21y + 12 &= -4y - 8 \\ \Rightarrow 21y + 4y &= -8 - 12 \\ \Rightarrow 25y &= -20 \\ \Rightarrow y &= \frac{-20}{25} = \frac{-4}{5}\end{aligned}$$

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 age of Hari be $5x$ and Harry be $7x$.

4 years later,

$$\text{Age of Hari} = 5x + 4$$

$$\text{Age of Harry} = 7x + 4$$

According to the question,

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

$$\Rightarrow 4(5x + 4) = 3(7x + 4)$$

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

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

$$\Rightarrow x = 4$$

$$\text{Hari age} = 5x = 5 \times 4 = 20 \text{ years}$$

$$\text{Harry age} = 7x = 7 \times 4 = 28 \text{ years}$$

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

Solution:

Let the numerator be x then denominator will be $(x + 8)$.

According to the question,

$$\begin{aligned}\frac{(x+17)}{(x+8-1)} &= \frac{3}{2} \\ \Rightarrow \frac{(x+17)}{(x+7)} &= \frac{3}{2} \\ \Rightarrow 2(x+17) &= 3(x+7) \\ \Rightarrow 2x+34 &= 3x+21 \\ \Rightarrow 34-21 &= 3x-2x \\ \Rightarrow 13 &= x\end{aligned}$$

The rational number is $\frac{x}{x+8} = \frac{13}{21}$

CHAPTER 2

LINEAR EQUATIONS IN ONE VARIABLE

EQUATION

❖ An equation is a statement equating two algebraic expressions involving one or more unknown variables.

Example: $x + y = 5$

❖ A polynomial is said to be linear if its degree is 1.

❖ A linear equation in one variable is an equation involving linear polynomials having only one variable.

Example: $2x + 7 = 17$.

SOLVING A LINEAR EQUATION WHICH HAVE LINEAR EXPRESSIONS ON ONE SIDE AND NUMBERS ON THE OTHER SIDE

5. $6x = 12$

Solution:

$$6x = 12$$

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

$$\Rightarrow x = 2$$

6. $\frac{t}{5} = 10$

Solution:

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

$$\Rightarrow t = 10 \times 5$$

$$\Rightarrow t = 50$$

$$8. \quad 1.6 = \frac{y}{1.5}$$

Solution:

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

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

$$y = 1.6 \times 1.5$$

$$y = 2.4$$

$$9. \quad 7x - 9 = 16$$

Solution:

$$7x - 9 = 16$$

$$7x = 16 + 9$$

$$7x = 25$$

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

$$10. \quad 14y - 8 = 13$$

Solution:

$$14y - 8 = 13$$

$$14y = 13 + 8$$

$$14y = 21$$

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

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

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

Solution:

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

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

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

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

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

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

SOME APPLICATIONS

Exercise 2.2

Question 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?

Answer 1:

Let the number be x .

According to the question,

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

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

[Multiplying both sides by 2]

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

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

[Adding both sides $\frac{1}{2}$]

$$\Rightarrow x = \frac{1+2}{4} \quad \Rightarrow x = \frac{3}{4}$$

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



Question 2:

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

Given that,

Perimeter of rectangular swimming pool = 154 m

Let the breadth of rectangle be = x

According to the question,

$$\text{Length of the rectangle} = 2x + 2$$

We know that,

$$\text{Perimeter} = 2(\text{length} + \text{breadth})$$

$$\Rightarrow 2(2x + 2 + x) = 154 \text{ m}$$

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

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

$$\Rightarrow 3x = 77 - 2$$

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

$$\Rightarrow x = 25 \text{ m}$$

$$\therefore \text{Breadth} = x = 25 \text{ m}$$

$$\text{Length} = 2x + 2$$

Question 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?

Let the length of equal sides be x cm.

$$\text{Perimeter} = x \text{ cm} + x \text{ cm} + \text{Base} = 4\frac{2}{15} \text{ cm}$$

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

On transposing $\frac{4}{3}$ to R.H.S, we obtain

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

$$2x = \frac{62 - 4 \times 5}{15} = \frac{62 - 20}{15}$$

$$2x = \frac{42}{15}$$

On dividing both sides by 2, we obtain

$$\frac{2x}{2} = \frac{42}{15} \times \frac{1}{2}$$

$$x = \frac{7}{5} = 1\frac{2}{5}$$

Therefore, the length of equal sides is $1\frac{2}{5}$ cm.

Question 5:

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

Let the common ratio between these numbers be x . Therefore, the numbers will be $5x$ and $3x$ respectively.

Difference between these numbers = 18

$$5x - 3x = 18$$

$$2x = 18$$

Dividing both sides by 2,

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

$$x = 9$$

$$\text{First number} = 5x = 5 \times 9 = 45$$

$$\text{Second number} = 3x = 3 \times 9 = 27$$

Question 7:

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

Let the three consecutive multiples of 8 be

x , $x + 8$ and $x + 16$

According to question

$$x + x + 8 + x + 16 = 888$$

$$\Rightarrow 3x + 24 = 888$$

$$\Rightarrow 3x = 888 - 24$$

$$\Rightarrow 3x = 864$$

$$\Rightarrow x = \frac{864}{3} = 288$$

\therefore The three consecutive multiples are 288, $288 + 8$, $288 + 16$

Ans: The req. multiples are 288, 296, 304

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

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

$$\Rightarrow 8(x + x+1 + x+2) = 888 \quad (\text{Taking 8 as common})$$

$$\Rightarrow 8(3x + 3) = 888$$

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

$$\Rightarrow 3x + 3 = 111$$

$$\Rightarrow 3x = 111 - 3$$

$$\Rightarrow 3x = 108$$

$$\Rightarrow x = \frac{108}{3}$$

$$\Rightarrow x = 36$$

SECOND METHOD

Thus, the three consecutive multiples of 8 are:

$$\text{First multiple} = 8x = 8 \times 36 = 288$$

$$\text{Second multiple} = 8(x + 1) = 8 \times (36 + 1) = 8 \times 37 = 296$$

$$\text{Third multiple} = 8(x + 2) = 8 \times (36 + 2) = 8 \times 38 = 304$$

Hence, the required numbers are 288, 296, and 304.

Q8. [HOMEWORK]

Let three consecutive integers be x , $x + 1$, $x + 2$. According to the question,

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

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

$$9x + 11 = 74$$

On transposing 11 to R.H.S, we obtain

$$9x = 74 - 11$$

$$9x = 63$$

On dividing both sides by 9, we obtain

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

$$x = 7$$

$$x + 1 = 7 + 1 = 8$$

$$x + 2 = 7 + 2 = 9$$

Hence, the numbers are 7, 8, and 9.

Question 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?

Let the ages of Rahul and Haroon be $5x$ and $7x$.

Four years later,

The ages of Rahul and Haroon will be $(5x + 4)$ and $(7x + 4)$ respectively.

According to the question,

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

$$\Rightarrow 5x + 4 + 7x + 4 = 56$$

$$\Rightarrow 12x + 8 = 56$$

$$\Rightarrow 12x = 56 - 8$$

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

$$\Rightarrow x = 4$$

$$\therefore, \text{Present age of Rahul} = 5x = 5 \times 4 = 20$$

$$\text{And, present age of Haroon} = 7x = 7 \times 4 = 28$$

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

Let the number of girls be x . Then, the number of boys = $x+8$.

According to the question, $\frac{x+8}{x} = \frac{7}{5}$

$$\Rightarrow 5(x+8) = 7x \quad \Rightarrow 5x+40 = 7x$$

$$\Rightarrow 5x - 7x = -40 \quad \text{[Transposing } 7x \text{ to L.H.S. and } 40 \text{ to R.H.S.]}$$

$$\Rightarrow -2x = -40$$

$$\Rightarrow \frac{-2x}{-2} = \frac{-40}{-2} \quad \text{[Dividing both sides by } -2]$$

$$\Rightarrow x = 20$$

Hence the number of girls = 20 and number of boys = $20 + 8 = 28$.

Therefore, total class strength is 48

Question 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 three is 135 years. What is the age of each one of them?

Let Baichung's father's age be x years. Therefore, Baichung's age and Baichung's grandfather's age will be $(x - 29)$ years and $(x + 26)$ years respectively.

According to the given question, the sum of the ages of these 3 people is 135 years.

$$\text{Therefore, } x + x - 29 + x + 26 = 135$$

$$3x - 3 = 135$$

On transposing 3 to R.H.S, we obtain

$$3x = 135 + 3$$

$$3x = 138$$

On dividing both sides by 3, we obtain

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

$$x = 46$$

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

Baichung's age = $(x - 29)$ years = $(46 - 29)$ years = 17 years

Baichung's grandfather's age = $(x + 26)$ years = $(46 + 26)$ years = 72 years.

Question 12:

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

Let Ravi's present age be x years.

Fifteen years later, Ravi's age = $4 \times$ His present age

$$x + 15 = 4x$$

On transposing x to R.H.S, we obtain

$$15 = 4x - x$$

$$15 = 3x$$

On dividing both sides by 3, we obtain

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

$$5 = x$$

Hence, Ravi's present age = 5 years

Question 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?

Let the number be x .

According to the given question,

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

On transposing $\frac{2}{3}$ to R.H.S, we obtain

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

$$\frac{5}{2}x = \frac{-7 - (2 \times 4)}{12}$$

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

On multiplying both sides by $\frac{2}{5}$, we obtain

$$x = -\frac{15}{12} \times \frac{2}{5} = -\frac{1}{2}$$

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

Question 14:

Lakshmi is a cashier in the 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 with Lakshmi is ₹ 4,00,000. How many notes of each denomination does she have?

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

$$\text{Value of ₹100} = 2x \times 100 = 200x$$

$$\text{Value of ₹50} = 3x \times 50 = 150x$$

$$\text{Value of ₹10} = 5x \times 10 = 50x$$

According to the question,

$$200x + 150x + 50x = 4,00,000$$

$$\Rightarrow 400x = 4,00,000$$

$$\Rightarrow x = \frac{400000}{400}$$

$$\Rightarrow x = 1000$$

$$\text{Numbers of ₹100 notes} = 2x = 2000$$

$$\text{Numbers of ₹50 notes} = 3x = 3000$$

$$\text{Numbers of ₹10 notes} = 5x = 5000$$

Question 15:

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

Total sum of money = ₹300

Let the number of ₹5 coins be x , number of ₹2 coins be $3x$ and number of ₹1 coins be $160 - (x + 3x) = 160 - 4x$.

According to question, $5 \times x + 2 \times (3x) + 1 \times (160 - 4x) = 300$

$$\Rightarrow 5x + 6x + 160 - 4x = 300$$

$$\Rightarrow 7x + 160 = 300$$

$$\Rightarrow 7x + 160 - 160 = 300 - 160 \quad \text{[Subtracting 160 from both sides]}$$

$$\Rightarrow 7x = 140$$

$$\Rightarrow \frac{7x}{7} = \frac{140}{7} \quad \text{[Dividing both sides by 7]}$$

$$\Rightarrow x = 20$$

Hence, the number of coins of ₹5 denomination = 20

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

Number of coins of ₹1 denomination = $160 - 4 \times 20 = 160 - 80 = 80$

Question 16:

The organizers 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.

Given

Total prize money = ₹ 3000

Total participants = 63

Let the No. of winners be x and who are not winners = $63 - x$

According to question

$$100x + 25(63 - x) = 3000$$

$$\Rightarrow 100x + 1575 - 25x = 3000$$

$$\Rightarrow 75x = 3000 - 1575$$

$$\Rightarrow 75x = 1425$$

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

$$\Rightarrow x = 19$$

Hence the number of winners = 19

TEST - 1

The sum of three consecutive multiples of 11 is 363. Find these multiples.

Equations having variable on both sides

Exercise 2.3

Q2. Solve the following and check your results

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

On transposing $3t$ to L.H.S and -3 to R.H.S, we obtain

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

$$2t = -2$$

On dividing both sides by 2, we obtain

$$t = -1$$

$$\text{L.H.S} = 5t - 3 = 5 \times (-1) - 3 = -8$$

$$\text{R.H.S} = 3t - 5 = 3 \times (-1) - 5 = -3 - 5 = -8$$

$$\text{L.H.S.} = \text{R.H.S.}$$

Hence, the result obtained above is correct.

Q6.

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

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

Transposing $3x$ to L.H.S and 4 to R.H.S, we obtain

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

$$5x = -7 + 7$$

$$x = 0$$

$$\text{L.H.S} = 8x + 4 = 8 \times (0) + 4 = 4$$

$$\text{R.H.S} = 3(x - 1) + 7 = 3(0 - 1) + 7 = -3 + 7 = 4$$

$$\text{L.H.S.} = \text{R.H.S.}$$

Hence, the result obtained above is correct.

Q7.

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

Multiplying both sides by 5, we obtain

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

$$5x = 4x + 40$$

Transposing $4x$ to L.H.S, we obtain

$$5x - 4x = 40$$

$$x = 40$$

$$\text{L.H.S} = x = 40$$

$$\text{R.H.S} = \frac{4}{5}(x + 10) = \frac{4}{5}(40 + 10) = \frac{4}{5} \times 50 = 40$$

$$\text{L.H.S} = \text{R.H.S.}$$

Hence, the result obtained above is correct.

Q8.

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

Transposing $\frac{7x}{15}$ to L.H.S and 1 to R.H.S, we obtain

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

$$\frac{5 \times 2x - 7x}{15} = 2$$

$$\frac{3x}{15} = 2$$

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

Multiplying both sides by 5, we obtain

$$x = 10$$

$$\text{L.H.S} = \frac{2x}{3} + 1 = \frac{2 \times 10}{3} + 1 = \frac{2 \times 10 + 1 \times 3}{3} = \frac{23}{3}$$

$$\text{R.H.S} = \frac{7x}{15} + 3 = \frac{7 \times 10}{15} + 3 = \frac{7 \times 2}{3} + 3 = \frac{14}{3} + 3 = \frac{14 + 3 \times 3}{3} = \frac{23}{3}$$

$$\text{L.H.S.} = \text{R.H.S.}$$

Hence, the result obtained above is correct.



Q9.

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

Transposing y to L.H.S and $\frac{5}{3}$ to R.H.S, we obtain

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

$$3y = \frac{21}{3} = 7$$

Dividing both sides by 3, we obtain

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

$$\text{L.H.S} = 2y + \frac{5}{3} = 2 \times \frac{7}{3} + \frac{5}{3} = \frac{14}{3} + \frac{5}{3} = \frac{19}{3}$$

$$\text{R.H.S} = \frac{26}{3} - y = \frac{26}{3} - \frac{7}{3} = \frac{19}{3}$$

$$\text{L.H.S.} = \text{R.H.S.}$$

Hence, the result obtained above is correct.

Q10.

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

Transposing $5m$ to L.H.S, we obtain

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

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

Dividing both sides by -2 , we obtain

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

$$\text{L.H.S} = 3m = 3 \times \frac{4}{5} = \frac{12}{5}$$

$$\text{R.H.S} = 5m - \frac{8}{5} = 5 \times \frac{4}{5} - \frac{8}{5} = \frac{12}{5}$$

$$\text{L.H.S.} = \text{R.H.S.}$$

Hence, the result obtained above is correct.

Exercise 2.4

Question 1:

Amina thinks of a number and subtracts $\frac{5}{2}$ 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?

Let the number be x .

According to the given question,

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

$$8x - 20 = 3x$$

Transposing $3x$ to L.H.S and -20 to R.H.S, we obtain

$$8x - 3x = 20$$

$$5x = 20$$

Dividing both sides by 5, we obtain

$$x = 4$$

Hence, the number is 4.

Question 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?

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

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

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

Therefore, new number after interchanging the digits = $10(9 - x) + x$

$$= 90 - 10x + x$$

$$= 90 - 9x$$

According to the given question,

New number = Original number + 27

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

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

Transposing $9x$ to R.H.S and 36 to L.H.S, we obtain

$$90 - 36 = 18x$$

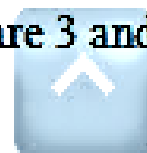
$$54 = 18x$$

Dividing both sides by 18 , we obtain

$$3 = x \text{ and } 9 - x = 6$$

Hence, the digits at tens place and ones place of the number are **3** and **6** respectively.

Therefore, the two-digit number is $9x + 9 = 9 \times 3 + 9 = 36$



Question 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?

Let the present age of Shobo be x and mother be $6x$ years

According to question

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

$$\Rightarrow 3(x + 5) = 6x$$

$$\Rightarrow 3x + 15 = 6x$$

$$\Rightarrow 15 = 6x - 3x$$

$$\Rightarrow 15 = 3x$$

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

$$\Rightarrow x = 5$$

\therefore Present age of Shobo is 5 years and mother is $6 \times 5 = 30$ years

Question 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 metre it will cost the village panchayat 75000 to fence the plot. What are the dimensions of the plot?

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

Rate of fencing per metre = ₹100

Total cost of fencing = ₹75000

Perimeter of the plot = $2(l+b) = 2(11x + 4x) = 2 \times 15x = 30x$

Total amount

of fencing = $(30x \times 100)$

According to the question,

$$(30x \times 100) = 75000$$

$$\Rightarrow 3000x = 75000$$

$$\Rightarrow x = \frac{75000}{3000}$$

$$\Rightarrow x = 25$$

Length of the plot = $11x = 11 \times 25 = 275\text{m}$

Breadth of the plot = $4x = 4 \times 25 = 100\text{m}$

Question 8:

Half of a herd of deer are grazing in the field and $\left(\frac{3}{4}\right)^{\text{th}}$ of the remaining are playing nearby. The rest 9 are drinking water from the pond. Find the number of deer in the herd.

Let the total number of deer be x .

Deer grazing in the field = $\frac{x}{2}$

Deer playing nearby = $\frac{3}{4} \left(x - \frac{x}{2} \right) = \frac{3}{4} \times \frac{x}{2} = \frac{3x}{8}$

Deer drinking water = 9

According to the question,

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

$$\frac{4x + 3x}{8} + 9 = x$$

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

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

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

$$\Rightarrow x = 9 \times 8$$

$$\Rightarrow x = 72$$

Question 9:

A grandfather is 10 times older than his granddaughter. He is also 54 years older than her. Find their present ages.

Let present age of granddaughter be x years.

Therefore, Grandfather's age = $10x$ years

According to question,

$$10x = x + 54$$

$$\Rightarrow 10x - x = 54$$

$$\Rightarrow 9x = 54$$

$$\Rightarrow x = \frac{54}{9} = 6 \text{ years}$$

Hence, granddaughter's age = 6 years and grandfather's age = $10 \times 6 = 60$ years.

Question 10:

Aman's age is 3 times his son's age. 10 years ago he was 5 times his son's age. Find their present ages.

Let the age of Aman's son be x then age of Aman will be $3x$.

According to the question,

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

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

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

$$\Rightarrow 2x = 40$$

$$\Rightarrow x = 20$$

Aman's son age = $x = 20$ years

Aman age = $3x = 3 \times 20 = 60$ years

TEST - 2

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?

EXERCISE 2.5

Reducing equations to simpler form

Solve the following linear equations.

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

Solution:

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

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

$$\Rightarrow \frac{(3x-2x)}{6} = \frac{(5+4)}{20}$$

$$\Rightarrow 3x - 2x = \frac{9}{20} \times 6$$

$$\Rightarrow x = \frac{54}{20}$$

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

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

Solution:

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

$$\Rightarrow \frac{(6n-9n+10n)}{12} = 21$$

$$\Rightarrow \frac{7n}{12} = 21$$

$$\Rightarrow 7n = 21 \times 12$$

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

$$\Rightarrow n = 36$$

Question 3:

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

Answer 3:

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

$$\Rightarrow \frac{x}{1} - \frac{8x}{3} + \frac{5x}{2} = \frac{17}{6} - \frac{7}{1} \qquad \Rightarrow \frac{6x - 16x + 15x}{6} = \frac{17 - 42}{6}$$

$$\Rightarrow \frac{5x}{6} = \frac{-25}{6} \qquad \Rightarrow x = \frac{-25 \times 6}{6 \times 5} \qquad \Rightarrow x = -5$$

Question 5:

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

Answer 5:

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

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

$$\Rightarrow \frac{9t-6-8t-12+12t}{12} = \frac{2}{3}$$

$$\Rightarrow 3 \times (13t-18) = 2 \times 12$$

$$\Rightarrow 39t = 78$$

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

$$\Rightarrow \frac{13t-18}{12} = \frac{2}{3}$$

$$\Rightarrow 39t - 54 = 24 \quad \Rightarrow 39t = 24 + 54$$

$$\Rightarrow t = \frac{78}{39} = 2$$

Question 6:

Solve the following linear equation: $m - \frac{m-1}{2} = 1 - \frac{m-2}{3}$

Answer 6:

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

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

$$\Rightarrow \frac{6m - 3m + 3 + 2m - 4}{6} = 1 \qquad \Rightarrow \frac{5m - 1}{6} = 1 \qquad \Rightarrow 5m - 1 = 6$$

$$\Rightarrow 5m = 6 + 1 \qquad \Rightarrow 5m = 7 \qquad \Rightarrow m = \frac{7}{5}$$

Question 9:

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

$$\Rightarrow 15z - 21 - 18z + 22 = 32z - 52 - 17 \text{ (Opening the brackets)}$$

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

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

$$\Rightarrow -35z = -70$$

$$\Rightarrow z = \frac{70}{35} = 2$$

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

Solution:

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

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

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

$$\Rightarrow 0.5f = 0.30$$

$$\Rightarrow f = \frac{0.30}{0.5}$$

$$\Rightarrow f = \frac{3}{5} = 0.6$$

EXERCISE 2.6

Question 4:

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

Answer 4:

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

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

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

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

$$\Rightarrow 3y = -24$$

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

$$\Rightarrow y = -8$$

Question 5:

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

Answer 5:

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

$$\Rightarrow 3(7y+4) = -4(y+2) \quad \Rightarrow 21y+12 = -4y-8$$

$$\Rightarrow 21y+4y = -8-12 \quad \Rightarrow 25y = -20$$

$$\Rightarrow y = \frac{-20}{25} \quad \Rightarrow y = \frac{-4}{5}$$

Question 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.

Answer 6:

Let the Ages of Hari and Harry be $5x$ years and $7x$ years.

According to question, $\frac{5x+4}{7x+4} = \frac{3}{4}$

$$\Rightarrow 4(5x+4) = 3(7x+4)$$

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

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

$$\Rightarrow -x = -4$$

$$\Rightarrow x = 4$$

Hence, the age of Hari = $5x = 5 \times 4 = 20$ years and the age of Harry = $7x = 7 \times 4 = 28$ years.

Question 7:

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

Answer 7:

Let the numerator of a rational number be x , then the denominator is $x+8$.

$$\text{Therefore, Rational number} = \frac{x}{x+8}$$

$$\text{According to the question, } \frac{x+17}{x+8-1} = \frac{3}{2}$$

$$\Rightarrow \frac{x+17}{x+7} = \frac{3}{2}$$

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

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

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

$$\Rightarrow -x = -13 \quad \Rightarrow x = 13$$

$$\text{Hence, the required rational number} = \frac{x}{x+8} = \frac{13}{13+8} = \frac{13}{21}.$$

TEST -3

1) Present ages of Anil and Sunil are in the ratio 4:5. Eight years from now the ratio of their ages will be 5:6. Find their present ages.

2) Solve : $\frac{x+1}{2x+3} = \frac{3}{8}$

DELHI PUBLIC SCHOOL, GANDHINAGAR
CHAPTER: 3 UNDERSTANDING QUADRILATERALS

MIND MAP

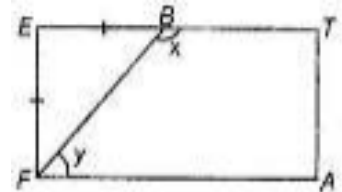
This chapter consists of two different topics. The most probable questions from examination point of view are given below.

TYPE:1 POLYGONS , ANGLE SUM PROPERTY

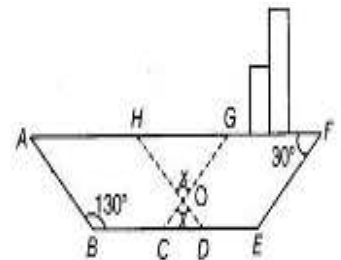
- Q.1. Draw the following:
 (a) a convex polygon (b) a concave polygon
- Q.2. How many diagonals does a triangle have?
- Q.3. Find the number of sides of a regular polygon whose each exterior angle has a measure of 15° .
- Q.4. The sum of two opposite angles of a quadrilateral is 172° . The other two angles of the quadrilateral are equal find the equal angles.

TYPE:2 KINDS OF QUADRILATERALS AND THEIR PROPERTIES

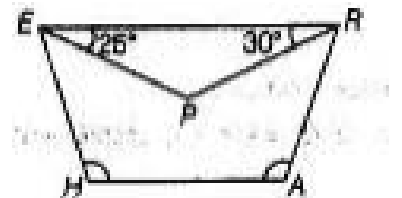
- Q.1. A playground is in the form of a rectangle ATEF.
 Two players are standing at the points F and B, where $EF = EB$.
 Find the values of x and y .



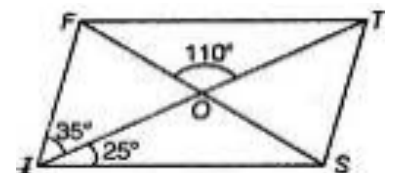
- Q.2. In the following figure of a ship, ABDH and CEFG are parallelograms.
 Find the value of x .



- Q.3. In trapezium HARE, EP and RP are bisectors of $\angle E$ and $\angle R$, respectively.
 Find $\angle HAR$ and $\angle EHA$.



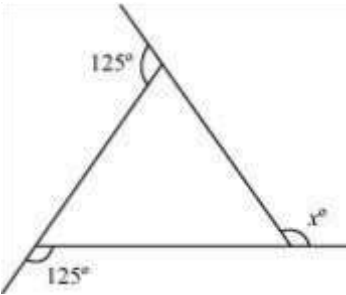
- Q.4. In parallelogram FIST, find, $\angle SFT$, $\angle OST$ and $\angle STO$.



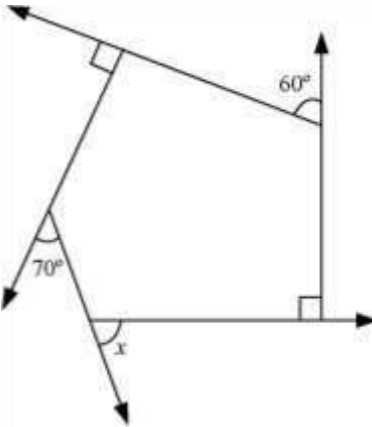
Exercise 3.2 : Solutions of Questions on Page Number : 44

Q1 :

Find x in the following figures.



(a)



(b)

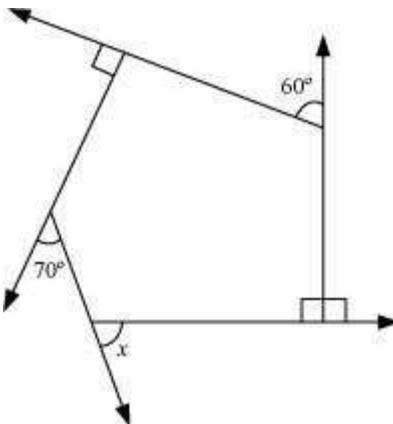
Answer :

We know that the sum of all exterior angles of any polygon is 360° .

$$(a) 125^\circ + 125^\circ + x = 360^\circ$$

$$250^\circ + x = 360^\circ \quad x = 110^\circ$$

(b)



$$60^\circ + 90^\circ + 70^\circ + x + 90^\circ = 360^\circ$$

$$310^\circ + x = 360^\circ - x$$
$$= 50^\circ$$

Q2 :

Find the measure of each exterior angle of a regular polygon of

(i) 9 sides

(ii) 15 sides

Answer :

(i) Sum of all exterior angles of the given polygon = 360°

Each exterior angle of a regular polygon has the same measure.

Thus, measure of each exterior angle of a regular polygon of 9 sides

$$= \frac{360^\circ}{9} = 40^\circ$$

(ii) Sum of all exterior angles of the given polygon = 360°

Each exterior angle of a regular polygon has the same measure.

Thus, measure of each exterior angle of a regular polygon of 15 sides

$$= \frac{360^\circ}{15} = 24^\circ$$

Q3 :

How many sides does a regular polygon have if the measure of an exterior angle is 24°

Answer :

Sum of all exterior angles of the given polygon = 360°
Measure of each exterior angle = 24°

Thus, number of sides of the regular polygon = $\frac{360^\circ}{24^\circ} = 15$

Q4 :

How many sides does a regular polygon have if each of its interior angles is 165°

Answer :

Measure of each interior angle = 165°

Measure of each exterior angle = $180^\circ - 165^\circ = 15^\circ$

The sum of all exterior angles of any polygon is 360° .

Thus, number of sides of the polygon = $\frac{360^\circ}{15^\circ} = 24$

Q5 :

(a) Is it possible to have a regular polygon with measure of each exterior angle as 22° (b) Can it be an interior angle of a regular polygon Why

Answer :

The sum of all exterior angles of all polygons is 360° . Also, in a regular polygon, each exterior angle is of the same measure. Hence, if 360° is a perfect multiple of the given exterior angle, then the given polygon will be possible.

(a) Exterior angle = 22°

360° is not a perfect multiple of 22° . Hence, such polygon is not possible.

(b) Interior angle = 22°

$$\text{Exterior angle} = 180^\circ - 22^\circ = 158^\circ$$

Such a polygon is not possible as 360° is not a perfect multiple of 158° .

Q6 :

(a) What is the minimum interior angle possible for a regular polygon

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

Answer :

Consider a regular polygon having the lowest possible number of sides (i.e., an equilateral triangle). The exterior angle of this triangle will be the maximum exterior angle possible for any regular polygon.

Exterior angle of an equilateral triangle $= \frac{360^\circ}{3} = 120^\circ$

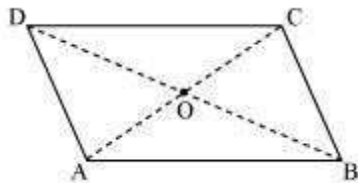
Hence, maximum possible measure of exterior angle for any polygon is 120° . Also, we know that an exterior angle and an interior angle are always in a linear pair.

$$\text{Hence, minimum interior angle} = 180^\circ - 120^\circ = 60^\circ$$

Exercise 3.3 : Solutions of Questions on Page Number : 50

Q1 :

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



(i) $AD = \dots$

(ii) $\angle DCB = \dots$

(iii) $OC = \dots$

(iv) $m\angle DAB + m\angle CDA = \dots$

Answer :

(i) In a parallelogram, opposite sides are equal in length.

$$AD = BC$$

(ii) In a parallelogram, opposite angles are equal in measure.

$$\angle DCB = \angle DAB$$

(iii) In a parallelogram, diagonals bisect each other.

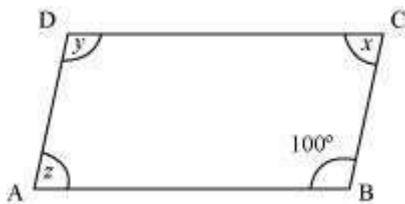
$$\text{Hence, } OC = OA$$

(iv) In a parallelogram, adjacent angles are supplementary to each other.

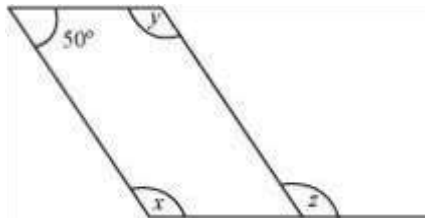
$$\text{Hence, } m\angle DAB + m\angle CDA = 180^\circ$$

Q2 :

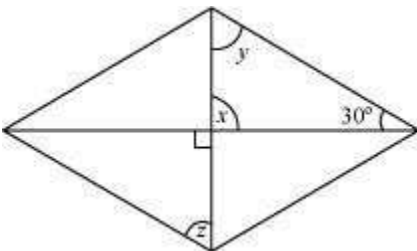
Consider the following parallelograms. Find the values of the unknowns x, y, z .



(i)



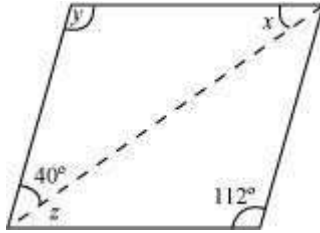
(ii)



(iii)



(iv)



(v)

Answer :

(i) $x + 100^\circ = 180^\circ$ (Adjacent angles are supplementary) $x = 80^\circ$ $z = x = 80^\circ$ (Opposite angles are equal) $y = 100^\circ$ (Opposite angles are equal)

(ii) $50^\circ + y = 180^\circ$ (Adjacent angles are supplementary) $y = 130^\circ$ $x = y = 130^\circ$ (Opposite angles are equal) $z = x = 130^\circ$ (Corresponding angles) (iii) $x = 90^\circ$ (Vertically opposite angles) $x + y + 30^\circ = 180^\circ$

(Angle sum property of triangles)

$120^\circ + y = 180^\circ$ $y = 60^\circ$ $z = y = 60^\circ$ (Alternate

interior angles) (iv) $z = 80^\circ$ (Corresponding

angles) $y = 80^\circ$ (Opposite angles are equal) $x + y$

$= 180^\circ$ (Adjacent angles are supplementary) $x =$

$180^\circ - 80^\circ = 100^\circ$

(v) $y = 112^\circ$ (Opposite angles are equal) $x + y + 40^\circ$

$= 180^\circ$ (Angle sum property of triangles) $x + 112^\circ +$

$$40^\circ = 180^\circ - x \quad 152^\circ = 180^\circ - x \quad x = 28^\circ \quad z = x = 28^\circ$$

(Alternate interior angles)

Q3 :

Can a quadrilateral ABCD be a parallelogram if

(i) $\angle D + \angle B = 180^\circ$

(ii) $AB = DC = 8 \text{ cm}$, $AD = 4 \text{ cm}$ and $BC = 4.4 \text{ cm}$

(iii) $\angle A = 70^\circ$ and $\angle C = 65^\circ$

Answer :

(i) For $\angle D + \angle B = 180^\circ$, quadrilateral ABCD may or may not be a parallelogram. Along with this condition, the following conditions should also be fulfilled.

The sum of the measures of adjacent angles should be 180° .

Opposite angles should also be of same measures.

(ii) No. Opposite sides AD and BC are of different lengths.

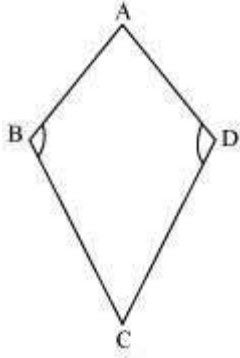
(iii) No. Opposite angles A and C have different measures.

Q4 :

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

Answer :

Here, quadrilateral ABCD (kite) has two of its interior angles, $\angle B$ and $\angle D$, of same measures. However, still the quadrilateral ABCD is not a parallelogram as the measures of the remaining pair of opposite angles, $\angle A$ and $\angle C$, are not equal.



Q5 :

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

Answer :

Let the measures of two adjacent angles, $\angle A$ and $\angle B$, of parallelogram ABCD are in the ratio of 3:2. Let $\angle A = 3x$ and $\angle B = 2x$

We know that the sum of the measures of adjacent angles is 180° for a parallelogram.

$$\angle A + \angle B = 180^\circ$$

$$3x + 2x = 180^\circ$$

$$5x = 180^\circ$$

$$x = \frac{180^\circ}{5} = 36^\circ$$

$$\angle A = \angle C = 3x = 108^\circ \text{ (Opposite angles)}$$

$$\angle B = \angle D = 2x = 72^\circ \text{ (Opposite angles)}$$

Thus, the measures of the angles of the parallelogram are 108° , 72° , 108° , and 72° .

Q6 :

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

Answer :

Sum of adjacent angles = 180°

$$\angle A + \angle B = 180^\circ$$

$$2\angle A = 180^\circ (\angle A = \angle B)$$

$$\angle A = 90^\circ$$

$$\angle B = \angle A = 90^\circ$$

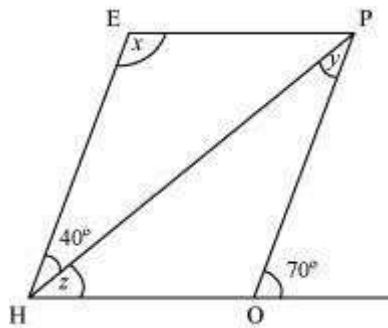
$$\angle C = \angle A = 90^\circ \text{ (Opposite angles)}$$

$$\angle D = \angle B = 90^\circ \text{ (Opposite angles)}$$

Thus, each angle of the parallelogram measures 90° .

Q7 :

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



Answer :

$$y = 40^\circ \text{ (Alternate interior angles)}$$

$$70^\circ = z + 40^\circ \text{ (Corresponding angles)}$$

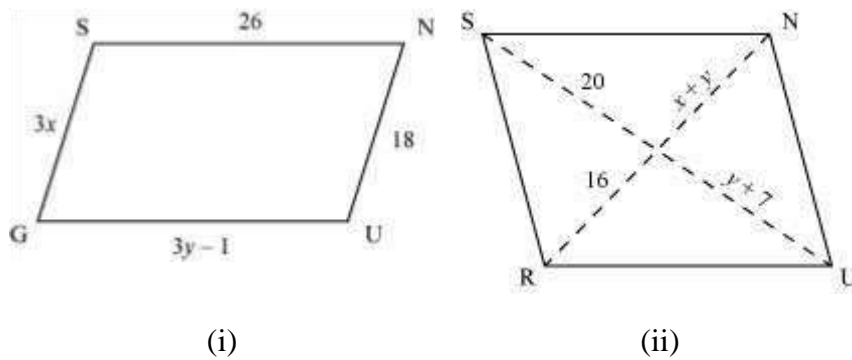
$$70^\circ - 40^\circ = z \quad z = 30^\circ \quad x + (z + 40^\circ) = 180^\circ$$

$$\text{(Adjacent pair of angles)} \quad x + 70^\circ = 180^\circ \quad x =$$

$$110^\circ$$

Q8 :

The following figures GUNS and RUNS are parallelograms. Find x and y . (Lengths are in cm)



Answer :

(i) We know that the lengths of opposite sides of a parallelogram are equal to each other.

$$GU = SN$$

$$3y - 1 = 26$$

$$3y = 27$$

$$y = 9$$

$$SG = NU$$

$$3x = 18 \quad x$$

$$= 6$$

Hence, the measures of x and y are 6 cm and 9 cm respectively. (ii) We know that the diagonals of a parallelogram bisect each other.

$$y + 7 = 20$$

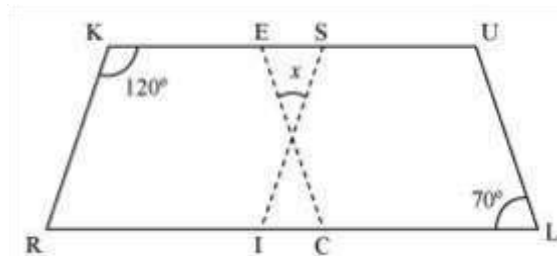
$$y = 13 \quad x + y =$$

$$16 \quad x + 13 =$$

$$16 \quad x = 3$$

Hence, the measures of x and y are 3 cm and 13 cm respectively.

Q9 :



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

Answer :

Adjacent angles of a parallelogram are supplementary.

In parallelogram RISK, $\angle RKS + \angle ISK = 180^\circ$

$$120^\circ + \angle ISK = 180^\circ$$

$$\angle ISK = 60^\circ$$

Also, opposite angles of a parallelogram are equal.

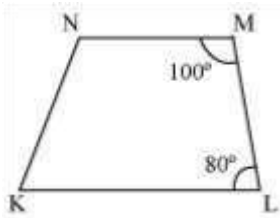
In parallelogram CLUE, $\angle ULC = \angle CEU = 70^\circ$

The sum of the measures of all the interior angles of a triangle is 180° .

$$x + 60^\circ + 70^\circ = 180^\circ \quad x = 50^\circ$$

Q10 :

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



Answer :

If a transversal line is intersecting two given lines such that the sum of the measures of the angles on the same side of transversal is 180° , then the given two lines will be parallel to each other.

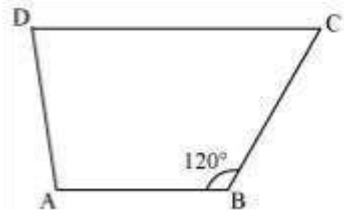
$$\text{Here, } \angle NML + \angle MLK = 180^\circ$$

Hence, $NM \parallel LK$

As quadrilateral KLMN has a pair of parallel lines, therefore, it is a trapezium.

Q11 :

Find $m\angle C$ in the following figure if $\overline{AB} \parallel \overline{DC}$



Answer :

Given that, $\overline{AB} \parallel \overline{DC}$

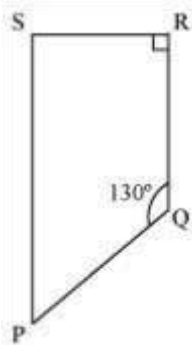
$\angle B + \angle C = 180^\circ$ (Angles on the same side of transversal)

$$120^\circ + \angle C = 180^\circ$$

$$\angle C = 60^\circ$$

Q12 :

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



Answer :

$\angle P + \angle Q = 180^\circ$ (Angles on the same side of transversal)

$$\angle P + 130^\circ = 180^\circ$$

$$\angle P = 50^\circ$$

$\angle R + \angle S = 180^\circ$ (Angles on the same side of transversal)

$$90^\circ + \angle R = 180^\circ$$

$$\angle S = 90^\circ$$

Yes. There is one more method to find the measure of $m\angle P$.

$m\angle R$ and $m\angle Q$ are given. After finding $m\angle S$, the angle sum property of a quadrilateral can be applied to find $m\angle P$.

Exercise 3.4 : Solutions of Questions on Page Number : 55

Q1 :

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.**

Answer :

- (a) False. All squares are rectangles but all rectangles are not squares.
- (b) True. Opposite sides of a rhombus are equal and parallel to each other.
- (c) True. All squares are rhombuses as all sides of a square are of equal lengths. All squares are also rectangles as each internal angle measures 90° .
- (d) False. All squares are parallelograms as opposite sides are equal and parallel.
- (e) False. A kite does not have all sides of the same length.
- (f) True. A rhombus also has two distinct consecutive pairs of sides of equal length.
- (g) True. All parallelograms have a pair of parallel sides.
- (h) True. All squares have a pair of parallel sides.

Q2 :

Identify all the quadrilaterals that have

(a) four sides of equal length

(b) four right angles

Answer :

(a) Rhombus and Square are the quadrilaterals that have 4 sides of equal length.

(b) Square and rectangle are the quadrilaterals that have 4 right angles.

Q3 :

Explain how a square is.

(i) a quadrilateral

(ii) a parallelogram

(iii) a rhombus

(iv) a rectangle

Answer :

(i) A square is a quadrilateral since it has four sides.

(ii) A square is a parallelogram since its opposite sides are parallel to each other. (iii) A square is a rhombus since its four sides are of the same length.

(iv) A square is a rectangle since each interior angle measures 90° .

Q4 :

Name the quadrilaterals whose diagonals.

(i) bisect each other

(ii) are perpendicular bisectors of each other

(iii) are equal

Answer :

(i) The diagonals of a parallelogram, rhombus, square, and rectangle bisect each other.

(ii) The diagonals of a rhombus and square act as perpendicular bisectors.

(iii) The diagonals of a rectangle and square are equal.

Q5 :

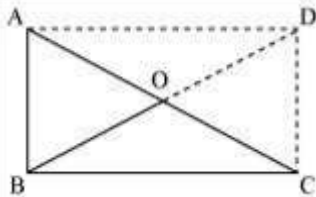
Explain why a rectangle is a convex quadrilateral.

Answer :

In a rectangle, there are two diagonals, both lying in the interior of the rectangle. Hence, it is a convex quadrilateral.

Q6 :

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).



Answer :

Draw lines AD and DC such that $AD \parallel BC$, $AB \parallel DC$

$AD = BC$, $AB = DC$

ABCD is a rectangle as opposite sides are equal and parallel to each other and all the interior angles are of 90° .

In a rectangle, diagonals are of equal length and also these bisect each other.

Hence, $AO = OC = BO = OD$

Thus, O is equidistant from A, B, and C.

DELHI PUBLIC SCHOOL, GANDHINAGAR
CHAPTER 6: SQUARES AND SQUARE ROOTS
MIND MAP

This chapter consists of three different topics. The most probable questions from examination point of view are given below.

TYPE:1 SQUARE NUMBERS AND PROPERTIES OF SQUARE NUMBERS

- Q.1. Find the square of the given number.
- Q.2. Express 121 as the sum of 11 odd numbers.
- Q.3. Find the number of non- square numbers between 6^2 and 7^2 .
- Q.4. Find the Pythagorean Triplet whose one member is 16.

TYPE: 2 FINDING SQUARE ROOT

- Q.1. Find square root of 5629 by the **prime factorisation** method.
- Q.2. Find the square root of 2304 by **long division** method.
- Q.3. Find the square root of 12.25 by **long division** method.
- Q.4. Find the smallest number by which 1008 should be **multiplied** so as to get a perfect square. Also find the square root of the square number so obtained.
- Q.5. Find the smallest number by which 2645 should be **divided** so as to get a perfect square. Also find the square root of the square number so obtained.
- Q.6. Find the least number which must be **subtracted** from 3520 so as to get a perfect square. Also find the square root of the square number so obtained.
- Q.7. Find the least number which must be **added** to 1750 so as to get a perfect square. Also find the square root of the square number so obtained.

TYPE: 3 APPLICATION OF SQUARE AND SQUARE ROOT IN REAL LIFE SITUATIONS

- Q.1. There are 2401 students in a school. P.T teacher wants them to stand in rows and columns such that the number of rows is equal to the number of columns. Find the number of rows.
- Q.2. Area of a square plot is $2304 m^2$. Find the side of the square plot.

Exercise 6.1 : Solutions of Questions on Page Number : 96

Q1 :

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

Answer :

We know that if a number has its unit's place digit as a , then its square will end with the unit digit of the multiplication $a \times a$.

(i) 81

Since 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

Since 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

Since 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

Since 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

Since 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

Since 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

Since 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

Since 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

Since 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

Since 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.

Q2 :

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

Answer :

The square of numbers may end with any one of the digits 0, 1, 5, 6, or 9. Also, a perfect square has even number of zeroes at the end of it.

- (i) 1057 has its unit place digit as 7. Therefore, it cannot be a perfect square.
- (ii) 23453 has its unit place digit as 3. Therefore, it cannot be a perfect square.
- (iii) 7928 has its unit place digit as 8. Therefore, it cannot be a perfect square.
- (iv) 222222 has its unit place digit as 2. Therefore, 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. Therefore, it cannot be a perfect square.
- (vii) 222000 has three zeroes at the end of it. However, 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. However, since a perfect square cannot end with odd number of zeroes, it is not a perfect square.

Q3 :

The squares of which of the following would be odd numbers?

- (i) 431 (ii) 2826
- (iii) 7779 (iv) 82004

Answer :

The square of an odd number is odd and the square of an even number is even. Here, 431 and 7779 are odd numbers.

Thus, the square of 431 and 7779 will be an odd number.

Q4 :

Observe the following pattern and find the missing digits.

$$11^2 = 121$$

$$101^2 = 10201$$

$$1001^2 = 1002001$$

$$100001^2 = 1\dots2\dots1$$

$$10000001^2 = \dots$$

Answer :

In 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,

$$100001^2 = 10000200001$$

$$10000001^2 = 100000020000001$$

Q5 :

Observe the following pattern and supply the missing number.

$$11^2 = 121$$

$$101^2 = 10201$$

$$10101^2 = 102030201$$

$$1010101^2 = \dots$$

$$\dots^2 = 10203040504030201$$

Answer :

By following the given pattern, we obtain

$$1010101^2 = 1020304030201$$

$$101010101^2 = 10203040504030201$$

Q6 :

Using the given pattern, find the missing numbers.

$$1^2 + 2^2 + 2^2 = 3^2$$

$$2^2 + 3^2 + 6^2 = 7^2$$

$$3^2 + 4^2 + 12^2 = 13^2$$

$$4^2 + 5^2 + _{}^2 = 21^2$$

$$5^2 + _{}^2 + 30^2 = 31^2$$

$$6^2 + 7^2 + _{}^2 = _{}^2$$

Answer :

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 as follows.

$$4^2 + 5^2 + \underline{20^2} = 21^2$$

$$5^2 + \underline{6^2} + 30^2 = 31^2$$

$$6^2 + 7^2 + \underline{42^2} = \underline{43^2}$$

Q7 :

Without adding find the sum

(i) $1 + 3 + 5 + 7 + 9$

(ii) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19$

(iii) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23$

Answer :

We know that the sum of first n odd natural numbers is n^2 .

(i) Here, we have to find the sum of first five odd natural numbers.

Therefore, $1 + 3 + 5 + 7 + 9 = (5)^2 = 25$

(ii) Here, we have to find the sum of first ten odd natural numbers.

Therefore, $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 = (10)^2 = 100$

(iii) Here, we have to find the sum of first twelve odd natural numbers.

Therefore, $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 = (12)^2 = 144$

Q8 :

(i) Express 49 as the sum of 7 odd numbers.

(ii) Express 121 as the sum of 11 odd numbers.

Answer :

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.

$$121 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21$$

Q9 :

How many numbers lie between squares of the following numbers?

(i) 12 and 13 (ii) 25 and 26 (iii) 99 and 100

Answer :

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 : Solutions of Questions on Page Number : 98

Q1 :

Find the square of the following numbers

(i) 32 (ii) 35

(iii) 86 (iv) 93

(v) 71 (vi) 46

Answer :

$$(i) 32^2 = (30 + 2)^2$$

$$= 30(30 + 2) + 2(30 + 2)$$

$$= 30^2 + 30 \times 2 + 2 \times 30 + 2^2$$

$$= 900 + 60 + 60 + 4$$

$$= 1024$$

(ii) The number 35 has 5 in its unit's place. Therefore,

$$35^2 = (30 + 5)^2$$

$$= (3 \times 10 + 5)^2$$

$$= 1200 + 25 = 1225$$

$$(iii) 86^2 = (80 + 6)^2$$

$$= 80(80 + 6) + 6(80 + 6)$$

$$= 80^2 + 80 \times 6 + 6 \times 80 + 6^2$$

$$= 6400 + 480 + 480 + 36$$

$$= 7396$$

$$(iv) 93^2 = (90 + 3)^2$$

$$= 90(90 + 3) + 3(90 + 3)$$

$$= 90^2 + 90 \times 3 + 3 \times 90 + 3^2$$

$$= 8100 + 270 + 270 + 9$$

$$= 8649$$

$$(v) 71^2 = (70 + 1)^2$$

$$= 70(70 + 1) + 1(70 + 1)$$

$$= 70^2 + 70 \times 1 + 1 \times 70 + 1^2$$

$$= 4900 + 70 + 70 + 1$$

$$= 5041$$

$$(vi) 46^2 = (40 + 6)^2$$

$$= 40(40 + 6) + 6(40 + 6)$$

$$= 40^2 + 40 \times 6 + 6 \times 40 + 6^2$$

$$= 1600 + 240 + 240 + 36$$

$$= 2116$$

Q2 :

Write a Pythagorean triplet whose one member is

(i) 6 (ii) 14

(iii) 16 (iv) 18

Answer :

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.

$$\text{Let } 2m = 6 \quad m = 3$$

Therefore, the Pythagorean triplets are 2×3 , $3^2 - 1$, $3^2 + 1$ or 6, 8, and 10.

(ii) If we take $m^2 + 1 = 14$, then $m^2 = 13$

The value of m will not be an integer.

If we take $m^2 - 1 = 14$, then $m^2 = 15$

Again the value of m is not an integer.

$$\text{Let } 2m = 14 \quad m = 7$$

Thus, $m^2 - 1 = 49 - 1 = 48$ and $m^2 + 1 = 49 + 1 = 50$

Therefore, the required triplet is 14, 48, and 50.

(iii) If we take $m^2 + 1 = 16$, then $m^2 = 15$

The value of m will not be an integer.

If we take $m^2 - 1 = 16$, then $m^2 = 17$

Again the value of m is not an integer.

$$\text{Let } 2m = 16 \quad m = 8$$

Thus, $m^2 - 1 = 64 - 1 = 63$ and $m^2 + 1 = 64 + 1 = 65$

Therefore, the Pythagorean triplet is 16, 63, and 65.

(iv) If we take $m^2 + 1 = 18$, $m^2 = 17$

The value of m will not be an integer.

If we take $m^2 - 1 = 18$, then $m^2 = 19$

Again the value of m is not an integer.

Let $2m = 18$ $m = 9$

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 : Solutions of Questions on Page Number : 102

Q1 :

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

Answer :

(i) If the number ends with 1, then the one's digit of the square root of that number may be 1 or 9. Therefore, 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. Therefore, 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. Therefore, 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. Therefore, the one's digit of the square root of 657666025 is 5.

Q2 :

Without doing any calculation, find the numbers which are surely not perfect squares.

(i) 153 (ii) 257

(iii) 408 (iv) 441

Answer :

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, if any.

(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.

Q3 :

Find the square roots of 100 and 169 by the method of repeated subtraction.

Answer :

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 have subtracted successive odd numbers starting from 1 to 100, and obtained 0 at 10th 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 13th step.

Therefore, $\sqrt{169} = 13$

Q4 :

Find the square roots of the following numbers by the Prime Factorisation Method.

(i) 729 (ii) 400

(iii) 1764 (iv) 4096

(v) 7744 (vi) 9604

(vii) 5929 (viii) 9216

(ix) 529 (x) 8100

Answer :

(i) 729 can be factorised as follows.

3	729
3	243
3	81
3	27
3	9
3	3
	1

$$729 = \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$$

$$\therefore \sqrt{729} = 3 \times 3 \times 3 = 27$$

(ii) 400 can be factorised as follows.

2	400
2	200
2	100
2	50
5	25
5	5
	1

$$400 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5}$$

$$\therefore \sqrt{400} = 2 \times 2 \times 5 = 20$$

(iii) 1764 can be factorised as follows.

2	1764
2	882
3	441
3	147
7	49
7	7
	1

$$1764 = 2 \times 2 \times 3 \times 3 \times 7 \times 7$$

$$\therefore \sqrt{1764} = 2 \times 3 \times 7 = 42$$

(iv) 4096 can be factorised as follows.

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16

2	8
2	4
2	2
	1

$$4096 = 2^{\underline{\quad}} \times \underline{\quad}$$

Q5 :

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

Answer :

(i) 252 can be factorised as follows.

2	252
2	126
3	63
3	21
7	7
	1

$$252 = \underline{2 \times 2} \times \underline{3 \times 3} \times 7$$

Here, prime factor 7 does not have its pair.

If 7 gets a pair, then the number will become a perfect square. Therefore, 252 has to 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 can be factorised as follows.

2	180
2	90
3	45
3	15
5	5
	1

$$180 = \underline{2 \times 2} \times \underline{3 \times 3} \times 5$$

Here, prime factor 5 does not have its pair. If 5 gets a pair, then the number will become a perfect square. Therefore, 180 has to 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 can be factorised as follows.

2	1008
2	504
2	252
2	126
3	63
3	21
7	7
	1

$$1008 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times 7$$

Here, prime factor 7 does not have its pair. If 7 gets a pair, then the number will become a perfect square. Therefore, 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 can be factorised as follows.

2	2028
2	1014

Q6 :

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

Answer :

(i) 252 can be factorised as follows.

2	252
2	126
3	63
3	21
7	7
	1

$$252 = 2 \times 2 \times 3 \times 3 \times 7$$

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 has to be divided by 7 to obtain a perfect square.

$252 \div 7 = 36$ is a perfect square.

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

$$\therefore \sqrt{36} = 2 \times 3 = 6$$

(ii) 2925 can be factorised as follows.

3	2925
3	975
5	325
5	65
13	13
	1

$$2925 = 3 \times 3 \times 5 \times 5 \times 13$$

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.

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

$$\therefore \sqrt{225} = 3 \times 5 = 15$$

(iii) 396 can be factorised as follows.

2	396
2	198
3	99
3	33
11	11
	1

$$396 = 2 \times 2 \times 3 \times 3 \times 11$$

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 has to be divided by 11 to obtain a perfect square.

$396 \div 11 = 36$ is a perfect square.

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

$$\therefore \sqrt{36} = 2 \times 3 = 6$$

(iv) 2645 can be factorised as follows.

5	2645
---	------

Q7 :

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.

Answer :

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.

$$\text{Number of students in the class} = \sqrt{2401}$$

$$2401 = 7 \times 7 \times 7 \times 7$$

$$\therefore \sqrt{2401} = 7 \times 7 = 49$$

Hence, the number of students in the class is 49.

Q8 :

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.

Answer :

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 \times Number of plants in each row

Number of rows \times Number of plants in each row = 2025

(Number of rows)² = 2025

$$\text{Number of rows} = \sqrt{2025}$$

$$2025 = \underline{5 \times 5} \times \underline{3 \times 3} \times \underline{3 \times 3}$$

$$\therefore \sqrt{2025} = 5 \times 3 \times 3 = 45$$

Thus, the number of rows and the number of plants in each row is 45.

Q9 :

Find the smallest square number that is divisible by each of the numbers 4, 9, and 10.

Answer :

The number that will be perfectly divisible by each one of 4, 9, and 10 is their LCM. The LCM of these numbers is as follows.

2	4, 9, 10
2	2, 9, 5
3	1, 9, 5
3	1, 3, 5
5	1, 1, 5
	1, 1, 1

LCM of 4, 9, 10 = $\underline{2} \times \underline{2} \times \underline{3} \times \underline{3} \times 5 = 180$

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 $180 \times 5 = 900$

Q10 :

Find the smallest square number that is divisible by each of the numbers 8, 15, and 20.

Answer :

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 6.4 : Solutions of Questions on Page Number : 107

Q1 :

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

Answer :

(i) The square root of 2304 can be calculated as follows.

	48
4	$\overline{2304}$ -16
88	704 704
	0

$\therefore \sqrt{2304} = 48$

(ii) The square root of 4489 can be calculated as follows.

	67
6	$\overline{4489}$ -36
127	889 889
	0

$\therefore \sqrt{4489} = 67$

(iii) The square root of 3481 can be calculated as follows.

	59
5	$\overline{3481}$ -25

109	981 981
	0

Therefore, $\sqrt{3481} = 59$

(iv) The square root of 529 can be calculated as follows.

	23
2	$\overline{529}$ -4
43	129 129
	0

$\therefore \sqrt{529} = 23$

(v) The square root of 3249 can be calculated as follows.

	57
5	$\overline{3249}$ -25
107	749 749
	0

∴

Q2 :

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

Answer :

(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

$$144 = \overline{144}$$

Since there are two bars, the square root of 144 will have 2 digits in it.

(iii) By placing bars, we obtain

$$4489 = \overline{4489}$$

Since there are two bars, the square root of 4489 will have 2 digits in it.

(iv) By placing bars, we obtain

$$27225 = \overline{27225}$$

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.

Q3 :

Find the square root of the following decimal numbers.

(i) 2.56 (ii) 7.29

(iii) 51.84 (iv) 42.25

(v) 31.36

Answer :

(i) The square root of 2.56 can be calculated as follows.

	1.6
1	$\overline{2.56}$ -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	$\overline{7.29}$ -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	$\overline{51.84}$ -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	$\overline{42.25}$ -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	$\overline{31.36}$ -25
106	636 636
	0

\therefore

Q4 :

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

Answer :

(i) The square root of 402 can be calculated by long division method as follows.

	20
2	$\overline{402}$ -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	$\overline{1989}$ -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	$\overline{3250}$ -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	$\overline{825}$ -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

Q5 :

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

Answer :

(i) The square root of 525 can be calculated by long division method as follows.

	22
2	$\overline{525}$ -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 = $23^2 - 525 = 529 - 525 = 4$

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	$\overline{1750}$ -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	$\overline{252}$ -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	$\overline{1825}$ -16
82	225 164
	61

The remainder is 61. It represents that the square of 42

Q6 :

Find the length of the side of a square whose area is 441 m^2 .

Answer :

Let the length of the side of the square be $x \text{ m}$.

$$\text{Area of square} = (x)^2 = 441 \text{ m}^2$$

$$x = \sqrt{441}$$

The square root of 441 can be calculated as follows.

	21
2	$\overline{441}$ -4
41	041 41
	0

$$\therefore x = 21 \text{ m}$$

Hence, the length of the side of the square is 21 m.

Q7 :

In a right triangle ABC, $\angle B = 90^\circ$.

(a) If $AB = 6 \text{ cm}$, $BC = 8 \text{ cm}$, find AC

(b) If $AC = 13$ cm, $BC = 5$ cm, find AB

Answer :

(a) $\triangle ABC$ is right-angled at B .

Therefore, by applying Pythagoras theorem, we obtain

$$AC^2 = AB^2 + BC^2$$

$$AC^2 = (6 \text{ cm})^2 + (8 \text{ cm})^2$$

$$AC^2 = (36 + 64) \text{ cm}^2 = 100 \text{ cm}^2$$

$$AC = (\sqrt{100}) \text{ cm} = (\sqrt{10 \times 10}) \text{ cm}$$

$$AC = 10 \text{ cm}$$

(b) $\triangle ABC$ is right-angled at B .

Therefore, by applying Pythagoras theorem, we obtain

$$AC^2 = AB^2 + BC^2$$

$$(13 \text{ cm})^2 = (AB)^2 + (5 \text{ cm})^2$$

$$AB^2 = (13 \text{ cm})^2 - (5 \text{ cm})^2 = (169 - 25) \text{ cm}^2 = 144 \text{ cm}^2$$

$$AB = (\sqrt{144}) \text{ cm} = (\sqrt{12 \times 12}) \text{ cm}$$

$$AB = 12 \text{ cm}$$

Q8 :

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.

Answer :

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	$\overline{1000}$ - 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.

Q9 :

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?

Answer :

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	$\overline{500}$ -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.

DELHI PUBLIC SCHOOL, GANDHINAGAR

CHAPTER 7: CUBES AND CUBE ROOTS

MIND MAP

This chapter consists of two different topics. The most probable questions from examination point of view are given below.

TYPE:1 CUBES

- Q.1. Check whether the given number is a perfect cube or not.
- Q.2. Find the smallest number by which 243 must be multiplied to obtain a perfect cube.
- Q.3. Find the smallest number by which 135 must be divided to obtain a perfect cube.

TYPE: 2 FINDING CUBE ROOT

- Q.1. Find the cube root of 13824 by prime factorisation method.
- Q.2. Find the cube root of 32768 by estimation method.

Class -VIII Mathematics (Ex. 7.1)

Answers

1. (i) 216

Prime factors of 216 = $2 \times 2 \times 2 \times 3 \times 3 \times 3$
Here all factors are in groups of 3's (in triplets)
Therefore, 216 is a perfect cube number.

2	216
2	108
2	54
3	27
3	9
3	3
	1

(ii) 128

Prime factors of 128 = $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
Here one factor 2 does not appear in a 3's group.
Therefore, 128 is not a perfect cube.

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

(iii) 1000

Prime factors of 1000 = $2 \times 2 \times 2 \times 3 \times 3 \times 3$
Here all factors appear in 3's group.
Therefore, 1000 is a perfect cube.

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

(iv) 100

Prime factors of 100 = $2 \times 2 \times 5 \times 5$
Here all factors do not appear in 3's group.
Therefore, 100 is not a perfect cube.

2	100
2	50
5	25
5	5
	1

(v) 46656

Prime factors of 46656 = $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

Here all factors appear in 3's group.

Therefore, 46656 is a perfect cube.

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

2. (i) 243

Prime factors of 243 = $3 \times 3 \times 3 \times 3 \times 3$

Here 3 does not appear in 3's group.

Therefore, 243 must be multiplied by 3 to make it a perfect cube.

3	243
3	81
3	27
3	9
3	3
	1

(ii) 256

Prime factors of 256 = $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

Here one factor 2 is required to make a 3's group.

Therefore, 256 must be multiplied by 2 to make it a perfect cube.

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

(iii) 72

Prime factors of 72 = $2 \times 2 \times 2 \times 3 \times 3$

Here 3 does not appear in 3's group.

Therefore, 72 must be multiplied by 3 to make it a perfect cube.

2	72
2	36
2	18
3	9
3	3
	1

(iv) 675

Prime factors of 675 = $3 \times 3 \times 3 \times 5 \times 5$

Here factor 5 does not appear in 3's group.

Therefore 675 must be multiplied by 3 to make it a perfect cube.

3	675
3	225
3	75
5	25
5	5
	1

(v) 100

Prime factors of 100 = $2 \times 2 \times 5 \times 5$

Here factor 2 and 5 both do not appear in 3's group.

Therefore 100 must be multiplied by $2 \times 5 = 10$ to make it a perfect cube.

2	100
2	50
5	25
5	5
	1

3. (i)

81

Prime factors of 81 = $3 \times 3 \times 3 \times 3$

Here one factor 3 is not grouped in triplets.

Therefore 81 must be divided by 3 to make it a perfect cube.

3	81
3	27
3	9
3	3
	1

(ii)

128

Prime factors of 128 = $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

Here one factor 2 does not appear in a 3's group.

Therefore, 128 must be divided by 2 to make it a perfect cube.

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

(iii)

135

Prime factors of 135 = $3 \times 3 \times 3 \times 5$

Here one factor 5 does not appear in a triplet.

Therefore, 135 must be divided by 5 to make it a perfect cube.

3	135
3	45
3	15
5	5
	1

(iv) 192

Prime factors of $192 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$

Here one factor 3 does not appear in a triplet.

Therefore, 192 must be divided by 3 to make it a perfect cube.

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

(v) 704

Prime factors of $704 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 11$

Here one factor 11 does not appear in a triplet.

Therefore, 704 must be divided by 11 to make it a perfect cube.

2	704
2	352
2	176
2	88
2	44
2	22
2	11
	1

4. Given numbers = $5 \times 2 \times 5$

Since, Factors of 5 and 2 both are not in group of three.

Therefore, the number must be multiplied by $2 \times 2 \times 5 = 20$ to make it a perfect cube.

Hence he needs 20 cuboids.

Class -VIII Mathematics (Ex. 7.2)

Answers

1. (i)

64

$$\sqrt[3]{64} = \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2}$$

$$\sqrt[3]{64} = 2 \times 2$$

$$= 4$$

2	64
2	32
2	16
2	8
2	4
2	2
	1

(ii)

512

$$\sqrt[3]{512} = \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$$

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

$$= 8$$

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

(iii)

10648

$$\sqrt[3]{10648} = \sqrt[3]{2 \times 2 \times 2 \times 11 \times 11 \times 11}$$

$$= 2 \times 11$$

$$= 22$$

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

(iv)

27000

$$\sqrt[3]{27000} = \sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5}$$

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

$$= 30$$

2	27000
2	13500
2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

(v) 15625

$$\sqrt[3]{15625} = \sqrt[3]{5 \times 5 \times 5 \times 5 \times 5 \times 5}$$

$$= 5 \times 5$$

$$= 25$$

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

(vi) 13824

$$\sqrt[3]{13824} = \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3}$$

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

$$= 24$$

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

(vii) 110592

$$\sqrt[3]{110592} = \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3}$$

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

$$= 48$$

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

(viii) 46656

$$\begin{aligned}\sqrt[3]{46656} &= \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3} \\ &= 2 \times 2 \times 3 \times 3 \\ &= 36\end{aligned}$$

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

(ix) 175616

$$\begin{aligned}\sqrt[3]{175616} &= \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 7 \times 7 \times 7} \\ &= 2 \times 2 \times 2 \times 7 \\ &= 56\end{aligned}$$

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

(x) 91125

$$\begin{aligned}\sqrt[3]{91125} &= \sqrt[3]{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5} \\ &= 3 \times 3 \times 5 \\ &= 45\end{aligned}$$

3	91125
3	30375
3	10125
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

2. (i) False
Since, $1^3 = 1, 3^3 = 27, 5^3 = 125, \dots$ are all odd.

(ii) True
Since, a perfect cube ends with three zeroes.
e.g. $10^3 = 1000, 20^3 = 8000, 30^3 = 27000, \dots$ so on

-
- (iii) False
Since, $5^2 = 25, 5^3 = 125, 15^2 = 225, 15^3 = 3375$
(Did not end with 25)
- (iv) False
Since $12^3 = 1728$ [Ends with 8]
And $22^3 = 10648$ [Ends with 8]
- (v) False
Since $10^3 = 1000$ [Four digit number]
And $11^3 = 1331$ [Four digit number]
- (vi) False
Since $99^3 = 970299$ [Six digit number]
- (vii) True
 $1^3 = 1$ [Single digit number]
 $2^3 = 8$ [Single digit number]

3. We know that $10^3 = 1000$ and Possible cube of $11^3 = 1331$

Since, cube of unit's digit $1^3 = 1$

Therefore, cube root of 1331 is 11.

4913

We know that $7^3 = 343$

Next number comes with 7 as unit place $17^3 = 4913$

Hence, cube root of 4913 is 17.

12167

We know that $3^3 = 27$

Here in cube, ones digit is 7

Now next number with 3 as ones digit $13^3 = 2197$

And next number with 3 as ones digit $23^3 = 12167$

Hence cube root of 12167 is 23.

32768

We know that $2^3 = 8$

Here in cube, ones digit is 8

Now next number with 2 as ones digit $12^3 = 1728$

And next number with 2 as ones digit $22^3 = 10648$

And next number with 2 as ones digit $32^3 = 32768$

Hence cube root of 32768 is 32.

DELHI PUBLIC SCHOOL – GANDHINAGAR

CHAPTER 5 DATA HANDLING

MIND MAP

This chapter consists of four different topics. The most probable questions from examination point of view are given below.

TYPE:1 FREQUENCY DISTRIBUTION TABLE & BAR GRAPH

Q.1. The blood groups of 30 students in a class are given below. Make a frequency distribution table using tally marks. Draw a bar graph to illustrate it.

B, A, A, O, AB, O, A, B, O, A, B, AB, A, B, AB,

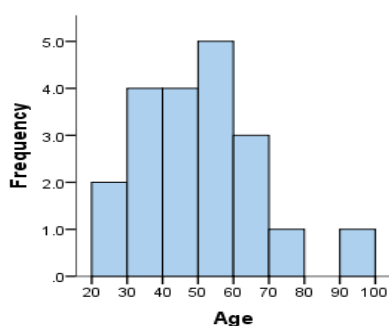
B, A, B, A, B, A, B, O, A, B, AB, O, A, B, A.

TYPE: 2 HISTOGRAM

Q.1. Draw a histogram to represent the following data. A garment exporting firm made the following amount of exports.

Year	Exports in crores of rupees
1997- 1998	6
1998- 1999	8
1999- 2000	10
2000- 2001	9
2001- 2002	12

Q.2. The following histogram represents the number of people of different age groups in a club. Find the following:



- (a) How many are senior citizens(above 60)?
- (b) Which age group shows the highest frequency?
- (c) How many are below 50 years?

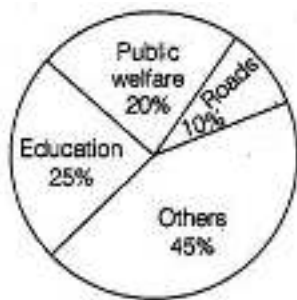
TYPE: 3 PIE CHART

Q.1 Jivan’s report card states his marks as

Subject	Marks
English	60
Hindi	54
Maths	86
Science	54
Social studies	46
Total	300

Make a Pie chart exhibiting his marks in various subjects.

Q.2 The following pie chart depicts the expenditure of a state government under different heads:



- (i) If the total spending is 10 crore, how much money was spent on roads?
- (ii) How many times is the amount of money spent on education compared to the amount spent on roads?
- (iii) What fraction of the total expenditure is spent on both roads and public welfare together?

TYPE: 4 PROBABILITY

Q.1 When a die is thrown, list the outcomes of an event getting:

- (a) a prime number.
- (b) not a prime number.
- (c) a number greater than 5.

Q.2 State the sample space and find the probability of drawing a slip labelled as 5 from a bag containing four slips labelled as 3, 5, 8 and 9.

Exercise 5.1 : Solutions of Questions on Page Number : 76

Q1 :

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 an 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.

Answer :

In case of the data given in alternative (b) and (d), we will use histogram as we can divide the given data in class intervals. In case of alternatives (a) and (c), we do not know about the number of letters of different areas and the number of cassettes produced by the given companies. We do not have any approximate idea about it. Therefore, we cannot define class intervals for this data and thus, we will not use a histogram.

Q2 :

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 during the first hour in the morning:

W W W G B W W M G G M M W W W W G B M W B G G M W W M M W W W M W B W G M W
W W W G W M M W W M W G W M G W M M B G G W

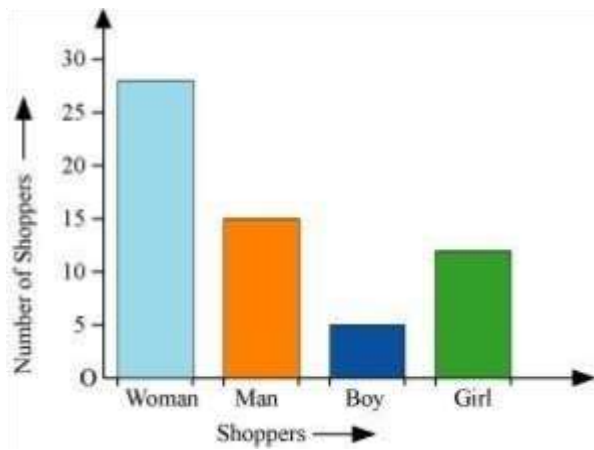
Make a frequency distribution table using tally marks. Draw a bar graph to illustrate it.

Answer :

By observing the data given above, we can make a frequency distribution table as follows.

Shopper	Tally marks	Number
W	 	28
M	 	15
B		5
G	 	12

The bar graph of this data can be drawn as follows.



Q3 :

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.

Answer :

A frequency distribution table by using tally marks for the above data 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

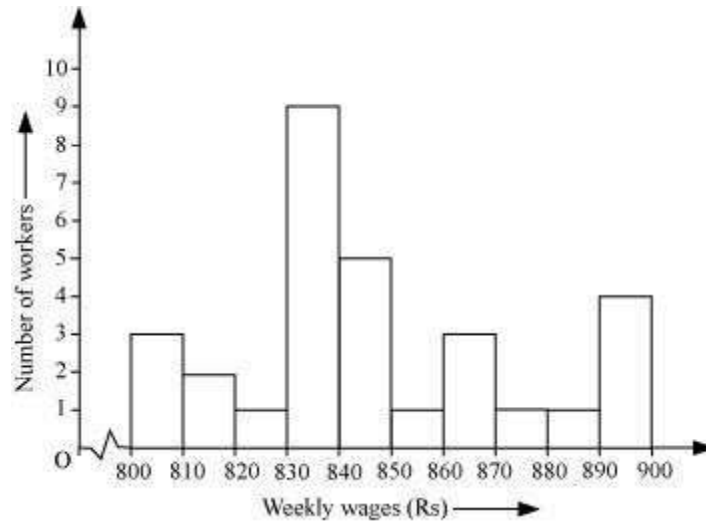
Q4 :

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

Answer :

A histogram for the above frequency distribution table is as follows.



(i) 830 - 840 is the group which has the maximum number of workers.

(ii) The workers who earn more than Rs 850 are the number of workers who fall in the group of 850 - 860 or 860 - 870 or 870 - 880 or 880 - 890. Hence, the total number of workers earning more than 850 will be the sum of the numbers of all these workers i.e., $1 + 3 + 1 + 1 + 4 = 10$

(iii) The workers who earn less than Rs 850 are the number of workers who fall in the group of 800 - 810 or 810 - 820 or 820 - 830 or 830 - 840 or 840 - 850. Hence, the total number of workers earning less than 850 will be the sum of the numbers of all these workers i.e., $3 + 2 + 1 + 9 + 5 = 20$

Q5 :

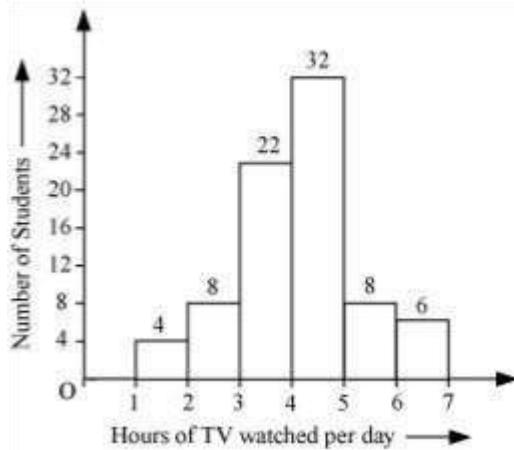
The number of hours for which students of a particular class watched television during holidays is shown through the given graph.

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



Answer :

(i) From the graph, it can be observed that the maximum number of students (i.e., 32) watched TV for 4 - 5 hours.

(ii) The students who watched TV for less than 4 hours are the students who watched TV for 1 - 2 hours or 2 - 3 hours or 3 - 4 hours.

Hence, total number of students = $4 + 8 + 22 = 34$

(iii) The students who watched TV for more than 5 hours are the students who watched TV for 5 - 6 hours or 6 - 7 hours.

Hence, total number of students = $8 + 6 = 14$

Exercise 5.2 : Solutions of Questions on Page Number : 82

Q1 :

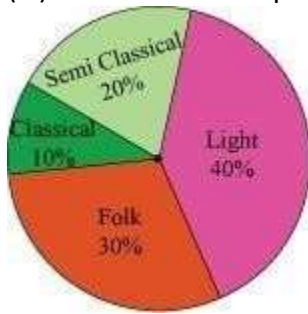
A survey was made to find the type of music that a certain group of young people liked in a city. Adjoining pie chart shows the findings of this survey.

From this pie chart answer the following -

(i) If 20 people liked classical music, how many young people were surveyed

(ii) Which type of music is liked by the maximum number of people

(iii) If a cassette company were to make 1000 CD's, how many of each type would they make



Answer :

(i) Number of people who like classical music = 10%

This 10% represents 20 people.

$$100 \% \text{ represents } = \frac{20 \times 100}{10} = 200 \text{ people}$$

Therefore, 200 young people were surveyed.

(ii) From the pie chart, it can be easily observed that the light music is represented by the maximum part of the pie chart (i.e., 40 %). Hence, most of the people like light music. (iii) Number of CD's of classical music = 10% of 1000

$$\begin{aligned} &= \frac{10}{100} \times 1000 \\ &= 100 \end{aligned}$$

Number of CD's of semi-classical music = 20% of 1000

$$\begin{aligned} &= \frac{20}{100} \times 1000 \\ &= 200 \end{aligned}$$

Number of CD's of folk music = 30% of 1000

$$\begin{aligned} &= \frac{30}{100} \times 1000 \\ &= 300 \end{aligned}$$

Number of cassettes of light music = 40% of 1000

$$\begin{aligned} &= \frac{40}{100} \times 1000 \\ &= 400 \end{aligned}$$

Q2 :

A group of 360 people were asked to vote for their favourite season from the three seasons rainy, winter and summer.

- (i) Which season got the most votes
- (ii) Find the central angle of each sector.
- (iii) Draw a pie chart to show this information.

Season	Number of votes
Summer	90
Rainy	120
Winter	150

Answer :

- (i) Winter
- (ii) Total number of votes = $90 + 120 + 150 = 360$

Season	Number of votes	In fraction	Central angle
Summer	90	$\frac{90}{360}$	$\frac{90}{360} \times 360^\circ = 90^\circ$

Rainy	120	$\frac{120}{360}$	$\frac{120}{360} \times 360^\circ = 120^\circ$
Winter	150	$\frac{150}{360}$	$\frac{150}{360} \times 360^\circ = 150^\circ$

(iii) A pie chart can be drawn for the above data as follows.



Q3 :

Draw a pie chart showing the following information. The table shows the colours preferred by a group of people.

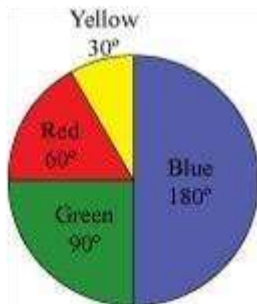
Colours	Number of people
Blue	18
Green	9
Red	6
Yellow	3
Total	36

Answer :

The central angle for each colour can be calculated as follows.

Colours	Number of people	In fraction	Central angle
Blue	18	$\frac{18}{36}$	$\frac{18}{36} \times 360^\circ = 180^\circ$
Green	9	$\frac{9}{36}$	$\frac{9}{36} \times 360^\circ = 90^\circ$
Red	6	$\frac{6}{36}$	$\frac{6}{36} \times 360^\circ = 60^\circ$
Yellow	3	$\frac{3}{36}$	$\frac{3}{36} \times 360^\circ = 30^\circ$

The pie chart of the above data is as follows.



Q4 :

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 students were 540, answer the following questions.

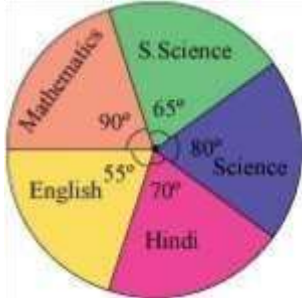
(i) In which subject did the student score 105 marks

(Hint: For 540 marks, the central angle = 360° . So, for 105 marks, what is the central angle)

(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.

(Hint: Just study the central angles).



Answer :

(i) Total marks obtained by the student are 540. Hence, 540 marks represent 360° . The central angle for 105 marks has to be calculated.

$$\text{Central angle for 105 marks} = \frac{105}{540} \times 360^\circ = 70^\circ$$

Hindi is the subject having its central angle as 70° .

Therefore, the student scored 105 marks in Hindi.

(ii) Difference between the central angles of Mathematics and Hindi

$$= 90^\circ - 70^\circ = 20^\circ$$

$$\text{Marks for } 20^\circ \text{ central angle} = \frac{20^\circ}{360^\circ} \times 540 = 30$$

There is a difference of 30 marks between the score obtained in Mathematics and Hindi.

Therefore, 30 more marks were obtained by the student in Mathematics than in Hindi.

(iii) Sum of central angles of Social Science and Mathematics

$$= 90^\circ + 65^\circ = 155^\circ$$

$$\text{Sum of central angles of Science and Hindi} = 80^\circ + 70^\circ = 150^\circ$$

The sum of the central angles for Social Science and Mathematics is more than that of Science and Hindi. Therefore, the student scored more in Social Science and Mathematics than in Science and Hindi.

Q5 :

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

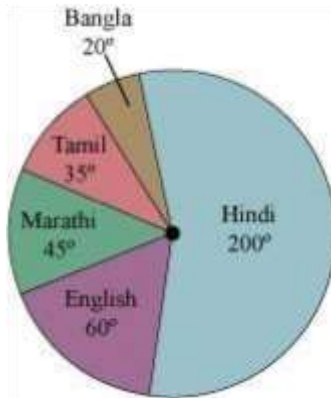
Answer :

The central angle for each subject can be calculated as follows.

Language	Number of students	In fraction	Central angle
Hindi	40	$\frac{40}{72}$	$\frac{40}{72} \times 360^\circ = 200^\circ$
English	12	$\frac{12}{72}$	$\frac{12}{72} \times 360^\circ = 60^\circ$
Marathi	9	$\frac{9}{72}$	$\frac{9}{72} \times 360^\circ = 45^\circ$
Tamil	7	$\frac{7}{72}$	$\frac{7}{72} \times 360^\circ = 35^\circ$

Bengali	4	$\frac{4}{72}$	$\frac{4}{72} \times 360^\circ = 20^\circ$
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A pie chart of the above data is as follows.

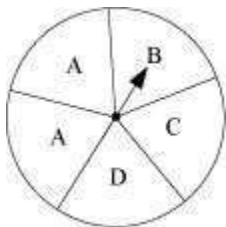


Exercise 5.3 : Solutions of Questions on Page Number : 87

Q1 :

List the outcomes you can see in these experiments.

(a) Spinning a wheel



(b) Tossing two coins together

Answer :

(a) On spinning the given wheel, the possible outcomes are A, B, C, D.

(b) By tossing two coins together, the possible outcomes are HT, TH, HH, TT where H and T represents Head and Tail of the coins respectively.

Q2 :

When a die is thrown, list the outcomes of an event of getting

(i) (a) a prime number (b) not a prime number

(ii) (a) a number greater than 5 (b) a number not greater than 5

Answer :

When a dice is thrown, the possible outcomes are 1, 2, 3, 4, 5, and 6.

(i) (a) Out of these outcomes, 2, 3, 5 are prime numbers. Hence, these are the outcomes of an event of getting a prime number on the face of a dice.

(b) Out of these outcomes, 1, 4, 6 are not prime numbers. Hence, these are the outcomes of an event of not getting a prime number on the face of a dice.

(ii) (a) Out of these outcomes, a number greater than 5 is possible when 6 comes on the face of the dice.

(b) Out of these outcomes, a number not greater than 5 is possible when the number on the face of the dice is any one of the outcomes 1, 2, 3, 4, 5.

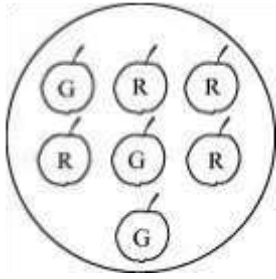
Q3 :

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)



Answer :

(i) The pointer can stop at one of the following regions.

A, A, B, C, D

Out of these 5 cases, it is possible only in 1 case that the pointer will stop at region D.

Therefore, probability that the pointer will stop at region D = $\frac{1}{5}$

(ii) There are 52 cards in a deck of cards and there are 4 ace cards in 1 deck of cards.

Probability of getting an ace card = $\frac{4}{52} = \frac{1}{13}$

(iii) There are a total of 7 apples, out of which, 4 are red and 3 are green.

Probability of getting a red apple = $\frac{4}{7}$

Q4 :

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.

(i) getting a number 6

(ii) getting a number less than 6

(iii) getting a number greater than 6

(iv) getting a 1-digit number

Answer :

(i) There are 10 slips in the box. However, 6 is written only on 1 slip.

Probability of getting a number 6 = $\frac{1}{10}$

(ii) The numbers less than 6 are 1, 2, 3, 4, 5.

Probability of getting a number less than 6 = $\frac{5}{10} = \frac{1}{2}$

(iii) The numbers greater than 6 are 7, 8, 9, 10.

Probability of getting a number greater than 6 = $\frac{4}{10} = \frac{2}{5}$

(iv) There are 9 numbers which are single digit numbers.

1, 2, 3, 4, 5, 6, 7, 8, 9

Probability of getting a single digit number = $\frac{9}{10}$

Q5 :

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

Answer :

Total sectors = 3 + 1 + 1 = 5

There are 5 sectors and we can get a green sector in three cases.

Probability of getting a green sector = $\frac{3}{5}$

We will get a non blue sector when we will get either a green sector or a red sector. Hence, 4 cases of such type are possible in which we will get a non blue sector.

Probability of getting a non blue sector = $\frac{4}{5}$

Q6 :

Find the probabilities of the events given in Question 2.

Answer :

(i) (a) Out of 6 possible outcomes, a prime number can be obtained in three cases. Therefore,

probability of getting a prime number = $\frac{3}{6} = \frac{1}{2}$

(b) Out of 6 possible outcomes, a prime number may not be obtained in three cases.

Therefore, probability of getting not a prime number = $\frac{3}{6} = \frac{1}{2}$

(ii) (a) Out of 6 possible outcomes, a number greater than 5 can be obtained in only 1 case.

Therefore, probability of getting a number greater than 5 = $\frac{1}{6}$

(b) Out of 6 possible outcomes, a number not greater than 5 can be obtained in 5 cases.

Therefore, probability of getting a number not greater than 5 = $\frac{5}{6}$

DELHI PUBLIC SCHOOL – GANDHINAGAR

CHAPTER 8 COMPARING QUANTITIES

MIND MAP

This chapter consists of five different topics. The most probable questions from examination point of view are given below.

TYPE:1 PERCENTAGE INCREASE AND DECREASE

- Q.1. Shiv went to a restaurant and ordered for a pizza. When he saw the bill, he was surprised to notice that it was ₹ 330 which was 10% more than of last time. What was the price of the same pizza when he came last time?
- Q.2. A computer costs ₹ 39600. In the last 6 months, the price had come down by 12%. What was the price of the computer six months back?

TYPE: 2 COST PRICE , SELLING PRICE, PROFIT & LOSS

- Q.1. Find:

CP	SP	PROFIT	PROFIT%	LOSS	LOSS%
₹ 3650	₹ 2920	-	-	₹	₹
₹ 4892	₹ 4900	₹		-	-
₹ 784	₹ 682			₹	₹
₹ 9684		-	-	₹ 684	
	₹ 7894			₹ 306	

- Q.2. A coat was sold by a shopkeeper at a gain of 5%. If it had been sold for ₹ 1650 less, he would have suffered a loss of 5%. Find the cost price.
- Q.3. By selling a bicycle for ₹ 819, Vinay loses 9%. At what price should he sell it to make a profit of 5%?

TYPE: 3 DISCOUNT , TAX

- Q.1. Sheeba bought an air cooler for ₹ 3300 including Tax of 10%. Find the price of the air cooler before tax was added.
- Q.2. The marked price of an article is ₹ 80. If it is sold at ₹ 72, What is the discount percentage?
- Q.3. A television set was sold for ₹ 5760 after giving successive discounts of 10% and 20%, respectively. What was the marked price?
- Q.4. A trader marks his goods 40% above the cost price. He sells them at a discount of 20%. What is his loss or gain percentage?

TYPE: 4 SIMPLE INTEREST & COMPOUND INTEREST

- Q.1. Farhan deposits ` 6000 in a bank at the rate of 6% for 3 years at simple interest. Find the amount he will get back at the end of this period?
- Q.2. A sum of money invested at a certain rate doubles itself in 10 years. How much time will it take to triple itself at the same rate?
- Q.3. Find the difference between CI and SI on `15000 at 12% p.a for 3 years compounded annually.
- Q.4. Find the amount and CI on `24000 compounded semi – annually for $1\frac{1}{2}$ years at the rate of 10% p.a.

TYPE: 5 APPLICATIONS OF COMPOUNDED INTEREST FORMULA

- Q.1. The population of a city was 20,000 in the year 1997. It increased at a rate of 5% p.a. Find the population at the end of the year 2000.
- Q.2. The population of a village has a constant growth of 5% p.a. If its present population is 33,075 ,What was the population two years ago?
- Q.3. The price of a plot increases at a constant rate of 5% every year. Find its expected price after 3 years if the present price is ` 2,00,000.
- Q.4. A car which costs ` 2,50,000 depreciates 10% every year. What will the car be worth after 3 years?

Exercise 8.1 : Solutions of Questions on Page Number : 119

Q1 :

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 Rs 5

Answer :

(a) Ratio of the speed of cycle to the speed of scooter $= \frac{15}{30} = 1:2$

(b) Since 1 km = 1000 m,

Required ratio $= \frac{5 \text{ m}}{10 \text{ km}} = \frac{5 \text{ m}}{10 \times 1000 \text{ m}} = 1:2000$

(c) Since Re 1 = 100 paise,

Required ratio $= \frac{50 \text{ paise}}{\text{Rs } 5} = \frac{50 \text{ paise}}{500 \text{ paise}} = 1:10$

Q2 :

Convert the following ratios to percentages.

(a) 3:4 (b) 2:3

Answer :

(a) $3:4 = \frac{3}{4} = \frac{3}{4} \times \frac{100}{100} = \frac{3}{4} \times 100\% = 75\%$

$$(b) \quad 2:3 = \frac{2}{3} = \frac{2}{3} \times \frac{100}{100} = \frac{2}{3} \times 100\% = \frac{200}{3}\%$$

$$= \left(\frac{66 \times 3 + 2}{3} \right)\% = 66\frac{2}{3}\%$$

Q3 :

72% of 25 students are good in mathematics. How many are not good in mathematics?

Answer :

It is given that 72% of 25 students are good in mathematics.

Therefore,

Percentage of students who are not good in mathematics = $(100 - 72)\%$

= 28%

∴ Number of students who are not good in mathematics = $\frac{28}{100} \times 25$

= 7

Thus, 7 students are not good in mathematics.

Q4 :

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?

Answer :

Let the total number of matches played by the team be x .

It is given that the team won 10 matches and the winning percentage of the team was 40%.
Therefore,

$$\frac{40}{100} \times x = 10$$
$$x = 10 \times \frac{100}{40}$$
$$x = 25$$

Thus, the team played 25 matches.

Q5 :

If Chameli had Rs 600 left after spending 75% of her money, how much did she have in the beginning?

Answer :

Let the amount of money which Chameli had in the beginning be x .

It is given that after spending 75% of Rs x , she was left with Rs 600.

Therefore,

$$(100 - 75)\% \text{ of } x = \text{Rs } 600$$

$$\text{Or, } 25 \% \text{ of } x = \text{Rs } 600$$

$$\frac{25}{100} \times x = \text{Rs } 600$$
$$x = \text{Rs } \left(600 \times \frac{100}{25} \right) = \text{Rs } 2400$$

Thus, she had Rs 2400 in the beginning.

Q6 :

If 60% people in 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 are 50 lakh, find the exact number who like each type of game.

Answer :

Percentage of people who like other games = $(100 - 60 - 30)\%$

= $(100 - 90)\% = 10\%$

Total number of people = 50 lakh

Therefore, number of people
lakh $= \left(\frac{60}{100} \times 50\right)$ lakh who like cricket = 30

$$= \left(\frac{30}{100} \times 50\right) \text{ lakh} = 15 \text{ lakh}$$

Number of people who like
football

$$= \left(\frac{10}{100} \times 50\right) \text{ lakh}$$

Number of people who like other games = 5 lakh

Exercise 8.2 : Solutions of Questions on Page Number : 125

Q1 :

A man got a 10% increase in his salary. If his new salary is Rs 1,54,000, find his original salary.

Answer :

Let the original salary be x . It is given that the new salary is Rs 1,54,000.

Original salary + Increment = New salary

However, it is given that the increment is 10% of the original salary.

Therefore,

$$x + \frac{10}{100} \times x = 154000$$

$$\frac{110x}{100} = 154000$$

$$x = \left(154000 \times \frac{100}{110} \right)$$

$$x = 140000$$

Thus, the original salary was Rs 1,40,000.

Q2 :

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?

Answer :

It is given that on Sunday, 845 people went to the zoo and on Monday, 169 people went.

Decrease in the number of people = 845 - 169 = 676

$$\text{Percentage decrease} = \left(\frac{\text{Decrease in the number of people} \times 100}{\text{Number of people who went to zoo on sunday}} \right) \%$$

$$= \left(\frac{676}{845} \times 100 \right) \%$$

$$= 80\%$$

Q3 :

A shopkeeper buys 80 articles for Rs 2,400 and sells them for a profit of 16%. Find the selling price of one article.

Answer :

It is given that the shopkeeper buys 80 articles for Rs 2,400.

$$\text{Cost of one article} = \text{Rs } \frac{2400}{80} = \text{Rs } 30$$

Profit percent = 16

$$\text{Profit Percent} = \frac{\text{Profit}}{\text{C.P.}} \times 100$$

$$16 = \frac{\text{Profit}}{\text{Rs } 30} \times 100$$

$$\text{Profit} = \text{Rs } \left(\frac{16 \times 30}{100} \right) = \text{Rs } 4.80$$

Selling price of one article = C.P. + Profit = Rs (30 + 4.80) = Rs 34.80

Q4 :

The cost of an article was Rs 15,500. Rs 450 were spent on its repairs. If it is sold for a profit of 15%, find the selling price of the article.

Answer :

Total cost of an article = Cost + Overhead expenses

$$= \text{Rs } 15500 + \text{Rs } 450$$

$$= \text{Rs } 15950$$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{C.P.}} \times 100$$

$$15 = \frac{\text{Profit}}{\text{Rs } 15950} \times 100$$

$$\text{Profit} = \text{Rs } \left(\frac{15950 \times 15}{100} \right) = \text{Rs } 2392.50$$

∴ Selling price of the article = C.P. + Profit = Rs (15950 + 2392.50)

= Rs 18342.50

Q5 :

A VCR and TV were bought for Rs 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.

Answer :

C.P. of a VCR = Rs 8000

The shopkeeper made a loss of 4 % on VCR.

This means if C.P. is Rs 100, then S.P. is Rs 96.

When C.P. is Rs 8000, S.P. = $\text{Rs} \left(\frac{96}{100} \times 8000 \right) = \text{Rs } 7680$

C.P. of a TV = Rs 8000

The shopkeeper made a profit of 8 % on TV.

This means that if C.P. is Rs 100, then S.P. is Rs 108.

When C.P. is Rs 8000, S.P. = $\text{Rs} \left(\frac{108}{100} \times 8000 \right) = \text{Rs } 8640$

Total S.P. = Rs 7680 + Rs 8640 = Rs 16320

Total C.P. = Rs 8000 + Rs 8000 = Rs 16000

Since total S.P. > total C.P., there was a profit.

Profit = Rs 16320 - Rs 16000 = Rs 320

$$\begin{aligned}\text{Profit \%} &= \frac{\text{Profit}}{\text{C.P.}} \times 100 \\ &= \frac{320}{16000} \times 100 = 2\%\end{aligned}$$

Therefore, the shopkeeper had a gain of 2% on the whole transaction.

Q6 :

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 Rs 1450 and two shirts marked at Rs 850 each?

Answer :

Total marked price = Rs (1,450 + 2 × 850) = Rs (1,450 + 1,700) = Rs 3,150

Given that, discount % = 10%

$$\text{Discount} = \text{Rs} \left(\frac{10}{100} \times 3150 \right) = \text{Rs} 315$$

Also, Discount = Marked price - Sale price

Rs 315 = Rs 3150 - Sale price

∴ Sale price = Rs (3150 - 315) = Rs 2835

Thus, the customer will have to pay Rs 2,835.

Q7 :

A milkman sold two of his buffaloes for Rs 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.

(Hint: Find CP of each)

Answer :

S.P. of each buffalo = Rs 20000

The milkman made a gain of 5% while selling one buffalo.

This means if C.P. is Rs 100, then S.P. is Rs 105.

$$\text{C.P. of one buffalo} = \text{Rs} \left(20000 \times \frac{100}{105} \right) = \text{Rs } 19,047.62$$

Also, the second buffalo was sold at a loss of 10%.

This means if C.P. is Rs 100, then S.P. is Rs 90.

$$\therefore \text{C.P. of other buffalo} = \text{Rs} \left(20000 \times \frac{100}{90} \right) = \text{Rs } 22222.22$$

$$\text{Total C.P.} = \text{Rs } 19047.62 + \text{Rs } 22222.22 = \text{Rs } 41269.84$$

$$\text{Total S.P.} = \text{Rs } 20000 + \text{Rs } 20000 = \text{Rs } 40000$$

$$\text{Loss} = \text{Rs } 41269.84 - \text{Rs } 40000 = \text{Rs } 1269.84$$

Thus, the overall loss of milkman was Rs 1,269.84.

Q8 :

The price of a TV is Rs 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,

Answer :

On Rs 100, the tax to be paid = Rs 12

$$\text{On Rs 13000, the tax to be paid will be} = \text{Rs} \left(\frac{12}{100} \times 13000 \right)$$

= Rs 1560

Required amount = Cost + Sales Tax = Rs 13000 + Rs 1560

= Rs 14560

Thus, Vinod will have to pay Rs 14,560 for the T.V.

Q9 :

Arun bought a pair of skates at a sale where the discount given was 20%. If the amount he pays is Rs 1,600, find the marked price.

Answer :

Let the marked price be x .

$$\begin{aligned}\text{Discount percent} &= \frac{\text{Discount}}{\text{Marked price}} \times 100 \\ 20 &= \frac{\text{Discount}}{x} \times 100 \\ \text{Discount} &= \frac{20}{100} \times x = \frac{1}{5}x\end{aligned}$$

Also,

Discount = Marked price - Sale price

$$\frac{1}{5}x = x - \text{Rs } 1600$$

$$x - \frac{1}{5}x = \text{Rs } 1600$$

$$\frac{4}{5}x = \text{Rs } 1600$$

$$x = \text{Rs} \left(1600 \times \frac{5}{4} \right) = \text{Rs } 2000$$

Thus, the marked price was Rs 2000.

Q10 :

I purchased a hair-dryer for Rs 5,400 including 8% VAT. Find the price before VAT was added.

Answer :

The price includes VAT.

Thus, 8% VAT means that if the price without VAT is Rs 100, then price including VAT will be Rs 108.

When price including VAT is Rs 108, original price = Rs 100

$$\begin{aligned} \text{When price including VAT is Rs 5400, original price} &= \text{Rs} \left(\frac{100}{108} \times 5400 \right) \\ &= \text{Rs } 5000 \end{aligned}$$

Thus, the price of the hair-dryer before the addition of VAT was Rs 5,000.

Q11 :

I purchased a hair-dryer for Rs 5,400 including 8% VAT. Find the price before VAT was added.

Answer :

The price includes VAT.

Thus, 8% VAT means that if the price without VAT is Rs 100, then price including VAT will be Rs 108.

When price including VAT is Rs 108, original price = Rs 100

$$\begin{aligned} \text{When price including VAT is Rs 5400, original price} &= \text{Rs} \left(\frac{100}{108} \times 5400 \right) \\ &= \text{Rs } 5000 \end{aligned}$$

Thus, the price of the hair-dryer before the addition of VAT was Rs 5,000.

Exercise 8.3 : Solutions of Questions on Page Number : 133

Q1 :

Calculate the amount and compound interest on

- (a) Rs 10800 $2\frac{1}{2}$ for 3 years at $12\frac{1}{2}\%$ per annum compounded annually.
(b) Rs 18000 $2\frac{1}{2}$ for years at 10% per annum compounded annually.

- (c) Rs 62500 $1\frac{1}{2}$ for years at 8% per annum compounded half yearly. (d) Rs 8000 for 1 year at 9% per annum compound half yearly. (You could use the year by year calculation using SI formula to verify)

- (e) Rs 10000 for 1 year at 8% per annum compounded half yearly.

Answer :

- (a) Principal (P) = Rs 10, 800

$$\text{Rate (R)} = 12\frac{1}{2}\% = \frac{25}{2} \% \text{ (annual)}$$

$$\text{Number of years (n)} = 3$$

$$\text{Amount, } A = P \left(1 + \frac{R}{100} \right)^n$$

$$= \text{Rs} \left[10800 \left(1 + \frac{25}{200} \right)^3 \right]$$

$$= \text{Rs} \left[10800 \left(\frac{225}{200} \right)^3 \right]$$

$$= \text{Rs} \left(10800 \times \frac{225}{200} \times \frac{225}{200} \times \frac{225}{200} \right)$$

$$= \text{Rs } 15377.34375$$

$$= \text{Rs } 15377.34 \quad (\text{approximately})$$

$$\text{C.I.} = A - P = \text{Rs } (15377.34 - 10800) = \text{Rs } 4,577.34$$

(b) Principal (P) = Rs 18,000

Rate (R) = 10% annual

Number of years (n) = $2\frac{1}{2}$ years

The amount for 2 years and 6 months can be calculated by first calculating the amount for 2 years using the compound interest formula, and then calculating the simple interest for 6 months on the amount obtained at the end of 2 years.

Firstly, the amount for 2 years has to be calculated.

$$A = \text{Rs} \left[18000 \left(1 + \frac{10}{100} \right)^2 \right] = \text{Rs} \left(18000 \times \frac{11}{10} \times \frac{11}{10} \right) = \text{Rs } 21780$$

By taking Rs 21780 as principal, the S.I. for the next $\frac{1}{2}$ year will be calculated.

$$\text{S.I.} = \text{Rs} \left(\frac{21780 \times \frac{1}{2} \times 10}{100} \right) = \text{Rs } 1089$$

∴ Interest for the first 2 years = Rs (21780 - 18000) = Rs 3780

And interest for the next $\frac{1}{2}$ year = Rs 1089

∴ Total C.I. = Rs 3780 + Rs 1089 = Rs 4,869

A = P + C.I. = Rs 18000 + Rs 4869 = Rs 22,869

(c) Principal (P) = Rs 62,500

Rate = 8% per annum or 4% per half year

Number of years = $1\frac{1}{2}$

There will be 3 half years in $1\frac{1}{2}$ years.

$$\begin{aligned} A &= P \left(1 + \frac{R}{100} \right)^n = \text{Rs} \left[62500 \left(1 + \frac{4}{100} \right)^3 \right] \\ &= \text{Rs} \left(62500 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25} \right) \\ &= \text{Rs } 70304 \end{aligned}$$

C.I. = A - P = Rs 70304 - Rs 62500 = Rs 7,804

(d) Principal (P) = Rs 8000

Rate of interest = 9% per annum or $\frac{9}{2}$ % per half year

Number of years = 1 year

There will be 2 half years in 1 year.

$$A = P \left(1 + \frac{R}{100} \right)^n$$

$$= \text{Rs} \left[8000 \left(1 + \frac{9}{200} \right)^2 \right]$$

$$= \text{Rs} \left[8000 \left(\frac{209}{200} \right)^2 \right] = \text{Rs } 8,736.20$$

$$\text{C.I.} = A - P = \text{Rs } 8736.20 - \text{Rs } 8000 = \text{Rs } 736.20$$

(e) Principal (P) = Rs 10,000

Rate = 8% per annum or 4% per half year

Number of years = 1 year

There are 2 half years in 1 year.

$$A = P \left(1 + \frac{R}{100} \right)^n$$

$$= \text{Rs} \left[10000 \left(1 + \frac{4}{100} \right)^2 \right] = \text{Rs} \left[10000 \left(1 + \frac{1}{25} \right)^2 \right]$$

$$= \text{Rs} \left(10000 \times \frac{26}{25} \times \frac{26}{25} \right) = \text{Rs } 10,816$$

$$\text{C.I.} = A - P = \text{Rs } 10816 - \text{Rs } 10000 = \text{Rs } 816$$

Q2 :

Kamala borrowed Rs 26400 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?

(Hint: Find A for 2 years with interest is compounded yearly and then find SI on the 2nd year

amount for $\frac{4}{12}$ years.)

Answer :

Principal (P) = Rs 26,400

Rate (R) = 15% per annum

Number of years (n) = $2\frac{4}{12}$ years

The amount for 2 years and 4 months can be calculated by first calculating the amount for 2 years using the compound interest formula, and then calculating the simple interest for 4 months on the amount obtained at the end of 2 years.

Firstly, the amount for 2 years has to be calculated.

$$\begin{aligned} A &= \text{Rs} \left[26400 \left(1 + \frac{15}{100} \right)^2 \right] = \text{Rs} \left[26400 \left(1 + \frac{3}{20} \right)^2 \right] \\ &= \text{Rs} \left(26400 \times \frac{23}{20} \times \frac{23}{20} \right) = \text{Rs} 34,914 \end{aligned}$$

By taking Rs 34,914 as principal, the S.I. for the next $\frac{1}{3}$ years will be calculated.

$$\text{S.I.} = \text{Rs} \left(\frac{34914 \times \frac{1}{3} \times 15}{100} \right) = \text{Rs} 1,745.70$$

Interest for the first two years = Rs (34914 - 26400) = Rs 8,514

And interest for the next $\frac{1}{3}$ year = Rs 1,745.70

Total C.I. = Rs (8514 + Rs 1745.70) = Rs 10,259.70

Amount = P + C.I. = Rs 26400 + Rs 10259.70 = Rs 36,659.70

Q3 :

Fabina borrows Rs 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?

Answer :

$$\text{Interest paid by Fabina} = \frac{P \times R \times T}{100}$$

$$= \text{Rs} \left(\frac{12500 \times 12 \times 3}{100} \right) = \text{Rs} 4,500$$

$$\text{Amount paid by Radha at the end of 3 years} = A = P \left(1 + \frac{R}{100} \right)^n$$

$$A = \text{Rs} \left[12500 \left(1 + \frac{10}{100} \right)^3 \right]$$

$$= \text{Rs} \left(12500 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} \right) = \text{Rs} 16,637.50$$

$$\text{C.I.} = A - P = \text{Rs} 16637.50 - \text{Rs} 12500 = \text{Rs} 4,137.50$$

The interest paid by Fabina is Rs 4,500 and by Radha is Rs 4,137.50.

Thus, Fabina pays more interest.

$$\text{Rs} 4500 - \text{Rs} 4137.50 = \text{Rs} 362.50$$

Hence, Fabina will have to pay Rs 362.50 more.

Q4 :

I borrowed Rs 12000 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?

Answer :

P = Rs 12000

R = 6% per annum

T = 2 years

$$\text{S.I.} = \frac{P \times R \times T}{100} = \text{Rs} \left(\frac{12000 \times 6 \times 2}{100} \right) = \text{Rs } 1,440$$

To find the compound interest, the amount (A) has to be calculated.

$$\begin{aligned} A &= P \left(1 + \frac{R}{100} \right)^n = \text{Rs} \left[12000 \left(1 + \frac{6}{100} \right)^2 \right] \\ &= \text{Rs} \left[12000 \left(1 + \frac{3}{50} \right)^2 \right] = \text{Rs} \left(12000 \times \frac{53}{50} \times \frac{53}{50} \right) \\ &= \text{Rs } 13,483.20 \end{aligned}$$

$$\therefore \text{C.I.} = A - P = \text{Rs } 13483.20 - \text{Rs } 12000 = \text{Rs } 1,483.20$$

$$\text{C.I.} - \text{S.I.} = \text{Rs } 1,483.20 - \text{Rs } 1,440 = \text{Rs } 43.20$$

Thus, the extra amount to be paid is Rs 43.20.

Q5 :

Vasudevan invested Rs 60000 at an interest rate of 12% per annum compounded half yearly.
What amount would he get

(i) after 6 months?

(ii) after 1 year?

Answer :

(i) P = Rs 60,000

Rate = 12% per annum = 6% per half year

$n = 6$ months = 1 half year

$$A = P \left(1 + \frac{R}{100} \right)^n$$
$$= \text{Rs} \left[60000 \left(1 + \frac{6}{100} \right)^1 \right] = \text{Rs} \left(60000 \times \frac{106}{100} \right) = \text{Rs } 63,600$$

(ii) There are 2 half years in 1

year. $n = 2$

$$A = \text{Rs} \left[60000 \left(1 + \frac{6}{100} \right)^2 \right] = \text{Rs} \left(60000 \times \frac{106}{100} \times \frac{106}{100} \right) = \text{Rs } 67,416$$

Q6 :

Arif took a loan of Rs 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

Answer :

(i) $P = \text{Rs } 80,000$

$R = 10\%$ per annum

$$n = 1\frac{1}{2} \text{ years}$$

The amount for 1 year and 6 months can be calculated by first calculating the amount for 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.

Firstly, the amount for 1 year has to be calculated.

$$\begin{aligned} A &= \text{Rs} \left[80000 \left(1 + \frac{10}{100} \right)^1 \right] \\ &= \text{Rs} \left[80000 \left(1 + \frac{10}{100} \right) \right] = \text{Rs} \left(80000 \times \frac{11}{10} \right) = \text{Rs} 88,000 \end{aligned}$$

By taking Rs 88,000 as principal, the SI for the next $\frac{1}{2}$ year will be calculated.

$$\text{S.I.} = \frac{P \times R \times T}{100} = \text{Rs} \left(\frac{88000 \times 10 \times \frac{1}{2}}{100} \right) = \text{Rs} 4,400$$

Interest for the first year = Rs 88000 - Rs 80000 = Rs 8,000

And interest for the next $\frac{1}{2}$ year = Rs 4,400

Total C.I. = Rs 8000 + Rs 4,400 = Rs 12,400

A = P + C.I. = Rs (80000 + 12400) = Rs 92,400

(ii) The interest is compounded half yearly.

Rate = 10% per annum = 5% per half year

There will be three half years in $1\frac{1}{2}$ years.

$$\begin{aligned} A &= \text{Rs} \left[80000 \left(1 + \frac{5}{100} \right)^3 \right] = \text{Rs} \left[80000 \left(1 + \frac{1}{20} \right)^3 \right] \\ &= \text{Rs} \left(80000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs } 92,610 \end{aligned}$$

Difference between the amounts = Rs 92,610 - Rs 92,400 = Rs 210

Q7 :

Maria invested Rs 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.

Answer :

(i) P = Rs 8,000

R = 5% per annum

n = 2 years

$$\begin{aligned} A &= \text{Rs} \left[8000 \left(1 + \frac{5}{100} \right)^2 \right] = \text{Rs} \left(8000 \left(1 + \frac{1}{20} \right)^2 \right) \\ &= \text{Rs} \left(8000 \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs } 8,820 \end{aligned}$$

(ii) The interest for the next one year, i.e. the third year, has to be calculated.

By taking Rs 8,820 as principal, the S.I. for the next year will be calculated.

$$\text{S.I.} = \text{Rs} \left(\frac{8820 \times 5 \times 1}{100} \right) = \text{Rs } 441$$

Q8 :

Find the amount and the compound interest on Rs 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?

Answer :

$$P = \text{Rs } 10,000$$

Rate = 10% per annum = 5% per half year

$$n = 1\frac{1}{2} \text{ years}$$

There will be 3 half years in $1\frac{1}{2}$ years.

$$\begin{aligned} A &= \text{Rs} \left[10000 \left(1 + \frac{5}{100} \right)^3 \right] = \text{Rs} \left[10000 \left(1 + \frac{1}{20} \right)^3 \right] \\ &= \text{Rs} \left(10000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs } 11,576.25 \end{aligned}$$

$$\text{C.I.} = A - P$$

$$= \text{Rs } 11576.25 - \text{Rs } 10000 = \text{Rs } 1,576.25$$

The amount for 1 year and 6 months can be calculated by first calculating the amount for 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 the first year has to be calculated first.

$$A = \text{Rs} \left[10000 \left(1 + \frac{10}{100} \right)^1 \right] = \text{Rs} \left[10000 \left(1 + \frac{10}{100} \right) \right]$$

$$= \text{Rs} \left(10000 \times \frac{11}{10} \right) = \text{Rs} 11,000$$

By taking Rs 11,000 as the principal, the S.I. for the next $\frac{1}{2}$ year will be calculated.

$$\text{S.I.} = \text{Rs} \left(\frac{11000 \times 10 \times \frac{1}{2}}{100} \right) = \text{Rs} 550$$

∴ Interest for the first year = Rs 11000 - Rs 10000 = Rs 1,000

∴ Total compound interest = Rs 1000 + Rs 550 = Rs 1,550

Therefore, the interest would be more when compounded half yearly than the interest when compounded annually.

Q9 :

Find the amount which Ram will get on Rs 4,096, he gave it for 18 months at $12\frac{1}{2}\%$ per annum, interest being compounded half yearly.

Answer :

P = Rs 4,096

R = $12\frac{1}{2}\%$ per annum = $\frac{25}{4}\%$ per half year

n = 18 months

There will be 3 half years in 18 months.

Therefore,

$$A = \text{Rs} \left[4096 \left(1 + \frac{25}{400} \right)^3 \right] = \text{Rs} \left[4096 \left(1 + \frac{1}{16} \right)^3 \right]$$
$$= \text{Rs} \left(4096 \times \frac{17}{16} \times \frac{17}{16} \times \frac{17}{16} \right) = \text{Rs } 4,913$$

Thus, the required amount is Rs 4,913.

Q10 :

The population of a place increased to 54000 in 2003 at a rate of 5% per annum

- (i) find the population in 2001
- (ii) what would be its population in 2005?

Answer :

- (i) It is given that, population in the year 2003 = 54,000

Therefore,

$$54000 = \left(1 + \frac{5}{100} \right)^2 \text{ (Population in 2001)}$$

$$\text{Population in 2001} = 54000 \times \frac{20}{21} \times \frac{20}{21} = 48979.59$$

Thus, the population in the year 2001 was approximately 48,980.

$$\text{(ii) Population in 2005} = 54000 \left(1 + \frac{5}{100} \right)^2$$

$$= 54000 \left(1 + \frac{1}{20} \right)^2 = 54000 \times \frac{21}{20} \times \frac{21}{20} = 59,535$$

Thus, the population in the year 2005 would be 59,535.

Q11 :

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.

Answer :

The initial count of bacteria is given as 5,06,000.

$$\begin{aligned} \text{Bacteria at the end of 2 hours} &= 506000 \left(1 + \frac{2.5}{100}\right)^2 \\ &= 506000 \left(1 + \frac{1}{40}\right)^2 = 506000 \times \frac{41}{40} \times \frac{41}{40} \\ &= 531616.25 = 5,31,616 \text{ (approx.)} \end{aligned}$$

Thus, the count of bacteria at the end of 2 hours will be 5,31,616 (approx.).

Q12 :

A scooter was bought at Rs 42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year.

Answer :

Principal = Cost price of the scooter = Rs 42,000

Depreciation = 8% of Rs 42,000 per year

$$\begin{aligned} &= \text{Rs} \left(\frac{42000 \times 8 \times 1}{100} \right) \\ &= \text{Rs } 3,360 \end{aligned}$$

Value after 1 year = Rs 42000 - Rs 3360 = Rs 38,640