Chapter 1

Rational Numbers

Exercise 1.1

1. (a) $\frac{5}{13}$

$p = \frac{5}{13}$

$|p| = \left|\frac{5}{13}\right| = \frac{5}{13}$

(b) $\frac{-17}{12}$

$p = \frac{-17}{12}$

$|p| = \left|\frac{-17}{12}\right| = \frac{17}{12}$

(c) -1

$p = -1$

$|p| = |-1| = 1$

(d) 0

$p = 0$

$|p| = |0| = 0$

(e) $\frac{-18}{19}$

$p = \frac{-18}{19}$

$|p| = \left|\frac{-18}{19}\right| = \frac{18}{19}$

(f) $\frac{8}{-5}$

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

$p = \left|\frac{8}{-5}\right| = \frac{8}{5}$

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

$|x| = \left|\frac{-2}{5}\right|$

$= \frac{2}{5}$

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

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

$|-x| = \left|\frac{2}{5}\right| = \frac{2}{5}$

So, $|-x| = |x|$ **Proved**

(b) $x = \frac{5}{-11}$

$|x| = \left|\frac{5}{-11}\right|$

$= \frac{5}{11}$

$-x = -\left(\frac{-5}{11}\right)$

$-x = \frac{5}{11}$

$|-x| = \left|\frac{5}{11}\right| = \frac{5}{11}$

So, $|-x| = |x|$ **Proved**

(c) $x = \frac{4}{7}$ $\qquad$ $-x = \frac{-4}{7}$

$|x| = \left|\frac{4}{7}\right| = \frac{4}{7}$ $\qquad$ $|-x| = \left|\frac{-4}{7}\right| = \frac{4}{7}$

So, $|-x| = |x|$ **Proved**

(d) $x = \frac{-19}{-25}$ $\qquad$ $-x = -\left(\frac{-19}{-25}\right)$

$x = \frac{19}{25}$ $\qquad$ $-x = \frac{-19}{25}$

$|x| = \left|\frac{19}{25}\right| = \frac{19}{25}$ $\qquad$ $|-x| = \left|\frac{-19}{25}\right| = \frac{19}{25}$

So, $|-x| = |x|$ **Proved**

(e) $x = \frac{0}{-8}$ $\qquad$ $-x = -\left(\frac{0}{-8}\right)$

$x = 0$ $\qquad$ $-x = -0$

$|x| = |0| = 0$ $\qquad$ $-x = 0$

So, $|x| = |x|$ $\qquad$ $|-x| = |0| = 0$

So, $|-x| = |-x|$ **Proved**

3. (a) $x = \frac{2}{5}$; $y = \frac{-1}{3}$ $\qquad$ $|x| + |y|$

$|x + y|$ $\qquad$ $\left|\frac{2}{5}\right| + \left|\frac{-1}{3}\right|$

$\left|\frac{2}{5} + \left(\frac{-1}{3}\right)\right|$ $\qquad$ $\frac{2}{5} + \frac{1}{3}$

$\left|\frac{2}{5} - \frac{1}{3}\right|$ $\qquad$ $\frac{6+5}{15}$

$\left|\frac{6-5}{15}\right| = \left|\frac{1}{15}\right| = \frac{1}{15}$ $\qquad$ $= \frac{11}{15}$

Hence, $|x + y| < |x| + |y|$

(b) $x = \frac{-2}{3}$; $y = \frac{5}{6}$

$|x + y|$

$= \left|\frac{-2}{3} + \frac{5}{6}\right|$

$= \left|\frac{-4+5}{6}\right| = \left|\frac{1}{6}\right| = \frac{1}{6}$

$|x| + |y|$

$= \left|\frac{-2}{3}\right| + \left|\frac{5}{6}\right|$

$= \frac{2}{3} + \frac{5}{6} = \frac{9}{6}$

Hence, $|x + y| < |x| + |y|$ **Proved**

(c) $x = \frac{-7}{8}$; $y = \frac{-3}{5}$

$|x + y|$

$= \left|\frac{-7}{8} + \left(\frac{-3}{8}\right)\right|$

$= \left|\frac{-7}{8} - \frac{3}{5}\right|$

$\left|\frac{-35-24}{40}\right| = \left|\frac{-59}{40}\right| = \frac{59}{40}$

$|x| + |y|$

$= \left|\frac{-7}{8}\right| + \left|\frac{-3}{5}\right|$

$= \frac{7}{8} + \frac{3}{5}$

$= \frac{35+24}{40} = \frac{59}{40}$

Hence, $|x + y| = |x| + |y|$ **Proved**

4. (a) $x = \frac{-1}{7}$; $y = \frac{1}{5}$

Now, $|x \times y|$

$= \left|\frac{-1}{7} \times \frac{1}{5}\right|$

$= \left|\frac{-1}{35}\right| = \frac{1}{35}$

$|x| \times |y|$

$= \left|\frac{-1}{7}\right| \times \left|\frac{1}{5}\right|$

$= \frac{1}{7} \times \frac{1}{5} = \frac{1}{35}$

So, $|x \times y| = |x| \times |y|$ **Proved**

(b) $x = \frac{-1}{9}$; $y = \frac{-3}{4}$

Now, $|x \times y|$

$= \left|\frac{-1}{9} \times \frac{-3}{4}\right|$

$|x| \times |y|$

$= \left|\frac{-1}{9}\right| \times \left|\frac{-3}{4}\right|$

$= \left|\frac{1}{12}\right| = \frac{1}{12}$ $\qquad$ $= \frac{1}{9} \times \frac{3}{4} = \frac{1}{12}$

So, $\qquad |x \times y| = |x| \times |y|$ $\qquad$ **Proved**

(c) $x = \frac{5}{9}$; $y = \frac{2}{3}$

$|x \times y|$ $\qquad$ $|x| \times |y|$

$= \left|\frac{5}{9} \times \frac{2}{3}\right| = \left|\frac{10}{27}\right| = \frac{10}{27}$ $\qquad$ $= \left|\frac{5}{9}\right| \times \left|\frac{2}{3}\right| = \frac{5}{9} \times \frac{2}{3} = \frac{10}{27}$

So, $\qquad |x \times y| = |x| \times |y|$ $\qquad$ **Proved**

5. (a) $\frac{4}{7}$

So, possible rational no.

$= \frac{4}{7}, \frac{-4}{7}$

(b) $\frac{3}{8}$

So, possible rational no.

$= \frac{3}{8}, \frac{-3}{8}$

(c) $\frac{9}{17}$

So, possible rational no.

$= \frac{9}{17}, \frac{-9}{17}$

(d) 0

So, possible rational no

$= 0$

6. (a) $\left|\frac{3}{5} - \frac{2}{3}\right|$

$= \left|\frac{3}{5} - \frac{2}{3}\right|$

$= \left|\frac{9-10}{15}\right| = \left|\frac{-1}{15}\right| = \frac{1}{15}$

(b) $\left|\frac{-4}{5} - \frac{1}{4}\right|$

$= \left|\frac{-16-5}{20}\right|$

$= \left|\frac{-21}{20}\right| = \frac{21}{20}$

(c) $\left|\frac{-7}{5} - \frac{8}{13}\right|$

$= \left|\frac{-91-40}{65}\right|$

$= \left|\frac{-131}{65}\right| = \frac{131}{65}$

(d) $\left|\frac{-5}{7} + 1\right|$

$= \left|\frac{-5}{7} + \frac{1}{1}\right|$

$= \left|\frac{-5+7}{7}\right| = \left|\frac{2}{7}\right| = \frac{2}{7}$

(e) $\left|-4+\frac{10}{21}\right| = \left|\frac{-4}{1}+\frac{10}{21}\right| = \left|\frac{-84+10}{21}\right| = \left|\frac{-74}{21}\right| = \frac{74}{21}$

Exercise 1.2

1. (a) $\frac{-15}{7}+\mathbf{0}=\mathbf{0}+\frac{-15}{7}=\frac{-15}{7}$.

(b) $\frac{-12}{5}+\frac{2}{7}=\mathbf{\frac{2}{7}}+\left(\frac{-12}{5}\right)$

(c) $\frac{3}{-8}+\mathbf{\frac{3}{8}}=0=\frac{3}{8}+\mathbf{\frac{-3}{8}}$.

(d) $\frac{-2}{9}+\left\{\frac{-3}{7}+\left(\frac{-9}{14}\right)\right\}$

$=\left(\frac{-2}{9}+\frac{-3}{7}\right)+\mathbf{\frac{-9}{14}}$.

(e) $-7+\left(\frac{-21}{8}\right)=\left(\mathbf{\frac{-21}{8}}\right)+(-7)$

(f) $-1+\left(\frac{-2}{3}+\frac{-3}{5}\right)$

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

2. (a) $\frac{-7}{5}$ and $\frac{2}{7}$

$=\frac{-7}{5}+\frac{2}{7}$

$=\frac{-49+10}{35}$

$=\frac{-39}{35}$

(b) $\frac{-9}{13}$ and $\frac{-8}{5}$

$=\frac{-9}{13}+\left(\frac{-8}{5}\right)$

$=\frac{-9}{13}-\frac{8}{5}$

$=\frac{-45-104}{65}=\frac{-149}{65}$

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

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

$=\frac{3}{4}-\frac{2}{5}$

$=\frac{15-8}{20}=\frac{7}{20}$

(d) $\frac{2}{-7}$ and $\frac{4}{-21}$

$=\frac{2}{-7}+\left(\frac{4}{-21}\right)$

$=\frac{-2}{7}-\frac{4}{21}$

$=\frac{-6-4}{21}=\frac{-10}{21}$

(e) 0 and $\frac{-4}{5}$

$=0+\left(\frac{-4}{5}\right)$

$=\frac{0}{1}-\frac{4}{5}$

$=\frac{0-4}{5}=\frac{-4}{5}$

(f) 1 and $\frac{-1}{3}$

$=1+\left(\frac{-1}{3}\right)$

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

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

3. (a) $a=\frac{2}{3}$ and $b=\frac{-3}{7}$

$$(a+b)=(b+a) \quad \Rightarrow \quad \frac{2}{3}+\left(\frac{-3}{7}\right)=\frac{-3}{7}+\frac{2}{3}$$

$$\frac{2}{3}-\frac{3}{7}=\frac{-9+14}{21} \quad \Rightarrow \quad \frac{14-9}{21}=\frac{5}{21}$$

$$\frac{5}{21}=\frac{5}{21}$$

L.H.S. = R.H.S. **Proved**

(b) $a=\frac{-3}{11}$ and $b=\frac{-4}{7}$

$$(a+b)=(b+a)$$

$$\left[\frac{-3}{11}+\left(\frac{-4}{7}\right)\right]=\left[\frac{-4}{7}+\left(\frac{-3}{11}\right)\right]$$

$$\left[\frac{-3}{11}-\frac{4}{7}\right]=\left[\frac{-4}{7}-\frac{3}{11}\right]$$

$$\left[\frac{-21-44}{-77}\right]=\left[\frac{-44-21}{77}\right]$$

$$\left[\frac{-65}{77}\right]=\left[\frac{-65}{77}\right]$$

$$\frac{-65}{77}=\frac{-65}{77}$$

L.H.S. = R.H.S. **Proved**

(c) $a=6$ and $b=\frac{3}{5}$

$$(a+b)=(b+a)$$

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

$$\left(\frac{30+3}{5}\right)=\left(\frac{3+30}{5}\right)$$

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

L.H.S. = R.H.S. **Proved**

(d) $a=-3$, $b=\frac{-7}{12}$

$$(a+b)=(b+a)$$

$$-3+\left(\frac{-7}{12}\right)=\frac{-7}{12}+\left(\frac{-3}{1}\right)$$

$$\frac{-3}{1}-\frac{7}{12}=\frac{-7}{12}-\frac{3}{1}$$

$$\frac{-36-7}{12}=\frac{-7-36}{12}$$

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

L.H.S. = R.H.S. **Proved**

4. (a) $a=\frac{-2}{3}, b=\frac{5}{6}$ and $c=\frac{-5}{8}$

Now, $(a+b)+c=a+(b+c)$

$$\left(\frac{-2}{3}+\frac{5}{6}\right)+\left(\frac{-5}{8}\right)=\frac{-2}{3}+\left(\frac{5}{6}+\left(\frac{-5}{8}\right)\right)$$

$$\left(\frac{-12+15}{18}\right)+\left(\frac{-5}{8}\right)=\frac{-2}{3}+\left(\frac{5}{6}-\frac{5}{8}\right)$$

$$\left(\frac{3}{18}\right)+\left(\frac{-5}{8}\right)=\frac{-2}{3}+\left(\frac{20-15}{24}\right)$$

$$\frac{1}{6}-\frac{5}{8}=\frac{-2}{3}+\frac{5}{24}$$

$$\frac{4-15}{24}=\frac{-16+5}{24}$$

$$-\frac{11}{24}=\frac{-11}{24}$$

Hence, L.H.S. = R.H.S. **Proved**

(b) $a=\frac{-9}{11}, b=\frac{3}{-5}$ and $c=\frac{-9}{22}$

Now, $(a+b)+c=a+(b+c)$

$$\left(\frac{-9}{11}+\left(\frac{-3}{5}\right)\right)+\left(\frac{-9}{22}\right)=\left(\frac{-9}{11}\right)+\left(\frac{-3}{5}+\left(\frac{-9}{22}\right)\right)$$

$$\left(\frac{-9}{11}-\frac{3}{5}\right)+\left(\frac{-9}{22}\right)=\left(\frac{-9}{11}\right)+\left(\frac{-3}{5}-\frac{9}{22}\right)$$

$$\left(\frac{-45-33}{55}\right)-\frac{9}{22}=\frac{-9}{11}+\left(\frac{-66-45}{110}\right)$$

$$\frac{-78}{55}-\frac{9}{22}=\frac{-9}{11}+\left(\frac{-111}{110}\right)$$

$$\frac{-156-45}{110}=\frac{-90-111}{110}$$

$$\frac{-201}{110}=\frac{-201}{110}$$

Hence, L.H.S. = R.H.S. **Proved**

(c) $a=-1,\ b=\left(\frac{-2}{3}\right)$ and $c=\frac{-3}{4}$

$$(a+b)+c=a+(b+c)$$

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

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

$$\left(\frac{-3-2}{3}\right)-\frac{3}{4}=-1+\left(\frac{-8-9}{12}\right)$$

$$\frac{-5}{3}-\frac{3}{4}=\frac{-1}{1}+\left(\frac{-17}{12}\right)$$

$$\frac{-20-9}{12}=\frac{-1}{1}-\frac{17}{12}$$

$$\frac{-29}{12}=\frac{-12-17}{12}$$

$$\frac{-29}{12}=\frac{-29}{12}$$

Hence, L.H.S. = R.H.S. **Proved**

5. (a) Additive inverse of $\frac{-1}{3}=-\left(\frac{-1}{3}\right)=+\frac{1}{3}$

(b) Additive inverse of $\frac{-23}{9}=-\left(\frac{-23}{9}\right)=+\frac{23}{9}$

(c) Additive inverse of $18=-18$

(d) Additive inverse of $\frac{17}{8} = \frac{-17}{8}$

(e) Additive inverse of $\frac{15}{4}$

$= \frac{-15}{4}$

(f) Additive inverse of $\frac{3}{5}$

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

(g) Additive inverse of

$= -\left(\frac{-3}{8}\right) = \frac{+3}{8}$

(h) Additive inverse of $\frac{42}{7}$

$= -\frac{42}{7}$

(i) Additive inverse of $-8 = +8$

(j) Additive inverse of $\frac{5}{26}$

$= \frac{-5}{26}$

6. (a) $\frac{3}{7}$ from $\frac{2}{3}$

$\frac{2}{3} - \frac{3}{7}$

$= \frac{14-9}{21}$

$= \frac{5}{21}$

(b) 6 from $\frac{3}{5}$

$\frac{3}{5} - \frac{6}{1}$

$= \frac{3-30}{5}$

$= \frac{-27}{5}$

(c) $\frac{-4}{7}$ from $\frac{-3}{11}$

$\frac{-3}{11} - \left(\frac{-4}{7}\right)$

$= \frac{-3}{11} + \frac{4}{7}$

$= \frac{-21+44}{77}$

$= \frac{23}{77}$

7. (a) 0 from $\frac{4}{7}$

$\frac{4}{7} - 0 = \frac{4}{7}$

(b) $\frac{4}{7}$ from 0

$0 - \frac{4}{7} = \frac{-4}{7}$

So, both results are not same.

8. (a) $\frac{2}{3} + \frac{-4}{5} + \frac{-2}{3} + 1 + \frac{-11}{15}$

$= \frac{2}{3} + \frac{-2}{3} + \frac{-4}{5} + 1 + \frac{-11}{15}$

$$= \frac{2}{3} - \frac{2}{3} - \frac{4}{5} + \frac{1}{1} - \frac{11}{15}$$

$$= \frac{-12+15-11}{15} = \frac{-23+15}{15} = \frac{-8}{15}$$

(b) $\frac{5}{8} + \frac{-8}{9} + 0 + \frac{-13}{3} + \frac{17}{24}$

$$= \frac{5}{8} + \frac{17}{24} + \left(\frac{-8}{9}\right) + \left(\frac{-13}{3}\right)$$

$$= \left(\frac{15+17}{24}\right) + \left(\frac{-8-39}{9}\right)$$

$$= \frac{32}{24} + \left(\frac{-47}{9}\right) = \frac{32}{24} - \frac{47}{9} = \frac{96-376}{72}$$

$$= \frac{-280}{72} = \frac{-35}{9}$$

(c) $\frac{-13}{20} + \frac{11}{14} + \frac{-5}{7} + 1$

$$= \frac{-13}{20} + \frac{1}{1} + \left(\frac{11}{14} - \frac{5}{7}\right) = \left(\frac{-13+20}{20}\right) + \left(\frac{11-10}{14}\right)$$

$$= \frac{7}{20} + \frac{1}{14} = \frac{49+10}{140} = \frac{59}{140}$$

(d) $\frac{4}{7} + \frac{-8}{9} + \frac{-5}{21} + \frac{1}{3}$

$$= \frac{4}{7} + \left(\frac{-5}{21}\right) + \left(\frac{-8}{9}\right) + \frac{1}{3} = \frac{4}{7} - \frac{5}{21} + \frac{1}{3} - \frac{8}{9} = \left(\frac{12-5}{21}\right) + \left(\frac{3-8}{9}\right)$$

$$= \frac{7}{21} + \left(\frac{-5}{9}\right) = \frac{7}{21} - \frac{5}{9} = \frac{21-35}{63} = \frac{-14}{63} = \frac{-2}{9}$$

9. Sum of two rational number $= \frac{2}{3}$

One number $= \frac{-1}{6}$

So, second no. $= \frac{2}{3} - \left(-\frac{1}{6}\right) = \frac{2}{3} + \frac{1}{6} = \frac{4+1}{6} = \frac{5}{6}$

10. Sum of two rational no. $= \frac{3}{20}$

One no. $= \frac{3}{4}$

So, the other no. $= \left(\frac{3}{20} - \frac{3}{4}\right) = \frac{3-15}{20} = \frac{-12}{20} = \frac{-3}{5}$

11. Let x should be added to $\frac{-7}{12}$ to get $\frac{1}{24}$.

So, $x + \left(\frac{-7}{21}\right) = \frac{1}{24}$

$$x = \frac{1}{24} + \frac{7}{12} \Rightarrow x = \frac{1+14}{24} \Rightarrow x = \frac{15}{24} = \frac{5}{8}$$

So, the required no. $= \frac{5}{8}$

12. Let x should be added to $\frac{3}{4}$ to get $\frac{-1}{4}$.

So, $x + \frac{3}{4} = -\frac{1}{4} \Rightarrow x = \frac{-1}{4} - \frac{3}{4}$

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

$$x = -1$$

So, the required no. $= -1$

13. What number should be added to $\frac{3}{20}$ to get $\frac{3}{4}$?

Let x should be added to $\frac{3}{20}$ to get $\frac{3}{4}$.

So, $x + \frac{3}{20} = \frac{3}{4} \Rightarrow x = \frac{3}{4} - \frac{3}{20}$

$$x = \frac{15-3}{20} \Rightarrow x = \frac{12}{20} = \frac{3}{5}$$

So, the required no. $\frac{3}{5}$

14. (a) True (b) True (c) True (d) True
(e) False (f) True (g) True (h) True

Exercise 1.3

1. (a) $\frac{-3}{7} \times \frac{4}{9}$

$= \frac{-3 \times 4}{7 \times 9} = \frac{-4}{21}$

(b) $\frac{1}{2} \times \frac{3}{4}$

$= \frac{1 \times 3}{2 \times 4} = \frac{3}{8}$

(c) $\frac{-5}{7} \times \frac{7}{11}$

$= \frac{-5 \times 7}{7 \times 11} = \frac{-5}{11}$

(d) $\frac{2}{3} \times \frac{(-7)}{9}$

$= \frac{2 \times (-7)}{3 \times 9} = \frac{-14}{27}$

(e) $\frac{-2}{5} \times \frac{-3}{11}$

$= \frac{(-2) \times (-3)}{5 \times 11} = \frac{6}{55}$

(f) $\frac{3}{2} \times \frac{-5}{-7}$

$= \frac{3 \times (-5)}{2 \times (-7)} = \frac{15}{14}$

(g) $\frac{-14}{15} \times \frac{9}{16}$

$= \frac{-14 \times 9}{15 \times 16} = \frac{-21}{40}$

(h) $\frac{-15}{12} \times \frac{-18}{25}$

$= \frac{-15 \times (-18)}{12 \times 25} = \frac{9}{10}$

2. (a) $\left(\frac{13}{5}\right) \times \left(\frac{7}{26}\right) \times \left(\frac{-50}{7}\right) \times \left(\frac{-1}{5}\right) = \frac{13 \times 7 \times (-50) \times (-1)}{5 \times 26 \times 7 \times 5} = 1$

(b) $(-3) \times \left(\frac{2}{-14}\right) \times \left(\frac{-5}{12}\right) \times \left(\frac{7}{15}\right) = \frac{-3 \times 2 \times (-5) \times 7}{1 \times (-14) \times 12 \times 15} = \frac{-1}{12}$

3. (a) $\frac{3}{4} \times \frac{5}{7} = \frac{5}{7} \times \frac{3}{4}$

$= \frac{3 \times 5}{4 \times 7}$

$= \frac{5 \times 3}{7 \times 4}$

$= \frac{15}{28} = \frac{15}{28}$

L.H.S. = R.H.S. (verified)

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

$= \frac{2 \times (-3)}{1 \times 5}$

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

$= \frac{-6}{5} = \frac{-6}{5}$

L.H.S. = R.H.S. (verified)

(c) $$0\times\left(\frac{-5}{9}\right)=\left(\frac{-5}{9}\right)\times 0$$

$$\frac{0\times(-5)}{1\times 9}=\frac{-5\times 0}{9\times 1}$$

$$\frac{0}{9}=\frac{0}{9}\Rightarrow 0=0$$

L.H.S. = R.H.S. (verified)

(d) $$\left(\frac{-12}{5}\right)\times\left(\frac{7}{-36}\right)=\left(\frac{7}{-36}\right)\times\left(\frac{-12}{5}\right)$$

$$\frac{-12\times 7}{5\times(-36)}=\frac{7\times(-12)}{-36\times 5}$$

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

L.H.S. = R.H.S. (verified)

(e) $$(-9)\times\left(\frac{-16}{12}\right)=\left(\frac{-16}{12}\right)\times(-9)$$

$$\frac{-9}{1}\times\frac{-16}{12}=\frac{-16}{12}\times\frac{-9}{1}$$

$$\frac{-9\times(-16)}{1\times 12}=\frac{-16\times(-9)}{12\times 1}$$

$$+12=+12$$

L.H.S. = R.H.S. (verified)

4. (a) $$\left(\frac{7}{5}\times\frac{-9}{4}\right)\times\frac{1}{2}=\frac{7}{5}\times\left(\frac{-9}{7}\times\frac{1}{2}\right)$$

$$\left(\frac{7\times(-9)}{5\times 7}\right)\times\frac{1}{2}=\frac{7}{5}\times\left(\frac{-9\times 1}{7\times 2}\right)$$

$$\left(\frac{-9}{5}\right)\times\frac{1}{2}=\frac{7}{5}\times\frac{-9}{14}$$

$$\frac{-9\times 1}{5\times 2}=\frac{7\times(-9)}{5\times 14}$$

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

L.H.S. = R.H.S. (verified)

(b) $\left(\frac{3}{2}\times\frac{-5}{7}\right)\times\left(\frac{-1}{3}\right)=\frac{3}{2}\times\left(\frac{-5}{7}\times\frac{-1}{3}\right)$

$$\left(\frac{3\times(-5)}{2\times 7}\right)\times\left(\frac{-1}{3}\right)=\frac{3}{2}\times\left(\frac{-5\times(-1)}{7\times 3}\right)$$

$$\left(\frac{-15}{14}\right)\times\left(\frac{-1}{3}\right)=\frac{3}{2}\times\left(\frac{5}{21}\right)$$

$$\frac{-15\times(-1)}{14\times 3}=\frac{3\times 5}{2\times 21}$$

$$\frac{5}{14}=\frac{5}{14}$$

L.H.S. = R.H.S. (verified)

(c) $\left(\frac{-5}{2}\times\frac{16}{3}\right)\times(-1)=\frac{-5}{2}\times\left(\frac{16}{3}\times -1\right)$

$$\left(\frac{-5\times 16}{2\times 3}\right)\times(-1)=\frac{-5}{2}\times\left(\frac{16\times(-1)}{3\times 1}\right)$$

$$\left(\frac{-40}{3}\right)\times\frac{(-1)}{1}=\frac{-5}{2}\times\left(\frac{-16}{3}\right)$$

$$\frac{40}{3}=\frac{-5\times(-1)}{2\times 3}$$

$$\frac{40}{3}=\frac{40}{3}$$

L.H.S. = R.H.S. (verified)

(d) $\frac{-12}{5}\times\left(\frac{4}{15}\times\frac{25}{-16}\right)=\left(\frac{-12}{5}\times\frac{4}{15}\right)\times\frac{25}{-16}$

$$\frac{-12}{5}\times\left(\frac{4\times 25}{15\times(-16)}\right)=\left(\frac{-12\times 4}{5\times 15}\right)\times\left(\frac{25}{-16}\right)$$

$$\left(\frac{-12}{5}\right)\times\left(\frac{-5}{12}\right)=\left(\frac{-16}{25}\right)\times\left(\frac{25}{-16}\right)$$

$$\frac{-12\times(-5)}{5\times 12}=\frac{-16\times 25}{25\times(-16)}$$

$$1=1$$

L.H.S. = R.H.S. (verified)

5. (a) $\frac{0}{9}$

Multiplicative inverse of $\frac{0}{9}$ = does not exist

(b) $\frac{-7}{11}$

Multiplicative inverse of $\frac{-7}{11} = \frac{-11}{7}$

(c) $\frac{8}{-19}$

Multiplicative inverse of $\frac{8}{-19} = \frac{-19}{8}$

(d) $\frac{-1}{7}$

Multiplicative inverse of $\frac{-1}{7} = -7$

(e) -18

Multiplicative inverse of $-18 = \frac{-1}{18}$

(f) $\frac{-4}{-5}$

Multiplicative inverse of $\frac{-4}{-5}$ or $\frac{4}{5} = \frac{5}{4}$

6. (a)

$$\frac{-15}{4} \times \left(\frac{3}{7} + \frac{-12}{5}\right) = \left(\frac{-15}{4} \times \frac{3}{7}\right) + \left(\frac{-15}{4} \times \frac{-12}{5}\right)$$

$$\frac{-15}{4} \times \left(\frac{3}{7} - \frac{12}{5}\right) = \left(\frac{-45}{28}\right) + \frac{(+9)}{1}$$

$$\frac{-15}{4} \times \left(\frac{15-84}{35}\right) = \frac{-45+(252)}{28}$$

$$\frac{-15}{4} \times \left(\frac{-69}{35}\right) = \frac{-45+252}{28}$$

$$\frac{207}{28} = \frac{207}{28}$$

L.H.S. = R.H.S. (verified)

(b)

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

$$\frac{-3}{4} \times \left(\frac{4+(-5)}{6}\right) = \frac{-1}{2} + \frac{5}{8}$$

$$\frac{-3}{4} \times \left(\frac{4-5}{6}\right) = \left(\frac{-4+5}{8}\right)$$

$$\frac{-3}{4} \times \frac{-1}{6} = \frac{1}{8}$$

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

$$\text{L.H.S.} = \text{R.H.S.} \qquad \text{(verified)}$$

(c) $$\frac{1}{3}\times\left(0+\frac{-7}{6}\right)=\frac{1}{3}\times(0)+\frac{1}{3}\times\left(\frac{-7}{6}\right)$$

$$\frac{1}{3}\times\left(\frac{-7}{6}\right)=0+\frac{1}{3}\times\left(\frac{-7}{6}\right)$$

$$\frac{-7}{18}=\frac{-7}{18}$$

$$\text{L.H.S.} = \text{R.H.S.} \qquad \text{(verified)}$$

(d) $$\frac{-5}{2}\times\left(-2+\frac{11}{3}\right)=\frac{-5}{2}\times(-2)+\frac{-5}{2}\times\left(\frac{11}{3}\right)$$

$$\frac{-5}{2}\times\left(\frac{-2}{1}+\frac{11}{3}\right)=\frac{5}{1}+\left(\frac{-55}{6}\right)$$

$$\left(\frac{-5}{2}\right)\times\left(\frac{-6+11}{3}\right)=\frac{5}{1}-\frac{55}{6}$$

$$\frac{-5\times5}{2\times3}=\frac{30-55}{6}$$

$$\frac{-25}{6}=\frac{-25}{6}$$

$$\text{L.H.S.} = \text{R.H.S.} \qquad \text{(verified)}$$

7. (a) $\left(\frac{-14}{18}\right)\times0=\mathbf{0}\times\frac{-14}{18}=\mathbf{0}$ (property of zero).

(b) $\left(\frac{-45}{101}\right)\times1=1\times\left(\frac{\mathbf{-45}}{\mathbf{101}}\right)=\left(\frac{\mathbf{-45}}{\mathbf{101}}\right)$ (property of 1).

(c) $\left(\frac{-5}{9}\right)\times\left(\frac{3}{7}\right)=\left(\frac{\mathbf{3}}{\mathbf{7}}\right)\times\frac{-5}{9}$ (commutative property).

(d) $\left(\frac{-13}{24}\times\frac{-12}{5}\right)\times\frac{35}{36}=\frac{\mathbf{-13}}{\mathbf{24}}\times\left(\frac{-12}{5}\times\frac{35}{36}\right)$ (associative property)

(e) $\frac{-9}{5}\times\left(\frac{-10}{3}\times\frac{21}{-4}\right)=\left(\frac{-9}{5}\times\frac{-10}{3}\right)\times\left(\frac{\mathbf{21}}{\mathbf{-4}}\right)$ (associative property).

(f) The product of a rational number and its **reciprocal** is 1.

(g) **1** and **–1** are the only two rational numbers, which are their own reciprocals.

(h) Rational number **0** has no reciprocal.

(i) Product of two negative rational numbers is **positive**.

(j) Product of a positive and a negative rational number is **negative**.

(k) **1** is the multiplicative identity for rational numbers.

(l) The product of two rational numbers is always a **rational number**.

Exercise 1.4

1. Fill in the blanks.

(a) $\frac{7}{5} \div \frac{-9}{7} \boxed{} \frac{-9}{7} \div \frac{7}{5} \Rightarrow \frac{7}{5} \times \frac{7}{-9} \boxed{} \frac{-9}{7} \times \frac{5}{7} \Rightarrow \frac{-49}{45} < \frac{-45}{49}$

(b) $\frac{7}{9} \div \boxed{} = \frac{7}{9}$

Let suitable no. $= x$

$\frac{7}{9} \div x = \frac{7}{9} \Rightarrow x = \frac{7}{9} \div \frac{7}{9} \Rightarrow x = 1$

So, $\frac{7}{9} \div \boxed{1} = \frac{7}{9}$

(c) $\frac{-8}{11} \div \boxed{} = \frac{8}{11}$

Let suitable no. be $= x$

$\frac{-8}{11} \div x = \frac{8}{11} \Rightarrow x = \frac{-8}{11} \div \frac{8}{11} \Rightarrow x = -1$

So, $\frac{-8}{11} \div \boxed{-1} = \frac{8}{11}$

(d) $\frac{5}{7} \div \boxed{} = 1$

Let required no. be $= x$

$\frac{5}{7} \div x = 1 \Rightarrow x = \frac{5}{7} \div 1 \Rightarrow x = \frac{5}{7}$

So, $\frac{5}{7} \div \frac{5}{7} = 1$

(e) $\frac{4}{11} \div \frac{4}{11} = \square$

L.H.S. $= \frac{4}{11} \times \frac{11}{4} = 1$

So, $\frac{4}{11} \div \frac{4}{11} = \boxed{1}$

(f) $\frac{5}{21} \div \frac{-5}{21} = \square$

L.H.S $= \frac{5}{21} \times \frac{21}{-5} = -1$

So, $\frac{5}{21} \div \frac{-5}{21} = \boxed{-1}$

(g) $\frac{0}{9} \div \frac{8}{11} = \square$

L.H.S $= 0 \div \frac{8}{11}$

$= 0 \times \frac{11}{8} = \frac{0}{8} = 0$

So, $\frac{0}{9} \div \frac{8}{11} = \boxed{0}$

(h) $\left(\frac{5}{9} \div \frac{1}{3}\right) \div \frac{5}{2} \square \frac{5}{9} \div \left(\frac{1}{3} \div \frac{5}{2}\right)$

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

$\frac{5}{3} \div \frac{5}{2} \square \frac{5}{9} \div \frac{2}{15}$

$\frac{5}{3} \times \frac{2}{5} \square \frac{5}{9} \times \frac{15}{2}$

$\frac{2}{3} < \frac{25}{6}$

2. (a) $\frac{7}{9} \div \frac{3}{7}$

$\frac{7}{9} \times \frac{7}{3} = \frac{49}{27}$

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

$\frac{-3}{3} \times \frac{4}{3} = \frac{-4}{3}$

(c) $\frac{5}{6} \div \frac{5}{6}$

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

(d) $\frac{3}{4} \div \frac{5}{9}$

$\frac{3}{4} \times \frac{9}{5} = \frac{27}{20}$

(e) $\frac{-16}{35} \div \frac{15}{14}$

$\frac{-16}{35} \times \frac{14}{15} = \frac{-32}{75}$

(f) $\frac{-4}{5} \div \frac{5}{12}$

$\frac{-4}{5} \times \frac{12}{5} = \frac{-48}{25}$

3. (a) $\frac{2}{5} \div \frac{3}{8} = \frac{3}{8} \div \frac{2}{5}$

$\frac{2}{5} \times \frac{8}{3} = \frac{3}{8} \times \frac{5}{2}$

$\frac{16}{15} = \frac{15}{16}$ (False)

(b) $\frac{3}{4} \div \frac{5}{9} = \frac{9}{5} \div \frac{4}{3}$

$\frac{3}{4} \times \frac{9}{5} = \frac{9}{5} \times \frac{3}{4}$

$\frac{27}{20} = \frac{27}{20}$ (True)

(c)
$$\left(\frac{2}{5}\div\frac{3}{8}\right)\div\frac{-3}{5}=\frac{2}{5}\div\left(\frac{3}{8}\div\frac{-3}{5}\right)$$
$$\left(\frac{2}{5}\div\frac{3}{8}\right)\div\left(\frac{-3}{5}\right)=\frac{2}{5}\div\left(\frac{3}{8}\times\frac{5}{-3}\right)$$
$$\left(\frac{2}{5}\times\frac{8}{3}\right)\div\frac{3}{5}=\frac{2}{5}\div\left(\frac{-5}{8}\right)$$
$$\frac{16}{15}\times\frac{5}{(-3)}=\frac{2}{5}\times\frac{8}{(-5)}$$
$$\frac{-16}{9}=\frac{-16}{25}\text{ (False)}$$

(d)
$$\left(\frac{7}{9}\div\frac{3}{7}\right)\div\frac{-3}{7}=\frac{7}{9}\div\left(\frac{3}{7}\div\frac{-3}{7}\right)$$
$$\left(\frac{7}{9}\times\frac{7}{3}\right)\div\frac{-3}{7}=\frac{7}{9}\div\left(\frac{3}{7}\times\frac{7}{(-3)}\right)$$
$$\left(\frac{49}{27}\div\frac{-3}{7}\right)=\frac{7}{9}\div-1$$
$$\frac{49}{27}\times\frac{7}{-3}=\frac{7}{9}\times\frac{-1}{1}$$
$$\frac{-343}{81}=\frac{-7}{9}\text{ (False)}$$

4. Product of two rational number $=\frac{-40}{3}$

One number $=\frac{-5}{2}$

So, the other no. $=\frac{-40}{3}\div\frac{-5}{2}=\frac{-40}{3}\times\frac{2}{-5}=\frac{16}{3}$

5. Let x should be multiplied $\frac{11}{5}$ to get $\frac{-33}{25}$.

So, $x\times\frac{11}{5}=\frac{-33}{25}$ $\Rightarrow$ $x=\frac{-33}{25}\div\frac{11}{5}$

$x=\frac{-33}{25}\times\frac{5}{11}$ $\Rightarrow$ $x=\frac{-3}{5}$

6. Let we divide $\frac{-10}{21}$ by x to get $\frac{-2}{3}$.

So, $\frac{-10}{21} \div x = \frac{-2}{3} \quad \Rightarrow \quad x = \frac{-10}{21} \div \frac{-2}{3}$

$x = \frac{-10}{21} \times \frac{3}{-2} \quad \Rightarrow \quad x = \frac{5}{7}$

7. $$\left(\frac{5}{9} \times \frac{-6}{5}\right) \div \left(\frac{5}{9} - \left(\frac{-6}{5}\right)\right) = \left(\frac{5}{9} \times \frac{-6}{5}\right) \div \left(\frac{5}{9} + \frac{6}{5}\right)$$

$$= \frac{-2}{3} \div \frac{25+54}{45} = \frac{-2}{3} \div \frac{79}{45}$$

$$= \frac{-2}{3} \times \frac{45}{79} = \frac{-30}{79}$$

8. Let $\frac{5}{9}$ should be divided by x to get $\frac{5}{3}$.

So, $\frac{5}{9} \div x = \frac{5}{3} \quad \Rightarrow \quad \frac{5}{9} \div \frac{5}{3} = x$

$x = \frac{5}{9} \times \frac{3}{5} \quad \Rightarrow \quad x = \frac{1}{3}$

9. $$= \left(\frac{-3}{4} + \frac{5}{6}\right) \div \left(\frac{-3}{4} \times \frac{5}{6}\right)$$

$$= \left(\frac{-9+10}{12}\right) \div \left(\frac{-5}{8}\right) = \frac{1}{12} \times \frac{8}{-5} = \frac{-2}{15}$$

10. Let, we should multiply $\frac{-3}{7}$ by x to get $\frac{6}{49}$.

So, $\frac{-3}{7} \times x = \frac{6}{49}$

$\Rightarrow \quad x = \frac{6}{49} \div \frac{-3}{7}$

$x = \frac{6}{49} \times \frac{7}{-3}$

$\Rightarrow \quad x = \frac{-2}{7}$

11. (a) True (b) False (c) False

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

Mental Maths :

Fill in the blanks :

1. A rational number between $\frac{-1}{5}$ and $\frac{1}{6}$ is $\mathbf{\frac{-1}{60}}$.

2. The value of $\frac{-3}{5} \div \frac{4}{11}$ is $\mathbf{\frac{-33}{20}}$.

3. $\frac{1}{6} + \frac{1}{5} - \frac{1}{3}$ is equal to $\mathbf{\frac{1}{30}}$.

4. $\frac{5}{4} \times \frac{-3}{7} + \frac{5}{4} \times \frac{9}{13} = \frac{5}{4}\left[\frac{-3}{7} + \frac{9}{13}\right]$

$$= \frac{5}{4}\left(\frac{-39+63}{91}\right)$$

$$= \frac{5}{4} \times \left(\frac{24}{91}\right) = \frac{30}{91}$$

5. $\left|\frac{-7}{9} + \frac{3}{11} - \left(\frac{-16}{22}\right)\right| = \left|\frac{-154-54+144}{198}\right|$

$$= \left|\frac{-208+144}{198}\right|$$

$$= \left|\frac{-64}{198}\right| = \frac{64}{198}$$

6. $\frac{-225 \div 15}{255 \div 15} = \frac{-15}{17}$

7. $\frac{-13}{25} - \frac{91}{125} = \frac{-65-91}{125} = \frac{-156}{125}$

8. $\frac{-34}{7} \div \frac{85}{9} = \frac{-34}{7} \times \frac{9}{85} = \frac{-18}{35}$

Chapter 2

Linear Equations in One Variable

Exercise 2.1

1. Solve the following linear equations and check the result :

(a) $x+\frac{2}{5}=3$

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

$x=\frac{15-2}{5} \Rightarrow x=\frac{13}{5}$

So, $x=\frac{13}{5}$ is the solution of given equation.

Check : $x+\frac{2}{5}=3$

$\frac{13}{5}+\frac{2}{5}=3$

$\frac{13+2}{5}=3$

$\frac{15}{5}=3$

$3=3$

(b) $\frac{4}{5}x-\frac{2}{3}x=\frac{7}{12}$

$\frac{12x-10x}{15}=\frac{7}{12}$

$\frac{2x}{15}=\frac{7}{12}$

$x=\frac{15\times 7}{12\times 2}$

$x=\frac{35}{8}$

So, $x=\frac{35}{8}$ is the solution of given equation.

Check : $\frac{4}{5}x-\frac{2}{3}x=\frac{7}{12}$

$\frac{4\times 35}{5\times 8}-\frac{2}{3}\times\frac{35}{8}=\frac{7}{12}$

$\frac{7}{2}-\frac{35}{12}=\frac{7}{12}$

$\frac{42-35}{12}=\frac{7}{12}$

$\frac{7}{12}=\frac{7}{12}$

(c) $\frac{x}{2}-\frac{x}{3}+\frac{x}{4}=6$

$\frac{6x-4x+3x}{12}=6$

$x=\frac{6\times 12}{5}$

Check : $\frac{x}{2}-\frac{x}{3}+\frac{x}{4}=6$

$\frac{72}{2\times 5}-\frac{72}{5\times 3}+\frac{72}{4\times 5}=6$

$$x = \frac{72}{5}$$

So, $x = \frac{72}{5}$ is the solution of given equation.

$$\frac{36}{5} - \frac{24}{5} + \frac{18}{5} = 6$$

$$\frac{36 - 24 + 18}{5} = 6$$

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

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

(d) $$\frac{x}{5} + \frac{x}{15} = \frac{2}{15}$$

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

$$\frac{4x}{15} = \frac{2}{15}$$

$$x = \frac{2 \times 15}{4 \times 15}$$

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

So, $x = \frac{1}{2}$ is the solution of the given equation :

Check : $$\frac{x}{5} + \frac{x}{15} = \frac{2}{15}$$

$$\Rightarrow \quad \frac{1}{5 \times 2} + \frac{1}{15 \times 2} = \frac{2}{15}$$

$$\frac{1}{10} + \frac{1}{30} = \frac{2}{15}$$

$$\Rightarrow \quad \frac{3+1}{30} = \frac{2}{15}$$

$$\frac{4}{30} = \frac{2}{15}$$

$$\Rightarrow \quad \frac{2}{15} = \frac{2}{15}$$

L.H.S. = R.H.S.

(e) $$1\frac{1}{4}x + \frac{3}{8} = 2$$

$$\frac{5x}{4} = \frac{2}{1} - \frac{3}{8}$$

$$\frac{5x}{4} = \frac{16 - 3}{8}$$

$$\frac{5x}{4} = \frac{13}{8}$$

$$x = \frac{13 \times 4}{5 \times 8}$$

$$x = \frac{13}{10}$$

Check : $$1\frac{1}{4}x + \frac{3}{8} = 2$$

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

$$\frac{5}{4} \times \frac{13}{10} + \frac{3}{8} = 2$$

$$\frac{65}{40} + \frac{3}{8} = 2$$

$$\frac{65 + 15}{40} = 2$$

$$\frac{80}{40} = 2$$

$$2 = 2$$

L.H.S. = R.H.S.

So, $x = \frac{13}{10}$ is the solution of given equation.

(f) $\frac{x}{3} - \frac{x}{5} + \frac{2x}{7} - \frac{3x}{4} = 3\frac{1}{2}$

$$= \frac{140x - 84x + 120x - 315x}{420} = \frac{7}{2}$$

$$= \frac{260x - 399x}{420} = \frac{7}{2}$$

$$\frac{-139x}{420} = \frac{7}{2} \quad \Rightarrow \quad x = \frac{-420 \times 7}{139 \times 2}$$

$$x = \frac{-1470}{139}$$

Check : $\frac{x}{3} - \frac{x}{5} + \frac{2x}{7} - \frac{3x}{4} = 3\frac{1}{2}$

$$= \frac{-1470}{3 \times 139} - \left(\frac{-1470}{5 \times 139}\right) + \frac{2 \times (-1470)}{7 \times 139} - \frac{3 \times (-1470)}{4 \times 139} = \frac{7}{2}$$

$$= \frac{-490}{139} + \frac{294}{139} - \frac{420}{139} + \frac{1102.5}{139} = \frac{7}{2}$$

$$= \frac{-490 + 294 - 420 + 1102.5}{139} = \frac{7}{2}$$

$$= \frac{-910 + 1396.5}{139} = \frac{7}{2} \Rightarrow \frac{486.5}{139} = \frac{7}{2} \Rightarrow \frac{4865}{1390} = \frac{7}{2}$$

$$\Rightarrow \quad \frac{973}{278} = \frac{7}{2} \Rightarrow \frac{7}{2} = \frac{7}{2}$$

L.H.S. = R.H.S.

So, $x = \frac{-1470}{139}$ is the solution of the given equation.

(g) $\frac{x-1}{4} + \frac{x-2}{3} = 4\frac{1}{6}$

$$= \frac{3(x-1) + 4(x-2)}{12} = \frac{25}{6}$$

$$= \frac{3x-3+4x-8}{12} = \frac{25}{6}$$

$$= \frac{7x-11}{12} = \frac{25}{6}$$

$$= 6(7x-11) = 12 \times 25$$

$$42x - 66 = 300$$

$$42x = 300 + 66$$

$$42x = 366$$

$$x = \frac{366}{42}$$

$$x = \frac{61}{7}$$

Check : $\frac{x-1}{4} + \frac{x-2}{3} = 4\frac{1}{6} \quad \Rightarrow \quad \frac{\frac{61}{7}-1}{4} + \frac{\frac{61}{7}-2}{3} = \frac{25}{6}$

$$\frac{61-7}{7\times 4} + \frac{61-14}{3\times 7} = \frac{25}{6} \quad \Rightarrow \quad \frac{54}{28} + \frac{47}{21} = \frac{25}{6}$$

$$\frac{162+188}{84} = \frac{25}{6} \quad \Rightarrow \quad \frac{350}{84} = \frac{25}{6}$$

$$\frac{25}{6} = \frac{25}{6}$$

L.H.S. = R.H.S.

So, $x = \frac{61}{7}$ is the solution of given equation.

(h) $\frac{4}{x} + 20 = \frac{1}{15}$

$$\frac{4}{x} = \frac{1}{15} - \frac{20}{1} \quad \Rightarrow \quad \frac{4}{x} = \frac{1-300}{15}$$

$$\frac{4}{x} = \frac{-299}{15} \quad \Rightarrow \quad 15 \times 4 = -299 \times x$$

$$x = \frac{-60}{299}$$

Check : $\frac{4}{x}+20=\frac{1}{15} \quad \Rightarrow \quad \frac{4\times 299}{-60}+20=\frac{1}{15}$

$\frac{-1196}{60}+20=\frac{1}{15} \quad \Rightarrow \quad \frac{-1196+1200}{60}=\frac{1}{15}$

$\frac{4}{60}=\frac{1}{15} \quad \Rightarrow \quad \frac{1}{15}=\frac{1}{15}$

So, $x=\frac{-60}{299}$ is the solution of given equation :

2. (a) $\frac{x-4}{2}-\frac{x-3}{4}=\frac{1}{6} \quad \Rightarrow \quad \frac{2(x-4)-(x-3)}{4}=\frac{1}{6}$

$\frac{2x-8-x+3}{4}=\frac{1}{6} \quad \Rightarrow \quad \frac{x-5}{4}=\frac{1}{6}$

$6x-30=4 \quad \Rightarrow \quad 6x=30+4$

$6x=34 \quad \Rightarrow \quad x=\frac{34}{6}$

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

Check : $\frac{x-4}{2}-\frac{x-3}{4}=\frac{1}{6} \quad \Rightarrow \quad \frac{\frac{17}{3}-4}{2}-\frac{\frac{17}{3}-3}{4}=\frac{1}{6}$

$\frac{17-12}{6}-\frac{17-9}{12}=\frac{1}{6} \quad \Rightarrow \quad \frac{5}{6}-\frac{8}{12}=\frac{1}{6}$

$\frac{10-8}{12}=\frac{1}{6} \quad \Rightarrow \quad \frac{2}{12}=\frac{1}{6}$

$\Rightarrow \quad \frac{1}{6}=\frac{1}{6}$

L.H.S. = R.H.S.

So, $x=\frac{17}{3}$ is the solution of the given equation.

(b) $\frac{3x-2}{4}+x=\frac{2}{3}-\frac{2x+3}{3} \quad \Rightarrow \quad \frac{3x-2+4x}{4}=\frac{2-2x-3}{3}$

$\frac{7x-2}{4}=\frac{-2x-1}{3} \quad \Rightarrow \quad (7x-2)\times 3=(-2x-1)4$

$21x-6=-8x-4 \quad \Rightarrow \quad 21x+8x=-4+6$

$29x=2 \quad \Rightarrow \quad x=\frac{2}{29}$

Check :

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

$$\frac{\frac{3\times 2}{29}-2}{4}+\frac{2}{29}=\frac{2}{3}-\frac{\frac{2\times 2}{29}+3}{3}$$

$$\frac{6-58}{116}+\frac{2}{29}=\frac{2}{3}-\left(\frac{4+87}{87}\right)$$

$$\frac{-52}{116}+\frac{2}{29}=\frac{2}{3}-\frac{91}{87}$$

$$\frac{-52+8}{116}=\frac{58-91}{87}$$

$$\frac{-44}{116}=\frac{-33}{87}$$

$$\frac{-11}{29}=\frac{-11}{29}$$

L.H.S. = R.H.S.

So, $x=\frac{2}{29}$ is the solution of the given equation :

(c) $15(x-4)-2(x-9)+5(x+6)=0$

$$15x-60-2x+18+5x+30=0$$

$$18x-12=0$$

$$18x=12$$

$$x=\frac{12}{18}$$

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

Check : $15(x-4)-2(x-9)+5(x+6)=0$

$$15\left(\frac{2}{3}-4\right)-2\left(\frac{2}{3}-9\right)+5\left(\frac{2}{3}+6\right)=0$$

$$10-60-\frac{4}{3}+18+\frac{10}{3}+30=0$$

$$10-60+18+\frac{6}{3}+30=0$$

$$10-60+18+2+30=0$$

$$60-60=0$$

$$0=0$$

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

So, $x=\frac{2}{3}$ is the solution of the given equation :

(d) $\frac{2}{3}x+1=\frac{3}{4}(x+1)$

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

$$4(2x+3)=9(x+1)$$

$$8x+12=9x+9$$

$$9x-8x=12-9$$

$$x=3$$

Check : $\frac{2}{3}x+1=\frac{3}{4}(x+1)$

$$\frac{2\times 3}{3}+1=\frac{3}{4}(3+1)$$

$$2+1=\frac{3}{4}\times 4$$

$$3=3$$

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

So, $x=3$ is the solution of the given equation :

(e) $$\frac{x}{3}+1.5-0.12x=\frac{0.5}{2}$$

$$\frac{x}{3}-0.12x=\frac{0.5}{2}-\frac{1.5}{1}$$

$$\frac{x-0.36x}{3}=\frac{0.5-3.0}{2}$$

$$\frac{0.64x}{3}=\frac{-2.5}{2}$$

$$x=\frac{-2.5\times 3}{2\times 0.64}$$

$$x=\frac{-7.5}{1.28}$$

$$\Rightarrow \quad x=\frac{-750}{128}$$

$$x=\frac{-375}{64}$$

Check : $$\frac{x}{3}+1.5-0.12x=\frac{0.5}{2}$$

$$\frac{-375}{64\times 3}+1.5-\frac{0.12\times(-375)}{64}=\frac{0.5}{2}$$

$$\frac{-125}{64}+1.5+\frac{45}{64}=\frac{0.5}{2}$$

$$\frac{-125}{64}+\frac{15}{10}+\frac{45}{64}=\frac{5}{20}$$

$$\frac{-125}{64}+\frac{3}{2}+\frac{45}{64}=\frac{1}{4} \quad \Rightarrow \quad \frac{-125+96+45}{64}=\frac{1}{4}$$

$$\frac{-125+141}{64}=\frac{1}{4} \quad \Rightarrow \quad \frac{16}{64}=\frac{1}{4}$$

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

L.H.S. = R.H.S.

So, $x=\frac{1}{4}$ is the solution of the given equation.

(f) $$(x+4)^2+(x-4)^2=2x(x-5)+8$$

$$x^2+16+8x+x^2+16-8x=2x^2-10x+8$$

$$2x^2 + 32 = 2x^2 - 10x + 8$$
$$2x^2 - 2x^2 + 10x = 8 - 32$$
$$10x = -24$$
$$x = \frac{-24}{10} \qquad \Rightarrow \qquad x = \frac{-12}{5}$$

Check : $(x+4)^2 + (x-4)^2 = 2x(x-5)+8$

$$\left(\frac{-12}{5}+4\right)^2 + \left(\frac{-12}{5}-4\right)^2 = 2\times\frac{-12}{5}\left(\frac{-12}{5}-5\right)+8$$
$$\left(\frac{-12+20}{5}\right)^2 + \left(\frac{-12-20}{5}\right)^2 = \frac{288}{25}+24+8$$
$$\left(\frac{8}{5}\right)^2 + \left(\frac{-32}{5}\right)^2 = \frac{288}{25}+32$$
$$\frac{64}{25}+\frac{1024}{25} = \frac{288+800}{25}$$
$$\frac{1088}{25} = \frac{1088}{25}$$
$$\text{L.H.S.} = \text{R.H.S.}$$

So, $x = \frac{-12}{5}$ is the solution of the given equation.

(g) $$\frac{5x-2}{4} - \frac{1}{5}\left(3x - \frac{2-x}{6}\right) = \frac{12}{5}$$
$$\frac{5x-2}{4} - \frac{3x}{5} + \frac{2-x}{30} = \frac{12}{5}$$
$$\frac{75x-30-36x+4-2x}{60} = \frac{12}{5}$$
$$\frac{37x-26}{60} = \frac{12}{5}$$
$$(37x-26)\times 5 = 12\times 60$$
$$185x - 130 = 720$$
$$185x = 720+130$$
$$185x = 850$$
$$x = \frac{850}{185} \qquad \Rightarrow \qquad x = \frac{170}{37}$$

Check : $$\frac{5x-2}{4}-\frac{1}{5}\left(3x-\frac{2-x}{6}\right)=\frac{12}{5}$$

$$\frac{\frac{5\times170}{37}-2}{4}-\frac{1}{5}\left(\frac{3\times170}{37}-\frac{2-\frac{170}{37}}{6}\right)=\frac{12}{5}$$

$$\frac{850-74}{148}-\frac{1}{5}\left(\frac{510}{37}-\frac{74-170}{222}\right)=\frac{12}{5}$$

$$\frac{776}{148}-\frac{1}{5}\left(\frac{510}{37}+\frac{96}{222}\right)=\frac{12}{5}$$

$$\frac{776}{148}-\frac{102}{37}-\frac{96}{1110}=\frac{12}{5}$$

$$\frac{11640-6120-192}{2220}=\frac{12}{5}$$

$$\frac{5328}{2220}=\frac{12}{5}$$

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

L.H.S. = R.H.S.

So, $x=\frac{170}{37}$ is the solution of the given equation :

(h) $\{(3x+5)+(x+2)\}^2+\{(3x+5)-(x+2)\}^2=20x^2-78$

$$(3x+5)^2+(x+2)^2+2(3x+5)(x+2)+(3x+5)^2+(x+2)^2-2(3x+5)(x+2)=20x^2-78$$

$$(3x)^2+(5)^2+30x+x^2+4+4x+(3x)^2+(5)^2+30x+x^2+4+4x=20x^2-78$$

$$9x^2+25+30x+x^2+4+4x+9x^2+25+30x+x^2+4+4x=20x^2-78$$

$$20x^2+68x+58=20x^2-78$$

$$68x=-78-58$$

$$68x=-136$$

$$x=\frac{-136}{68} \quad \Rightarrow \quad x=-2$$

Check : $\{(3x+5)+(x+2)\}^2+\{(3x+5)-(x+2)\}^2 = 20x^2-78$

$$\{[(-3\times 2)+5]+(-2+2)\}^2+\{(3\times -2+5)-(-2+2)\} = 20\times(-2)^2-78$$

$$(-1+0)^2+(-1-0)^2 = 20\times 4-78$$

$$1+1 = 80-78$$

$$2 = 2$$

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

So, $x=-2$ is the solution of the given equation.

(i) $$\frac{(x-0.4)\times 0.5}{0.35}-(x+6.1)=\frac{(x-2.71)\times 0.6}{0.42}$$

$$\frac{(x-0.4)\times 0.1}{0.07}-(x+6.1)=\frac{(x-2.71)\times 0.1}{0.07}$$

$$\frac{(x-0.4)\times 10}{7}-(x+6.1)=\frac{(x-2.71)\times 10}{7}$$

$$\frac{10x-4-7x-42.7}{7}=\frac{10x-27.1}{7}$$

or $$3x-46.7=10x-27.1$$

$$10x-3x=-46.7+27.1$$

$$7x=-19.6$$

$$x=\frac{-19.6}{7}$$

$$x=-2.8$$

Check : $$\frac{(x-0.4)\times 0.5}{0.07}-(x+6.1)=\frac{(x-2.71)\times 0.6}{0.42}$$

$$\frac{(-2.8-0.4)\times 0.5}{0.35}-(-2.8+6.1)=\frac{(-2.8-2.71)\times 0.6}{0.42}$$

$$\frac{-3.2\times 0.1}{0.07}-3.3=\frac{-5.51\times 0.1}{0.07}$$

$$\frac{-32}{7}-3.3=\frac{-55.1}{7}$$

$$\frac{-32-23.1}{7}=\frac{-55.1}{7}$$

$$\frac{-55.1}{7}=\frac{-55.1}{7}$$

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

So, $x=-2.8$ is the solution of the given equation.

(j) $$(x-2)(x+5)+12=(x+3)(x-4)-2$$
$$x^2-2x+5x-10+12=x^2-4x+3x-12-2$$
$$x^2-x^2+3x+4x-3x+2+12+2=0$$
$$4x+16=0$$
$$4x=-16$$
$$x=\frac{-16}{4}$$
$$x=-4$$

Check : $$(x-2)(x+5)+12=(x+3)(x-4)-2$$
$$(-4-2)(-4+5)+12=(-4+3)(-4-4)-2$$
$$-6\times1+12=-1\times(-8)-2$$
$$-6+12=8-2$$
$$6=6$$
$$\text{L.H.S.}=\text{R.H.S.}$$

So, $x=-4$ is the solution of the given equation.

(k) $$x-\left(\frac{8+2x}{3}\right)+3=\frac{x}{4}-\left(\frac{2-x}{24}\right)$$
$$\frac{3x-8-2x+9}{3}=\frac{6x-2+x}{24}$$
$$\frac{x+1}{3}=\frac{7x-2}{24}$$
$$(x+1)24=3\times(7x-2)$$
$$24x+24=21x-6$$
$$24x-21x=-6-24$$
$$3x=-30$$
$$x=\frac{-30}{3}$$
$$x=-10$$

Check : $x-\left(\frac{8+2x}{3}\right)+3=\frac{x}{4}-\left(\frac{2-x}{24}\right)$

$$-10-\left(\frac{8+2\times(-10)}{3}\right)+3=\frac{-10}{4}-\left(\frac{2-(-10)}{24}\right)$$

$$-10-\left(\frac{8-20}{3}\right)+3=\frac{-10}{4}-\frac{(2+10)}{24}$$

$$-10-\left(\frac{-12}{3}\right)+3=\frac{-10}{4}-\frac{12}{14}$$

$$-10+4+3=\frac{-5}{2}-\frac{1}{2}$$

$$-10+7=\frac{-5-1}{2}$$

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

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

L.H.S. = R.H.S.

So, $x=-10$ is the solution of the given equation.

Exercise 2.2

1. (a) $\frac{x+1}{\frac{2}{3}x+1}=\frac{4}{3}$

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

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

$$9(x+1)=4(2x+3)$$

$$9x+9=8x+12$$

$$9x-8x=12-9$$

$$x=3$$

(b) $\frac{6x-8}{5x}=\frac{2}{3}$

$$3(6x-8)=2\times 5x$$

$$18x-24=10x$$

$$18x-10x=24$$

$$x=\frac{24}{8}$$

$$x=3$$

(c) $$\frac{(2x^2+x+1)-(x-1)(2x-3)}{x-2}=\frac{7}{2}$$

$$\frac{(2x^2+x+1)-(2x^2-3x-2x+3)}{(x-2)}=\frac{7}{2}$$

$$\frac{2x^2+x+1-2x^2+5x-3}{(x-2)}=\frac{7}{2}$$

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

$$12x-4=7x-14$$

$$12x-7x=-14+4$$

$$5x=-10$$

$$x=\frac{-10}{5} \qquad \Rightarrow \quad x=-2$$

(d) $$\frac{6x+11}{(2x+3)-(5x-2)}=\frac{17}{2}$$

$$\frac{6x+11}{2x+3-5x+2}=\frac{17}{2}$$

$$\frac{6x+11}{-3x+5}=\frac{17}{2}$$

$$12x+22=-15x+85$$

$$12x+51x=85-22$$

$$63x=63$$

$$x=\frac{63}{63} \qquad \Rightarrow \quad x=1$$

(e) $$\frac{x-3}{2x+5}=\frac{3x-4}{6x+7}$$

$$(x-3)(6x+7)=(3x-4)(2x+5)$$

$$6x^2+7x-18x-21=6x^2+15x-8x-20$$

$$6x^2-11x-21=6x^2+7x-20$$

$$6x^2-6x^2-11x-7x=-20+21$$

$$-18x=1 \qquad \Rightarrow \quad x=\frac{-1}{18}$$

(f)
$$\left(\frac{x+2}{x+1}\right)^2 = \frac{x+4}{x+2}$$
$$(x+2)^2 \times (x+2) = (x+4)(x+1)^2$$
$$(x^2+4+4x)(x+2) = (x+4)(x^2+1+2x)$$
$$x^3+2x^2+4x+8+4x^2+8x = x^3+x+2x^2+4x^2+4+8x$$
$$x^3+6x^2+12x+8 = x^3+6x^2+9x+4$$
$$x^3+6x^2+12x+8-x^3-6x^2-9x-4 = 0$$
$$3x+4 = 0$$
$$3x = -4 \qquad \Rightarrow \qquad x = \frac{-4}{3}$$

(g)
$$\frac{3x-(8-4x)}{6x-(2+3x)} = \frac{5}{8}$$
$$\frac{3x-8+4x}{6x-2-3x} = \frac{5}{8}$$
$$\frac{7x-8}{3x-2} = \frac{5}{8}$$
$$56x-64 = 15x-10$$
$$56x-15x = -10+64$$
$$41x = 54 \qquad \Rightarrow \qquad x = \frac{54}{41}$$

(h)
$$\frac{x^2-1}{3x^2+2} = \frac{3}{10}$$
$$10x^2-10 = 9x^2+6$$
$$10x^2-9x^2 = 6+10$$
$$x^2 = 16$$
$$x = \sqrt{16} \qquad \Rightarrow \qquad x = \pm 4$$

(i)
$$\frac{x}{3}+\frac{(2x+4)}{5} = \frac{2x}{15}-\frac{6x+7}{30}$$
$$\frac{5x+6x+12}{15} = \frac{4x-6x-7}{30}$$
$$\frac{11x+12}{15} = \frac{-2x-7}{30}$$
$$(11x+12)\times 30 = 15(-2x-7)$$

$$330x + 360 = -30x - 105$$
$$330x + 30x = -105 - 360$$
$$360x = -465$$
$$x = \frac{-465}{360} \quad \Rightarrow \quad x = \frac{-31}{24}$$

(j)
$$\frac{x+3}{x-3} = 5$$
$$x + 3 = 5x - 15$$
$$x - 5x = -15 - 3$$
$$-4x = -18$$
$$4x = 18$$
$$x = \frac{18}{4} \quad \Rightarrow \quad x = \frac{9}{2}$$

(k)
$$\frac{x}{2} - \frac{3x}{4} + \frac{5x}{6} = 21$$
$$\frac{6x - 9x + 10x}{12} = 21$$
$$\frac{16x - 9x}{12} = 21$$
$$\frac{7x}{12} = 21$$
$$x = \frac{12 \times 21}{7} \quad \Rightarrow \quad x = 36$$

(l)
$$2(3x - 1) - 5x = \frac{-7}{2} - 2(2x - 7)$$
$$6x - 2 - 5x = \frac{-7}{2} - 4x + 14$$
$$x + 4x = \frac{-7}{2} + 14 + 2$$
$$5x = \frac{-7 + 28 + 4}{2}$$
$$5x = \frac{25}{2}$$
$$x = \frac{25}{5 \times 2}$$
$$x = \frac{5}{2}$$

2. (a)

$$\frac{x^2-4}{3+x^2}=\frac{-3}{4}$$
$$4x^2-16=-9-3x^2$$
$$4x^2+3x^2=-9+16$$
$$7x^2=7$$
$$x^2=1$$

or

$$x=\sqrt{1}$$
$$x=+1,-1$$

But we take only positive value, so $x=+1$

(b)

$$\frac{x^2-15}{x^2-17}=-1$$
$$x^2-15=-x^2+17$$
$$x^2+x^2=17+15$$
$$2x^2=32$$
$$x^2=\frac{32}{2}$$
$$x^2=16$$
$$x=\sqrt{16}$$
$$x=+4,-4$$

But, we take only positive value, so $x=+4$

Exercise 2.3

1. Let no. are $7x$ and $8x$.

So,
$$7x+8x=45$$
$$15x=45$$
$$x=\frac{45}{15}$$
$$x=3$$

So. first no. $=7x=7\times3=21$

and second no. $=8x=8\times3=24$

2. Let first no. $=x$

So, second no. $=(x+1)$

So,
$$(x+1)^2-x^2=31$$
$$x^2+1+2x-x^2=31$$

$$2x = 31 - 1$$
$$2x = 30$$
$$x = \frac{30}{2}$$
$$x = 15$$

So, first no. $= 15$

Second no. $= 15 + 1 = 16$

3. Let the digit at unit place $= x$

So, digit at tens place will be $= 3x$

So, $3x \times 10 + x - 36 = x \times 10 + 3x$

$$30x + x - 36 = 10x + 3x$$
$$31x - 36 = 13x$$
$$31x - 13x = 36$$
$$18x = 36$$
$$x = \frac{36}{18}$$
$$x = 2$$

Hence, digit at unit place $= x = 2$

and digit at tens place $= 3x = 3 \times 2 = 6$

So, required number is 62.

4. Let the digit at unit place $= x$

Then, the digit at tens place $= 8 - x$

So, $(8 - x) \times 10 + x - 54 = (x \times 10) + 8 - x$

$$80 - 10x + x - 54 = 10x + 8 - x$$
$$26 - 9x = 9x + 8$$
$$26 - 8 = 9x + 9x$$
$$18x = 18$$
$$x = \frac{18}{18}$$
$$x = 1$$

So, the digit at unit place $= x = 1$

and the digit at tens place $= 8 - x = 8 - 1 = 7$

5. Let the present age of Rahul $= x$ years

and his father's age $= (40 - x)$ years.

So, $$(40-x-5) = 5(x-5)$$
$$35-x = 5x-25$$
$$-x-5x = -25-35$$
$$-6x = -60$$
$$6x = 60$$
$$x = \frac{60}{6}$$
$$x = 10$$

So, present age of Rahul $= x = 10$ years

and his father's age $= 40-x = 40-10 = 30$ years

6. Let Aarti had = ₹ x

Now,

She spent on socks = ₹ $\frac{x}{2}$

left money = ₹ $\left(x-\frac{x}{2}\right)$ = ₹ $\frac{x}{2}$

She gave to bigger = ₹ 2

Left money = ₹ $\left(\frac{x}{2}-2\right)$

Again she spent $\frac{1}{2}$ of left money on lunch = ₹ $\frac{1}{2}\left(\frac{x}{2}-2\right)$ = ₹ $\left(\frac{x}{4}-1\right)$

Left money = ₹ $\left(\frac{x}{2}-2-\frac{x}{4}+1\right)$

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

= ₹ $\left(\frac{x}{4}-1\right)$

She gave tip to waiter = ₹ 10

Now, left money = ₹ $\left(\frac{x}{4}-1-10\right)$

= ₹ $\left(\frac{x}{4}-11\right)$

Again, she spent $\frac{1}{2}$ of left money on buying stationary

$$= ₹\frac{1}{2}\left(\frac{x}{4}-11\right)$$

$$= ₹\left(\frac{x}{8}-\frac{11}{2}\right)$$

Let money $₹\left(\frac{x}{4}-11-\frac{x}{8}+\frac{11}{2}\right)$

$$= ₹\left(\frac{x}{4}-\frac{x}{8}-11+\frac{11}{2}\right)$$

$$= ₹\left(\frac{x}{8}-\frac{11}{2}\right)$$

and spent ₹ 6 to bus fair.

So, left money $= ₹\left(\frac{x}{8}-\frac{11}{2}-6\right)$

So, she had left money in purse

$$= \frac{x}{8}-\frac{11-12}{2} = \frac{x}{8}-\frac{23}{2}$$

So, $\frac{x}{8}-\frac{23}{2} = 20$

$$\frac{x}{8} = 20+\frac{23}{2}$$

$$\frac{x}{8} = \frac{40+23}{2}$$

$$\frac{x}{8} = \frac{63}{2}$$

$$x = ₹\frac{63\times 8}{2}$$

$$x = ₹\ 252$$

7. The number of passengers of first category $= (20x+50)$

The number of passengers of second category $= (30x-20)$

Total number of passengers $= 480$

So, $(20x+50)+(30x-20) = 480$

$$20x + 50 + 30x - 20 = 480$$
$$50x + 30 = 480$$
$$50x = 480 - 30$$
$$50x = 450$$
$$x = 450 \div 50$$
$$x = 9$$

So, the number of passengers of first category

$$= (20x + 50)$$
$$= (20 \times 9 + 50) = 230$$

And the number of passengers of second category

$$= (30x - 20)$$
$$= (30 \times 9 - 20) = 250$$

Since, the cost of first and second category of tickets are ₹ 500 and ₹ 750.

So, total money paid for the ticket

$$= ₹\ 230 \times 500 + ₹\ 250 \times 750$$
$$= ₹\ 115000 + ₹\ 187500 = ₹\ 302500$$

8. Arnav has money = ₹ 740

Let the number of ₹ 1 coins be x.

Then, the number of ₹ 2 coins will be $3x$

And the number of ₹ 5 coins will be $2 \times 3x$ or $6x$

So, the total amount of ₹ 1 = ₹ $1 \times x$ = ₹ x

So, the total amount of ₹ 2 = ₹ $2 \times 3x$ = ₹ $6x$

So, the total amount of ₹ 5 = ₹ $5 \times 6x$ = ₹ $30x$

According to the questions,

$$x + 6x + 30x = 740$$
$$37x = 740$$
$$x = 740 \div 37$$
$$x = 20$$

$\therefore$ Number of ₹ 1 coins $= 1 \times x = 1 \times 20 = 20$ coins

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

Number of ₹ 5 coins $= 6 \times x = 6 \times 20 = 120$ coins

9. Let the number of three notes be $3x$, $4x$ and $5x$ respectively.

Total amount of ₹ $50 = 50 \times 3x = 150x$

Total amount of ₹ $20 = 20 \times 4x = 80x$

Total amount of ₹ $10 = 10 \times 5x = 50x$

According to the question,

$$150x + 80x + 50x = 280000$$
$$280x = 280000$$
$$x = 280000 \div 280$$
$$x = 1000$$

$\therefore$ Number of ₹ 50 notes $= 3x = 3 \times 1000 = 3000$

Number of ₹ 20 notes $= 4x = 4 \times 1000 = 4000$

Number of ₹ 10 notes $= 5x = 5 \times 1000 = 5000$

Notes

10. Let the present age of Karishma be x years.

Then, the age of Ankita will be $2x$ years

According to the questions,

$$4(x-6) = (2x+4)$$
$$4x - 24 = 2x + 4$$
$$4x - 24 = 24 + 4$$
$$2x = 28$$
$$x = 28 \div 2$$
$$x = 14$$

So, the age of Karishma 2 years ago $= 14 - 2 = 12$ years

And the age of Ankita 2 years ago

$$= 2x - 2$$
$$= 2 \times 14 - 2$$
$$= 28 - 2$$
$$= 26 \text{ years}$$

11. Total number of questions in the competitive exam = 90

Number of unattempted questions = 10

So, the number of attempted questions $= 90 - 10 = 80$

His total scored = 195

Marks obtained for unattempted questions $= 0.5 \times 10 = 5$

So, marks secured by a student $= 195 + 5 = 200$

Let the number of correct questions be x.
Then, the number of incorrect questions will be $(80-x)$.
Now, according to the questions,

$$\begin{aligned} 4x-2(80-x) &= 200 \\ 4x-160+2x &= 200 \\ 6x-160 &= 200 \\ 6x &= 360 \\ x &= 360 \div 6 \\ x &= 60 \end{aligned}$$

Hence, the number of correct questions is 60.

12. Let the weight of box II be x kg.

Then, the weight of box I will be $\left(x+2\frac{1}{2}\right)$ kg

And the weight of box III will be $\left(x+10\frac{1}{4}\right)$ kg

According to the questions,

$$\begin{aligned} \left(x+2\frac{1}{2}\right)\text{kg}+x\text{ kg}+\left(x+10\frac{1}{4}\right)\text{kg} &= 34\frac{3}{4}\text{ kg} \\ x+\frac{5}{2}\text{ kg}+x+x+\frac{41}{4}\text{ kg} &= \frac{219}{4}\text{ kg} \\ 3x+\left(\frac{5}{2}+\frac{41}{4}\right)\text{kg} &= \frac{219}{4}\text{ kg} \\ 3x &= \left[\frac{219}{4}-\left(\frac{5}{2}+\frac{41}{4}\right)\right]\text{kg} \\ 3x &= \left(\frac{219}{4}-\frac{51}{4}\right)\text{kg} \\ 3x &= \left(\frac{219-51}{4}\right)\text{kg} \\ 3x &= \frac{168}{4}\text{ kg} \\ 3x &= \frac{168}{4}\text{ kg} \\ 3x &= 42\text{ kg} \end{aligned}$$

$$x = (42 \div 3) \text{ kg}$$
$$x = 14 \text{ kg}$$

13. Let the labourer was absent $= x$ days

Then, the labourer was present $= (30 - x)$ days

So, according to the questions,

$$70(30 - x) - 10x = 1700$$
$$2100 - 70x - 10x = 1700$$
$$80x = 2100 - 1700$$
$$80x = 400$$
$$x = 400 \div 80$$
$$x = 5 \text{ days}$$

Hence, he remained absent for 5 days.

14. Let x be added to 400 mL of 15% acid solution to increase its strength to 32%.

Quantity of acid in 400 L $= 400 \times 15\%$

$$= 400 \times \frac{15}{100} \text{ mL} = 60 \text{ mL}$$

So, according to the questions,

$$\frac{60 + x}{400 + x} = 32\%$$
$$\frac{60 + x}{400 + x} = \frac{32}{100}$$
$$\frac{60 + x}{400 + x} = \frac{8}{25}$$

By cross multiplication method

$$25 \times 60 + 25x = 400 \times 8 + 8x$$
$$1500 + 25x = 3200 + 8x$$
$$25x - 8x = 3200 - 1500$$
$$17x = 1700$$
$$x = 1700 \div 17$$
$$x = 100 \text{ mL}$$

Hence, 100 mL acid should be added to 400 mL of 15% acid solution to increase its strength to 32%.

15. Let the number be x.

Then, according to question,

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

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

$$\frac{5x-4x}{4} = 10$$

$$\frac{x}{4} = 10$$

$$x = 4\times 10$$

$$x = 40$$

Hence, the number is 40.

16. Let the side of second square be x cm.

Then, the side of one square will be $(2x+3)$ cm.

So, according to the question,

The difference in their areas = 144

$$(2x+3)^2 - x^2 = 144$$

$$4x^2 + 9 + 12x - x^2 = 144$$

$$3x^2 + 12x + 9 - 144 = 0$$

$$x^2 + 4x - 45 = 0$$

$$x^2 + 9x - 5x - 45 = 0$$

$$x(x+9) - 5(x+9) = 0$$

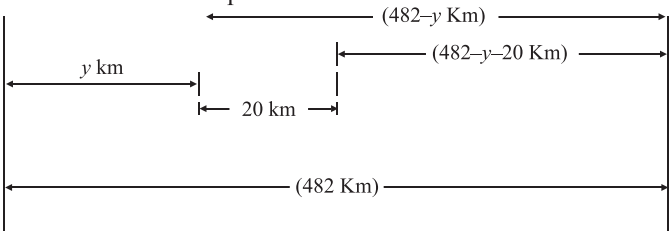
$$(x+9)(x-5) = 0$$

$$x = 5\text{ cm} \quad \text{and} \quad x = -9 \text{ (Not possible)}$$

So, the side of one square $= (2x+3) = 2\times 5 + 3 = 13$ cm

The side of second square $= x = 5$ cm

17.



Let the speed of first train be x km/h.
Then, the speed of second train will be $(x+4)$ km/h.
For first condition,

$$\text{Speed}_1 = \frac{\text{Distance}}{\text{time}}$$

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

$$y = 3x \qquad \ldots\text{(i)}$$

For second condition,

$$\text{Speed}_2 = \frac{482 - y - 20}{3}$$

$$x + 4 = \frac{462 - y}{3}$$

$$3x + 12 = 462 - y \qquad \ldots\text{(ii)}$$

From equation (i)

$$3x + 12 = 462 - 3x$$

$$3x + 3x = 462 - 12$$

$$6x = 450$$

$$x = 450 \div 6$$

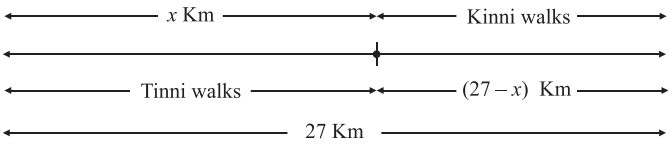
$$x = 75 \text{ km/h}$$

Hence, the speed of first train is $x = 75$ km/h
and the speed of second train is $(x+4)$

$$= (75+4) \text{ m/h}$$

$$= 79 \text{ km/h}$$

18. Let hrs. be the required time.



So, Tnni's speed $= \dfrac{x}{y}$

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

$$x = 5y \text{ km} \qquad \ldots(i)$$

$$\text{Kinni's speed} = \frac{27-x}{y}$$

$$4 = \frac{27-x}{y}$$

$$4y = 27-x$$

$$x = 27-4y \qquad \ldots(ii)$$

Comparing the equation (i) and (ii), we get

$$5y = 27-4y$$

$$5y+4y = 27$$

$$9y = 27$$

$$y = 27 \div 9$$

$$y = 3 \text{ hrs.}$$

Hence, the 3 hrs. is the required time.

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

Mental Maths :

True or False

1. T **2.** F **3.** F **4.** T **5.** F

HOTS

1. The cost of a banana = ₹ 6

The cost of an apple = ₹ 5

∴ Cost of 2 bananas = ₹ 2×6 = ₹ 12

and cost of 4 apples = ₹ 5×4 = ₹ 20

So, the cost of 2 bananas and 4 apples = ₹ 12 + ₹ 20

= ₹ 32

Hence, 4 apples and 2 bananas can be purchased for the total of ₹ 32.

Chapter 3

Understanding Quadrilaterals

Exercise 3

1. (a) If the diagonals of a quadrilateral bisect each other it is a parallelogram.

(b) If the diagonals of a quadrilateral bisect each other at right angles, the quadrilateral is a **rhombus**.

(c) In a square all angles are equal and **all** sides are equal. So it is called a **regular** quadrilateral.

(d) In a rhombus, **opposite** angles are equal and **all** sides are equal.

2. One angle of a parallelogram = 130°

Let the other angles be $\angle B, \angle C$ and $\angle D$ respectively.

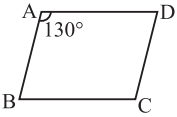
In the given parallelogram $ABCD$, $\angle A$ and $\angle B$ are adjacent angles.

Therefore, $\angle A + \angle B = 180°$ (co-interior $\angle S$)

$130° + \angle B = 180°$

$\angle B = 180° - 130°$

$\angle B = 50°$



Now, opposite angles of a parallelogram are equal.

Therefore, $\angle A = \angle C = 130°$

and $\angle B = \angle D = 50°$

Hence, the measure of the remaining angles are

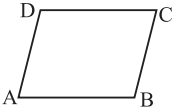
$\angle B = 50°$, $\angle C = 130°$ and $\angle D = 130°$

3. Since, two adjacent angles of a parallelogram are equal.

So, Rectangle is another name for this parallelogram.

4. The measurements of all the sides are equal.

Rhombus is another name for the figure.



5. Square is the specific name for this figure.

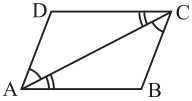
6. Given

$ABCD$ is a parallelogram

$\therefore$ $\angle B = \angle D$

(opposite angle of a parallelogram are equal.)

In $\Delta\, ABC$ and $\Delta\, ADC$,



$\angle DCA = \angle BAC$ (Alternate angle)

$\angle DAC = \angle BCA$ (Alternate angle)

$AB = DC$ (opposite sides of a parallelogram)

$\therefore \quad \Delta\, ABC \cong \Delta\, ADC$ (By ASA congruency)

Hence, AC divides parallelogram $ABCD$ into two congruent triangles.

7. In $\square\, STAR$,

$\angle S$ and $\angle R$ are adjacent angles.

Therefore, $\angle S + \angle R = 180°$

$50° + \angle R = 180°$

$\angle R = 180° - 50°$

$\Rightarrow \quad \angle R = 130°$

Similarly $\angle T + \angle A = 180°$

$50° + \angle A = 180°$

$\angle A = 180° - 50°$

$\Rightarrow \quad \angle A = 130°$

Hence, $\angle R = \angle A = 130°$

8. (a) Yes, because two pair of adjacent sides are equal.

(b) Yes, because two pair of adjacent sides are equal.

(c) Yes,

Because $AB = AD$

and $BC = DC$

and $AC = AC$ (Common side)

So, $\Delta\, ADC \cong \Delta\, ABC$ (By *SSS* rule)

(d) Yes, Because $AB = AD$

and $BC = DC$

and $\angle ADC = \angle ABC$

(One pair of diagonally opposite angles is equal)

(e) Yes, because diagonal AC is bisect $\angle DAB$

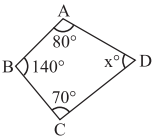
$\therefore \quad \angle DAO \cong \angle BAO$

(f) Yes, becasue diagonal AC is bisect $\angle DCB$

$\therefore \quad \angle DCA \cong \angle BCA$

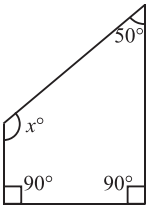
9. (a) Yes (b) Yes (c) Yes (d) Yes (e) Yes

10. (a) We know that,



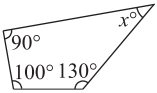
$$\angle A + \angle B + \angle C + \angle D = 360°$$
$$80° + 140° + 70° + \angle D = 360°$$
$$290° + \angle D = 360°$$
$$x = \angle D = 360° - 290°$$
$$(\because \angle D = x)$$
$$x = 70°$$

(b) $\because$ $\angle A + \angle B + \angle C + \angle D = 360°$



$$x + 90° + 90° + +50° = 360°$$
$$x + 230° = 360°$$
$$x = 360° - 230°$$
$$x = 130°$$

(c) $\angle A + \angle B + \angle C + \angle D = 360°$



$$90° + 100° + 130° + x = 360°$$
$$320° + x = 360°$$
$$x = 360° - 320°$$
$$x = 40°$$

(d) $\angle A + \angle B + \angle C + \angle D = 360°$
$$60° + x + 100° + 120° = 360°$$
$$x + 280° = 360°$$
$$x = 360° - 280°$$
$$x = 80°$$

MCQs 1. (b) 2. (c) 3. (a)

Mental Maths :

Write 'T' for 'True' or 'F' for 'False' :

1. T **2.** T **3.** T **4.** T **5.** T

Chapter 4

Data Handling

Exercise 4.1

1. (a) The production of rice in India is 100 million tonnes.

(b) Bangladesh has the minimum productions of rice.

(c) China has the maximum production of rice.

(d) Thailand produces 70 million tonnes of rice.

2. (a) The period covered in the bar graph is 5 years.

(b) The fees increase from 2016 to 2019 was (₹ 700 – 400) = ₹ 300

(c) The fees was minimum in 2016.

(d) The maximum fees was ₹ 700 per month.

(e) No.

3. (a) U.P. had reported the maximum number of crime.

(b) Goa had reported the minimum number of crimes.

(c) Maximum no. of crimes : minimum no. of crimes

$= 4000 : 1000 = 4 : 1$

(d) The difference in the no. of crimes reported in Bihar and Tamil Nadu $= 3500 - 3000 = 500$

4. (a) Mount Everest is the highest peak and its heights is 8800 m.

(b) Ratio of highest peak and the next highest peak

$= 8800 : 8200$

$= 44 : 41$

(c) Annapurna is the lowest peak.

(d) The difference between the heights of the highest and the lowest peaks is (8800 m – 6000 m) = 2800 m.

(e) The height of peaks in descending order

$= 8800 < 8200 < 8000 < 7500 < 6000$

(f) The difference between the heights of Nanda Devi peak and Annapurna peak $= 7500\,\text{m} - 6000\,\text{m}$

$= 1500\,\text{m}.$

5. (a) The title given to the bar graph is public expenditure on health and nutrition.

(b) Brazil has the minimum expenditure on health and nutritions.

(c) Denmark has ten thousand crores expenditure on health and nutritions.

(d) India : New Zealand = 7 : 11

6. (a) The maximum temperature of the day = 70°F.

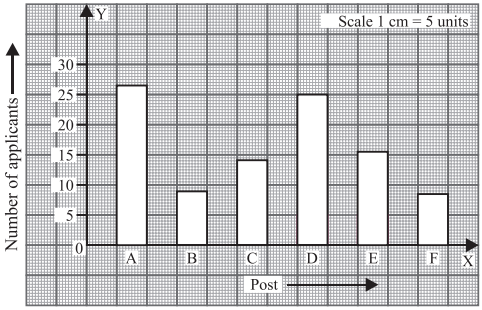
(b) The temperature was recored as 55°F at 6 : 00 pm.

(c) The temperature was 25°F at 5 : 00 am.

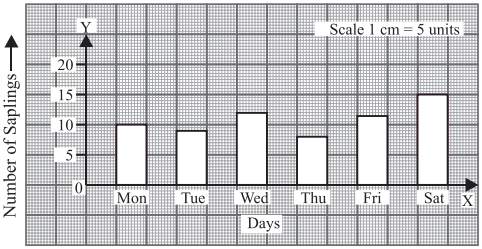
(d) The difference between the maximum and the minimum temperatures of the day was (70 – 25) °F = 45°F.

Exercise 4.2

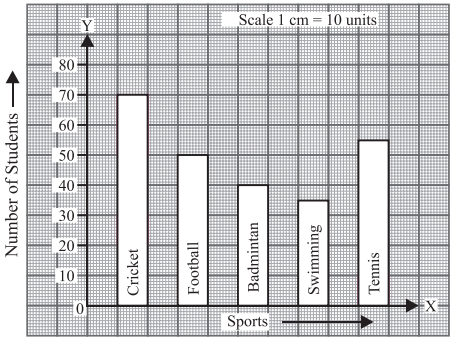
1. To represent this data on a graph paper.



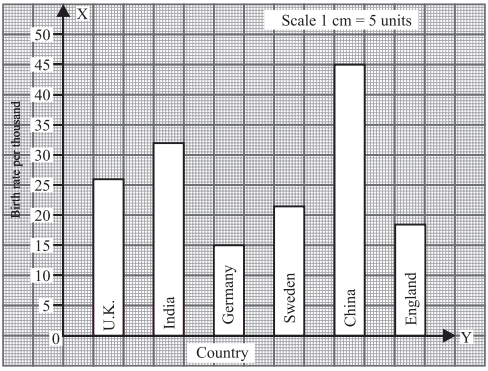
2. To represent this data on a graph paper.



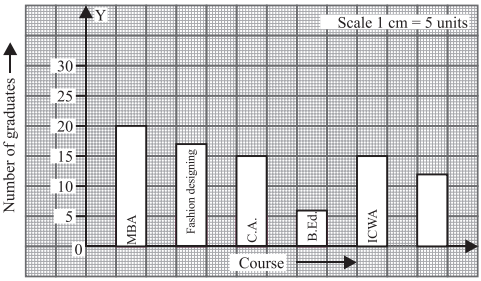
3. To represent this data on a graph paper.



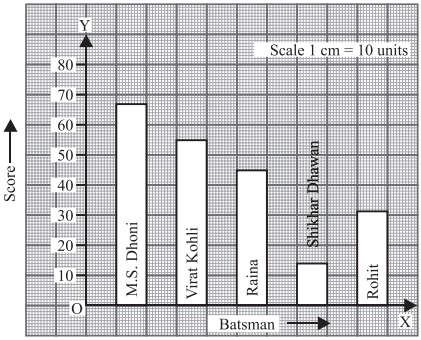
4. To represent this data on a graph paper.



5. To represent this data on a graph paper.



6.



Exercise 4.3

1. (a) There are 6 teachers in the age group of (50 – 55) years.

(b) There are 13 teachers above the age of 49 years.

(c) There are 4 teachers below the age of 35 years.

(d) (45 – 50) age group has maximum no. of teachers.

(e) 30 – 35 age group has minimum no. of teachers.

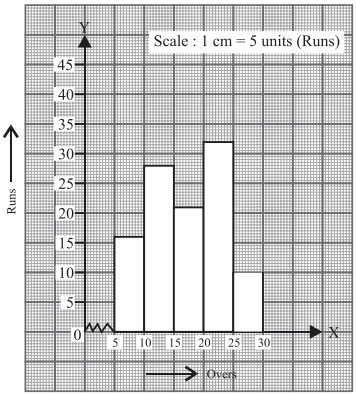
2. (a) The class size of each class interval is 20.

(b) The interval of maximum earnings is 40 – 60.

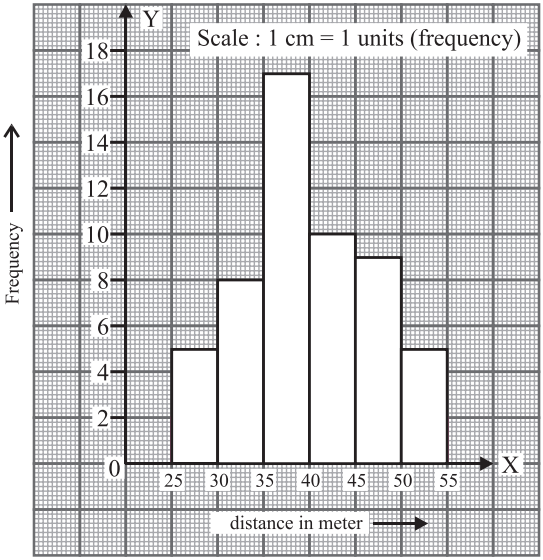
(c) The interval of minimum earnings is 0 – 20.

(d) $2+5+10=17$ chemists earn less than ₹ 60 per day.

3.

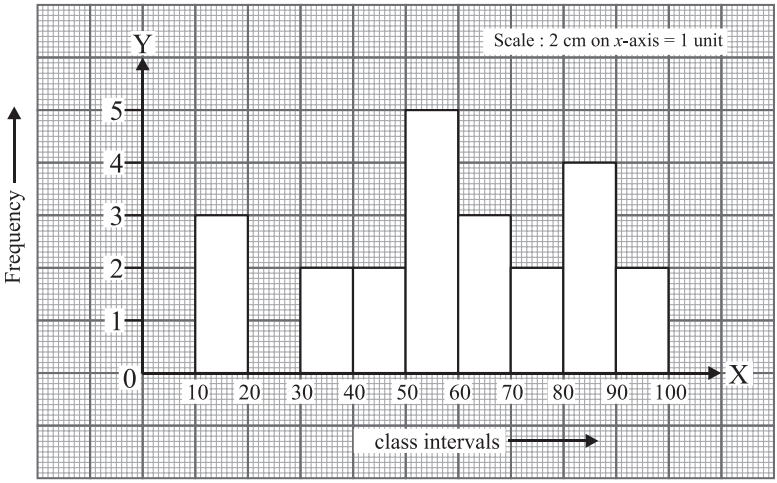


4.



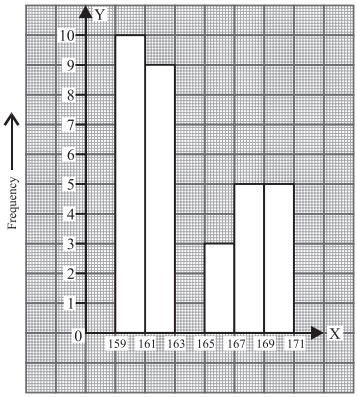
5.

S.No.	Class Interval	Tally Marks	Frequency
1.	0-10		0
2.	10-20	|||	3
3.	20-30	|	1
4.	30-40	||	2
5.	40-50	||	2
6.	50-60	~~||||~~	5
7.	60-70	|||	3
8.	70-80	||	2
9.	80-90	||||	4
10.	90-100	||	2
		Total	24

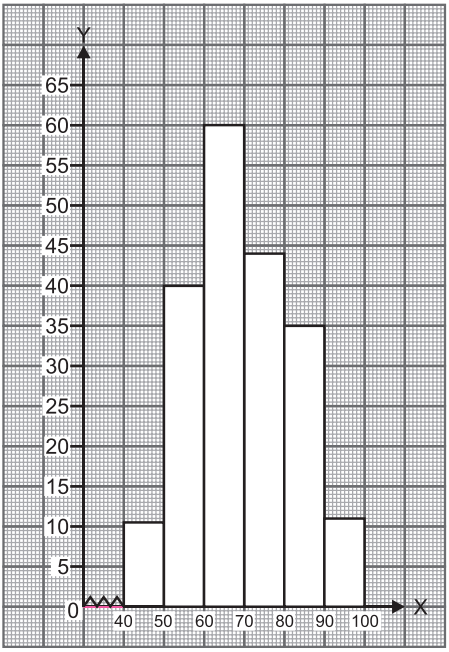


6.

S.No.	Class Interval	Tally Marks	Frequency
1.	159-161	卌 卌	10
2.	161-163	卌 ||||	9
3.	163-165		0
4.	165-167	|||	3
5.	167-169	卌	5
6.	169-171	卌	5
		Total	32

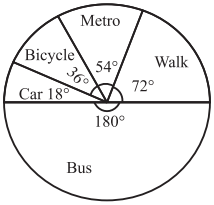


7. Scale : 1 cm = 5 students



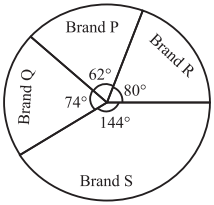
Exercise 4.4

1. Total no. of students = 2000



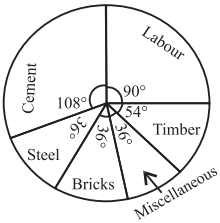
Transport to students	Number of students	Central angle
Walk	400	$\frac{400}{2000} \times 360° = 72°$
Bus	1000	$\frac{1000}{2000} \times 360° =$ 180°
Bicycle	200	$\frac{200}{2000} \times 360° = 36°$
Metro	300	$\frac{300}{2000} \times 360° = 54°$
Car	100	$\frac{100}{2000} \times 360° = 18°$
Total	2000	360°

2.



Brand	No. of people	Sector angle
Brand P	31	$\frac{31}{180} \times 360° = 62°$
Brand Q	37	$\frac{37}{180} \times 360° = 74°$
Brand R	40	$\frac{40}{180} \times 360° = 80°$
Brand S	72	$\frac{72}{180} \times 360° = 144°$
Total	180	360°

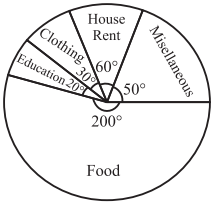
3.



Items	Expenditure	Percentage	Sector Angle
Cement	30%	30%	$\frac{30}{100} \times 360° = 108°$
Steel	10%	10%	$\frac{10}{100} \times 360° = 36°$
Bricks	10%	10%	$\frac{10}{100} \times 360° = 36°$
Timber	15%	15%	$\frac{15}{100} \times 360° = 54°$

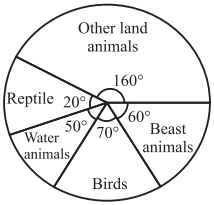
Labour	25%	25%	$\frac{25}{100} \times 360° = 90°$
Miscellaneous	10%	10%	$\frac{10}{100} \times 360° = 36°$
Total		100%	360°

4. Monthly salary = ₹ 7200



Items	Amount Spent (₹)	Sector angle
Clothing	600	$\frac{6000}{7200} \times 360° = 30°$
Food	4000	$\frac{4000}{7200} \times 360° = 200°$
House rent	1200	$\frac{1200}{7200} \times 360° = 60°$
Education	400	$\frac{400}{7200} \times 360° = 20°$
Miscellaneous	1000	$\frac{1000}{7200} \times 360° = 50°$
Total	7200	360°

5. Creatures = 1800



Animals in Zoo	No. of Animals	Sector angle
Beast animals	300	$\frac{300}{1800} \times 360° = 60°$
Other land animals	800	$\frac{800}{1800} \times 360° = 160°$
Birds	350	$\frac{350}{1800} \times 360° = 70°$
Water animals	250	$\frac{250}{1800} \times 360° = 50°$
Reptile	100	$\frac{100}{1800} \times 360° = 20°$
Total	1800	360°

6. (a) Let total amount spent be x.

Now, money spent on football = ₹ 900

So, $$x \times \frac{20°}{360°} = 900°$$

$$x = \frac{900 \times 360°}{20°}$$

$$x = ₹\ 16200$$

So, total amount spent on sports is ₹ 16200

(b) Sector angles of tennis = 35°

So, money spent on tennis = ₹ $\frac{35°}{360°} \times 16200 =$ ₹ 1575

(c) Money spent on hockey $= \frac{100°}{360°} \times ₹\ 16200 = ₹\ 4500$

given money spent on football $= ₹\ 900$

difference $= ₹\ (4500 - 900) = ₹\ 3600$

So, ₹ 3600 less was spent on football than Hockey.

(d) Since sector angle of cricket is greater than all other angles. So, amount spent on cricket was maximum.

(e) Since, sector angle of football is smallest among all angles. So, amount spent on football was minimum.

7. (a) Let the market value of total share $= x$

Market value of share of S (given) = 8 crores = 80000000

Central angle of company $S = 80°$

So, $x \times \frac{80°}{360°} = 80000000$

$$x = \frac{80000000 \times 360}{80}$$

$x = ₹\ 360000000$ or 36 crores.

(b) Company V has the maximum market share.

(c) Total market value (given) = ₹ 72 crores = ₹ 720000000

Central angle of $U = 100°$

So, share of Company $U = \frac{100°}{360°} \times 720000000$

$= ₹\ 20000000$ or 20 crores

Chapter 5

Square and Square Roots

Exercise 5.1

1. (a) $8^2 = 8 \times 8 = 64$ (b) $15^2 = 15 \times 15 = 225$

(c) $19^2 = 19 \times 19 = 361$ (d) $25^2 = 25 \times 25 = 625$

(e) $11^2 = 11 \times 11 = 121$ (f) $39^2 = 39 \times 39 = 1521$

(g) $115^2 = 115 \times 115 = 13225$ (h) $103^2 = 103 \times 103 = 10609$

(i) $123^2 = 123 \times 123 = 15129$ (j) $45^2 = 45 \times 45 = 2025$

2. (a) 256

Resolving 256 into its prime factors,

we get

$256 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}$

From the above, it is clear that all the prime factors are grouped into pairs of identical factors. And, no factor is leftover.

Hence, 256 is a perfect square.

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

(b) 169

Resolving 169 into its prime factors,

we get $169 = 13 \times 13$

From the above, it is clear that all the prime factors are grouped into pairs of identical factors. And, no factor is leftover.

Hence, 169 is a perfect square.

13	169
13	13
	1

(c) 226

Resolving 226 into its prime factors, we get

$$226 = 2 \times 113$$

From the above, it is clear that all the prime factors are not grouped into pairs of identical factors. So, 226 is not perfect square.

2	226
13	113
	1

(d) 100

Resolving 100 into its prime factors, we get

$$100 = \underline{2 \times 2} \times \underline{5 \times 5}$$

From the above, it is clear that all the prime factors are grouped into pairs of identical factors, and no factor is leftover.

Hence, 100 is a perfect square.

2	100
2	50
5	25
5	5
	1

(e) 121

Resolving 121 into its prime factors, we get

$$121 = 11 \times 11$$

11	121
11	11
	1

From the above, it is clear that all the prime factors are grouped into pairs of identical factors, and no factors is leftover.

Hence, 121 is a perfect square.

(f) 299

Resolving 299 into its prime factors, we get

$$299 = 13 \times 23$$

13	299
23	23
	1

From the above, it is clear that all the prime factors are not grouped into pairs of identical factors. So, 299 is not a perfect square.

(g) 324

Resolving 324 into its prime factors, we get

$$324 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3}$$

2	324
2	162
3	81
3	27
3	9
3	3
	1

From the above, it is clear that all the prime factors are grouped into pairs of identical factors. And, no factors is leftover.

Hence, 324 is perfect square.

(h) 1024

Resolving 1024 into its prime factors, we get

$$1024 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}$$

2	1024
2	512
2	256
2	128
2	64

From the above, it is clear that all the prime factors are grouped into pairs of identical factors. And, no factors is leftover.

Hence, 1024 is a perfect square.

(i) 2027

Resolving 2027 into its prime factors, we get

$$2027 = 2027 \times 1$$

2027	2027
	1

From the above, it is clear that all the prime factors are grouped into pairs of identical factors.

So, 2027 is not a perfect square.

(j) 10404

Resolving 10404 in its prime factors, we get

$$10404 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{17 \times 17}$$

From the above, it is clear that all the prime factors are grouped in to pairs of identical factors. And, no factors is leftover. Hence, 10404 is a perfect square.

2	10404
2	5202
3	2601
3	867
17	289
17	17
	1

3. We know that a number ending in 2, 3, 7 or 8 is never a perfect square. So, (a) 125, (b) 137, (c) 188, (f) 697, (g) 228, (h) 233, (j) 2205 are not perfect squares.

4. Since, a number ending with odd number of zeroes is not a perfect square.

So, (a) 16000, (b) 2500000, (c) 1000, (f) 169000, (h) 9000, (i) 81000 are not perfect squares.

5. We know that, square root of odd number is odd and square root of even number is even.

So, square of even numbers = (b) 36, (d) 64, (e) 144, (g) 100, (i) 196

and square of odd numbers = (a) 169, (c) 225, (f) 625, (h) 121, (j) 1225

6. From the proerty :

$(n+1)^2 - n^2 = 2n + 1$

(a) $98^2 - 97^2$

$= 2 \times 97 + 1$

$= 194 + 1 = 195$

(b) $44^2 - 43^2$

$= 2 \times 43 + 1$

$= 86 + 1 = 87$

(c) $80^2 - 79^2$

$= 2 \times 79 + 1$

$= 158 + 1 = 159$

(d) $36^2 - 35^2$

$= 2 \times 35 + 1$

$= 70 + 1 = 71$

(e) $105^2 - 104^2$

$= 2 \times 104 + 1$

$= 208 + 1 = 209$

(f) $147^2 - 146^2$

$= 2 \times 146 + 1$

$= 292 + 1$

$= 293$

(g) $238^2 - 237^2$

$= 2 \times 237 + 1$

$= 474 + 1$

$= 475$

(h) $269^2 - 268^2$

$= 2 \times 268 + 1$

$= 536 + 1$

$= 537$

7. (a) (4, 6, 8)

Three natural numbers a, b, and c are called pythagorean triplet if

$$a^2 + b^2 = c^2$$

So,

$$4^2 + 6^2 = 8^2$$

$$16 + 36 = 64$$

$$52 \neq 64$$

Hence, (4, 6, 8) are not pythagorean triplets.

(b) (6, 8, 10)

Three natural numbers a, b and c are called pythagorean triplets if

$$a^2 + b^2 = c^2$$

So,

$$6^2 + 8^2 = 10^2$$

$$36 + 64 = 100$$

$$100 = 100$$

Hence, (6, 8, 10) are pythagorean triplets.

(c) (9, 81, 82)

Three natural numbers a, b and c are called pythagorean triplets if

$$a^2 + b^2 = c^2$$

So,

$$9^2 + 81^2 = 82^2$$

$$81 + 6561 = 6724$$

$$6642 \neq 6724$$

Hence, (9, 81, 82) are not pythagorean triplets.

(d) (10, 24, 26)

Three natural numbers a, b and c are called pythagorean triplets if

$$a^2 + b^2 = c^2$$

So,

$$10^2 + 24^2 = 26^2$$

$$100 + 576 = 676$$

$$676 = 676$$

Hence, (10, 24, 26) are pythagoreas triplets.

(e) (15, 85, 87)

Three natural numbers a, b and c are called pythagorean triplets, if

$$a^2 + b^2 = c^2$$

So,

$$15^2 + 85^2 = 87^2$$
$$225 + 7225 = 7569$$
$$7450 \neq 7569$$

Hence, (15, 85, 87) are not pythagorean triples.

(f) (26, 168, 170)

Three natural numbers, a, b and c are called pythagorean triplets if

$$a^2 + b^2 = c^2$$

So,

$$26^2 + 168^2 = 170^2$$
$$676 + 28224 = 28900$$
$$28900 = 28900$$

Hence, (26, 168, 170) are pythagorean triplets.

(g) (30, 224, 226)

Three natural numbers a, b and c are called pythagorean triplets, if

$$a^2 + b^2 = c^2$$

So,

$$30^2 + 224^2 = 226^2$$
$$900 + 50176 = 51076$$
$$51076 = 51076$$

Hence, (30, 224, 226) are phythagorean triplets.

(h) (42, 440, 442)

Three natural numbers. a, b and c are called phythagorean triplets, if

$$a^2 + b^2 = c^2$$

So,

$$42^2 + 440^2 = 442^2$$
$$1764 + 193600 = 195364$$
$$195364 = 195364$$

Hence, (42, 440, 442) are phythagorean triplets.

8. (a) $1 + 3 + 5 + 7 + \mathbf{9} = 5^2$

(b) $1 + 3 + 5 + 7 + 9 + \mathbf{11} = 6^2$

(c) $1 + 3 + 5 + 7 + 9 + 11 + \mathbf{13} = 7^2$

(d) $1 + 3 + 5 + 7 + 9 + 11 + 13 + \mathbf{15} = 8^2$

9. (a) $121 = 11^2$

Sum of first 11 odd numbers.

$= 1+3+5+7+9+11+13+15+17+19+21$

(b) $169 = 13^2$

Sum of first 13 odd numbers.

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25$

(c) $289 = (17)^2$

Sum of first 17 odd numbers.

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23$
$+ 25 + 27 + 29 + 31 + 33$

10. (a)

$11^2 = 121$

$101^2 = 10201$

$1001^2 = 1002001$

$10001^2 = 1\mathbf{00020001}$

$100001^2 = 1\mathbf{0000200001}$

$1000001^2 = 1\mathbf{000002000001}$

$10000001^2 = 1\mathbf{00000020000001}$

(b)

$11^2 = 1\ 2\ 1$

$101^2 = 10201$

$10101^2 = 102030201$

$1010101^2 = \mathbf{1020304030201}$

$\mathbf{101010101} = 10203040504030201$

11. (a) $\dfrac{55555^2}{123454321}$

$= \dfrac{(5\times 11111)^2}{123454321}$

$= \dfrac{5\times 5\times 11111\times 11111}{123454321}$

$= \dfrac{25\times 123454321}{123454321} = 25$

(b) $\dfrac{7777777^2}{1234567654321}$

$= \dfrac{(7\times 1111111)^2}{1234567654321}$

$= \dfrac{7^2\times 1234567654321}{1234567654321}$

$= 7\times 7 = 49$

Exercise 5.2

1. (a) If $8 \times 8 = 64$, then $\sqrt{64}$ is **8**.

(b) If 11×11 is 121, then $\sqrt{121}$ is **11**.

(c) If 25×25 is 625, then $\sqrt{625}$ is **25**.

(d) If 15^2 is 225, then $\sqrt{225}$ is **15**.

(e) If $(2 \times 9)(2 \times 9)$ is 324, then $\sqrt{324}$ is **18**.

(f) If $(2 \times 3 \times 5)(2 \times 3 \times 5)$ is 900, then $\sqrt{900}$ is **30**.

(g) If $(2 \times 3 \times 7)(2 \times 3 \times 7)$ is 1764, then $\sqrt{1764}$ is **42**.

(h) If $(7 \times 11 \times 13)^2 = 1002001$, then $\sqrt{1002001}$ is **1001**.

2. (a) 169

$\sqrt{169}$

$$169 = \underline{13 \times 13}$$

Hence, $\sqrt{169} = \sqrt{13 \times 13} = 13$

13	169
13	13
	1

(b) 625

$\sqrt{625}$

$$625 = \underline{5 \times 5} \times \underline{5 \times 5}$$

Hence, $\sqrt{625} = \sqrt{\underline{5 \times 5} \times \underline{5 \times 5}} = 5 \times 5 = 25$

5	625
5	125
5	25
5	5
	1

(c) 900

Hence, $\sqrt{900} = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5}$

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

2	900
2	450
3	225
3	75
5	25
5	5
	1

(d) $\sqrt{1600}$

$$1600 = \underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{5\times5}$$

$$= 2\times2\times2\times5 = 40$$

2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

(e) $\sqrt{2916}$

$$2916 = \underline{2\times2}\times\underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}$$

Hence, $\sqrt{2916} = \sqrt{\underline{2\times2}\times\underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}}$

$$= 2\times3\times3\times3 = 54$$

2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

(f) 7744

$$7744 = \underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{11\times11}$$

Hence, $\sqrt{7744}$

$$= \sqrt{\underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{11\times11}}$$

$$= 2\times2\times2\times11 = 88$$

2	7744
2	3872
2	1936
2	968
2	484
2	242
11	121
11	11
	1

(g) $\sqrt{8281}$

7	8281
7	1183
13	169
13	13
	1

$$8281 = \underline{7 \times 7} \times \underline{13 \times 13}$$

Hence, $\sqrt{8281} = \sqrt{\underline{7 \times 7} \times \underline{13 \times 13}}$

$$= 7 \times 13 = 91$$

(h) 8464

2	8464
2	4232
2	2116
2	1058
23	529
23	23
	1

$$8464 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{23 \times 23}$$

Hence, $\sqrt{8464} = \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{23 \times 23}}$

$$= 2 \times 2 \times 25 = 92$$

(i) 9216

2	9216
2	4608
2	2304
2	1152
2	576
2	288
2	144

2	72
2	36
2	18
3	9
3	3
	1

$$9216 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3}$$

Hence, $\sqrt{9216} = \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3}}$

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

$$= 96$$

(j) 10000

$1000 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5} \times \underline{5 \times 5}$

Hence, $\sqrt{10000}$

$= \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5} \times \underline{5 \times 5}}$

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

3	11025
3	3675
5	1225
5	245
7	49
7	7
	1

(k) 11025

$11025 = \underline{3 \times 3} \times \underline{5 \times 5} \times \underline{7 \times 7}$

Hence, $\sqrt{11025} = \sqrt{\underline{3 \times 3} \times \underline{5 \times 5} \times \underline{7 \times 7}}$

$= 3 \times 5 \times 7 = 105$

2	10000
2	5000
2	2500
2	1250
5	625
5	125
5	25
5	5
	1

(l) 12544

$12544 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{7 \times 7}$

Hence, $\sqrt{12544}$

$= \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{7 \times 7}}$

$= 2 \times 2 \times 2 \times 2 \times 2 \times 7 = 112$

2	12544
2	6272
2	3136
2	1568
2	784
2	392
2	196
2	98
7	49
7	7
	1

(m) 27225

$27225 = \underline{3 \times 3} \times \underline{5 \times 5} \times \underline{11 \times 11}$

Hence, $\sqrt{27225} = \sqrt{\underline{3 \times 3} \times \underline{5 \times 5} \times \underline{11 \times 11}}$

$= 3 \times 5 \times 11 = 165$

3	27225
3	9075
5	3025
5	605
11	121
11	11

(n) 57600

2	57600
2	28800
2	14400
2	7200
2	3600
2	1800
2	900

2	450
3	225
3	75
5	25
5	5
	1

$57600 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5}$

Hence, $\sqrt{57600} = \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5}}$

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

(o) 67600

$67600 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5} \times \underline{13 \times 13}$

Hence, $\sqrt{67600}$

$= \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5} \times \underline{13 \times 13}}$

$= 2 \times 2 \times 5 \times 13 = 260$

2	67600
2	33800
2	16900
2	8450
5	4225
5	845
13	169
13	13
	1

(p) 99225

$99225 = \underline{3\times3}\times\underline{3\times3}\times\underline{5\times5}\times\underline{7\times7}$

Hence, $\sqrt{99225}$

$= \sqrt{\underline{3\times3}\times\underline{3\times3}\times\underline{5\times5}\times\underline{7\times7}}$

$= 3\times3\times5\times7 = 315$

3	99225
3	33075
3	11025
3	3675
5	1225
5	245
7	49
7	7
	1

3. Let no. of plants in 9 rows $= x$

and columns x

So, total number of plant in the garden $x^2 = 2500$

$$x = \sqrt{2500}$$

$$x = \sqrt{\underline{2\times2}\times\underline{5\times5}\times\underline{5\times5}}$$

$$= 2\times5\times5 = 50$$

So, No. of plants in each row and column = 50.

4. Base = 3 cm; height = 4 cm; hypotenuse = ?

By pythagoras theorem, we get

$$\text{hypotenuse}^2 = \text{base}^2 + \text{height}^2$$

$$= 3^2 + 4^2$$

$$\text{hypotenuse}^2 = 9+16$$

$$\text{hypotenuse} = \sqrt{9+16} = \sqrt{25} = 5\,\text{cm}$$

5. Finding all the prime factors of 338, we get

$$338 = 2\times\underline{13\times13}$$

From the above, it is clear that 2 is leftover without pair. So, 338 must be multiplied by 2 to make it a perfect square.

Verification : $338\times2 = 676$ which is perfect square of 26.

2	338
13	169
13	13
	1

6. Finding all the prime factors of 1575, we get

$$1575 = \underline{3 \times 3} \times \underline{5 \times 5} \times 7$$

3	1575
3	525
5	175
5	35
7	7
	1

From the above, it is clear that 7 is leftover without pair. So, 1575 is to be divided by 7 to make it a perfect square.

Hence, $1575 \div 7 = 225$ is the perfect square of 15.

7. The least number which will be divisible by 10, 12 and 8 is the L.C.M of 10, 12 and 8.

2	10, 12, 8
2	5, 6, 4
2	5, 3, 2
3	5, 3, 1
5	5, 1, 1
	1, 1, 1

2	120
2	60
2	30
3	15
5	5
	1

LCM of 10, 12 and 8 is $(2 \times 2 \times 2 \times 3 \times 5)$ i.e., 120

Now, $120 = \underline{2 \times 2} \times 2 \times 3 \times 5$

To make 120 a perfect square, it must be multiplied by $(2 \times 3 \times 5)$ *i.e.*, 30. Hence, the required least number is (120×30), *i.e.*, 3600.

8. Size of tile $= 3 \times 3 \text{ inch}^2$

Area of roof $= 9 \times 9 \text{ feet}^2$

$$\text{So, no. of tiles} = \frac{\text{Area of roof}}{\text{Size of one tile}}$$

$$= \frac{9 \times 9 \text{ feet}^2}{3 \times 3 \text{ inch}^2}$$

$$= \frac{9 \times 9 \times 12 \times 12 \text{ inch}^2}{3 \times 3 \text{ inch}^2}$$

$$= 1296 \text{ tiles}$$

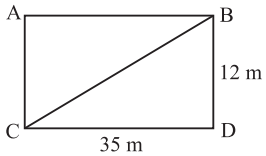
9. In ΔBCD

$BC = 12$ m;

$CD = 35$ m

Diagonal $BD = ?$

By Pythagoras theorem, we have



$$BD^2 = BC^2 + CD^2$$
$$BD^2 = 12^2 + 35^2$$
$$BD^2 = 144 + 1225$$
$$BD^2 = 1369$$
$$BD = \sqrt{1369}$$
$$BD = 37\,\text{m}$$

So, diagonal = 37 m

10. Side of square = 125 m

$$\text{Area of square} = \text{side} \times \text{side}$$
$$= 125\,\text{m} \times 125\,\text{m}$$
$$= 15625\,\text{m}^2$$

Cost of leveling the entire ground = ₹ 15625×17

= ₹ 265625

11. Let the no. of students in the class = x

So, each student contributed rupees = ₹ x

So, total contributed amount = ₹ 1024

$$x \times x = 1024$$
$$x^2 = 1024$$
$$x = \sqrt{1024}$$
$$x = \sqrt{\underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}}$$
$$x = 2\times2\times2\times2\times2$$
$$x = ₹\ 32$$

So, there are 32 students in the class.

Exercise 5.3

1. (a) 529

	23
2 +2	$\overline{5}\ \overline{29}$ 4
43	129 129
	×

$\therefore \quad \sqrt{529} = 23$

(b) 1444

	38
3 +3	$\overline{14}\ \overline{44}$ 9
68	544 544
	×

$\therefore \quad \sqrt{1444} = 38$

(c) 1156

	34
3 +3	$\overline{11}\ \overline{56}$ –9
64	256 –256
	×

(d) 12544

	112
1 +1	$\overline{1}\ \overline{25}\ \overline{44}$ –1
21 +1	25 –21
222	444 – 444
	×

$\therefore \quad \sqrt{12544} = 112$

(e) 974169

	987
9 + 9	$\overline{97}\ \overline{41}\ \overline{69}$ – 81
188 + 8	1641 1504
1967	13769 13769
	×

Hence, $\therefore \sqrt{974169} = 987$

(f) 12321

	111
1 + 1	$\overline{12}\ \overline{32}\ \overline{1}$ –1
21 + 1	23 – 22
221	221 – 221
	×

Hence, $\therefore \sqrt{12321} = 111$

(g) 352836

	594
5	$\overline{35}\ \overline{28}\ \overline{36}$
+ 5	– 25
109	1028
+ 9	– 981
1184	4736
4	– 4736
	×

Hence, $\therefore \sqrt{352836} = 594$

(h) 363609

	603
6	$\overline{36}\ \overline{36}\ \overline{09}$
+ 6	–36
120	36
+ 0	– 00
1203	3609
	– 3609
	×

Hence, $\therefore \sqrt{363609} = 603$

(i) 17956

	134
1	$\overline{1}\ \overline{79}\ \overline{56}$
+1	–1
23	79
+3	– 69
264	1056
	–1056
	×

Hence, $\therefore \sqrt{17956} = 134$

(j) 92416

	304
3	$\overline{9}\ \overline{24}\ \overline{16}$
+ 3	–9
60	24
+ 0	00
604	2416
	–2416
	×

Hence, $\therefore \sqrt{92416} = 304$

2. Greatest no. of four digits = 9999

Our purpose is to find the least no. which when subtracted from 9999, gives a perfect square.

Now, on finding the square root of 9999 by long division method, we have

	99
9	$\overline{99}\ \overline{99}$
+ 9	– 81
189	1899
	1701
	198

$$99^2 + 198 = 9999$$

So, the least number to be subtracted is 198.

$\therefore$ the required number $= 9999 - 198 = 9801$

Also, $\sqrt{9801} = 99$

3. Finding square root of 650 by long division method and on comparing, we have

$$25^2 < 650 < 26^2$$

	25
2	$\overline{6}\ \overline{50}$
+ 2	− 4
45	250
	−225
	25

	26
2	$\overline{6}\ \overline{76}$
+ 2	−4
46	276
	−276
	×

The required no. to be added $= 26^2 - 650$

$= 676 - 650$

$= 26$

4. Finding square root of 17455 by long division method, we have

Here, 31 is the remainder.

So, the required no. to be subtracted is 31 to make 17455 perfect square.

	132
1	$\overline{1}\ \overline{74}\ \overline{55}$
+1	−1
23	74
+3	− 69
262	555
	−524
	31

5. Least no. of five digits = 10000

Now, no. remainder is left.

Hence, 10000 is a perfect square

$\therefore \quad \sqrt{10000} = 100$

	100
1	$\overline{1}\ \overline{00}\ \overline{00}$
+1	−1
20	00
	00
200	00
	00
	×

6. Find square root of 60509 by long division method and on comparing, we have

$$245^2 < 60509 < 246^2$$

	245
2	$6\ \overline{05}\ 0\ \overline{9}$
+2	−4
44	205
+4	−176
485	2909
	−2425
	484

	246
2	$\overline{6}\ \overline{05}\ \overline{16}$
+2	− 4
44	205
+4	176
486	2916
	2916
	×

The required no. to be added $= 246^2 - 60509 = 60516 - 60509 = 7$

7. (a) $\overline{225}$

No. of digits in square root of 225 = 2

(b) 625

No. of digits in square root of 625 = 2

(c) 10000

No. of digits in square root of 10000 = 3

(d) 63001

No. of digits in square root of 63001 = 3

8. The greatest no. of 7-digit = 9999999

Our purpose is to find the least no. which when subtracted from 9999999, gives a perfect square.

Now, on finding the square root of 9999999 by long division method, we have

$$3162^2 + 1755 = 9999999$$

So, the least no. to be subtracted is 1755

∴ The required no.

$$= 9999999 - 1755 = 9998244$$

	3162
3	$\overline{9}\ \overline{99}\ \overline{99}\ \overline{99}$
+3	−9
61	99
+1	−61
626	3899
+6	3756
6322	14399
	12644
	1755

Also, $\sqrt{9998244} = 3162$

9. Least no. of eight-digits = 10000000

	3162
3	$\overline{10}\ \overline{00}\ \overline{00}\ \overline{00}$
+3	−9
61	100
+1	−61
626	3900
+6	− 3756
6322	14400
	−12644
	1756

Finding square root of 10000000 by long division method and on comparing, we have

$$3162^2 < 10000000 < 3163^2$$

	3163
3	$\overline{10}\ \overline{00}\ \overline{45}\ \overline{69}$
+ 3	− 9
61	100
+ 1	− 61
626	3945
+ 6	− 3756
6323	18969
	−18969
	×

So, the required no. to be added

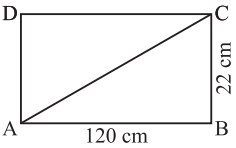
$$= 3163^2 - 10000000$$
$$= 10004569 - 10000000 = 4569$$

$\therefore$ The required perfect square $= 10000000 + 4569 = 10004569$

Therefore, $\sqrt{10004569} = 3163$

10. In $\Delta\, ABC$, $AB = 120$ cm; $BC = 22$ cm; diagonal $AC = ?$

By Pythagoras theorem, we have



$$AC^2 = AB^2 + BC^2$$
$$AC^2 = 120^2 + 22^2$$
$$AC^2 = 14400 + 484$$
$$AC^2 = 14884$$
$$AC = \sqrt{14884} = 122 \text{ cm}$$

	122
1	$\overline{1}\ \overline{48}\ \overline{84}$
+ 1	–1
22	48
+ 2	– 44
242	484
	– 484
	×

So, diagonal $= 122$ cm

11. Area of square $= 119025\ \text{m}^2$

Let its side $= x$

So, $x^2 = 119025$

$$x = \sqrt{119025}$$
$$= 345 \text{ m}$$

Now, perimeter of square $= 4 \times x$

$$= 4 \times 345 \text{ m}$$
$$= 1380 \text{ m}$$

	345
3	$\overline{11}\ \overline{90}\ \overline{25}$
+ 3	–9
64	290
+ 4	–256
685	3425
+ 5	3425
	×

So, distance covered by a man in 2 round of its boundary

$$= 2 \times 1380 \text{ m}$$

$$= 2760 \text{ m}$$

12. Area of square field $= 164025 \text{ m}^2$

Let, side of square $= x$ m

So, area $= 164025$

or $x^2 = 164025$

$x = \sqrt{164025}$

or $x = 405$ m

Now, perimeter $= 4 \times x$

$= 4 \times 405$ m

$= 1620$ m

So, cost of fencing the field = ₹ 15×1620

= ₹ 24300

	405
4	$\overline{16}\ \overline{40}\ \overline{25}$
+4	−16
80	40
+0	− 00
805	4025
+5	− 4025
	×

Exercise 5.4

1. (a) $\dfrac{625}{1296} = \sqrt{\dfrac{625}{1296}} = \dfrac{\sqrt{625}}{\sqrt{1296}}$

	25
2	$\overline{6}\ \overline{25}$
+2	− 4
45	225
	225
	×

	36
3	$\overline{12}\ \overline{96}$
+3	− 9
66	396
	396
	×

$\therefore \quad \sqrt{\dfrac{625}{1296}} = \dfrac{\sqrt{625}}{\sqrt{1296}} = \dfrac{25}{36}$

(b) $\sqrt{\frac{4096}{14641}} = \frac{\sqrt{4096}}{\sqrt{14641}}$

	64
6	$\overline{40}\ \overline{96}$
+6	−36
124	496
	496
	×

	121
1	$\overline{1}\ \overline{46}\ \overline{41}$
+1	−1
22	46
+2	−44
241	241
	241
	×

So, $\sqrt{\frac{4096}{14641}} = \frac{64}{121}$

(c) $\sqrt{4\frac{29}{49}}$

$\sqrt{\frac{225}{49}} = \frac{\sqrt{225}}{\sqrt{49}}$

	15
1	$\overline{2}\ \overline{25}$
+1	−1
25	125
	125
	×

	7
7	$\overline{49}$
	− 49
	×

So, $\sqrt{4\frac{29}{49}} = \frac{\sqrt{225}}{49} = \frac{15}{7} = 2\frac{1}{7}$

(d) $\sqrt{17\frac{13}{36}}$

$$\sqrt{\frac{625}{36}} = \frac{\sqrt{625}}{\sqrt{36}}$$

	215
2	$\overline{6}\ \overline{25}$
+2	– 4
45	225
	225
	×

	6
6	$\overline{36}$
	–36
	×

So, $$\sqrt{\frac{625}{36}} = \frac{25}{6} = 4\frac{1}{6}$$

(e) $\sqrt{407\frac{37}{121}}$

$$\sqrt{\frac{49284}{121}} = \frac{\sqrt{49284}}{\sqrt{121}}$$

	222
2	$\overline{4}\ \overline{92}\ \overline{84}$
+2	–4
42	92
+2	– 84
442	884
	– 884
	×

	11
1	$1\ \overline{21}$
+1	– 1
21	21
+21	– 21
	×

$\therefore$ $$\frac{\sqrt{49284}}{\sqrt{121}} = \frac{222}{11} = 20\frac{2}{11}$$

(f) $\sqrt{35\frac{85}{1444}}$

$$\sqrt{\frac{50625}{1444}} = \frac{\sqrt{50125}}{\sqrt{1444}}$$

	225
2	$\overline{5}\ \overline{06}\ \overline{25}$
+2	−4
42	106
+2	84
445	2225
	2225
	×

	38
3	$\overline{14}\ \overline{44}$
+3	− 9
68	544
	544
	×

$\therefore$ $$\frac{\sqrt{50625}}{\sqrt{1444}} = \frac{225}{38} = 5\frac{35}{38}$$

(g) $\sqrt{23\frac{394}{729}}$ $\Rightarrow$ $\sqrt{\frac{17161}{729}} = \frac{\sqrt{17161}}{\sqrt{729}}$

	131
1	$\overline{1}\ \overline{71}\ \overline{61}$
+ 1	−1
23	71
+ 3	69
261	261
	261
	×

	27
2	$\overline{7}\ \overline{29}$
+2	− 4
47	329
	329
	×

So, $$\frac{\sqrt{17161}}{\sqrt{729}} = \frac{131}{27} = 4\frac{23}{27}$$

(h) $\sqrt{21\frac{2797}{3364}}$

$$\sqrt{\frac{73441}{3364}} = \frac{\sqrt{73441}}{\sqrt{3364}}$$

	271
2	$\overline{7}\ \overline{34}\ \overline{41}$
+ 2	– 4
47	334
+ 7	–329
541	541
+ 1	–541
	×

	58
5	$\overline{33}\ \overline{64}$
+ 5	–25
108	864
	864
	×

So, $$\frac{\sqrt{73441}}{\sqrt{3364}} = \frac{271}{58} = 4\frac{39}{58}$$

(i) $80\frac{244}{729}$

$$\sqrt{\frac{58564}{729}} = \frac{\sqrt{58564}}{\sqrt{729}}$$

	242
2	$\overline{5}\ \overline{85}\ \overline{64}$
+ 2	– 4
44	185
+ 4	–176
482	964
	– 964
	×

	27
2	$\overline{7}\ \overline{29}$
+ 2	– 4
47	329
	–329
	×

$\therefore$ $$\frac{\sqrt{58564}}{\sqrt{729}} = \frac{242}{27} = 8\frac{26}{27}$$

2. Area of square sheet $= 3\frac{942}{2209}\ m^2$

Let side of square sheet $= x$

So, $$x \times x = 3\frac{942}{2209}$$

$$x^2 = 3\frac{942}{2209}$$

$$x = \sqrt{3\frac{942}{2209}} = \sqrt{\frac{7569}{2209}} = \frac{\sqrt{7569}}{\sqrt{2209}}$$

	87
8	$\overline{75}\ \overline{85}$
+8	–64
167	1169
	–1169
	×

	47
4	$\overline{22}\ \overline{09}$
+4	–16
87	609
	– 609
	×

So, $$\frac{\sqrt{7569}}{\sqrt{2209}} = \frac{87}{47} = 1\frac{40}{47}$$

3. Area of square field $= 332\frac{61}{169}\ m^2$

Let the side of square $= x$ m

So, $$x \times x = 332\frac{61}{169}$$

$$x^2 = 332\frac{61}{169}$$

$$x = \sqrt{332\frac{61}{169}}$$

$$x = \sqrt{\frac{56169}{169}} = \frac{\sqrt{56169}}{\sqrt{169}}$$

	237
2	$\overline{5}\ \overline{61}\ \overline{69}$
+ 2	–4
43	161
+ 3	–129
467	3269
	– 3269
	×

	13
1	$\overline{1}\ \overline{69}$
+ 1	–1
23	69
	– 69
	×

So, $$\frac{\sqrt{56169}}{\sqrt{169}} = \frac{237}{13} = 18\frac{3}{13}$$

So, $$\text{side} = 18\frac{3}{13}\text{ m}$$

4. (a) $\dfrac{\sqrt{405}}{\sqrt{180}}$

$$= \frac{\sqrt{3\times3\times3\times3\times5}}{\sqrt{2\times2\times3\times3\times5}}$$

$$= \frac{3\times3\sqrt{5}}{2\times3\sqrt{5}} = \frac{3}{2}$$

(b) $\dfrac{\sqrt{625}}{\sqrt{441}}$

$$= \frac{\sqrt{5\times5\times5\times5}}{\sqrt{3\times3\times7\times7}}$$

$$= \frac{5\times5}{3\times7} = \frac{25}{21}$$

(c) $$\frac{\sqrt{1587}}{\sqrt{1728}} = \frac{\sqrt{3\times23\times23}}{\sqrt{2\times2\times2\times2\times2\times2\times3\times3\times3}}$$

$$= \frac{23\sqrt{3}}{2\times2\times2\times3\sqrt{3}} = \frac{23}{24}$$

(d) $$\sqrt{338}\times\sqrt{72} = \sqrt{2\times13\times13}\times\sqrt{2\times2\times2\times3\times3}$$

$$= 13\sqrt{2}\times2\times3\sqrt{2}$$

$$= 13\sqrt{2}\times6\sqrt{2}$$

$$= 78 \times \sqrt{2} \times \sqrt{2}$$
$$= 78 \times 2 = 156$$

(e) $\sqrt{980} \times \sqrt{1620}$

$$= \sqrt{2 \times 2 \times 5 \times 7 \times 7} \times \sqrt{2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5}$$
$$= 2 \times 7 \times \sqrt{5} \times 2 \times 3 \times 3 \times \sqrt{5}$$
$$= 14\sqrt{5} \times 18\sqrt{5}$$
$$= 14 \times 18 \times \sqrt{5} \times \sqrt{5}$$
$$= 252 \times 5$$
$$= 1260$$

(f) $\dfrac{\sqrt{1183}}{\sqrt{2023}} = \dfrac{\sqrt{7 \times 13 \times 13}}{\sqrt{7 \times 17 \times 17}} = \dfrac{13\sqrt{7}}{17\sqrt{7}} = \dfrac{13}{17}$

(g) $\sqrt{147} \times \sqrt{243} = \sqrt{3 \times 7 \times 7} \times \sqrt{3 \times 3 \times 3 \times 3 \times 3}$

$$= 7\sqrt{3} \times 3 \times 3 \times \sqrt{3}$$
$$= 7\sqrt{3} \times 9\sqrt{3}$$
$$= 63 \times \sqrt{3} \times \sqrt{3}$$
$$= 63 \times 3 = 189$$

5. (a) $\sqrt{1.4641}$

	1.21
1	$\overline{1}.\overline{46}\ \overline{41}$
+ 1	−1
22	46
+ 2	− 44
241	241
	− 241
	×

$\therefore\ \sqrt{1.4641} = 1.21$

(b) $\sqrt{6.7081}$

	2.59
2	$\overline{6}.\overline{70}\ \overline{81}$
+ 2	−4
45	270
+ 5	−225
509	4581
	− 4581
	×

$\therefore\ \sqrt{6.7081} = 2.59$

(c) $\sqrt{1011.24}$

	31.8
3	$\overline{10}\ \overline{11.24}$
+ 3	− 9
61	111
+ 1	− 61
628	5024
	− 5024
	×

$\therefore \sqrt{1011.24} = 31.8$

(d) $\sqrt{0.053361}$

	0.231
0	$\overline{0.05}\ \overline{33}\ \overline{61}$
+ 0	− 0
2	5
+ 2	− 4
43	133
+ 3	−129
461	461
	− 461
	×

$\therefore \sqrt{0.053361} = 0.231$

(e) $\sqrt{477.4225}$

	21.85
2	$\overline{4}\ \overline{77.42}\ \overline{25}$
+ 2	− 4
41	77
+ 1	−41
428	3642
+ 8	− 3424
4365	21825
	− 21825
	×

$\therefore \sqrt{477.4225} = 21.85$

(f) $\sqrt{0.00008649}$

	0.0093
0	$\overline{0.00}\ \overline{00}\ \overline{86}\ \overline{49}$
+ 0	− 0
0	00
0	− 00
9	86
+ 9	− 81
183	549
	−549
	×

$\therefore \sqrt{0.00008649} = 0.0093$

(g) $\sqrt{150.0625}$

	12.25
1	$\overline{1}\ \overline{50}.\overline{06}\ \overline{25}$
+ 1	−1
22	50
+ 2	− 44
242	606
+ 2	− 484
2445	12225
	−12225
	×

$\therefore \sqrt{150.0625} = 12.25$

(h) $\sqrt{9998.0001}$

	99.99
9	$\overline{99}\ \overline{98}.\overline{00}\ \overline{01}$
+ 9	−81
189	1898
+ 9	−1701
1989	19700
+ 9	−17901
19989	179901
	−179901
	×

$\therefore \sqrt{9998.0001} = 99.99$

(i) $\sqrt{493.7284}$

	22.22
2	$\overline{4}\ \overline{93}.\overline{72}\ \overline{84}$
+ 2	− 4
42	93
+ 2	−84
442	972
+ 2	−884
4442	8884
	−8884
	×

$\therefore \sqrt{493.7284} = 22.22$

(j) $\sqrt{225.6004}$

	15.02
1	$\overline{2}\ \overline{25}.\overline{60}\ \overline{04}$
+ 1	−1
25	125
+ 5	−125
300	60
+ 0	− 00
3002	6004
	− 6004
	×

$\therefore \sqrt{225.6004} = 15.02$

(k) $\sqrt{0.00015129}$

	0.0123
0	$\overline{0}.\overline{00}\ \overline{01}\ \overline{51}\ \overline{29}$
	0
0	00
	00
1	01
+1	–1
22	51
+2	– 44
243	729
	–729
	×

$\therefore\ \sqrt{0.00015129} = 0.0123$

(l) $\sqrt{227.798649}$

	15.093
1	$\overline{2}\ \overline{27}.\overline{79}\ \overline{86}\ \overline{49}$
+1	–1
25	127
+5	–125
300	279
+0	–000
3009	27986
+9	–27081
30183	90549
	90549
	×

$\therefore\ \sqrt{227.798649} = 15.093$

6. Area of square field = 144.28814 m^2

Let the length of side = x m

So, area of square field

$= x \times x$

But $x \times x = 144.28814$

$x^2 = 144.28814$

$x = \sqrt{144.28814}$

$= 12.012$ m

So, side = 12.012 m

	12.012
1	$\overline{1}\ \overline{44}.\overline{28}\ \overline{84}\ \overline{4}$
+1	–1
22	44
+2	– 44
240	28
	– 00
2401	2881
+1	–2401
24022	48044
	– 48044
	×

7. Let fraction $= x$

So, $$x \times x = 0.00001156$$
$$x^2 = 0.00001156$$
$$x = \sqrt{0.00001156}$$

	0.0034
0	$\overline{0}.\overline{00}\ \overline{00}\ \overline{11}\ \overline{56}$
+ 0	0
0	00
+ 0	− 00
0	00
+ 0	− 00
3	11
+3	− 9
64	256
	− 256
	×

$$x = 0.0034$$

8. (a) $\sqrt{0.09102289}$

	30.17
3	$\overline{9}\ \overline{10}.\overline{22}\ \overline{89}$
+ 3	− 9
60	10
+ 0	− 00
601	1022
+ 1	601
6027	42189
	42189
	×

$\therefore$ $$\sqrt{910.2289} = 30.17$$

(a) $\sqrt{0.09102289}$

We have, $\sqrt{910.2289} = 30.17$

So, $\sqrt{0.09102289} = 0.3017$

(b) $\sqrt{9.102289}$

We have, $\sqrt{910.2289} = 30.17$

So, $= \sqrt{9.102289} = 3.017$

(c) $\sqrt{91022.89}$

We have, $\sqrt{910.2289} = 30.17$

So, $\sqrt{91022.89} = 301.7$

MCQs : 1. (b) 2. (b) 3. (b) 4. (d) 5. (b)

Mental Maths :

I. Fill in the blanks :

(a) If m is a rational number, then its square is $\mathbf{m^2}$.

(b) If $x = y^2$, where y is a natural number, then x is a **also natural number**.

(c) The square of an odd number is **odd**.

(d) For a natural number $n > 1$, $(2n, n^2 - 1, n^2 + 1)$ is a **pythagorean triplets**.

(e) If m is a number, then $\sqrt{m} \times \sqrt{\boldsymbol{m}} = m$.

II. (a)

(i) $\sqrt{27556}$

2	27556
2	13778
83	6889
83	83
	1

Hence, $\sqrt{27556}$

$= \sqrt{\underline{2 \times 2} \times \underline{83 \times 83}}$

$= 2 \times 83 = 166$

(ii) 30625

5	30625
5	6125
5	1225
5	245
7	49
7	7
	1

Hence, $30625 = 5 \times 5 \times 5 \times 5 \times 7 \times 7$

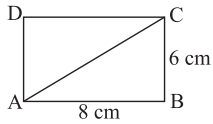
So, $\sqrt{30625} = \sqrt{\underline{5 \times 5} \times \underline{5 \times 5} \times \underline{7 \times 7}}$

$= 5 \times 5 \times 7 = 175$

(b) $AB = 8$ cm;

$BC = 6$ cm;

Diagonal $AC = ?$



By Pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2$$

$$\Rightarrow \quad AC^2 = 8^2 + 6^2$$

$$\Rightarrow \quad AC^2 = 64 + 36$$

$$\Rightarrow \quad AC^2 = 100$$

$$\Rightarrow \quad AC = \sqrt{100} = 10\,\text{cm}$$

So, Diagonal $= 10$ cm

(c) $\dfrac{\sqrt{0.2304} - \sqrt{0.1764}}{\sqrt{0.2304} + \sqrt{0.1764}}$

	0.48
0	$\overline{0}.\overline{23}\ \overline{04}$
+ 0	0
4	23
+ 4	–16
88	704
	–704
	×

	0.42
0	$\overline{0}.\overline{17}\ \overline{64}$
+ 0	0
4	17
+ 4	–16
82	164
	–164
	×

$$= \frac{0.48 - 0.42}{0.48 + 0.42}$$

$$= \frac{0.06}{0.90} = \frac{6}{90}$$

$$= \frac{3}{45} = \frac{1}{15}$$

Chapter 6

Cubes and Cube Roots

Exercise 6.1

1. (a) $(18)^3 = 18 \times 18 \times 18 = 5832$

(b) $(36)^3 = 36 \times 36 \times 36 = 46656$

(c) $(44)^3 = 44 \times 44 \times 44 = 85184$

(d) $(75)^3 = 75 \times 75 \times 75 = 421875$

(e) $(99)^3 = 99 \times 99 \times 99 = 970299$

(f) $(104)^3 = 104 \times 104 \times 104 = 1124864$

(g) $(231)^3 = 231 \times 231 \times 231 = 12326391$

2.

S.No.	Number	Number's cube	Calculation	Value
1.	1	$(1)^3$	$1 \times 1 \times 1$	1
2.	2	$(2)^3$	$2 \times 2 \times 2$	8
3.	3	$(3)^3$	$3 \times 3 \times 3$	27
4.	4	$(4)^3$	$4 \times 4 \times 4$	64
5.	5	$(5)^3$	$5 \times 5 \times 5$	125
6.	6	$(6)^3$	$6 \times 6 \times 6$	216
7.	7	$(7)^3$	$7 \times 7 \times 7$	343
8.	8	$(8)^3$	$8 \times 8 \times 8$	512
9.	9	$(9)^3$	$9 \times 9 \times 9$	729
10.	10	$(10)^3$	$10 \times 10 \times 10$	1000
11.	11	$(11)^3$	$11 \times 11 \times 11$	1331
12.	12	$(12)^3$	$12 \times 12 \times 12$	1728
13.	13	$(13)^3$	$13 \times 13 \times 13$	2197
14.	14	$(14)^3$	$14 \times 14 \times 14$	2744
15.	15	$(15)^3$	$15 \times 15 \times 15$	3375

(a) & (b) From the above table, we observe that cubes of all natural odd numbers are odd and cubes of all natural even numbers are even.

3. 4 Natural numbers which are multiple of 3 = 3, 6, 9, 12

Now, cube of $3 = 3 \times 3 \times 3 = 27$

cube of $6 = 6 \times 6 \times 6 = 216$

cube of $9 = 9 \times 9 \times 9 = 729$

cube of $12 = 12 \times 12 \times 12 = 1728$

Now, we see that

$$27 \div 27 = 1$$
$$216 \div 27 = 8$$
$$729 \div 27 = 27$$
$$1728 \div 27 = 64$$

So, it is verified that the cube of a natural number which is a multiple of 3 is a multiple of 27.

4. 4 natural numbers which are multiple of 5 = 5, 10, 15 20.

Now, cube of $5 = 5 \times 5 \times 5 = 125$

cube of $10 = 10 \times 10 \times 10 = 1000$

cube of $15 = 15 \times 15 \times 15 = 3375$

cube of $20 = 20 \times 20 \times 20 = 8000$

Now, we see that

$$125 \div 125 = 1$$
$$1000 \div 125 = 8$$
$$3375 \div 125 = 27$$
$$8000 \div 125 = 64$$

So, it is verified that the cube of a natural number which is a multiple of 5 is a multiple of 125.

5.

$$1^3 = 1$$
$$1^3 + 2^3 = (1+2)^2$$
$$1^3 + 2^3 + 3^3 = (1+2+3)^2$$
$$1^3 + 2^3 + 3^3 + 4^3 = (1+2+3+4)^2$$
$$1^3 + 2^3 + 3^3 + 4^3 + 5^3 = (1+2+3+4+5)^2$$
$$1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 = (1+2+3+4+5+6)^2$$
$$1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3 = (1+2+3+4+5+6+7)^2$$
$$1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3 + 8^3 + 9^3 + 10^3$$
$$= (1+2+3+4+5+6+7+8+9+10)^2$$
$$= 55^2 = 3025$$

6. We know that cubes odd numbers are odd.

So, (a), (b), (d) (f) are cubes of odd natural numbers.

7. (a) 1,728

Writing 1728 as product of its prime factors, we get

2	1728
2	864
2	432
2	216
2	108

2	54
3	27
3	9
3	3
	1

$$1728 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}$$

Grouping them into groups of three, we can see that no number is left ungrouped.

So, 1728 is a perfect cube.

(b) 3,840

Writing 3840 as product of its prime factors, we get

2	3840
2	1920
2	960
2	480
2	240
2	120

2	60
2	30
3	15
5	5
	1

$$3840 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 2 \times 2 \times 3 \times 5$$

Grouping them into group of three, we can see that 2, 3 and 5 are left ungrouped

So, 3840 is not a perfect cube.

(c) 12,167

Writing 12167 as product of its prime factors, we get

23	12167
23	529
23	23
	1

$$12167 = 23 \times 23 \times 23$$

Grouping them into group of three, we can see that no. number is left ungrouped.

So, 12,167 is a perfect cube.

(d) 11,109

3	11109
7	3703
23	529
23	23
	1

Writing 11109 as product of its prime factors, we get

$$11109 = 3 \times 7 \times 23 \times 23$$

Grouping them into group of three, we can see that all the prime factors are not in the group of three.

So, 11109 is not a perfect cube.

(e) 85,184

Writing 85,184 as product of its prime factors, we get

2	85184
2	42592
2	21296
2	10648
2	5324

2	2662
11	1331
11	121
11	11
	1

$$85184 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{11 \times 11 \times 11}$$

Grouping them into group of three, we can see that no number is left ungrouped

So, 85184 is a perfect cube.

(f) 20,48,383

127	2048383
127	16129
127	127
	1

Writing 20,48,383 as product of its prime factors, we get

$$2048383 = 127 \times 127 \times 127$$

Grouping, them into group of three, we can see that no number is left ungrouped.

So, 20,48,383 is a perfect cube.

8. We know that cubes of even natural no. are even.

So, (a) 13,824, (c) 8,000, (d) 6,36,056 and (f) 32,768 are cubes of natural even number.

9. 7 natural no. which are in the form of $3n+1 = 4, 7, 10, 13, 16, 19, 22$

Now,
$$4^3 = 4\times4\times4 = 64$$
$$7^3 = 7\times7\times7 = 343$$
$$10^3 = 10\times10\times10 = 1000$$
$$13^3 = 13\times13\times13 = 2197$$
$$16^3 = 16\times16\times16 = 4096$$
$$19^3 = 19\times19\times19 = 6859$$
$$22^3 = 22\times22\times22 = 10648$$

Now,
$$64 \div 3 = 21+1 \text{ Remainder}$$
$$343 \div 3 = 114+1 \text{ Remainder}$$
$$1000 \div 3 = 333+1 \text{ Remainder}$$
$$2197 \div 3 = 732+1 \text{ Remainder}$$
$$4096 \div 3 = 1365+1 \text{ Remainder}$$
$$6859 \div 3 = 2286+1 \text{ Remainder}$$
$$10648 \div 3 = 3549+1 \text{ Remainder}$$

So, from above, it is verified that the cube of a natural number of the form $3n+1$ when divided by 3 leaves remainder 1.

10. 7 natural numbers which are in the form of $3n+2$ are = 5 8, 11, 14, 17, 20 and 23.

Now,
$$5^3 = 5\times5\times5 = 125$$
$$8^3 = 8\times8\times8 = 512$$
$$11^3 = 11\times11\times11 = 1331$$
$$14^3 = 14\times14\times14 = 2744$$
$$17^3 = 17\times17\times17 = 4913$$
$$20^3 = 20\times20\times20 = 8000$$
$$23^3 = 23\times23\times23 = 12167$$

Now,
$$125 \div 3 = 41+2 \text{ Remainder}$$
$$512 \div 3 = 170+2 \text{ Remainder}$$
$$1331 \div 3 = 443+2 \text{ Remainder}$$
$$2744 \div 3 = 914+2 \text{ Remainder}$$
$$4913 \div 3 = 1637+2 \text{ Remainder}$$
$$8000 \div 3 = 2666+2 \text{ Remainder}$$
$$12167 \div 3 = 4055+2 \text{ Remainder}$$

So, from above, it is verified that the cube of a natural number of the form $(3n+2)$ when divided by 3 leaves remainder 2.

11. (a) 5,324

Writing 5324 as a product of its prime factors, we get

$$5324 = 2 \times 2 \times \underline{11 \times 11 \times 11}$$

2	5324
2	2662
11	1331
11	121
11	11
	1

Grouping them into group of three, we see that 2 is left ungrouped. So, to make it a perfect cube, complete the group by multiplying 5324 by 2.

So, the smallest number by which 5324 should be multiplied to make it a perfect cube is 2.

(b) 1,323

Writing 1323 as a product of its prime factors, we get

$$1323 = \underline{3 \times 3 \times 3} \times 7 \times 7$$

3	1323
3	441
3	147
7	49
7	7
	1

Grouping them into group of three, we see that 7 is left ungrouped. So, to make it a perfect cube, complete the group by multiplying 1323 by 7.

So, the smallest number by which 1323 should be multiplied to make it a perfect cube is 7.

(c) 27,783

Writing 27783 as a product of its prime factors, we get

$$27783 = \underline{3 \times 3 \times 3} \times 3 \times \underline{7 \times 7 \times 7}$$

3	27783
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

Grouping them into group of three, we see that 3 is left ungrouped. So, to make it a perfect cube, complete the group by multiplying 27783 by $(3 \times 3) = 9$.

So, the smallest number by which 27783 should be multiplied to make it a perfect cube is 9.

(d) 12,348

2	12,348
2	6174
3	3087
3	1029
7	343
7	49
7	7
	1

Writing 12348, as a product of its prime factors, we get

$$12348 = 2 \times 2 \times 3 \times 3 \times \underline{7 \times 7 \times 7}$$

Grouping them into group of three, we see that 2 and 3 are left ungrouped. So, to make it a perfect cube, complete the group by multiplying 12348 by $2 \times 3 = 6$.

So, the smallest number by which 12348 should be multiplied to make a perfect cube is 6.

(e) 3,125

5	3125
5	625
5	125
5	25
5	5
	1

Writing 3125, as a product of its prime factors, we get

$$3125 = 5 \times 5 \times \underline{5 \times 5 \times 5}$$

Grouping them into group of three, we see that 5 is left ungrouped. So, to make it a perfect cube, complete the group by multiplying 3125 by 5.

So, the smallest number by which 3125 should be multiplied to make it a perfect cube is 5.

(f) 1,01,306

2	101306
37	50653
37	1369
37	37
	1

Writing 101306, as a product of its prime factors, we get

$$101306 = 2 \times \underline{37 \times 37 \times 37}$$

Grouping them into group of three, we see that 2 is left ungrouped. So, to make it a perfect cube, complete the group by multiplying 101306 by 2.

So, the smallest number by which 101306 should be multiplied to make it a perfect cube is 5.

12. Edge = 13 cm

So, volume of cubical box = $(\text{edge})^3$

$$= 13\text{ cm} \times 13\text{ cm} \times 13\text{ cm} = 2197\text{ cm}^3$$

13. Surface area of cube = $294\ m^2$

Let the edge of cube = x m

Since, the surface area of the cube = $6x^2$

So,
$$6x^2 = 294$$
$$x^2 = \frac{294}{6}$$
$$x^2 = 49$$
$$x = \sqrt{49} = 7\,m$$

Now, Volume of the cube = $x \times x \times x = 7\,m \times 7\,m \times 7\,m = 343\,m^3$

14. (a) 1,536

Writing 1536 as a product of its prime factors, we get

$1536 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 3$

Grouping them into group of three, we see that 3 is left ungrouped and should be removed to make 1536 a perfect cube.

So, the smallest number by which 1536 should be divided to make it a perfect cube is 3.

2	1536
2	768
2	384
2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

(b) 9,826

Writing 9826 as a product of its prime factors, we get

$9826 = 2 \times \underline{17 \times 17 \times 17}$

Grouping them into group of three, we see that 2 is left ungrouped and should be removed to make 9826 a perfect cube. So, the smallest number by which 9826 should be divided to make it a perfect cube is 2.

2	9826
17	4913
17	289
17	17
	1

(c) 3,97,535

Writing 397535 as a product of its prime factors, we get

$397535 = 5 \times \underline{43 \times 43 \times 43}$

Grouping them into group of three, we see that 5 is left ungrouped and should be

5	397535
43	79507
43	1849
43	43
	1

removed to make 397535 a perfect cube. So, the smallest number by which 397535 should be divided to make it a perfect cube is 5.

(d) 3,26,592

Writing 326592 as a product of its prime factors, we get.

2	326592
2	163296
2	81648
2	40824
2	20412
2	10206
3	5103

3	1701
3	567
3	189
3	63
3	21
7	7
	1

$326592 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{3\times3\times3}\times7$

Grouping them into groups of three, we see that 7 is left ungrouped and should be removed to make 326592 a perfect cube.

So, the smallest number by which 326592 should be divided to make it a perfect cube is 7.

(e) 3,31,776

Writing 331776 as a product of its prime factors, we get.

2	331776
2	165888
2	82944
2	41472
2	20736
2	10368
2	5184
2	2592
2	1296

2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

331776

$= \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}\times3$

Grouping them into groups of three, we see that 3 is left ungrouped and should be removed to make 331776 a perfect cube.

So, the smallest number by which 3,31,776 should be divided to make it a perfect cube is 3.

(f) 8,788

Writing 8788 as a product of its prime factors, we get

$$8788 = 2 \times 2 \times \underline{13 \times 13 \times 13}$$

2	8788
2	4394
13	2197
13	169
13	13
	1

Grouping them into groups of three, we see that 2 is left ungrouped and should be removed to make 8788 a perfect cube.

So, the smallest number by which 8788 should be divided to make it a perfect cube is $2 \times 2 = 4$.

15. Let no.$= x$

It's cube $= x^3$ ...(i)

Now,, number is tippled $= 3 \times x = 3x$

It's cube $= (3x)^3$

$= 3 \times 3 \times 3 \times x^3$

$= 27x^3$ ...(ii)

From (i) and (ii)....

It is verified that if a no. is tippled, then its cube is 27 times the cube of the given no.

16. (a) 2

Let no. be x.

Cube of this no. $= x^3$

Now, if no. is multiplied by 2, we get.

New no. $= 2x$

Cube of this no. $= (2x)^3$

$= 2 \times 2 \times 2 \times x^3 = 8x^3$

Hence the cube of new no. will be 8 times of cube of original no.

(b) 5

Let no. be x.

Cube of this no. $= x^3$

Now, if no. is multiplied by 5, we get

New no. $= 5x$

Cube of this no. $= (5x)^3$

$= 5 \times 5 \times 5 \times x^3 = 125x^3$

Hence. the cube of new no. will be 125 times of cube of original no.

(c) 7

Let no. be x.

Cube of this no. $= x^3$

Now, if no. is multiplied by 7, we get

New no. $= 7x$

Cube of this no. $= (7x)^3$

$= 7 \times 7 \times 7 \times x^3 = 343x^3$

Hence, the cube of new no. will be 343 times of cube of original no.

(d) 6

Let no. be x.

Cube of this no. $= x^3$

Now, if no. is multiplied by 6, we get

New no. $= 6x$

Cube of this no. $= (6x)^3$

$= 6 \times 6 \times 6 \times x^3 = 217x^3$

Hence the cube of new no. will be 216times of cube of original no.

17. (a) $\{(5^2 + 12^2)^{1/2}\}^3$

$= \{(25 + 144)^{\frac{1}{2}}\}^3$

$= \{(169)^{\frac{1}{2}}\}^3$

$= \{(13^2)^{\frac{1}{2}}\}^3$

$= \{13^{2 \times \frac{1}{2}}\}^3$

$= \{13\}^3$

$= 13 \times 13 \times 13$

$= 2197$

(b) $(\sqrt{10^3 - 6^3})^3$

$= (\sqrt{10 \times 10 \times 10 - 6 \times 6 \times 6})^3$

$= (\sqrt{1000 - 216})^3$

$= (\sqrt{784})^3$

$= (\sqrt{28 \times 28})^3$

$= (28)^3$

$= 28 \times 28 \times 28$

$= 21952$

(c) $\{(10^2 + 24^2)^{1/2}\}^3$

$= \{(10 \times 10 + 24 \times 24)^{\frac{1}{2}})^3$

(d) $\{(37^2 - 35^2)^{1/2}\}^3$

$= \{(37 \times 37 - 35 \times 35)^{\frac{1}{2}}\}^3$

$= \{(100+576)^{\frac{1}{2}}\}$

$= \{(676)^{\frac{1}{2}}\}^3$

$= \{(26^2)\}^3$

$= \{26^{2\times\frac{1}{2}}\}^3$

$= \{26\}^3$

$= 26\times26\times26 = 17576$

$= \{(1369-1225)^{\frac{1}{2}}\}^3$

$= \{(144)^{\frac{1}{2}}\}^3$

$= \{(12^2)^{\frac{1}{2}}\}^3$

$= \{12^{2\times\frac{1}{2}}\}^3$

$= \{12\}^3$

$= 12\times12\times12 = 1728$

18. (a) 33

Unit digit of the cube of $33 = 3\times3\times3 = 27$

So, cube of 33 has digit of 7 at unit place.

(b) 132

Unit digit of the cube of $132 = 2\times2\times2 = 8$

So, cube of 132 has digit of 8 at unit place.

(c) 995

Unit digit of the cube of $995 = 5\times5\times5 = 125$

So, cube of 995 has digit of 5 at unit place.

(d) 654

Unit digit of the cube of $654 = 4\times4\times4 = 64$

So, cube of 654 has digit of 4 at unit place.

(e) 1,999

Unit digit of the cube of $1,999 = 9\times9\times9 = 729$

So, cube of 1999 has digit of 9 at unit place.

(f) 2,008

Unit digit of the cube of $2008 = 8\times8\times8 = 512$

So, cube of 2008 has digit of 2 at unit place.

Exercise 6.2

1. (a) $(-12)^3$

$= (-12)\times(-12)\times(-12)$

$= -1728$

(b) $(-23)^3$

$= (-23)\times(-23)\times(-23)$

$= -12167$

(c) $(-35)^3$

$= (-35)\times(-35)\times(-35)$

$= -42875$

(d) $(-42)^3$

$= (-42)\times(-42)\times(-42)$

$= -74088$

2. (a) –1,331, (b) –4,913 and (d) –1,40,608 are cube of negative integers.

3. (a) $\sqrt[3]{-6,859}$

$= -1 \times \sqrt[3]{6859}$

$= -1 \times \sqrt[3]{19 \times 19 \times 19}$

$= -1 \times 19$

$= -19$

19	6859
19	361
19	19
	1

(b) $\sqrt[3]{-97,336}$

$= -1 \times \sqrt[3]{97336}$

$= -1 \times \sqrt[3]{2 \times 2 \times 2 \times 23 \times 23 \times 23}$

$= -1 \times 2 \times 23$

$= -46$

2	97336
2	48668
2	24334
23	12167
23	529
23	23
	1

(c) $\sqrt[3]{-21952}$

2	21952
2	10976
2	5488
2	2744
2	1372

2	686
7	343
7	49
7	7
	1

$= -1 \times \sqrt[3]{21952} = -1 \times \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 7 \times 7 \times 7}$

$= -1 \times 2 \times 2 \times 7 = -28$

(d) $\sqrt[3]{-1771561}$

11	1771561
11	161051
11	14641
11	1331

11	121
11	11
	1

$= -1 \times \sqrt[3]{1771561}$

$= -1 \times \sqrt[3]{11 \times 11 \times 11 \times 11 \times 11 \times 11}$

$= -1 \times 11 \times 11 = -121$

(e) $\sqrt[3]{-8,57,375}$

$= -1 \times \sqrt[3]{857375}$

$= -1 \times \sqrt[3]{5 \times 5 \times 5 \times 19 \times 19 \times 19}$

$= -1 \times 5 \times 19 = -95$

5	857375
5	171475
5	34295
19	6859
19	361
19	19
	1

4. (a) $(6.3)^3 = 6.3 \times 6.3 \times 6.3$

$$= \frac{63 \times 63 \times 63}{10 \times 10 \times 10} = \frac{250047}{1000} = 250.047$$

(b) $(-0.21)^3$

$$= (-0.21) \times (-0.21) \times (-0.21)$$

$$= \frac{(-21) \times (-21) \times (-21)}{100 \times 100 \times 100}$$

$$= \frac{-9261}{1000000} = -0.009261$$

(c) $\left(3\frac{1}{4}\right)^3 = \left(\frac{13}{4}\right)^3 = \frac{13 \times 13 \times 13}{4 \times 4 \times 4} = \frac{2197}{64}$

(d) $\left(-5\frac{1}{6}\right)^3 = \left(\frac{-31}{6}\right)^3 = \frac{(-31) \times (-31) \times (-31)}{6 \times 6 \times 6} = \frac{-29791}{216}$

(e) $(0.08)^3 = 0.08 \times 0.08 \times 0.08$

$$= \frac{8 \times 8 \times 8}{100 \times 100 \times 100}$$

$$= \frac{512}{1000000} = 0.000512$$

(f) $(-7.02)^3 = (-7.02) \times (-7.02) \times (-7.02)$

$$= \frac{(-702)}{100} \times \frac{(-702)}{100} \times \frac{(-702)}{100}$$

$$= \frac{-345948408}{1000000}$$

$$= -345.948408$$

5. (a) $\sqrt[3]{\dfrac{1728}{4913}} = \dfrac{\sqrt[3]{1728}}{\sqrt[3]{4913}}$

By prime factorization method

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

17	4913
17	289
17	17
	1

$$= \frac{\sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}}}{\sqrt[3]{17\times17\times17}} = \frac{2\times2\times3}{17} = \frac{12}{17}$$

(b) $\sqrt[3]{\dfrac{-512}{2{,}197}} - 1\times\sqrt[3]{\dfrac{512}{2197}} = -\dfrac{\sqrt[3]{512}}{\sqrt[3]{2197}}$

By prime factorization method.

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

13	2197
13	169
13	13
	1

$$= \frac{-\sqrt{2\times2\times2\times2\times2\times2\times2\times2}}{\sqrt{13\times13\times13}} = \frac{-(2\times2\times2)}{13} = \frac{-8}{13}$$

(c) $\sqrt[3]{0.551368} = \sqrt[3]{\dfrac{551368}{1000000}} = \dfrac{\sqrt[3]{551368}}{\sqrt[3]{1000000}}$

By prime factorization method

2	551368
2	275684
2	137842
41	68921
41	1681
41	41
	1

2	1000000
2	500000
2	250000
2	125000
2	62500
2	31250
5	15625

5	3125
5	625
5	125
5	25
5	5
	1

$$= \frac{\sqrt[3]{\underline{2\times2\times2}\times\underline{41\times41\times41}}}{\sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{5\times5\times5}\times\underline{5\times5\times5}}}$$

$$= \frac{2\times41}{2\times2\times5\times5} = \frac{82}{100} = 0.82$$

(d) $\sqrt[3]{-0.024389} = -\sqrt[3]{0.024389} = -\sqrt[3]{\dfrac{24389}{1000000}} = \dfrac{-\sqrt[3]{24389}}{\sqrt[3]{1000000}}$

By prime factorization method

29	24389
29	841
29	29
	1

2	1000000
2	500000
2	250000
2	125000
2	62500
2	31250
5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$$= \frac{-\sqrt[3]{29 \times 29 \times 29}}{\sqrt{\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5}}}$$

$$= \frac{-29}{2 \times 2 \times 5 \times 5} = \frac{-29}{100} = -0.29$$

(e) $\sqrt[3]{-0.008} = -\sqrt[3]{0.008} = \frac{-\sqrt[3]{8}}{\sqrt[3]{1000}}$

2	8
2	4
2	2
	1

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

$$= \frac{-\sqrt[3]{2 \times 2 \times 2}}{\sqrt[3]{2 \times 2 \times 2 \times 5 \times 5 \times 5}} = \frac{-2}{2 \times 5} = \frac{-2}{10} = -0.2$$

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

Mental Maths :

I. Write 'T' for 'True' and 'F' for 'False' :

1. True **2.** True **3.** False **4.** False **5.** True
6. True **7.** False **8.** True **9.** False **10.** False

II. Fill in the Blanks :

1. The cube of 14 = **2744**.
2. The units digit of the cube of 388 is **2**.
3. If a number is multiplied by 4, its cube gets multiplied by **64**.
4. $\sqrt[3]{2,744} = 2 \times \mathbf{7}$.
5. $\sqrt[3]{480} = \sqrt[3]{\mathbf{3}} \times 2 \times \sqrt[3]{20}$
6. $\sqrt[3]{\frac{512}{2,197}} = \frac{8}{\mathbf{13}}$

Chapter 7

Comparing Quantities

Exercise 7.1

1. (a) $35\% = \frac{\boxed{35}}{100}$ (b) $8\% = \frac{\boxed{8}}{100}$ (c) $\frac{\boxed{33}}{100} = 33\%$

2. (a) $\frac{80}{100} = \boxed{80}\%$ (b) $\frac{42}{100} = \boxed{42}\%$ (c) $\frac{8}{100} = \boxed{8}\%$

3. (a)

$$\frac{1}{20} = \frac{x}{100} = y\%$$

Taking first two ratio, we get

$$\frac{1}{20} = \frac{x}{100}$$

$$20x = 100$$

(By cross multiplication method)

$$x = 100 \div 20$$

$$x = 5$$

Taking first and last ratio, we get

$$\frac{1}{20} = y\%$$

$$\frac{1}{20} = \frac{y}{100}$$

$$y = \frac{100}{20}$$

(By cross multiplication method)

$$y = 5$$

Hence, $x = 5$ and $y = 5$

(b) $\frac{4}{5} = \frac{x}{100} = y\%$

Taking first two ratio, we get

$$\frac{4}{5} = \frac{x}{100}$$

$$5x = 4 \times 100$$

(By cross multiplication method)

$$x = 400 \div 5$$

$$x = 80$$

Taking first and last two ratio, we get

$$\frac{4}{5} = y\%$$

$$\frac{4}{5} = \frac{y}{100}$$

$$5y = 4 \times 100$$

(By cross multiplication method)

$$y = 400 \div 5$$

$$y = 80$$

Hence, $x = 80$ and $y = 80$

4. $(100 - 25)\%$ of money he had $=$ ₹ 18000

75% of money he had $=$ ₹ 18000

Money he had $=$ ₹ $\frac{18000}{75\%}$

$=$ ₹ $\frac{18000 \times 100}{75}$

$=$ ₹ 24000

So, he had ₹ 24000

5. Let x be the original number of dolls.

So, the number of damaged dolls $= x - x$ of 20%

$$= x - x \times \frac{20}{100}$$

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

The number of dolls were left over $= \frac{4}{5}x - \frac{4}{5}x$ of 25%

$$= \frac{4}{5}x - \frac{4}{5}x \times \frac{25}{100}$$

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

So, the number of dolls were left over = 4800

$$\frac{3}{5}x = 4800$$

$$x = \frac{4800 \times 5}{3}$$

$$x = 1600 \times 5 = 8000$$

8000 was the original number of dolls.

6. Let the maximum marks be x.

We have, 82% of $x = 410$

$$\frac{82}{100} \times x = 410$$

$$x = \frac{410 \times 100}{82}$$

$$x = 500$$

Hence, the maximum marks is 500.

7. The total obtained marks in each subject

$$= 85 + 70 + 90 + 99 + 75 = 419$$

The total maximum number of marks in each subject

$$= 100 + 100 + 100 + 100 + 100 = 500$$

Ravi got percentage $= \left(\frac{419}{500} \times 100\right)\% = 83.8\%$

8. Let x be the number of days on which the school was closed.

So, according to the questions,

$$\frac{260}{(365 - x)} = 80\%$$

$$\frac{260}{365 - x} = \frac{80}{100} = \frac{4}{5}$$

$$260 \times 5 = 4(365 - x)$$

$$1300 = 1460 - 4x$$

$$4x = 1460 - 1300$$

$$4x = 160$$

$$x = 160 \div 4$$

$$x = 40 \text{ days}$$

So, the number of days on which the school was open

$$= (365 - 40) \text{ days} = 325 \text{ days.}$$

9. Let x be his monthly income.

We have, x of 15% = ₹ 2400

$$x \times \frac{15}{100} = ₹\ 2400$$

$$x = ₹\ \frac{2400 \times 100}{15} = ₹\ 16000$$

Hence, ₹ 16000 his monthly income.

10. Let x be the mass of nickel.

Percentage of nickel $= (100 - 72 - 24)\% = 4\%$

So, mass of nickel = 4% of 5kg

$$x = \frac{4}{100} \times 5000 \text{ g}$$

$$x = 4 \times 50 \text{ g} = 200 \text{ g}$$

Hence, 200 g is the mass of nickel in 5 kg of the alloy.

11. Suppose Mukesh's income = ₹ 100

$$27\% \text{ of } 100 = \frac{27}{100} \times 100 = ₹\ 27$$

$\therefore$ Suresh's income = ₹ (100 – 27) = ₹ 73

If Suresh's income is ₹ 73, then Mukesh's income = ₹ 100

If Suresh's income is ₹ 100, the Mukesh's income

$$= ₹\ \frac{100}{73} \times 100$$

$$= ₹\ \frac{10000}{73}$$

$\therefore$ Mukesh's income is ₹ $\left(\frac{10000}{73} - 100\right) = ₹\ \frac{2700}{73}$ *i.e.*,

$\frac{2700}{13}$% more than Suresh's

Let Mukesh's income = ₹100 then Suresh's income

= ₹ (100 – 27) = ₹ 73

Then Mukesh's income is ₹ 27 more than Suresh's

Mukesh income $= \frac{27}{73} \times 100 = 36\frac{72}{73}\%$

12. Let the original price of the car be ₹ x.

The value of car in first year $= x - x$ of 20%

$$= x - \frac{20x}{100}$$

$$\frac{10x - 2x}{10} = \frac{8}{10}x = \frac{4}{5}x$$

The value of car in second year $= \frac{4}{5}x - \frac{4}{5}x$ of 20%

$$= \frac{4}{5}x - \frac{4}{5}x \times \frac{20}{100}$$

$$= \frac{4}{5}x - \frac{4}{5}x \times \frac{1}{5}$$

$$= \frac{4x}{5} - \frac{4x}{25} = \frac{20x - 4x}{25}$$

$$= \frac{16}{25}x$$

So, $\frac{16}{25}x =$ ₹ 420000

$$x = ₹\ \frac{420000 \times 25}{16} = ₹\ 656250$$

Hence, ₹ 656250 is the original price of the car.

13. Mrs. Suchita earns per month = ₹ 11000

Percentage of saving amount $= (100 - 85)\% = 15\%$

So, the saving amount = ₹ 11000 of 15%

$$= ₹\ 11000 \times \frac{15}{100} = ₹\ 1650$$

After increment,

her salary = ₹ 11000 + ₹ 11000 of 20%

$$= ₹\ 11000 + ₹\ 11000 \times \frac{20}{100}$$

$$= ₹\ 11000 + ₹\ 2200 = ₹\ 13200$$

Now, the saving percentage $= (100 - 87)\% = 13\%$

So, the saving amount $= ₹\ 13200$ of 13%

$$= ₹\ 13200 \times \frac{13}{100}$$

$$= ₹\ 132 \times 13 = ₹\ 1716$$

So, the difference between in her to both saving

$$= ₹\ 1716 - 1650 = ₹\ 66$$

14. Let x be the total number of passengers before station A.

So, the number of passengers at station A

$$= x - x \text{ of } 30\%$$

$$= \frac{100x - 30x}{100} = \frac{70}{100}x = \frac{7}{10}x$$

Now, the number of passengers at station B.

$$= \frac{7}{10}x - \frac{7}{10}x \text{ of } \frac{70}{100}$$

$$= \frac{7}{10}x - \frac{49}{100}x = \frac{21}{100}x$$

So, according to the question,

$$\frac{21}{100}x = 1050$$

$$x = 50 \times 100$$

$$x = 5000$$

Hence, there were 5000 passengers before station A.

15. The present annual income $= ₹\ 880000$

Increasing percentage every year $= 10\%$

(a) The income of a man after one year

$$= ₹\ 880000 + ₹\ 880000 \times 10\%$$

$$= ₹\ 880000 + ₹\ 880000 \times \frac{10}{100}$$

$$= ₹\ 968000$$

Now, the income of a man after 2 years

$$= ₹\ 968000 + ₹\ 968000 \times 10\%$$

$$= ₹\ 968000 + ₹\ 968000 \times \frac{10}{100}$$

$= ₹\ 968000 + ₹\ 96800$
$= ₹\ 1064800$

Hence, ₹ 1064800 will be his income 2 years later.

(b) Let us suppose his salary before increase was ₹ x.

Increase in salary is 10% of $x = \frac{10 \times x}{100} = \frac{x}{10}$

Salary after increase $= ₹\left(x + \frac{x}{10}\right) = ₹\ \frac{11}{10}x$

Thus, $\frac{11}{10}x = ₹\ 880000$

$$x = ₹\ \frac{880000 \times 10}{11} = ₹\ 800000$$

Hence, ₹ 800000 was his income 1 year earlier.

Exercise 7.2

1. (a) We know that,

$$\text{S.P.} = \frac{(100 - \text{loss }\%)}{100} \times \text{C.P.}$$

C.P. = ₹ 875, loss % = 12% S.P. = ?

$$\text{S.P.} = ₹\ \frac{(100-12)}{100} \times 875 = ₹\ \frac{77000}{700} = ₹\ 770$$

(b) We know that,

$$\text{S.P.} = \frac{(100 + \text{gain }\%)}{100} \times \text{C.P.} \qquad \left[\begin{array}{l}\text{C.P.} = ₹\ 300 \\ \text{gain} = 2\%\end{array}\right.$$

$$\text{S.P.} = ₹\ \frac{(100+2)}{100} \times 300 = ₹\ \frac{102}{100} \times 300 = ₹\ 306$$

2. (a) S.P. = ₹ 777.60, gain = 8%, C.P. = ?

We know that,

$$\text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{gain}} = ₹\ \frac{777.60 \times 100}{100 + 8} = ₹\ \frac{77760}{108} = ₹\ 720$$

(b) S.P. = ₹ 261, loss = 10%, C.P. = ?

We know that,

$$\text{C.P.} = \frac{\text{S.P.} \times 100}{100 - \text{loss}} = ₹\ \frac{261 \times 100}{100 - 10} = ₹\ \frac{26100}{90} = ₹\ 290$$

3. (a) C.P. = ₹ 800, S.P. = ₹ 900

Since, C.P. < S.P. So, there is a profit (gain).

gain = S.P. – C.P. = ₹ (900 – 800) = ₹ 100

So, gain % $= \frac{\text{gain}}{\text{C.P.}} \times 100 = \left(\frac{100}{800} \times 100\right)\% = 12.5\%$

(b) C.P. = ₹ 345, S.P. = ₹ 372.60

Since, C.P. < S.P. So, there is a profit (gain)

gain = S.P. – C.P. = ₹ (372.60 – 345) = ₹ 27.60

So, gain% $= \frac{\text{gain}}{\text{C.P.}} \times 100\% = \left(\frac{27.60}{345} \times 10\right)\% = 8\%$

(c) C.P. = ₹ 80, S.P. = ₹ 76.80,

Since, C.P. > S.P. So, there is a loss.

loss = C.P. – S.P. = ₹ (80 – 76.80) = ₹ 3.2

So, loss % $= \frac{\text{loss}}{\text{C.P.}} \times 100\% = \left(\frac{3.2}{80} \times 100\right)\% = 4\%$

(d) C.P. = ₹ 2.50, S.P. = ₹ 3

Since, C.P. < S.P. So, there is a profit (gain).

gain = S.P. – C.P. = ₹ (3 – 2.50) = ₹ 0.50

So, gain% $= \frac{\text{gain}}{\text{C.P}} \times 100\% = \left(\frac{0.50}{2.50} \times 100\right)\% = 20\%$

(e) C.P. = ₹ 3.50, S.P. = ₹ 2

Since, S.P. < C.P. So, there is a loss.

loss = C.P. – S.P. = ₹ (3.50 – 2) = ₹ 1.50

So, loss% $= \frac{\text{loss}}{\text{C.P.}} \times 100\% = \left(\frac{1.50}{3.50} \times 100\right)\% = 42.85\%$

(f) C.P. = ₹ 250, overhead expenses = ₹ 50 and loss = ₹ 50.

loss % $= \frac{\text{loss}}{\text{C.P.} + \text{O.E.}} = \left(\frac{50}{250 + 50} \times 100\right)\%$

$= \left(\frac{5000}{300} \times 100\right)\% = 16.66\%$

(g) C.P. = ₹ 500, overhead expenses = ₹ 80 and S.P. = ₹ 600

Total C.P. = ₹ (500 + 80) = ₹ 580

Since, S.P. > C.P. so, there is a profit (gain).

$$\text{gain} = \text{S.P.} - \text{C.P.} = ₹\,(600 - 580) = ₹\,20$$

$$\text{So, gain \%} = \frac{\text{gain}}{\text{C.P.}} \times 100\% = \left(\frac{20}{580} \times 100\right)\% = 3.45\%$$

4. A man sold a fridge (S.P.) = ₹ 6251

Let the cost price (C.P.) of the fridge be ₹ x.

Then, $\text{loss} = \frac{1}{20}$ of C.P. $= \frac{x}{20}$

$\because$ $\text{loss} = \text{C.P.} - \text{S.P.}$

$$\frac{x}{20} = x - 6251$$

$$x - \frac{x}{20} = ₹\,6251$$

$$\frac{20x - x}{20} = ₹\,6251$$

$$\frac{19}{20}x = ₹\,6251$$

$$x = ₹\,\frac{6251 \times 20}{19}$$

$$x = ₹\,\frac{125020}{19}$$

$$x = ₹\,6580$$

Hence, the C.P. of a fridge is ₹ 6580.

5. Hari purchased an old bike (C.P.) = ₹ 73500

Overhead expenses = ₹ 10300 + ₹ 2600

So, total C.P. = ₹ (73500 + 10300 + 2600)

= ₹ 86400

The selling price = ₹ 84240

Since, C.P. > S.P.

So, there is a loss.

$$\text{loss} = \text{C.P.} - \text{S.P.} = ₹\,(86400 - 84240) = ₹\,2160$$

$$\text{So, loss\%} = \frac{\text{loss}}{\text{C.P.}} \times 100 = \left(\frac{2160}{86400} \times 100\right)\% = 2.5\%$$

6. C.P. of 75 kg of apples = ₹ 30×75 = ₹ 2250

Desired profit% = 10%

$\therefore$ Desired profit = 10% of ₹ 2250 = ₹ $\left(\frac{10}{100} \times 2250\right)$ = ₹ 225

$\therefore$ S.P. of 75 kg o apples = ₹ 2250 + ₹ 225 = ₹ 2475

$\because$ C.P. of $\frac{1}{3}$ kg of apples = ₹ $\frac{75}{3} \times 30$ = ₹ 25×30 = ₹ 750

$\therefore$ S.P. of $\frac{1}{3}$ kg of apples = ₹ $\left(\frac{100-5}{100}\right) \times 750$

= ₹ $\frac{95 \times 750}{100}$ = ₹ 712.50

Hence, desired S.P. of remaining $(75-25)$ kg or 50 kg apples = ₹ $(2475-712.50)$ = ₹ 1762.50

$\therefore$ S.P. of 1 kg of apples = ₹ $1762.50 \div 50$ = ₹ 35.25

7. C.P. of 5 clocks = ₹ 4050

Overhead expenses = ₹ 50

So, total C.P. of 5 clocks = ₹ $(4050+50)$ = ₹ 4100

gain% = 15%

So, the selling price of 5 clocks = $\frac{(100+\text{gain\%})}{100} \times$ C.P.

= ₹ $\frac{(100+15)}{100} \times 4100$

$= 115 \times 41$ = ₹ 4715

Hence, the selling price of a clock = ₹ $(4715 \div 5)$

= ₹ 943

8. C.P. of 20 kg of rice = ₹ 18×20 = ₹ 360

C.P. of 25 kg of rice = ₹ 25×16 = ₹ 400

Total quantity of rice = $(20+25)$ kg = 45 kg

C.P. of the total rice = ₹ $(360+400)$ = ₹ 760

S.P. of total rice = ₹ 45×19 = ₹ 855

Since, C.P. < S.P. So, there is a loss.

$$\text{Gain} = \text{S.P.} - \text{C.P.}$$
$$= ₹\,(855 - 760) = ₹\,95$$
$$\text{Gain\%} = \frac{\text{Profit}}{\text{C.P.}} \times 100$$
$$= \left(\frac{95}{760} \times 100\right)\% = 12.5\%$$

9. Let two varieties of rice be $5x$ and $2x$ respectively.

$$\text{C.P. of } 5x \text{ kg of rice} = ₹\,250 \times 5x = ₹\,1250x$$
$$\text{C.P. of } 2x \text{ kg of rice} = ₹\,75 \times 2x = ₹\,150x$$
$$\text{Total quantity of rice} = (5x + 2x)\text{ kg} = 7x \text{ kg}$$
$$\text{C.P. of total rice} = ₹\,(1250x + 150x) = ₹\,1400x$$
$$\text{S.P. of total rice} = ₹\,7x \times 230 = ₹\,1610x$$
$$\text{Gain} = \text{S.P.} - \text{C.P.} = ₹\,(1610x - 1400x)$$
$$= ₹\,210x$$
$$\text{Gain \%} = \frac{\text{Profit}}{\text{C.P.}} \times 100 = \left(\frac{210x}{1400x} \times 100\right)\%$$
$$= 15\%$$

10. C.P. of oranges per dozen $= ₹\,8.50$

$\therefore$ C.P. of a orange $= ₹\,\dfrac{8.50}{12}$

Overhead expenses per dozen $= ₹\,0.50$

Overhead expenses per orange $= ₹\,\dfrac{0.50}{12}$

So, total C.P. of per hundred oranges $= ₹\left(\dfrac{8.50}{12} + \dfrac{0.50}{12}\right) \times 100$

$$= ₹\left(\frac{850}{12} + \frac{50}{12}\right) = ₹\,\frac{900}{12} = ₹\,75$$

$$\text{Gain \%} = 12\%$$

So, S.P. $= \dfrac{100 + \text{gain\%}}{100} \times$ C.P. of per hundred oranges

$$= ₹\,\frac{100 + 12}{100} \times 75$$
$$= ₹\,\frac{112}{100} \times 75 = ₹\,84$$

11. C.P. of eggs per dozen = ₹ 16

$\therefore$ C.P. of a egg = ₹ $\frac{16}{12}$

$\therefore$ C.P. of 18 eggs = ₹ $\frac{16}{12} \times 18 =$ ₹ 24

S.P. of 10 eggs = ₹ 18

$\therefore$ S.P. 1 egg = ₹ $\frac{18}{10}$

$\therefore$ S.P. of 18 eggs = $\frac{18}{10} \times 18 =$ ₹ 32.40

Since, S.P. > S.P. So, there is profit

Gain = ₹ (32.40 – 24) = ₹ 8.40

$$\text{Gain\%} = \frac{\text{Profit}}{\text{C.P.}} \times 100 = \left(\frac{8.40}{24} \times 100\right)\%$$

$$= \frac{840}{24}\% = 35\%$$

12. S.P. of a flask = ₹ 72, loss = 10%

C.P. of a flask = ?

C.P. a flask = $\frac{\text{S.P.} \times 100}{100 - \text{loss\%}}$ = ₹ $\frac{72 \times 100}{100 - 10}$ = ₹ $\frac{7200}{90}$ = ₹ 80

Hence, the cost price was ₹ 80.

13. S.P. of oranges per dozen = ₹ 72

$\therefore$ S.P. of a orange = ₹ $72 \div 12 =$ ₹ 6

$\therefore$ S.P. of 100 oranges = ₹ $6 \times 100 =$ ₹ 600

Thus, C.P. of 100 oranges = $\frac{\text{S.P. of 100 oranges} \times 100}{100 - \text{loos\%}}$

= ₹ $\frac{600 \times 100}{(100 - 10)}$

= ₹ $\frac{60000}{90}$ = ₹ $\frac{2000}{3}$

Since, S.P. < C.P. So, there is a loss.

loss = ₹ $\left(\frac{2000}{3} - 600\right)$ = ₹ $\frac{200}{3}$

So, $$\text{loss\%} = \frac{100 \times \text{loss}}{\text{C.P. of 100 oranges}}$$

$$= ₹\ \frac{100 \times \frac{200}{3}}{\frac{2000}{3}} = ₹\ \frac{\frac{20000}{3}}{\frac{2000}{3}} = 10\%$$

14. Let x be the C.P. of an article for Dev. profit = 20%

So, S.P. of an article for Radha

$$= \frac{100 + \text{gain\%}}{100} \times \text{C.P.}$$

$$= ₹\ \frac{100+20}{100} \times x = ₹\ \frac{12}{10}x = ₹\ \frac{6}{5}x$$

This S.P. will be C.P. for Radha.

So, now $\text{C.P.} = ₹\ \frac{6}{5}x$

And profit = 4%

So, S.P. of an article for Jack $= \frac{100 + \text{gain\%}}{100} \times \text{C.P.}$

$$= ₹\ \frac{100+4}{100} \times \frac{6}{5}x$$

$$= \frac{104}{100} \times \frac{6}{5}x$$

$$= \frac{26}{25} \times \frac{6}{5}x = \frac{156}{125}x$$

This S.P. will be C.P. for Jack. But Jack has paid ₹ 624.

So, $$\frac{156}{125}x = ₹\ 624$$

$$x = ₹\ \frac{624 \times 125}{156}$$

$$x = ₹\ \frac{78000}{156}$$

$$x = ₹\ 500$$

Hence, the cost price of given article is ₹ 500.

15. Let the cost price of each candle be ₹ 1.

So, S.P. of 15 candles = the C.P. of 12 candles

But, the C.P. of 12 candles = ₹ 12

∴ the S.P. of 15 candles = ₹ 12

So, the C.P. of 15 candles = ₹ 15

And the S.P. of 12 candles = ₹ 12

∴ Hence, S.P. < C.P.

So, loss = C.P. – S.P. = ₹ (15 – 12) = ₹ 3

$$\therefore \quad \text{loss\%} = \frac{\text{loss}}{\text{C.P.}} \times 100 = \left(\frac{3}{15} \times 100\right)\% = 20\%$$

16. S.P. of a bouquet = ₹ 322

gains = 15%

$$\text{C.P. of a bouquet} = \frac{\text{S.P.} \times 100}{100 + \text{gain\%}}$$

$$= ₹\ \frac{322 \times 100}{100 + 15} = ₹\ \frac{32200}{115} = ₹\ 280$$

For gain 25%,

$$\text{S.P.} = \frac{100 + \text{gain\%}}{100} \times \text{C.P.}$$

$$= ₹\left(\frac{100 + 25}{100}\right) \times 280$$

$$= ₹\ \frac{125 \times 280}{100} = ₹\ 350$$

Hence, he should sell bought for ₹ 350 to get gain 25%

17. Let the cost price (C.P.) of the toy be ₹ x.

Profit % = 12%

$$\therefore \quad \text{S.P. of the toy} = \text{C.P.} + \text{gain}$$

$$= x + \frac{12}{100} \times x = \frac{28}{25} x$$

If it had been sold for ₹ 33 more.

Then, new S.P. of the toy $= \left(\frac{28}{25} x + ₹\ 33\right)$

And profit% = 14%

So, the C.P. of the toy $= \dfrac{\text{New S.P.} \times 100}{100 + \text{gain\%}}$

$$x = \frac{\left(\frac{28}{25}x + 33\right) \times 100}{100 + 14}$$

$$114x = 112x + 3300$$

$$114x - 112x = 3300$$

$$2x = ₹\ 3300$$

$$x = ₹\ 3300 \div 2$$

$$x = ₹\ 1650$$

Hence, the cost price of the toy is ₹ 1650.

18. S.P. of a bucket = ₹ 67.50

loss% = 10%

C.P. of a bucket = ?

$$\text{C.P. of a bucket} = \frac{\text{S.P.} \times 100}{100 - \text{loss\%}}$$

$$= ₹\ \frac{67.50 \times 100}{100 - 10} = ₹\ \frac{6750}{90} = ₹\ 75$$

If the new S.P. be ₹ 82.50

Then, there is a profit. ($\because$ S.P. > C.P.)

So, $$\text{profit\%} = \frac{\text{Profit}}{\text{C.P.}} \times 100$$

($\because$ Profit = ₹ 82.50 – ₹ 75 = ₹ 7.5)

$$= \left(\frac{7.5}{75} \times 100\right)\% = 10\%$$

19. Let the original S.P. be ₹ x

profit % = 5%

$$\text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{gain\%}} = ₹\ \frac{x \times 100}{100 + 5} = ₹\ \frac{100}{105}x = ₹\ \frac{20}{21}x$$

By reducing the selling price of an article by ₹ 50.

So, new S.P. = ₹ $(x - 50)$

loss% = 5%

$$\text{C.P. of an article} = \frac{\text{New S.P.} \times 100}{100 - \text{loss\%}}$$

$$\frac{20}{21}x = ₹\ \frac{(x-50)\times 100}{100-5}$$

$$\frac{20}{21}x = ₹\ \frac{100x-5000}{95}$$

$$2\times 95x = ₹\ (210x - 10500)$$

$$190x = 210x - ₹\ 10500$$

$$210x - 190x = ₹\ 10500$$

$$x = ₹\ (10500 \div 20)$$

$$x = ₹\ 525$$

Hence, the original selling price is ₹ 525.

20. C.P. of the first hockey stick = ₹ 560

profit % = 15%

∴ S.P. of the first hockey stick

$$= \frac{100+\text{profit\%}}{100} \times \text{C.P.}$$

$$= ₹\ \frac{100+15}{100} \times 560 = ₹\ \frac{115}{100} \times 560$$

$$= ₹\ \frac{64400}{100} = ₹\ 644$$

C.P. of second hockey stick = ₹ 240

loss % = 5%

$$\text{S.P. of second hockey stick} = \frac{100-\text{loss\%}}{100} \times \text{C.P.}$$

$$= ₹\ \frac{100-5}{100} \times 240$$

$$= ₹\ \frac{95}{10} \times 24 = ₹\ \frac{2280}{10} = ₹\ 228$$

Total C.P. of two hockey sticks = ₹ (560 + 240) = ₹ 800

Total S.P. of two hockey sticks = ₹ (644 + 228) = ₹ 872

Since, S.P. > C.P. So, there is a profit in the whole transaction.

Profit = S.P. – C.P. = ₹ (872 – 800) = ₹ 72

$$\text{Profit \%} = \left(\frac{\text{Profit}}{\text{C.P.}} \times 100\right)\%$$

$$= \left(\frac{72}{800} \times 100\right)\% = 90\%$$

Exercise 7.3

1. (a) M.P. = ₹ 850, Discount% = 5%, S.P. = ?

We know that,

$$\text{S.P.} = \text{M.P.} - \text{Discount}$$

$$\left[\because \text{ Discount} = \frac{\text{Discount \%} \times \text{M.P.}}{100}\right]$$

$$= ₹\ 850 - ₹\ 850 \times \frac{5}{100}$$

$$= ₹\ 850 - ₹\ 42.50 = ₹\ 807.50$$

(b) M.P. = ₹ 1550, Discount% = 8%

$$\text{Discount} = \frac{\text{Discount \%} \times \text{M.P.}}{100}$$

$$= ₹\ \frac{8 \times 1550}{100} = ₹\ 124$$

So, $\text{S.P.} = \text{M.P.} - \text{Discount}$

$$= ₹\ (1550 - 124) = ₹\ 1426$$

2. (a) S.P. = ₹ 1880, Discount% = 6%, M.P. = ?

$$\text{M.P.} = \text{S.P.} + \text{Discount}$$

$$= ₹\ 1880 + \frac{\text{Discount\%} \times \text{M.P.}}{100}$$

$$= ₹\ 1880 + \frac{6\ \text{M.P.}}{100}$$

$$\text{M.P.} - \frac{6\ \text{M.P.}}{100} = ₹\ 1880$$

$$\frac{100\ \text{M.P.} - 6\ \text{M.P.}}{100} = ₹\ 1880$$

$$\frac{94}{100}\ \text{M.P.} = ₹\ 1880$$

$$\text{M.P.} = \frac{₹\,1880 \times 100}{94}$$

$$\text{M.P.} = ₹\,2000$$

(b) S.P. = ₹ 2392, Discount% = 8%, M.P. = ?

$$\text{M.P.} = \text{S.P.} + \text{Discount}$$

$$\text{M.P.} = ₹\,2392 + \frac{\text{Discount\%} \times \text{M.P.}}{100}$$

$$\text{M.P.} = ₹\,2392 + \frac{8 \times \text{M.P.}}{100}$$

$$\text{M.P.} - \frac{8\,\text{M.P.}}{100} = ₹\,2392$$

$$\frac{100\,\text{M.P.} - 8\,\text{M.P.}}{100} = ₹\,2392$$

$$\frac{92\,\text{M.P.}}{100} = ₹\,2392$$

$$\text{M.P.} = ₹\,\frac{2392 \times 100}{92}$$

$$\text{M.P.} = ₹\,2600$$

3. (a) M.P. = ₹ 800, S.P. = ₹ 750, Discount% = ?

$$\text{M.P.} = \text{S.P.} + \text{Discount}$$

$$\text{M.P.} = \text{S.P.} + \frac{\text{Discount\%} \times \text{M.P.}}{100}$$

$$= ₹\,800 = ₹\,750 + \frac{\text{Discount\%} \times ₹\,800}{100}$$

$$= ₹\,(800 - 750)$$

$$= ₹\,8 \times \text{Discount\%}$$

$$\text{Discount\%} = \frac{50}{8}\% = 6.25\%$$

(b) M.P. = ₹ 950,

S.P. = ₹ 760, Discount%

M.P. = S.P. + Discount

$$\text{M.P.} = \text{S.P.} + \frac{\text{Discount\%} \times \text{M.P}}{100}$$

$$₹\,950 = ₹\,760 + \frac{\text{Discount\%} \times ₹\,950}{100}$$

$$= ₹\,190 = ₹\,\frac{95}{10} \times \text{Discount\%}$$

$$\text{Discount\%} = \frac{1900}{95}\% = 20\%$$

4. Discount% = 35%, M.P. = ₹ 500, S.P. = ?

$$\text{S.P.} = \text{M.P.} - \text{Discount}$$

$$= \text{M.P.} - \frac{\text{Discount\%} \times \text{M.P.}}{100}$$

$$= ₹\,500 - ₹\,\frac{35 \times 500}{100}$$

$$= ₹\,500 - ₹\,175 = ₹\,325$$

Hence, I need to pay ₹ 325.

5. C.P. of a pack of juice = ₹ 90

∴ C.P. two pack of juices = ₹ 180

Because there is a scheme buy one get one free

So, S.P. of two pack of juices = ₹ 90

(a) Discount = C.P. – S.P. = ₹ 180 – ₹ 90 = ₹ 90

(b) $\text{Discount\%} = \frac{\text{Discount}}{\text{M.P.}} \times 100 = \left(\frac{90}{180} \times 100\right)\% = 50\%$

6. M.P. = ₹ 1250, Discount% = 6%, S.P. = ?

S.P. = M.P. – Discount

$$= \text{M.P.} - \frac{\text{Discount\%} \times \text{M.P.}}{100}$$

$$= ₹\,1250 - ₹\,\frac{6 \times 1250}{100}$$

$$= ₹\,1250 - ₹\,75 = ₹\,1175$$

Hence, the S.P. of the given fan is ₹ 1175.

7. Let the amount paid by the shopkeeper be ₹ x.

S.P. of 1 kg of sugar and a chocolate = ₹ 28

∴ S.P. of 1 kg sugar = ₹ (28 – 5) = ₹ 23

And profit% = 25%

So, C.P. of 1 kg of sugar $= ₹\ \dfrac{\text{S.P.} \times 100}{100 + \text{Profit\%}} = ₹\ \dfrac{23 \times 100}{100 + 15}$

$$= ₹\ \frac{2300}{115} = ₹\ 20$$

Hence, the amount paid by the shopkeeper is ₹ 20.

8. C.P. of goods = ₹ 1100

So, M.P. = C.P. + C.P. of 20%

$$= ₹\ 1100 + ₹\ 1100 \times \frac{20}{100}$$

$$= ₹\ (1100 + 220) = ₹\ 1320$$

Discount = Discount% of M.P.

$$= ₹\ \frac{20}{100} \times 1320 = ₹\ 264$$

$\therefore$ S.P. = M.P. – Discount

$$= ₹\ 1320 - ₹\ 264 = ₹\ 1056$$

Since, S.P. < C.P. So, there is a loss.

Loss = C.P. – S.P.

$$= ₹\ 1100 - 1056 = ₹\ 44$$

$$\text{Loss \%} = \frac{\text{Loss}}{\text{C.P.}} \times 100 = \left(\frac{44}{1100} \times 100\right)\% = 4\%$$

9. Discount% = 25%, Profit% = 20%

gains = ₹ 360

$$\text{Profit\%} = \frac{\text{gains}}{\text{C.P.}} \times 100$$

$$20 = \frac{360}{\text{C.P.}} \times 100$$

$$\text{C.P.} = ₹\ \frac{360 \times 100}{20}$$

$$\text{C.P.} = ₹\ 360 \times 5$$

$$\text{C.P.} = ₹\ 1800$$

$\because$ S.P. = C.P. + gain

$$= ₹\ 1800 + ₹\ 360$$

$$= ₹\ 2160$$

$$\text{M.P.} = \text{S.P.} + \text{Discount}$$

$$\text{M.P.} = ₹\,2160 + \frac{\text{M.P.} \times \text{Discount\%}}{100}$$

$$\text{M.P.} = ₹\,2160 + \text{M.P.} \times \frac{25}{100}$$

$$\text{M.P.} = ₹\,2160 + \frac{\text{M.P.}}{4}$$

$$\text{M.P.} - \frac{\text{M.P.}}{4} = ₹\,2160$$

$$\frac{4\,\text{M.P.} - \text{M.P.}}{4} = ₹\,2160$$

$$\frac{3}{4}\,\text{M.P.} = ₹\,2160$$

$$\text{M.P.} = ₹\,\frac{2160 \times 4}{3}$$

$$\text{M.P.} = ₹\,720 \times 4 = ₹\,2880$$

10. M.P. = ₹ 800, discount = 10%, profit% = 20%

C.P.= ? , Profit% (if no discount) = ?

$$\text{S.P.} = \text{M.P.} - \frac{\text{Discoun\%} \times \text{M.P.}}{100}$$

$$= ₹\,800 - ₹\,\frac{10 \times 800}{100}$$

$$= ₹\,800 - ₹\,80 = ₹\,720$$

$$\therefore \qquad \text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{gain\%}}$$

$$= ₹\,\frac{720 \times 100}{100 + 20} = ₹\,\frac{72000}{120} = ₹\,600$$

Now, if no discount had been allowed.

$$\text{S.P.} = \text{M.P.} = ₹\,800$$

So, new profit% $= \dfrac{\text{S.P.} - \text{C.P.}}{\text{C.P.}} \times 100$

$$= \left(\frac{800 - 600}{600} \times 100\right)\% = \left(\frac{200}{600} \times 100\right)\% = 33\frac{1}{3}\%$$

11. M.P. of a DVD = ₹ 4500

First discount% = 10%

Selling price after 1st discount = ₹ 4500 – ₹ 4500 × $\frac{10}{100}$

= ₹ 4500 – ₹ 450

= ₹ 4050

Second discount% = 5%

Selling price after 2nd discount = ₹ 4050 – ₹ 4050 × $\frac{5}{100}$

= ₹ 4050 – ₹ 202.50

= ₹ 3847.50

Hence, the net selling price of a DVD is ₹ 3847.50.

12. M.P. of a bicycle = ₹ 1500

First discount% = 8%

Selling price after 1st discount = ₹ 1500 – ₹ 1500 × $\frac{8}{100}$

= ₹ 1500 – ₹ 120 = ₹ 1380

Second discount% = 4%

So, selling price after 2nd discount

= ₹ 1380 – ₹ 1380 × $\frac{4}{100}$

= ₹ 1380 – ₹ 55.20 = ₹ 1324.80

And third discount% = $2\frac{1}{2}\% = \frac{5}{2}\%$

So, selling price after third discount

= ₹ 1324.80 – ₹ 1324.80 × $\frac{5}{2 \times 100}$

= ₹ 1324.80 – ₹ 33.12

= ₹ 1291.68

Hence, the net selling price of a bicycle is ₹ 1291.68

13. Let the M.P. be ₹ 100.

1st discount% = 8%

Selling price after 1st discount = ₹ 100 – ₹ 8 = ₹ 92

Second discount% = 5%

Selling price after second discount $= ₹\,92 - ₹\,92 \times \frac{5}{100}$

$= ₹\,92 - ₹\,4.60$

$= ₹\,87.40$

Thus, S.P. $= ₹\,87.40$

Total discount $= ₹\,(100 - 87.40)$

$= ₹\,12.60$

Rate of equivalent discount% $= \frac{\text{Total discount}}{\text{M.P.}} \times 100$

$= \left(\frac{12.60}{100} \times 100\right)\%$

$= 12.60\%$

14. For discount 14%

Let the M.P. be ₹ 100

Single discount% = 14%

So, selling price after single discount $= ₹\,100 - ₹\,14 = ₹\,86$

And for two successive discounts of 12% and 2% 1st discount% $= 12\%$

So, selling price after 1st discount $= ₹\,100 - ₹\,12 = ₹\,88$

Second discount% = 2%

So, selling price after 2nd discount $= ₹\,88 - ₹\,88 \times \frac{2}{100}$

$= ₹\,88 - ₹\,1.76 = ₹\,86.24$

Since, $₹\,86 < ₹\,86.24$

So, 14% is a better deal for the customer.

Exercise 7.4

1. List price of some stationary = ₹ 450

Sales tax charged is 7% $= ₹\,\frac{7 \times 450}{100} = ₹\,31.50$

Amount $= ₹\,31.50$

$\therefore$ Mohan paid to buy some stationary $= ₹\,(450 + 31.50)$

$= ₹\,481.50$

2. Selling price of a geyser = ₹ 1242

Let list price be ₹ x

$$\text{Tax is 8\% of ₹ } x = \frac{8x}{100} = \frac{2}{25}x$$

$$x + \frac{2}{25}x = ₹\ 1242$$

$$\frac{25x + 2x}{25} = ₹\ 1242$$

$$\frac{27x}{25} = ₹\ 1242$$

$$x = ₹\ \frac{1242 \times 25}{27}$$

$$x = ₹\ 46 \times 25 = ₹\ 1150$$

Thus, the selling price (without tax) of the geyser is ₹ 1150.

3. List price of a music system = ₹ 7540

Sales tax charged is 7% = ₹ $\frac{7 \times 7540}{100}$ = ₹ $\frac{52780}{100}$ = ₹ 527.80

Amount = ₹ 527.80

∴ The selling price of the music system = ₹ (7540 + 527.80)

= ₹ 8067.80

4. Let the M.P. of the mixer grinder be ₹ x.

So, selling price after discount $= x - \frac{10}{100}x = \frac{9}{10}x$

Sales tax charged is 5% = ₹ $\frac{5 \times \frac{9}{10}x}{100} = \frac{9}{200}x$

∴ Selling price with tax $= \frac{9}{10}x + \frac{9}{200}x = \frac{189}{200}x$

Selling price with tax is equal to ₹ 945

Now, $\frac{189}{200}x =$ ₹ 945

⇒ $x =$ ₹ $\frac{945 \times 200}{189}$

$x =$ ₹ 1000

Hence, the M.P. of the mixer grinder is ₹ 1000.

5. Amount of sales tax paid = ₹ (1980 − 1800) = ₹ 180

$\therefore$ Rate of sales tax $= \left(\frac{180}{1800} \times 100\right)\% = 10\%$

6. Selling price of a moniter including VAT is ₹ 13407.

Let M.P. be ₹ x.

$$\text{VAT is 9\% of ₹ } x = \frac{9 \times x}{100} = \frac{9x}{100}$$

$$\Rightarrow \quad x + \frac{9x}{100} = ₹\ 13407$$

$$\Rightarrow \quad \frac{100x + 9x}{100} = ₹\ 13407$$

$$\Rightarrow \quad \frac{109x}{100} = ₹\ 13407$$

$$\Rightarrow \quad x = ₹\ \frac{13407 \times 100}{109} = ₹\ 12300$$

Thus, selling price before adding VAT = ₹ 12300

7. Let the M.P. of each of the items be ₹ x and ₹ y. *i.e.*, $x + y =$ ₹ 980 ...(i)

Total amount of VAT = ₹ 94

For pant :

$$\text{VAT is 10\% of ₹ } x = \frac{10 \times x}{100} = \frac{x}{10}$$

For shirt :

$$\text{VAT is 5\% of ₹ } y = \frac{5 \times y}{100} = \frac{y}{20}$$

Since, total amount of VAT = ₹ 94

So, $\frac{x}{10} + \frac{y}{20} =$ ₹ 94

$2x + y =$ ₹ 1880 ...(ii)

Solving the equation (i) and (ii), we get

$2x + y =$ ₹ 1880 ...(ii)

$x + y =$ ₹ 980 ...(i)

$- \quad - \quad -$ sub.

$x =$ ₹ 900

Putting the value of x in equation (i), we get

$$x + y = ₹\ 980$$

$$₹\ 900 + y = ₹\ 980$$

$$y = ₹\ 980 - ₹\ 900$$

$$y = ₹\ 80$$

Hence, the marked price of each of the items are ₹ 900 (for pant) and ₹ 80 (for shirt) respectively.

8. Selling price of a watch including VAT is ₹ 330.

Let list price be ₹ x.

$$\text{VAT is 10\% of ₹ } x = \frac{10 \times x}{100} = \frac{x}{10}$$

$$\Rightarrow \quad x + \frac{x}{10} = ₹\ 330$$

$$\frac{11x}{10} = ₹\ 330$$

$$x = ₹\ 30 \times 10 = ₹\ 300$$

And selling price of a pen including VAT is ₹ 212.

Let list price be ₹ y.

$$\text{VAT is 6 \% of ₹ } y = \frac{6 \times y}{100} = \frac{3y}{50}$$

$$\Rightarrow \quad y + \frac{3y}{50} = ₹\ 212$$

$$= \frac{50y + 3y}{50} = ₹\ 212$$

$$= \frac{53y}{50} = ₹\ 212$$

$$y = ₹\ \frac{212 \times 50}{53}$$

$$y = ₹\ 4 \times 50 = ₹\ 200$$

Hence, the M.P. of a watch and a pen are ₹ 300 and ₹ 200 respectively.

9. For pulse :

List price of a pulse is ₹ 80

$$\text{Sales tax charged is } 5\% = ₹\ \frac{5 \times 80}{100}$$

$$\text{Amount} = ₹\ 4$$

So, selling price of a pulse = ₹ (80 + 4) = ₹ 84

For tined food : List price of a tined food is ₹ 60.

$$\text{Sales tax charged is } 8\% = ₹\ \frac{8 \times 60}{100}$$

$$\text{Amount} = ₹\ 4.80$$

So, selling price of a tined food = ₹ (60 + 4.80) = ₹ 64.80

Since, she gave a 1000 rupee note to the shopkeeper.

Thus, the balance amount returned to her = ₹ (1000 – 84 – 64.80)

= ₹ (1000 – 148.80)

= ₹ 851.20

10. Let ₹ x be the marked price of the article.

Now, if the rate of VAT increases by 2% then selling price of an article goes up by ₹ 140

So, VAT is 2% of ₹ x = ₹ 140

$$\frac{2 \times x}{100} = ₹\ 140$$

$$x = ₹\ \frac{140 \times 100}{2}$$

$$x = ₹\ 7000$$

Hence, ₹ 7000 is the marked price of the article.

Exercise 7.5

1. P = ₹ 18000, T = 3 years, R = 6%, I = ?

$$I = \frac{P \times R \times T}{100}$$

$$= ₹\ \frac{18000 \times 6 \times 3}{100}$$

$$= ₹\ 180 \times 6 \times 3 = ₹\ 3240$$

Hence, she will get ₹ 3240 at the end of 3 years.

2. $P = ₹\ 24000,\ R_1 = 7\%,\ T = 2$ years, $R_2 = 10\%$

For Riya : $I = \dfrac{P \times R \times T}{100} = ₹\ \dfrac{24000 \times 7 \times 2}{100}$

$= ₹\ 240 \times 14 = ₹\ 3360$

For Rivita : $I = \dfrac{P \times R \times T}{100} = ₹\ \dfrac{24000 \times 10 \times 2}{100}$

$= ₹\ 240 \times 20 = ₹\ 4800$

Riya's gain $= ₹\ (4800 - 3360) = ₹\ 1440$

3. Let ₹ x be the value of the wrist watch.

$P = ₹\ 16000,\ R = 18\%,\ T = 2$ years

$A = ₹\ (20800 + x)$

$\because \quad I = A - P$

$\therefore \quad \dfrac{P \times R \times T}{100} = (20800 + x) - 16000$

$₹\ \dfrac{16000 \times 18 \times 2}{100} = ₹\ (20800 - 16000) + x$

$₹\ 160 \times 36 = ₹\ 4800 + x$

$x = ₹\ 5760 - ₹\ 4800$

$x = ₹\ 960$

Hence, ₹ 960 is the value of the wrist watch.

4. $P = ₹\ 100000,\ R = 12\%,\ T = 1$ year, $I = ?$

$I = \dfrac{P \times R \times T}{100}$

$= ₹\ \dfrac{100000 \times 12 \times 1}{100} = ₹\ 12000$

The amount of 3 scholarships $= ₹\ 12000$

$\therefore$ the value of each scholarship $= ₹\ (12000 \div 3) = ₹\ 4000$

5. $I = ₹\ 812,\ R = 3\frac{1}{2}\% = \frac{7}{2}\%,\ T = 7\frac{1}{4}$ years $= \frac{29}{4}$ years

$\because \quad I = \dfrac{P \times R \times T}{100}$

$₹\ 812 = \dfrac{P \times \frac{7}{2} \times \frac{29}{4}}{100}$

$$₹\ 81200 = \frac{P \times 7 \times 29}{8}$$

$$P = ₹\ \frac{81200 \times 8}{7 \times 29}$$

$$P = ₹\ \frac{649600}{203}$$

$$P = ₹\ 3200$$

6. $P = ₹\ 8450$, $T = 4$ years, $A = ₹\ 12506$, $R = ?$

$\because$ $I = A - P$

$\therefore$ $I = ₹\ (12506 - 8450) = ₹\ 4056$

So, $$I = \frac{P \times R \times T}{100}$$

$$4056 = \frac{8450 \times R \times 4}{100}$$

$$R = \frac{4056 \times 100}{8450 \times 4}\% = \frac{48}{4}\%$$

$$R = 12\%$$

Hence, 12% was the rate of interest.

7. $P = ₹\ 5000$, $A = ₹\ 5500$, $R = 8\%$, $T = ?$

$\because$ $I = A - P$

$\therefore$ $I = ₹\ (5500 - 5000) = ₹\ 500$

$$I = \frac{P \times R \times T}{100}$$

$$500 = \frac{5000 \times 8 \times T}{100}$$

$$T = \frac{500}{400} = 1\frac{1}{4} \text{ years}$$

8. $T = ?$, $P = x$, $A = 2x$ and $R = 12\frac{1}{2}\% = \frac{25}{2}\%$

$\because$ $I = A - P$

$\therefore$ $I = 2x - x = x$

$$I = \frac{P \times R \times T}{100}$$

$$x = \frac{x \times 25 \times T}{2 \times 100}$$

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

$$T = 8 \text{ years}$$

9. $P = ₹\ 4000,\ R = \frac{15}{2}\%,\ T = 146 \text{ days}$

$$I = \frac{P \times R \times T}{100} = ₹\ \frac{400 \times 15 \times 146}{100 \times 2 \times 365} \qquad (\because 1 \text{ year} = 365 \text{ days})$$

$$= ₹\ \frac{4 \times 15 \times 73}{365}$$

$$= ₹\ \frac{4380}{365} = ₹\ 120$$

Exercise 7.6

1. We know that,

$$\text{C.I.} = P\left\{\left(1 + \frac{R}{100}\right)^n - 1\right\}$$

(a) $P = ₹\ 5000,\ n = 3 \text{ years},\ R = 12\%$

So,

$$\text{C.I.} = ₹\ 5000\left\{\left(1 + \frac{12}{100}\right)^3 - 1\right\}$$

$$= ₹\ 5000\left\{\left(1 + \frac{3}{25}\right)^3 - 1\right\}$$

$$= ₹\ 5000\left\{\left(\frac{28}{25}\right)^3 - 1\right\}$$

$$= ₹\ 5000\left(\frac{28 \times 28 \times 28}{25 \times 25 \times 25} - 1\right)$$

$$= ₹\ 5000\left\{\frac{21952}{15625} - 1\right\}$$

$$= ₹\ 5000\left(\frac{21952-15625}{15625}\right)$$

$$= ₹\ \frac{5000\times 6327}{15625} = ₹\ 2024.64$$

$\because A = \text{C.I.} + P = ₹\ (2014.64 + 5000) = ₹\ 7024.64$

(b) $P = ₹\ 2500$, $n = 3$ years, $R = 6\%$

So, $$\text{C.I.} = ₹\ 2500\left\{\left(1+\frac{6}{100}\right)^3 - 1\right\}$$

$$= ₹\ 2500\left\{\left(1+\frac{3}{50}\right)^3 - 1\right\}$$

$$= ₹\ 2500\left\{\left(\frac{53}{50}\right)^3 - 1\right\}$$

$$= ₹\ 2500\left(\frac{53\times 53\times 53}{50\times 50\times 50} - 1\right)$$

$$= ₹\ 2500\left(\frac{148877}{125000} - 1\right)$$

$$= ₹\ 2500\left(\frac{148877-125000}{125000}\right)$$

$$= ₹\ 2500\times\frac{23877}{125000}$$

$$= ₹\ \frac{59692500}{125000} = ₹\ 477.54$$

$\because \quad A = \text{C.I.} + P$

$\therefore \quad A = ₹\ (477.54 + 2500) = ₹\ 2977.54$

(c) $P = ₹\ 12000$, $n = 2$ years, $R = 8\%$

So, $$\text{C.I.} = ₹\ 12000\left\{\left(1+\frac{8}{100}\right)^2 - 1\right\}$$

$$\text{C.I.} = ₹\ 12000\left\{\left(1+\frac{2}{25}\right)^2 - 1\right\}$$

$$= ₹\ 12000\left\{\left(\frac{27}{25}\right)^2 - 1\right\}$$

$$= ₹\ 12000\left(\frac{27\times 27}{25\times 25} - 1\right)$$

$$= ₹\ 12000\left(\frac{729}{625} - 1\right)$$

$$= ₹\ 12000 \times \left(\frac{729-625}{625}\right)$$

$$= ₹\ 12000 \times \frac{104}{625} = ₹\ 1996.80$$

$\because$ $A = \text{C.I.} + P$

$\therefore$ $A = ₹\ (1996.80 + 12000) = ₹\ 13996.80$

2. (a) $P = ₹\ 4000$,

$R = 10\%$ P.a. $= 10\% \div 2$ half yearly $= 5\%$ per unit.

$n = 1\frac{1}{2}$ year $= 3$ half year or 3 conversion periods

$\therefore$ $$A = P\left(1+\frac{R}{100}\right)^n$$

$$= ₹\ 4000\left(1+\frac{5}{100}\right)^3 = ₹\ 4000\left(1+\frac{1}{20}\right)^3$$

$$= ₹\ 4000 \times \frac{21\times 21\times 21}{20\times 20\times 20}$$

$$= ₹\ \frac{9261}{2} = ₹\ 4630.50$$

C.I. $= A - P = ₹\ (4630.50 - 4000) = ₹\ 630.50$

(b) $P = ₹\ 2560$, $R = 12\frac{1}{2}\% = \frac{25}{4}\%$ per unit

$n = 1$ year $= 2$ half year or 2 conversion period

$\therefore$ $$A = P\left(1+\frac{R}{100}\right)^n$$

$$= ₹\ 2560\left(1+\frac{\frac{25}{4}}{100}\right)^2$$

$$= ₹\ 2560\left(1+\frac{1}{16}\right)^2$$

$$= ₹\ 2560 \times \frac{17\times 17}{16\times 16}$$

$$= ₹\ 10\times 17\times 17 = ₹\ 2890$$

C.I. $= A - P =$ ₹ 2890 – ₹ 2560 = ₹ 380

(c) $P =$ ₹ 4096, $R = 10\% = 5\%$ per unit

$n = 18$ months = 3 half year or 3 conversion periods

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n = ₹\ 4096\left(1+\frac{5}{100}\right)^3$$

$$= ₹\ 4096\left(1+\frac{1}{20}\right)^3$$

$$= ₹\ 4096 \times \frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}$$

$$= ₹\ 512 \times \frac{9261}{1000} = ₹\ 4741.63$$

C.I. $= A - P =$ ₹ (4741.63 – 4096) = ₹ 645.63

(d) $P =$ ₹ 12000, $R = 6\% = 3\%$ per unit

$n = 1\frac{1}{2}$ years = 3 half year or 3 conversion periods

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= ₹\ 12000\left(1+\frac{3}{100}\right)^3 = ₹\ 12000 \times \frac{103}{100}\times\frac{103}{100}\times\frac{103}{100}$$

$$= ₹\ \frac{13112724}{1000} = ₹\ 13112.72$$

$\therefore$ C.I. $= A - P =$ ₹ (13112.72 – 12000) = ₹ 1112.72

3. Since, the interest is compounded quarterly.

(a) $P = ₹\ 8000$, $R = 16\% \div 4 = 4\%$ per quarter.

$n = 9$ months $= \frac{9}{3}$ quarters $= 3$ quarters

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^{n\,(\text{no. of units})}$$

$$= ₹\ 8000\left(1+\frac{4}{100}\right)^{3} = ₹\ 8000\left(1+\frac{1}{25}\right)^{3}$$

$$= ₹\ 8000 \times \frac{26\times 26\times 26}{25\times 25\times 25}$$

$$= ₹\ 320 \times \frac{17576}{25\times 25} = ₹\ \frac{64\times 17576}{125} = ₹\ 8998.91$$

C.I. $= A - P = ₹\ (8998.91 - 8000) = ₹\ 998.91$

(b) $P = ₹\ 20000$, $R = 16\% \div 4 = 4\%$ per quarter.

$n = 6$ months $= \frac{6}{3}$ quarter $= 2$ quarter.

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^{n\,(\text{no. of units})}$$

$$= ₹\ 20000\left(1+\frac{4}{100}\right)^{2}$$

$$= ₹\ 20000\left(1+\frac{1}{25}\right)^{2}$$

$$= ₹\ 20000 \times \frac{26\times 26}{25\times 25}$$

$$= ₹\ 32 \times 26 \times 26 = ₹\ 21632$$

C.I. $= A - P = ₹\ (20000 - 21632) = ₹\ 1632$

(c) $P = ₹\ 28000$, $R = 12\% \div 4 = 3\%$ per quarter

$n = 9$ months $= 3$ quarters

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^{n\,(\text{no. of units})}$$

$$= ₹\ 28000\left(1+\frac{3}{100}\right)^3$$

$$= ₹\ 28000 \times \frac{103\times103\times103}{100\times100\times100}$$

$$= ₹\ \frac{28\times1092727}{1000} = ₹\ 30596.36$$

$$\text{C.I.} = A - P$$

$$= ₹\ (30596.36 - 28000) = ₹\ 2596.36$$

(d) $P = ₹\ 10000,\ R = 10\% = \frac{10}{4}\% = \frac{5}{2}\%$

$n = 6$ months $= 2$ quarters,

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^{n\ (\text{no. of units})}$$

$$= ₹\ 10000\left(1+\frac{5}{2\times100}\right)^2$$

$$= ₹\ 10000\left(1+\frac{1}{40}\right)^2$$

$$= ₹\ 10000 \times \frac{41}{40} \times \frac{41}{40}$$

$$= ₹\ \frac{25\times41\times41}{4} = ₹\ 10506.25$$

$$\text{C.I.} = A - P$$

$$= ₹\ (10506.25 - 1000) = ₹\ 506.25$$

4. $P = ₹\ 100000,\ R = 8\%,\ n = 3$ years, $A = ?$

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$= ₹\ 100000\left(1+\frac{8}{100}\right)^3$$

$$= ₹\ 100000\left(1+\frac{2}{25}\right)^3$$

$$= ₹\ 100000 \times \frac{27 \times 27 \times 27}{25 \times 25 \times 25}$$

$$= ₹\ \frac{32 \times 19683}{5}$$

$$= ₹\ 125971.20$$

Hence, the amount will be paid ₹ 125971.20 back at the end of 3 years.

5. $P = ₹\ 10000$, $n = 2$ years, $R = 5\%$, $A = ?$

$$\therefore \quad A = P\left(1 + \frac{R}{100}\right)^n$$

$$= ₹\ 10000\left(1 + \frac{5}{100}\right)^2$$

$$= ₹\ 10000\left(1 + \frac{1}{20}\right)^2$$

$$= ₹\ 10000 \times \frac{21}{20} \times \frac{21}{20}$$

$$= ₹\ 25 \times 21 \times 21 = ₹\ 11025$$

Hence, she will receive ₹ 11025 after 2 years.

6. $P = ₹\ 5000$, $R = 8\frac{1}{3}\% = \frac{25}{3}\%$, $n = 2$ years $A = ?$

$$\therefore \quad A = P\left(1 + \frac{R}{100}\right)^n$$

$$= ₹\ 5000\left(1 + \frac{25}{3 \times 100}\right)^2 = ₹\ 5000\left(1 + \frac{1}{12}\right)^2$$

$$= ₹\ 5000 \times \frac{13}{12} \times \frac{13}{12}$$

$$= ₹\ 5000 \times \frac{169}{144} = ₹\ \frac{845000}{144}$$

$$= ₹\ 5868.05$$

Hence, Guneet will pay ₹ 5868.05 to Anju after 2 years.

7. $P = ₹\ 15625,\ R = 16\%,\ n = 2\frac{1}{4}$ years, $A = ?$

$$\therefore \qquad A = P\left(1+\frac{R}{100}\right)^n$$

In this case, the time is in fractions.

$$\therefore \qquad A = P\left(1+\frac{R}{100}\right)^q\left(1+\frac{\frac{m}{n}R}{100}\right)$$

where, $q = 2$ and $\frac{m}{n} = \frac{1}{4}$

$$= ₹\ 15625\left(1+\frac{16}{100}\right)^2\left(1+\frac{\frac{1}{4}\times 16}{100}\right)$$

$$= ₹\ 15625\left(1+\frac{4}{25}\right)^2\left(1+\frac{1}{25}\right)$$

$$= ₹\ 15625\left(\frac{29}{25}\right)^2\left(\frac{26}{25}\right)$$

$$= ₹\ 15625\times\frac{29}{25}\times\frac{29}{25}\times\frac{26}{25}$$

$$= ₹\ 29\times 29\times 26 = ₹\ 21866$$

Hence, he will pay ₹ 21866 after $2\frac{1}{4}$ years.

8. S.I. $= ₹\ 6750,\ R = 6\frac{2}{3}\% = \frac{20}{3}\%,\ n = 3$ years

$P = ?,$ C.I. $= ?$

$$\because \qquad \text{S.I.} = \frac{P\times R\times T}{100}$$

$$₹\ 6750 = \frac{P\times 20\times 3}{100\times 3} \Rightarrow P = ₹\ 6750\times 5$$

$$P = ₹\ 33750$$

We know that,

$$\text{C.I.} = P\left\{\left(1+\frac{R}{100}\right)^n - 1\right\}$$

$$= ₹\ 33750\left\{\left(1+\frac{20}{3\times 100}\right)^3 - 1\right\}$$

$$= ₹\ 33750\left\{\left(1+\frac{1}{15}\right)^3 - 1\right\}$$

$$= ₹\ 33750\left(\frac{16\times 16\times 16}{15\times 15\times 15} - 1\right)$$

$$= ₹\ 33750\left(\frac{4096}{3375} - 1\right)$$

$$= ₹\ 33750\left(\frac{4096-3375}{3375}\right)$$

$$= ₹\ 10\times 721 = ₹\ 7210$$

9. Since, the interest is compounded halfly.

Therefore, $R = 12.5\% \div 2$ half yearly $= \frac{25}{4}\%$ per unit.

$$P = ₹\ 32500$$

Time $= 1\frac{1}{2}$ year $= 3$ half year or 3 conversion periods.

$\therefore$ $$\text{Amount} = P\left(1+\frac{R}{100}\right)^n$$

$$= ₹\ 32500\left(1+\frac{25}{4\times 100}\right)^3$$

$$= ₹\ 32500\left(1+\frac{1}{16}\right)^3$$

$$= ₹\ 32500\times\frac{17\times 17\times 17}{16\times 16\times 16}$$

$$A = ₹\ 38982.54$$

$\therefore$ $$\text{C.I.} = A - P$$

$$= ₹\ (38982.54 - 32500) = ₹\ 6482.54$$

Hence, Golu will be paid ₹ 6482.54 to Polu after $1\frac{1}{2}$ years.

10. $P = ₹\ 18000$, $R = 15\% \div 2$ half yearly $= \frac{15}{2}$ per unit

$n = 1$ year $= 2$ half year or 2 conversion periods

$\therefore$ $$\text{Amount} = P\left(1+\frac{R}{100}\right)^n$$

$$= ₹\ 18000\left(1+\frac{15}{2\times 100}\right)^2$$

$$= ₹\ 18000\left(1+\frac{3}{40}\right)^2$$

$$= ₹\ 18000 \times \frac{43}{40} \times \frac{43}{40}$$

$$= ₹\ \frac{45\times 43\times 43}{4} = ₹\ 20801.25$$

11. $P = ₹\ 5000$, $R = 8\frac{1}{3}\% = \frac{25}{3}\%$, $n = 2$ years, $A = ?$

$\therefore$ $$A = P\left(1+\frac{R}{100}\right)^n$$

$$= ₹\ 5000\left(1+\frac{25}{3\times 100}\right)^2$$

$$= ₹\ 5000\left(1+\frac{1}{12}\right)^2$$

$$= ₹\ 5000\left(\frac{13}{12}\right)^2 = ₹\ 5000 \times \frac{13}{12} \times \frac{13}{12}$$

$$= ₹\ 5868.06$$

Hence, Jyoti will be paid ₹ 5868.06 to Rakhi after 2 years.

12. $P = ₹\ 10000,\ R = 10\%,\ n = 12$ months $= 1$ years

(a) Since, the interest is annually.

$$\therefore \quad \text{C.I.} = P\left\{\left(1+\frac{R}{100}\right)^n - 1\right\}$$

$$= ₹\ 10000\left\{\left(1+\frac{10}{100}\right)^1 - 1\right\}$$

$$= ₹\ 10000\left\{\left(\frac{11}{10}\right) - 1\right\}$$

$$= ₹\ 10000\left(\frac{11-10}{10}\right) = ₹\ 1000$$

(b) Since, the interest is half yearly.

Then, $R = 10\% \div 2 = 5\%$ per unit

$n = 1$ year $= 2$ half year or 2 conversion periods.

$$\therefore \quad \text{C.I.} = P\left\{\left(1+\frac{R}{100}\right)^n - 1\right\}$$

$$= ₹\ 10000\left\{\left(1+\frac{5}{100}\right)^2 - 1\right\}$$

$$= ₹\ 10000\left\{\left(1+\frac{1}{20}\right)^2 - 1\right\}$$

$$= ₹\ 10000\left\{\frac{21\times 21}{20\times 20} - 1\right\}$$

$$= ₹\ 10000\left(\frac{441-400}{400}\right)$$

$$= ₹\ 10000 \times \frac{41}{400} = ₹\ 1025$$

(c) Since, the interest is quarterly

Then, $R = 10\% \div 4 = \frac{5}{2}\%$ per unit

$n = 12$ months $= 4$ quarters

$$\therefore \quad \text{C.I.} = P\left\{\left(1+\frac{R}{100}\right)^n - 1\right\}$$

$$= ₹\ 10000\left\{\left(1+\frac{5}{2\times 100}\right)^4 - 1\right\}$$

$$= ₹\ 10000\left\{\left(1+\frac{1}{40}\right)^4 - 1\right\}$$

$$= ₹\ 10000\left\{\left(\frac{41}{40}\right)^4 - 1\right\}$$

$$= ₹\ 10000\left(\frac{2825761-2560000}{2560000}\right)$$

$$= ₹\ \frac{10000\times 265761}{2560000} = ₹\ 1038.12$$

Exercise 7.7

1. $A = ₹\ 10240$, $n = 2$ years, $R = 6\frac{2}{3}\% = \frac{20}{3}\%$, $P = ?$

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$₹\ 10240 = P\left(1+\frac{20}{3\times 100}\right)^2$$

$$₹\ 10240 = P\left(1+\frac{1}{15}\right)^2$$

$$₹\ 10240 = P\left(\frac{16}{15}\right)^2$$

$$P = ₹\ \frac{15\times 15\times 10240}{16\times 16}$$

$$= ₹\ 225\times 40 = ₹\ 9000$$

Hence, the sum is ₹ 9000.

2. $A =$ ₹ 5832, $n = 2$ years, $R = 8\%$, $P = ?$

$$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$₹\ 5832 = P\left(1+\frac{8}{100}\right)^2$$

$$₹\ 5832 = P\left(1+\frac{2}{25}\right)^2$$

$$₹\ 5832 = P\left(\frac{27}{25}\right)^2$$

$$P = ₹\ \frac{5832\times 25\times 25}{27\times 27}$$

$$P = ₹\ 8\times 625 = ₹\ 5000$$

Hence, the sum is ₹ 5000.

3. Given, C.I. – S.I. = ₹ 180, $R = 10\%$ $n = T = 1$ years.

$$\Rightarrow \quad P\left\{\left(1+\frac{5}{100}\right)^2 - 1\right\} - \frac{P\times 10\times 1}{100} = ₹\ 180$$

[Since, the interest is half yearly.]

$$\Rightarrow \quad P\left\{\left(1+\frac{1}{20}\right)^2 - 1\right\} - \frac{P}{10} = ₹\ 180$$

$$\Rightarrow \quad P\left\{\left(\frac{21}{20}\right)^2 - 1\right\} - \frac{P}{10} = ₹\ 180$$

$$\Rightarrow \quad P\left(\frac{441-400}{400}\right) - \frac{P}{10} = ₹\ 180$$

$$\Rightarrow \quad P\left[\frac{41}{400} - \frac{1}{10}\right] = ₹\ 180$$

$$\Rightarrow \quad P = ₹\ \frac{180\times 400}{(41-40)}$$

$$\Rightarrow \quad P = ₹\ 72000$$

4. $A_1 = ₹\ 7396$, $n_1 = 2$ years, $A_2 = ₹\ 7950.70$, $n_2 = 3$ years, $R = ?$

We know that,

$$A = P\left(1+\frac{R}{100}\right)^n$$

$$\therefore \quad A_1 = P\left(1+\frac{R}{100}\right)^{n_1} \quad \ldots(i)$$

$$A_2 = P\left(1+\frac{R}{100}\right)^{n_2} \quad \ldots(ii)$$

Divide (ii) by (i), we get

$$\frac{A_2}{A_1} = \frac{\left(1+\frac{R}{100}\right)^{n_2}}{\left(1+\frac{R}{100}\right)^{n_1}}$$

$$\frac{7950.70}{7396} = \frac{\left(1+\frac{R}{100}\right)^{3}}{\left(1+\frac{R}{100}\right)^{2}}$$

$$\frac{7950.70}{7396} = 1+\frac{R}{100}$$

$$\frac{R}{100} = \frac{7950.70-7396}{7396}$$

$$\frac{R}{100} = \frac{554.70}{7396}$$

$$R = \frac{55470}{7396}\%$$

$$R = \frac{15}{2}\% = 7\frac{1}{2}\%$$

5. S.I. $= ₹\ 2100$, $R = 14\%$, $T = 2$ years, C.I. $= ?$

$$\because \quad \text{S.I.} = \frac{P \times R \times T}{100}$$

$$₹\,2100 = \frac{P \times 14 \times 2}{100}$$

$$P = ₹\,\frac{2100 \times 25}{7}$$

$$= ₹\,300 \times 25 = ₹\,7500$$

So, $$\text{C.I.} = P\left\{\left(1+\frac{R}{100}\right)^2 - 1\right\}$$

$$= ₹\,7500\left\{\left(1+\frac{14}{100}\right)^2 - 1\right\}$$

$$= ₹\,7500\left(\frac{3249-2500}{2500}\right)$$

$$= ₹\,7500 \times \frac{749}{2500} = ₹\,2247$$

Hence, C.I. is ₹ 2247

6. $A =$ ₹ 774.40, $P =$ ₹ 640, $T = 2$ years, $R = ?$

$\because$ $$A = P\left(1+\frac{R}{100}\right)^n$$

$\therefore$ $$₹\,774.40 = ₹\,640\left(1+\frac{R}{100}\right)^2$$

$\Rightarrow$ $$\frac{774.40}{640} = \left(1+\frac{R}{100}\right)^2$$

$\Rightarrow$ $$\frac{77440}{64000} = \left(1+\frac{R}{100}\right)^2$$

$\Rightarrow$ $$\left(1+\frac{R}{100}\right) = \sqrt{\frac{77440}{64000}}$$

$\Rightarrow$ $$1+\frac{R}{100} = \frac{88}{80}$$

$\Rightarrow$ $$\frac{R}{100} = \frac{88-80}{80}$$

$\Rightarrow$ $$\frac{R}{100} = \frac{8}{80} \quad \Rightarrow \quad R = \frac{800}{80}\%$$

$\Rightarrow$ $$R = 10\%$$

7. $P = ₹\ 2000$, $A = ₹\ 2205$, $n = 2$ years, $R = ?$

$$\because \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$\Rightarrow \quad 2205 = 2000\left(1+\frac{R}{100}\right)^2$$

$$\Rightarrow \quad \frac{2205}{2000} = \left(1+\frac{R}{100}\right)^2$$

$$\Rightarrow \quad \frac{441}{400} = \left(1+\frac{R}{100}\right)^2$$

$$\Rightarrow \quad \left(1+\frac{R}{100}\right) = \sqrt{\frac{441}{400}}$$

$$\Rightarrow \quad 1+\frac{R}{100} = \frac{21}{20}$$

$$\Rightarrow \quad \frac{R}{100} = \frac{21}{20} - 1$$

$$\Rightarrow \quad \frac{R}{100} = \frac{21-20}{20}$$

$$\Rightarrow \quad \frac{R}{100} = \frac{1}{20}$$

$$\Rightarrow \quad R = \frac{100}{20}$$

$$\Rightarrow \quad R = 5\%$$

8. $A = ₹\ 784$, $P = ₹\ 625$, $n = 2$ years, $R = ?$

$$\because \quad A = P\left(1+\frac{R}{100}\right)^n$$

$$784 = 625\left(1+\frac{R}{100}\right)^2$$

$$\frac{784}{625} = \left(1+\frac{R}{100}\right)^2$$

$$\left(1+\frac{R}{100}\right) = \sqrt{\frac{784}{625}}$$

$$1+\frac{R}{100}=\frac{28}{25}$$

$$R=\left(\frac{28-25}{25}\times 100\right)\%$$

$$R=12\%$$

9. $P=₹\,500,\ A=₹\,605,\ R=10\%,\ n=?$

$\because$ $$A=P\left(1+\frac{R}{100}\right)^n$$

$$605=500\left(1+\frac{10}{100}\right)^n$$

$\Rightarrow$ $$\frac{605}{500}=\left(1+\frac{1}{10}\right)^n$$

$\Rightarrow$ $$\frac{121}{100}=\left(\frac{11}{10}\right)^n$$

$\Rightarrow$ $$\left(\frac{11}{10}\right)^2=\left(\frac{11}{10}\right)^n$$

$\because$ Base $\frac{11}{10}$ is the same on both the sides. $\therefore$ Power = Power

$$n=2$$

10. $P=₹\,8000,\ A=₹\,8820,\ R=20\%,\ n=?$

Since, the interest is compounded quarterly.

So, $R=20\%\div 4=5\%$ per unit.

$\because$ $$A=P\left(1+\frac{R}{100}\right)^{4n}$$

$$8820=8000\left(1+\frac{5}{100}\right)^{4n}$$

$$\frac{8820}{8000}=\left(1+\frac{1}{20}\right)^{4n}$$

$$\left(\frac{441}{400}\right)=\left(\frac{21}{20}\right)^{4n} \quad \Rightarrow \quad \left(\frac{21}{20}\right)^2=\left(\frac{21}{20}\right)^{4n}$$

$\because$ Base is the same on both sides

$\therefore \quad 4n = 2$ years

$\Rightarrow \quad n = \frac{2}{4}$

$\Rightarrow \quad n = \frac{1}{2}$ years

11. $P =$ ₹ 4400, $A =$ ₹ 4576, $R = 8\%$, $n = ?$

Since, the interest is compounded halfly.

So, $R = 8\% \div 2 = 4\%$

$$\because \quad A = P\left(1+\frac{R}{100}\right)^{2n}$$

$$\therefore \quad 4576 = 4400\left(1+\frac{4}{100}\right)^{2n}$$

$$\Rightarrow \quad \frac{4576}{4400} = \left(1+\frac{1}{25}\right)^{2n}$$

$$\Rightarrow \quad \frac{4576}{4400} = \left(\frac{26}{25}\right)^{2n}$$

$$\Rightarrow \quad \left(\frac{26}{25}\right)^{1} = \left(\frac{26}{25}\right)^{2n}$$

$\because$ Base is the same on both sides

$\therefore \quad 2n = 1$ years

$\Rightarrow \quad n = \frac{1}{2}$ years

12. Let ₹ x be the sum, $n = 2$ years, $R = 10\%$

Given, C.I. – S.I. = ₹ 10

So, according to the question,

$$x\left\{\left(1+\frac{10}{100}\right)^{2} - 1\right\} - \frac{x \times 10 \times 2}{100} = ₹\ 10$$

$$x\left\{\left(1+\frac{1}{10}\right)^{2} - 1\right\} - \frac{x}{5} = ₹\ 10$$

$$x\left\{\left(\frac{11}{10}\right)^2-1\right\}-\frac{x}{5}=₹\ 10$$

$$x\left(\frac{121-100}{100}\right)-\frac{x}{5}=₹\ 10$$

$$x\times\frac{21}{100}-\frac{x}{5}=₹\ 10$$

$$\frac{21x-20x}{100}=₹\ 10$$

$$x=₹\ 10\times 100$$

$$x=₹\ 1000$$

Hence, the sum is ₹ 1000.

13. Given, C.I. = ₹ 110, $n = T = 2$ years, S.I. = ₹ 100

$$P\left\{\left(1+\frac{R}{100}\right)^2-1\right\}=₹\ 110 \qquad \ldots(i)$$

$$\frac{P\times R\times 2}{100}=₹\ 100 \qquad \ldots(ii)$$

Divide (i) by (ii), we get

$$\frac{P\left\{\left(1+\frac{R}{100}\right)^2-1\right\}}{2\frac{PR}{100}}=\frac{110}{100}$$

$$\Rightarrow \quad \frac{\left(1+\frac{R^2}{10000}+\frac{2R}{100}-1\right)}{\frac{2R}{100}}=\frac{11}{10}$$

$$\Rightarrow \quad \frac{\frac{R}{100}\left(\frac{R}{100}+2\right)}{2\frac{R}{100}}=\frac{11}{10}$$

$$\Rightarrow \quad \frac{R}{100}+2=\frac{22}{10}$$

$$\Rightarrow \qquad \frac{R}{100} = \frac{22}{10} - 2 = \frac{22-20}{10}$$

$$R = \frac{2 \times 100}{10}\%$$

$$R = 20\%$$

Since, $$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$100 = \frac{P \times 20 \times 2}{100}$$

$$P = ₹\ 10000 \div 40$$

$$P = ₹\ 250$$

Hence, the sum and rate are ₹ 250 and 20% respectively.

Exercise 7.8

1. $P_0 = ₹\ 10000$, $R = 10\%$, $n = 2$ years, $P_1 = ?$

$\therefore$ Value of a machine after 2 years

$$\therefore \qquad P_1 = P_0\left(1 - \frac{r}{100}\right)^n$$

$$P_1 = 10000\left(1 - \frac{10}{100}\right)^2$$

$$P_2 = ₹\ 10000\left(1 - \frac{1}{10}\right)^2$$

$$= ₹\ 10000 \times \frac{9 \times 9}{10 \times 10}$$

$$= ₹\ 100 \times 81 = ₹\ 8100$$

Hence, its value will be ₹ 8100 after 2 years.

2. $P_0 = 80000$, $R = \frac{75}{1000} \times 100 = 7.5\%$, $n = 2$ years, $P_1 = ?$

$$\therefore \qquad P_1 = P_0\left(1 + \frac{R}{100}\right)^n$$

$$= 80000\left(1 + \frac{75}{1000}\right)^2$$

$$P_1 = 80000\left(1+\frac{3}{40}\right)^2 = 80000\times\frac{43\times43}{40\times40}$$

$$P_1 = 50\times43\times43$$

$$P_1 = 92450$$

Hence, the population of the town will 92450 after 2 years.

3. $P_0 = 12000$, $R = 10\%$ $n = 3$ years, $P_1 = ?$

$\therefore$

$$P_1 = P_0\left(1+\frac{R}{100}\right)^n$$

$$= 12000\left(1+\frac{10}{100}\right)^3 = 12000\left(1+\frac{1}{10}\right)^3$$

$$P_1 = 12000\times\frac{11\times11\times11}{10\times10\times10}$$

$$P_1 = 12\times11\times121$$

$$P_1 = 15972$$

Hence, the population of a town will be 15972 after 3 years.

4. $P_0 =$ ₹ 64000, $R = 2.5\%$, $n = 3$ years., $P_1 = ?$

$$P_1 = P_o\left(1-\frac{R}{100}\right)^n$$

$$= ₹\ 64000\left(1-\frac{2.5}{100}\right)^3$$

$$= ₹\ 64000\left(1-\frac{1}{40}\right)^3$$

$$= ₹\ 64000\left(\frac{40-1}{40}\right)^3$$

$$= ₹\ 64000\times\frac{39\times39\times39}{40\times40\times40}$$

$$= ₹\ 39\times39\times39 = ₹\ 59319$$

Hence, the value of the T.V. will be ₹ 59319 after 3 years.

And the value of the T.V. gone down

$$= ₹\ (64000-59319) = ₹\ 4681$$

5. $P_0 = 1000$

Since, it is increases at the rate of 5% every six months.

So, $R = 5\%$, $n = 18$ months $= 3$ half year $P_t = ?$

$$\therefore \quad P_t = P_o\left(1+\frac{R}{100}\right)^3 = 1000\left(1+\frac{5}{100}\right)^3$$

$$= 1000\left(1+\frac{1}{20}\right)^3 = 1000\left(\frac{21}{20}\right)^3$$

$$= 1000 \times \frac{21\times 21\times 21}{20\times 20\times 20}$$

$$= 1157.6 \text{ or } 1158$$

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

Write 'T' for True 'F' for 'False' :

1. T 2. F 3. T 4. T 5. F

Mental Maths :

1. $65\% = \frac{65}{100} = \frac{13}{20}$

2. 5% or $y = 4$ $\Rightarrow$ $\frac{5}{100} \times y = 4$

$y = \frac{4\times 100}{5}$ $\Rightarrow$ $y = 80$

3. Let x be a number.

Then, $x = 130 - 50\%$ of $130 = 130 - \frac{50}{100}\times 130 = 130 - 65 = 65$

4. Let x be the number.

Then, $x = 180 + 60\%$ of 180

$$= 180 + \frac{60}{100}\times 180 = 180 + 108 = 280$$

5. 10% of $x = 20$ $\Rightarrow$ $\frac{10}{100}\times x = 20$

$\Rightarrow$ $x = \frac{20\times 100}{10}$ $\Rightarrow$ $x = 200$

Chapter 8

Algebraic Expressions and Identities

Exercise 8.1

1. Classify the following algebraic expressions as monomials, binomials, and trinomials.

(a) $\frac{2}{7}ab^2$ (Monomials) (b) $x^2 - xy + 15$ (Trinomials)

(c) $6pq + 3$ (Binomials) (d) $x^2 + y^2$ (Binomials)

2. (a) $3x^2, -7x^2, \frac{1}{5}x^2$

$$= 3x^2 + (-7x^2) + \frac{1}{5}x^2 = \frac{3x^2}{1} - \frac{7x^2}{1} + \frac{x^2}{5}$$

$$= \frac{15x^2 - 35x^2 + x^2}{5} = \frac{16x^2 - 35x^2}{5} = \frac{-19x^2}{5}$$

(b) $-5a^2b^2, \frac{3}{5}a^2b^2, \frac{-1}{7}a^2b^2, \frac{1}{2}a^2b^2$

$$= -5a^2b^2 + \frac{3}{5}a^2b^2 + \left(-\frac{1}{7}a^2b^2\right) + \frac{1}{2}a^2b^2$$

$$= \frac{-5a^2b^2}{1} + \frac{3}{5}a^2b^2 - \frac{1}{7}a^2b^2 + \frac{1}{2}a^2b^2$$

$$= \frac{-350a^2b^2 + 42a^2b^2 - 10a^2b^2 + 35a^2b^2}{70}$$

$$= \frac{-360a^2b^2 + 77a^2b^2}{70} = \frac{-283a^2b^2}{70}$$

(c) $-19p^2 + 3q^2 - 5r^2, 2q^2 - 5p^2 + 17r^2, \frac{-1}{7}p^2 + \frac{3}{5}q^2 - r^2$

$$= -19p^2 + 3q^2 - 5r^2 + 2q^2 - 5p^2 + 17r^2 - \frac{1}{7}p^2 + \frac{3}{5}q^2 - r^2$$

$$= \frac{-19p^2}{1} - \frac{5p^2}{1} - \frac{1p^2}{7} + \frac{3q^2}{1} + \frac{2q^2}{1} + \frac{3q^2}{5} - 5r^2 + 17r^2 - r^2$$

$$= \left(\frac{-133p^2 - 35p^2 - 1p^2}{7}\right) + \left(\frac{15q^2 + 10q^2 + 3q^2}{5}\right) + 11r^2$$

$$= \frac{-169p^2}{7} + \frac{28q^2}{5} + 11r^2$$

(d) $12.5x^2 - 15x + 7, 2.25x^2 - 6x - 3, 5.6x^2 - 2.5x + 13$

$= 12.5x^2 - 15x + 7 + 2.25x^2 - 6x - 3 + 5.6x^2 - 2.5x + 13$

$= 12.5x^2 + 2.25x^2 + 5.6x^2 - 15x - 6x - 2.5x + 7 - 3 + 13$

$= 20.35x^2 - 23.5x + 17$

(e) $\frac{1}{3}x^2 - \frac{2}{3}y + 11z, \frac{-7}{9}x^2 - 13z + y, \frac{23}{3}x^2 - 4y$

$$= \frac{1}{3}x^2 - \frac{2}{3}y + 11z - \frac{7}{9}x^2 - 13z + y + \frac{23}{3}x^2 - 4y$$

$$= \frac{1}{3}x^2 - \frac{7}{9}x^2 + \frac{23}{3}x^2 - \frac{2}{3}y + \frac{y}{1} - \frac{4y}{1} + 11z - 13z$$

$$= \frac{3x^2 - 7x^2 + 69x^2}{9} + \left(\frac{-2y + 3y - 12y}{3}\right) - 2z$$

$$= \frac{65x^2}{9} - \frac{11y}{3} - 2z$$

3. (a) $-6y^2x^2$ from $-19y^2x^2$

$= -19y^2x^2 - (-6y^2x^2)$

$= -19y^2x^2 + 6y^2x^2 = -13y^2x^2$

(b) $\frac{-1}{5}xy^2z$ from $17xy^2z$

$$= 17xy^2z - \left(-\frac{1}{5}xy^2z\right) = \frac{17xy^2z}{1} + \frac{1}{5}xy^2z$$

$$= \frac{85xy^2z + xy^2z}{5}$$

$$= \frac{86xy^2}{5}$$

(c) $p^2 - 2p + \frac{1}{3}$ from $-p^2 + 2p - \frac{1}{3}$

$= \left(-p^2 + 2p - \frac{1}{3}\right) - \left(p^2 - 2p + \frac{1}{3}\right)$

$= -p^2 + 2p - \frac{1}{3} - p^2 + 2p - \frac{1}{3} = -2p^2 + 4p - \frac{2}{3}$

(d) -1 from $3x^2 + 7y^2 - 8z^2$

$= 3x^2 + 7y^2 - 8z^2 - (-1) = 3x^2 + 7y^2 - 8z^2 + 1$

(e) $3a + 7b - 6c + 4$ from $-3a - 7b + 6c - 4$

$= (-3a - 7b + 6c - 4) - (3a + 7b - 6c + 4)$

$= -3a - 7b + 6c - 4 - 3a - 7b + 6c - 4$

$= -6a - 14b + 12c - 8$

4. Let length of rectangle $= (2x + y)$ unit

Breadth of rectangle $= (3y - 2x)$ unit

Perimeter of rectangle $= 2(l + b)$

$= 2(2x + y + 3y - 2x)$

$= 2 \times 4y$

$= 8y$ unit

Exercise 8.2

1. (a) $5x^3$ and $4x^9$

$= 5x^3 \times 4x^9 = 20x^{12}$

(b) $3y^2$ and $7y^5$

$= 3y^2 \times 7y^5 = 21y^7$

(c) $11x^2y$ and $2x^2y^2$

$= 11x^2y \times 2x^2y^2$

$= 22x^4y^3$

(d) $-9xy$ and $4x^2z$

$= -9xy \times 4x^2z$

$= -36x^3yz$

2. (a) $(6a^2b)(-2b^2c)(3ac^2)$

$= 6 \times a^2b \times (-2b^2c) \times (3ac^2)$

$= 36a^3b^3c^3$

(b) $(ab)(bc)(ca)$

$= (ab) \times (bc) \times (ca)$

$= a^2b^2c^2$

(c) $(-2xy^2)(5y)(-3z^2)$

$= (-2xy^2) \times 5y \times (-3z^2)$

$= +30xy^3z^2$

(d) $\left(\frac{5}{9}ab\right)\left(\frac{9}{7}bc\right)\left(\frac{-7}{5}ca\right)$

$= \frac{5}{9}ab \times \frac{9}{7}bc \times \left(\frac{-7}{5}ca\right)$

$= a^2b^2c^2$

3. $$= (-8x^2y^3) \times \left(\frac{1}{5}xy^2\right)$$

$$= \frac{-8}{5}x^3y^5$$

Now, putting, $x = -1$ and $y = 2$, we have

$$= \frac{-8}{5} \times (-1)^3 \times (2)^5$$

$$= \frac{-8}{5} \times -1 \times -1 \times -1 \times 2 \times 2 \times 2 \times 2 \times 2$$

$$= \frac{256}{5}$$

4. We have,

$$= (3p^2q) \times (8q^3)$$
$$= 24p^2q^4$$

Now, putting $p = 1$ and $q = \frac{-1}{4}$, we have

$$= 24 \times (1)^2 \times \left(\frac{-1}{4}\right)^4$$

$$= 24 \times 1 \times 1 \times \frac{-1}{4} \times \frac{-1}{4} \times \frac{-1}{4} \times \frac{-1}{4} = \frac{3}{32}$$

5. (a) $(-3x)(2x^2 + 6x - 7)$

$$= (-3x) \times (2x^2) + (-3x) \times (6x) + (-3x) \times (-7)$$
$$= -6x^3 - 18x^2 + 21x$$

(b) $\frac{1}{2}xy(x^2 - 2xy + y^2)$

$$= \frac{1}{2}xy \times x^2 + \frac{1}{2}xy \times (-2xy) + \frac{1}{2}xy \times y^2$$

$$= \frac{x^3y}{2} - x^2y^2 + \frac{1}{2}xy^3$$

(c) $a^2(a^3 + 3a^2b + b^3 + 3ab^2)$

$$= a^2 \times a^3 + a^2 \times 3a^2b + a^2 \times b^3 + a^2 \times 3ab^2$$
$$= a^5 + 3a^4b + a^2b^3 + 3a^3b^2$$

6. $$a^2b^2c^2 = (ab)\times(bc)\times(ca)$$

Putting $a = 3$, and $b = 4$ on both sides.

$$3^2 \times 4^2 \times c^2 = (3\times4)\times(4\times c)\times(c\times3)$$
$$9\times16\times c^2 = 12\times4c\times3c$$
$$144c^2 = 144c^2$$
$$\text{L.H.S.} = \text{R.H.S.}$$

Proved

7.
$$= \frac{5}{9}y^2z\times\frac{7}{10}x^2\times-3xz^2$$
$$= \left(\frac{5}{9}\times\frac{7}{10}\times-3\right)\times y^2z\times x^2(xz^2)$$
$$= \frac{-7}{6}\times x^3y^2z^3 = \frac{-7}{6}x^3y^2z^3$$

Putting $x = \frac{1}{2}$, $y = \frac{1}{3}$ and $z = \frac{1}{4}$ on both sides.

$$= \frac{-7}{6}\times\left(\frac{1}{2}\right)^3\times\left(\frac{1}{3}\right)^2\times\left(\frac{1}{3}\right)^3$$
$$= \frac{-7}{6}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{3}\times\frac{1}{3}\times\frac{1}{4}\times\frac{1}{4}\times\frac{1}{4}$$

8. (a) $2x(3x+y^2) = 2x\times3x+2x\times y^2 = 6x^2+2xy^2$

(b) $(-3y)(x^2+3xy) = (-3y)\times(x^2)+(-3y)\times(3xy)$
$$= -3x^2y-9xy^2$$

(c) $3a^2(4a-5a^2) = 3a^2\times4a+3a^2\times(-5a^2) = 12a^3-15a^4$

(d) $-8a^2b(-3a^2-2b)$
$$= (-8a^2b)\times(-3a^2)+(-8a^2b)\times(-2b) = 24a^4b+16a^2b^2$$

(e) $\frac{-5}{9}abc\left(\frac{18}{15}a^2bc-\frac{3}{10}abc^2\right)$
$$= \frac{-5}{9}abc\times\frac{18}{15}a^2bc+\left(\frac{-5}{9}abc\right)\times\left(\frac{-3}{10}abc^2\right)$$
$$= \frac{-2}{3}a^3b^2c^2+\frac{1}{6}a^2b^2c^3$$

(f) $7a(0.1a^2-0.5b) = 7a\times0.1\,a^2-7a\times0.5b$
$$= 0.7a^3-3.5ab$$

Exercise 8.3

1. (a) $(x^2 - a^2)(x - a)$

$$= x^2(x-a) - a^2(x-a)$$
$$= x^3 - ax^2 - a^2x + a^3$$

(b) $\left(x^3 + \frac{1}{x^3}\right)\left(x + \frac{1}{2}\right)$

$$= x^3\left(x + \frac{1}{2}\right) + \frac{1}{x^3}\left(x + \frac{1}{2}\right)$$

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

(c) $(a^2b + ab^2)(b^2c + c^2b)$

$$= a^2b(b^2c + c^2b) + ab^2(b^2c + c^2b)$$
$$= a^2b^3c + a^2b^2c^2 + ab^4c + ab^3c^2$$

(d) $(2x - y)(3x + y^2) = 2x(3x + y^2) - y(3x + y^2)$

$$= 6x^2 + 2xy^2 - 3xy - y^3$$
$$= 6x^2 - 3xy + 2xy^2 - y^3$$

(e) $(x - 3y)(x^2 + 3xy)$

$$= x(x^2 + 3xy) - 3y(x^2 + 3xy)$$
$$= x^3 + 3x^2y - 3x^2y - 9xy^2$$

(f) $\left(\frac{2}{7}x + \frac{3}{5}y\right)(x^2 + y^2) = \frac{2}{7}x(x^2 + y^2) + \frac{3}{5}y(x^2 + y^2)$

$$= \frac{2}{7}x^3 + \frac{2}{7}xy^2 + \frac{3}{5}x^2y + \frac{3}{5}y^3$$
$$= \frac{2}{7}x^3 + \frac{3}{5}x^2y + \frac{2}{y}xy^2 + \frac{3}{5}y^3$$

2. (a) $(3x^2 + 2y^2)(x + y) = 3x^2(x + y) + 2y^2(x + y)$

$$= 3x^3 + 3x^2y + 2xy^2 + 2y^3$$

Putting $x = -1$ and $y = -2$, we have

$= 3(-1)^3 + 3\times(-1)^2 \times(-2) + 2\times(-1)\times(-2)^2 + 2\times(-2)^3$

$= 3\times(-1) + 3\times1\times-2 + 2\times-1\times4 + 2\times-8$

$= -3-6-8-16 = -33$

(b) $(x^2 - y^2)(x^2 + y^2)$

$= x^2(x^2 + y^2) - y^2(x^2 + y^2)$

$= x^4 + x^2y^2 - x^2y^2 - y^4 = x^4 - y^4$

Putting $x = -1$ and $y = -2$, we have

$= (-1)^4 - (-2)^4 = 1-(+16) = 1-16 = -15$

(c) $\left(3x^2 + \frac{1}{3}y^2\right)(2y - 3x^2) = 3x^2(2y - 3x^2) + \frac{1}{3}y^2(2y - 3x^2)$

$= 6x^2y - 9x^4 + \frac{2}{3}y^3 - x^2y^2$

Putting $x = -1$ and $y = -2$, we have

$= 6\times(-1)^2 \times(-2) - 9\times(-1)^4 + \frac{2}{3}\times(-2)^3 - (-1)^2 \times(-2)^2$

$= 3\times1\times-2 - 9\times1 + \frac{2}{3}\times(-8) - 1\times4 \qquad = -12-9-\frac{16}{3}-4$

$= -25-\frac{16}{3} = \frac{-75-16}{3} = \frac{-91}{3}$

(d) $(x^4 - y^4)(x + y)$

$= x^4(x + y) - y^4(x + y) = x^5 + x^4y - xy^4 - y^5$

Putting $x = -1$ and $y = -2$, we have

$= (-1)^5 + (-1)^4 \times(-2) - (-1)\times(-2)^4 - (-2)^5$

$= -1 + 1\times-2 - (-1\times16) - (-32)$

$= -1-2+16+32 = -3+48 = 45$

(e) $\left(\frac{1}{2}x - y\right)\left(\frac{3}{5}x + y\right) = \frac{1}{2}x\left(\frac{3}{5}x + y\right) - y\left(\frac{3}{5}x + y\right)$

$= \frac{3}{10}x^2 + \frac{xy}{2} - \frac{3xy}{5} - y^2$

$= \frac{3}{10}x^2 + \left(\frac{5xy - 6xy}{10}\right) - y^2$

$= \frac{3}{10}x^2 - \frac{xy}{10} - y^2$

Putting $x = -1$ and $y = -2$, we have

$$= \frac{3}{10} \times (-1)^2 - \frac{(-1)\times(-2)}{10} - (-2)^2$$

$$= \frac{3}{10} \times 1 - \frac{2}{10} - 4 = \frac{3}{10} - \frac{2}{10} - \frac{4}{1}$$

$$= \frac{3-2-40}{10} = \frac{-39}{40}$$

(f) $(0.7x - 0.6y)(2.3x - 2y)$

$= 0.7x\,(2.3x - 2y) - 0.6y\,(2.3x - 2y)$

$= 1.61\,x^2 - 1.4xy - 1.38xy + 1.2y^2$

$= 1.61x^2 - 2.78xy + 1.2y^2$

Putting $x = -1$ and $y = -2$, we have

$= 1.61 \times (-1)^2 - 2.78 \times (-1)\times(-2) + 1.2 \times (-2)^2$

$= 1.61 \times 1 - 2.78 \times 2 + 1.2 \times 4$

$= 1.61 - 5.56 + 4.8 = 6.41 - 5.56 = 0.85$

3. (a) $(3x - 2)(5x^2 + 6x + 2)$

$= 3x(5x^2 + 6x + 2) - 2(5x^2 + 6x + 2)$

$= 15x^3 + 18x^2 6x - 10x^2 - 12x - 4 = 15x^3 + 8x^2 - 6x - 4$

(b) $(x^2 + y^2 + z^2)(xy + yz)$

$= x^2(xy + yz) + y^2(xy + yz) + z^2(xy + yz)$

$= x^3y + x^2yz + xy^3 + y^3z + xyz^2 + yz^3$

(c) $(x + y)(x^2 - xy + y^2)$

$= x(x^2 - xy + y^2) + y(x^2 - xy + y^2)$

$= x^3 - x^2y + xy^2 + x^2y - xy^2 + y^3 = x^3 + y^3$

(d) $(5x^2 + y)(3x + 2y)$

$= 5x^2(3x + 2y) + y(3x + 2y)$

$= 15x^3 + 10x^2y + 3xy + 2y^2$

(e) $(x^3 + y^3)(x^2 - xy + y^2)$

$= x^3(x^2 - xy + y^2) + y^3(x^2 - xy + y^2)$

$= x^5 - x^4y + x^3y^2 + x^2y^3 - xy^4 + y^5$

(f) $\left(\frac{3}{5}x^2 - 3y + 2\right)\left(\frac{1}{3}x - y\right)$

$$= \frac{3}{5}x^2\left(\frac{1}{3}x - y\right) - 3y\left(\frac{1}{3}x - y\right) + 2\left(\frac{x}{3} - y\right)$$

$$= \frac{1}{5}x^3 - \frac{3}{5}x^2y - xy + 3y^2 + \frac{2x}{3} - 2y$$

4. (a) $(2x^2 + 3y + 3)(2y - 3x^2)$

$= 2x^2(2y - 3x^2) + 3y(2y - 3x^2) + 3(2y - 3x^2)$

$= 4x^2y - 6x^4 + 6y^2 - 9x^2y + 6y - 9x^2$

$= -6x^4 - 5x^2y - 9x^2 + 6y^2 + 6y$

Now, putting $x = -2$ and $y = -5$, we have

$= -6 \times (-2)^4 - 5 \times (-2)^2 \times (-5) - 9 \times (-2)^2 + 6 \times (-5)^2 + 6 \times (-5)$

$= -6 \times 16 - 5 \times 4 \times (-5) - 9 \times 4 + 6 \times 25 - 30$

$= -96 + 100 - 36 + 150 - 30$

$= -162 + 250 = 88$

(b) $(x - y)(x^2 + xy + y^2)$

$= x(x^2 + xy + y^2) - y(x^2 + xy + y^2)$

$= x^3 + x^2y + xy^2 - x^2y - xy^2 - y^3 = x^3 - y^3$

Putting $x = -2$ and $y = -5$, we have

$= (-2)^3 - (-5)^3 = -8 - (-125) \quad = -8 + 125 = 117$

(c) $(2x + 3y)(4x^2 - 6xy + 9y^2)$

$= 2x(4x^2 - 6xy + 9y^2) + 3y(4x^2 - 6xy + 9y^2)$

$= 8x^3 - 12x^2y + 18xy^2 + 12x^2y - 18xy^2 + 27y^3$

$= 8x^3 + 27y^3$

Putting $x = -2$ and $y = -5$, we have

$= 8 \times (-2)^3 + 27 \times (-5)^3 = 8 \times -8 + 27 \times -125$

$= -64 - 3375 = -3439$

(d) $(x^2 + y)(x^4 - x^2y + y^2)$

$= x^2(x^4 - x^2y + y^2) + y(x^4 - x^2y + y^2)$

$= x^6 - x^4y + x^2y^2 + x^4y - x^2y^2 + y^3 = x^6 + y^3$

Putting $x = -2$ and $y = -5$, we have

$= (-2)^6 + (-5)^3 = 64 + (-125) = 64 - 125 = -61$

(e) $(3x + y)\left(\frac{4}{3}x^2 + \frac{5}{6}xy + \frac{2}{5}y^2\right)$

$= 3x\left(\frac{4}{3}x^2 + \frac{5}{6}xy + \frac{2}{5}y^2\right) + y\left(\frac{4}{3}x^2 + \frac{5}{6}xy + \frac{2}{5}y^2\right)$

$$= 4x^3 + \frac{5}{2}x^2y + \frac{6}{5}xy^2 + \frac{4}{3}x^2y + \frac{5}{6}xy^2 + \frac{2}{5}y^3$$

$$= 4x^3 + \left(\frac{5}{2} + \frac{4}{3}\right)x^2y + \left(\frac{6}{5} + \frac{5}{6}\right)xy^2 + \frac{2}{5}y^3$$

$$= 4x^3 + \left(\frac{15+8}{6}\right)x^2y + \left(\frac{36+25}{30}\right)xy^2 + \frac{2}{5}y^3$$

$$= 4x^3 + \frac{23}{6}x^2y + \frac{61}{30}xy^2 + \frac{2}{5}y^3$$

Putting $x = -2$ and $y = -5$, we have

$$= 4 \times (-2)^3 + \frac{23}{6} \times (-2)^2 \times (-5) + \frac{61}{30} \times (-2) \times (-5)^2 + \frac{2}{5} \times (-5)^3$$

$$= 4 \times (-8) + \frac{23}{6} \times 4 \times (-5) + \frac{61}{30} \times (-2) \times 25 + \frac{2}{5} \times (-125)$$

$$= \frac{(-32)}{1} - \frac{230}{3} - \frac{305}{3} - \frac{50}{1}$$

$$= \frac{-96 - 230 - 305 - 150}{3} = \frac{-781}{3}$$

(f) $(x^4 - y^4)(x^2 - xy + y^2)$

$$= x^4(x^2 - xy + y^2) - y^4(x^2 - xy + y^2)$$

$$= x^6 - x^5y + x^4y^2 - x^2y^4 + xy^5 - y^6$$

Putting $x = -2$ and $y = -5$, we have

$$= (-2)^6 - (-2)^5 \times (-5) + (-2)^4 \times (-5)^2 - (-2)^2 \times (-5)^4 + (-2)(-5)^5 - (-5)^6$$

$$= 64 - (-32) \times (-5) + 16 \times 25 - 4 \times 625 + (-2) \times (-3125) - 15625$$

$$= 64 - 160 + 400 - 2500 + 6250 - 15625$$

$$= 6714 - 18285 = -11571$$

5. (a) $3x^2(3x+2)(4x-1) = (9x^3 + 6x^2)(4x-1)$

$$= 9x^3(4x-1) + 6x^2(4x-1)$$

$$= 36x^4 - 9x^3 + 24x^3 - 6x^2$$

$$= 36x^4 + 15x^3 - 6x^2$$

(b) $(2x^2+7)(2-x)(5+x) = (2x^2+7)[2(5+x)-x(5+x)]$

$= (2x^2+7)[10+2x-5x-x^2]$

$= (2x^2+7)(10-3x-x^2)$

$= 2x^2(10-3x-x^2)+7(10-3x-x^2)$

$= 20x^2-6x^3-2x^4+70-21x-7x^2$

$= -2x^4-6x^3+13x^2-21x+70$

(c) $(3-5x)(8-3x)(2x+5) = [3(8-3x)-5x(8-3x)](2x+5)$

$= (24-9x-40x+15x^2)(2x+5)$

$= (24-49x+15x^2)(2x+5)$

$= 24(2x+5)-49x(2x+5)$

$+15x^2(2x+5)$

$= 48x+120-98x^2-245x$

$+30x^3+75x^2$

$= 30x^3-23x^2-197x+120$

(d) $(x+3)(x-3)(x-1) = [x(x-3)+3(x-3)](x-1)$

$= (x^2-3x+3x-9)(x-1)$

$= (x^2-9)(x-1)$

$= (x^2-9)(x-1)$

$= x^2(x-1)-9(x-1)$

$= x^3-x^2-9x+9$

6. (a) $(3y+2)(y-2)-(7y+3)(y-4)$

$= [3y(y-2)+2(y-2)]-[7y(y-4)+3(y-4)]$

$= [3y^2-6y+2y-4]-[7y^2-28y+3y-12]$

$= (3y^2-4y-4)-(7y^2-25y-12)$

$= 3y^2-4y-4-7y^2+25y+12$

$= -4y^2+21y+8$

(b) $(2x-3y)(x+y)-(5x+2y)(x-y)$

$= [2x(x+y)-3y(x+y)]-[5x(x-y)+2y(x-y)]$

$= [2x^2+2xy-3xy-3y^2]-[5x^2-5xy+2xy-2y^2]$

$= [2x^2-xy-3y^2]-[5x^2-3xy-2y^2]$

$= 2x^2-xy-3y^2-5x^2+3xy+2y^2$

$= -3x^2+2xy-y^2$

(c) $x^2+(3x-y)(3x+y+y^2)$

$= x^2+3x(3x+y+y^2)-y(3x+y+y^2)$

$= x^2+9x^2+3xy+3xy^2-3xy-y^2-y^3$

$= 10x^2+3xy^2-y^2-y^3$

(d) $(a^2-3a+5)(2a-3)-(5a^2+3a-3)(a-1)$

$$=[a^2(2a-3)-3a(2a-3)+5(2a-3)]-[5a^2(a-1)$$
$$+3a(a-1)-3(a-1)]$$
$$=[2a^3-3a^2-6a^2+9a+10a-15]$$
$$-[5a^3-5a^2+3a^2-3a-3a-3c+3]$$
$$=[2a^3-9a^2+19a-15]-[5a^3-2a^2-6a+3]$$
$$=2a^3-9a^2+19a-15-5a^3+2a^2+6a-3$$
$$=-3a^3-7a^2+25a-18$$

Exercise 8.4

1. (a) $64x^3y^3z^3$ by $16xyz=\dfrac{64x^3y^3z^3}{16xyz}=4x^2y^2z^2$

(b) $125x^3y^2z$ by $25xy^2z=\dfrac{125x^3y^2z}{25xy^2z}=5x^2$

(c) $64xy^3z^2$ by $64x^4yz=\dfrac{64xy^3z^2}{64x^4yz}=\dfrac{y^2z}{x^3}$

(d) $-54(x^2+y^2+z^2)$ by $(x^2+y^2+z^2)$

$$=\frac{-54(x^2+y^2+z^2)}{(x^2+y^2+z^2)}=-54$$

2. (a) $a^5+a^3+8a^2$ by a

$$=\frac{a^5+a^3+8a^2}{a}=\frac{a^5}{a}+\frac{a^3}{a}+\frac{8a^2}{a}=a^4+a^2+8a$$

(b) $2x^3+5x^2$ by x

$$=\frac{2x^3+5x^2}{x}=\frac{2x^3}{x}+\frac{5x^2}{x}=2x^2+5x$$

(c) $12a^3+3a^2+4a$ by $4a$

$$=\frac{12a^3+3a^2+4a}{4a}=\frac{12a^3}{4a}+\frac{3a^2}{4a}+\frac{4a}{4a}=3a^2+\frac{3a}{4}+1$$

(d) $x^3y^2+8x^2y+6xy$ by $2xy$

$$=\frac{x^3y^2+8x^2y+6xy}{2xy}=\frac{x^3y^2}{2xy}+\frac{8x^2y}{2xy}+\frac{6xy}{2xy}=\frac{x^2y}{2}+4x+3$$

(e) $p^4 - p^3 + 5p^2$ by p^2

$$= \frac{p^4 - p^3 + 5p^2}{p^2} = \frac{p^4}{p^2} - \frac{p^3}{p^2} + \frac{5p^2}{p^2} = p^2 - p + 5$$

(f) $6x^3y^2 - 4x^2y + 2xy$ by $\frac{2xy}{3}$

$$= \frac{3(6x^3y^2 - 4x^2y + 2xy)}{2xy} = \frac{18x^3y^2}{2xy} - \frac{12x^2y}{2xy} + \frac{6xy}{2xy}$$

$$= 9x^2y - 6x + 3$$

3. Divide :

(a) $(28x^3 - 9x^2 - 11x + 4)$ by $(7x - 4)$

$$
\begin{array}{l}
7x-4\,\big)\,28x^3 - 9x^2 - 11x + 4\,\big(\,4x^2 + x - 1 \\
\quad\;\; 28x^3 - 16x^2 \\
\quad\;\; - \qquad + \\
\hline
\qquad\qquad + 7x^2 - 11x + 4 \\
\qquad\qquad + 7x^2 - 4x \\
\qquad\qquad - \qquad + \\
\hline
\qquad\qquad\qquad - 7x + 4 \\
\qquad\qquad\qquad - 7x + 4 \\
\qquad\qquad\qquad + \quad - \\
\hline
\qquad\qquad\qquad\qquad \times
\end{array}
$$

$$(28x^3 - 9x^2 - 11x + 4) \div (7x - 4) = 4x^2 - x - 1$$

(b) $x^3 + 6x^2 + 12x + 8$ by $x + 2$

$$
\begin{array}{l}
(x+2)\,\big)\,x^3 + 6x^2 + 12x + 8\,\big(\,x^2 + 4x + 4 \\
\quad\;\; x^3 + 2x^2 \\
\quad - \quad - \\
\hline
\qquad\quad 4x^2 \qquad + 12x \\
\qquad\quad 4x^2 \qquad + 8x \\
\qquad - \qquad\qquad - \\
\hline
\qquad\qquad\qquad\quad 4x + 8 \\
\qquad\qquad\qquad\quad 4x + 8 \\
\qquad\qquad\qquad - \qquad - \\
\hline
\qquad\qquad\qquad\qquad \times
\end{array}
$$

$$(x^3 + 6x^{2+}\ 12x + 8) \div (x + 2) = x^2 + 4x + 4$$

(c) $3x^4 - x^3 + 12x^2 - \frac{4}{3}$ by $(3x-1)$

$$(3x-1)\overline{)\,3x^4 - x^3 + 12x^2 - \frac{4}{3}\,}\,(\,x^3 + 4x + \frac{4}{3}$$

$$\begin{array}{r} 3x^4 - x^3 \\ - \quad + \\ \hline 12x^2 - \frac{4}{3} \\ 12x^2 - 4x \\ - \quad + \\ \hline 4x - \frac{4}{3} \\ 4x - \frac{4}{3} \\ - \quad + \\ \hline \times \end{array}$$

$$(3x^4 - x^3 + 12x^2 - \frac{4}{3}) \div (3x-1) = x^3 + 4x + \frac{4}{3}$$

(d) $a^4 + a^3 - a - 1$ by $(a^2 + a + 1)$

$$(a^2 + a + 1)\overline{)\,a^4 + a^3 - a - 1\,}\,(\,a^2 - 1$$

$$\begin{array}{r} a^4 + a^3 + a^2 \\ - \quad - \quad - \\ \hline -a^2 - a - 1 \\ -a^2 - a - 1 \\ + \quad + \quad + \\ \hline \times \end{array}$$

$$(a^4 + a^3 - a - 1) \div (a^2 + a + 1) = a^2 - 1$$

(e) $x^5 + x^4 + x^3 + x^2 + x + 1$ by $x^3 + 1$

$$(x^3 + 1)\overline{)\,x^5 + x^4 + x^3 + x^2 + x + 1\,}\,(\,x^2 + x + 1$$

$$\begin{array}{rrrr} -x^5 & & +x^2 & \\ \hline & +x^4 & +x^3 & +x+1 \\ & -x^4 & & +x \\ \hline & & x^3 & +1 \\ & & x^3 & +1 \\ \hline & & & \times \end{array}$$

$$(x^5 + x^4 + x^3 + x^2 + x + 1) \div x^3 + 1 = x^2 + x + 1$$

(f) $x^3 - 1$ by $x - 1$

$$
\begin{array}{r|l}
 & x^2 + x + 1 \\
\hline
x - 1 & x^3 - 1 \\
 & x^3 - x^2 \\
 & - \quad + \\
\hline
 & x^2 - 1 \\
 & x^2 - x \\
 & - \quad + \\
\hline
 & x - 1 \\
 & x - 1 \\
\hline
 & \times
\end{array}
$$

(g) $3x^3 - x^2 + 4x + 4$ by $3x + 2$

$$
\begin{array}{r|l}
3x + 2 & 3x^3 - x^2 + 4x + 4 \;(x^2 - x + 2 \\
 & \underline{-}3x^3 \underline{+} 2x^2 \\
\hline
 & -3x^2 + 4x \\
 & -3x^2 - 2x \\
 & + \quad + \\
\hline
 & 6x + 4 \\
 & 6x + 4 \\
\hline
 & \times
\end{array}
$$

$(3x^3 - x^2 + 4x + 4) \div (3x + 2) = x^2 - x + 2$

(h) $p^5 - p^4 + 3p^3 + 4p^2 + 6p + 2$ by $p^2 + 1$

$$
\begin{array}{r|l}
p^2 + 1 & p^5 - p^4 + 3p^3 + 4p^2 + 6p + 2 \;(p^3 - p^2 + 2p + 5 \\
 & \underline{-}p^5 \quad \underline{+}p^3 \\
\hline
 & -p^4 + 2p^3 + 4p^2 \\
 & -p^4 \qquad -p^2 \\
\hline
 & 2p^3 + 5p^2 + 6p \\
 & 2p^3 \qquad +2p \\
 & - \qquad - \\
\hline
 & 5p^2 + 4p + 2 \\
 & 5p^2 + \quad +5 \\
 & - \qquad - \\
\hline
 & 4p - 3
\end{array}
$$

$Q = P^3 - P^2 + 2P + 5, R = 4P - 3$

(i) $3x^4 - 3x^3 + 5x^2 + x - 2$ by $3x^2 - 1$

$$
\begin{array}{l}
3x^2 - 1 \,\big)\, 3x^4 - 3x^3 + 5x^2 + x - 2 \,\big(\, x^2 - x + 2 \\
\quad\;\; 3x^4 \qquad\qquad -x^2 \\
\quad\; - \qquad\qquad\quad + \\
\hline
\qquad\quad -3x^3 + 6x^2 + x - 2 \\
\qquad\quad -3x^2 \qquad\quad +x \\
\hline
\qquad\qquad\qquad 6x^2 - 2 \\
\qquad\qquad\qquad 6x^2 - 2 \\
\hline
\qquad\qquad\qquad\qquad \times
\end{array}
$$

(j) $x^4 + 10x^3 + 41x - 17$ by $x^2 + 4$

$$
\begin{array}{l}
x^2 + 4 \,\big)\, x^4 + 10x^3 + 41x - 17 \,\big(\, x^2 + 10x - 4 \\
\quad\; x^4 \qquad\quad +4x^2 \\
\quad\; - \qquad\quad\; - \\
\hline
\qquad\quad 10x^3 - 4x^2 + 41x - 17 \\
\qquad\quad 10x^3 \qquad\quad + 40x \\
\quad\; - \qquad\qquad\quad - \\
\hline
\qquad\qquad -4x^2 + x - 17 \\
\qquad\qquad -4x^2 \qquad\quad - 16 \\
\hline
\qquad\qquad\qquad\qquad x - 1 \\
\hline
\end{array}
$$

$Q = x^2 + 10x - 4, \qquad R = (x - 1)$

(k) $a^4 + a^2 - a - 3$ by $a^2 + 6$

$$
\begin{array}{l}
a^2 + 6 \,\big)\, a^4 + a^2 - a - 3 \,\big(\, a^2 - 5 \\
\quad\; a^4 + 6a^2 \\
\quad\; - \quad - \\
\hline
\qquad -5a^2 - a - 3 \\
\qquad -5a^2 \qquad - 30 \\
\qquad\; + \qquad\quad + \\
\hline
\qquad\qquad -a + 27
\end{array}
$$

$Q = (a^2 - 5); \; R = (27 - a)$

(l) $u^3 - 14u^2 + 37u - 26$ by $u^2 - 12u + 3$

$$
\begin{array}{r|l}
u^2 - 12u + 3 & u^3 - 14u^2 + 3u - 26 \;(\; u - 2 \\
 & u^3 - 12u^2 + 3u \\
 & - \quad + \quad\quad - \\
\hline
 & -2u^2 + 34u - 26 \\
 & -2u^2 + 24u - 6 \\
 & + \quad - \quad\quad + \\
\hline
 & 10u - 20 \\
\hline
\end{array}
$$

$Q = (u - 2)$; $R = (10u - 20)$

4.

$$
\begin{array}{r|l}
2x + 3 & 8x^3 + 36x^2 + 54x + 27 \;(\; 2x + 3 \\
 & 8x^3 + 12x^2 \\
 & - \quad - \\
\hline
 & 24x^2 + 54x \\
 & 24x^2 + 36x \\
 & - \quad - \\
\hline
 & 18x + 27 \\
 & 18x + 27 \\
 & - \quad - \\
\hline
 & \times \\
\end{array}
$$

Since, $(2x + 3)$ divides $(8x^3 + 36x^2 + 54x + 27)$ exactly.
So, $(2x + 3)$ is a factor of $(8x^3 + 36x^2 + 54x + 27)$.

5.

$$
\begin{array}{r|l}
 & a^2 + a + 1 \\
\hline
a - 1 & a^3 - 1 \\
 & a^3 - a^2 \\
 & - \quad + \\
\hline
 & a^2 - 1 \\
 & a^2 - a \\
 & - \quad + \\
\hline
 & a - 1 \\
 & a - 1 \\
\hline
 & \times \\
\end{array}
$$

Since, $(a - 1)$ divides $(a^3 - 1)$ exactly.
So, $(a - 1)$ is a factor of $(a^3 - 1)$.

6.

$$
\begin{array}{l}
a^2+1\,\overline{)\,a^4+a^3+8a^2+a+p\,(}\;a^2+a+7 \\
\quad\;\; \underline{a^4+0+a^2} \\
\quad\;\; -\qquad\;\; - \\
\qquad\quad a^3+7a^2+a+p \\
\qquad\quad \underline{a^3\qquad\quad +a} \\
\qquad\quad -\qquad\quad\;\; - \\
\qquad\qquad\quad 7a^2\quad +p \\
\qquad\qquad\quad \underline{7a^2\quad +7} \\
\qquad\qquad\quad -\qquad\;\; - \\
\qquad\qquad\qquad\quad p-7
\end{array}
$$

Hence, $(a^4+a^3+8a^2+a+p)$ is divisible by (a^2+1). So, remainder should be zero.

So, $P-7=0$

or, $P=7$

7.

$$
\begin{array}{l}
y+3\,\overline{)\,2y^3-14y+k\,(}\;2y^2-6y+4 \\
\quad\;\; \underline{2y^3+6y^2} \\
\quad\;\; -\qquad\;\; - \\
\qquad\quad -6y^2-14y+k \\
\qquad\quad \underline{-6y^2-18y} \\
\qquad\quad +\qquad\;\; + \\
\qquad\qquad\quad 4y+k \\
\qquad\qquad\quad \underline{4y+12} \\
\qquad\qquad\quad -\qquad\;\; - \\
\qquad\qquad\qquad\quad k-12
\end{array}
$$

Since, $(y+3)$ is a factor of $(2y^3-14y+k)$

So, remainder. should be 0

or $k-12=0$

$$\boxed{k=12}$$

8.

$$
\begin{array}{l}
\qquad\qquad\quad x^2-4x+1 \\
x^2-2x+3\,\overline{)\,x^4-6x^3+12x^2-17x+5\,(} \\
\qquad\quad \underline{x^4-2x^3+3x^2} \\
\qquad\quad -\quad\;\; + \qquad\;\; - \\
\qquad\qquad -4x^3+9x^2-17x+5 \\
\qquad\qquad \underline{-4x^3+8x^2-12x} \\
\qquad\qquad +\qquad\;\; - \qquad\;\; +
\end{array}
$$

$$\begin{array}{r} x^2 - 5x + 5 \\ x^2 - 2x + 3 \\ - \quad + \quad - \\ \hline -3x + 2 \end{array}$$

We see that $(-3x + 2)$ is remainder. So, we have to subtract $(2 - 3x)$ from $x^4 - 6x^3 + 12x^2 - 17x + 5$ to make this exactly divisible by $(x^2 - 2x + 3)$.

Exercise 8.5

1. (a) $(2a + 3b)(2a + 3b)$

$= (2a + 3b)^2$

$= (2a)^2 + (3b)^2 + 2 \times 2a \times 3b$

$= 4a^2 + 9b^2 + 12ab$

(b) $(x + 3)(x + 3)$

$= (x + 3)^2$

$= (x)^2 + (3)^2 + 2 \times x \times 3$

$= x^2 + 9 + 6x$

(c) $\left(\frac{7}{9}x + y\right)\left(\frac{7}{9}x + y\right)$

$= \left(\frac{7}{9}x + y\right)^2$

$= \left(\frac{7}{9}x\right)^2 + (y)^2 + 2 \times \frac{7}{9}x \times y$

$= \frac{49x^2}{81} + y^2 + \frac{14xy}{9}$

(d) $\left(\frac{2}{3}x + 5\right)\left(\frac{2}{3}x + 5\right)$

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

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

$= \frac{4}{9}x^2 + 25 + \frac{20x}{3}$

2. (a) $(5x - 3y)(5x - 3y)$

$= (5x - 3y)^2 = (5x)^2 + (3y)^2 - 2 \times 5x \times 3y$

$= 25x^2 + 9y^2 - 30xy$

(b) $(y - 3)(y - 3)$

$= (y - 3)^2 = (y^2) + (3)^2 - 2 \times y \times 3 = y^2 + 9 - 6y$

(c) $\left(\frac{3}{4}x - \frac{5}{6}y\right)\left(\frac{3}{4}x - \frac{5}{6}y\right)$

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

$= \frac{9}{16}x^2 + \frac{25}{36}y^2 - \frac{5xy}{4}$

(d) $(x^2 - 5)(x^2 - 5)$

$= (x^2 - 5)^2 = (x^2)^2 + (5)^2 - 2 \times x^2 \times 5$

$= x^4 + 25 - 10x^2$

3. (a) $(5x + 9)(5x - 9)$

$= (5x)^2 - (9)^2$

$= 25x^2 - 81$

(b) $(x^3 + y^2)(x^3 - y^2)$

$= (x^3)^2 - (y^2)^2$

$= x^6 - y^4$

(c) $(x^2 y + 3z)(x^2 y - 3z)$

$= (x^2 y)^2 - (3z)^2$

$= x^4 y^2 - 9z^2$

(d) $\left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right)$

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

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

4. (a) 102^2

$= (100 + 2)^2$

$= (100)^2 + (2)^2 + 2 \times 100 \times 2$

$= 10000 + 4 + 400$

$= 10404$

(b) 89^2

$= (100 - 11)^2$

$= (100)^2 + (11)^2 - 2 \times 100 \times 11$

$= 10000 + 121 - 2200$

$= 7921$

(c) $(311)^2$

$= (300 + 11)^2$

$= (300)^2 + (11)^2 + 2 \times 300 \times 11$

$= 90000 + 121 + 6600$

(d) 72^2

$= (70 + 2)^2$

$= (70)^2 + (2)^2 + 2 \times 70 \times 2$

$=$`$4900 + 4 + 280 = 5184$

(e) 118^2

$= (120 - 2)^2$

$= (120)^2 + (2)^2 - 2 \times 120 \times 2$

$= 14400 + 4 - 480$

$= 14404 - 480$

$= 13924$

(f) 989^2

$= (1000 - 11)^2$

$= (1000)^2 + (11)^2$

$- 2 \times 1000 \times 11$

$= 1000000 + 121 - 22000$

$= 1000121 - 22000$

$= 978121$

(g) 13×7

$= (10 + 3) \times (10 - 3)$

$= (10)^2 - (3)^2$

$= 100 - 9$

$= 91$

(h) 73×67

$= (70 + 3)(70 - 3)$

$= (70)^2 - (3)^2$

$= 4900 - 9$

$= 4891$

(i) 9.3×8.7
$= (9.0 + 0.3)(9.0 - 0.3)$
$= (9.0)^2 - (0.3)^2$
$= 81.00 - 0.09$
$= 80.91$

(j) 12.5×11.5
$= (12.0 + 0.5)(12.0 - 0.5)$
$= (12.0)^2 - (0.5)^2$
$= 144.00 - 0.25$
$= 143.75$

(k) 105×95
$= (100 + 5)(100 - 5)$
$= (100)^2 - (5)^2$
$= 10000 - 25$
$= 9975$

(l) 153×147
$= (150 + 3)(150 - 3)$
$= (150)^2 - (3)^2$
$= 22500 - 9$
$= 22491$

5. (a) $49x^2 + 126xy + 81y^2$
Putting $x = 4$ and $y = 7$, we have
$= 49 \times (4)^2 + 126 \times 4 \times 7 + 81 \times (7)^2$
$= 49 \times 16 + 126 \times 28 + 81 \times 49$
$= 784 + 3528 + 3969$
$= 8281$

(b) $4x^2 - 12xy + 9y^2$
Putting $x = 4$ and $y = 7$, we have
$= 4 \times (4)^2 - 12 \times 4 \times 7 + 9 \times (7)^2$
$= 4 \times 16 - 12 \times 28 + 9 \times 49$
$= 64 - 336 + 441$
$= 505 - 336 = 169$

(c) $x^4 - y^4$
Putting $x = 4$ and $y = 7$, we have
$= (4)^4 - (7)^4$
$= 4 \times 4 \times 4 \times 4 - 7 \times 7 \times 7 \times 7$
$= 256 - 2401$
$= -2145$

6. $36x^2 + 60xy + 2y^2$
Putting $x = 4$ and $y = -7$, we have
$= 36 \times (4)^2 + 60 \times 4 \times (-7) + 2 \times (-7)^2$
$= 36 \times 16 + 60 \times (-28) + 2 \times 49$
$= 576 - 1680 + 98$
$= 674 - 1680 = -1006$

7. $64a^2 - 112ab + 49b^2$

$= (8a)^2 - 2 \times 8a \times 7b + (7b)^2 = (8a - 7b)^2$

Putting $a = \frac{1}{2}$ and $b = \frac{3}{2}$, we have

$$= \left(8 \times \frac{1}{2} - 7 \times \left(-\frac{3}{2}\right)\right)^2$$

$$= \left(4 + \frac{21}{2}\right)^2 = \left(\frac{8+21}{2}\right)^2 = \left(\frac{29}{2}\right)^2 = \frac{841}{4}$$

8. Simplify using identities :

(a) $133 \times 133 - 121 \times 121$

$= (133)^2 - (121)^2$

$= (133 + 121)(133 - 121)$

$= 254 \times 12 = 3048$

(b) $5.89 \times 5.89 - 0.11 \times 0.11$

$= (5.89)^2 - (0.11)^2$

$= (5.89 + 0.11)(5.89 - 0.11)$

$= (6.0) \times (5.78)$

$= 34.68$

(c) $\frac{93 \times 93 - 5 \times 5}{88}$

$= \frac{(93)^2 - (5)^2}{88}$

$= \frac{(93+5)(93-5)}{88}$

$= \frac{98 \times 88}{88} = 98$

(d) $\frac{3.29 \times 3.29 - 0.17 \times 0.17}{3.12}$

$= \frac{(3.29)^2 - (0.17)^2}{3.12}$

$= \frac{(3.29 + 0.17)(3.29 - 0.17)}{3.12}$

$= \frac{3.46 \times 3.12}{3.12} = 3.46$

9. Since, $x + \frac{1}{x} = 3$

Squaring the both sides, we get

$$\Rightarrow \quad \left(x + \frac{1}{x}\right)^2 = (3)^2$$

$$(x)^2 + \left(\frac{1}{x}\right)^2 + 2 \times x \times \frac{1}{x} = 9$$

$$x^2 + \frac{1}{x^2} + 2 = 9$$

$$x^2 + \frac{1}{x^2} = 7$$

10. Since, $$\left(x+\frac{1}{x}\right)=8$$

(Squaring the both sides, we get)

$$\Rightarrow \quad \left(x+\frac{1}{x}\right)^2=8^2$$

$$\Rightarrow \quad x^2+\left(\frac{1}{x}\right)^2+2\times x\times\frac{1}{x}=64$$

$$\Rightarrow \quad x^2+\frac{1}{x^2}+2=64$$

$$x^2+\frac{1}{x^2}=62$$

Now, Since $$x^2+\frac{1}{x^2}=62$$

Squaring on both sides again

$$\left(x^2+\frac{1}{x^2}\right)^2=(62)^2$$

$$(x^2)^2+\left(\frac{1}{x^2}\right)^2+2\times x^2\times\frac{1}{x^2}=3844$$

$$x^4+\frac{1}{x^4}+2=3844$$

$$x^4+\frac{1}{x^4}=3842$$

11. Since, $$\left(x-\frac{1}{x}\right)=2$$

(Squaring the both sides, we get)

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

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

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

$$x^2+\frac{1}{x^2}=6$$

12. Since, $x - \frac{1}{x} = 6$

(Squaring the both sides, we get)

$\Rightarrow \quad \left(x - \frac{1}{x}\right)^2 = (6)^2$

$$(x)^2 + \left(\frac{1}{x}\right)^2 - 2 \times x \times \frac{1}{x} = 36$$

$$x^2 + \frac{1}{x^2} - 2 = 36$$

$$x^2 + \frac{1}{x^2} = 38$$

Now, Since $x^2 + \frac{1}{x^2} = 38$

Squaring on both sides again

$$\left(x^2 + \frac{1}{x^2}\right) = 38^2$$

$$(x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2 \times x^2 \times \frac{1}{x^2} = 1444$$

$$x^4 + \frac{1}{x^4} + 2 = 1444$$

$$x^4 + \frac{1}{x^4} = 1442$$

13. Since, $x + y = 12$ and $xy = 3$ given

Squaring on both sides, we get

$$(x + y)^2 = (12)^2$$
$$x^2 + y^2 + 2xy = 12 \times 12$$
$$x^2 + y^2 + 2xy = 144$$
$$x^2 + y^2 + 2 \times 3 = 144 \qquad (\because xy = 3 \text{ given})$$
$$x^2 + y^2 + 6 = 144$$
$$x^2 + y^2 = 144 - 6$$
$$x^2 + y^2 = 138$$

14. Since, $x - y = 9$ and $xy = 2$

Squaring on both sides, we get

$$\Rightarrow \quad (x - y)^2 = (9)^2$$
$$\Rightarrow \quad (x)^2 + (y)^2 - 2xy = 81$$
$$\Rightarrow \quad x^2 + y^2 - 2 \times 2 = 81 \qquad (\because xy = 2)$$
$$\Rightarrow \quad x^2 + y^2 - 4 = 81$$
$$\Rightarrow \quad x^2 + y^2 = 81 + 4$$
$$x^2 + y^2 = 85$$

15. Since, $x + 5y = 9$ and $xy = 4$

Squaring on both sides, we get

$$(x + 5y)^2 = (9)^2$$
$$\Rightarrow \quad x^2 + 25y^2 + 10xy = 81$$
$$\Rightarrow \quad x^2 + 25y^2 + 10 \times 4 = 81 \qquad (\because xy = 4 \text{ given})$$
$$\Rightarrow \quad x^2 + 25y^2 + 40 = 81$$
$$\Rightarrow \quad x^2 + 25y^2 = 81 - 40$$
$$x^2 + 25y^2 = 41$$

16. (a) $(x + 2)(x - 2)(x^2 + 4)$

$$= (x^2 - (2)^2)(x^2 + 4) = (x^2 - 4)(x^2 + 4)$$
$$= (x^2)^2 - (4)^2 = x^4 - 16$$

(b) $(x + 1)(x - 1)(x^2 + 1)(x^4 + 1)$

$$= [x^2 - (1)^2](x^2 + 1)(x^4 + 1)$$
$$= (x^2 - 1)(x^2 + 1)(x^4 + 1)$$
$$= [(x^2)^2 - (1)^2](x^4 + 1) = (x^4 - 1)(x^4 + 1)$$
$$= (x^4)^2 - (1)^2 = (x^8 - 1)$$

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

Mental Maths :

I. Write 'T' for 'True' and 'F' for 'False' :

1. False **2.** False **3.** True **4.** True **5.** True

Chapter

9 Mensuration

Exercise 9.1

1. $a = 10$ cm (given)

We know that,

Area of equilateral $\Delta\, ABC$

$$= \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times 10^2$$

$$= \frac{\sqrt{3} \times 100}{4} \text{ cm}^2 = 25\sqrt{3} \text{ cm}^2$$

2. Area of the triangle = 54 cm^2

height = 9 cm

base = ?

$\therefore$ Area of the triangle $= \frac{1}{2}$ base $\times$ height

$$54 = \frac{1}{2} \times \text{base} \times 9$$

$$\text{base} = \frac{54 \times 2}{9} \text{ cm}$$

$$\text{base} = 6 \times 2 \text{ cm} = 12 \text{ cm}$$

3. The given, $a = 12$ cm, $b = 35$ cm and $c = 37$ cm

By Hero's formula,

$$S = \frac{a+b+c}{2} = \frac{12+35+37}{2} \text{ cm}$$

$$= \frac{84}{2} \text{ cm} = 42 \text{ cm}$$

Area of the given formula $= \sqrt{S\,(S-a)(S-b)(S-c)}$

$$= \sqrt{42\,(42-12)(42-35)(42-37)} \text{ cm}$$

$$= \sqrt{42 \times 30 \times 7 \times 5} \text{ cm}^2$$

$$= \sqrt{7 \times 6 \times 6 \times 5 \times 7 \times 5} \text{ cm}^2$$

$$= 7 \times 6 \times 5 \text{ cm}^2 = 210 \text{ cm}^2$$

4. Let the base and height of triangle be $3x$ and $5x$ respectively.

So, the are of a triangle $= \frac{1}{2}$ base $\times$ height

$$67.5 \text{ cm}^2 = \frac{1}{2} \times 3x \times 5x$$
$$135 \text{ cm}^2 = 15x^2$$
$$x^2 = 9 \text{ cm}^2$$
$$x = \sqrt{9} \text{ cm}$$
$$x = 3 \text{ cm}$$

So, the base $= 3x = 3 \times 3 \text{ cm} = 9 \text{ cm}$

height $= 5x = 5 \times 3 \text{ cm} = 15 \text{ cm}$

5. Side (a) = 2.4 cm (given)

$\therefore$ the area of an equilateral triangle

$$= \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times (2.4)^2 \text{ cm}^2$$
$$= \frac{\sqrt{3}}{4} \times 5.76 \text{ cm}^2 = \sqrt{3} \times 1.44 \text{ cm}^2$$
$$= 1.732 \times 1.44 \text{ cm}^2 = 2.494 \text{ cm}^2$$

6. Area of square $= 196 \text{ m}^2$, side = ?

We know that,

$$\text{Area of square} = \text{side}^2$$
$$196 \text{ m}^2 = \text{side}^2$$
$$\text{side} = \sqrt{196} \text{ m}$$
$$\text{side} = 14 \text{ m}$$
$$\text{Perimeter} = 4 \text{ side}$$
$$= 4 \times 14 \text{ m}$$
$$= 4 \times 1400 \text{ cm}$$
$$= 5600 \text{ cm}$$

7. Length of a rectangular room = 7.2 m

Breadth of a rectangular room = 4 m

So, area of a rectangular room = length $\times$ breadth

$$= 7.2 \times 4 \text{ m}^2 = 28.8 \text{ m}^2$$
$$= 28.8 \times 10000 \text{ cm}^2 = 288000 \text{ cm}^2$$

Length of a marble piece = 60 cm

Breadth of a marble piece = 40 cm

So, area of a marble piece = $l \times b$

$= 60 \times 40 \text{ cm}^2$

$= 2400 \text{ cm}^2$

(a) The number of marble pieces

$$= \frac{\text{Area of a rectangular room}}{\text{Area of a marble piece}}$$

$$= \frac{288000}{2400} = 120$$

(b) $\because$ Cost of flooring = ₹ 46.50 per marble piece

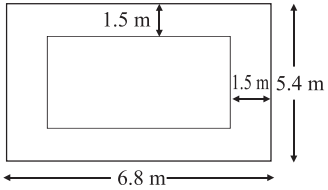
$\therefore$ Total cost = ₹ 46.50 × 120 = ₹ 5580

8. Length of a rectangular garden = 6.8 m

Breadth of a rectangular garden = 5.4 m

The area of a rectangular garden = length × breadth

$= 6.8 \times 5.4 \text{ m}^2 = 36.72 \text{ m}^2$



The area of the grassy field = $(6.8 - 3) \times (5.4 - 3) \text{ m}^2$

$= 3.8 \times 2.4 \text{ m}^2 = 9.12 \text{ m}^2$

(a) The area of the flower bed = The area of a rectangular garden – the area of the grassy field

$= (36.72 - 9.12) \text{ m}^2 = 27.60 \text{ m}^2$

(b) $\because$ Cost of growing grass = ₹ 48.50 per m^2

$\therefore$ Total cost = ₹ 43.50 × 9.12 = ₹ 396.72

9. Length of a rectangle = 14 m

Breadth of a rectangle = 12 m

Since, the perimeter of the square

= the perimeter of a rectangle

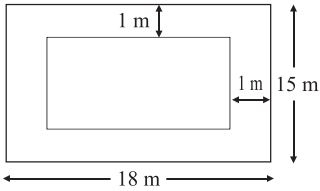
4 side = 2 (length + breadth)

$$2 \text{ side} = (14+12)\,\text{m}$$
$$\text{side} = (26 \div 2)\,\text{m}$$
$$\text{side} = 13\,\text{m}$$

So, the area of the square $= \text{side}^2 = (13)^2\ \text{m}^2 = 169\,\text{m}^2$

10. The area of covering the floor $= (18-2)(15-2)\ \text{m}^2$

$$= 16 \times 13\,\text{m}^2 = 208\,\text{m}^2$$



$\therefore$ Cost of covering the floor = ₹ 105 per m^2

$\therefore$ Total cost $= ₹\ 105 \times \dfrac{208}{200 \times 100} \times 100 \times 100$

$$= ₹\ 105 \times \frac{208}{2} = ₹\ 105 \times 104 = ₹\ 10920$$

11. The area of a square park $= 1089\,\text{m}^2$

$$\text{side}^2 = 1089\,\text{m}^2$$
$$\text{side} = \sqrt{1089}\,\text{m}$$
$$\text{side} = 33\,\text{m}$$

The perimeter of a square park = 4 side $= 4 \times 33$ m $= 132$ m

$\therefore$ The cost of fencing the park = ₹ 26.5 per metre

$\therefore$ Total cost = ₹ 26.50×132

= ₹ 3498

12. Total cost of a rectangular garden = ₹ 1312

Cost of fencing per meter = ₹ 8.00

So, the perimeter of the rectangular garden $= \dfrac{1312}{8}\,\text{m} = 164\,\text{m}$

The perimeter of the rectangular garden = 2 (length + breadth)

$$164 = 2(46 + \text{breadth})$$
$$82 = 46 + \text{breadth}$$
$$\text{breadth} = (82-46)\,\text{m}$$
$$= 36\,\text{m}$$

13. (a) Area of the (horizontal) shaded portion

i.e., $A_1 = 7.5 \times 2\ m^2 = 15\,m^2$

Area of the (vertical) shaded portion

i.e., $A_2 = 5 \times 1.5\ m^2 = 7.5\ m^2$

Area of the dark shaded portion

i.e., $A_3 = 2 \times\ 1.5\ m^2 = 3\,m^2$

$\therefore$ Area of the shaded portion $= A_1 + A_2 - A_3$

$= (15 + 7.5 - 3)\ m^2 = 19.5\ m^2$

(b) Area of the (horizontal) unshaded portion

i.e., $A_1 = 2 \times 10\,m^2 = 20\,m^2$

Area of the (vertical) unshaded $= 8 \times 2\ m^2$

i.e., $A_2 = 16\,m^2$

Area of the cross section

i.e., $A_3 = 2 \times 2\,m = 4\,m^2$

So, area of the unshaded portion = Area of outer rectangle

– Area of shaded portion + area of cross section.

$= 10 \times 8\,m^2 - (A_1 + A_2) + A_3$

$= 80\ m^2 - (20 + 16)\,m^2 + 4\ m^2$

$= 80\,m^2 - 36\,m^2 + 4\ m^2 = 48\,m^2$

14. (a) The perimeter of given figure $= 2(3+9) + 2(5+3)$

$= 2 \times 12 + 2 \times 8$

$= 24 + 16 = 40\,cm$

The area of given figure $= 3 \times 9 + 5 \times 3$

$= 27 + 15 = 42\,cm^2$

(b) The perimeter of given figure

$= (6+2+4+2+5+3+15+7)\,cm = 14\ cm$

The area of given figure $= 6 \times 7 + 4 \times 5 + 5 \times 3$

$= 42 + 20 + 15$

$= 77\,cm^2$

(c) The perimeter of the given figure

$= (7+1+2+7+2+1+7+1+2+7+2+1)\,cm$

$= 40\,cm$

The area of the given figure $= 7 \times 1 + 3 \times 7 + 7 \times 1$

$= 7 + 21 + 7 = 35\,cm^2$

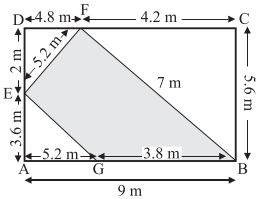
(d) The perimeter of the given figure

$$= (8+2+5+3+3+2+3+3+5+2+8+12)\,\text{m} = 56\,\text{cm}$$

The area of the given figure

$$= (8\times2+3\times3+6\times2+3\times3+8\times2)\,\text{cm}^2$$
$$= (16+9+12+9+16)\,\text{cm}^2$$
$$= 62\,\text{cm}^2$$

15. (a) In $\Delta\, BCF$,



$$BF^2 = FC^2 + BC^2$$

(Pythagoras theorem)

$$7^2 = 4.2^2 + BC^2$$
$$BC^2 = 49 - 17.64$$
$$BC^2 = 31.36$$
$$BC = \sqrt{31.36}$$
$$BC = 5.6\text{ m}$$
$$AE = AD - ED = (5.6 - 2)\text{ m}$$
$$= 3.6\text{ m} \qquad (\because AD = BC)$$

Similarly, $DF = DC - FC$

$$= (9 - 4.2)\text{ m} = 4.8\text{ m} \qquad (\because DC = AB)$$

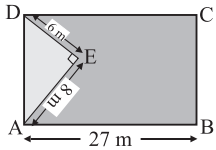
The area of shaded region

$= \text{area of } ABCD - \text{area of } \Delta\, BCF - \text{area of } \Delta\, DEF - \text{area of } \Delta\, AEB$

$$= 9\times5.6\,\text{m}^2 - \frac{1}{2}\times4.2\times5.6\,\text{m}^2 - \frac{1}{2}\times2\times4.8\,\text{m}^2 - \frac{1}{2}\times3.6\times5.2\,\text{m}^2$$

$$= 50.40\,\text{m}^2 - (11.76+4.80+9.36)\,\text{m}^2 = 50.40\,\text{m}^2 - 25.92\,\text{m}^2$$

(b) In $\Delta\, AED$,



$$AD^2 = AE^2 + DE^2$$

(Pythagoras theorem)

$$AD^2 = 8^2 + 6^2$$
$$AD^2 = (64+36)\text{m}^2$$
$$AD^2 = 100\,\text{m}^2$$
$$AD = 10\,\text{m}$$

The area of shaded region

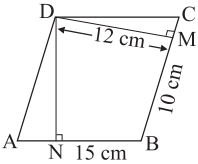
$= \text{area of } ABCD - \text{area of } \Delta\, AED$

$$= 27\times10\,\text{m}^2 - \frac{1}{2}\times6\times8\,\text{m}^2 = 270\,\text{m}^2 - 24\,\text{m}^2 = 246\,\text{m}^2$$

Exercise 9.2

1. We know that,

Area of parallelogram



$$ABCD = \text{base} \times \text{height}$$
$$= 10 \times 12\,\text{cm}^2 = 120\,\text{cm}^2$$

Also, area of parallelogram $ABCD = 120\,\text{cm}$

$$AB \times DN = 120\,\text{cm}^2$$
$$15\,\text{cm} \times DN = 120\,\text{cm}^2$$
$$DN = 8\,\text{cm}$$

Hence, the distance between the longer sides is 8 cm.

2. The area of a parallelogram $= 90\,\text{m}^2$

Let the base of the parallelogram be x m.

Then, altitude will be $\frac{2}{5}x$ m.

So, $$x \times \frac{2}{5}x = 90\,\text{m}^2$$
$$x^2 = 45 \times 5\,\text{m}^2$$
$$x^2 = 225\,\text{m}^2$$
$$x = \sqrt{225}\,\text{m}^2$$
$$x = 15\,\text{m}$$

So, $$\text{base} = x = 15\,\text{m}$$

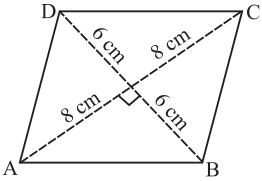
$$\text{And height} = \frac{2}{5}x = \frac{2}{5} \times 15\,\text{m} = 6\,\text{m}$$

3. $d_1 = 12$ cm, $d_2 = 16$ cm

(a) Area of rhombus $= \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 12 \times 16\,\text{cm}^2 = 96\,\text{cm}^2$

(b) Since $AC = 16\,\text{cm}$ and $BD = 12\,\text{cm}$

We know that diagonals of a rhombus bisect each other at right angle.



$$\therefore \quad OC = \frac{1}{2}(AC) = \frac{1}{2} \times 16\,\text{cm} = 8\,\text{cm}$$

$$OB = \frac{1}{2}(BD) = \frac{1}{2} \times 12\,\text{cm} = 6\,\text{cm}$$

$$\angle BOC = 90^\circ$$

$\therefore$ BOC is a right angled triangle.

By pythagoras theorem

$$BC^2 = OB^2 + OC^2 = 8^2 + 6^2 = 64 + 36$$
$$BC^2 = 100$$
$$BC = 10\,\text{cm}$$

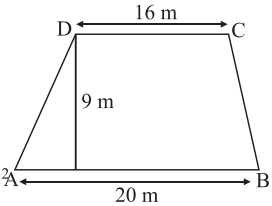
Hence, length of side is 10 cm.

(c) Perimeter of rhombus $ABCD = 4$ side $= 4 \times 10\,\text{cm} = 40\,\text{cm}$

(d) Cost of fencing the boundary of the rhombus

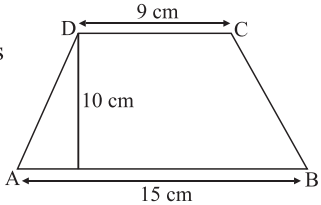
$$= ₹\ 40 \times 27.5 = ₹\ 1100$$

4. Area of the trapezium



$$= \frac{1}{2} \times \text{height} \times \text{sum of parallel sides}$$
$$= \frac{1}{2} \times 9 \times (20+16)\,\text{m}^2$$
$$= \frac{1}{2} \times 9 \times 36\,\text{m}^2 = 9 \times 18\,\text{m}^2 = 162\,\text{m}^2$$

5. Area of the trapezium



$$= \frac{1}{2} \times \text{height} \times \text{sum of parallel sides}$$
$$= \frac{1}{2} \times 10 \times (15+9)\,\text{cm}^2$$
$$= 5 \times 24\,\text{cm}^2 = 120\,\text{cm}^2$$

6. Sum of parallel side = 60 cm, $h = ?$

Area of a trapezium $= 660\,\text{cm}^2$

$\therefore$ Area of a trapezium$= \frac{1}{2} \times h \times$ sum of parallel side

$$660 = \frac{1}{2} \times h \times 60$$
$$660 \times 2 = 60h$$
$$h = 11 \times 2\ \text{cm} = 22\,\text{cm}$$

7. The Area of a trapezium $= 448\,\text{cm}^2$

height $= 14$ cm

Let two parallel sides be $3x$ and $5x$ respectively.

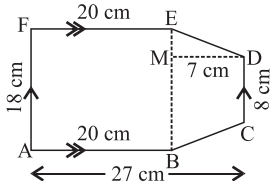
$\therefore$ The area of a trapezium $= \frac{1}{2}$ height $\times$ sum of parallel sides

$$448 \text{ cm}^2 = \frac{1}{2} \times 14 \times (3x + 5x)$$
$$64 \text{ cm} = 8x$$
$$x = (64 \div 8) \text{ cm}$$
$$x = 8 \text{ cm}$$

So, the first parallel side $= 3x = 3 \times 8$ cm $= 24$ cm

The second parallel side $= 5x = 5 \times 8$ cm $= 40$ cm

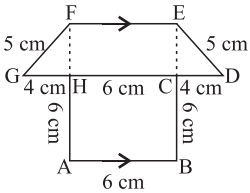
8. (a)



$\therefore$ The area enclosed figure

$$= \text{Area of } \square\, ABEF + \text{Area of } \trapezium\, BCDE$$
$$= (AB \times AE) + \frac{1}{2} \times DM \times (BE + DC)$$
$$= (20 \times 18) \text{ cm}^2 + \frac{1}{2} \times 7 \times (18 + 8) \text{ cm}^2$$
$$= 360 \text{ cm}^2 + 7 \times 13 \text{ cm}^2$$
$$= 360 \text{ cm}^2 + 91 \text{ cm}^2 = 451 \text{ cm}^2$$

(b)



Since, $ABCD$ is a square.

So, $AB = HC = 6 \text{ cm} = FE$

In ΔGHF,

$$GF^2 = GH^2 + HF^2 \qquad \text{(Pythagoras theorem)}$$
$$(5)^2 = (4)^2 + HF^2$$
$$25 = 16 + HF^2$$
$$HF = \sqrt{25 - 16} = \sqrt{9}$$
$$HF = 3 \text{ cm}$$

$\therefore$ The area enclosed figure

$$= \text{Area of } \square\, ABCH + \text{Area of } \trapezium\, GDEF$$

$$= (AB \times BC) + \frac{1}{2} \times HF \times (GD + FE)$$

$$= 6 \times 6\,\text{cm}^2 + \frac{1}{2} \times 3 \times [(4+6+4)+6]$$

$$= 36\,\text{cm}^2 + 10 \times 3\,\text{cm}^2$$

$$= 36\,\text{cm}^2 + 30\,\text{cm}^2 = 66\,\text{cm}^2.$$

9. Area of a trapezium $= 98\ \text{cm}^2$

height $= 7\,\text{cm}$

Let the second parallel side be x cm

Then, the first parallel side will be $(x+8)$ cm

$\therefore$ Area of a trapezium $= \frac{1}{2} \times \text{height} \times [x + (x+8)]$

$$98\,\text{cm}^2 = \frac{1}{2} \times 7 \times (x + x + 8)$$

$$196\,\text{cm}^2 = 7 \times (2x + 8)$$

$$28\ \text{cm} = 2x + 8$$

$$2x = (28 - 8)\,\text{cm}$$

$$x = 20 \div 2\,\text{cm} \quad \Rightarrow \quad x = 10\,\text{cm}$$

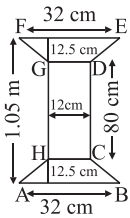
So, the first parallel side $= (x + 8)\,\text{cm} = (10 + 8)\,\text{cm} = 18\,\text{cm}$

And the second parallel sie $= 10\,\text{cm}$

10. $\therefore$ The area enclosed figure

$= \text{Area of } \trapezium\, ABCH + \text{Area of}$

$\square\, HCDG + \text{Area of } \trapezium\, GDEF$



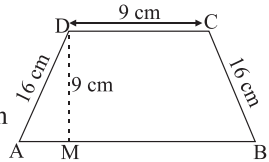
$$= \frac{1}{2} \times HN \times (AB + HC) + HC \times DC + \frac{1}{2} GM \times (GD + FE)$$

$$= \frac{1}{2} \times 12.5 \times (32+12) + 80 \times 12 + \frac{1}{2} \times 12.5 \times (32+12)$$

$$= \frac{1}{2} \times 12.5 \times 44\ \text{cm}^2 + 960\,\text{cm}^2 + \frac{1}{2} \times 12.5 \times 44$$

$$= 275\,\text{cm}^2 + 960\,\text{cm}^2 + 275\,\text{cm}^2 = 1510\,\text{cm}^2$$

11. The perimeter of a trapezium = 90 cm



$$(AB+BC+CD+DA) = 90\,\text{cm}$$
$$(AB+CD)+16+16 = 90\,\text{cm}$$
$$AB+CD = (90-32)\,\text{cm}$$
$$AB+CD = 58\,\text{cm}$$

$\therefore$ The area of a trapezium $= \frac{1}{2} \times DM \times (AB+CD)$

$$= \frac{1}{2} \times 9 \times (58)\,\text{cm}^2$$
$$= \frac{1}{2} \times 9 \times 58\,\text{cm}^2 = 261\,\text{cm}^2$$

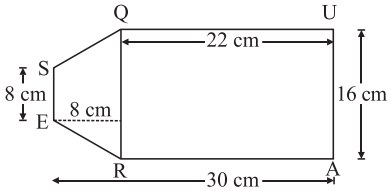
12. Let the second parallel side be x m.
Then, the first parallel side will be $2x$ cm.

$\therefore$ The area of a trapezium $= \frac{1}{2}$ height $\times$ sum of parallel side

$$180\ \text{m}^2 = \frac{1}{2} \times 12 \times (2x+x)$$
$$180\ \text{m}^2 = 6 \times 3x$$
$$x = (180 \div 18)\,\text{m}$$
$$x = 10\,\text{m}$$

So, the first parallel side is $2x = 2 \times 10 = 20\,\text{m}$
And second parallel side is $x = 10\,\text{m}$.

13. (a)



The area of enclosed figure

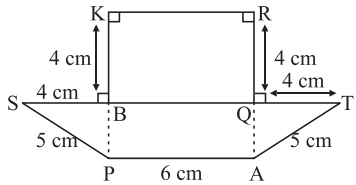
$$= \text{Area of } \trapezium\ SERQ + \text{Area of } \square\ RAUQ$$
$$= \frac{1}{2} \times EM \times (RQ+ES) + RA \times AU$$
$$= \frac{1}{2} \times 8 \times (16+8)\,\text{cm}^2 + 22 \times 16\,\text{cm}^2$$

$$= 4 \times 24\,\text{cm}^2 + 352\,\text{cm}^2$$
$$= 96\,\text{cm}^2 + 352\,\text{cm}^2 = 448\,\text{cm}^2$$

(b) By pythagoras theorem,

In ΔSBP,

$$SP^2 = SB^2 + BP^2$$
$$5^2 = 4^2 + BP^2$$
$$25 = 16 + BP^2$$
$$BP^2 = 25 - 16$$
$$BP = \sqrt{9}$$
$$BP = 3\,\text{cm}$$



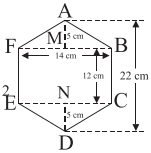
$\therefore$ The area enclosed figure = Area of $\square\, KBQR$ + Area of ⏢ $SPAT$

$$= (KR \times KB) + \frac{1}{2} \times PB \times (ST + PA)$$
$$= 6 \times 4\,\text{cm}^2 + \frac{1}{2} \times 3 \times (14 + 6)\,\text{cm}^2$$
$$= 24\,\text{cm}^2 + 10 \times 3\,\text{cm}^2$$
$$= 24\,\text{cm}^2 + 30\,\text{cm}^2 = 54\,\text{cm}^2$$

(c) The area of enclosed figure

= Area of $\Delta\, AFB$ + Area $\square\, FBCE$ + Area of $\Delta\, DCE$

$$= \frac{1}{2} \times FB \times AM + FB \times FE + \frac{1}{2} \times DN \times EC$$
$$= \frac{1}{2} \times 14 \times 5\,\text{cm}^2 + 14 \times 12\ \text{cm}^2 + \frac{1}{2} \times 5 \times 14\,\text{cm}^2$$
$$= 35\,\text{cm}^2 + 168\ \text{cm}^2 + 35\ \text{cm}^2 = 238\,\text{cm}^2$$



14. The area of the hexagon $TAGORE$ = Area of Δ TBA + Area of ⏢ $ABHG$ + Area of $\Delta\, GHO$ + Area of $\Delta\, OSR$ + Area of ⏢ $RSFE$ + Area of $\Delta\, EFT$

$$= \frac{1}{2} \times TB \times AB + \frac{1}{2} \times BH \times (AB + GH)$$
$$+ \frac{1}{2} \times HO \times HG + \frac{1}{2} \times OS \times SR$$

$$+\frac{1}{2}\times FS\times(SR+FE)$$

$$+\frac{1}{2}\times TF\times FE$$

$$=\frac{1}{2}\times 2\times 3\text{ cm}^2+\frac{1}{2}(TH-TB)\times(3+5)\text{ cm}^2$$

$$+\frac{1}{2}\times(TO-TH)\times 5\text{ cm}^2+\frac{1}{2}(TO-TS)\times 2\text{ cm}^2$$

$$+\frac{1}{2}\times(TS-TF)\times(2+4)\text{ cm}^2+\frac{1}{2}\times 4\times 4\text{ cm}^2$$

$$=3\text{ cm}^2+\frac{1}{2}\times(6-2)\times 8\text{ cm}^2+\frac{1}{2}\times(9-6)\times 5\text{ cm}^2$$

$$+\frac{1}{2}(9-7)\times 2\text{ cm}^2+\frac{1}{2}\times(7-4)\times 6\text{ cm}^2$$

$$+8\text{ cm}^2$$

$$=3\text{ cm}^2+16\text{ cm}^2+7.5\text{ cm}^2+2\text{ cm}^2+9\text{ cm}^2$$

$$+8\text{ cm}^2=45.5\text{ cm}^2$$

Exercise 9.3

1. (a) $r = 7.7$ cm (Given)

$$\text{Circumference} = 2\pi r = 2\times\frac{22}{7}\times 7.7\text{ cm} = 48.4\text{ cm}$$

$$\text{The area of the circle } = \pi r^2 = \frac{22}{7}\times 7.7\times 7.7\text{ cm}^2$$

$$= 22\times 1.1\times 7.7\text{ cm}^2 = 186.34\text{ cm}^2$$

(b) $r = 1.05$ m (Given)

$$\text{Circumference } = 2\pi r = 2\times\frac{22}{7}\times 1.05\text{ m} = \frac{44\times 1.05}{7}\text{ m} = 6.6\text{ m}$$

$$\text{The area of the circle} = \pi r^2 = \frac{22}{7}\times 1.05^2 = \frac{24.255}{7} = 3.465\text{ m}^2$$

(c) Diameter = 8.4 m (Given)

$$\therefore \qquad r = \frac{8.4}{2}\text{ m} = 4.2\text{ m}$$

$$\text{Circumference } = 2\pi r = 2\times\frac{22}{7}\times 4.2\text{ m} = 44\times 0.6\text{ m} = 26.4\text{ m}$$

$$\text{Area} = \pi r^2 = \frac{22}{7} \times 4.2 \times 4.2 \text{ m}^2 = 55.44 \text{ m}^2$$

(d) Diameter = 35 cm (Given)

$$\therefore \quad r = \frac{35}{2} \text{ cm}$$

$$\therefore \quad \text{Circumference} = 2\pi r = 2 \times \frac{22}{7} \times \frac{35}{2} \text{ cm} = 22 \times 5 \text{ cm} = 110 \text{ cm}$$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} \text{ cm}^2$$

$$= \frac{11 \times 5 \times 35}{2} \text{ cm}^2 = 962.50 \text{ cm}^2$$

2. Area = 1386 m^2 (Given)

$\because$ Area $= \pi r^2$ (Where, r = radius)

$$\pi r^2 = 1386$$

$$\frac{22}{7} \times r^2 = 1386 \text{ m}^2$$

$$r^2 = \frac{1386 \times 7}{22} \text{ cm}^2$$

$$r^2 = 63 \times 7$$

$$r^2 = 441 \text{ m}^2$$

$$r = \sqrt{441} \text{ m}$$

$$r = 21 \text{ m}$$

$$\text{Circumference} = 2\pi r = 2 \times \frac{22}{7} \times 21 \text{ m}^2 = 44 \times 3 \text{ m}^2 = 132 \text{ m}^2$$

3. $\because$ Circumference $= 2\pi r$

$$66 = 2 \times \frac{22}{7} \times r$$

$$r = \frac{66 \times 7}{2 \times 22} = 3 \times 3.5 \text{ cm} = 10.5 \text{ cm}$$

$\therefore$ Area of the circle $= \pi r^2$

$$= \frac{22}{7} \times 10.5 \times 10.5 \text{ cm}^2$$

$$= 22 \times 1.5 \times 10.5 \text{ cm}^2 = 346.5 \text{ cm}^2$$

4. We know that, $r_1 : r_2 = 3:2$ (Given)

$$\text{Area} = \pi r^2$$

So, $A_1 = \pi r_1^2$ ...(i)

$A_2 = \pi r_2^2$ ...(ii)

Divide equation (i) by equation (ii), we get

$$\frac{A_1}{A_2} = \frac{\pi r_1^2}{\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$$

$\therefore$ the ratio of their areas

i.e., $A_1 : A_2 = 9:4$

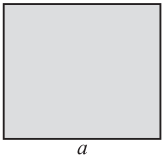
5. Given, area of a square $= 121\,\text{m}^2$

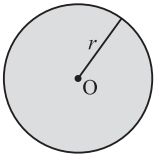
Let a be the side of the square

then area $a^2 = 121\,\text{m}^2$

$a = \sqrt{121}\,\text{m}$

$a = 11\,\text{m}$





Now, length of the wire = perimeter of the square

$= 4a = 4 \times 11\,\text{m} = 44\,\text{m}$

Let r be the radius of the circle formed by this wire.

$\therefore$ Circumference of the circle = 44 m

$$2\pi r = 44\,\text{m}$$

$$2 \times \frac{22}{7} \times r = 44\,\text{m}$$

$$r = 7\,\text{m}$$

Area of the circle $= \pi r^2 = \frac{22}{7} \times (7)^2\ \text{m}^2$

$= 22 \times 7\,\text{m}^2 = 154\,\text{m}^2$

$\therefore$ Area of the region covered increase by $(154 - 121)\,\text{m}^2 = 33\,\text{m}^2$

6. $r = 6398\,\text{km}$ (Given)

$\therefore$ The length of the equator of the Earth $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 6398\,\text{km} = 44 \times 914\,\text{km} = 40216\,\text{km}$$

7. Let r_1 be the outer radius of the circle.

Then, r_2 will be the radius of the inner circle.

Therefore, $\pi r_1^2 - \pi r_2^2 = 346.5\ \text{m}^2$

$$(r_1^2 - r_2^2) = \frac{346.5 \times 7}{22} \text{ m}^2$$

$$r_1^2 - r_2^2 = 110.25 \text{ m}^2 \qquad \ldots(i)$$

The circumference of the unshaded region = 88 m

$$2\pi r_2 = 88 \text{ m}$$

$$\frac{22}{7} \times r_2 = 44 \text{ m} \qquad \Rightarrow \qquad r_2 = 2 \times 7 = 14 \text{ m}$$

Putting the value of r_2 in equation (i), we get

$$r_1^2 - (14 \text{ m})^2 = 110.25 \text{ m}^2$$

$$r_1^2 - 196 \text{ m}^2 = 110.25 \text{ m}^2$$

$$r_1^2 = 110.25 \text{ m}^2 + 196 \text{ m}^2$$

$$r_1^2 = 306.25 \text{ m}^2$$

$$r_1 = \sqrt{306.25} \text{ m} \qquad \Rightarrow \qquad r_1 = 17.5 \text{ m}$$

So, the circumference of the outer circle

$$= 2\pi r_1 = 2 \times \frac{22}{7} \times 17.5 = \frac{770}{7} \text{ m} = 110 \text{ m}$$

8. Diameter = 210 m (Given)

$\therefore$ $r_1 = 105$ m ($\because$ $r_1 > r_2$)

$\therefore$ $r_2 = (105 - 5)$ m = 100 m

(a) Area of the path

= Area of the outer circle – Area of the inner circle.

$$= \pi (r_1^2 - r_2^2)$$

$$= \frac{22}{7}(105^2 - 100^2) \text{ m}^2$$

$$= \frac{22}{7}(11025 - 10000) \text{ m}^2 = \frac{22}{7} \times 1025 \text{ m}^2$$

$$= 3221.43 \text{ m}^2$$

(b) Cost of constructing = ₹ 42 per m^2

$\therefore$ Total cost of constructing = ₹ 42 × 3221.43 = ₹ 135300

9. Diameter = 140 cm (Given)

$\therefore$ $r = \frac{140}{2}$ cm = 70 cm

$$\text{Circumference} = 2\pi r = 2 \times \frac{22}{7} \times 70 \text{ cm} = 44 \times 10 \text{ cm} = 440 \text{ cm}$$

The number of revolutions $= \dfrac{\text{Total covered distance}}{\text{Circumference}}$

$$= \frac{61.6 \times 100}{440} = 14$$

10. Diameter $= 70$ cm (Given)

$\therefore$ $r = \dfrac{70}{2}$ cm $= 35$ cm

Circumference $= 2\pi r = 2 \times \dfrac{22}{7} \times 35$ cm

$= 44 \times 5$ cm $= 220$ cm

Number of revolutions $= 500$

Time $= 5$ min

Total covered distance by a wheel

$= 500 \times 220$ cm $= 110000$ cm or $= 1.1$ km

So, Speed of the wheel $= \dfrac{\text{distance}}{\text{time}}$

$$= \frac{1.1}{\frac{5}{60}} \text{ km/h} = \frac{1.1 \times 60}{5} \text{ km/h} = 13.2 \text{ km/h}$$

11. Let the diameters of two circles be $d_1 d_2$.

So, according to the questions,

$d_1 + d_2 = 280$ cm ...(i)

$2\pi r_1 - 2\pi r_2 = 88$

$\pi(2r_1 - 2r_2) = 88$

$\dfrac{22}{7}(d_1 - d_2) = 88$ $(\because 2r_1 = d_1, 2r_2 = d_2)$

$d_1 - d_2 = 28$ ...(ii)

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

$d_1 + d_2 = 280$ ...(i)

$d_1 - d_2 = 28$ Adding ...(ii)

$2d_1 = 308$ cm

$d_1 = (308 \div 2)$ cm $= 154$ cm

$\therefore$ $2r_1 = 154$ cm

$r_1 = 77$ cm

Similarly, $d_2 = 280 - d_1$ [from (i)]

$$d_2 = 280 - 154 \text{ cm}$$
$$d_2 = 126 \text{ cm}$$
$$2r_2 = 126 \text{ cm}$$
$$r_2 = (126 \div 2) \text{ cm} = 63 \text{ cm}$$

So, the difference of the radii of two circles

$$= r_1 - r_2 = (77 - 63) \text{ cm} = 14 \text{ cm}$$

Hence, the difference of the radii of two circles and two radii are 14 cm, 77 cm and 63 cm respectively.

12. (a) We know that,

$$\text{Area of a semicircle} = \frac{1}{2}\pi r^2$$

So, the area of the shaded portion $= \frac{1}{2}\pi r^2 - 2 \times \frac{1}{2}\pi r_1^2$

$$= \frac{1}{2} \times \frac{22}{7} \times \left(\frac{AC}{2}\right)^2 - \frac{22}{7} \times \left(\frac{AB}{2}\right)^2$$
$$= \frac{1}{2} \times \frac{22}{7} \times \left(\frac{28}{2}\right)^2 - \frac{22}{7} \times \left(\frac{28}{4}\right)^2$$
$$= \frac{22}{7} \times \left(\frac{1}{2} \times 196 - 49\right) \text{cm}^2 = \frac{22}{7} \times (98 - 49) \text{ cm}^2$$
$$= \frac{22}{7} \times 49 \text{ cm}^2 = 22 \times 7 \text{ cm}^2 = 154 \text{ cm}^2$$

(b) The area of the shaded portion $= \frac{1}{2}\pi r^2 - 2 \times \frac{1}{2}\pi r_1^2$

$$= \frac{1}{2} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^2 - \frac{22}{7} \times \left(\frac{7}{2}\right)^2$$
$$= \frac{1}{2} \times \frac{22}{7} \times \frac{21 \times 21}{2 \times 2} - \frac{22}{7} \times \frac{7 \times 7}{2 \times 2}$$
$$= \frac{11 \times 3 \times 21}{4} - \frac{11 \times 7}{2}$$
$$= \left(\frac{693}{4} - \frac{77}{2}\right) \text{cm}^2 = \left(\frac{693 - 154}{4}\right) \text{cm}^2$$
$$= \frac{539}{4} \text{ cm}^2 = 134.75 \text{ cm}^2$$

13. The perimeter of adjoining shaded region

$$= \pi OD + \pi BC - \pi AC$$

$$= \frac{22}{7}(5+2-3)\,\text{m} = \frac{22}{7} \times 4\,\text{m} = \frac{88}{7}\,\text{m} = 12.57\ \text{m}$$

The area of adjoining shaded region

$$= \frac{1}{2}\pi OD^2 + \frac{1}{2}\pi BC^2 - \frac{1}{2}\pi AC^2$$

$$= \frac{22}{2 \times 7}(5^2 + 2^2 - 3^2)\,\text{m}^2$$

$$= \frac{11}{7} \times (25+4-9)\,\text{m}^2 = \frac{11}{7} \times 20\,\text{m}^2 = \frac{220}{7}\,\text{m}^2 = 31.43\ \text{m}^2$$

14. The area of the remaining part

$$= \text{Area of } \square\ ARKD - \text{Area of semi circle}$$

$$= AD \times DK - \frac{1}{2}\pi \times \left(\frac{RA}{2}\right)^2$$

$$= 30 \times 21\,\text{cm}^2 - \frac{1}{2} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^2\ \text{cm}^2$$

$$= 630\ \text{cm}^2 - \frac{11}{7} \times \frac{21}{2} \times \frac{21}{2}\ \text{cm}^2$$

$$= 630\ \text{cm}^2 - 173.25\ \text{cm}^2 = 456.75\ \text{cm}^2$$

Exercise 9.4

1. (a) $l = 15$ cm, $b = 12$ cm and $h = 8$ cm

Volume of cuboid $= l \times b \times h$

$= 15 \times 12 \times 8 = 1440\ \text{cm}^3$

(b) $l = 4$ m, $b = 2.6$ m and $h = 80$ cm or $h = 0.80$ m

Volume of cuboid $= l \times b \times h$

$= 4 \times 2.6 \times 0.80 = 8.32\ \text{m}^3$

2. Edge of big cube $= 9$ cm

Volume of big cube $= 9\,\text{cm} \times 9\,\text{cm} \times 9\,\text{cm} = 729\,\text{cm}^3$

Edge of small cube $= 3$ cm

Volume of small cube $= 3\,\text{cm} \times 3\,\text{cm} \times 3\,\text{cm} = 27\,\text{cm}^3$

No. of cubes that can be cut $= \dfrac{729\,\text{cm}^3}{27\,\text{cm}^3} = 27$ cubes

3. Area of base of a cuboid $= 45\,\text{cm}^2$

Its height $= 6\,\text{cm}$

Volume $=$ area $\times$ height $= 45 \times 6 = 270\,\text{cm}^3$

4. $l = 1.5$ m, $b = 25$ cm or 0.25 m

$h = 150\,\text{cm}$ or 1.50 m

So, volume $= l \times b \times h$

$= 1.5 \times 0.25 \times 1.50 = 0.5625\ \text{m}^3$

5. Edge of cubical block $= 12\,\text{cm}$

Volume of cubical block $= 12 \times 12 \times 12 = 1728\,\text{cm}^3$

Volume of cubical block $= 1.2\ \text{m} \times 0.72\ \text{m} \times 0.6\ \text{m}$

or $= 120\ \text{cm} \times 72\ \text{cm} \times 60\ \text{cm}$

No. of wooden cubical block $= \dfrac{120 \times 72 \times 60}{1728} = 300$ blocks

6. (a) Let edge of cubes $= x$ cm

Then, its volume $= x \times x \times x$

$= x^3\ \text{cm}^3$

Now, according to questions

edge of cube will be $= \dfrac{x}{2}$ cm

Then, its volume $= \dfrac{x}{2} \times \dfrac{x}{2} \times \dfrac{x}{2} = \dfrac{1}{8}x^3\ \text{cm}^3$

So, volume will be $\dfrac{1}{8}$ of its original volume.

(b) Let the edge of cube $= x$ cm

Then, its volume $= x \times x \times x = x^3\ \text{cm}^3$

Now, according to questions

edge of cube will be $= 2x$

Then, its volume $= 2x \times 2x \times 2x = 8x^3$

So, volume will be 8 times of the original volume :

7. Length of soap $= 7\,\text{cm}$

Breadth of soap $= 5\,\text{cm}$

Height of soap $= 2.5$ cm

Length of the box $= 56\,\text{cm}$

Breadth of the box $= 40\,\text{cm}$

Height of the box $= 25\,\text{cm}$

So, no. of soap can be placed in the box

$$= \frac{\text{Volume of box}}{\text{Volume of a soap}}$$

$$= \frac{56 \times 40 \times 25 \times 10}{7 \times 5 \times 25} = 640 \text{ soaps}$$

8.

$$l = 4 \text{ m}$$
$$b = 3.5 \text{ m}$$
$$h = 3.0 \text{ m}$$

Volume of air = Volume of room

$$= l \times b \times h$$
$$= 4 \times 3.5 \times 3.0 = 42 \text{ m}^3$$

We know that $1 \text{ m}^3 = 1000$ litre

$$= 42 \times 1000 \text{ L}$$

So, volume of air in the room = 42000 L

9.

Length = 800 cm or 8.0 m

Breadth = 650 cm or 6.5 m

Height = ?

Volume = 104,000 litres or 104 m^3

Volume of water in a tank = 104 m^3

$$l \times b \times h = 104 \text{ m}^3$$
$$8 \times 6.5 \times h = 104$$
$$h = \frac{104}{8 \times 6.5} \text{ m}$$
$$h = 2 \text{ m}$$

So, height of tank = 2 m

10. $l = 6$ cm, $b = 6$ cm, $h = 10$ cm

Volume of brick $= l \times b \times h$

$$= 6 \times 6 \times 10$$
$$= 360 \text{ cm}^2$$

No. of bricks = 250

So, volume of wall $= 360 \times 250$

$$= 90000 \text{ cm}^3$$

or $= \frac{90000}{1000000} \text{ m}^3 = 0.09 \text{ m}^3$

11. $l = 50$ cm, $b = 40$ cm, $h = ?$

$$\text{Volume of water} = 60\,\text{dm}^3$$
$$= 60 \times 1000\,\text{cm}^3$$
$$\text{Now, volume of water} = \text{Volume of tank}$$
$$60 \times 1000 = 50 \times 40 \times h$$
$$h = \frac{60000}{50 \times 40} = 30\,\text{cm}$$
$$\text{So, the height of tank} = 30\,\text{cm}$$

12.
$$\text{Length of iron piece} = 8\,\text{cm}$$
$$\text{Breadth of iron piece} = 2\,\text{cm}$$
$$\text{Height of iron piece} = 4\,\text{cm}$$
$$\text{Volume of iron piece} = 8 \times 2 \times 4 = 64\,\text{cm}^3$$
$$\text{So, weight of iron piece} = 64 \times 12\,\text{gram} = 768\,\text{gram}$$

13. Area of the floor of a room = 67.5 sq. m

$$\text{Height of room} = h$$
$$\text{Volume of room} = 270\,\text{m}^3$$
$$\text{Volume of room} = \text{Area} \times \text{height}$$
$$270 = 67.5 \times \text{h}$$
$$h = \frac{270}{67.5}$$
$$h = 4\,\text{m}$$

14.
$$\text{Length of cuboid} = 27\,\text{cm}$$
$$\text{Breadth of cuboid} = 18\,\text{cm}$$
$$\text{Height of cuboid} = 12\,\text{cm}$$
$$\text{Volume of cuboid} = 27 \times 18 \times 12\,\text{cm}^3 = 5832\,\text{cm}^3$$
$$\text{Edge of cube} = 3\,\text{cm}$$
$$\text{Volume of cube} = 3 \times 3 \times 3 = 27\,\text{cm}^3$$
$$\text{So, no. of cubes} = \frac{\text{Volume of cuboid}}{\text{Volume of cube}} = \frac{5832}{27} = 216\,\text{cubes.}$$

15.
$$\text{Length of cake} = 40\,\text{cm}$$
$$\text{Breadth of cake} = 25\,\text{cm}$$
$$\text{Height of cake} = 12\,\text{cm}$$
$$\text{Volume of cape} = 40 \times 25 \times 12 = 12000\,\text{cm}^3$$

If each child will get 250 cm^3 of cake

$$\text{So, no. of children} = \frac{\text{Volume of cake}}{\text{One child's part}}$$

$$= \frac{12000}{250} = 48 \text{ children}$$

16. Length of hall = 16 m

Breadth of hall = 12.5 m

Height of hall = 4.5 m

Volume of hall = $l \times b \times h = 16 \times 12.5 \times 4.5 = 900 \text{ m}^3$

Each person required = 3.6 m^3 of air

$$\text{So, no. of person accommodated in a hall} = \frac{900}{3.6} = 250 \text{ persons}$$

17. Area of courtyard = 375 m^2

Height = 1 cm = 0.01 m

Volume of gravel = $375 \times 0.01 \text{ m}^3$

$= 3.75 \text{ m}^3$

So, cast of gravel = ₹ 3.75×6.40

= ₹ 24

18. Length of match box = 4 cm

Breadth of match box = 2.5 cm

Height of match box = 1.5 cm

Volume of match box = $4 \times 2.5 \times 1.5 = 15 \text{ cm}^3$

Now, volume of a packet containing 144 matchboxes

$= 15 \times 144 \text{ cm}^3 = 2160 \text{ cm}^3$

Length (l) of carton = 1.5 m or 150 cm

Breadth (b) of carton = 84 cm

Height (h) of carton = 60 cm

$$\text{So, no. of packet} = \frac{\text{Volume of carton}}{\text{Volume of a packet}}$$

$$= \frac{150 \times 84 \times 60}{2160} = 350 \text{ packets}$$

19. Length of pit = 2 m or 200 cm

Breadth of pit = 1.5 m or 150 cm

Height of pit = 8 m or 800 cm

Height of platform = 15 m

Length of platform = 12.5 m or 1250 cm

Breadth of platform = ?

Now, the dug out earth was evenly spread on platform.

So, volume of platform = volume of pit

$$15 \times 1250 \times b = 200 \times 150 \times 800$$

$$b = \frac{200 \times 150 \times 800}{15 \times 1250}$$

$$b = 1280 \text{ cm or } 12.80 \text{ m}$$

20. Rain $(h) = 5$ cm

Area of field = 5 hectare or 500 areas

$= 500 \times 100 \text{ m}^2 = 50000 \text{ m}^2$

No. volume of water = Area of field $\times$ h of rain

$= 50000 \text{ m}^2 \times 5$ cm

$= 50000 \text{ m}^2 \times \frac{5}{100}$ m

$= 2500 \text{ m}^3$

or $= 2500 \times 1000$ litres

$= 2500000$ litres

21. External length of box = 36 cm

External breadth of box = 25 cm

External height of box = 16.5 cm

External volume $= l \times b \times h$

$= 36 \times 25 \times 16.5$

$= 14850 \text{ cm}^3$

Now, box is 1.5 cm thick throught.

So, internal length $= 36 - 1.5 - 1.5 = 33$ cm

Internal breadth $= 25 - 1.5 - 1.5 = 22$ cm

Internal height $= 16.5 - 1.5 = 15$ cm

Internal volume $= l \times b \times h$

$= 33 \times 22 \times 15 = 10890$

Volume of iron $= 14850 - 10890$

$= 3960 \text{ cm}^3$

So, weight of empty iron box $= 3960 \times 8.5$ grams

$= 33660$ grams or $= 33.66$ kg

Exercise 9.5

1. (a) Edge $= 7\,\text{cm}$

Lateral surface area of cube $= 4a^2 = 4 \times 7 \times 7 = 196\,\text{cm}^2$

Total surface area of cube $= 6a^2 = 6 \times 7 \times 7 = 294\,\text{cm}^2$

(b) Edge of cube $= 8\,\text{dm}\ 5\,\text{cm}$ or $85\,\text{cm}$

Lateral surface area of cube $= 4a^2$

$= 4 \times 85 \times 85$

$= 28900\,\text{cm}^2$ or $289\,\text{dm}^2$

Total surface area of cube $= 6a^2$

$= 6 \times 85 \times 85$

$= 43350\,\text{cm}^2$ or $433.50\,\text{dm}^2$

2. $l = 14$ cm, $b = 10$ cm and height $= 12$ cm

Lateral surface area of cuboid $= 2(lh + bh)$

$= 2 \times h(l + b)$

$= 2 \times 12 \times (10 + 14)\,\text{cm}^2$

$= 24 \times 24 = 576\,\text{cm}^2$

Total surface area of cuboid $= 2(lb + bh + hl)$

$= 2(14 \times 10 + 10 \times 12 + 12 \times 14)\,\text{cm}^2$

$= 2(140 + 120 + 168)\ \text{cm}^2$

$= 2 \times 428 = 856\,\text{cm}^2$

(b) $l = 3.5$ m, $b = 32$ dm or 3.2 m, $h = 260\,\text{cm} = 2.6$ m

Lateral surface of cuboid $= 2(lh + bh)$

$= 2 \times h(l + b)$

$= 2 \times 2.6 \times (3.5 + 3.2)\ \text{m}^2$

$= 5.2 \times 6.7$

$= 34.84\ \text{m}^2$

Total surface area $= 2(lb + bh + hl)$

$= 2(3.5 \times 3.2 + 3.2 \times 2.6 + 2.6 \times 3.5)\ \text{m}^2$

$= 2(11.2 + 8.32 + 9.1)\ \text{m}^2$

$= 2 \times (28.62) = 57.24\ \text{m}^2$

3. Surface area of cube $= 600\,\text{m}^2$

Edge of the cube (a) $= ?$

$\because$ Surface area of cube $= 6a^2$

$\therefore$ $600 = 6a^2$

$$a^2 = \frac{600}{6}\,\text{m}^2$$
$$a^2 = 100\,\text{m}^2$$
$$a = \sqrt{100}\,\text{m}^2$$
$$a = 10\,\text{m}$$

So, edge of the cube $= 10\,\text{m}$

4. $l = 15$ cm, $b = 10$ cm, $h = ?$

Surface area $= 1300\,\text{cm}^2$

Surface area $= 2(lb + bh + hl)$

$$1300 = 2(15 \times 10 + 10 \times h + h \times 15)$$
$$650 = 150 + 10h + 15h$$
$$25h = 650 - 150$$
$$25h = 500$$
$$h = \frac{500}{25}$$
$$h = 20\,\text{cm}$$

5. Total surface area $= 150$ sq. cm.

We know that,

Total surface area $= 6a^2$

$$6a^2 = 150\,\text{cm}^2$$
$$a^2 = \frac{150}{6}\,\text{cm}^2$$
$$a^2 = 25\,\text{cm}^2$$
$$a = \sqrt{25}\,\text{cm}$$
$$a = 5\,\text{cm}$$

6. Total surface area $= 50$ sq. m

Lateral surface area $= 36$ sq. m

Let, Length $= l$ m

Breadth $= b$ m

Height $= h$ m

So, Total surface area $= 2(lb + bh + hl)$ ...(i)

Lateral surface of area $= 2(bh + hl)$ ...(ii)

Subtracting eq^n (ii) from eq^n (i),

we get

$$50 = 2lb + 2bh + 2hl$$
$$36 = \quad 2bh + 2hl$$
$$- \quad - \quad -$$
$$14 = 2lb$$
$$lb = 7\,\text{m}^2$$

So, area of base $= 7\,\text{m}^2$

7. Length of tin $= 60\,\text{cm}$

Breadth of tin $= 35\,\text{cm}$

Height of tin $= 24\,\text{cm}$

Lateral surface area of tin $= 2h(l+b)$

$= 2 \times 24 \times (60+35)$

$= 48 \times (95)$

$= 48 \times 95$

$= 4560\,\text{cm}^2$

Total surface area of tin $= 2(lb+bh+hl)$

$= 2(60 \times 35 + 35 \times 24 + 24 \times 60)$

$= 2 \times (2100 + 840 + 1440)$

$= 2 \times 4380 = 8760\,\text{cm}^2$

Tin sheet required for making 40 tins

$= 8760 \times 40\,\text{cm}^2$

$= 350400\,\text{cm}^2$ or $= 35.04\,\text{m}^2$

So, cost of tin sheet $=$ ₹ $25 \times 35.04 =$ ₹ 876

8. Length of a log of wood $= 2\text{m}$

$= 200\,\text{cm}$

Breadth of a log of wood $= 20\,\text{cm}$

Height of a log of wood $= 10\,\text{cm}$

Volume of a log of wood $= 200 \times 20 \times 10\ \text{cm}^3$

Length of block $= 10\,\text{cm}$

Breadth of block $= 5\,\text{cm}$

Height of block $= 4\,\text{cm}$

Volume of small block $= 10 \times 5 \times 4\ \text{cm}^3$

$$\text{No. of wooden blocks} = \frac{\text{Volume of log of wood}}{\text{Volume of wooden block}}$$

$$= \frac{200 \times 20 \times 10}{10 \times 5 \times 4}$$

$$= 200 \text{ blocks}$$

Total surface area of one small block

$$= 2(lb + bh + hl)$$
$$= 2(10 \times 5 + 5 \times 4 + 4 \times 10)\text{ cm}^2$$
$$= 2(50 + 20 + 40)\text{ cm}^2$$
$$= 2 \times (110)\text{ cm}^2$$
$$= 220\text{ cm}^2$$

So, Total surface area of 200 small blocks

$$= 200 \times 220\text{ cm}^2$$
$$= 44000\text{ cm}^2$$

9. Length of cuboid $= 64$ cm

Breadth of cuboid $= 27$ cm

Height of cuboid $= 8$ cm

Volume of cuboid $= 64 \times 27 \times 8\text{ cm}^3$

$$= 13824\text{ cm}^3$$

Given, volume of cube = volume of cuboid

or $a^3 = 13824\text{ cm}^3$

$$a = \sqrt[3]{13824}\text{ cm}$$
$$a = \sqrt[3]{24 \times 24 \times 24}\text{ cm}$$
$$a = 24\text{ cm}$$

Now, total surface area of cuboid

$$= 2(lb + bh + hl)$$
$$= 2(64 \times 27 + 27 \times 8 + 8 \times 64)\text{ cm}^2$$
$$= 2(1788 + 216 + 512)\text{ cm}^2$$
$$= 2 \times 2456\text{ cm}^2$$
$$= 4912\text{ cm}^2$$

Total surface area of cube $= 6a^2$

$$= 6 \times 24 \times 24\text{ cm}^2$$
$$= 3456\text{ cm}^2$$

So, cuboid has $(4912 - 3456)\text{ cm}^2 = 1456\text{ cm}^2$ more surface area than cube.

10. $l = 20$ m, $b = 15$ m, $h = 4$ m

$$\text{Area of four wall} = 2 \times h(l+b)$$
$$= 2 \times 4(15+20)\,\text{m}^2$$
$$= 2 \times 4 \times 35\ \text{m}^2$$
$$= 280\,\text{m}^2$$

So, cost of cementing its four wall = ₹ 50×280 = ₹ 14000

Now, area of flour $= l \times b = 20 \times 15 = 300\,\text{m}^2$

So, cost of cementing its flour = ₹ 50×300 = ₹ 15000

So, total cost of connecting = ₹ 14000 + ₹ 15000 = ₹ 29000

11. (a) $l = 1.5$ m, $b = 1.25$ m, $h = 65$ cm or 0.65 m

Area of sheet to make the box $= 2(lb + bh + hl) - lb$

$= 2(1.5 \times 1.25 + 1.25 \times 0.65 + 0.65 \times 1.5)\ \text{m}^2$

$- 1.5 \times 1.25\ \text{m}^2$

$= 2(1.875 + 0.8125 + 0.975)\ \text{m}^2 - 1.875\ \text{m}^2$

$= 2 \times 3.6625\ \text{m}^2 - 1.875\ \text{m}^2$

$= 7.325\ \text{m}^2 - 1.875\ \text{m}^2$

$= 5.45\ \text{m}^2$

(b) $7\ \text{m} \times 3.5\ \text{m}$ costs = ₹ 490

or $24.5\ \text{m}^2$ sheet costs = ₹ 490

$1\ \text{m}^2$ sheet costs = ₹ $\dfrac{490}{24.5}$

$5.45\ \text{m}^2$ sheet costs = ₹ 20×5.45 = ₹ 109

12. Total surface area of cube $= 294\ \text{cm}^2$

$$6a^2 = 294\ \text{cm}^2$$
$$a^2 = \frac{294}{6}\ \text{cm}^2$$
$$a^2 = 49\,\text{cm}^2$$
$$a = \sqrt{49}\ \text{cm}$$
$$a = 7\,\text{cm}$$

So, edge of cube $= 7\,\text{cm}$

13. So, $l = 5+5+5+5 = 20\,\text{cm}$

$b = 5\,\text{cm}$

$h = 5\,\text{cm}$

Total surface area $= 2(lb + bh + hl)$

$$= 2\times(20\times5+5\times5+5\times20)\,\text{cm}^2$$
$$= 2\times(100+25+100)$$
$$= 2\times225\ \text{cm}^2$$
$$= 450\,\text{cm}^2$$

or $= 0.0450\ \text{m}^2$

So, cost of painting $=$ ₹ 300×0.0450

$=$ ₹ 13.50

14. Let $l = 5x,\ b = 4x,\ h = 3x$

Total surface area $= 2(lb+bh+hl) = 94$ (given)

$$= 2(5x\times4x+4x\times3x+3x\times5x) = 94$$
$$= 2(20x^2+12x^2+15x^2)$$
$$= 94$$
$$= 2\times47x^2$$
$$= 94$$
$$= 94x^2$$
$$= 94$$
$$x^2 = 1$$

or $x = 1$

So, $l = 5x$

$$= 5\times1$$
$$= 5\,\text{cm}$$
$$b = 4x = 4\times1 = 4\ \text{cm}$$
$$h = 3x = 3\times1 = 3\,\text{cm}$$

15. $l = 30$ cm, $b = 20$ cm, $h = 20$ cm

Total surface area of the box

$$= 2(lb+bh+hl)$$
$$= 2(30\times20+20\times20+20\times30)\,\text{cm}^2$$
$$= 2(600+400+600)\,\text{cm}^2$$
$$= 2\times1600\ \text{cm}^2$$
$$= 3200\,\text{cm}^2$$
$$= 0.32\ \text{m}^2$$

So, cardboard needed for 250 boxes $= 250\times0.32\ \text{m}^2$

$$= 80\,\text{m}^2$$

Exercise 9.6

1. (a) $r = 8$ cm, $h = 21$ cm

Volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 8 \times 8 \times 21 \text{ cm}^3$$

$$= 4224 \text{ cm}^3$$

(b) $r = 0.2$ m, $h = 1.4$ m

Volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 0.2 \times 0.2 \times 1.4 \text{ m}^3$$

$$= 0.176 \text{ m}^3$$

2. Circumference of the base $= 176$ cm

height $= 30$ cm

Circumference $= 2\pi r$

$$2\pi r = 176 \text{ cm}^2$$

$$\frac{2 \times 22}{7} \times r = 176 \text{ cm}^2$$

$$r = \frac{176 \times 7}{2 \times 22} \text{ cm}$$

$$r = 28 \text{ cm}$$

Now, volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 28 \times 28 \times 30 \text{ cm}^3$$

$$= 73920 \text{ cm}^3$$

3. Area of base of cylinder $= 154 \text{ cm}^2$

Height $= 8$ cm

Volume of cylinder $=$ Area of base $\times$ height

$$= 154 \times 8 \text{ cm}^3$$

$$= 1232 \text{ cm}^3$$

4. $h = 20$ m

Diameter $= 7$ m

So, $r = \frac{7}{2}$ m

$$= 3.5 \text{ m}$$

$$\text{Volume of will} = \pi r^2 h$$
$$= \frac{22}{7} \times 3.5 \times 3.5 \times 20 \text{ m}^3$$
$$= 770 \text{ m}^3$$

Now, Length of plot $= 28$ m

Breadth of plot $= 11$ m

So, height of plot $= \dfrac{\text{volume of soil of well}}{\text{Area of plot}}$

$$= \frac{770}{28 \times 11} \text{ m}$$
$$= 2.5 \text{ m}$$

5. Let, Radius $= 7x$ cm

Height $= 2x$ cm

Volume $= 8316 \text{ cm}^3$

$\because$ Volume of the cylinder $= \pi r h$

$$\pi r^2 h = 8316 \text{ cm}^3$$
$$\frac{22}{7} \times (7x)^2 \times 2x = 8316 \text{ cm}^3$$
$$\frac{22}{7} \times 7x \times 7x \times 2x = 8316 \text{ cm}^3$$
$$x^3 = \frac{8316}{7 \times 2 \times 22} \text{ cm}^3$$
$$x^3 = 27 \text{ cm}^3$$
$$x = \sqrt[3]{27} \text{ cm}$$
$$x = \sqrt[3]{3 \times 3 \times 3} \text{ cm}$$
$$x = 3 \text{ cm}$$

So, radius $= 7x = 7 \times 3 = 21$ cm

and, height $= 2x = 2 \times 3 = 6$ cm

6. (a) External diameter $= 10$ cm

So, external radius $(r_1) = 5$ cm

Height $= 8$ cm

Thickness $= 2$ cm

So, internal radius $(r_2) = (5 - 2)\text{cm} = 3$ cm

Now, capacity of cylinder $= \pi r_2^2 h$

$$= \frac{22}{7} \times 3 \times 3 \times 8$$

$$= 226.28 \text{ cm}^3$$

(b) Volume of metal $= \pi (r_1^2 - r_2^2) h$ $\quad (\because r_1 > r_2)$

$$= \frac{22}{7} \times (5^2 - 3^2) \times 8 \text{ cm}^3$$

$$= \frac{22}{7} \times (25 - 9) \times 8 \text{ cm}^3$$

$$= \frac{22}{7} \times 16 \times 8 = 402.28 \text{ cm}^3$$

7. $l = 9$ cm, $b = 9$ cm, $h = 12$ cm

Volume of box $= l \times b \times h = 9 \times 9 \times 12 \text{ cm}^3$

$$= 972 \text{ cm}^3$$

For another box

Now, $r = 3.5$ cm

$h = 10$ cm

Volume of cylindrical box $= \pi r^2 h$

$$= \frac{22}{7} \times 3.5 \times 3.5 \times 10 \text{ cm}^3$$

$$= 385 \text{ cm}^3$$

Clearly box with square base has more capacity.

So, $(972 - 385) \text{ cm}^3 = 587 \text{ cm}^3$

8. $d = 1.5$ cm

$$r = \frac{1.5}{2} = 0.75 \text{ cm}$$

And height cylinder $= 16$ cm

Diameter of cylinder $= 6$ cm or $r = 3$ cm

$$\text{New, no. of coins} = \frac{\text{Volume of big cylinder}}{\text{Volume of a mental is a coin}}$$

$$= \frac{\pi \times 3 \times 3 \times 16}{\pi \times 0.75 \times 0.75 \times 0.2}$$

$$= 1280$$

So, 1280 coins needed to make required cylinder.

9. Let, It rectangular solid of size 28 cm × 11 cm × 10 cm is immersed in the water, then water will be raised h cm.

$$\text{For bucket, } r = 14 \text{ cm}$$
$$\text{Height} = h \text{ cm}$$

Therefore,

$$\text{Volume of cuboid} = \text{Volume of increase water}$$
$$28 \times 11 \times 10 = \pi \times 14 \times 14 \times h$$
$$28 \times 11 \times 10 = \frac{22}{7} \times 14 \times 14 \times h$$
$$h = \frac{28 \times 11 \times 10 \times 7}{22 \times 14 \times 14} = 5 \text{ cm}$$

10.

$$r = 154 \text{ cm or } 1.54 \text{ m}$$
$$h_1 = 3 \text{ m}$$
$$h_2 = 4.5 \text{ m}$$
$$\text{Increase in height} = h_2 - h_1 = (4.5 - 3.0) \text{ m} = 1.5 \text{ m}$$

So, increased volume of water = $\pi r^2 \times$ increased height

$$= \frac{22}{7} \times 1.54 \times 1.54 \times 1.5$$
$$= 11.1804 \text{ m}^3$$

11.

$$h_1 = 15 \text{ cm}$$
$$d_1 = 3.5 \text{ cm}$$
$$r_1 = \frac{3.5}{2} = 1.75 \text{ cm}$$
$$r_2 = 3.5 \text{ cm}$$
$$h_2 = ?$$
$$\text{Volume of old rod} = \text{Volume of new road}$$
$$\pi r_1^2 \times h_1 = \pi r_2^2 \times h_2$$
$$1.75 \times 1.75 \times 15 = 3.5 \times 3.5 \times h_2$$
$$h_2 = \frac{1.75 \times 1.75 \times 15}{3.5 \times 3.5}$$
$$h_2 = 3.75 \text{ cm}$$

So, the length of new rod will be 3.75 cm

12. (a) Radius = r

Height = h

$$\text{Volume} = \pi r^2 h$$

Now, new height $= 2h$

The new volume $= \pi r^2 \times 2h = 2 \times \pi r^2 h$

or $2 \times$ original volume

So, Volume will be doubled, when its height is doubled.

(b) Again, radius $= r$

$$\text{Height} = h$$

$$\text{Volume} = \pi r^2 h$$

$$\text{New height} = 2h$$

$$\text{New radius} = \frac{r}{2}$$

So, new volume $= \pi \left(\frac{r}{2}\right)^2 \times 2h = \pi \times \frac{r}{2} \times \frac{r}{2} \times 2h = \frac{1}{2}(\pi r^2 h)$

So, if height is doubled and radius is halved, then its volume be halved of the original volume.

(c) Radius $= r$

$$\text{Height} = h$$

$$\text{Volume} = \pi r^2 h$$

$$\text{New height} = h$$

$$\text{and new radius} = \frac{r}{2}$$

$$\text{New volume} = \pi \left(\frac{r}{2}\right)^2 \times h$$

$$= \pi \times \frac{r}{2} \times \frac{r}{2} \times h = \frac{1}{4} \pi r^2 h$$

So, if height is same and the radius is halved, then its volume will be one fourth of the original volume.

13. A rectangular piece of paper of with 30 cm and length 77 cm is rolled along its width to form a cylinder.

So, width the becomes its height = 30 cm

and length will becomes its circumference = 77 cm

So, $2\pi r = 77$

$$\frac{2 \times 22 \times r}{7} = 77 \text{ cm}$$

$$r = \frac{77 \times 7}{2 \times 22} \text{ cm} \quad \Rightarrow \quad r = 12.25 \text{ cm}$$

So, Volume of cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times 12.25 \times 12.25 \times 30 \text{ cm}^3$$

$$= 14148.75 \text{ cm}^3$$

Exercise 9.7

1. (a) $r = 5.6$ m, $h = 1.25$ m

Curved surface area of cylinder $= 2\pi rh$

$$= 2 \times \frac{22}{7} \times 5.6 \times 1.25 = 44 \text{ m}^2$$

Total surface area of cylinder

$$= 2\pi r(h + r)$$

$$= 2 \times \frac{22}{7} \times 5.6 \times (5.6 + 1.25) \text{ m}^2$$

$$= \frac{44 \times 5.6 \times 6.85}{7} \text{ m}^2$$

$$= \frac{1687.84}{7} \text{ m}^2$$

$$= 241.12 \text{ m}^2$$

(b) $r = 14$ m

$h = 15$ m

Curved surface area of the cylinder $= 2\pi rh$

$$= 2 \times \frac{22}{7} \times 14 \times 15 \text{ m}^2$$

$$= 2 \times 22 \times 2 \times 15 \text{ m}^2$$

$$= 1320 \text{ m}^2$$

Total surface area of the cylinder $= 2\pi r(h + r)$

$$= 2 \times \frac{22}{7} \times 14 \times (14 + 15) \text{ m}^2$$

$$= 2 \times \frac{22}{7} \times 14 \times 29 \text{ m}^2$$

$$= 2 \times 22 \times 2 \times 29 \text{ m}^2$$

$$= 2552 \text{ m}^2$$

2. Volume of the cylinder $= 5544 \text{ cm}^3$

$$h = 16 \text{ cm}$$

$$r = ?$$

$$\text{Volume} = \pi r^2 h$$

$$\pi r^2 h = 5544 \text{ cm}^3$$

$$\frac{22}{7} \times r^2 \times 16 = 5544 \text{ cm}^3$$

$$r^2 = \frac{5544 \times 7}{22 \times 16} \text{ cm}^2$$

$$r^2 = 110.25 \text{ cm}^2$$

$$r = \sqrt{110.25} \text{ cm}$$

$$r = 10.5 \text{ cm}$$

Now, Curved surface area of the cylinder $= 2\pi rh$

$$= 2 \times \frac{22}{7} \times 10.5 \times 16 \text{ cm}^2$$

$$= 2 \times 22 \times 1.5 \times 6 \text{ cm}^2$$

$$= 1056 \text{ cm}^2$$

3. Circumference $= 308$ cm

Height $= 40$ cm

Curved surface area of the cylinder

$$= \text{Circumference of base} \times \text{height}$$

$$= 308 \times 40 \text{ cm}^2$$

$$= 12320 \text{ cm}^2$$

4. $h = 14$ cm

Curved surface area of the cylinder $= 176$ sq. cm

$$r = ?$$

Curved surface area of the cylinder $= 2\pi rh$

$$2\pi rh = 176 \text{ cm}^2$$

$$2 \times \frac{22}{7} \times r \times 14 = 176 \text{ cm}^2$$

$$r = \frac{176}{2 \times 22 \times 2} \text{ cm}$$

$$r = 2 \text{ cm}$$

5. $d = 3.5$ m

So, $r = \frac{3.5}{2}$ m $= 1.75$ m

$h = 7$ m

Total surface area of the cylinder

$$= 2\pi r(h+r)$$
$$= 2 \times \frac{22}{7} \times 1.75 \times (7 + 1.75)\ \text{m}^2$$
$$= 2 \times \frac{22}{7} \times 1.75 \times 8.75\ \text{m}^2$$
$$= 96.25\ \text{m}^2$$

But it is open at one side, so area to be painted

$$= 96.25 - \pi r^2$$
$$= \left(96.25 - \frac{22}{7} \times 1.75 \times 1.75\right)\text{m}^2$$
$$= (96.25 - 9.625)\text{m}^2$$
$$= 86.625\ \text{m}^2$$

Now, cost of painting $=$ ₹ $5 \times 86.25 =$ ₹ 433.125

6. Let, $r = 7x$ cm

$h = 2x$ cm

Volume of cylinder $= \pi r^2 h = 8316\ \text{cm}^3$

$$\frac{22}{7} \times 7x \times 7x \times 2x = 8316\ \text{cm}^3$$
$$x^3 = \frac{8316}{22 \times 7 \times 2}\ \text{cm}^3$$
$$x^3 = 27\ \text{cm}^3$$
$$x = \sqrt[3]{27}\ \text{cm}^3$$
$$x = \sqrt[3]{3 \times 3 \times 3}\ \text{cm}$$
$$x = 3\ \text{cm}$$

So, $r = 7x = 7 \times 3 = 21$ cm

$h = 2x = 2 \times 3 = 6$ cm

So, total surface area of the cylinder $= 2\pi r(h+r)$

$$= 2 \times \frac{22}{7} \times 21 \times (21 + 6)\ \text{cm}^2$$

$$= 2 \times 22 \times 3 \times 27 \text{ cm}^2$$
$$= 3564 \text{ cm}^2$$

7. Given,

$$r_1 : r_2 = 2:3 \text{ and } h_1 : h_2 = 5:4$$

Let $r_1 = 2x$ Let $h_1 = 5y$

$r_2 = 3x$ $h_2 = 4y$

$$V_1 : V_2$$
$$\pi r_1^2 h_1 = \pi r_2^2 h^2$$
$$(2x)^2 \times 5y = (3x)^2 \times 4y$$

So, $$\frac{V_1}{V_2} = \frac{4x^2 \times 5y}{9x^2 \times 4y} = \frac{5}{9}$$

So, $$\frac{V_1}{V_2} = 5:9$$

Now, $$S_1 : S_2$$
$$2\pi r_1 h_1 : 2\pi r_2 h_2 = \frac{2x \times 5y}{3x \times 4y} = \frac{5}{6}$$

So, $$S_1 : S_2 = 5:6$$

8. Let, $$r = x \text{ m}$$

Then, $$h = (37 - x) \text{ m}$$
$$\text{Total surface area} = 1628 \text{ m}^2$$
$$2\pi r(h + r) = 1628 \text{ m}^2$$
$$2\pi x(x + 37 - x) = 1628 \text{ m}^2$$
$$2\pi x \times 37 = 1628 \text{ m}^2$$
$$2 \times \frac{22}{7} \times x \times 37 = 1628 \text{ m}^2$$
$$x = \frac{1628 \times 7}{2 \times 22 \times 37} \text{ m}$$
$$x = 7 \text{ m}$$

So, $$r = x = 7 \text{ m}$$
$$h = 37 - x = (37 - 7) \text{ m} = 30 \text{ m}$$

Now, volume $$= \pi r^2 h = \frac{22}{7} \times 7 \times 7 \times 30 \text{ m}^3$$
$$= 4620 \text{ m}^3$$

9. $r = 14$ cm

Height of a plate (h) = thickness of a plate = 3 cm

Number of plates = 30

So, total height of the solid formed $= 3 \times 30 = 90$ cm

Now, total surface area of the solid $= 2\pi r(h + r)$

$$= 2 \times \frac{22}{7} \times 14 \times (14 + 90) \text{ cm}^2$$

$$= 2 \times 22 \times 2 \times 104 \text{ cm}^2$$

$$= 9152 \text{ cm}^2$$

10. $d = 2.1$ m

$$r = \frac{2.1}{2} \text{ m}$$

$$= 1.05 \text{ m}$$

$h = 14$ m

Curved surface area of the well $= 2\pi rh$

$$= 2 \times \frac{22}{7} \times 1.05 \times 14 \text{ m}^2$$

$$= 92.4 \text{ m}^2$$

Total cost of plastering = ₹ 5×92.4 = ₹ 462

11. $h = 1$ m

$d = 140$ cm or 1.40 m

So, $r = \frac{1.40}{2}$ m $= 0.70$ m

Sheet required = Total surface area of cylindrical tank

$$= 2\pi r(h + r)$$

$$= 2 \times \frac{22}{7} \times 0.70 \times (1 + 0.70) \text{ m}^2$$

$$= 2 \times \frac{22}{7} \times 0.70 \times 1.70 \text{ m}^2 = 7.48 \text{ m}^2$$

So, 7.48 m^2 sheet are required

12. Total surface area $= 462 \text{ cm}^2$

Curved surface area $= \frac{1}{3} \times$ Total surface area

$$= \frac{1}{3} \times 462 \text{ cm}^2 = 154 \text{ cm}^2$$

Now, we know that

$$\text{Total surface area} = \text{Curved surface area} + 2\pi r^2$$
$$462 = 154 + 2\pi r^2$$
$$2\pi r^2 = (462 - 154)\ \text{cm}^2$$
$$2 \times \frac{22}{7} \times r^2 = 308\ \text{cm}^2$$
$$r^2 = \frac{308 \times 7}{2 \times 22}\ \text{cm}^2$$
$$r^2 = 49\ \text{cm}^2$$
$$r = \sqrt{49}\ \text{cm} \qquad \Rightarrow \qquad r = 7\ \text{cm}$$

Again curved surface area $= 154\ \text{cm}^2$

$$2\pi rh = 154\ \text{cm}^2$$
$$2 \times \frac{22}{7} \times 7 \times h = 154\ \text{cm}$$
$$h = \frac{154}{2 \times 22}\ \text{cm}$$

$\Rightarrow$ $h = 3.5$ cm

So, volume $= \pi r^2 h$

$$= \frac{22}{7} \times 7 \times 7 \times 3.5\ \text{cm}^3$$
$$= 539\ \text{cm}^3$$

13. Let Outer radius $= r_1$ cm

And inner radius $= r_2$ cm

$h = 14$ cm

According to the questions,

Outer surface area $= 2\pi r_1 h = 2 \times \pi \times r_1 \times 14\ \text{cm}^2$

$$S_1 = 28\pi r_1 \qquad \ldots\text{(i)}$$

Inner surface Area $= 2\pi r_2 h = 2 \times \pi \times r_2 \times 14$

$$S_2 = 28\pi r_2 \qquad \ldots\text{(ii)}$$

From eq^n (i) and (ii), we get

$$28\pi r_1 - 28\pi r_2 = 44\ \text{cm}^2 \qquad \text{(given)}$$
$$28\pi (r_1 - r_2) = 44\ \text{cm}^2$$
$$28 \times \frac{22}{7} \times (r_r - r_2) = 44\ \text{cm}^2$$

$$r_1 - r_2 = \frac{44}{22 \times 4} \text{ cm}$$

or $$(r_1 - r_2) = 0.5 \text{ cm} \quad \ldots\text{(iii)}$$

Now, volume of pipe $= 99 \text{ cm}^3$

$$\pi (r_1^2 - r_2^2) \times h = 99 \text{ cm}^3$$

$$\pi (r_1 + r_2)(r_1 - r_2) \times 14 = 99 \text{ cm}^3$$

Now, putting the value of $(r_1 - r_2)$ from

$$\frac{22}{7} \times 14 \times (r_1 + r_2) \times 0.5 = 99 \text{ cm}^3$$

$$r_1 + r_2 = \frac{99 \times 10}{22 \times 2 \times 0.5} \text{ cm}$$

$$r_1 + r_2 = 4.5 \text{ cm} \quad \ldots\text{(iv)}$$

Now, equation (iii) + (iv)

$$r_1 + r_2 = 4.5 \quad \ldots\text{(iv)}$$

$$r_1 - r_2 = 0.5 \quad \ldots\text{(iii)}$$

$$2r_1 = 5.0 \text{ cm}$$

$$r_1 = \frac{5.0}{2} \text{ cm}$$

$$r_1 = 2.5 \text{ cm}$$

Putting the value of r_1 in equation (iv)

$$2.5 + r_2 = 4.5 \text{ cm}$$

$$r_2 = (4.5 - 2.5) \text{ cm}$$

$$r_2 = 2.0 \text{ cm}$$

So, outer radius = 2.5 cm and inner radius = 2.0 cm.

14. $$d = 48 \text{ cm}$$

So, $$r = \frac{48}{2} \text{ cm} = 24 \text{ cm or } 0.24 \text{ m}$$

$$h = 7 \text{ m}$$

Now curved surface area of 1 pillar

$$= 2\pi rh = 2 \times \frac{22}{7} \times 0.24 \times 7 \text{ m}^2$$

$$= 10.56 \text{ m}^2$$

Curved surface area of 15 pillars $= 10.56 \times 15 \text{ m}^2 = 158.4 \text{ m}^2$

So, cost of painting = ₹ 2.50 × 158.4 = ₹ 396

15. $h = 20\,\text{cm}$

External $d = 25\,\text{cm}$

So, external radius $= \frac{25}{2}\,\text{cm} = 12.5\text{ cm}$

Now, thickness $= 1\,\text{cm}$

So, $r = 12.5\text{ cm} - 1\text{ cm} = 11.5\text{ cm}$

Now, total surface area of hollow pipe

$$= 2\pi(R+r)(h+R-r)$$
$$= 2\pi\,(R+r)(h+R-r)$$
$$= 2\times\frac{22}{7}\times(12.5+11.5)(20+12.5-11.5)\,\text{cm}^2$$
$$= 2\times\frac{22}{7}\times 24\times 21\,\text{cm}^2$$
$$= 3168\,\text{cm}^2$$

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

Mental Maths :

Fill in the blanks :

1. Unit of measurement of area is **square** centimetre.
2. Area of an equilateral triangle $= \frac{\sqrt{3}}{4}\,a^2$.
3. Area of a square = **side**^{2}.
4. The parallel sides are called the **bases** of the trapezium.
5. **Diameter** is a chord passing through the centre of the circle.
6. Circumference of a circle = $2\pi r$.
7. Volume of a cuboid = $l \times b \times h$.
8. Volume of a cube = a^3.
9. Sum of the areas of all the six faces of a cuboid is called **total surface area**.
10. $1\text{ m}^3 = 1000\text{ dm}^3$.
11. Surface area of a cylinder = $2\pi rh$.

Chapter 10

Exponents and Powers

Exercise 10.1

1. (a) $\frac{3}{4}\times\frac{3}{4}\times\frac{3}{4}=\left(\frac{3}{4}\right)^3$

(b) $\frac{9}{11}\times\frac{9}{11}\times\frac{9}{11}\times\frac{9}{11}=\left(\frac{9}{11}\right)^4$

(c) $\frac{-11}{3}\times\frac{-11}{3}=\left(\frac{-11}{3}\right)^2$

(d) $\frac{-3}{7}\times\frac{-3}{7}\times\frac{-3}{7}\times\frac{-3}{7}\times\frac{-3}{7}$

$=\left(\frac{-3}{7}\right)^5$

2. (a) $\frac{32}{243}=\frac{2\times2\times2\times2\times2}{3\times3\times3\times3\times3}=\left(\frac{2}{3}\right)^5$

(b) $\frac{81}{25}=\frac{9\times9}{5\times5}=\left(\frac{9}{5}\right)^2$

(c) $\frac{64}{169}=\frac{8\times8}{13\times13}=\left(\frac{8}{13}\right)^2$

(d) $\frac{256}{289}=\frac{16\times16}{17\times17}=\left(\frac{16}{17}\right)^2$

(e) $\frac{49}{25}=\frac{7\times7}{5\times5}=\left(\frac{7}{5}\right)^2$

(f) $\frac{125}{64}=\frac{5\times5\times5}{4\times4\times4}=\left(\frac{5}{4}\right)^3$

(g) $\frac{-1}{125}=\frac{-1\times-1\times-1}{5\times5\times5}=\left(\frac{-1}{5}\right)^3$

(h) $\frac{-27}{512}=\frac{-3\times-3\times-3}{8\times8\times8}=\left(\frac{-3}{8}\right)^3$

3. (a) $\left(\frac{7}{2}\right)^2=\frac{7\times7}{2\times2}=\frac{49}{4}$

(b) $\left(\frac{-4}{5}\right)^4=\frac{-4\times-4\times-4\times-4}{5\times5\times5\times5}=\frac{256}{625}$

(c) $\left(\frac{-3}{4}\right)^5=\frac{-3\times-3\times-3\times-3\times-3}{4\times4\times4\times4\times4}=\frac{-243}{1024}$

(d) $\left(\frac{4}{7}\right)^3=\frac{4\times4\times4}{7\times7\times7}=\frac{64}{343}$

(e) $\left(\frac{3}{5}\right)^3 = \frac{3\times3\times3}{5\times5\times5} = \frac{27}{125}$

(f) $\left(\frac{-1}{3}\right)^7 = \frac{-1\times-1\times-1\times-1\times-1\times-1\times-1}{3\times3\times3\times3\times3\times3\times3} = \frac{-1}{2187}$

(g) $\left(\frac{-13}{11}\right)^2 = \frac{-13\times-13}{11\times11} = \frac{169}{121}$

(h) $\left(\frac{-7}{5}\right)^5 = \frac{-7\times-7\times-7\times-7\times-7}{5\times5\times5\times5\times5} = \frac{-16807}{3125}$

4. (a) The reciprocal of $\frac{5}{7} = \frac{7}{5}$

(b) The reciprocal of $9 = \frac{1}{9}$

(c) The reciprocal of $-3 = \frac{-1}{3}$

(d) The reciprocal of $\frac{-11}{3} = \frac{-3}{11}$

(e) The reciprocal of $\left(\frac{1}{13}\right)^4 = (13)^4$

(f) The reciprocal of $\left(\frac{-19}{7}\right)^2 = \left(\frac{7}{-19}\right)^2$

(g) The reciprocal of $\left(\frac{17}{-15}\right)^3 = \left(\frac{-15}{17}\right)^3$

(h) The reciprocal of $\left(\frac{-8}{-5}\right)^5 = \left(\frac{-5}{-8}\right)^5$

5. (a) $\left(\frac{-6}{7}\right)^5 \times \left(\frac{-2}{6}\right)^6 = \frac{-6\times-6\times-6\times-6\times-6}{7\times7\times7\times7\times7}$

$$\times \frac{-2\times-2\times-2\times-2\times-2\times-2}{6\times6\times6\times6\times6\times6}$$

$$= \frac{-32}{50421}$$

(b) $\left(\frac{2}{3}\right)^4 \times \left(\frac{1}{3}\right)^2 = \frac{2\times2\times2\times2}{3\times3\times3\times3} \times \frac{1\times1}{3\times3} = \frac{16}{729}$

(c) $\left(\frac{-1}{3}\right)^5 \times 2^3 \times \left(\frac{3}{4}\right)^4 = \frac{-1}{3} \times \frac{-1}{3} \times \frac{-1}{3} \times \frac{-1}{3} \times \frac{-1}{3} \times \frac{2}{1} \times \frac{2}{1} \times \frac{2}{1}$

$\times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{-1}{96}$

(d) $\left(\frac{-4}{7}\right)^2 \times \left(\frac{3}{4}\right)^3 \times \left(\frac{7}{5}\right)^8 = \frac{-4}{7} \times \frac{-4}{7} \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4}$

$\times \frac{7}{5} \times \frac{7}{5} \times \frac{7}{5} \times \frac{7}{5} \times \frac{7}{5} \times \frac{7}{5} \times \frac{7}{5} \times \frac{7}{5} \times \frac{7}{5} = \frac{3176523}{1562500}$

6. (a) $\left(\frac{3}{11}\right)^8 \div \left(\frac{3}{11}\right)^5 = \left(\frac{3}{11}\right)^{8-5} = \left(\frac{3}{11}\right)^3 = \frac{3\times3\times3}{11\times11\times11} = \frac{27}{1331}$

(b) $\left(\frac{13}{17}\right)^{15} \div \left(\frac{13}{17}\right)^{11} = \left(\frac{13}{17}\right)^{15-11} = \left(\frac{13}{17}\right)^4$

$= \frac{13\times13\times13\times13}{17\times17\times17\times17} = \frac{28561}{83521}$

(c) $\left(\frac{4}{15}\right)^6 \div \left(\frac{4}{15}\right)^9 = \left(\frac{4}{15}\right)^{6-9} = \left(\frac{4}{15}\right)^{-3} = \left(\frac{15}{4}\right)^3$

$= \frac{15\times15\times15}{4\times4\times4} = \frac{3375}{64}$

(d) $\left(\frac{15}{19}\right)^{11} \div \left(\frac{15}{19}\right)^8 = \left(\frac{15}{19}\right)^{11-8} = \left(\frac{15}{19}\right)^3 = \frac{15\times15\times15}{19\times19\times19} = \frac{3375}{6859}$

7. (a) $\left(\frac{-1}{9}\right)^{-1} = \left(\frac{-9}{1}\right)^1 = -9$ (b) $\left(\frac{7}{13}\right)^{-1} = \left(\frac{13}{7}\right)^1 = \frac{13}{7}$

(c) $(-5)^{-1} \times \left(\frac{1}{5}\right)^{-1} = \left(\frac{-1}{5}\right)^1 \times \left(\frac{5}{1}\right)^1 = \frac{-1}{5} \times \frac{5}{1} = -1$

(d) $(-9)^{-1} = \left(\frac{-1}{9}\right)^1 = \frac{-1}{9}$

(e) $(6^{-1} - 7^{-1})^{-1} = \left(\frac{1}{6} - \frac{1}{7}\right)^{-1} = \left(\frac{7-6}{42}\right)^{-1} = \left(\frac{1}{42}\right)^{-1} = (42)^1 = 42$

(f) $\left(\frac{3}{7}\right)^{-1} \times \left(\frac{7}{5}\right)^{-1} = \left(\frac{7}{3}\right)^{1} \times \left(\frac{5}{7}\right)^{1} = \frac{7}{3} \times \frac{5}{7} = \frac{5}{3}$

8. (a) $\left(\frac{9}{5}\right)^{-3} \times \left(\frac{12}{7}\right)^{0} \times 5^{-3} \times \left(\frac{1}{9}\right)^{-1} = \left(\frac{5}{9}\right)^{3} \times 1 \times \left(\frac{1}{5}\right)^{3} \times 9$

$$= \frac{5}{9} \times \frac{5}{9} \times \frac{5}{9} \times 1 \times \frac{1}{5} \times \frac{1}{5} \times \frac{1}{5} \times 9 = \frac{1}{81}$$

(b) $\left[\left\{\left(\frac{2}{5}\right)^{4}\right\}^{2} \div \left(\frac{2}{5}\right)^{2}\right] \times \left(\frac{1}{2}\right)^{-2} \times 2^{-1} \times \left(\frac{1}{4}\right)^{-1}$

$$= \left[\left\{\frac{2}{5}\right\}^{8} \div \left(\frac{2}{5}\right)^{2}\right] \times \frac{(2)^2}{1^2} \times \frac{1}{2} \times \frac{4}{1}$$

$$= \left[\left(\frac{2}{5}\right)^{8-2}\right] \times \frac{2 \times 2}{1 \times 1} \times \frac{1}{2} \times \frac{4}{1}$$

$$= \left(\frac{2}{5}\right)^{6} \times \frac{2 \times 2 \times 1 \times 4}{1 \times 1 \times 2 \times 1}$$

$$= \frac{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 1 \times 4}{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 1 \times 1 \times 2 \times 1} = \frac{512}{15625}$$

9. $\left(\frac{2}{5}\right)^{3} \times \left(\frac{2}{5}\right)^{-6} = \left(\frac{2}{5}\right)^{2a-1} \Rightarrow \left(\frac{2}{5}\right)^{3+(-6)} = \left(\frac{2}{5}\right)^{2a-1}$

$\left(\frac{2}{5}\right)^{3-6} = \left(\frac{2}{5}\right)^{2a-1} \Rightarrow \left(\frac{2}{5}\right)^{-3} = \left(\frac{2}{5}\right)^{2a-1}$

Hence, $2a - 1 = -3 \Rightarrow 2a = -3 + 1 \Rightarrow 2a = -2$

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

10. Let $\left(\frac{-2}{9}\right)^{-3}$ should be divided by x to get $\frac{3}{-8}$.

So, $\left(\frac{-2}{9}\right)^{-3} \div x = \frac{3}{-8}$

$\left(\frac{9}{-2}\right)^{3} \div x = \frac{3}{-8}$

$$\left(\frac{9}{-2}\right)^3 \div \frac{3}{-8} = x$$

$$\frac{9\times9\times9}{-2\times-2\times-2}\times\frac{-8}{3} = x$$

$$243 = x$$

or $$x = 243$$

11. The given,

(a) $\left(\frac{x}{y}\right)^{-2}$

Given, $\frac{x}{y} = \left(\frac{-2}{3}\right)^3 \div \left(\frac{3}{5}\right)^{-2} = \left(\frac{-2}{3}\right)^3 \div \left(\frac{5}{3}\right)^2$

$$= \frac{-2\times-2\times-2}{3\times3\times3}\times\left(\frac{3}{5}\right)^2$$

$$= \frac{-2\times-2\times-2}{3\times3\times3\times5\times5} = \frac{-8}{75}$$

Now, $\left(\frac{x}{y}\right)^{-2} = \left(\frac{-8}{75}\right)^{-2} = \left(\frac{-75}{8}\right)^2 = \frac{-75\times-75}{8\times8} = \frac{5625}{64}$

(b) $\left(\frac{x}{y}+\frac{y}{x}\right)^{-1}$

Given, $\frac{x}{y} = \frac{-8}{75}$

So, $\left[\frac{-8}{75}+\left(\frac{-75}{8}\right)\right]^{-1} = \left(\frac{-8}{75}-\frac{75}{8}\right)^{-1} = \left(\frac{-64-5625}{600}\right)^{-1}$

$$= \left(\frac{-5689}{600}\right)^{-1} = \frac{-600}{5689}$$

(c) $\left(\frac{x}{y}\right)^{-\frac{8y}{5x}}$

Given, $\frac{x}{y} = \frac{-8}{75}$

So, $$\left(\frac{x}{y}\right)^{\frac{-8y}{5x}} = \left(\frac{-8}{75}\right)^{-\left(\frac{-75\times 8}{8\times 5}\right)}$$

$$= \left(\frac{-8}{75}\right)^{-(-15)} = \left(\frac{-8}{75}\right)^{15}$$

Exercise 10.2

1. (a) $68450 = 6.845 \times 10^4$ (b) $0.31 = 3.1 \times 10^{-1}$

(c) $0.000000000009 = 9.0 \times 10^{-12}$

(d) $473 = 4.73 \times 10^2$

(e) $459731452 = 4.59731452 \times 10^8$

(f) $0.00000879 = 8.79 \times 10^{-6}$

2. (a) $5.3897 = 5.3897 \times 10^{-2}$ (b) $0.00035 = 3.5 \times 10^3$

$5.3897 = 5.3897 \times 10^0$ $0.00035 = 3.5 \times 10^{-4}$

(c) $0.0001 = 1.000 \times 10^{-5}$ (d) $0.056739 = 5.6739 \times 10^2$

$0.0001 = 1.000 \times 10^{-4}$ $0.056739 = 5.6739 \times 10^{-2}$

(e) $3.0012 = 3.0012 \times 10^{-1}$ (f) $30085 = 30.085 \times 10^{-3}$

$3.0012 = 3.0012 \times 10^0$ $30085 = 3.0085 \times 10^4$

3. (a) $3.4567 \times 10^7 = 34567000$ (b) $7.0004 \times 10^7 = 70004000$

(c) $1.00075 \times 10^2 = 100.075$ (d) $0.9813 \times 10^{-5} = 0.000009813$

(e) $3.87 \times 10^{-3} = 0.00387$ (f) $8.0031 \times 10^{-3} = 0.0080031$

4. The speed of an aircraft is 2.012×10^3 km/h.

$$\text{speed} = 2.012 \times 10^3 \text{ km/hr}$$

$$\text{time} = 3 \text{ hour } 30 \text{ min} = 3\frac{1}{2} \text{ hour}$$

$$\text{distance} = \text{speed} \times \text{time} = 2.012 \times 10^3 \times 3\frac{1}{2}$$

$$= 2.012 \times 10^3 \times \frac{7}{2} = 7.042 \times 10^3 \text{ km}$$

5. speed of light = 300000000 m/sec

or $= 3.0 \times 10^8$ m/s

6. Mass of proton

$= 0.000,000,000,000,000,000,000,000,000,001673$ kg

$= 1.673 \times 10^{-30}$ kg

MCQs : **1.** (b) **2.** (b) **3.** (c) **4.** (b) **5.** (b)

Mental Maths :

1. $\left(\frac{-3}{7}\right)^{-8} \div \left(\frac{-3}{7}\right)^{-6} = \left(\frac{-3}{7}\right)^{-2}$

2. $\left(\frac{8}{9}\right)^{3} \times \left(\frac{8}{9}\right)^{-5} = \left(\frac{8}{9}\right)^{-2}$

3. $\left[\left(\frac{13}{15}\right)^{0}\right]^{-5} = 1$

4. $\left[\left\{\left(\frac{-8}{13}\right)^{2}\right\}^{3}\right]^{0} = 1$

HOTS

1. Thickness of a book = 20 mm
Thickness of 5 books = 20×5 mm = 100 mm
Thickness of a paper sheet = 0.016 mm
Thickness of 5 paper sheet = 5×0.016 mm = 0.080 mm
Total thickness of the stack = 100 mm + 0.080 mm = 100.080 mm

2. $0.000000000054 = 5.4 \times 10^{-11}$

3. Mass of Earth = 5.97×10^{24} kg
Mass of Moon = 7.35×10^{22} kg
$\therefore$ Total mass = 5.97×10^{24} kg + 7.35×10^{22} kg
= 597×10^{22} kg + 7.35×10^{22} kg
= $10^{22}(597 + 7.35)$ kg
= 604.35×10^{22} kg or 6.0435×10^{24} kg

4. Distance between Sun and Earth = 1.496×10^{11} m
Distance between Earth and Moon = 3.84×10^{8} m
During solar eclipse moon comes in between Earth and Sun.
So, distance between Moon and Sun at that time
= 1.496×10^{11} m – 3.84×10^{8} m
= 1496×10^{8} m – 3.84×10^{8} m
= $10^{8}(1496 - 3.84)$ m = $10^{8}(1492.16)$ m
= 1492.16×10^{8} m or 1.49216×10^{11} m

5. $a^{x^2 - y^2} \times a^{y^2 - z^2} \times a^{z^2 - x^2} = 1$
L.H.S. $a^{x^2 - y^2} \times a^{y^2 - z^2} \times a^{z^2 - x^2} = a^{x^2 - y^2 + y^2 - z^2 + z^2 - x^2}$
$a^{0} = 1 =$ R.H.S. **Proved**

Chapter 11

Direct and Inverse Variation

Exercise 11.1

1. b, c, and e are direct variation.

2. (a)

x	8	16	20	32	60
y	2	4	5	8	15

$$\frac{8}{2}=\frac{4}{1},\ \frac{16}{4}=\frac{4}{1},\ \frac{20}{5}=\frac{4}{1},\ \frac{32}{8}=\frac{4}{1},\ \frac{60}{15}=\frac{4}{1}$$

Since, the ratio of the corresponding values of x and y is equal.
So, x is direct variation with y.

(b)

x	3	5	6	9	10
y	5	3	10	15	6

$$\frac{3}{5}=\frac{3}{5},\ \frac{5}{3}=\frac{5}{3},\ \frac{6}{10}=\frac{3}{5},\ \frac{9}{15}=\frac{3}{5},\ \frac{10}{6}=\frac{5}{3}$$

Since, the ratio of the corresponding values of x and y is not equal x and y do not vary directly.

3. (a) $\frac{60}{4}=\frac{15}{1}$ and $\frac{180}{12}=\frac{15}{1}$

So, $\frac{15}{1}$ is the constant ratio.

Since, x and y vary directly,

$\therefore\ \frac{x_1}{8}=\frac{15}{1} \quad\Rightarrow\quad x_1=15\times 8=120$

$\frac{x_2}{15}=\frac{15}{1} \quad\Rightarrow\quad x_2=15\times 15=225$

$\frac{x_3}{20}=\frac{15}{1} \quad\Rightarrow\quad x_3=20\times 15=300$

$\frac{x_4}{25}=\frac{15}{1} \quad\Rightarrow\quad x_4=25\times 15=375$

So, the missing entries are :

x	60	120	180	225	300	375
y	4	8	12	15	20	25

(b) $\frac{9}{4.5} = \frac{1}{0.5}$

So, $\frac{1}{0.5}$ is the constant ratio.

Since, x and y vary directly

$\therefore \quad \frac{x_1}{3.5} = \frac{1}{0.5} \quad \Rightarrow \quad x_1 = \frac{3.5}{0.5} = 7$

$\frac{x_2}{6.5} = \frac{1}{0.5} \quad \Rightarrow \quad x_1 = \frac{6.5}{0.5} = 13$

$\frac{15}{y_1} = \frac{1}{0.5} \quad \Rightarrow \quad y_1 = 15 \times 0.5 = 7.5$

$\frac{x_3}{9.25} = \frac{1}{0.5} \quad \Rightarrow \quad x_3 = \frac{9.25}{0.5} = 18.50$

$\frac{26.5}{y_2} = \frac{1}{0.5} \quad \Rightarrow \quad y_2 = 13.25$

$\therefore$ The missing entries are :

x	7	9	13	15	18.50	26.5
y	3.5	4.5	6.5	7.5	9.25	13.25

4. Let x number of notebooks can be bought in ₹ 160 :

No. of note books	15	x
Amount (₹)	24	160

$$\frac{x}{15} = \frac{160}{24}$$

$$x = \frac{160 \times 15}{24}$$

$$x = 20 \times 5$$
$$x = 100$$

Hence, he can buy 100 note books for ₹ 160.

5. Let x litres of petrol will be needed for a journey of 345 km.

Petrol (in L)	20	x
Distance (in km)	115	345

$$\frac{20}{x} = \frac{115}{345}$$
$$x = \frac{20 \times 345}{115}$$
$$x = 60$$

Hence, 60 litres of petrol will be needed for a journey of 345 km.

6. Let she will take x minutes to walk 275 m.

Time (min)	130	x
Distance (m)	110	275

$$\frac{x}{130} = \frac{275}{110}$$
$$x = \frac{275 \times 130}{110}$$
$$x = 325 \text{ minutes}$$

7. Let ₹ x will be the worth of 250 us dollars.

Rupees (₹)	74425	x
Dollars ($)	150	250

$$\frac{7425}{x} = \frac{150}{250}$$
$$x = ₹\ \frac{7425 \times 250}{150} = ₹\ 12375$$

Hence, on the same day, ₹ 12375 will be the worth of 250 us dollars.

8. Let, it will cover x km in 25 minutes

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$70 = \frac{\text{Distance}}{1}$$

$$\text{Distance} = 70 \times 1\,\text{km} = 70\,\text{km}$$

Distance	70	x
Time (min)	60	25

$$\frac{70}{x} = \frac{60}{25}$$

$$\Rightarrow \quad x = \frac{70 \times 25}{60}\,\text{km} = 29.17\ \text{km}$$

Hence, it will cover 29.17 km in 25 minutes.

9. Let the required number of bottles be x :

No. of bottles	5	x
Servings	8	32

So,

$$\frac{5}{x} = \frac{8}{32}$$

$$x = \frac{5 \times 32}{8} = 5 \times 4 = 20\,\text{bottles}$$

Hence, the required number of bottles is 20.

10. 5 men = 8 women $\Rightarrow$ 1 man $= \frac{8}{5}$ women

$\Rightarrow$ 8 men $= \frac{8}{5} \times 8 = \frac{64}{5}$ women

$\therefore$ 8 men and 12 women $= \frac{64}{5} + 12 = \frac{64+60}{5} = \frac{124}{5}$ women

Let ₹ x be the earning by 8 men and 12 women in a day.

$\therefore$ ₹ x will also be the earning of $\frac{124}{5}$ women in a day.

No. of women	8	$\frac{124}{5}$
Earning (in ₹)	625	x

Note that more the number of women, more will be the earning.
So, number of women is in direct variation with the earnings.

$$\therefore \quad \frac{8}{\frac{124}{5}} = \frac{625}{x}$$

$$x = \frac{625 \times 124}{40} = ₹\ 1937.50$$

Hence, 8 men and 12 women earn ₹ 1937.50 in one day.

11. Let x be the number of days.

Income (₹)	240	1008
Days	5	x

Note that more income, more days
So, number of days is in direct variation with the working days.

$$\frac{240}{1008} = \frac{5}{x}$$

$$x = \frac{5 \times 1008}{240} \text{ days} = 21 \text{ days}$$

Hence, he worked 21 days.

12. Let x g be the required weight.

Weight (g)	250	x
Length (cm)	3.5	21

So, $$\frac{250}{x} = \frac{3.5}{21}$$

$$\Rightarrow \quad x = \frac{250 \times 21}{3.5} = 1500 \text{ g}$$

Hence, 1500 g is the required weight of produce an extension of 21 cm.

13. Let x mm be the thickness of 294 sheets of chart paper.

Thickness (mm)	35	x
No. of sheets	12	294

So,
$$\frac{35}{x} = \frac{12}{294}$$
$$x = \frac{35 \times 294}{12} \text{ mm}$$
$$x = 857.5 \text{ mm}$$

Hence, 857.5 mm be the thickness of 294 seets of chart paper.

14. Let, in x days, it will pick up 7.2×10^8 kg of dust.

Day	12	x
Dust (in kg)	1.8×10^8	7.2×10^8

So,
$$\frac{12}{x} = \frac{1.8 \times 10^8}{7.2 \times 10^8}$$
$$x = \frac{12 \times 7.2 \times 10^8}{1.8 \times 10^8}$$
$$x = 12 \times 4 \text{ days}$$
$$x = 48 \text{ days}$$

Hence, in 48 days, it will pick up 7.2×10^8 kg of dust from the atmosphere.

15. Let x children can give the performance.

No. of children	35	x
Space (m^2)	122.5	21

$$\frac{35}{x} = \frac{122.5}{21}$$
$$x = \frac{35 \times 21}{122.5} = 6 \text{ children}$$

Hence, 6 children can give the performance.

Exercise 11.2

1. a and c are inverse variation.

2. (a) Since, p and q are vary inversely.

So, $pq = \text{constant } (k)$

$k = 9 \times 8 = 72$

Now, $q_1 \times 3 = 72 \Rightarrow q_1 = 72 \div 3 = 24$

$p_1 \times 6 = 72 \Rightarrow p_1 = 72 \div 6 = 12$

$q_2 \times 4 = 72 \Rightarrow q_2 = 72 \div 4 = 18$

$p_2 \times 36 = 72 \Rightarrow p_2 = 72 \div 36 = 2$

$\therefore$ the missing entries are :

p	9	3	12	4	2
q	8	24	6	18	36

(b) Since, p and q are vary inversely.

So, $pq = k$ (constant)

$k = 12 \times 10 = 120$

Now, $q_1 \times 3 = 120 \Rightarrow q_1 = 120 \div 3 = 40$

$p_1 \times 20 = 120 \Rightarrow p_1 = 120 \div 20 = 60$

$q_2 \times 15 = 120 \Rightarrow q_2 = 120 \div 15 = 8$

$p_2 \times 5 = 120 \Rightarrow p_2 = 120 \div 5 = 24$

$\therefore$ the missing entries are :

p	12	3	6	15	24
q	10	40	20	8	5

3. Let x cm^3 be the volume of the gas at pressure 400 mm. We may put the given data in a table as under :

Pressure (mm)	360	400
Volume (cm^3)	760	x

Clearly, it is a case of inverse variation

So, $360 : 400 = x : 760$

$$\frac{360}{400} = \frac{x}{760}$$

$\Rightarrow$ $$x = \frac{360 \times 760}{400} \text{ cm}^3$$

$\Rightarrow$ $$x = 9 \times 76 \text{ cm}^3 = 684 \text{ cm}^3$$

Hence, 684 cm^3 is the volume of the gas at pressure 400 mm.

4. Let x cows will graze the same field in 7 days.

No. of cows	35	x
Day	15	7

The ratio of the number of cows = inverse ratio of the number of days.

So, $$35 : x = 7 : 15$$

$\Rightarrow$ $$\frac{35}{x} = \frac{7}{15}$$

$\Rightarrow$ $$x = \frac{35 \times 15}{7}$$

$\Rightarrow$ $$x = 5 \times 15 = 75 \text{ cows}$$

Hence, 75 cows will graze the same field in 7 days.

5. Let x men take 30 days to complete it.

No. of men	1800	x
Day	50	30

The ratio of the number of men = inverse ratio of the number of days.

So, $$1800 : x = 30 : 50$$

$$\frac{1800}{x} = \frac{30}{50}$$

$\Rightarrow$ $$x = \frac{1800 \times 50}{30}$$

$\Rightarrow$ $$x = 60 \times 50 = 3000$$

So, more men needed = 3000 − 1800 = 1200 men.

6. Let x men must be engaged to reap the harvest in 20 days.

No. of men	20	x
Day	25	20

So, the ratio of the number of men = inverse ratio of the number of days.

$$20 : x = 20 : 25$$

$$\frac{20}{x} = \frac{20}{25}$$

$$\Rightarrow \quad x = \frac{20 \times 25}{20} = 25$$

Hence, 25 men must be engaged to reap the harvest in 20 days.

7. Let x hours would 56 pumps take to do the same work.

No. of pumps	21	56
Time (hrs)	36	x

So, the ratio of the number of pumps = inverse ratio of the number of hours.

$$21 : 56 = x : 36$$

$$\frac{21}{56} = \frac{x}{36}$$

$$\Rightarrow \quad x = \frac{21 \times 36}{56} \text{ hrs.}$$

$$= 13 \text{ hrs. } 30 \text{ min.}$$

8. Let 18 men take x days to complete the same work.

Number of men	12	18
No. of days	6	x

So, the ratio of the number of men = inverse ratio of the number of days

$$12 : 18 = x : 6$$

$$\frac{12}{18} = \frac{x}{6}$$

$$\Rightarrow \qquad x = \frac{12 \times 6}{18} = 4 \text{ days}$$

Hence, 18 men take 4 days to complete the same work.

9. Let the ration last be x days :

Day	8	x
Number of girls	25	40

So, the ratio of the number of days = inverse ratio of the number of days.

$$8 : x = 40 : 25$$
$$\frac{8}{x} = \frac{40}{25}$$
$$x = \frac{25 \times 8}{40} = 5 \text{ days}$$

Hence, the ration last in 5 days.

10. Let reading x hours a day he can finish it in 8 days.

Hours	5	x
No. of days	10	8

So, the ratio of the number of hours

= inverse ratio of the number of days.

$$5 : x = 8 : 10$$
$$\frac{5}{x} = \frac{8}{10}$$
$$x = \frac{5 \times 10}{8} \text{ hrs.} = 6 \text{ hrs } 15 \text{ min}$$

$\therefore$ Reading 6 hrs 15 min a day, Dinesh can finish the book in 8 days.

11. Let 525 people have a stock of food for x days :

No. of people	350	525
No. of days	15	x

So, the ratio of the number of people

= inverse ratio of the number of days.

$$350 : 525 = x : 15$$

$$\frac{350}{525} = \frac{x}{15}$$

$$\Rightarrow \quad x = \frac{350 \times 15}{525}$$

$$x = 10 \text{ days}$$

Hence, 525 people have a stock of food for 10 days.

12. Let the number of died cows be x.

No. of cows	24	$(24 - x)$
No. of days	10	15

So, the ratio of the number of cows

$$= \text{inverse ratio of the number of days}$$

$$24 : (24 - x) = 15 : 10$$

$$\frac{24}{(24 - x)} = \frac{15}{10}$$

$$24 \times 10 = 24 \times 15 - 15x$$

$$15x = 360 - 240$$

$$15x = 120$$

$$x = 8 \text{ cows}$$

Hence, the number of died cows is 8.

13. Let working x hours a day he can finish it in 10 days.

Hours	8	x
No. of days	15	10

Clearly, lesser the number of days to finish a book, the greater the number of hours required. So, it is a case of inverse variation we know that,

$$\text{Ratio of hours} = \text{inverse ratio of number of days}$$

$$8 : x = 10 : 15$$

$$\frac{8}{x} = \frac{10}{15}$$

$$\Rightarrow \quad x = \frac{8 \times 15}{10}$$

$\Rightarrow \qquad x = 12$ hours

$\therefore$ Working 12 hours a day, a person can finish the book in 10 days.

14. Let the average speed of her be x km/h.

Speed (km/h)	14	x
Time (h)	20	10

So, the ratio of the number of speed = inverse ratio of the number of time.

$$14 : x = 10 : 20$$

$$\frac{14}{x} = \frac{10}{20}$$

$$\Rightarrow \qquad x = \frac{14 \times 20}{10} \text{ km/h}$$

$$x = 28 \text{ km/h}$$

Hence, the average speed of her is 28 km/h.

15. Let the food is enough for x days.

No. of men	420	350
No. of days	$(35-10)$	x

Clearly, the more the number of men, the less will be the number of days for which the provision will last.

So, it is a case of inverse variation.

The ratio of the number of men

= inverse ratio of the number of days.

So,
$$\frac{420}{350} = \frac{x}{35-10}$$

$$x = \text{days}$$

$$x = \frac{420 \times 25}{350}$$

$$x = 30 \text{ days}$$

Hence, the food is enough for 30 days.

Exercise 11.3

1. Hemant can do a work in 7 days

$\therefore$ Work done by Hemant in 1 day $= \frac{1}{7}$ part

$\therefore$ He will be able to complete in 5 days $= \frac{1}{7} \times 5 = \frac{5}{7}$ part

2. 30 baskets were weaved by Vidhi in 45 days

$\therefore$ 1 basket were weaved by Vidhi in $\frac{45}{30}$ days.

$\therefore$ She will weave 120 baskets in $\frac{45}{30} \times 120$ days $= 45 \times 4$ days

$= 180$ days

3. Ankur can do a work in 4 days

$\therefore$ Ankur's 1 days's work $= \frac{1}{4}$ part

Varun can do the same work in 8 days

$\therefore$ Varun's 1 day's work $= \frac{1}{8}$ part

So, Ankur's + Varun's 1 day's work $= \left(\frac{1}{4} + \frac{1}{8}\right) = \left(\frac{2+1}{8}\right) = \frac{3}{8}$

$\therefore$ (Ankur's + Varun's) together can finish the work in $\frac{8}{3}$ days *i.e.*,

$2\frac{2}{3}$ days.

4. The time taken by Sahid to finish the work = 5 days
The time taken by Sameer to finish the work = 10 days
The time taken by Salman to finish the work = 15 days

$\therefore$ The work done by Sahid in 1 day $= \frac{1}{5}$ part

$\therefore$ The work done by Sameer in 1 day $= \frac{1}{10}$ part

$\therefore$ The work done by Salman in 1 day $= \frac{1}{15}$ part

The work done by (Sahid + Sammer + Salman) in 1 day

$$= \left(\frac{1}{5}+\frac{1}{10}+\frac{1}{15}\right) = \left(\frac{6+3+2}{30}\right) = \frac{11}{30}$$

Hence, Sahid, Sameer and Salman together can finish the work in $\frac{30}{11}$ *i.e.*, $2\frac{8}{11}$ days.

5. The time taken by A and B to finish the work = 18 days

$\therefore$ (A's + B's) 1 day's work $= \frac{1}{18}$ part

(A's + B's) 8 day's work $= \frac{8}{18}$ part

The remaining work $= \left(1-\frac{8}{18}\right) = \frac{10}{18} = \frac{5}{9}$ part

Now, A finish the rest of work in 15 days.

$\therefore$ A finish whole work separately $= 15 \times \frac{9}{5}$ days

$= 3 \times 9$ days $= 27$ days

A's 1 days work $= \frac{1}{27}$ part

$\therefore$ B's 1 days work $= \left(\frac{1}{18}-\frac{1}{27}\right) = \frac{3-2}{54} = \frac{1}{54}$

Hence, B alone can finish the work in 54 days.

6. A's 1 day's work $= \frac{1}{40}$ part

B's 1 day's work $= \frac{1}{45}$ part

$\therefore$ $(A+B)$'s 1 day's work $= \frac{1}{40}+\frac{1}{45} = \left(\frac{9+8}{360}\right) = \frac{17}{360}$

$\therefore$ $(A+B)$'s 10 day's work $= 10 \times \frac{17}{360} = \frac{17}{36}$

The remaining work $= \left(1-\frac{17}{36}\right) = \left(\frac{36-17}{36}\right) = \frac{19}{36}$

Now, A can do the whole work in 40 days.

$\therefore$ A can do $\frac{19}{36}$ work in $40 \times \frac{19}{36} = \frac{190}{9}$ days.

Hence, the remaining work is done by A in $21\frac{1}{9}$ days.

7. P's 1 days work $= \frac{1}{5}$; P's 3 days work $= \frac{3}{5}$

Q's 1 days work $= \frac{1}{7}$

The remaining work of $P = 1 - \frac{3}{5} = \frac{2}{5}$

$(P+Q)$'s 1 days work $= \frac{1}{5} + \frac{1}{7} = \left(\frac{7+5}{35}\right) = \frac{12}{35}$

$(P+Q)$'s do 1 work in $\frac{35}{12}$ days

$\therefore (P+Q)$'s do $\frac{2}{5}$ of work in $\frac{35}{12} \times \frac{2}{5} = \frac{7}{6} = 1\frac{1}{6}$ days

8. 4 men = 6 boys $\Rightarrow$ 1 man $= \frac{6}{4}$ boys

$\Rightarrow$ 2 men $= \frac{6}{4} \times 2$ boys = 3 boys

$\therefore$ 2 men and 4 boys = 3 boys + 4 boys = 7 boys

6 boys can dig a well in 14 days

$\therefore$ 1 boys can dig a well in 14×6 days

$\therefore$ 7 boys can dig a well in $\frac{14 \times 6}{7}$ days $= 2 \times 6$ days = 12 days

Hence, 2 men and 4 boys will dig, the same well in 12 days.

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

Mental Maths :

1. $\frac{2}{15} = \frac{8}{60}$

2. The time of journey is in **inverse** variation with the speed of car.

3. If $xy = 48$ and $y = 6$, then $x =$ **8**.

4. If $PQ = 56$ and $Q = 7$, then $P =$ **8**.

Chapter 12

Factorisation

Exercise-12.1

1. **Find all possible factors of the following :**

(a) $12p^2q = 2 \times 2 \times 3 \times p \times p \times q$

(b) $16xy^2z = 2 \times 2 \times 2 \times 2 \times x \times y \times y \times z$

(c) $20a^2b^2c^2 = 2 \times 2 \times 5 \times a \times a \times b \times b \times c \times c$

(d) $21m^2np^2 = 3 \times 7 \times m \times m \times n \times p \times p$

2. **Find the common factors of the following monomials** :

(a) $2xy, 12x^2y$

$2xy = 2 \times x \times y$

$12x^2y = 2 \times 2 \times 3 \times x \times x \times y$

The common factor $= 2 \times x \times y = 2xy$

(b) $3m^2, 15m^4$

$3m^2 = 3 \times m \times m$

$15m^4 = 3 \times 5 \times m \times m \times m \times m$

The common factor $= 3 \times m \times m = 3m^2$

(c) $3ax^2y, 18axy$

$3ax^2y = 3 \times a \times x \times x \times y$

$18axy = 2 \times 3 \times 3 \times x \times y$

The common factor $= 3 \times x \times y = 3xy$

(d) $25p^2q^4, 15pq^2$

$25p^2q^4 = 5 \times 5 \times p \times p \times q \times q \times q \times q$

$15pq^2 = 3 \times 5 \times p \times q \times q$

The comon factor $= 5 \times p \times q \times q = 5pq^2$

3. **Find the common factors of the following expressions :**

(a) $6x^2 + 15x^3 + 21x^4 = 3x(2x + 5x^2 + 7x^3)$

$$= 3x \times x(2 + 5x + 7x^2)$$
$$= 3x^2(2 + 5x + 7x^2)$$

The comon factor $= 3x^2$

(b) $9x^2y^3 + 18x^3y^2 - 36x^2y^2 = 9x^2y^2(y + 2x - 4)$

The comon factor $= 9x^2y^2$

(c) $5a^3bc + 15ab^3 + 25a^3 = 5a(a^2bc + 3ab^3 + 5a^2)$

The comon factor $= 5a$

(d) $8p^3 - 16q^3 + 32r^3 = 8(p^3 - 2q^3 + 4r^3)$

The common factor = 8

4. Factorise :

(a) $(x+3)x + (x+3)y = (x+3)(x+y)$

(b) $3a(x-4y) - 2b(x-4y) = (x-4y)(3a-2b)$

(c) $-4(a-2b) + 8(a-2b)^2 = (a-2b)(-4+8)$
$= (a-2b) \times 4 = 4(a-2b)$

(d) $5(m-n)^2 - 6(m-n) = (m-n)(5(m-n)-6)$
$= (m-n)(5m-5n-6)$

5. Factorise using suitable grouping :

(a) $abc - ab - c + 1 = ab(c-1) - 1(c-1)$
$= (a-1)(c-1)$

(b) $p^2q - pr^2 - pq + r^2 = pq(p-1) - r^2(p-1)$
$= (pq - r^2)(p-1)$

(c) $4x^2 + 2y^2 + x^2y^2 + 8 = 4(x^2+2) + y^2(x^2+2)$
$= (x^2+2)(4+y^2)$

(d) $ax^2 + by^2 + bx^2 + ay^2 = x^2(a+b) + y^2(a+b)$
$= (a+b)(x^2+y^2)$

6. Factorise the following :

(a) $x^2 - 16 = x^2 - 4^2 = (x+4)(x-4)$

(b) $4 - 36y^2 = 4(1 - 9y^2) = 4(1+3y)(1-3y)$

(c) $a^4b^4 - c^4 = (a^2b^2)^2 - (c^2)^2$

$= (a^2b^2 + c^2)(a^2b^2 - c^2)$

$= (a^2b^2 + c^2)(ab + c)(ab - c)$

(d) $m^2 - (n+p)^2 = (m+n+p)(m-n-p)$

(e) $8p^3 - 2p = 2p(4p^2 - 1)$

$= 2p(2p+1)(2p-1)$

(f) $16x^4 - (z-x)^4 = 2^4x^4 - (z-x)^4$

$= (2^2x^2)^2 - [(z-x)^2]^2$

$= (2^2x^2 + (z-x)^2)(2^2x^2 - (z-x)^2)$

$= (4x^2 + z^2 + x^2 - 2zx)(2x + z - x)(2x - z + x)$

$= (3x - z)(x + z)(5x^2 - 2zx + z^2)$

7. Factorise the following expressions :

(a) $y^2 - 8y + 81 = y^2 - 9y - 9y - 81 = y(y-9) - 9(y-9)$

$= (y-9)(y-9) = (y-9)^2$

(b) $x^4 + 22x^2 + 121 = x^4 + 11x^2 + 11x^2 + 121$

$= x^2(x^2 + 11) + 11(x^2 + 11)$

$= (x^2 + 11)(x^2 + 11)$

(c) $p^6 - 4p^3 + 4 = p^6 - 2p^3 - 2p^3 + 4$

$= p^3(p^3 - 2) - 2(p^3 - 2)$

$= (p^3 - 2)(p^3 - 2)$

(d) $a^2 + 2ab + b^2 - 16 = a^2 + ab + ab + b^2 - 16$

$= a(a+b) + b(a+b) - 16$

$= (a+b)^2 - 4^2$

$= (a+b+4)(a+b-4)$

(e) $9z^2 - x^2 - 4y^2 + 4xy = 9z^2 - (x^2 - 4xy + 4y^2)$

$= 9z^2 - [x^2 - 2xy - 2xy + 4y^2]$

$= 9z^2 - [x(x-2y) - 2y(x-2y)]$

$= 9z^2 - [(x-2y)(x-2y)]$

$= 9z^2 - (x-2y)^2$

$$= (3z)^2 - (x-2y)^2$$
$$= (3z - x - 2y)(3z + x - 2y)$$

(f) $x^8 - y^8 + x^4 - y^4$

$$= (x^4)^2 - (y^4)^2 + (x^2)^2 - (y^2)^2$$
$$= (x^4 + y^4)(x^4 - y^4) + (x^2 + y^2)(x^2 - y^2)$$
$$= (x^4 + y^4)(x^2 + y^2)(x^2 - y^2) + (x^2 + y^2)(x + y)(x - y)$$
$$= (x^4 + y^4)(x^2 + y^2)(x + y)(x - y) + (x^2 + y^2)(x + y)(x - y)$$
$$= (x^2 + y^2)(x + y)(x - y)(x^4 + y^4 + 1)$$

8. Factorise by splitting the middle term :

(a) $x^2 + 9x + 20$

Here, $a = 1$ and $c = 20$, therefore, $ac = 1 \times 20 = 20$

So, we have to factorise 20 into two factors in such a way that the sum of those factors is 9 and product is 20. All possible factors of 20 are :

$20 = 20 \times 1$	sum = 21	product = 20
$= 10 \times 2$	sum = 12	product = 20
$= 5 \times 4$	sum = 9	product = 20

So, we accept only the combination 5 and 4 becvause their sum is 9 and product is 20.

Therefore, $x^2 + 9x + 20 = x^2 + (5+4)x + 5 \times 4$

$$= x^2 + 5x + 4x + 5 \times 4$$
$$= x(x+5) + 4(x+5) = (x+5)(x+5)$$

(b) $x^2 - 14x + 13 = x^2 - 13x - x + 13$

$$= x(x-13) - 1(x-13)$$
$$= (x-13)(x-1)$$

(c) $p^2 + 2p - 15 = p^2 + 5p - 3p - 15$

$$= p(p+5) - 3(p+5)$$
$$= (p+5)(p-3)$$

(d) $m^2 + 11mn + 18n^2 = m^2 + 9mn + 2mn + 18n^2$

$$= m(m+9n) + 2n(m+9n)$$
$$= (m+9n)(m+2n)$$

(e) $m^2 - 3m - 70 = m^2 - 10m + 7m - 70$
$= m(m-10) + 7(m-10)$
$= (m-10)(m+7)$

(f) $3x^2 - 10x + 8 = 3x^2 - 6x - 4x + 8$
$= 3x(x-2) + 4(x-2)$
$= (x-2)(3x+4)$

(n) $10p^2 + 11p + 3 = 10p^2 + 5p + 6p + 3$
$= 5p(2p+1) + 3(2p+1)$
$= (2p+1)(5p+3)$

(h) $11a^2 + 54a + 63 = 11a^2 + 33a + 21a + 63$
$= 11a(a+3) + 21(a+3)$
$= (a+3)(11a+21)$

(i) $12y^2 + 28y - 5 = 12y^2 + 30y - 2y - 5$
$= 6y(2y+5) - 1(2y+5)$
$= (2y+5)(6y-1)$

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

Exercise-12.2

1. (c) Buying a bread

2. (a) picking a green ball from a bag containing green balls.

3. Total number of families = 100

Let A be the event that the selected family has 1 girl. Then,

P (selected family has 1 girl)

$$P(A) = \frac{\text{Number of families having 1 girl}}{\text{total number of families}}$$

$$= \frac{35}{100} = \frac{7}{20}$$

Hence, $\frac{7}{20}$ the event that the selected family has 1 girl.

4. Total number of families = 400

Let E_1 and E_2 be the events that the selected family has 3 children and 2 children respectively. Then,

(a) P (selected family has 3 children)

$$P(E_1) = \frac{\text{Number of families having 3 children}}{\text{total number of families}}$$

$$= \frac{37}{400} = \frac{37}{200}$$

(b) P (selected of families having 2 children)

$$P(E_2) = \frac{\text{number of families having 2 children}}{\text{total number of families}}$$

$$= \frac{182}{400} = \frac{91}{200}$$

5. There are 9 letters.

$\therefore$ Total outcomes = 9

$$\therefore \quad P(A) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{1}{9}$$

6. When a fair die is rolled once, the possible outcomes are 1, 2, 3, 4, 5, 6, 7 and 8.

$\therefore$ Total outcomes = 8

Event numbers are 1, 3, 5 and 7.

So, favourable outcomes = 4

Hence, probability of getting an odd number

$$= \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

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

7. When pentagonal spinner is spun, the possible outcomes are 1, 2, 3, 4 and 5.

$\therefore$ Total outcomes = 5

Favourable outcomes = 1

$$\therefore \quad P(A) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{1}{5}$$

8. Total number of balls in the box $= (4+6+5) = 15$

Number of green balls $= 4$

Number of red balls $= 6$

And number of blue balls $= 5$

(a) The probability of getting a red ball $= \dfrac{\text{Number of red balls}}{\text{Total number of balls}}$

(b) The probability of getting a blue ball

$$= \frac{\text{Number of blue balls}}{\text{Total number of balls}}$$

$$= \frac{5}{15} = \frac{1}{3}$$

9. Let E be the event of selecting Monday from a week.

Total outcomes = 7

Favourable outcomes = 1

Hence, $P(E) = \dfrac{1}{7}$

10. When two dice are rolled simultaneously, the possible outcomes are :

(1, 1)	(2, 1)	(3, 1)	(4, 1)	(5, 1)	(6, 1)
(1, 2)	(2, 2)	(3, 2)	(4, 2)	(5, 2)	(6, 2)
(1, 3)	(2, 3)	(3, 3)	(4, 3)	(5, 3)	(6, 3)
(1, 4)	(2, 4)	(3, 4)	(4, 4)	(5, 4)	(6, 4)
(1, 5)	(2, 5)	(3, 5)	(4, 5)	(5, 5)	(6, 5)
(1, 6)	(2, 6)	(3, 6)	(4, 6)	(5, 6)	(6, 6)

Total number of outcomes when two dice are rolled simultaneously

$= 36$ (i.e., 6×6)

(a) Let E, be the event of getting the sum more than 10, i.e., (6, 5), (5, 6) and (6, 6)

$\therefore$ Favourable outcomes = 3

Hence, $P(A) = \dfrac{\text{Favourable outcomes}}{\text{Total number of outcomes}} = \dfrac{3}{36} = \dfrac{1}{12}$

(b) Let E_2 be the event of getting a sum more than 6 and a multiple of 3, i.e., (6, 3), (5, 4), (3, 6), (4, 5) and (6, 6).

$\therefore$ Favourable outcomes = 5

Hence, $P(A) = \dfrac{\text{Favourable outcomes}}{\text{Total outcomes}} = \dfrac{5}{36}$

11. Number of white blocks = 2

Number of red blocks = 4

Number of black blocks = 3

(a) P (red block) $= \dfrac{\text{Number of red block}}{\text{Total number of block}} = \dfrac{4}{9}$

(b) P (black block) $= \dfrac{\text{Number of black block}}{\text{Total number of block}} = \dfrac{3}{9} = \dfrac{1}{3}$

(c) P (white block) $= \dfrac{\text{Number of white block}}{\text{Total number of block}} = \dfrac{2}{9}$

(d) P (a red, white or black block) $= \dfrac{4}{9} + \dfrac{1}{3} + \dfrac{2}{9} = \dfrac{4+3+2}{9} = \dfrac{9}{9} = 1$

Chapter

13 Introduction to Graphs

Exercise 19.1

1. With the help of graph we can conclude :

Coordinates of $P = (-13, 0)$

Coordinates of $Q = (5, 5)$

Coordinates of $R = (11, -6)$

Coordinates of $S = (-11, -9)$

Coordinates of $T = (15, 0)$

Coordinates of $L = (1, -6)$

Coordinates of $M = (-7, 3)$

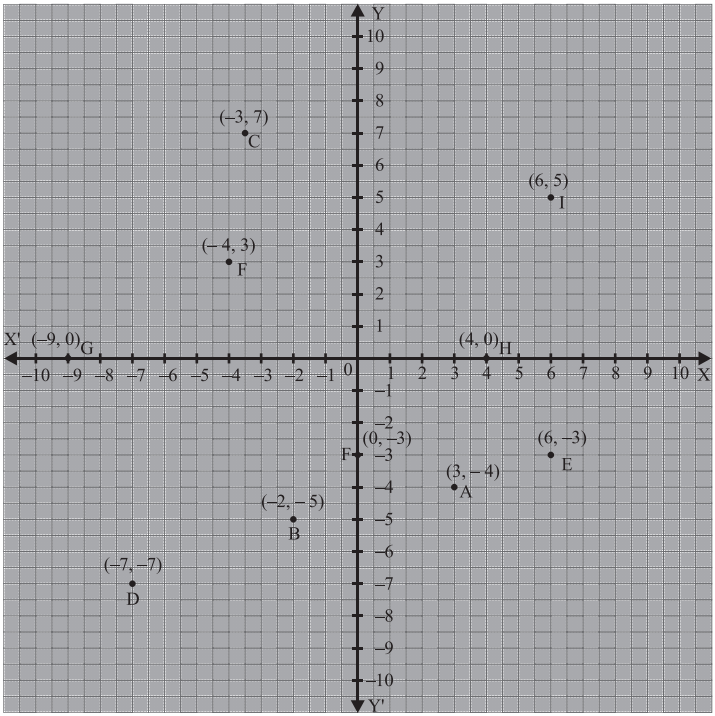
2. (a) $S\ (4, 2)$ lie in I quadrant (b) $T\ (-8, 4)$ lie in II quadrant

(c) $Z\ (0, -11)$ lie in IV quadrant (d) $R\ (3, 0)$ lie in I quadrant

(e) $L\ (7, -5)$ lie in IV quadrant

(f) $G\ (-3, -10)$ lie in III quadrant

3.



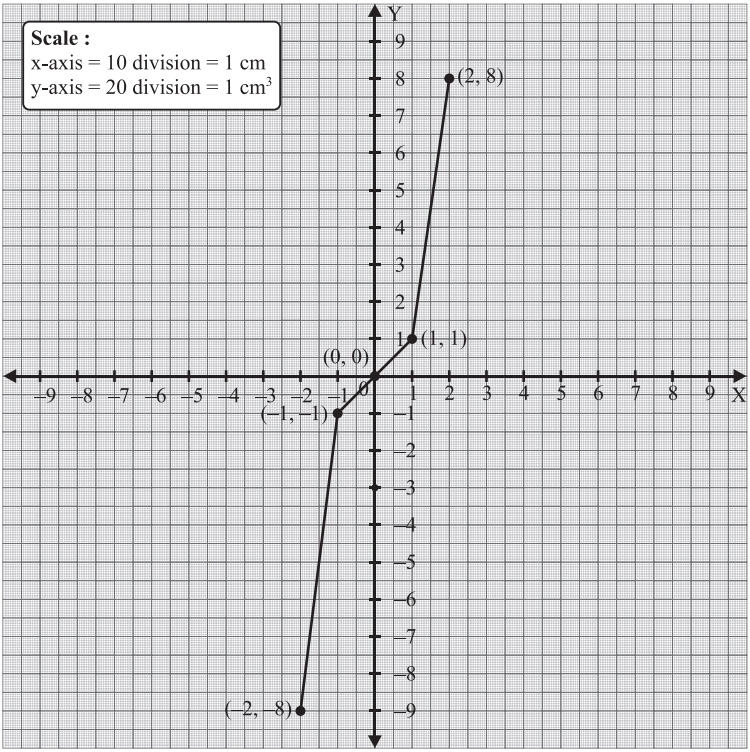
Exercise 13.2

1. We know that,

Volume of cube $(V) = (\text{side } (a))^3$

$V = a^3$

a	0	1	2	-1	-2
V	0	1	8	-1	-8



2. We know that,

Where r = radius

Area of circle $= \pi r^2$

Let $r = 7$ cm

Then, $A = \pi r^2$

$$= \frac{22}{7} \times 7 \times 7 \text{ cm}^2 = 154 \text{ cm}^2$$

$r = 3.5$ cm

Then, $A = \pi r^2$

$$= \frac{22}{7} \times 3.5 \times 3.5 \text{ cm}^2 = 38.5 \text{ cm}^2$$

Again, $r = 10.5$ cm

Then, $A = \pi r^2$

$$A = \frac{22}{7} \times 10.5 \times 10.5 \text{ cm}^2$$

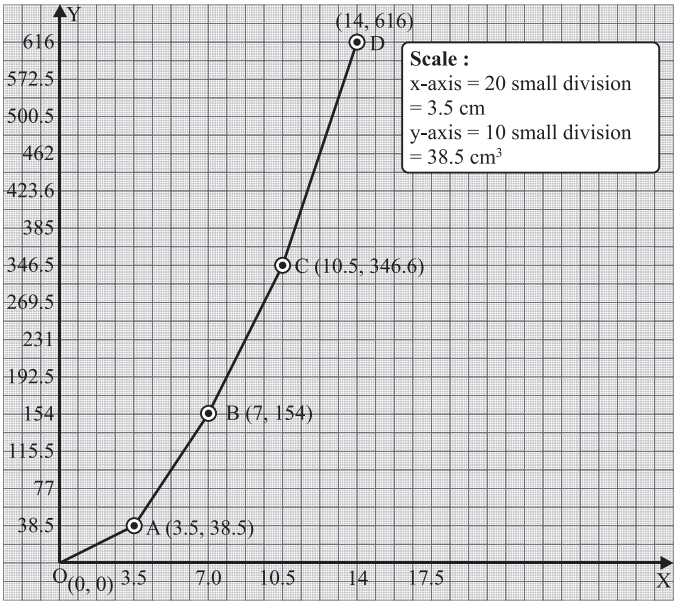
$$A = 346.5 \text{ cm}^2$$

Again, $r = 14$

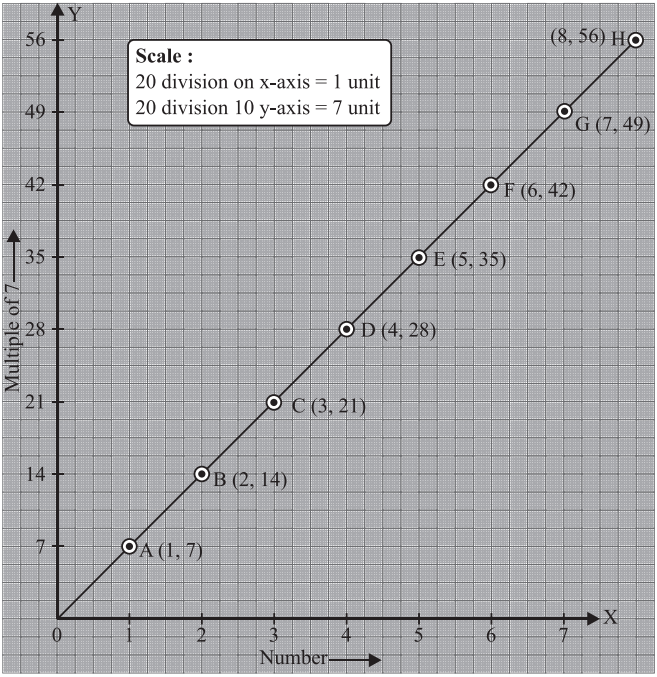
$$A = \pi r^2$$

$$A = \frac{22}{7} \times 14 \times 14 \text{ cm}^2 = 616 \text{ cm}^2$$

r	0	3.5	7	10.5	14
A	0	38.5	154	346.5	616



3. Multiple of 7 = 7, 14, 21, 28, 35, 42, 49, 56, 63, 70.



4. $P = ₹\ 4000$

$R = 3\%$

$T = 1$ year

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= ₹\ \frac{4000 \times 3 \times 1}{100} = ₹\ 120$$

When $T = 4$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= ₹\ \frac{4000 \times 3 \times 4}{100} = ₹\ 480$$

When $T = 2$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= ₹\ \frac{4000 \times 3 \times 2}{100}$$

When $T = 5$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= ₹\ \frac{4000 \times 3 \times 5}{100}$$

$= ₹\ 240$

When $T = 3$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= ₹\ \frac{4000 \times 3 \times 3}{100}$$

$= ₹\ 360$

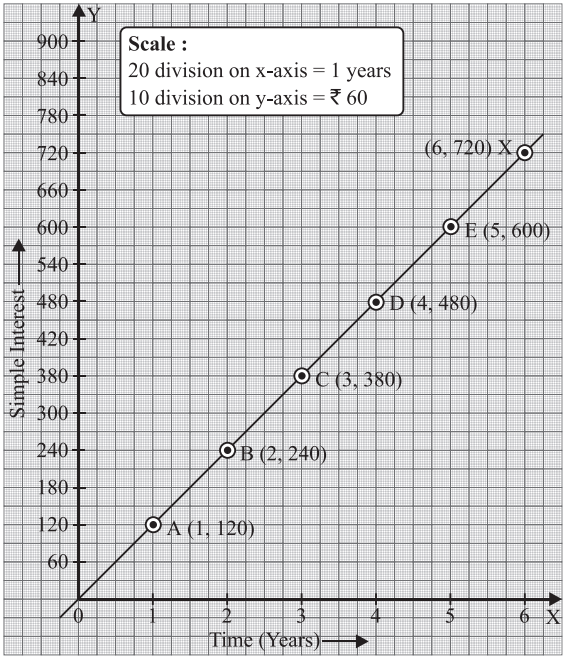
When $T = 6$ years

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

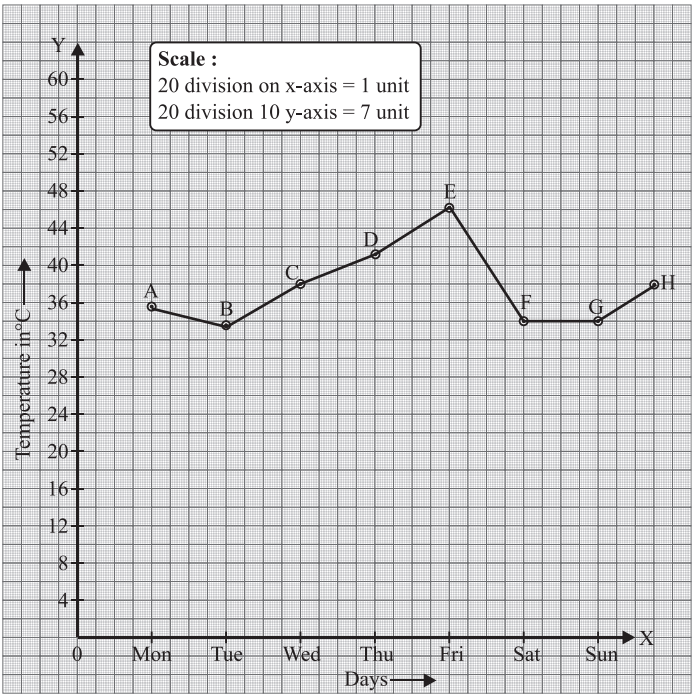
$$= ₹\ \frac{4000 \times 3 \times 6}{100}$$

$= ₹\ 720$

T years	1	2	3	4	5	6
S.I. (₹)	120	240	360	480	600	720



5.



Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Temperature (in °C)	35°C	34°C	37°C	39°C	42°C	36°C	40°C

6. (a) Distance travelled from C to $E = 15$ cm

(b) Speed of car between 20-40 seconds

$$= \frac{\text{Distance covered in this period}}{\text{Time taken}} = \frac{40}{20} = 2 \text{ m/sec}$$

(c) The speed of car is zero between 0 to 20 seconds.

7. (a) Speed between 0-4 hrs. $= \dfrac{\text{Disatnce covered}}{\text{Time taken}}$

$$= \frac{450 \text{km}}{4 \text{ hrs}} = 112.5 \text{ km/hr}$$

Speed between 14-16 hrs.= $\frac{\text{Disatnce covered}}{\text{Time taken}} = \frac{50\text{ km}}{2\text{ hr}} = 25\text{ km/hr}$

(b) Speed at 13th hrs = 0 (zero)

(c) Total distance travelled after 16 hrs.

$= 700\text{ km} + 600\text{ km} + 200\text{ km} + 300\text{ km} + 50\text{ km}$
$= 1850\text{ km}$

8. (a) The plant was no more than 12 cm at the end of 4th weeks.

(b) There was the greatest increase in height in 1st and 2nd week.

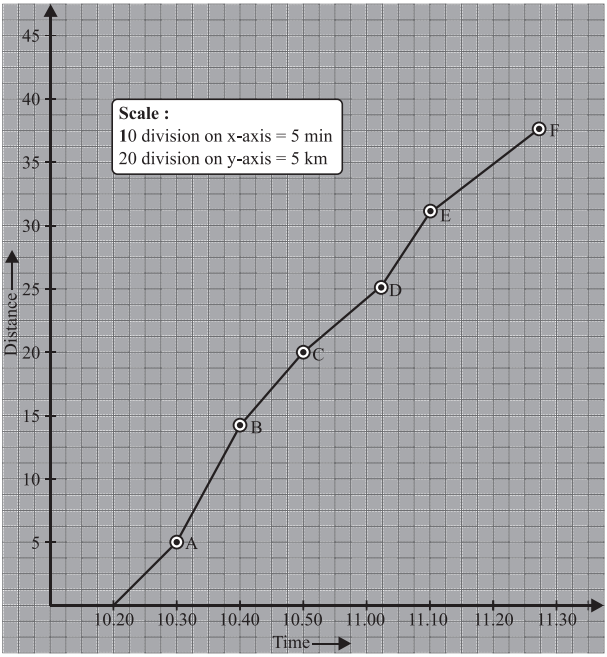
(c) The plant grew 2 cm in height from 3rd week to 4th week.

9. (a) 175 runs were scored in 35 overs.

(b) 50 runs were scored between 20 to 25 overs.

(c) 25 runs were scored between 0-5 overs and 15-20 overs.

10. (a)



Time	10 : 20 am	10 30 am	10 : 40 am	10 : 50 am	11 : 00 am	11 : 10 am	11 : 20 am
Distance (in km)	0	5	12	20	26	28	38

(b) The car was travelling at the greatest speed at 11 : 10 to 11 : 20 am.

(c) Distance covered between 10 : 40 to 10 : 50 = 8 km

So, distance covered in 10 minutes = 8 km

Then, distance covered in 60 minutes *i. e.*, 1 hr. = 8×6 km = 48 km

(d) $$\text{Average speed} = \frac{\text{Total distance covered (in km)}}{\text{Total time taken (in hr)}}$$

$$= \frac{38}{(10+10+10+10+10+10)} \text{ min}$$

$$= \frac{38 \text{ km}}{60 \text{ min}}$$

$$= \frac{38 \text{ km}}{1 \text{ hr.}} = 38 \text{ km/hr.}$$

MCQs **1.** (c) **2.** (c) **3.** (b) **4.** (d) **5.** (b)