# HINTS AND SOLUTIONS

## CHAPTER 1 : RATIONAL NUMBERS

### Let's Recall

**1.** (*a*) $7 = \frac{7}{1}$ (*b*) $0 = \frac{0}{1}$

(*c*) $-3 = \frac{-3}{1}$ (*d*) $14 = \frac{14}{1}$

**2.** (*a*) $\frac{3}{4} = \frac{3\times2}{4\times2} = \frac{6}{\boxed{8}}$ (*b*) $\frac{9}{27} = \frac{9\div9}{27\div9} = \frac{\boxed{1}}{3}$

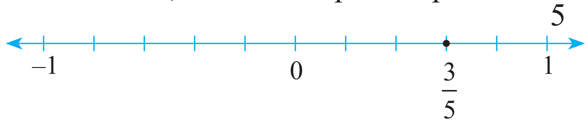
(*c*) $\frac{30}{105} = \frac{30\div3}{105\div3} = \frac{\boxed{10}}{35}$ (*d*) $\frac{9}{31} = \frac{9\times4}{31\times4} = \frac{36}{\boxed{124}}$

**3.** (*a*) **Step 1.** Firstly, we draw a number line and mark three integers –1, 0, 1 on it.

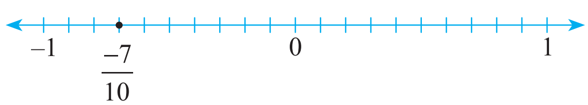
**Step 2.** Since the denominator of rational number is 5, so we divide the distance between two consecutive integers 0 and 1 into 5 equal parts.

**Step 3.** In $\frac{3}{5}$, as the numerator is 3, so we mark a dot at 3rd equal part between 0 and 1.

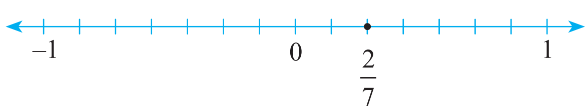
Thus, the marked point represents $\frac{3}{5}$.




(*b*)



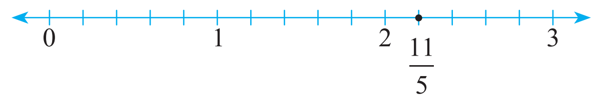

(*c*)




(*d*) **Step 1.** First we will draw a number line and mark integers 1, 2, 3 on it. Since $\frac{11}{5} = 2\frac{1}{5}$, so the whole number part is 2.

**Step 2.** Since the denominator of the rational number $\frac{1}{5}$ is 5, so we divide the distance between two consecutive integers 2 and 3 into 5 equal parts.

**Step 3.** Mark the first equal part to the right of 2. This point will be the representation of $\frac{11}{5}$ on the number line.




**4.** (*a*) $\frac{3}{4}+\frac{1}{4} = \frac{3+1}{4} = \frac{4}{4} = 1$

(*b*) $\frac{-3}{24}+\frac{3}{8}-\frac{5}{48} = \frac{-6+18-5}{48} = \frac{7}{48}$

(*c*) $\frac{2}{15}\times\frac{3}{10} = \frac{\cancel{2}^{1}}{\cancel{15}_{5}}\times\frac{\cancel{3}^{1}}{\cancel{10}_{5}} = \frac{1}{5}\times\frac{1}{5} = \frac{1}{25}$

(*d*) $\frac{-4}{7}\div\frac{3}{14} = \frac{-4}{7}\times\frac{14}{3} = \frac{-8}{3}$

### Think and Answer (Page 10)

By observing the figure, we can say that the distance between –1 and –2 = 1 unit and it is divided into 5 equal parts. So, $P = -1 + \left(\frac{-4}{5}\right) = \frac{-9}{5}$

Now, the distance between –2 and – 3 is divided into 3 equal parts. So, $R = -2+\left(\frac{-2}{3}\right) = \frac{-8}{3}$, and the distance between 1 and 2 is divided into 7 equal parts. So, $Q = 1+\frac{4}{7} = \frac{11}{7}$.

### Practice Time 1A

**1.** (*a*) To convert $\frac{4}{5}$ into a rational number with a denominator 15, multiply both the numerator and denominator of $\frac{4}{5}$ by 3.

$\therefore \frac{4}{5} = \frac{4\times3}{5\times3} = \frac{12}{15}$

(*b*) To convert $\frac{4}{5}$ into a rational number with denominator –20, multiply both the numerator and denominator of $\frac{4}{5}$ by –4.

$\therefore \frac{4}{5} = \frac{4\times(-4)}{5\times(-4)} = \frac{-16}{-20}$

(*c*) To convert $\frac{4}{5}$ into a rational number with numerator 28, multiply both the numerator and denominator of $\frac{4}{5}$ by 7.

$\therefore \frac{4}{5} = \frac{4\times 7}{5\times 7} = \frac{28}{35}$

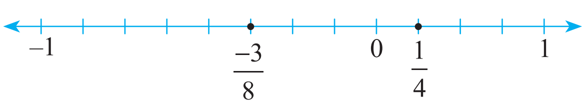
(*d*) To convert $\frac{4}{5}$ into a rational number with numerator –8, multiply both the numerator and denominator of $\frac{4}{5}$ by –2.

$\therefore \frac{4}{5} = \frac{4\times(-2)}{5\times(-2)} = \frac{-8}{-10}$

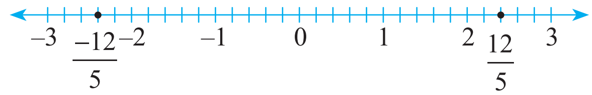
**2.** The equivalent form of $-\frac{22}{55} = -\frac{22\div 11}{55\div 11} = -\frac{2}{5}$. But $\frac{2}{-5}$ is not in the standard form as –ve sign should be written in the numerator or before the fraction, not in the denominator.

**3.** We know that $\frac{1}{4}$ lies between 0 and 1. Draw a number line and divide the unit length between 0 and 1 into 4 equal parts. Since $\frac{1}{4}$ is positive, move 1 step to the right from 0 and mark the position of $\frac{1}{4}$.

Since $\frac{-3}{8}$ is negative, divide the unit length between –1 and 0 into 8 equal parts and move 3 steps to the left of 0 and mark $\frac{-3}{8}$.




**4.** We know that $\frac{12}{5} = 2\frac{2}{5}$ lies between 2 and 3 and $\frac{-12}{5}$ lies between –2 and –3. Draw a number line and divide the unit length between 2 and 3; –2 and –3 into 5 equal parts. Since $\frac{12}{5}$ is positive, move right of 2 by 2 steps, and mark the position $\frac{12}{5}$. Since $\frac{-12}{5}$ is negative, move left of –2 by 2 steps, and mark $\frac{-12}{5}$.




Yes, both the points are equidistant from the origin.

**5.** (*a*) Let us convert $\frac{3}{9}$ into its simplest form.

$\frac{3}{9} = \frac{3\div 3}{9\div 3} = \frac{1}{3}$.

$\therefore \frac{1}{3} \boxed{=} \frac{3}{9}$

(*b*) Here, LCM of 7 and 4 is 28.

So, $\frac{2}{7} = \frac{2\times 4}{7\times 4} = \frac{8}{28}$ and $\frac{-3}{4} = \frac{-3\times 7}{4\times 7} = \frac{-21}{28}$

Now, $\frac{-21}{28} < \frac{8}{28}$ or $\frac{-3}{4} < \frac{2}{7}$

Thus, $\frac{2}{7} \boxed{>} \frac{-3}{4}$.

**Alternative method:** A positive rational number is always greater than a negative rational number. So, $\frac{2}{7} > \frac{-3}{4}$.

(*c*) Here, LCM of 9 and 4 is 36.

So, $\frac{-4}{9} = \frac{-4\times 4}{9\times 4} = \frac{-16}{36}$ and $\frac{9}{4} = \frac{9\times 9}{4\times 9} = \frac{81}{36}$.

Now, $\frac{-16}{36} < \frac{81}{36}$ or $\frac{-4}{9} \boxed{<} \frac{9}{4}$

(*d*) Here, LCM of 3 and 27 is 27.

So, $\frac{-2}{3} = \frac{-2\times 9}{3\times 9} = \frac{-18}{27}$

Now, $\frac{-18}{27} < \frac{-9}{27}$ or $\frac{-2}{3} \boxed{<} \frac{-9}{27}$

**6.** (*a*) LCM of 3, 4, 5 and 11 is 660. So we first convert given rational numbers into equivalent rational numbers having the same denominator.

$\frac{1}{3} = \frac{1\times 220}{3\times 220} = \frac{220}{660}$; $\frac{1}{4} = \frac{1\times 165}{4\times 165} = \frac{165}{660}$;

$\frac{3}{5} = \frac{3\times 132}{5\times 132} = \frac{396}{660}$; $\frac{-7}{11} = \frac{-7\times 60}{11\times 60} = \frac{-420}{660}$.

Now, comparing the numerators, we have

$-420 < 165 < 220 < 396$

$\therefore \quad \frac{-420}{660} < \frac{165}{660} < \frac{220}{660} < \frac{396}{660}$

Thus, the ascending order of the given rational numbers is $\frac{-7}{11} < \frac{1}{4} < \frac{1}{3} < \frac{3}{5}$.

(*b*) LCM of 5, 7 and 11 is 385. So, we first convert the given rational numbers into equivalent rational numbers having the same denominator.

$\frac{2}{5} = \frac{2\times 77}{5\times 77} = \frac{154}{385}$; $\frac{1}{7} = \frac{1\times 55}{7\times 55} = \frac{55}{385}$;

$\frac{-4}{5} = \frac{-4\times 77}{5\times 77} = \frac{-308}{385}$; $\frac{-7}{11} = \frac{-7\times 35}{11\times 35} = \frac{-245}{385}$

Now, comparing the numerators, we have

$-308 < -245 < 55 < 154$

$\therefore \quad \frac{-308}{385} < \frac{-245}{385} < \frac{55}{385} < \frac{154}{385}$

Thus, the ascending order of the given rational numbers is $\frac{-4}{5} < \frac{-7}{11} < \frac{1}{7} < \frac{2}{5}$.

**7.** (*a*) To arrange the given rational numbers into descending order, we first need to convert the mixed fractions into improper fractions, i.e., $1\frac{1}{3} = \frac{4}{3}$; so we have $\frac{4}{3}, \frac{3}{4}, \frac{-3}{5}, \frac{-9}{11}$.

LCM of 3, 4, 5 and 11 is 660.

$\therefore \quad \frac{4}{3} = \frac{4\times 220}{3\times 220} = \frac{880}{660}$; $\frac{3}{4} = \frac{3\times 165}{4\times 165} = \frac{495}{660}$;

$\frac{-3}{5} = \frac{-3\times 132}{5\times 132} = \frac{-396}{660}$;

$\frac{-9}{11} = \frac{-9\times 60}{11\times 60} = \frac{-540}{660}$.

Now, comparing the numerators, we have

$880 > 495 > -396 > -540$

$\therefore \quad \frac{880}{660} > \frac{495}{660} > \frac{-396}{660} > \frac{-540}{660}$

Thus, the descending order of the given rational numbers is

$1\frac{1}{3} > \frac{3}{4} > \frac{-3}{5} > \frac{-9}{11}$.

(*b*) Converting mixed fractions into improper fractions, we have $1\frac{2}{5} = \frac{7}{5}$ and $1\frac{1}{7} = \frac{8}{7}$.

So, we have the given rational numbers as: $\frac{7}{5}, \frac{8}{7}, \frac{-4}{5}, \frac{7}{11}$

LCM of 5, 7 and 11 is 385.

$\therefore \quad \frac{7}{5} = \frac{7\times 77}{5\times 77} = \frac{539}{385}$; $\frac{8}{7} = \frac{8\times 55}{7\times 55} = \frac{440}{385}$;

$\frac{-4}{5} = \frac{-4\times 77}{5\times 77} = \frac{-308}{385}$;

$\frac{7}{11} = \frac{7\times 35}{11\times 35} = \frac{245}{385}$.

Now, comparing the numerators, we have

$\frac{539}{385} > \frac{440}{385} > \frac{245}{385} > \frac{-308}{385}$

$\therefore \quad 1\frac{2}{5} > 1\frac{1}{7} > \frac{7}{11} > \frac{-4}{5}$.

**8.** LCM of 8 and 3 is 24.

$\therefore \quad \frac{1}{8} = \frac{1\times 3}{8\times 3} = \frac{3}{24}$; $\frac{1}{3} = \frac{1\times 8}{3\times 8} = \frac{8}{24}$.

Here, there are only four integers i.e., 4, 5, 6 and 7 lying between 3 and 8. So, we can have $\frac{3}{24} < \frac{4}{24} < \frac{5}{24} < \frac{6}{24} < \frac{7}{24} < \frac{8}{24}$.

But, we need to write five rational numbers. So, we take them between $\frac{3\times 2}{24\times 2} = \frac{6}{48}$ and $\frac{8\times 2}{24\times 2} = \frac{16}{48}$.

Thus, any five rational numbers between $\frac{1}{8}$ and $\frac{1}{3}$ are $\frac{7}{48}, \frac{8}{48}, \frac{9}{48}, \frac{10}{48}, \frac{11}{48}, \ldots, \frac{15}{48}$ (Answers may vary).

**9.** A rational number between 1.2 and 1.3

$\frac{1}{2}\times(1.2+1.3) = \frac{2.5}{2} = 1.25$

Clearly, $1.2 < 1.25 < 1.3$.

Next, we will find the rational number between 1.2 and 1.25.

$\frac{1}{2}\times(1.2+1.25) = \frac{2.45}{2} = 1.225$

$\therefore$ The rational number between 1.2 and 1.25 is 1.225.

Clearly, $1.2 < 1.225 < 1.25 < 1.3$

Now, we will find the rational number between 1.25 and 1.3.

$$\frac{1}{2}(1.25+1.3)=1.275$$

Clearly, 1.2 < 1.225 < 1.25 <1.275 < 1.3.

Thus, the three rational numbers are 1.225, 1.25, 1.275 (Answer may vary).

**10.** By using the common denominator method, we can find any ten rational numbers between $-\frac{1}{7}$ and $\left|-\frac{1}{7}\right|$ i.e., $\frac{-1}{7}$ and $\frac{1}{7}$ or $\frac{-10}{70}$ and $\frac{10}{70}$ as $\frac{-9}{70}, \frac{-8}{70}, \frac{-7}{70}, \frac{-6}{70}, ...0, \frac{1}{70}, \frac{2}{70}, \frac{3}{70}, ..., \frac{8}{70}, \frac{9}{70}$.

(Answers may vary).

## Quick Check (Page 18)

**1.** Since, $\frac{2}{3}+0=0+\frac{2}{3}=\frac{2}{3}$ and

$$\frac{2}{3}+\left(\frac{-2}{3}\right)=\left(\frac{-2}{3}\right)+\frac{2}{3}=0$$

So, 0 is the additive identity and $\left(-\frac{2}{3}\right)$ is the additive inverse.

**2.** Since, $\left(\frac{-3}{7}\right)+0=0+\left(\frac{-3}{7}\right)=\frac{-3}{7}$ and

$$\left(\frac{-3}{7}\right)+\frac{3}{7}=\frac{3}{7}+\left(\frac{-3}{7}\right)=0.$$

So, 0 is the additive identity and $\frac{3}{7}$ is the additive inverse.

**3.** $\frac{4}{-7}=\frac{4\times(-1)}{-7\times(-1)}=\frac{-4}{7}$

Since, $\frac{-4}{7}+0=0+\left(\frac{-4}{7}\right)=\frac{-4}{7}$ and

$$\left(\frac{-4}{7}\right)+\frac{4}{7}=\frac{4}{7}+\left(\frac{-4}{7}\right)=0$$

So, 0 is the additive identity and $\frac{4}{7}$ is the additive inverse.

**4.** Since, $\frac{-3}{-7}+0=0+\frac{-3}{-7}=\frac{-3}{-7}$ and

$$\left(\frac{-3}{-7}\right)+\left(\frac{-3}{7}\right)=\left(\frac{-3}{7}\right)+\left(\frac{-3}{-7}\right)=0$$

So, 0 is the additive identity and $\frac{-3}{7}$ is the additive inverse.

## Practice Time 1B

**1.** (*a*) $\frac{3}{8}+\left(\frac{-5}{8}\right)=\frac{3-5}{8}$ [Since denominator is same]

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

(*b*) $\frac{-3}{7}+\left(\frac{-5}{14}\right)=\frac{-3\times2}{7\times2}+\left(\frac{-5}{14}\right)$

$$=\frac{-6}{14}+\left(\frac{-5}{14}\right)=\frac{-6-5}{14}=\frac{-11}{14}$$

(*c*) $\frac{1}{-3}+\frac{3}{4}=\frac{-1\times4}{3\times4}+\frac{3\times3}{4\times3}$

[LCM of 3 and 4 is 12]

$$=\frac{-4}{12}+\frac{9}{12}$$

$$=\frac{-4+9}{12}=\frac{5}{12}$$

(*d*) $\frac{-3}{4}+\frac{5}{18}=\frac{-3\times9}{4\times9}+\frac{5\times2}{18\times2}$

[LCM of 4 and 18 is 36]

$$=\frac{-27}{36}+\frac{10}{36}=\frac{-27+10}{36}=\frac{-17}{36}$$

(*e*) $\frac{-3}{7}+\frac{1}{4}+\frac{1}{8}=\frac{-3\times8}{7\times8}+\frac{1\times14}{4\times14}+\frac{1\times7}{8\times7}$

[LCM of 7, 4 and 8 is 56]

$$=\frac{-24}{56}+\frac{14}{56}+\frac{7}{56}=\frac{-3}{56}$$

(*f*) $\frac{-2}{3}+\frac{1}{5}+\frac{1}{8}=\frac{-2\times40}{3\times40}+\frac{1\times24}{5\times24}+\frac{1\times15}{8\times15}$

[LCM of 3, 5 and 8 is 120]

$$=\frac{-80}{120}+\frac{24}{120}+\frac{15}{120}=\frac{-41}{120}$$

(*g*) $\frac{-3}{11}+\frac{1}{11}+\frac{2}{11}=\frac{-3+1+2}{11}=0$

**2.** (*a*) $\left(\frac{2}{5}\right)+\left(\frac{-3}{5}\right)=\left(\frac{-3}{5}\right)+\left(\frac{2}{5}\right)$

It holds commutative property of addition.

(*b*) $\left[\left(\frac{-1}{3}\right)+\left(\frac{2}{5}\right)\right]+\left(\frac{1}{7}\right)=\left(\frac{-1}{3}\right)+\left[\left(\frac{2}{5}\right)+\left(\frac{1}{7}\right)\right]$

It holds associative property of addition.

(c) $\frac{14}{17}+0=\frac{14}{17}$

It shows existence of additive identity

(d) $\frac{4}{7}+\left(\frac{-4}{7}\right)=0$

It shows existence of additive inverse.

**3.** (a) $\frac{-4}{7}+\frac{7}{8}=\frac{7}{8}+\left(\frac{\mathbf{-4}}{\mathbf{7}}\right)$ [Commutative property of addition]

(b) $\frac{6}{7}+\mathbf{0}=\frac{6}{7}$ [Additive identity]

(c) $\frac{-2}{3}+\left(\frac{7}{8}+\frac{3}{5}\right)=\left(\frac{-2}{3}+\frac{7}{8}\right)+\frac{\mathbf{3}}{\mathbf{5}}$

[Associative property of addition]

(d) $\frac{4}{9}+\left(\frac{\mathbf{-4}}{\mathbf{9}}\right)=0$ [Additive inverse]

**4.** (a) $\frac{3}{7}+\left(\frac{-5}{7}\right)=\frac{3-5}{7}=\frac{-2}{7}$ (A rational number)

Hence, closure property is verified.

(b) $\frac{-2}{5}+\left(\frac{-5}{7}\right)=\frac{-2\times7}{5\times7}+\left(\frac{-5\times5}{7\times5}\right)$

[LCM of 5 and 7 is 35]

$=\frac{-14}{35}+\left(\frac{-25}{35}\right)$

$=\frac{-39}{35}$ (A rational number)

Hence, closure property is verified.

(c) $\frac{-11}{12}+\frac{5}{18}=\frac{-11\times3}{12\times3}+\frac{5\times2}{18\times2}$

[LCM of 12 and 18 is 36]

$=\frac{-33}{36}+\frac{10}{36}$

$=\frac{-23}{36}$ (A rational number)

Hence, closure property is verified.

(d) $\frac{1}{4}+\frac{7}{9}=\frac{1\times9}{4\times9}+\frac{7\times4}{9\times4}$

[LCM of 4 and 9 is 36]

$=\frac{9}{36}+\frac{28}{36}=\frac{37}{36}$ (A rational number)

Hence, closure property is verified.

**5.** (a) By grouping the first two rational numbers, we have

$\left(\frac{2}{3}+\frac{2}{5}\right)+\frac{1}{7}=\left(\frac{10+6}{15}\right)+\frac{1}{7}$

$=\frac{16}{15}+\frac{1}{7}=\frac{112+15}{105}=\frac{127}{105}$

By grouping the last two rational numbers, we have

$\frac{2}{3}+\left(\frac{2}{5}+\frac{1}{7}\right)=\frac{2}{3}+\left(\frac{14+5}{35}\right)$

$=\frac{2}{3}+\frac{19}{35}=\frac{70+57}{105}$

$=\frac{127}{105}$

Thus, $\left(\frac{2}{3}+\frac{2}{5}\right)+\frac{1}{7}=\frac{2}{3}+\left(\frac{2}{5}+\frac{1}{7}\right)$

Hence, associative property is verified.

(b) We have, $\left(\frac{-3}{7}+\frac{1}{5}\right)+\frac{1}{8}=\left(\frac{-15+7}{35}\right)+\frac{1}{8}$

$=\frac{-8}{35}+\frac{1}{8}=\left(\frac{-64+35}{280}\right)$

$=\frac{-29}{280}$

and $\left(\frac{-3}{7}\right)+\left(\frac{1}{5}+\frac{1}{8}\right)=\left(\frac{-3}{7}\right)+\left(\frac{8+5}{40}\right)$

$=\frac{-3}{7}+\frac{13}{40}=\frac{-120+91}{280}$

$=\frac{-29}{280}$

Thus, $\left(\frac{-3}{7}+\frac{1}{5}\right)+\frac{1}{8}=\left(\frac{-3}{7}\right)+\left(\frac{1}{5}+\frac{1}{8}\right)$

Hence, associative property is verified.

(c) We have, $\left[\frac{2}{9}+\left(\frac{-4}{5}\right)\right]+\frac{7}{9}=\left(\frac{10-36}{45}\right)+\frac{7}{9}$

$=\frac{-26}{45}+\frac{7}{9}=\left(\frac{-26+35}{45}\right)$

$=\frac{9}{45}=\frac{1}{5}$

and $\frac{2}{9}+\left(\frac{-4}{5}+\frac{7}{9}\right) = \frac{2}{9}+\left(\frac{-36+35}{45}\right)$

$= \frac{2}{9}+\left(-\frac{1}{45}\right)=\left(\frac{10-1}{45}\right)$

$= \frac{9}{45}=\frac{1}{5}$

Thus, $\left[\frac{2}{9}+\left(\frac{-4}{5}\right)\right]+\frac{7}{9} = \frac{2}{9}+\left(\frac{-4}{5}+\frac{7}{9}\right)$.

Hence, associative property is verified.

(*d*) We have, $\left(\frac{4}{7}+\frac{1}{14}\right)+\left(\frac{-1}{21}\right) = \left(\frac{8+1}{14}\right)+\left(\frac{-1}{21}\right)$

$= \frac{9}{14}+\left(\frac{-1}{21}\right)$

$= \left(\frac{27-2}{42}\right)=\frac{25}{42}$

and $\frac{4}{7}+\left(\frac{1}{14}+\left(\frac{-1}{21}\right)\right) = \frac{4}{7}+\left(\frac{3-2}{42}\right)$

$= \frac{4}{7}+\frac{1}{42}$

$= \left(\frac{24+1}{42}\right) = \frac{25}{42}$

Thus, $\left(\frac{4}{7}+\frac{1}{14}\right)+\left(\frac{-1}{21}\right) = \frac{4}{7}+\left(\frac{1}{14}+\frac{-1}{21}\right)$.

Hence, associative property is verified.

**6.** Given, $a = \frac{5}{8}$ and $b = \frac{-3}{7}$.

Now, $a + b = \frac{5}{8}+\left(\frac{-3}{7}\right) = \left(\frac{35-24}{56}\right) = \frac{11}{56}$

and $b + a = \left(\frac{-3}{7}\right)+\left(\frac{5}{8}\right) = \left(\frac{-24+35}{56}\right) = \frac{11}{56}$

$\therefore \quad a + b = b + a$

**7.** Given, $x = \frac{5}{8}$, $y = \frac{-3}{7}$ and $z = \frac{8}{11}$

Now, $x + (y + z) = \frac{5}{8}+\left(\frac{-3}{7}+\frac{8}{11}\right)$

$= \frac{5}{8}+\left(\frac{-33+56}{77}\right) = \frac{5}{8}+\frac{23}{77}$

$= \frac{385+184}{616} = \frac{569}{616}$.

$(x + y) + z = \left(\frac{5}{8}+\left(\frac{-3}{7}\right)\right)+\frac{8}{11}$

$= \left(\frac{35-24}{56}\right)+\frac{8}{11}$

$= \frac{11}{56}+\frac{8}{11}$

$= \frac{121+448}{616}$

$= \frac{569}{616}$.

$\therefore \quad x + (y + z) = (x + y) + z$

**8.** '0' is the only number whose negative is 0 itself. Thus, '0' is the only rational number which is the additive inverse of its own.

## Practice Time 1C

**1.** (*a*) $\frac{5}{4}-\frac{3}{8} = \frac{5\times2-3\times1}{8} = \frac{10-3}{8}$ [LCM of 4 and 8 is 8]

$= \frac{7}{8}$

(*b*) $\frac{-2}{5}-\left(\frac{-1}{2}\right) = \frac{-2}{5}+\frac{1}{2} = \left(\frac{-4+5}{10}\right)$ [LCM of 5 and 2 is 10]

$= \frac{1}{10}$

(*c*) $\frac{-5}{9}-\left(\frac{-3}{8}\right) = \frac{-5}{9}+\frac{3}{8} = \frac{-40+27}{72}$ [LCM of 9 and 8 is 72]

$= \frac{-13}{72}$

(*d*) $\frac{-3}{-4}-\left(\frac{-2}{7}\right) = \frac{3}{4}+\frac{2}{7} = \frac{21+8}{28}$ [LCM of 4 and 7 is 28]

$= \frac{29}{28}$

**2.** (*a*) $\frac{2}{3}-\frac{4}{5} = \frac{2\times5}{3\times5}-\frac{4\times3}{5\times3} = \frac{10}{15}-\frac{12}{15}$ [LCM of 3 and 5 is 15]

$= \frac{10-12}{15} = \frac{-2}{15}$

(*b*) $\frac{-7}{10}-\frac{1}{8} = \frac{-7\times4}{10\times4}-\frac{1\times5}{8\times5} = \frac{-28}{40}-\frac{5}{40}$

[LCM of 10 and 8 is 40]

$= \frac{-28-5}{40} = \frac{-33}{40}.$

(*c*) $\frac{-3}{7}-\left(\frac{-5}{6}\right) = \frac{-3\times6}{7\times6}+\frac{5\times7}{6\times7} = \frac{-18}{42}+\frac{35}{42}$

[LCM of 7 and 6 is 42]

$= \frac{-18+35}{42} = \frac{17}{42}$

(*d*) $\frac{5}{24}-\left(\frac{-7}{-12}\right) = \frac{5}{24}-\frac{7\times2}{12\times2} = \frac{5}{24}-\frac{14}{24}$

[LCM of 24 and 12 is 24]

$= \frac{5-14}{24} = \frac{-9}{24} = \frac{-3}{8}$

**3.** (*a*) $p = 1, q = \frac{5}{7}$

Now, $p - q = 1-\frac{5}{7} = \frac{1\times7}{1\times7}-\frac{5}{7} = \frac{7-5}{7} = \frac{2}{7}$

(A rational number)

(*b*) $p = \frac{-3}{7},\ q = \frac{-2}{5}$

Now, $p - q = \frac{-3}{7}-\left(\frac{-2}{5}\right)$

$= \frac{-3\times5}{7\times5}+\left(\frac{2\times7}{5\times7}\right)$

[LCM of 7 and 5 is 35]

$= \frac{-15+14}{35} = \frac{-1}{35}$

(A rational number)

**4.** (*a*) Let the other number be '*x*'.

A.T.Q., $x+\left(\frac{-14}{5}\right) = -2$

$\Rightarrow x = -2-\left(\frac{-14}{5}\right) = \frac{-2\times5}{1\times5}+\frac{14}{5}$

$\Rightarrow x = \frac{-10+14}{5} = \frac{4}{5}.$

(*b*) Let *x* should be added to $\left(\frac{-5}{8}\right)$ to get $\left(\frac{-3}{22}\right)$.

$\therefore \quad x+\left(\frac{-5}{8}\right) = \frac{-3}{22}$

$\Rightarrow \quad x = \frac{5}{8}-\frac{3}{22} = \frac{5\times11}{8\times11}-\frac{3\times4}{22\times4}$

$= \frac{55}{88}-\frac{12}{88} = \frac{43}{88}$

(*c*) Let *x* should be subtracted from $\left(\frac{-2}{8}\right)$ to get $\left(\frac{-1}{6}\right)$.

$\therefore \quad \frac{-2}{8}-x = \frac{-1}{6}$

$\Rightarrow \quad x = \frac{1}{6}-\frac{2}{8} = \frac{1\times4}{6\times4}-\frac{2\times3}{8\times3}$

$= \frac{4}{24}-\frac{6}{24} = \frac{4-6}{24}$

$= \frac{-2}{24} = \frac{-1}{12}$

**5.** (*a*) $\frac{-5}{18}-\frac{7}{12}+\frac{5}{24} = \frac{-5\times4}{18\times4}-\frac{7\times6}{12\times6}+\frac{5\times3}{24\times3}$

[∵ LCM of 18, 12 and 24 is 72]

$= \frac{-20}{72}-\frac{42}{72}+\frac{15}{72} = \frac{-47}{72}.$

(*b*) $\frac{-5}{18}+\frac{3}{8}-\left(\frac{-2}{9}\right) = \frac{-5\times4}{18\times4}+\frac{3\times9}{8\times9}+\frac{2\times8}{9\times8}$

[∵ LCM of 18, 8 and 9 is 72]

$= \frac{-20}{72}+\frac{27}{72}+\frac{16}{72} = \frac{23}{72}$

(*c*) $\frac{-2}{5}-\left(\frac{-4}{15}\right)-\left(\frac{-3}{10}\right) = \frac{-2\times6}{5\times6}+\frac{4\times2}{15\times2}+\frac{3\times3}{10\times3}$

[∵ LCM of 5, 15 and 10 is 30]

$= \frac{-12}{30}+\frac{8}{30}+\frac{9}{30}$

$= \frac{5}{30} = \frac{1}{6}$

**6.** (*a*) We have, $x = \frac{-4}{5}$ and $y = \frac{2}{5}$

Now, $x - y = \frac{-4}{5}-\frac{2}{5} = \frac{-4-2}{5} = \frac{-6}{5}$

and $y - x = \frac{2}{5}-\left(\frac{-4}{5}\right) = \frac{2+4}{5} = \frac{6}{5}$

$\therefore \quad x - y \neq y - x.$

(*b*) We have, $x = \frac{2}{9}$ and $y = \frac{-1}{5}$

Now, $x - y = \frac{2}{9} - \left(-\frac{1}{5}\right) = \frac{2\times5}{9\times5} + \frac{1\times9}{5\times9}$

[$\because$ LCM of 9 and 5 is 45]

$= \frac{10}{45} + \frac{9}{45} = \frac{19}{45}$

and $y - x = \frac{-1}{5} - \frac{2}{9}$

$= \frac{-1\times9}{5\times9} - \frac{2\times5}{9\times5}$

$= \frac{-9-10}{45} - \frac{-19}{45}$

$\therefore \quad x - y \neq y - x$

**7.** (*a*) Here $x = \frac{-4}{5}$, $y = \frac{2}{5}$, $z = \frac{2}{7}$.

Now, $x - (y - z) = \frac{-4}{5} - \left(\frac{2}{5} - \frac{2}{7}\right)$

$= \frac{-4}{5} - \left(\frac{2\times7}{5\times7} - \frac{2\times5}{7\times5}\right)$

[$\because$ LCM of 5 and 7 is 35]

$= \frac{-4}{5} - \left(\frac{14-10}{35}\right)$

$= \frac{-4\times7}{5\times7} - \frac{4}{35}$

$= \frac{-28-4}{35} = \frac{-32}{35}$

and $(x - y) - z = \left(\frac{-4}{5} - \frac{2}{5}\right) - \frac{2}{7}$

$= \frac{-6}{5} - \frac{2}{7} = \frac{-6\times7}{5\times7} - \frac{2\times5}{7\times5}$

[$\because$ LCM of 5 and 7 is 35]

$= \frac{-42}{35} - \frac{10}{35}$

$= \frac{-42-10}{35}$

$= \frac{-52}{35}$

$\therefore \; x - (y - z) \neq (x - y) - z$

(*b*) Here $x = \frac{2}{9}$, $y = \frac{-1}{5}$, $z = \frac{8}{9}$.

Now, $x - (y - z) = \frac{2}{9} - \left(\frac{-1}{5} - \frac{8}{9}\right)$

$= \frac{2}{9} - \left(\frac{-1\times9}{5\times9} - \frac{8\times5}{9\times5}\right)$

$= \frac{2}{9} - \left(\frac{-9-40}{45}\right)$

$= \frac{10+49}{45} = \frac{59}{45}$.

and $(x - y) - z = \left(\frac{2}{9} - \left(\frac{-1}{5}\right)\right) - \frac{8}{9}$

$= \left(\frac{2\times5}{9\times5} + \frac{1\times9}{5\times9}\right) - \frac{8}{9}$

$= \left(\frac{10+9}{45}\right) - \frac{8}{9}$

$= \frac{19-40}{45} = \frac{-21}{45}$

$\therefore \; x - (y - z) \neq (x - y) - z$

## Think and Answer (Page 22)

Total length of journey = 2525 km

Length of journey through valley $= \frac{1}{10} \times 2525$

$= 252.5$ km

Length of journey through plains $= 2525 - 252.5$

$= 2272.5$ km

## Think and Answer (Page 24)

1 and –1 are two rational numbers which are also the multiplicative inverse of themselves.

## Practice Time 1D

**1.** (*a*) $\frac{3}{10} \times \frac{5}{12} = \frac{1}{8}$ (*b*) $\frac{-7}{18} \times \frac{6}{7} = \frac{-1}{3}$

(*c*) $\frac{3}{4} \times \frac{8}{-9} = \frac{-2}{3}$ (*d*) $\frac{-5}{8} \times \frac{6}{-5} = \frac{3}{4}$

**2.** (*a*) $\frac{-19}{36} \times 26 = \frac{-247}{18} = -13\frac{13}{18}$

(*b*) $\frac{-12}{15} \times (-10) = \frac{120}{15} = 8$

(*c*) $\frac{18}{35}\times\left(-3\frac{1}{6}\right)=\frac{18}{35}\times\left(\frac{-19}{6}\right)=\frac{-57}{35}=-1\frac{22}{35}$

(*d*) $-5\frac{1}{4}\times3\frac{1}{7}=\frac{-21}{4}\times\frac{22}{7}=\frac{-33}{2}=-16\frac{1}{2}$

**3.** (*a*) $\left(\frac{-2}{9}\times\frac{27}{-16}\right)+\left(\frac{-1}{2}\times\frac{5}{3}\right)=\left(\frac{-3}{-8}\right)+\left(\frac{-5}{6}\right)$

$=\frac{3\times3}{8\times3}+\left(\frac{-5\times4}{6\times4}\right)$

[∵ LCM of 8 and 6 is 24]

$=\frac{9}{24}-\frac{20}{24}$

$=\frac{9-20}{24}=\frac{-11}{24}.$

(*b*) $\left(\frac{5}{2}\times\frac{-16}{5}\right)-\left(\frac{-35}{3}\times\frac{1}{7}\times21\right)=(-8)-(-35)$

$=-8+35=27$

**4.** (*a*) $\frac{-13}{9}\times\frac{11}{15}=\frac{11}{15}\times\left(\mathbf{\frac{-13}{9}}\right)$

[By commutative property of multiplication]

(*b*) $-19\times\left(\frac{-5}{13}\right)=\frac{-5}{13}\times\mathbf{(-19)}$

[By commutative property of multiplication]

(*c*) $\left(\frac{11}{9}\times\frac{-8}{7}\right)\times\frac{-3}{8}=\mathbf{\frac{11}{9}}\times\left(\frac{-8}{7}\times\frac{-3}{8}\right)$

[By associative property of multiplication]

(*d*) $\frac{-17}{9}\times\left(\frac{3}{7}\times\frac{-35}{16}\right)=\left(\frac{-17}{9}\times\frac{3}{7}\right)\times\left(\mathbf{\frac{-35}{16}}\right)$

[By associative property of multiplication]

**5.** (*a*) $\frac{2}{7}\times\frac{5}{3}+\frac{2}{7}\times\frac{4}{3}=\frac{2}{7}\times\left(\frac{5}{3}+\frac{4}{3}\right)$

$=\frac{2}{7}\times\frac{9}{3}$

$=\frac{2}{7}\times3=\frac{6}{7}$

(*b*) $\frac{6}{11}\times\frac{5}{9}-\frac{6}{11}\times\frac{2}{9}=\frac{6}{11}\times\left(\frac{5}{9}-\frac{2}{9}\right)$

$=\frac{6}{11}\times\frac{3}{9}=\frac{2}{11}$

(*c*) $\frac{3}{8}\times\left(\frac{-6}{11}\right)+(-4)\times\frac{6}{11}=\frac{-6}{11}\times\left(\frac{3}{8}+4\right)$

$=\frac{-6}{11}\times\frac{35}{8}=\frac{-105}{44}$

**6.** (*a*) $\frac{1}{13}\times\left(\frac{-16}{5}\right)=\frac{-16}{5}\times\frac{1}{13}$

It shows commutative property of multiplication.

(*b*) $\left\{\frac{(-2)}{3}\times\frac{7}{6}\right\}\times\frac{(-9)}{5}=\frac{(-2)}{3}\times\left\{\frac{7}{6}\times\frac{(-9)}{5}\right\}$

It shows associative property of multiplication.

(*c*) $\frac{-11}{-13}\times\left(\frac{-13}{-11}\right)=\frac{-13}{-11}\times\left(\frac{-11}{-13}\right)=1$

It shows existence of multiplicative inverse.

(*d*) $\frac{(-3)}{4}\times\left\{\frac{(-7)}{9}+\frac{7}{8}\right\}$

$=\left\{\frac{(-3)}{4}\times\frac{(-7)}{9}\right\}+\left\{\frac{(-3)}{4}\times\frac{7}{8}\right\}$

It shows distributive property of multiplication over addition.

**7.** (*a*) Here, $x=\frac{1}{7}$, $y=\frac{2}{3}$ and $z=\frac{2}{7}$

$x\times(y\times z)=\frac{1}{7}\times\left(\frac{2}{3}\times\frac{2}{7}\right)$

$=\frac{1}{7}\times\frac{4}{21}=\frac{4}{147}$

and $(x\times y)\times z=\left(\frac{1}{7}\times\frac{2}{3}\right)\times\frac{2}{7}$

$=\frac{2}{21}\times\frac{2}{7}=\frac{4}{147}$

∴ $x\times(y\times z)=(x\times y)\times z$

(*b*) Here, $x=\frac{2}{9}$, $y=\frac{-1}{3}$ and $z=1\frac{2}{3}=\frac{5}{3}$

$x\times(y\times z)=\frac{2}{9}\times\left(\frac{-1}{3}\times\frac{5}{3}\right)=\frac{2}{9}\times\frac{-5}{9}=\frac{-10}{81}$

and $(x\times y)\times z=\left[\frac{2}{9}\times\left(\frac{-1}{3}\right)\right]\times\frac{5}{3}$

$=\frac{-2}{27}\times\frac{5}{3}=\frac{-10}{81}$

∴ $x\times(y\times z)=(x\times y)\times z$

**8.** (*a*) Here, $x = \frac{-4}{7}$, $y = \frac{2}{3}$ and $z = \frac{2}{7}$

$$\text{Now, } x \times (y+z) = \left(\frac{-4}{7}\right)\times\left(\frac{2}{3}+\frac{2}{7}\right)$$
$$= \frac{-4}{7}\times\left(\frac{2\times7}{3\times7}+\frac{2\times3}{7\times3}\right)$$
$$= \frac{-4}{7}\times\left(\frac{14+6}{21}\right)$$
$$= \frac{-4}{7}\times\frac{20}{21} = \frac{-80}{147}$$
$$\text{and } (x\times y)+(x\times z) = \left(\frac{-4}{7}\times\frac{2}{3}\right)+\left(\frac{-4}{7}\times\frac{2}{7}\right)$$
$$= \frac{-8}{21}+\left(\frac{-8}{49}\right)$$
$$= \frac{-8\times7}{21\times7}+\left(\frac{-8\times3}{49\times3}\right)$$

[LCM of 21 and 49 is 147]

$$= \frac{-56-24}{147} = \frac{-80}{147}$$

$\therefore\ x\times(y+z) = (x\times y)+(x\times z)$

(*b*) Here, $x = \frac{2}{9}$, $y = \frac{-1}{3}$ and $z = \frac{17}{9}$

$$\text{Now, } x\times(y+z) = \frac{2}{9}\times\left(\frac{-1}{3}+\frac{17}{9}\right)$$
$$= \frac{2}{9}\times\left(\frac{-1\times3}{3\times3}+\frac{17}{9}\right)$$
$$= \frac{2}{9}\times\left(\frac{-3+17}{9}\right)$$
$$= \frac{2}{9}\times\frac{14}{9} = \frac{28}{81}$$
$$\text{and } (x\times y)+(x\times z) = \left[\frac{2}{9}\times\left(\frac{-1}{3}\right)\right]+\left[\frac{2}{9}\times\frac{17}{9}\right]$$
$$= \frac{-2}{27}+\frac{34}{81}$$
$$= \frac{-2\times3}{27\times3}+\frac{34}{81}$$
$$= \frac{-6+34}{81} = \frac{28}{81}$$

$\therefore\ x\times(y+z) = (x\times y)+(x\times z)$

**9.** (*a*) Here, $a = \frac{-4}{5}$, $b = \frac{2}{5}$ and $c = \frac{2}{7}$.

$$\text{Now, } a\times(b-c) = \left(\frac{-4}{5}\right)\times\left(\frac{2}{5}-\frac{2}{7}\right)$$
$$= \left(\frac{-4}{5}\right)\times\left(\frac{2\times7}{5\times7}-\frac{2\times5}{7\times5}\right)$$
$$= \left(\frac{-4}{5}\right)\times\left(\frac{14-10}{35}\right)$$
$$= \frac{-4}{5}\times\frac{4}{35} = \frac{-16}{175}$$
$$\text{and } (a\times b)-(a\times c) = \left(\frac{-4}{5}\times\frac{2}{5}\right)-\left(\frac{-4}{5}\times\frac{2}{7}\right)$$
$$= \frac{-8}{25}+\frac{8}{35}$$
$$= \frac{-8\times7}{25\times7}+\frac{8\times5}{35\times5}$$

[LCM of 25 and 35 is 175]

$$= \frac{-56+40}{175} = \frac{-16}{175}$$

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

(*b*) Here, $a = \frac{2}{9}$, $b = \frac{-1}{5}$ and $c = \frac{8}{9}$

$$\text{Now, } a\times(b-c) = \frac{2}{9}\times\left(\frac{-1}{5}-\frac{8}{9}\right)$$
$$= \frac{2}{9}\times\left(\frac{-1\times9}{5\times9}-\frac{8\times5}{9\times5}\right)$$
$$= \frac{2}{9}\times\left(\frac{-9-40}{45}\right)$$
$$= \frac{2}{9}\times\left(\frac{-49}{45}\right) = \frac{-98}{405}$$
$$\text{and } (a\times b)-(a\times c) = \left[\frac{2}{9}\times\left(\frac{-1}{5}\right)\right]-\left[\frac{2}{9}\times\frac{8}{9}\right]$$
$$= \frac{-2}{45}-\frac{16}{81}$$
$$= \frac{-2\times9}{45\times9}-\frac{16\times5}{81\times5}$$
$$= \frac{-18-80}{405}$$
$$= \frac{-98}{405}$$

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

**10.** (*a*) $-1+\left(\frac{-3}{5}\right) = \frac{-1\times5}{1\times5}+\left(\frac{-3}{5}\right) = \frac{-5-3}{5} = \frac{-8}{5}$

$\therefore$ Reciprocal of $\frac{-8}{5}=\frac{-5}{8}$.

(*b*) $\frac{-2}{3}\times\left(\frac{1}{2}-\frac{1}{4}\right) = \frac{-2}{3}\times\left(\frac{1\times2}{2\times2}-\frac{1}{4}\right)$

$= \frac{-2}{3}\left(\frac{2-1}{4}\right) = \frac{-2}{12} = \frac{-1}{6}$.

$\therefore$ Reciprocal of $\frac{-1}{6} = -6$.

(*c*) $\frac{2}{3}\times\frac{3}{5}+\frac{2}{3}\times\frac{2}{5} = \frac{6}{15}+\frac{4}{15}$

$= \frac{10}{15}=\frac{2}{3}$

$\therefore$ Reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$.

## Create and Solve (Page 27)

| Rational numbers | Do as directed | Property | Satisfied (Yes/No) |
|---|---|---|---|
| $a = \frac{1}{3}, b = \frac{1}{3}$ | $a + b = \frac{1}{3}+\frac{1}{3}=\frac{2}{3}$ | Closure property for addition | Yes |
| $a = \frac{5}{7}, b = \frac{1}{3}$ | $a \div b = \frac{15}{7}$<br>$b \div a = \frac{7}{15}$ | Commutative property for division | No |
| $a = \frac{4}{7}, b = \frac{2}{3}$ | $a \times b = \frac{8}{21}$<br>$b \times a = \frac{8}{21}$ | Commutative property for multiplication | Yes |
| $a = \frac{2}{3}, b = \frac{1}{3}$ and $c = \frac{5}{7}$ | $a + (b + c) = \frac{12}{7}$<br>$(a + b) + c = \frac{12}{7}$ | Associative property for addition | Yes |
| $a = \frac{4}{7}, b = \frac{1}{3}$ and $c = 1\frac{2}{5}$ | $a \times (b \times c) = \frac{4}{15}$<br>$(a \times b) \times c = \frac{4}{15}$ | Associative property for multiplication | Yes |
| $a = 1\frac{3}{8}, b = 0$ | $a + b = 1\frac{3}{8}$<br>$b + a = 1\frac{3}{8}$ | Additive identity | Yes |
| $a = \frac{3}{8}, b = 1$ | $a \times b = \frac{3}{8}$<br>$b \times a = \frac{3}{8}$ | Multiplicative identity | Yes |
| $a = \frac{4}{7}, b = -\frac{4}{7}$ | $a - b = \frac{8}{7}$<br>$b - a = -\frac{8}{7}$ | Commutative property for subtraction | No |
| $a = \frac{1}{3}, b = \frac{1}{5}$ and $c = \frac{5}{7}$ | $a \times (b + c) = \frac{32}{105}$<br>$(a \times b) + (a \times c) = \frac{32}{105}$ | Distributive property of multiplication over addition | Yes |

## Practice Time 1E

**1.** (*a*) $\frac{2}{3}\div\frac{-4}{15}=\frac{2}{3}\times\frac{15}{(-4)}=\frac{-5}{2}$

(*b*) $\frac{11}{12}\div\frac{-5}{8}=\frac{11}{12}\times\frac{8}{-5}=\frac{-22}{15}$

(*c*) $\frac{-3}{10}\div\frac{-6}{11}=\frac{-3}{10}\times\frac{11}{-6}=\frac{11}{20}$

(*d*) $\frac{-3}{16}\div\frac{15}{8}=\frac{-3}{16}\times\frac{8}{15}=\frac{-1}{10}$

**2.** (*a*) $\frac{21}{36}\div\left(\frac{-30}{44}\right)=\frac{21}{36}\times\left(\frac{44}{-30}\right)=\frac{-77}{90}$

(*b*) $\frac{5}{8}\div\frac{7}{10}=\frac{5}{8}\times\frac{10}{7}=\frac{25}{28}$

(*c*) $\frac{18}{49}\div\frac{72}{-35}=\frac{-5}{28}$

**3.** (*a*) $\frac{3}{13}\div\frac{(-4)}{65}=\frac{3}{13}\times\frac{65}{(-4)}=\frac{15}{-4}$

Reciprocal of $\frac{15}{-4}$ is $\frac{-4}{15}$.

(*b*) $\left(\frac{-5\times12}{15}\right)\div\left(\frac{-3\times2}{9}\right)$

$=\left(\frac{-5\times12}{15}\right)\times\left(\frac{9}{-3\times2}\right)=6$

Reciprocal of 6 is $\frac{1}{6}$.

**4.** (*a*) Let $x\div(-3)=\frac{-4}{15}$

$\Rightarrow\quad x\times\left(\frac{1}{-3}\right)=\frac{-4}{15}$

$\Rightarrow\quad x=\frac{-4}{15}\times(-3)=\frac{4}{5}$

$\therefore\quad x=\frac{4}{5}$

(*b*) Let $(-12)\div x=\frac{-6}{5}$

$\Rightarrow\quad(-12)\times\frac{1}{x}=\frac{-6}{5}$

$\Rightarrow\quad x=-12\div\left(\frac{-6}{5}\right)$

$=(-12)\times\left(\frac{5}{-6}\right)=10$

$\therefore\quad x=10$

**5.** Sum of $\frac{-13}{5}$ and $\frac{12}{7}=\frac{-13}{5}+\frac{12}{7}$

$=\frac{-13\times7}{5\times7}+\frac{12\times5}{7\times5}$

$=\frac{-91}{35}+\frac{60}{35}=\frac{-31}{35}$

Product $=\left(\frac{-31}{7}\times\frac{-1}{2}\right)=\frac{31}{14}$

A.T.Q., $\frac{-31}{35}\div\frac{31}{14}=\frac{-31}{35}\times\frac{14}{31}=\frac{-2}{5}$

**6.** (*a*) Here, $x=\frac{-4}{5}$ and $y=\frac{2}{5}$

Now, $x\div y=\frac{-4}{5}\div\frac{2}{5}=\frac{-4}{5}\times\frac{5}{2}=-2$

and $y\div x=\frac{2}{5}\div\left(\frac{-4}{5}\right)=\frac{2}{5}\times\frac{5}{-4}=\frac{-1}{2}$

$\therefore\quad x\div y\neq y\div x$

(*b*) Here, $x=\frac{2}{9}$ and $y=\frac{-1}{5}$

Now, $x\div y=\frac{2}{9}\div\left(\frac{-1}{5}\right)=\left(\frac{2}{9}\right)\times(-5)$

$=\frac{-10}{9}$

$y\div x=\left(\frac{-1}{5}\right)\div\frac{2}{9}=\frac{-1}{5}\times\frac{9}{2}$

$=\frac{-9}{10}$

$\therefore\quad x\div y\neq y\div x$

**7.** (*a*) Here, $x=\frac{1}{8}$, $y=\frac{2}{3}$ and $z=\frac{1}{4}$.

Now, $x\div(y\div z)=\frac{1}{8}\div\left(\frac{2}{3}\div\frac{1}{4}\right)=\frac{1}{8}\div\left(\frac{2}{3}\times\frac{4}{1}\right)$

$=\frac{1}{8}\times\frac{3}{8}=\frac{3}{64}$

and $(x\div y)\div z=\left(\frac{1}{8}\div\frac{2}{3}\right)\div\frac{1}{4}=\left(\frac{1}{8}\times\frac{3}{2}\right)\div\frac{1}{4}$

$=\frac{3}{16}\times4=\frac{3}{4}$

$\therefore\quad(x\div y)\div z\neq x\div(y\div z)$

(*b*) Here, $x = \frac{2}{9}$, $y = \frac{-1}{3}$ and $z = 1\frac{2}{3} = \frac{5}{3}$

$$\therefore \quad x \div (y \div z) = \frac{2}{9} \div \left(\frac{-1}{3} \div \frac{5}{3}\right) = \frac{2}{9} \div \left(\frac{-1}{3} \times \frac{3}{5}\right)$$

$$= \frac{2}{9} \times (-5) = \frac{-10}{9}$$

$$\text{and } (x \div y) \div z = \left(\frac{2}{9} \div \left(\frac{-1}{3}\right)\right) \div \frac{5}{3}$$

$$= \left(\frac{2}{9} \times \frac{3}{-1}\right) \div \frac{5}{3}$$

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

$$\therefore \quad x \div (y \div z) \neq (x \div y) \div z$$

## Practice Time 1F

**1.** Time spent for Maths $= 1\frac{1}{4}$ hours $= \frac{5}{4}$ hours

Time spent for English literature $= 1\frac{1}{3}$ hours

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

Time spent for Map work for $= 2\frac{3}{5}$ hours

$= \frac{13}{5}$ hours.

Total time spent on studying

$$= \frac{5}{4} + \frac{4}{3} + \frac{13}{5}$$

$$= \frac{5 \times 15}{4 \times 15} + \frac{4 \times 20}{3 \times 20} + \frac{13 \times 12}{5 \times 12}$$

[∵ LCM of 4, 3 and 5 is 60]

$$= \frac{75}{60} + \frac{80}{60} + \frac{156}{60} = \frac{311}{60} = 5\frac{11}{60} \text{ hours}$$

**2.** Weight of a drum full of wheat $= 31\frac{1}{6}$ kg

$= \frac{187}{6}$ kg

Weight of an empty drum $= 11\frac{3}{4}$ kg $= \frac{47}{4}$ kg

∴ Weight of wheat in the drum

$$= \frac{187}{6} - \frac{47}{4} = \frac{187 \times 2}{6 \times 2} - \frac{47 \times 3}{4 \times 3}$$

[∵ LCM of 6 and 4 is 12]

$$= \frac{374 - 141}{12} = \frac{233}{12} = 19\frac{5}{12} \text{ kg}$$

**3.** Time taken $= 4\frac{1}{3}$ hours $= \frac{13}{3}$ hours

Speed $= 70\frac{1}{4} = \frac{281}{4}$ km/h

Since, Distance = Speed × Time

$$\Rightarrow \text{Distance} = \frac{281}{4} \times \frac{13}{3} = \frac{3653}{12}$$

$$= 304\frac{5}{12} \text{ km}$$

**4.** Length of a rectangular plot $= 7\frac{1}{4}$ m $= \frac{29}{4}$ m

Breadth of the rectangular plot $= 6\frac{1}{4}$ m $= \frac{25}{4}$ m

∴ Area of the rectangular plot

= length × breadth

$$= \frac{29}{4} \times \frac{25}{4} = \frac{725}{16}$$

$$= 45\frac{5}{16} \text{ m}^2$$

**5.** Let the other rational number be '$x$'.

$$\text{A.T.Q.,} \quad x \times \left(\frac{-14}{15}\right) = \frac{-16}{35}$$

$$\Rightarrow \quad x = \frac{-16}{35} \div \left(\frac{-14}{15}\right)$$

$$= \frac{-16}{35} \times \frac{15}{-14} = \frac{24}{49}$$

**6.** Let the number be '$x$'.

$$\text{A.T.Q.,} \quad \frac{9}{14}x - \frac{5}{14}x = 24$$

$$\Rightarrow \quad \frac{9x - 5x}{14} = 24$$

$$\Rightarrow \quad \frac{4x}{14} = 24$$

$$\Rightarrow \quad x = \frac{24 \times 14}{4} = 84$$

7. Let the other number be '$x$'.

A.T.Q., $x \times \frac{7}{3} = \frac{-3}{2}$

$\Rightarrow \quad x = \frac{-3}{2} \div \frac{7}{3} = \frac{-3}{2} \times \frac{3}{7} = \frac{-9}{14}$

8. Distance covered = 480 km

Time taken = $2\frac{1}{5}$ hours = $\frac{11}{5}$ hours

$\therefore$ Speed = $\frac{480}{\frac{11}{5}} = 480 \times \frac{5}{11}$

$= \frac{2400}{11} = 218\frac{2}{11}$ km/h

Also, time taken by a sports car to cover a distance of 800 km = $800 \div \frac{2400}{11} = 800 \times \frac{11}{2400}$

$= \frac{11}{3} = 3\frac{2}{3}$ hours

## Brain Sizzlers (Page 30)

1. $5+\cfrac{1}{3+\cfrac{\frac{2}{5}}{1+\frac{1}{2}}} = 5+\cfrac{1}{3+\cfrac{\frac{2}{5}}{\frac{3}{2}}} = 5+\cfrac{1}{3+\frac{4}{15}}$

$= 5+\cfrac{1}{\frac{49}{15}} = 5+\frac{15}{49} = \frac{260}{49} = 5\frac{15}{49}$

2. $12 \div \cfrac{1}{1 \times \cfrac{2}{\frac{2}{3}+\frac{3}{7}-\frac{3}{5}}} = 12 \div \cfrac{1}{1 \times \cfrac{2}{\frac{70+45-63}{105}}}$

$= 12 \div \cfrac{1}{1 \times \frac{2 \times 105}{52}}$

$= 12 \times \frac{105}{26} = \frac{630}{13} = 48\frac{6}{13}$

## Chapter Assessment

**A.**

1. (*a*) The standard form of 0 is $\frac{0}{1} = 0$

2. (*d*) $-1.5 = \frac{-15}{10} = \frac{-3}{2}$

3. (*c*) As there are infinitely many rational numbers between any two rational numbers, so between 1 and 3 there are unlimited rational numbers.

4. (*b*) $1\frac{5}{10} = \frac{15}{10} = \frac{3}{2}$

Now $\frac{3}{2}+\left(\frac{-3}{2}\right) = \left(\frac{-3}{2}\right)+\frac{3}{2} = 0$

$\therefore$ Additive inverse of $\frac{3}{2}$ is $\frac{-3}{2}$.

5. (*a*) $\frac{-6}{7}+\frac{5}{14} = \frac{-6\times2}{7\times2}+\frac{5}{14} = \frac{-12+5}{14}$

$= \frac{-7}{14} = \frac{-1}{2}$

$\therefore$ Rational numbers are closed under addition.

6. (*a*) Since $\frac{3}{5} \div 0$ is not defined.

Therefore, division of rational numbers is not closed when it involves 0 as a divisor.

Hence, rational numbers are not closed under division.

7. (*d*) Given, $a$ is reciprocal of rational number $b$.

So, $b = \frac{1}{a}$ or $a = \frac{1}{a}$

Now, reciprocal of reciprocal of $b$

= reciprocal of $a = \frac{1}{a} = b$.

8. (*a*) White onions = $1\frac{1}{4}$ kg = $\frac{5}{4}$ kg

Red onions = $8\frac{2}{3}$ kg = $\frac{26}{3}$ kg

Total onions chopped = $\frac{5}{4}+\frac{26}{3}$

$= \frac{5\times3}{4\times3}+\frac{26\times4}{3\times4}$

[$\because$ LCM of 4 and 3 is 12]

$= \frac{15+104}{12} = \frac{119}{12}$

$= 9\frac{11}{12}$ kg.

9. (*c*) $\frac{-5}{3}\times\frac{-9}{10}\times\frac{8}{21}\times\frac{-1}{6} = \frac{-2}{21}$.

**10.** (*b*) Since, $\frac{3}{10} \times \frac{10}{3} = 1$

$\therefore$ $\frac{10}{3}$ is the multiplicative inverse of $\frac{3}{10}$.

**B.**

**1.** (*a*) **Assertion:** Let $\frac{6}{7}$ and $\frac{1}{7}$ are two rational numbers.

$\therefore$ Difference $= \frac{6}{7} - \frac{1}{7} = \frac{5}{7}$, which is a rational number.

**Reason:** Rational numbers $\frac{6}{7}$ and $\frac{1}{7}$ are closed under subtraction as the difference is also a rational number and satisfies closure property of subtraction.

Thus, both assertion and reason are true and reason is the correct explanation of assertion.

**2.** (*b*) **Assertion:** Reciprocal of $1 = \frac{1}{1} = 1$. So, 1 is the reciprocal of itself.

**Reason:** Reciprocal of $\frac{a}{b} = \frac{1}{\frac{a}{b}} = \frac{b}{a}$.

Thus, both assertion and reason are true, but reason is not the correct explanation of assertion.

**3.** (*a*) **Assertion:** $a \div b \neq b \div a$, where $a$ and $b$ are rational numbers.

**Reason:** By property, division is not commutative for rational numbers.

Both assertion and reason are true and reason is the correct explanation of assertion.

**C.**

**1.** The negative of a negative rational number is positive. So, if $p$ is a negative rational number, then the negative of $p$ is a **positive** rational number.

**2.** Rational numbers can be added or multiplied in any **order**.

**3.** The reciprocal of $\frac{-2}{3}$ is $\mathbf{\frac{-3}{2}}$.

**4.** The additive inverse of $\frac{-3}{-5} = \frac{3}{5}$ is $\mathbf{\frac{-3}{5}}$.

**5.** The two rational numbers lying between –4 and –7 with denominator as 1 are $\mathbf{\frac{-5}{1}}$ and $\mathbf{\frac{-6}{1}}$.

**D.**

**1.** Cost of $3\frac{1}{2}$ kg mangoes @ ₹$40\frac{3}{4}$ per kg

$= \frac{7}{2} \times \frac{163}{4} = ₹\frac{1141}{8}$.

Cost of $1\frac{1}{4}$ kg grapes @ ₹$50\frac{1}{2}$ per kg

$= \frac{5}{4} \times \frac{101}{2} = ₹\frac{505}{8}$.

$\therefore$ Total money spent by Mrs Mishra

$= ₹\left(\frac{1141}{8} + \frac{505}{8}\right) = ₹\frac{1646}{8} = ₹\frac{823}{4} = ₹205\frac{3}{4}$

**2.** Money with the person = ₹190 [Given]

Cost of $2\frac{1}{2}$ dozen eggs @ ₹$66\frac{1}{2}$ per dozen

$= ₹\left(66\frac{1}{2} \times 2\frac{1}{2}\right) = ₹\left(\frac{133}{2} \times \frac{5}{2}\right) = ₹\frac{665}{4}$

Total money left with the person

$= ₹\left(190 - \frac{665}{4}\right) = ₹\left(\frac{760 - 665}{4}\right) = ₹\frac{95}{4}$

$= ₹23\frac{3}{4}$

**3.** Area of aluminium strip $= 8\frac{3}{4} \times 1\frac{1}{4} = \frac{35}{4} \times \frac{5}{4}$ cm$^2$

Diameter of circle = breadth of strip

$= 1\frac{1}{4}$ cm $= \frac{5}{4}$ cm

Radius of circle $= \frac{1}{2} \times \frac{5}{4} = \frac{5}{8}$ cm

$\therefore$ Number of circles Shalini cut out

$= \frac{\text{Total length}}{\text{Diameter of circle}} = \frac{\frac{35}{4}}{\frac{5}{4}} = 7$

Wastage of aluminium strip = Area of aluminium strip – Total area of circles

$= \left(\frac{35}{4} \times \frac{5}{4}\right) - 7 \times \left(\frac{22}{7} \times \frac{5}{8} \times \frac{5}{8}\right)$

$= \left(\frac{175}{16}\right) - \frac{275}{32} = \frac{350 - 275}{32}$

$= \frac{75}{32} = 2\frac{11}{32}$ cm$^2$

**4.** Total number of students = 360

(*a*) Students who are rewarded with grade A

$= \frac{1}{6} \times 360 = 60$ students.

(*b*) Students who are rewarded with grade C = Total number of students – students rewarded with grade A – students rewarded with grade B

$= 360 - 60 - \frac{3}{4}$ of 360

$= 360 - 60 - 270 = 30$ students

(*c*) Difference between the numbers of students rewarded with grade B and grade C = 270 – 30 = 240 students.

## Maths Connect (Page 33)

Given, Earth's radius = 6371 km

Now, altitude of satellite = $\frac{3}{4}$ of Earth's radius

$= \frac{3}{4} \times 6371 = \frac{19113}{4} = 4778.25$ km

∴ Satellite's orbital altitude is approximately = 4778.25 km.

## Life Skills (Page 33)

Value of golden ratio = 1.618 = $\frac{a}{b}$.

Height of the dome (*a*) = 80 feet.

Now, $\frac{a}{b} = \frac{a+b}{a}$

$\Rightarrow 1.618 = \frac{80+b}{80}$

$\Rightarrow b = 1.618 \times 80 - 80 = 49.44$ feet

∴ Length of the base of the dome (*b*) = 49.44 feet.

## Mental Maths (Page 33)

**1.** $\frac{32 \div 16}{80 \div 16} = \frac{2}{5}$

Sum of 2 and 5 = 2 + 5 = 7, which is a prime number.

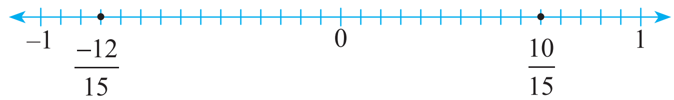
∴ $\frac{2}{5}$ is the rational number.

**2.** Let '*a*' be a non-zero rational number.

∴ Its additive inverse is '–*a*' and reciprocal is '$\frac{1}{a}$'.

A.T.Q., $(-a) \times \left(\frac{1}{a}\right) = -1$.

**3.** Equivalent rational numbers of $\frac{-4}{5}$ and $\frac{6}{9}$ $\left(=\frac{2}{3}\right)$ is $\frac{-4 \times 3}{5 \times 3} = \frac{-12}{15}$ and $\frac{2 \times 5}{3 \times 5} = \frac{10}{15}$




Clearly, $\frac{10}{15}$ is closer to 0 than $\frac{-12}{15}$.

So, $\frac{6}{9}$ is closer to 0 on the number line.

**4.** Let '*x*' should be added to $\left(\frac{-5}{9} + \frac{5}{6}\right)$ to get 1.

$\Rightarrow x + \left(\frac{-5}{9} + \frac{5}{6}\right) = 1$

$\Rightarrow x = 1 - \left(\frac{-5}{9} + \frac{5}{6}\right) = 1 + \frac{5}{9} - \frac{5}{6}$

$= \frac{18+10-15}{18} = \frac{13}{18}$

# CHAPTER 2 : LINEAR EQUATIONS IN ONE VARIABLE

## Let's Recall

**1.** Mathematical statement is: $3 + \frac{1}{3}x = 30$

i.e., $\frac{x}{3} + 3 = 30$

**2.** The equation in statement form is: When 2 is subtracted from four times *y*, the result is 18.

**3.** No

$11 + 2p = 19$

$\Rightarrow 2p = 19 - 11 = 8$

$\Rightarrow p = \frac{8}{2} = 4$

Thus, $p = 4$ is the solution.

**4.** Given, $5 \times 3000 + x = 5 \times 6000 + \frac{x}{2}$

$\Rightarrow 15000 + x = 30000 + \frac{x}{2}$

$\Rightarrow x - \frac{x}{2} = 30000 - 15000$

$$\Rightarrow \quad \frac{2x-x}{2} = 15000$$

$$\Rightarrow \quad x = 30000$$

## Quick Check (Page 36)

1. The equation $3x - 7y = 8$ has two variables $x$ and $y$, so it is not a linear equation with one variable.
2. The equation $5x - 6 = 9$ has only one variable $x$, so it is a linear equation with one variable.
3. The equation $x^2 + y = 0$ has two variables ($x$ and $y$), and the term $x^2$ also has 2 as power, so it is not a linear equation with one variable.
4. Since, the equation $7z = 14$ has only one variable $z$, so it is a linear equation with one variable.

## Think and Answer (Page 39)

Step 1: $11x = 41 - 19$

Step 2: $11x = 22$

Step 3: $x = \frac{22}{11}$ [Transposing 11 to RHS]

Step 4: $x = 2$

## Practice Time 2A

**1.** (*a*) The equation $\frac{3}{2}x + 4 = 2x - 3$ is a linear equation since it has only one variable $x$ with power 1.

(*b*) The equation $x^2 + 2 = x + 1$ is not a linear equation since it involves $x^2$, which has power 2.

(*c*) The equation $u + \frac{1}{u} = 5$ or $u^2 + 1 = 5u$ is not a linear equation since it involves $u^2$, which has power 2.

(*d*) The equation $y - 3 = 3y + 4$ is a linear equation, since it has only one variable $y$ with power 1.

**2.** (*a*) $5x - 2 = 18$

$5x = 18 + 2$ (Transposing 2 to RHS)

$\Rightarrow 5x = 20$

$\Rightarrow x = \frac{20}{5} \Rightarrow x = 4$

So, $x = 4$ is the required solution.

**Verification:** LHS $= 5x - 2 = 5 \times 4 - 2$

$= 20 - 2 = 18$

and RHS $= 18$

$\Rightarrow$ LHS = RHS, hence verified.

(*b*)–(*c*) Same as part (*a*)

(*d*) $\frac{x}{3} + \frac{5}{4} = -\frac{3}{4}$

$\Rightarrow \frac{x}{3} = \frac{-3}{4} - \frac{5}{4}$ $\left(\text{Transposing } \frac{5}{4} \text{ to RHS}\right)$

$\Rightarrow \frac{x}{3} = \frac{-3-5}{4} = \frac{-8}{4} = -2$

$\Rightarrow x = -2 \times 3 = -6$

**Verification:** Substituting $x = -6$ in the LHS of the given equation, we get

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

$= \frac{-8+5}{4} = \frac{-3}{4} =$ RHS

Clearly, LHS = RHS. Hence the solution is verified.

(*e*)–(*h*) Same as part (*d*)

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

$\Rightarrow \frac{3x}{2} + \frac{x}{4} = 2 + \frac{6}{4}$ $\left(\text{Transposing } \frac{6}{4} \text{ to RHS}\right)$

$\Rightarrow \frac{6x+x}{4} = \frac{8+6}{4}$

$\Rightarrow \frac{7x}{4} = \frac{14}{4}$

$\Rightarrow x = \frac{14}{4} \times \frac{4}{7}$ $\left(\text{Multiplying both sides by } \frac{4}{7}\right)$

$\Rightarrow x = 2$

**Verification:** Substituting $x = 2$ in the LHS of the given equation, we get

LHS $= \frac{3 \times 2}{2} + \frac{2-6}{4} = 3 - \frac{4}{4}$

$= 3 - 1 = 2 =$ RHS

Clearly, LHS = RHS. Hence the solution is verified.

(*j*)–(*k*) Same as part (*i*)

(*l*) $3(3x - 4) - 2(4x - 5) = 6$

$\Rightarrow 9x - 12 - 8x + 10 = 6$

$\Rightarrow (9x - 8x) - 12 + 10 = 6$

$\Rightarrow x - 2 = 6$

$\Rightarrow x = 6 + 2$ (Transposing 2 to RHS)

$\Rightarrow x = 8$

**Verification:** Substituting $x = 8$ in the LHS of the given equation, we get

$$\text{LHS} = 3(3 \times 8 - 4) - 2(4 \times 8 - 5)$$
$$= 3(24 - 4) - 2(32 - 5) = 3(20) - 2(27)$$
$$= 60 - 54 = 6 = \text{RHS}$$

Clearly, LHS = RHS. Hence the solution is verified.

(*m*)–(*n*) Same as part (*l*)

(*o*) $$\frac{2(2x-1)}{5} - \frac{x-1}{2} = 0$$

$$\Rightarrow \frac{4x}{5} - \frac{2}{5} - \frac{x}{2} + \frac{1}{2} = 0$$

$$\Rightarrow \left(\frac{4x}{5} - \frac{x}{2}\right) + \left(\frac{1}{2} - \frac{2}{5}\right) = 0$$

$$\Rightarrow \left(\frac{8x - 5x}{10}\right) + \left(\frac{5-4}{10}\right) = 0$$

$$\Rightarrow \left(\frac{3x}{10}\right) + \left(\frac{1}{10}\right) = 0$$

$$\Rightarrow \frac{3x}{10} = \frac{-1}{10} \qquad \left(\text{Transposing } \frac{1}{10} \text{ to RHS}\right)$$

$$\Rightarrow x = \frac{-1}{10} \times \frac{10}{3} \qquad \left(\text{Transposing } \frac{3}{10} \text{ to RHS}\right)$$

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

**Verification:** Substituting $x = \frac{-1}{3}$ in the LHS of the given equation, we get

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

$$= \frac{2\left(\frac{-2}{3} - 1\right)}{5} - \frac{\left(\frac{-1}{3} - 1\right)}{2} = \frac{-10}{15} + \frac{4}{6}$$

$$= \frac{-2}{3} + \frac{2}{3} = 0 = \text{RHS}$$

Clearly, LHS = RHS

Hence the solution is verified.

(*p*) Same as part (*o*)

**3.** Let the number be $x$.

According to the question,

$$3x - 7 = 17$$
$$\Rightarrow 3x = 17 + 7 \qquad \text{(Transposing 7 to RHS)}$$
$$\Rightarrow 3x = 24$$
$$\Rightarrow x = 8 \qquad \text{(Dividing both sides by 3)}$$

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

According to the question,

$$8x + 8(x + 1) + 8(x + 2) = 888$$
$$\Rightarrow 3(8x) + 8 + 16 = 888$$
$$\Rightarrow 24x + 24 = 888$$
$$\Rightarrow 24x = 888 - 24$$
$$\Rightarrow 24x = 864$$
$$\Rightarrow x = 36$$

Thus, the three consecutive multiples of 8 are $8 \times 36$, $8(36 + 1)$, $8(36 + 2)$, i.e., 288, 296, 304.

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

$$x + (x + 1) + (x + 2) = 60$$
$$\Rightarrow 3x + 3 = 60$$
$$\Rightarrow 3x = 57$$
$$\Rightarrow x = 19$$

Thus, the three consecutive integers are 19, 19 + 1, 19 + 2, i.e., 19, 20, 21.

**6.** Angles of a triangle are $3x°$, $(2x + 20)°$ and $(5x - 40)°$.

Since, sum of all angles of a triangle is 180°.

$$\therefore 3x° + (2x + 20)° + (5x - 40)° = 180°$$
$$10x - 20 = 180$$
$$\Rightarrow 10x = 180 + 20 = 200 \qquad \Rightarrow x = 20$$

$\therefore$ The angles are

$3 \times 20°$, $(2 \times 20 + 20)°$, $(5 \times 20 - 40)°$

i.e., 60°, 60°, 60°

**7.** Let the two numbers be $3x$ and $4x$.

$$\therefore 4x - 3x = 19$$
$$\Rightarrow x = 19$$

Thus, the two numbers are

$$3x = 3 \times 19 = 57 \text{ and}$$
$$4x = 4 \times 19 = 76.$$

**8.** Let Robert's present age be $x$.

So, his father's present age be $4x$.

After 5 years,

$$\therefore (x + 5) + (4x + 5) = 60$$
$$\Rightarrow 5x + 10 = 60$$
$$\Rightarrow 5x = 50$$
$$\Rightarrow x = 10$$

So, Robert's present age is 10 years and his father's present age is $4 \times 10 = 40$ years.

**9.** Let the breadth of the rectangular hall is $x$ metres.

So, length of the hall is $(3 + 2x)$ metres.

Given, perimeter of the hall is 66 metres.

According to the question,

$$2[x + (3 + 2x)] = 66$$
$$\Rightarrow \quad 2[3x + 3] = 66$$
$$\Rightarrow \quad 6x + 6 = 66$$
$$\Rightarrow \quad 6x = 60$$
$$\Rightarrow \quad x = 10$$

$\therefore$ Length of the rectangular hall $= 3 + 2 \times 10$

$= 23$ metres.

**10.** Let the value of the first prize be ₹$x$.

Then the value of the second prize

$$= \frac{5}{6} \times (₹x) = ₹\frac{5}{6}x$$

and the value of the third prize

$$= \frac{4}{5}\left(\frac{5}{6}x\right) = ₹\frac{4x}{6} = ₹\frac{2}{3}x$$

According to the question,

$$x + \frac{5}{6}x + \frac{2x}{3} = 1500$$
$$\Rightarrow \quad \frac{6x + 5x + 4x}{6} = 1500$$
$$\Rightarrow \quad 15x = 9000 \quad \Rightarrow \quad x = 600$$

Thus, the value of the three prizes be ₹600, ₹$\frac{5}{6} \times 600$ and ₹$\frac{2}{3} \times 600$ i.e., ₹600, ₹500 and ₹400 respectively.

## Think and Answer (Page 44)

**1.** Let Ravi's present age be $x$ of a person.

According to the question, $x + 15 = 4x$

$\Rightarrow 4x - x = 15 \quad \Rightarrow \quad 3x = 15 \quad \Rightarrow \quad x = 5$

$\therefore$ Ravi's present age be 5 years.

**2.** Let '$x$' be the present age of a person.

According to the question,

$x = (x + 3) \times 3 - 3(x - 3)$

$= 3x + 9 - 3x + 9 = 18$ years

## Practice Time 2B

**1.** (*a*) $\frac{15}{4} - 7x = 9x + 4$

$$\Rightarrow \quad \frac{15}{4} - 4 = 9x + 7x$$

[Transposing $7x$ to RHS and 4 to LHS]

$$\Rightarrow \quad 16x = \frac{15 - 16}{4} = \frac{-1}{4}$$
$$\Rightarrow \quad x = \frac{-1}{4} \times \frac{1}{16} \quad \text{[Transposing 16 to RHS]}$$
$$\Rightarrow \quad x = -\frac{1}{64}$$

**Verification:** Substituting $x = \frac{-1}{64}$ in $\frac{15}{4} - 7x = 9x + 4$, we have

$$\frac{15}{4} - 7\left(\frac{-1}{64}\right) = 9\left(\frac{-1}{64}\right) + 4$$
$$\Rightarrow \quad \frac{15}{4} + \frac{7}{64} = \frac{-9}{64} + 4$$
$$\Rightarrow \quad \frac{240 + 7}{64} = \frac{-9 + 256}{64}$$
$$\Rightarrow \quad \frac{247}{64} = \frac{247}{64}$$

Therefore, LHS = RHS (Hence verified).

(*b*)–(*c*) Same as part (*a*)

(*d*) $$\frac{13}{5}x + 8 = \frac{8x}{5} - 3$$
$$\Rightarrow \quad \frac{13x}{5} - \frac{8x}{5} = -3 - 8$$
$$\Rightarrow \quad \frac{5x}{5} = -11$$
$$\Rightarrow \quad x = -11$$

**Verification:** Substituting $x = -11$ in $\frac{13x}{5} + 8 = \frac{8x}{5} - 3$, we have

$$\frac{13}{5}(-11) + 8 = \frac{8}{5}(-11) - 3$$
$$\Rightarrow \quad \frac{-143 + 40}{5} = \frac{-88 - 15}{5}$$
$$\frac{-103}{5} = \frac{-103}{5}$$

Therefore, LHS = RHS (Hence verified).

(*e*) $-3(2x + 2) = 5(x - 3) - 2$

$\Rightarrow \quad -6x - 6 = 5x - 15 - 2$

$\Rightarrow \quad -6x - 6 = 5x - 17$

$\Rightarrow \quad -6x - 5x = -17 + 6$

$\Rightarrow \quad -11x = -11$

$x = 1$

**Verification:** Substituting $x = 1$ in

$$-3(2x + 2) = 5(x - 3) - 2, \text{ we get}$$
$$-3(2 \times 1 + 2) = 5(1 - 3) - 2$$
$$\Rightarrow \quad -12 = -10 - 2$$
$$\Rightarrow \quad -12 = -12$$

Therefore, LHS = RHS (Hence verified).

(*f*) Same as part (*d*)

**2.** (*a*)
$$0.3(6 + m) = 0.4(8 - m)$$
$$\Rightarrow \quad 1.8 + 0.3m = 3.2 - 0.4m$$
$$\Rightarrow \quad 0.3m + 0.4m = 3.2 - 1.8$$
$$\Rightarrow \quad 0.7m = 1.4$$
$$\Rightarrow \quad m = 2$$

(*b*)
$$\frac{2x-5}{3} + \frac{3x-2}{2} = 1$$
$$\Rightarrow \quad \frac{6(2x-5)}{3} + \frac{6(3x-2)}{2} = 6$$

[Multiplying both sides by 6, the LCM of 3 and 2]

$$\Rightarrow \quad 2(2x - 5) + 3(3x - 2) = 6$$
$$\Rightarrow \quad 4x - 10 + 9x - 6 = 6$$
$$\Rightarrow \quad 13x - 16 = 6$$
$$\Rightarrow \quad 13x = 16 + 6 = 22$$
$$\Rightarrow \quad x = \frac{22}{13}$$

(*c*) Same as part (*b*)

(*d*)
$$\frac{m}{4} - \frac{m-1}{2} = \frac{1}{8} - \frac{m-2}{3}$$
$$\Rightarrow \quad \frac{24(m)}{4} - \frac{24(m-1)}{2} = \frac{24}{8} - \frac{24(m-2)}{3}$$

[Multiplying both sides by 24]

$$\Rightarrow \quad 6m - 12(m - 1) = 3 - 8(m - 2)$$
$$\Rightarrow \quad 6m - 12m + 12 = 3 - 8m + 16$$
$$\Rightarrow \quad -6m + 12 = 19 - 8m$$
$$\Rightarrow \quad 8m - 6m = 19 - 12$$
$$\Rightarrow \quad 2m = 7$$
$$\Rightarrow \quad m = \frac{7}{2}$$

(*e*)–(*f*) Same as part (*d*)

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

$$x + (x + 1) + (x + 2) = 10 + 2x$$
$$\Rightarrow \quad 3x + 3 = 10 + 2x$$
$$\Rightarrow \quad 3x - 2x = 10 - 3 \quad \Rightarrow \quad x = 7$$

∴ The three consecutive integers are 7, 8 and 9 respectively.

**4.** Let the total number of chocolate pies be $x$.

After giving $\frac{1}{3}$ of chocolate pies to his brother, and $\frac{1}{6}$ of them to his friend, Rohan is left with 30 chocolate pies.

$$\therefore \quad x - \frac{1}{6}x - \frac{1}{3}x = 30$$
$$\Rightarrow \quad 6x - \frac{6x}{6} - \frac{6x}{3} = 6 \times (30)$$

[Multiplying both sides by 6]

$$\Rightarrow \quad 6x - x - 2x = 180$$
$$\Rightarrow \quad 3x = 180$$
$$\Rightarrow \quad x = 60$$

∴ Chocolate pies received by his brother

$$= \frac{1}{3} \times 60 = 20 \text{ pies}$$

and chocolate pies received by his friend

$$= \frac{1}{6} \times 60 = 10 \text{ pies}$$

**5.** Let the digits be $x$ and $y$ such that the two-digit number be $10x + y$.

Also, $x + y = 9$ ...(*i*)

According to the question,

$$10y + x = \frac{3}{8}(10x + y)$$
$$\Rightarrow \quad 8(10y + x) = 3(10x + y)$$
$$\Rightarrow \quad 80y + 8x = 30x + 3y \quad \Rightarrow 77y = 22x$$
$$\Rightarrow \quad 7y = 2x$$
$$\Rightarrow \quad 7(9 - x) = 2x \quad \text{[From } (i), y = 9 - x]$$
$$\Rightarrow \quad 63 - 7x = 2x \quad \Rightarrow 63 = 2x + 7x = 9x$$
$$\Rightarrow \quad x = \frac{63}{9} = 7$$

Thus, $x = 7$ and $y = 2$

∴ The number is $10 \times 7 + 2 = 70 + 2 = 72$

**6.** Let the integers be $3x$ and $4x$.

According to the question,

$$3x + 4x = 98$$
$$\Rightarrow \quad 7x = 98$$
$$\Rightarrow \quad x = 14$$

∴ The integers are $3x = 3 \times 14 = 42$ and $4x = 4 \times 14 = 56$

**7.** Let the two-digit number be $10x + y$. Given,

$$x + y = 7 \quad ...(i)$$

According to the question,

$$10x + y + 45 = 10y + x$$

$\Rightarrow$ $9x + 45 = 9y$

$\Rightarrow$ $x + 5 = y \quad ...(ii)$

Putting $y = x + 5$ in equation $(i)$, we get

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

$\Rightarrow$ $2x + 5 = 7$

$\Rightarrow$ $2x = 7 - 5 = 2$

$\Rightarrow$ $x = 1$

Thus, $y = 1 + 5 = 6$

$\therefore$ The required number is $10 \times 1 + 6 = 16$.

## Quick Check (Page 47)

Let the present ages of Mohan and Ram be $5x$ and $7x$ respectively.

Four years later, Mohan's age = $(5x + 4)$ years and Ram's age = $(7x + 4)$ years.

According to the question,

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

By cross multiplication,

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

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

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

$\Rightarrow$ $x = 4$

$\therefore$ Mohan's age = $5 \times 4 = 20$ years and Ram's age = $7 \times 4 = 28$ years.

## Practice Time 2C

**1.** $(a)$ $\dfrac{2x-3}{5} = \dfrac{-1}{3}$

By cross multiplication, we have

$3(2x - 3) = (-1)(5)$

$\Rightarrow$ $6x - 9 = -5$

$\Rightarrow$ $6x = 9 - 5$

$\Rightarrow$ $6x = 4$

$\Rightarrow$ $x = \dfrac{4}{6} = \dfrac{2}{3}$

$(b)$ Same as part $(a)$

$(c)$ $\dfrac{3x+1}{x-2} = \dfrac{-6}{11}$

By cross-multiplication, we have

$11(3x + 1) = (-6)(x - 2)$

$\Rightarrow$ $33x + 11 = -6x + 12$

$\Rightarrow$ $39x = 12 - 11$

$\Rightarrow$ $39x = 1$

$\Rightarrow$ $x = \dfrac{1}{39}$

$(d)$–$(f)$ Same as part $(c)$

$(g)$ $\dfrac{x+1}{2x+3} = \dfrac{3}{8}$

By cross-multiplication, we have

$8(x + 1) = 3(2x + 3) \Rightarrow 8x + 8 = 6x + 9$

$\Rightarrow$ $2x = 1$

$\Rightarrow$ $x = \dfrac{1}{2}$

$(h)$ $\dfrac{4x}{2x+7} = 3$

By cross-multiplication, we have

$4x = 3(2x + 7) \Rightarrow 4x = 6x + 21$

$\Rightarrow$ $4x - 6x = 21$

$\Rightarrow$ $-2x = 21$

$\Rightarrow$ $x = -\dfrac{21}{2}$

**2.** Given, $\dfrac{y^2+1}{y^2-1} = \dfrac{5}{4}$

Let $y^2 = x$, then $\dfrac{x+1}{x-1} = \dfrac{5}{4}$

By cross-multiplication, we have

$4(x + 1) = 5(x - 1)$

$\Rightarrow$ $4x + 4 = 5x - 5$

$\Rightarrow$ $x = 9$

$\therefore$ $y^2 = 9$ or $y = \pm 3$

Thus, the positive value of $y$ is 3.

**3.** Let the present ages of Mohan and Gopal be $4x$ and $5x$ respectively.

After eight years, Mohan's age = $(4x + 8)$ years and Gopal's age = $(5x + 8)$ years.

According to the question, $\dfrac{4x+8}{5x+8} = \dfrac{5}{6}$

By cross-multiplication, we have

$6(4x + 8) = 5(5x + 8)$

$\Rightarrow$ $24x + 48 = 25x + 40$

$\Rightarrow$ $25x - 24x = 48 - 40$

$\Rightarrow$ $x = 8$

$\therefore$ Mohan's present age = $4 \times 8 = 32$ years and Gopal's present age = $5 \times 8 = 40$ years

4. Let present ages of A and B be $7x$ and $9x$ years respectively. 9 years ago, there ages were $(7x - 9)$ years and $(9x - 9)$ years respectively.

A.T.Q., $\frac{7x-9}{9x-9} = \frac{2}{3}$

On solving this, we get $x = 3$.

$\therefore$ The present ages of A and B are $7 \times 3 = 21$ years and $9 \times 3 = 27$ years respectively.

5. Let the numerator be $x$. Then denominator $= x + 4$.

According to the question,

$$\frac{x+11}{x+4-1} = \frac{7}{3} \quad \Rightarrow \frac{x+11}{x+3} = \frac{7}{3}$$

By cross-multiplication, we have

$$3(x + 11) = 7(x + 3) \quad \Rightarrow 3x + 33 = 7x + 21$$

$$\Rightarrow \quad 4x = 12 \quad \Rightarrow x = 3$$

$\therefore$ The required number is $\frac{3}{3+4} = \frac{3}{7}$.

6. Let the number of deer in the herd be '$x$'.

Half of herd of deer, i.e., $\frac{x}{2}$ are grazing

Three-fourths of the remaining deer i.e.,

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

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

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

$$\Rightarrow \quad x = 8 \times 9 = 72$$

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

## Maths Connect (Page 48)

Savita visited four shelters and at each shelter she gave away half of the food packets she had at that moment. At the end, she was left with 5 packets.

$\therefore$ Before visiting 4th shelter she had 10 packets.

Before visiting 3rd shelter she had 20 packets.

Before visiting 2nd shelter she had 40 packets.

Before visiting 1st shelter she had 80 packets.

$\therefore$ At the beginning she has 80 packets.

**Alternative Method:**

Let the number of food packets Savita had in the beginning be $x$.

Then, number of food packets given at the 1st shelter $= \frac{x}{2}$

number of food packets given at the 2nd shelter $= \frac{1}{2}\left(x-\frac{x}{2}\right) = \frac{x}{4}$

number of food packets given at the 3rd shelter $= \frac{1}{2}\left(\frac{x}{2}-\frac{x}{4}\right) = \frac{x}{8}$

number of food packets given at the 4th shelter $= \frac{1}{2}\left(\frac{x}{4}-\frac{x}{8}\right) = \frac{x}{16}$

Now, she had left 5 food packets

$$\Rightarrow \quad \left(\frac{x}{8}-\frac{x}{16}\right) = 5 \quad \Rightarrow \frac{x}{16} = 5$$

$$\therefore \quad x = 5 \times 16 = 80$$

## Brain Sizzlers (Page 48)

To decode the mobile number, we first solve the given equations.

1. $\frac{5X-8}{4X} = 1 \quad \Rightarrow 5X - 8 = 4X$

$\Rightarrow \quad X = 8$

2. $\frac{6Y-7}{3Y+9} = \frac{1}{3} \quad \Rightarrow 18Y - 21 = 3Y + 9$

$\Rightarrow \quad 15Y = 30 \quad \Rightarrow Y = 2$

3. $\frac{Z-9}{5+Z} = -\frac{5}{9} \quad \Rightarrow 9Z - 81 = -25 - 5Z$

$\Rightarrow \quad 14Z = 56 \quad \Rightarrow Z = 4$

4. $P+\frac{5P}{10} = \frac{15}{10} \quad \Rightarrow \frac{15P}{10} = \frac{15}{10}$

$\Rightarrow \quad P = 1$

5. $5(Q + 4) = 6(Q + 2)$

$\Rightarrow \quad 5Q + 20 = 6Q + 12$

$\Rightarrow \quad 6Q - 5Q = 20 - 12 \quad \Rightarrow Q = 8$

6. $4(R + 10) + 300 = 348$

$\Rightarrow \quad 4R + 40 + 300 = 348$

$\Rightarrow \quad 4R = 348 - 340$

$\Rightarrow \quad 4R = 8 \quad \Rightarrow R = 2$

Hence, Surendra's mobile number = 9824118223

## Mental Maths (Page 49)

1. Solution can be any type of number i.e., natural number, whole number, integer, rational number, etc. So the solution of an equation is not always a natural number.
2. Let the number be '$x$'.
According to question,
$\frac{3}{4}x - 2 = 1 \quad \Rightarrow \frac{3}{4}x = 3$
$\Rightarrow x = 4$
So, the number is 4.
3. When we move a term from one side of an equation to the other, we use the transposition method.
4. Given, $4x + 9 = 1$
$\Rightarrow 4x = 1 - 9 = -8$
$\Rightarrow x = -2$
5. Let the three consecutive odd numbers be $x$, $x + 2$ and $x + 4$.
According to the question,
$x + (x + 2) + (x + 4) = 99$
$\Rightarrow 3x = 99 - 6 = 93$
$\Rightarrow x = 31$
$\therefore$ The three odd numbers are 31, 33 and 35.
Out of these, 31 is a prime number.

## Chapter Assessment

**A.**

1. (*b*) Here, $\frac{1}{3} + x = \frac{2}{5}$
$\Rightarrow x = \frac{2}{5} - \frac{1}{3} = \frac{6-5}{15} = \frac{1}{15}$
2. (*c*) Given, $\frac{-7}{6}y = \frac{-6}{7}$
$y = \frac{-6}{7} \times \left(\frac{6}{-7}\right) = \left(\frac{6}{7}\right)^2$
3. (*d*) Given, $4x - \frac{2}{3} = \frac{25}{3} + x$
$\Rightarrow 4x - x = \frac{25}{3} + \frac{2}{3}$
$\Rightarrow 3x = \frac{27}{3} = 9 \quad \Rightarrow x = 3$
4. (*c*) Given, $3x - 5 = 4$
$\Rightarrow 3x = 9 \quad \Rightarrow x = 3$
5. (*c*) Given, $4x - 3 = 5 \quad \Rightarrow 4x = 8$
$x = 2$
6. (*b*) An example of linear equation involving two variables is $6p + 2q = 10$.
7. (*a*) A linear equation in one variable has only one solution.
8. (*a*) Rozal's present age = $(x + 3)$ years
Ryesa's present age = $2(x + 3)$ years

**B.**

1. (*d*) **Assertion:** Given, $\frac{7}{x} = 2 \Rightarrow x = \frac{7}{2}$
So, assertion is false.
**Reason:** The value of the variable which makes left hand side equal to right hand side in the given equation is called the solution of the equation. So, reason is true.
2. (*b*) **Assertion:** The equation of 'a number when subtracted from 30 results into 24' is $30 - x = 24$. So, assertion is true.
**Reason:** Standard form for linear equation in one variable is $ax + b = 0$, where $x$ is the variable and $a$, $b$ are arbitrary constants.
Thus, both assertion and reason are true but reason is not the correct explanation of assertion.
3. (*d*) **Assertion:** The equation is $\frac{x}{3} + 1 = \frac{9}{15}$
$\Rightarrow \frac{x}{3} = \frac{9}{15} - 1 \quad \Rightarrow \frac{x}{3} = \frac{-6}{15}$
$\Rightarrow x = \frac{-6}{5}$
So, assertion is false.
**Reason:** To solve the linear equation with fractions, multiply both side of equation by the LCM of denominators.
So, reason is true.
4. (*d*) **Assertion:** Let the number be $x$.
A.T.Q., $7x = 56 - 3x \quad \Rightarrow 10x = 56$
$\Rightarrow x = \frac{56}{10} = 5.6$
So the number is not equal to 14. Hence assertion is false.
**Reason:** To solve a linear equation with variable on both sides, we use transposition method, which is true.

**C.**

**1.** $3a + 14 = 9 + 5a \Rightarrow 5a - 3a = 14 - 9$

$\Rightarrow 2a = 5$

$\Rightarrow a = \frac{5}{2}$

**2.** Given, $a - 6 = 3 \Rightarrow a = 3 + 6 = 9$

$\therefore a = 9$

**3.** Let the number be '$x$'.

$\therefore 2x = 20 \Rightarrow x = 10$

**4.** Given, $\frac{3x}{2} - 5 = 2 - \frac{4x}{2}$

$\Rightarrow \frac{3x}{2} + \frac{4x}{2} = 2 + 5 \Rightarrow \frac{7x}{2} = 7$

$\Rightarrow x = 2$

**5.** Given, $2x + 1 = -3 \Rightarrow 2x = -3 - 1$

$\Rightarrow 2x = -4 \Rightarrow x = -2$

**D.**

**1.** The given equation is $2x - 2 = 4$

$\Rightarrow 2x = 4 + 2$

$\Rightarrow 2x = 6$

So, in the equation $2x - 2 = 4$, transposing $-2$ to RHS, we get $2x = 4$ is false.

**2.** Given, $\frac{x}{3} = 5$

$\Rightarrow x = 15$ (multiplying both sides by 3)

So, if $\frac{x}{3} = 5$, then $x = \frac{5}{3}$ is false.

**3.** According to question, $a = 3b \Rightarrow a - 3b = 0$

So, if quantity $a$ is thrice the quantity $b$, then $3a - b = 0$ is false.

**4.** We can add or subtract the same number or expression to both sides of an equation is true.

**5.** The solution of a linear equation in one variable can be any real number, not necessarily an integer. So, it is false.

**E.**

**1.** (*a*) $\frac{n}{4} - 5 = \frac{n}{6} + \frac{1}{2} \Rightarrow \frac{n}{4} - \frac{n}{6} = 5 + \frac{1}{2}$

$\Rightarrow \frac{12n}{4} - \frac{12n}{6} = 12\left(\frac{11}{2}\right)$

[Multiplying both sides by 12]

$\Rightarrow 3n - 2n = 6(11) \Rightarrow n = 66$

(*b*) Same as part (*a*).

(*c*) $6x + 1 = 2x + 17 \Rightarrow 6x - 2x = 17 - 1$

$\Rightarrow 4x = 16 \Rightarrow x = 4$

(*d*) $2t - \frac{1}{5} - \frac{2t+2}{3} = -t$

$\Rightarrow 15(2t) - 15 \times \frac{1}{5} - \frac{15(2t+2)}{3} = -15t$

[Multiplying both sides by 15]

$\Rightarrow 30t - 3 - 5(2t + 2) = -15t$

$\Rightarrow 30t + 15t - 10t = 3 + 10$

$\Rightarrow 30t + 15t - 10t = 3 + 10$

$\Rightarrow 35t = 13$

$\Rightarrow t = \frac{13}{35}$

(*e*) $\frac{x+1}{2} + \frac{x+2}{3} + \frac{x+4}{5} = 3$

$\Rightarrow 30\left(\frac{x+1}{2}\right) + 30\left(\frac{x+2}{3}\right) + 30\left(\frac{x+4}{5}\right) = 30 \times 3$

[Multiplying both sides by 30]

$\Rightarrow 15x + 15 + 10x + 20 + 6x + 24 = 90$

$\Rightarrow 31x = 90 - 24 - 20 - 15 = 31$

$\Rightarrow x = \frac{31}{31} = 1$

(*f*) $\frac{1-9y}{19-3y} = \frac{5}{8} \Rightarrow 8(1-9y) = 5(19-3y)$

$\Rightarrow 8 - 72y = 95 - 15y$

$\Rightarrow -72y + 15y = 95 - 8$

$\Rightarrow -57y = 87 \Rightarrow y = \frac{-87}{57} = \frac{-29}{19}$

**2.** Let the present age of Yanshu be '$x$' years.

Then Yanshu's mother's age = $5x$ years

According to the question, after 5 years

$5x + 5 = 3(x + 5) \Rightarrow 5x + 5 = 3x + 15$

$\Rightarrow 5x - 3x = 15 - 5 \Rightarrow 2x = 10$

$\Rightarrow x = 5$

$\therefore$ Yanshu's age = 5 years and Mother's age = 5 × 5 = 25 years

**3.** Let Arvind's age = $5x$ years and Raj's age = $6x$ years

According to the question,

$6x - 5x = 6 \Rightarrow x = 6$

$\therefore$ Arvind's age = 5 × 6 = 30 years.

**4.** Let the two numbers be $x$ and $x + 16$.

$\therefore x + x + 16 = 24 \Rightarrow 2x + 16 = 24$

$\Rightarrow 2x = 8 \Rightarrow x = 4$

and $x + 16 = 4 + 16 = 20$

∴ Larger number is 20.

**5.** Let the number added be '$x$'.

According to the question,

$$\frac{5+x}{17+x} = \frac{1}{3} \quad \Rightarrow 3(5 + x) = 1(17 + x)$$

$\Rightarrow$ $3x - x = 17 - 15 \Rightarrow 2x = 2$

$\Rightarrow$ $x = 1$

**6.** Let the breadth of the rectangular board be $x$ metres. Then, its length = $(2 + 2x)$ metres

According to the question,

$2[(2 + 2x) + x] = 220$

[∵ Perimeter = 220 m (Given)]

$\Rightarrow$ $4 + 6x = 220 \quad \Rightarrow 6x = 220 - 4 = 216$

$\Rightarrow$ $x = 36$

∴ Breadth = 36 metres and

Length = 2 + 2 × 36 = 74 metres

**7.** Let the length of equal sides of an isosceles triangle be '$x$' cm.

According to the question,

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

$$\left[\because \text{Perimeter} = 3\frac{2}{15} \text{ cm (given)}\right]$$

$$\Rightarrow \quad 2x = \frac{47}{15} - \frac{2}{3} = \frac{47-10}{15} = \frac{37}{15}$$

$$\Rightarrow \quad x = \frac{37}{30} \text{ cm}$$

Length of equal side = $\frac{37}{30}$ cm

**8.** Let Sam's age be $x$ years.

Sam's father age be $(x + 25)$ years.

Sam's grandfather age be $(x + 25 + 25)$ years

= $(x + 50)$ years

According to the question,

$x + (x + 25) + (x + 50) = 105$

$\Rightarrow$ $3x + 75 = 105$

$\Rightarrow$ $3x = 30$

$\Rightarrow$ $x = 10$

∴ Sam's age = 10 years, Sam's father age = 35 years and Sam's grandfather age = 10 + 50 = 60 years

**9.** Let number of ₹5 coins be $x$.

Number of ₹2 coins = $3x$

and number of ₹1 coins = $160 - (x + 3x)$

Amount of ₹5 coins = ₹5 × $x$ = ₹$5x$

Amount of ₹2 coins = ₹2 × $(3x)$ = ₹$6x$

Amount of ₹1 coins = ₹1 × $[160 - (x + 3x)]$

= ₹$160 - 4x$.

Now, total amount = ₹300

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

$\Rightarrow$ $7x = 300 - 160 = 140$

$\Rightarrow$ $x = 20$

∴ Number of ₹5 coins = 20,

Number of ₹2 coins = 3 × 20 = 60 and

Number of ₹1 coins = 160 – (20 + 60)

= 160 – 80 = 80

**10.** Let a man buys '$x$' of 50 paise stamps and '$30 - x$', of 100 paise stamps.

According to the question,

$$\frac{50}{100}x + \frac{100}{100}(30 - x) = ₹20$$

$$\Rightarrow \quad \frac{x}{2} + (30 - x) = ₹20$$

$\Rightarrow$ $x + 60 - 2x = 40$

[Multiplying both sides by 2]

$\Rightarrow$ $60 - 40 = 2x - x = x$

$\Rightarrow$ $x = 20$

∴ Number of 50 paise stamps bought by the man is 20.

**11.** Let one number be '$x$'. Then other number be $2490 - x$.

According to the question,

6.5% of $x$ = 8.5% of $(2490 - x)$

$$\Rightarrow \quad \frac{65x}{1000} = \frac{85}{1000}(2490 - x)$$

$\Rightarrow$ $65x = 211650 - 85x$

$\Rightarrow$ $150x = 211650$

$\Rightarrow$ $x = 1411$

∴ One number is 1411 and other number is 2490 – 1411 = 1079.

**12.** According to the question,

$$\frac{-26}{5} = \frac{F-32}{9}$$

$\Rightarrow$ $-26 \times 9 = 5(F - 32)$

$\Rightarrow$ $-234 = 5F - 160$

$\Rightarrow$ $5F = -234 + 160 = -74$

$$\Rightarrow \quad F = \frac{-74}{5} = -14.8°$$

So, the temperature in Fahrenheit (°F) = –14.8°F.

**13.** (*a*) Let speed of the boat in still water = $x$ km/h.

Now, while going downstream, the speed of the boat is $(x + 2)$ km/h and while going upstream, the speed of the boat is $(x - 2)$ km/h. Since the boat travelling downstream covers the distance between two coastal town in five hours, then

Distance covered in 5 hours

$$= 5(x + 2) \text{ km} \quad ...(i)$$

Also, the boat travelling upstream covering the same distance in six hours.

$\therefore$ Distance covered in 6 hours

$$= 6(x - 2) \text{ km} \quad ...(ii)$$

From (*i*) and (*ii*)

$$5(x + 2) = 6(x - 2)$$

$$\Rightarrow \quad 5x + 10 = 6x - 12$$

$$\Rightarrow \quad 6x - 5x = 10 + 12$$

$$\Rightarrow \quad x = 22 \text{ km/h}$$

Thus, speed of the boat in still water

$$= 22 \text{ km/h}$$

(*b*) Speed of the boat upstream = (22 – 2) km/h

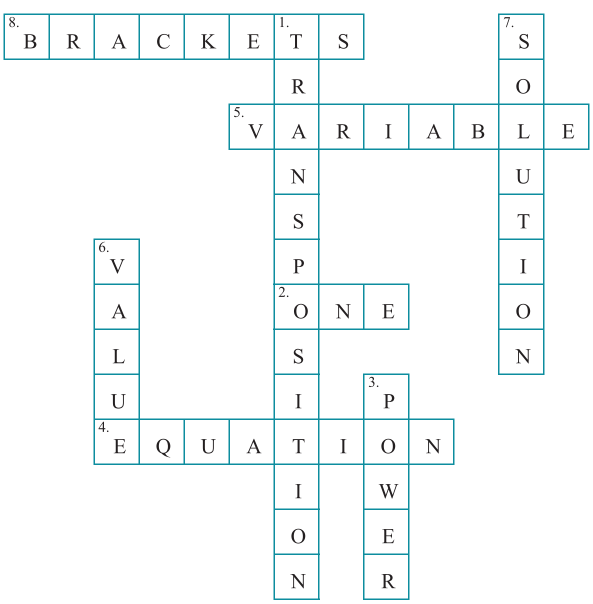
= 20 km/h

(*c*) Speed of the boat downstream = $x + 2$

= 22 + 2 = 24 km/h

Time taken by the boat if it goes 96 km downstream = $\frac{96}{24}$ = 4 hours.

## Maths Fun (Page 52)



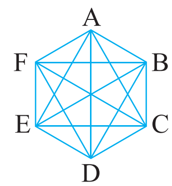

# CHAPTER 3 : QUADRILATERALS

## Let's Recall

1. Triangle is the smallest polygon made up of three line segments. So the polygons having 3 sides are CDI and HGI.
2. A quadrilateral is a polygon made up of four line segments. So the polygons having 4 sides are ABEF, ABCG, ABDH, CEFG, HDEF.
3. There are 9 polygons (2 triangles, 5 quadrilaterals and 2 pentagons) in all.
4. ABEF is a trapezium.
5. Polygons ABDH and GCEF are parallelograms.

## Quick Check (Page 58)

The adjoining figure is a 6-sided polygon, i.e., hexagon. We can draw 9 diagonals in it, which are as follows:




Diagonals from vertex A = AE, AD, AC

Diagonals from vertex B = BF, BE, BD

Diagonals from vertex C = CF, CE

Diagonals from vertex D = DF

## Quick Check (Page 58)

A star is a concave polygon since the measure of one or more interior angles is greater than 180°.

## Practice Time 3A

1. (*a*) A curve that does not begin and end at the same point is called an open curve. Therefore, (*ii*), and (*iv*) are open curves.

   (*b*) A curve that begins and ends at the same point is called a simple closed curve. Therefore, (*i*), (*iii*), (*v*) and (*vi*) are closed curves.
2. A polygon is defined as a closed figure formed by line segments such that no two line segments intersect each other except at their end points. Therefore, (*a*), (*c*) and (*d*) are polygons.
3. In the polygons, if at least one of the diagonals lies in the exterior of the polygon and the measure of at least one angle is more than 180°, then it is known as concave polygons. Therefore, (*a*), (*c*), (*e*), and (*g*) are concave polygons.

In the polygons, if all the diagonals lie in the interior of the polygons, and the measure of each angle is less than 180°, then it is known as convex polygon. Therefore, (*b*), (*d*), (*f*), and (*h*) are convex polygons.

**4.** Polygons which are equiangular and equilateral are called regular polygons.

(*a*) A square is a regular polygon of 4 sides.

(*b*) A hexagon is a regular polygon of 6 sides.

(*c*) A decagon is a regular polygon of 10 sides.

**5.** We have, the number of diagonals of $n$-sides polygon $= \frac{n(n-3)}{2}$.

(*a*) Number of diagonals of a heptagon (7-sided polygon) $= \frac{7(7-3)}{2} = \frac{7\times4}{2} = 14$.

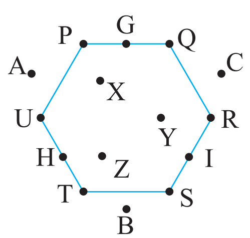
(*b*) Number of diagonals of a nonagon (9-sided polygon) $= \frac{9(9-3)}{2} = \frac{9\times6}{2} = 27$.

(*c*) Number of diagonals of a decagon (10-sided polygon) $= \frac{10(10-3)}{2} = \frac{10\times7}{2} = 35$.

**6.** Regular quadrilateral is a 4-sided polygon which is equiangular and equilateral.

$\therefore$ Number of diagonals $= \frac{4(4-3)}{2} = \frac{4\times1}{2} = 2$.

**7.** All the points are marked in the hexagon PQRSTU which is shown as follow:




## Quick Check (Page 61)

| Polygon | Number of sides | Sum of interior angles |
|---|---|---|
| Hexagon | 6 | (6 – 2) × 180° = 720° |
| Nonagon | 9 | (9 – 2) × 180° = 1260° |
| $n$-gon | $n$ | ($n$ – 2) × 180° |

## Think and Answer (Page 63)

The measure of each exterior angle of a polygon = 22° [Given]

Now, the number of sides of a regular polygon

$$= \frac{360°}{\text{measure of one exterior angle}}$$

$$= \frac{360°}{22°} \approx 16.36,$$

which is not a natural number.

Thus, it is not possible to have a regular polygon with a measure of each exterior angle as 22°.

## Practice Time 3B

**1.** We have, the sum of the exterior angles of a polygon = 360°.

$\therefore$ In the given figure, 70° + 80° + 70° + $x$ = 360°

$\Rightarrow$ $x$ = 360° – 220° = 140°

**2.** Number of sides, $n$ = 12

We have, the measure of each exterior angle of a regular polygon of 12 sides $= \frac{360°}{12} = 30°$

**3.** The measure of each exterior angle of the regular polygon = 90° [Given]

Now, find the number of sides of a regular polygon

$$= \frac{360°}{90°} = 4.$$

Thus, the number of sides is 4.

**4.** The exterior angle will be maximum when the interior angle is minimum.

As the number of sides increases, the measure of each exterior angle decreases. Hence the polygon with the fewest sides (i.e., an equilateral triangle with 3 sides) has the largest exterior angle.

$\therefore$ For an equilateral triangle $= \frac{360°}{3} = 120°$, is the maximum exterior angle.

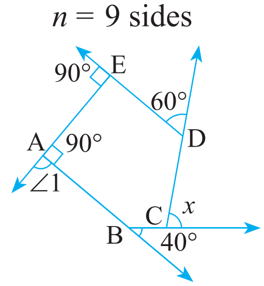
**5.** Each interior angle of a regular polygon is 140°

$\therefore$ $140° = \frac{(n-2)\times180°}{n}$ $\Rightarrow$ $140n = 180n - 360°$

$\Rightarrow$ $360 = 180n - 140n$ $\Rightarrow$ $40n = 360$

$\Rightarrow$ $n$ = 9 sides

**6.** (*a*)

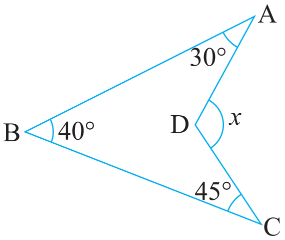



Here ∠1 = 180° – 90° = 90°

∴ Sum of the exterior angles of every polygon is 360°.

⇒ $90° + 40° + x + 60° + 90° = 360°$

⇒ $x = 360° - 280° = 80°$

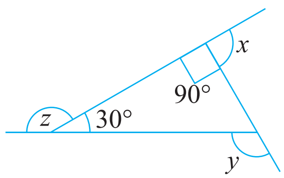
(*b*) 


$\angle ADC = 360° - (40° + 30° + 45°)$

[∵ Sum of all interior angles of a quadrilateral is 360°]

$= 360° - 115 = 245°$

Since ∠ADC is a reflex angle, so exterior $\angle ADC = x = 360° - 245° = 115°$.

**7.** (*a*) 

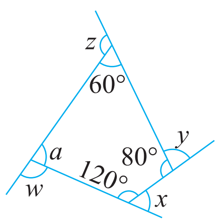

Here, $x = 180° - 90° = 90°$

$z = 180° - 30° = 150°$

$y = 90° + 30°$ (exterior angle theorem)

$= 120°$

Now, $x + y + z = 90° + 120° + 150° = 360°$

(*b*) 


Sum of the measures of all interior angles of a quadrilateral is 360°.

∴ $a + 60° + 80° + 120° = 360°$

⇒ $a = 360° - 260° = 100°$

Now, $x = 180° - 120° = 60°$,

$y = 180° - 80° = 100°$,

$z = 180° - 60° = 120°$,

$w = 180° - a = 180° - 100° = 80°$

∴ $x + y + z + w = 60° + 100° + 120° + 80°$

$= 360°$

**8.** (*a*) Sum of the exterior angles of a polygon is 360°.

∴ $x + y + z + p + q + r = 360°$

(*b*) Since, all the sides of the polygon are equal.

∴ It is a regular hexagon. So, all the interior angles are also equal.

∴ $x = y = z = p = q = r$

(*c*) (*i*) Given, $x + y + z + p + q + r = 360°$ and all these angles are equal.

∴ Measure of each exterior angle $= \dfrac{360°}{6} = 60°$

(*ii*) Since, exterior angle = 60°

∴ Interior angle = 180° – 60° = 120°

**9.** Ratio of interior and exterior angle of a regular octagon $= \dfrac{\frac{(8-2)\times 180°}{8}}{\frac{360°}{8}} = \dfrac{6\times 180°}{360°} = \dfrac{3}{1}$ or 3 : 1.

**10.** Let the number of sides of a regular polygon be '$n$'. According to the question,

Exterior angle $= \dfrac{1}{5} \times$ interior angle

⇒ $\dfrac{360°}{n} = \dfrac{1}{5} \times \dfrac{(n-2)\times 180°}{n}$

⇒ $360 \times 5 = (n - 2) \times 180°$

⇒ $10 = n - 2$

⇒ $n = 10 + 2 = 12$

Thus, the number of sides of the regular polygon is 12.

## Think and Answer (Page 64)

No, in a concave quadrilateral, at least one interior angle is more than 180° which makes it possible for a diagonal to lie outside the figure, but not both.

## Quick Check (Page 65)

**1.** According the angle sum property of a quadrilateral, the sum of all angles of a quadrilateral = 360°

⇒ $50° + 130° + 120° + x = 360°$

⇒ $x = 360° - 300° = 60°$

**2.** Similarly, solve as solution 1.

$x + 90° + 75° + 55° = 360°$

⇒ $x = 360° - 220° = 140°$

## Think and Answer (Page 65)

Sum of all angles of a quadrilateral = 360°

⇒ 105° + 160° + 60° + 45° = 370° > 360°

Since, the sum of these angles is greater than 360°, so it is not possible to have a quadrilateral with these angle measures.

## Think and Answer (Page 69)

In a parallelogram, diagonals bisect each other.

∴ OP = OE and OH = OL.

Now OP = OE = 4 cm

∴ PE = OP + OE = 4 + 4 = 8 cm.

Also, HL = 5 + PE = 5 + 8 = 13 cm

∴ OH = $\frac{13}{2}$ = 6.5 cm

## Think and Answer (Page 71)

In a parallelogram, opposite angles are equal and adjacent angles are supplementary. Also, the sum of the interior angles of a parallelogram is always 360°. So, with the help of these properties we can find all the four angles of the parallelogram.

## Practice Time 3C

**1.** (*a*) Sum of all angles of a quadrilateral = 360°

⇒ 94° + $x$ + 57° + 81° = 360°

⇒ $x$ = 360° – 232° = 128°

(*b*) Same as part (*a*)

(*c*) Here 62° + ∠PSR = 180° (Linear pair of angles)

⇒ ∠PSR = 180° – 62° = 118°

Also, $m$ + 54° + 118° + 107° = 360°

[Sum of all angles of a quadrilateral is 360°]

⇒ $m$ = 360° – 279° = 81°

(*d*) In the given figure,

∠TIM = 180° – 75° = 105°,

∠IME = 180° – 110° = 70°,

∠TEM = 180° – 105° = 75°.

Now, $y$ + 105° + 70° + 75° = 360°

[Sum of all angles of a quadrilateral is 360°]

⇒ $y$ = 360° – 250° = 110°

(*e*) In the given trapezium MNOP, MN || PO.

∴ ∠M + ∠P = 180° and ∠N + ∠O = 180°

⇒ $x$ + 75° = 180° and $y$ + 34° = 180°

⇒ $x$ = 180° – 75° and $y$ = 180° – 34°

⇒ $x$ = 105° and $y$ = 146°

(*f*) In the given parallelogram XYZW, XY||WZ and XW|| YZ.

Since, opposite angles of a parallelogram are equal.

∴ ∠X = ∠Z ⇒ $x$ = 38°

Also, adjacent angles of a parallelogram are supplementary.

∴ 38 + $z$ = 180° and $y$ + $x$ = 180°

⇒ $z$ = 180° – 38° and $y$ = 180° – 38°

⇒ $z$ = 142° and $y$ = 142°

**2.** Let the fourth angle be '$x$'.

Since, sum of interior angles of a quadrilateral = 360°.

∴ 80° + 80° + 80° + $x$ = 360°

⇒ $x$ = 360° – 240° = 120°

**3.** Let the measure of each of the equal angle be $x$.

According to the angle sum property of a quadrilateral,

50° + 50° + $x$ + $x$ = 360°

⇒ 2$x$ = 360° – 100° = 260°

∴ $x$ = $\frac{260}{2}$ = 130°

Hence, the measure of each of the equal angles is 130°.

**4.** The ratio of the angles of a quadrilateral is 2 : 3 : 5 : 8.

Let the measures of angles be 2$x$, 3$x$, 5$x$ and 8$x$.

∴ 2$x$ + 3$x$ + 5$x$ + 8$x$ = 360°

[∵ Sum of all angles of a quadrilateral is 360°]

⇒ 18$x$ = 360° ⇒ $x$ = 20°

∴ 2$x$ = 2 × 20 = 40°,

3$x$ = 3 × 20 = 60°,

5$x$ = 5 × 20 = 100°,

8$x$ = 8 × 20 = 160°.

Thus, the angles are 40°, 60°, 100° and 160°.

**5.** Let the measures of angles be 1$x$, 2$x$, 3$x$ and 4$x$.

∴ $x$ + 2$x$ + 3$x$ + 4$x$ = 360°

[Sum of all angles of a quadrilateral is 360°]

⇒ 10$x$ = 360° ⇒ $x$ = 36°

∴ 2$x$ = 2 × 36° = 72°,

3$x$ = 3 × 36° = 108°,

4$x$ = 4 × 36° = 144°

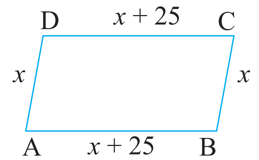
∴ The measure of smallest angle is 36°.

6. In a parallelogram, opposite angles are equal. Given, one angle is 75°, therefore the opposite angle is also 75°.
Also, adjacent angles are supplementary.

$\therefore \quad 180° - 75° = 105°$

So, the other angles are 75°, 105° and 105°.

7. Let one side of a parallelogram be '$x$' cm.
Then other side 'AB' be '$x + 25$' cm.
Now, AD = BC = $x$ and
AB = CD = $x + 25$.
[∵ Opposite sides of a parallelogram are equal]




Also, perimeter = 150 cm

$\Rightarrow [x + (x + 25) + x + (x + 25)] = 150$

$\Rightarrow (4x + 50) = 150$

$\Rightarrow 4x = 150 - 50 = 100$

$\Rightarrow x = \frac{100}{4} = 25$ cm

∴ The sides of a parallelogram are 25 cm, 50 cm, 25 cm and 50 cm.

8. Since diagonals of a quadrilateral bisect each other.

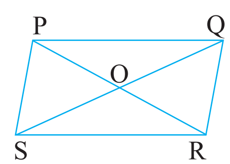
$\therefore \quad 5b - 7 = 3b + 6$

$\Rightarrow 5b - 3b = 6 + 7$

$\Rightarrow 2b = 13$

$\Rightarrow b = \frac{13}{2} = 6.5$

9. Since diagonals of a parallelogram bisect each other.
∴ OP = OR and OS = OQ.
Now, given PR = 12.8 cm and QS = 7.6 cm




$\Rightarrow$ OP + OR = 12.8 and OS + OQ = 7.6

$\Rightarrow$ OR = $\frac{12.8}{2}$ = 6.4 cm and OS = $\frac{7.6}{2}$ = 3.8 cm

∴ OR = 6.4 cm and OS = 3.8 cm.

10. (*a*) Let the measures of angles be $x$, $3x$, $7x$ and $9x$.

$\therefore x + 3x + 7x + 9x = 360°$

[∵ Sum of all angles of a quadrilateral is 360°]

$\Rightarrow 20x = 360° \qquad \Rightarrow x = 18°$

Thus, the measures of all angles are:

$x = 18°$,
$3x = 3 \times 18° = 54°$,
$7x = 7 \times 18° = 126°$,
$9x = 9 \times 18° = 162°$

(*b*) Yes, ABCD is a trapezium since the pair of adjacent angles are supplementary.
i.e., $3x + 7x = 54° + 126° = 180°$
and $18° + 162° = 180°$

(*c*) No, ABCD is not a parallelogram, since the opposite angles are not equal.

## Quick Check (Page 75)

1. Not a parallelogram as diagonals are not bisecting each other.
2. Do not follow any property of parallelogram.
3. Since the opposite sides of a quadrilateral are equal and parallel.
So, the given figure is a parallelogram.
4. Not a parallelogram as opposite sides are not equal.

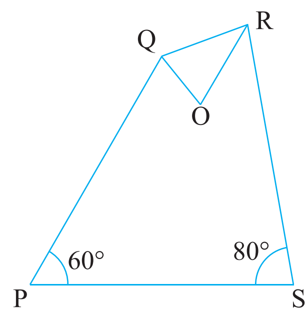
## Practice Time 3D

1. In the given figure, ∠EBC = ∠ECB = 60°. So, ∠BEC = 180° – 120° = 60° and ΔEBC is an equilateral triangle.
Also, it is given that EC = 8 cm.

∴ EC = BE = BC = 8 cm
[∵ EBC is an equilateral triangle]

Since, BC = 8 cm, so length of the side of the square ABCD is of 8 cm.

2. Since, sum of interior angles of a quadrilateral = 360°.




$\Rightarrow \angle P + \angle Q + \angle R + \angle S = 360°$

$\Rightarrow 60° + \angle Q + \angle R + 80° = 360°$

$\Rightarrow \angle Q + \angle R = 220°$ ...(*i*)

Since OQ and OR are bisectors of ∠Q and ∠R.

$\therefore \angle Q = 2\angle OQR$ and $\angle R = 2\angle ORQ$

From (*i*),

$2(\angle OQR + \angle ORQ) = 220°$

$\Rightarrow \angle OQR + \angle ORQ = 110°$ ...(*ii*)

In ΔOQR,

$\angle OQR + \angle ORQ + \angle QOR = 180°$

$\Rightarrow 110° + \angle QOR = 180°$ [from (*ii*)]

$\therefore \angle QOR = 180° - 110° = 70°$

3. Let ∠OAB = $3x$ and ∠OBA = $2x$.
Since diagonals of rhombus make an angle of 90° at the point of intersection.

$\therefore$ $\angle AOB = 90°$

In $\Delta AOB$, $\angle OAB + \angle OBA + \angle AOB = 180°$

$\Rightarrow$ $3x + 2x + 90° = 180°$

$\Rightarrow$ $5x = 180° - 90° = 90°$

$\Rightarrow$ $x = 18°$

$\therefore$ $\angle OAB = 3x = 3 \times 18 = 54°$ and

$\angle OBA = 2 \times 18 = 36°$

Since, diagonals of rhombus bisect at vertex angles.

$\therefore$ $\angle OAB = \angle OAD = 54°$ and also $\angle AOD = 90°$

[Diagonals of rhombus are perpendicular to each other]

In $\Delta AOD$,

$\angle AOD + \angle ODA + \angle OAD = 180°$

$\Rightarrow$ $90° + \angle ODA + 54° = 180°$

$\Rightarrow$ $\angle ODA = 180° - 144° = 36°$

$\therefore$ The angles of the $\Delta AOD$ are 36°, 90° and 54°.

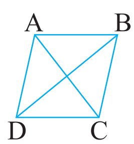
**4.** Since, diagonals of a rectangle are equal and bisect each other.

$\therefore$ AO = DO

$\Rightarrow$ $2y + 3 = 3y + 1 \quad \Rightarrow 3y - 2y = 3 - 1$

$\Rightarrow$ $y = 2.$

**5.** Since, it is given that one of the diagonals of a rhombus is equal to one of its sides.




$\therefore$ AC = BC ...(*i*)

BC = AB ...(*ii*)

From (*i*) and (*ii*)

AC = BC = AB

$\therefore$ ABC is an equilateral triangle and

$\angle ABC = \angle BCA = \angle BAC = 60°$ ...(*iii*)

Similarly, $\Delta DAC$ is also an equilateral triangle.

$\angle ADC = \angle DAC = \angle DCA = 60°$ ...(*iv*)

From (*iii*) and (*iv*)

$\angle BCA + \angle DCA = 60° + 60° = 120°$

$\Rightarrow$ $\angle C = 120°$

and $\angle CAB + \angle CAD = 60° + 60° = 120°$

$\Rightarrow$ $\angle A = 120°$

Hence, the four angles of rhombus are 120°, 60°, 120° and 60°.

**6.** Given $\angle ACD = 40° = \angle OCD$.

Since, diagonals of rhombus bisect each other perpendicularly.

$\therefore$ $\angle COD = 90°$

In $\Delta OCD$, $\angle OCD + \angle COD + \angle ODC = 180°$

$\Rightarrow$ $40° + 90° + \angle ODC = 180°$

$\Rightarrow$ $\angle ODC = 180° - 130° = 50°$

So $\angle BDC = 50°$

Since diagonals of a rhombus bisect at vertex angle.

$\therefore$ $\angle ADB = \angle BDC = 50°$

**7.** Since in a square, all four sides are equal.

$\therefore$ PQ = QR

$\Rightarrow$ $5a - 17 = 2a + 4$

$\Rightarrow$ $5a - 2a = 17 + 4$

$\Rightarrow$ $3a = 21$ or $a = 7$ cm

Now, $PS = PQ = 5a - 17$

$= 5 \times 7 - 17$

$= 35 - 17 = 18$ cm.

**8.** Since, a rhombus has all the four sides equal.

$\therefore$ RE = RI

$\Rightarrow$ $13 = z$

Thus, $z = 13$ units

Also, diagonals are perpendicular bisector to each other. i.e., RO = OC and EO = OI

$\Rightarrow$ $y = 12$ units and $x = 5$ units

Perimeter of the given rhombus = 13 × 4 = 52 units

**9.** Given, $\angle ROE = 60°$

$\therefore$ $\angle AOE = 180° - 60° = 120°$

(Linear pair)

$\angle AOD = \angle ROE = 60°$

(Vertically opposite angles)

Let, $\angle OEA = \angle OAE = x$

[Angles opposite to equal side of a triangle]

In $\Delta AOE$, $\angle OEA + \angle AOE + \angle OAE = 180°$

$\Rightarrow$ $x + 120° + x = 180°$

$\Rightarrow$ $2x = 60°$

$\Rightarrow$ $x = 30°$

$\Rightarrow$ $\angle EAR = 30°$

Also, $\angle OAD = \angle ODA = y$

Similarly, in $\Delta AOD$,

$\angle OAD + \angle AOD + \angle ODA = 180°$

$\Rightarrow$ $y + 60° + y = 180°$

$\Rightarrow$ $2y = 120°$

$\Rightarrow$ $y = 60°$

$\therefore$ $\angle RAD = 60°$

**10.** In rhombus BEAM, given $\angle OAM = 70°$

Since, diagonals of a rhombus bisect at 90°.

So, $\angle AOM = 90°$.

In $\Delta AOM$,

$\angle AOM + \angle OAM + \angle AMO = 180°$

$\Rightarrow$ $90° + 70° + \angle AMO = 180°$

$\Rightarrow$ $\angle AMO = 180° - 160°$

$\Rightarrow$ $\angle AMO = 20°$

or $\angle AME = 20°$

In $\Delta AME$,

$AM = AE$ [Sides of a rhombus are equal]

$\angle AEM = \angle AME = 20°$

## Think and Answer (Page 77)

Here $\angle P + \angle Q + \angle R = 360°$ but for a quadrilateral the sum of all 4 angles should be 360°. So, we cannot construct a quadrilateral PQRS.

## Practice Time 3E

1. **Steps of construction:**

**Step 1:** Draw a line segment PE = 10 cm.

**Step 2:** With P as centre and radius = 6 cm, draw an arc.

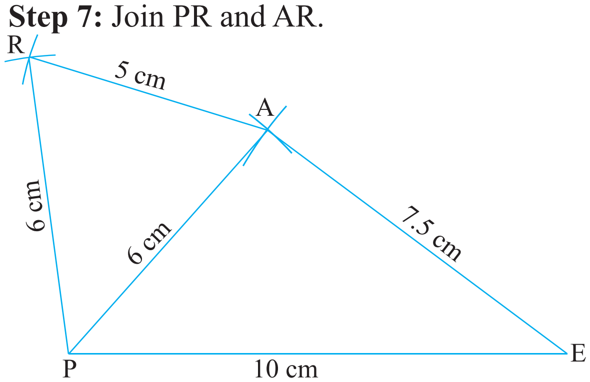
**Step 3:** With E as centre and radius = 7.5 cm, draw another arc to intersect the previous arc at A.

**Step 4:** Join AP and AE.

**Step 5:** Again with P as centre and radius = 6 cm, draw an arc on the left of AP.

**Step 6:** With A as centre and radius = 5 cm, draw another arc to intersect the previous arc at R.

**Step 7:** Join PR and AR.




Thus, PEAR is the required quadrilateral.

2. **Steps of construction:**

**Step 1:** Draw a line segment PS = 5 cm.

**Step 2:** With P as centre and radius = 7 cm, draw an arc.

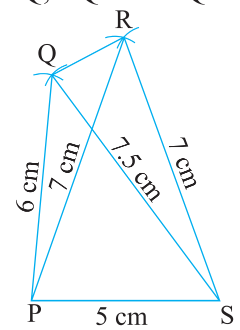
**Step 3:** With S as centre and radius = 7 cm, draw another arc, cutting the previous arc at R.

**Step 4:** Join PR and SR.

**Step 5:** Again with P as centre and radius equal to 6 cm, draw an arc on the left of PR.

**Step 6:** With S as centre and radius equal to 7.5 cm, draw an arc, cutting the previous arc at Q.

**Step 7:** Join PQ, SQ and RQ.




Thus, PQRS is the required quadrilateral.

3. Similarly solve as Q.2.

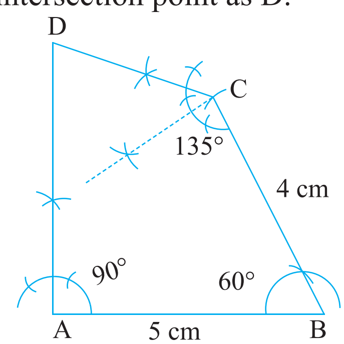
4. **Steps of construction:**

**Step 1:** Draw a line segment AB = 5 cm.

**Step 2:** From points A and B, construct angles of 90° and 60° respectively.

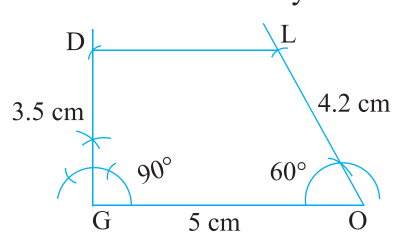
**Step 3:** Taking a measurement of 4 cm on a compass and from point B, mark along the 60° angle line drawn. Name the intersection point as C.

**Step 4:** From point C, draw an angle of 135° and let this meet at $\angle A$ extended. Name this intersection point as D.

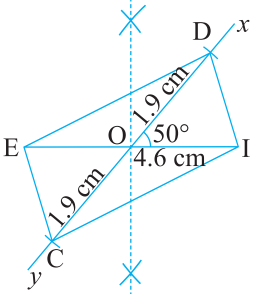



Thus, ABCD is the required quadrilateral.

5. **Steps of construction:** Do it yourself.



**6. Steps of construction:** Do it yourself.




**7. Steps of construction:**

**Step 1:** Draw a line segment AB = 4.8 cm.

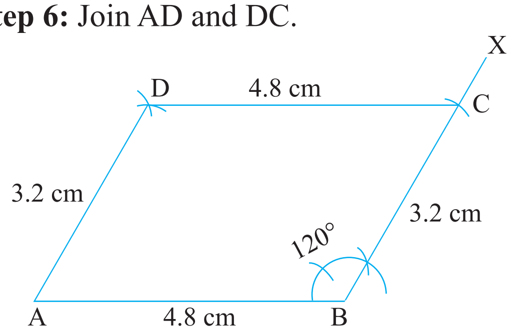
**Step 2:** Draw ∠ABX = 120°

**Step 3:** With B as centre and radius = 3.2 cm, draw an arc which cut off BX at C.

**Step 4:** Taking C as centre and radius = 4.8 cm, draw an arc.

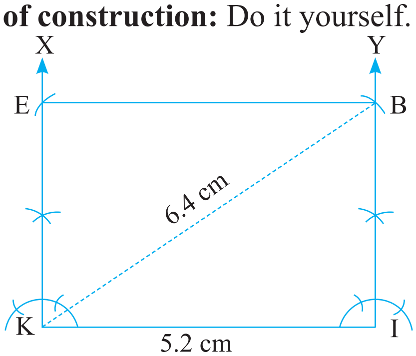
**Step 5:** With A as centre and radius = 3.2 cm, draw another arc to intersect the previous arc at D.

**Step 6:** Join AD and DC.

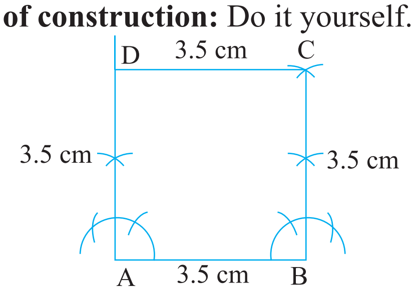



Thus, ABCD is the required parallelogram.

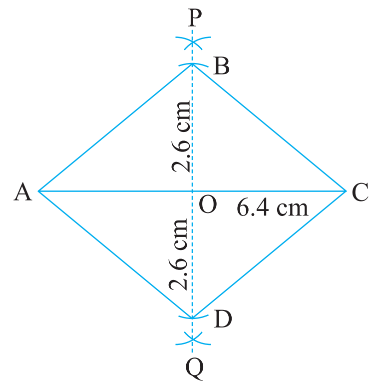
**8. Steps of construction:** Do it yourself.



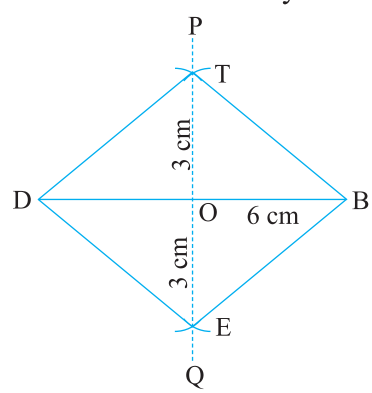

**9. Steps of construction:** Do it yourself.




**10. Steps of construction:** Do it yourself.




**11. Steps of construction:** Do it yourself.




For a square, its both diagonals are equal.

**12. Steps of construction:**

**Step 1:** Draw a line segment AB = 5 cm.

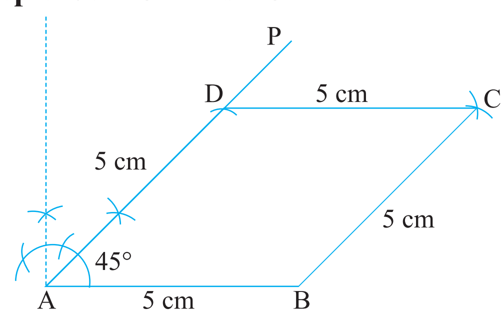
**Step 2:** At A, construct ∠BAP = 45°

**Step 3:** Cut off AD = 5 cm along AP.

**Step 4:** With B as centre and radius = 5 cm, draw an arc on the right of AD.

**Step 5:** With D as centre and radius = 5 cm, draw another arc to meet the previous arc at C.

**Step 6:** Join CD and BC.




Thus, ABCD is the required rhombus.

## Chapter Assessment

**A.**

**1.** (*a*) A trapezium is a quadrilateral in which exactly one pair of opposite side is parallel to each other.

**2.** (*a*) A rectangle is a quadrilateral whose opposite sides and all the angles are equal (i.e., 90°).

**3.** (*a*) If the adjacent angles of a parallelogram are equal, then the parallelogram is a rectangle. In trapezium and rhombus, the sum of adjacent angles is supplementary.

**4.** (*d*) Let the angles be $3x$, $7x$, $6x$, and $4x$.

Now, sum of angles in a quadrilateral = 360°.

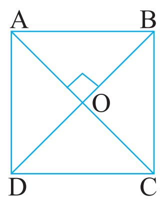
$$\Rightarrow \quad 3x + 7x + 6x + 4x = 360°$$
$$\Rightarrow \quad 20x = 360°$$
$$\Rightarrow \quad x = 18°$$

∴ The angles are 54°, 126°, 108°, 72°.

Since a trapezium has one pair of opposite angles supplementary (126° and 54°).

Hence, the quadrilateral ABCD is a trapezium.

**5.** (*a*) In a square ABCD, diagonals bisect each other at 90° and are equal in length.

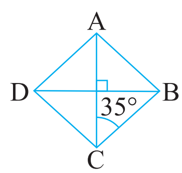



In ΔAOB,

OA = OB and ∠AOB = 90°.

Thus, ΔAOB is an isosceles right triangle.

**6.** (*c*) In rhombus ABCD, BC || AD and BD is a transversal.




∴ ∠ADB = ∠DBC.

Since, diagonals of a rhombus bisect each other perpendicularly.

∴ ∠BOC = 90°

In ΔBOC,

$$\angle BOC + \angle OCB + \angle OBC = 180°$$
$$\Rightarrow \quad \angle OBC = 180° - 90° - 35° = 55°$$
$$[\because \angle OCB = \angle ACB = 35°]$$

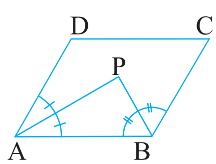
Thus, ∠ADB = ∠DBC = ∠OBC = 55°.

**7.** (*d*) In a parallelogram, opposite angles are equal and adjacent angles are supplementary.

∴ ∠A = ∠C = 67.5° and ∠B = ∠D = 180° – 67.5° = 112.5°

$$\therefore \quad \frac{\angle A}{\angle B} = \frac{67.5}{112.5} = \frac{3}{5} = 3 : 5$$

**8.** (*b*) Given, bisectors of ∠A and ∠B of a parallelogram ABCD intersect at P. Now, AD || BC and AB is a transversal.




$$\therefore \quad \angle DAB + \angle CBA = 180°$$
$$\Rightarrow \quad \frac{1}{2}\angle DAB + \frac{1}{2}\angle CBA = 90° \qquad ...(i)$$

Since AP and PB are angle bisectors of A and B respectively, then

$$\angle PAB = \frac{1}{2}\angle DAB \text{ and } \angle PBA = \frac{1}{2}\angle CBA$$

From (*i*), ∠PAB + ∠PBA = 90° ...(*ii*)

Now, in ΔPAB,

$$\angle PAB + \angle PBA + \angle APB = 180°$$
$$\Rightarrow \quad 90° + \angle APB = 180° \quad \text{(using (ii))}$$
$$\therefore \quad \angle APB = 180° - 90° = 90°$$

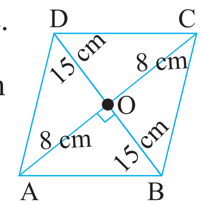
**B.**

**1.** (*b*) **Assertion:** An octagon has 8 sides.

**Reason:** A polygon is a simple closed curve formed by fine number of line segment.

Here, both assertion and reason are true but reason is not the correct explanation of assertion.

**2.** (*a*) **Assertion:** Since, the diagonals of a rhombus bisect each other at right angles.




$$OD = \left(\frac{1}{2} \times 30\right) cm = 15 \text{ cm}$$

and

$$OA = \left(\frac{1}{2} \times 16\right) cm = 8 \text{ cm}.$$

In right-angled triangle AOD, we have

$$AD^2 = OA^2 + OD^2 = 64 + 225 = 289$$

∴ AD = 17 cm

Thus, the length of its each side will be 17 cm.

**Reason:** To solve above problem diagonals of a rhombus should bisect each other perpendicularly.

Both assertion and reason are true and reason is the correct explanation of assertion.

**3.** (*d*) **Assertion:** For a parallelogram, knowing one side and one diagonal is not sufficient as we need additional information like angles or sides. At least 5 measurements are needed.

**Reason:** Special quadrilaterals like square, rectangle can be constructed with less than 5 measurements because of their special properties.

Here, assertion is false and reason is true.

**C.**

1. Number of sides of a pentagon = 5.

$\therefore$ Measure of each exterior angle of a regular pentagon $= \dfrac{360°}{5} = 72°$.

2. Sum of the angles of hexagon $= (6 - 2) \times 180°$
$= 4 \times 180° = 720°$

3. Measure of exterior angle of a regular polygon having 18 sides $= \dfrac{360°}{18} = 20°$.

4. A quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure is a kite.

5. A quadrilateral can be constructed uniquely if its three sides and two included angles are given.

6. Since both the diagonals of a rectangle are equal.

$\therefore$ Length of the other diagonal is 6 cm.

**D.**

1. (*a*) No,  is not a simple closed curve. For, a simple closed curve, no two line segments intersect except at their end points.

(*b*)  is a concave hexagon as it has 6 sides and one of its diagonals lies on the exterior of the polygon.

2. In parallelogram ABCD,

$y + 56° = 125°$

[$\because$ Opposite angles are equal].

$\Rightarrow \quad y = 125° - 56° = 69°$

Also, $x + 125° = 180°$

[$\because$ Linear pair]

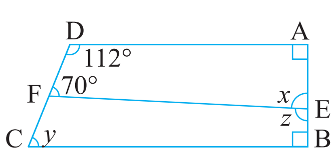
$\Rightarrow \quad x = 180° - 125° = 55°$

Now, AECD is a quadrilateral.

$\therefore \quad 125° + z + y + x = 360°$

$\Rightarrow \quad 125° + z + 69° + 55° = 360°$

$\Rightarrow \quad z = 111°$

3. 


In quadrilateral AEFD,

$90° + x + 70° + 112° = 360°$

[$\because$ Angle sum property of a quadrilateral]

$\Rightarrow \quad x = 88° \quad ...(i)$

Now, $\quad x + z = 180° \quad$ [Linear pair]

$\Rightarrow \quad z = 180° - 88° = 92° \quad$ [from (*i*)]

Also, $\angle EFD + \angle EFC = 180° \quad$ [Linear pair]

$70° + \angle EFC = 180°$

$\Rightarrow \quad \angle EFC = 180° - 70° = 110°$

In quadrilateral BCFE,

$90° + y + \angle EFC + z = 360°$

[Angle sum property of a quadrilateral]

$\Rightarrow \quad y = 360° - 90° - 110° - 92°$

$\Rightarrow \quad y = 68°$

4. In parallelogram ABCD,

$\angle A = \angle C = 30°$

[Opposite angles are equal in a parallelogram]

In $\Delta$CBD,

$\angle BCD + \angle BDC + \angle CBD = 180°$

$\Rightarrow \quad 30° + \angle BDC + 90° = 180°$

$\Rightarrow \quad \angle BDC = 60°$

or $\quad \angle D = 60°$

In parallelogram BDCE, $\quad \angle D = \angle E$

[$\because$ Opposite angles are equal in a parallelogram]

$\therefore \quad \angle E = \angle BEC = 60°$

5. Let $\angle RWA = \angle RAW = x$.

In $\Delta$ARW,

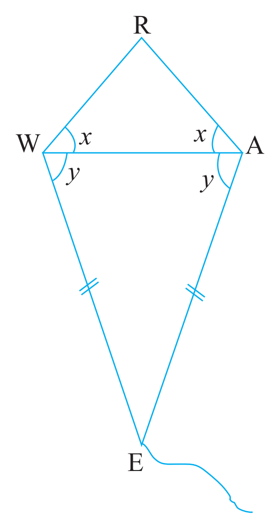
$\angle RWA + \angle RAW + \angle ARW = 180°$

$\Rightarrow \quad x + x + 80° = 180°$

[Given $\angle ARW = 80°$]

$\Rightarrow \quad 2x = 100°$

$\Rightarrow \quad x = 50°$




Let $\angle AWE = \angle WAE = y$.

In $\Delta$AEW,

$\angle AWE + \angle WAE + \angle WEA$

$= 180°$

$\Rightarrow \quad y + y + 70° = 180°$

[Given, $\angle WEA = 70°$]

$\Rightarrow \quad 2y = 110°$

$\Rightarrow \quad y = 55°$

$\therefore \angle RWE = x + y = 50° + 55°$

$= 105° = \angle RAE$

6. In parallelogram ABDH,

$\angle A + \angle B = 180°$

[$\because$ Adjacent angles are supplementary]

$\Rightarrow \quad \angle A = 180° - \angle B$

$= 180° - 110° = 70°$

and $\angle D = \angle A = 70°$

[∵ Opposite angles are equal]

In parallelogram CEFG, $\angle C = \angle F = 30°$

[∵ Opposite angles are equal]

In ΔICD,

$$x + \angle C + \angle D = 180°$$

$$\Rightarrow \quad x = 180° - 30° - 70°$$

$$= 80°$$

**7.** Measure of an interior angle of a regular polygon of 5 sides $= \dfrac{(5-2)\times 180°}{5} = 108°$

In quadrilateral AMCB,

$$\frac{108°}{2} + 108° + 108° + \angle AMC = 360°$$

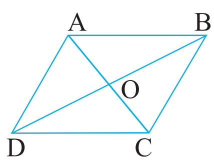
[∵ AM is the bisector of angle A]

$$\Rightarrow \quad \angle AMC = 360° - 54° - 216° = 90°$$

$$\therefore \quad \angle AMC = 90°$$

**8.** ABCD be the quadrilateral in which AC and BD are the diagonals which intersect at O.

Now, $\dfrac{AO}{OC} = \dfrac{1}{2}$ [Given]




Since, we know that diagonals of a parallelogram bisect each other. So for ABCD to be a parallelogram $\dfrac{AO}{OC} = \dfrac{1}{1}$.

∴ The quadrilateral can't be a parallelogram in which the point of intersection of the diagonals divides the diagonal in the ratio 1 : 2.

**9.** Since, in a kite the two adjacent pair of sides are equal.

∴ Each of two equal sides = 23 m

Let third and fourth side = $x$, which are also equal.

$$\therefore \quad 23 + 23 + x + x = \text{perimeter} = 106$$

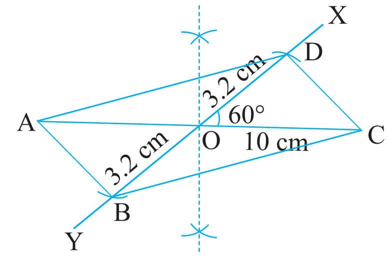
$$\Rightarrow \quad 2x = 106 - 46$$

$$= 60$$

$$\Rightarrow \quad x = 30$$

∴ Length of other three sides are 23 m, 30 m, 30 m.

**10. Steps of construction:** Do it yourself




**11.** (*a*) • They can form a kite, since it has two pairs of adjacent sides equal.

• They can form a rectangle, since opposite sides are equal and make angles of 90° each.

• They can form parallelogram, since opposite sides are equal.

(*b*) 'COLD' is a parallelogram in which opposite sides and angles are equal.

(*c*) 'SNOW' is a kite in which there are two pairs of adjacent equal sides and pair of opposite angles are equal.

## Maths Connect (Page 85)

Let the intersection point of two line segments AC and BD be O.

In ΔAOB, $AO^2 + OB^2 = AB^2$

$$\Rightarrow \quad (3+3)^2 + (4+4)^2 = AB^2$$

$$\Rightarrow \quad AB^2 = 36 + 64$$

$$= 100$$

$$\Rightarrow \quad AB = 10 \text{ units}$$

Now, AB is the side of a rhombus ABCD = Diameter of the semi-circle.

$$\therefore \text{Radius of semi-circle} = \frac{\text{Diameter of semi circle}}{2}$$

$$= \frac{10}{2} = 5 \text{ units}$$

## UNIT TEST – 1

**A.**

**1.** (*d*) There are infinite rational number(s) between any two rational numbers.

**2.** (*b*) For rational number $\frac{2}{5}$, we have

$$\frac{2}{5}+\left(\frac{-2}{5}\right) = 0$$

Hence, $\frac{-2}{5}$ is the additive inverse of $\frac{2}{5}$.

**3.** (*a*) Let the number be '$x$'.

According to the question,

$$3x + 8 = 17$$

$$\Rightarrow \quad 3x = 17 - 8 = 9$$

$$\Rightarrow \quad x = 3$$

**4.** (*b*) We have, $\frac{x}{3}+\frac{1}{2} = \frac{x}{5}+\frac{1}{10}$

$$\frac{x}{3}-\frac{x}{5} = \frac{1}{10}-\frac{1}{2}$$

$$\left[\text{Transposing } \frac{x}{5} \text{ to LHS and } \frac{1}{2} \text{ to RHS}\right]$$

$$\Rightarrow \quad \frac{5x-3x}{15} = \frac{1-5}{10}$$

$$\Rightarrow \quad \frac{2x}{15} = \frac{-4}{10}$$

$$\Rightarrow \quad x = \frac{-4\times 15}{10\times 2} = -3$$

**5.** (*d*) Number of diagonals in a polygon with 7 sides

$$= \frac{7(7-3)}{2} = \frac{7\times 4}{2} = 14.$$

**6.** (*c*) We have, $\frac{5}{3}\times\frac{-9}{20}\times\frac{8}{20}\times 10 = -3$

**7.** (*b*) Given, breadth of a rectangle is 6 cm and diagonal measures 10 cm.

Let length of the rectangle be $x$.

Now, $(\text{Diagonal})^2 = (\text{Length})^2 + (\text{Breadth})^2$

$$\Rightarrow \quad \text{Length} = \sqrt{(10)^2-(6)^2}$$

$$= \sqrt{100-36}$$

$$= \sqrt{64} = 8 \text{ cm}$$

**8.** (*c*) In a parallelogram, adjacent angles are supplementary and opposite angles are equal.

$$\therefore \quad \angle A = \angle C = 77.5°$$

and $\angle B + \angle C = 180°$

$$\Rightarrow \quad \angle B = 180° - 77.5°$$

$$= 102.5°$$

$$\therefore \quad \frac{\angle A}{\angle B} = \frac{77.5°}{102.5°} = \frac{31}{41} = 31 : 41$$

**9.** (*a*) **Assertion:** Since $4 \div 8 = \frac{1}{2}$ and $8 \div 4 = 2$.

So $4 \div 8 \neq 8 \div 4$ i.e., assertion is true.

**Reason:** Division is not commutative for rational numbers.

Reason is the correct explanation of assertion.

**10.** (*c*) **Assertion:** Yes, we can construct a unique quadrilateral when measures of 3 sides and 2 diagonals are given. So assertion is true.

**Reason:** We can say that at least five measurements are required to construct a unique quadrilateral. So, reason is false.

**B.**

**1.** The absolute value of $\frac{-2}{5} = \left|\frac{-2}{5}\right| = \frac{2}{5}$.

**2.** $\frac{-a}{b}\times 1 = \frac{-b}{a}$

**3.** The given equation is $12 + 2x = 32$

$$\Rightarrow \quad 2x = 32 - 12 = 20$$

$$\Rightarrow \quad x = 10$$

Solution of equation $12 + 2x = 32$ is $x = 10$.

**4.** Measure of each exterior angle of a regular polygon of 12 sides is $\frac{360°}{12} = 30°$.

**5.** Let the length of the adjacent sides be $5x$ and $3x$.

According to the question,

$$2(5x + 3x) = 56$$

$$\Rightarrow \quad 16x = 56$$

$$\Rightarrow \quad x = 3.5 \text{ cm}$$

Now, calculate side lengths:

$$5x = 5(3.5) = 17.5 \text{ cm}$$

$$3x = 3(3.5) = 10.\ 5 \text{ cm}$$

$\therefore$ The length of its adjacent sides are 17.5 cm and 10.5 cm.

**C.**

**1.** The rational number on the left is smaller than the rational number on its right.

LCM of 9 and 6 is 18.

Now, $\frac{-1\times 3}{6\times 3} = \frac{-3}{18} > \frac{-4\times 2}{9\times 2} = \frac{-8}{18}$

$\therefore\ -\frac{1}{6} > \frac{-4}{9}$

So, $\frac{-1}{6} < \frac{-4}{9}$ is false.

**2.** $\frac{-16}{25}$ is in standard form itself.

So, the given statement is false.

**3.** The given equation is $2x - 6 = 4$

$\Rightarrow\quad 2x = 6 + 4 = 10$

$\Rightarrow\quad x = \frac{10}{2} = 5$

which is true.

**4.** Sum of interior angles of a pentagon

$= (5 - 2) \times 180°$

$= 3 \times 180° = 540°$

which is true.

**5.** Since, sum of all the exterior angles of a quadrilateral is 360°.

$\Rightarrow\quad 90° + 50° + 110° + x = 360°$

$\Rightarrow\quad x = 360° - 250° = 110°$

which is true.

**D.**

**1.** We have, $a = -1$, $b = \frac{3}{4}$ and $c = \frac{5}{8}$.

$$\text{LHS} = -1\times\left(\frac{3}{4}\times\frac{5}{8}\right) = -1\times\left(\frac{15}{32}\right) = \frac{-15}{32}$$

$$\text{RHS} = \left(-1\times\frac{3}{4}\right)\times\frac{5}{8} = \left(\frac{-3}{4}\right)\times\frac{5}{8} = \frac{-15}{32}$$

$\therefore$ LHS = RHS

Thus, associative property of multiplication holds for $a = -1,\ b = \frac{3}{4}$ and $c = \frac{5}{8}$.

**2.** We have, $\frac{32}{5} + \left[\frac{23}{11}\times\frac{22}{15}\right]$

$$= \frac{32}{5} + \frac{46}{15} = \frac{32\times 3}{5\times 3} + \frac{46}{15} = \frac{96+46}{15} = \frac{142}{15}$$

**3.** Let the present age of son be $x$ years.

Then, the present age of father be $4x$ years.

After 10 years,

Age of son = $(x + 10)$ years

$\Rightarrow$ and age of father = $(4x + 10)$ years

According to the question,

$\Rightarrow\quad 4x + 10 = 3(x + 10)$

$\Rightarrow\quad 4x + 10 = 3x + 30$

$\Rightarrow\quad x = 20$

$\therefore$ Present age of son = 20 years and present age of father = 4(20) = 80 years.

**4.** We have, $\frac{2x-3}{4} - \frac{3x-5}{2} = x + \frac{3}{4}$

Multiplying by 4 on both sides, we get

$$4\times\frac{(2x-3)}{4} - 4\times\frac{(3x-5)}{2} = 4\times x + 4\times\frac{3}{4}$$

$\Rightarrow\quad 2x - 3 - 2(3x - 5) = 4x + 3$

$2x - 3 - 6x + 10 = 4x + 3$

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

Transposing $4x$ to RHS and 3 to LHS, we have

$8x = 7 - 3 = 4$

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

**5.** In the given figure,

$90° + \angle 1 = 180°$ [Linear pair]

$\Rightarrow\quad \angle 1 = 180° - 90° = 90°$

Since, sum of exterior angles of a polygon is 360°.

$\therefore\ 60° + 90° + 90° + 40° + x = 360°$

$\Rightarrow\quad x = 80°$

**6.** Let the angles be $3x$, $4x$, $5x$ and $6x$.

Since, sum of the angles of a quadrilateral = 360°.

$\Rightarrow\quad 3x + 4x + 5x + 6x = 360°$

$\Rightarrow\quad 18x = 360°$

$\Rightarrow\quad x = \frac{360}{18}$

$\Rightarrow\quad x = 20°$

$\therefore$ The required angles are:

$3x = 3 \times 20 = 60°$,

$4x = 4 \times 20 = 80°$,

$5x = 5 \times 20 = 100°$,

$6x = 6 \times 20 = 120°$

7. We know that the opposite angles of a parallelogram are equal.

$\therefore \quad (4x + 5)° = (60 - x)°$

$\Rightarrow \quad 4x + x = 60° - 5°$

$\Rightarrow \quad 5x = 55°$

$\Rightarrow \quad x = \frac{55}{5} = 11°$

So, the angles are

$(4x + 5)° = (4 \times 11 + 5)° = 49°$

and $(60 - x)° = (60 - 11)° = 49°$

Also, the adjacent angles in a parallelogram are supplementary.

$\therefore$ Third angle = 180° – 49° = 131° = fourth angle.

8. Do it yourself

# CHAPTER 4 : DATA HANDLING

## Let's Recall

1. Range of current demand = Highest current demand – lowest current demand

 = ₹(9738.80 – 1668.00) = ₹8070.80

2. Average monthly payment of bills

$$= \frac{8200+9740+7950+3830+860+870}{6}$$

$$= \frac{31450}{6} = ₹5241.70$$

3. Units in ascending order are

 305, 315, 541, 925, 954, 1091

 Number of observations = 6 (even)

$\therefore$ Median of the electricity consumption

$$= \frac{541+925}{2} = 733 \text{ units.}$$

4. Mode of the days for bills generated are:

 33, 32, 32, 32, 31, 34.

 Mode = 32 days (as it appeared most frequently).

## Think and Answer (Page 91)

1. 4 observations have frequency 3.
2. 22 students obtained more than 10 marks.
3. Maximum number of students is 5, who obtained 15 marks.

## Quick Check (Page 94)

The given data in ascending order is 38, 39, 41, 42, 43, 44, 45, 47, 48, 49, 50, 52, 54, 55, 56, 57, 60, 61, 62, 63.

$\therefore$ Range = 63 – 38 = 25.

The class intervals are 38 – 48, 48 – 58, 58 – 68.

The 3rd class interval is 58 – 68.

Now, class mark for the third class interval (i.e., 58 – 68) with class size 10 = $\frac{58+68}{2}$ = 63.

## Think and Answer (Page 95)

1. The upper limit of the class interval 40 – 45 is 45.
2. Class mark of the class interval 45 – 50

$$= \frac{45+50}{2} = 47.5.$$

3. The first class has a lower limit 40 and upper limit 45.

$\therefore$ Class size = 45 – 40 = 5

4. The class interval 50-55 has the highest frequency i.e., 11.
5. The number of students weigh less than 50 kg = 5 + 7 = 12 students.

## Practice Time 4A

1. The weights of 20 parcels in assenting order as follows: 30, 31, 36, 38, 38, 40, 41, 42, 44, 53, 54, 63, 64, 74, 75, 77, 82, 83, 93, 98.

 (*a*) Range of the data = 98 – 30 = 68.

 (*b*)

| Weights (in g) | Tally marks | Number of Parcels |
|---|---|---|
| 30-40 | ~~IIII~~ | 5 |
| 40-50 | IIII | 4 |
| 50-60 | II | 2 |
| 60-70 | II | 2 |
| 70-80 | III | 3 |
| 80-90 | II | 2 |
| 90-100 | II | 2 |
| | **Total** | **20** |

**2.**

| Number of members | Tally marks | Number of families |
|---|---|---|
| 1-3 | \|\| | 2 |
| 3-5 | 卌 \| | 6 |
| 5-7 | 卌 卌 | 10 |
| 7-9 | 卌 \|\| | 7 |
| | **Total** | **25** |

**3.**

| Maximum temperature (in °C) | Tally marks | Number of days |
|---|---|---|
| 15-20 | 卌 \|\| | 7 |
| 20-25 | 卌 | 5 |
| 25-30 | 卌 | 5 |
| 30-35 | 卌 | 5 |
| 35-40 | 卌 \|\|\| | 8 |
| | **Total** | **30** |

(*a*) The class intervals which has the least frequency are 20-25, 25-30 and 30-35.

(*b*) Class 35-40 has the maximum frequency.

**4.**

| Marks | Tally marks | Number of students |
|---|---|---|
| 4-8 | \|\|\| | 3 |
| 8-12 | 卌 卌 | 10 |
| 12-16 | 卌 卌 卌 \| | 16 |
| 16-20 | 卌 \|\|\|\| | 9 |
| 20-24 | \|\| | 2 |
| | **Total** | **40** |

**5.**

| Time taken (in minutes) | Tally marks | Number of candidates |
|---|---|---|
| 25-30 | 卌 \|\| | 7 |
| 30-35 | 卌 \|\|\|\| | 9 |
| 35-40 | 卌 \| | 6 |
| 40-45 | 卌 卌 卌 | 15 |
| 45-50 | 卌 \|\|\| | 8 |
| | **Total** | **45** |

(*a*) Class 40-45 has the highest frequency.

(*b*) The class having the least frequency is 35-40 i.e., 6.

∴ The class mark of the class interval 35-40

$$= \frac{35+40}{2} = 37.5$$

(*c*) The number of candidates completed the test in less than 40 minutes = 7 + 9 + 6 = 22 candidates.

(*d*) The number of candidates who took 35 minutes or more to complete the test = 6 + 15 + 8 = 29 candidates.

**6.** Class size is the difference between any two consecutive class marks.

(*a*) Class size = 35 – 25 = 45 – 35 = 55 – 45 = 65 – 55 = 10.

Lower limit = Class mark – Half of class size

$$\text{Lower limit} = 25 - \frac{10}{2} = 25 - 5 = 20$$

Upper limit = Class mark + Half of class size

$$\text{Upper limit} = 25 + \frac{10}{2} = 25 + 5 = 30$$

So, the first interval is 20-30.

The second interval is

$$\left(35-\frac{10}{2}\right)-\left(35+\frac{10}{2}\right) = 30\text{-}40$$

The third interval is

$$\left(45-\frac{10}{2}\right)-\left(45+\frac{10}{2}\right) = 40\text{-}50$$

The fourth interval is

$$\left(55-\frac{10}{2}\right)-\left(55+\frac{10}{2}\right) = 50\text{-}60$$

The fifth interval is

$$\left(65-\frac{10}{2}\right)-\left(65+\frac{10}{2}\right) = 60\text{-}70$$

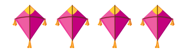
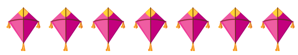
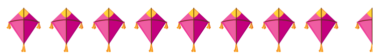
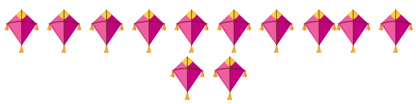
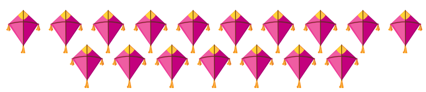
(*b*) Same as part (*a*).

## Quick Check (Page 97)

1. The least number of watches sold is 200 and seller C sold them.
2. The highest number of watches sold = 700
   The lowest number of watches sold = 200
   Their difference = 700 – 200 = 500
3. Seller D sold more than 500 watches.
4. Total number of watches sold by all the sellers = 400 + 500 + 200 + 700 + 300 = 2100 watches.

## Practice Time 4B

**1.**

| Shopkeeper | Number of kites sold |
|---|---|
| Raman |  |
| Rukaiya |  |
| Afsana |  |
| Dori Lal |  |
| Neeta |  |

Key: 1  = 50 kites and  = 25 kites

(*a*) If one kite symbol = 100, then eight and half symbols represent the kites purchased by Neeta.

(*b*) Since, Neeta purchased 850 kites and Dori Lal purchased 600 kites. So Neeta purchased more kites than Dori Lal.

(*c*) Raman purchased 200 kites and Neeta purchased 850 kites.
The given statement is incorrect.
Neeta purchased $4\frac{1}{4}$ times more kites than Raman.

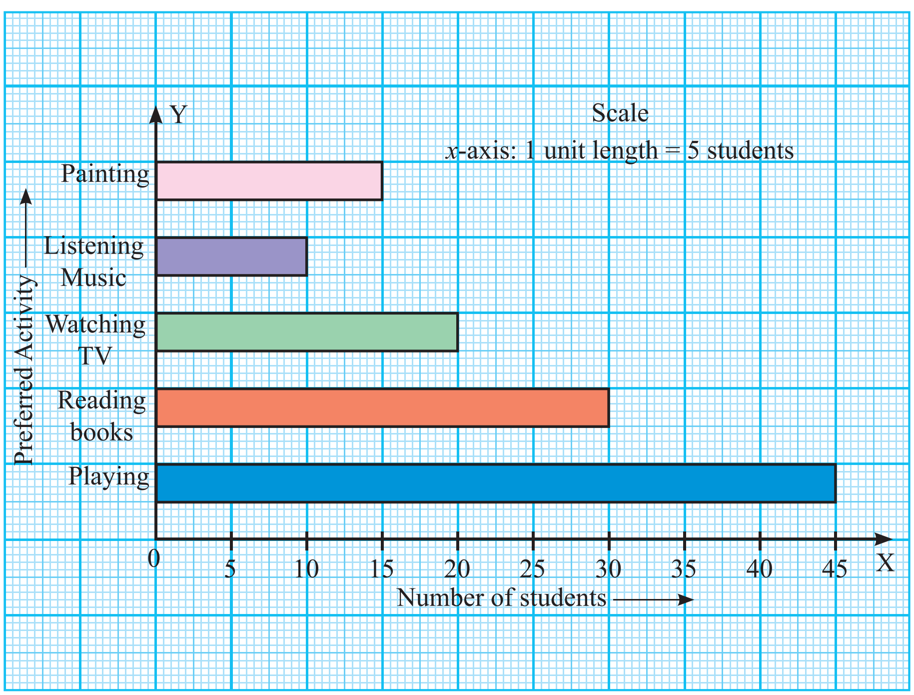
**2.** (*a*) The given bar graph shows the number of refrigerators manufactured from 2020-2024.

(*b*) In 2024, the minimum refrigerators manufactured.

(*c*) In year 2022, the maximum number of refrigerators i.e., 2000 manufactured.

(*d*) In 2022, the number of refrigerators manufactured = 2000.
In 2023, the number of refrigerators manufacturer = 1800
∴ 200 fewer refrigerators were manufactured in 2023 than in 2022.

**3.**



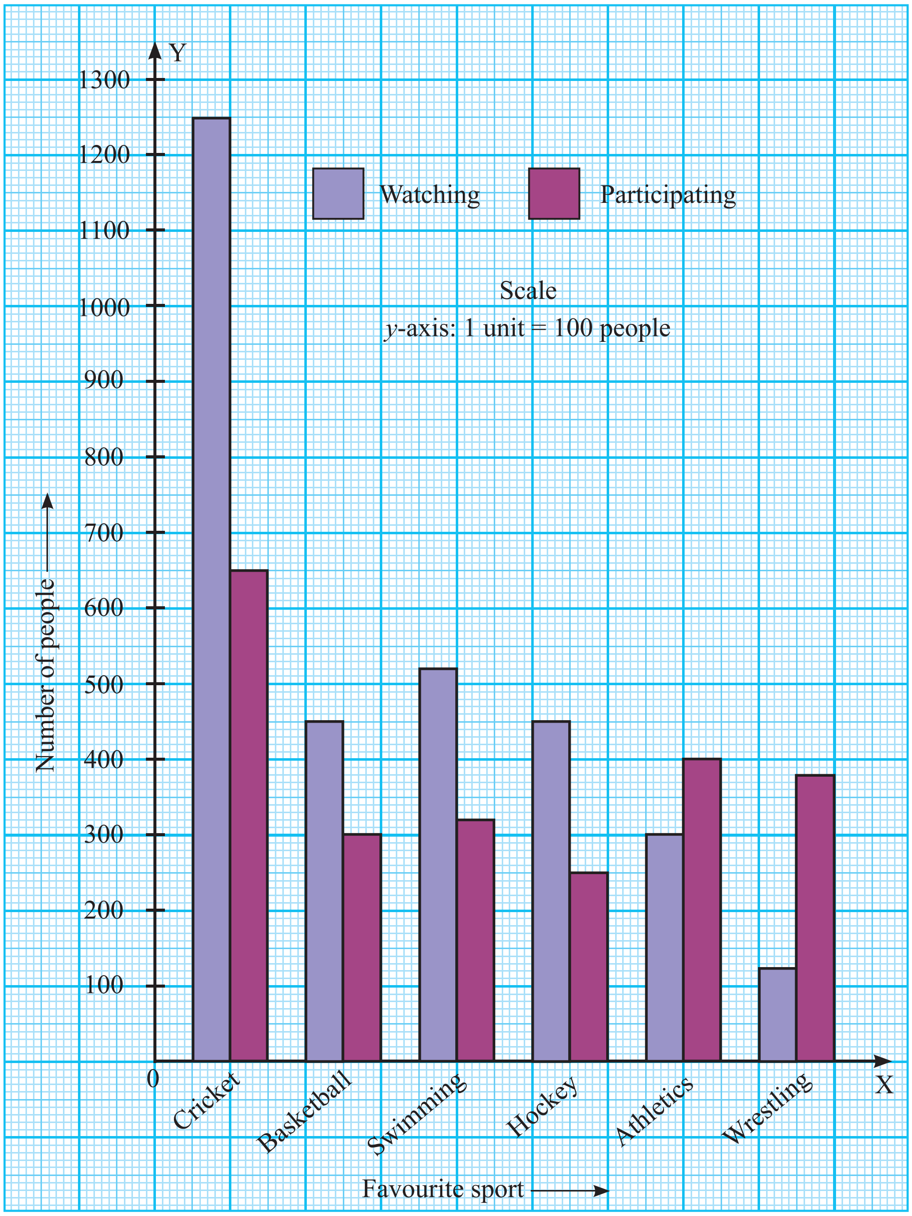

The activity which is preferred by most of the students other than Playing is Reading books.

**4.** (*a*) The given bar graph shown the marks obtained by Aziz in different subjects in half yearly examination.

(*b*) In Hindi, Aziz scored maximum marks.

(*c*) In Social science, Aziz scored minimum marks.

**5.** (*a*)




From the data, we can conclude that people prefer to watch more in Cricket, Basketball, Swimming and Hockey, and prefer to participate more in Athletics and Wrestling.

(*b*) Cricket is the most popular.

(*c*) Watching is more preferred in the sports.

**6.** (*a*) ₹15,000 was spent on food in the year 2023.

(*b*) In 2024, the rent was ₹27,500 and in 2023 the rent was ₹20,000.

∴ Difference = ₹(27,500 – 20,000) = ₹7500

A.T.Q., $\frac{7500}{20000} \times 100 = 37.5\%$

Thus, 37.5% rent was increased in 2024 than in 2023.

(*c*) Money spent on education in 2024 = ₹15,000

Money spent on education in 2023 = ₹10,000

∴ ₹(15,000 – 10,000) = ₹5000 more money is spent on education in 2024.

(*d*) In 2023 money spent on clothing is ₹12,500 and in 2024 money spent on clothing is ₹10,000.

∴ In clothing, family saved money

= ₹12500 – 10000

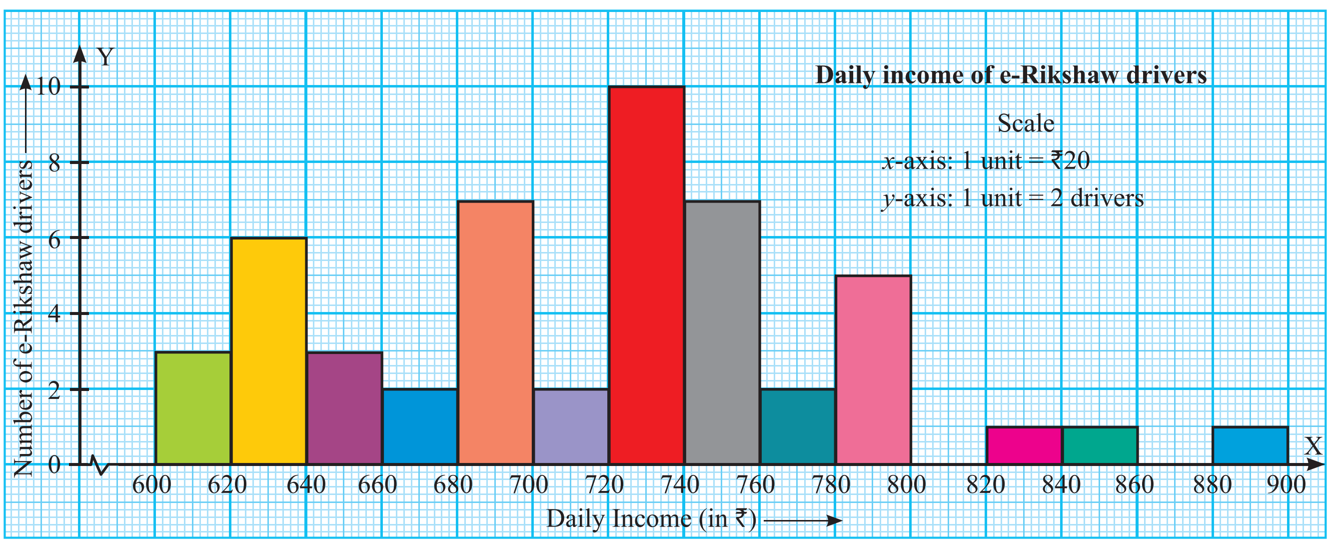
= ₹2500

## Maths Connect (Page 103)

1.

| Daily income (in ₹) | Tally marks | Number of e-Rikshaw drivers |
|---|---|---|
| 600-620 | \|\|\| | 3 |
| 620-640 | ~~\|\|\|\|~~ \| | 6 |
| 640-660 | \|\|\| | 3 |
| 660-680 | \|\| | 2 |
| 680-700 | ~~\|\|\|\|~~ \|\| | 7 |
| 700-720 | \|\| | 2 |
| 720-740 | ~~\|\|\|\|~~ ~~\|\|\|\|~~ | 10 |
| 740-760 | ~~\|\|\|\|~~ \|\| | 7 |
| 760-780 | \|\| | 2 |
| 780-800 | ~~\|\|\|\|~~ | 5 |
| 800-820 | | 0 |
| 820-840 | \| | 1 |
| 840-860 | \| | 1 |
| 860-880 | | 0 |
| 880-900 | \| | 1 |
| | **Total** | **50** |

2.




3. The income group 720-740 has the maximum number of drivers i.e., 10.
4. Number of drivers earn ₹740 and more = 7 + 2 + 5 + 1 + 1 + 1 = 17.

## Practice Time 4C

1. (*a*) The total number of people surveyed is 8 + 14 + 5 + 6 + 2 = **35**.
   (*b*) The total number of people owning 60 or more books is 6 + 2 = **8**.
   (*c*) The number of people owning books less than 40 is 8 + 14 = **22**.
   (*d*) The are **14** people having books in the range 20-40.

**2.** We can tabulate the frequency distribution from the given histogram as shown below:

| Temperature (in °C) | Number of days |
|---|---|
| 0-5 | 4 |
| 5-10 | 8 |
| 10-15 | 8 |
| 15-20 | 10 |

**3.** (*a*) The information depicted in the given histogram is number of teachers in different age groups.

(*b*) Number of teachers in the youngest age group (20-25) in the school is 4.

(*c*) In age group 20-25 and 45-50, the number of teachers is the least.

(*d*) In age group 35-40, the number of teachers is maximum.

(*e*) Class size of class interval is 25-20 = 30-25 = 35 – 30 = ....... = 5.

(*f*) Class mark of first class interval

$$= \frac{25+20}{2} = 22.5$$

Class mark of second class interval

$$= \frac{30+25}{2} = 27.5$$

Class mark of third class interval

$$= \frac{35+30}{2} = 32.5$$

(*g*) Number of teachers below 40 years of age

= 4 + 8 + 6 + 14 = 32.

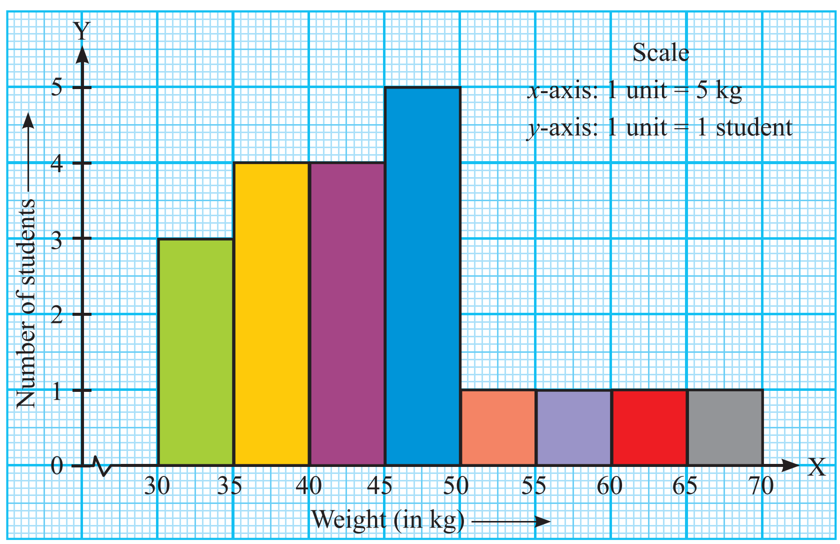
**4.** (*a*) Number of students got 50 or more but less than 60 marks = 12.

(*b*) In group 50-60, the maximum number of students fall.

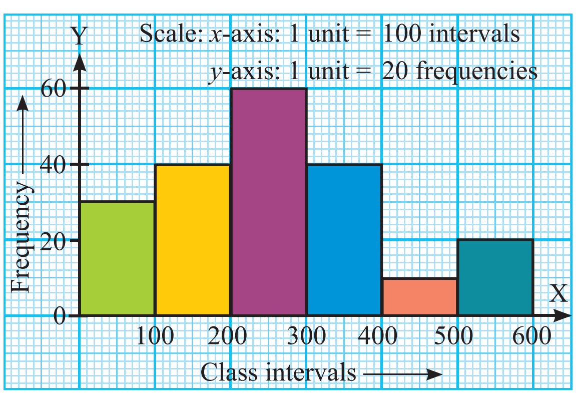
(*c*) Number of students scored 40 or more than 40 marks = 10 + 12 + 4 = 26.

**5.**

| Weights (in kg) | Number of students |
|---|---|
| 30-35 | 3 |
| 35-40 | 4 |
| 40-45 | 4 |
| 45-50 | 5 |
| 50-55 | 1 |
| 55-60 | 1 |
| 60-65 | 1 |
| 65-70 | 1 |
| Total | **20** |




**6.** (*a*)




(*b*) Similar as part (*a*).

(*c*) Similar as part (*a*).

## Think and Answer (Page 108)

Client's monthly salary = ₹80,000

On rent and food he spends $= \frac{30}{100} \times 80,000$

= ₹24,000

On saving he spends $= \frac{1}{5} \times 80,000$ = ₹16,000

On loan EMI's he spends $= \frac{90}{360} \times 80,000$

= ₹20,000

On utilities he spends $= \frac{10}{100} \times 80,000 = ₹8,000$

On phone and internet he spends

$$= \frac{1}{20} \times 80,000 = ₹4,000$$

On clothing he spends $= \frac{5}{100} \times 80,000 = ₹4,000$

On entertainment he spends

$$= \frac{18}{360} \times 80,000 = ₹4,000$$

## Practice Time 4D

**1.** Total number of ice creams $= 192 + 228 + 180$
$= 600$

Now, $\frac{38}{100} \times 600 = 228.$

So, chocolate ice-cream appears in sector having 38%.

Similarly, $\frac{30}{100} \times 600 = 180.$

So, butterscotch ice-cream appears in sector having 30%.

Also, $\frac{32}{100} \times 600 = 192.$

So, vanilla ice-cream appears in sector having 32%.

**2.** (*a*) Maximum angle in pie chart = 144°.

$\therefore$ Cold drinks is liked by the maximum number of people.

(*b*) Given 45 people like tea.

$$\therefore \quad \frac{54}{360} \times x = 45$$

('$x$' be total number of people surveyed)

$$\Rightarrow \quad x = \frac{45 \times 360}{54} = 300$$

$\therefore$ 300 people were surveyed.

**3.** (*a*) Money spent on roads

$$= \frac{10}{100} \times 1000 \text{ crores} = 100 \text{ crores.}$$

(*b*) Amount of money spent on education

$$= \frac{25}{100} \times 1000 \text{ crores} = 250 \text{ crores}$$

Amount of money spent on roads = 100 crores

$\therefore$ Amount spent on education is 2.5 times more as compared to amount spent on roads.

(*c*) Expenditure spent on roads $= \frac{10}{100} = \frac{1}{10}$

Expenditure spent on public welfare

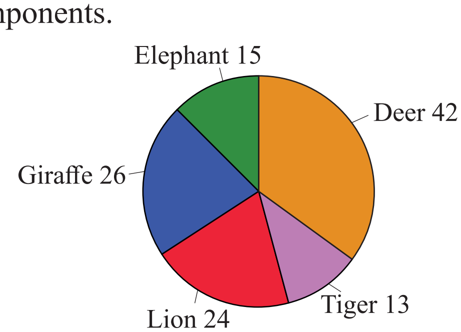
$$= \frac{20}{100} = \frac{2}{10}$$

$\therefore$ Total expenditure on both road and public welfare together $= \frac{1}{10} + \frac{2}{10} = \frac{3}{10}.$

**4.** We first calculate the central angle for each component as shown below.

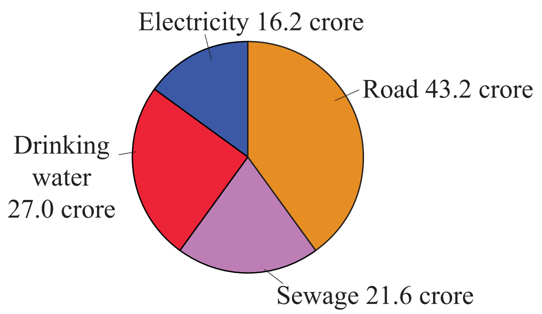
| Kind of animal | Number of animals | Central angle |
|---|---|---|
| Deer | 42 | $\frac{42}{120} \times 360° = 126°$ |
| Elephant | 15 | $\frac{15}{120} \times 360° = 45°$ |
| Giraffe | 26 | $\frac{26}{120} \times 360° = 78°$ |
| Lion | 24 | $\frac{24}{120} \times 360° = 72°$ |
| Tiger | 13 | $\frac{13}{120} \times 360° = 39°$ |
| **Total** | **120** | **360°** |

Now, draw a circle of any radius and divide it into sectors according to the central angle of all components.



**5.**

| Item head | Amount (in crore ₹) | Central angle |
|---|---|---|
| Road | 43.2 | $\frac{43.2}{108} \times 360° = 144°$ |
| Electricity | 16.2 | $\frac{16.2}{108} \times 360° = 54°$ |
| Drinking water | 27.0 | $\frac{27}{108} \times 360° = 90°$ |
| Sewage | 21.6 | $\frac{21.6}{108} \times 360° = 72°$ |
| **Total** | **108** | **360°** |




**6.** Same as Question 5.

## Quick Check (Page 110)

| Certain to happen | Impossible to happen | May or may not happen |
|---|---|---|
| (*a*) Getting the sum of angles of a triangle as 180° is certain to happen.<br>(*c*) Sun setting in the evening. | (*d*) Getting 7 when a die is thrown is impossible since there are only 6 possible outcomes on throwing a die.<br>(*e*) Sun rising from the west is impossible as sun rises from the east. | (*b*) India winning a cricket match because result of the match is unpredictable.<br>(*f*) Winning a racing competition by you as winning a competition is unpredictable. |

## Think and Answer (Page 113)

When three coins are tossed together, the possible outcomes are HHH, HHT, HTH, THH, HTT, THT, TTH, TTT.

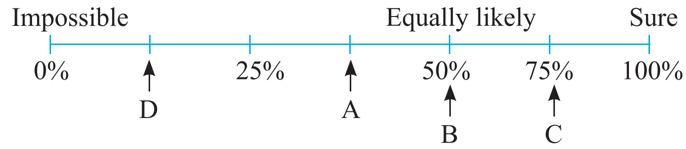
Probability of A: getting exactly two tails = $\frac{3}{8}$

Probability of B: getting at least two tails

$= \frac{4}{8} = \frac{1}{2}$

Probability of C: getting at least one head and one tail $= \frac{6}{8} = \frac{3}{4}$

Probability of D: not getting a tail $= \frac{1}{8}$




## Practice Time 4E

**1.** When we roll a die once, no. of possible outcomes, S = {1, 2, 3, 4, 5, 6}.

∴ Total outcomes, $n(s) = 6$.

(*a*) Odd numbers = 1, 3, 5. Thus $n(\text{E}) = 3$

∴ P(getting an odd number) $= \frac{3}{6} = \frac{1}{2}$.

(*b*) Multiple of 3 = 3, 6. Thus $n(\text{E}) = 2$.

∴ P(getting a multiple of 3) $= \frac{2}{6} = \frac{1}{3}$

**2.** Here $n(\text{S}) = 200$

Let E denotes the event of getting heads and F denotes the event of getting tails.

∴ $n(\text{E}) = 105$, $n(\text{F}) = 95$.

(*a*) ∴ P(getting heads) i.e.,

$$\text{P(E)} = \frac{n(\text{E})}{n(\text{S})} = \frac{105}{200} = \frac{21}{40}$$

(*b*) ∴ P(getting tails) i.e.,

$$\text{P(F)} = \frac{n(\text{F})}{n(\text{S})} = \frac{95}{200} = \frac{19}{40}$$

**3.** Total number of outcomes = 52 i.e., $n(\text{S}) = 52$.

(*a*) Let E be the event of getting an ace.

So, $n(\text{E}) = 4$

∴ P(getting an ace) $= \frac{n(\text{E})}{n(\text{S})} = \frac{4}{52} = \frac{1}{13}$.

(*b*) Let F be the event of getting a red card.

So, $n(\text{F}) = 26$.

∴ P(getting a red card) $= \frac{26}{52} = \frac{1}{2}$

(*c*) Let G be the event of getting a number card.
So, $n(G) = 36$

$\therefore$ P(getting a number card) = $\frac{36}{52} = \frac{9}{13}$.

**4.** Total number of cards = 4 + 3 +7 = 14

(*a*) P(getting a red card) = $\frac{7}{14} = \frac{1}{2}$

(*b*) P(getting a black or a white card)

$= \frac{4}{14} + \frac{3}{14} = \frac{4+3}{14} = \frac{7}{14} = \frac{1}{2}$

(*c*) P(getting not a white card)

= 1– P(getting a white card)

$= 1 - \frac{3}{14} = \frac{11}{14}$

**5.** Total number of cards = 25

(*a*) P(getting an even number) = $\frac{12}{25}$

[$\because$ Even number = 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24]

(*b*) P(getting a prime number) = $\frac{9}{25}$

[$\because$ Prime number = 2, 3, 5, 7, 11, 13, 17, 19, 23]

(*c*) P(getting a composite number) = $\frac{15}{25} = \frac{3}{5}$

[$\because$ Composite number = 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25]

(*d*) P(getting a one-digit number) = $\frac{9}{25}$

[$\because$ 1-digit number = 1, 2, 3, 4, 5, 6, 7, 8, 9]

(*e*) P(getting a number greater than 16] = $\frac{9}{25}$

(*f*) P(getting a number less than 12) = $\frac{11}{25}$

**6.** Total number i.e., $n(S) = 20$.
Let E be the event that the numbers are factors of 18. So, $n(E) = 1, 2, 3, 6, 9, 18 = 6$.

$\therefore$ P(number selected from 1, 2, ..., 20 is a factor of 18) = $\frac{6}{20} = \frac{3}{10}$.

**7.** Given word is 'MATHEMATICS'.
So, total number of letters is 11 i.e., $n(S) = 11$.
Number of consonants is 7.

$\therefore$ P(getting a consonant) = $\frac{7}{11}$.

**8.** Total number of electric bulbs is 100 i.e., $n(S) =$ 100.
Number of defective bulbs = 8
Number of non-defective bulbs = 100 – 8 = 92

(*a*) P(getting a defective bulb) = $\frac{8}{100} = \frac{2}{25}$.

(*b*) P(getting a non-defective bulb) = $\frac{92}{100} = \frac{23}{25}$.

## Mental Maths (Page 115)

**1.** (*a*) 9 students got full marks.

(*b*) Number of students who got less than 8 marks
= 5 + 10 + 8 = 23

(*c*) Maximum number of students is 12 and they get 9 marks.

**2.** Frequency of an observation is defined as the number of times the observation occurs in an experiment.

**3.** Given, probability of choosing a white ball = $\frac{4}{9}$.

$\therefore$ Probability of choosing a yellow ball = $1 - \frac{4}{9} = \frac{5}{9}$.

Now, number of yellow balls = $\frac{5}{9} \times 36 = 20$

[$\because$ Total number of balls = 36]

**4.** Histogram leaves no gap between bars.

**5.** Class size is the difference of the upper and lower limit of a class interval and the class mark is the average of the upper and lower limit of a class interval.

**6.** The probability of an impossible event is 0 since the impossible events are events that does not exist.

## Brain Sizzlers (Page 115)

Total girls = 30 + 35 + 20 + 25 + 40 = 150.

**1.** Percentage of total girls in section VIII A

$= \left(\frac{\text{Number of girls in section VIII A}}{\text{Total girls}}\right) \times 100$

$= \frac{30}{150} \times 100 = 20\%$.

**2.** Central angle for VIII E

$= \left(\frac{\text{Number of girls in section VIII E}}{\text{Total girls}}\right) \times 360°$

$= \frac{40}{150} \times 360 = 96°$.

**3.** In class VIII C, total number of girls is 20 which is less as compared to other sections. Thus in section VIII C, a girl has the greatest chance to be the monitor. So, the probability of a girl for the position of monitor $= \frac{1}{20}$ in section VIII C.

**4.** For equal number of girls in each section

$= \frac{\text{Total girls}}{\text{Number of sections}} = \frac{150}{5} = 30.$

In section VIII A, 30 girls will remain same.

In section VIII B, reduce 5 girls (35 – 5) = 30 girls.

In section VIII C, add 10 girls (20 + 10) = 30 girls.

In section VIII D, add 5 girls (25 + 5) = 30 girls.

In section VIII E, reduce 10 girls (40 – 10) = 30 girls.

∴ Move 5 girls from section VIII B to VIII D and move 10 girls from section VIII E to VIII C.

## Chapter Assessment

**A.**

**1.** (*a*) The given data is 30, 61, 55, 56, 60, 20, 16, 46, 28, 56.

∴ Range = 61 – 16 = 45.

**2.** (*d*) A pie chart is a circular graph divided into slices to show numerical portions. Each slice represents a part of the whole.

**3.** (*d*) Tossing a coin: The outcome (head or tail) is uncertain.

Rolling a dice: The outcome (1, 2, 3, 4, 5 or 6) is uncertain.

Choosing a card from a deck of 52 cards: The specific card drawn is uncertain.

Throwing a stone from the roof a building: The output is it will fall down on the ground so it is not a random experiment.

**4** (*d*) Spinner (*iv*) should be used to make the game fair as the area occupied by each colour is equal in this spinner.

**5** (*a*) The classes are 0-10, 10-20, 20-30, 30-40, 40-50, ... .

The class mark for the fifth class

$= \frac{40+50}{2} = \frac{90}{2} = 45.$

**6** (*c*) Amount spend on food and house rent

$= \frac{75°}{360°} \times 30,000 = ₹6250.$

**7** (*c*) Since 40% of the buyers are interested in buying a particular brand of toothpaste.

∴ Central angle $= \frac{40}{100} \times 360° = 144°$

**8** (*b*) A die only has numbers 1, 2, 3, 4, 5 and 6.

∴ Probability of getting number 7 = 0

**B.**

**1.** (*d*) **Assertion:** A die has numbers 1, 2, 3, 4, 5, 6.

∴ $n(S) = 6$

and let E be the event of getting an even number.

∴ $n(E) = 3$

Thus, probability of getting an even number

$= \frac{3}{6} = \frac{1}{2}$.

Assertion is false.

**Reason:** The occurrence of an even or odd number on throwing a die is a sure event, which is true.

**2.** (*c*) **Assertion:** If a person saves 20% of his income, then he spends 80% of his income on expenses.

Central angle for 80% of his expenses = $\frac{80}{100} \times 360° = 288°$, which is true.

**Reason:** The central angle of a sector in a pie chart can be more than 180°.

**3.** (*d*) **Assertion:** In the class intervals 10-20, 20-30, ... etc., 20 lies in the class interval 20-30.

So, assertion is false.

**Reason:** When the number of observations is large, the observations usually organised in groups (classes) of equal width. So, reason is true.

4. (*a*) **Assertion:** The temperature 4°C appears three times in the given data, making it the most frequent temperature. So, assertion is true.
**Reason:** The number of times a particular observation occurs in a given data is called its frequency. So reason is also true and it is the correct explanation of assertion.

**C.**

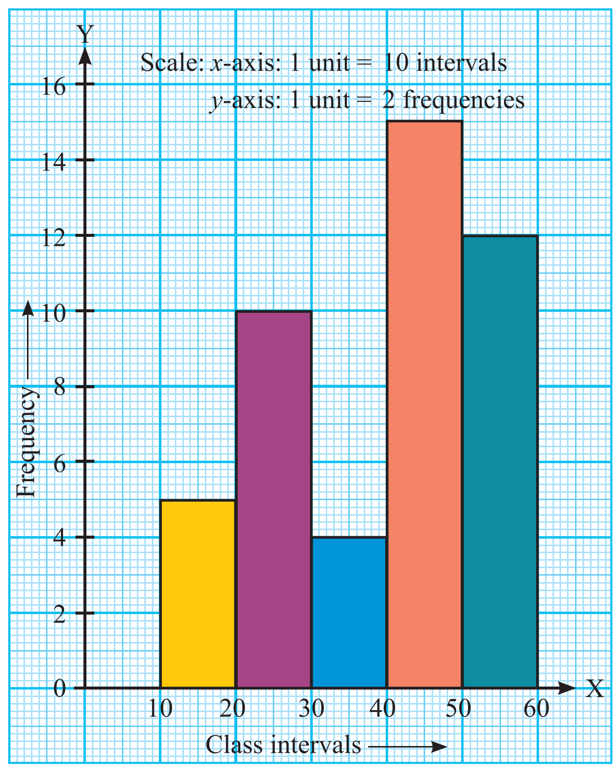
1. Ratio of proteins in the muscles to that of proteins in bones $= \dfrac{\frac{1}{3}}{\frac{1}{6}} = \dfrac{1}{3} \times \dfrac{6}{1} = 2:1.$
2. Central angle of skin and bones together
$$= \frac{360°}{10} + \frac{360°}{6} = 36° + 60° = 96°.$$
3. The central angle of 144° corresponds to hormones, enzymes and other proteins.
Hormones, enzymes and proteins $= \dfrac{144°}{360°} = \dfrac{2}{5}$
4. Amount of protein in man's body
$$= \frac{15}{100} \times 60 = 9 \text{ kg}$$
Amount of protein in man's skin
$$= \frac{1}{10} \times 9 \text{ kg} = \frac{9000 \text{ g}}{10} = 900 \text{ g}$$
5. Sarita has 4.5 kg protein in her muscles.
$\therefore$ Protein in her bones $= \dfrac{4.5 \times 3}{6} = 2.25$ kg.

**D.**

1. Pythagoras theorem is not a random experiment because the outcome is already known. So, the given statement is false.
2. In a throw of dice the possible outcomes are 1, 2, 3, 4, 5, 6. So, $n(S) = 6$.
Now, probability of getting a prime number
$= \dfrac{3}{6} = \dfrac{1}{2}$ [$\because$ Prime Numbers = 2, 3, 5]
Probability of getting a composite number
$= \dfrac{2}{6} = \dfrac{1}{3}$ [$\because$ Composite number = 4, 6]
So, probability of a prime number is not same as probability of a composite number. So, the given statement is false.
3. Central angle for a component
$$= \frac{\text{Value of the component}}{\text{Total value}} \times 360°,$$
which is true.
4. Class mark is the average of lower limit and upper limit of a class in a frequency distribution. So, the given statement is false.
5. The data arranged in ascending/descending order is called arrayed data. So, the given statement is false.

**E.**

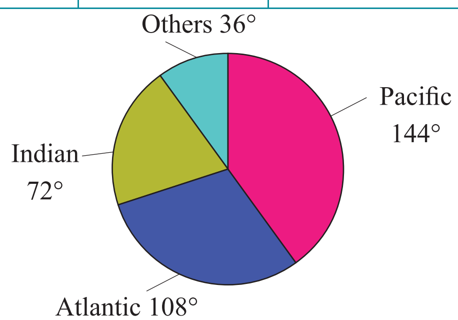
1. (*a*) The lower limit of the second class interval i.e., 20-30 is 20.
(*b*) The upper limit of the last class interval i.e., 50-60 is 60.
(*c*) The frequency of the third data i.e., 30-40 is 4.
(*d*) Interval 20-30 has a frequency of 10.
(*e*) Interval 30-40 has the lowest frequency.




2. (*a*) Number of students having height more than or equal to 135 cm but less than 150 cm
= 10 + 10 + 12 = 32.
(*b*) Class interval 130-135 has the least number of students.
(*c*) Class size = upper limit – lower limit
= 130 – 125 = 5.
(*d*) Number of students having height less than 140 cm = 6 + 3 + 10 = 19.

**3.**

| Oceans | Percentage of water | Central Angle |
|---|---|---|
| Pacific | 40% | $\frac{40}{100} \times 360° = 144°$ |
| Atlantic | 30% | $\frac{30}{100} \times 360° = 108°$ |
| Indian | 20% | $\frac{20}{100} \times 360° = 72°$ |
| Others | 10% | $\frac{10}{100} \times 360° = 36°$ |




**4.** (*a*) Let E be the event of getting an odd number.
So, $n$(E) = 5 [$\because$ Odd numbers = 1, 3, 5, 7, 9]

$\therefore$ P(of getting an odd number) = $\frac{5}{10} = \frac{1}{2}$.

(*b*) P(getting a Y card) = $\frac{3}{10}$.

(*c*) P(getting a G card) = $\frac{2}{10} = \frac{1}{5}$.

(*d*) P(B card bearing number > 7) = 0.

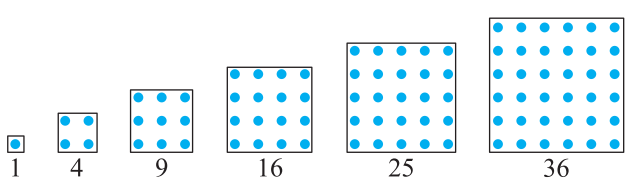
## Maths Connect (Page 119)

Do it yourself.

# CHAPTER 5 : SQUARES AND SQUARE ROOTS

## Let's Recall

**1.**




**2.** Area of a square = (side)$^2$

(*a*) Area of square with side 3 cm $= (3 \text{ cm})^2 = 9 \text{ cm}^2$

(*b*) Area of square with side 11 m $= (11 \text{ m})^2 = 121 \text{ m}^2$

(*c*) Area of square with side 8 mm $= (8 \text{ m})^2 = 64 \text{ mm}^2$

(*d*) Area of square with side 100 m $= (100 \text{ m})^2 = 10000 \text{ m}^2$

**3.** (*a*) $(100 + 5)^2 = (100 + 5)(100 + 5)$

$= 10000 + 500 + 500 + 25 = 11025$

(*b*) $(121)^2 = 121 \times 121 = 14641$

**4.** The next two rows are:

$66666^2 = 4444355556$

$666666^2 = 444443555556$

## Quick Check (Page 124)

**1.** Perfect square numbers between 20 and 50:
$5^2 = 25,\ 6^2 = 36,\ 7^2 = 49.$
So, the perfect squares are 25, 36, 49.

**2.** Perfect square numbers between 70 and 100:
$9^2 = 81.$
So, the perfect square is 81.

## Practice Time 5A

**1.** (*a*) Resolving into prime factors, we find that

$243 = \underbrace{3 \times 3} \times \underbrace{3 \times 3} \times 3 = 3^2 \times 3^2 \times 3$

| | |
|---|---|
| 3 | 243 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

Grouping the prime factors into pairs of equal factors, we find that 3 is left unpaired.

So, 243 is not a perfect square.

(*b*) Resolving into prime factors, we find that

$729 = \underbrace{3 \times 3} \times \underbrace{3 \times 3} \times \underbrace{3 \times 3} = 3^2 \times 3^2 \times 3^3$

Since the prime factors can be grouped into pairs of equal factors, so 729 is a perfect square.

(*c*) Same as part (*a*)

(*d*) Resolving into prime factors, we find that

$5625 = \underbrace{5 \times 5} \times \underbrace{5 \times 5} \times \underbrace{3 \times 3}$

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

| | |
|---|---|
| 5 | 5625 |
| 5 | 1125 |
| 5 | 225 |
| 5 | 45 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

Since 5625 can be grouped into pairs of equal factors, so 5625 is a perfect square.

**2.** (*a*) Resolving into prime factors, we find that

$1444 = \underbrace{2 \times 2} \times \underbrace{19 \times 19} = 2^2 \times 19^2$

| | |
|---|---|
| 2 | 1444 |
| 2 | 722 |
| 19 | 361 |
| 19 | 19 |
| | 1 |

Thus, we find that prime factors of 1444 can be grouped into pairs and no factor is left unpaired. Therefore, 1444 is a perfect square.

Also, $1444 = 2^2 \times 19^2 = (2 \times 19)^2 = 38^2$.
So, the square of 38 is 1444.

(*b*) Same as part (*a*).

(*c*) Resolving into prime factors, we find that

$$2025 = \underbrace{3 \times 3} \times \underbrace{3 \times 3} \times \underbrace{5 \times 5}$$
$$= 3^2 \times 3^2 \times 5^2$$

Thus, we find that prime factors of 2025 can be grouped into pairs and no factor is left unpaired. Therefore, 2025 is a perfect square.
Also, $2025 = 3^2 \times 3^2 \times 5^2 = (3 \times 3 \times 5)^2 = (45)^2$.
So, 2025 is the square of 45.

(*d*) Similar as part (*c*).

**3.** Resolving into prime factors, we find that

$$5808 = \underbrace{2 \times 2} \times \underbrace{2 \times 2} \times 3 \times \underbrace{11 \times 11}$$
$$= 2^2 \times 2^2 \times 3 \times 11^2$$

| | |
|---|---|
| 2 | 5808 |
| 2 | 2904 |
| 2 | 1452 |
| 2 | 726 |
| 3 | 363 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

Grouping the prime factors into pairs of equal factors, we find that 3 is left unpaired.
So, to get a perfect square, 5808 should be multiplied by 3.

**4.** Resolving into prime factors, we find that

$$9800 = \underbrace{2 \times 2} \times 2 \times \underbrace{5 \times 5} \times \underbrace{7 \times 7}$$
$$= 2^2 \times 2 \times 5^2 \times 7^2$$

| | |
|---|---|
| 2 | 9800 |
| 2 | 4900 |
| 2 | 2450 |
| 5 | 1225 |
| 5 | 245 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

Grouping the prime factors into pairs of equal factors, we find that 2 is left unpaired.
So, to get a perfect square, 9800 should be divided by 2.

**5.** LCM of 2, 3, 6, 10 = 2 × 3 × 5 = 30

| | |
|---|---|
| 2 | 2,3,6,10 |
| 3 | 1,3,3, 5 |
| 5 | 1,1,1, 5 |
| | 1,1,1, 1 |

But 30 is not a perfect square as 2, 3 and 5 are not in pairs.
Thus, 30 must be multiplied by 2 × 3 × 5 = 30.
Hence, the smallest square number exactly divisible by 2, 3, 6 and 10 is 30 × 30 = 900.

**6.** Similar as question 5.

## Quick Check (Page 128)

(*a*) Ones digit of 24 is 4 and 4 × 4 = 16, so ones digit of $24^2$ would be 6.
Ones digit of 38 is 8 and 8 × 8 = 64, so ones digit of $38^2$ would be 4.
So, 24 and 38 does not have the same digit at the unit's place in their squares.

(*b*) Similar as part (*a*).

(*c*) Ones digit of 16 is 6 and 6 × 6 = 36, so ones digit of $16^2$ would be 6.
Ones digit of 24 is 4 and 4 × 4 = 16, so ones digit of $24^2$ would be 6.
So, 16 and 24 have the same digit at the unit's place in their squares.

(*d*) Similar as part (*a*).

## Quick Check (Page 133)

**1.** $58 = (50 + 8)^2 = (50 + 8) \times (50 + 8)$
$= 50(50 + 8) + 8(50 + 8)$
$= 50^2 + 50 \times 8 + 8 \times 50 + 8^2$
$= 2500 + 400 + 400 + 64 = 3364$

**2.** $73 = (70 + 3)^2 = (70 + 3) \times (70 + 3)$
$= 70(70 + 3) + 3(70 + 3)$
$= 70^2 + 70 \times 3 + 3 \times 70 + 3^2$
$= 4900 + 210 + 210 + 9 = 5329$

## Practice Time 5B

**1.** (*a*) Ones digit of 82 is 2, so ones digit of $82^2$ would be 4. ($\because$ 2 × 2 = 4)

(*b*) Ones digit of 93 is 3, so ones digit of $93^2$ would be 9. ($\because$ 3 × 3 = 9)

(*c*) Ones digit of 128 is 8, so ones digit of $128^2$ would be 4. ($\because$ 8 × 8 = 64)

(*d*) Ones digit of 179 is 9, so ones digit of $179^2$ would be 1. ($\because$ 9 × 9 = 81)

**2.** We know that a perfect square never ends with the digit 2, 3, 7 or 8. So, the numbers (*a*) 9057, (*b*) 33453, (*c*) 9928 and (*d*) 34532 are not perfect squares.

**3.** We know that the squares of even numbers are even, and squares of odd numbers are odd.
$\therefore$ Squares of 61 and 499 are odd.

**4.** (*a*) $35^2 = 3(3 + 1)$ hundreds + 25
= (3 × 4) hundreds + 25
= 1200 + 25 = 1225.

(*b*) $115^2 = 11(11 + 1)$ hundreds + 25
= (11 × 12) hundreds + 25
= 13200 + 25 = 13225.

(*c*) $26^2 = (20 + 6)^2 = (20 + 6) \times (20 + 6)$
$= 20\,(20 + 6) + 6\,(20 + 6)$
$= 20^2 + 20 \times 6 + 6 \times 20 + 6^2$
$= 400 + 120 + 120 + 36 = 676.$

(*d*) $92^2 = (90 + 2) \times (90 + 2)$
$= 90(90 + 2) + 2(90 + 2)$
$= 90^2 + 90 \times 2 + 2 \times 90 + 2^2$
$= 8100 + 180 + 180 + 4 = 8464.$

**5.** (*a*) Let $2m = 8 \Rightarrow m = 4$
$\therefore m^2 - 1 = 4^2 - 1 = 16 - 1 = 15$
and $m^2 + 1 = 4^2 + 1 = 16 + 1 = 17$
$\therefore$ The Pythagorean triplet is 8, 15 and 17.
(*b*) Similar as part (*a*).
(*c*) Let $2m = 18 \Rightarrow m = 9$
$\therefore m^2 - 1 = 9^2 - 1 = 81 - 1 = 80$
and $m^2 + 1 = 9^2 + 1 = 81 + 1 = 82$
$\therefore$ The Pythagorean triplet is 9, 80 and 82.

**6.** Here the number and its squares both are palindromic numbers.
Moreover, number of 1s in 101 is 2.
So, we write numbers up to 2 and then decrease.
$101^2 = 1\ \_\ 2\ \_\ 1$
Now, adding 1 zero between the digits
$101^2 = 1\ \underline{0}\ 2\ \underline{0}\ 1$
Therefore, $1010101^2 = 1020304030201$
and $101010101^2 = 10203040504030201$

**7.** (*a*) $1 + 3 + 5 + 7 + 9 + 11 = 6^2 = 36$
(*b*) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 = 11^2 = 121$
(*c*) $11 + 13 + 15 + 17 + ... + 29 + 31$
$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + ... + 29 + 31 - (1 + 3 + 5 + 7 + 9)$
$= 16^2 - 5^2 = 256 - 25 = 231$

**8.** $(\mathbf{6})^2 + 7^2 + 42^2 = \mathbf{43}^2$
$(\mathbf{7})^2 + 8^2 + 56^2 = (\mathbf{57})^2$
$(8)^2 + (\mathbf{9})^2 + 72^2 = (\mathbf{73})^2$

**9.** (*a*) 100 as the sum of first 10 odd natural numbers
$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19$
$= 100.$
(*b*) 225 as the sum of first 15 odd natural numbers
$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29 = 225.$

**10.** We know that the difference of the squares of two consecutive natural numbers is equal to their sum.
(*a*) $(48)^2 - (47)^2 = 48 + 47 = 95$
(*b*) $(25)^2 - (24)^2 = 25 + 24 = 49$
(*c*) $(92)^2 - (91)^2 = 92 + 91 = 183$
(*d*) $(142)^2 - (141)^2 = 142 + 141 = 283$
(*e*) $(180)^2 - (179)^2 = 180 + 179 = 359$
(*f*) $(256)^2 - (255)^2 = 256 + 255 = 511$

## Practice Time 5C

**1.** (*a*) Since, $5625 = \underbrace{5 \times 5} \times \underbrace{5 \times 5} \times \underbrace{3 \times 3}$

| | |
|---|---|
| 5 | 5625 |
| 5 | 1125 |
| 5 | 225 |
| 5 | 45 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

$\therefore \sqrt{5625} = 5 \times 5 \times 3$
$= 75$
(*b*) Similar as part (*a*).
(*c*) Since, $2601 = \underbrace{3 \times 3} \times \underbrace{17 \times 17}$

| | |
|---|---|
| 3 | 2601 |
| 3 | 867 |
| 17 | 289 |
| 17 | 17 |
| | 1 |

$\therefore \sqrt{2601} = 3 \times 17$
$= 51$
(*d*) Similar as part (*c*).

**2.** (*a*) Resolving 768 into prime factors, we have
$768 = 2^2 \times 2^2 \times 2^2 \times 2^2 \times 3$

| | |
|---|---|
| 2 | 768 |
| 2 | 384 |
| 2 | 192 |
| 2 | 96 |
| 2 | 48 |
| 2 | 24 |
| 2 | 12 |
| 2 | 6 |
| 3 | 3 |
| | 1 |

Since, a perfect square has pairs of equal factors, here 3 is left unparied. Hence, 768 should be multiplied by 3 to get a perfect square.
$\Rightarrow 768 \times 3 = 2304$
and $2304 = 2^2 \times 2^2 \times 2^2 \times 2^2 \times 3^2$
$= (2 \times 2 \times 2 \times 2 \times 3)^2$
$= 48^2$
Thus, $\sqrt{2304} = 48$
(*b*) Similar as part (*a*).
(*c*) Resolving 2028 into prime factors, we have
$2028 = 2^2 \times 13^2 \times 3$

| | |
|---|---|
| 2 | 2028 |
| 2 | 1014 |
| 13 | 507 |
| 13 | 39 |
| 3 | 3 |
| | 1 |

Since, a perfect square has pairs of equal factors, here 3 is left unpaired. Hence, 2028 should be multiplied by 3 to get a perfect square.
$\Rightarrow 2028 \times 3 = 6084$
and $6084 = 2^2 \times 13^2 \times 3^2 = (2 \times 3 \times 13)^2 = 78^2$
Thus, $\sqrt{6084} = 78$
(*d*) Similar as part (*a*).

**3.** (*a*) Here, $396 = 2 \times 2 \times 3 \times 3 \times 11$
$= 2^2 \times 3^2 \times 11$

| | |
|---|---|
| 2 | 396 |
| 2 | 198 |
| 3 | 99 |
| 3 | 33 |
| 11 | 11 |
| | 1 |

Since factor 11 does not exist in pair, so it is clearly not a perfect square. Here, 11 is the smallest number by which 396 be divided to make it a perfect square.
$\Rightarrow \frac{396}{11} = 36$
and $36 = 6 \times 6 = 6^2$
Thus, $\sqrt{36} = 6$
(*b*) Similar as part (*a*).

(*c*) Here, $6480 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5$

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

Since factor 5 does not exist in pair, so 6480 is clearly not a perfect square. Hence, 5 is the smallest number by which 6480 be divided to make it a perfect square.

| | |
|---|---|
| 2 | 6480 |
| 2 | 3240 |
| 2 | 1620 |
| 2 | 810 |
| 3 | 405 |
| 3 | 135 |
| 3 | 45 |
| 3 | 15 |
| 5 | 5 |
| | 1 |

$\Rightarrow \quad \frac{6480}{5} = 1296$

and $\quad 1296 = 36 \times 36 = 36^2$

Thus, $\sqrt{1296} = 36$

(*d*) Similar as part (*c*).

**4.** Area of a square field = 7056 sq. m

$= 2^2 \times 2^2 \times 21^2$

$= (2 \times 2 \times 21)^2$

$= 84^2$

| | |
|---|---|
| 2 | 7056 |
| 2 | 3528 |
| 2 | 1764 |
| 2 | 882 |
| 21 | 441 |
| 21 | 21 |
| | 1 |

∴ Side length of the square field

$= \sqrt{7056} = \sqrt{84^2} = 84$ m

## Quick Check (Page 139)

Greatest 4-digit number = 9999.

Since 9999 is not a perfect square, so we find a 4-digit number closest to it which is a perfect square. Clearly, 9999 is greater than $(99)^2$ by 198.

| | 99 |
|---|---|
| 9 | 99 99 |
| | –81 |
| 189 | 1899 |
| | –1701 |
| | 198 |

∴ By subtracting 198 from 9999, we get

9999 – 198 = 9801 which is a perfect square.

## Practice Time 5D

**1.** (*a*) We have, 9604 = 98 × 98

So, $\sqrt{9604} = 98$

| | 9 8 |
|---|---|
| 9 | 96 04 |
| | –81 |
| 188 | 1504 |
| | –1504 |
| | 0 |

(*b*) Similar as part (*a*).

(*c*) We have, 42849 = 207 × 207

So, $\sqrt{42849} = 207$

| | 2 0 7 |
|---|---|
| 2 | 4 28 49 |
| | –4 |
| 407 | 2849 |
| | –2849 |
| | 0 |

(*d*) Similar as part (*c*).

**2.** (*a*) First, we find the square root of 1750.

We see that the remainder is 69.

∴ By subtracting 69 from 1750, we get $1681 = 41^2$

Hence, the required number = 69.

| | 4 1 |
|---|---|
| 4 | 17 50 |
| | –16 |
| 81 | 150 |
| | –81 |
| | 69 |

Thus, 1750 – 69 = 1681 is a perfect square,

∴ $\sqrt{1681} = 41$.

(*b*) Similar as part (*a*).

(*c*) The remainder is 12. If 12 is subtracted from the given number, the remainder will be zero and the new number will be a perfect square.

| | 8 0 |
|---|---|
| 8 | 64 12 |
| | –64 |
| 160 | 12 |
| | –0 |
| | 12 |

∴ The required number = 12.

Thus, 6412 – 12 = 6400 is a perfect square,

∴ $\sqrt{6400} = 80$.

(*d*) The remainder is 75. If 75 is subtracted from the given number, the remainder will be zero and the new number will be a perfect square.

| | 625 |
|---|---|
| 6 | 39 07 00 |
| | –36 |
| 122 | 307 |
| | –244 |
| 1245 | 6300 |
| | –6225 |
| | 75 |

∴ The required number = 75.

Thus, 390700 – 75 = 390625, which is a perfect square.

∴ $\sqrt{390625} = 625$.

**3.** (*a*) We have, 402 lies between

$20^2 = 400$ and $21^2 = 441$

From the working shown alongside, we see that 402 is greater than $(20)^2$ but less than $(21)^2$.

| | 2 0 |
|---|---|
| 4 | 4 02 |
| | –4 |
| 40 | 02 |
| | –00 |
| | 2 |

Hence, the required smallest number to be added is 441 – 402 = 39 to make 402 a perfect square.

Now 402 + 39 = 441 and 441 is a perfect square.

∴ $\sqrt{441} = 21$.

(*b*) Similar as part (*a*).

(*c*) We have, 3250

From the working shown alongside, we see that 3250 is greater than $(57)^2$ but less than $(58)^2$.

| | 5 7 |
|---|---|
| 5 | 32 50 |
| | –25 |
| 107 | 750 |
| | –749 |
| | 1 |

Hence, the required least number to be added is ($58^2$ =) 3364 – 3250 = 114 to make 3250 a perfect square.

∴ 3250 + 114 = 3364 and 3364 is a perfect square, $\sqrt{3364} = 58$.

(*d*) Similar as part (*c*).

4. Here, $(316)^2 = 99856 < 100000 < (317)^2 = 100489$

Since 100000 is greater than $(316)^2$ but less than $(317)^2$.

Hence the required least number to be added is $(317)^2 - 100000 = 489$ to make 100000 a perfect square.

Now, 100000 + 489 = 100489 and 100489 is a perfect square.

| | |
|---|---|
| | 316 |
| 3 | $\overline{10}\,\overline{00}\,\overline{00}$ |
| | –9 |
| 61 | 100 |
| | –61 |
| 626 | 3900 |
| | –3756 |
| | 144 |

$\therefore \quad \sqrt{100489} = 317$

Greatest 6-digit number = 999999.

Since, 999999 is not a perfect square, so we find a 6-digit number closest to it which is a perfect square. Clearly, 999999 is greater than $(999)^2$ by 1998.

| | |
|---|---|
| | 9 9 9 |
| 9 | $\overline{99}\,\overline{99}\,\overline{99}$ |
| | –81 |
| 189 | 1899 |
| | –1701 |
| 1989 | 19899 |
| | –17901 |
| | 1998 |

$\therefore$ By subtracting 1998 from 999999, we get 999999 – 1998 = 998001, which is a perfect square.

5. Greatest five-digit number = 99999.

Since, 99999 is not a perfect square, so we find a 5-digit number closest to it which is a perfect square. Clearly, 99999 is greater than $(316)^2$ by 143.

| | |
|---|---|
| | 3 1 6 |
| 3 | $\overline{9}\,\overline{99}\,\overline{99}$ |
| | –9 |
| 61 | 99 |
| | –61 |
| 626 | 3899 |
| | –3756 |
| | 143 |

$\therefore$ By subtracting 143 from 99999, we get = 99999 – 143 = 99856, which is a perfect square.

$\therefore \quad \sqrt{99856} = 316.$

## Quick Check (Page 142)

1. $\sqrt{30} = 5.477 = 5.48$

| | |
|---|---|
| | 5.477 |
| 5 | $\overline{30}.\overline{00}\,\overline{00}\,\overline{00}$ |
| | –25 |
| 104 | 500 |
| | –416 |
| 1087 | 8400 |
| | –7609 |
| 10947 | 79100 |
| | –76629 |
| | 2471 |

2. We have,

$$\sqrt{4\frac{1}{2}} = \sqrt{\frac{9}{2}} = \frac{\sqrt{9}}{\sqrt{2}}$$

$$= \frac{3}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{2}}{2}$$

Now, $\sqrt{2} = 1.414$

| | |
|---|---|
| | 1. 4 1 4 |
| 1 | $\overline{2}.\overline{00}\,\overline{00}\,\overline{00}$ |
| | –1 |
| 24 | 100 |
| | –96 |
| 281 | 400 |
| | –281 |
| 2824 | 11900 |
| | –11296 |
| | 604 |

$$\therefore \quad \frac{3\sqrt{2}}{2} = \frac{3 \times 1.414}{2} = 2.121$$

## Practice Time 5E

1. (*a*) $\sqrt{\frac{36}{81}} = \frac{\sqrt{36}}{\sqrt{81}} = \frac{6}{9}$

(*b*) $\sqrt{\frac{225}{324}} = \frac{\sqrt{225}}{\sqrt{324}} = \frac{15}{18}$

(*c*) $\sqrt{14\frac{25}{36}} = \sqrt{\frac{529}{36}} = \frac{\sqrt{529}}{\sqrt{36}}$

$= \frac{23}{6} = 3\frac{5}{6}$

(*d*) $\sqrt{2\frac{1}{4}} = \sqrt{\frac{9}{4}} = \frac{\sqrt{9}}{\sqrt{4}}$

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

2. Since, $\sqrt{50625} = 225$

$\therefore \sqrt{506.25} + \sqrt{5.0625}$

$= \frac{\sqrt{50625}}{\sqrt{100}} + \frac{\sqrt{50625}}{10000}$

$= \frac{225}{10} + \frac{225}{100}$

$= 22.5 + 2.25 = 24.75.$

| | |
|---|---|
| | 2 2 5 |
| 2 | $\overline{5}\,\overline{06}\,\overline{25}$ |
| | –4 |
| 42 | 106 |
| | –84 |
| 445 | 2225 |
| | –2225 |
| | 0 |

3. (*a*)

| | |
|---|---|
| | 7 . 2 |
| 7 | $\overline{51}.\overline{84}$ |
| | –49 |
| 142 | 284 |
| | –284 |
| | 0 |

$\therefore \sqrt{51.84} = 7.2$

(*b*)

| | |
|---|---|
| | 0. 7 7 |
| 7 | $0.\overline{59}\,\overline{29}$ |
| | –49 |
| 147 | 1029 |
| | –1029 |
| | 0 |

$\therefore \sqrt{0.5929} = 0.77$

(*c*)

| | |
|---|---|
| | 1 8 . 2 |
| 1 | $\overline{3}\,\overline{31}.\overline{24}$ |
| | –1 |
| 28 | 231 |
| | –224 |
| 362 | 724 |
| | –724 |
| | 0 |

$\therefore \sqrt{331.24} = 18.2$

(*d*)

| | |
|---|---|
| | 0.025 |
| 2 | $0.\overline{00}\,\overline{06}\,\overline{25}$ |
| | –4 |
| 45 | 225 |
| | –225 |
| | 0 |

$\therefore \sqrt{0.000625} = 0.025$

**4.** (*a*) $\dfrac{\sqrt{59.29}-\sqrt{5.29}}{\sqrt{59.29}+\sqrt{5.29}}$

Now,

| | 7.7 |
|---|---|
| 7 | 59.29 |
| | –49 |
| 147 | 1029 |
| | –1029 |
| | 0 |

| | 2.3 |
|---|---|
| 2 | 5.29 |
| | –4 |
| 43 | 129 |
| | –129 |
| | 0 |

$\therefore \dfrac{\sqrt{59.29}-\sqrt{5.29}}{\sqrt{59.29}+\sqrt{5.29}} = \dfrac{7.7-2.3}{7.7+2.3} = \dfrac{5.4}{10} = 0.54.$

(*b*) Similar as part (*a*).

**5.** (*a*) $\sqrt{25.6\times 52.9} = \sqrt{\dfrac{256}{10}\times\dfrac{529}{10}}$

$= \dfrac{1}{10}\times\sqrt{256}\times\sqrt{529}$

$= \dfrac{1}{10}\times 16\times 23 = \dfrac{368}{10} = 36.8$

(*b*) $\sqrt{1024\times 1849} = \sqrt{1024}\times\sqrt{1849}$

$= 32 \times 43 = 1376$

**6.** $\therefore \sqrt{12.0068} = 3.465$

| | 3. 4 6 5 0 8 |
|---|---|
| 3 | 12.00 68 00 00 00 |
| | –9 |
| 64 | 300 |
| | –256 |
| 686 | 4468 |
| | –4116 |
| 6925 | 35200 |
| | –34625 |
| 693008 | 5750000 |
| | –5544064 |
| | 205936 |

**7.** (*a*) $10\times\sqrt{2} = 10\times 1.414 = 14.14$

(*b*) $7\times\sqrt{7} = 7\times 2.646 = 18.522$

(*c*) $\sqrt{81}\times\sqrt{5} = 9\times 2.236 = 20.124$

(*d*) $\dfrac{\sqrt{3}}{\sqrt{36}} = \dfrac{1.732}{6} = 0.2886 \simeq 0.289$

**8.** (*a*) $\sqrt{2.9} = 1.70$

| | 1. 7 0 2 |
|---|---|
| 1 | 2.90 00 00 |
| | –1 |
| 27 | 190 |
| | –189 |
| 3402 | 10000 |
| | –6804 |
| | 3196 |

## Mental Maths (Page 143)

**1.** The smallest perfect square greater than 100 is $11^2 = 121$.

The largest perfect square less than 1000 is $31^2 = 961$.

So, the perfect square between 100 and 1000 are $11^2, 12^2, 13^2, 14^2, ..., 31^2$.

$\therefore$ Total number of perfect squares between 100 and 1000 is 31 – 10 = 21.

**2.** The natural numbers lying between $12^2$ and $15^2$ i.e., 144 and 225 is (225 – 144) – 1 = 80.

**3.** Let $2m = 15 \Rightarrow m = \dfrac{15}{2}$, which is not a whole number.

So, let $m^2 - 1 = 15 \Rightarrow m^2 = 16 \Rightarrow m = 4$

$\therefore\quad 2m = 2\times 4 = 8$

and $m^2 + 1 = 4^2 + 1 = 16 + 1 = 17$

$\therefore$ The triplet is 8, 15, 17.

Other Pythagorean triplets with one member 15 are (9, 12, 15); (15, 20, 25) but we cannot find it using the above formula.

**4.** Given, $3p = \sqrt{12^2+9^2} = \sqrt{144+81} = \sqrt{225} = 15$

$\Rightarrow\quad 3p = 15 \Rightarrow p = 5$

$\therefore\quad \dfrac{p}{3} = \dfrac{5}{3}$

**5.** Given, area of a square $= 12\dfrac{1}{4}\text{ cm}^2 = \dfrac{49}{4}\text{ cm}^2$

Let *a* be the side of a square.

So, area of square $= a^2$ and perimeter of square $= 4\times$ side.

Now area of square $= \dfrac{49}{4} = \left(\dfrac{7}{2}\right)^2 = a^2$

$\therefore\quad a = \dfrac{7}{2}$ cm

Thus, perimeter of square $= 4\times\dfrac{7}{2}$ cm = 14 cm.

## Brain Sizzlers (Page 143)

**1.** $\sqrt{10+\sqrt{25+\sqrt{108+\sqrt{154+\sqrt{225}}}}}$

$= \sqrt{10+\sqrt{25+\sqrt{108+\sqrt{154+15}}}}$

$= \sqrt{10+\sqrt{25+\sqrt{108+\sqrt{169}}}}$

$= \sqrt{10+\sqrt{25+\sqrt{108+13}}}$

$= \sqrt{10+\sqrt{25+\sqrt{121}}} = \sqrt{10+\sqrt{25+11}}$

$= \sqrt{10+\sqrt{36}} = \sqrt{10+6} = \sqrt{16} = 4$

**2.** We have, $\sqrt{\dfrac{4+\sqrt{7}}{4-\sqrt{7}}} = \sqrt{\dfrac{4+\sqrt{7}}{4-\sqrt{7}} \times \dfrac{4+\sqrt{7}}{4+\sqrt{7}}}$

$$= \sqrt{\frac{(4+\sqrt{7})^2}{4^2-(\sqrt{7})^2}}$$

$$= \frac{\sqrt{(4+\sqrt{7})^2}}{\sqrt{16-7}}$$

$$= \frac{4+\sqrt{7}}{\sqrt{9}} = \frac{4+\sqrt{7}}{3} \qquad ...(i)$$

Now, we will find the square root of 7.

| | 2. 6 4 5 |
|---|---|
| 2 | $\overline{7}.\overline{00}\,\overline{00}\,\overline{00}$ |
| | –4 |
| 46 | 300 |
| | –276 |
| 524 | 2400 |
| | –2096 |
| 5285 | 30400 |
| | –26425 |
| | 3975 |

$\therefore\ \sqrt{7} = 2.645$

From $(i)$, $\sqrt{\dfrac{4+\sqrt{7}}{4-\sqrt{7}}} = \dfrac{4+\sqrt{7}}{3} = \dfrac{4+2.645}{3}$

$$= \frac{6.645}{3} = 2.22$$

## Chapter Assessment

**A.**

**1.** (*a*) We have, $\sqrt{4\times 25} = \sqrt{100} = \sqrt{10^2} = 10$

The square of $\sqrt{4\times 25}$ is $\left(\sqrt{4\times 25}\right)^2 = 10^2 =$ 100.

**2.** (*a*) $(2535)^2 - (2534)^2 = 2535 + 2534 = 5069$

$[\because (n+1)^2 - n^2 = \{(n+1)+n\}]$

**3.** (*a*) Difference of the squares 17 and 13

$= 17^2 - 13^2 = 289 - 169 = 120$

The smallest number which is added to 120, to make it a perfect square is 1.

i.e., $120 + 1 = 121 = 11^2$.

**4.** (*d*) Here $196 = 14^2$, $625 = 25^2$, $1225 = 35^2$

But 404 is not a perfect square.

**5.** (*c*) $\sqrt{\dfrac{1}{16}} + \sqrt{\dfrac{1}{25}} = \dfrac{\sqrt{1}}{\sqrt{16}} + \dfrac{\sqrt{1}}{\sqrt{25}}$

$$= \frac{1}{4} + \frac{1}{5} = \frac{5+4}{20} = \frac{9}{20}$$

**B.**

**1.** (*d*) **Assertion:** Between 60 and 70, the perfect square number is $64 = 8^2$. So, assertion is false.

**Reason:** A perfect square is a number that can be expressed as the product of an integer by itself. So, reason is true.

**2.** (*a*) **Assertion:** The number of zeros in the square of the number $9000 = (9000)^2 = 81000000$ is 6. So, assertion is true.

**Reason:** The number of zeros at the end of a square of a number is twice the number of zeros at the end of the number. So reason is true and it is the correct explanation of assertion.

**3.** (*b*) **Assertion:** $6^2 = 36$ and $7^2 = 49$. So, the number of natural numbers between 49 and 36 is 12. Thus, assertion is true.

**Reason:** Natural numbers are positive integers that start from 1 and ends at infinity. So, reason is also true but it is not the correct explanation of assertion.

**4.** (*a*) **Assertion:** $7^2 = 49 = 24 + 25$. So, assertion is true.

**Reason:** The square of an odd number can be expressed as the sum of two consecutive natural numbers. So reason is true and it is the correct explanation of assertion.

**C.**

1. The square of an even number is always **even**.
2. A number ending in 2,3,7 or 8 is never a **perfect square**.
3. $\sqrt{49} + \sqrt{36} + \sqrt{16} - \sqrt{9} = 7 + 6 + 4 - 3 =$ **14**.
4. The sum of the first $n$ odd natural numbers is $\boldsymbol{n^2}$.
5. The Pythagorean triplet is $2m$, $\boldsymbol{m^2 - 1}$, $\boldsymbol{m^2 + 1}$.

**D.**

1. $(x, y, z)$ is a Pythagorean triplet, if $x^2 + y^2 = z^2$. It is true.
2. The square of an even number is always even. So, the given statement is false.
3. Number of zeros at the end of a perfect square number is always even. That means a number ending in an odd number of zeros is never a perfect square. So, the given statement is true.

4. The number 264196 has 6 digits, so, the number of digits in the square root of 264196 is $\frac{6}{2} = 3$. So, the given statement is true.

5. Square of 87 will end with the digit 9 is true, since $7 \times 7 = 49$.

**E.**

1. (*a*) $21^2 = (20 + 1)^2 = (20 + 1)(20 + 1)$
$= 20 \times 20 + 20 \times 1 + 1 \times 20 + 1 \times 1$
$= 400 + 20 + 20 + 1 = 441$

(*b*) $33^2 = (30 + 3)^2 = (30 + 3)(30 + 3)$
$= 30 \times 30 + 30 \times 3 + 3 \times 30 + 3 \times 3$
$= 900 + 90 + 90 + 9 = 1089$

(*c*) $(1.4)^2 = \left(\frac{14}{10}\right)^2 = \frac{196}{100} = 1.96$

(*d*) $(-0.5)^2 = \left(\frac{-5}{10}\right)^2 = \frac{25}{100} = 0.25$

2. Let the number of plants in each row = $x$ and the number of rows = $x$.

∴ Total number of plants = $x \times x = x^2$

But $x^2 = 9216$ (Given)

$\Rightarrow \quad x = \sqrt{9216} = \sqrt{96 \times 96} = 96$

So, number of rows = 96

Hence, number of plants in each row = 96.

3. Given, that a gardener wants to plant these in such a way so that the number of rows and number of columns remain the same.

Number of plants = 1000

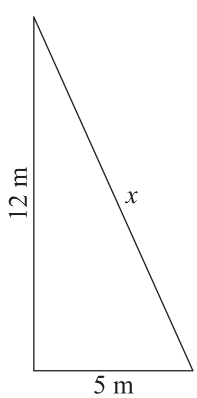
Now, we will find out the square root of 1000.

| | 31 |
|---|---|
| 3 | 10 00 |
| | –9 |
| 61 | 100 |
| | –61 |
| | 39 |

It shows that $31^2 < 1000$, so we will take $32^2 = 1024$. So the gardener needs 32 rows and 32 columns to plant them properly. Minimum number of plants he needs more for this = 1024 – 1000 = 24 plants.

4. Let the length of the ladder = $x$ m

Given, height of the wall = 12 m and distance between foot of the ladder and wall = 5 m.




∴ By Pythagoras theorem,

$x = \sqrt{12^2 + 5^2} = \sqrt{144 + 25}$

$= \sqrt{169} = \sqrt{13^2} = 13$

So, the length of the ladder = 13 m.

5. Let the number of the students = $x$

Then amount donated by each student = ₹$x$.

[∵ Each student donated as much amount as the number of students.]

According to question,

$x \times x = 10{,}201 \quad \Rightarrow \quad x^2 = 10201$

$\Rightarrow \quad x = \sqrt{10201} = 101$

So, the number of students = 101.

6. Total number of candies distributed by Reema among 12 children = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 = $12^2$ = 144.

7. Given, $\sqrt{0.9} \times \sqrt{1.6} = 0.3 \times 0.4 = 0.12$, which is wrong.

∴ $\sqrt{0.9} \times \sqrt{1.6} = \sqrt{0.9 \times 1.6} = \sqrt{\frac{9}{10} \times \frac{16}{10}}$

$= \frac{3 \times 4}{10} = \frac{12}{10} = 1.2$

8. (*a*) Area of Taekwondo court = 110.25 $m^2$.

Let '$x$' be the length of each side of Taekwondo court.

∴ Area of court = $x^2 = 110.25$

$\Rightarrow \quad x = \sqrt{110.25} = 10.5$ m

(*b*) Given, perimeter of Kabaddi court is 5 m longer than that of Taekwondo court.

So, perimeter of Kabaddi court

$= 5 + 4 \times 10.5 = 5 + 42 = 47$ m

Let breadth of Kabaddi court = '$x$' m

∴ Length of Kabaddi court = $(3 + x)$ m

∴ Perimeter of Kabaddi court = $2(x + 3 + x)$

$\Rightarrow \quad 47 = 2(2x + 3) \quad \Rightarrow \quad 4x + 6 = 47$

$\Rightarrow \quad 4x = 41 \quad \Rightarrow \quad x = \frac{41}{4} = 10.25$

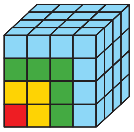
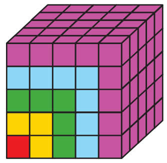
∴ Length of Kabaddi court = 3 + 10.25
= 13.25 m

(*c*) Area of Kabaddi court = Length × Breadth
= 13.25 × 10.25
= 135.8125 $m^2$

(*d*) Since area of Taekwondo court = 110.25 $m^2$ and area of Kabaddi court = 135.8125 $m^2$. So, the perfect square that lies between these two areas = 121, i.e., $11^2$.

# CHAPTER 6 : CUBES AND CUBE ROOTS

## Let's Recall

**1.**  

$1 + 7 + 19 + 37 = 64$ $\quad$ $1 + 7 + 19 + 37 + 61 = 125$

**2.** 1, 8, 27, 64, 125, ........, ........, ........

$1^3, 2^3, 3^3, 4^3, 5^3, 6^3, 7^3, 8^3 = 1, 8, 27, 64, 125, 216, 343, 512.$

**3.** (*a*) $4^3 = 4 \times 4 \times 4 = 64$

(*b*) $10^3 = 10 \times 10 \times 10 = 1000$

(*c*) $\left(\frac{1}{5}\right)^3 = \frac{1}{5} \times \frac{1}{5} \times \frac{1}{5} = \frac{1}{125}$

## Think and Answer (Page 149)

Volume of cube whose each side is 8 cm

$= 8^3 = 512 \text{ cm}^3$

Volume of cube whose each side is 2 cm

$= 2^3 = 8 \text{ cm}^3$

$\therefore$ Number of cubes that can be formed with every 2 cm side of the 8 cm side $= \frac{512}{8} = 64.$

## Quick Check (Page 150)

12 is not a perfect cube, since there does not exist a natural number '*m*' such that $12 = m^3$.

## Quick Check (Page 151)

By prime factorisation,

$49000 = 7 \times 7 \times \underbrace{2 \times 2 \times 2} \times \underbrace{5 \times 5 \times 5}$

Here $7 \times 7$ is not a triple, so 49000 is not a perfect cube.

| | |
|---|---|
| 7 | 49000 |
| 7 | 7000 |
| 2 | 1000 |
| 2 | 500 |
| 2 | 250 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

## Think and Answer (Page 153)

**1.** Ones digit of 15 = 5

and the cube of $5 = 5^3 = 5 \times 5 \times 5 = 125$

So, the digit at ones place of cube of 15 is 5.

**2.** Ones digit of 48 = 8

and the cube of $8 = 8^3 = 8 \times 8 \times 8 = 512$

So, the digit at ones place of cube of 48 is 2.

## Think and Answer (Page 153)

Since, $91 + 93 + 95 + 97 + 99 + 101 + 103 + 105 + 107 + 109 = 1000 = 10^3$

So, 10 consecutive odd numbers will be needed to obtain the sum as $10^3$.

## Practice Time 6A

**1.** (*a*) Cube of $13 = 13 \times 13 \times 13 = 2197$

(*b*) Same as part (*a*)

(*c*) Cube of $-15 = (-15) \times (-15) \times (-15) = -3375$

(*d*) Cube of $5.8 = (5.8) \times (5.8) \times (5.8) = 195.112$

(*e*) Same as part (*d*)

(*f*) Cube of $\frac{3}{14} = \frac{3}{14} \times \frac{3}{14} \times \frac{3}{14} = \frac{27}{2744}$

(*g*) Same as part (*f*).

**2.** (*a*) By prime factorisation,

$343 = \underbrace{7 \times 7 \times 7}$

So, 343 is a perfect cube.

| | |
|---|---|
| 7 | 343 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

(*b*) Same as part (*a*).

(*c*) By prime factorisation,

| | |
|---|---|
| 2 | 1728 |
| 2 | 864 |
| 2 | 432 |
| 2 | 216 |
| 2 | 108 |
| 2 | 54 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

$1728 = \underbrace{2 \times 2 \times 2} \times \underbrace{2 \times 2 \times 2} \times \underbrace{3 \times 3 \times 3}$

So, 1728 is a perfect cube.

(*d*) Same as part (*c*).

(*e*) Same as part (*c*).

(*f*) By prime factorisation,

| | |
|---|---|
| 5 | 91125 |
| 5 | 18225 |
| 5 | 3645 |
| 3 | 729 |
| 3 | 243 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

$91125 = \underbrace{5 \times 5 \times 5} \times \underbrace{3 \times 3 \times 3} \times \underbrace{3 \times 3 \times 3}$

So, 91125 is a perfect cube.

(*g*) Same as part (*f*).

**3.** Since the cubes of all even numbers are even. So, the cubes of 122, 728, 2300, 9000 are even.

**4.** Since, the cubes of all odd numbers are odd. So, the cubes of 55, 1227, 9813, 8125 and 10001 are odd.

**5.** Consider the even numbers 2 and 4.

Now, $2 \times 2 \times 2 = 8$ (an even number),

Also, $4 \times 4 \times 4 = 64$ (an even number)

This shows that the cube of an even number is always even.

**6.** Consider the odd numbers 3 and 5.

Now, $3 \times 3 \times 3 = 27$ (an odd number),

Also, $5 \times 5 \times 5 = 125$ (an odd number)

This shows that the cube of an odd number is always odd.

**7.** (*a*) $432 = \underbrace{2 \times 2 \times 2} \times 2 \times \underbrace{3 \times 3 \times 3}$

Here 2 is not a triple, so 432 is not a perfect cube.

| | |
|---|---|
| 2 | 432 |
| 2 | 216 |
| 2 | 108 |
| 2 | 54 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

(*b*) Same as part (*a*).

(*c*) $2197 = \underbrace{13 \times 13 \times 13}$

So, 2197 is a perfect cube of 13.

| | |
|---|---|
| 13 | 2197 |
| 13 | 169 |
| 13 | 13 |
| | 1 |

(*d*) Same as part (*c*).

(*e*) Same as part (*c*).

(*f*) $10648 = \underbrace{2 \times 2 \times 2} \times \underbrace{11 \times 11 \times 11}$

So, 10648 is a perfect cube of 22.

| | |
|---|---|
| 2 | 10648 |
| 2 | 5324 |
| 2 | 2662 |
| 11 | 1331 |
| 11 | 121 |
| 11 | 11 |
| | 1 |

**8.** (*a*) Since prime factorisation of 72

$= \underbrace{2 \times 2 \times 2} \times 3 \times 3$

| | |
|---|---|
| 2 | 72 |
| 2 | 36 |
| 2 | 18 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

Here prime factor 2 appear in the group of three, but prime factor 3 is left ungrouped. So, if we multiply 72 by 3, we will get one more factor of 3, forming a complete triplet of 3.

$\therefore \quad 72 \times 3 = \underbrace{2 \times 2 \times 2} \times \underbrace{3 \times 3 \times 3} = 216,$

which is a perfect cube.

Therefore, 3 is the smallest number by which 72 must be multiplied to make it a perfect cube.

(*b*) Same as part (*a*).

(*c*) Prime factorisation of 576

$= \underbrace{2 \times 2 \times 2} \times \underbrace{2 \times 2 \times 2} \times 3 \times 3$

| | |
|---|---|
| 2 | 576 |
| 2 | 288 |
| 2 | 144 |
| 2 | 72 |
| 2 | 36 |
| 2 | 18 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

Here prime factor 2 appear in the group of three, but prime factor 3 is left ungrouped. So, if we multiply 576 by 3, we will get one more factor of 3, forming a complete triplet of 3.

$\therefore \quad 576 \times 3 = \underbrace{2 \times 2 \times 2} \times \underbrace{2 \times 2 \times 2} \times \underbrace{3 \times 3 \times 3}$

$= 1728,$

which is a perfect cube.

Therefore, 3 is the smallest number by which 576 must be multiplied to make it a perfect cube.

(*d*) Same as part (*c*).

**9.** (*a*) Prime factorisation of 625

$= \underbrace{5 \times 5 \times 5} \times 5$

| | |
|---|---|
| 5 | 625 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

Here prime factor 5 appear in the group of three, but one prime factor 5 is left ungrouped. So, if we divide 625 by 5, we are left with a triplet of 5, making the quotient ($625 \div 5 = 125$) a perfect cube.

Therefore, 5 is the smallest number by which 625 must be divided to make it a perfect cube.

(*b*) Same as part (*a*).

(*c*) Prime factorisation of 6750

$= 2 \times \underbrace{5 \times 5 \times 5} \times \underbrace{3 \times 3 \times 3}$

| | |
|---|---|
| 2 | 6750 |
| 5 | 3375 |
| 5 | 675 |
| 5 | 135 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

Here prime factors 5 and 3 appear in the group, but one prime factor of 2 is left ungrouped. So, if we divide 6750 by 2, we are left with a triplet of 5 and 3, making the quotient ($6750 \div 2 = 3375$) a perfect cube. Therefore 2, is the smallest number by which 6750 must be divided to make it a perfect cube.

(*d*) Same as part (*a*).

**10.** Since, we know that $n^3 - (n-1)^3 = 1 + 3n(n-1)$

(*a*) $80^3 - 79^3 = 1 + 3 \times 80(80 - 1)$

$= 1 + 3(6320) = 1 + 18960 = 18961$

(*b*) $101^3 - 100^3 = 1 + 3 \times 101(101 - 1)$

$= 1 + 3(10100) = 1 + 30300$

$= 30301$

## Practice Time 6B

**1.** (*a*) Prime factorisation of 2744

| | |
|---|---|
| 2 | 2744 |
| 2 | 1372 |
| 2 | 686 |
| 7 | 343 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

$= 2 \times 2 \times 2 \times 7 \times 7 \times 7$

$= 2^3 \times 7^3 = (2 \times 7)^3$

$\therefore \quad \sqrt[3]{2744} = 2 \times 7 = 14$

(*b*) Same as part (*a*).

(*c*) Prime factorisation of 132651

| | |
|---|---|
| 3 | 132651 |
| 3 | 44217 |
| 3 | 14739 |
| 17 | 4913 |
| 17 | 289 |
| 17 | 17 |
| | 1 |

$= 3\times3\times3\times17\times17\times17$

$= 3^3 \times 17^3 = (3 \times 17)^3$

$\therefore \quad \sqrt[3]{132651} = 3 \times 17 = 51$

**2.** (*a*) Given number = 91125

= 91 125

Second group (91) First group (125)

The unit's digit of first group of the given number is 5.

So, the unit's digit of the cube root of the given number is 5.

The number formed by the second group is 91.

Since, $4^3 < 91 < 5^3$

So, the tens digit of the cube root of the original number = 4.

Hence, the cube root of 91125

i.e., $\sqrt[3]{91125} = 45$.

(*b*) Given number = 389017

= 389 017

Second group (389) First group (017)

The unit's digit's of first group of the given number is 7.

So, the unit's digit of the cube root of the given number is 3.

The number formed by the second groups is 389.

Since, $7^3 < 389 < 8^3$

So, the ten's digit of the cube root of the original number = 7.

Hence, the cube root of 389017,

i.e., $\sqrt[3]{389017} = 73$.

(*c*) Same as part (*b*).

**3.** (*a*) 216 – 1 = 215, 215 – 7 = 208, 208 – 19 = 189, 189 – 37 = 152, 152 – 61 = 91, 91 – 91 = 0.

Since, we have subtracted six times to get 0, so $\sqrt[3]{216} = 6$.

(*b*) Same as part (*a*).

(*c*) 1728 – 1 = 1727, 1727 – 7 = 1720, 1720 – 19 = 1701, 1701 – 37 = 1664, 1664 – 61 = 1603, 1603 – 91 = 1512, 1512 – 127 = 1385, 1385 – 169 = 1216, 1216 – 217 = 999, 999 – 271 = 728, 728 – 331 = 397, 397 – 397 = 0

Since, we have subtracted twelve times to get.

So, $\sqrt[3]{1728} = 12$.

**4.** (*a*) Prime factorisation of 3600

| | |
|---|---|
| 2 | 3600 |
| 2 | 1800 |
| 2 | 900 |
| 2 | 450 |
| 3 | 225 |
| 3 | 75 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

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

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

The prime factors 2, 3, 5 do not appear in groups of three.

Therefore, 3600 is not a perfect cube.

To make it a perfect cube, it must be multiplied by $2 \times 2 \times 3 \times 5 = 60$.

So, the smallest number by which 3600 must be multiplied to make the product a perfect cube = 60.

$3600 \times (2 \times 2 \times 3 \times 5)$

$= 2^3 \times \underbrace{2 \times 2 \times 2} \times \underbrace{3 \times 3 \times 3} \times \underbrace{5 \times 5 \times 5}$

which is a perfect cube.

Hence, the perfect cube is $3600(2 \times 2 \times 3 \times 5) = 216000$.

$\therefore \quad \sqrt[3]{216000} = \sqrt{2\times2\times2\times2\times2\times2\times3\times3\times3 \times5\times5\times5}$

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

(*b*) Same as part (*a*).

**5.** (*a*) Prime factorisation of 3087

| | |
|---|---|
| 3 | 3087 |
| 3 | 1029 |
| 7 | 343 |
| 7 | 49 |
| 7 | 7 |
| | 1 |

$= 3 \times 3 \times 7 \times 7 \times 7$

Grouping them into groups of three, we get

$3087 = 3 \times 3 \times (7 \times 7 \times 7) = 3^2 \times 7^3$

We see that number $(3 \times 3)$ is left ungrouped.

So, if we divide 3087 by $(3 \times 3)$, it becomes a perfect cube.

Also, the quotient $\dfrac{3087}{3\times3} = 343$ is a perfect cube.

Therefore, $343 = 7 \times 7 \times 7$

$\therefore \quad \sqrt[3]{343} = \sqrt[3]{7\times7\times7} = 7.$

(*b*) Prime factorisation of 16875

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

| | |
|---|---|
| 3 | 16875 |
| 3 | 5625 |
| 3 | 1875 |
| 5 | 625 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

Grouping them into groups of three, we get

$16875 = (3 \times 3 \times 3) \times 5 \times (5 \times 5 \times 5)$

$= 3^3 \times 5 \times 5^3$

We see that the number 5 is left ungrouped.

So, if we divide 16875 by 5, it becomes a perfect cube.

Also, the quotient $\frac{16875}{5} = 3375$ is a perfect cube.

Therefore, $3375 = (3 \times 3 \times 3) \times (5 \times 5 \times 5)$

$\sqrt[3]{3375} = \sqrt[3]{(3\times3\times3)\times(5\times5\times5)}$

$= 3 \times 5 = 15.$

**6.** (*a*) $\sqrt[3]{\frac{729}{1000}} = \frac{\sqrt[3]{729}}{\sqrt[3]{1000}} = \frac{\sqrt[3]{9\times9\times9}}{\sqrt[3]{10\times10\times10}} = \frac{9}{10}$

(*b*) Same as part (*a*).

(*c*) We have, $\sqrt[3]{648} \times \sqrt[3]{576}$

We observe that 648 and 576 are not perfect cubes. Therefore, we first combine and then factorise them and then use the property.

$\therefore \sqrt[3]{648} \times \sqrt[3]{576}$

$= \sqrt[3]{648 \times 576}$

$= \sqrt[3]{(2^3 \times 3 \times 3^3) \times (2^3 \times 2^3 \times 3^2)}$

$= \sqrt[3]{2^3 \times 3^3 \times 3^3 \times 2^3 \times 2^3}$

Thus, $\sqrt[3]{648} \times \sqrt[3]{576} = 2 \times 3 \times 3 \times 2 \times 2 = 72$

(*d*) We have,

$\sqrt[3]{2197 \times 5832}$

$= \sqrt[3]{(13\times13\times13)\times(8\times27\times27)}$

$= \sqrt[3]{13\times13\times13} \times \sqrt[3]{2\times2\times2} \times \sqrt[3]{3\times3\times3}$

$\times \sqrt[3]{3\times3\times3}$

$= 13 \times 2 \times 3 \times 3 = 234$

**7.** (*a*) We have, $-216 \times 1728$

$= -(2 \times 2 \times 2 \times 3 \times 3 \times 3)$

$\times (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3)$

$= -(2^3 \times 3^3) \times (2^3 \times 2^3 \times 3^3)$

Now, $\sqrt[3]{-216 \times 1728}$

$= \sqrt[3]{-(2^3 \times 3^3) \times (2^3 \times 2^3 \times 3^3)}$

$= -(2 \times 3) \times (2 \times 2 \times 3)$

$= -6 \times 12 = -72$

(*b*) $\frac{-1331}{4096} = \frac{-(11\times11\times11)}{16\times16\times16}$

$\therefore \sqrt[3]{\frac{-1331}{4096}} = \sqrt[3]{\frac{-(11\times11\times11)}{16\times16\times16}} = \frac{-11}{16}$

(*c*) $\frac{-1875}{-5145} = \frac{-3\times5\times5\times5\times5}{-3\times5\times7\times7\times7} = \frac{5\times5\times5}{7\times7\times7}$

$\therefore \sqrt[3]{\frac{-1875}{-5145}} = \sqrt[3]{\frac{5\times5\times5}{7\times7\times7}} = \frac{5}{7}$

(*d*) $3.375 = \frac{3.375\times1000}{1000} = \frac{3375}{1000}$

$\therefore \sqrt[3]{\frac{3375}{1000}} = \frac{\sqrt[3]{3375}}{\sqrt[3]{1000}} = \frac{\sqrt[3]{3\times3\times3\times5\times5\times5}}{\sqrt[3]{10\times10\times10}}$

$= \frac{3\times5}{10} = \frac{15}{10} = 1.5$

**8.** Given, the volume of a cubical box = 32.768 $m^3$.

Let '*x*' be the length of the side of the box.

Volume of cube $= x \times x \times x = x^3$

$\Rightarrow \quad 32.768 = x^3$

$x = \sqrt[3]{32.768}$

$= \sqrt[3]{\frac{32768}{1000}} = \frac{\sqrt[3]{32\times32\times32}}{\sqrt[3]{10\times10\times10}}$

$= \frac{32}{10} = 3.2$

$\therefore$ Length of each side of the box = 3.2 m

**9.** The volume of a cube is $112\frac{197}{216}$ $m^3$ (Given).

Let the side of a cube be '*x*' m.

$\therefore$ Volume of cube $= x \times x \times x = x^3$

$\Rightarrow \quad 112\frac{197}{216} = x^3$

$\Rightarrow \quad x = \sqrt[3]{\frac{24389}{216}} = \frac{\sqrt[3]{24389}}{\sqrt[3]{216}} = \frac{\sqrt[3]{29\times29\times29}}{\sqrt[3]{6\times6\times6}}$

$= \frac{29}{6} = 4\frac{5}{6}$ metres

$\therefore$ The side of a cube is $4\frac{5}{6}$ metres.

**10.** Let the three numbers be *x*, 2*x* and 3*x*.

Given, sum of their cubes = 98784

$\therefore \quad x^3 + (2x)^3 + (3x)^3 = 98784$

$\Rightarrow \quad x^3 + 8x^3 + 27x^3 = 98784$

$\Rightarrow \quad 36x^3 = 98784$

$$\Rightarrow \quad x^3 = \frac{98784}{36} = 2744$$

$$\Rightarrow \quad x = \sqrt[3]{2744} = \sqrt[3]{14 \times 14 \times 14} = 14$$

So, the required numbers are 14, 2 × 14 = 28, 3 × 14 = 42.

## Brain Sizzlers

1. $\sqrt[3]{x \times 0.000001} = 0.2$

   Squaring both sides, we have

   $\sqrt[3]{x \times 0.000001} = (0.2)^2 = 0.04$

   Cubing both sides, we have

   $$x \times 0.000001 = (0.04)^3 = 0.000064$$

   $$\Rightarrow \quad x = \frac{0.000064}{0.000001} = 64$$

   $$\Rightarrow \quad x = 64$$

2. The number is 4096, which is the cube of 16 as 16 × 16 × 16 = 4096 and square of 64 i.e., 64 × 64 = 4096.

## Mental Maths

1. Cubes of first five natural numbers are as follows: $1^3 = 1, 2^3 = 8, 3^3 = 27, 4^3 = 64, 5^3 = 125$.
2. By prime factorisation,

   $2000 = \underbrace{2 \times 2 \times 2} \times 2 \times \underbrace{5 \times 5 \times 5}$

| | |
|---|---|
| 2 | 2000 |
| 2 | 1000 |
| 2 | 500 |
| 2 | 250 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

   Here 2 is not a triple, so 2000 is not a perfect cube.
3. To find the smallest number by which 4 should be multiplied to get a perfect cube, we need to express 4 as a product of its prime factors.

   Now, 4 = 2 × 2

   Here the prime factor 2 appears twice. So, we need one more 2 to make it three 2s. i.e., 2 × 2 × 2 = 8. So, the smallest number by which 4 should be multiplied to get a perfect cube is 2.
4. To find the smallest number by which 81 should be divided to get a perfect cube, we need to express 81 as a product of its prime factors.

   Now, $81 = \underbrace{3 \times 3 \times 3} \times 3$

   Here the prime factor 3 is left ungrouped. So, we divide 81 by 3 to make it three 3s. i.e., 3 × 3 × 3 = 27 which is a perfect cube.

   So, the smallest number by which 81 should be divided to get a perfect cube is 3.
5. Cube of 0.1 = $(0.1)^3$ = 0.1 × 0.1 × 0.1 = 0.001
6. We have, 27 × 8 = 216 = 6 × 6 × 6

   So, the cube root of 27 × 8 = $\sqrt[3]{27 \times 8}$

   $= \sqrt[3]{6 \times 6 \times 6} = 6$
7. We have 0.343 = 0.7 × 0.7 × 0.7

   So, cube root of 0.343 $= \sqrt[3]{0.343}$

   $= \sqrt[3]{0.7 \times 0.7 \times 0.7} = 0.7$
8. Given, the length of the edge of cube = 11 cm

   ∴ Volume of a cube = 11 × 11 × 11

   [∵ Volume of a cube = $(\text{side})^3$]

   = 1331 $\text{cm}^3$.
9. $3^3 = 27, 5^3 = 125, 7^3 = 343$, .....

   Thus, the cube of an odd natural number is always odd.
10. (*a*) $75^3 - 74^3 = 1 + 75 \times 74 \times 3$

    $= 1 + 16650 = 16651$

    (*b*) $111^3 - 110^3 = 1 + 111 \times 110 \times 3$

    $= 1 + 36630 = 36631$

## Chapter Assessment

**A.**

1. (*a*) $2^3 = 8, 4^3 = 64, 6^3 = 216$, .....

   Thus, the cube of an even natural number is an even natural number.
2. (*c*) To find the smallest number by which 32 should be multiplied to get a perfect cube, we need to express 32 as a product of its prime factors.

   Now, $32 = \underbrace{2 \times 2 \times 2} \times 2 \times 2$

   Here the prime factor 2 appears twice. So we need one more 2 to make it three 2s.

   i.e., 2 × 2 × 2 × 2 × 2 × 2 = 64

   So, the smallest natural number by which 32 must be multiplied to get a perfect cube is 2.
3. (*c*) $\sqrt[3]{8 \times 64} = \sqrt[3]{8 \times 8 \times 8} = 8$
4. (*b*) Given, volume of a cube = 729 $\text{cm}^3$ ...(i)

   Let '*x*' be the length of the side of a cube.

   ∴ Volume of cube = $x^3$

   $\Rightarrow 729 = x^3$ [Using (i)]

   $\Rightarrow x = \sqrt[3]{729} = \sqrt[3]{9 \times 9 \times 9} = 9$

   ∴ The length of its side = 9 cm.

5. (*b*) 512 = 8 × 8 × 8; 9261 = 21 × 21 × 21;
4096 = 16 × 16 × 16; 8000 = 20 × 20 × 20

∴ 9261 is the cube of an odd number.

6. (*c*) Since –27 = –3 × –3 × –3. So, –27 is the cube of an odd number.

7. (*b*) $(0.11)^3 = 0.11 \times 0.11 \times 0.11 = \frac{11}{100} \times \frac{11}{100} \times \frac{11}{100}$

$= \frac{1331}{1000000} = 0.001331$

8. (*b*) –512 = –8 × –8 × –8.

Cube root of $-512 = \sqrt[3]{-512}$

$= \sqrt[3]{-8 \times -8 \times -8} = -8.$

9. (*d*) $\sqrt[3]{(-1331) \times 125}$

$= \sqrt[3]{(-11) \times (-11) \times (-11) \times 5 \times 5 \times 5}$

= (–11) × 5 = –55.

**B.**

1. (*b*) **Assertion:** Since, the cube of the numbers having digits 1, 4, 5, 6 and 9 at its ones place are numbers ending in the same digits respectively.

So, the ones digit of the cube of the number 364 is 4. So, assertion is true.

**Reason:** A cube number is a number multiplied by itself three times is also true.

So, assertion and reason are true but reason is not the correct explanation of assertion.

2. (*a*) **Assertion:** $50^3 = 50 \times 50 \times 50$

= 125000 (3 zeros)

So, the number of zeros at the end of the cube of number 50 is 3. So, assertion is true.

**Reason:** The number of zeros at the end of a perfect cube is always a multiple of 3. Thus reason is also true and it is the correct explanation of assertion.

**C.**

1. A perfect cube is obtained when a number is multiplied by itself **three** times.
2. Symbol '$\sqrt[3]{\ }$' denotes **cube root**.
3. $2^3 = 2 \times 2 \times 2 = 8$, $4^3 = 4 \times 4 \times 4 = 64$, .....

So, the cube of every **even** number is even.

4. $\sqrt[3]{540} = \sqrt[3]{2 \times 2 \times 3 \times 3 \times 3 \times 5}$

$= \sqrt[3]{4 \times 3 \times 3 \times 3 \times 5} = \sqrt[3]{\mathbf{4}} \times 3 \times \sqrt[3]{5}$

5. $\sqrt[3]{\frac{1331}{4913}} = \frac{\sqrt[3]{11 \times 11 \times 11}}{\sqrt[3]{17 \times 17 \times 17}} = \mathbf{\frac{11}{17}}$

**D.**

1. Since, $1^3 = 1 \times 1 \times 1 = 1$; $3^3 = 3 \times 3 \times 3 = 27$;
$5^3 = 5 \times 5 \times 5 = 125$

So, the cube of any odd number is odd.

Hence, the given statement is false.

2. We know that $(99)^3 = 99 \times 99 \times 99 = 970299$

Since, no other two-digit number has a cube with seven or more digits. So, the cube of a 2-digit number may have six or more digits is false.

3. $(512)^{\frac{1}{3}} = \sqrt[3]{512} = \sqrt[3]{8 \times 8 \times 8} = 8$

So, $(512)^{\frac{1}{3}} = 8$ is true.

4. Consider, $\sqrt[3]{9 \times (-3)} = \sqrt[3]{-27}$

So, $-27 = -(3 \times 3 \times 3) = -(3)^3$

∴ $\sqrt[3]{-27} = -3.$

So, the cube root of the product of a positive number and a negative number is a negative number, is true.

5. Prime factorisation of 648

$= \underbrace{2 \times 2 \times 2} \times \underbrace{3 \times 3 \times 3} \times 3$

| | |
|---|---|
| 2 | 648 |
| 2 | 324 |
| 2 | 162 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

Here one prime factor 3 is left ungrouped. So, if we divide 648 by 3, we are left with a triplet of 2 and 3, making the quotient (648 ÷ 3 = 216) a perfect cube. Therefore 3, is the smallest natural number by which 648 must be divided to make it a perfect cube. Hence, the given statement is false.

**E.**

1. (*a*) Cube of 17 = 17 × 17 × 17 = 4913.

(*b*) Same as part (*a*).

(*c*) Cube of (–101) = –101 × –101 × –101
= 1030301.

(*d*) Cube of $\frac{3}{11} = \frac{3}{11} \times \frac{3}{11} \times \frac{3}{11} = \frac{3 \times 3 \times 3}{11 \times 11 \times 11}$

$= \frac{27}{1331}$

(*e*) Cube of $(-3a^2b) = (-3a^2b) \times (-3a^2b) \times (-3a^2b)$

$= -27a^6b^3$

**2.** (*a*) $\sqrt[3]{36} \times \sqrt[3]{384}$

$= \sqrt[3]{2\times2\times3\times3} \times \sqrt[3]{2\times2\times2\times2\times2\times2\times2\times3}$

$= \sqrt[3]{2\times2\times2\times2\times2\times2\times2\times2\times2\times3\times3\times3}$

$= \sqrt[3]{2^3\times2^3\times2^3\times3^3} = 2 \times 2 \times 2 \times 3$

$= 24$

(*b*) $\sqrt[3]{2592} \times \sqrt[3]{144}$

$= \sqrt[3]{2\times2\times2\times2\times2\times3\times3\times3\times3}$
$\times \sqrt[3]{2\times2\times2\times2\times3\times3}$

$= \sqrt[3]{2\times2\times2\times2\times2\times2\times2\times2\times2 \times3\times3\times3\times3\times3\times3}$

$= \sqrt[3]{2^3\times2^3\times2^3\times3^3\times3^3} = 2 \times 2 \times 2 \times 3 \times 3$

$= 72$

**3.** (*a*) $\sqrt[3]{226981} = \sqrt[3]{61\times61\times61} = 61$

So, the unit's digit of the cube root of the number 226981 is 1.

(*b*) $\sqrt[3]{274625} = \sqrt[3]{5\times5\times5\times13\times13\times13}$

$= \sqrt[3]{5^3\times13^3} = 5 \times 13 = 65.$

So, the unit's digit of the cube root of 274625 is 5.

**4.** No, 578 is not a perfect cube. Since prime factorisation of 578 = 2 × 17 × 17. Here prime factors 2 and 17 both are left ungrouped, so if we multiply 578 by (2 × 2 × 17), we will get triplet of 2 and 17.

| | |
|---|---|
| 2 | 578 |
| 17 | 289 |
| 17 | 17 |
| | 1 |

∴ 578(2 × 2 × 17) = 2 × 2 × 2 × 17 × 17 × 17
= 39304

which is a perfect cube.

Therefore, 2 × 2 × 17 = 68 is the smallest number by which 578 must be multiplied so that the product is a perfect cube.

**5.** $\sqrt[3]{2.197} + \sqrt[3]{0.008} - \sqrt[3]{0.125}$

$= \sqrt[3]{1.3\times1.3\times1.3} + \sqrt[3]{0.2\times0.2\times0.2}$
$- \sqrt[3]{0.5\times0.5\times0.5}$

$= 1.3 + 0.2 - 0.5 = 1$

**6.** (*a*) $\frac{-3375}{6859} = \frac{-(15\times15\times15)}{19\times19\times19} = \left(\frac{-15}{19}\right)^3$

So, $\frac{-15}{19}$ is a rational number.

(*b*) $0.238328 = \frac{238328}{1000000}$

$= \frac{2\times2\times2\times31\times31\times31}{100\times100\times100}$

$= \left(\frac{62}{100}\right)^3$

So, $\frac{62}{100}$ or $\frac{31}{50}$ is a rational number.

(*c*) $-0.343 = \frac{-343}{1000} = \frac{(-7)\times(-7)\times(-7)}{10\times10\times10} = \left(\frac{-7}{10}\right)^3$

So, $\frac{-7}{10}$ is a rational number.

**7.** Let the cube root of smaller and larger number be 4 and $x$ respectively.

A.T.Q., $x^3 - 4^3 = 279$ (Given)

⇒ $x^3 = 64 + 279 = 343 = 7^3$

∴ $x = 7$

∴ Cube root of the larger number is 7.

**8.** Let the ratio of the number of students getting prizes in the three categories be $3x$, $5x$ and $7x$.

Since the product of the number of students in these categories was 2835.

∴ $3x \times 5x \times 7x = 2835$

⇒ $105x^3 = 2835$

⇒ $x^3 = 27 \Rightarrow x = 3$

(*a*) The number of students receiving prizes in the 'obedience' category = 5 × $x$ = 5 × 3 = 15.

(*b*) The number of students receiving prizes in the 'regularity' category = 3 × $x$ = 3 × 3 = 9.

(*c*) The total number of prizes in all the three categories = 9 + 15 + 7 × 3 = 9 + 15 + 21 = 45.

(*d*) Since, total number of prizes = 45.

So, the total amount spent on the prizes
= 45 × 250 = ₹11,250

## UNIT TEST – 2

**A.**

**1.** (*a*) Since, the height of each bar indicates the corresponding value of the numerical data. So, the height of a bar in a bar graph shows the **frequency** of the corresponding observation.

**2.** (*c*) Pictorial representation of grouped data in the form of rectangles touching each other is called a **histogram**.

**3.** (*c*) When we roll a die once, possible outcomes are,

S = {1, 2, 3, 4, 5, 6}

∴ Total outcomes, $n$(S) = 6.

Prime numbers = 2, 3, 5. Thus $n$(E) = 3.

∴ P(getting a prime number) = $\frac{n(E)}{n(S)} = \frac{3}{6} = \frac{1}{2}$ .

**4.** (*c*) In the given data, the minimum value = 0 and the maximum value = 5.

∴ Range of the above data = 5 – 0 = 5.

**5.** (*d*) We have, $\sqrt[3]{8\times125} = \sqrt[3]{2\times2\times2\times5\times5\times5}$

$= \sqrt[3]{10\times10\times10} = 10$

∴ Square of $\sqrt[3]{8\times125} = (10)^2 = 100$

**6.** (*d*) Resolving into prime factors, we find that 1001 = 7 × 11 × 13.

| | |
|---|---|
| 7 | 1001 |
| 11 | 143 |
| 13 | 13 |
| | 1 |

Grouping the factors we find that 7, 11, 13 all are left unpaired. So, 1001 is not a perfect square.

**7.** (*a*) $15^2 = 15 \times 15 = 225$ and $16^2 = 16 \times 16 = 256$

So, there are 30 natural numbers lie between $15^2$ and $16^2$.

**8.** (*b*) Area of a square = 7225 $m^2$. ...(i)

Let side of a square = $x$.

∴ Area of a square = $x \times x = x^2$

⇒ $7225 = x^2$ [Using (i)]

⇒ $x = \sqrt[2]{7225} = \sqrt[2]{5\times5\times17\times17}$

$= 5 \times 17 = 85$

Thus, side of square = 85 m.

**9.** (*d*) **Assertion:** In the class interval 10–20, all the observations from 10 to 19 are only taken (20 is not included). So, assertion is false.

**Reason:** In continuous class intervals, the upper limit of the class interval does not included in corresponding class interval so, reason is true.

**10.** (*a*) **Assertion:** 4488 is not a perfect square, as its unit or ones digit is 8. Resolving into prime factors, we find that

| | |
|---|---|
| 2 | 4488 |
| 2 | 2244 |
| 2 | 1122 |
| 11 | 561 |
| 17 | 51 |
| 3 | 3 |
| | 1 |

4488 = 2 × 2 × 2 × 11 × 17 × 3

Grouping the factors into pair of equal factors, we find that 2, 11, 17 and 3 is left unpaired.

So, 4488 is not a perfect square. So, assertion is true.

**Reason:** A number ending with 2, 3, 7 or 8 is never a perfect square is true. Thus, both assertion and reason are true and reason is the correct explanation of assertion.

**B.**

**1.** The difference between the upper and lower limit of a class interval is called the **size** of the class interval.

**2.** When a coin is tossed, the outcomes are head or tail.

So, the total number of outcomes when a coin is tossed is **2**.

**3.** Since a die has numbered 1 to 6. So in a throw of a die, the probability of getting the number 7 is **0**.

**4.** 1, 4, 9, 16, 25, 36, 49 are all perfect squares between 1 to 50.

So, there are **7** perfect squares between 1 to 50.

**5.** $10024^2 - 10023^2 = 10024 + 10023 =$ **20047**

**C.**

**1.** When we throw a die, the possible outcomes are S = {1, 2, 3, 4, 5, 6}. So total outcomes, $n$(S) = 6.

Prime numbers = 2, 3, 5 and Even numbers = 2, 4, 6.

∴ P(getting a prime number) = $\frac{3}{6} = \frac{1}{2}$ and

P (getting an even number) = $\frac{3}{6} = \frac{1}{2}$ .

So, the given statement is true.

**2.** Consider $2^2 = 4 = (3 \times 1) + 1$; $3^2 = 9 = 3 \times 3$; $4^2 = 16 = 3 \times 5 + 1$, .....

Thus, the square of a natural number (other than 1) is either a multiple of 3 or exceeds a multiple of 3 by 1 is true.

**3.** Central angle for each data value as central angle

$$= \frac{\text{Value of the component}}{\text{Sum of the values of all components}} \times 360°$$

So, the given statement is false.

**4.** Prime factorisation of 2700

| | |
|---|---|
| 3 | 2700 |
| 3 | 900 |
| 3 | 300 |
| 2 | 100 |
| 2 | 50 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

$= \underbrace{3 \times 3 \times 3} \times 2 \times 2 \times 5 \times 5$

Since, after the prime factorisation of 2700, 2 and 5 is left unpaired. So, 2700 is not a perfect cube. So, the cube root of 2700 is 90 is false.

**5.** The cube of the numbers having digits 0, 1, 4, 5, 6 and 9 at its ones place are the numbers ending in the same digits respectively, is true.

Like $11^3 = 11 \times 11 \times 11 = 1331$;

$15^3 = 15 \times 15 \times 15 = 3375$.

**D.**

**1.** The frequency distribution of weights of 30 students is shown below:

| **Weights** | 25–30 | 30–35 | 35–40 | 40–45 | 45–50 |
|---|---|---|---|---|---|
| **Number of Students** | 2 | 7 | 11 | 7 | 3 |

(*a*) Class 25–30 has the least frequency i.e., 2.

(*b*) Class 35–40 has the maximum frequency i.e., 11.

**2.** Given word is 'GENIUS'.

So, total letter is 6. Number of vowels = E, I, U = 3.

P (chosen letter is a vowel) $= \frac{3}{6} = \frac{1}{2}$.

**3.** (*a*) The number of students having height less than 140 cm = 6 + 3 + 10 = 19.

(*b*) The number of students having a height greater than 140 cm but less than 155 cm = 10 + 12 + 5 = 27.

**4.** Let us consider $2m = 12 \Rightarrow m = 6$.

$\Rightarrow \quad m^2 - 1 = 6^2 - 1 = 36 - 1 = 35$ and

$m^2 + 1 = 6^2 + 1 = 36 + 1 = 37$

Thus, 12, 35, and 37 is the triplet with 12 as the smallest number.

**5.** Smallest 4-digit number = 1000. Let us find the square root of 1000.

| | 31 |
|---|---|
| 3 | 1000 |
| | –9 |
| 61 | 100 |
| | – 61 |
| | 39 |

We know that by taking square root, we find 39 is left.

$31^2 = 961$, which is a 3-digit number.

Take $32^2 = 1024$

Here 1024 – 1000 = 24

Thus, 24 should be added to 1000 to obtain the smallest 4-digit perfect square.

Greatest 4-digit number = 9999

| | 99 |
|---|---|
| 9 | 9999 |
| | –81 |
| 189 | 1899 |
| | –1701 |
| | 198 |

Let us find the square root of 9999. Thus, 198 should be subtracted form 9999 to obtain the greatest 4-digit perfect square.

∴ Greatest 4-digit perfect square

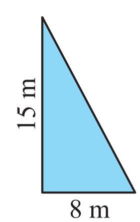
= 9999 – 198 = 9801.

**6.**

| | 65.5 |
|---|---|
| 6 | 4290.25 |
| | –36 |
| 125 | 690 |
| | –625 |
| 1305 | 6525 |
| | –6525 |
| | 0 |

$\therefore \sqrt{4290.25} = 65.5$

**7.** Since the ladder form a right-angled triangle.




$\therefore$ Length of the ladder $= \sqrt{15^2 + 8^2}$

$= \sqrt{225 + 64}$

$= \sqrt{289}$

$= 17$ m

**8.** No, 26244 is not a perfect cube.

Prime factorisation of 26244 is as follows:

$26244 = 2 \times 2 \times \underbrace{3 \times 3 \times 3} \times \underbrace{3 \times 3 \times 3} \times 3 \times 3$

Here prime factors 2 and 3 are left ungrouped. So, if we divide 26244 by 2 × 2 × 3 × 3 = 36, we are left with the triplets of 3, making the quotient (26244 ÷ 36 = 729), a perfect cube.

There, 36 is the smallest natural number by which 26244 must be divided to make it a perfect cube.

## CHAPTER 7 : COMPARING QUANTITIES

### Let's Recall

**1.** (*a*) Total weight = 100 g

Extra weight = 20 g

$\therefore$ Required ratio = $\frac{20}{100} = \frac{1}{5}$ or 1 : 5

(*b*) Extra weight = 20 g and recommended weight = 80 g.

$\therefore$ Required percentage = $\frac{20}{80} \times 100 = 25\%$

(*c*) Earlier the company sold 100 g for ₹10 and now 80 g for ₹10. Thus by reducing the quantity from 100 g to 80 g they are increasing the price per gram i.e., $\frac{10}{100} = 0.1$ per gram and $\frac{10}{80} = 0.125$ per gram. Thus the company makes more money per gram by reducing the weight.

Now, 0.125 is 25% higher than 0.1.

So, the company will make a 25% profit not 20%.

**2.** 50 g toothpaste for ₹90

Cost per gram = ₹ $\frac{90}{50}$ = ₹1.8 per gram

125 g toothpaste for ₹180

Cost per gram = ₹ $\frac{180}{125}$ = ₹1.44 per gram

Since, the cost per gram of 125 g toothpaste for ₹180 is less than the cost per gram of 50 g toothpaste for ₹90. So, 125 g toothpaste for ₹180 is a better choice.

### Quick Check (Page 169)

**1.** (*a*) 2.5% of 200 bulbs = $\frac{2.5}{100} \times 200 = 5$

(*b*) $16\frac{2}{3}\%$ of 600 L = $\frac{50}{3 \times 100} \times 600 = 100$ L

**2.** Let the number be $x$.

A.T.Q., 15% of $x$ = 30

$\Rightarrow \frac{15}{100} \times x = 30$

$\Rightarrow x = \frac{30 \times 100}{15} = 200$

**3.** Since the agent receives the commission, which is 4% of the selling price.

$\therefore$ Commission = 4% × Selling price

$\Rightarrow 50,000 = \frac{4}{100} \times$ Selling price

[$\because$ Commission = 50,000 (Given)]

$\Rightarrow$ Selling price = $\frac{50,000 \times 100}{4}$ = ₹12,50,000

### Practice Time 7A

**1.** Let the number be '$x$'.

A.T.Q., 7% of $x$ = 42

$\Rightarrow x = \frac{42 \times 100}{7} = 600$

**2.** A drum contains 225 L of petrol. Out of which 4.5 L of petrol was wasted due to leakage.

$\therefore$ Leakage percentage of petrol = $\frac{4.5}{225} \times 100$

= 2%

**3.** A taxi is filled with 15 kg of CNG before starting a journey and 2.25 kg of CNG is left after reaching the destination.

$\therefore$ CNG consumed = 15 – 2.25 = 12.75 kg.

Thus, per cent of CNG consumed during the journey = $\frac{12.75}{15} \times 100 = \frac{1275}{15 \times 100} \times 100 = 85\%$.

**4.** Nagma's Salary is ₹45,000 and she gets an increment of 12%.

$\therefore$ Nagma's new salary = 45,000 + $\frac{12}{100} \times 45,000$

= 45,000 + 5,400

= ₹50,400

Also, Shipra's new salary after an increase of 8% becomes ₹81,000. Let $x$ be the previous salary of shipra, then

$x + \frac{8}{100} \times x = 81,000$

$\Rightarrow \frac{108x}{100} = 81,000$

$\Rightarrow x = \frac{81,000 \times 100}{108}$ = ₹75,000

**5.** Original speed = 45 km/h, New speed = 60 km/h

Increase in speed = 60 – 45 = 15 km/h.

$\therefore$ Percentage increase in speed = $\frac{15}{45} \times 100$

= 33.33%

**6.** Let the total number of oranges be $x$.

A.T.Q., $\frac{40}{100} \times x + 180 = x$

$\Rightarrow \quad 0.4x + 180 = x$

$\Rightarrow \quad x - 0.4x = 180 \quad \Rightarrow 0.6x = 180$

$\Rightarrow \quad x = \frac{180}{6} \times 10 = 300$

Thus, the number of oranges he originally had = 300.

**7.** Let '$x$' be the total number of subject experts.

A.T.Q., 80% of $x + 25 = x$

$\Rightarrow \quad 0.8x + 25 = x$

$\Rightarrow \quad (1 - 0.8)x = 25$

$\Rightarrow \quad 0.2x = 25$

$\Rightarrow \quad x = \frac{25 \times 10}{2} = 125$

$\therefore$ Total subject experts = 125 and number of female subject experts = $\frac{80}{100} \times 125 = 100$.

**8.** Let the number be 100.

If the number is increased by 20%, then the increased number = $100 + \frac{20}{100} \times 100 = 100 + 20$
$= 120$.

If the increased number is decreased by 20%, then the decreased number $= 120 - \frac{20}{100} \times 120$
$= 120 - 24 = 96$

Net decrease = 100 – 96 = 4.

$\therefore$ Net decrease per cent = $\frac{4}{100} \times 100 = 4\%$.

**9.** Normal price of ticket = ₹320 and its cost is increased by 40%.

$\therefore$ New price of the ticket = $320 + \frac{40}{100} \times 320$
$= 320 + 128 =$ ₹448

**10.** Original cost of motorcycle = ₹80,000 and its cost has decreased by 22%.

$\therefore$ Decreased value = $\frac{22 \times 80,000}{100} =$ ₹17,600

[Percentage decrease = $\frac{\text{Change in value}}{\text{Original value}} \times 100$]

Thus, the cost after two years
= ₹80,000 – ₹17,600 = ₹62,400.

**11.** Let $x$ be the money he originally have.

Now, he give 40% of the money to his children, so he is left with $= x - \frac{40}{100} \times x = (1 - 0.4)x = 0.6x$

Remaining amount = $0.6x$.

Out of the remaining amount he gave 20% to a trust.

$\therefore$ Amount left $= 0.6x - \frac{20}{100} \times 0.6x$
$= 0.6x - 0.12x = 0.48x$

Now, $0.48x =$ ₹96,000 [Given]

$\Rightarrow \quad x = \frac{96,000}{48} \times 100 =$ ₹2,00,000

So, the man originally have ₹2,00,000.

**12.** It is given that the 67% of a person's total body weight is water. Nanda's weight = 60 kg.

$\therefore$ Weight of water in Nanda's body = $\frac{67}{100} \times 60$
= 40.2 kg

## Think and Answer (Page 171)

**1.** Calculation done by Vijay is incorrect.

CP = ₹10, SP = ₹20

Profit% = $\frac{20 - 10}{10} \times 100 = \frac{10}{10} \times 100$

The correct calculation is $\frac{10}{10} \times 100\% = 100\%$. So Madhu is making a profit of 100%.

**2.** Extra expenses like cartage, labour charges, cost of repairing, etc are called overhead expenses, which are to be included in the cost price.

Now, SP = ₹20, CP = ₹15.

$\therefore \quad$ Profit% = $\frac{20 - 15}{15} \times 100\%$

$\left[\because \text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100\%\right]$

$= \frac{5}{15} \times 100 = \frac{100}{3} = 33\frac{1}{3}\%$

## Quick Check (Page 172)

CP of the first sewing machine = ₹4500. Percentage of loss = 8%.

Therefore, its

$$SP = \frac{4500 \times (100 - 8)}{100}$$

$$\left[\because \text{SP} = \frac{\text{CP} \times (100 - \text{L\%})}{100}\right]$$

$= 45 \times 92 = ₹4140$

Now, CP of the second sewing machine = ₹4500.
Percentage of profit = 15%.
Therefore, its

$$\text{SP} = \frac{4500 \times (100 + 15)}{100}$$

$$\left[\because \text{SP} = \frac{\text{CP} \times (100 + \text{P\%})}{100}\right]$$

$= 45 \times 115 = ₹5175$

Total SP of the two machines = ₹(4140 + 5175)
= ₹9315

Total CP of the two machines = ₹4500 × 2
= ₹9000

Since, total SP > total CP, therefore a profit of ₹(9315 – 9000) = ₹315 has been made.

## Practice Time 7B

1. Cost Price (CP) = ₹960 + ₹40 = ₹1000 (overhead expenses are added to CP).

   Percentage of gain = 15%, then

$$\text{SP} = \left(\frac{100 + 15}{100}\right) \times 1000 = \frac{115}{100} \times 1000$$

$$= ₹1,150 \quad \left[\therefore \text{SP} = \left(\frac{100 + \text{P\%}}{100}\right) \times \text{CP}\right]$$

2. Cost Price (CP) of car = ₹2,75,000 + ₹25,000
   = ₹3,00,000

   Selling Price (SP) of car = ₹3,45,000

   Profit = ₹(3,45,000 – 3,00,000) = ₹45,000

$$\therefore \quad \text{Profit\%} = \frac{45,000}{3,00,000} \times 100 = \frac{45}{3} = 15\%$$

3. CP of first electric iron = ₹1200. Percentage of loss = 8%. Therefore, its

$$\text{SP} = \frac{1200 \times (100 - 8)}{100} = \frac{1200 \times 92}{100} = ₹1104$$

   Now, CP of the second iron = ₹1200. Percentage of profit = 10%. Therefore, its

$$\text{SP} = \frac{1200 \times (100 + 10)}{100} = 12 \times 110 = ₹1320$$

   Total SP of two irons = ₹(1104 + 1320) = ₹2424

   Total CP of two irons = ₹1200 × 2 = ₹2400

   Since, total SP > total CP, therefore a profit of ₹(2424 – 2400) = ₹24 has been made.

4. C.P. of 200 LED bulbs = ₹(200 × 60) = ₹12,000

   Since 10 bulbs was fused and had to be thrown away. So, remaining bulbs = 200 – 10 = 190, which was sold for ₹75 each.

   ∴ SP of 190 bulbs = 190 × 75 = ₹14250.

   Since SP > CP, so there is a profit.

   Profit = ₹(14250 – 12000) = ₹2250

$$\therefore \quad \text{Profit\%} = \frac{\text{Profit}}{\text{CP}} \times 100\% = \frac{2250}{12000} \times 100\%$$

$= 18.75\%$

5. Same as solution of Q3.
6. SP of table = ₹744 and loss = 7%

$$\therefore \quad \text{CP of table} = \left(\frac{100}{100 - 7}\right) \times 744$$

$$\left[\because \text{CP} = \left(\frac{100}{100 - \text{L\%}}\right) \times \text{SP}\right]$$

$$= \frac{74400}{93} = ₹800$$

   Now, we have to find SP to have a gains of 11%.

$$\therefore \quad \text{SP} = \left(\frac{100 + 11}{100}\right) \times 800$$

$$\left[\because \text{SP} = \left(\frac{100 + \text{P\%}}{100}\right) \times \text{CP}\right]$$

$= 111 \times 8 = ₹888$

7. Let the shopkeeper buys '$x$' pencils for ₹3 and '$x$' pencils for ₹6.

   Total number of pencils = $x + x = 2x$.

   Cost of first '$x$' pencils = $3 \times x$ = ₹$3x$

   Cost of second '$x$' pencils = $6 \times x$ = ₹$6x$

   Total cost = $3x + 6x$ = ₹$9x$ for $2x$ pencils

   Now the shopkeeper sells '$2x$' pencils for ₹7 each.

   ∴ SP of '$2x$' pencils = $2x \times 7$ = ₹$14x$

   Since SP > CP, so we have a profit = $14x - 9x$
   $= 5x$

$$\therefore \quad \text{Profit \%} = \frac{5x}{9x} \times 100 = \frac{500}{9} \approx 55.56\%$$

8. CP of 12 lemon = ₹84

$$\text{CP of 1 lemon} = \frac{84}{12} = ₹7$$

   SP of 10 lemon = ₹60

$$\text{SP of 1 lemon} = \frac{60}{10} = ₹6$$

Since CP > SP, so it is a loss.

$$\text{Loss} = \text{CP} - \text{SP} = ₹(7-6) = ₹1$$

$$\text{Loss\%} = \frac{1}{7} \times 100\% = \frac{100}{7} \approx 14.29\%$$

$$\left[\because \text{Loss\%} = \frac{\text{Loss}}{\text{CP}} \times 100\right]$$

**9.** Given, CP of 10 chairs = SP of 8 chairs. ...(i)

Let CP of 1 chair = $x$

So, CP of 10 chairs = $10x$

$\Rightarrow$ SP of 8 chairs = $10x$ [Using (i)]

$\Rightarrow$ SP of 1 chair = $\frac{10x}{8} = 1.25x$

Since SP > CP, so it is a profit.

Profit = $1.25x - x = (1.25 - 1)x = 0.25x$

$\therefore$ Profit % = $\frac{0.25x}{x} \times 100 = 25\%$

**10.** C.P. of AC = ₹48,000. Now, A sold it to B and earn a profit of 10%.

So, S.P. of A = $48,000 + \frac{10}{100} \times 48,000$

= ₹(48,000 + 4800) = ₹52,800

Now, S.P. of B = ₹52,800 + $\frac{10}{100} \times 52,800$

= ₹(52,800 + 5280) = ₹58,080

(*a*) A's profit = ₹4800 and B's profit = ₹5280.

No, both A and B did not earn same profit.

(*b*) S.P. of B = C.P. of C.

So, C pay ₹58,080 for AC.

(c) S.P. of A (to C) with a 20% profit

$= 48,000 + \frac{20}{100} \times 48,000$

= 48,000 + 9600 = ₹57,600

So, if A sold directly to C at a profit of 20%, C would have to pay ₹57,600, which is less than ₹58,080.

## Quick Check (Page 174)

Let CP = ₹100

Then MP = ₹100 + 25% of ₹100 = ₹125

Now, SP after allowing a discount of 20%

$$= \left(\frac{100-20}{100}\right) \times 125$$

$$\left[\because \text{SP} = \left(\frac{100 - \text{Discount\%}}{100}\right) \times \text{MP}\right]$$

$$= \frac{80}{100} \times 125 = ₹100$$

Since, SP = CP, so there is no gain or loss.

## Practice Time 7C

**1.** Original price = ₹2400

Sale price = ₹1800

$\therefore$ Discount = 2400 – 1800 = ₹600

Thus, discount % = $\frac{600}{2400} \times 100$

$$\left[\because \text{Discount\%} = \frac{\text{Discount}}{\text{MP}} \times 100\%\right]$$

= 25%

**2.** (*a*) CP of toy = ₹900

Discounted price = $\frac{60}{100} \times 900$ = ₹540.

$\therefore$ Savings = ₹(900 – 540) = ₹360

(*b*) CP of toy = ₹540

Discounted price (Sale price) = $\frac{60}{100} \times 540$

= ₹324

**3.** Original price at store A = ₹750

Discount = 25% of 750 = $\frac{25}{100} \times 750$ = ₹187.50

$\therefore$ Sale price = ₹(750 – 187.50) = ₹562.50 at store A.

Sale price at store B = ₹600

Thus, at store A the set of mechanix is less expensive.

**4.** Discount = 15%. Mobile phone bought after receiving a discount of ₹1950.

$$15 = \frac{1950}{\text{MP}} \times 100$$

$$\therefore \quad \text{MP} = \frac{1950}{15} \times 100 = ₹13,000$$

$$\left[\because \text{Rate of discount} = \frac{\text{Discount}}{\text{MP}} \times 100\%\right]$$

$\therefore$ Marked price of the mobile phone = ₹13,000.

**5.** Cost price of an article = ₹1600

Profit on article = 20% of 1600 = $\frac{20}{100} \times 1600$

= ₹320

$\therefore$ Selling price of an article = ₹(1600 + 320)

= ₹1920

Let marked price = $x$.

Now, we know that,

$$SP = MP - Discount$$

$\Rightarrow$ $1920 = x - 10\%$ of $x$

$\Rightarrow$ $1920 = x(1 - 0.1)$

$\Rightarrow$ $x = \frac{1920}{0.9} = ₹2133.33$

**6.** Let MP = ₹100. Now

$$\text{Selling price} = \left(\frac{100-25}{100}\right) \times \left(\frac{100-10}{100}\right) \times 100$$

[$\because$ Two successive discounts are 25% and 10%]

$$= \frac{75}{100} \times \frac{90}{100} \times 100 = 0.75 \times 90$$

$$= ₹67.50$$

$\therefore$ Discount = 100 – 67.50

[$\because$ SP = MP – Discount]

$$= 32.50$$

$$\text{Discount\%} = \frac{32.50}{100} \times 100 = 32.5\%$$

Thus, single discount equivalent to two successive discounts of 25% and 10% is 32.5%.

**7.** The final selling price of a sweater listed at ₹2500 with two successive discounts of 30% and 5%

$$= \left(\frac{100-30}{100}\right) \times \left(\frac{100-5}{100}\right) \times 2500$$

$$= \frac{70}{100} \times \frac{95}{100} \times 2500 = \frac{7 \times 2375}{10}$$

$$= ₹1662.50$$

**8.** After giving a discount of 5%, a mobile phone adapter is sold for ₹570.

Let '$x$' be the list price of the adapter.

$\therefore$ $x - 5\%$ of $x = 570$ $\Rightarrow x\left(1 - \frac{5}{100}\right) = 570$

$\Rightarrow$ $x = \frac{570 \times 100}{95} = ₹600$

**9.** Let CP = $x$.

A.T.Q., MP = $x + 60\%$ of $x$

$$= x + \frac{60}{100} \times x = 1.6x \quad ...(i)$$

$$\text{Discount} = \frac{\text{Discount\%}}{100} \times MP$$

$$= \frac{25}{100} \times (1.6x) = 0.4x \quad ...(ii)$$

$\therefore$ SP = MP – Discount

$= 1.6x - 0.4x$ [Using (i) and (ii)]

$= 1.2x$

$$\text{Gain\%} = \frac{SP - CP}{CP} \times 100$$

$$= \frac{1.2x - x}{x} \times 100$$

$$= \frac{0.2x}{x} \times 100 = 20\%$$

**10.** Let CP = ₹100, Gain% = 30%

SP = CP + 30% of CP = $100 + \frac{30}{100} \times 100 = ₹130$

A.T.Q., MP = SP + 20% of MP

$\Rightarrow$ SP = MP – 20% of MP

$\Rightarrow$ 130 = MP(1 – 0.2) = 0.8 MP

$\Rightarrow$ $MP = \frac{130}{0.8} = ₹162.50$

$\therefore$ Required increase = ₹(162.50 – 100) = ₹62.50.

$$\text{\% Increase} = \frac{62.50}{100} \times 100 = 62.5\%$$

Hence, the required percent should be ₹62.5% more than that of the cost price.

## Practice Time 7D

**1.** Total cost of goods = ₹24,000

Since GST rate on goods = 18%

So, 9% is of CGST and 9% is of SGST.

$\therefore$ $CGST = \frac{9}{100} \times 24{,}000 = ₹2160,$

and $SGST = \frac{9}{100} \times 24{,}000 = ₹2160.$

**2.** (*a*) Given, SP = ₹5450 and VAT = 5%

$$VAT = \frac{5}{100} \times 5450 = ₹272.50$$

Thus, bill amount = ₹(5450 + 272.50)

= ₹5722.50

(*b*) Given, SP = ₹1300 and GST = 18%

$$GST = \frac{18}{100} \times 1300 = ₹234$$

Thus, bill amount = ₹1300 + ₹234

= ₹(1300 + 234) = ₹1534

3. List price of a coffee maker = ₹6500

Bill amount = ₹6760.

Sales tax = ₹(6760 – 6500) = ₹260

Rate of sales tax = $\frac{260}{6500} \times 100 = 4\%$

4. Let the original price of a shampoo bottle = ₹$x$.

A.T.Q., $x + 8\%$ of $x = 324$

$\Rightarrow x(1 + 0.08) = 324$

$\Rightarrow x = \frac{324}{1.08} = \frac{324 \times 100}{108} = 300$

So, the original price of a shampoo = ₹300.

5. Let the price before tax was added = ₹$x$

∴ According to question,

$x + 28\%$ of $x = 44800$

$\Rightarrow x(1 + 0.28) = 44800$

$\Rightarrow x = \frac{44800}{1.28} = \frac{44800 \times 100}{128} =$ ₹35,000

6. C.P. of radio = ₹2560, Rate of GST = 28%

Let the price of radio before adding GST = ₹$x$

∴ $x + 28\%$ of $x = 2560$

$\Rightarrow x(1 + 0.28) = 2560$

$\Rightarrow x = \frac{2560}{1.28} = \frac{2560}{128} \times 100 =$ ₹2000

∴ Reduction needed in the price of the radio

= ₹(2560 – 2000) = ₹560.

7. Marked price on the computer = ₹65,000

Discount amount = $\frac{20}{100} \times 65000$ = ₹13,000

Price after discount = ₹(65,000 – 13,000)

= ₹52,000

∴ Total amount Raman paid

= 52,000 + 12.5% × 52000

= $52000 + \frac{12.5}{100} \times 52000$

= 52000 + 6500 = ₹58,500

8. List price of the refrigerator = ₹15,500

Discount amount = $\frac{8}{100} \times 15{,}500$ = ₹1240

Price after discount = ₹(15,500 – 1240) = ₹14260

∴ Total amount customer has to pay to buy the refrigerator after GST = 14260 + 28% of 14260

= $14260 + \frac{28}{100} \times 14260$

= 14260 + 3992.80

= ₹18252.80

## Maths Fun (Page 181)

We know that, Simple Interest (SI) = $\frac{P \times R \times T}{100}$

and CI = $P\left[\left(1 + \frac{R}{100}\right)^n - 1\right]$

Given P = ₹1000, and R = 5%

For 1 year, SI = $\frac{1000 \times 5 \times 1}{100}$ = ₹50 and

$CI = 1000\left[\left(1 + \frac{5}{100}\right)^1 - 1\right] = 1000\left(\frac{105 - 100}{100}\right)$

= ₹50

For 2nd year, SI = $\frac{1000 \times 5 \times 2}{100}$ = ₹100

$CI = 1000\left[\left(1 + \frac{5}{100}\right)^2 - 1\right] = 1000\left(\frac{441 - 400}{400}\right)$

= ₹102.50 ≈ ₹103

For 3rd year, SI = $\frac{1000 \times 5 \times 3}{100}$ = ₹150

$CI = 1000\left[\left(1 + \frac{5}{100}\right)^3 - 1\right] = 1000\left(\frac{9261 - 8000}{8000}\right)$

= ₹157.60 ≈ ₹158

For 4th year, SI = $\frac{1000 \times 5 \times 4}{100}$ = ₹200

$CI = 1000\left[\left(1 + \frac{5}{100}\right)^4 - 1\right]$

$= 1000\left(\frac{194481 - 160000}{160000}\right)$ = ₹215.50 ≈ ₹216

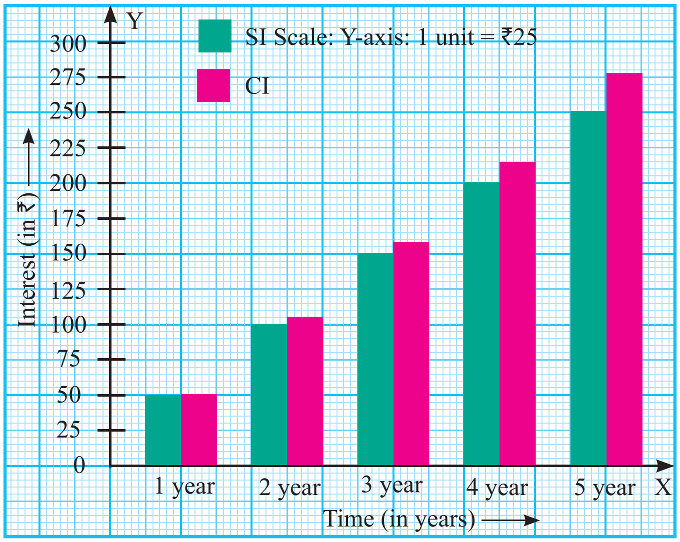
For 5th year, SI = $\frac{1000 \times 5 \times 5}{100}$ = ₹250

$CI = 1000\left[\left(1 + \frac{5}{100}\right)^5 - 1\right]$

$= 1000\left(\frac{4084101 - 3200000}{3200000}\right)$ = ₹276.30

≈ ₹276

| Time period (Years) | SI (in ₹) | CI (in ₹) |
|---|---|---|
| 1 | 50 | 50 |
| 2 | 100 | 103 |
| 3 | 150 | 158 |
| 4 | 200 | 216 |
| 5 | 250 | 276 |




## Practice Time 7E

**1.** (*a*) Here P = ₹5000, R = 8% per annum, T = 2 years

Using the formula, $A = P\left(1+\frac{R}{100}\right)^n$, we get

$$A = 5000\left(1+\frac{8}{100}\right)^2 = 5000\left(1+\frac{2}{25}\right)^2$$

$$= 5000 \times \frac{27}{25} \times \frac{27}{25} = ₹5832$$

C.I. = A – P = ₹(5832 – 5000) = ₹832

(*b*) Here P = ₹10,000, R = 10% p.a. as 5% half yearly, T = 1½ year or 3 half-years.

So, $A = 10000\left(1+\frac{5}{100}\right)^3$

$$= 10000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

= ₹11576.25

C.I. = A – P = ₹(11576.25 – 10000)

= ₹1576.25

(*c*) Here P = ₹18,000, Rate = 8% per annum or $\frac{1}{4} \times 8\% = 2\%$ quarterly, and $n$ = 1 year or 1 × 4 = 4 quarters.

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n = 18000\left(1+\frac{2}{100}\right)^4$$

$$= 18000\left(\frac{51}{50}\right)^4$$

$$= 18000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50}$$

= ₹19483.77

and C.I. = A – P = ₹(19483.77 – 18,000)

= ₹1483.77

**2.** Here P = ₹50,000, Rate 15% p.a., Time = 2 year and 4 months.

So, we will first calculate the amount for 2 years and then calculate the simple interest for 4 months on the amount obtained at the end of 2 years.

$$A = 50,000\left(1+\frac{15}{100}\right)^2$$

$$= 50,000 \times \frac{115}{100} \times \frac{115}{100} = ₹66125$$

CI = ₹(66125 – 50,000) = ₹16125

Now, $SI = \frac{66125 \times 15 \times 4}{100 \times 12} = \frac{66125}{20}$

= ₹3306.25

So, CI for 2 years 4 months = ₹(16125 + 3306.25)

= ₹19431.25

Amount = P + Interest = ₹(50,000 + 19431.25)

= ₹69431.25

**3.** Here P = ₹25,000

**Case I:** For Kavita, rate = 12% p.a., time = 3 years.

$$\therefore \quad SI = \frac{25,000 \times 12 \times 3}{100} = ₹9000$$

**Case II:** For Savita, rate = 10%, time = 3 years

$$\therefore \quad \text{Amount} = 25,000\left(1+\frac{10}{100}\right)^3$$

$$= 25,000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

= ₹33275

CI = A – P = ₹(33275 – 25,000)

= ₹8275

So, Kavita pays more interest by ₹(9000 – 8275)

= ₹725

**4.** Here P = ₹1,25,000, Rate of interest = 8% p.a., Time = 1 year 6 months.

(*a*) Amount after 1 year $= 1,25,000\left(1+\frac{8}{100}\right)^1$

$$= 1,25,000 \times \frac{27}{25}$$

= ₹1,35,000

Interest after 1 year = 1,35,000 – 1,25,000

= ₹10,000

$$\text{SI for 6 months} = \frac{1,35,000 \times 8 \times 6}{100 \times 12} = \frac{135000}{25}$$
$= ₹5400$

$A = P + I$
$= 1,25,000 + (10,000 + 5400)$
$= ₹1,40,400$

(*b*) Amount after 1 year 6 months

$$= 1,25,000\left(1+\frac{4}{100}\right)^3 = 1,25,000\left(\frac{26}{25}\right)^3$$
$$= 1,25,000 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25}$$
$= 8 \times 26 \times 26 \times 26 = ₹1,40,608$

Thus, the difference between two amounts
$= ₹(140608 – 140400) = ₹208$

**5.** Let the population at the end of year 2024 be P.
Initial population in 2021 ($P^1$) = 2,00,000
Increase in value ($R_1$) = 5% p.a.
∴ Population at the end of 2024 (P)
$$= 2,00,000\left(1+\frac{5}{100}\right)^3 = 2,00,000 \times \left(\frac{21}{20}\right)^3$$
$$= 2,00,000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$
$= 25 \times 21 \times 21 \times 21 = 231525$

**6.** Let the population in the year 2021 = P and population in the year 2023 = A = 3,64,500 (Given).

A.T.Q., $3,64,500 = P\left(1+\frac{8}{100}\right)^2$

$\Rightarrow \quad 3,64,500 = P\left(\frac{27}{25}\right)^2$

$$\Rightarrow \quad P = \frac{364500}{\left(\frac{27}{25}\right)^2} = \frac{364500 \times 25 \times 25}{27 \times 27}$$
$= 500 \times 25 \times 25 = 3,12,500$

**7.** Cost of the car = ₹6,25,000, Rate of depreciation = 12% p.a.
Therefore, value of the car after 2 years
$$= 625000\left(1-\frac{12}{100}\right)^2 = 625000 \times \left(\frac{22}{25}\right)^2$$
$$= 625000 \times \frac{22}{25} \times \frac{22}{25} = 1000 \times 22 \times 22$$
$= ₹4,84,000$

**8.** In a factory, the production of bikes increased from 20,000 to 26,620 in 3 years.

$$\therefore \quad 26,620 = 20,000\left(1+\frac{R}{100}\right)^3$$
$$\Rightarrow \frac{26,620}{20,000} = \left(1+\frac{R}{100}\right)^3 \Rightarrow \frac{1331}{1000} = \left(1+\frac{R}{100}\right)^3$$
$$\Rightarrow \left(\frac{11}{10}\right)^3 = \left(1+\frac{R}{100}\right)^3 \Rightarrow \frac{11}{10} - 1 = \frac{R}{100}$$
$$\Rightarrow \frac{R}{100} = \frac{1}{10} \Rightarrow R = 10\%$$

**9.** Given, P = ₹10,000, A = ₹12,100, Rate = 10%
$$\Rightarrow \quad 12,100 = 10000\left(1+\frac{10}{100}\right)^T$$
$$\Rightarrow \frac{121}{100} = \left(1+\frac{10}{100}\right)^T \Rightarrow \left(\frac{11}{10}\right)^2 = \left(\frac{10+1}{10}\right)^T$$
$$\Rightarrow \left(\frac{11}{10}\right)^T = \left(\frac{11}{10}\right)^2 \Rightarrow T = 2 \text{ years.}$$

**10.** Given, A = ₹29,160, T = 2 years, R = 8% p.a.
Let P be the sum.
$$\therefore \quad 29160 = P\left(1+\frac{8}{100}\right)^2$$
$$\Rightarrow 29160 = P\left(1+\frac{2}{25}\right)^2 \Rightarrow 29160 = P\left(\frac{27}{25}\right)^2$$
$$\Rightarrow \quad P = \frac{29160 \times 25 \times 25}{27 \times 27}$$
$\Rightarrow \quad P = 40 \times 25 \times 25 = ₹25,000$

**11.** Let the value of machinery after 3 years = P.
Given, initial value of machinery ($P_1$) = ₹16,000 and its value depreciates 6% in first year, 5% in second year and 4% in third year.
∴ Value of machinery after 3 years (P)
$$= 16,000\left(1-\frac{6}{100}\right)\left(1-\frac{5}{100}\right)\left(1-\frac{4}{100}\right)$$
$$= 16,000\left(\frac{47}{50}\right)\left(\frac{19}{20}\right)\left(\frac{24}{25}\right)$$
$$= \frac{16 \times 47 \times 19 \times 24}{25} = ₹13716.48$$

**12.** Given, A = ₹7865, P = ₹6500, Time = 1 year or 2 half-years.

$$\therefore \quad 7865 = 6500\left(1+\frac{R}{200}\right)^2$$

$$\Rightarrow \quad \frac{7865}{6500} = \left(1+\frac{R}{200}\right)^2 \quad \Rightarrow \quad 1.21 = \left(1+\frac{R}{200}\right)^2$$

$$\Rightarrow \quad (1.1)^2 = \left(1+\frac{R}{200}\right)^2 \quad \Rightarrow \quad \frac{R}{200} = 1.1 - 1$$

$$\Rightarrow \quad R = 0.1 \times 200 = 20$$

$$\therefore \quad R = 20\%$$

## Maths Connect (Page 186)

**1.** Calories from fat in sweet corn soup = 9

Calories from fat in tomato soup = 20

∴ Ratio of calories from fat in sweet corn soup to the calories from fat in cream of tomato soup = 9 : 20.

**2.** According to the question, 1 serving of sweet corn Soup contains 22% of sodium for a 2000 calorie diet = 540 mg.

So, recommended daily value of sodium

$$= \frac{540}{22} \times 100 = 2454.54 \text{ mg}$$

**3.** Increased percent of protein consumed

$$= (3 - 2) \text{ g} = 1 \text{ g}$$

∴ Required percentage $= \frac{1}{2} \times 100\% = 50\%$

## Mental Maths

**1.** $\frac{9}{25} \times 100 = 36\%$

**2.** Marked price of a bottle (MP) = ₹250 and percentage of discount = 20%

$$\therefore \quad SP = \left(\frac{100-20}{100}\right) \times 250$$

$$\left[\because \ SP = \left(\frac{100 - \text{Discount}\%}{100}\right) \times MP\right]$$

$$= \frac{80 \times 250}{100} = ₹200$$

**3.** Shubham bought a jacket, so (CP) = ₹1280

Gain% = 10%.

$$\therefore \quad SP = \left(\frac{100+10}{100}\right) \times 1280$$

$$\left[\because \ SP = \left(\frac{100 + P\%}{100}\right) \times CP\right]$$

$$= \frac{110}{100} \times 1280 = ₹1408$$

**4.** Given, a certain sum of money is doubled in 7 years at a fixed rate compounded yearly.

$$\therefore \quad 2P = P\left(1+\frac{R}{100}\right)^7$$

$$\Rightarrow \quad 2 = \left(1+\frac{R}{100}\right)^7 \quad \text{...(i)}$$

Now, we have to calculate the time in which it will be four times i.e.,

$$4P = P\left(1+\frac{R}{100}\right)^T$$

$$\Rightarrow \quad 4 = \left(1+\frac{R}{100}\right)^T$$

$$\Rightarrow \quad (2)^2 = \left(1+\frac{R}{100}\right)^T \quad \text{[from (i)]}$$

$$\Rightarrow \quad \left(1+\frac{R}{100}\right)^{7\times 2} = \left(1+\frac{R}{100}\right)^T$$

$$\Rightarrow \quad \left(1+\frac{R}{100}\right)^T = \left(1+\frac{R}{100}\right)^{14}$$

∴ The sum of money in 14 years will be four times.

**5.** Let the original price of the article = ₹100

After an increase of 30%,

$$\text{price} = 100 + 30\% \text{ of } 100$$

$$= 100 + \frac{30}{100} \times 100 = ₹130$$

After an decrease of 30%,

$$\text{price} = 130 - 30\% \text{ of } 130 = 130 - \frac{30}{100} \times 130$$

$$= 130 - 39 = ₹91$$

So, the new price of an article after increased by 30% and then decreased by 30%, is ₹91 with respect to initial price of ₹100. Thus, the new price is 9% less then the initial price.

**6.** Let CP of 1 article = ₹$x$

Then, CP of 5 articles = ₹$5x$

⇒ SP of 4 articles = ₹$5x$

[∵ CP of 5 articles = SP of 4 articles]

⇒ SP of 1 article = ₹ $\frac{5x}{4}$

Since SP > CP, so

$$\text{Profit} = \frac{5x}{4} - x = x\left(\frac{5-4}{4}\right) = \frac{x}{4}$$

$$\therefore \quad \text{Profit\%} = \frac{\frac{x}{4}}{x} \times 100 = \frac{100}{4} = 25\%$$

## Chapter Assessment

**A.**

**1.** (*b*) 40% of [100 – 20% of 300]

$= 40\% \text{ of } \left[100 - \frac{20}{100} \times 300\right]$

$= 40\% \text{ of } [100 - 60] = \frac{40}{100} \times 40 = 16$

**2.** (*d*) When we calculate compound interest, compounded semi-annually, then rate $= \left(\frac{r}{2}\right)\%$ per half year and Time = (2*n*) half years.

$\therefore$ Required formula for CI $= P\left[\left(1 + \frac{r}{200}\right)^{2n} - 1\right]$

**3.** (*a*) Here P = ₹2,88,000, R = 12% p.a., T = 9 months

$\therefore \text{ SI} = \frac{2,88,000 \times 12 \times 9}{100 \times 12} = ₹25,920$

**4.** (*c*) Given, P = ₹5000, Rate = 4%, Time = 2 years

$\therefore \quad \text{Amount} = 5000\left(1 + \frac{4}{100}\right)^2 = 5000\left(\frac{26}{25}\right)^2$

$= 5000 \times \frac{26}{25} \times \frac{26}{25} = ₹5408$

CI = A – P = ₹(5408 – 5000) = ₹408

**5.** (*a*) Given SP = ₹630, profit% = 5%

$\therefore \quad \text{CP} = \left(\frac{100}{100+5}\right) \times 630$

$\left[\because \text{ CP} = \left(\frac{100}{100+5}\right) \times \text{SP}\right]$

$= \frac{100}{105} \times 630 = ₹600$

**6.** (*b*) Let the price of the article without GST = ₹*x*

$\therefore$ Billing amount = ₹*x* + 18% of ₹*x* = ₹1357 [Given]

$\Rightarrow x\left(1 + \frac{18}{100}\right) = 1357 \Rightarrow x \times \left(\frac{118}{100}\right) = 1357$

$\Rightarrow x = \frac{1357 \times 100}{118} = 1150$

Thus, the price of the article without GST = ₹1150.

**7.** (*a*) CP of 10 machines = ₹7,50,000

MP of each machine = ₹80,000

Since the shopkeeper sold each machine after a discount of 10%.

$\therefore \quad \text{Discount} = 80,000 \times \frac{10}{100} = ₹8,000$

So, the shopkeeper sells machine @ ₹72,000

$\therefore$ SP of 10 machines = ₹7,20,000

Since CP > SP, so

Loss = CP – SP = 7,50,000 – 7,20,000 = ₹30,000

**8.** (*c*) CP of a teapot = ₹120, Profit = 5%

$\therefore \quad \text{SP} = \left(\frac{100+5}{100}\right) \times 120 = ₹126.$

CP of a set of cups = ₹400, Loss = 5%

$\therefore \quad \text{SP} = \left(\frac{100-5}{100}\right) \times 400 = ₹380$

$\therefore$ Amount received by Lata = ₹(126 + 380) = ₹506

**B.**

**1.** (*a*) **Assertion:** MP of a cup = ₹80, and rate of discount = 5%

$\text{Discount} = \frac{5}{100} \times 80 = ₹4$

$\therefore$ SP = MP – Discount = ₹(80 – 4) = ₹76.

So, Neha bought a cup for ₹76 after getting a 5% discount on its marked price of ₹80.

So, assertion is true.

**Reason:** Also, Sale price = Marked price – Discount is also true, which is the correct explanation of assertion.

**2.** (*a*) **Assertion:** Here P = ₹1600 and rate = 5% p.a. or $\frac{5}{2}$ half yearly and time = 2 years.

$\therefore \quad \text{CI} = 1600\left(1 + \frac{5}{200}\right)^2 = 1600\left(\frac{41}{40}\right)^2$

$= 1600 \times \frac{41}{40} \times \frac{41}{40} = ₹1681$

So, the assertion is true.

**Reason:** Amount when interest is compounded half-yearly is $A = P\left(1 + \frac{R}{200}\right)^{2n}$, is also true and it is the correct explanation of assertion.

**3.** (*d*) **Assertion:** Cost price (CP)

= ₹(2,25,000 + 25,000)

= ₹2,50,000

Selling price (SP) = ₹3,00,000

Since SP > CP, so profit is made

= ₹3,00,000 – ₹2,50,000

= ₹50,000

So, Profit % = $\frac{50,000}{2,50,000} \times 100\% = 20\%$

So, assertion is false.

**Reason:** In case of profit,

$CP = \left(\frac{100}{100 + \text{Profit\%}}\right) \times SP$, which is true.

**C.**

**1.** Let **P** be the sum.

$\therefore \quad 3136 = \mathbf{P}\left(1 + \frac{12}{100}\right)^2 \quad \Rightarrow \quad 3136 = \mathbf{P}\left(\frac{28}{25}\right)^2$

$\Rightarrow \quad \mathbf{P} = 3136 \times \frac{25}{28} \times \frac{25}{28} \quad \Rightarrow \quad \mathbf{P} = ₹2500$

So, the sum is **₹2500**

**2.** MP = ₹2500, SP = **₹2125**.

So, Discount = ₹(2500 – 2125) = **₹375**

$\therefore$ Rate of discount = $\frac{375}{2500} \times 100 = \mathbf{15\%}$

**3.** **Tax** is charged on the sale of an item by the government and its added to the bill amount.

**4.** **Overhead** expenses are the additional expenses incresed by a buyer for an item over and above its cost of purchase.

**5.** Let SP of one geometry box = ₹$x$

Then SP of 10 geometry boxes = ₹$10x$

and SP of 140 geometry boxes = ₹$140x$

Given, Loss made by selling 140 geometry boxes

= SP of 10 geometry boxes

= $10x$

$\therefore$ CP of 140 geometry boxes

= SP of 140 geometry boxes

+ loss occurred by selling 10 geometry boxes

= $140x + 10x = 150x$.

So, loss% = $\frac{10x}{150x} \times 100 = \frac{10}{150} \times 100$

$= \frac{100}{15} = \frac{20}{3} = \mathbf{6\frac{2}{3}\%}$

**6.** Marked Price = ₹2000

Since 5% discount is given.

$\therefore$ Selling price = $2000 - 2000 \times \frac{5}{100}$

= ₹(2000 – 100) = ₹1900

Selling price includes GST of 5%, so we have

= 1900 + 1900 × $\frac{5}{100}$ = ₹(1900 + 95) = ₹1995

So, the amount payable = ₹1995.

**D.**

**1.** Let the number be 100.

If the number is increased by 20%, then

$100 + \frac{20}{100} \times 100 = 120$

If the number is decreased by 20%, then

$120 - \frac{20}{100} \times 120 = 120 - 24 = 96$

Thus the number is not the same. So, the given statement is false.

**2.** Let the number B = 100.

A = 100 – 50% of 100 = 100 – 50 = 50

$\therefore$ B = 50 + 100% of 50 = $50 + \frac{100}{100} \times 50$

= 100, which is true.

So, the given statement is true.

**3.** Rate of 1 pen = ₹3.50

Rate of 100 pens = 100 × 3.50 = ₹350

Now, Abida paid sales tax of 4% on ₹350.

$\therefore$ Total amount = $\frac{4}{100} \times 350 + 350 = 14 + 350$

= ₹364

So, the given statement is true.

**4.** Let the number be $x$. So four times a number ($x$) is $4x$. Now, $4x$ is greater than $x$ by $4x - x = 3x$.

Percentage increase = $\frac{3x}{x} \times 100 = 300\%$

Now one-fourth of a number ($x$) is $\frac{1}{4}x$. So difference between $x$ and $\frac{x}{4} = x - \frac{x}{4} = \frac{3x}{4}$.

$$\text{Decrease percentage} = \frac{\frac{3x}{4}}{x} \times 100 = \frac{3x}{4} \times \frac{1}{x} \times 100$$
$$= 75\%$$

So, the given statement is false.

**5.** CP = ₹1040, SP = ₹800

Since SP < CP, so loss = ₹(1040 – 800) = ₹240

$$\text{Loss \%} = \frac{240}{1040} \times 100 = 23\frac{1}{13}\%$$

Thus, the given statement is false.

**6.** To check whether 2500 is smaller or greater, we will first find their difference.

i.e., 2500 – 500 = 2000

$$\text{Percentage difference} = \frac{2000}{500} \times 100 = 400\%$$

So, 2500 is greater than 500 by 400%. So, the given statement is false.

**E.**

**1.** Given, SI = ₹3,200, Rate = 10% p.a., T = 2 years.

$$\therefore \quad 3200 = \frac{P \times 10 \times 2}{100} \quad \left[\because SI = \frac{P \times R \times T}{100}\right]$$

$$\Rightarrow \quad P = \frac{3200 \times 100}{20} = ₹16,000$$

$$\text{Now, Amount} = 16,000\left(1 + \frac{5}{100}\right)^3 \quad \left[\because A = P\left(1 + \frac{R}{100}\right)^T\right]$$

$$= 16,000\left(\frac{21}{20}\right)^3$$

$$= 16,000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= ₹18,522$$

∴ CI = A – P = ₹(18,522 – 16,000) = ₹2,522

**2.** Given, Arvind borrows at SI annually,

P = ₹2,50,000, R = 6% p.a., T = 3 years.

$$\therefore \quad SI = \frac{2,50,000 \times 6 \times 3}{100} = ₹45,000$$

Asif borrows, P = ₹2,50,000, R = 6% p.a.,

T = 3 years compounded annually.

$$\therefore \quad A = 2,50,000\left(1 + \frac{6}{100}\right)^3 = 2,50,000\left(\frac{53}{50}\right)^3$$

$$= 2,50,000 \times \frac{53}{50} \times \frac{53}{50} \times \frac{53}{50}$$

$$= ₹2,97,754$$

Thus, C.I. = ₹(2,97,754 – 2,50,000) = ₹47,754

Thus, Asif pays more interest of

₹(47,754 – 45,000) = ₹2,754.

**3.** Let the present value of machine be P and the initial value of machine = $P_1$.

So, P = ₹1,21,743, $P_1$ = ₹$x$, decrease in value = 10% and Time = 3 years.

$$\therefore \quad P = P_1\left(1 - \frac{R}{100}\right)^T$$

$$\Rightarrow \quad 1,21,743 = x\left(1 - \frac{10}{100}\right)^3$$

$$\Rightarrow \quad 1,21,743 = x\left(1 - \frac{1}{10}\right)^3$$

$$\Rightarrow \quad 1,21,743 \times \left(\frac{10}{9}\right)^3 = x$$

$$\Rightarrow \quad x = 1,21,743 \times \frac{10}{9} \times \frac{10}{9} \times \frac{10}{9} = ₹1,67,000$$

**4.** Cost of 1 kg of mangoes = ₹48.

Cost of 160 kg mangoes = 48 × 160 = ₹7680

S.P. of 70% of 160 kg mangoes @ ₹70 / kg = $\frac{70}{100}$ × 160 = ₹7840.

SP of remaining mangoes i.e., (160 – 112 = 48) mangoes = 48 × 40 = ₹1920.

So, total SP = ₹(7840 + 1920) = ₹9760

Since, SP > CP, so profit = ₹(9760 – 7680)

= ₹2080

$$\therefore \text{Profit \%} = \frac{2080}{7680} \times 100 = 27.08\%$$

**5.** List price of set of tools = ₹1250

GST on tools = 18% of ₹1250

$$= \frac{18}{100} \times 1250 = ₹225$$

So, total price of set of tools = ₹(1250 + 225)

= ₹1475

List price of a packet of nuts and bolts = ₹360 and

GST on nuts and bolts = 12% of 360

$$= \frac{12}{100} \times 360 = ₹43.20$$

So, total amount of a packet of nuts and bolts

= ₹(360 + 43.20) = ₹403.20

Thus, the total amount which John paid for the purchase of these articles = ₹(1475 + 403.20)

= ₹1878.20

## MODEL TEST PAPER – 1

**A.**

**1.** (*c*) $-5.5 = \frac{-55}{10} = \frac{-55 \div 5}{10 \div 5} = \frac{-11}{2}$, which is in standard form.

**2.** (*d*) Since $\frac{0}{5} = 0$. Thus, there is no multiplicative inverse for the rational number zero, as 0 cannot be a divisor. So it is not defined.

**3.** (*c*) Given, $\frac{3x}{2} - 7 = 13 - \frac{5x}{2}$

$\Rightarrow \frac{3x}{2} + \frac{5x}{2} = 13 + 7$ [Transposing the variable terms to LHS and constant terms to RHS.]

$\Rightarrow \frac{8x}{2} = 20 \Rightarrow x = \frac{20}{4} = 5$

**4.** (*d*) Let the present age of Sumit's younger sister = $x$ years then the present age of Sumit = $2x$ years.

5 years ago Sumit's younger sister age = $x - 5$ years and Sumit age = $2x - 5$.

According to the question, $x - 5 = 3 \Rightarrow x = 8$

So, Sumit's present age = $2x = 2 \times 8 = 16$ years.

**5.** (*c*) Sum of interior angles of a hexagon (a 6-sided polygon) = $(6 - 2) \times 180° = 4 \times 180° = 720°$

[∵ Sum of interior angles of a polygon = $(n - 2 \times 180°)$].

**6.** (*b*) Let the measure of each of the equal angles = $x^0$.

According to the angle sum property of a quadrilateral, the sum of all angles of a quadrilateral = 360°.

$\Rightarrow 70° + 70° + x + x = 360°$

$\Rightarrow 140° + 2x = 360°$

$\Rightarrow 2x = 360° - 140° = 220°$

$\Rightarrow x = 110°$

So, the measure of each of the equal angles = 110°.

**7.** (*c*) The value of $500^2 - 499^2 = 500 + 499 = 999$

[Since, $(n + 1)^2 - n^2 = (n + 1) + n$, where $n$ is a natural number.]

**8.** (*b*) We have $66^3 = 66 \text{ x } 66 \text{ x } 66 = 287496$

So, 66 is the number having the same ones digit as its cube.

**9.** (*b*) 40% of [100 – 30% of 300]

$= 40\% \text{ of } \left[100 - \frac{30}{100} \times 300\right]$

$= 40\% \text{ of } [100 - 90] = 40\% \text{ of } 10$

$= \frac{40}{100} \times 10 = 4$

**10.** (*a*) SP = ₹840, and profit % = 5%

$\therefore \text{CP} = \left(\frac{100}{100 + 5}\right) \times 840 = \frac{100}{105} \times 840 = ₹800$

**11.** (*d*) **Assertion:** $12^2 = 144$ and $13^2 = 169$. So natural number between 144 and 169 = 24. So, assertion is false.

**Reason:** Natural numbers are the positive integers or non-negative integers which start from 1 and ends at infinity. Thus, reason is true.

**12.** (*b*) **Assertion:** CP of cistern = ₹1040, SP of cistern = ₹1352. Since SP > CP.

So, profit = ₹(1352 – 1040) = ₹312

$\therefore \text{Profit } \% = \frac{312}{1040} \times 100 = 30\%$

Thus, assertion is true.

**Reason:** In case of gain,

$\text{CP} = \left(\frac{100}{100 + \text{P}\%}\right) \times \text{SP}$, which is true.

So, both assertion and reason are true but reason is not a correct explanation of assertion.

**B.**

**1.** $2^3 = 2 \times 2 \times 2 = 8$, $4^3 = 4 \times 4 \times 4 = 64$,

$6^3 = 6 \times 6 \times 6 = 216$.

The cube of every **even** number is even.

**2.** MP = ₹3000, SP = ₹2850

So, discount = ₹(3000 – 2850) = ₹150

$\text{Discount\%} = \frac{150}{3000} \times 100$

$\left[\because \text{Discount\%} = \frac{\text{Discount}}{\text{MP}} \times 100\right]$

= **5%**

**3.** Sum of first one odd number = $1 = 1^2$

Sum of first two odd numbers = $1 + 3 = 4 = 2^2$

Sum of first three odd numbers = $1 + 3 + 5 = 9 = 3^2$

......................................................................

......................................................................

So, the sum of fist $n$ odd numbers is $\boldsymbol{n^2}$.

4. Since, both the diagonals of a rectangle are equal. So, if one diagonal = 12 cm, then the length of the other diagonal = **12 cm**.

5. MP of an article = ₹2000, Discount = 5%

SP = $2000 - \frac{5}{100} \times 2000 = 2000 - 100 =$ ₹1900

Since, SP includes 5% tax = 1900 + 5% of 1900

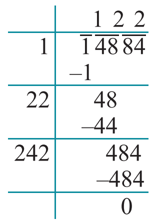
$= 1900 + \frac{5}{100} \times 1900$

$= 1900 + 5 \times 19$

= **₹1995**

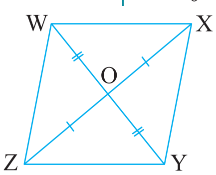
**C.**

1. The, square root of 14884 is 122. Thus, the number of digits in the square root of 14884 is 3, which is true.




2. A rhombus is a parallelogram, so its diagonals bisect each other.

WO = OY and ZO = OX.




In ΔWOZ and ΔWOX,

WZ = WX (All sides of rhombus are equal)

WO = WO (Common)

ZO = OX (Diagonals of a ||gm bisect each other)

$\therefore$ ΔWOZ ≅ ΔWOX (By SSS criterion)

$\Rightarrow$ ∠WOZ = ∠WOX (By CPCT)

We have, ∠WOZ + ∠WOX = 180°

$\Rightarrow$ ∠WOZ + ∠WOZ = 180°

$\Rightarrow$ 2∠WOZ = 180°

$\Rightarrow$ ∠WOZ = 90°

Hence, diagonals of a rhombus bisect each other at right angles. Thus the statement is true.

3. The upper limit of the continuous class-interval 45–55 is 55, is true.

4. Let the number be $x$.

Then, 8% of $x$ = 48 $\Rightarrow \frac{8}{100} \times x = 48$

$\Rightarrow \quad x = \frac{48 \times 100}{8} = 600$

So, the statement is false.

5. The ratio of the angles of a quadrilateral is 9 : 8 : 4 : 15.

Let the measures of angles be $9x$, $8x$, $4x$ and $15x$.

Since sum of all angles of a quadrilateral = 360°.

$9x + 8x + 4x + 15x = 360°$

$\Rightarrow 36x = 360° \Rightarrow x = \frac{360°}{36} \Rightarrow x = 10°$

So, the angles of a quadrilateral are 9 × 10 = 90°, 8 × 10 = 80°, 4 × 10 = 40° and 15 × 10 = 150°.

Thus, the given statement is false.

**D.**

1. Let the two numbers are $x$ and $y$.

$\therefore \quad x \times y = 4$ [Given] ...(1)

One number is $\frac{1}{6}$, say $x = \frac{1}{6}$.

Thus, from (1) $\frac{1}{6} \times y = 4$

$\Rightarrow \quad y = 24$

So, the other number = 24.

2. Let $x$ be a multiple of 7. Therefore, the next two multiples of 7 will be $x + 7$, $x + 14$.

A.T.Q., $x + (x + 7) + (x + 14) = 777$

$\Rightarrow \quad 3x = 777 - 21 = 756$

$\Rightarrow \quad x = \frac{756}{3} = 252$

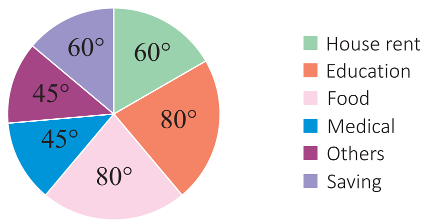
$\therefore$ The second multiple = $x + 7 = 252 + 7 = 259$ and the third multiple = $x + 14 = 252 + 14 = 266$.

Thus, the three consecutive multiples of 7 whose sum is 777 is 252, 259 and 266.

3. We first calculate the central angle for each item as shown below:

| Item | Amount (₹) | Central angle |
|---|---|---|
| House rent | 12,000 | $\frac{12000}{72000} \times 360° = 60°$ |
| Education | 16,000 | $\frac{16000}{72000} \times 360° = 80°$ |
| Food | 16,000 | $\frac{16000}{72000} \times 360° = 80°$ |
| Medical | 9,000 | $\frac{9000}{72000} \times 360° = 45°$ |
| Others | 9,000 | $\frac{9000}{72000} \times 360° = 45°$ |
| Saving | 10,000 | $\frac{10000}{72000} \times 360° = 50°$ |
| **Total** | **72,000** | **360°** |

Now, draw a circle of any radius and divide it into sectors according to the central angle of all items.




**4.** $18^3 - 17^3 = 1 + 3 \times 18(18 - 1)$

$[\because n^3 - (n-1)^3 = 1 + 3n(n-1)]$

$= 1 + 54 \times 17 = 1 + 918 = 919$

**5.** Let the numbers be $x$, $2x$ and $3x$, then

$(x)^3 + (2x)^3 + (3x)^3 = 147456$

$\Rightarrow \quad x^3 + 8x^3 + 27x^3 = 147456$

$\Rightarrow \quad 36x^3 = 147456$

$\Rightarrow \quad x^3 = \dfrac{147456}{36} = 4096 = 16 \times 16 \times 16$

$\Rightarrow \quad x = \sqrt[3]{16 \times 16 \times 16} = 16$

Hence, the numbers are $x = 16$, $2x = 2 \times 16 = 32$, $3x = 3 \times 16 = 48$.

**6.** Here P = ₹40,000, T = 2 years = 4 half annually,

Rate = 10% p.a. or 5% half yearly.

$$\therefore \quad A = 40,000\left(1 + \frac{5}{100}\right)^4$$

$$= 40,000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= \frac{21 \times 21 \times 21 \times 21}{4} = ₹48620.25$$

Thus, C.I. = A – P = ₹(48620.25 – 40,000)

= ₹8620.25

**7.** Let MP = ₹100.

Now selling price

$$= \left(\frac{100-25}{100}\right) \times \left(\frac{100-12}{100}\right) \times 100$$

[∵ Two discounts are 25% and 12%]

$$= \frac{75}{100} \times \frac{88}{100} \times 100 = ₹66$$

∴ Discount = (100 – 66) = ₹34

[∵ SP = MP – Discount]

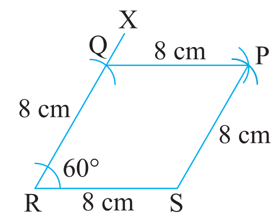
Thus, single discount equivalent to two successive discounts of 25% and 12% is 34%.

**8.** Number of sides, $n = 12$.

We have, the measure of each exterior angle of a regular polygon of $n$ sides $= \dfrac{360°}{n}$.

∴ The measure of each exterior angle of a polygon having sides $12 = \dfrac{360°}{12} = 30°$.

**9. Steps of Construction:**




**Step 1:** Draw a line segment RS = 8 cm.

**Step 2:** At R, construct ∠XRS = 60°.

**Step 3:** From XR, cut off QR = 8 cm on line RX.

**Step 4:** With S as centre and radius = 8 cm, draw an arc on the right of point Q.

**Step 5:** With Q as centre and radius = 8 cm, draw an arc to meet the previous arc at P.

**Steps 6:** Join PQ and PS. Thus, PQRS is the required rhombus.

**10.** (*a*) Total students = 150.

Now 20% take tuition for 1 h to 1.5 h.

∴ Students who take tuition for 1 h to 1.5 h

$$= \frac{20}{100} \times 150 = 30.$$

(*b*) 30% students take tuition for 1.5 h to 2 h.

∴ Number of students $= \dfrac{30}{100} \times 150 = 45$

Students who take tuition for more than 2 hours

= 150 – (students who take tuition for 1.5 h to 2 h)

– (students who take tuition for 1 h to 1.5 h)

– (students who did not take tuition at all)

= 150 – 45 – 30 – 60 = 15

Thus, total students who take tuitions for more than 1.5 h = 45 + 15 = 60

(*c*) Number of students who take tution for more than 2 hours = 15

∴ Required percentage $= \dfrac{15}{150} \times 100 = 10\%$

(*d*) Percentage of students who do self-study

$$= \frac{60}{150} \times 100 = 40\%$$

# CHAPTER 8 : ALGEBRAIC EXPRESSIONS

## Let's Recall

**1.** The given expression is $3x^2 - 5xy + 7y^2 - 6y + 9$.
'3' is the coefficient of $3x^2$.
'–5' is the coefficient of $-5xy$.
'7' is the coefficient of $7y^2$.
'–6' is the coefficient of $-6y$.

**2.** Terms $a^3b^2$, and $7a^3b^2$ having the same variable so they are like terms.

**3.** The given expression is $6a^2 - 7ab + 4b^2 - (b^2 - 3ab + 2a^2)$

$$= 6a^2 - 7ab + 4b^2 - b^2 + 3ab - 2a^2$$
$$= (6a^2 - 2a^2) + (4b^2 - b^2) + (3ab - 7ab)$$
$$= 4a^2 + 3b^2 - 4ab$$

**4.** Putting $x = -2$ in $5x^2 + 4x - 7$, we have

$$5(-2)^2 + 4(-2) - 7 = 5(4) + (-8) - 7$$
$$= 20 - 8 - 7 = 5$$

**5.** Since, total number of saplings planted by Aman and Ria together $= 5n + 3m + 4$.
If $m = 10$ and $n = 18$, then total number of saplings $= 5(18) + 3(10) + 4 = 90 + 30 + 4 = 124$.

## Quick Check (Page 196)

**1.** Two terms which are like terms with $3pq$ is $4pq$ and $\frac{2}{3}pq$. (Answer may vary).

**2.** Two terms which are like terms with $7xy^2$ is $xy^2$, $16xy^2$. (Answer may vary).

## Think and Answers (Page 198)

Perimeter of the given drawing is $15a - 14b + 13c$. Two sides of the drawing arc $5a + 7b - 9c$ and $4a - 6b + 12c$. Thus, third side of the drawing

$$= 15a - 14b + 13c - (5a + 7b - 9c + 4a - 6b + 12c)$$

[∵ Perimeter of triangle $= a + b + c$, where $a$, $b$, $c$ are sides of the triangle.]

$$= 15a - 14b + 13c - (9a + b + 3c)$$
$$= (15a - 9a) + (-14b - b) + (13c - 3c)$$
$$= 6a - 15b + 10c$$

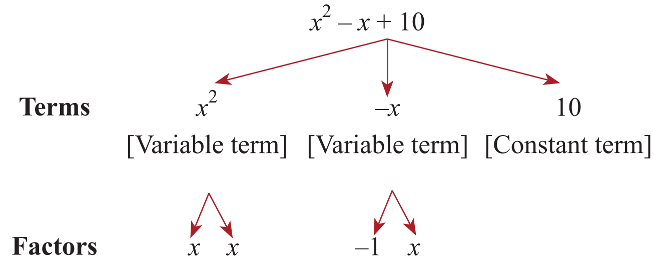
## Practice Time 8A

**1.** (*a*) The given expression is $9ab - 5b^2 + 1$. So, the terms are $9ab$, $-5b^2$, 1. The coefficients of terms $9ab$ and $-5b^2$ are '9' and '–5' respectively.

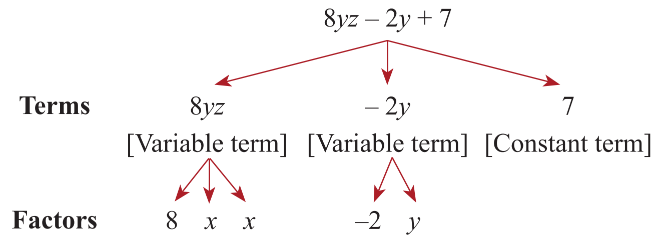
(*b*) The given expression is $11xyz - 6yz + xy$. So, the terms are $11xyz$, $-6yz$ and $xy$. The coefficients of terms $11xyz$, $-6yz$ and $xy$ and '11', '–6' and '1' respectively.

(*c*) The given expression is $7m^2n^2 + 8mn^2 - 4mn - 3$. So, the terms are $7m^2n^2$, $8mn^2$, $-4mn$ and $-3$. The coefficients of terms $7m^2n^2$, $8mn^2$ and $-4mn$ are '7', '8' and '4' respectively.

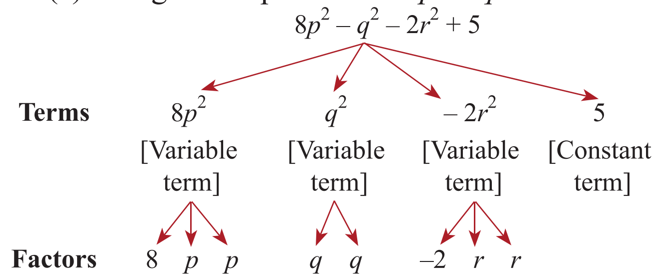
**2.** (*a*) The given expression is $x^2 - x + 10$.




(*b*) The given expression is $8yz - 2y + 7$.




(*c*) The given expression is $8p^2 - q^2 - 2r^2 + 5$.




**3.** The like terms are $24x^2y$, $-7yx^2$, $55x^2y$ since these terms are having the same variable with equal exponents.
The unlike terms are $17y^3x^2$ and $99y^2x^3$.

**4.** (*a*) The expression $2x^2 + 7x$ contains two terms, so it is called a binomial.

(*b*) The expression –145 contain only one term, so it is called a monomial.

(*c*) Same as part (*a*).

(*d*) The expression $7x + y - 9$ contains three terms, so it is called a trinomial.

(*e*) Same as part (*d*).

**5.** (*a*) In the expression $97d^{54}$, the highest power of variable *d* is 54 in term $97\ d^{54}$. So, the degree of polynomial is 54.

(*b*) In the expression $7x^2 - 4x + 8$, the highest power of variable *x* is 2 in term $7x^2$. So, the degree of polynomial is 2.

(*c*) In the expression $1 - 6a^3 + 5a - 8a^2$, the highest power of variable a is 3 in term $-6a^3$. So, the degree of polynomial is 3.

(*d*) In the expression $4x^3y + 5x^3y^3 + 8$, the highest power of variable *x* and *y* is $3 + 3 = 6$ in term $5x^3y^3$. So, the degree of polynomial is 6.

(*e*) In the expression $2x^3y^2z + 5x^3y^3z^3 + 8x^4yz^2 + 7x^2y$, the highest power of variable *x*, *y* and *z* is $3 + 3 + 3 = 9$ is term $5x^3y^3z^3$. So, the degree of polynomial is 9.

**6.** (*a*) $(30x + y - z) + (x - 30y + z) + (x + y - 30z)$

$= (30x + y - z) + (x + x) + (y - 30y) + (z - 30y)$

$= (30x + 2x) + (y - 29y) + (-z - 29z)$

$= 32x - 28y - 30z.$

(*b*) Same as part (*a*).

(*c*) $3a^2b^3 + (-13a^2b^3) + (-7b^3a^2) + (-a^2b^3)$

$= -18a^2b^3$

(*d*)
$$\begin{array}{rrrrr} 2p^4 & -\ 3p^3 & +\ p^2 & -5p & +\ 7 \\ (+)\ -3p^4 & -\ 7p^3 & -3p^2 & -\ p & -12 \\ \hline -\ p^4 & -10p^3 & -2p^2 & -6p & -\ 5 \end{array}$$

(*e*) $25m^2n - 27mn + 18mn^2$, $23m^2n - 25mn - 19mn^2$ and $22m^2n + 31mn - 34mn^2$

$= 25m^2n - 27mn + 18mn^2 + (23 + 22)m^2n + (-25 + 31)mn + (-19-34)mn^2$

$= 70m^2n - 21mn - 35mn^2$

**7.** (*f*)
$$\begin{array}{rrr} 10x & -9y & +\ 11z \\ 9x & -8y & -\ \ 7z \\ (-) & (+) & (+) \\ \hline x & -\ \ y & +\ 18z \end{array}$$

(*b*) Same as part (*a*).

(*c*) $-10a^2b^2c + 4ab^2c^2 + 2a^2bc^2 - (2ab^2c^2 + 4a^2b^2c - 5a^2bc^2)$

$= -10a^2b^2c + 4ab^2c^2 + 2a^2bc^2 - 2ab^2c^2 - 4a^2b^2c + 5a^2bc^2$

$= (-10 - 4)a^2b^2c + (4 - 2)ab^2c^2 + (2+5)a^2bc^2$

$= -14a^2b^2c + 2ab^2c^2 + 7a^2bc^2$

(*d*) Same as part (*c*).

(*e*) Same as part (*c*).

**8.** By adding $35ab + 34bc + 4abc$ and $17bc + 3abc$, we have $(35ab + 34bc + 4abc) + (17bc + 3abc)$

$= 35ab + 51bc + 7abc$ ...(*i*)

By adding $17bc + 40ac + 20abc$ and $33ab - 23abc$, we have $(17bc + 40ac + 20abc) + (33ab - 23abc)$

$= 33ab + 17bc + 40ac - 3abc$ ...(ii)

A.T.Q.,

$[(17bc + 40ac + 20abc) + (33ab - 23abc)] - [(35ab + 34bc + 4abc) + (176bc + 3abc)]$

$= (33ab + 17bc + 40ac - 3abc) - (35ab + 51bc + 7abc)$ [using (*i*) and (*ii*)]

$= -2ac - 34bc + 40ac - 10abc.$

## Quick Check (Page 200)

Volume of rectangular boxes = length × breadth × height

| Length | Breadth | Height | Volume |
|---|---|---|---|
| $7kl$ | $5l^2$ | $6k^2$ | $210k^3l^3$ |
| $3a^2b^3$ | $4ab$ | $\frac{5}{6}a^7b^2$ | $10a^{10}b^6$ |
| $20x^2y$ | $15y^2$ | $7x^4$ | $2100x^6y^3$ |

## Practice Time 8B

**1.** (*a*) $7xy$ and $-4xy = 7xy \times (-4xy)$

$= (7 \times -4) \times (xy \times xy)$

$= -28x^{1+1}y^{1+1}$

$= -28x^2y^2$

(*b*) Same as part (*a*).

(*c*) $-5a^2bc$, $11ab$ and $13abc^2$

$= (-5a^2bc) \times (11ab) \times (13abc^2)$

$= -715 \times (a^{2+1+1}b^{1+1+1}c^{1+2})$

$= -715a^4b^3b^3.$

($d$) Same as part ($c$).

($e$) $(-16pq), (20p^2q^2), (15p)$ and $(-13q)$

$= (-16pq) \times (20p^2q^2) \times (15p) \times (-13q)$

$= (-16 \times 20 \times 15 \times -13) \times (pq \times p^2q^2 \times p \times q)$

$= 62400 \times (p^{1+2+1} q^{1+2+1}) = 62400p^4q^4.$

**2.** ($a$) $19x^2yz^2 \times 7xy^2z \times 5xyz$

$= (19 \times 7 \times 5) \times (x^2yz^2 \times xy^2z \times xyz)$

$= 665 \times (x^4y^4z^4)$

For $x = 1$, $y = -1$ and $z = 2$, we have

$665x^4y^4z^4 = 665 (1)^4 \times (-1)^4 \times (2)^4$

$= 10640$

($b$) $-7x^2y^3 \times (-9xyz) \times 17x^3z^5 \times (-y^2z)$

$= [-7 \times (-9) \times 17 \times (-1)] \times (x^2y^3 \times xyz \times x^3z^5 \times y^2z)$

$= -1071x^6y^6z^7$

For $x = 1$, $y = -1$ and $z = 2$, we have

$-1017x^6y^6z^7 = -1071 \times (1)^6 \times (-1)^6 \times (2)^7$

$= -1017 \times 128$

$= -137088$

**3.** Area of rectangle = length × breadth

($a$) Length = $2p^2q$, Breadth = $\frac{1}{4}pqr$.

$\therefore$ Area of rectangle $= (2p^2q) \times \left(\frac{1}{4}pqr\right)$

$= \left(2 \times \frac{1}{4}\right) \times (p^{2+1}q^{1+1}r)$

$= \frac{1}{2}p^3q^2r.$

($b$) Same as part ($a$).

($c$) Length = $\frac{1}{4}x^2y^2$, Breadth = $\frac{3}{7}yz^2$

$\therefore$ Area of rectangle $= \left(\frac{1}{4}x^2y^2\right) \times \left(\frac{3}{7}yz^2\right)$

$= \left(\frac{1}{4} \times \frac{3}{7}\right) \times (x^2y^{2+1}z^2)$

$= \frac{3}{28} \times (x^2y^3z^2)$

**4.** Product of $(-3ab^2)$ and $(1.7ab)$

$= (-3) \times (1.7) \times a^2b^3 = -5.1a^2b^3.$

Product of $(5a^2b^3)$ and $(-2ab)$

$= (5) \times (-2) \times (a^3b^4) = -10a^3b^4.$

Sum of $(-5.1a^2b^3)$ and $(-10a^3b^4)$

$= -5.1a^2b^3 - 10a^3b^4$

## Think and Answer (Page 200)

Cost of planting one flower = ₹10

Cost of planting $(2x + 5)$ flower

= ₹$[10 \times (2x + 5)]$

= ₹$(20x + 50)$

## Quick Check (Page 201)

Length of rectangular park = $(x + 5y)$ units

Breadth of rectangular park = $(3x - 2y)$ units

Area of rectangular park = length × breadth

$= (x + 5y) \times (3x - 2y)$

$= x \times (3x - 2y) + (5y) \times (3x - 2y)$

$= 3x^2 - 2xy + 15xy - 10y^2$

$= (3x^2 - 10y^2 + 13xy)$ square units

For $x = 2.5$ and $y = 3$, we have

$3x^2 - 10y^2 + 13xy = 3(2.5)^2 - 10(3)^2 + 13(2.5)(3)$

$= 18.75 - 10 \times 9 + 97.5$

$= 26.25$ square units.

## Practice Time 8C

**1.** ($a$) $3p^2(p + q) = 3p^2(p) + 3p^2(q)$

$= 3p^3 + 3p^2q$

($b$) $4.4ab(a - 2.2) = 4.4ab(a) + 4.4ab(-2.2)$

$= 4.4a^2b - 9.68ab$

($c$) Same as part ($b$).

($d$) $x^2y^2(6x^3yz - 7xy^2z^2)$

$= x^2y^2(6x^3yz) + x^2y^2(-7xy^2z^2)$

$= 6x^5y^3z - 7x^3y^4z^2$

($e$) Same as part ($d$).

($f$) $\frac{6}{7x}(x^2 + y^2 - 5z^2)$

$= \frac{6}{7x}(x^2) + \frac{6}{7x}(y^2) + \frac{6}{7x}(-5z^2)$

$= \frac{6}{7}x + \frac{6y^2}{7x} - \frac{30z^2}{7x}$

**2.** $-5n(mn + n^2) + 278$

$= (-5n) \times mn + (-5n)(n^2) + 278$

$= -5mn^2 - 5n^3 + 278$

For $m = 3$, and $n = 4$, we have

$-5mn^2 - 5n^3 + 278 = -5(3)(4)^2 - 5 \times (4)^3 + 278$
$= -240 - 320 + 278$
$= -560 + 278$
$= -282$

**3.** (*a*) $(4x^2 - 7xy^2) \times (x^2 - y^2)$
$= 4x^2 \times (x^2 - y^2) + (-7xy^2) \times (x^2 - y^2)$
$= 4x^4 - 4x^2y^2 - 7x^3y^2 + 7xy^4$

(*b*) $\left(\frac{3}{4}x - \frac{3}{4}y\right) \times \left(\frac{2}{3}x + \frac{2}{3}y\right)$

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

$= \frac{x^2}{2} + \frac{1}{2}xy - \frac{1}{2}xy - \frac{1}{2}y^2$

$= \frac{x^2}{2} - \frac{y^2}{2}$

(*c*) Same as part (*a*).

(*d*) $(0.3p - 0.4q) \times (2.5p - 5q)$
$= 0.3p \times (2.5p - 5q) + (-0.4q) \times (2.5p - 5q)$
$= 0.75p^2 - 1.5pq - pq + 2q^2$
$= 0.75p^2 - 2.5pq + 2q^2$

**4.** (*a*) $(3x^2 + 4x - 8)$ and $(2x^2 - 4x + 3)$
$= (3x^2 + 4x - 8) \times (2x^2) + (3x^2 + 4x - 8) \times (-4x) + (3x^2 + 4x - 8) \times 3$
$= (6x^4 + 8x^3 - 6x^2 + (-12x^3) + (-16x^2) + 32x + 9x^2 + 12x - 24$
$= 6x^4 - 4x^3 - 23x^2 + 44x - 24$

(*b*) Same as part (*a*).

**5.** (*a*) $(3a^2 - b^2)(a + 5b) + a^2b^2$
$= 3a^2 \times (a + 5b) + (-b^2) \times (a + 5b) + a^2b^2$
$= 3a^2 + 15a^2b - ab^2 - 5b^3 + a^2b^2$

(*b*) Same as part (*a*)

(*c*) $(x^2 - 3x + 3)(5x - 2) - (4x^2 + 5x - 6)(3x - 1)$
$= (x^2 - 3x + 3) \times (5x) + (x^2 - 3x + 3) \times (-2)$ $(4x^2 + 5x - 6) \times (3x) - (4x^2 + 5x - 6)(-1)$
$= 5x^3 - 15x^2 + 15x - 2x^2 + 6x - 6 - 12x^3 - 15x^2 + 18x + 4x^2 + 5x - 6$
$= -7x^3 - 28x^2 + 44x - 12$

(*d*) Same as part (*c*).

**6.** (*a*) $[pq(p^2 - 21p + 3)] + [5pq(p^2 + 4p - 7)]$
$= p^3q - 21p^2q + 3pq + 5p^3q + 20p^2q - 35pq$
$= 6p^3q - p^2q - 32pq$

(*b*) $[3q(4p^2 - 3pq + 8)] - [5pq(p - q)]$
$= 12p^2q - 9pq^2 + 24q - 5p^2q + 5pq^2$
$= 7p^2q - 4pq^2 + 24q$

**7.** (*a*) We have, $(3b^2 - 8) - [b(b^2 + b - 7) + 5]$
$= 3b^2 - 8 - b^3 - b^2 + 7b - 5$
$= -b^3 + 2b^2 + 7b - 13$

For $b = -3$, we have
$= -b^3 + 2b^2 + 7b - 13$
$= -(-3)^3 + 2(-3)^2 + 7(-3) - 13$
$= 27 + 18 - 21 - 13$
$= 11$

**8.** We have, $-\frac{5}{2}a(3a - 4b + 5c) + \frac{7}{2}$

$= -\frac{15}{2}a^2 + 10ab - \frac{25}{2}ac + \frac{7}{2}$

For $a = 2$, $b = -2$ and $c = -3$, we have

$-\frac{15}{2}a^2 + 10ab - \frac{25}{2}ac + \frac{7}{2}$

$= -\frac{15}{2}(2)^2 + 10(2)(-2) - \frac{25}{2}(2)(-3) + \frac{7}{2}$

$= -15 \times 2 - 40 + 75 + \frac{7}{2}$

$= 5 + \frac{7}{2} = \frac{17}{2} = 8.5$

## Practice Time 8D

**1.** (*a*) We have $56x^5 \div 14x$

So, the quotient of numerical coefficient is $56 \div 14 = 4$.

Quotient of the variable $= \frac{x^5}{x} = x^4$

Thus, $56x^5 \div 14x = 4x^4$

(*b*) Same as part (*a*).

(*c*) We have $54l^4m^3n^2 \div 9l^2m^2n^2$.

$\frac{54l^4m^3n^2}{9l^2m^2n^2}$

$= \frac{\cancel{3} \times \cancel{3} \times 3 \times 2 \times \cancel{l} \times \cancel{l} \times l \times l \times \cancel{m} \times \cancel{m} \times m \times \cancel{n} \times \cancel{n}}{\cancel{3} \times \cancel{3} \times \cancel{l} \times \cancel{l} \times \cancel{m} \times \cancel{m} \times \cancel{n} \times \cancel{n}}$

$= 6l^2m$.

(*d*) Same as part (*c*).

**2.** (*a*) We have, $(24x^2 - 6x) \div 3x = \dfrac{24x^2 - 6x}{3x}$

$$= \frac{24x^2}{3x} - \frac{6x}{3x} = 8x - 2.$$

(*b*) Same as part (*a*).

(*c*) We have, $(75x^7 - 45x^6) \div 15x^5$

$$= \frac{75x^7 - 45x^6}{15x^5} = \frac{75x^7}{15x^2} - \frac{45x^6}{15x^5} = 5x^2 - 3x$$

**3.** (*a*) We have, $(21p^3 + 35p^2 - 49p) \div 7p$

$$= \frac{21p^3}{7p} + \frac{35p^2}{7p} - \frac{49p}{7p}$$

$$= 3p^2 + 5p - 7$$

(*b*) Same as part (*a*).

(*c*) We have, $(4x^2 + 17x + 4) \div (4x + 1)$

$$\begin{array}{r|l} & x + 4 \\ \hline 4x + 1 & 4x^2 + 17x + 4 \\ & 4x^2 + \quad x \qquad \leftarrow \text{Multiplying } (4x + 1) \text{ by } x \\ & (-) \quad (-) \\ \hline & \qquad 16x + 4 \\ & \qquad 16x + 4 \qquad \leftarrow \text{Multiplying } (4x + 1) \text{ by } 4 \\ & \qquad (-) \quad (-) \\ \hline & \qquad\quad 0 \end{array}$$

So, $\dfrac{4x^3 + 17x + 4}{4x + 1} = x + 4$

(*d*) Same as part (*c*)

**4.** (*a*) We have $(6a^4 - 7a^3 + 9a^2 - 2a + 5) \div (a + 1)$

$$\begin{array}{r|l} & 6a^3 - 13a^2 + 22a - 24 \\ \hline a + 1 & 6a^4 - 7a^3 + 9a^2 - 2a + 5 \\ & 6a^4 + 6a^3 \\ & (-) \quad (-) \\ \hline & \quad -13a^3 + \;\; 9a^2 \\ & \quad -13a^3 - 13a^2 \\ & \quad (+) \quad (+) \\ \hline & \qquad\quad 22a^2 - \;\; 2a \\ & \qquad\quad 22a^2 + 22a \\ & \qquad\quad (-) \quad (-) \\ \hline & \qquad\qquad -24a + \;\; 5 \\ & \qquad\qquad -24a - 24 \\ & \qquad\qquad (+) \quad (+) \\ \hline & \qquad\qquad\qquad 29 \end{array}$$

Thus, quotient $= 6a^3 - 13a^2 + 22a - 24$ and remainder $= 29$

(*b*) We have, $(x^3 + 3x^2 - 7x - 8) \div (x^2 + x - 1)$

$$\begin{array}{r|l} & x + 2 \\ \hline x^2 + x - 1 & x^3 + 3x^2 - 7x - 8 \\ & x^3 + \;\; x^3 - \;\; x \\ & (-) \;\; (-) \quad (+) \\ \hline & \qquad 2x^2 - 6x - 8 \\ & \qquad 2x^2 + 2x - 2 \\ & \qquad (-) \quad (-) \quad (+) \\ \hline & \qquad\qquad -8x - 6 \end{array}$$

Thus, quotient $= x + 2$ and remainder $= -8x - 6$.

**5.** We have, $6x^6 + 5x^5 + 4x^4 - 3x^3 + 2x^2 + 2 \div (x^2 - x)$

$$\begin{array}{r|l} & 6x^4 + 11x^3 + 15x^2 + 12x + 14 \\ \hline x^2 - x & 6x^6 + 5x^5 + 4x^4 - 3x^3 + 2x^2 + 2 \\ & 6x^6 - 6x^5 \\ & (-) \quad (+) \\ \hline & \quad 11x^5 + \;\; 4x^4 \\ & \quad 11x^5 - 11x^4 \\ & \quad (-) \quad (+) \\ \hline & \qquad 15x^4 - \;\; 3x^3 \\ & \qquad 15x^4 - 15x^3 \\ & \qquad (-) \quad (+) \\ \hline & \qquad\quad 12x^3 + 2x^2 \\ & \qquad\quad 12x^3 - 12x^2 \\ & \qquad\quad (-) \quad (+) \\ \hline & \qquad\qquad 14x^2 + 2 \\ & \qquad\qquad 14x^2 - 14x \\ & \qquad\qquad (-) \quad (+) \\ \hline & \qquad\qquad\qquad 14x + 2 \end{array}$$

Thus, quotient $= 6x^4 + 11x^3 + 15x^2 + 12x + 14$ and remainder $= 14x + 2$.

## Quick Check

**1.** $(103)^2 = (100 + 3)^2 = (100)^2 + 2 \times 100 \times 3 + (3)^2$
$= 10000 + 600 + 9$
$= 10609$

**2.** $105 \times 95 = (100 + 5) \times (100 - 5)$
$= (100)^2 - (5)^2$
$= 10000 - 25$
$= 9975$

## Practice Time 8E

**1.** (*a*) We have, $(7t + 9u)(7t + 9u)$

$= (7t)^2 + (9u + 9u)\ 7t + (9u)\ (9u)$

$= 49t^2 + (18u)7t + 81u^2$

$= 49t^2 + 126tu + 81u^2$

(*b*) Same as part (*a*).

(*c*) We have, $(6a + 12b)\ (6a + 12b)$

$= (6a)^2 - (12b)^2$

$= 36a^2 - 144b^2$

(*d*) Same as part (*c*).

(*e*) We have, $\left(\frac{1}{3}x^2 - \frac{1}{2}y^2\right)\left(\frac{1}{3}x^2 - \frac{1}{2}y^2\right)$

$= \left(\frac{1}{3}x^2 - \frac{1}{2}y^2\right)^2$

$= \left(\frac{1}{3}x^2\right)^2 - 2\times\left(\frac{1}{3}x^2\right)\times\left(\frac{1}{2}y^2\right) + \left(\frac{1}{2}y^2\right)^2$

$= \frac{x^4}{9} - \frac{x^2y^2}{3} + \frac{y^4}{4}$

(*f*) Same as part (*a*).

**2.** (*a*) $(5x + 6)^2 = (5x)^2 + 2(5x)(6) + 6^2$

$= 25x^2 + 60x + 36$

(*b*) Same as part (*a*).

(*c*) $(s^2t - tu^2)^2 = (s^2t)^2 - 2(s^2t)(tu^2) + (tu^2)^2$

$= s^4t^2 - 2s^2t^2u^2 + t^2u^4$

(*d*) Same as part (*c*).

**3.** (*a*) We have, $(x + 3)(x + 8)$

$= x^2 + (3 + 8)x + (3)(8)$

$= x^2 + 11x + 24$

(*b*) Same as part (*a*).

(*c*) $(9x + 10)\ (9x - 11)$

$= (9x)^2 + (10 - 11)9x + (10)(-11)$

$= 18x^2 - 9x - 110$

(*d*) Same as part (*a*).

**4.** (*a*) $51^2 = (50 + 1)^2$

$= (50)^2 + 2 \times (50) \times 1 + (1)^2$

$= 2500 + 100 + 1 = 2601$

(*b*) Same as part (*a*).

(*c*) $96 \times 104 = (100 - 4) \times (100 + 4)$

$= (100)^2 + (-4 + 4)100 + (-4)(4)$

$= 10000 - 16 = 9984$

(*d*) $1.05 \times 9.5 = \frac{105}{100}\times\frac{95}{10}$

$= \frac{(100)^2 + (5-5)100 + (5)(-5)}{1000}$

$= \frac{10000 - 25}{1000}$

$= \frac{9975}{1000}$

$= 9.975$

**5.** (*a*) We have, $11x = (60)^2 - (50)^2$

$\Rightarrow 11x = (60 - 50)\ (60 + 50)$

$\Rightarrow 11x = 10 \times 110$

$\Rightarrow x = \frac{1100}{11} = 100$

(*b*) We have, $pqx = (3p + q)^2 - (3p - q)^2$

$\Rightarrow pqx = (3p)^2 + 2(3p)(q) + q^2 - [(3p)^2 - 2(3p)(q) + q^2]$

$\Rightarrow pqx = 9p^2 + 6pq + q^2 - 9p^2 + 6pq - q^2$

$\Rightarrow pqx = 12pq \Rightarrow x = 12$

**6.** (*a*) We have, $(8a - 9b)^2 + (8a + 9b)^2$

$= (8a)^2 - 2(8a)(9b) + (9b)^2 + (8a)^2 + 2(8a)(9b) + (9b)^2$

$= 64a^2 + 81b^2 + 64a^2 + 81b^2$

$= 128a^2 + 162b^2$

(*b*) Same as part (*a*).

(*c*) We have, $(xy + yz)^2 - 2xy^2z$

$= (xy)^2 + 2(xy)(yz) + (yz)^2 - 2xy^2z$

$= x^2y^2 + 2xy^2z + y^2z^2 - 2xy^2z$

$= x^2y^2 + y^2x^2$

(*d*) We have, $(x + 4)(x - 4)(x^2 + 16)$

$= (x^2 - 4^2)(x^2 + 16)$

$= (x^2 - 16)(x^2 + 16)$

$= ((x^2)^2 - (16)^2)$

$= x^4 - 256$

(*e*) We have, $(3x - 1)(3x + 1)(9x^2 + 1)(81x^4 + 1)$

$= ((3x)^2 - 1^2)\ (9x^2 + 1)(81x^4 + 1)$

$= (9x^2 - 1)\ (9x^2 + 1)(81x^4 + 1)$

$= ((9x^2)^2 - 1^2)(81x^4 + 1)$

$= (81x^4 - 1)(81x^4 + 1)$

$= ((81x^4)^2 - 1^2)$

$= 6561x^8 - 1$

(f) We have, $(a-b)(a+b)+(b-c)(b+c)+(c-a)(c+a)$
$= (a^2-b^2)+(b^2-c^2)+(c^2-a^2)=0$

**7.** We have, $x-\frac{1}{x}=5$

$\Rightarrow \left(x-\frac{1}{x}\right)^2 = 5^2 = 25$

$\Rightarrow x^2+\left(\frac{1}{x}\right)^2-2(x)\left(\frac{1}{x}\right) = 25$

$\Rightarrow x^2+\left(\frac{1}{x^2}\right)-2 = 25$

$\Rightarrow x^2+\frac{1}{x^2} = 25+2=27$

**8.** (a) L.H.S. $=(5x+8)^2-160x$
$=(5x)^2+8^2+2(5x)(8)-160x$
$=25x^2+64-80x$
$=(5x)^2+8^2-2(5x)(8)$
$=(5x-8)^2=$ R.H.S.

(b) L.H.S. $=\left(\frac{5}{4}s-\frac{4}{5}t\right)^2+2st$

$=\left(\frac{5}{4}s\right)^2+\left(\frac{4}{5}t\right)^2-2\left(\frac{5}{4}s\right)\left(\frac{4}{5}t\right)+2st$

$=\frac{25}{16}s^2+\frac{16}{25}t^2=$ R.H.S.

**9.** We have, $(9x^2+12xy+4y^2)$

For $x=\frac{2}{3}$ and $y=\frac{5}{2}$, we have.

$9\left(\frac{2}{3}\right)^2+12\left(\frac{2}{3}\right)\left(\frac{5}{2}\right)+4\left(\frac{5}{2}\right)^2$

$=9\times\frac{4}{9}+12\times\frac{5}{3}+4\times\frac{25}{4}$

$=4+20+25=49$

## Brain Sizzlers

Given, $(s+3)(s+a)=s^2+8s+b$
$\Rightarrow s^2+(3+a)s+(3)(a)=s^2+8s+b$
$\Rightarrow s^2+(3+a)s+3a=s^2+8s+b.$
Compare both sides, we have
$s(3+a)=8s$
$\Rightarrow s(3+a)=8s \Rightarrow 3+a=8$
$\Rightarrow a=8-3=5$
Also, $3a=b \Rightarrow 3\times 5=b \Rightarrow b=15$

## Chapter Assessment

**A.**

**1.** (b) $-5xyz^2$ and $7xyz^2$ are pair of like terms since they have the same variable.

**2.** (d) The coefficient in $(-56pqr)$ is $-56$.

**3.** (c) The expression $2p^3q-7q^3$ contains two terms, so it is called a binomial.

**4.** (c) Sum of $(-8ab)$ and $(3ab)=-8ab+3ab$
$=-5ab$

**5.** (d) $x^2y^2-(-3x^2y^2)=x^2y^2+3x^2y^2=4x^2y^2$

**6.** (c) $(5a)\times(-5b^3)\times(9ab)$
$=(5\times -5\times 9)\times(a^{1+1}b^{3+1})$
$=-225a^2b^4$

**7.** (d) $(3x-4y)^2=(3x)^2-2(3x)(4y)+(4y)^2$
$=9x^2+16y^2-24xy$

**8.** (b) Volume of rectangular box $=3x\times 4y\times 5z$
[∵ given, length $=3x$, breadth $=4y$, height $=5z$]
$=60xyz$

**B.**

**1.** (d) The coefficient in the term $-121x^2y^2$ is $-121$.
So, assertion is false.
A coefficient is a number multiplied by a variable is true. So, reason is true.

**2.** (d) When we divide $-25x^2y^3z^2$ by $5xy^2$, then

$\frac{-25x^2y^3z^2}{5xy^2}$

$=\frac{-\cancel{5}\times 5\times\cancel{x}\times x\times\cancel{y}\times\cancel{y}\times y\times z\times z}{\cancel{5}\times\cancel{x}\times\cancel{y}\times\cancel{y}}$

$=-5xyz^2=$ Quotient
So, assertion is false.
Division of one monomial by another is always a monomial, is correct. So, reason is true.

**3.** (b) The given expression is $x(x+y^3)=x^2+xy^3$ for $x=1$ and $y=2$, we have
$x^2+xy^3=(1)^2+1(2)^3=1+8=9.$
So, assertion is true.
While multiplying a polynomial by a monomial, we multiply every term of polynomial by the monomial is true. So, reason is true but it is not the correct explanation of assertion.

4. (*a*) We have $3yz^2 \times (2y^2z + 3y^2z^2)$

$= 3yz^2 \times 2y^2z + 3yz^2 \times 3y^2z^2$,

So assertion is true.

Distributive property of multiplication over addition is $a \times (b + c) = a \times b + a \times b$ is also true. So reason is the correct explanation of assertion.

**C.**

1. Let $x$ should be added to $4c(-a + b + c)$ to obtain $3a(a + b + c) - 2b(a - b + c)$

$\therefore\ x + [4c(-a + b + c)]$

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

$\Rightarrow x = 3a^2 + 3ab + 3ac - 2ab + 2b^2 - 2bc - [-4ac + 4bc + 4c^2]$

$\Rightarrow x = 3a^2 + 2b^2 - 4c^2 + ab + 7ac - 6bc$

2. Total area of the wall $= (7x + 2) \times (7x)$

Total area of the window $= (2x) \times (x) = 2x^2$

Total area of the door $= (5x) \times x = 5x^2$

$\therefore$ Area of the wall to be painted = Total area of the wall – Area of the window – Area of the door

$= (7x + 2)(7x) - 2x^2 - 5x^2$

$= 7x(7x + 2) - 7x^2$

3. Cost of a pen $= ₹(x + y)$

Cost of $(x + y)$ pens $= ₹[(x + y) \times (x + y)]$

$= ₹(x + y)^2$

$= ₹(x^2 + y^2 + 2xy)$

For $x = 8$ and $y = 4$, we have

$x^2 + y^2 + 2xy = (8)^2 + (4)^2 + 2(8)(4)$

$= 64 + 16 + 64 = 144$

So, amount paid by Samarth = ₹144.

4. Area of rectangle with dimensions $(pq + 3q^2)$ and $(4p^2 + 2pq)$

$= (pq + 3q^2) \times (4p^2 + 2pq)$

$= pq \times (4p^2 + 2pq) + (3q^2)(4p^2 + 2pq)$

$= 4p^3q + 2p^2q^2 + 12p^2q^2 + 6pq^3$

$= 4p^3q + 14p^2q^2 + 6pq^3$

For $p = 5$ units and $q = 10$ units

Area of rectangle

$= 4(5)^3(10) + 14(5)^2(10)^2 + 6(5)(10)^3$

$= 5000 + 35000 + 30000$

$= 70000$ units

5. We have, $\left(4x + \frac{3}{2}y\right)^2$

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

$$= 16x^2 + 12xy + \frac{9}{4}y^2$$

$$= 16(-1)^2 + 12(-1)(2) + \frac{9}{4}(2)^2$$

$$= 16 - 24 + 9 = 1$$

6. L.H.S $= (11pq + 4q)^2 - (11pq - 4q)^2$

$= (11pq)^2 + 2(11pq)(4q) + (4q)^2 - [(11pq)^2 - 2(11pq)(4q) + (4q)^2]$

$= 121p^2q^2 + 88pq^2 + 16q^2 - 121p^2q^2 + 88pq^2 - 16q^2$

$= 176pq^2$ = R.H.S

7. Given, $5p - \frac{1}{5p} = 10$.

Squaring both sides, we have.

$$\left(5p - \frac{1}{5p}\right)^2 = 10^2$$

$$\Rightarrow \quad (5p)^2 - 2(5p)\left(\frac{1}{5p}\right) + \left(\frac{1}{5p}\right) = 100$$

$$\Rightarrow \quad 25p^2 - 2 + \frac{1}{25p^2} = 100$$

$$\Rightarrow \quad 25p^2 + \frac{1}{25p^2} = 100 + 2 = 102$$

8. Given, $(a + b) = 36$ and $a^2 + b^2 = 256$

We know that $(a + b)^2 = a + 2ab + b^2$ ...(*i*)

Using the above values in (*i*), we have

$$(36)^2 = 256 + 2ab$$

$$\Rightarrow \quad 2ab + 256 = 1296$$

$$\Rightarrow \quad 2ab = 1296 - 256 = 1040$$

$$\Rightarrow \quad ab = \frac{1040}{2} = 520$$

**9.** We have, $(2x^3 + 5x^2 - 7x - 10) \div (x + 1)$

$$\begin{array}{r|l} & 2x^2 + 3x - 10 \\ \hline x+1 & 2x^3 + 5x^2 - 7x - 10 \\ & 2x^3 + 2x^2 \\ & (-) \quad (-) \\ \hline & \quad 3x^2 - 7x \\ & \quad 3x^2 + 3x \\ & \quad (-) \quad (-) \\ \hline & \qquad -10x - 10 \\ & \qquad -10x - 10 \\ & \qquad (+) \quad (+) \\ \hline & \qquad\qquad 0 \end{array}$$

Thus, $\dfrac{2x^3+5x^2-7x-10}{x+1} = 2x^2 + 3x - 10$

**10.** Given, $s^2 + t^2 = 13$ and st = 6 ...(*i*)

(*a*) We know that, $(s + t)^2$

$= s^2 + t^2 + 2st$

$= 13 + 2 \times 6$ [Using (*i*)]

$= 13 + 12 = 25 = 5^2$

$\therefore \quad s + t = 5$

(*b*) We know that, $(s - t)^2 = s^2 - 2st + t^2$

$= 13 - 2 \times 6$

$= 13 - 12 = 1 = 1^2$

$\therefore \quad s - t = 1$

(*c*) we know that, $(s^2 + t^2)^2 = (s^2)^2 + (t^2)^2 + 2s^2t^2$

$= s^4 + t^4 + 2(st)^2$

$\Rightarrow \quad (13)^2 = s^4 + t^4 + 2(6)^2$

$\Rightarrow \quad s^4 + t^4 = (13)^2 - 72$

$= 169 - 72 = 97$

$\therefore \quad s^4 + t^4 = 97.$

**11.** Given, perimeter of triangle $= 27x^2 - 20x + 11$.

Two sides of a triangle are

$5x^2 + 8x - 3$ and $8x^2 - 3x + 12$.

Third side of triangle

$= 27x^2 - 20x + 11 - (5x^2 + 8x - 3 + 8x^2 - 3x + 12)$

$= 27x^2 - 20x + 11 - 13x^2 - 5x - 9$

$= 14x^2 - 25x + 2$

**12.** Perimeter of land A $= 8x^2 + 2x^2y - 2xy - 4y^2$

and length of land A $= 4x^2 + x^2y - 2xy$

(*a*) Breadth of agricultural land

$$A = \left[\frac{8x^2+2x^2y-2xy-4y^2}{2} - (4x^2+x^2y-2xy)\right]$$

$= 4x^2 + x^2y - xy - 2y^2 - 4x^2 - x^2y + 2xy$

$= xy - 2y^2 = (x - 2y)y$

(*b*) After combining land A and B, the length of agricultural land is increased by $x^2 + xy$.

So, length of the combined land

$= (4x^2 + x^2y - 2xy) + (x^2 + xy)$

$= 5x^2 + x^2y - xy$

(*c*) Perimeter of the combined land

$= 2$[length + breadth]

$= 2[(5x^2 + x^2y - xy)] + (xy - 2y^2)]$

$= 2[5x^2 + x^2y - xy + xy - 2y^2]$

$= 10x^2 + 2x^2y - 4y^2$

(*d*) Area of the agricultural land B

= length × breadth

$= (x^2 + xy) \times (xy - 2y^2)$

$= (x^2)(xy - 2y^2) + (xy)(xy - 2y^2)$

$= x^3y - 2x^2y^2 + x^2y^2 - 2xy^3$

$= x^3y - x^2y^2 - 2xy^3$

## Maths Connect (Page 212)

(*a*) For $x$ unit of milk and y unit of chicken breast, protein Intake $= 3.4x + 31y$

(*b*) For $2x$ units of eggs and 1 unit of lentils, Protein Intake $= 2x \times (13) + 9 \times 1 = 26x + 9$

## Mental Maths

**1.** We have, $x^2 - y^2 + (x + y)^2$

$= x^2 - y^2 + x^2 + y^2 + 2xy$

$= 2x^2 + 2xy$

For $x = 1$ and $y = -1$, we have

$2x^2 + 2xy = 2(1)^2 + 2(1)(-1)$

$= 2 - 2 = 0$

**2.** We have, $(x - 4)(x - 4) = x^2 - 4^2 = x^2 - 16$

So, the constant term of $(x - 4)(x + 4)$ is $-16$

**3.** Product of $\left(\frac{1}{4}xy\right)$ and $(-16x^2y^2)$

$$= \left(\frac{1}{4}xy\right) \times (-16x^2y^2)$$

$= -4x^3y^3$

**4.** Given, $x + \dfrac{1}{x} = 2$

Squaring both sides, we have

$$\left(x+\frac{1}{x}\right)^2 = 2^2 = 4$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} + 2(x)\left(\frac{1}{x}\right) = 4$$

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

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

**5.** Given, area of rectangle = $x^2 + 7x + 12$ and breadth = $x + 4$

We know that, Area of rectangle = length × breadth

$$\Rightarrow \quad x^2 + 7x + 12 = \text{length} \times (x + 4)$$

$$\Rightarrow \quad \text{Length} = \frac{x^2+7x+12}{x+4}$$

Now,

$$\begin{array}{r|l} & x + 3 \\ \hline x + 4 & x^2 + 7x + 12 \\ & x^2 + 4x \\ & (-) \quad (-) \\ \hline & \quad 3x + 12 \\ & \quad 3x + 12 \\ & \quad (-) \quad (-) \\ \hline & \quad\quad 0 \\ \hline \end{array}$$

$$\therefore \text{Length} = \frac{x^2+7x+12}{x+4} = x + 3.$$

**6.** Given, $x^2 + y^2 = 10$ and $xy = 3$ ...(*i*)

We know that, $(x\text{-}y)^2 = x^2 - 2xy + y^2$

$= 10 - 2 \times 3$ (using (*i*)

$$\Rightarrow \quad (x - y)^2 = 4$$

$$\Rightarrow \quad x - y = 2$$

# CHAPTER 9 : VISUALISING SOLID SHAPES

## Let's Recall

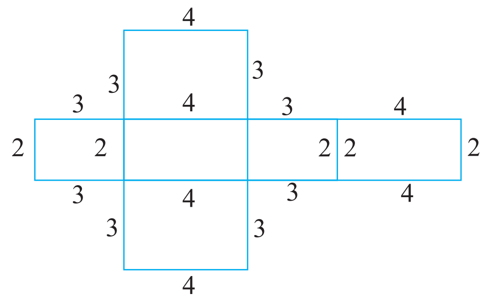
**1.** (*a*) The edge that lies at the intersection of faces ADHE and HEFG is HE.

(*b*) The two faces that meet at edge EF are ABFE and HEFG.

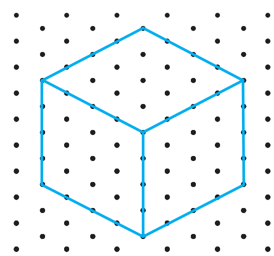
(*c*) From the vertex A, the faces are connected: ABCD, ABFE and ADHE

**2.** A net is a two-dimensional representation of a three-dimensional shape, showing all its faces laid flat. It can be folded to reconstruct the original solid. For this cuboid, the net will consist of:

- 2 rectangles of 4 cm × 3 cm (front and back faces)
- 2 rectangles of 4 cm × 2 cm (top and bottom faces)
- 2 rectangles of 3 cm × 2 cm (side faces).




**3.** Isometric sketch



## Quick Check (Page 217)

(*i*) Top view (*ii*) Front view (*iii*) Side view

## Practice Time 9A

**1.** (*b*) (*i*) Front view (*ii*) Top view (*iii*) Side view

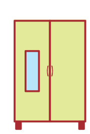
(*c*) (*i*) Front view (*ii*) Top view (*iii*) Side view

**2.** (*a*) (*i*) Front view (*ii*) Side view (*iii*) Top view

(*b*) (*i*) Front view (*ii*) Top view (*iii*) Side view

(*c*) (*i*) Top view (*ii*) Front view (*iii*) Side view

**3.** (*a*)


Front view


Top view


Side view

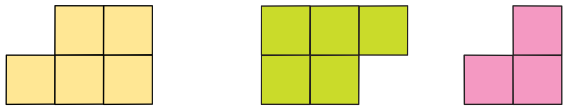
(*b*)


Front view


Top view

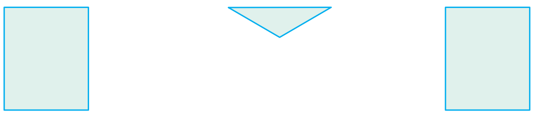

Side view

(*c*)



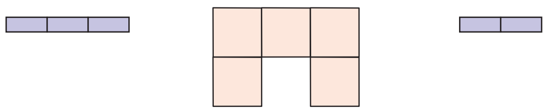
Front view | Top view | Side view

(*d*)



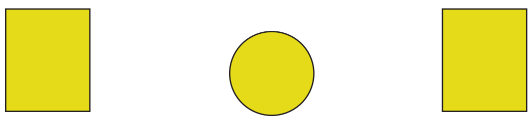
Front view | Top view | Side view

(*e*)



Front view | Top view | Side view

(*f*)



Front view | Top view | Side view

## Think and Answer (Page 219)

The map shows the locations of airports in India.

## Quick Check (Page 221)

**1.** A cube has six square faces, with opposite faces being identical. Each vertex is shared by three edges, and each edge is shared by two faces.

Faces — 6: ABCD, BCFG, ABGH, ADEH, DCFE, EFGH

Edges — 12: AB, BC, CD, DA, EF, FG, GH, HE, AH, DE, BG, CF

Vertices — 8: A, B, C, D, E, F, G, H

**2.** A triangular pyramid has four triangular faces that meet at a common apex (the top vertex).

Faces — 4: ABC, BOC, AOB, AOC.

Edges — 6: AB, BC, AC, OA, OB, OC.

Vertices — 4: O, A, B, C

**3.** A triangular prism has two parallel triangular faces (top and bottom) connected by three rectangular faces.

Faces — 5: PQR, ABC, APRC, APQB, RQBC.

Edges — 9: AB, BC, CA, PQ, QR, RP, AP, CR, BQ.

Vertices — 6: A, B, C, P, Q, R.

## Think and Answer (Page 224)

**1.** a tetrahedron

A triangular pyramid has a triangular base and three triangular faces meeting at a common vertex. This structure is known as a tetrahedron.

**2.** 7 faces

A pentagonal prism consists of:

- 2 pentagonal faces (top and bottom).
- 5 rectangular lateral faces connecting the corresponding edges of the pentagons.

So, the total number of faces is 7.

**3.** A solid shape having 5 faces, 5 vertices and 8 edges is a rectangular pyramid.

**4.** 3 lateral faces.

Explanation:

A triangular prism consists of:

- 2 triangular bases (top and bottom).
- 3 rectangular faces (lateral faces) connecting the sides of the triangles.

**5.** No

A square prism has square bases and rectangular lateral faces. If the height of the prism is equal to the side length of the square base, then it becomes a cube. But in general, a square prism is not always a cube.

## Practice Time 9C

**1.** Euler's formula is:

$F + V - E = 2$

where F is the number of faces, V is the number of vertices, and E is the number of edges.

(*a*) Cuboid

- Faces (F): 6
- Vertices (V): 8
- Edges (E): 12
- Verify Euler's Formula: $6+8-12=2$

(*b*) Triangular Prism

- Faces (F): 5 (2 triangular bases + 3 rectangular lateral faces)
- Vertices (V): 6
- Edges (E): 9
- Verify Euler's Formula: $5 + 6 - 9 = 2$

(*c*) Square Pyramid

- Faces (F): 5 (1 square base + 4 triangular faces)
- Vertices (V): 5

- Edges (E): 8
- Verify Euler's Formula: 5 + 5 – 8 = 2

(*d*) Rectangular Prism

- Faces (F): 6
- Vertices (V): 8
- Edges (E): 12
- Verify Euler's Formula: 6 + 8 - 12 = 2

(*e*) Pentagonal Pyramid

- Faces (F): 6 (1 pentagonal base + 5 triangular faces)
- Vertices (V): 6
- Edges (E): 10
- Verify Euler's Formula: 6 + 6 – 10 = 2

(*f*) Pentagonal Prism

- Faces (F): 7 (2 pentagonal bases + 5 rectangular lateral faces)
- Vertices (V): 10
- Edges (E): 15
- Verify Euler's Formula: 7 + 10 – 15 = 2

**2.** Euler's formula is F + V – E = 2.

(*a*) F = 4, E = 8, V = ?

$4 + V - 8 = 2 \Rightarrow V = 6$

**Ans.** V = 6

(*b*) F = 6, V = 8, E = ?

$6 + 8 - E = 2 \Rightarrow E = 12$

**Ans.** E = 12

(*c*) F = 20, V = 12, E = ?

$20 + 12 - E = 2 \Rightarrow E = 30$

**Ans.** E = 30

(*d*) F = ?, V = 6, E = 12

$F + 6 - 12 = 2 \Rightarrow F = 8$

**Ans.** F = 8

**3.** Using Euler's formula:

F + V – E = 2

$10 + 15 - 20 = 5 \neq 2$

No, a polyhedron cannot have 10 faces, 20 edges, and 15 vertices because it does not satisfy Euler's formula.

## Chapter Assessment

**A.**

**1.** A cube is a polyhedron because it has flat polygonal faces.

So, the correct option is (*b*).

**2.** A prism is a three-dimensional figure.

So, the correct option is (*b*).

**3.** A square pyramid has one square base and four triangular faces.

So, the correct option is (*a*).

**4.** The scale can be calculated as $\frac{420 \text{ cm}}{3 \text{ cm}} = 140$, so the scale is 1:140.

So, the correct option is (*c*).

**B.**

**1.** A cube is a regular polyhedron because all its faces are congruent squares, and Reason correctly explains why a cube is regular.

So, the correct option is (*a*).

**2.** The side view of a cone resembles a triangle due to its tapering shape, but the Reason describes the cone, not why its side view looks like a triangle.

So, the correct option is (*b*).

**3.** While it's true that pyramids can have bases with any polygonal shape, the description given in Reason R specifically pertains to square pyramids only.

So, the correct option is (*b*).

**C.**

**1.** A solid figure with only one vertex is known as a cone.

Explanation: A cone is a three-dimensional shape with a flat circular base and one vertex.

**2.** A regular polyhedron is a solid made up of congruent faces.

Explanation: A regular polyhedron has faces that are all identical in shape and size.

**3.** If the actual distance between A and B is 110 km, and is represented on a map by 22 mm, then the scale used is 1:5000000.

Explanation: The scale is given by:

$$\text{Scale} = \frac{\text{Map Distance (mm)}}{\text{Actual Distance (km converted to mm)}}$$

$$= \frac{22}{110 \times 1000 \times 1000} = \frac{1}{5,000,000}$$

**4.** A regular hexahedron is also called a cube.

Explanation: A regular hexahedron has six square faces of equal size, which is the definition of a cube.

5. Total number of faces in a pyramid, which has 8 edges is 5.

   Explanation: A pyramid with 8 edges has a square base (4 edges) and 4 triangular faces, making a total of 5 faces.

**D.**

1. False

   Explanation: A polyhedron must have at least 4 faces to form a closed three-dimensional shape. For example, a tetrahedron has the minimum number of 4 triangular faces.
2. False

   Explanation: A pentagonal prism has 2 pentagonal bases and 5 rectangular lateral faces, making a total of 7 faces.
3. True

   Explanation: An octahedron has 8 triangular faces, 6 vertices, and 12 edges.
4. False

   Explanation: Euler's formula $V - E + F = 2$ is valid only for polyhedron that is convex and closed. It does not apply to 3-D shapes with holes or other irregularities.
5. True

   Explanation: The five regular convex polyhedrons are the Platonic solids: tetrahedron, cube, octahedron, dodecahedron, and icosahedron.

**E.**

1. We have given:

   $V = F = 9$ and $E = 16$

   Use the Euler's formula:

   $$V - E + F = 2$$

   Substitute the given values:

   $$9 - 16 + 9 = 2$$
   $$2 = 2$$

   Yes, a polyhedron can have $V = 9$, $F = 9$, and $E = 16$, as it satisfies Euler's formula.
2. Use the Euler's formula:

   $$V - E + F = 2$$

   Substitute $V = 20$, $F = 12$:

   $$20 - E + 12 = 2$$
   $$32 - E = 2$$
   $$E = 30$$

   Number of edges: $E = 30$.
3. Using Euler's formula:

   $$V - E + F = 2$$

   Substitute $E = 60$, $F = 40$:

   $$V - 60 + 40 = 2$$
   $$V - 20 = 2$$
   $$V = 22$$

   Number of vertices: $V = 22$.
4. Using Euler's formula:

   $$V - E + F = 2$$

   For X:

   $$10 - X + 7 = 2$$
   $$X = 17 - 2$$
   $$X = 15$$

   For Y:

   $$12 - 18 + Y = 2$$
   $$Y = 2 + 6$$
   $$Y = 8$$

   For Z:

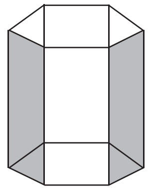
   $$Z - 16 + 9 = 2$$
   $$Z = 2 + 7$$
   $$Z = 9$$

   For P:

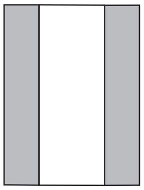
   $$6 - 12 + P = 2$$
   $$P = 2 + 6$$
   $$P = 8$$

   For Q:

   $$Q - 12 + 8 = 2$$
   $$Q = 2 + 4$$
   $$Q = 6$$
5. A hexagonal prism is a prism with two hexagon-shaped bases and six rectangular faces.

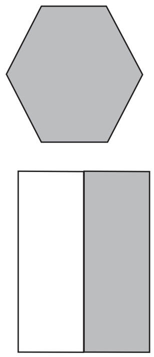


Front view



Top view

Side view



6. (*a*) If a polyhedron has 4 faces (F = 4) and 4 vertices (V = 4), to find the number of edges (E) use Euler's formula:

$$F + V = E + 2$$

Substitute F = 4 and V = 4:

$$4 + 4 = E + 2$$
$$E = 6$$

Number of edges: E = 6.

(*b*) If for a polyhedron V = 7 and E = 12, to find the value of F use Euler's formula:

$$F + V = E + 2$$

Substitute V = 7 and E = 12:

$$F + 7 = 12 + 2$$
$$F + 7 = 14$$
$$F = 7$$

Number of faces: F = 7.

(c) A solid has F=6, V=8, and E=12.

This matches the properties of a cube or cuboid.

(*d*) If a polyhedron has 20 faces (F = 20) and 30 edges (E = 30), to find the vertices use Euler's formula:

$$F + V = E + 2$$

Substitute F = 20 and E = 30:

$$20 + V = 30 + 2$$
$$20 + V = 32$$
$$V = 12$$

Number of vertices: V = 12.

## Mental Maths (Page 228)

1. Solids that are not polyhedrons include:
   - Sphere
   - Cone
   - Cylinder

   These are not polyhedrons because they have curved surfaces.
2. The polyhedron with 5 faces, 5 vertices, is a square pyramid.
3. The solid is a triangular prism or a triangular pyramid (tetrahedron).
4. Given scale 1:1600000:

$$1 \text{ cm on the map} = 1600000 \text{ cm in reality.}$$

For 8 cm:

$$\text{Actual distance} = 8 \times 1600000 \text{ cm}$$

Convert to kilometres:

$$\text{Actual distance} = \frac{8 \times 1600000}{100000} \text{ km}$$
$$= 128 \text{ km}$$

The actual distance is 128 km.

# CHAPTER 10 : MENSURATION

## Let's Recall

1. Area is the part of a plane occupied by a closed figure.

   So, the correct answer is (*a*).
2. Calculate the length of the wire.

   The perimeter of the square:

$$4 \times 11 = 44 \text{ cm}$$

   Use this length as the circumference of the circle.

   Circumference of a circle:

$$2\pi r = 44 \Rightarrow r = \frac{44}{2\pi} = \frac{44}{6.28} \approx 7 \text{ cm.}$$

   So, the correct answer is (*d*).
3. Area of the rectangle $= 14 \times 11 = 154 \text{ cm}^2$

   Use this area as the area of the circle.

   Area of a circle:

$$\pi r^2 = 154 \Rightarrow r^2 = \frac{154}{\pi} = \frac{154}{3.14} \approx 49$$
$$\Rightarrow r = \sqrt{49} = 7 \text{ cm.}$$

   So, the correct answer is (*d*).
4. Area of a triangle $= \frac{1}{2} \times \text{base} \times \text{height}$

   So, the correct answer is (*d*).
5. The perimeter of a semicircle is:

$$\pi r + 2r = r(\pi + 2)$$

   So, the correct answer is (*c*).

**6.** Find the area of the original sheet.

$6 \times 5 = 30 \text{ cm}^2$

Find the area of the cut piece.

$3 \times 2 = 6 \text{ cm}^2$

Subtract the area of the cut piece from the total area.

$30 - 6 = 24 \text{ cm}^2$

So, the correct answer is (*b*).

## Quick Check (Page 231)

Area of a square = side$^2$

Area of square = $60^2 = 3600 \text{ cm}^2$

Area of a rectangle = length × breadth

Area of rectangle = 80 × 40

= $3200 \text{ cm}^2$

Difference in area:

Difference = $3600 - 3200 = 400 \text{ cm}^2$

The square has a larger area, and the difference is 400 cm².

## Think and Answer (Page 232)

(*a*) Radius of the semicircle part = $\frac{2.8}{2}$ cm = 1.4

Perimeter of the circle = $2\pi r$

The perimeter of the semicircle = $\pi r$

The perimeter of the food piece = 2.8 cm + $\pi r$

$= 2.8 \text{ cm} + \left(\frac{22}{7} \times 1.4\right) \text{ cm}$

= 2.8 cm + 4.4 cm = 7.2 cm

(*b*) Radius of semicircle part = $\frac{2.8}{2}$ cm = 1.4 cm

Perimeter of the food piece = 1.5 cm + 2.8 cm + 1.5 cm + $\pi r$

$= 5.8 \text{ cm} + \left(\frac{22}{7} \times 1.4\right) \text{ cm}$

= 5.8 cm + 4.4 cm

= 10.2 cm

(*c*) Radius of the food piece = $\frac{2.8}{2}$ cm = 1.4 cm

Perimeter of the food piece

= 2 cm + $\pi r$ + 2 cm

$= 4 \text{ cm} + \left(\frac{22}{7} \times 1.4\right) \text{ cm}$

= 4 cm + 4.4 cm = 8.4 cm

Thus, the ant will have to take a longer round for food pieces in (*b*) because the perimeter of the figure given in (*b*) is the greatest among all.

## Quick Check (Page 232)

Consider the triangle DEC is similar to triangle DAB, therefore

$$\frac{EC}{DC} = \frac{6}{10}$$

$$\frac{EC}{4} = \frac{6}{10}$$

$$EC = \frac{4 \times 6}{10}$$

EC = 2.4 cm

## Practice Time 10A

**1.** Calculate the area and total cost of the plot

Dimensions of the plot:

Length = 60 ft, Breadth = 40 ft

Area of the plot = Length × Breadth

= 60 × 40 = 2400 sq. ft.

Cost per sq. ft = ₹4500

Total cost of the plot = 2400 × 4500

= ₹1,08,00,000.

Calculate the area of the house

Dimensions of the house:

Length = 30 ft, Breadth = 20 ft

Area of the house =30×20=600 sq. ft.

Calculate the area of the garden

Garden area = Area of the plot - Area of the house

Garden area = 2400 – 600 = 1800 sq.ft.

Calculate the cost of developing the garden

Cost per sq. ft for garden = ₹110

Total garden cost = 1800 × 110 = ₹1,98,000.

**2.** Calculate the area of the square park

Side of the square park = 80 m

Area of the square park = Side$^2$

= $80^2$ = 6400 sq. m.

Use the area of the rectangular park to find its breadth

Length of the rectangular park = 100 m

Area of the rectangular park = Length × Breadth.

Equating the areas of the square and rectangular parks:

$6400 = 100 \times \text{Breadth}.$

Solving for breadth:

$$\text{Breadth} = \frac{6400}{100} = 64 \text{ m}.$$

Hence, the breadth of the rectangular park is 64 m.

**3.** Dimensions of the park:

Length = 600 m, Breadth = 320 m.

- Width of each road: 12 m .
- Area of the horizontal road (running along the breadth): Area = Length × Width
 = 600 × 12 = 7200 sq.m.

Area of the vertical road (running along the length):

Area = Breadth × Width
 = 320 × 12 = 3840 sq.m.

Overlapping area at the intersection: The intersection is a square of side 12 m:

Overlapping area =12 × 12 = 144 sq.m.

Total area of the crossroads:

Total road area = 7200 + 3840 – 144
 = 10896 sq.m.

Calculate the remaining area of the park

Total area of the park:

Area of the park = Length × Breadth
 = 600 × 320 = 192,000 sq. m.

Remaining area =192,000 – 10,896
 =181104 sq.m.

**4.** The formula to find the area of a parallelogram is:

Area = Base × Height

(*a*) Base = 8 cm, Height = 3 cm

Area =8 × 3 = 24 $cm^2$

(*b*) Base = 4 cm, Height = 2.8 cm

Area = 4 × 2.8 = 11.2 $cm^2$

(*c*) Base = 5.5 cm, Height = 4 cm

Area = 5.5 × 4 = 22 $cm^2$

**5.** The formula to find the area of a triangle is:

$$\text{Area} = \frac{1}{2} \times \text{Base} \times \text{Height}$$

(*a*) Base = 5 cm, Height = 3.4 cm

$$\text{Area} = \frac{1}{2} \times 5 \times 3.4 = \frac{1}{2} \times 17 = 8.5 \text{ cm}^2$$

(*b*) Base = 4 cm, Height = 3 cm

$$\text{Area} = \frac{1}{2} \times 4 \times 3 = \frac{1}{2} \times 12 = 6 \text{ cm}^2$$

(*c*) Base = 4 cm, Height = 2.5 cm

$$\text{Area} = \frac{1}{2} \times 4 \times 2.5 = \frac{1}{2} \times 10 = 5 \text{ cm}^2$$

**6.** The formula for the area of a parallelogram is:

Area of a tile = Base × Height

Calculate the area of one tile:

Area of one tile = 24 × 10 = 240 $cm^2$

Convert the area of the tile to square meters:

$$240 \text{ cm}^2 = \frac{240}{10000} \text{ m}^2 = 0.024 \text{ m}^2$$

Calculate the number of tiles required:

$$\text{Number of tiles} = \frac{\text{Total area of the floor}}{\text{Area of one tile}}$$

$$\text{Number of tiles} = \frac{1080}{0.024} = 45000$$

**7.** The formula for the area of a circle is:

Area of a circle = $\pi r^2$

The formula for the area of a rectangle is:

Area of a rectangle = Length × Breadth

Calculate the total area of the circular card sheet:

Area of the circular card sheet = $\pi r^2$

$$= \frac{22}{7} \times 28^2$$

$$\text{Area of the circular card sheet} = \frac{22}{7} \times 784$$

= 2464 $cm^2$

Calculate the total area of the two small circles:

Area of one small circle = $\pi r^2$

$$= \frac{22}{7} \times 7^2$$

$$= \frac{22}{7} \times 49 = 154 \text{ cm}^2$$

Total area of two small circles = 2 × 154
 =308 $cm^2$

Now, calculate the area of the rectangle

Area of the rectangle = 6 × 2 = 12 $cm^2$

Calculate the remaining area

Remaining area = Total area of the card sheet – Area of the two circles and rectangle

Remaining area = 2464 – (308 + 12)
 = 2464 – 320 = 2144 $cm^2$

## Quick Check (Page 234)

1. To find the area of a trapezium, use the formula:

$$\text{Area} = \frac{1}{2}\times(a+b)\times h$$

where $a$ and $b$ are the lengths of the parallel sides, and $h$ is the height.

Parallel sides: AB = 16 cm, CD = 25 cm

Height: BC = 10 cm

$$\text{Area} = \frac{1}{2}\times(16+25)\times 10$$

$$\text{Area} = \frac{1}{2}\times 41\times 10$$

$$\text{Area} = 205 \text{ cm}^2$$

2. Parallel sides: 7 cm, 9 cm

Height: 3 cm

$$\text{Area} = \frac{1}{2}\times(7+9)\times 3$$

$$\text{Area} = \frac{1}{2}\times 16\times 3$$

$$\text{Area} = 24 \text{ cm}^2$$

## Think and Answer (Page 235)

Yes, a trapezium can be divided into two triangles, but they will not be congruent. This is because the non-parallel sides and angles are unequal.

## Quick Check (Page 237)

The area of a rhombus can be calculated using the formula:

Area = side × altitude

Given:

Side = 6 cm

Altitude = 4 cm

$$\text{Area} = 6 \times 4 = 24 \text{ cm}^2$$

Now, find the length of the other diagonal.

The area of a rhombus can also be calculated using the formula:

$$\text{Area} = \frac{1}{2}\times d_1 \times d_2$$

Where $d_1$ and $d_2$ are the lengths of the diagonals.

We are given:

- $d_1$ = 8 cm
- Area = 24 cm²

Substituting the known values:

$$24 = \frac{1}{2} \times 8 \times d_2$$

$$24 = 4 \times d_2$$

$$d_2 = \frac{24}{2} = 6 \text{ cm}$$

Therefore, the length of the other diagonal is 6 cm.

## Practice Time 10B

1. The area of a trapezium is given by:

$$\text{Area} = \frac{1}{2} \times (a + b) \times h$$

Where a and b are the lengths of the parallel sides, and h is the height.

(*a*) Parallel sides: PQ = 7 cm, RS = 9 cm, Height: QR = 4 cm

$$\text{Area} = \frac{1}{2} \times (7 + 9) \times 4$$

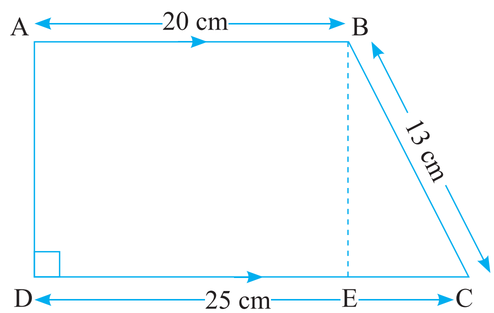
$$\text{Area} = \frac{1}{2} \times 16 \times 4 = 32 \text{ cm}^2$$

(*b*) Parallel sides: MN = 13 cm, OP = 21 cm, Height: $h$ = 10 cm

$$\text{Area} = \frac{1}{2} \times (13 + 21) \times 10$$

$$\text{Area} = \frac{1}{2} \times 34 \times 10 = 170 \text{ cm}^2$$

(*c*)




Here, DC = 25 cm and AB = 20 cm

So, EC = 25 – 20 = 5 cm.

By Pythagoras theorem,

The value of BE = 12 cm.

Parallel sides: AB = 20 cm, DC = 25 cm,

Height: BE =12 cm

$$\text{Area} = \frac{1}{2} \times (20 + 25) \times 12$$

$$\text{Area} = \frac{1}{2} \times 45 \times 12 = 270 \text{ cm}^2$$

**2.** The area of a quadrilateral is given by:

$$\text{Area} = \frac{1}{2} \times \text{Diagonal} \times (\text{Height}_1 + \text{Height}_2)$$

(*a*) Diagonal: BD = 11 cm,
Heights: AE = 9 cm,CF = 10 cm

$$\text{Area} = \frac{1}{2} \times 11 \times (9 + 10)$$

$$\text{Area} = \frac{1}{2} \times 11 \times 19 = 104.5 \text{ cm}^2$$

(*b*) Diagonal: AC = 6 cm,
Heights: BE = 3 cm, DF = 5 cm

$$\text{Area} = \frac{1}{2} \times 6 \times (3 + 5)$$

$$\text{Area} = \frac{1}{2} \times 6 \times 8 = 24 \text{ cm}^2$$

(*c*) Diagonal: AC = 4 cm, Heights: BD = 3 cm

$$\text{Area} = \frac{1}{2} \times 4 \times (3)$$

$$\text{Area} = \frac{1}{2} \times 12 = 6 \text{ cm}^2$$

**3.** Convert units to the same system: 225 mm = 22.5 cm, 295 mm = 29.5 cm .

$$\text{Area} = \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$$

$$\text{Area} = \frac{1}{2} \times (22.5 + 29.5) \times 150 = \frac{1}{2} \times 52 \times 150$$

$$= 3900 \text{ cm}^2$$

**4.** $\text{Area} = \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

$$\text{Area} = \frac{1}{2} \times (1 + 1.2) \times 0.8$$

$$= \frac{1}{2} \times 2.2 \times 0.8 = 0.88 \text{ m}^2$$

**5.** $\text{Area} = \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

$$\text{Area} = \frac{1}{2} \times (13 + 21) \times 10$$

$$= \frac{1}{2} \times 34 \times 10 = 170 \text{ cm}^2$$

**6.** In figure,
Distance between the parallel sides of II and IV

$$= \frac{24 \text{ cm} - 16 \text{ cm}}{2} = 4 \text{ cm}$$

Distance between the parallel sides of I and III

$$= \frac{28 \text{ cm} - 20 \text{ cm}}{2} = 4 \text{ cm}$$

Area of section I = Area of section III

$= \frac{1}{2} \times$ (sum of parallel sides) × distance between the parallel sides

$$= \frac{1}{2} \times 4 \text{ cm } (20 \text{ cm} + 28 \text{ cm})$$

$$= 2 \text{ cm } (48 \text{ cm}) = 96 \text{ cm}^2$$

Area of section II = Area of section IV

$= \frac{1}{2} \times$ (sum of parallel sides) × distance between the parallel sides

$$= \frac{1}{2} \times 4 \text{ cm} \times (16 \text{ cm} + 24 \text{ cm})$$

$$= 2 \text{ cm} \times 40 \text{ cm} = 80 \text{ cm}^2$$

**7.** Rearrange the formula for the area of a trapezium to find the height (*h*):

$$\text{Area} = \frac{1}{2} \times (\text{sum of parallel sides}) \times h$$

$$1968 = \frac{1}{2} \times (63 + 101) \times h$$

$$1968 = \frac{1}{2} \times 164 \times h$$

$$1968 = 82h$$

$$h = \frac{1968}{82} = 24 \text{ cm}$$

**8.** Let the shorter parallel side be $x$, and the longer side be $x + 6$. Using the area formula:

$$\text{Area} = \frac{1}{2} \times (\text{sum of parallel sides}) \times h$$

$$540 = \frac{1}{2} \times (x + x + 6) \times 18$$

$$540 = \frac{1}{2} \times (2x + 6) \times 18$$

$$540 = 18x + 54$$

$$486 = 18x$$

$$x = \frac{486}{18} = 27 \text{ cm}$$

Thus, the parallel sides are:

$$x = 27 \text{ cm}, x + 6 = 33 \text{ cm}$$

**9.** Let the length of the side along the road be $x$. The length of the side along the river is $2x$. The area of the trapezium is given by:

$$\text{Area} = \frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$$

$$22338 = \frac{1}{2} \times (x + 2x) \times 102$$

$$22338 = \frac{1}{2} \times 3x \times 102$$

$$22338 = 153x$$

$$x = \frac{22338}{153} = 146 \text{ m}$$

The side along the river is:

$$2x = 2 \times 146 = 292 \text{ m}$$

Thus, the side along the river is 292 m.

**10.** The area of a rhombus is given by:

$$\text{Area} = \frac{1}{2} \times (\text{product of diagonals})$$

Let the other diagonal be $d_2$:

$$432 = \frac{1}{2} \times 36 \times d_2$$

$$432 = 18 \times d_2$$

$$d_2 = \frac{432}{18} = 24 \text{ cm}$$

Hence, the other diagonal is 24 cm.

**11.** The area of one rhombus-shaped brick is:

$$\text{Area of one brick} = \frac{1}{2} \times (\text{product of diagonals})$$

$$\text{Area of one brick} = \frac{1}{2} \times 15 \times 20 = 150 \text{ cm}^2$$

The total area to be paved is:

Total area = 2500 × 150 = 375000 $\text{cm}^2$ = 37.5 $\text{m}^2$

The total cost of paving at ₹100 per $m^2$ is:

Cost = 37.5 × 100 = ₹3750

So, the total cost is ₹3750.

**12.** $\text{Area} = \frac{1}{2} \times (\text{product of diagonals})$

$$\text{Area} = \frac{1}{2} \times 24 \times 32 = 384 \text{ cm}^2$$

In a rhombus, the diagonals bisect each other at right angles. The length of each half-diagonal is:

$$\frac{24}{2} = 12 \text{ cm}, \quad \frac{32}{2} = 16 \text{ cm}$$

Using the Pythagoras theorem:

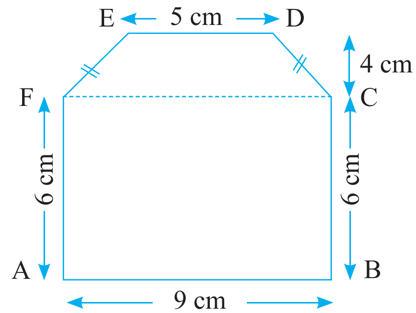
$$\text{Side} = \sqrt{(12)^2 + (16)^2}$$

$$= \sqrt{144 + 256} = \sqrt{400} = 20 \text{ cm}$$

Hence, the area is 384 $\text{cm}^2$, and the length of each side is 20 cm.

## Practice Time 10C

**1.** From the figure we can write,




Area of figure = Area of trapezium + Area of rectangle

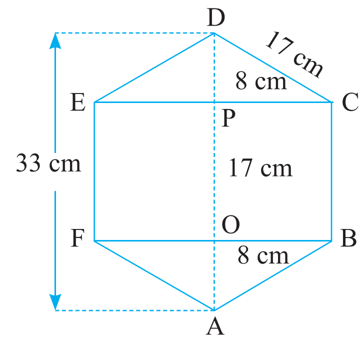
Area of figure = $\frac{1}{2}$ (Sum of lengths of parallel sides) × altitude + Length × Breadth

$$\text{Area of figure} = \frac{1}{2}(9 + 5) \times 4 + 9 \times 6$$

$$\text{Area of figure} = \frac{1}{2}(14) \times 4 + 54$$

$$\text{Area of figure} = 7 \times 4 + 54 = 28 + 54 = 82 \text{ cm}^2$$

**2.** (*a*)




$$DA = 33 \text{ cm}$$

$$DP = OA = \frac{16}{2} = 8 \text{ cm}$$

$$EF = PO = CB = 17 \text{ cm}$$

In the right triangle BOA

$$BA^2 = OA^2 + OB^2$$

Substituting the values

$$(17)^2 = (8)^2 + OB^2$$

$$289 = 64 + OB^2$$

So we get

$OB^2 = 289 - 64 = 225$

OB = 15 cm

Here

BF = CE = 2 × 15 = 30 cm

Area of rectangle BCEF $= BC \times CE$

$= 17 \times 30 = 510 \text{ cm}^2$

Area of triangle ABF $= \frac{1}{2} \times OA \times BF$

$= \frac{1}{2} \times 30 \times 8$

$= 120 \text{ cm}^2$

So, the area of triangle DEC = 120 $\text{cm}^2$

Therefore, the area of the hexagon

$= 510 + 120 + 120 = 750 \text{ cm}^2$.

(*b*) Similarly, solve this part like part (*a*).

**3.** (*a*) From the given figure we can calculate these values:

GH = AG – AH = 8 – 6 = 2 cm

HF = AH – AF = 6 – 3 = 3 cm

GD = AD – AG = 10 – 8 = 2 cm

From the figure we can write,

Area of given figure = Area of triangle AFB + Area of trapezium BCGF + Area of triangle CGD + Area of triangle AHE + Area of triangle EHD

We know that,

Area of right angled triangle $= \frac{1}{2} \times \text{base} \times \text{altitude}$

Area of trapezium $= \frac{1}{2}$ (Sum of lengths of parallel sides) × altitude

Area of given pentagon $= \frac{1}{2} \times AF \times BF + \frac{1}{2} (CG + BF) \times FG + \frac{1}{2} \times GD \times CG + \frac{1}{2} \times AH \times EH + \frac{1}{2} \times HD \times EH$

Area of given pentagon $= \frac{1}{2} \times 3 \times 5 + \frac{1}{2} (7 + 5) \times 5 + \frac{1}{2} \times 2 \times 7 + \frac{1}{2} \times 6 \times 3 + \frac{1}{2} \times 4 \times 3$

Area of given pentagon = 7.5 + 30 + 7 + 9 + 6

= 59.5

Hence, the area of given pentagon is 59.5 $\text{cm}^2$.

(*b*) Similarly, solve this part like part (*a*).

**4.** We can redraw the figure in two different ways:

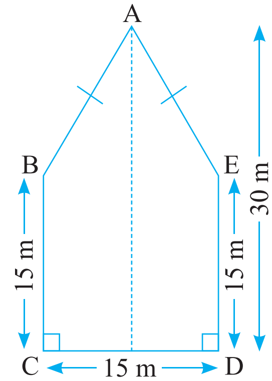


Figure 1

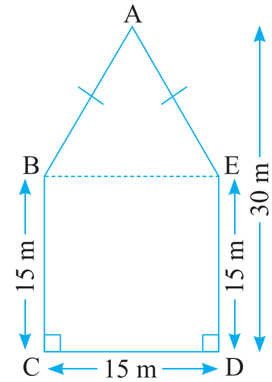


Figure 2

Area of Figure 1 $= 2 \times \frac{1}{2}$ (Sum of lengths of parallel sides) × altitude

Area of figure $= 2 \times \frac{1}{2} \times (15 + 30) \times 7.5$

Area of figure = 45 × 7.5 = 337.5

Therefore, the area of figure 1 is 337.5 $\text{cm}^2$.

We also know that,

Area of Pentagon = Area of triangle + area of rectangle

Area of figure 2 $= \frac{1}{2} \times \text{Base} \times \text{Altitude} + \text{Length} \times \text{Breadth}$

Area of figure 2 $= \frac{1}{2} \times 15 \times 15 + 15 \times 15$

Area of figure 2 = 112.5 + 225 = 337.5

Therefore, the area of figure 2 is 337.5 $\text{m}^2$.

Hence, the area in each case is same.

## Think and Answer (Page 245)

Joining three cubes end-to-end gives the length as:

3 × 3 = 9 cm

The breadth and height will remain the same as the side of one cube: 3 cm

Thus, the dimensions of the cuboid are:

Length = 9 cm, Breadth = 3 cm, Height = 3 cm.

The surface area of a cuboid is:

Surface Area = 2 × (Length × Breadth + Breadth × Height + Height × Length)

Substitute the values:

Surface Area = 2 × (9 × 3 + 3 × 3 + 3 × 9)

Surface Area = 2 × (27 + 9 + 27)

$= 2 \times 63 = 126 \text{ cm}^2$

## Quick Check (Page 246)

**1.** Radius = 14 cm, Height = 8 cm

Curved Surface Area (CSA) of a cylinder = $2\pi rh$

Total Surface Area (TSA) of a cylinder

$= 2\pi r(r + h)$

Curved Surface Area:

CSA = $2\pi rh = 2 \times \pi \times 14 \times 8$

$= 2 \times \frac{22}{7} \times 14 \times 8 = 704 \text{ cm}^2$

Total Surface Area:

TSA = $2\pi r(r + h) = 2 \times \pi \times 14 \times (14 + 8)$

TSA = $2 \times \frac{22}{7} \times 14 \times 22 = 1936 \text{ cm}^2$

**2.** Diameter = 2 m, Height = 2 m

Here, the radius $r = \frac{\text{diameter}}{2} = 1$ m.

Curved Surface Area:

CSA = $2\pi rh = 2 \times \pi \times 1 \times 2$

$= 2 \times \frac{22}{7} \times 2 \approx 12.57 \text{ m}^2$

Total Surface Area:

TSA = $2\pi r(r + h) = 2 \times \pi \times 1 \times (1 + 2)$

TSA = $2 \times \frac{22}{7} \times 1 \times 3 \approx 18.86 \text{ m}^2$

## Practice Time 10D

**1.** (*a*) Cube, side: 4 cm

Lateral surface area (LSA) of a cube = $4 \times \text{side}^2$

LSA = $4 \times 4^2 = 4 \times 16 = 64 \text{ cm}^2$

Total surface area (TSA) of a cube = $6 \times \text{side}^2$

TSA = $6 \times 4^2 = 6 \times 16 = 96 \text{ cm}^2$

(*b*) Cylinder, height: 12 cm, radius: 6 cm

Lateral surface area (LSA) of a cylinder = $2\pi rh$

LSA = $2 \times \pi \times 6 \times 12 \approx 2 \times 3.14 \times 6 \times 12$

$\approx 452.16 \text{ cm}^2$

Total surface area (TSA) of a cylinder

$= 2\pi r(r + h)$

TSA = $2 \times \pi \times 6 \times (6 + 12)$

$= 2 \times 3.14 \times 6 \times 18 \approx 678.24 \text{ cm}^2$

(*c*) Cuboid, length: 8 cm, breadth: 5 cm, height: 6 cm

Lateral surface area (LSA) of a cuboid

$= 2 \times h \times (l + b)$

LSA = $2 \times 6 \times (8 + 5)$

$= 2 \times 6 \times 13$

$= 156 \text{ cm}^2$

Total surface area (TSA) of a cuboid

$= 2 \times (lb + bh + hl)$

TSA = $2 \times (8 \times 5 + 5 \times 6 + 6 \times 8)$

$= 2 \times (40 + 30 + 48)$

$= 2 \times 118$

$= 236 \text{ cm}^2$

**2.** Each cube has an edge of 10 cm.

When the two cubes are joined face-to-face, the resulting cuboid will have dimensions:

Length $l = 10 + 10 = 20$ cm

Breadth $b = 10$ cm

Height $h = 10$ cm

Surface area of the cuboid:

Surface Area = $2(l \cdot b + b \cdot h + h \cdot l)$

Substitute the values:

Surface Area = $2(20 \cdot 10 + 10 \cdot 10 + 10 \cdot 20)$

Surface Area = $2(200 + 100 + 200)$

$= 2 \cdot 500 = 1000 \text{ cm}^2$

The surface area of the cuboid is $1000 \text{ cm}^2$.

**3.** The cabinet is a cuboid with:

Length $l = 10$ m ,

Breadth $b = 8$ m ,

Height $h = 2.5$ m .

Surface area of all faces except the bottom:

Surface Area = $2(l \cdot h + b \cdot h) + l \cdot b$

Substitute the values:

Surface Area = $2(10 \cdot 2.5 + 8 \cdot 2.5) + 10 \cdot 8$

Surface Area = $2(25 + 20) + 80$

$= 2 \cdot 45 + 80 = 90 + 80$

$= 170 \text{ m}^2$

The surface area covered by Raman is $170 \text{ m}^2$.

**4.** The internal measures of a cuboidal hall (length $l = 18$ m , breadth $b = 10$ m , height $h = 5$ m) are given.

(*i*) Cost of whitewashing all four walls:

Surface area of four walls:

Surface Area of Walls = $2(l \cdot h + b \cdot h)$

Substitute the values:

Surface Area of Walls = $2(18 \cdot 5 + 10 \cdot 5)$

Surface Area of Walls = $2(90 + 50) = 2 \cdot 140$
$= 280 \text{ m}^2$

Cost of whitewashing the walls:

Cost = Surface Area × Cost per $m^2$

$= 280 \cdot 50 = ₹14,000$

(*ii*) Cost of whitewashing the walls and the ceiling:

The surface area of the ceiling:

Ceiling Area = $l \cdot b = 18 \cdot 10 = 180$ $m^2$

Total surface area:

Total Area = $280 + 180 = 460$ $m^2$

Cost of whitewashing the walls and ceiling:

Cost = $460 \cdot 50 = ₹23,000$

**5.** The side of the cube is $a = 18$ cm .

Lateral surface area (4 faces):

Lateral Surface Area = $4a^2$

Lateral Surface Area = $4 \cdot 18^2 = 4 \cdot 324 = 1296$ $cm^2$

Total surface area (6 faces):

Total Surface Area = $6a^2$

Total Surface Area = $6 \cdot 18^2 = 6 \cdot 324 = 1944$ $cm^2$

**6.** Total surface area:

Total Surface Area = $6a^2$

Substitute 150 $cm^2$ for total surface area:

$$6a^2 = 150$$

$$a^2 = \frac{150}{6} = 25$$

$$a = \sqrt{25} = 5 \text{ cm}$$

Therefore, the side of the cube is 5 cm.

**7.** The road roller is a cylinder with:

Radius $r = 21$ cm ,

Length (height) $h = 100$ cm .

Curved surface area of the roller (area covered in one revolution):

Curved Surface Area = $2\pi rh$

Curved Surface Area = $2 \cdot \frac{22}{7} \cdot 21 \cdot 100 = 13200$ $cm^2$

Total area covered by 500 revolutions:

Total Area = $500 \cdot 13200 = 6600000$ $cm^2$

Therefore, the area of the road is 6600000 $cm^2$.

**8.** Let the original side of the cube be $a$.

Original total surface area:

$$TSA_1 = 6a^2$$

If each side is doubled, the new side becomes $2a$.

New total surface area:

$$TSA_2 = 6(2a)^2 = 24a^2$$

Increase in surface area:

Increase Factor = $\frac{TSA_2}{TSA_1} = \frac{24a^2}{6a^2} = 4$

Therefore, the total surface area will increase by 4 times.

**9.** Let the dimensions of the cuboid be $5x$, $3x$, and $x$.

Total surface area:

$$TSA = 2(l \cdot b + b \cdot h + h \cdot l)$$

Substitute the dimensions:

$414 = 2(5x \cdot 3x + 3x \cdot x + x \cdot 5x)$

$414 = 2(15x^2 + 3x^2 + 5x^{2)}$

$414 = 2 \cdot 23x^2$

$414 = 46x^2$

$x^2 = \frac{414}{46} = 9$

$x = \sqrt{9} = 3$

Dimensions:

l $= 5x = 15$ m, $b = 3x = 9$ m, $h = x = 3$ m.

Therefore, the dimensions of the cuboid are 15 m, 9 m, and 3 m.

**10.** The cuboid has:

Length $l = 120$ cm ,

Breadth $b = 40$ cm ,

Height $h = 60$ cm .

Area of the faces to be covered:

1. Back face: $l \cdot h = 120 \cdot 60 = 7200$ $cm^2$,
2. Bottom face: $l \cdot b = 120 \cdot 40 = 4800$ $cm^2$,
3. Two side faces: $2 \cdot (b \cdot h) = 2 \cdot (40 \cdot 60)$ $= 4800$ $cm^2$.

Total area to be covered:

Total Area = $7200 + 4800 + 4800 = 16800$ $cm^2$

Therefore, the area of the paper needed is 16800 $cm^2$.

**11.** We have given,

- Radius ($r$) = 7 cm
- Height ($h$) = 8 cm

Curved Surface Area (CSA):

$$CSA = 2\pi rh$$

CSA = $2 \cdot \frac{22}{7} \cdot 7 \cdot 8 = 352$ $cm^2$

Total Surface Area (TSA):

TSA = $2\pi r(r + h)$

$$\text{TSA} = 2 \cdot \frac{22}{7} \cdot 7 \cdot (7 + 8)$$

$$= 2 \cdot \frac{22}{7} \cdot 7 \cdot 15 = 660 \text{ cm}^2$$

**12.** We have given,

- Total Surface Area (TSA) = 484 cm²
- Radius ($r$) = 7 cm

TSA formula:

$$\text{TSA} = 2\pi r(r + h)$$

Substitute the values:

$$484 = 2 \cdot \frac{22}{7} \cdot 7 \cdot (7 + h)$$

$$484 = 44 \cdot (7 + h)$$

$$7 + h = \frac{484}{44} = 11$$

$$h = 11 - 7 = 4 \text{ cm}$$

The height of the cylinder is 4 cm.

**13.** We have given,

- Radius ($r$) = 14 m
- Height ($h$) = 6 m

Total Surface Area (TSA):

$\text{TSA} = 2\pi r(r + h)$

$$\text{TSA} = 2 \cdot \frac{22}{7} \cdot 14 \cdot (14 + 6)$$

$$\text{TSA} = 2 \cdot \frac{22}{7} \cdot 14 \cdot 20 = 2 \cdot 880 = 1760 \text{ m}^2$$

The area of the required sheet is 1760 $\text{m}^2$.

**14.** We have given,

- Radius ($r$) = 28 cm = 0.28 m
- Height ($h$) = 50 cm = 0.5 m
- Rate = ₹150 per $\text{m}^2$

Curved Surface Area of one drum:

$\text{CSA} = 2\pi rh$

$$\text{CSA} = 2 \cdot \frac{22}{7} \cdot 0.28 \cdot 0.5 = 0.88 \text{ m}^2$$

Total CSA for 12 drums:

Total CSA = $12 \cdot 0.88 = 10.56 \text{ m}^2$

Total cost:

Total Cost = $10.56 \cdot 150$ = ₹1584

The total cost of painting all drums is ₹1584.

**15.** We have given,

- Length ($l$) = 15 m
- Breadth ($b$) = 10 m
- Height ($h$) = 7 m

Total area to be painted:

$$\text{Area of four walls} = 2h(l + b)$$
$$\text{Area of ceiling} = l \cdot b$$
$$\text{Total Area} = 2h(l + b) + l \cdot b$$

$$\text{Total Area} = 2 \cdot 7 \cdot (15 + 10) + 15 \cdot 10$$
$$= 2 \cdot 7 \cdot 25 + 150$$
$$= 350 + 150 = 500 \text{ m}^2$$

Number of cans required:

$$\frac{\text{Total Area}}{\text{Area Covered by One Can}} = \frac{500}{100} = 5$$

Raman will need 5 cans.

## Quick Check (Page 250)

**1.** Length = 6 units, Breadth = 3 units, Height = 2 units

The volume of a cuboid is calculated using the formula:

Volume = Length × Breadth × Height

Volume = $6 \times 3 \times 2 = 36 \text{ unit}^3$

The volume is 36 $\text{unit}^3$.

**2.** Length = 9 units, Breadth = 1 unit, Height = 4 units

Volume = $9 \times 1 \times 4 = 36 \text{ unit}^3$

The volume is 36 $\text{unit}^3$.

**3.** Length = 6 units, Breadth = 6 units, Height = 1 unit

Volume = $6 \times 6 \times 1 = 36 \text{ unit}^3$

The volume is 36 $\text{unit}^3$.

## Think and Answer (Page 252)

($a$) Use the Volume.

The cylinder's volume gives the tank's total capacity, indicating how much water it can store.

Formula: Volume = $\pi r^2 h$

($b$) Use the Surface Area.

Specifically, the total surface area (TSA) of the cylinder will help determine the amount of material needed to cover the entire outer surface.

Formula: TSA = $2\pi r(r + h)$

(*c*) Use the Volume.

By comparing the volume of the larger tank with the volume of the smaller tanks, we can determine how many smaller tanks are needed.

Formula:

Number of smaller tanks

$$= \frac{\text{Volume of larger tank}}{\text{Volume of one smaller tank}}$$

## Practice Time 10E

**1.** (*a*) Length = 6 units, Breadth = 4 units, Height = 3 units

The volume of a cuboid is calculated using the formula:

Volume = Length × Breadth × Height

Volume = 6 × 4 × 3 = 72 unit$^3$

The volume is 72 unit$^3$.

(*b*) Similarly solve this part like part (*a*).

(*c*) Length = 4 units, Breadth = 4 units, Height = 4 unit

The volume of a cube is calculated using the formula:

Volume = (side)$^3$

Volume = $4^3$ = 64 unit$^3$

The volume is 64 unit$^3$.

**2.** (*a*) A cuboid of dimensions 15 cm × 8 cm × 12 cm

Volume = Length × Breadth × Height

Volume = 15 × 8 × 12 = 1440 cm$^3$

(*b*) A cuboid of dimensions 3 m × 2 m × 1.5 m

Volume = 3 × 2 × 1.5 = 9 m$^3$

(*c*) A cube of side 8 cm

Volume = Side$^3$

Volume = $8^3$ = 512 cm$^3$

(*d*) A cube of side 1.3 m

Volume = $1.3^3$ = 1.3 × 1.3 × 1.3 = 2.197 m$^3$

(*e*) A cylinder of base radius 14 cm and height 28 cm

Volume = $\pi r^2 h$

$$\text{Volume} = \frac{22}{7} \times 14^2 \times 28$$

$$= 22 \times 14 \times 14 \times 4$$

$$= 17248 \text{ cm}^3$$

(*f*) Convert height to meters: 140 cm = 1.4 m

Volume = $\pi r^2 h$

$$\text{Volume} = \frac{22}{7} \times 0.35^2 \times 1.4$$

$$= \frac{22}{7} \times 0.1225 \times 1.4 = 0.539 \text{ m}^3$$

**3.** The height of the box:

$$\text{Height} = \frac{\text{Volume}}{\text{Base Area}}$$

$$\text{Height} = \frac{13400}{670} = 20 \text{ cm}$$

**4.** The volume of a water tank is:

Volume (in m$^3$) = 4.2 × 3 × 1.8 = 22.68 m$^3$

Convert to litres:

1 m$^3$ = 1000 litres

Capacity = 22.68 × 1000 = 22680 litres

**5.** The volume of one small cube:

Volume = $(0.5)^3$ = 0.125 cm$^3$

The number of small cubes:

$$\text{Number} = \frac{\text{Volume of large cube}}{\text{Volume of one small cube}}$$

$$\text{Number} = \frac{8}{0.125} = 64 \text{ cubes}$$

**6.** Volume of cuboid:

Volume = 27 × 4 × 2 = 216 cm$^3$

Side of the cube:

$$\text{Side} = \sqrt[3]{\text{Volume}} = \sqrt[3]{216} = 6 \text{ cm}$$

**7.** The radius of the well:

$$r = \frac{\text{Diameter}}{2} = \frac{2.8}{2} = 1.4 \text{ m}$$

The volume of well (cylinder):

Volume = $\pi r^2 h$

$$\text{Volume} = \frac{22}{7} \times 1.4^2 \times 14$$

$$= \frac{22}{7} \times 1.96 \times 14 = 86.24 \text{ m}^3$$

**8.** Let the side of the original cube be *a*.

Original volume:

$$V_1 = a^3$$

After tripling the edge length:

New side = $3a$, $V_2 = (3a)^3 = 27a^3$

Change in volume:

Change = $V_2 - V_1 = 27a^3 - a^3 = 26a^3$

The new volume is 27 times the original volume.

**9.** Original cube surface area:

Area = $6 \times (\text{side})^2 = 6 \times 6^2 = 216$ cm$^2$

Number of small cubes:

$$\text{Number} = \frac{\text{Volume of original cube}}{\text{Volume of small cube}} = \frac{6^3}{1^3} = 216$$

Surface area of each small cube:

Area = $6 \times 1^2 = 6$ cm$^2$

Total surface area of all small cubes:

Total area = $216 \times 6 = 1296$ cm$^2$

$$\text{Ratio} = \frac{\text{Original surface area}}{\text{Total surface area of small cubes}}$$

$$= \frac{216}{1296} = \frac{1}{6}$$

Therefore, the ratio is 1 : 6.

**10.** Let the radius $r = 3x$ and height $h = 2x$.

Volume of cylinder:

$$V = \pi r^2 h = 19404$$

Substitute $r = 3x$ and $h = 2x$:

$$\pi(3x)^2\,(2x) = 19404$$

$$\frac{22}{7} \times 9x^2 \times 2x = 19404$$

$$\frac{22}{7} \times 18x^3 = 19404$$

$$x^3 = \frac{19404 \times 7}{22 \times 18} = 343$$

$$x = \sqrt[3]{343} = 7$$

Radius:

$r = 3x = 3 \times 7 = 21$ cm

Height:

$h = 2x = 2 \times 7 = 14$ cm

**11.** Original volume:

$$V_1 = \pi r^2 h$$

New height:

$$h' = 2h$$

New volume:

$$V_2 = \pi r^2 h' = \pi r^2 (2h) = 2\pi r^2 h$$

The volume increases by twice.

**12.** The volume of a cylinder:

$$V = \pi r^2 h$$

Let the radii and heights of the two cylinders be $r_1$, $r_2$ and $h_1$, $h_2$:

$r_1 : r_2 = 1 : 2$ , $h_1 : h_2 = 2 : 3$

Ratio of volumes:

$$\frac{V_1}{V_2} = \frac{\pi r_1^2 h_1}{\pi r_2^2 h_2} = \frac{(1)^2 \cdot 2}{(1)^2 \cdot 3} = \frac{2}{12} = \frac{1}{6}$$

**13.** Volume of cylinder:

$$V = \pi r^2 h$$

$$\frac{22}{7} \times 1.4^2 \times 77$$

$$= \frac{22}{7} \times 1.96 \times 77 = 474.32$$

Convert to litres:

1 litre = 1000 cm$^3$

$$\text{Capacity} = \frac{474.32}{1000} = 0.47432 \text{ litres}$$

**14.** Convert reservoir volume to litres:

1 m$^3$ = 1000 litres

Volume = $108 \times 1000 = 108000$ litres

Time to fill:

$$\text{Time (in minutes)} = \frac{\text{Volume}}{\text{Rate}} = \frac{108000}{60}$$

= 1800 minutes

Convert minutes to hours:

$$\text{Time} = \frac{1800}{60} = 30 \text{ hours}$$

## Brain Sizzlers (Page 254)

Let the side of the cube be a.

From the given, the height of the cylinder is equal to the side of the cube:

$a = 10$ cm

The volume of a cube is given by:

Volume = $a^3$

Substitute $a = 10$:

Volume = $10^3 = 1000$ cm$^3$

The surface area of a cube is given by:

Surface Area = $6a^2$

Substitute $a = 10$:

Surface Area = $6 \times 10^2 = 6 \times 100 = 600$ cm$^2$

## Maths Connect (Page 255)

Area of the ΔAJG = $\frac{1}{2}$ × Base × Height

$= \frac{1}{2} \times 100 \times 160$

$= 8000 \text{ m}^2$

Area of the Trapezium GJHF

$= \frac{1}{2}$ × (Sum of the two parallel sides) × Height

$= \frac{1}{2} \times (40 + 160) \times 160$

$= \frac{1}{2} \times 200 \times 160$

$= 16000 \text{ m}^2$

Area of the Trapezium BCIK = $\frac{1}{2}$ × (Sum of the two parallel sides) × Height

$= \frac{1}{2} \times (60 + 100) \times 120$

$= \frac{1}{2} \times 160 \times 120$

$= 9600 \text{ m}^2$

Area of the Rectangle CDEI = Length × Breadth

$= 160 \times 100$

$= 16000 \text{ m}^2$

Area of the ΔFHE = $\frac{1}{2}$ × Base × Height

$= \frac{1}{2} \times 80 \times 40$

$= 1600 \text{ m}^2$

Area of the ΔAKB = $\frac{1}{2}$ × Base × Height

$= \frac{1}{2} \times 60 \times 60$

$= 1800 \text{ m}^2$

Total area $= (8000 + 16000 + 9600 + 16000 + 1600 + 1800) \text{ m}^2$

$= 53000 \text{ m}^2$

## Chapter Assessment

**A.**

**1.** The formula for the area of a rhombus is:

$$\text{Area} = \frac{1}{2} \times d_1 \times d_2$$

Substitute $d_1 = 6$ cm and $d_2 = 4$ cm:

$$\text{Area} = \frac{1}{2} \times 6 \times 4 = 12 \text{ cm}^2$$

So, the correct option is (*b*).

**2.** The total number of cubes formed when a cube of side *a* = 5 cm is divided into 1cm$^3$ cubes is:

$5^3 = 125$

Cubes with exactly one face painted are located on the faces of the cube but not on the edges or corners. These are inner cubes on each face.

Number of such cubes per face:

$(5–2)^2 = 3^2 = 9$

Since there are 6 faces:

$6 \times 9 = 54$

So, the correct option is (*c*).

**3.** Surface area of the original cube:

Surface Area = $6 \times (\text{side})^2 = 6 \times 4^2 = 96 \text{ cm}^2$

Surface area of each small cube:

$6 \times 1^2 = 6 \text{ cm}^2$

Number of small cubes:

$$\frac{\text{Volume of original cube}}{\text{Volume of small cube}} = \frac{4^3}{1^3} = 64$$

Total surface area of the cut-out cubes:

$64 \times 6 = 384 \text{ cm}^2$

Ratio of surface areas:

$$\frac{96}{384} = 1: 4$$

So, the correct option is (*c*).

**4.** The volume of a cube is given by:

$V = (\text{side})^3$

Let the original side be *a*. The original volume is:

$V = a^3$

When the side becomes 10a, the new volume is:

$V_{new} = (10a)^3 = 1000a^3$

The volume increases by 1000 times.

So, the correct option is (*a*).

5. Compare the volumes of containers A, B, and C:
Volume of Container A (cylinder): $V_A = \pi r^2 h$
Volume of Container B (cylinder):
$$V_B = \pi(2r)^2 \times \frac{1}{2} h = \pi \times 4r^2 \times \frac{1}{2} h = 2\pi r^2 h$$
Volume of Container C (cuboid):
$$V_C = r \times r \times h = r^2 h$$
Arrangement in increasing order:
$$V_C < V_A < V_B$$
So, the correct option is (*c*).

6. The total surface areas of opposite faces are:
16 $cm^2$, 32 $cm^2$, 72 $cm^2$
Let the dimensions of the cuboid be *a*, *b*, *c*:
$$ab = 16, bc = 32, ca = 72$$
Multiply the three equations:
$(ab)(bc)(ca) = (abc)^2 = 16 \times 32 \times 72$
Solve:
$$abc = \sqrt{16 \times 32 \times 72} = \sqrt{36864} = 192$$
The volume of the solid is:
$$abc = 192 \text{ cm}^3$$
So, the correct option is (a).

**B.**

1. The correct option is (*a*).
The area of the largest triangle that can fit into a rectangle is $\frac{lb}{2}$, also the formula $\frac{1}{2}$ × Area of rectangle is correct reason for the provided assertion.
2. The correct option is (*a*).
The total surface area of a cube is six times the area of one face, which correctly explains how the total surface area equals 54 $cm^2$.
3. The correct option is (*d*).
The volume of the cuboid is calculated as 300 $cm^3$, not 150 $cm^3$. However, the formula for volume given in Reason is correct.
4. The correct option is (*a*).
The formula for the area of a rhombus, $\frac{1}{2} \times d_1 \times d_2$, explains the given area calculation as 48 $cm^2$.

**C.**

1. The surface area of a cuboid formed by joining two cubes of side '*a*' face to face is $\underline{10a^2}$.
2. Volume of a solid is the measurement of the space occupied by it.
3. Lateral surface area of a room = Area of 4 walls.
4. Two cylinders of same volume have their radii in the ratio 1 : 6, then ratio of their heights is 36 : 1.
5. The area of a parallelogram is 60 $cm^2$ and one of its altitudes is 5 cm. The length of its corresponding side is 12 cm.

**D.**

1. False – Two cuboids with equal volumes may have different surface areas if their dimensions differ.
2. False – If the height of a trapezium doubles, its area becomes 2 times.
3. True – The areas of two opposite faces of a cuboid are equal.
4. False – Two cylinders with equal volumes can have different surface areas due to variations in radius and height.
5. True – 1 L = 1000 $cm^3$.
6. True – The ratio of the area of a circle to the area of a square whose side is equal to the radius of the circle is π : 1.

**E.**

1. Area of the larger circle = $\pi R^2 = \pi(5)^2 = 25\pi$ $cm^2$.
Area of the smaller circle = $\pi r^2 = \pi(2)^2 = 4\pi$ $cm^2$.
Area of the remaining sheet = Area of the larger circle - Area of the smaller circle
$$= 25\pi - 4\pi = 21\pi \text{ cm}^2.$$
Thus, the area of the remaining sheet is:
$$21\pi = 21 \times \frac{22}{7} = 66 \text{ cm}^2$$
2. Let the number of revolutions made by the rear wheel be *x*.
Distance travelled by the rear wheel = 4*x* m .
Number of revolutions made by the front wheel
$= x + 5$.
Distance travelled by the front wheel
$= 3(x + 5)$ m .
Since both wheels travel the same distance:
$$4x = 3(x + 5)$$
Expanding and solving:
$$4x = 3x + 15$$
$$x = 15$$
Distance travelled by the cart:
$$4x = 4 \times 15 = 60 \text{ m}.$$
Thus, the cart travels a distance of 60 m.

**3.** (*a*) Area of the triangle = $\frac{1}{2}$ × Base × height

Area of sails of sailboat = $\frac{1}{2}$ × (20 + 22) × 22.3 + $\frac{1}{2}$ × (20 + 22) × 16.8

= 21 × 22.3 $m^2$ + 21 × 16.8

= 468.3 $m^2$ + 352.8 $m^2$

= 821.1 $m^2$

(*b*) Area of sails of sailboat = $\frac{1}{2}$ × (10.9) × 19.5 + $\frac{1}{2}$ × (23.9) × 8.6

= 106.275 + 102.77

= 209.05 $m^2$

(*c*) Area of sails of sailboat = $\frac{1}{2}$ × (3.0) × 8.9 + $\frac{1}{2}$ × (9.6) × 16.8 + $\frac{1}{2}$ × (25) × 12.4

= 1.5 × 8.9 + 4.8 × 16.8 + 12.5 × 12.4

= 13.35 + 80.64 + 155

= 13.35 + 235.64

= 248.99 $m^2$

**4.** We are given:

- Depth of river = 2 meters
- Width of river = 45 meters
- Speed of river flow = 3 km/h

To find the volume of water flowing per minute, we need to calculate the flow rate in cubic meters per minute.

Convert the speed of the river to meters per minute:

- 1 km = 1000 meters, and 1 hour = 60 minutes.
- So, the speed of the river in meters per minute is:

Speed in meters per minute

$$= \frac{3 \text{ km/h} \times 1000 \text{ m/km}}{60 \text{ minutes/hour}} = 50 \text{ m/min}$$

Now calculate the cross-sectional area of the river:

- Area of the cross-section = Depth × Width = 2 m × 45 m = 90 $m^2$

Now, calculate the volume of water flowing per minute:

- Volume per minute = Area × Speed = 90 $m^2$ × 50 m/min = 4500 $m^3$/min

So, the amount of water flowing into the sea per minute is 4500 cubic meters.

**5.** We are given:

- Dimensions of each brick = 25 cm × 15 cm × 8 cm
- Dimensions of the wall = 32 m long, 3 m high, and 40 cm thick

Convert the dimensions of the wall to centimetres:

- 32 m = 3200 cm
- 3 m = 300 cm
- The thickness is already given as 40 cm.

Now, calculate the volume of the wall:

- Volume of the wall = Length × Height × Thickness
- Volume of the wall = 3200 cm × 300 cm × 40 cm = 38,400,000 $cm^3$

Now, calculate the volume of one brick:

- Volume of one brick = 25 cm × 15 cm × 8 cm = 3000 $cm^3$

Now, calculate the number of bricks required:

- Number of bricks = Volume of the wall ÷ Volume of one brick
- Number of bricks = 38,400,000 $cm^3$ ÷ 3000 $cm^3$ = 12,800 bricks

So, 12,800 bricks are required to build the wall.

**6.** Since the speed of the flow of water through all the pipes is the same the amount of water flowing out of these pipes will depend on the cross-sectional area of the pipes, which depends on the radius of the pipes.

The joint area of the pipes in Figure A is:

= $\pi r^2 + \pi r^2$

= $\pi(8)^2 + \pi(8)^2$

= $64\pi + 64\pi$

= $128\pi cm^2$

The area of pipe in Figure B will be:

= $\pi R^2$

= $\pi(15)^2$

= $225\pi cm^2$

Since the rate at which the water flows is the same and the pipe area in Figure B is more than in Figure A. So, figure B will fill the swimming pool faster.

**7.** (*a*) Area of the $\Delta$DFC = $\frac{1}{2}$ × Base × Height

$= \frac{1}{2} \times 100 \times 100$

$= 5000 \text{ m}^2$

Area of the Trapezium BCFH = $\frac{1}{2}$ × (Sum of the two parallel sides) × Height

$= \frac{1}{2} \times (50 + 100) \times 110$

$= \frac{1}{2} \times 150 \times 110$

$= 8250 \text{ m}^2$

Area of the $\Delta$EGD = $\frac{1}{2}$ × Base × Height

$= \frac{1}{2} \times 120 \times 180$

$= 10800 \text{ m}^2$

Area of the $\Delta$AGE = $\frac{1}{2}$ × Base × Height

$= \frac{1}{2} \times 120 \times 80$

$= 4800 \text{ m}^2$

Area of the $\Delta$ABH = $\frac{1}{2}$ × Base × Height

$= \frac{1}{2} \times 50 \times 50$

$= 1250 \text{ m}^2$

Total area

$= (5000 + 8250 + 10800 + 4800 + 1250) \text{ m}^2$

$= 30100 \text{ m}^2$

(*b*) Similarly solve this part like part (*a*).

**8.** We have given:

- Inner radius of the pipe $r = 0.75$ cm
- Speed of water flow $v = 7$ m/s
- Time = 1 hour = 3600 seconds

Now, calculate the cross-sectional area of the pipe:

$A = \pi r^2$

$A = \pi(0.75)^2 = 1.7678 \text{ cm}^2$

Calculate the volume of water flowing per second:

The volume of water flowing per second is the cross-sectional area multiplied by the speed of water flow:

Volume per second = $A \times v = 1.7678 \text{ m}^2 \times 700 \text{ cm}/s = 1237.46 \text{ cm}^3/s$

Calculate the volume of water flowing in 1 hour (3600 seconds):

Multiply the volume per second by the number of seconds in 1 hour:

Volume in 1 hour = $1237.46 \text{ cm}^3/\text{s} \times 3600 \text{ s} = 4454856 \text{ cm}^3$

Convert the volume from cubic centimetres to litres:

$\frac{4454856}{1000} = 4454.856 \approx 4455$ litres

The volume of water delivered by the pipe in 1 hour is 4455 litres.

## Mental Maths (Page 258)

**1.** A cubical pit has one face open (the top), while the remaining 5 faces are exposed.

The surface area of a cube with side length $a = 6$ m:

Surface area of the pit = 5 × Area of one face

$= 5 \times a^2 = 5 \times 6^2 = 5 \times 36 = 180 \text{ m}^2$

The surface area of the pit is $180 \text{ m}^2$.

**2.** Let the side lengths of the two cubes be $a_1$ and $a_2$.

The volume of a cube is given by $a_3$.

The ratio of their volumes is 27 : 8:

$$\frac{a_1}{a_2} = \frac{27}{8}$$

Taking the cube root of both sides:

$$\frac{a_1}{a_2} = \sqrt[3]{\frac{27}{8}} = \frac{\sqrt[3]{27}}{\sqrt[3]{8}} = \frac{3}{2}$$

The ratio of their sides is 3 : 2.

**3.** Let the original edge length of the cube be a. The original volume is:

Original Volume = $a^3$

If the edge is doubled, the new edge length is 2a.

The new volume is:

New Volume = $(2a)^3 = 8a^3$

Percentage increase in volume:

Percentage Increase =

$$\frac{\text{New Volume} - \text{Original Volume}}{\text{Original Volume}} \times 100$$

$$= \frac{8a^3 - a^3}{a^3} \times 100 = \frac{7a^3}{a^3} \times 100 = 700\%$$

The percentage increase in the volume is 700%.

**4.** Let the original side length of the square be a. The original area is:

$$\text{Original Area} = a^2$$

If the side length is halved, the new side length is $\frac{a}{2}$. The new area is:

$$\text{New Area} = \left(\frac{a}{2}\right)^2 = \frac{a^2}{4}$$

Percentage decrease in area:

Percentage Decrease

$$= \frac{\text{Original Area} - \text{New Area}}{\text{Original Area}} \times 100$$

$$= \frac{a^2 - \frac{a^2}{4}}{a^2} \times 100 = \frac{\frac{4a^2 - a^2}{4}}{a^2} \times 100$$

$$= \frac{\frac{3a^2}{4}}{a^2} \times 100 = \frac{3}{4} \times 100 = 75\%$$

The percentage decrease in the area is 75%.

## UNIT TEST – 3

**A.**

**1.** The sum of – 8*ab* and 3*ab* is:

(– 8 + 3) ab = – 5ab

Which is monomial. So, the correct option is (*a*).

**2.** Like terms must have the same variables with identical powers.

In option (*b*): $-8xyz^2$ and $7xyz^2$ (same variables and powers).

So, the correct option is (*b*).

**3.** The top view of a cuboid looks like a rectangle.

So, the correct option is (*c*).

**4.** A triangular pyramid (tetrahedron) has 1 base and 3 triangular lateral faces.

Total faces = 1 + 3 = 4.

So, the correct option is (*b*).

**5.** The area of a rhombus is 480 cm$^2$ and one diagonal is 40 cm . Then the other diagonal is

The formula for area: $\frac{1}{2} \times d_1 \times d_2$

Substitute: $\frac{1}{2} \times 40 \times d_2 = 480$

$$d_2 = \frac{480 \times 2}{40} = 24 \text{ cm}$$

So, the correct option is (*c*).

**6.** The lateral surface area of a cube of side 12 cm is

Formula: 4 × (side$^2$)

Substitute: $4 \times 12^2 = 4 \times 144 = 576$ cm$^2$

So, the correct option is (*b*).

**7.** The formula for lateral surface area: $2\pi rh$

Substitute $r = 7 : 2 \times \frac{22}{7} \times 7 \times h = 1056$

Simplify:

$$44h = 1056$$

$$h = \frac{1056}{44} = 24 \text{ cm}$$

So, the correct option is (c).

8. A polyhedron has 6 faces and 5 vertices:

Use Euler's formula: F + V – E = 2

Substitute: 6 + 5 – E = 2

E = 6 + 5 – 2 = 9

So, the correct option is (*c*).

**9.** The assertion is correct because the product $(3x + 5y)(3x - 5y)$ is $9x^2 - 25y^2$.

The reason is incorrect because $(a + b)^2$ represents the square of a binomial formula:

$(a + b)^2 = a^2 + 2ab + b^2$, not the difference of squares.

So, the correct option is (*c*).

**10.** The assertion is correct because the volume is calculated as: Volume = Length × Breadth × Height = 5 × 6 × 8 = 240 cm$^3$

The reason is also correct because the volume of a cuboid is indeed the product of its dimensions.

So, the correct option is (*a*).

**B.**

**1.** The coefficient of $-99xyz$ is – 99.

**2.** Volume of a rectangular box with length 3*x*, breadth 4*y*, and height 5*z* is 60xyz.

Volume = Length × Breadth × Height

$= 3x \cdot 4y \cdot 5z = 60xyz$.

**3.** Top view of the given prism (alongside) is a hexagon.

4. Pentagonal prism can have 2 pentagons. (one on the top and one on the bottom as bases).

5. The area of a trapezium is 256 $cm^2$ and the sum of its parallel sides is 32 cm, then the distance between its parallel sides is 16 cm.

$$\text{Area} = \frac{1}{2} \times \text{Sum of parallel sides} \times \text{Height}$$

$$256 = \frac{1}{2} \times 32 \times \text{Height}$$

$$\Rightarrow \text{Height} = \frac{256 \times 2}{32} = 16 \text{ cm}$$

**C.**

1. True. The Euler's formula holds for $F = 6$, E = 12, V = 8.
   Euler's Formula: F + V – E = 2
   6 + 8 – 12 = 2 (True).
2. True.
3. False. A sphere has no edges.
4. True. A cube is a cuboid where all sides are equal.
5. False. If $x^2 + y^2 = 26$ and $xy = 6$, then $x - y = 14$.
   Using the identity:
   $$(x - y)^2 = x^2 + y^2 - 2xy$$
   $$(x - y)^2 = 26 - 12 = 14 \Rightarrow x - y = \sqrt{14} \neq 14.$$

**D.**

1. Let the required term be $x$.
   $(-a + b + c) + x = a(a + b + c) - b(a - b + c)$
   Rearrange to find $x$:
   $x = a(a + b + c) - b(a - b + c) - (-a + b + c)$
   Simplify:
   $x = a^2 + ab + ac - ba + b^2 - bc + a - b - c$
   Combine like terms:
   $x = a^2 + ab + ac - ab + b^2 - bc + a - b - c$
   $x = a^2 + ac + b^2 - bc + a - b - c$

2. Let $y = 8x + \frac{1}{8x}$, so $y = 10$.
   Square both sides:
   $$y^2 = \left(8x + \frac{1}{8x}\right)^2 = 64x^2 + \frac{1}{64x^2} + 2$$
   Substitute $y^2 = 10^2 = 100$:
   $$100 = 64x^2 + \frac{1}{64x^2} + 2$$
   $$64x^2 + \frac{1}{64x^2} = 98$$

3. $$\begin{array}{r|l} (x+1) & x^3 + 3x^2 - 4x - 6 \;(\; x^2 + 2x - 6 \\ & \underline{\cancel{x^3} + x^2} \\ & \quad\; - \quad - \\ & \quad 2\cancel{x^2} - 4x \\ & \quad \underline{2\cancel{x^2} + 2x} \\ & \quad\;\; - \quad - \\ & \qquad -\cancel{6x} - \cancel{6} \\ & \qquad \underline{-\cancel{6x} - \cancel{6}} \\ & \qquad\;\; + \quad + \\ & \qquad\qquad 0 \end{array}$$

4. Let the third side be S:
   S = Perimeter – (Side 1 + Side 2)
   Substitute:
   $S = (16x^2 - 20x + 12) - [(5x^2 + 8x - 3) + (8x^2 - 3x + 12)]$
   Simplify:
   $S = 16x^2 - 20x + 12 - (13x^2 + 5x + 9)$
   $S = (16x^2 - 13x^2) + (-20x - 5x) + (12 - 9)$
   $S = 3x^2 - 25x + 3$

5. A dodecahedron has 12 faces (F = 12), 20 vertices (V = 20), and 30 edges (E = 30).
   Euler's formula:
   F + V – E = 2
   Substitute the values into the formula:
   12 + 20 – 30 = 2
   Hence verified.

6. Volume of the cuboid:
   $$V = 80 \cdot 144 \cdot 16 = 184320 \text{ cm}^3$$
   The volume of one small cube:
   $$v = 8^3 = 512 \text{ cm}^3$$
   The number of small cubes:
   $$\frac{184320}{512} = 360$$

7. The volume of the tank:
   $V = 4.2 \cdot 3 \cdot 12.8 = 161.28 \text{ m}^3$
   Convert to litres:
   $1 \text{ m}^3 = 1000$ litres
   $\Rightarrow V = 161.28 \cdot 1000$
   $= 161280$ litres.

8. Ratio of radii ($r_1 : r_2$) = 2 : 3, ratio of heights ($h_1 : h_2$) = 1 : 32.
   Volume ratio = $r_1^2 h_1 : r_2^2 h2 = (2^2 \cdot 1) : (3^2 \cdot 32)$ = 4 : 288 = 1 : 72.

## CHAPTER 11 : EXPONENTS AND POWERS

**A.**

**1.** (*a*) $(-1)^{10}$: Since $(-1)^{10}$ is an even power of $-1$, the result is 1.

$$(-1)^{10} = 1$$

(*b*) $2^5$:

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$$

(*c*) $[(-3)^2]^2$:

First, calculate $(-3)^2 = 9$. Then, $(9)^2 = 81$.

$$[(-3)^2]^2 = 81$$

(*d*) $(-2)^4 \times (-2)^6$:

Using the law of exponents, $a^m \times a^n = a^{(m+n)}$:

$$(-2)^4 \times (-2)^6 = (-2)^{(4+6)} = (-2)^{10}$$

Since $(-2)^{10}$ is an even power, the result is positive:

$$(-2)^{10} = 1024$$

**2.** (*a*) $10^2 \times 100$:

Rewrite 100 as $10^2$:

$10^2 \times 100 = 10^2 \times 10^2 = 10^{(2+2)} = 10^4$

(*b*) $(-7) \times (-7) \times (-7) \times (-7) \times (-7)$:

$(-7) \times (-7) \times (-7) \times (-7) \times (-7) = (-7)^5$

(*c*) $(-5)^3 \times 125$:

Rewrite 125 as $5^3$:

$(-5)^3 \times 125 = (-5)^3 \times (5^3) = -[(5)]^{3+3} = -(5)^6$

(*d*) $6^3 \div 3^3$:

Rewrite $6^3$ as $(2 \cdot 3)^3 = 2^3 \cdot 3^3$:

$$6^3 \div 3^3 = \frac{2^3 \cdot 3^3}{3^3} = 2^3$$

**3.** (*a*) $\dfrac{18^2 \times 9^3 \times 4^3}{12^2 \times 6^4}$:

Rewrite $18 = 2 \cdot 3^2$, $9 = 3^2$, $12 = 2^2 \cdot 3$, and $6 = 2 \cdot 3$:

$18^2 = (2 \cdot 3^2)^2 = 2^2 \cdot 3^4$, $9^3 = (3^2)^3 = 3^6$,

$4^3 = (2^2)^3 = 2^6$

$12^2 = (2^2 \cdot 3)^2 = 2^4 \cdot 3^2$, $6^4 = (2 \cdot 3)^4 = 2^4 \cdot 3^4$

Substitute:

$$\frac{18^2 \cdot 9^3 \cdot 4^3}{12^3 \cdot 6^4} = \frac{(2^2 \cdot 3^4) \cdot (3^6) \cdot (2^6)}{(2^4 \cdot 3^4) \cdot (2^4 \cdot 3^4)}$$

Simplify:

$$\frac{2^{2+6} \cdot 3^{4+6}}{2^{4+4} \cdot 3^{2+4}} = \frac{2^8 \cdot 3^{10}}{2^8 \cdot 3^6} = 3^{10-6} = 3^4 = 81$$

(*b*) $\dfrac{8^3 \times (2^2)^4}{2^6 \times 8}$:

Rewrite $8 = 2^3$:

$8^3 = (2^3)^3 = 2^9$, $(2^2)^4 = 2^8, 8 = 2^3$

Substitute:

$$\frac{8^3 \times (2^2)^4}{2^6 \times 8} = \frac{2^9 \cdot 2^8}{2^6 \times 2^3} = \frac{2^{9+8}}{2^{6+3}} = 2^{17-9} = 2^8 = 256$$

**4.** (*a*) 67,500,000,000:

$67{,}500{,}000{,}000 = 6.75 \times 10^{10}$

(*b*) 18,312,620,000,000,000:

$18{,}312{,}620{,}000{,}000{,}000 = 1.831262 \times 10^{16}$

(c) 2210.735:

$$2210.735 = 2.210735 \times 10^3$$

**5.** (*a*) $2.2 \times 10^4$:

$$2.2 \times 10^4 = 22{,}000$$

(*b*) $9.81 \times 10^{10}$:

$$9.81 \times 10^{10} = 98100000000$$

(*c*) $1.231 \times 10^5$:

$$1.231 \times 10^5 = 123{,}100$$

## Life Skills (Page 263)

In each generation, the number of ancestors is $2^n$, where n is the generation number.

Therefore, the number of ancestors (Tenth generation back) = 210

## Think and Answer (Page 264)

**1.** The growth of bacteria is given by:

$$N = 2^t$$

Here:

$N$ = Number of bacteria

$t$ = Time in hours

We are given N = 32, so substitute this value into the equation:

$$32 = 2^t$$

Now, rewrite 32 as a power of 2:

$$32 = 2^5$$

So,

$$2^t = 2^5$$

Since the bases are the same, the powers must be equal:

$t = 5$

Therefore, after 5 hours, the number of bacteria will be 32.

**2.** Here, $t = 10$. Substitute value of $t$ into the equation:

$N = 2^{10}$

Calculate $2^{10}$:

$2^{10} = 1024$

Therefore, after 10 hours, the number of bacteria will be 1024.

## Practice Time 11A

**1.** (*a*) $(-5)^4$

Base: $-5$

Exponent: 4

(*b*) $(9)^8$

Base: 9

Exponent: 8

(*c*) $\left(\frac{-2}{5}\right)^3$

Base: $\frac{-2}{5}$

Exponent: 3

(*d*) $\frac{1}{4^5}$

Base: $\frac{1}{4}$

Exponent: 5

**2.** (*a*) $6 \times 6 \times 6 \times 6 \times 6$

In exponential form: $6^5$

(*b*) $(-4) \times (-2) \times (-2) \times (-2) \times (-4)$

Simplify: $(2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (2)$

In exponential form: $(-2)^7$

(*c*) $\frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5}$

In exponential form: $\left(\frac{2}{5}\right)^6$

**3.** (*a*) $3^3 \times 3 \times 3^2$

Using the property $a^m \times a^n = a^{(m+n)}$:

$3^3 \times 3 \times 3^2 = 3^{(3+1+2)} = 3^6$

(*b*) $(-25)^{10} \times (-25)^{10}$

Using the property $a^m \times a^n = a^{(m+n)}$:

$(-25)^{10} \times (-25)^{10} = (-25)^{(10+10)} = (-25)^{20}$

(*c*) $\left(\frac{2}{9}\right)^7 \times \left(\frac{2}{9}\right)^2$

Using the property $a^m \times a^n = a^{(m+n)}$:

$$\left(\frac{2}{9}\right)^7 \times \left(\frac{2}{9}\right)^2 = \left(\frac{2}{9}\right)^{7+2} = \left(\frac{2}{9}\right)^9$$

(*d*) $\left[\left\{\left(\frac{-3}{7}\right)^2\right\}^2\right]^2$

Using the property $(a^m)^n = a^{(m \times n)}$:

$$\left[\left\{\left(\frac{-3}{7}\right)\right\}^2\right]^2 = \left(\frac{-3}{7}\right)^{2\times2\times2} = \left(\frac{-3}{7}\right)^8$$

(*e*) $5^5 \times 10^5$

Using the property $a^m \times b^m = (a \times b)^m$ and $a^m \times a^n = a^{(m+n)}$:

$5^5 \times 10^5 = 5^5 \times (2 \times 5)^5$

$= 5^5 \times 2^5 \times 5^5 = 2^5 \times 5^{(5+5)}$

$= 2^5 \times 5^{10}$

(*f*) $(2)^{10} \times (4)^{10}$

Rewrite 4 as $2^2$:

$(2)^{10} \times (4)^{10} = 2^{10} \times (2^2)^{10}$

$= 2^{10} \times 2^{20}$

$= 2^{(10+20)}$

$= 2^{30}$

(*g*) $\left(\frac{2}{7}\right)^7 \div \left(\frac{2}{7}\right)^2$

Using the property $\frac{a^m}{a^n} = a^{(m-n)}$:

$$\left(\frac{2}{7}\right)^7 \div \left(\frac{2}{7}\right)^2 = \left(\frac{2}{7}\right)^{7-2} = \left(\frac{2}{7}\right)^5$$

(*h*) $(-7)^4 \times (3)^4$

Using the property $a^m \times b^m = (a \times b)^m$:

$(-7)^4 \times (3)^4 = (-7 \times 3)^4 = (-21)^4$

**4.** (*a*) $(a^5 \times a^4)^3$

Using the property $(a^m \times a^n) = a^{(m+n)}$:

$(a^5 \times a^4)^3 = a^{(5+4)\times 3} = a^{27}$

(*b*) $(25 \times a^5 \times b^4)/(5 \times a^2 \times b^4)$

Simplifying:

$$\frac{25}{5} \times \frac{a^5}{a^2} \times \frac{b^4}{b^4} = 5 \times a^{5-2} \times 1 = 5a^3$$

(*c*) $\left(\frac{-4}{6}\right)^2 \times \left(\frac{-3}{4}\right)^2$

Simplifying:

$$\left(\frac{-4}{6}\right)^2 \times \left(\frac{-3}{4}\right)^2 = \frac{(-4)^2}{6^2} \times \frac{(-3)^2}{4^2}$$

$$= \frac{16}{36} \times \frac{9}{16} = \frac{9}{36} = \frac{1}{4}$$

(*d*) $\left(\frac{5}{6}\right)^9 \times \left(\frac{6}{5}\right)^5 \times \left(\frac{-25}{36}\right)$

Simplifying:

$$\left(\frac{5}{6}\right)^9 \times \left(\frac{6}{5}\right)^5 = \frac{5^9}{6^9} \times \frac{6^5}{5^5} = \frac{5^{9-5}}{6^{9-5}} = \frac{5^4}{6^4}$$

Now multiply by $\frac{-25}{36}$:

$$\frac{5^4}{6^4} \times \frac{-25}{36} = \frac{5^4 \times (-25)}{6^4 \times 36}$$
$$= \frac{5^4 \times 5^2 \times (-1)}{6^4 \times 6^2}$$
$$= \frac{-5^6}{6^6} = -\left(\frac{5}{6}\right)^6$$

**5.** (*a*) $5x = 125$

Write 125 as a power of 5:

$$5x = 5^3 \Rightarrow x = 3$$

(*b*) $4^{x+4} = 1024$

Write 1024 as a power of 4:

$4^{x+4} = 4^5 \Rightarrow x + 4 = 5 \Rightarrow x = 1$

(*c*) $\left(\frac{5}{2}\right)^2 \times \left(\frac{5}{2}\right)^{14} = \left(\frac{5}{2}\right)^{8x}$

Using the property $a^m \times a^n = a^{m+n}$:

$$\left(\frac{5}{2}\right)^{2+14} = \left(\frac{5}{2}\right)^{8x} \Rightarrow \left(\frac{5}{2}\right)^{16} = \left(\frac{5}{2}\right)^{8x}$$

So, $16 = 8x \Rightarrow x = 2$

(*d*) $\frac{(-2)^9}{(-2)^2} = (-2)^{2x-1}$

Using the property $\frac{a^m}{a^n} = a^{m-n}$:

$(-2)^{9-2} = (-2)^{(2x-1)} \Rightarrow (-2)^7 = (-2)^{2x-1}$

So, $7 = 2x - 1 \Rightarrow 2x = 8 \Rightarrow x = 4$

## Quick Check (Page 266)

| Exponential form | Expanded form | Value | Positive Exponential form |
|---|---|---|---|
| $3^3$ | $3 \times 3 \times 3$ | 27 | $3^3$ |
| $3^3$ | 1 | 1 | $\frac{3}{3}$ |
| $3^{-3}$ | $3^{(-1)} \times 3^{(-1)} \times 3^{(-1)}$ | $\frac{1}{27}$ | $\frac{1}{3^3}$ |
| $3^{-4}$ | $3^{(-1)} \times 3^{(-1)} \times 3^{(-1)} \times 3^{(-1)}$ | $\frac{1}{81}$ | $\frac{1}{3^4}$ |

## Think and Answer (Page 267)

**1.** Use the rule of exponents:

$$a^{-n} = \frac{1}{a^n}$$

Here, $a = 6$ and $n = 3$.

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

Now calculate $6^3$:

$$6^3 = 6 \times 6 \times 6 = 216$$

Thus,

$$6^{-3} = \frac{1}{216}$$

**2.** The multiplicative inverse of a number $x$ is $\frac{1}{x}$.

Here, $x = 100^{-20}$.

So, $100^{-20} = \frac{1}{100^{-20}} = 100^{20}$

Thus the multiplicative inverse is $100^{20}$.

## Practice Time 11B

**1.** (*a*) $2^2 \times (-3)^2$:

$$2^2 = 4, (-3)^2 = 9,$$

So $2^2 \times (-3)^2 = 4 \times 9 = 36$

(*b*) $81 \times 3^2$:

$$3^2 = 9, 81 \times 9 = 729$$

(*c*) $(3^6 \div 3^3)^2$:

Apply the formula: $a^m \div a^n = a^{(m-n)}$.

$$3^6 \div 3^3 = 3^{(6-3)} = 3^3,$$

So $(3^3)^2 = 3^{(3 \cdot 2)} = 3^6$

$$3^6 = 729$$

(*d*) $(2^2 \times 3^{(-1)})^3$:

$$2^2 = 4,\ 3^{-1} = \frac{1}{3},\ 2^2 \times 3^{-1} = \frac{4}{3}$$

$$\left(\frac{4}{3}\right)^3 = \frac{4^3}{3^3} = \frac{64}{27}$$

(*e*) $\left(\frac{11}{5}\right)^{-1}$:

Apply the formula: $a^{-1} = \frac{1}{a}$.

$$\left(\frac{11}{5}\right)^{-1} = \frac{5}{11}$$

(*f*) $4^{-2} \times 27$:

Apply the formula: $a^{-m} = \frac{1}{a^m}$.

$$4^{-2} = \frac{1}{4^2} = \frac{1}{16}, \frac{1}{16} \times 27 = \frac{27}{16}$$

(*g*) $3^{-1} + 3^0 + 3^1$:

Apply the formula: $3^0 = 1, 3^{-m} = \frac{1}{3^m}$.

$$3^{-1} = \frac{1}{3}, 3^0 = 1, 3^1 = 3$$

$$\frac{1}{3} + 1 + 3 = \frac{1}{3} + \frac{3}{3} + \frac{9}{3} = \frac{13}{3}$$

(*h*) $(6^0 + 5^0) + (6^0 - 5^0)$:

Apply the formula: $a^0 = 1$.

$$6^0 = 1, 5^0 = 1$$

$$(6^0 + 5^0) = 1 + 1 = 2, (6^0 - 5^0) = 1 - 1 = 0$$

$$2 + 0 = 2$$

**2.** (*a*) $7^6 \times 7^8 \div (7^5)^2$:

Formulas:

1. $a^m \times a^n = a^{(m+n)}$,
2. $a^m \div a^n = a^{(m-n)}$,
3. $(a^m)^n = a^{(m \cdot n)}$.

Apply the above formulas to simplify the expression:

$$7^6 \times 7^8 = 7^{6+8} = 7^{14}, (7^5)^2 = 7^{5 \cdot 2} = 7^{10}$$

$$7^{14} \div 7^{10} = 7^{14-10} = 7^4$$

$$7^4 = 2401$$

(*b*) $3^0 \times 8^3 \times 4^{-2}$:

Formulas:

1. $a^0 = 1$,
2. $a^{-m} = \frac{1}{a^m}$.

Apply the above formulas to simplify the expression:

$$3^0 = 1, 8^3 = 512, 4^{-2} = \frac{1}{4^2} = \frac{1}{16}$$

$$1 \times 512 \times \frac{1}{16} = \frac{512}{16} = 32$$

(*c*) $\left\{\left(\frac{-3}{2}\right)^{-3}\right\}^{-1}$:

Formulas:

1. $(a^{-m}) = \frac{1}{a^m}$,
2. $(a^m)^n = a^{m \cdot n}$.

Apply the above formulas to simplify the expression:

$$\left(\frac{-3}{2}\right)^{-3} = \left(\frac{-2}{3}\right)^3, \left\{\left(\frac{-2}{3}\right)\right\}^{-1} = \left(\frac{-3}{2}\right)^3$$

$$\left(\frac{-3}{2}\right)^3 = \frac{-27}{8}$$

(*d*) $3^{-5} \times \frac{3^8}{3^{-3}}$:

Formulas:

1. $a^m \div a^n = a^{m-n}$,
2. $a^m \times a^n = a^{m+n}$

Apply the above formulas to simplify the expression:

$$\frac{3^8}{3^{-3}} = 3^{8-(-3)} = 3^{8+3} = 3^{11}$$

$$3^{-5} \times 3^{11} = 3^{-5+11} = 3^6$$

$$3^6 = 729$$

(*e*) $(3^{-4} \div 3^{-3})^3$

Formula: $a^m \div a^n = a^{m-n}, (a^m)^n = a^{m \cdot n}$

Apply the above formulas to simplify the expression:

$3^{-4} \div 3^{-3} = 3^{-4-(-3)} = 3^{-1}$

$(3^{-1})^3 = 3^{-1 \cdot 3} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$

(*f*) $(6^2 \times 3^{-2})(6^2 \div 3^{-2})$

Formula:

1. $a^m \div b^m = \left(\frac{a}{b}\right)^m$,
2. $a^m \cdot b^n = a^m \times b^n$.

Apply the above formulas to simplify the expression:

$6^2 \times 3^{-2} = \frac{6^2}{3^2} = \left(\frac{6}{3}\right)^2 = 2^2 = 4$

$6^2 \div 3^{-2} = 6^2 \cdot 3^2 = (6 \cdot 3)^2 = 18^2 = 324$

$(6^2 \times 3^{-2})(6^2 \div 3^{-2}) = 4 \cdot 324 = 1296$

**3.** (*a*) $(2^{-1} + 5^{-1} + 7^{-1})^0$

Formula: $a^0 = 1$.

$$(2^{-1} + 5^{-1} + 7^{-1})^0 = 1$$

(*b*) $\left[\left(-\frac{5}{9}\right)^{-3}\right]^3$

Formulas:

1. $a^{-m} = \frac{1}{a^m}$,

2. $(a^m)^n = a^{(m \cdot n)}$.

Apply the above formulas to simplify the expression:

$$\left(-\frac{5}{9}\right)^{-3} = \left(\frac{-9}{5}\right)^3$$

$$\left[\left(\frac{-9}{5}\right)^3\right]^3 = \left(\frac{-9}{5}\right)^{3\cdot 3} = \left(\frac{-9}{5}\right)^9$$

(*c*) $(6^0 + 5^{-1}) \times \frac{1}{10^{-2}}$

Formulas:

1. $a^0 = 1$,

2. $a^{-m} = \frac{1}{a^m}$

Apply the above formulas to simplify the expression:

$$6^0 = 1, 5^{-1} = \frac{1}{5},$$

$$6^0 + 5^{-1} = 1 + \frac{1}{5} = \frac{5}{5} + \frac{1}{5} = \frac{6}{5}$$

$$\frac{6}{5} \times \frac{1}{10^{-2}} = \frac{6}{5} \times 10^2 = \frac{6}{5} \times 100 = \frac{600}{5} = 120$$

(*d*) $\left[\left(\frac{1}{4}\right)^{-2} - \left(\frac{1}{7}\right)^{-2}\right]^{-3}$

Formulas:

1. $a^{-m} = \frac{1}{a^m}$,

2. $(a^m)^n = a^{m \cdot n}$.

Apply the above formulas to simplify the expression:

$$\left(\frac{1}{4}\right)^{-2} = 4^2 = 16, \left(\frac{1}{7}\right)^{-2} = 7^2 = 49$$

$$16 - 49 = -33$$

$$(-33)^{-3} = \frac{1}{(-33)^3} = \left(\frac{-1}{33}\right)^3$$

**4.** (*a*) $\frac{81}{256}$:

The reciprocal of $\frac{81}{256}$ is $\frac{256}{81}$,

expressed as: $\frac{256}{81} = \left(\frac{4}{3}\right)^4$

(*b*) $(-5)^5$:

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

(*c*) $\left(\frac{-2}{5}\right)^3$:

The reciprocal is: $\frac{1}{\left(\frac{-2}{5}\right)^3} = \left(\frac{-5}{2}\right)^3$

(*d*) $\left(\frac{3}{7}\right)^{-4}$:

The reciprocal of $\left(\frac{3}{7}\right)^{-4}$ is:

$$\frac{1}{\left(\frac{3}{7}\right)^{-4}} = \left(\frac{3}{7}\right)^4$$

**5.** (*a*) $(-3)^{-5} \times (-3)^{-7}$:

Using the formula $a^m \cdot a^n = a^{(m+n)}$:

$(-3)^{-5} \cdot (-3)^{-7} = (-3)^{-5-7} = (-3)^{-12}$

Expressing with positive exponents:

$$(-3)^{-12} = \frac{1}{(-3)^{12}}$$

(*b*) $(2^{-1} \times 5^{-1} \times 7^{-1})^{-2}$:

First, simplify the terms inside:

$$2^{-1} \cdot 5^{-1} \cdot 7^{-1} = \left(\frac{1}{2} \cdot \frac{1}{5} \cdot \frac{1}{7}\right) = \frac{1}{70}$$

Raise to the power – 2:

$$\left(\frac{1}{70}\right)^{-2} = 70^2$$

(*c*) $4^7 \cdot \left(\frac{4}{5}\right)^{-7}$:

Rewrite $\left(\frac{4}{5}\right)^{-7}$ : $\left(\frac{4}{5}\right)^{-7} = \frac{5^7}{4^7}$

Now multiply:

$$4^7 \cdot \frac{5^7}{4^7} = \frac{4^7 \cdot 5^7}{4^7} = 5^7$$

(*d*) $(2^0 + 5^0 + 70^0) \div (3 \cdot 7^0)$:

Simplify the terms:

$2^0 = 1, 5^0 = 1, 70^0 = 1, 7^0 = 1$

So:

$$2^0 + 5^0 + 70^0 = 1 + 1 + 1 = 3$$

$$3 \div (3 \cdot 1) = 3 \div 3 = 1$$

**6.** (*a*) $\frac{3x^4y^3}{18x^3y^5}$:

Simplify the coefficients:

$$\frac{3}{18} = \frac{1}{6}$$

Simplify the variables using $a^m \div a^n = a^{m-n}$:

$x^4 \div x^3 = x^{4-3} = x, y^3 \div y^5 = y^{(3-5)} = y^{-2}$

$$\frac{3x^4y^3}{18x^3y^5} = \frac{x}{6y^2}$$

(*b*) $\frac{8^{-1} \times 5^3}{2^{-4}}$:

Simplify the numerator:

$8^{-1} = \frac{1}{8}, 5^3 = 125 \Rightarrow 8^{-1} \cdot 5^3 = \frac{125}{8}$

Simplify the denominator:

$2^{-4} = \frac{1}{2^4} = \frac{1}{16}$

Divide:

$$\frac{\frac{125}{8}}{\frac{1}{16}} = \frac{125}{8} \cdot 16 = \frac{125 \cdot 16}{8} = 125 \cdot 2 = 250$$

(*c*) $\frac{25t^{-4}}{5^{-3} \times 10 \times t^{-8}}$

Express 10 as 2 × 5,

$$\frac{25t^{-4}}{5^{-3} \times (2 \times 5) \times t^{-8}} = \frac{25t^{-4}}{5^{-3} \times 5^1 \times 2 \times t^{-8}}$$

Combine powers of 5 and *t*:

$$\frac{25t^{-4}}{5^{-3+1} \times 2 \times t^{-8}} = \frac{25t^{-4}}{5^{-2} \times 2 \times t^{-8}}$$

Simplify the expression:

$$25 = 5^2, \frac{5^2}{5^{-2}} = 5^{2-(-2)} = 5^4$$

Thus, the expression becomes:

$$\frac{5^4t^{-4}}{2 \times t^{-8}} = \frac{5^4t^{-4}}{2t^{-8}}$$

Combine powers of *t*:

$$\frac{t^{-4}}{t^{-8}} = t^{-4-(-8)} = t^4$$

So,

$$\frac{5^4 \cdot t^4}{2} = \frac{(5t)^4}{2}$$

(*d*) $\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$

Express each term as powers of prime factors:

$125 = 5^3, 10^{-5} = (2 \times 5)^{-5} = 2^{-5} \times 5^{-5}$.

Substitute these values:

$$\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}} = \frac{3^{-5} \times (2^{-5} \times 5^{-5}) \times 5^3}{5^{-7} \times 6^{-5}}$$

Combine powers of 5:

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

Factor the expression for $6^{-5}$ as 6 = 2 × 3:

$$6^{-5} = (2 \times 3)^{-5} = 2^{-5} \times 3^{-5}$$

Now substitute:

$$\frac{3^{-5} \times 2^{-5} \times 5^5}{(2^{-5} \times 3^{-5})}$$

Cancel terms:

$$\frac{3^{-5}}{3^{-5}} = \frac{2^{-5}}{2^{-5}} = 1$$

Thus,

$$\frac{3^{-5} \times 2^{-5} \times 5^5}{(2^{-5} \times 3^{-5})} = 5^5$$

**7.** (*a*) $(xy^{-1})^{-2}$

Apply the rule $(a^m)^n = a^{m \cdot n}$:

$$(xy^{-1})^{-2} = x^{-2} \cdot y^2$$

So the expression with positive exponents is:

$$x^{-2} \cdot y^2 = \frac{y^2}{x^2}$$

(b) $a^2 \times b^{-2} \times b^5 \times c$

Combine the powers of $b$:

$$b^{-2} \times b^5 = b^{-2+5} = b^3$$

Now the expression is:

$$a^2 \times b^3 \times c = a^2b^3c$$

(c) $\left(x^{-2}y\right)^{\frac{1}{2}}\left(xy^{-3}\right)^{\frac{1}{3}}$

Apply the power rule:

$$\left(x^{-2}y\right)^{\frac{1}{2}} = x^{-1} \cdot y^{\frac{1}{2}},$$

$$\left(xy^{-3}\right)^{\frac{1}{3}} = x^{\frac{1}{3}} \cdot y^{-1}$$

Now multiply the two expressions:

$$x^{-1} \cdot y^{\frac{1}{2}} \cdot x^{\frac{1}{3}} \cdot y^{-1} = x^{-1+\frac{1}{3}} \cdot y^{\frac{1}{2}-1}$$

Simplify the exponents:

$$x^{-1+\frac{1}{3}} = x^{-\frac{2}{3}},\ y^{\frac{1}{2}-1} = y^{-\frac{1}{2}}$$

So the final expression is: $\dfrac{1}{x^{\frac{2}{3}} \cdot x^{\frac{1}{2}}}$

**8.** Simplify both terms:

$$\left[\left(\frac{-9}{2}\right)^3\right]^3 = \left(\frac{-9}{2}\right)^{3\cdot 3} = \left(\frac{-9}{2}\right)^9$$

$$\left(-\frac{5}{9}\right)^4 = \frac{(-5)^4}{9^4}$$

Let $x$ be the number by which we need to multiply:

$$\left(\frac{-9}{2}\right)^9 \cdot x = \left(-\frac{5}{9}\right)^4$$

Solve for $x$:

$$x = \frac{\left(-\frac{5}{9}\right)^4}{\left(\frac{-9}{2}\right)^9}$$

Simplify the expression:

$$x = \frac{\frac{(-5)^4}{9^4}}{\left(\frac{-9}{2}\right)^9} = \frac{(-5)^4}{9^4} \cdot \frac{2^9}{(-9)^9}$$

$$= \frac{(5)^4}{9^{4+9}} \cdot \frac{2^9}{(-1)}$$

$$= \frac{-5^4 2^9}{9^{13}}$$

**9.** Simplify both terms:

$$\left(-\frac{5}{2}\right)^{-3} = \left(\frac{-2}{5}\right)^3 = \frac{-8}{125},$$

$$\left(\frac{25}{4}\right)^{-2} = \left(\frac{5^2}{2^2}\right)^{-2} = \frac{2^4}{5^4} = \frac{16}{625}$$

Let $y$ be the number by which we need to divide:

$$\frac{\frac{-8}{125}}{y} = \frac{16}{625}$$

Solve for $y$:

$$y = \frac{\frac{-8}{125}}{\frac{16}{625}} = \frac{-8}{125} \cdot \frac{625}{16} = \frac{-8 \cdot 625}{125 \cdot 16}$$

Simplify the expression:

$$y = \frac{-5000}{2000} = \frac{-5}{2}$$

**10.** $6^{2x+1} \div 36 = 216$

Express 36 and 216 as powers of 6:

$$36 = 6^2,\ 216 = 6^3$$

Rewrite the equation:

$$\frac{6^{2x+1}}{6^2} = 6^3$$

Use the rule $\dfrac{a^m}{a^n} = a^{m-n}$:

$$6^{(2x+1)-2} = 6^3$$

This simplifies to:

$$6^{2x-1} = 6^3$$

Since the bases are the same, set the exponents equal:

$$2x - 1 = 3$$

Solve for $x$:

$$2x = 3 + 1 = 4$$

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

**11.** (a) $\left(\frac{5}{3}\right)^{-5} \times \left(\frac{5}{3}\right)^{-11} = \left(\frac{5}{3}\right)^{8x}$

Use the rule $a^m \times a^n = a^{m+n}$:

$$\left(\frac{5}{3}\right)^{-5+(-11)} = \left(\frac{5}{3}\right)^{8x}$$

Simplifying the left – hand side:

$$\left(\frac{5}{3}\right)^{-16} = \left(\frac{5}{3}\right)^{8x}$$

Since the bases are the same, set the exponents equal:

$$-16 = 8x$$

Solve for $x$:

$$x = \frac{-16}{8} = -2$$

(*b*) $\left(\frac{2}{7}\right)^{-3} \times \left(\frac{2}{7}\right)^{8} = \left(\frac{2}{7}\right)^{2x+1}$

Use the rule $a^m \times a^n = a^{m+n}$:

$$\left(\frac{2}{7}\right)^{-3+8} = \left(\frac{2}{7}\right)^{2x+1}$$

Simplifying the left – hand side:

$$\left(\frac{2}{7}\right)^{5} = \left(\frac{2}{7}\right)^{2x+1}$$

Since the bases are the same, set the exponents equal:

$$5 = 2x + 1$$

Solve for $x$:

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

**12.** (*a*) 2.368

$2.368 = 2 + 0.3 + 0.06 + 0.008$

$= 2 \times 10^0 + 3 \times 10^{-1} + 6 \times 10^{-2} + 8 \times 10^{-3}$

(*b*) 45.2394

$45.2394 = 40 + 5 + 0.2 + 0.03 + 0.009 + 0.0004$

$= 4 \times 10^1 + 5 \times 10^0 + 2 \times 10^{-1} + 3 \times 10^{-2} + 9 \times 10^{-3} + 4 \times 10^{-4}$

(*c*) 0.359898

$0.359898 = 0.3 + 0.05 + 0.009 + 0.0008 + 0.00009 + 0.000008$

$= 3 \times 10^{-1} + 5 \times 10^{-2} + 9 \times 10^{-3} + 8 \times 10^{-4} + 9 \times 10^{-5} + 8 \times 10^{-6}$

## Practice Time 11C

**1.** (*a*) $4.7865 \times 10^5 \times 10^3$

$4.7865 \times 10^5 \times 10^3 = 4.7865 \times 10^{5+3}$

$= 4.7865 \times 10^8$

(*b*) $999 \times 10^5$

$999 \times 10^5 = 9.99 \times 10^2 \times 10^5 = 9.99 \times 10^7$

(*c*) $0.00100001 \times 10^8$

$0.00100001 \times 10^8 = 1.00001 \times 10^{-3} \times 10^8 = 1.00001 \times 10^5$

(*d*) 8020000000000000

$8020000000000000 = 8.02 \times 10^{15}$

**2.** (*a*) $7 \times 10^{11}$

$7 \times 10^{11} = 700000000000$

(*b*) $5.651672 \times 10^6$

$5.651672 \times 10^6 = 5651672$

(*c*) $2.0000002 \times 10^{-10}$

$2.0000002 \times 10^{-10} = 0.00000000020000002$

**3.** (*a*) $0.05 = 5 \times 10^{-2}$ mm

(*b*) 100 billion $= 100 \times 10^9 = 1 \times 10^{11}$

(*c*) $384317695 = 3.84317695 \times 10^8$ m

(*d*) $0.00001275 = 1.275 \times 10^{-5}$ m

**4.** Total mass $= 1.67 \times 10^{-24} + 9.10 \times 10^{-28}$

We convert to have the same exponent:

$1.67 \times 10^{-24} = 1.67 \times 10^{-24}$, $9.10 \times 10^{-28}$

$= 0.000910 \times 10^{-24}$

Now, add the two:

Total mass $= (1.67 + 0.000910) \times 10^{-24}$

$= 1.670910 \times 10^{-24}$ g

**5.** The distance is $8.1 \times 10^{13}$ km , which we convert to metres:

$8.1 \times 10^{13}$ km $= 8.1 \times 10^{13} \times 10^3$ m $= 8.1 \times 10^{16}$ m

Now, use the formula, Time $= \frac{\text{Distance}}{\text{Speed}}$:

$$\text{Time} = \frac{8.1 \times 10^{16}}{3 \times 10^8} = 2.7 \times 10^8 \text{ seconds}$$

Thus, light takes $2.7 \times 10^8$ seconds to travel from the star to Earth.

## Mental Maths (Page 273)

**1.** First, simplify $7 - 1 = 6$, so $(7 - 1)^0 = 6^0 = 1$.

Now, we have $3 \times 1 = 3$.

The multiplicative inverse of 3 is $\frac{1}{3}$.

**2.** First, calculate the powers:

$8^2 = 64$

$4^4 = 256$

Now, simplify the ratio:

$$\frac{64}{256} = \frac{1}{4}$$

The simplified ratio is 1 : 4.

3. Use the power of a power rule: $(x^m)^n = x^{m \times n}$.

$$(x^{a+b})^{(a-b)} = x^{(a+b)(a-b)} = x^{a^2-b^2}$$

$$(x^{b+c})^{(b-c)} = x^{(b+c)(b-c)} = x^{b^2-c^2}$$

$$(x^{c+a})^{(c-a)} = x^{(c+a)(c-a)} = x^{c^2-a^2}$$

Now, multiply the terms:

$$x^{a^2-b^2} \times x^{b^2-c^2} \times x^{c^2-a^2}$$

Use the rule $x^m \times x^n = x^{m+n}$:

$$x^{(a^2-b^2)+(a^2-b^2)+(a^2-b^2)} = x^{a^2-b^2+a^2-b^2+c^2-a^2}$$

The terms cancel out:

$$x^0 = 1$$

Therefore, the value is 1.

4. First, simplify the expression inside the parentheses:

$x^0 \times x \times x^2 \times x^3 \times x^4 \times x^5 = x^{0+1+2+3+4+5} = x^{15}$

Now, we have $(x^{15})a = 1$, which means:

$$x^{15a} = 1$$

For $x^{15a} = 1$, the exponent must be 0, so:

$$15a = 0$$
$$a = 0$$

5. Apply the negative exponent rule: $\frac{a^{-m}}{b^{-m}} = \frac{b^n}{a^m}$.

$$\frac{4^{-4}}{5^{-2}} = \frac{5^2}{4^4}$$

6. 100 billion = $100 \times 10^9$.

This can be written as:

$$1 \times 10^2 \times 10^9 = 1 \times 10^{11}$$

Therefore, the number of cells is $10^{11}$.

7. The number is 1234000000, which can be written as:

$$1.234 \times 10^9$$

The standard form is $1.234 \times 10^9$.

8. To express in the usual form, move the decimal point 5 places to the left:

$5.03 \times 10^{-5} = 0.0000503$

Therefore, the usual form is 0.0000503.

## Maths Fun (Page 274)

**Across:** 2. Sum 3. Reciprocal 5. Nine 6. Difference 8. Negative 9. Usual

**Down:** 1. One Thousand Twenty Four 4. One 7. Power

## Maths Connect (Page 274)

Exabyte (EB) = 1000000000000000000 = $10^{18}$

Zettabyte (ZB) = 1000000000000000000000 = $10^{21}$

Yottabyte (YB) = 1000000000000000000000000 = $10^{24}$

## Puzzle (Page 274)

**Clue (*i*):** I am a power of 2.

This means the number is of the form $2^n$, where $n$ is a whole number.

**Clue (*ii*):** When I am multiplied by 8, the result is 256.

We are looking for a number x such that:

$$x \times 8 = 256$$

Divide both sides by 8:

$$x = \frac{256}{8} = 32$$

**Clue (*iii*):** I am less than 50.

So, $x = 32$ satisfies this condition because 32 is less than 50.

Finally, let's check if 32 is a power of 2:

$$32 = 2^5$$

So, 32 is indeed a power of 2.

The magic number is 32.

## Chapter Assessment

**A.**

1. In $a^n$, $n$ is known as exponent.
Hence, the correct option is (*c*).

2. Use the negative exponent rule: $a^{-m} = \frac{1}{a^m}$
So, the number $5^{-2}$ can be written as, $\frac{1}{5^2}$.
Hence, the correct option is (*b*).

3. Use the quotient rule: $a^m \div a^n = a^{m-n}$.
So, $2^5 \div 2^{-6} = 2^{5-(-6)} = 2^{5+6} = 2^{11}$
Hence, the correct option is (*d*).

4. $\left(\frac{1}{2}\right)^{-1}$ = 2,and the reciprocal of 2 is $\frac{1}{2}$.
Hence, the correct option is (*b*).

5. Using the law $a^m \div a^n = a^{m-n}$:

$$x^4 \div x^{12} = x^{4-12} = x^{-8}$$

Hence, the correct option is (*c*).

6. $0.00000064 = 6.4 \times 10^{-7}$

Hence, the correct option is (*d*).

7. $5.05 \times 10^{-5} = 0.0000505$.

Hence, the correct option is (*b*).

8. First, calculate $\left(\frac{1}{2}\right)^{-3}$:

$$\left(\frac{1}{2}\right)^{-3} = 2^3 = 8$$

We need to divide 8 by a number $x$ to get $(60)^{-1}$:

$$8 \div x = \frac{1}{60} \Rightarrow x = 8 \times 60 = 480$$

Hence, the correct option is (*d*).

**B.**

1. (*a*) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Explanation: The rule of exponents states that if the exponents are the same, we multiply the bases. Hence, $a^m \times b^m = (a \times b)m$.

2. (*c*) Assertion (A) is true but Reason (R) is false.

Explanation: $3.5 \times 10^7$ is indeed equal to 35000000, but the reason is incorrect. The exponent indicates the power to which a number is raised, not the number of times it is multiplied by itself. The correct explanation is that the exponent tells how many times to multiply 10 by itself and then multiply by 3.5.

**C.**

1. If $2^{(3x+4)} = 2^{-x}$

By equating the exponents, $3x + 4 = -x$, solve for $x$.

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

2. The value of $\left(\frac{-1}{2}\right)^4 = \frac{1}{16}$.

The negative sign is raised to an even power, so the result is positive.

3. The value of $\left(\frac{1}{4}\right)^{-3}$ is 64.

4. The value of $\left(\frac{1}{2^6}\right) = 2^{-6}$.

Using the negative exponent rule.

**D.**

1. **True:** For any non – zero rational number $a$, $a^0 = 1$.
2. **False:** $a^{-m} \neq -a^m$; $a^{-m} = \frac{1}{a^m}$ instead.
3. **True:** $2^0 = 1$, and $(-1)^{135} = -1$. Hence, $2^0 > (-1)^{135}$.
4. **False:** $a^m b^n \neq (ab)^{mn}$; the correct relation is $a^m b^n = (ab)^{mn}$ only if $m = n$.
5. **False:** $(2^3 \times 2^2)^{-2} = (2^{3+2})^{-2} = 2^{-10} \neq 2^{-12}$.

**E.**

1. (*a*) $5^6 \times 5^0 \times 5^9 = 5^{6+0+9} = 5^{15}$

(*b*) $(-7)^6 \div 7^6 = \frac{(-7)^6}{7^6} = (-1)^6 \times \frac{7^6}{7^6} = 1$

(*c*) $\left[\left\{\left(\frac{3}{2}\right)^7 \div \left(\frac{3}{2}\right)^9\right\} \times \left(\frac{3}{2}\right)^2\right]$

$$= \left[\left(\frac{3}{2}\right)^{7-9} \times \left(\frac{3}{2}\right)^2\right] = \left(\frac{3}{2}\right)^0 = 1$$

(*d*) $\left[6^{-1} + \left(\frac{3}{2}\right)^{-1}\right]^{-1} = \left[\frac{1}{6} + \frac{2}{3}\right]^{-1}$

$$= \left[\frac{1}{6} + \frac{4}{6}\right]^{-1} = \left[\frac{5}{6}\right]^{-1} = \frac{6}{5}$$

(*e*) $\left[\left\{\left(\frac{-1}{5}\right)^{-2}\right\}^2\right]^{-1} = \left[\left(\frac{-1}{5}\right)^{-4}\right]^{-1} = [5^4]^{-1} = \frac{1}{5^4}$

(*f*) $\left[\left(\frac{1}{3}\right)^{-3} - \left(\frac{1}{2}\right)^{-3}\right] \div \left(\frac{1}{4}\right)^{-3}$

$$= [3^3 - 2^3] \div 4^3 = \frac{27-8}{64} = \frac{19}{64}$$

2. (*a*) $(2^{-1} \div 5^{-1})^2 \times \left(\frac{-5}{8}\right)^{-1} = \left(\frac{2^{-1}}{5^{-1}}\right)^2 \times \left(-\frac{8}{5}\right)^2$

$$= \left(\frac{5}{2}\right)^2 \times \left(-\frac{8}{5}\right) = \frac{25}{4} \times \left(-\frac{8}{5}\right) = -10$$

(*b*) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

$$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$$

$$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1} = 24 + 6 = 30$$

**3.** (*a*) $3^{-4} \times 2^{-4}$

To solve the expression, use the formula: $a^m \times b^m = (a \cdot b)^m$

$$3^{-4} \times 2^{-4} = (3 \cdot 2)^{-4} = 6^{-4} = \frac{1}{6^4}$$

(*b*) $\left(\frac{3}{4}\right)^5 \times \left(\frac{3}{4}\right)^2$

To solve the expression, use the formula: $a^m \times a^n = a^{m+n}$

$$\left(\frac{3}{4}\right)^5 \times \left(\frac{3}{4}\right)^2 = \left(\frac{3}{4}\right)^{5+2} = \left(\frac{3}{4}\right)^7$$

(*c*) $(3^{-4} \div 3^{-10}) \times 3^{-5}$

To solve the expression, use the formula as:

$\frac{a^m}{a^n} = a^{m-n}$ and $a^m \times a^n = a^{m+n}$

$$(3^{-4} \div 3^{-10}) \times 3^{-5} = 3^{-4-(-10)} \times 3^{-5}$$
$$= 3^6 \times 3^{-5} = 3^{6-5} = 3^1$$

(*d*) $(-3)^4 \times \left(\frac{5}{3}\right)^4$

To solve the expression, use the formula: $a^m \times b^m = (a \cdot b)^m$

$$(-3)^4 \times \left(\frac{5}{3}\right)^4 = \left(-3 \cdot \frac{5}{3}\right)^4 = (5)^4$$

**4.** (*a*) $\left(\frac{5}{8}\right)^{-7} \times \left(\frac{5}{8}\right)^{-11} = \left(\frac{5}{8}\right)^{9x}$

To solve the equation, use the formula: $a^m \times a^n = a^{m+n}$

$$\left(\frac{5}{3}\right)^{-7} \times \left(\frac{5}{8}\right)^{-11} = \left(\frac{5}{8}\right)^{-7+(-11)} = \left(\frac{5}{8}\right)^{-18}$$

Comparing the exponents:

$$-18 = 9x \Rightarrow x = -2$$

(*b*) $\left(\frac{2}{9}\right)^3 \times \left(\frac{2}{9}\right)^{-6} = \left(\frac{2}{9}\right)^{2x-1}$

To solve the equation, use the formula: $a^m \times a^n = a^{m+n}$

$$\left(\frac{2}{9}\right)^3 \times \left(\frac{2}{9}\right)^{-6} = \left(\frac{2}{9}\right)^{3+(-6)} = \left(\frac{2}{9}\right)^{-3}$$

Comparing the exponents:

$$-3 = 2x - 1 \Rightarrow 2x = -2 \Rightarrow x = -1$$

**5.** To find the value of $x$, use the formula: $a^m \times a^n = a^{m+n}$, and $(a^m)^n = a^{m \cdot n}$

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

$$x^{-2} = \left[\left(\frac{3}{2}\right)^{-2}\right]^{-2} = \left(\frac{3}{2}\right)^{(-2)\cdot(-2)} = \left(\frac{3}{2}\right)^4$$

$$x^{-2} = \frac{3^4}{2^4} = \frac{81}{16}$$

**6.** (*a*) 0.000007:

Move the decimal 6 places to the right:

$$0.000007 = 7 \times 10^{-6}$$

(*b*) 0.000000564:

Move the decimal 7 places to the right:

$$0.000000564 = 5.64 \times 10^{-7}$$

**7.** (*a*) $3 \times 10^{-8}$:

Move the decimal 8 places to the left:

$$3 \times 10^{-8} = 0.00000003$$

(*b*) $1.0001 \times 10^9$:

Move the decimal 9 places to the right:

$$1.0001 \times 10^9 = 1000100000$$

(c) $5.8 \times 10^2$:

Move the decimal 2 places to the right:

$$5.8 \times 10^2 = 580$$

(*d*) $3.61492 \times 10^6$:

Move the decimal 6 places to the right:

$$3.61492 \times 10^6 = 3614920$$

**8.** Diameter of the Sun: $1.4 \times 10^9$ m

Diameter of the Earth: $1.275 \times 10^7$ m

Formula used: Ratio = $\frac{\text{Diameter of Sun}}{\text{Diameter of Earth}}$:

$$\frac{1.4 \times 10^9}{1.275 \times 10^7} = \frac{1.4}{1.275} \times 10^{9-7} = 1.098 \times 10^2 \approx 110$$

The Sun's diameter is approximately 110 times that of the Earth.

9. (*a*) Express the distance of Venus from the Sun in standard form:

Distance = 108,200,000 km :

$108{,}200{,}000 = 1.082 \times 10^8$ km

(*b*) Express the radius of Venus in metres in standard form:

Radius = 6051.8 km

Convert to metres: $6051.8 \times 10^3$

6051.8 km $= 6.0518 \times 10^6$ m

(*c*) Time for a satellite to reach the Sun:

Speed = 20,000 km/h ,

Distance = 108,200,000 km :

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$= \frac{108{,}200{,}000}{20{,}000}$$

= 5410 hours

(*d*) Time for light to reach Venus from the Sun:

Speed of light = $3 \times 10^5$ km/s, Distance = $1.082 \times 10^8$ km :

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{1.082\times10^8}{3\times10^5}$$

= 360.66 Seconds

## Brain Sizzlers (Page 277)

1. A 54 cm sandwich is first stretched by $\times\ 4^3$ and then shrunk by $\div\ 3^4$.

**Step 1:** Stretching with $\times\ 4^3$:

$4^3 = 64$, so the length becomes:

$54 \times 64 = 3456$ cm

**Step 2:** Shrinking with $\div\ 3^4$:

$3^4 = 81$, so the length becomes:

$$\frac{3456}{81} = 42.67 \text{ cm (approximately).}$$

Therefore, the length of the sandwich will be approximately 42.67 cm.

2. Rewrite the equation using powers of 5:

$125 = 5^3,\ 25 = 5^2,\ 3125 = 5^5$

Substituting these, the equation becomes:

$$(5^3)^a = \frac{5^2}{(5^5)^b}$$

Simplify:

$$5^{3a} = \frac{5^2}{5^{5b}} = 5^{2-5b}$$

Compare the exponents:

$3a = 2 - 5b$

To find $6a + 10b$:

From $3a = 2 - 5b$, solve for a:

$$a = \frac{2-5b}{3}$$

Substitute a into $6a + 10b$:

$$6a + 10b = 6\times\frac{2-5b}{3}+10b$$

$$= 4 - 10b + 10b$$

$$= 4$$

Therefore, the value of $6a + 10b$ is 4.

# CHAPTER 12 : DIRECT AND INDIRECT VARIATIONS

## Let's Recall

1. Compare the total area of the photos.

**Passport-sized photo:**

Dimensions = 3.5 cm × 4.5 cm

Area = 3.5 × 4.5 = 15.75 sq. cm

**Stamp-sized photo:**

Dimensions = 2.0 cm × 2.5 cm

Area = 2.0 × 2.5 = 5.0 sq. cm

Printing 20 stamp-size photos requires less space than 8 passport-size photos, so the cost of photographs is less for 20 stamp-size photos.

2. **Postcard-sized photo:**

Price for 2 copies = ₹150

Price per copy = $\frac{150}{2}$ = ₹75 per copy

Passport-sized photo:

Price per copy = $\frac{60}{8}$ = ₹7.50

Now, the ratio of the rate of a postcard-sized photo to the rate of a passport-sized photo:

$$\text{Ratio} = \frac{75}{7.5} = 10$$

Thus, the ratio between the rates of per copy of a postcard-sized photo and a Passport-sized photo is 10 : 1.

3. Postcard-sized photo area:

Area = 10 × 15 = 150 sq. cm

Stamp-sized photo area:

Area = 2.0 × 2.5 = 5.0 sq. cm

Now, the ratio of the area of the postcard-sized photo to the area of the stamp-sized photo:

$$\text{Ratio of areas} = \frac{150}{5.0} = 30$$

So, a postcard-sized photo is 30 times larger than a stamp-sized photo in terms of area.

4. We will now complete the table based on the information given.

| Photos | Passport | Postcard | Stamp |
|---|---|---|---|
| Size (in sq. cm) | 15.75 | 150 | 5 |
| Rate per copy (in ₹) | 7.50 | 75 | 3 |

We need to check if the rate per square cm for each type of photo is proportional to the size.

- Passport-sized photo rate per square cm:

$$\frac{7.50}{15.75} = ₹0.48 \text{ per sq. cm}$$

- Postcard-sized photo rate per square cm:

$$\frac{75}{150} = ₹0.50 \text{ per sq. cm}$$

- Stamp-sized photo rate per square cm:

$$\frac{3.00}{5} = ₹0.60 \text{ per sq. cm}$$

The rates per square cm are not proportional. The rate per square cm increases as the photo size decreases. Therefore, the rates are not proportional to the sizes of the photos.

## Think and Answer (Page 282)

2. In this situation, the gravitational force of attraction F between an object and the Earth is directly proportional to the mass m of the object. This relationship can be written as:

$$F = k \cdot m$$

The force of attraction F=147 N,

The mass $m$ = 15 kg.

To find the constant of proportionality $k$:

Substitute the given values into the formula,

$$F = k \cdot m:$$

$$147 = k \cdot 15$$

Now, solve for $k$:

$$k = \frac{147}{15} = 9.8 \text{ N/kg}$$

The constant of proportionality $k$ is 9.8 N/kg .

## Practice Time 12A

1. We find the ratios $\frac{x}{y}$ for the values of $x$ and the corresponding values of $y$ and compare them.

(*a*) Calculate $\frac{x}{y}$:

$$\frac{x}{y} = \frac{2}{6} = \frac{1}{3}, \frac{4}{12} = \frac{1}{3}, \frac{5}{15} = \frac{1}{3},$$

$$\frac{10}{30} = \frac{1}{3}, \frac{25}{75} = \frac{1}{3}, \frac{24}{72} = \frac{1}{3}$$

The ratio $\frac{x}{y}$ is constant at $\frac{1}{3}$.

Thus, $x$ and $y$ are in direct variation.

(*b*) Calculate $\frac{x}{y}$:

$$\frac{x}{y} = \frac{12}{15} = 0.8, \frac{15}{30} = 0.5, \frac{8}{40} = 0.2,$$

$$\frac{10}{50} = 0.2, \frac{14}{56} = 0.25, \frac{57}{76} = 0.75,$$

The ratio $\frac{x}{y}$ is not constant.

Thus, $x$ and $y$ are not in direct variation.

(*c*) Calculate $\frac{x}{y}$:

$$\frac{x}{y} = \frac{6}{15} = 0.4, \frac{12}{30} = 0.4, \frac{16}{40} = 0.4,$$

$$\frac{10}{25} = 0.4, \frac{14}{35} = 0.4, \frac{38}{95} = 0.4,$$

The ratio $\frac{x}{y}$ is constant at 0.4.

Thus, $x$ and $y$ are in direct variation.

**2.** Given $x$ and $y$ are in direct variation, $\frac{x}{y}$ is constant.

Let the constant of variation be $k$.

$$k = \frac{x}{y}$$

Using the first pair, $x = 9$ and $y = 12$:

$$k = \frac{9}{12} = \frac{3}{4}$$

Using $k = \frac{3}{4}$, calculate the missing values:

$$x_1 = k \cdot y_1 = \frac{3}{4} \cdot 28 = 21$$

$$y_1 = \frac{x}{k} = \frac{36}{\frac{3}{4}} = 48$$

$$x_2 = k \cdot y_1 = \frac{3}{4} \cdot 84 = 63$$

$$y_2 = \frac{x}{k} = \frac{51}{\frac{3}{4}} = 68$$

The completed table:

| $x$ | 9 | 12 | 21 | 36 | 63 | 51 |
|---|---|---|---|---|---|---|
| $y$ | 12 | 16 | 28 | 48 | 84 | 68 |

**3.** (*a*) The equation is:

$$l = k \cdot m$$

(*b*) When $l = 6$ and $m = 18$:

$$k = \frac{l}{m} = \frac{6}{18} = \frac{1}{3}$$

(*c*) When m=33:

$$l = k \cdot m = \frac{1}{3} \cdot 33 = 11$$

(*d*) When $l = 8$:

$$m = \frac{l}{k} = \frac{8}{\frac{1}{3}} = 24$$

**4.** $x$ varies directly as $y$:

$$\frac{x}{y} = \text{Constant}$$

Given $x = 80$ and $y = 160$, find $y$ when $x = 64$:

$$\frac{x}{y} = \frac{80}{160} = \frac{1}{2}$$

$$\frac{64}{y} = \frac{1}{2} \Rightarrow y = 64 \cdot 2 = 128$$

Thus, $y = 128$.

**5.** The distance covered per liter:

$$\text{Distance per liter} = \frac{270}{27} = 10 \text{ km/L}$$

For 15.5 L:

$$\text{Distance} = 10 \cdot 15.5 = 155 \text{ km}$$

The car covers 155 km.

**6.** (*a*) Distance traveled in 15 minutes:

Speed = 72 km/h

$$\Rightarrow \text{Distance in 1 minute} = \frac{72}{60} = 1.2 \text{ km}$$

Distance in 15 minutes = 1.2 · 15 = 18 km

The train travels 18 km.

(*b*) Time required to cover 400 km:

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{400}{72} \text{ hours}$$

$$\text{Time} = \frac{100}{18} \approx 5.56 \text{ hours}$$

The time required is 5.56 hours.

**7.** Time taken by Kanika = 1 hour 20 minutes = 80 minutes

Words typed in 80 minutes = 1440

$$\text{Words typed per minute} = \frac{1440}{80} = 18 \text{ words}$$

Words typed in 42 minutes:

$$18 \times 42 = 756 \text{ words}$$

**8.** Space required for 75 persons = 250 $m^2$

$$\text{Space required per person} = \frac{250}{75} = \frac{10}{3} \text{ m}^2$$

Number of persons in 60 $m^2$:

$$\frac{60}{\frac{10}{3}} = 60 \times \frac{3}{10} = 18 = 18 \text{ persons}$$

**9.** Number of crystals in 3 kg = $1.35 \times 10^7$

Number of crystals in 1 kg:

$$\frac{1.35 \times 10^7}{3} = 0.45 \times 10^7 = 4.5 \times 10^6$$

Number of crystals in 7 kg:

$$7 \times 4.5 \times 10^6 = 31.5 \times 10^6 = 3.15 \times 10^7$$

**10.** Interest for ₹5,000 = ₹1,250 in 3 years.

Rate of interest:

$$R = \frac{1250 \times 100}{5000 \times 3} = 8.33\%$$

Interest for ₹48,000 in 3 years:

$$SI = \frac{48,000 \times 8.33 \times 3}{100} = ₹11995.20$$

**11.** Scale = 1:3,50,00,000

Distance on map = 4.8 cm

Actual distance:

4.8 × 3,50,00,000 cm = 16,80,00,000 cm

Convert to kilometres:

$$\frac{16,80,00,000}{100,000} = 1680 \text{ km}$$

**12.** Mass varies directly with length.

Let mass = $m$ and length = $l$, so $\frac{m}{l}$ = Constant.

Given:

Mass of 16 cm rod = 192 g

Constant:

$$\frac{192}{16} = 12$$

(*a*) For $m$ = 108:

$$l = \frac{m}{12} = \frac{108}{12} = 9 \text{ cm}$$

(*b*) For l=24.5:

$$m = 12 \times 24.5 = 294 \text{ g}$$

**13.** The height of the tree and the length of its shadow are proportional to the height of the water tank and the length of its shadow.

Let the height of the water tank be $h$. Using the concept of direct proportion:

$$\frac{\text{Height of tree}}{\text{Length of tree's shadow}} = \frac{\text{Height of tank}}{\text{Length of tank's shadow}}$$

Substitute the values:

$$\frac{9.5}{8} = \frac{h}{21}$$

Solve for $h$:

$$h = \frac{9.5 \times 21}{8} = \frac{199.5}{8} = 24.9375 \text{ m}$$

Height of the tank = 24.9375 m

**14.** Let the number of white keys be w and the number of black keys be $b$.

(*a*) The given keyboard has $w$ = 29 white keys and $b$ = 20 black keys.

Ratio of white keys to black keys = $\frac{w}{b} = \frac{29}{20}$

Ratio = 29 : 20

(*b*) Using the ratio $\frac{w}{b} = \frac{29}{20}$:

$$\frac{w}{b} = \frac{29}{20}$$

Solve for $w$:

$$w = \frac{29 \times 160}{20} = 232$$

Number of white keys = 232

## Practice Time 12B

**1.** (*a*) Inverse proportion.

Reason: More workers reduce the time taken to complete the job and vice versa.

(*b*) Direct proportion.

Reason: The more the distance traveled, the more CNG is consumed, assuming consistent efficiency.

(*c*) Inverse proportion.

Reason: If the cost of each pencil increases, fewer pencils can be bought, and vice versa.

(*d*) Direct proportion.

Reason: Higher income typically results in higher income tax, assuming a proportional taxation system.

(*e*) Inverse proportion.

Reason: As population increases, the area of land per person decreases, and vice versa.

(*f*) Direct proportion.

Reason: The cost of apples increases with the weight purchased, assuming a fixed price per kilogram.

(*g*) Neither of the two.

Reason: The height of a tree may not always grow at a fixed rate over time. Different factors, such as tree species, environment, and age, affect growth.

(*h*) Direct proportion.

Reason: As the number of students increases, the total food consumption also increases.

2. (*a*) For inverse variation, the product $x \cdot y$ should be constant.

Find the product $x \cdot y$ for each pair of values.

$x = 6, \; y = 300 \Rightarrow x \cdot y = 6 \cdot 300 = 1800$

$x = 12, y = 150 \Rightarrow x \cdot y = 12 \cdot 150 = 1800$

$x = 15, y = 120 \Rightarrow x \cdot y = 15 \cdot 120 = 1800$

$x = 30, y = 60 \Rightarrow x \cdot y = 30 \cdot 60 = 1800$

$x = 75, y = 24 \Rightarrow x \cdot y = 75 \cdot 24 = 1800$

$x = 72, y = 25 \Rightarrow x \cdot y = 72 \cdot 25 = 1800$

Since the product $x \cdot y = 1800$ is constant, $x$ and $y$ are in inverse variation.

(*b*) Calculate $x \cdot y$ for each pair of values.

$x = 15, y = 60 \Rightarrow x \cdot y = 15 \cdot 60 = 900$

$x = 30, y = 50 \Rightarrow x \cdot y = 30 \cdot 50 = 1500$

$x = 40, y = 30 \Rightarrow x \cdot y = 40 \cdot 30 = 1200$

$x = 50, y = 40 \Rightarrow x \cdot y = 50 \cdot 40 = 2000$

$x = 56, y = 45 \Rightarrow x \cdot y = 56 \cdot 45 = 2520$

$x = 84, y = 35 \Rightarrow x \cdot y = 84 \cdot 35 = 2940$

Since the product $x \cdot y$ is not constant, $x$ and $y$ are not in inverse variation.

(*c*) Similarly solve this part as part (*a*).

3. For inverse variation, the constant of variation is

$$k = m \cdot n.$$

Find $k$:

Using $m = 90$ and $n = 12$:

$$k = m \cdot n = 90 \cdot 12 = 1080$$

Find the missing values:

$m_1 \cdot 27 = 1080$:

$$m_1 = \frac{1080}{27} = 40$$

$36 \cdot n_1 = 1080$:

$$n_1 = \frac{1080}{36} = 30$$

$m_2 \cdot 54 = 1080$:

$$m_2 = \frac{1080}{54} = 20$$

$18 \cdot n_2 = 1080$:

$$n_2 = \frac{1080}{18} = 60$$

4. The relationship between $x$ and $y$ is $x \cdot y = k$, where $k$ is a constant.

$$k = x \cdot y = 80 \cdot 160 = 12800$$

When $x = 64$:

$$y = \frac{k}{x} = \frac{12800}{64} = 200$$

5. Let the number of days the flour lasts be $d$. The total consumption is proportional to the number of people and days, so:

$$300 \cdot 42 = 350 \cdot d$$

$$d = \frac{300 \cdot 42}{350} = 36$$

The flour will last for 36 days.

6. (*a*) Time to travel at 90 km/h:

The distance travelled is:

Distance = Speed · Time = 72 · 20 = 1440 km

At 90 km/h , the time is:

$$\frac{\text{Distance}}{\text{Speed}} = \frac{1440}{90} = 16 \text{ hours}$$

(*b*) Speed to reach in 24 hours:

The required speed is:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{1440}{24} = 60 \text{ km/h}$$

7. Work is proportional to the number of workers and time. Let the total work be W:

$$W = 560 \cdot 9 = 5040$$

If the work must be completed in 5 months:

$$\text{Workers needed} = \frac{W}{5} = \frac{5040}{5} = 1008$$

Extra workers required:

Extra workers = 1008 – 560 = 448

The contractor needs 448 extra workers.

8. The amount of money Akhil has is:

Total money = 30 · 12 = ₹360

When the price of sugar increases to ₹40 per kg:

$$\text{Quantity of sugar} = \frac{\text{Total money}}{\text{Price per kg}} = \frac{360}{40} = 9 \text{ kg}$$

Akhil can buy 9 kg of sugar.

**9.** 8 pipes can fill the tank in 1 hour 45 minutes = 1.75 hours.

The time taken to fill the tank is inversely proportional to the number of pipes, so:

Time taken by 10 pipes

$$\text{Time taken} = \frac{1.75\times 8}{10} = 1.4 \text{ hours}$$

$$= 1 \text{ hour } 24 \text{ minutes}$$

**10.** The relationship is $x \cdot y^3 = k$.

When $y = 5$ and $x = 81$:

$$k = 81 \cdot 5^3 = 81 \cdot 125 = 10125$$

When $x = 3$:

$$3 \cdot y^3 = 10125$$

$$y^3 = \frac{10125}{3} = 3375$$

$$\Rightarrow \quad y = \sqrt[3]{3375} = 15$$

**11.** The relationship is $y \cdot \sqrt{x} = k$.

When $x = 25$ and $y = 6$:

$$k = 6 \cdot \sqrt{25} = 6 \cdot 5 = 30$$

When $y = 5$:

$$5.\sqrt{x} = 30 \Rightarrow \sqrt{x} = \frac{30}{5} = 6 \Rightarrow x = 6^2 = 36$$

**12.** The number of machines is inversely proportional to the number of days. Let n be the required number of machines:

$$40 \cdot 60 = n \cdot 50$$

$$n = \frac{(40 \cdot 60)}{50} = 48$$

**13.** The number of horses is inversely proportional to the number of days. Let n be the number of horses needed:

$$45 \cdot 8 = n \cdot 20$$

$$n = \frac{45 \cdot 8}{20} = 18$$

Difference in horses:

$$45 - 18 = 27$$

27 fewer horses.

**14.** The total number of sweets distributed:

$$35 \cdot 6 = 210$$

If 5 children were absent, the sweets are distributed among 35 – 5=30 children. Each child receives:

$$\frac{210}{30} = 7 \text{ sweets}$$

Extra sweets per child:

$$7 - 6 = 1$$

Each child gets 1 extra sweet.

## Quick Check (Page 291)

**1.** Shyama can knit a sweater in 6 hours, so her rate of work is:

Rate of Shyama = $\frac{1}{6}$ sweater per hour.

Radha can knit a sweater in 8 hours, so her rate of work is:

Rate of Radha = $\frac{1}{8}$ sweater per hour.

The combined rate of Shyama and Radha working together:

Combined rate = $\frac{1}{6} + \frac{1}{8} = \frac{4}{24} + \frac{3}{24} = \frac{7}{24}$ sweaters per hour.

$$\text{Time} = \frac{1}{\text{Combined rate}} = \frac{1}{\frac{7}{24}} = \frac{24}{7} \text{ hours.}$$

$$\frac{24}{7} = 3\frac{3}{7} \text{ hours.}$$

**2.** P, Q, and R together complete the work in 4 days.

Total work = 1 unit per day × 4 days = 4 units.

The rate of P, Q, and R together is:

Rate of (P + Q + R) = $\frac{4}{4}$ = 1 unit per day.

P and Q complete the same work in 10 days. Their rate of work is:

Rate of (P + Q) = $\frac{4}{10}$ = 0.4 units per day.

Q and R complete the work in 5 days. Their rate of work is:

Rate of (Q + R) = $\frac{4}{5}$ = 0.8 units per day.

To find Q's rate of work, use the relation:

Rate of (P + Q + R) = Rate of (P + Q) + Rate of (Q + R) – Rate of Q.

Substitute the values:

$$1 = 0.4 + 0.8 - \text{Rate of Q.}$$

Rate of Q = 0.4 + 0.8 – 1 = 0.2 units per day.

Time taken by Q alone:

$$\text{Time} = \frac{\text{Total work}}{\text{Rate of Q}} = \frac{4}{0.2} = 20 \text{ day.} = 20 \text{ days.}$$

To find P + R's rate of work, use the relation:

Rate of (P + Q + R)

= Rate of (P + R) + Rate of Q.

Substitute the values:

1= Rate of (P + R) + 0.2.

Rate of (P + R) = 1 – 0.2 = 0.8 units per day.

Time taken by P + R together:

$$\text{Time} = \frac{\text{Total work}}{\text{Rate of (P + R)}} = \frac{4}{0.8} = 5 \text{ days.}$$

## Think and Answer (Page 292)

The inlet can fill the tank in 8 hours.

Rate of the inlet:

Rate of inlet = $\frac{1}{8}$ tanks per hour.

Due to the leakage, the tank is filled in 10 hours.

Net rate of filling:

Net rate = $\frac{1}{10}$ tanks per hour.

The leakage reduces the effective filling rate. Hence:

Rate of leakage = Rate of inlet – Net rate.

Substitute the values:

Rate of leakage = $\frac{1}{8} - \frac{1}{10}$.

Take the LCM of 8 and 10 (LCM = 40):

Rate of leakage = $\frac{10-8}{80} = \frac{2}{80} = \frac{1}{40}$ tanks per hour.

The rate of leakage is $\frac{1}{40}$ tanks per hour.

Now, find the time taken to empty the full tank:

$$\text{Time} = \frac{1}{\text{Rate of leakage}} = \frac{1}{\frac{1}{40}} = 40 \text{ hours}.$$

The leakage will empty the full tank in 40 hours.

## Practice Time 12C

1. Calculate individual rates of work

   Joseph's rate of work: $\frac{1}{6}$ fields per day.

   Peter's rate of work: $\frac{1}{12}$ fields per day.

   Combined rate of work

   Combined rate = $\frac{1}{6} + \frac{1}{12} = \frac{2}{12} + \frac{1}{12} = \frac{3}{12} = \frac{1}{4}$ fields per day.

   Time to complete the work together

   $$\text{Time} = \frac{1}{\text{Combined rate}} = \frac{1}{\frac{1}{4}} = 4 \text{ days}.$$

   They will weed the field in 4 days.

2. Calculate individual rates of work

   - Archana's rate: $\frac{1}{16}$ work per hour.
   - Chetna's time to finish the work: $\frac{16}{2} = 8$ hours.
   - Chetna's rate: $\frac{1}{8}$ work per hour.

   Combined rate of work

   Combined rate = $\frac{1}{16} + \frac{1}{8} = \frac{1}{16} + \frac{2}{16} = \frac{3}{16}$ work per hour.

   Work done in 2 hours

   Work done = Combined rate × Time

   $$= \frac{3}{16} \times 2 = \frac{6}{16} = \frac{3}{8}.$$

   They will finish $\frac{3}{8}$ of the work in 2 hours.

3. Calculate individual rates of work

   - Combined rate of A and B: $\frac{1}{15}$ work per day.
   - Rate of B: $\frac{1}{25}$ work per day.

   Rate of A alone

   Rate of A= Combined rate – Rate of B = $\frac{1}{15} - \frac{1}{25}$

   Take the LCM of 15 and 25 (LCM = 75):

   Rate of A = $\frac{5}{75} - \frac{3}{75} = \frac{2}{75}$ work per day

Time for A to complete the work

$$\text{Time for A} = \frac{1}{\text{Rate of A}} = \frac{1}{\frac{2}{75}} = 37.5 \text{ days}$$

A alone will finish the work in 37.5 days.

**4.** Time taken by X and Y to complete the work = 36 days

So, (X + Y)'s 1 day's work = $\frac{1}{36}$

Time taken by Y and Z to complete the work = 48 days

So, (Y + Z)'s 1 day's work = $\frac{1}{48}$

Time taken by X and Z to complete the work = 60 days

So, (X + Z)'s 1 day's work = $\frac{1}{60}$

Find (X + Y + Z)'s 1 day's work

$(X + Y) + (Y + Z) + (Z + X) = \frac{1}{36} + \frac{1}{48} + \frac{1}{60}$

So, 2(X + Y + Z)'s 1 day's work = $\frac{1}{36} + \frac{1}{48} + \frac{1}{60}$

$$(X + Y + Z) = \frac{47}{1440}$$

Now, find work done by X in 1 day = Work done by X, Y, and Z together in 1 day – work done by Y and Z in 1 day

$$= \frac{47}{1440} - \frac{1}{48} = \frac{47 - 30}{1440} = \frac{17}{1440}$$

Thus, X alone can complete the work in $\frac{1440}{17}$ days, i.e., $84\frac{12}{17}$ days.

Now, find work done by Y in 1 day = Work done by X, Y, and Z together in 1 day – work done by X and Z in 1 day

$$= \frac{47}{1440} - \frac{1}{60} = \frac{47 - 24}{1440} = \frac{23}{1440}$$

Thus, Y alone can complete the work in $\frac{1440}{23}$ days, i.e., $62\frac{14}{23}$ days.

Now, find work done by Z in 1 day = Work done by X, Y, and Z together in 1 day – work done by X and Y in 1 day

$$= \frac{47}{1440} - \frac{1}{36} = \frac{7}{1440} = \frac{7}{1440}$$

Thus, Z alone can complete the work in $\frac{1440}{7}$ days, i.e., $205\frac{5}{7}$ days.

**5.** Let the total time taken be $t$.

B works for $(t - 3)$ days, and A works for $t$ days.

Equation for total work

The total work is 1 unit:

Work by A + Work by B = 1.

$$\frac{t}{10} + \frac{t-3}{20} = 1$$

Solve for $t$

Take the LCM of 10 and 20 (LCM = 20):

$$\frac{2t}{20} + \frac{t-3}{20} = 1$$

$$\frac{2t + t - 3}{20} = 1$$

$3t - 3 = 20 \Rightarrow 3t = 23 \Rightarrow t = \frac{23}{3} \approx 7.67$ days.

The work will be completed in approximately 7.67 days or $\frac{23}{3}$ days.

**6.** Rate at which P fills the tank = $\frac{1}{15}$ tank/hour.

Rate at which Q fills the tank = $\frac{1}{18}$ tank/hour.

Rate at which R empties the tank = $\frac{1}{12}$ tank/hour.

When all three taps are on at the same time, the net rate is the sum of the rates of P and Q minus the rate of R (since R is emptying the tank).

Net rate = $\frac{1}{15} + \frac{1}{18} - \frac{1}{12}$

To simplify, find the LCM of 15, 18, and 12, which is 180.

$$\frac{1}{15} = \frac{12}{180}, \frac{1}{18} = \frac{10}{180}, \frac{1}{12} = \frac{15}{180}$$

$$\text{Net rate} = \frac{12}{180} + \frac{10}{180} - \frac{15}{180} = \frac{7}{180}$$

So, the rate at which the tank is filled is

$$\frac{7}{180} \text{ tank/hour.}$$

Now, to find the time taken to fill the tank:

$$\text{Time} = \frac{1 \text{ tank}}{\frac{7}{180} \text{tank/hour}} = \frac{180}{7} \approx 25.71 \text{ hours.}$$

Thus, it will take approximately 25.71 hours to fill the tank completely.

**7.** Speed of the train = 60 km/h.

Time to cross the pole = 9 seconds.

First, convert the speed into metres per second:

$$1 \text{ km/h} = \frac{1000}{3600} \text{ m/s},$$

$$60 \text{ km/h} = \frac{60 \times 1000}{3600} = 16.67 \text{ m/s}.$$

Now, use the formula Distance = Speed × Time:

Length of the train

$= 16.67 \text{ m/s} \times 9 \text{ seconds} \approx 150 \text{ m}.$

Thus, the length of the train is 150 metres.

**8.** Speed of the train = $72 \text{ km/h} = \frac{72 \times 1000}{3600}$

$= 20 \text{ m/s}.$

Length of the train = 300 metres.

(a) Time to pass an electric pole:

When the train passes a pole, it travels its own length.

$$\text{Time} = \frac{\text{Length of the train}}{\text{Speed}} = \frac{300 \text{ m}}{20 \text{ m/s}}$$

$= 15$ seconds.

So, it will take 15 seconds to pass the pole.

(*b*) Time to pass a platform 400 m long:

When the train passes the platform, it travels the sum of the lengths of the train and the platform:

Total distance = 300 m + 400 m = 700 m.

$$\text{Time} = \frac{700 \text{ m}}{20 \text{ m/s}} = 35 \text{ seconds.}$$

So, it will take 35 seconds to pass the platform.

**9.** Speed of the jogger = 9 km/h.

Speed of the train = 45 km/h.

Length of the train = 120 metres.

Distance between the jogger and the train's engine = 240 metres.

Relative speed between the train and the jogger (since they are moving in the same direction) is:

Relative speed = 45 km/h – 9 km/h = 36 km/h.

Convert relative speed to metres per second:

$$36 \text{ km/h} = \frac{36 \times 1000}{3600} = 10 \text{ m/s}.$$

Now, the total distance the train needs to cover to pass the jogger is the sum of the length of the train and the initial distance between the jogger and the train:

Total distance = 120 m + 240 m = 360 m.

Now, use the formula, $\text{Time} = \frac{\text{Distance}}{\text{Speed}}$ :

$$\text{Time} = \frac{360 \text{ m}}{10 \text{ m/s}} = 36 \text{ seconds.}$$

So, the train will pass the jogger in 36 seconds.

**10.** Speed of first train = 60 km/h.

Speed of second train = 90 km/h.

Length of the first train = 1.10 km = 1100 metres.

Length of the second train = 0.9 km = 900 metres.

When two trains are moving in opposite directions, their relative speed is the sum of their individual speeds:

Relative speed = 60 km/h + 90 km/h = 150 km/h.

Convert relative speed to metres per second:

$$150 \text{ km/h} = \frac{150 \times 1000}{3600} = 41.67 \text{ m/s}.$$

Now, the total distance covered when the two trains pass each other is the sum of their lengths:

Total distance=1100 m + 900 m = 2000 m.

Now, use the formula $\text{Time} = \frac{\text{Distance}}{\text{Speed}}$ :

$$\text{Time} = \frac{2000 \text{ m}}{41.67 \text{ m/s}} \approx 48 \text{ seconds}$$

So, it will take approximately 48 seconds for the two trains to cross each other.

## Mental Maths (Page 294)

**1.** (*a*) Check the ratio $\frac{y}{x}$:

$$\frac{2}{0.5}=4, \frac{8}{2}=4, \frac{32}{8}=4, \frac{128}{32}=4$$

Conclusion: $x$ and $y$ vary directly.

(*b*) Check the relation between $p$ and $q$:

No constant ratio or product; $p$ and $q$ vary neither directly nor inversely.

(*c*) Check the product $r \times s$:

$2 \cdot 25 = 50, 5 \cdot 10 = 50, 10 \cdot 5 = 50,$
$25 \cdot 2 = 50, 50 \cdot 0.5 = 25$

No constant ratio or product; $p$ and $q$ vary neither directly nor inversely.

(*d*) Check the product $u \times v$:

$2 \cdot 18 = 36, 4 \cdot 9 = 36, 6 \cdot 6 = 36, 9 \cdot 4 = 36,$
$12 \cdot 3 = 36$

Conclusion: $u$ and $v$ vary inversely.

**2.** Answer may vary

Given: $x = 10, y = 14$.

Ratio $k = \frac{y}{x} = \frac{14}{10} = 1.4$

Possible pairs:

- $x = 5, y = 7$
- $x = 20, y = 28$
- $x = 15, y = 21$.

**3.** Answer may vary

Given: $m = 8, n = 15$.

Product $k = m \times n = 8 \times 15 = 120$.

Possible pairs:

- $m = 10, n = 12$
- $m = 6, n = 20$
- $m = 12, n = 10$.

**4.** Speed = 48 km/h .

Convert 12 min = $\frac{12}{60}$ hour = 0.2 hour .

Distance = Speed × Time = 48 × 0.2 = 9.6 km.

**5.** Given: Distance = 36 km, Time = 3 km/h.

Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{36}{3}$ = 3 hours.

New Speed = 12 + 4 = 16 km/h.

New Time = $\frac{36}{12}$ = 2.25 hours

**6.** Area of 15 stamps = 60 cm$^2$.

Area of 1 stamp = $\frac{60}{15}$ = 4 cm$^2$.

Area of 120 stamps = 120 × 4 = 480 cm$^2$.

## BRAIN SIZZLERS (Page 295)

**1.** Given:

- 20 packets, each of 1.5 kg, cost ₹6000.
- Total weight = 20 × 1.5 = 30 kg.

  Cost per kg = $\frac{6000}{30}$ = ₹200 per kg .

Now, 15 packets, each of 3 kg, will weigh 15 × 3 = 45 kg .

Cost = 45 × 200 = ₹9000.

**2.** Let the speeds of the two trains be $v_1$ and $v_2$, and their lengths be $l_1$ and $l_2$.

Time taken to cross a man:

$$\frac{l_1}{v_1} = 27 \text{ seconds}, \frac{l_2}{v_2} = 17 \text{ seconds}$$

When crossing each other:

$$\frac{l_1 + l_1}{v_1 + v_2} = 23 \text{ seconds.}$$

From the above:

$$l_1 = 27v_1, l_2 = 17v_2.$$

Substitute in the equation for crossing each other:

$$\frac{27v_1 + 17v_2}{v_1 + v_2} = 23$$

Simplify:

$$27v_1 + 17v_2 = 23(v_1 + v_2)$$
$$\Rightarrow 27v_1 + 17v_1 = 23v_2 + 23v_2.$$

$$4v_1 = 6v_2 \Rightarrow \frac{v_1}{v_2} = \frac{3}{2}.$$

The ratio of their speeds is 3:2.

**3.** Given:

- Scale: 12 cm$^2$ in plan = 24 m$^2$ actual area .
- Actual side of the square room = 6 m .
- Actual area of the square room = $6^2$ = 36 m$^2$.

Conversion factor for the scale:

$$\frac{\text{Plan area}}{\text{Actual area}} = \frac{12}{24} = \frac{1}{2}$$

Plan area of the square room:

$$\frac{1}{2}\times 36 = 18\ \text{cm}^2$$

The area of the square room in the plan is 18 $\text{cm}^2$.

## Chapter Assessment

**A.**

**1.** $x$ and $y$ vary directly, so:

$$\frac{x_1}{y_1} = \frac{x_2}{y_2}$$

Substitute the values:

$$\frac{5}{60} = \frac{x}{108}$$

$$x = \frac{5\times 108}{60} = 9$$

**Answer:** (*d*) 9.

**2.** Inversely varying quantities satisfy $x \cdot y =$ constant.

(*a*) Speed and distance covered: **Direct variation**.

(*b*) Distance covered and taxi fare: **Direct variation**.

(*c*) Distance travelled and time taken: **Direct variation**.

(*d*) Speed and time taken: **Inverse variation**.

**Answer:** (*d*) Speed and time taken.

**3.** Cost of 2 dozen = 24 chocolates = ₹360.

Cost per chocolate = $\frac{360}{24}$ = ₹15.

Cost of 8 chocolates = 8 × 15 = ₹120.

**Answer:** (*a*) ₹120.

**4.** Given: 54 litres for 297 km .

Diesel per km = $\frac{54}{297}$ = 0.1818 litres per km.

Diesel for 550 km = 550 × 0.1818

= 99.99 litres ≈ 100 litres.

**Answer:** (*a*) 100 litres.

**5.** Distance = Speed × Time

= 48 km/h × 10 = 480 km.

To cover 480 km in 8 hours :

Required speed = $\frac{480}{8}$ = 60 km/h.

Increase in speed = 60 – 48 = 12 km/h.

**Answer:** (*a*) 12 km/h .

**6.** The relative speed of the two trains:

46 – 36 = 10 km/h = $\frac{10\times 1000}{3600} = \frac{25}{9}$ m/s

Time taken = 36 seconds . Let the length of each train = L.

$$\frac{2L}{\frac{25}{9}} = 36 \Rightarrow 2L = 36\times\frac{25}{9} = 100 \Rightarrow L = 50\ \text{m}$$

Answer: (*b*) 50 m.

**7.** Initially, 100 persons for 24 days.

Total provision = 100 × 24 = 2400 person – days.

If 20 persons leave, remaining persons = 80.

New duration = $\frac{2400}{80}$ = 30 days.

**Answer:** (*a*) 30 days.

**8.** Filling rate of Pipe A: $\frac{1}{10}$ tank/hour .

Emptying rate of Pipe B: $-\frac{1}{12}$ tank/hour .

Net filling rate:

$$\frac{1}{10}-\frac{1}{12} = \frac{6-5}{60} = \frac{1}{60}\ \text{tank/hour}$$

Time to fill = $\frac{1}{\frac{1}{60}}$ = 60 hours .

**Answer:** (*b*) 60 hours.

**B.**

**1.** If the number of goats decreases, the fodder will last longer. This is an inverse proportion. So, the assertion is false.

The number of goats and days fodder lasts show an inverse relation between the two quantities. So, the reason is correct.

Thus, the correct option is (*d*)

**2.** If 10 men can make a wall in 15 days, then 3 men can make the wall in 50 days.

So, the assertion is false.

Two quantities $x$ and $y$ are said to be in 'direct proportion' if they increase (or decrease) together so that the ratio of their corresponding values remains constant.

This reason is True.

Thus, the correct option is (*d*).

3. The perimeter of a square is 4 × side $= 4 \times 4.5$ cm
$= 18$ cm.

The area of a square is side × side
$= 4.5 \text{ cm} \times 4.5 \text{ cm} = 20.25$ sq. cm.

The area of a square is proportional to the square of its side, not directly proportional to its side.

Thus, the correct option is (*c*)

**C.**

1. 12 workers can build a wall in 24 days. One worker can build it in 288 days.

Total work (in worker – days) = 12 × 24 = 288.

2. If 18 pumps can empty a reservoir in 20 hours, then the time required by 45 such pumps to empty the same reservoir is 8 hours.

Total work (in pump – hours) = 18 × 20 = 360

For 45 pumps:

$$45 \times x = 360 \Rightarrow x = \frac{360}{45} = 8 \text{ hours.}$$

3. The circumference of a circle and its diameter vary directly with each other.

C = πd (Circumference is directly proportional to the diameter).

4. If the thickness of a pile of 12 cardboard sheets is 45 mm, then the thickness of a pile of 240 sheets is 900 mm.

Thickness per sheet $= \frac{45}{12} = 3.75$ mm.

For 240 sheets:

240 × 3.75 = 900 mm.

5. Devangi travels 50 m distance in 75 steps, then the distance travelled in 525 steps is 0.35 km.

Distance per step $= \frac{50}{75} = \frac{2}{3}$ m.

For 525 steps:

$$525 \times \frac{2}{3} = 350 \text{ m}$$

Converting to kilometres:

350 m = 0.35 km.

**D.**

1. False. Time and speed are inversely proportional:

Time $\propto \frac{1}{\text{Speed}}$.

2. False. Weight and cost are directly proportional.

3. False. For direct variation, $\frac{x}{y}$ must be constant.

4. True. The number of workers and the days are inversely proportional:

8 × 12 = 16 × 6.

5. True. Total distance to be covered = 400 + 600 = 1000 m .

Speed = 60 km/h = $60 \times \frac{1000}{3600} = 16.67$ m/s .

Time:

$$t = \frac{\text{Distance}}{\text{Speed}} = \frac{1000}{16.67} \approx 60 \text{ seconds}$$

**E.**

1. This is a direct proportion problem.

Number of boxes per carton $= \frac{560}{35}$
= 16 boxes/carton.

For 15 cartons:

15 × 16 = 240 boxes

2. This is a direct proportion problem.

Dust picked per day $= \frac{6.4 \times 10^7}{16} = 4 \times 10^6$ kg/day.

For 20 days:

$20 \times 4 \times 10^6 = 8 \times 10^7$ kg.

3. Convert 5.1 kg to grams:

5.1 kg = 5100 g.

Number of sheets for 5100 g:

$$\frac{5100 \times 24}{85} \approx 1440 \text{ Sheets}$$

4. Their work rates are:

Mayank's rate $= \frac{1}{21}$, Nishank's rate $= \frac{1}{28}$.

Combined rate:

$$\frac{1}{21} + \frac{1}{28} = \frac{4}{84} + \frac{3}{84} = \frac{7}{84} = \frac{1}{12}$$

Time taken together:

$$\frac{1}{\frac{1}{12}} = 12 \text{ days}$$

**5.** (*a*) Convert speed to m/s:

$$90 \text{ km/h} = 90 \times \frac{1000}{3600} = 25 \text{ m/s}$$

Time to pass the person:

$$t = \frac{\text{Length of train}}{\text{Speed}} = \frac{240}{25} = 9.6 \text{ seconds}$$

(*b*) Total distance to cover:

Length of train + Length of platform = 240 + 660 = 900 m.

Time to pass the platform:

$$t = \frac{900}{25} = 36 \text{ seconds}$$

**6.** Convert speed to m/s:

120 km/h = 120 × 1000/3600 = 33.33 m/s.

Time to travel 20 m: $\frac{20}{33.33} \approx 0.6$ seconds

**7.** (*a*) The lightest green shade will have the lowest ratio of green paint to the total paint.

Total paint = White paint + Green paint.

$$\text{Green ratio} = \frac{\text{Green paint}}{\text{Total paint}}.$$

| Mixture | White | Green | Total | Green Ratio |
|---|---|---|---|---|
| A | 3 | 3 | 6 | 0.5 |
| B | 3 | 4 | 7 | 0.57 |
| C | 4 | 3 | 7 | 0.43 |
| D | 5 | 2 | 7 | 0.29 |
| E | 2 | 5 | 7 | 0.71 |
| F | 1 | 6 | 7 | 0.86 |
| G | 5 | 1 | 6 | 0.17 |
| H | 2 | 4 | 6 | 0.67 |

Lightest green shade: Mixture G (Green Ratio = 0.17).

(*b*) Shade H is darker than Shade B, and A is lighter than Shade B. Since the Green Ratio of H > B > A.

(*c*) The darkest green shade is Mixture F (Green Ratio = 0.86).

In Mixture F:

- White paint = 1 container.
- Green paint = 6 containers.
- Total paint = 7 containers.

Proportion of white and green paint in Mixture F:

White proportion = $\frac{1}{7}$, Green proportion = $\frac{6}{7}$.

For 112 litres of paint:

White paint required = $\frac{1}{7} \times 112 = 16$ litres = 16 litres.

Green paint required = $\frac{6}{7} \times 112 = 96$ litres = 96 litres.

Hence, 16 containers of white paint and 96 containers of green paint are required to paint the building with the darkest green shade.

(*d*) Work is inversely proportional to the number of days.

Painters required

$$= \frac{\text{Current painters} \times \text{Current days}}{\text{Required days}}$$

$$= \frac{6 \times 30}{12} = 15$$

## MATHS CONNECT (Page 298)

Observation 1 alone is not sufficient because an increase in weight with volume does not guarantee direct proportionality (the ratio might not remain constant).

Observation 2 alone is sufficient because constant weight per cubic centimetre directly implies that the weight and volume are proportional.

Thus, the option (b) is correct.

# CHAPTER 13 : FACTORISATION

### Let's Recall

**1.** The sum of $3x^5 a$ and $-4x^5 a$ is:

$3x^5 a + (-4x^5 a) = (3-4)x^5 a = -x^5 a$

**2.** The product of $(4p^3 qr)$ and $(-7qr)$ is:

$(4p^3 qr)(-7qr) = 4 \times (-7) \times p^3 \times q^2 \times r^2$

$= -28p^3 q^2 r^2$

**3.** To find the value of $5x^3 - 4x^2 + \frac{1}{8}$ for $x = -\frac{1}{2}$:

Substitute $x = -\frac{1}{2}$ into the expression:

$$5\left(-\frac{1}{2}\right)^3 - 4\left(-\frac{1}{2}\right)^2 + \frac{1}{8}$$

Simplify:

$$5\left(-\frac{1}{8}\right)-4\times\left(\frac{1}{4}\right)+\frac{1}{8}=-\frac{5}{8}-1+\frac{1}{8}$$

$$=-\frac{5}{8}+\frac{1}{8}-1=-\frac{4}{8}-1=-\frac{1}{2}-1=-\frac{3}{2}$$

So, the value is $-\frac{3}{2}$.

**4.** To find the product of $(6a^2 – 7a – 3)$ and $(2a – 3)$, apply distributive property (FOIL):

$$(6a^2 – 7a – 3)(2a – 3)$$

Distribute each term:

$$6a^2 (2a – 3) – 7a(2a – 3) – 3(2a – 3)$$

Now multiply:

$= 6a^2 \times 2a – 6a^2 \times 3 – 7a \times 2a + 7a \times 3 – 3 \times 2a + 3 \times 3$

$= 12a^3 – 18a^2 – 14a^2 + 21a – 6a + 9$

$= 12a^3 – 32a^2 + 15a + 9$

So, the product is $12a^3 – 32a^2 + 15a + 9$.

## Quick Check (Page 300)

**1.** 48:

Divide 48 by the smallest prime number, 2.

$48 \div 2 = 24$

$24 \div 2 = 12$

$12 \div 2 = 6$

$6 \div 2 = 3$

$3 \div 3 = 1$

So, the prime factorisation of 48 is:

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

**2.** 96:

Divide 96 by the smallest prime number, 2.

$96 \div 2 = 48$

$48 \div 2 = 24$

$24 \div 2 = 12$

$12 \div 2 = 6$

$6 \div 2 = 3$

$3 \div 3 = 1$

So, the prime factorisation of 96 is:

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

## Quick Check (Page 301)

To factorise $14xy – 21yz$, first find the HCF of the terms.

$14xy = 2 \times 7 \times x \times y$

$21yz = 3 \times 7 \times y \times z$

HCF $= 7y$

Now, factor out, $7y$, from both terms:

$$14xy – 21yz = 7y(2x – 3z)$$

## Practice Time 13A

**1.** (*a*) $6a^4 + 12a^3 – 18a^2b$

Find the common factors in each term.

The HCF of $6a^4$, $12a^3$, and $– 18a^2 b$ is $6a^2$.

Factor out the common factor $6a^2$.

$6a^4 + 12a^3 – 18a^2 b = 6a^2 (a^2 + 2a – 3b)$

(*b*) $2mn^2 + 3m^2 n + 4n^3$

Find the common factors in each term.

The HCF of $2mn^2$, $3m^2 n$, and $4n^3$ is $n$.

Factor out the common factor $n$.

$2mn^2 + 3m^2 n + 4n^3 = n(2mn + 3m^2 + 4n^2)$

(*c*) $2a^2 b + 3b^2 c^2 + 6a^2 b^2 c^2$

Find the common factors in each term.

The HCF of $2a^2 b$,$3b^2 c^2$, and $6a^2 b^2 c^2$ is $b$.

Factor out the common factor $b$.

$2a^2 b + 3b^2 c^2 + 6a^2 b^2 c^2$

$= b(2a^2 + 3bc^2 + 6a^2 bc^2)$

**2.** (*a*) $45xy^2 – 54x^2y$

The HCF of $45xy^2$ and $54x^2 y$ is $9xy$.

Factor out the common factor $9xy$.

$45xy^2 – 54x^2 y = 9xy(5y – 6x)$

(*b*) $38u^3 – 19u$

The HCF of $38u^3$ and $– 19u$ is $19u$.

Factor out the common factor $19u$.

$38u^3 – 19u = 19u(2u^2 – 1)$

(*c*) $– 3x^2 + 3xy + 3xz$

The HCF of $– 3x^2$,$3xy$, and $3xz$ is $– 3x$.

Factor out the common factor $– 3x$.

$– 3x^2 + 3xy + 3xz = – 3x(x – y – z)$

(*d*) $33l^2mn – 44m^2n + 55mn^2$

The HCF of $33l^2 mn$, $– 44m^2 n$, and $55mn^2$ is $11mn$.

Factor out the common factor mn.

$33l^2 mn – 44m^2 n + 55mn^2$

$= 11mn(3l^2 – 4m + 5n)$

(*e*) $2x(x-y)+3y(x-y)+5(y-x)$

Notice that $(y-x)=-(x-y)$.

So, the expression becomes:

$2x(x-y)+3y(x-y)-5(x-y)$

Factor out the common factor $(x-y)$.

$=(x-y)(2x+3y-5)$

(*f*) $-5(x-3y)^2+15(x-3y)$

The common factor is $-5(x-3y)$.

Factor out the common factor $-5(x-3y)$.

$-5(x-3y)^2+15(x-3y)$

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

(*g*) $4(a+b)(3x-y)+6(a+b)(2y-3x)$

The common factor is $(a+b)$.

Factor out the common factor $(a+b)$.

$4(a+b)(3x-y)+6(a+b)(2y-3x)$

$=(a+b)[4(3x-y)+6(2y-3x)]$

Simplify inside the brackets.

$=(a+b)[12x-4y+12y-18x]$

$=-2(a+b)(3x-4y)$

**3.** (*a*) $2st-3-6s+t$

Group terms into pairs.

$(2st-6s)+(t-3)$

Factor out common factors from each pair.

$2s(t-3)+1(t-3)$

Factor out the common factor $(t-3)$.

$(2s+1)(t-3)$

(*b*) $3axy^2+15x+5ay^2+25$

Group terms into pairs.

$(3axy^2+5ay^2)+(15x+25)$

Factor out common factors from each pair.

$ay^2(3x+5)+5(3x+5)$

Factor out the common factor $(3x+5)$.

$(ay^2+5)(3x+5)$

(*c*) $1+p+pq+p^2q$

Group terms into pairs.

$(1+p)+(pq+p^2q)$

Factor out common factors from each pair.

$1(1+p)+pq(1+p)$

Factor out the common factor $(1+p)$.

$(1+p)(1+pq)$

(*d*) $xy-x-y+1$

Group terms into pairs.

$(xy-x)-(y-1)$

Factor out common factors from each pair.

$x(y-1)-1(y-1)$

Factor out the common factor $(y-1)$.

$(x-1)(y-1)$

(*e*) $x^2-2ax-2ab+bx$

Group terms into pairs.

$(x^2-2ax)+(-2ab+bx)$

Factor out common factors from each pair.

$x(x-2a)+b(x-2a)$

Factor out the common factor $(x-2a)$.

$(x+b)(x-2a)$

(*f*) $26x^2y^2+4x^2y+13x^3y^3+8x$

Group terms into pairs.

$(26x^2y^2+13x^3y^3)+(4x^2y+8x)$

Factor out common factors from each pair.

$13x^2y^2(2+xy)+4x(2+xy)$

Factor out the common factor $(2+xy)$.

$(13x^2y^2+4x)(2+xy)$

## Quick Check (Page 302)

**1.** $100-49p^2=$

This expression can be simplified using the identity

$x^2-y^2=(x-y)(x+y)$.

Here, $49p^2=(7p)^2$ and $100=(10)^2$, so the expression becomes:

$100-(7p)^2=(10-7p)(10+7p)$

**2.** $(105)^2-(95)^2=$

Using the difference of squares formula,

$x^2-y^2=(x-y)(x+y)$,

let $x=105$ and $y=95$, then:

$(105)^2-(95)^2=(105-95)(105+95)$

$=(10)(200)=2000$

Therefore, the answer is 2000.

## Practice Time 13B

**1.** (*a*) $x^2+6x+9$

To solve the given expression we use the identity: $x^2+2xy+y^2=(x+y)^2$

Here, $x=x$ and $y=3$.

So, $x^2+6x+9=(x+3)^2$

$=(x+3)(x+3)$

(*d*) $49m^2+84mn+36n^2$

To solve the given expression we use the identity: $x^2+2xy+y^2=(x+y)^2$

Here, $x=7m$ and $y=6n$.

So, $49m^2 + 84mn + 36n^2 = (7m + 6n)^2$
$= (7m+6n)(7m+6n)$

(*g*) $9y^2 - 4xy + \frac{4x^2}{9}$

To solve the given expression we use the identity: $x^2 - 2xy + y^2 = (x - y)^2$

Here, $x = 3y$ and $y = \frac{2x}{3}$.

So, $9y^2 - 4xy + \frac{4x^2}{9} = \left(3y - \frac{2x}{3}\right)^2$

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

**Note:** Similarly solve the rest of the parts according to the parts (*a*), (*d*) and (*g*).

**2.** (*a*) $25x^2 - 81y^2$

This is a difference of squares. The identity used is: $x^2 - y^2 = (x - y)(x + y)$

Here, $a = 5x$ and $b = 9y$.

So, $25x^2 - 81y^2 = (5x - 9y)(5x + 9y)$

(*c*) $\frac{x^2}{64} - \frac{y^2}{49}$

This is a difference of squares. The identity used is: $x^2 - y^2 = (x - y)(x + y)$

Here, $a = \frac{x}{8}$ and $b = \frac{y}{7}$.

So, $\frac{x^2}{64} - \frac{y^2}{49} = \left(\frac{x}{8} - \frac{y}{7}\right)\left(\frac{x}{8} + \frac{y}{7}\right)$

(*d*) $(5a - b)^2 - 16c^2$

This is a difference of squares. The identity used is: $x^2 - y^2 = (x - y)(x + y)$

Here, $x = (5a - b)$ and $x = 4c$.

So, $(5a - b)^2 - 16c^2 = (5a - b - 4c)(5a - b + 4c)$

(*g*) $\frac{a^2b^2}{36} - \frac{16b^2c^2}{49}$

This is a difference of squares. The identity used is: $x^2 - y^2 = (x - y)(x + y)$

Here, $x = \frac{ab}{6}$ and $y = \frac{4ab}{7}$.

So, $\frac{a^2b^2}{36} - \frac{16b^2c^2}{49} = \left(\frac{ab}{6} - \frac{4bc}{7}\right)\left(\frac{ab}{6} + \frac{4bc}{7}\right)$

**Note:** Similarly solve the rest of the parts according to the parts (*a*), (*c*), (*d*) and (*g*).

**3.** (*a*) $x^2 + 9x + 20$

To factor, find two numbers that multiply to 20 and add to 9. These numbers are 4 and 5.

We split the middle term $9x$ into $4x + 5x$.

So, $x^2 + 9x + 20 = x^2 + 4x + 5x + 20$
$= x(x + 4) + 5(x + 4)$
$= (x + 4)(x + 5)$

(*c*) $y^2 + 4y - 21$

To factor, find two numbers that multiply to $-21$ and add to 4. These numbers are 7 and $-3$.

We split the middle term $4y$ into $7y - 3y$.

So, $y^2 + 4y - 21 = y^2 + 7y - 3y - 21$
$= y(y + 7) - 3(y + 7)$
$= (y - 3)(y + 7)$

(*d*) $12x^2 - 29x + 15$

To factor, find two numbers that multiply to $12 \times 15 = 180$ and add to $-29$. These numbers are $-20$ and $-9$.

We split the middle term $-29x$ into $-20x - 9x$.

So, $12x^2 - 29x + 15 = 12x^2 - 20x - 9x + 15$
$= 4x(3x - 5) - 3(3x - 5)$
$= (3x - 5)(4x - 3)$

**Note:** Similarly solve the rest of the parts according to the parts (*a*), (*c*) and (*d*).

## Practice Time 13C

**1.** (*a*) $\frac{27x^3}{54x}$

Factor the numerator and denominator then simplify:

$$\frac{27x^3}{54x} = \frac{\cancel{9} \cdot \cancel{3} \cdot \cancel{x} \cdot x \cdot x}{2 \cdot \cancel{3} \cdot \cancel{9} \cdot \cancel{x}} = \frac{x^2}{2}$$

(*b*) $\frac{30m^3n^4}{6mn}$

Factor the numerator and denominator then simplify:

$$\frac{30m^3n^4}{6mn} = \frac{\cancel{6} \cdot 5 \cdot \cancel{m} \cdot m \cdot m \cdot \cancel{n} \cdot n \cdot n \cdot n}{\cancel{6} \cdot \cancel{m} \cdot \cancel{n}}$$

$$= 5m^2m^3$$

(*c*) $\dfrac{9x^3y^3z^3}{xy^2z}$

Factor the numerator and denominator:

$$\frac{9x^3y^3z^3}{xy^2z} = \frac{9\cdot x^3\cdot y^3\cdot z^3}{x\cdot y^2\cdot z}$$

Now cancel the common factors of $x$, $y^2$, and $z$:

$$= 9x^2yz^2$$

(*d*) $\dfrac{17ab^2c^3}{-abc^2}$

Factor the numerator and denominator:

$$\frac{17ab^2c^3}{-abc^2} = \frac{17\cdot a\cdot b^2\cdot c^3}{-a\cdot b\cdot c^2}$$

Now cancel the common factors of $a$, $b$, and $c^2$:

$$= -17bc$$

**2.** (*a*) $\dfrac{10a^3+25a^2+20a}{5a}$

Factor out $5a$ from the numerator:

$$\frac{10a^3+25a^2+20a}{5a} = \frac{5a(2a^2+5a+4)}{5a}$$

Now cancel the common factor of 5a:

$$= 2a^2 + 5a + 4$$

(*b*) $\dfrac{-21x^3-7x^2-14x+35}{-7x}$

Factor out – 7 from the numerator:

$$\frac{-21x^3-7x^2-14x+35}{-7x}$$

$$= \frac{-7(3x^3+x^2+2x-5)}{-7x}$$

Now cancel the common factor of – 7:

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

**3.** (*a*) $(9x + 33)$ by $(3x + 11)$

Factor the numerator:

$$9x + 33 = 3(3x + 11)$$

Now divide:

$$\frac{9x+33}{3x+11} = \frac{3(3x+11)}{3x+11} = 3$$

(*b*) $(6x^2 + 12x)$ by $(x + 2)$

Factor the numerator:

$$6x^2 + 12x = 6x(x + 2)$$

Now divide:

$$\frac{6x^2+12x}{x+2} = \frac{6x(x+2)}{x+2} = 6x$$

(*c*) $76ab(a + 5)(b – 4)$ by $38a(b – 4)$

Cancel common factors:

$$\frac{76ab(a+5)(b-4)}{38a(b-4)} = \frac{76}{38}\cdot\frac{ab}{a}\cdot(a+5)$$

$$= 2b(a + 5)$$

(*d*) $3p(p + 1)(p + 2)(p + 3) \div p(p + 2)$

Cancel common factors:

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

**4.** (*a*) $(x^2 – 5x + 6) \div (x – 3)$

Factor the numerator:

$$x^2 – 5x + 6 = (x – 3)(x – 2)$$

Now divide:

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

(*b*) $2(9x^2 – 16y^2) \div (3x + 4y)$

Factor the numerator (difference of squares):

$$9x^2 – 16y^2 = (3x – 4y)(3x + 4y)$$

Thus:

$$2(9x^2 – 16y^2) = 2(3x – 4y)(3x + 4y)$$

Now divide:

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

(*c*) $52y^3(25y^2 – 49) \div 26y^2(5y + 7)$

Factor the numerator (difference of squares):

$$25y^2 – 49 = (5y – 7)(5y + 7)$$

Thus:

$$52y^3(25y^2 – 49) = 52y^3(5y – 7)(5y + 7)$$

Now divide:

$$\frac{52y^3(25y^2-49)}{26y^2(5y+7)} = \frac{52}{26}\cdot\frac{y^3}{y^2}\cdot\frac{(5y-7)(5y+7)}{(5y+7)}$$

$$= 2y(5y – 7)$$

(*d*) $(3x^4 – 1875) \div (3x^2 – 75)$

Factor the numerator (difference of squares):

$$3x^4 – 1875 = 3(x^4 – 625)$$
$$= 3(x^2 – 25)(x^2 + 25)$$
$$= 3(x – 5)(x + 5)(x^2 + 25)$$

Factor the denominator:

$$3x^2 – 75 = 3(x^2 – 25) = 3(x – 5)(x + 5)$$

Now divide:

$$\frac{3x^4 - 1875}{3x^2 - 75} = \frac{3(x-5)(x+5)(x^2+25)}{3(x-5)(x+5)}$$

$$= x^2 + 25$$

(*e*) $24x^3 - 8x^2 + 12x - 4$ by $2x^2 + 1$

Group the terms of $24x^3 - 8x^2 + 12x - 4$

$24x^3 - 8x^2 + 12x - 4 = (24x^3 - 8x^2) + (12x - 4)$

Factorise each group and factor out the common terms from each group:

$8x^2(3x - 1) + 4(3x - 1)$

Now factor out the common binomial $(3x - 1)$:

$$= (3x - 1)(8x^2 + 4)$$

Now, divide by $2x^2 + 1$

$$\frac{(3x-1)(8x^2+4)}{2x^2+1}$$

Notice that $8x^2 + 4$ can be factored further:

$$8x^2 + 4 = 4(2x^2 + 1)$$

Now divide:

$$\frac{(3x-1)(4)(2x^2+1)}{2x^2+1} = 4(3x - 1)$$

$$= 12x - 4$$

**5.** We know that the area of a square is the square of its side.

The given expression is:

$$4x^2 + 12xy + 9y^2$$

This is a perfect square trinomial because:

$$4x^2 = (2x)^2,\ 9y^2 = (3y)^2,\ 12xy = 2 \cdot (2x) \cdot (3y)$$

Thus, we can write:

$$4x^2 + 12xy + 9y^2 = (2x + 3y)^2$$

Now, identify the side of the square.

The side of the square is: $2x + 3y$

**6.** Given Problems:

- $P_1$: $2x(2x - 5) = 4x^2 - 25$
- $P_2$: $\frac{5x+3}{3} = 5x$
- $P_3$: $\frac{x^2-9}{x-3} = x + 3$

Correct Solutions for Each Problem:

P1: Expand $2x(2x - 5)$:

$$2x(2x - 5) = 4x^2 - 10x$$

Compare this with $4x^2 - 25$.

This is incorrect. The correct expression is:

$$2x(2x - 5) = 4x^2 - 10x$$

$P_2$: $\frac{5x+3}{3} = 5x$

This is incorrect.

$P_3$: Simplify the left side:

$$\frac{x^2-9}{x-3} = \frac{(x-3)(x+3)}{(x-3)} = (x + 3)$$

Compare this with $(x + 3)$.

This is correct.

(*a*) All three houses answered $P_1$ incorrectly.

(*b*) The correct expression of $P_1$ is:

$$2x(2x - 5) = 4x^2 - 10x$$

(*c*) The red house replied $P_2$ incorrectly.

(*d*) The blue house answered $P_3$ correctly.

## Brain Sizzlers (Page 306)

The area of the square is given as $9t^2 + 4 + 12t$

Rearrange the terms:

$$9t^2 + 12t + 4$$

This is a perfect square trinomial:

$$(3t + 2)^2$$

Thus, the side length of the square is:

$$3t + 2$$

So, we can say the breadth of the rectangle is

$$3t + 2.$$

The length of the rectangle is increased by 3 m compared to the side length of the square:

$$\text{Length} = (3t + 2) + 3$$
$$= 3t + 5$$

Now, the area of the rectangle is:

$$\text{Area} = \text{Length} \times \text{Breadth}$$

Substitute the values:

$$\text{Area} = (3t + 5)(3t + 2)$$

Expand using the distributive property:

$$\text{Area} = 9t^2 + 6t + 15t + 10$$
$$= 9t^2 + 21t + 10$$

## Mental Maths (Page 307)

1. $x^2 + x - 72$

   Split the middle term:

   $$x^2 + 9x - 8x - 72$$

   Group terms:

   $$(x^2 + 9x) - (8x + 72)$$

   Factorise:

   $$x(x + 9) - 8(x + 9) = (x - 8)(x + 9)$$

   **Match:** 1 → $(x + 9)(x - 8)$ $(d)$

2. $2x^2 - 3x - 9$

   Split the middle term:

   $$2x^2 - 6x + 3x - 9$$

   Group terms:

   $$(2x^2 - 6x) + (3x - 9)$$

   Factorise:

   $$2x(x - 3) + 3(x - 3) = (2x + 3)(x - 3)$$

   **Match:** 2 → $(x - 3)(2x + 3)$ $(a)$

3. $7x^2 + 35x + 42$

   Factor out 7:

   $$7(x^2 + 5x + 6)$$

   Factorise $x^2 + 5x + 6$:

   $$7(x^2 + 3x + 2x + 6) = 7(x + 2)(x + 3)$$

   **Match:** 3 → $7(x + 2)(x + 3)$ $(e)$

4. $3x^2 + 14x + 8$

   Split the middle term:

   $$3x^2 + 12x + 2x + 8$$

   Group terms:

   $$(3x^2 + 12x) + (2x + 8)$$

   Factorise:

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

   **Match:** 4 → $(x + 4)(3x + 2)$ $(b)$

5. $14x^2 + 11xy - 15y^2$

   Split the middle term:

   $$14x^2 + 21xy - 10xy - 15y^2$$

   Group terms:

   $$(14x^2 + 21xy) - (10xy + 15y^2)$$

   Factorise:

   $$7x(2x + 3y) - 5y(2x + 3y) = (2x + 3y)(7x - 5y)$$

   **Match:** 5 → $(2x + 3y)(7x - 5y)$ (c)

## Chapter Assessment

**A.**

1. The factors of $x^2 - 9$ are $(x + 3)(x - 3)$. Here we are using the property $(x^2 - y^2) = (x - y)(x + y)$.
   So, the correct option is $(b)$.
2. The expression $(x - y)^2 - z^2$ is equal to $(x - y - z)(x - y + z)$ by using the property, $(x^2 - y^2) = (x - y)(x + y)$.
   So, the correct option is $(b)$.
3. Factor both the terms and divide the common factor.

   $$\frac{-32x^2y}{-8xy} = \frac{\cancel{-2}\cdot\cancel{2}\cdot\cancel{2}\cdot 2\cdot 2\cdot\cancel{x}\cdot x\cdot\cancel{y}}{\cancel{-2}\cdot\cancel{2}\cdot\cancel{2}\cdot\cancel{x}\cdot\cancel{y}} = 4x$$

   So, the correct option is $(d)$.
4. Group the terms.

   $$(23xy - 46x) + (54y - 108)$$

   Take out the common factor.

   $23x(y - 2) + 54(y - 2) = (y - 2)(23x + 54)$

   So, the correct option is $(a)$.
5. To check if an option is a factor, divide $-51st^2$ by each option and see if the result is an integer expression.

   $(a)$ $-51st^2$: Clearly, it is a factor of itself.

   $(b)$ $-3st$: $\dfrac{51st^2}{-3st} = 17t$, which is valid.

   $(c)$ $7t$: $\dfrac{-51st^2}{-7t} = \dfrac{51st}{7}$, which is not an integer expression. So, $7t$ is not a factor.

   $(d)$ $-17st$: $\dfrac{-51st^2}{-17st} = 3t$, which is valid.

   So, the correct option is $(c)$.
6. Rearrange the terms to group them conveniently:

   $$ab - bc + ad - cd = (ab - bc) + (ad - cd)$$

   Factorise:

   $$ab - bc = b(a - c),\ ad - cd = d(a - c)$$

   Combine:

   $$b(a - c) + d(a - c) = (a - c)(b + d)$$

   So, the correct option is $(b)$.
7. Find two numbers whose product is $-16$ and sum is 6: These numbers are 8 and $-2$.

   $m^2 + 6m - 16 = m^2 + 8m - 2m - 16 = (m + 8)(m - 2)$

   So, the correct option is $(a)$.

**8.** Rearrange:

$$1 - 2mn - m^2 - n^2 = 1 - m^2 - n^2 - 2mn$$
$$= 1 - (m^2 + n^2 + 2mn)$$
$$= 1 - (m + n)^2$$

Recognise it as the expansion of:

$$(1 - m - n)(1 + m + n)$$

So, the correct option is (*a*).

**B.**

**1. Verification of Assertion:**

$$\frac{15a^3 + 5a^2 + 10a}{-5a} = \frac{15a^3}{-5a} + \frac{5a^2}{-5a} + \frac{10a}{-5a}$$
$$= -3a^2 - a - 2$$

Assertion (A) is **true**.

**Verification of Reason:**

The quotient's sign depends on the sign of the dividend and divisor. When the dividend and divisor have opposite signs, the quotient is negative. This is true, and it explains why the quotient is negative.

So, the correct option is (*a*).

**2. Verification of Assertion:**

Expand $(2x + 3y)^2 - 12xy$

$$(2x + 3y)^2 - 12xy = 4x^2 + 9y^2 + 12xy - 12xy$$
$$= 4x^2 + 9y^2$$

Assertion (A) is **true**.

**Verification of Reason:**

Although factorisation using $a^2 - b^2$ is valid for the difference of squares, it is not used in this scenario. Here, we directly expanded the square and simplified terms. The reason does not explain the assertion.

So, the correct option is (*b*).

**3. Verification of Assertion:**

The prime factors of $4x^3 y$ are $4 \cdot x^3 \cdot y$, and for $16x^2 y^3$, they are $16 \cdot x^2 \cdot y^3$. The common factors are:

$$4x^2 y$$

Assertion (A) is **true**.

**Verification of Reason:**

The reason describes what a common factor is, and this aligns with the explanation of how the common factor was determined.

So, the correct option is (*a*).

**4. Verification of Assertion:**

Expand $a(2b - 5c)^2$

$$a[(2b)^2 - 2(2b)(5c) + (5c)^2]$$
$$= a[4b^2 - 20bc + 25c^2]$$
$$= 4b^2 a + 25ac^2 - 10abc$$

The given assertion $4b^2$ a + $25ac^2$ + 10abc is **incorrect** because the sign of 10abc is wrong. Hence, Assertion (A) is **false**.

**Verification of Reason:**

The formula $(x - y)^2 = x^2 - 2xy + y^2$ is **true**.

So, the correct option is (d).

**C.**

1. The representation of an expression as the product of its factors is called factorisation.
2. Factorised form of $4m^2 - 12m + 9$ *is* $(2m - 3)^2$.
3. Area of a rectangular plot with sides $5p^2$ and $6q^2$ is $30p^2q^2$.
4. The factors of $3x^2 + 22x + 35$ are $(x + 5)$ and $(3x + 7)$.
5. On simplification, $\frac{7x+21}{7} = x + 3$.

**D.**

**1.** The value of $(a + 1)(a - 1)(a^2 + 1)$ is $a^4 - 1$.

**True**.

Explanation: $(a + 1)(a - 1) = a^2 - 1$, *and* $(a^2 - 1)(a^2 + 1) = a^4 - 1$.

**2.** $y^2 + (a + b)y + ab = (a + b)(y + ab)$.

**False**.

Explanation: Correct factorisation is $(y + a)(y + b)$.

**3.** Common factor of $12pq^2$, $144p^2q^2$, and $1728p^2q$ is $12p^2q^2$.

**False**.

Explanation: The actual common factor is $12pq$.

**4.** Factorised form of $u^2 + 30u + 216$ is $(u + 18)(u + 12)$.

**True**.

Explanation: $18 \times 12 = 216$ and $18 + 12 = 30$.

**5.** To factorise an algebraic expression of the form $ax^2 + bx + c$, we split $b$ into two parts whose sum $= c$ and product $= ac$.

**False**.

Explanation: when we split $b$ into two parts, sum $= b$ and product $= ac$.

**E.**

**1.** (*a*) $-5a^2 + 5ab - 5ca$

Factor out $-5a$:

$$-5a(a - b + c)$$

(b) $24(3x - 4y)^2 - 18(4y - 3x)$

Rewrite, $4y - 3x = -(3x - 4y)$:

$$24(3x - 4y)^2 - 18(-(3x - 4y))$$

Factor out $6(3x - 4y)$:

$$6(3x - 4y)(4(3x - 4y) + 3)$$

Simplify:

$$6(3x - 4y)(12x - 16y + 3)$$

(*c*) $63p^2q^2r^2s - 9pq^2r^2s^2 + 15p^2qr^2s^2 - 60p^2q^2rs^2$

Factor out $3pqrs$:

$= 3pqrs(21pqr - 3qrs + 5prs - 20pqs)$

(*d*) $2ax^2 + 4axy + 3bx^2 + 2ay^2 + 6bxy + 3by^2$

Group terms:

$= (2ax^2 + 4axy + 2ay^2) + (3bx^2 + 6bxy + 3by^2)$

Factor each group:

$= 2a(x^2 + 2xy + y^2) + 3b(x^2 + 2xy + y^2)$

$2a(x + y)^2 + 3b(x + y)^2$

Factor out $(x + y)^2$:

$= (2a + 3b)(x + y)^2$

$= (2a + 3b)(x + y)(x + y)$

**2.** (*a*) $\dfrac{6.25\times6.25-1.75\times1.75}{4.5}$

Use the identity $a^2 - b^2 = (a - b)(a + b)$:

$$\frac{(6.25-1.75)(6.25+1.75)}{4.5} = \frac{4.5\times8}{4.5} = 8$$

(*b*) $\dfrac{198\times198-102\times102}{96}$

Use the identity $a^2 - b^2 = (a - b)(a + b)$:

$$\frac{(198\times198)-(102\times102)}{96} = \frac{96\times300}{96} = 300$$

**3.** (*a*) $44(x^3 - 2x^2 - 15x)$ by $11x(x - 5)$

Factorise the numerator:

$44x(x^2 - 2x - 15) = 44x(x - 5)(x + 3)$

Divide by $11x(x - 5)$:

$$\frac{44x(x-5)(x+3)}{11x(x-5)} = 4(x+3)$$

(*b*) $51x^3(98x^2 - 32)$ by $34x^2\,(7x + 4)$

Factorise the numerator:

$51x^3\,2\,(98x^2 - 32) = 102x^3\,(7x + 4)(7x - 4)$

Divide by $34x^2\,(7x + 4)$:

$$\frac{102x^3(7x+4)(7x-4)}{34x^2\ (7x+4)} = \frac{102x(7x-4)}{34}$$

$$= \frac{102}{34}x(7x-4)$$

Simplify the coefficient:

$$\frac{102}{34} = 3$$

So, the polynomial is $3x(7x - 4)$.

**4.** (*a*) $p$ if $p(q - r) = \dfrac{16q^2-16r^2}{q+r}$

Simplify the right side using $a^2 - b^2 = (a - b)(a + b)$:

$$\frac{16q^2-16r^2}{q+r} = 16(q-r)$$

Equating $p(q - r) = 16(q - r)$

$$p = 16$$

(*b*) $16y^2 + \dfrac{1}{16y^2}$, *if* $4y - \dfrac{1}{4y} = 7$

Let $x = 4y$. Then, $x - \dfrac{1}{x} = 7$.

Square both sides:

$$x^2 - 2 + \frac{1}{x^2} = 49$$

$$x^2 + \frac{1}{x^2} = 51$$

Substitute $x^2 = 16y^2$

$$16y^2 + \frac{1}{16y^2} = 51$$

**5.** To simplify this apply the formula,

$$a^2 - b^2 = (a - b)(a + b)$$

$(0.6x + 0.5y)^2 - (0.6x - 0.5y)^2$

$= (0.6x + 0.5y - 0.6x + 0.5y)$

$(0.6x + 0.5y + 0.6x - 0.5y)$

$= (1y)(1.2x)$

$= 1.2\,xy$

6. Use the identity $x^2 - y^2 = (x + y)(x - y)$

$$x^2 - y^2 = (20)(13) = 260$$

7. The number of floors is given by:

Number of floors

$$= \frac{\text{Total height}}{\text{Height of each floor}} = \frac{5a^2 + 70a - 160}{a - 2}$$

Factorise the numerator:

$$5a^2 + 70a - 160 = 5(a^2 + 14a - 32)$$
$$= 5(a - 2)(a + 16)$$

Divide by $a - 2$:

$$\frac{5(a-2)(a+16)}{a-2} = 5(a+16)$$

Simplify:

$$5a + 80$$

8. The formula for CSA of a cylinder is:

$$\text{CSA} = 2\pi rh$$

Given:

$$2\pi(y^2 - 7y + 12) = 2\pi(y - 3)h$$

Cancel $2\pi$:

$$y^2 - 7y + 12 = (y - 3)h$$

Factorise $y^2 - 7y + 12$:

$$y^2 - 7y + 12 = (y - 3)(y - 4)$$

Substitute:

$$(y - 3)(y - 4) = (y - 3)h$$

Cancel $y - 3$ (assuming $y \neq 3$):

$$y - 4 = h$$

9. Total cost of chocolates $= (x + y)(x + y) = ₹(x + y)^2$

Substitute $x = 10$ and $y = 5$:

$$(x + y)^2 = (10 + 5)^2 = 15^2 = 225$$

10. The formula for the area of a square is:

$$\text{Area} = (\text{side})^2$$

Given:

$$(4x + 6)^2 = 676$$

Take the square root of both sides:

$$4x + 6 = \pm 26$$

Solve for $x$:

1. $4x + 6 = 26$:

$$4x = 20 \Rightarrow x = 5$$

2. $4x + 6 = -26$ (not valid since side length cannot be negative).

So, the side length is 26 units and $x = 5$.

## UNIT TEST – 4

**A.**

1. Simplify the expression:

$(4 - 1)^0 = 1$, so $2(4 - 1)^0 = 2$.

The multiplicative inverse of 2 is $\frac{1}{2}$.

So, the correct option is ($c$).

2. The value of $\frac{1}{2^{-2}}$ is:

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

So, $$\frac{1}{2^{-2}} = \frac{1}{\frac{1}{4}} = 4$$

So, the correct option is ($b$).

3. If $x$ and $y$ vary inversely and $x = 5$, $y = 60$, then find $x$ when $y = 12$:

$$x \times y = k.$$

So, $$5 \times 60 = 300.$$

When $y = 12$, $x = \frac{300}{12} = 25$

So, the correct option is ($b$).

4. The petrol required to cover 550 km, if 54 litres is needed for 297 km:

Petrol required per km: $\frac{54}{297} = 0.1818$ litres/km.

For 550 km: $550 \times 0.1818 = 99.99 \approx 100$ litres.

So, the correct option is ($a$).

5. The distance between Earth and the Sun, 149 million km, in standard form:

149 million $= 149 \times 10^6 = 1.49 \times 10^8$.

So, the correct option is ($a$).

6. If $x$ is any non –zero integer, $m$ is positive, and $n$ is negative, then $x^m \times x^n$:

$$x^m \times x^n = x^{(m+n)}$$

So, the correct option is ($a$).

7. The factorised form of $x^2 - 17x - 38$:

Find two numbers whose product is –38 and sum is –17: –19 and 2.

Factorised form: $(x - 19)(x + 2)$.

So, the correct option is ($b$).

**8.** The value of $(x + y)^2 - (x - y)^2$:
Using the formula $a^2 - b^2 = (a - b)(a + b)$:
$(x + y)^2 - (x - y)^2$
$= [(x + y) - (x - y)][(x + y) + (x - y)]$
$= (2y)(2x) = 4xy$
So, the correct option is (*c*).

**9.** The total amount of work can be expressed as Work = Men × Days.
For 15 men: 15 × 25 = 375 units of work.
For 3 men: Days = $\frac{\text{Work}}{\text{Men}} = \frac{375}{3}$ = 125 days.
The assertion is incorrect as 3 men will take 125 days, not 45 days.
**Reason (R):** Two quantities *x* and *y* are said to be in direct proportion if they increase (or decrease) together in such a manner that the ratio of their corresponding values remains constant.
This is a true definition of direct proportion.
So, the correct option is (*d*).

**10.** The given expression is $4x^2 y + 28xy^2$.
Factoring out the common term $4xy$:
$$4x^2 y + 28xy^2 = 4xy(x + 7y).$$
The assertion is true.
Reason (R): The factorisation is defined as expressing an algebraic expression as a product of its prime factors or irreducible factors.
This is the correct definition of factorisation.
So, the correct option is (*a*).

**B.**

**1.** If $x = 7y$, then *x* and *y* vary directly proportional with each other.

**2.** When the speed remains constant, the distance travelled is directly proportional to the time.

**3.** The value of $(2 - 3)^2 \times (3 - 2)^3$ is 1.
Explanation: $(2 - 3)^2 = (-1)^2 = 1$, $(3 - 2)^3 = (1)^3 = 1$, so $1 \times 1 = 1$.

**4.** Multiplicative inverse of $4^7$ is $\frac{1}{4^7}$.

**5.** The value of $(x + 1)(x - 1)(x^2 + 1)$ is $x^4 - 1$.
{Apply the difference of the square formula}

**C.**

**1.** True.

**2.** True.
The weight of sugar and its cost are directly proportional since an increase in weight corresponds to an increase in cost.

**3** False.
When *x* and *y* are in indirect proportion, their product is constant $(x \cdot y = k)$, not the ratio $\left(\frac{x}{y} = k\right)$.

**4.** True.
e.g., $0.001 = 10^{-3}$

**5.** False.
The irreducible factorisation of $3x^3 + 6x$ is $3x(x^2 + 2)$, not $3 \times x \times x \times x + 2 \times 3 \times x$.

**D.**

**1.** Using the law of exponents $a^m \times a^n = a^{(m + n)}$, we have:
$(-7)^{(x + 1)} \times (-7)^7 = (-7)^{(x + 1) + 7} = (-7)^{(x + 8)}$
Equating this to $(-7)^{11}$, we get:
$(-7)^{(x + 8)} = (-7)^{11}$
So, $x + 8 = 11$, which gives:
$$x = 11 - 8 = 3$$
Therefore, the value of *x* is 3.

**2.** The amount of food provision is directly proportional to the number of cadets and the number of days. So we use the equation:
Total Food Provision = Cadets × Days
Initially:
$$200 \times 45 = 9000 \text{ cadet-days of food}$$
With 50 more cadets, there will be 250 cadets. Let the new number of days be D. So:
$$250 \times D = 9000$$
Solving for D:
$$D = \frac{9000}{250} = 36$$
Therefore, the provision will last for 36 days.

**3.** First, find the rate of typing:
$\frac{126 \text{ words}}{6 \text{ minutes}} = 21$ words per minute
In 30 minutes, he will type:
$$21 \times 30 = 630 \text{ words}$$
Therefore, Sohil would type 630 words in half an hour.

4. Using the law of exponents $a^m \div a^n = a^{m-n}$, we simplify the expression inside the brackets:

$$\left(\frac{4}{15}\right)^{-6} \div \left(\frac{4}{15}\right)^{2} = \left(\frac{4}{15}\right)^{-6-2} = \left(\frac{4}{15}\right)^{-8}$$

Now, raise this to the power of 4:

$$\left[\left(\frac{4}{15}\right)^{-8}\right]^{4} = \left(\frac{4}{15}\right)^{-32}$$

Now, multiply by $\left(\frac{4}{15}\right)^{-8}$:

$$\left(\frac{4}{15}\right)^{-32} \times \left(\frac{4}{15}\right)^{-8} = \left(\frac{4}{15}\right)^{-32+(-8)}$$

$$= \left(\frac{4}{15}\right)^{-40} = \left(\frac{15}{4}\right)^{40}$$

Therefore, the value of the expression is $\left(\frac{15}{4}\right)^{40}$.

5. Factorise: $24(3x - 4y)^2 - 18(3x - 4y)$:

Let $z = 3x - 4y$, then the expression becomes:

$$24z^2 - 18z$$

Factor out the greatest common factor (GCF), which is $6z$:

$$6z(4z - 3)$$

Substituting $z = 3x - 4y$ back in:

$6(3x - 4y)(4(3x - 4y) - 3) = 6(3x - 4y)(12x - 16y - 3)$

Therefore, the factorised form is

$6(3x - 4y)(12x - 16y - 3)$.

6. The given area is a perfect square trinomial:

$4x^2 + 12xy + 9y^2 = (2x + 3y)^2$

So, the side of the square is $(2x + 3y)$.

7. The sum of $(x + 5)$ observations is $x^4 - 625$. The mean is given by:

$$\text{Mean} = \frac{\text{Sum of Observations}}{\text{Number of Observations}} = \frac{x^4 - 625}{x + 5}$$

Factor $x^4 - 625$ as a difference of squares:

$$x^4 - 625 = (x^2 - 25)(x^2 + 25)$$

Now, divide by $x + 5$:

$$\frac{(x^2 - 25)(x^2 + 25)}{x + 5}$$

Factor $x^2 - 25$ as $(x - 5)(x + 5)$:

$$\frac{(x-5)(x+5)(x^2+25)}{x+5}$$

Cancel $x + 5$:

$$(x - 5)(x^2 + 25)$$

Therefore, the mean of the observations is

$$(x - 5)(x^2 + 25).$$

8. Write the equation for A:

$$256 \times 2^{-3} = A$$

$$A = 256 \times \frac{1}{8}$$

$$A = 32$$

Now write the equation for B:

$$32 \times 12^{-1} = B$$

$$B = 32 \times \frac{1}{12}$$

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

Now write the equation for C:

$$\frac{8}{3} \times 3^{-2} = C$$

$$C = \frac{8}{3} \times \frac{1}{9}$$

$$C = \frac{8}{27}$$

# CHAPTER 14 : INTRODUCTION TO GRAPHS

## Let's Recall

1. (*a*) 10-15 marks group has the maximum number of students.

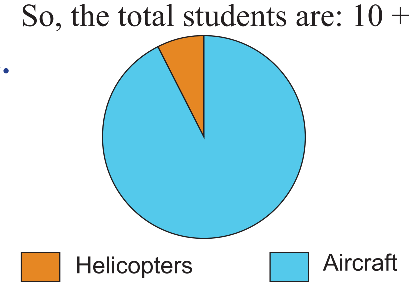
(*b*) 10-15 and 15-20 marks groups have got more than 50% marks:

So, the total students are: 16 + 14 = 30

(*c*) The students who got marks more than 5 but less than 15 are 10 and 16 respectively.

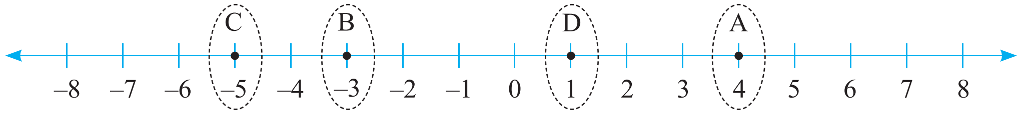
So, the total students are: 10 + 16 = 26

2.



## Quick Check (Page 314)

The number line with the numbers −5, −3, 1, and 4 is plotted below.




## Practice Time 14A

**1.** The abscissa is the $x$-coordinate of the ordered pair.

(*a*) (5, 8): 5 (*b*) (–2, 3): –2

(*c*) (8, 0): 8 (*d*) (2, –3): 2

**2.** The ordinate is the y-coordinate of the ordered pair.

(*a*) (3, 4): 4 (*b*) (–2, 8): 8

(*c*) (9, 0): 0 (*d*) (0, 2): 2

**3.** Quadrant rules:

**Quadrant I:** (+ $x$, + $y$)
**Quadrant II:** (–$x$, + $y$)
**Quadrant III:** (–$x$, –$y$)
**Quadrant IV:** (+ $x$, –$y$)

(*a*) (5, 5): Quadrant I (+ $x$, + $y$)

(*b*) (–4, 6): Quadrant II (–$x$, + $y$)

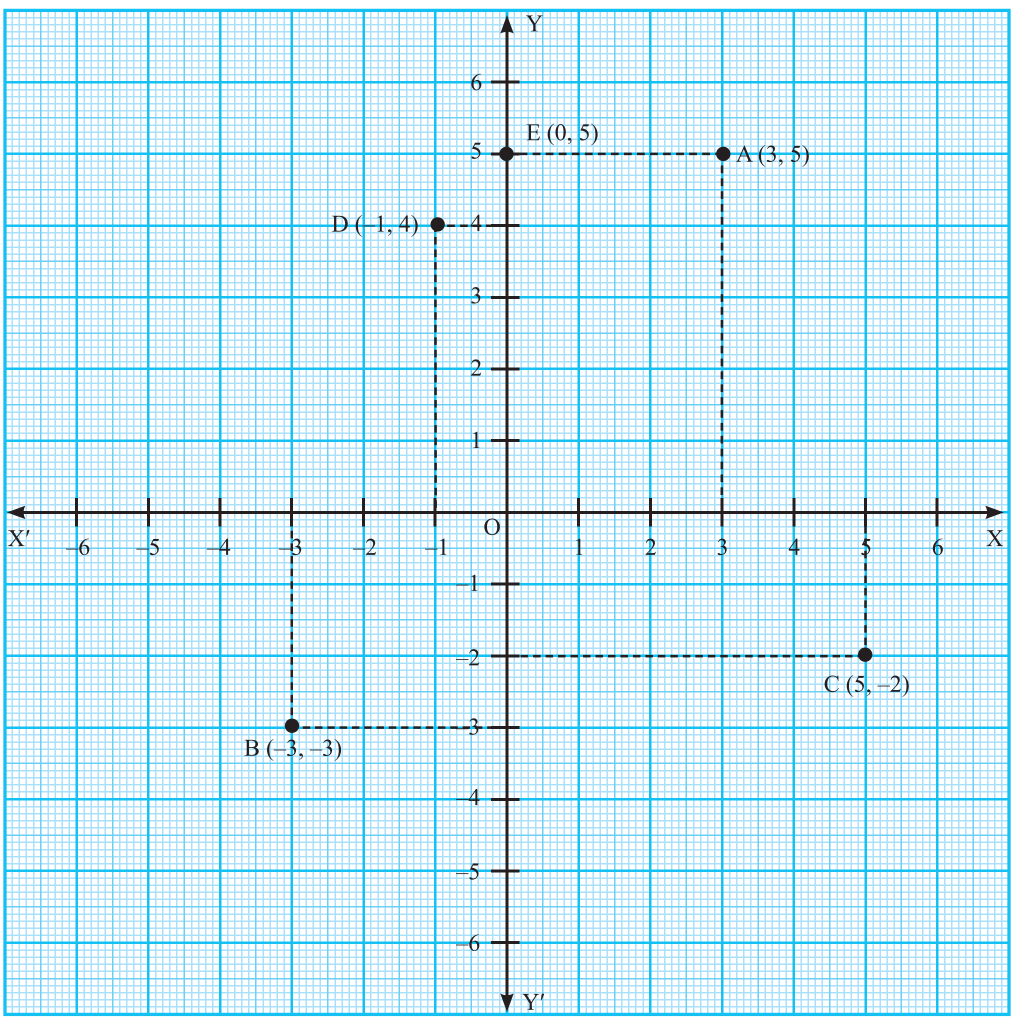
(*c*) (3, –4): Quadrant IV (+ $x$, –$y$)

(*d*) (–5, –7): Quadrant III (–$x$, –$y$)

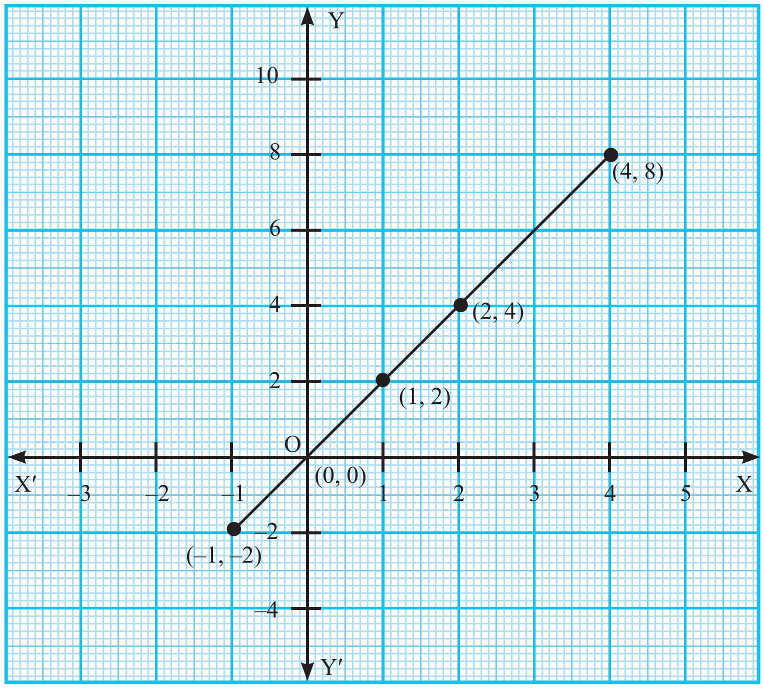
**4.** Based on the given graph:
A(3, 2); B(1, 1); C(2, 3); D(4, 3); E(4, 0); F(0, 2)

**5.** Based on the given graph:
In square KLMN: K(0, 4), L(3, 4), M(3, 7), N(0, 7)
In quadrilateral DEFG: D(4, 7), E(4, 5), F(7, 4), G(7, 6)
In triangle AOB: A(3, 0), O(0, 0), B(0, 3)
In trapezium PQRS: P(4, 1), Q(9, 1), R(7, 3), S(5, 3)

**6.** Based on the given points:



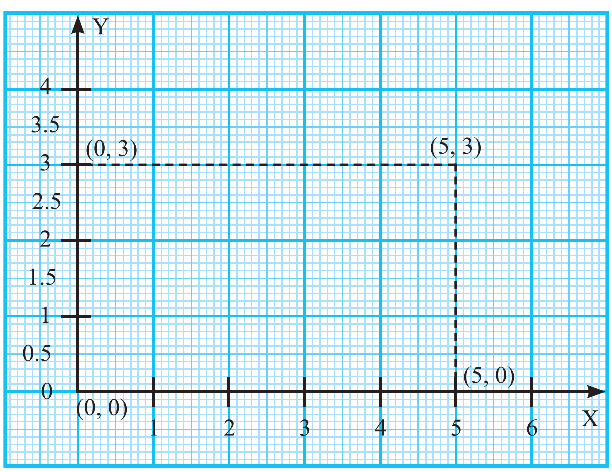
**7.** Based on the given points:




(*i*) Yes, all points lie on the same straight line.

(*ii*) The point (−1, −2) is not in the same quadrant as the others.

**8.** The rectangle lies in the first quadrant, has the origin (0, 0) as one vertex, is 5 units long along the *x*-axis, and 3 units long along the *y*-axis. The vertices are: (0, 0), (5, 0), (5, 3), and (0, 3).

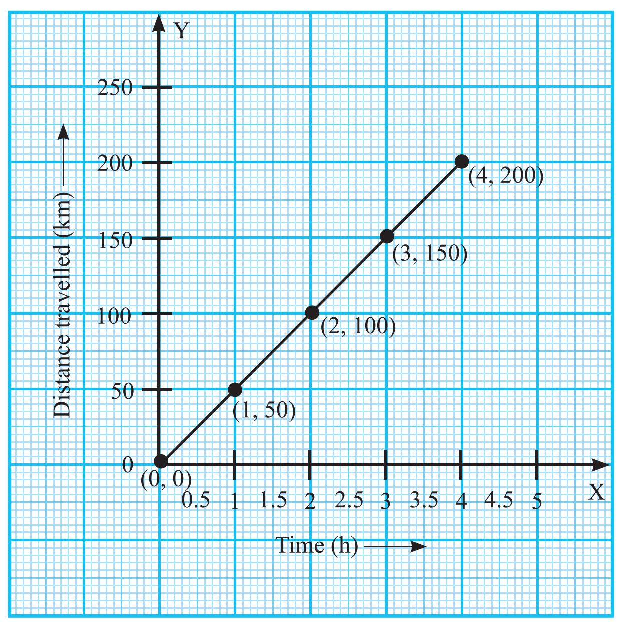



## Think and Answer (Page 322)

The cost changes based on the quantity of items purchased. In the relationship between cost and quantity, the quantity is the independent variable, and the cost is the dependent variable.

## Quick Check (Page 325)

Based on the table data the graph is shown below:

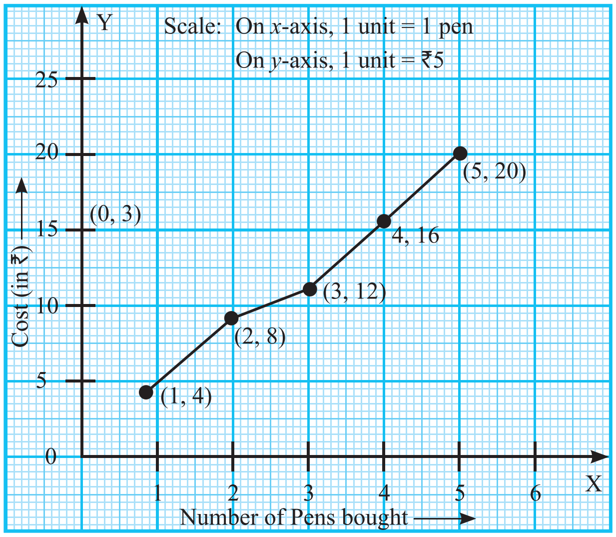



1. From the table, in 2 hours, the vehicle travels 100 km.

2. At 3 hours, the vehicle will have travelled 150 km. So, the position of a vehicle is (3, 150).

## Practice Time 14B

**1.** Based on the table data the graph is shown below:

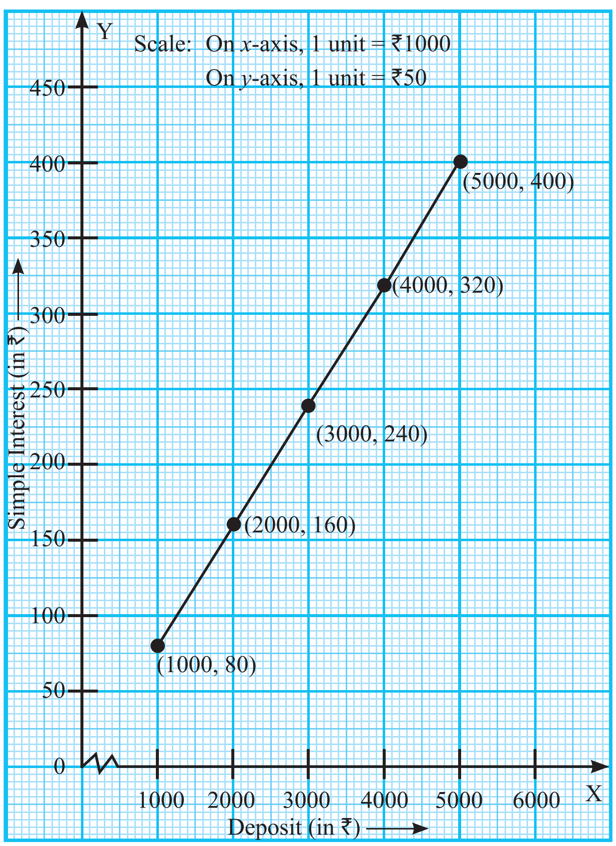



(*a*) From the graph, the cost per pen is ₹4.
For 6 pens:
Cost = 6 × 4 = ₹24

(*b*) From the graph, for ₹32:

$$\text{Number of pens} = \frac{32}{4} = 8 \text{ pens}$$

**2.** Based on the table data the graph is shown below:




Yes, the graph passes through the origin.

(*a*) From the graph or calculation, the interest rate is ₹80 per ₹1000:

$$\text{Interest for ₹2500} = \frac{80}{1000} \times 2500$$
$$= ₹200$$

(*b*) Deposit to get ₹280 interest per year:

Using the interest rate (₹80 per ₹1000):

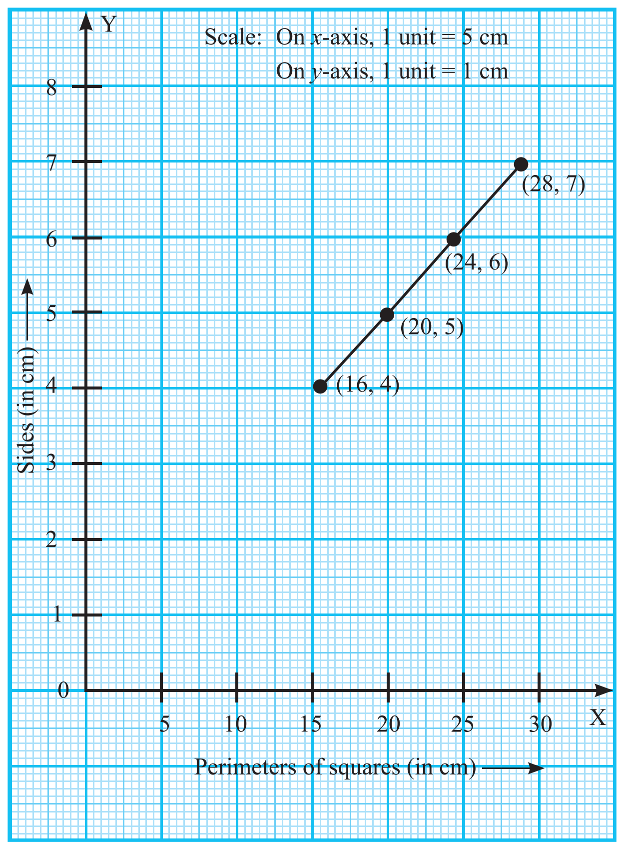
$$\text{Deposit} = \frac{280}{80} \times 1000$$
$$= ₹3500$$

(*c*) Deposit to get ₹560 interest per year:

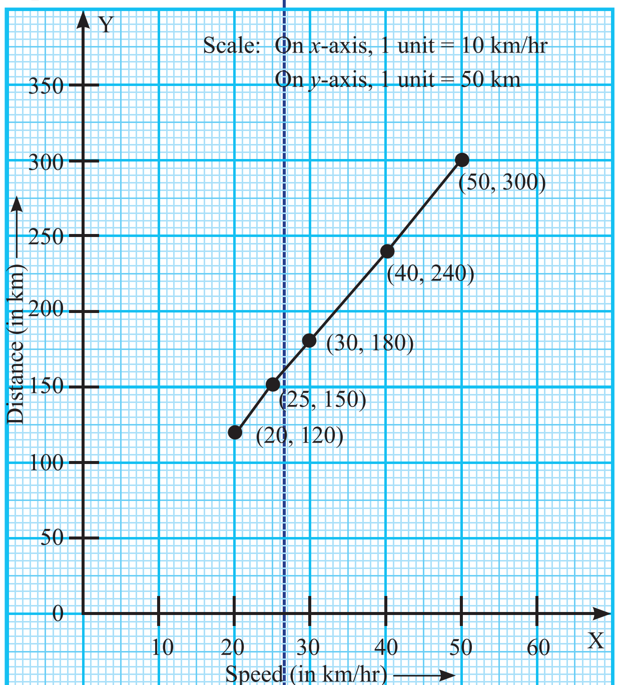
Using the same interest rate:

$$\text{Deposit} = \frac{560}{80} \times 1000$$
$$= ₹7000$$

**3.** Based on the table data the graph is shown below:



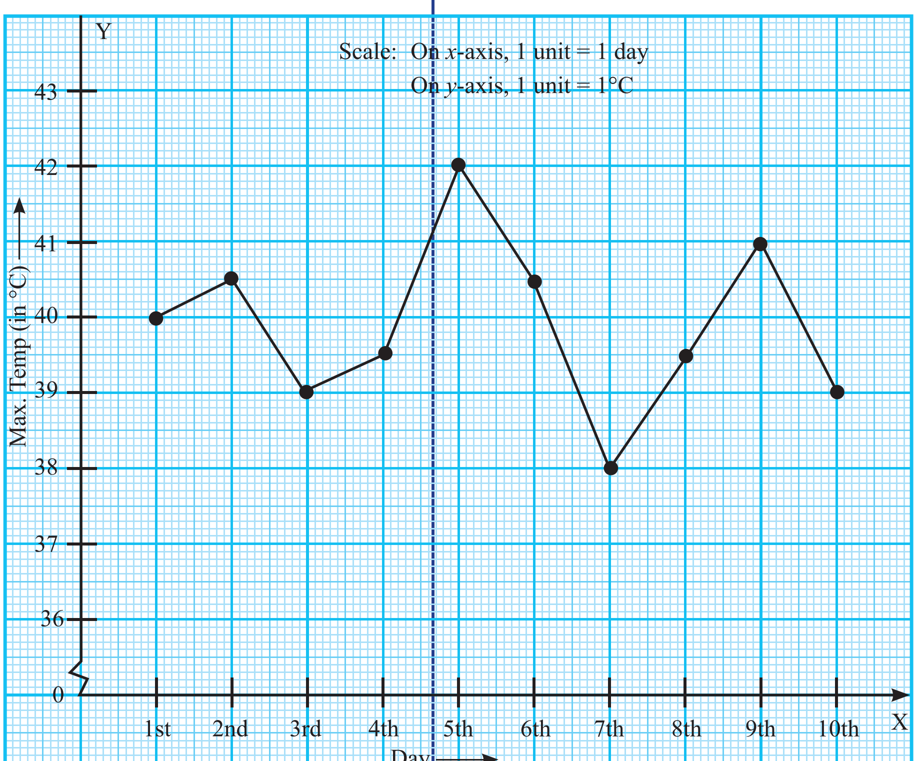
**4.** Based on the table data the graph is shown below:



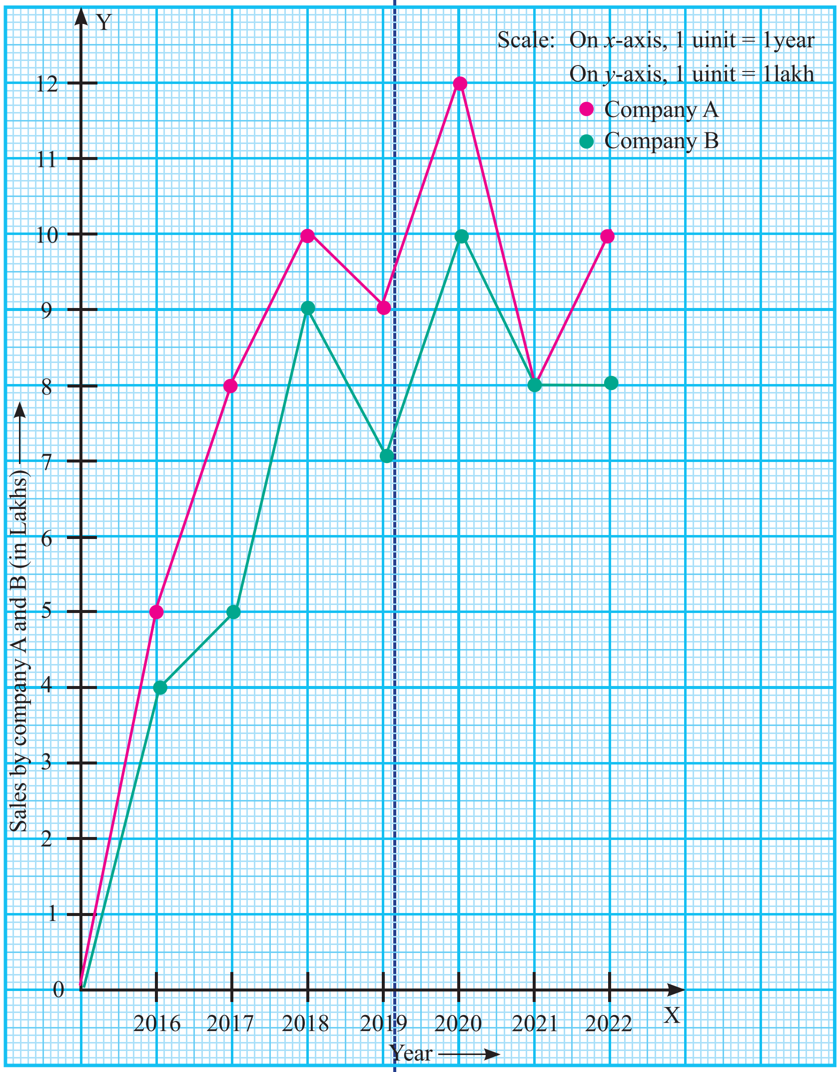

(*a*) From the graph: corresponding to 45 km/h on the *x*-axis, we get a point 270 km on *y*-axis. Thus, the distance covered at a speed of 45/hr is 270 km.

(*b*) Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{450}{6}$ = 75 km/hr

**5.** Based on the table data the graph is shown below:



**6.** Based on the table data the graph is shown below:




**7.** (*a*) From the graph, the rate of interest is 9% in the 3rd, and 9th years.

(*b*) The maximum rate of interest shown in the graph is 14%, which occurs in the 6th year.

(*c*) The largest increase in the rate of interest is seen in 6th year.

(*d*) The rate of interest is 10% in the 2nd year.

(*e*) The rate of interest remained the same during the 3rd and 9th years and the 1st and 10th years.

**8.**(*a*) Student A scored the highest marks in Class IV.

(*b*) Both students scored equal marks in Class V, where they both scored 80 marks.

(*c*) In Class III, Class VI and Class IX, student B scored minimum marks, i.e., 60 marks.

(*d*) In Class IV and Class V, student B scored the same marks, i.e., 80 marks.

(*e*) Student A scored 80 marks in Class VIII and 40 marks in Class IX. The fall in performance is 40 marks.

## Brain Sizzlers (Page 331)

**1.** By observing the graph, in the first 3 hours the vehicle covered 40 km distance.

**2.** The vehicle is stationary in two times, from B to C and D to E. Thus, the total time period is:

$$\frac{30}{60} \text{ h} + 1 \text{ h} = 1.5 \text{ hours}$$

**3.** $$\text{Average speed} = \frac{\text{Total distance}}{\text{Time}}$$

$$= \frac{80}{5} = 16 \text{ km/h}$$

## Chapter Assessment

**A.**

**1.** The abscissa is the x-coordinate, which is 2.
So, the correct option is (*a*).

**2.** The point (-2, 5) has a negative $x$-coordinate and a positive $y$-coordinate, placing it in quadrant II.
So, the correct option is (*b*).

**3.** The point is 3 units from the $x$-axis and 4 units from the $y$-axis, giving the coordinates (4, 3).
So, the correct option is (*b*).

**4.** The point (6, 0) lies on the $x$-axis because the $y$-coordinate is 0.
So, the correct option is (*a*).

**5.** The point (0, –7) lies on the $y$-axis because the $x$-coordinate is 0.
So, the correct option is (*b*).

**6.** The ordinate is the y-coordinate, which is 8.
So, the correct option is (*b*).

**7.** The point with $y = 2$ and $x = 5$ has coordinates (5, 2).
So, the correct option is (*a*).

**8.** The point with abscissa 8 and ordinate 9 has coordinates (8, 9).
So, the correct option is (*a*).

**9.** A point on the $x$-axis has a $y$-coordinate of 0, so (–2, 0) lies on the $x$-axis.
So, the correct option is (*c*).

**10.** The coordinates of the origin are (0, 0).
So, the correct option is (*c*).

**B.**

**1.** The coordinate axes intersect at the origin, which has coordinates (0, 0) and the coordinates of the origin are indeed (0, 0). So, the correct option is (*a*).

**2.** The coordinates of a point whose $x$-coordinate is 3 and $y$-coordinate is 4 is (3, 4). However, the corresponding point in the second quadrant would indeed be (−3, 4). The reason does not explain the assertion.
So, the correct option is (*b*).

**3.** The coordinates (1, 0) are on the $x$-axis, and this aligns with the explanation the point (1, 0) lies on the $x$-axis.
So, the correct option is (*a*).

**4.** The coordinates of a point whose x-coordinate is 0 and y-coordinate is 1 is (0, 1). However, (0, 1) lie on the y-axis, which makes Reason (R) true. So, the correct option is (*d*).

**C.**

**1.** The point (6, 0) lies on the $x$ axis.

**2.** The point (–7, 1) lies in II quadrant and (1, –7) lies in IV quadrant.

**3.** The point (–5, –3) lies in III quadrant.

**4.** The coordinates of a point whose abscissa is 7 and ordinate is 5 are (7, 5).

**5.** (–3, 0) will lie on the $x$-axis.

**D.**

**1.** A point whose $x$-coordinate is zero and y-coordinate is non-zero will lie on the $y$-axis. True

**2.** A point whose $y$-coordinate is zero and $x$-coordinate is 5 will lie on $y$-axis. False

**3.** The coordinates of the origin are (0, 0). True

**4.** If the point $(x, y)$ lie on the x-axis, then its abscissa is zero. False

**5.** If the point $(x, y)$ lie on the y-axis, then its ordinate is zero. False

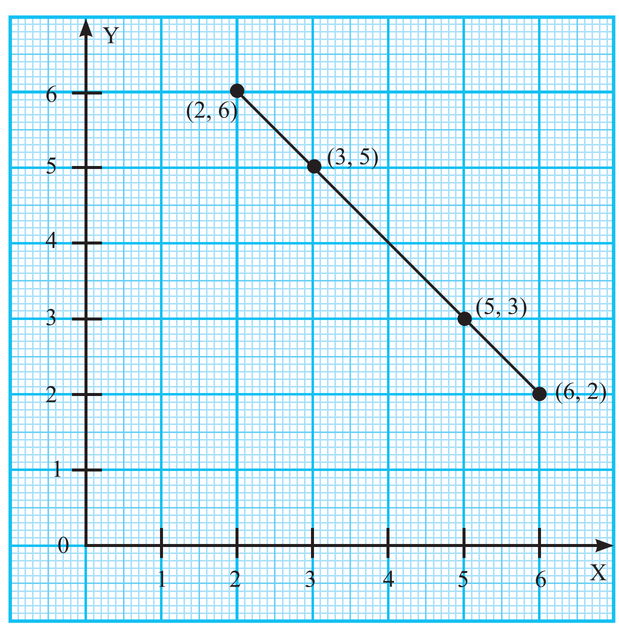
**6.** The point $(x, y)$ lies on y-axis if $x = 0$. True

**7.** The point (–1, –2) lies on the fourth quadrant. False

**8.** The point (6, –2) lies in the second quadrant. False

**E.**

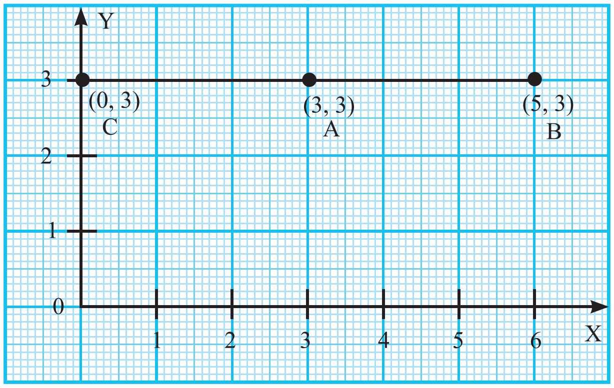
**1.** (*a*) Based on the points the graph is shown below:




This is a straight line graph.

(*b*) Similarly solve this part.

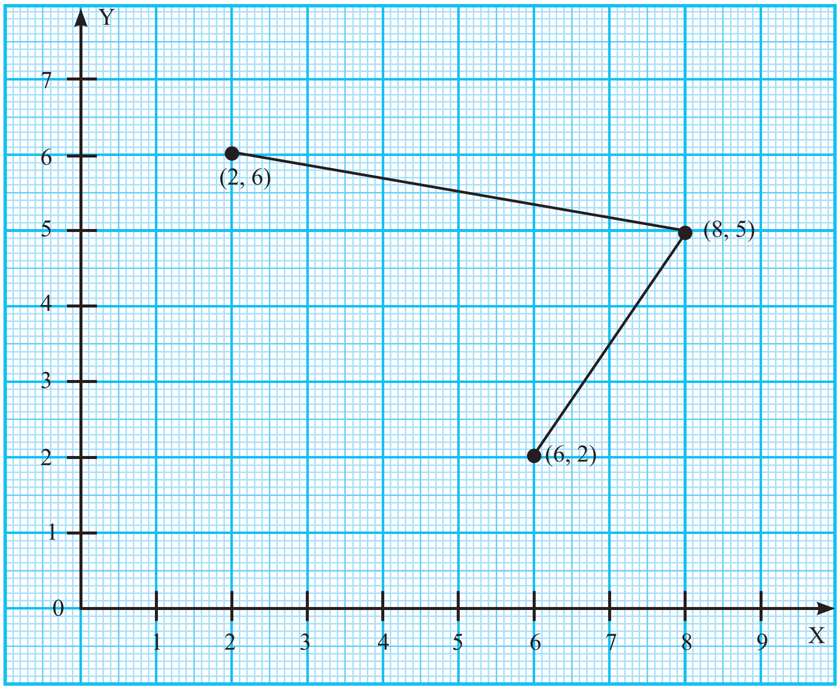
**2.** (*a*) Based on the points the graph is shown below:




Yes, the points are lie on a straight line.

(*b*) Similarly solve this part as part (*a*).

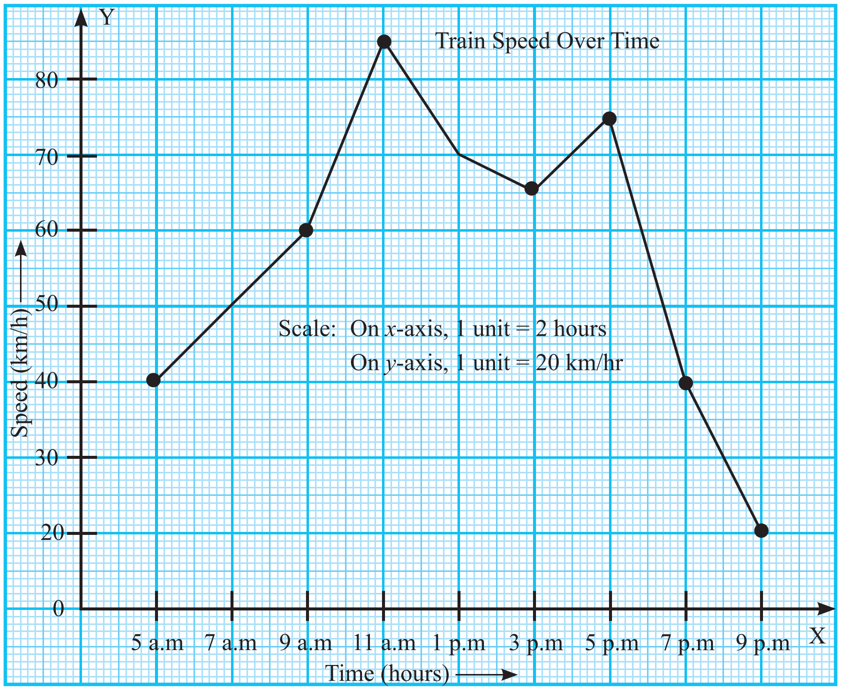
**3.** Based on the points the graph is shown below:



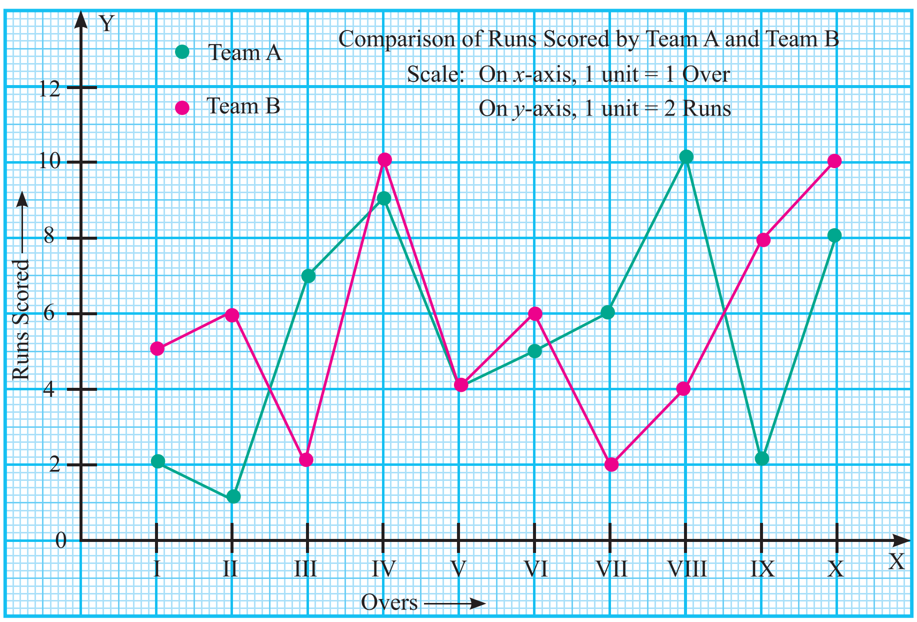

By observing the graph, the common point is (8, 5).

**4.** By observing the graph, the coordinates of the vertices are: A (3, 2); B (6, 2); C (5, 1); D (2, 1)

**5.** Based on the table data the graph is shown below:




**6.** Based on the table data the graph is shown below:




**7.** (*a*) On the *x*-axis, the time taken to cover the distance is shown and on the *y*-axis, the distance in kilometres is shown.

(*b*) The car begins its journey from city P at 8 a.m.

(*c*) The car covered the distance in the first hour is 50 km.

(*d*) (*i*) 100 km (*ii*) 50 km

(*e*) No, the speed of the car is different for 1st, 2nd and 3rd hours. It is 50 km/hr, 100 km/hr and 50 km/hr respectively.

(*f*) Yes, between 11 a.m. and 12 noon, the car stops at that time.

(*g*) The car reaches city Q at 2 p.m.

8. (*a*) On the $x$-axis, the number of matches played and on the $y$-axis runs scored by batsman A and B is shown.
   (*b*) Green line shows the runs scored by batsman A
   (*c*) Yes, in 4th match they scored 60 runs.
   (*d*) Since batsman B scored almost the same number of runs in every match and fluctuations is also less as compared to batsman A. So batsman B is steadier.
9. (*a*) By observing the graph, the patient's temperature at 11 a.m. is 39°C.
   (*b*) At 12 noon the patient's temperature was 37°C.
   (*c*) The temperature remained constant at 9 a.m.-10 a.m.
   (*d*) 7 a.m.-8 a.m.

## Mental Maths (Page 335)

1. The coordinate of origin is (0, 0).
2. The abscissa ($x$-coordinate) is -5.
3. The ordinate ($y$-coordinate) is 7.
4. The ordinate of every point on the $x$-axis is 0.
5. All these points lie on the $y$-axis since their abscissa ($x$-coordinate) is 0.
6. (*a*) A (3, 2): Lies in the 1st Quadrant.
   (*b*) B (-1, -7): Lies in the 3rd Quadrant.
   (*c*) C (-5, 0): Lies on the $x$-axis.
   (*d*) D (-6, 6): Lies in the 2nd Quadrant.
   (*e*) E (0, 4): Lies on the $y$-axis.
   (*f*) F (0, 0): Lies at the origin.
   (*g*) G (8, -6): Lies in the 4th Quadrant.
7. (*a*) The graph shows a steady increase in distance over time, indicating the car is moving at a constant speed.
   (*b*) The graph shows a flat line (no change in distance) after an initial increase, indicating the car is stationary after moving for some time.
8. From the graph:

   A: (0, 2)
   B: (1, 0)
   C: (2, 1)
   D: (2, 3)
   E: (3, 1)
   F: (4, 0)

# CHAPTER 15 : PLAYING WITH NUMBERS

### Let's Recall

1. The expanded form of a number shows the value of each digit based on its place value.
   1234 = 1 × 1000 + 2 × 100 + 3 × 10 + 4 × 1
   Thus, the expanded form of 1234 is:
   1000 + 200 + 30 + 4
2. The prime numbers less than 20 are:
   2, 3, 5, 7, 11, 13, 17, 19
   Now, check the sums of different pairs:
   - 2 + 3 = 5 (divisible by 5)
   - 2 + 13 = 15 (divisible by 5)
   - 3 + 17 = 20 (divisible by 5)
   - 3 + 7 = 10 (divisible by 5)
   - 13 + 17 = 30 (divisible by 5)

   Thus, five pairs of prime numbers whose sum is divisible by 5 are:
   (2, 3), (2, 13), (3, 17), (3, 7), (13, 17)
3. (*a*) A number is divisible by 4, if the last two digits form a number that is divisible by 4.
   Now, check the divisibility by 4:
   - 15742 – The last two digits are 42. 42 ÷ 4 = 10.5 (Not divisible by 4)
   - 64728 – The last two digits are 28. 28 ÷ 4 = 7 (Divisible by 4)
   - 34769 – The last two digits are 69. 69 ÷ 4 = 17.25 (Not divisible by 4)
   - 57894 – The last two digits are 94. 94 ÷ 4 = 23.5 (Not divisible by 4)

   So, the correct option is (*ii*) 64728.

   (*b*) A number is divisible by 3 if the sum of the digits is divisible by 3.
   Now, check the divisibility by 3:
   - 45276 – Sum of digits: 4 + 5 + 2 + 7 + 6 = 24 (Divisible by 3)
   - 3794814 – Sum of digits: 3 + 7 + 9 + 4 + 8 + 1 + 4 = 36 (Divisible by 3)
   - 47857 – Sum of digits: 4 + 7 + 8 + 5 + 7 = 31 (Not divisible by 3)
   - 67584 – Sum of digits: 6 + 7 + 5 + 8 + 4 = 30 (Divisible by 3)

   So, the correct option is (*iii*) 47857.

**4.** (*a*) False - For example, 3 is divisible by 3 but not by 9.

(*b*) False - For example, 12 is divisible by 3 and 6 but not divisible by 18.

(*c*) False - For example, 4 is divisible by 4 but not by 8.

(*d*) True - For example, 3 divides 6 and 9 separately, it will also divide 6 + 9 = 15.

**5.** A number is divisible by 8 if number formed by last three digits is divisible by 8.

(*a*) 865*

To make 865* divisible by 8, we need to check the possibilities for *:

- 650 ÷ 8 = 81.25 (Not divisible by 8)
- 651 ÷ 8 = 81.375 (Not divisible by 8)
- 652 ÷ 8 = 81.5 (Not divisible by 8)
- 653 ÷ 8 = 81.625 (Not divisible by 8)
- 654 ÷ 8 = 81.75 (Not divisible by 8)
- 655 ÷ 8 = 81.875 (Not divisible by 8)
- 656 ÷ 8 = 82 (Divisible by 8)
- The smallest digit for * is 6.

(*b*) 88*0

To make 88*0 divisible by 8, we need to check the possibilities for *:

800 ÷ 8 = 110 (Divisible by 8)

So, the smallest digit for * is 0.

(*c*) 9*68

To make 9*68 divisible by 8, we need to check the possibilities for *:

- 068 ÷ 8 = 8.5 (Not divisible by 8)
- 168 ÷ 8 = 21 (Divisible by 8)

So, the smallest digit for * is 1.

(*d*) 1*128

To make 1*128 divisible by 8, we need to check the possibilities for *:

- 128 ÷ 8 = 16 (Divisible by 8)

The smallest digit for * is 0.

## Quick Check (Page 339)

**1.** (*a*) The number 55 can be written as: 5 × 10 + 5

(*b*) The number 70 can be written as: 7 × 10

(*c*) The number 121 can be written as: 1 × 100 + 2 × 10 + 1

(*d*) The number 999 can be written as: 9 × 100 + 9 × 10 + 9

**2.** (*a*) 10 × 8 + 7 = 80 + 7 = 87

(*b*) 100 × 7 + 10 × 7 + 7 = 700 + 70 + 7 = 777

(*c*) 100 × 9 + 10 × 0 + 8 = 900 + 0 + 8 = 908

## Quick Check (Page 342)

**Step 1:** Here, we have A × 1 = A, this is only possible
when A = between 0 and 9.

**Step 2:** If A = 1 and B = 2, then 21 × 21 = 441 ≠ 821 and if A = 1 and B = 5, then 21 × 51 = 1071 ≠ 821

**Step 3:** If A = 0 and B = 4, then 21 × 40 = 840 = 840.
Thus, A = 0 and B = 4.

## Practice Time 15A

**1.** (*a*) The number 36 can be written as: 3 × 10 + 6

(*b*) The number 405 can be written as: 4 × 100 + 0 × 10 + 5

(*c*) The number 1211 can be written as: 1 × 1000 + 2 × 100 + 1 × 10 + 1

(*d*) The number 6500 can be written as: 6 × 1000 + 5 × 100 + 0 × 10 + 0

**2.** (*a*) 10 × 6 + 5 = 60 + 5 = 65

(*b*) 100 × 7 + 10 × 0 + 8 = 700 + 0 + 8 = 708

(*c*) 100 × 0 + 10 × 9 + 9 = 0 + 90 + 9 = 99

(*d*) $1000 \times a + 100 \times d + 10 \times b + c = 1000a + 100d + 10b + c$

**3.** The digits 2, 3, and 7 can be arranged in 6 ways:
237, 273, 327, 372, 723, 732

Now, calculate their sum.

Total Sum = 237 + 273 + 327 + 372 + 723 + 732
= 510 + 699 + 1455 = 2664

Check divisibility by 37.

2664 ÷ 37 = 72

The remainder is 0, so 2664 is divisible by 37.

Now, check if 237 is divisible by the sum of digits of 12.

Calculate the sum of the digits of 12.

1 + 2 = 3

Check divisibility of 237 by 3.

237 ÷ 3 = 79

The remainder is 0, so 237 is divisible by 3.

**4.** Let the unit digit of the number be $x$.

Then, tens digit $= 12 - x$

Original number $= 10(12 - x) + x$

$= 120 - 10x + x$

$= 120 - 9x$

On reversing the digits the new number formed.

$= 10x + (12 - x) = 9x + 12$

According to question, we have

$9x + 12 = 120 - 9x + 36$

$\Rightarrow 18x = 144 \Rightarrow x = 8$

Thus, the required number is $120 - 9x$

$= 120 - 9 \times 8$

$= 120 - 72$

$= 48$

**5** Let the unit digit of the number be $x$.

Then, tens digit $= 7 - x$

Original number $= 10(7 - x) + x$

$= 70 - 10x + x$

$= 70 - 9x$

On reversing the digits the new number formed

$= 10x + (7 - x)$

$= 9x + 7$

According to question, we have

$9x + 7 = 70 - 9x - 27$

$\Rightarrow 18x = 36 \Rightarrow x = 2$

Thus, the required number is $70 - 9x = 70 - 9 \times 2$

$= 70 - 18 = 52$

**6.** (*a*)Here, the addition in the units column:

$B + 1 = 8$

Therefore, B = 7.

Now, A + 7 = 1 (carryover 1), meaning A + 7 = 11. Thus, A = 4.

Finally, in the hundreds place, 2 + A = B. Substituting A = 4, 2 + 4 + 1 = 7, which matches B = 7.

So, the puzzle can be solved as below:

$$\begin{array}{r} 2\ 4\ 7 \\ +\ 4\ 7\ 1 \\ \hline 7\ 1\ 8 \\ \hline \end{array}$$

Thus, A = 4 and B = 7.

(*b*) Similarly solve this question as part (*a*)

(*c*) **Step 1:** Here, we have B × 6 = B, this is only possible when either B = 0, B = 4, B = 6 or B = 8.

**Step 2:** If B = 0 and A = 4, then 40 × 6 = 240 ≠ 000 and if A = 7 and B = 4, then 74 × 6 = 444 = 444.

So, the puzzle can be solved as below:

$$\begin{array}{r} 7\ 4 \\ \times\ \ 6 \\ \hline 444 \\ \hline \end{array}$$

Thus, A = 7 and B = 4.

(*d*) Similarly solve this question as part (*c*).

## Quick Check (Page 343)

To decode the numbers into a word, match each number with its corresponding letter in the alphabet where A = 1, B = 2, C = 3, …, Z = 26.

Decoding:

1. 2 = B
2. 5 = E
3. 8 = H
4. 1 = A
5. 16 = P
6. 16 = P
7. 25 = Y

Decoded Word: BE HAPPY

## Quick Check (Page 345)

**1.** Sequence: 81, 27, 9, 3, ______.

In this sequence each term is divided by 3 to get the next term:

81 ÷ 3 = 27, 27 ÷ 3 = 9, 9 ÷ 3 = 3, 3 ÷ 3 = 1

Next number: 1

**2.** Sequence: 7, 12, 18, 25, 33, 42, ______.

In this sequence, the difference between consecutive terms is:

12 – 7 = 5, 18 – 12 = 6, 25 – 18 = 7, 33 – 25 = 8, 42 – 33 = 9

The difference increases by 1 each time. So, the next difference will be 9 + 1 = 10:

42 + 10 = 52

Next number: 52

3. Sequence: 0, 11, 22, ______, 44, ______, 66

This is an arithmetic sequence, where the difference between consecutive terms is:

$$11 - 0 = 11, 22 - 11 = 11$$

Each term increases by 11. After 22:

$$22 + 11 = 33$$

And after 44:

$$44 + 11 = 55$$

So, missing numbers are 33 and 55.

## Think and Answer (Page 345)

Observe Pascal's triangle, the left – most and the right – most diagonal contain the number 1 and the remaining numbers are the sum of the nearest two numbers in the above row.

To follow this process, we filled in the blank boxes shown below:

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 16 15 20 15 6 1

## Practice Time 15B

1. The code for each letter corresponds to the position of the letter in the alphabet.

A = 1 → 1
P = 16 → 16
P = 16 → 16
L = 12 → 12
E = 5 → 5

Similarly, for SWEET POTATO:

S = 19 → 19
W = 23 → 23
E = 5 → 5
E = 5 → 5
T = 20 → 20
P = 16 → 16
O = 15 → 15
T = 20 → 20
A = 1 → 1
T = 20 → 20
O = 15 → 15

SWEET POTATO = 192355201615201 2015

2. HAPPY = 27558, RUNG = 6134:

Consider both codes, as we can see H = 2, A = 7, P = 5, Y = 8, R = 6, U = 1, N = 3 and G = 4.

Thus we can write, HURRY = 21668

3. DRAMA = 37:

The pattern seems to involve some form of summing or operation on the position values of the letters.

D = 4
R = 18
A = 1
M = 13
A = 1

Summing these values: 4 + 18 + 1 + 13 + 1 = 37.

Code for PLAY:

P = 16
L = 12
A = 1
Y = 25

Summing these values: 16 + 12 + 1 + 25 = 54

Thus, PLAY = 54.

4. (*a*) 3, 8, 6, 11, 9, ______, ______, ______.

Observe the difference between consecutive terms:

8 – 3 = 5, 6 – 8 = −2, 11− 6 = 5, 9 −11 = − 2.

The pattern alternates between adding 5 and subtracting 2.

Continuing the pattern:

9 + 5 = 14, 14−2 = 12, 12 + 5 = 17

So, the next three terms are 14, 12 and 17.

(*b*) 1, 1, 2, 4, 3, 9, ______, ______, ______.

Break the sequence into pairs:

(1, 1), (2, 4), (3, 9).

In each pair, the second number is the square of the first.

Continuing the pattern:

(4, 16) (since $4^2 = 16$)

(5, 25) (since $5^2 = 25$)

So, the next three terms are 4, 16 and 5.

**5.** (*a*) 16, 20, _____, 28, _____, _____, 40

Observe the difference between consecutive terms:

20 – 16 = 4

The difference increases by 4.

Add the next differences:

20 + 4 = 24, 28 + 4 = 32, 32 + 4 = 36.

The missing terms are, 24, 32 and 36.

(*b*) 2, 6, _____, 54, 162, _____, _____.

Observe the relationship between terms:

2 × 3 = 6, 6 × 3 = 18, 18 × 3 = 54.

The next term is a multiplier of 3.

Continuing the pattern:

162 × 3 = 486, 486 × 3 = 1458.

The missing terms are 18, 486 and 1458.

**6.** (*a*) The sum of each row, column, and diagonal must be consistent.

The third column already gives us: 7 + 8 + 3 = 18. So, the magic sum is 18.

In the second row, we have given 4 and 8. The sum of 4 and 8 is 12, which means the third term should be 6. As, 4 + 8 + 6 = 18

Now consider the diagonal, we have 6 and 3. The sum of 3 and 6 is 9, which means the third term of the diagonal should be 9. As, 3 + 6 + 9 = 18

Now consider the first row, we have 7 and 9. The sum of 7 and 9 is 16, which means the third term should be 2. As, 2 + 7 + 9 = 18.

Now consider the third row, we have 3. As we see in columns 1 and 2 the respective terms are 9, 4 and 2, 6. So the third term for column 1 will be 5 and column 2 will be 10.

As, 9 + 4 + 5 = 18 and 2 + 6 + 10 = 18.

Thus the complete magic square is:

| | | |
|---|---|---|
| 9 | 2 | 7 |
| 4 | 6 | 8 |
| 5 | 10 | 3 |

(*b*) Similarly solve this question as part (*a*).

## Quick Check (Page 347)

To check the divisibility of a number by 2, a number must have its units digit as 0, 2, 4, 6, or 8.

**1.** 1080

The unit digit is 0.

Hence, 1080 is divisible by 2.

**2.** 9998

The unit digit is 8.

Hence, 9998 is divisible by 2.

**3.** 10887

The unit digit is 7.

Hence, 10887 is not divisible by 2.

**4.** 555550

The unit digit is 0.

Hence, 555550 is divisible by 2.

## Think and Answer (Page 348)

If a number leaves a remainder of 1 when divided by 5, it means the number can be expressed as:

Number = 5k + 1(where k is an integer)

The units digit of the number will be the same as the units digit of 5k + 1, and since 5k always ends in 0 or 5 (because it's a multiple of 5), adding 1 to it gives:

- If 5k ends in 0, 5k + 1 ends in 1.
- If 5k ends in 5, 5k + 1 ends in 6.

The units digit of the number can only be 1 or 6.

## Quick Check (Page 349)

1. A number is divisible by 5 if its units digit is 0 or 5, and it is divisible by 10 if its units digit is 0. Therefore, we are looking for a number that ends in 5 (divisible by 5 but not by 10).

(*a*) 210: Ends in 0 → Divisible by both 5 and 10

(*b*) 125: Ends in 5 → Divisible by 5 but not by 10

(*c*) 500: Ends in 0 → Divisible by both 5 and 10

(*d*) 755: Ends in 5 → Divisible by 5 but not by 10

Hence options (*b*) and (*d*) are correct.

**2.** A number is divisible by 3 if the sum of its digits is divisible by 3 and it is divisible by 9 if the sum of its digits is divisible by 9.

(*a*) 504: Sum of digits = 5 + 0 + 4
= 9 → Divisible by 3 and 9.

(*b*) 744: Sum of digits = 7 + 4 + 4
= 15 → Divisible by 3 but not by 9.

(*c*) 960: Sum of digits = 9 + 6 + 0
= 15 → Divisible by 3 but not by 9.

($d$) 1224: Sum of digits = 1 + 2 + 2 + 4
= 9 → Divisible by 3 and 9.

Hence options ($a$) and ($d$) are correct.

## Practice Time 15C

1. A number is divisible by 3 if the sum of its digits is divisible by 3 and it is divisible by 9 if the sum of its digits is divisible by 9.
   Sum of the digits = 1 + 5 + 2 + 8 + 8 = 24
   Since 24 is divisible by 3. As 24 ÷ 3 = 8.
   But 24 is not divisible by 9.
   So, 15288 is divisible by 3 but not by 9.
2. For divisibility by 9, the sum of the digits of $21a5$ must be divisible by 9.
   Sum of the digits = $2 + 1 + a + 5 = 8 + a$.
   $8 + a$ must be divisible by 9.
   Possible value of $a$:
   $$8 + a = 9$$
   $$a = 1$$
   Hence the value of $a = 1$.
3. For a number to be divisible by 3, the sum of its digits must be divisible by 3.
   The sum of the digits of 5aab is:
   $$5 + a + a + b = 5 + 2a + b$$
   This must be divisible by 3.
   For a number to be divisible by 8, the last three digits ($aab$) must form a number divisible by 8.
   Thus, aab, which is $100a + 10a + b = 110a + b$, must be divisible by 8.
   Now, take small values of a and b, starting from the smallest possible values:
   Case 1: $a = 0$
   $110(0) + b = b$:
   $b$ must be divisible by 8.
   The smallest even $b = 8$.
   Check divisibility by 3:
   5 + 2(0) + 8 = 13 {not divisible by 3}
   This case fails.
   Case 2: $a = 1$
   $110(1) + b = 110 + b$:
   $110 + b$ must be divisible by 8.
   110 ÷ 8 = 13 remainder 6 . So, $b + 6$ must be divisible by 8.
   The smallest $b = 2$ (as 2 + 6 = 8 ).
   Check divisibility by 3:
   5 + 1 + 1 + 2 = 9 {divisible by 3}
   This case works.
   The least values of a and b are:
   $a = 1$, $b = 2$
   The number is 5112, and it is divisible by both 3 and 8.
4. For the number to be divisible by 5, the last digit must be 0 or 5. In the number $5yxy2x$, the last digit is $x$. Therefore, $x = 5$.
   For the number to be divisible by 3, the sum of its digits must be divisible by 3. The digits are 5, $y$, 5, $y$, 2, 5, so the sum is:
   $$5 + y + 5 + y + 2 + 5 = 2y + 17.$$
   Now, we check when $2y + 17$ is divisible by 3:
   If $y = 2$: 2(2) + 17 = 21, which is divisible by 3.
   If $y = 5$: 2(5) + 17 = 27, which is divisible by 3.
   If $y = 8$: 2(8) + 17 = 33, which is divisible by 3.
   So, $y$ can be 2, 5, or 8.
   The greatest value of $y$ is 8. Therefore, the greatest values of $x$ and $y$ are $x = 5$ and $y = 8$.
5. To find the smallest number divisible by all these numbers, we need to find the Least Common Multiple (LCM) of these numbers.
   The LCM of 2, 3, 4, 5, 6, 8, 9, and 10 is 360.
   Thus, the smallest number divisible by all these numbers is 360.
6. Yes, Apurva is correct.
   A number is divisible by 15 if it is divisible by both 3 and 5. This is because 15 = 3 × 5. So, if a number is divisible by both 3 and 5, it is also divisible by their product, 15.
   For example, let's take a number 45. As we can see 45 ÷ 3 = 15 and 45 ÷ 5 = 9. Thus 45 ÷ 15 = 3.
7. When a number x is divided by 10 and leaves a remainder of 5, it means that $x$ ends in the digit 5. This is because the remainder when dividing by 10 is always the last digit of the number.
   Therefore, the ones digit of $x$ is 5.
8. Yes, some numbers are divisible by both 2 and 4 but not by 8.
   (Answer may vary) Consider the number 124:
   124 is divisible by 2 because it is an even number (last digit is 4).

124 is divisible by 4 because the last two digits (24) form a number that is divisible by 4.

124 is not divisible by 8.

Thus, 124 is divisible by both 2 and 4 but not by 8.

**9.** When a number N is divided by 3 and leaves a remainder of 2, it means that the ones digit of N must give a remainder of 2 when divided by 3.

Let's check the ones digits (0 – 9) and divide them by 3:

- $0 \div 3 = 0$ (remainder 0)
- $1 \div 3 = 0$ (remainder 1)
- $2 \div 3 = 0$ (remainder 2)
- $3 \div 3 = 1$ (remainder 0)
- $4 \div 3 = 1$ (remainder 1)
- $5 \div 3 = 1$ (remainder 2)
- $6 \div 3 = 2$ (remainder 0)
- $7 \div 3 = 2$ (remainder 1)
- $8 \div 3 = 2$ (remainder 2)
- $9 \div 3 = 3$ (remainder 0)

The ones digits that leave a remainder of 2 when divided by 3 are 2, 5, and 8.

**10.** It is given that $N \div 4$ leaves a remainder of 3. Therefore, the units digit of N when divided by 4 must leave a remainder of 3. This is possible when the units digit of N is either 3 or 7.

It is also given that the division of N by 2 leaves a remainder of 1. Therefore, N must be an odd number. So, the units digit of N can be 1, 3, 5, 7, or 9.

Clearly, 3 and 7 are the common values of the units digit in both cases. Thus, the required units digit of N is either 3 or 7.

## Mental Maths (Page 353)

**1.** First, calculate 725 − 527:

$$725 - 527 = 198$$

Now, divide 198 by 99:

$$198 \div 99 = 2$$

So, the quotient is 2.

**2.** First, we will find the remainder of each term when divided by 111.

$428 \div 111$: The quotient is 3, and the remainder is $428 - (111 \times 3) = 428 - 333 = 95$.

So, the remainder of 428 is 95.

$284 \div 111$: The quotient is 2, and the remainder is $284 - (111 \times 2) = 284 - 222 = 62$.

So, the remainder of 284 is 62.

$842 \div 111$: The quotient is 7, and the remainder is $842 - (111 \times 7) = 842 - 777 = 65$.

So, the remainder of 842 is 65.

Add the remainder:

$$95 + 62 + 65 = 222.$$

Divide the sum of the remainder by 111:

$222 \div 111$: The quotient is 2, and the remainder is $222 - (111 \times 2) = 222 - 222 = 0$.

So, the remainder will be 0.

**3.** AB represents a two – digit number with A as the tens digit and B as the ones digit.

Solve for AB

$$AB \times 4 = 96$$

$$AB = \frac{96}{4} = 24$$

Thus, the two – digit number AB = 24.

Therefore, the tens digit (A) of 24 is 2. The ones digit (B) of 24 is 4.

Now,

$$A + B = 2 + 4 = 6$$

The value of A + B is 6.

**4.** The units digit of $A \times A$ must equal the units digit of 4 (from 444).

The only digit that satisfies $A \times A = 4$ in the units place is $A = 2$ (since $2 \times 2 = 4$).

Now to verify this, substitute A = 2

AAA = 222 (since A = 2).

$$222 \times 2 = 444.$$

This satisfies the condition.

Hence, the value of A is 2.

**5.** In the given code language, letters are represented by their corresponding positions in the English alphabet.

Now decode how SCIENCE will be written:

**S** = 19

**C** = 3

**I** = 9

**E** = 5
**N** = 14
**C** = 3
**E** = 5

Thus, SCIENCE is written as:

193951435

**6.** It is given that N ÷ 5 leaves a remainder of 3. Therefore, the units digit of N when divided by 5 must leave a remainder of 3. This is possible only when the units digit of N is either 3 or 8. It is also given that N ÷ 2 leaves a remainder of 0. Therefore, N must be an even number. This means the units digit of N can only be an even digit, such as 0, 2, 4, 6, or 8.

Clearly, 8 is the common value of the units digit in both cases.

Thus, the remainder when N ÷ 10 is 8.

**7.** The sum of each row, column, and diagonal must be consistent.

The first column already gives us: 6 + 1 + 2 = 9.

So, the magic sum is 9.

In the first row, we have given 6 and –1. The sum of 6 and – 1 is 5, which means the third term should be 4. As, 6 – 1 + 4 = 9

Similarly, we can find the rest of the blank space in the magic square.

Thus the complete magic square is:

| | | |
|---|---|---|
| 6 | –1 | 4 |
| 1 | 3 | 5 |
| 2 | 7 | 0 |

## Brain Sizzlers (Page 353)

**1.** let's first find the three numbers whose sum should be 18.

Consider 3, 6 and 9.

Sum = 3 + 6 + 9 = 18

Set these numbers in the base of the triangle.

Take one corner number 3. Now, we have to find rest two numbers.

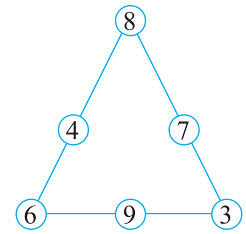
Let the other two numbers are 7 and 8.

Sum = 3 + 7 + 8 = 18

Similarly, take 6 as the other corner number so the rest two numbers are 4 and 8.

Sum = 6 + 4 + 8 = 18

The complete triangle is:




**2.** Units digit of 1AA + 715 = 8B7

The units digit of A + 5 should be 7, so:

A + 5 = 7 ⇒ A = 2

Now A = 2, the sum 122 + 715 = 837, so:

8B7 = 837 ⇒ B = 3

Since 837 ÷ 93 = 9, the number is divisible by 93.

Now find A + B

A + B = 2 + 3 = 5

## Chapter Assessment

**A.**

**1.** Let the number be $abc = 100a + 10b + c$

Number obtained by interchanging ones and hundreds digits is $cba = 100c + 10b + a$

Difference = $abc - cba = (100a + 10b + c) - (100c + 10b + a) = 99a - 99c = 99(a - c)$

The difference is always a multiple of 99, which is divisible by 3, 9, and 11.

Therefore, the difference is not divisible by 37.

Hence, the correct option is (*d*).

**2.** Since $z$ is an odd digit, the number $xyz$ will always be odd.

If $x + y + z = 6$, then the sum of the digits is divisible by 3.

Therefore, the number $xyz$ is an odd multiple of 3.

Hence, the correct option is (*a*).

**3.** A number is divisible by 3 if the sum of its digits is divisible by 3.

Sum of digits = $x + 6 + 8 = x + 14$

To make $x + 14$ divisible by 3, $x$ should be 1, 4, or 7.

Hence, the correct option is (*c*).

**4.** A number is divisible by 21 if it is divisible by both 3 and 7.

(*a* 2359: Sum of digits is 2 + 3 + 5 + 9 = 19 (not divisible by 3).

(*b*) 2595: Sum of digits is 2 + 5 + 9 + 5 = 21 (divisible by 3). 2595 ÷ 7 = 370.71 (not divisible by 7).

(*c*) 2706: Sum of digits is 2 + 7 + 0 + 6 = 15 (divisible by 3). 2706 ÷ 7 = 386.57 (not divisible by 7).

(*d*) 672: Sum of digits is 6 + 7 + 2 = 15 (divisible by 3). 672 ÷ 7 = 96 (divisible by 7).

Hence, the correct option is (*d*).

**5.** Let's find the pattern for "KING":
K = 11, I = 9, N = 14, G = 7.
The sum is 11 + 9 + 14 + 7 = 41.
Now for "QUEEN":
Q = 17, U = 21, E = 5, E = 5, N = 14.
The sum is 17 + 21 + 5 + 5 + 14 = 62.
Hence, the correct option is (*a*).

**B.**

**1.** To check the divisibility rule of 3: The sum of the digits should be divisible by 3. The sum of the digits for the number 1*x*5 is 1 + x + 5 = *x* + 6.
For *x* + 6 to be divisible by 3, *x* must be 0, 3, 6, or 9.
Both the assertion and reason are true, and the reason correctly explains the assertion.
Hence the correct option is (*a*).

**2.** To check divisibility by 9: The sum of the digits for the number 7*y*9 is 7 + *y* + 9 = *y* + 16.
For *y* + 16 to be divisible by 9, *y* must be 2 (since 2 + 16 = 18, which is divisible by 9).
Both the assertion and reason are true, and the reason correctly explains the assertion.
Hence the correct option is (*a*).

**3.** To check the divisibility rule of 3: The sum of the digits for the number 6y8 is 6 + *y* + 8 = *y* + 14.
For *y* + 14 to be divisible by 3, *y* must be 1, 4, or 7.
Both the assertion and reason are true, and the reason correctly explains the assertion.
Hence the correct option is (*a*).

**4.** To check divisibility by 9: The sum of the digits of 57204 is 5 + 7 + 2 + 0 + 4 = 18, which is divisible by 9.
Both the assertion and reason are true, and the reason correctly explains the assertion.
Hence the correct option is (*a*).

**C.**

**1.** Generalised form of a 3 – digit number '*abc*' is 100a + 10b + c.

**2.** Without performing actual division and addition, the quotient when the sum of 81 and 18 is divided by 11 is 9.
81 + 18 = 99, and when divided by 11, 99 ÷ 11 = 9.

**3.** The sum of the digits of a 2 – digit number is 6. If the digits are reversed, the new number so formed is increased by 18. The original number is 24.
Let the unit digit of the number be *x*.
Then, tens digit $= 6 - x$ original number

$$= 10(6 - x) + x = 60 - 9x$$

On reversing the digits the new number formed $= 10x + 6 - x = 9x + 6$
According to given condition, we have.

$$9x + 6 = 60 - 9x + 18$$

$$\Rightarrow \quad 18x = 72 \Rightarrow x = 4$$

So, the original number is $60 - 9x = 60 - 9 \times 4 = 24$

**4.** If A3 + 8B = 150, then the value of A + B is 13.
In 1′s column,

$$B + 3 = 10$$

B = 7 and 1 is carried forward.
In 10′s column,

$$A + 8 + 1 = 15$$

$$A = 6$$

Therefore, A = 6 and B = 7
So, A + B = 6 + 7 = 13.

**5.** 3*y*5 is divisible by 11, if the digit *y* is 8.
The divisibility rule for 11: The difference between the sum of the digits in odd positions and the sum of the digits in even positions must be divisible by 11.
For 3*y*5, the sum of digits in odd positions = 3 + 5 = 8, and the sum of digits in even positions = *y*.
The difference is 8 – *y*. For divisibility by 11, 8 – *y* is either 0 or multiple of 11.
Therefore, *y* = 8 satisfied the condition.

**D.**

**1.** False
The correct generalised form of a 3 – digit number *abc* is 100*a* + 10*b* + *c*, where *a*, *b* and *c* represent the digits of the number.

**2.** False
AB represents a 2 – digit number where A is the tens digit and B is the units digit. For AB × B = 96, the possible values of A and B do not add up to 15 (e.g., if AB = 16 and B = 6, then A + B = 1 + 6 = 7).

**3.** False

The formula of the magic sum/constant = Order × Central number.

**4.** True

Here, 645 – 546 = 99, which is divisible by 99.

**5.** False

For a number to be divisible by 3, the sum of its digits must be divisible by 3. The sum of the digits $7 + 9 + 3 + x + 0 = 19 + x$. To make $19 + x$ divisible by 3, $x = 2$.

**E.**

**1.** Divisible by 15 → (*b*) 51435

51435 is divisible by 3 (sum of digits = 18, divisible by 3) and divisible by 5 (ends in 5).

**2.** Divisible by 12 → (*d*) 51432

51432 is divisible by 3 (sum of digits = 15, divisible by 3) and divisible by 4 (last two digits, 32, divisible by 4).

**3.** Divisible by 14 → (*c*) 86422

86422 is divisible by 2 (even number) and divisible by 7 (86422 ÷ 7 = 12346).

**4.** Divisible by 33 → (*a*) 61809

61809 is divisible by 3 (sum of digits = 24, divisible by 3) and divisible by 11 (difference between sums of alternate digits: 6 + 8 + 9 – (1 + 0) = 22, divisible by 11).

**F.**

**1.** The number 45 reversed becomes 54.

Their sum is: 45 + 54 = 99

Check divisibility by 11:

The difference between the sum of alternate digits of 99 is 9 – 9 = 0, which is divisible by 11.

Hence, the statement is true.

**2.** (*a*) 62 + AB = 101

**Step 1:** Rearrange to find AB:

AB = 101 – 62

**Step 2:** Perform the subtraction:

AB = 39

That means, A = 3 and B = 9.

(*b*) Observe that the last digit of CB3 is 3. This implies that the unit digit of 4A + 98 must also be 3.

If A = 0: 40 + 98 = 138 (Unit digit is not 3)

If A = 5: 45 + 98 = 143 (Unit digit is 3)

So, CB3 = 143 that means C = 1, B = 4.

Thus, A = 5, B = 4 and C = 1.

(*c*) Similarly solve this question as part (*b*).

(*d*) **Step 1:** Rearrange to find BA:

BA = 41 – 14

**Step 2:** Perform the subtraction:

BA = 27

**Step 3:** Verify the solution:

41 – 27 = 14 (Correct)

Thus, A = 7, B = 2

(*e*) Observe that the last digit of R96 is 6. This implies that the unit digit of 53P – 2Q5 must also be 6.

If P = 1: (borrowed 1 from 3) 11 – 5 = 6 (Unit digit is 6)

Now, in second column we have 2 – Q = 9.

If Q = 3: (borrowed 1 from 5) 12 – 3 = 9 (Tens digit is 9)

Now, for third column we have, 4 – 2 = R

So, R = 2.

Thus, P = 1, Q = 3 and R = 2.

(*f*) Similarly solve this question as part (*e*).

(*g*) Observe that the last digit of 260 is 0. This implies that the unit digit of AB × C must also be 0.

If B = 5 and C = 4 then: 5 × 4 = 20 (Units digit is 0)

Now if we consider A = 6 then 6 × 4 = 24. Add 2 which is carried over.

So, 24 + 2 = 26.

Thus, A = 6, B = 5 and C = 4.

**3.** Similarly solve this question as question 2 part (*g*).

**4.** We are given:

$$x + y = 110 \text{ and } x - y = 20$$

Add the two equations:

$$(x + y) + (x - y) = 110 + 20$$

$$2x = 130 \Rightarrow x = 65$$

Now, substitute $x = 65$ into the equation $x + y = 110$:

$$65 + y = 110$$

$$y = 110 - 65$$

$$y = 45$$

Hence the value of $x = 65$ and $y = 45$.

**5.** (Answer may vary)

Solve for AB × C = DE and DE + FG = HI:

Each letter represents a unique digit from 1 to 9.

Use trial and error, testing unique digits for each letter, ensuring that A, B, C, D, E, F, G, H, I are distinct.

Let $AB = 17$ and $C = 4$:

$17 \times 4 = 68$ so $DE = 68$

For DE + FG = HI:

Let FG = 25:

$68 + 25 = 93$

So, $HI = 93$

**6.** (Answer may vary)

A number divisible by all these must be divisible by their LCM.

LCM (2, 3, 4, 5, 6) = 60

List multiples of 60:

60, 120, 180, 240, 300

The five numbers are: 60, 120, 180, 240, 300.

**7.** Let $xyz$ be represented as $100x + 10y + z$. Then:

$$yzx = 100y + 10z + x,$$

$$zxy = 100z + 10x + y$$

Add $xyz + yzx + zxy$:

$(100x + 10y + z) + (100y + 10z + x) + (100z + 10x + y)$

$= (100x + x + 10x) + (10y + 100y + y) + (z + 10z + 100z)$

$= 111x + 111y + 111z$

$= 111(x + y + z)$

Verify divisibility:

$111(x + y + z)$ is clearly divisible by $(x + y + z)$.

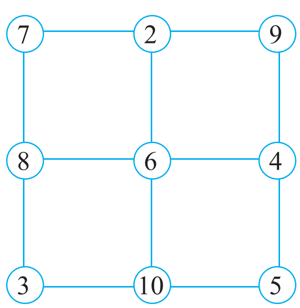
Hence, verified.

**8.** Fill the numbers 1 to 10 without repetition, such that each row, column, and diagonal sums to 18.

Place numbers systematically.

Ensure that every row, column, and diagonal sums to 18.

So the complete box is:




**9.** The given solution has an error in the arrangement. The sum of the rows, columns, and diagonals does not add to 15.

The values assigned to the positions B, D, F and C are incorrect.

The correct magic box is:

| | | |
|---|---|---|
| 8 | 1 | 6 |
| 3 | 5 | 7 |
| 4 | 9 | 2 |

**10.** Solve this question with the help of question 2 parts.

## MODEL TEST PAPER – 2

**A.**

**1.** A number divisible by 4 the number formed by last two digits divisible by 4. If it's also divisible by 8, the number formed by last three digits must be divisible by 8. Here, 204 is divisible by 4 but not 8.

So the correct option is (*c*).

**2.** (*a*) The generalised form of a 3 – digit number is $100 \times a + 10 \times b + c$.

So the correct option is (*a*).

**3.** The $x$ – coordinate is negative, and the $y$ – coordinate is positive in the II quadrant.

So the correct option is (*b*).

**4.** The ordinate is the $y$ – coordinate. So the ordinate of the point (2, 3) is 3.

So the correct option is (*c*).

**5.** Any point where $y = 0$ lies on the $x$ – axis.

So the correct option is (*a*).

**6.** let $x$ be the other number.

$$-10 \times x = -5$$

$$x = \frac{-5}{-10}$$

$$= \frac{1}{2}$$

So the correct option is (*b*).

**7.** The sum of digits $(x + 2 + 4)$ must be divisible by 9. For $x + 6 = 9$, $x = 3$.

So the correct option is (*d*).

**8.** The sum of the positional values of letters in 'APPLE' (1 + 16 + 16 + 12 + 5 = 50). Similarly, for 'ORANGE' (15 + 18 + 1 + 14 + 7 + 5 = 60).

So the correct option is (*c*).

9. Given that, $\sqrt{7225} = 85$ So, $\sqrt{0.7225} = 0.85$ and $\sqrt{72.25} = 8.5$. Adding them: 0.85 + 8.5 = 9.35.
So the correct option is (*c*).

10. 1 $m^3$ = 1000 L
So the correct option is (*d*).

11. The assertion statement is false because the coordinates should be written as ( – 8, 4), with the *x* – coordinate listed first.
The reason statement is true because it correctly explains the notation for coordinates.
So, the correct option is (*d*).

12. The assertion statement is true because a number is divisible by 4 if its last two digits form a number divisible by 4. Here, *x*8 should be divisible by 4. The possible values for *x* that make *x*8 divisible by 4 are 0, 2, 4, 6, and 8.
The reason statement is false because the divisibility rule for 4 depends on the last two digits of the number, not the sum of its digits.
So, the correct option is (*c*).

**B.**

1. The coordinates of origin are (0, 0).
2. (–7, 0) will lie on *x*-axis.
3. If A4 + 7B = 150, then the value of A + B is 13.
If A4 + 7B = 150, Then B should be 6 as we know 6 + 4 = 10.
That means A = 15 – 8 = 7. So, A + B = 13.
4. If 793*x*0 is a multiple of 3, where *x* is a digit, then the smallest value of *x* is 2.
A number is divisible by 3 if the sum of its digits is divisible by 3. The sum of the digits 7 + 9 + 3 + 0 = 19, so *x* = 2 is the smallest value that makes the sum 19 + *x* divisible by 3. Thus, *x* = 2 gives the smallest possible digit.
5. A polyhedron is regular if its faces are congruent regular polygons and the same number of faces meet at each vertex.

**C.**

1. False. The correct form is 155000000000 (the decimal should be moved 11 places).
2. True. The expression simplifies to $x^{(a+b)(a-b)} \times x^{(b+c)(b-c)} \times x^{(c+a)(c-a)}$, which is equivalent to $x^0$ = 1.
3. False. The lower limit of the class – interval 45 – 55 is 45 (it's the beginning of the range).
4. False. A rational number is any number that can be expressed as $\frac{p}{q}$, where $q \neq 0$, not necessarily 1.
5. True. The sum of the interior angles of an *n*-sided polygon is given by (*n* – 2) ×180°, which is equivalent to (*n* – 2) × straight angle.

**D.**

1. Rewrite the numbers as:
$$495 = 500 - 5$$
$$505 = 500 + 5$$
Now, use the identity $(a - b)(a + b) = a^2 - b^2$, where *a* = 500 and *b* = 5:
$495 \times 505 = (500 - 5)(500 + 5) = 500^2 - 5^2$
Now,
$495 \times 505 = 250000 - 25 = 249975$
Thus, the value of 495 × 505 is 249975.

2. (*a*) The provided image is a hexagonal prism.
Now, verify Euler's formula, V – E + F = 2.
We know a hexagonal prism has 8 faces, 18 edges and 12 vertices.
Therefore,
$$12 - 18 + 8 = 2$$
$$2 = 2$$
Hence verified.
(*b*) The provided image is a triangular pyramid.
Now, verify Euler's formula, V – E + F = 2.
We know a triangular pyramid has 4 faces, 6 edges and 4 vertices.
Therefore,
$$4 - 6 + 4 = 2$$
$$2 = 2$$
Hence verified.
(*c*) The provided image is a square pyramid.
Now, verify Euler's formula, V – E + F = 2.
We know a square pyramid has 5 faces, 8 edges and 5 vertices.
Therefore,
$$5 - 8 + 5 = 2$$
$$2 = 2$$
Hence verified.

3. We have given:
Volume of water (V) = 140 $m^3$
Area of the rectangular field (A) = 700 $m^2$
The height (*h*) of the water level is to be found.

We know that:

$$\text{Volume} = \text{Area} \times \text{Height}$$

Rearranging for height:

$$h = \frac{V}{A}$$

Substituting the values:

$$h = \frac{140}{700} = 0.2 \text{ m}$$

The height of the water level is 0.2 m.

**4.** To divide:

$$\frac{188}{10,00,000} = 0.000188$$

Now express this in standard form:

$0.000188 = 1.88 \times 10^{-4}$

The result in standard form is $1.88 \times 10^{-4}$.

**5.** First find the missing sides:

$$MP = AP - AM = 12 - 4 = 8 \text{ cm}$$

$$PD = AD - AP = 18 - 12 = 6 \text{ cm}$$

$$QD = AD - AQ = 18 - 14 = 4 \text{ cm}$$

$$NQ = AQ - AN = 14 - 8 = 6 \text{ cm}$$

Area of the $\Delta AMF = \frac{1}{2} \times \text{Base} \times \text{Height}$

$= \frac{1}{2} \times 4 \times 5$

$= 10 \text{ cm}^2$

Area of the Trapezium FMPE $= \frac{1}{2} \times$ (Sum of the two parallel sides) $\times$ Height

$= \frac{1}{2} \times (5 + 6) \times 8$

$= \frac{1}{2} \times 11 \times 8$

$= 44 \text{ cm}^2$

Area of the $\Delta EPD = \frac{1}{2} \times \text{Base} \times \text{Height}$

$= \frac{1}{2} \times 6 \times 6$

$= 18 \text{ cm}^2$

Area of the $\Delta ANB = \frac{1}{2} \times \text{Base} \times \text{Height}$

$= \frac{1}{2} \times 8 \times 5$

$= 20 \text{ cm}^2$

Area of the $\Delta DCQ = \frac{1}{2} \times \text{Base} \times \text{Height}$

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

$= 8 \text{ cm}^2$

Area of the Trapezium BCQN $= \frac{1}{2} \times$ (Sum of the two parallel sides) $\times$ Height

$= \frac{1}{2} \times (5 + 4) \times 6$

$= \frac{1}{2} \times 9 \times 6$

$= 27 \text{ cm}^2$

Total area $= (10 + 44 + 18 + 20 + 8 + 27) \text{ cm}^2$

$= 127 \text{ cm}^2$

**6.** To calculate the value of the car after 2 years, apply the percentage decrease for each year step – by – step.

The initial price of the car: ₹2,50,000

After the first year (10% decrease):

Price after 1st year = Initial price – 10% of Initial price

= 2,50,000 – 10% × 2,50,000

= 2,50,000 – 25,000 = 2,25,000

After the second year (12% decrease):

Price after 2nd year = Price after 1st year – 12% of Price after 1st year

= 2,25,000 – 12% × 2,25,000

= 2,25,000 – 27,000 = 1,98,000

So, the value of the car after 2 years is ₹1,98,000.

**7.** Simplify:

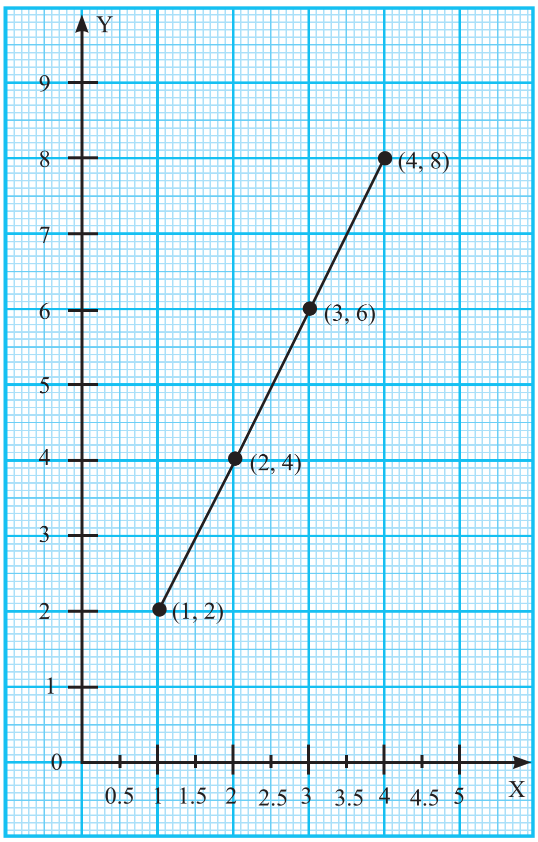
$$\left[\left\{\left(\frac{-4}{5}\right)^{-2}\right\}^{2}\right]^{-2}$$

Multiply the exponent:

$$\left[\left(\frac{-4}{5}\right)^{-2\times2}\right]^{-2} = \left[\left(\frac{-4}{5}\right)^{-4}\right]^{-2} = \left(\frac{-4}{5}\right)^{-4\times-2} = \left(\frac{-4}{5}\right)^{8}$$

**8.** Plot the given points and check for a straight line:

(*a*) Points: (1, 2), (2, 4), (3, 6), (4, 8)




Yes, the points lie on a straight line.

(*b*) Similarly solve this part like part (*a*).

**9.** Identify the cube root using estimation:

$$17576 = 26^3$$

Thus, $\sqrt[3]{17576} = 26$

**10.** (*a*) From the graph, in March, 30,000 instruments were recorded as sold.

(*b* The highest point on the graph is in July, with 95000 instruments sold.

(*c*) The lowest point on the graph is in March, with 30,000 instruments sold.

(*d*) Difference between maximum and minimum number of instruments sold = 95,000 – 30, 000 = 65,000