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Maths

Teacher's Manual (Class 8)

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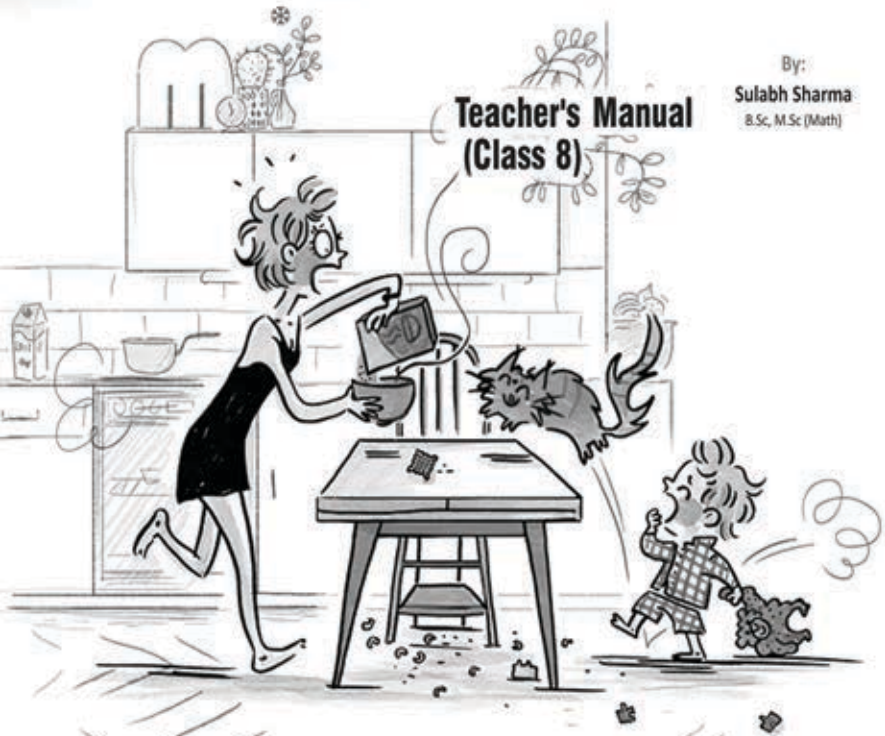


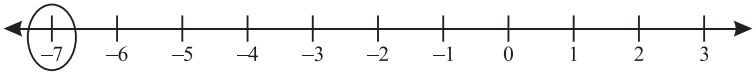
Chapter

1 Rational Numbers

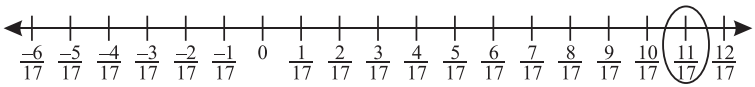
Exercise 1.1

1. Represent the following on the number line :

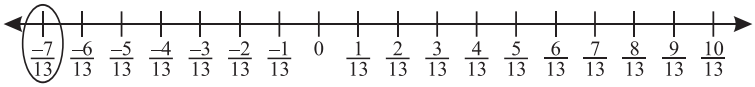
(a) -7



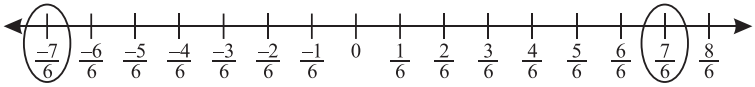
(b) $\frac{11}{17}$



(c) $\frac{-7}{13}$



(d) $\frac{7}{6}$ and $\frac{-7}{6}$



2. Which of the following rational numbers are on the left of O and which are on the right of O ?

(a) $\frac{5}{2}$ is right of the 0.

(b) $\frac{-9}{2}$ is left of 0.

(c) $\frac{7}{-5} = \frac{-7}{5}$ is left of the 0.

(d) $\frac{-8}{-5} = \frac{8}{5}$ is right of the 0.

3. Find the sum of the following :

(a) $\frac{3}{5}$ and $\frac{1}{5} = \frac{3}{5} + \frac{1}{5} = \frac{3+1}{5} = \frac{4}{5}$

(b) $\frac{7}{10}$ and $\frac{3}{10} = \frac{7}{10} + \frac{3}{10} = \frac{7+3}{10} = \frac{10}{10} = 1$

(c) $\frac{1}{2}$ and $\frac{3}{5}$

$= \frac{1}{2} + \frac{3}{5} = \frac{5+6}{10} = \frac{11}{10}$

(d) $\frac{-2}{7}$ and $\frac{11}{21}$

$= \frac{-2}{7} + \frac{11}{21}$

$= \frac{-2 \times 3 + 11 \times 1}{21}$

$= \frac{-6+11}{21} = \frac{5}{21}$

4. Find the difference of the following :

(a) $\frac{12}{13} - \frac{7}{13} = \frac{12-7}{13} = \frac{5}{13}$ (b) $\frac{70}{100} - \frac{23}{100} = \frac{70-23}{100} = \frac{47}{100}$

(c) $\frac{-6}{13} - \frac{-7}{15} = \frac{-6 \times 15 + 13 \times 7}{195} = \frac{-90+91}{195} = \frac{1}{195}$

(d) $\frac{12}{35} - \frac{23}{105} = \frac{12 \times 3 - 23 \times 1}{105} = \frac{36-23}{105} = \frac{13}{105}$

5. Find the product of the following :

(a) $\frac{2}{3}$ and $\frac{5}{6} = \frac{2}{3} \times \frac{5}{6} = \frac{5}{9}$ (b) $\frac{3}{7}$ and $\frac{21}{35} = \frac{3}{7} \times \frac{21}{35} = \frac{9}{35}$

(c) $1\frac{3}{7}$ and $2\frac{5}{8} = \frac{10}{7}$ and $\frac{21}{8}$

$= \frac{10}{7} \times \frac{21}{8} = \frac{15}{4}$

(d) $3\frac{1}{5}$ and $\frac{25}{64} = \frac{16}{5} \times \frac{25}{64} = \frac{5}{4}$

6. Divide the following :

(a) $\frac{3}{4} \div \frac{6}{9} = \frac{3}{4} \times \frac{9}{6} = \frac{9}{8}$ (b) $\frac{5}{9} \div \frac{12}{27} = \frac{5}{9} \times \frac{27}{12} = \frac{5}{4}$

(c) $\frac{10}{11} \div 1\frac{2}{3} = \frac{10}{11} \div \frac{5}{3} = \frac{10}{11} \times \frac{3}{5} = \frac{6}{11}$

(d) $5\frac{6}{7} \div 1\frac{2}{3} = \frac{41}{7} \div \frac{5}{3} = \frac{41}{7} \times \frac{3}{5} = \frac{123}{35}$

7. Write the absolute value of :

(a) $|-3| = 3$ (b) $\left|\frac{-3}{8}\right| = \frac{3}{8}$ (c) $\left|\frac{7}{13}\right| = \frac{7}{13}$ (d) $\left|\frac{-4}{-11}\right| = \frac{4}{11}$

8. Write in standard form :

(a) $\frac{-30}{100}=\frac{-30\div 10}{100\div 10}=\frac{-3}{10}$ (b) $\frac{144}{240}=\frac{144\div 48}{240\div 48}=\frac{3}{5}$

(c) $\frac{-44}{99}=\frac{-44\div 11}{99\div 11}=\frac{-4}{9}$ (d) $\frac{-36}{120}=\frac{-36\div 12}{120\div 12}=\frac{-3}{10}$

9. Sum of rational no. $=\frac{1}{2}$, one no. $=\frac{3}{4}$

Other no. $=\frac{1}{2}-\frac{3}{4}=\frac{2-3}{4}=\frac{-1}{4}$

10. Product of two numbers $=\frac{-15}{7}$

one no $=\frac{-10}{21}$

other no $=\frac{-15}{7}\div\frac{-10}{21}$

$=\frac{-15}{7}\times\frac{21}{-10}=\frac{9}{2}$

11. Are the rational number $\frac{8}{12}$ and $\frac{16}{-24}$ are equal?

$\frac{8}{12},\frac{16}{-24}$

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

No, they are not equal because they have opposite sign.

12. Which of the following statement are true or false?

(a) False (b) True (c) True (d) False (e) True

Exercise 1.2

1. Add :

(a) $\frac{7}{13}$ and $\frac{-9}{15}$

$=\frac{7}{13}+\frac{-9}{15}=\frac{105-117}{195}=\frac{-12}{195}=\frac{-4}{65}$

(b) $\frac{-5}{19}$ and $\frac{-6}{57} = \frac{-5}{19} + \frac{-6}{57}$

$$= \frac{-5\times 3 + -6\times 1}{57} = \frac{-15-6}{57} = \frac{-21}{57} = \frac{-7}{19}$$

(c) $\frac{4}{37}$ and $\frac{19}{105}$

$$= \frac{4}{37} + \frac{19}{105} = \frac{420+703}{3885} = \frac{1123}{3885}$$

(d) $\frac{11}{17}$ and $\frac{6}{23}$

$$= \frac{11}{17} + \frac{6}{23} = \frac{253+102}{391} = \frac{355}{391}$$

(e) $\frac{8}{-9}$ and $\frac{10}{3}$

$$= \frac{-8}{9} + \frac{10}{3} = \frac{-8+30}{9} = \frac{22}{9}$$

(f) $\frac{-15}{7}$ and $\frac{3}{19}$

$$= \frac{-15}{7} + \frac{3}{19} = \frac{-285+21}{133} = \frac{-264}{133}$$

2. Subtract :

(a) $\frac{-13}{14}$ from $\frac{-5}{7} = \frac{-5}{7} - \frac{-13}{14} = \frac{-5}{7} + \frac{13}{14} = \frac{-10+13}{14} = \frac{3}{14}$

(b) $\frac{-8}{22}$ from $\frac{-3}{55} = \frac{-3}{55} - \left(\frac{-8}{22}\right) = \frac{-3}{55} + \frac{8}{22} = \frac{-6+40}{110} = \frac{34}{110} = \frac{17}{55}$

(c) $\frac{3}{5}$ from $\frac{1}{9} = \frac{1}{9} - \frac{3}{5} = \frac{5-27}{45} = \frac{-22}{45}$

(d) $\frac{19}{15}$ from $\frac{7}{12} = \frac{7}{12} - \frac{19}{15} = \frac{35-76}{60} = \frac{-41}{60}$

(e) $\frac{7}{8}$ from $\frac{2}{3} = \frac{2}{3} - \frac{7}{8} = \frac{16-21}{24} = \frac{-5}{24}$

(f) $\frac{5}{12}$ from $\frac{13}{20} = \frac{13}{20} - \frac{5}{12} = \frac{39-25}{60} = \frac{14}{60} = \frac{-7}{30}$

3. Write the additive inverse of each of the following :

(a) $\frac{5}{8}$ additive inverse of $\frac{5}{8} = \frac{-5}{8}$

(b) $\frac{-5}{9}$ additive inverse of $\frac{-5}{9} = \frac{5}{9}$

(c) $\frac{19}{-20}$ additive inverse of $\frac{19}{-20} = \frac{19}{20}$

(d) $\frac{15}{-37}$ additive inverse of $\frac{15}{-37} = \frac{15}{37}$

4. Simplify :

(a) $\frac{-2}{3} + \frac{4}{9} - \frac{-5}{6} = \frac{-2}{3} + \frac{4}{9} + \frac{5}{6} = \frac{-12+8+15}{18} = \frac{11}{18}$

(b) $\frac{7}{8} - \frac{11}{12} + \frac{4}{15} = \frac{7}{8} - \frac{11}{12} + \frac{4}{15} = \frac{105-110+32}{120}$

$= \frac{137-110}{120} = \frac{27}{120} = \frac{9}{40}$

(c) $\frac{-1}{5} - \frac{4}{7} - \frac{5}{21} = \frac{-21-60-25}{105} = \frac{-106}{105}$

(d) $\frac{5}{12} + \frac{-7}{18} - \frac{11}{24} = \frac{30-28-33}{72} = \frac{30-61}{72} = \frac{-31}{72}$

(e) $\frac{4}{3} + \frac{3}{5} + \frac{-2}{3} + \frac{-11}{5} = \frac{20+9-10-33}{15} = \frac{29-43}{15} = \frac{-14}{15}$

(f) $\frac{7}{6} + \frac{1}{2} - \frac{5}{4} + \frac{4}{3} = \frac{14+6-15+16}{12} = \frac{36-15}{12} = \frac{21}{12} = \frac{7}{4}$

5. Simplify :

(a) $\frac{4}{13} + \frac{-5}{8} + \frac{-8}{13} + \frac{9}{13} = \frac{32-65-64+72}{104} = \frac{104-129}{104} = \frac{-25}{104}$

(b) $\frac{5}{3} + \frac{3}{-2} + \frac{-7}{3} + \frac{3}{1} = \frac{10-9-14+18}{6} = \frac{28-23}{6} = \frac{5}{6}$

(c) $\frac{3}{8} + \frac{7}{2} + \frac{-3}{5} + \frac{9}{8} + \frac{-3}{2} + \frac{6}{5} = \frac{15+140-24+45-60+48}{40}$

$= \frac{248-84}{40} = \frac{164}{40} = \frac{41}{10}$

(d) $\frac{1}{8}+\frac{5}{12}+\frac{2}{7}+\frac{7}{12}+\frac{9}{7}+\frac{-5}{16}=\frac{42+140+96+196+432-105}{336}$

$=\frac{906-105}{336}=\frac{801}{336}=\frac{267}{112}$

(e) $\frac{-3}{10}+\frac{7}{15}+\frac{3}{-20}+\frac{-9}{10}+\frac{13}{15}+\frac{13}{-20}$

$=\frac{-3}{10}+\frac{7}{15}-\frac{3}{20}-\frac{9}{10}+\frac{13}{15}-\frac{13}{20}$

$=\frac{-18+28-9-54+52-39}{60}=\frac{-120+80}{60}=\frac{-40}{60}=\frac{-2}{3}$

6. Multiply :

(a) $\frac{4}{7}$ by $\frac{-2}{5}=\frac{4}{7}\times\frac{-2}{5}=\frac{-8}{35}$ (b) $\frac{-9}{25}$ by $\frac{-5}{8}=\frac{-9}{25}\times\frac{-5}{8}=\frac{9}{40}$

(c) $\frac{-5}{9}$ by $\frac{81}{35}=\frac{-5}{9}\times\frac{81}{35}=\frac{-9}{7}$ (d) $\frac{6}{7}$ by $\frac{-19}{18}=\frac{6}{7}\times\frac{-19}{18}=\frac{-19}{21}$

(e) $\frac{8}{-11}$ by $\frac{33}{-24}=\frac{8}{-11}\times\frac{33}{-24}=$ l(f) $\frac{-17}{3}$ by $\frac{-21}{85}=\frac{-17}{3}\times\frac{-21}{85}=\frac{7}{5}$

7. Simplify :

(a) $\left(\frac{-3}{7}\times\frac{7}{5}\right)+\left(\frac{17}{15}\times\frac{3}{-34}\right)=\frac{-3}{7}\times\frac{7}{5}+\left(\frac{17}{15}\times\frac{3}{-34}\right)=\frac{-3}{5}+\left(\frac{1}{-10}\right)$

$=\frac{-3}{5}-\frac{1}{10}=\frac{-6-1}{10}=\frac{-7}{10}$

(b) $\left(\frac{-7}{21}\times\frac{-3}{14}\right)\times\left(\frac{5}{14}\times\frac{-4}{15}\right)=\frac{1}{14}\times\frac{-2}{21}=\frac{-1}{147}$

(c) $\left(\frac{3}{2}\times\frac{-7}{4}\right)-\left(\frac{-5}{2}\times\frac{3}{4}\right)=\frac{-21}{8}-\left(\frac{-15}{8}\right)=\frac{-21}{8}+\frac{15}{8}$

$=\frac{-21+15}{8}=\frac{-6}{8}=\frac{-3}{4}$

(d) $\left(\frac{9}{2}\times\frac{8}{3}\right)+\left(\frac{4}{3}\times\frac{5}{24}\right)-\left(\frac{3}{-5}\times\frac{-7}{6}\right)=\frac{12}{1}+\frac{5}{18}-\frac{7}{10}=\frac{1080+25-63}{90}$

$=\frac{1105-63}{90}=\frac{1042}{90}=\frac{521}{45}$

8. Verify that $x+y=y+x$, for each of the following :

(a) $x=\frac{-3}{5}$ and $y=\frac{-7}{10}$

Now, $x+y=y+x$

$$\frac{-3}{5}+\frac{-7}{10}=\frac{-7}{10}+\frac{-3}{5}$$

$$\frac{-3}{5}-\frac{7}{10}=\frac{-7}{10}-\frac{3}{5}$$

$$\frac{-6-7}{10}=\frac{-7-6}{10}$$

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

LHS = RHS Verified

(b) $x=\frac{6}{7}$ and $y=\frac{-11}{14}$

Now, $x+y=y+x$

$$\frac{6}{7}+\frac{-11}{14}=\frac{-11}{14}+\frac{6}{7}$$

$$\frac{6}{7}-\frac{11}{14}=\frac{-11}{14}+\frac{6}{7}$$

$$\frac{12-11}{14}=\frac{-11+12}{14}$$

$$\frac{1}{14}=\frac{1}{14}$$

LHS = RHS Verified

9. For each of the following, check that $x-y\neq y-x$:

(a) $x=\frac{-3}{2}$ and $y=\frac{4}{5}$

Now, $x-y\neq y-x$

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

$\frac{-3}{2}-\frac{4}{5}$, $\frac{4}{5}+\frac{3}{2}$

$$\frac{-15-8}{10} \neq \frac{8+15}{10}$$

$$\frac{-23}{10} \neq \frac{23}{10}$$

Verified

(b) $x = \frac{5}{7}$ and $y = \frac{-8}{12}$

Now, $x - y \neq y - x$

$$\frac{5}{7} - \frac{-8}{12} \neq \frac{-8}{12} - \frac{5}{7}$$

$$\frac{5}{7} + \frac{8}{12} \neq \frac{-56-60}{84}$$

$$\frac{60+56}{84} \neq \frac{-116}{84}$$

$$\frac{116}{84} \neq \frac{-116}{84}$$

Verified

10. $x = \frac{-9}{11}$ and $y = \frac{5}{7}$

$$(-x)+(-y) = -(x+y)$$

$$-\left(\frac{-9}{11}\right)+\left(\frac{-5}{7}\right) = -\left(\frac{-9}{11}+\frac{5}{7}\right)$$

$$\frac{9}{11} - \frac{5}{7} = -\left(\frac{-63+55}{77}\right)$$

$$\frac{63-55}{77} = -\left(\frac{-8}{77}\right)$$

$$\frac{8}{77} = \frac{8}{77}$$

proved

11. If $x = \frac{2}{3}$, $y = \frac{13}{21}$ and $z = \frac{5}{7}$

Then, $(x-y)-z \neq x-(y-z)$

$$= \left(\frac{2}{3} - \frac{13}{21}\right) - \frac{5}{7} \neq \frac{2}{3} - \left(\frac{13}{21} - \frac{5}{7}\right)$$

$$= \left(\frac{14-13}{21}\right) - \frac{5}{7} \neq \frac{2}{3} - \left(\frac{13-15}{21}\right)$$

$$= \frac{1}{21} - \frac{5}{7} \neq \frac{2}{3} - \left(\frac{-2}{21}\right)$$

$$= \frac{1}{21} - \frac{5}{7} \neq \frac{2}{3} + \frac{2}{21}$$

$$\frac{1-15}{21} \neq \frac{14+2}{21}$$

$$\frac{-14}{21} \neq \frac{16}{21}$$

No, it is not equal.

12. Verify the associative property of addition for the following rational numbers :

(a) $\frac{-2}{3}, \frac{5}{4}, \frac{7}{12}$

Now, $\left(\frac{-2}{3} + \frac{5}{4}\right) + \frac{7}{12} = \frac{-2}{3} + \left(\frac{5}{4} + \frac{7}{12}\right)$

$$\left(\frac{-8+15}{12}\right) + \frac{7}{12} = \frac{-2}{3} + \left(\frac{15+7}{12}\right)$$

$$\left(\frac{7}{12} + \frac{7}{12}\right) = \frac{-2}{3} + \left(\frac{22}{12}\right)$$

$$\frac{7+7}{12} = \frac{-8+22}{12}$$

$$\frac{14}{12} = \frac{14}{12}$$

LHS = RHS verified

(b) $\frac{3}{5}, \frac{3}{10}, \frac{7}{15}$

Now, $\left(\frac{3}{5} + \frac{3}{10}\right) + \frac{7}{15} = \frac{3}{5} + \left(\frac{3}{10} + \frac{7}{15}\right)$

$$\left(\frac{6+3}{10}\right) + \frac{7}{15} = \frac{3}{5} + \left(\frac{9+14}{30}\right)$$

$$\frac{9}{10} + \frac{7}{15} = \frac{3}{5} + \frac{23}{30}$$

$$\frac{27+14}{30} = \frac{18+23}{30}$$

$$\frac{41}{30} = \frac{41}{30}$$

$$\text{LHS} = \text{RHS} \qquad \text{verified}$$

13. Rearrange suitably and find the sum :

(a) $\frac{3}{7}+\frac{-5}{11}+\frac{-5}{14}+\frac{3}{11}$

$$=\left(\frac{3}{7}+\frac{-5}{14}\right)+\frac{-5}{11}+\frac{3}{11}$$

$$=\left(\frac{3}{7}-\frac{5}{14}\right)+\left(\frac{3}{11}-\frac{5}{11}\right)$$

$$=\left(\frac{6-5}{14}\right)+\left(\frac{3-5}{11}\right)=\frac{1}{14}+\left(\frac{-2}{11}\right)$$

$$=\frac{11-28}{154}=\frac{-17}{154}$$

(b) $-5+\frac{3}{10}+\frac{3}{7}+(-3)+\frac{5}{14}+\frac{7}{20}$

$$=(-5)+(-3)+\left(\frac{3}{10}+\frac{7}{20}\right)+\left(\frac{3}{7}+\frac{5}{14}\right)$$

$$=-8+\left(\frac{6+7}{20}\right)+\left(\frac{6+5}{14}\right)$$

$$=\frac{-8}{1}+\frac{13}{20}+\frac{11}{14}=\frac{-1120+91+110}{140}$$

$$=\frac{-1120+201}{140}=\frac{-919}{140}$$

14. Fill in the blanks, using commutative property for addition of rational numbers :

(a) $\frac{-5}{9}+\frac{2}{7}=\frac{-35+18}{63}=\frac{-17}{63}$

(b) $\frac{-15}{19}+\frac{18}{23}=\frac{-345+342}{437}=\frac{-3}{437}$

(c) $\frac{5}{6}+\left(\frac{-4}{9}\right)=\frac{15+(-8)}{18}=\frac{15-8}{18}=\frac{7}{18}$

(d) $\frac{1}{3}+\left(\frac{-6}{5}\right)=\frac{1}{3}-\frac{6}{5}=\frac{5-18}{15}=\frac{-13}{15}$

(e) $\frac{-7}{26}+\frac{16}{39}=\frac{-21+32}{78}=\frac{11}{78}$

(f) $\left(\frac{-11}{29}\right)+\left(\frac{-6}{31}\right)=\frac{-11\times 31+(-6\times 29)}{899}=\frac{-341-174}{899}=\frac{-515}{899}$

15. Fill in the blanks, using associative property for addition of rational numbers :

(a) $\left(\frac{1}{11}+\frac{1}{3}\right)+\frac{5}{6}=\mathbf{\frac{1}{11}}+\left(\mathbf{\frac{1}{13}}+\mathbf{\frac{5}{6}}\right)$

(b) $\left(\frac{-2}{5}\right)+\left(\frac{11}{5}+\frac{-3}{4}\right)=\left[\left(\mathbf{\frac{-2}{5}}\right)+\mathbf{\frac{11}{5}}\right]+\left(\mathbf{\frac{-3}{4}}\right)$

(c) $\left(\frac{3}{11}+\frac{1}{7}\right)+\left(\frac{-5}{13}\right)=\mathbf{\frac{3}{11}}+\left[\mathbf{\frac{1}{7}}+\left(\mathbf{\frac{-5}{13}}\right)\right]$

(d) $\frac{-11}{38}+\left(\frac{9}{14}+\frac{6}{19}\right)=\left(\mathbf{\frac{-21}{38}}+\mathbf{\frac{9}{14}}\right)+\mathbf{\frac{6}{19}}$

(e) $\left(\frac{-3}{4}\right)+\left[\frac{5}{6}+\left(\frac{-4}{9}\right)\right]=\left[\left(\mathbf{\frac{-3}{4}}\right)+\mathbf{\frac{5}{6}}\right]+\left(\mathbf{\frac{-4}{9}}\right)$

(f) $\frac{11}{29}+\left[\left(\frac{-6}{19}\right)+\frac{8}{11}\right]=\left[\mathbf{\frac{11}{29}}+\left(\mathbf{\frac{-6}{19}}\right)\right]+\mathbf{\frac{8}{11}}$

Exercise 1.3

1. For each of the following, check that $x \div y \neq y \div x$:

(a) $x=\frac{2}{5}$ and $y=\frac{26}{15}$

Check : $x \div y \neq y \div x$

$\frac{2}{5}\div\frac{26}{15}\neq\frac{26}{15}\div\frac{2}{5}$

$\frac{2}{5}\times\frac{15}{26}\neq\frac{26}{15}\times\frac{5}{2}$

$$\frac{3}{13} \neq \frac{13}{3}$$ verified

(b) $x = \frac{40}{99}$ and $y = 20$

Check : $x \div y \neq y \div x$

$$\frac{40}{99} \div \frac{20}{1} \neq \frac{20}{1} \div \frac{40}{99}$$

$$\frac{40}{99} \times \frac{1}{20} \neq \frac{20}{1} \times \frac{99}{40}$$

$$\frac{2}{99} \neq \frac{99}{2}$$ verified

2. Verify the property, $x \times (y \times z) = (x \times y) \times z$, for each of the following :

(a) $x = \frac{1}{2}, y = \frac{5}{4}$ and $z = \frac{-7}{5}$

Check : $x \times (y \times z) = (x \times y) \times z$

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

$$\frac{1}{2} \times \left(\frac{-7}{4}\right) = \left(\frac{5}{8}\right) \times \left(\frac{-7}{5}\right)$$

$$\frac{-7}{8} = \frac{-7}{8}$$ verified

(b) $x = \frac{-5}{7}, y = \frac{5}{2}$ and $z = \frac{7}{5}$

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

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

$$\left(\frac{-5}{7}\right) \times \left(\frac{7}{2}\right) = \left(\frac{-25}{14}\right) \times \left(\frac{7}{5}\right)$$

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

3. Verify the property, $x \times (y + z) = x \times y + x \times z$, for each of the following :

(a) $x = \frac{-8}{3}, y = \frac{5}{6}$ and $z = \frac{-7}{12}$

Prove that :

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

$$\left(\frac{-8}{3}\right)\times\left[\frac{5}{6}+\left(\frac{-7}{12}\right)\right]=\left(\frac{-8}{3}\times\frac{5}{6}\right)+\left(\frac{-8}{3}\times\frac{-7}{12}\right)$$

$$\left(\frac{-8}{3}\right)\times\left[\frac{10-7}{12}\right]=\left(\frac{-20}{9}\right)+\frac{14}{9}$$

$$\frac{-8}{3}\times\frac{3}{12}=\frac{-20}{9}+\frac{14}{9}$$

$$\frac{-2}{3}=\frac{-6}{9}$$

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

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

(b) $x=\frac{-3}{4}$, $y=\frac{-15}{4}$ and $z=\frac{8}{12}$

Prove that :

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

$$\frac{-3}{4}\times\left(\frac{-15}{4}+\frac{8}{12}\right)=\left(\frac{-3}{4}\right)\times\left(\frac{-15}{4}\right)+\left(\frac{-3}{4}\right)\times\left(\frac{8}{12}\right)$$

$$\left(\frac{-3}{4}\right)\times\left(\frac{-45+8}{12}\right)=\frac{+45}{16}+\frac{-1}{2}$$

$$\left(\frac{-3}{4}\right)\times\left(\frac{-37}{12}\right)=\left(\frac{45-8}{16}\right)$$

$$\frac{37}{16}=\frac{37}{16}$$

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

4. Use distributive property of multiplication of rational numbers over addition to simplify the following :

(a) $\frac{2}{7}\times\left(\frac{7}{16}+\frac{21}{4}\right)=\left(\frac{2}{7}\times\frac{7}{16}\right)+\left(\frac{2}{7}\times\frac{21}{4}\right)=\frac{1}{8}+\frac{3}{2}$

$$=\frac{1+12}{8}=\frac{13}{8}$$

(b) $\frac{-5}{4}\times\left(\frac{8}{5}+\frac{16}{5}\right)=\left(\frac{-5}{4}\times\frac{8}{5}\right)+\left(\frac{-5}{4}\times\frac{16}{5}\right)$

$=(-2)+(-4)$

$=-2-4=-6$

5. Find $(x+y)\div(x-y)$, for each of the following :

(a) $x=\frac{2}{7}$ and $y=\frac{4}{3}$

$=(x+y)\div(x-y)$

$=\left(\frac{2}{7}+\frac{4}{3}\right)\div\left(\frac{2}{7}-\frac{4}{3}\right)=\left(\frac{6+28}{21}\right)\div\left(\frac{6-28}{21}\right)$

$=\frac{34}{21}\div\left(\frac{-22}{21}\right)=\frac{34}{21}\times\frac{21}{-22}$

$=\frac{34}{-22}=\frac{-17}{11}$

(b) $x=\frac{5}{4}$ and $y=\frac{3}{2}$

Now, $(x+y)\div(x-y)$

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

$=\frac{11}{4}\div\frac{-1}{4}=\frac{11}{4}\times\frac{4}{-1}=-11$

6. Name the property of multiplication illustrated by the following statements :

(a) Commutative property over multiplication.

(b) Property of 1 (multiplinative identity of rational numbers)

(c) Distributive property of multiplication.

(d) Multiplicative inverse property.

(e) Property of zero.

(f) Associative property over multiplication.

7. Simplify :

(a) $\frac{-3}{5}\times\frac{-10}{9}\times\frac{21}{-4}\times(-6)$

$$= \frac{-3}{5} \times \frac{-10}{9} \times \frac{21}{-4} \times -6 = \frac{(-3) \times (-10) \times 21 \times (-6)}{5 \times 9 \times (-4) \times 1}$$

$$= \frac{2 \times 7 \times 6}{4}$$

$$= 7 \times 3 = 21$$

(b) $\frac{3}{11} \times \frac{-5}{6} \times \frac{-22}{9} \times \frac{-9}{5}$

$$= \frac{3}{11} \times \left(\frac{-5}{6}\right) \times \left(\frac{-22}{9}\right) \times \left(\frac{-9}{5}\right)$$

$$= \frac{3 \times (-5) \times (-22) \times (-9)}{11 \times 6 \times 9 \times 5}$$

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

$$= -1$$

8. Fill in the blanks :

(a) $\left(\frac{-23}{17}\right) \times \left(\frac{18}{35}\right) = \left(\frac{18}{35}\right) \times \left(\frac{\mathbf{-23}}{\mathbf{17}}\right)$

(b) $-38 \times \left(\frac{-7}{19}\right) = \left(\frac{-7}{19}\right) \times \left(\frac{\mathbf{-38}}{\mathbf{1}}\right)$

(c) $\left(\frac{15}{7} \times \frac{-21}{10}\right) \times \left(\frac{-5}{6}\right) = \left(\frac{\mathbf{15}}{\mathbf{7}}\right) \times \left[\left(\frac{-21}{10}\right) \times \left(\frac{-5}{6}\right)\right]$

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

(e) $\frac{-4}{5} \times \left(\frac{5}{7} \times \frac{-8}{9}\right) = \left(\frac{-4}{5} \times \frac{\mathbf{5}}{\mathbf{7}}\right) \times \frac{-8}{9}$

(f) $\frac{2}{5} \div \frac{2}{5} = \mathbf{1}$

(g) $\frac{4}{11} \div \left(\frac{\mathbf{4}}{\mathbf{-11}}\right) = -1$

(h) $\left(\frac{\mathbf{23}}{\mathbf{16}}\right) + (-1) = \frac{7}{16}$

(i) $\frac{-11}{15} \div \left(\frac{\mathbf{11}}{\mathbf{15}}\right) = -1$

(j) $\frac{4}{9} \div \mathbf{1} = \frac{4}{9}$

Exercise 1.4

1. $\frac{1}{5}$ and $\frac{1}{3}$

A rational number between $\frac{1}{5}$ and $\frac{1}{3}$

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

$$= \frac{1}{2} \times \frac{8}{15} = \frac{8}{30} = \frac{4}{15}$$

So, the required rational number is $\frac{4}{15}$.

2. $\frac{1}{6}$ and $\frac{2}{3}$

A rational number between $\frac{1}{6}$ and $\frac{2}{3}$

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

$$= \frac{1}{2} \times \frac{5}{6} = \frac{5}{12}$$

So, the required rational number is $\frac{5}{12}$.

3. $\frac{-6}{1}$ and $\frac{4}{5}$

Now, $\frac{-6}{1} = \frac{-6 \times 5}{1 \times 5} = \frac{-30}{5}$

So, four rational numbers between -6 and $\frac{4}{5}$ are

$$\frac{-29}{5}, \frac{-28}{5}, \frac{-27}{5}, \frac{-26}{5}$$

4. $\frac{1}{3}$ and $\frac{1}{5}$

$$\frac{1}{3} \text{ and } \frac{1}{5}$$

or $\frac{5}{15}$ and $\frac{3}{15}$

or $\frac{20}{60}$ and $\frac{12}{60}$

So three rational number between $\frac{20}{60}$ and $\frac{12}{60}$ are $= \frac{19}{60}, \frac{18}{60}, \frac{17}{60}$.

5. $\frac{-1}{2}$ and $\frac{-3}{4}$

or $\frac{-2}{4}$ and $\frac{-3}{4}$

or $\frac{-10}{20}$ and $\frac{-15}{20}$

Now, three rational be between $\frac{-10}{20}$ and $\frac{-15}{20}$ are$= \frac{-11}{20}, \frac{-12}{20}, \frac{-13}{20}$

6. $\frac{1}{3}$ and $\frac{1}{5}$

$\frac{1}{3}$ and $\frac{1}{5}$

or $\frac{5}{15}$ and $\frac{3}{15}$

or $\frac{20}{60}$ and $\frac{12}{60}$

So three rational number between $\frac{20}{60}$ and $\frac{12}{60}$ are $= \frac{19}{60}, \frac{18}{60}, \frac{17}{60}$.

7. $\frac{1}{3}$ and $\frac{1}{2}$

Rational No. $= \frac{1}{2}\left[\frac{1}{3} + \frac{1}{2}\right]$

$= \frac{1}{2}\left[\frac{2+3}{6}\right]$

$= \frac{1}{2}\left[\frac{5}{6}\right] = \frac{5}{12}$

8. $\frac{3}{4}$ and $\frac{2}{3}$

or $\frac{9}{12}$ and $\frac{8}{12} = \frac{45}{60}$ and $\frac{40}{60}$

So, four rational numbers between $\frac{45}{60}$ and $\frac{40}{60}$ are :

$$\frac{44}{60}, \frac{43}{60}, \frac{42}{60}, \frac{41}{60}$$

9. $\frac{7}{11}$ and $\frac{-4}{11}$

Ten rational number between $\frac{7}{11}$ and $\frac{-4}{11}$ are :

$$\frac{6}{11}, \frac{5}{11}, \frac{4}{11}, \frac{3}{11}, \frac{2}{11}, \frac{1}{11}, 0, \frac{-1}{11}, \frac{-2}{11}, \frac{-3}{11}$$

Exercise 1.5

1. Divide the sum of $\frac{65}{12}$ and $\frac{8}{3}$ by their difference.

$$= \left(\frac{65}{12} + \frac{8}{3}\right) \div \left(\frac{65}{12} - \frac{8}{3}\right)$$

$$= \left(\frac{65+32}{12}\right) \div \left(\frac{65-32}{12}\right) = \frac{97}{12} \div \frac{33}{12}$$

$$= \frac{97}{12} \times \frac{12}{33} = \frac{97}{33} = 2\frac{31}{33}$$

2. Product of two rational number $= \frac{-16}{9}$

one number $= \frac{-4}{3}$

So, other number $= \frac{-16}{9} \div \frac{-4}{3} = \frac{-16}{9} \times \frac{3}{-4} = \frac{4}{3}$

3. Let, $\frac{-33}{8}$ should be divided by x to get $\frac{-11}{2}$

So, $\frac{-33}{8} \div x = \frac{-11}{2}$

or $\frac{-33}{8} \div \frac{-11}{2} = x$

or $x = \frac{-33}{8} \times \frac{2}{-11}$

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

So, $\frac{-33}{8}$ should be divided by $\frac{3}{4}$ to get $\frac{-11}{2}$.

4. Cost of one metre of cloth $= ₹\ 36\frac{2}{3}$

Cost of $3\frac{3}{4}$ metres of cloth $= ₹\ 36\frac{2}{3} \times 3\frac{3}{4} = ₹\ \frac{110}{3} \times \frac{15}{4}$

$= ₹\ \frac{275}{2} = ₹\ 137\frac{1}{2}$

5. Length of rope $= 30$ m

Length of each piece $= 3\frac{3}{4}$ m

So, No. of pieces of rope $= 30 \div 3\frac{3}{4} = 30 \div \frac{15}{4}$

$= 30 \times \frac{4}{15} = 8$ pieces

6. Distance covered by cyclist $= 14\frac{2}{5}$ km

time taken $= 2\frac{1}{4}$ hrs

So, $\text{speed} = \frac{\text{Distance}}{\text{time}}$

$= 14\frac{2}{5} \div 2\frac{1}{4} = \frac{72}{5} \div \frac{9}{4} = \frac{72}{5} \times \frac{4}{9}$

$= \frac{32}{5} = 6\frac{2}{5}$ km/hr

7. Cost of 1 m of cloth $= ₹\ 25\frac{1}{4}$

Cost of $5\frac{3}{4}$ m of cloth $= ₹\ 25\frac{1}{4} \times 5\frac{3}{4}$

$$= \frac{101}{4} \times \frac{23}{4} = ₹\ \frac{2323}{16}$$

So, cost of $5\frac{3}{4}$ m of cloth $= ₹\ 145\frac{3}{16}$

8. Suresh walks in a day $= 4\frac{3}{5}$ km

Suresh will walk in $5\frac{1}{2}$ days $= 4\frac{3}{5} \times 5\frac{1}{2}$ km $= \frac{23}{5} \times \frac{11}{2}$ km

$$= \frac{253}{10} \text{ km} = 25\frac{3}{10} \text{ km}$$

9. Speed of car $= 40\frac{2}{5}$ m/hr

time $= 7\frac{1}{2}$ hours

Distance covered by car $=$ speed $\times$ time $= 40\frac{2}{5} \times 7\frac{1}{2}$

$$= \frac{202}{5} \times \frac{15}{2} = 303 \text{ km}$$

10. length of the park $= 45\frac{1}{2}$ m

breadth of the park $= 34\frac{3}{4}$ m

perimeter of the park $= 2(l + b)$

$$= 2\left(45\frac{1}{2} + 34\frac{3}{4}\right)$$

$$= 2\left(\frac{91}{2} + \frac{139}{4}\right) = 2\left(\frac{321}{4}\right)$$

$$= \frac{321}{2} = 160\frac{1}{2}$$

Area of the park $= l \times b$

$$= 45\frac{1}{2} \times 34\frac{3}{4} = \frac{91}{2} \times \frac{139}{4}$$

$$= \frac{12649}{8} = 1581\frac{1}{8}$$

11. Length of floor $= 2\frac{1}{4}$ m

Breadth of floor $= 1\frac{3}{4}$ m

Area of floor $= 2\frac{1}{4} \times 1\frac{3}{4} = \frac{9}{4} \times \frac{7}{4} = \frac{63}{16}$ m^2

$\therefore$ Side of carpet $= 1\frac{1}{2}$ m

Area of carpet $= 1\frac{1}{2}$ m $\times 1\frac{1}{2}$ m

$= \frac{3}{2}$ m $\times \frac{3}{2}$ m $= \frac{9}{4}$ m^2

Area of floor that is not carpeted $= \frac{63}{16} - \frac{9}{4} = \frac{63-36}{16}$

$= \frac{27}{16} = 1\frac{11}{16}$ m^2

12. Cloth required for 24 pair of trousers = 54 m

So, average length of trousers will be $= \frac{54}{24} = \frac{9}{4} = 2\frac{1}{4}$ m

Multiple Choice Questions

Tick (✓) the correct option :

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

Chapter

2 Playing with Numbers

Exercise 2.1

1. Write the following number in generalized form.

(a) $80 = 8 \times 10$

(b) $54 = 5 \times 10 + 4 \times 1$

(c) $231 = 200 + 30 + 1 = 2 \times 100 + 3 \times 10 + 1 \times 1$

(d) $999 = 9 \times 100 + 9 \times 10 + 9 \times 1$

2. Let the unit digit and tenth digits be y and x respectively.

According to the questions

$$(10x + y) + (10y + x) = 110$$
$$10x + y + 10y + x = 110$$
$$11x + 11y = 110$$
$$x + y = 10 \quad \ldots(i)$$

And their difference is 6.

So, $x - y = 6 \quad \ldots(ii)$

We added eq. (i) and (ii)

$$x + y = 10$$
$$x - y = 6$$
$$(-) \quad (+) \quad (-)$$
$$2x = 16$$
$$x = \frac{16}{2} = 8$$
$$x = 8$$

x's value put in eq. (i)

$$8 + y = 10$$
$$y = 10 - 8 = 2$$

Now, we get $x = 8$ and $y = 2$.

Hence, the required two digits number is 82.

3. Let the two digits number be $10x + y$.

So, according to the questions,

$$(10x + y) = 8 \times (x + y)$$
$$10x + y = 8x + 8y$$
$$10x - 8x + y - 8y = 0$$
$$2x - 7y = 0 \quad \ldots(i)$$

Similarly, when we subtract 45 from it then the digit is changed.

$$(10x + y) - 45 = (10y + x)$$
$$10x + y - 45 - 10y - x = 0$$
$$9x - 9y = 45$$
$$x - y = 5 \quad \ldots(ii)$$

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

$$2x - 7y = 0 \qquad \ldots(i)$$
$$x - y = 5 \qquad \ldots(ii) \times 2$$

Eq. (i) subtract from eq. (iii)

$$2x - 2y = 10$$
$$2x - 7y = 0$$
$$(-) \quad (+) \quad (-)$$
$$5y = 10$$
$$y = 2$$

y's value put in eq. (ii)

$$x - 2 = 5$$
$$x = 5 + 2 = 7$$

Now, we get $x = 7$ and $y = 2$.

Hence, the required two digits number is 72.

4. Original number $= (10a + b)$

Number formed by reversing the digits $= 10b + a$

According to questions,

The new number is increased by 54

Given; Sum of the digits $= 12$

$$a + b = 12 \quad \text{and} \quad b = 12 - a \qquad \ldots(i)$$
$$10a + b < 10b + a$$

The difference between the old number and new number $= 54$

$$10b + a - 10a - b = 54$$
$$9b - 9a = 54$$
$$9(b - a) = 54$$
$$(b - a) = \frac{54}{9} = 6 \qquad \ldots(ii)$$

Substituting in (ii) $b = 12 - a$ we have

$$(12 - a) - a = 6 \quad \Rightarrow \quad 12 - 2a = 6$$
$$-2a = 6 - 12 \quad \Rightarrow \quad -2a = -6$$
$$a = 3$$

form (i) $b = 12 - 3 = 9$

Hence the original number $= (10a + b)$

$$= 10 \times 3 + a = 30 + 9 = 39$$

5. Let original number $= 10a + b$

New number by reversing $= 10b + a$

The difference between the old number and new number is 45.

So, $(10a + b) - (10b + a) = 45$

$10a + b - 10b - a = 45$

$9a - 9b = 45$

$9(a - b) = 45$

$(a - b) = 45 \div 9 = 5$

The difference between two digits $= 5$.

Exercise 2.2

1. Which of the following are divisible by 2?

(A number is divisible by 2. If its units digit is even.)

(a) 350 = In 350, 0 is even number.
So, 350 is divisible by 2.

(b) 4015 = In 4015, 5 is not even number.
So, 4015 is not divisible by 2.

(c) 461 = In 461, 1 is not even number.
So, 461 is not divisible by 2.

(d) 298 = In 298, 8 is even number.
So, 298 is divisible by 2.

2. Which of the following are divisible by 3?

(We know that a number is divisible by 3. If the sum of its digits is divided by 3.)

(a) 9261 = Sum of the digit of $9261 = 9 + 2 + 6 + 1 = 18$
Which is divisible by 3, So, 9261 is divisible by 3.

(b) 3310 = Sum of the digit of $3310 = 3 + 3 + 1 + 0 = 7$
Which is not divisible by 3. So, 3310 is not divisible by 3.

(c) 2561= Sum of digits of $2561 = 2 + 5 + 6 + 1 = 14$
Which is not divisible by 3. So, 2561 is not divisible by 3.

(d) 1296 = Sum of the digits $= 1 + 2 + 9 + 6 = 18$
Which is divisible by 3.
So, 1296 is divisible by 3.

3. Which of the following are divisible by 5?

(A number is divisible by 5 if it units is 0 and 5)

(a) 4015 = Its unit digit is 5, So, 4015 is divisible by 5.

(b) 298 = Its unit digit is 8, So, 298 is not divisible by 5.

(c) 350 = Its unit digit is 0, So, 350 is divisible by 5.

(d) 461 = Its unit digit is 1, So, 461 is not divisible by 5.

4. Which of the following are divisible by 9?

We know that a number is divisible by 9 if sum of its digits is divisible by 9.

(a) 1769

Sum of digits = $1+7+6+9=23$.

Which is not divisible by 9.

So, 1769 is not divisible by 9.

(b) 3915

Sum of digits = $3+9+1+5=18$

Which is divisible by 9.

So, 3915 is divisible by 9.

(c) 6831

Sum of digits = $6+8+3+1=18$

Which is divisible by 9.

So, 6831 is divisible by 9.

(d) 6618

Sum of its digits = $6+6+1+8=21$

Which is not divisible by 9.

So, 6618 is not divisible by 9.

5. Which of the following are divisible by 10?

(A number is divisible by 10 if its units digit is 0.)

(a) 1709

Its unit digit is 9. So, 1709 is not divisible by 10.

(b) 2655

Its units digit is 5. So, 2655 is not divisible by 10.

(c) 1819

Its unit digit is 9. So, 1819 is not divisible by 10.

(d) 1400

Its unit digit is 0, So, 1400 is divisible by 10.

6. A number is divisible by 3 if it sum of its digit is divisible by 3.
A number is divisible by 9. If it sum of its digit is divisible by 9.
Now, as $9 > 3$ this implies that a number that is divisible by 3 may not be divisible by 9.
For example, $12(1+2=3)$ and $15\ (1+5=6)$ are divisible by 3 but not by 9.

7. Replace x by the smallest digit so that the number is divisible by (i) 3 (ii) 9.

(a) (i) Divisible by 3
$41\,x\,6 =$ Sum of digits should be divisible by 3.
Sum of digits $= 4+1+x+6=11+x$
We know that $3\times 3=9,\ 3\times 4=12$
$$9<11<12$$
So the sum should be 12
$$11+x=12$$
$$x=12-11=1$$
Thus, 41$\underline{1}$6 is divisible by 3.

(ii) $41\,x\,6$ is divisible by 9
Sum of digits should be divisible by 9.
Sum of digits $= 4+1+x+6=11+x$
We know that $9\times 1=9,\ 9\times 2=18$
$$9<11<18$$
So, sum should be 18
$$11+x=18$$
$$x=18-11=7$$
Thus, 41$\underline{7}$6 is divisible 9.

(b) (i) $x284$ is divisible by 3 : Sum of digits should be divisible by 3.
$x+2+8+4=14+x$
We know that $3\times 4=12,\ 3\times 5=15$
$$12<14<15$$
So, the sum should be $=15$
$$14+x=15$$
$$x=15-14=1$$
Thus, $\underline{1}284$ is divisible by 3.

(ii) $x\,284$ is divisible by 9.

Sum of digit should be divisible by 9.

$$x+2+8+4=14+x$$

We know that $9\times 2=18$

$$9<14<18$$

So the sum should be $=18$

$$14+x=18 \quad \Rightarrow \quad x=18-14=4$$

Thus $\underline{4}284$ is divisible by 9.

(c) (i) $5\,x\,02$ is divisible by 3 :

Sum of digit should be divisible by 3.

$$5+x+0+2=7+x$$

We know that $=2\times 3=6,\ 3\times 3=9$

So, the sum should be 9.

$$7+x=9 \quad \Rightarrow \quad x=9-7=2$$

Thus $5\underline{2}02$ is divisible by 3.

(ii) $5\,x\,02$ divisible by 9.

Sum of digits should be divided by 9.

Sum of digits $5+x+0+2=7+x$

We know that $9>7$

The sum should be 9.

$$7+x=9$$

$$x=9-7=2$$

Thus, $5\underline{2}02$ is divisible by 9.

(d) (i) $448\,x$ is divisible by 3.

Sum of digits should be divided by 3.

Sum of digits $=4+4+8+x=16+x$

We know that $3\times 5=15,\ 3\times 6=18$

$$16+x=18$$

$$x=18-16=2$$

Thus, $448\underline{2}$ is divisible by 3.

(ii) $448x$ is divisible by 9.

Sum of digits should by divide 9.

Sum of digits $=4+4+8+x=16+x$

We know that, $9\times 1=9,\ 18=2\times 9$

$$9<16<18$$

The sum should be 18.

$$16+x=18 \quad \Rightarrow \quad x=18-16=2$$

4482 is divisible by 9.

(e) (i) $5\,x\,21$ is divisible by 3.

Sum of digits should be divide by 3.

Sum of digits $5+x+2+1=8+x$

we know that, $3\times 2=6 \Rightarrow \quad 3\times 3=9$

$$6<3<9$$

Sum should be 9

$$8+x=9 \Rightarrow \quad x=9-8=1$$

5121 is divisible by 3.

(ii) $5\,x\,21$ is divisible by 9.

Sum digits should be divided by 9.

Sum of digits $=5+x+2+1=8+x$

We know that, $9\times 1=9 \Rightarrow \quad 8<9$

Sum should be 9.

$$8+x=9 \Rightarrow \quad x=9-8=1$$

5121 is divisible by 9.

Exercise 2.3

1. As. $10\times 10=100$. As ; $100\div 10=10$

$\therefore$ We can subtract 10 from 100 in 10 time.

2. Find the value of unknowns :

(a) (i) Starting from ones column we have

$$5+6+C=11+C$$

$$11+C=8$$

$$11+C=18$$

(8 will remain at the ones place and 1 is carried over.)

$$C=18-11=7$$

	4	3	5
	8	2	6
+	1	4	7
1	4	0	8

(ii) Tens column

We have; $3+B+4=0$

$7+B=10$

(0 will remain at the one's place and 1 is carried over)

$$B=10-1-7=10-8=2$$

(iii) Hundred column

We have; $A + 8 + 1 = 14$

$A + 9 = 14$

$A = 14 - 9 = 5$

Sum $5 + 8 + 1 = 14$

$D = 1$

(b) As ones digit as 2.

The B can either 3 or 8.

(As $4 \times 3 = 12$, $4 \times 8 = 32$)

As; $7 - 4 = 3 \therefore B = 8$

$$\begin{array}{r} 6\ 6\ 8 \\ \times\ 4 \\ \hline 2\ 6\ 7\ 2 \end{array}$$

In ten's digit the place the number is same as that in the hundreds place in product.

As the digit thousands place in product is 2.

$\therefore$ The required digit is 6 as $4 \times \underline{6} = 24$ and $24 + 2 = 2\underline{6}$

(c) Starting from ones column

$B + 1 = 8$

$B = 8 - 1 = 7$

$B = 7$

$$\begin{array}{r} 2\ 4\ 7 \\ +\ 4\ 7\ 1 \\ \hline 7\ 1\ 8 \end{array}$$

Tens columns

$7 + A = 1$ (1 will be remain at tens place and 1 is carried over)

$7 + A = 11 \quad \Rightarrow \quad A = 11 - 7$

$A = 4$

3. (a) Here a one digit is to be added to a 3-digit number. Who all are similar. Also, the result obtained is a 4-digit number, where ones, tens and hundreds digit is same. By this we conclude that $P = \underline{9}$, $A = \underline{1}$ and $B = \underline{0}$.

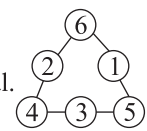
$$\begin{array}{r} 9\ 9\ 9 \\ +\ 1 \\ \hline 1\ 0\ 0\ 0 \end{array}$$

(b) Here, the digits are reversed by adding the digit at ones place and the digit at tens place is obtained as $9 + 9 = 18$. Thus, $X = 8$, and $Y = 9$.

$$\begin{array}{r} 8\ 9 \\ +\ 9 \\ \hline 9\ 8 \end{array}$$

4. We use the lowest three values on the points 1, 2, 3. From there we put the values biggest to smallest in the middle of each section from low total to high total.

So, $1 + 2 = 3$, $1 + 3 = 4$ and $2 + 3 = 5$



So, 6 goes between 1 and 2, 5 between 1 and 3, 4 between 2 and 3.

5.

	29	
83	23	17
	71	

Given total = 123

Given number = $83 = 123 - 83 = 40$

Sum of two prime number whose total is 40 = 23 and 17

Again $123 = 23 + 29 - x$

$$x = 123 - 52 = 71.$$

6. Complete the magic squares given below :

(a)

I	II	III
6	**1**	8
7	5	**3**
2	**9**	4

Sum of diagonals $= 6 + 5 + 4 = 15$

In third column $15 - (8 + 4) = 3$

In second diagonal $15 - (8 + 5) = 2$

In third row $15 - (4 + 2) = 9$

In second column $= 15 - (5 + 9) = 1$

In third column $= 15 - (6 + 2) = 7$

(b)

	C-I	C-II	C-III	C-IV
R-I	6	H 12	G $6 + B$	9
R-II	B	15	C -4	14
R-III	11	F $B + 4$	10	E_8
R-IV	16	D 2	13	A $B + 2$

We know that in magic squares sum of all sides and diagonals are equal.

Let the missing numbers be A, B, C, D, E, F, G, H respectively as shown in box

Now, Sum of diagonal and sum of column I are equal.

$$6 + 15 + 10 + A = 6 + B + 11 + 16$$

$$31 + A = 33 + B$$

$$A - B = 33 - 31 = 2$$

$$A = B + 2$$

• Sum of diagonal and Sum of row II are equal

$$B + 15 + C + 14 = 6 + 15 + 10 + A$$

$$B + 29 + C = 31 + B + 2 \quad \text{(putting A's value)}$$

$$C = 3 - 29 + B - B$$

$$C = 4$$

• Sum of diagonal and row IV are equal.

$$16+D+13+A=6+15+10+A$$
$$16+D+B+B+2=6+15+10+B+2$$
$$31+D+B=33+B$$
$$D=33-31+B-B$$
$$D=2$$

- **Sum of diagonal and sum of column are equal**

$$6+15+10+A=9+E+14+A$$
$$31+A+2=23+B+2+E$$
$$33+B=25+B+E$$
$$E=33-25+B-B$$
$$E=8$$

- **Sum of both the diagonals are equal**

$$9+4+F+16=6+15+10+A$$
$$29+F=31+B+2$$
$$F=33+B$$
$$F=33-29+B$$
$$F=4+B$$
$$F=B+4$$

- **Sum of diagonals and sum of column II are equal :**

$$6+15+10+A=H+15+F$$
$$31+B+2=H+15+B+4+2$$
$$33+B=H+B+21$$
$$H=33-21+B-B$$
$$H=12$$

- **Sum of diagonals and sum of row I are equal :**

$$6+H+G+9=6+15+10+A$$
$$6+12+G+9=31+B+2$$
$$27+G=33+B$$
$$G=33-27+B$$
$$G=6+B$$
$$G=B+6$$

We assumed the smallest value that is 1 as the value of B to make all the total equal.

Now $B = 1$

$\therefore \quad F = 1 + 4 = 5; \qquad \therefore \quad A = 1 + 2 = 3;$

$\therefore \quad G = 1 + 6 = 7$

Hence, the solved magical square is as follows :

6	12	7	9
1	15	4	14
11	5	10	8
16	2	13	3

Exercise 2.4

1. Fill in the blanks :

(a)

$$163 \underset{(+19)}{\longrightarrow} 182 \underset{(+19\times 2)}{\longrightarrow} 220 \underset{(+19\times 3)}{\longrightarrow} 277 \underset{(+19\times 4)}{\longrightarrow} 353 \underset{(+19\times 5)}{\longrightarrow} 448 \underset{(+19\times 6)}{\longrightarrow} 562$$

(b)

$$17 \underset{(17\times 1)}{\longrightarrow} 17 \underset{(17\times 3)}{\longrightarrow} 51 \underset{(51\times 5)}{\longrightarrow} 255 \underset{(255\times 7)}{\longrightarrow} 1785 \underset{(1785\times 9)}{\longrightarrow} 16065 \underset{(16065\times 11)}{\longrightarrow} 176715$$

2. Observe the following pattern and write the missing numbers :

$$11^2 = 121 \quad \Rightarrow \quad 101^2 = 10201$$

$$1001^2 = 1002001 \quad \Rightarrow \quad 10001^2 = 100020001$$

$$10001^2 = \mathbf{10000200001} \quad \Rightarrow \quad \mathbf{1000001^2} = 1000002000001$$

3. Using the pattern, find the missing numbers :

$$1^2 + 2^2 + 2^2 = 3^2 \quad \Rightarrow \quad 2^2 + 3^2 + 6^2 = 7^2$$

$$3^2 + 4^2 + 12^2 = 13^3 \quad \Rightarrow \quad 4^2 + 5^2 + 20^2 = 21^2$$

$$5^2 + 6^2 + \mathbf{30^2} = 31^2 \quad \Rightarrow \quad 6^2 + 7^2 + \mathbf{42^2} = \mathbf{43^2}$$

4. Study the number pattern given below :

$$0 \times 9 + 1 = 1$$
$$1 \times 9 + 2 = 11$$
$$12 \times 9 + 3 = 111$$
$$123 \times 9 + 4 = 1111$$
$$1234 \times 9 + 5 = 11111$$
$$12345 \times 9 + 6 = 111111$$

$$123456 \times 9 + 7 = 1111111$$
$$1234567 \times 9 + 8 = 11111111$$
$$12345678 \times 9 + 9 = 111111111$$
$$123456789 \times 9 + 10 = 1111111111$$

Investigate a similar number pattern where the first two lines are :

$$1 \times 8 + 1 = 9$$
$$12 \times 8 + 2 = 98$$

MCQs

Tick (✓) the correct answer :

1. (c) **2.** (c) **3.** (a) **4.** (d)

BRAIN BOOSTER

1.

4	14	12	$\rightarrow 12+10+8=30$
18	10	2	
8	6	16	$\rightarrow 4+10+16=30$

2. $6x5$ divisible by 3 and 9.

Sum of digits are divisible by 9 or 3.

$$6+5+x=11+x$$
$$11+x=18$$
$$x=7$$

The 675 is divisible by 3 and 9.

Chapter

3 Exponents (Powers)

Exercise 3.1

1. Simplify and write the answer in exponential form :

$$x^m \times x^n = x^{m+n}$$

(a) $6^4 \times 6^{-5} = (6)^{4+(-5)} = 6^{4-5} = 6^{-1}$

(b) $12^{-7} \times 12^3 = 12^{-7+3} = 12^{-4}$

(c) $\left(\frac{3}{7}\right)^{-5} \times \left(\frac{3}{7}\right)^{-5} = \left(\frac{3}{7}\right)^{-5+(-5)} = \left(\frac{3}{7}\right)^{-5-5} = \left(\frac{3}{7}\right)^{-10}$

(d) $\left(\frac{-8}{11}\right)^{-12} \times \left(\frac{-8}{11}\right)^{6} = \left(\frac{-8}{11}\right)^{-12+6} = \left(\frac{-8}{11}\right)^{-6}$

2. Simplify and write the answer with positive exponents :

$$x^m \div x^n = x^{m-n}; \; x^{-m} = \frac{1}{x^m}; \; x^\circ = 1$$

(a) $\left(\frac{21}{23}\right)^{-4} \div \left(\frac{21}{23}\right)^{-6} = \left(\frac{21}{23}\right)^{-4-(-6)} = \left(\frac{21}{23}\right)^{-4+6} = \left(\frac{21}{23}\right)^{2}$

(b) $10^{-5} \div 10^{-2} = (-10)^{-5-(-2)}$

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

(c) $\left(\frac{b^4}{b^2}\right) = b^4 \div b^2 = b^{4-2} = b^2$

(d) $\left(\frac{6}{7}\right)^{8} \div \left[\left(\frac{6}{7}\right)^{5} \times \left(\frac{6}{7}\right)^{3}\right] = \left(\frac{6}{7}\right)^{8} \div \left[\left(\frac{6}{7}\right)^{5+3}\right]$

$$= \left(\frac{6}{7}\right)^{8} \div \left(\frac{6}{7}\right)^{8} = \left(\frac{6}{7}\right)^{8-8} = \left(\frac{6}{7}\right)^{0} = 1$$

3. Find the value of the following :

$$x^{-m} = \frac{1}{x^m}$$

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

(b) $\left(\frac{625}{81}\right)^{\frac{-1}{4}} = \left(\frac{81}{625}\right)^{\frac{1}{4}} = \frac{(3)^{4 \times \frac{1}{4}}}{(5)^{4 \times \frac{1}{4}}} = \frac{3}{5}$

(c) $\left(\frac{25}{49}\right)^{\frac{7}{2}} = \left(\frac{5}{7}\right)^{2\times\frac{7}{2}} = \left(\frac{5}{7}\right)^{7} = \frac{78125}{823543}$

(d) $\left(\frac{32}{243}\right)^{\frac{4}{5}} = \left(\frac{(2)^5}{(3)^5}\right)^{\frac{4}{5}} = \left(\frac{2}{3}\right)^{5\times\frac{4}{5}} = \left(\frac{2}{3}\right)^{4} = \frac{16}{81}$

4. Find the value of the following :

(a) $(343)^{\frac{2}{3}} = (7\times 7\times 7)^{\frac{2}{3}} = (7)^{3\times\frac{2}{3}} = (7)^2 = 49$

(b) $(32768)^{\left(\frac{1}{15}\right)}$

$= 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2)^{1/15}$

$= (2)^{15\times\frac{1}{15}} = 2$

(c) $(279936)^{\frac{1}{7}} = (6\times 6\times 6\times 6\times 6\times 6\times 6)^{1/7} = (6)^{7\times\frac{1}{7}} = 6z$

(d) $(343)^{-\frac{1}{3}} = \left(\frac{1}{343}\right)^{\frac{1}{3}} = \left(\frac{1}{7\times 7\times 7}\right)^{\frac{1}{3}} = \left(\frac{1}{7}\right)^{3\times\frac{1}{3}} = \left(\frac{1}{7}\right)^{3\times\frac{1}{3}} = \frac{1}{7}$

5. Find the value of the following :

(a) $(0.04)^{\frac{5}{2}} = (0.2\times 0.2)^{\frac{5}{2}} = (0.2)^{2\times\frac{5}{2}} = (0.2)^5$

$= 0.2\times 0.2\times 0.2\times 0.2\times 0.2 = 0.00032$

(b) $(0.000729)^{\frac{5}{6}} = (0.3\times 0.3\times 0.3\times 0.3\times 0.3\times 0.3)^{5/6}$

$= (0.3)^{6\times\frac{5}{6}} = (0.3)^5$

$= 0.3\times 0.3\times 0.3\times 0.3\times 0.3 = .00243$

(c) $(0.125)^{\frac{2}{3}} = (0.5\times 0.5\times 0.5)^{\frac{2}{3}} = (0.5)^{3\times\frac{2}{3}}$

$= (0.5)^2 = 0.5\times 0.5 = 0.25$

(d) $(0.000064)^{\frac{5}{6}} = (0.2 \times 0.2 \times 0.2 \times 0.2 \times 0.2 \times 0.2)^{\frac{5}{6}}$

$= (0.2)^{6 \times \frac{5}{6}} = (0.2)^5$

$= 0.2 \times 0.2 \times 0.2 \times 0.2 \times 0.2 = 0.00032$

6. Simplify the following :

(a) $4^{-4} \times 5^{-4} = (4 \times 5)^{-4} = (20)^{-4}$

(b) $7^{-5} \times 8^{-5} = (7 \times 8)^{-5} = (56)^{-5}$

(c) $\left(\frac{-3}{8}\right)^{-6} \times \left(\frac{-4}{9}\right)^{-6} = \left(\frac{-3}{8} \times \frac{-4}{9}\right)^{-6} = \left(\frac{1}{6}\right)^{-6}$

(d) $(1^3 + 2^3 + 3^3 + 4^3)^{\frac{-3}{2}} = (100)^{\frac{-3}{2}} = (10)^{2 \times \frac{-3}{2}} = (10)^{-3}$

$= \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} = \frac{1}{1000}$

7. Simplify the following :

(a) $\left[(729)^{\frac{-5}{3}}\right]^{\frac{-1}{2}} = [((3)^6)^{-\frac{5}{3}}]^{-\frac{1}{2}}$

$= \left[\left(\frac{1}{(3)^6}\right)^{\frac{5}{3}}\right]^{-\frac{1}{2}} = \left[\frac{1}{(3)^{6 \times \frac{5}{3}}}\right]^{-\frac{1}{2}} = \left[\frac{1}{(3)^{10}}\right]^{-\frac{1}{2}}$

$= (3)^{10 \times \frac{1}{2}} = (3)^{\frac{10}{2}} = (3)^5 = 243$

(b) $\left(\frac{2}{13}\right)^{\frac{4}{3}} \left(\frac{2}{13}\right)^{\frac{5}{3}} = \left(\frac{2}{13}\right)^{\frac{4}{3} + \frac{5}{3}} = \left(\frac{2}{13}\right)^{\frac{9}{3}} = \left(\frac{2}{13}\right)^3 = \frac{8}{2197}$

Exercise 3.2

1. Write the following as radicals :

(a) $17^{1/2} = \sqrt{17}$ (b) $112^{1/7} = \sqrt[7]{112}$

(c) $\left(\frac{7}{12}\right)^{\frac{1}{9}} = \sqrt[9]{\frac{7}{12}}$ (d) $\left(\frac{516}{63}\right)^{\frac{-1}{14}} = \sqrt[14]{\frac{63}{516}}$

2. Write the following as a mixed radicals :

(a) $\sqrt{108} = \sqrt{2\times 2\times 3\times 3\times 3} = 2\times 3\sqrt{3} = 6\sqrt{3}$

(b) $\sqrt{99} = \sqrt{3\times 3\times 11} = 3\sqrt{11}$

(c) $\sqrt{405} = \sqrt{3\times 3\times 3\times 3\times 5} = 3^2 \times 3^2\sqrt{5} = 9\sqrt{5}$

(d) $\sqrt{162} = \sqrt{2\times 3\times 3\times 3\times 3} = 3\times 3\times \sqrt{2} = 9\sqrt{2}$

3. Write the following as a pure radicals :

(a) $2\sqrt{6} = \sqrt{(2)^2\times 6}$
$= \sqrt{4\times 6} = \sqrt{24}$

(b) $7\sqrt{6} = \sqrt{(7)^2\times 6}$
$= \sqrt{49\times 6} = \sqrt{294}$

(c) $10\sqrt{5} = \sqrt{(10)^2\times 5}$
$= \sqrt{100\times 5} = \sqrt{500}$

(d) $\frac{2}{3}\sqrt{40} = \sqrt{\frac{2}{3}\times\frac{2}{3}\times 40}$
$= \sqrt{\frac{4}{9}\times 40} = \sqrt{\frac{160}{9}}$

4. Write in standard form :

(a) $0.000000478 = 4.78\times 10^{-7}$

(b) $606.239 = 6.06239\times 10^{2}$

(c) $5230000000000 = (5.23)\times 10^{12}$

(d) $\frac{9}{100000000} = 9\times 10^{-8}$

(e) $4603\times (10)^{-5} = 4.603\times 10^{3}\times 10^{-5}$
$= 4.603\times 10^{3-5} = 4.603\times 10^{-2}$

(f) $0.0000478\times (10)^{4} = 0.478 = 4.78\times 10^{-1}$

5. Write in usual form :

(a) $1.29\times (10)^{-8} = 0.0000000129$

(b) $6.083\times (10)^{4} = 60830$

(c) $7.17\times (10)^{-5} = 0.0000717$

(d) $2.0001\times (10)^{9} = 2000100000$

(e) $8 \times (10)^{-9} = 0.000000008$

(f) $3.9 \times (10)^{3} = 3900$

6. Write each of the following in scientific notation.

(a) $573 = 5.73 \times 10^{2}$

(b) $88450 = 8.845 \times 10^{4}$

(c) $959731452 = 9.59731452 \times 10^{8}$

(d) $0.37 = 3.7 \times 10^{-1}$

(e) $0.00000129 = 1.29 \times 10^{-6}$

(f) $0.000000000009 = 9 \times 10^{-12}$

7. Speed of light $= 300000000$ m/s $= 3 \times 10^{8}$ m/s.

8. Speed of aircraft $= 2.012 \times 10^{3}$ km/h

$= 2.012 \times 10 \times 10 \times 10$ km/h $= 2012$ km/h

Time taken $= 3$ hrs 30 min $= 3 + \frac{1}{2}$ hrs $= \frac{7}{2}$ hrs

Distance $= 2012 \times \frac{7}{2} = 1006 \times 7 = 7042$

Distance $= 7.042 \times 10^{3}$ km.

9. Find x if :

(a) $3^{x} = 243$

$(3)^{x} = (3)^{5}$

$\therefore \quad x = 5$

(b) $(-2)^{x} \times (-2)^{2x} = (-2)^{-9}$

$(-2)^{3x} = (-2)^{-9}$

$x = \frac{-9}{3} = -3$

$\Rightarrow \quad x = -3$

(c) $5^{x} . 5^{x+1} = 125$

$(5)^{2x+1} = (5)^{3}$

$2x + 1 = 3$

$2x = 2$

$x = 1$

(d) $\frac{7^{5x}}{7^{7x}} = \frac{1}{2401}$

$\frac{(7)^{5x}}{(7)^{7x}} = \frac{1}{(7)^{4}}$

$5x - 7x = -4$

$-2x = -4$

$x = 2$

(e) $2^x = \left(\frac{1}{32}\right)^{-3}$

$2^x = \left(\frac{1}{(2)^5}\right)^{-3}$

$2^x = ((2)^5)^3$

$2^x = 2^{15}$

$x = 15$

(f) $3^x = \frac{1}{81}$

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

$3^x = 3^{-4}$

$x = -4$

Multiple Choice Questions

Tick (✓) the correct answer

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

BRAIN BOOSTER

1. Evaluate the following :

(a) $(0.000125)^{\frac{-4}{3}} = (0.05 \times 0.05 \times 0.05)^{-\frac{4}{3}}$

$= (0.05)^{3 \times \frac{-4}{3}} = (0.05)^{-4} = \left(\frac{1}{0.05}\right)^4 = 20^4$

(b) $\left[\left\{\left(\left(\frac{4}{5}\right)^{-1}\right)^{-2}\right\}^{\frac{1}{5}}\right]^{-10} = \left[\left\{\left(\frac{4}{5}\right)^2\right\}^{\frac{1}{5}}\right]^{-10}$

$= \left[\left(\frac{4}{5}\right)^{\frac{2}{5}}\right]^{-10} = \left(\frac{4}{5}\right)^{\frac{-2}{5} \times 10}$

$= \left(\frac{4}{5}\right)^{-4} = \left(\frac{5}{4}\right)^4 = \frac{625}{256}$

2. $a^{x^2-y^2} \times a^{y^2-z^2} \times a^{z^2-x^2} = 1$

$a^m \times a^n = a^{m+n}$

$a^{x^2-y^2+y^2-z^2+z^2-x^2} = 1 \quad \Rightarrow \quad a^0 = 1$

3. Solve : $5^{3x-5} = \frac{1}{25^x}$

$$5^{3x-5} = \frac{1}{(5)^{2x}} \quad \Rightarrow \quad 5^{3x-5} = (5)^{-2x}$$

$$3x-5 = -2x \quad \Rightarrow \quad 3x+2x = 5$$

$$5x = 5 \quad \Rightarrow \quad x = 1$$

Chapter

4 Square and Square Roots

Exercise 4.1

1. Find the squares of the following numbers :

(a) 39, square of $39 = 39 \times 39 = 1521$

(b) 103, square of $103 = 103 \times 103 = 10609$

(c) 115, square of $115 = 115 \times 115 = 13225$

(d) 209, square of $209 = 209 \times 209 = 43681$

2. Select the numbers which are squares of even numbers and odd numbers :

(The squares of an even number is even and the squares of an odd number is odd.)

169 : ∵ Digit at ones place is odd.
225 :
625 :
121 : ∴ All these numbers are square of odd numbers.
1225 :

36 : ∵ Digit at ones place is even.
64 :
144 :
100 : ∴ All these numbers are square of even numbers.
196 :

3. The greatest 3-digit number = 999

Now, we need to find the least number,

when subtracted from 999 gives a perfect square.

Thus, the required number = 999 − 38

= 961

Also, $\sqrt{961} = 31$

	31
3	$\overline{9}\ \overline{99}$
+3	−9
61	99
	−61
	38

4. The greatest 4-digit number = 9999

Now, we need to find the least number,

when subtracted from 9999 gives a perfect square.

Thus, the required number

9999 − 198 = 9801

Also, $\sqrt{9801} = 99$

	99
9	$\overline{99}\ \overline{99}$
+9	−81
189	18 99
	−1701
	19 8

5. Select the numbers which are not perfect squares?

- **418**

2	418
	209

Prime factors of 418 = 2 × 209

∴ 418 is not perfect square.

- **900**

2	900
2	450
3	225
3	75
5	25
5	5
	1

Prime factors of 900 = $\overline{2 \times 2} \times \overline{3 \times 3} \times \overline{5 \times 5}$

∴ 900 is a perfect square

- **563**

563	563
	1

Prime factors of 563 = 563 × 1

∴ 563 is not prefect square

- **1000**

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

Prime factors of $1000 = \overline{2\times 2}\times 2\times \overline{5\times 5}\times 5$

$\therefore$ 1000 is not perfect square.

- **289**

17	289
17	17
	1

Prime factors of $289 = \overline{17\times 17}$

$\therefore$ 289 is a perfect square.

- **612**

2	612
2	306
3	153
3	51
17	17
	1

Prime factors of $612 = \overline{2\times 2}\times \overline{3\times 3}\times 17$

612 is not perfect square.

- **256**

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

Prime factors of $256 = \overline{2\times 2}\times \overline{2\times 2}\times \overline{2\times 2}\times \overline{2\times 2}$

$\therefore$ 256 is a perfect square

- **697**

17	697
	41

Prime factors of $697 = 17\times 41$

$\therefore$ 697 is not perfect square

6. Find the smallest number by which the given number must be multiplied to make it a perfect square.

- **156**

Prime factors of $156 = (\overline{2\times 2})\times 3\times 13$

In the prime factors 3 and 13 are left unpaired.

Multiply 156 with 3×13, the ungrouped 3 and 13 will also be grouped in pair.

So, the required number is 39.

2	156
2	78
3	39
13	13
	1

- **1331**

Prime factors of $1331 = \overline{(11 \times 11)} \times 11$

In the prime factors 11 is left ungrouped.
Multiply 1331 with 11 the ungrouped 11 will also be grouped in pair.
So, the required number is 11.

11	1331
11	121
11	11
	1

- **432**

Prime factors of 432

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

In the prime factors 3 is left in unpaired.
Multiply 432 by 3, the ungrouped 3 will also be grouped in pairs.
So, the required number is 3.

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

- **700**

Prime factors of 700

$$= \overline{(2 \times 2)} \times \overline{(5 \times 5)} \times 7$$

In the prime factors 7 is left in unpaired.
Multiply 700 by 7, the ungrouped 7 will also be grouped in pair.
So, the required number is 7.

2	700
2	350
5	175
5	35
7	7
	1

- **882**

Prime factors of 882

$$= 2 \times \overline{(3 \times 3)} \times \overline{(7 \times 7)}$$

In the prime factor 2 is left in unpaired.
Multiply 882 with 2, the ungrouped 2 will be also in grouped in pairs.

2	882
3	441
3	147
7	49
7	7
	1

- **3698**

Prime factors of $3698 = 2 \times \overline{(43 \times 43)}$

In the prime factor 2 is left in unpaired.
Multiply 3698 with 2, the ungrouped 2 will be also in grouped in pairs.

2	3698
43	1849
43	43
	1

- **76800**

Prime factors of 76800

$= (\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{2\times 2})$
$\times(\overline{2\times 2})\times(\overline{2\times 2})$
$\times 3\times(\overline{5\times 5})$

In the prime factors 3 is left in unpaired.

Multiply 76800 with 3, the ungrouped 3 will be also in grouped in pairs.

2	76800
2	38400
2	19200
2	9600
2	4800
2	2400
2	1200
2	600
2	300

2	150
3	75
5	25
5	5
	1

- **845**

Prime factors of 845

$= 5\times(\overline{13\times 13})$

In the prime factors, 5 is left unpaired.

Multiply with 5, the ungrouped 5 will be also in pairs.

5	845
13	169
13	13
	1

7. Find the smallest number by which the given number must be divided to make it a perfect square.

- **8112**

Prime factors of 8112

$= (\overline{2\times 2})\times(\overline{2\times 2})\times 3\times(\overline{13\times 13})$

In the prime factors 3 is left unpaired.

If 8112 is divided by 3 then we will be left with a perfect square.

The required number = 3.

2	8112
2	4056
2	2028
2	1014
3	507
13	169
13	13
	1

- **3920**

Prime factors of 3920

$= (\overline{2\times 2})\times(\overline{2\times 2})\times 5\times(\overline{7\times 7})$

In prime factorisation, 5 is left unpaired.

If 3920 is divided by 5 then we will be left with a perfect square.

The required number = 5

2	3920
2	1960
2	980
2	490
5	245
7	49
7	7
	1

- **3971**

Prime factors of $3971 = \overline{(19 \times 19)} \times 11$

In prime factorisation, 11 is left unpaired.

If 3971 is divided by 11 then we will be left with a perfect square.

The required number = 11

19	3971
19	209
11	11
	1

- **10368**

Prime factors of 10368

$= \overline{(2 \times 2)} \times \overline{(2 \times 2)} \times \overline{(2 \times 2)} \times 2$

$\times \overline{(3 \times 3)} \times \overline{(3 \times 3)}$

In prime factorisation, 2 is left unpaired.

If 10368 is divided by 2 then we will be left with a perfect square.

The required number = 2

2	10368
2	5184
2	2592
2	1296
2	648
2	324
2	162

3	81
3	27
3	9
3	3
	1

- **141148**

Prime factors of 141148

$= \overline{(2 \times 2)} \times \overline{(71 \times 71)} \times 7$

In prime factorisation, 7 is left unpaired.

If 141148 is divided by 7 then we will be left with a perfect square.

The required number = 7.

2	141148
2	70574
7	35287
71	5041
71	71
	1

- **1568**

Prime factors of 1568

$= \overline{(2 \times 2)} \times \overline{(2 \times 2)} \times 2 \times \overline{(7 \times 7)}$

In prime factorization, 2 is left unpaired.

1568 is divided by 2 we will but left with a perfect square.

The required number is 2.

2	1568
2	784
2	392
2	196
2	98
7	49
7	7
	1

- **5184**

Prime factors of 5184

$= (\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{2\times 2})\times(\overline{3\times 3})\times(\overline{3\times 3})$

5184 is already perfect square

If 5184 is divided by 4 we will be left again perfect square.

The required number is 4.

2	5184
2	2592
2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

- **27378**

Prime factors of 27378

$= 2\times(\overline{3\times 3})\times(\overline{3\times 3})\times(\overline{13\times 13})$

In prime factorization, 2 is left unpaired.

If 27378 is divided by 2, we will be left with a perfect square.

The required number is 2.

2	27378
3	13689
3	4563
3	1521
3	507
13	169
13	13
	1

8. Find the value of :

(a) $(-0.03)^2 = -0.03\times -0.03 = 0.0009$

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

(c) $\left(\frac{-17}{105}\right)^2 = \left(\frac{-17}{105}\right)\times\left(\frac{-17}{105}\right) = \frac{289}{11025}$

(d) $\left(\frac{-39}{93}\right)^2 = \left(\frac{-39}{93}\right)\times\left(\frac{-39}{93}\right) = \frac{1521}{8649}$

Exercise 4.2

1. Find the squares of the following numbers :

(a) $25;\ 25\times 25 = 625$ $\quad\therefore$ 625 is the square of 25

(b) $39;\ 39\times 39 = 1521$ $\quad\therefore$ 1521 is the square of 39

(c) $45;\ 45\times 45 = 2025$ $\quad\therefore$ 2025 is the square of 45

(d) $103; 103 \times 103 = 10609$ $\therefore$ 10609 is the square of 103

(e) $115; 115 \times 115 = 13225$ $\therefore$ 13225 is the square of 115

(f) $123; 123 \times 123 = 15129$ $\therefore$ 15129 is the square of 12

2. Select the numbers which are squares of even numbers and odd numbers :

(The squares of even numbers are even. Squares of odd numbers are odd.)

Squares of even numbers = 36, 64, 144, 100, 196.

Squares of odd numbers = 225, 169, 625, 121, 1225.

3. Which of the following numbers are not perfect squares?

(By using property 2. All the perfect square are ending with an even number of zeros.)

Thus, 100, 10000, 16900, 22500, 640000 are perfect square.

So, 16000, 2500000, 1000, 9000, 81000 are not perfect square.

4. Check out which of the following numbers are perfect squares using prime factorization method : .

- **256**

Prime factor of 256

$= \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2}$

$= 16$

Thus, 256 is a perfect square of 16.

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

- **169**

13	169
13	13
	1

Prime factors of $169 = \overline{13 \times 13}$

Thus, 169 is a perfect square of 13.

- **226**

2	226
	113

Prime factors of $226 = 2 \times 113$

Thus, 226 is not a perfect square.

- **100**

2	100
2	50
5	25
5	5
	1

Prime factors of $100 = \overline{2 \times 2} \times \overline{5 \times 5}$

$= 2 \times 5 = 10$

Thus, 100 is perfect square of 10.

- **121**

11	121
11	11
	1

Prime factors of $121 = \overline{11 \times 11}$

Thus, 121 is a prefect square of 11.

- **299**

13	299
23	23
	1

Prime factors of $299 = 13 \times 23$

Thus, 299 is not perfect square.

- **324**

2	324
2	162
3	81
3	27
3	9
3	3
	1

Prime factors of $324 = \overline{2 \times 2} \times \overline{3 \times 3} \times \overline{3 \times 3}$

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

Thus, 324 is a perfect square of 18.

- **1024**

4	1024
4	256
4	64
4	16
2	4
2	2
	1

Prime factors of $1024 = \overline{4 \times 4} \times \overline{4 \times 4} \times \overline{2 \times 2}$

$= 4 \times 4 \times 2 = 32$

Thus, 1024 is a prefect square of 32..

- **2027**

2027	2027
	1

Prime factors of $2027 = 2027 \times 1$

Thus 2027 is not a prefect squares.

- **10404**

Prime factors of 10404

$$= (\overline{2\times 2})\times(\overline{3\times 3})\times(\overline{17\times 17})$$

$$= 2\times 3\times 17$$

Thus, 10404 is a perfect square of 102.

2	10404
2	5202
3	2601
3	867
17	289
17	17
	1

5. Check out which of the following numbers are not perfect squares, using the property of perfect squares :

(By using property 1. A number ending with 2, 3, 7 and 8 can never be a perfect square)

Thus, 137, 188, 697, 228, 233 are not perfect square.

$$125 = 5\times 5\times 5$$

- 125 is cube of 5 so it is not a perfect square.

$$2205 = 5\times 21\times 21$$

- 2205 is not a perfect square. As factors are not paired.

6. Fill in the blanks :

(a) $1+3+5+7+\mathbf{9}=\mathbf{25}=5^2$

(b) $1+3+5+7+9+\mathbf{11}=\mathbf{36}=6^2$

(c) $1+3+5+7+9+11+\mathbf{13}=\mathbf{49}=7^2$

(d) $1+3+5+7+9+11+13+\mathbf{15}=\mathbf{64}=8^2$

7. Find the values using the properties of squares :

$$\boxed{(n+1)^2-n^2=(n+1)+n}$$

(a) $105^2-104^2=105+104=209$

(b) $147^2-146^2=147+146=293$

(c) $238^2-237^2=238+237=475$

(d) $269^2-268^2=269+268=537$

8. Which of the following are Pythagorean triplets?

(a) (4, 6, 8)

$$2m=4 \quad\Rightarrow\quad m=2$$

$$(m^2-1)=2^2-1=4-1=3$$

$(m^2+1)=2^2+1=4+1=5$

4, 6, 8 are not pythagorean triplets.

(b) (6, 8, 10)

$2m=6 \quad \Rightarrow \quad m=3$

$(m^2-1)=3^2-1=9-1=8$

$(m^2+1)=3^2+1=9+1=10$

6, 8, 10 are pythagorean triplets.

(c) (9, 81, 82)

$2m=9 \quad \Rightarrow \quad m=4.5$

$(m^2-1)=4.5^2-1=20.25-1=19.25$

$(m^2+1)=4.5^2+1=20.25+1=21.25$

9, 81, 82 are not pythagorean triples.

(d) $(10, 24, 26) \Rightarrow 2m=10 \Rightarrow m=5$

$(m^2-1)=5^2-1=25-1=24$

$(m^2+1)=(5^2+1)=25+1=26$

10, 24, 26 are pythagorean triplets.

(e) $(15, 85, 87) \Rightarrow 2m=15 \quad \Rightarrow \quad m=7.5$

$(m^2-1)=7.5^2-1=56.25-1=55.25$

$(m^2+1)=7.5^2+1=56.25+1=57.25$

15, 85, 87 are not pythagorean triplets

(f) $(26, 168, 170) \Rightarrow 2m=26 \Rightarrow m=13$

$(m^2-1)=13^2-1=169-1=168$

$(m^2+1)=13^2+1=169+1=170$

26, 168, 170 are pythagorean triplets

(g) $(30, 224, 226) \Rightarrow 2m=30; m=15$

$(m^2-1)=15^2-1=225-1=224$

$(m^2+1)=15^2+1=225+1=226$

30, 224, 226 are phythagorean triplets.

(h) $(42, 440, 442) \Rightarrow 2m=42; m=21$

$(m^2-1)=21^2-1=441-1=440$

$(m^2 + 1) = 21^2 + 1 = 441 + 1 = 442$

42, 440, 442 are phythagorean triplets.

Exercise 4.3

1. Find the square root of the following by prime factorization method.

(a) 1521

3	1521
3	507
13	169
13	13
	1

Prime factorization of $\overline{3 \times 3} \times \overline{13 \times 13}$

Square root of $1521 = 3 \times 13 = 39$

(b) 1600

2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

Prime factorization of $1600 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{5 \times 5}$

$= 2 \times 2 \times 2 \times 5 = 8 \times 5 = 40$

Square root of $1600 = 40$

(c) 9604

2	9604
2	4802
7	2401
7	343
7	49
7	7
	1

Prime factorization of 9604

$= \overline{2 \times 2} \times \overline{7 \times 7} \times \overline{7 \times 7} = 2 \times 7 \times 7$

Square root of $9604 = 98$

(d) 11025

5	11025
5	2205
3	441
3	147
7	49
7	7
	1

Prime factorization of 11025

$= \overline{5 \times 5} \times \overline{3 \times 3} \times \overline{7 \times 7}$

Square root of 11025

$= 5 \times 3 \times 7 = 105$

2. Find the smallest number by which each of the following numbers should be multiplied so as to get a perfect squares.

(a) 126

Prime factors of $126 = 2 \times \overline{3 \times 3} \times 7$

This prime factorisation 2 and 7 are left unpaired.

By multiples 126 with 14 the ungrouped 2 and 7 will also be grouped in pairs.

So, the required number is 14.

2	126
3	63
3	21
7	7
	1

(b) 180

Prime factor of $180 = \overline{2 \times 2} \times \overline{3 \times 3} \times 5$

In, This prime factorization 5 is left unpaired

By multiplied 180 with 5 the ungrouped 5 will also be grouped in pairs.

So, required number = 5.

2	180
2	90
3	45
3	15
5	5
	1

(c) 1458

Prime factor of 1458

$= 2 \times \overline{3 \times 3} \times \overline{3 \times 3} \times \overline{3 \times 3}$

In this, prime factorization 2 is left unpaired.

By multiplied 1458 with 2 the ungrouped 2 will also be grouped paired.

So, required number = 2..

2	1458
3	729
3	243
3	81
3	27
3	9
	3
	1

(d) 2028

Prime factor of 2028

$= \overline{2 \times 2} \times 3 \times \overline{13 \times 13}$

In this, prime factorization 3 is left unpaired.

By multiplied 2028 with 3 the ungrouped 3 will also be grouped paired.

So, required number = 3.

2	2028
2	1014
3	507
13	169
13	13
	1

3. Find the square root of the following by division method.

(a) 15376

	124
1	$\overline{1}\ \overline{53}\ \overline{76}$
$+1$	-1
22	53
$+2$	44
244	976
	-976
	0

$\sqrt{15376} = 124$

(b) 974169

	987
9	$\overline{97}\ \overline{41}\ \overline{69}$
$+9$	-81
188	16 41
$+8$	$-15\ 04$
1967	1 37 69
	$-1\ 37\ 69$
	0

$\sqrt{974169} = 987$

(c) 4004001

	2001
2	$\overline{4}\ \overline{00}\ \overline{40}\ \overline{01}$
	-4
40	00
	00
4001	4001
	-4001
	$\times$

$\sqrt{4004001} = 2001$

(d) 7033104

	2652
2	$\overline{7}\ \overline{03}\ \overline{31}\ \overline{04}$
$+2$	-4
46	3 03
$+6$	$-2\ 76$
525	27 31
$+5$	26 25
5302	1 06 04
	1 06 04
	0

$\sqrt{7033104} = 2652$

4. In each of the following find the least number which must be added to make the following a perfect square.

(a) 5678

We observe that $75^2 < 5678 < 76^2$

Now, the number to be added $76^2 - 5678$

$= 5776 - 5678 = 98$

Required number is 98.

98 is added to $5678 = 5678 + 98 = 5776$

$\therefore$ 5776 is the perfect square of 76.

	75
7	56 78
$+7$	-49
145	7 78
	-725
	53

(b) 9991

We observe that

$$99^2 < 9991 < 100^2$$

Now, the number to be added

$$10000 - 9991 = 9$$

If 9 is added to $9991 = 9991 + 9 = 10000$

10000 is perfect square of 100.

	99
9	99 91
+9	−81
189	18 91
	17 01
	1 90

(c) 4215

We observe that $64^2 < 4215 < 65^2$

Now, the number to be added

$$65^2 - 4215 = 4225 - 4215 = 10$$

Required number = 10

If 10 is added to $4215 = 4215 + 10 = 4225$

4225 is perfect square of 65.

	64
6	$\overline{42}$ $\overline{15}$
+6	−36
124	6 15
	4 96
	1 19

(d) 306452

We observe that

$$553^2 < 306452 < 554^2$$

Now, the number to be added

$$554^2 - 306452$$

$$306916 - 306452 = 464$$

Required number = 464

If 464 is added to $306452 = 306452 + 464$

$$= 306916$$

306916 is perfect square of 554.

	553
5	$\overline{30}$ $\overline{64}$ $\overline{52}$
+5	25
105	564
+5	−525
1103	3952
	3309
	643

(e) 92700

We observe that $304^2 < 92700 < 305^2$

Now, the number to be added

$$305^2 - 92700 = 93025 - 92700$$

$$= 325$$

Required number = 325

If 325 is added to $92700 = 92700 + 325$

$$= 93025$$

93025 is perfect square of 305.

	304
3	$\overline{9}$ $\overline{27}$ $\overline{00}$
+3	−3
604	2700
	−2416
	284

5. The greatest 4-digit number $= 9999$

We observe that

$$99^2 = 9801$$

Now, we need to find the least number when subtracted from 9999 gives a perfect squares.

Thus, the required number is $9999 - 198 = 9801$

$$\sqrt{9801} = 99^2$$

	99
9	9999
+9	81
189	1899
	−1701
	198

6. The least number of 6 digits $= 100000$

We observe that

$$316^2 < 100000 < 317^2$$

Now, the number to be added

$$= 317^2 - 100000$$

$$= 100489 - 100000 = 489$$

Required prefect square

$$= 100000 + 489 = 100489$$

$$\sqrt{100489} = 317$$

	316
3	$\overline{10}\ \overline{00}\ \overline{00}$
+3	−9
61	100
+1	−61
626	3900
	3756
	144

7. The least number which will be divisible by 8, 12, 15 and 20 is the L.C.M. of 8,12,15 and 20.

2	8, 12, 15, 20
2	4, 6, 15, 10
2	2, 3, 15, 5
3	1, 3, 15, 5
5	1, 1, 5, 5
	1, 1, 1, 1

LCM of 8, 12, 15 and

$$20 = 2 \times 2 \times 3 \times 5 \times 2 = 120$$

To make 120 a perfect square 120

$$= 2 \times \overline{2 \times 2} \times 3 \times 5$$

It must be multiplied by 30.

Hence, the required the least number $120 \times 30 = 3600$.

2	120
2	60
2	30
3	15
5	5
	1

8. We observe that $245^2 < 60509 < 246^2$

Now, the number to be added

$$246^2 - 60509$$

$$60516 - 10509 = 7$$

Required number = 7

If 7 is added to 60509 = 60516

$$\sqrt{60516} = 246.$$

	245
2	$\overline{6}\ \overline{05}\ \overline{09}$
+2	−4
44	205
+4	−176
485	2909
	−2425
	484

9. The greatest 5-digit number = 99999

We observe that

$$316^2 = 99856$$

Now, we need to find the least number when subtracted from 99999 we gives a perfect square.

Thus, the required number

$$99999 - 143 = 99856$$

Square root of (99856) $= \sqrt{99856} = 316$

	316
3	99999
+3	−9
61	099
+1	−61
626	3899
	3756
	143

	316
3	$\overline{9}\ \overline{98}\ \overline{56}$
+3	9
61	098
+2	−61
626	3856
	−3856
	0

10. Length of recentangle = 22 cm

Breadth of recentangle = 120 cm

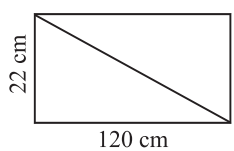
By using phythagorash theorem

$$d^2 = l^2 + b^2$$

$$= 22^2 + 120^2$$

$$= 484 + 14400 = 14884$$

$$d = \sqrt{14884} = 122$$



	122
1	1 48 84
+1	−1
22	48
+2	−44
242	4 84
	4 84
	0

∴ Diagonal of rectangle is 122 cm.

Exercise 4.4

1. Evaluate the following :

(a) $\sqrt{25\times 169}=\sqrt{25}\times\sqrt{169}=5\times 13=65$

(b) $\sqrt{45}\times\sqrt{20}=\sqrt{45\times 20}=\sqrt{900}=30$

(c) $\sqrt{25.6\times 52.9}=\sqrt{1354.24}=36.8$

	36.8
3	$\overline{13}$ $\overline{54.24}$
+3	−9
66	4 54
+6	−396
728	58 24
	58 24
	0

(d) $\sqrt{\dfrac{0.4225}{0.0169}}$

	0.65
6	0.$\overline{42}$ $\overline{25}$
+6	−36
125	6 25
	−6 25
	0

	0.13
1	0.$\overline{01}$ $\overline{69}$
+1	−1
23	69
	69
	0

$$=\frac{\sqrt{0.4225}}{\sqrt{0.0169}}=\frac{0.65}{0.13}=5$$

2. Find the Square root of the following :

(a) $\frac{1296}{1936} = \sqrt{\frac{1296}{1936}} = \frac{\sqrt{1296}}{\sqrt{1936}} = \frac{36}{44}$

	36
3	12 96
+3	−9
66	3 96
	−3 96
	0

	44
4	19 36
+4	−16
84	3 36
	− 3 36
	0

Square root of $\frac{1296}{1936} = \frac{36}{44}$

(b) $57\frac{19}{25} = \frac{1444}{24}$

$= \sqrt{\frac{1444}{25}}$

$= \frac{\sqrt{1444}}{\sqrt{25}}$

$= \frac{38}{5}$

	38
3	14 44
	−9
68	5 44
	− 5 44
	0

	5
5	25
	−25
	0

Square root of $\frac{1444}{25} = \frac{38}{5}$

(c) $6\frac{115}{289} = \sqrt{\frac{1849}{289}}$

$= \frac{\sqrt{1849}}{\sqrt{289}}$

$= \frac{43}{17}$

	43
4	$\overline{18}\ \overline{49}$
+4	−16
83	2 49
	2 49
	0

	17
1	$\overline{2}\ \overline{89}$
+1	−1
27	1 89
	1 89
	0

Square root of $\frac{1849}{289} = \frac{43}{17}$

(d) $3\frac{16}{256} = \frac{784}{256} = \sqrt{\frac{784}{256}} = \frac{\sqrt{784}}{\sqrt{256}} = \frac{28}{16}$

	28
2	$\overline{7}\ \overline{84}$
+2	−4
48	3 84
	3 84
	0

	16
1	$\overline{2}\ \overline{56}$
+1	−1
26	1 56
	1 56
	0

square root of $\frac{784}{256} = \frac{28}{16}$

3. Find the square root of the following numbers

(a) $3 \Rightarrow$ square root $3 = \sqrt{3}$

	1.732
1	$\overline{3}.\overline{00}\ \overline{00}\ \overline{00}$
+1	−1
27	2 00
+7	−189
343	11 00
+3	−10 29
3462	71 00
	69 24
	1 76

$\sqrt{3} = 1.732$

(b) $11 \Rightarrow$ Square root of $11 = \sqrt{11}$

	3.316
3	$\overline{11}.\overline{00}\ \overline{00}\ \overline{00}$
+3	−9
63	2 00
+3	−1 89
661	11 00
+1	−6 61
6626	4 39 00
	−3 97 56
	41 44

$\sqrt{11} = 3.316$

(c) 125 Square root of 125 $= \sqrt{125}$

	11.180
1	$\overline{1}\ \overline{25}.00\ 00\ 00$
+1	1
21	25
+1	21

(d) 3460 ; Square root of 3460 $= \sqrt{3460}$

	58.821
5	$\overline{34}\ \overline{60}.\overline{00}\ \overline{00}\ \overline{00}$
+5	−25
108	9 60
+8	−864

221	4 00
+1	2 21
2228	1 79 00
+8	−1 78 24
22360	76 00
	00 00
	076 00

1168	96 00
+8	−93 44
11762	2 56 00
+2	−2 35 24
11761	20 76 00
	−1 17 61
	19 58 39

$\therefore \quad \sqrt{3460} = 58.821$

4. Find the value of the following numbers correct upto 3 decimal places.

(a) $\sqrt{145.38}$

	12.057
1	1 45.38 00 00
+1	−1
22	45
+2	−44
2405	13800
+5	−12025
24107	177500
	−168749
	8751

$\therefore \quad \sqrt{145.38} = 12.057 \ldots$

(b) $\sqrt{35.35}$

	5.945
5	$\overline{35.35}$ $\overline{00}$ $\overline{00}$
+5	−25
109	1035
+9	−981
1184	5400
+4	−4736
11885	66400
	−59425
	6975

$\therefore \quad \sqrt{35.35} = 5.945$

(c) $\sqrt{19}$

	4.358
4	$\overline{19.00}$ $\overline{00}$ $\overline{00}$
+4	16
83	3 00
+3	2 43
865	51 00

(d) $\sqrt{15525.28}$

	124.600
1	$\overline{1}$ $\overline{55}$ $\overline{25.28}$ $\overline{00}$ $\overline{00}$
+1	−1
22	55
+2	−44
244	1125

+5	43 25
8708	7 75 00
	−6 96 64
	78 36

+4	−976
2486	14928
+6	−14916
249200	12 00 00
	00 00 00
	120 00 00

$\therefore \quad \sqrt{19} = 4.358$ $\qquad \therefore \quad \sqrt{15525.28} = 124.600$

5. Simplify :

(a) $\dfrac{\sqrt{72.25} - \sqrt{5.76}}{\sqrt{72.25} + \sqrt{5.76}}$

	8.5
8	$\overline{72.25}$
+8	−64
165	8 25
	−8 25
	0

	2.4
2	$\overline{5.76}$
+2	−4
44	1 76
	− 1 76
	0

$\sqrt{72.25} = 8.5$ $\qquad \sqrt{5.76} = 2.4$

value put in $\dfrac{\sqrt{72.25} - \sqrt{5.76}}{\sqrt{72.25} + \sqrt{5.76}}$

$$\frac{8.5 - 2.4}{8.5 + 2.4} = \frac{6.1}{10.9} \text{ or } \frac{61}{109}$$

(b) $\dfrac{\sqrt{0.2209} + \sqrt{0.1681}}{\sqrt{0.2209} - \sqrt{0.1681}}$

	0.47
4	$\overline{0.22}\ \overline{09}$
+4	−16
87	609
	−609
	0

	0.41
4	$\overline{0.16}\ \overline{81}$
+4	−16
81	0 81
	81
	0

$\therefore \quad \sqrt{0.2209} = 0.47$; $\qquad \sqrt{0.1681} = 0.41$

Value put in $\frac{\sqrt{0.2209}+\sqrt{0.1681}}{\sqrt{0.2209}-\sqrt{0.1681}}$

$$\frac{0.47+0.41}{0.47-0.41}=\frac{0.88}{0.06}=\frac{88}{6} \text{ or } \frac{44}{3}.$$

6. $\sqrt{25921}$ by using division method

$$\frac{\sqrt{259.21}-\sqrt{2.5921}}{\frac{\sqrt{25921}}{\sqrt{100}}-\frac{\sqrt{25921}}{\sqrt{10000}}}$$

$$=\frac{161}{10}-\frac{161}{100}$$

$$=\frac{1610-161}{100}$$

$$=\frac{1449}{100}$$

$$=14.49$$

	161
1	$\overline{2}\ \overline{59}\ \overline{21}$
+1	−1
26	159
+6	156
321	321
	−321
	0

7. $\sqrt{19044}$ by using division method

$\sqrt{190.44} \div \sqrt{1.9044}$

$$=\sqrt{\frac{19044}{100}} \div \sqrt{\frac{19044}{10000}}$$

$$=\frac{\sqrt{19044}}{\sqrt{100}} \div \frac{\sqrt{19044}}{\sqrt{10000}}$$

$$=\frac{138}{10} \div \frac{138}{100}$$

$$=\frac{138}{10} \times \frac{100}{138}=10$$

	138
1	$\overline{1}\ \overline{90}\ \overline{44}$
+1	1
23	90
+3	−69
268	2144
	2144
	0

8. Find the square root of the following.

(a) $\sqrt{20.8849}$

	4.57
4	20.88 49
+4	−16
85	4 88

(b) $\sqrt{180.0964}$

	13.42
1	$\overline{1}\ \overline{80}.\overline{09}\ \overline{64}$
+1	−1
23	80

$+5$	$-4\ 25$
907	$63\ 49$
	$-63\ 49$
	0

Square root of $20.8849 = 4.57$

$+3$	-69
264	$11\ 09$
$+4$	-1056
2682	$53\ 64$
	-5364
	0

Square root of $180.0964 = 13.42$

(c) $0.\overline{00}\ \overline{01}\ \overline{10}\ \overline{25}$

$$= \frac{11025}{1000000000}$$

$$\frac{\sqrt{11025}}{\sqrt{\overline{00}\,\overline{00}\,\overline{00}}} = \frac{105}{10000}$$

$$\frac{105}{10000} = 0.0105$$

square root of $0.00011025 = 0.0105$

	105
1	$\overline{1}\ \overline{10}\ \overline{25}$
$+1$	-1
205	$0\ 10\ 25$
	$-\ 10\ 25$
	0

(d) 0.104976

$$= \frac{104976}{100000}$$

$$= \frac{\sqrt{104976}}{\sqrt{100000}}$$

$$= \frac{324}{1000}$$

$$\frac{324}{1000} = 0.324$$

Square root of $0.104976 = 0.324$

	324
3	$\overline{10}\ \overline{49}\ \overline{76}$
$+3$	-9
62	149
-2	-124
644	$25\ 76$
	$-25\ \ 76$
	0

Multiple Choice Questions

Tick (✓) correct answer :

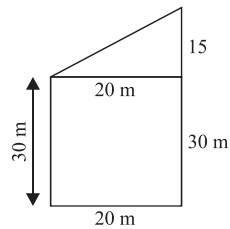
1. (b) **2.** (c) **3.** (a) **4.** (b) **5.** (b) **6.** (a) **7.** (b) **8.** (d) **9.** (b) **10.** (c)

BRAIN BOOSTER

1. Heights of first minar = 30 m

Height of second minar = 45 m

$$l^2 = b^2 + h^2$$
$$= (20)^2 + (15)^2$$
$$= 400 + 225$$
$$= 625$$
$$l = \sqrt{625} = 25$$



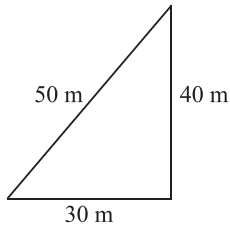
The distance between their tops 25 cm

2. Height of kite = 40 m

Length of string = 50 m

Distance between Raju and tree

$$l^2 = b^2 + h^2$$
$$b^2 = l^2 - h^2$$
$$= (50)^2 - (40)^2$$
$$= 2500 - 1600$$
$$= 900$$
$$b = \sqrt{900} = 30\,\text{m}$$

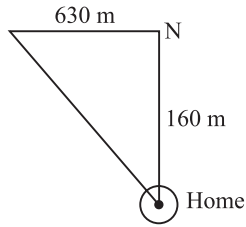


3. $h = 160\,\text{m}, b = 630\,\text{m}, l = x$

$$x^2 = (630)^2 + (160)^2 = 396900 + 25600 = 422500$$
$$x = \sqrt{422500} = 650\,\text{m}$$

She covered the distance while returning = 650 m

	650
6	$\overline{42}\ \overline{25}\ \overline{00}$
+ 6	36
125	625
0	625
1250	000
	000
	0



Chapter

5 Cube and Cube Roots

Exercise 5.1

1. Find the cubes of following numbers :

(a) $25.1 = 25.1 \times 25.1 \times 25.1 = 15813.251$

(b) $0.05 = 0.05 \times 0.05 \times 0.05 = 0.000125$

(c) $1.7 = 1.7 \times 1.7 \times 1.7 = 4.913$

(d) $0.9 = 0.9 \times 0.9 \times 0.9 = 0.729$

2. Which of the following are cubes of even natural numbers?
(The cube of an even number is even)

(a) 32,768 is cube of even natural number.

(b) 9,261 is not cube of even natural number.

(c) 6,36,056 is cube of even natural number.

(d) 8,000 is cube of even natural number.

(e) 42,875 is not cube of even natural number

(f) 13,824 is cube of even natural number.

3. Which of the following are cubes of odd natural numbers?
(The cube of an odd number are odd)

(a) 35,937 is cube of odd natural number.

(b) 2,744 is not cube of odd natural number.

(c) 2,197 is cube of odd natural number.

(d) 10,648 is not cube of odd natural number.

(e) 4,913 is cube of odd natural number.

(f) 6,859 is cube of odd natural number.

4. Which of the following are perfect cubes?

(a) 1,728

2	1728
2	864
2	432
2	216
2	108
2	54

(b) 3,840

2	3840
2	1920
2	960
2	480
2	240
2	120

3	27
3	9
3	3
	1

2	60
2	30
3	15
5	5
	1

$\sqrt[3]{1728} = (\overline{2\times 2\times 2}) \times (\overline{2\times 2\times 2}) \times (\overline{3\times 3\times 3})$

$= 2\times 2\times 3 = 12$

After grouping 2, 2, 5 and 3 are left.

$\therefore$ 1728 is a perfect cube

$3840 = (\overline{2\times 2\times 2}) \times (\overline{2\times 2\times 2}) \times 2\times 2\times 3\times 5$

$\therefore$ 3840 is not perfect cube.

(c) 12,167

23	12167
23	529
23	23
	1

$12167 = 23\times 23\times 23$

After grouping no factor is left.

$\therefore$ 12167 is a perfect cube.

(d) 11,109

3	11109
7	3703
23	529
23	23
	1

$11109 = 3\times 7\times 23$

Here we can not make any triplet

So, 11109 is not a perfect cube.

(e) 85,184

2	85184
2	42592
2	21296
2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

(f) 20,48,383

127	2048383
127	16129
127	127
	1

$85184 = \overline{2\times2\times2}\times\overline{2\times2\times2}\times\overline{11\times11\times11}$

After grouping no factor is left.

$\therefore$ 85184 is a perfect cube.

$2048383 = \overline{127\times127\times127}$

After grouping no factor is left

$\therefore$ 2048383 is a perfect cube.

5. Find the smallest number which should be multiplied to the given number so that the product is a perfect cube.

(a) 392 $\Rightarrow$ Prime factor of 392

$392 = \overline{2\times2\times2}\times7\times7$

After grouping together, the triplets of 2 are left with factors 7×7.

If we multiply 392 by 7 the product will be a perfect cube.

$$392\times7 = 2744$$

$\therefore$ 2744 is cube of 14.

2	392
2	196
2	98
7	49
7	7
	1

(b) 675

Prime factor of $675 = \overline{3\times3\times3}\times5\times5$

After grouping together, the triplets of 3 are left with factors 5×5

If we multiply 675 by 5. The product will be a perfect cube.

$$675\times5 = 3375$$

3375 is cube of 15.

3	675
3	225
3	75
5	25
5	5
	1

(c) 2560

Prime factors of 2560

$= \overline{2\times2\times2}\times\overline{2\times2\times2}\times\overline{2\times2\times2}\times5$

After grouping together the triples of $2\times2\times2$ are left with factor 5.

If we multiply 2560 by 5×5 the product will be perfect cube.

$$2560\times25 = 64000$$

$\therefore$ 64000 is cube of 40.

2	2560
2	1280
2	640
2	320
2	160
2	80
2	40
2	20
2	10
5	5
	1

(d) 8788

Prime factors $8788 = 2 \times 2 \times \overline{13 \times 13 \times 13}$

2	8788
2	4394
13	2197
13	169
13	13
	1

After grouping together the triplets of 13 are left with factor 2×2.

If we multiply 8788 by 2.

The product will be perfect cube.

6. Find the smallest number by which the following may be divided to obtain a perfect cube.

(a) 540

Prime factors of 540 $= 2 \times 2 \times \overline{3 \times 3 \times 3} \times 5$

After grouping together the triplets of 3 are left with factor $2 \times 2 \times 5$.

If we divided 540 by 20 the quotient will be a prefect cube.

$$540 \div 20 = 27$$

27 is cube of 3.

2	540
2	270
3	135
3	45
3	15
5	5
	1

(b) 2000

Prime factors of 2000

$$= \overline{2 \times 2 \times 2} \times 2 \times \overline{5 \times 5 \times 5}$$

After grouping together the triplets of 2 and 5 left with factor 2.

If we divided 2000 by 2 the quotient will be a perfect cube

$$2000 \div 2 = 1000$$

1000 is cube of 10.

2	2000
2	1000
2	500
2	250
5	125
5	25
5	5
	1

(c) 8640

Prime factor of 8640

$$= \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times \overline{3\times 3\times 3}\times 5$$

After grouping together, the triplets of 2, 3 and 2 are left with factor 5.

If we divide 8640 by 5. Then also the quotient will be perfect cube

$$8640 \div 5 = 1728$$

1728 is perfect cube of 12.

2	8640
2	4320
2	2160
2	1080
2	540
2	270
3	135
3	45
3	15
5	5
	1

(d) 27648

Prime factor of 27648

$$= \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times 2\times \overline{3\times 3\times 3}$$

After grouping together the triplets of 2, 2, 3 are left with 2.

If we divide 27648 by 2.

Then also the quotient will be perfect cube.

$$27648 \div 2 = 13824$$

13224 is perfect cube of 24.

2	27648
2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

Exercise 5.2

1. Find the cube root of the following :

(a) 74088

2	74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

Prime factors of 35937

$= \overline{3 \times 3 \times 3} \times \overline{11 \times 11 \times 11}$

$= 3 \times 11 = 33$

$= \sqrt[3]{35937} = 33$

(b) 35937

3	35937
3	11979
3	3993
11	1331
11	121
11	11
	1

Prime factors of 74088

$= \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{7 \times 7 \times 7}$

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

$= \sqrt[3]{74088}$

(c) 10^6

10	1000000
10	100000
10	10000
10	1000
10	100
10	10
	1

Prime factors of 1000000

$= \overline{10 \times 10 \times 10} \times \overline{10 \times 10 \times 10}$

$= 10 \times 10 = 100$

(d) 42875

5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

Prime factors of 42875

$= \overline{5 \times 5 \times 5} \times \overline{7 \times 7 \times 7}$

$= 35$

2. Find the cube root of the following :

(a) $10\frac{81}{125} = \frac{125\times 10+81}{125} = \frac{1331}{125}$

Cube root of $\frac{1331}{125}$

$$\sqrt[3]{\frac{1331}{125}} = \frac{\sqrt[3]{1331}}{\sqrt[3]{125}} = \frac{\sqrt[3]{11\times 11\times 11}}{\sqrt[3]{5\times 5\times 5}} = \frac{11}{5}$$

$$\frac{1331}{125} = \frac{11}{5}$$

(b) $\frac{-4913}{-2197}$

Cube root of $\frac{-4913}{-2197}$

$$\sqrt[3]{\frac{4913}{2197}} = \frac{\sqrt[3]{17\times 17\times 17}}{\sqrt[3]{13\times 13\times 13}} = \frac{17}{13}$$

$$\frac{-4913}{-2197} = \frac{-17}{-13} = \frac{17}{13}$$

(c) $\frac{3375}{5832}$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

Cube root of $\frac{3375}{5832} = \sqrt[3]{\frac{3375}{5832}}$

$$\frac{\sqrt[3]{3375}}{\sqrt[3]{5832}} = \frac{\sqrt[3]{3\times3\times3\times5\times5\times5}}{\sqrt{2\times2\times2\times3\times3\times3\times3\times3\times3}}$$

$$= \frac{3\times5}{2\times3\times3} = \frac{15}{18}$$

(d) $\frac{-343}{729} = \frac{343\times-1}{729}$

$$= (-1)\sqrt[3]{\frac{343}{729}} = \frac{(-1)\sqrt[3]{343}}{\sqrt[3]{729}} = \frac{\sqrt[3]{7\times7\times7}}{\sqrt[3]{3\times3\times3\times3\times3\times3}}$$

$$= \frac{-7}{3\times3} = \frac{7}{9} = \frac{-343}{729} = \frac{-7}{9}$$

7	343
7	49
7	7
	1

3	729
3	243
3	81
3	27
3	9
3	3
	1

3. Find the cube root of the following :

(a) $-29791 = -1\times29791$ $\quad\therefore\quad \sqrt[3]{-29791} = -31$

$$= -1\times\overline{31\times31\times31}$$

31	29791
31	961
31	31
	1

(b) $0.000512 = \frac{512}{1000000}$

10	1000000
10	100000
10	10000
10	1000
10	100
10	10
	1

2	512
2	256
2	128
2	64
2	32
2	16
2	8

2	4
2	2
	1

Prime factor of $\frac{512}{100000} = \frac{\overline{2\times2\times2}\times\overline{2\times2\times2}\times\overline{2\times2\times2}}{\overline{10\times10\times10}\times\overline{10\times10\times10}}$

$$= \sqrt[3]{0.000512}\ \sqrt[3]{\frac{512}{1000000}}$$

$$= \frac{\sqrt[3]{512}}{\sqrt[3]{1000000}} = \frac{2\times2\times2}{10\times10} = \frac{8}{100} = 0.08$$

(c) $(-6)^3 \times (-3)^3$

$(-6\times-6\times-6)\times(-3\times-3\times-3)$

$-216\times-27 = 5832$

Cube root of 5822

Prime factor of 5832

$= \overline{2\times2\times2}\times\overline{3\times3\times3}\times\overline{3\times3\times3}$

$= \sqrt[3]{5832}$

$= 2\times3\times3 = 18$

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

(d) 0.002197

13	2197
13	169
13	13
	1

2	1000000
2	500000
2	250000
2	125000
2	62500
2	31250
5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$$\sqrt[3]{0.002197} = \sqrt[3]{\frac{2197}{1000000}} = \frac{\sqrt[3]{2197}}{\sqrt[3]{1000000}}$$

$$= \frac{\sqrt[3]{13\times 13\times 13}}{\sqrt[3]{(2\times 2\times 2\times 2\times 2\times 2)\times (5\times 5\times 5\times 5\times 5\times 5)}}$$

$$= \frac{13}{(2\times 2)\times (5\times 5)} = \frac{13}{100} = 0.13$$

4. (a) Volume of cubical box $= 13824\ \text{cm}^3$

Edge $= \sqrt[3]{13824}$

$= \sqrt{2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 2\times 3\times 3\times 3}$

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

$= 24$

Edge of cubical box is 24 cm.

2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

(b) Volume of cubical box $= 32.768\ \text{m}^3$

Edge $= \sqrt[3]{32.768}$

2	32768
2	16384
2	8192
2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64

2	32
2	16
2	8
2	4
2	2
	1

10	1000
10	100
10	10
	1

$\overline{2\times 2\times 2}\times \overline{2\times 2\times 2}\times \overline{2\times 2\times 2}$

Edge of cubical box is $= \dfrac{\times\ \overline{2\times 2\times 2}\ \times \overline{2\times 2\times 2}}{10\times 10\times 10}$

$$= \frac{2\times 2\times 2\times 2\times 2}{10}$$

$$= \frac{32}{10} = 3.2 \text{ m}$$

5. Volumes two cubes $= 125 : 729$

Ratio of edges $= \sqrt[3]{125} : \sqrt[3]{729}$

$$= 5 : 9$$

Area of cube $= (\text{side})^2$

$$= (5)^2 : (9)^2$$

$$= 25 : 81$$

Multiple Choice Question

Tick (✓) the correct answer :

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

BRAIN BOOSTER

Ratio of three number 1 : 2 : 3

Let one number is x

Second number is $2x$

Third number is $3x$

Sum of their cubes $= 62208$

$$x^3 + (2x)^3 + (3x)^3 = 62208$$

$$x^3 + 8x^3 + 27x^3 = 62208$$

$$36x^3 = 62208$$

$$x^3 = 62208 \div 36$$

$$x^3 = 1728$$

$$x = \sqrt[3]{1728}$$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

Cube of $1728 = \overline{2\times 2\times 2\times 2\times 2\times 2} \times \overline{3\times 3\times 3}$

$$\sqrt[3]{1728} = \sqrt[3]{\overline{2\times 2\times 2}\times\overline{2\times 2\times 2}\times\overline{3\times 3\times 3}}$$

$$= 2\times 2\times 3 = 12$$

Thus value of one number is 12.

Value of second number is 24 (12×2).

Value of third number is 36 (12×3)

Chapter

6 Commercial Mathematics

Exercise 6.1

1. Express the following :

(a) 83% into a simple fraction

$$83\% = \frac{83}{100}$$

(b) 38% into a decimal

$$38\% = \frac{38}{100} = 0.38$$

(c) 45% into a simple ratio

$$45\% = \frac{45}{100} = \frac{9}{20} = \text{Ratio} = 9 : 20$$

2. Find x, if :

(a) 5% of x is 20

$$x \times \frac{5}{100} = 20$$

$$x = \frac{20 \times 100}{5} = 400$$

x's value $= 400$

(b) 8.5% of x is 1.615

$$x \times \frac{85}{1000} = 1.615$$

$$x = \frac{1.615 \times 1000}{85} = 19$$

x's value $= 19$

3. % of men in town $= 45\%$

% of women in town $= 30\%$

% of children in town $= 100 - (45 + 30)\% = (100 - 75)\% = 25\%$

Thus, the percent age of children is 25%.

4. If 8.5% of a number is 51, find the number.

$$8.5\% \text{ of } x = 51$$

$$x \times \frac{8.5}{100} = 51 \quad \Rightarrow \quad x = \frac{51 \times 100}{8.5} = 600$$

Thus, required number is 600.

5. The maximum marks $= x$

Bharti Scored $= 410$

She got 82% mark

So, $$x \times \frac{82}{100} = 410 \quad \Rightarrow \quad x = \frac{410 \times 100}{82} = 500$$

Thus, maximum mark is 500.

6. Total number of students $= x$

Number of boys $= x \times \dfrac{60}{100}$

Number of girls $= x - \dfrac{60x}{100} = \dfrac{100x - 60x}{100} = \dfrac{40x}{100}$

According to question; Number of girls $= 120$

$$\frac{40x}{100} = 120 \quad \Rightarrow \quad x = \frac{120 \times 100}{40} = 300$$

Total number of students is 300.

7. Percentage of copper $= 20\%$; Percentage of zinc $= 35\%$

Percentage of nickel $= 100 - (20 + 35)\% = (100 - 55)\% = 45\%$

Quantity of alloy $= 1.5$ kg or 1500 g

Quantity of nickel $= 1500 \times 45\% = 1500 \times \dfrac{45}{100}$ g $= 675$ g.

8. Original cost of a article $=$ ₹ 100

Reduced price $= 5\%$

Cost of price after reduce $= ₹\left(100 - \dfrac{100 \times 5}{100}\right) = ₹\ 100 - 5 = ₹\ 95$

Increase price article by retailer $=$ ₹ $100 - 95 =$ ₹ 5

Increase percentage of old price $= \dfrac{5 \times 100}{95} = \dfrac{100}{19}\%$ or $5\dfrac{5}{19}\%$

9. Jagan's income $=$ ₹ 18000

Spend for rent $=$ ₹ $18000 \times 14\% =$ ₹ $18000 \times \dfrac{14}{100} =$ ₹ 2520

Spend for other things $=$ ₹ $18000 \times 54\% =$ ₹ $18000 \times \dfrac{54}{100} =$ ₹ 9720

Total money spend $=$ ₹ $2520 +$ ₹ $9720 =$ ₹ 12240

His saving $=$ ₹ $18000 -$ ₹ $12240 =$ ₹ 5760

10. Let number of days school open $= x$

Rajat attendance $= 80\%$

He went to school $= \dfrac{80x}{100}$

According to question;

Rajant went to school $= 260$

$$\frac{80x}{100} = 260 \quad \Rightarrow \quad x = \frac{260 \times 100}{80} = 325$$

Thus, school is open for 325 days.

11. Suppose Bharat's income = ₹ 100

$$20\% \text{ of } 100 = \frac{20}{100} \times 100 = ₹\ 20$$

$\therefore$ Amar's income = ₹ (100 – 20) = ₹ 80

If Amar's income is ₹ 80, then Bharat's income = ₹ 100

If Amar's income is ₹ 1, then Bharat's income = ₹ $\frac{100}{80}$

If Amar's income is ₹ 100, then Bharat's income = ₹ $\frac{100}{80} \times 100$

= ₹ 125.

$\therefore$ Bharat's income is ₹ (125 – 100) or ₹25

i.e., 25% more than Amar's

12. Let the number be 180.

Increase = 40% = 100× 40% = 40

Number = 100 + 40 = 140

$$\text{Decrease} = 40\% \text{ of } 140 = 140 \times \frac{40}{100} = 56$$

Number = 140 – 56 = 84

Net decrease = 100 – 84 = 16 or 16%

13. Let share of third person = x

$$\text{Share of second person} = x \times 50\% = x \times \frac{50}{100} = \frac{x}{2}$$

$$\text{Share of first person} = \frac{x}{2} \times \frac{50}{100} = \frac{x}{4}$$

Total amount, $x + \frac{x}{2} + \frac{x}{4} = 3500$

$$\Rightarrow \quad \frac{4x + 2x + x}{4} = 3500$$

$$7x = 3500 \times 4$$

$$\Rightarrow \quad x = \frac{3500 \times 4}{7} = 500 \times 4 = 2000$$

Share of third person = ₹ 2000

$$\text{Share of second person} = ₹\ 2000 \times 50\% = ₹\ 2000 \times \frac{50}{100} = ₹\ 1000$$

$$\text{Share of first person} = ₹\ 1000 \times \frac{50}{100} = ₹\ 500$$

Thus, first person gets ₹ 500, second person ₹ 1000, and third person gets ₹ 2000.

14. Let Number of votes $= x$

$$31\% \text{ votes} = \frac{x}{100} \times 31$$

According to questions;

$$\frac{31x}{100} = 31000 \quad \Rightarrow \quad x = \frac{31000 \times 100}{31} = 100000$$

(a) Total votes = 100000

(b) Winning margin

= Number of votes got by winner

− Number of votes got by loser

$= 53000 - 31000 = 22000$

Exercise 6.2

1. Let cost price of laptop = ₹ x

$$\text{Selling price} = ₹\ x \times \frac{6}{5} = ₹\ \frac{6x}{5}$$

$$\text{Profit} = \frac{6x}{5} - x = \frac{6x - 5x}{5} = \frac{x}{5}$$

$$\text{profit \%} = \frac{x}{5x} \times 100\% = 20\%$$

Thus, percent profit is 20%.

2. Cost price of wrist watch = ₹ x

$$\text{profit} = x \times \frac{1}{8} = ₹\ \frac{x}{8}$$

$$\text{Selling price} = ₹\ x + \frac{x}{8} = ₹\ \frac{9x}{8}$$

According to question;

Selling price of wrist watch = ₹ 990

$$\frac{9x}{8} = 990 \quad \Rightarrow \quad x = \frac{990 \times 8}{9} = ₹\ 880$$

So, cost price of wrist watch = ₹ 880

$$\text{Profit} = ₹\ 880 \times \frac{1}{8} = ₹\ 110$$

$$\text{Profit \%} = \frac{110}{880} \times 100 = 12.5\%$$

Percent profit is 12.5%.

3. Let the original rate be ₹ x per kg.

$$\text{Reduced rate} = (80\% \text{ of } ₹\ x) \text{ per kg} = ₹ \left(\frac{80}{100} \times x \right) \text{per kg}$$

$$= ₹ \frac{4x}{5} \text{ per kg}$$

$$\text{Quantity of sugar for ₹ 160 at original rate} = \frac{160}{x} \text{ kg.}$$

$$\text{Quantity of sugar for ₹ 160 at new price} = \frac{160}{\left(\frac{4x}{5} \right)} \text{ kg}$$

$$= \frac{160 \times 5}{4x} = \frac{200}{x} \text{ kg}$$

$$\frac{200}{x} - \frac{160}{x} = 5 \quad \Rightarrow \quad 5x = (200 - 160)$$

$$5x = 40 \quad \Rightarrow \quad x = 8$$

(a) Original rate = ₹ 8 per kg.

(b) $\text{Reduced rate} = ₹ \left(\frac{4}{5} \times 8 \right) \text{per kg}$

$$= ₹ \frac{32}{5} \text{ per kg} = ₹\ 6.40 \text{ per kg.}$$

4. Number of eggs = 200

Number of broken eggs = 38

Number of remaining eggs = 200 − 38 = 162

Sale price of 12 eggs = ₹ 48

Sale price of an egg = ₹ 48 ÷ 12 = ₹ 4

Sales price of 162 eggs = ₹ 162 × 4 = ₹ 648

Let cost price of 200 eggs be x

Over all profit = 8%

$$\text{profit} = x \times \frac{8}{100} = \frac{8x}{100}$$

$$\Rightarrow \quad \text{S.P.} = \frac{8x}{100} + x = \frac{108x}{100}$$

According to question, total investment $\frac{108x}{100} = 648$

$$x = \frac{648 \times 100}{108} = 600$$

So, Total investment = ₹ 600.

5. Let cost price of article = ₹ x

If gain = 10%; gain = ₹ $x \times \frac{10}{100} =$ ₹ $\frac{10x}{100}$

$$\text{S.P.} = x + \frac{10x}{100} = \frac{110x}{100}$$

If gain = 14% ; gain = ₹ $x \times \frac{14}{100} =$ ₹ $\frac{14x}{100}$

$$\text{S.P.} = x + \frac{14x}{100} = \frac{114x}{100}$$

Difference of both S.P.

$$\frac{114x}{100} - \frac{110x}{100} = \frac{4x}{100}$$

According to question = Difference; $\frac{4x}{100} = 65$

$$x = \frac{65 \times 100}{4} = ₹\ 1625$$

So, the cost price = ₹ 1625.

6. Cost of 1 kg rice of Ist variety = ₹ 35

Let quantity of first variety rice = $3x$

Cost of 1 kg rice of 2nd variety = ₹ 45

Let quantity of second variety rice = $2x$

Total quantity of rice = $3x + 2x = 5x$

Total cost of rice = $3x \times 35 + 2x \times 45 = 105x + 90x = 195x$

Total selling price $= 5x \times 41.60 = ₹\ 208x$

$$\text{Profit} = \text{S.P.} - \text{C.P.} = 208x - 195x = 13x$$

$$\text{Profit \%} = \frac{\text{Profit}}{\text{C.P.}} \times 100 = \frac{13x}{195x} \times 100 = 6.67\%$$

Gain percent $= 6.67\%$.

7. We have

Gain = S.P. of 100 toys − C.P. of 100 toys = S.P. of 20 toys.

C.P. of 100 toys = S.P. of 100 toys − S.P. of 20 toys

C.P. of 100 toys = S.P. of 80 toys

C.P. of 5 toys = S.P. of 4 toys

Let C.P. of 1 toy = ₹ 1

Cost of 5 toys = ₹ 5 = S.P. of 4 toys

S.P. of 4 toys = ₹ 5

S.P. of 1 toys = $₹\ \frac{5}{4}$

$$\text{Gain} = \text{S.P. of 1 toys} - \text{C.P. of 1 toys} = ₹\ \frac{5}{4} - 1 = ₹\ \frac{1}{4}$$

$$\text{Gain\%} = \frac{\text{Gain}}{\text{C.P.}} \times 100 = \frac{1}{4} \times 100 = 25\%$$

Thus, Gain% is 25%.

8. Cost price of one kg mangoes = ₹ 30

Cost price of 75 kg mangoes = ₹ 30×75 = ₹ 2250

Cost price of $\left(75 \times \frac{1}{3}\right)$ 25 kg mangoes = ₹ 30×25 = ₹ 750

Loss = 5%

$$\text{Loss} = ₹\ 750 \times \frac{5}{100} = ₹\ 37.5$$

Sales price = C.P. − Loss = ₹ (750 − 37.5) = ₹ 712.5

Total cost = ₹ 2250

Overall gain = 10%

$$\text{gain} = ₹\ 2250 \times \frac{10}{100} = ₹\ 225$$

Total sale price = ₹ (2250 + 225) = ₹ 2475

Sales price of 50 kg mangoes = ₹ 2475 − ₹ 712.5 = ₹ 1762.50

Sales price of 1 kg mangoes $= ₹ \dfrac{1762.50}{50} = ₹\ 35.25$

9. Cost price of total wheat $= ₹\ 35000$

Cost price of spoiled wheat $= ₹\ 35000 \times \dfrac{1}{7} = 5{,}000$

Then cost price of good wheat $= ₹\ 35000 - ₹\ 5000 = ₹\ 30000$

Sold price of good wheat :

$$\text{gain} = 10\%$$

$$\text{C.P.} = ₹\ 30000$$

$$\text{Profit} = ₹\ 30000 \times \frac{10}{100} = ₹\ 3000$$

$$\text{S.P.} = \text{C.P.} + \text{Profit}$$

$$= ₹\ (30000 + 3000) = ₹\ 33000$$

Sold price of spoiled wheat :

$$\text{Loss} = 25\%\ ; \quad \text{C.P.} = ₹\ 5000$$

$$\text{Loss} = ₹\ 5000 \times \frac{25}{100} = ₹\ 1250$$

$$\text{S.P.} = ₹\ (5000 - 1250) = ₹\ 3750$$

Total sales price $= ₹\ 33000 + ₹\ 3750 = ₹\ 367500$

Total cost price $= ₹\ 35000$

$$\text{Gain} = ₹\ 36750 - 35000 = ₹\ 1750$$

$$\text{Gain \%} = \frac{\text{Gain} \times 100}{\text{C.P.}} = \frac{1750 \times 100}{35000} = 5\%.$$

10. Cost price of 5 fans $= ₹\ 4050$

Transportation exp… $= ₹\ 50$

$$\text{Total cost price} = ₹\ 4050 + ₹\ 50 = ₹\ 4100$$

$$\text{Gain \%} = 15\%$$

$$\text{Gain} = ₹\ 4100 \times \frac{15}{100} = ₹\ 615$$

$$\text{Sales price} = ₹\ 4100 + ₹\ 615 = ₹\ 4715$$

Sale price of a fan $= ₹\ 4715 \div 5 = ₹\ 943.$

11. Cost of 1 banana $= ₹\ 1$

Cost of 6 bananas $= ₹\ 6$

Cost of 5 bananas $= ₹\ 5$

S.P. of 6 bananas $=$ C.P. of 5 bananas

Loss = ₹ (6 – 5) = ₹ 1

$$\text{loss \%} = \frac{\text{Loss}}{\text{C.P}} \times 100 = \frac{1}{6} \times 100 = \frac{100}{6}\% \text{ or } 16\frac{2}{3}\%$$

12. Let cost price of fan = ₹ x

$$\text{gain} = ₹\, x \times \frac{1}{8} = ₹\, \frac{x}{8}$$

$$\text{Selling price} = ₹\, x + ₹\, \frac{x}{8} = ₹\, \frac{9x}{8}$$

According to question,

sales price of fan = ₹ 1152

$$₹\, \frac{9x}{8} = ₹\, 1152 \qquad \Rightarrow \quad x = \frac{1152 \times 8}{9} = ₹\, 1024.$$

13. Cost of 10 books = ₹ 10

Cost of 16 books = ₹ 16

Cost of 17 books = ₹ 17

S.P. of 16 books = C.P. of 17 books

S.P. of 16 books = ₹ 17

Profit = ₹ (17 – 16) = ₹ 1

$$\text{Profit \%} = \frac{1}{16} \times 100\% = \frac{100}{16}\% = 6.25\%$$

14. C.P. of 1 pen = ₹ 1

C.P. of 12 pen = ₹ 12

C.P. of 15 pens = ₹ 15

Cost of 12 pens = S.P of 15 pens

S.P. of 15 pens = ₹ 12

Loss = ₹ 15 – ₹ 12 = 3

$$\text{Loss \%} = \frac{\text{Loss} \times 100}{\text{C.P.}} = \frac{3}{15} \times 100 = 20\%$$

Percentage of loss is 20%.

15. Let cost price of article = ₹ x

$$\text{Loss in article} = ₹\, x \times \frac{1}{20} = ₹\, \frac{x}{20}$$

Sale Price = Cost Price – Loss

$$= ₹\, x - ₹\, \frac{x}{20} = \frac{20x - x}{20} = ₹\, \frac{19}{20}$$

If sales price ₹ $\frac{19x}{20}$ than cost price $= ₹\, x$

If sales price ₹ 6270 than cost price $= x \times \frac{20}{19x} \times 6270 = ₹\, 6600$

Thus, cost price of article $= ₹\, 6600$.

16. Cost of TV ₹ 6000

Loss % $= 15\%$

Loss on TV $= ₹\, 6000 \times 15\% = ₹\, 6000 \times \frac{15}{100} = ₹\, 900$

Sales price = Cost Price − Loss

Sales price $= ₹\, (6000 - 900) = ₹\, 5100$

Thus, sales price of the TV set is ₹ 5100.

17. Cost of car $= ₹\, 60000$

Repairing $= ₹\, 10000$

Sale value $= ₹\, 77000$

Profit = Sale Value − Cost Price

Profit $= ₹\, 77000 - (60000 + 10000) = ₹\, 7000$

$$\% \text{ Gain} = \frac{\text{Profit} \times 100}{\text{C.P.}} = \frac{7000}{70000} \times 100 = 10\%.$$

18. Cost price of two fans $= ₹\, 3120$

Let cost price of one fan $= x$

Cost price other fan $= ₹\, (3120 - x)$

For one fan, profit $= 36\%$ or $x \times \frac{36}{100} = \frac{36x}{100}$

$$\text{S.P.} = x + \frac{36x}{100} = \frac{136x}{100}$$

For other fan, Loss $= 15\%$ or $(3120 - x) \times \frac{15}{100} = \frac{46800 - 15x}{100}$

$$\text{S.P.} = \text{C.P.} - \text{Loss} = (3120 - x) - \frac{(46800 - 15x)}{100}$$

$$= \frac{(3120 - x) \times 100 - 46800 + 15x}{100}$$

$$= \frac{312000 - 100x - 46800 + 15x}{100}$$

$$= \frac{265200 - 85x}{100}$$

According to question; both fans selling price are equal.

$$\frac{136x}{100} = \frac{265200 - 85x}{100}$$

$$136x \times 100 = (265200 - 85x)100$$

$$13600x = 26520000 - 8500x$$

$$13600x + 8500x = 26520000$$

$$22100x = 26520000$$

$$x = \frac{26520000}{22100} = 1200$$

So, cost price of first fane = ₹ 1200

Cost price of second fan = ₹ (3120 − 1200) = ₹ 1920.

19. According to question;

Loss = C.P. of 45 apples − S.P. of 45 apples = S.P. of 3 apples

C.P. of 45 apples = S.P. of 3 apples + S.P. of 45 apples

C.P. of 45 apples = S.P. of 48 apples

C.P. of 15 apples = S.P. of 16 apples

Let C.P. of apple = ₹ 15

C.P. of 15 apples = ₹ 15 = S.P. of 16 apples

S.P. of 16 apples = ₹ 15

$$\text{S.P. of 1 apple} = ₹ \frac{15}{16}$$

$$\text{Loss} = \text{C.P. of 1 apple} - \text{S.P. of 1 apple}$$

$$= ₹\ 1 - \frac{15}{16} = \frac{16-15}{16} = \frac{1}{16}$$

$$\% \text{ Loss} = \frac{\text{Loss}}{\text{C.P.}} \times 100 = \frac{1}{16} \times 100 = \frac{100}{16}\% = 6.25\%$$

Loss percent = 6.25%.

20. S.P. of 1 kg or 1000 g = C.P. of 900 gm $\quad \because$ S.P. > C.P. (profit)

Gain = 1000 − 900 gm = 100 gm

$$\text{Gain\%} = \frac{100}{900} \times 100 = \frac{100}{9} = 11.1\%$$

21. Cost price of article = ₹ 200

Loss = 10%

Loss = 10% of ₹ 200 = ₹ 20

S.P. = ₹ (200 − 20) = ₹ 180

Reduced price = 5%

Now selling price = ₹ 180 − ₹ 180 × 5%

= ₹ 180 − ₹ 9 = ₹ 171

Thus, selling price ₹ 171 on article.

22. S.P. of one quintal rice = ₹ 896

Let C.P. of rice = ₹ 100

Profit = 12%

S.P. = ₹ 100 + 12 = ₹ 112

If, S.P. = ₹ 112 then C.P. = ₹ 100

If, S.P. = ₹ 1 then C.P. = ₹ $\frac{100}{112}$

₹ 896 = ₹ $\frac{100}{112} \times 896$ = ₹ 800

$\Rightarrow$ C.P. = ₹ 800

Cost price of one quintal rice = ₹ 800

Cost price of 1 kg rice = ₹ 800 ÷ 100 = ₹ 8

S.P. of one quantital sugar = ₹ 896

Let, C.P. of sugar = ₹ 100

Loss = 44% S.P. = ₹ 100 − 44 = ₹ 56

If, S.P. = ₹ 56 then C.P. = ₹ 100

S.P. = ₹ 1 then C.P. = ₹ $\frac{100}{56}$

S.P. = ₹ 896 then C.P. = ₹ $\frac{100}{56} \times 896$ = ₹ 1600

Cost price of one quantial sugar = ₹ 1600

Cost price of 1 kg sugar = ₹ 1600 ÷ 100 = ₹ 16

Total cost price sugar and rice ₹ (800 + 1600) = ₹ 2400

Total selling price = ₹ (896 + 896) = ₹ 1792

$$\text{Loss} = ₹\,(2400-1792) = ₹\,608$$

$$\text{Loss \%} = \frac{608}{2400}\times 100 = \frac{76}{3}\% \text{ or } 25.33\%.$$

Exercise 6.3

1. Cost price of book = ₹ 100; Profit 12%

$$\text{S.P.} = ₹\,100 + 100\times\frac{12}{100} = ₹\,(100+12) = ₹\,112$$

Discount = 10%

M.P. = 112 + 10% of 112 = ₹ 112 + ₹ 12 = ₹ 124

Ratio = Cost price : M.P. = 100 : 124 = 25 : 31.

2. Let selling price of fan = ₹ 100; tax = 8%

Selling price of fan without included tax = ₹ 100 – ₹ 8 = ₹ 92

If S.P. without included tax ₹ 92 than S.P. of fan ₹ 100

If S.P. without included tax ₹ 1 than S.P. of fan = ₹ $\frac{100}{92}$

If S.P. without included tax ₹ 1242 than S.P. of fan

$$= ₹\,\frac{100}{92}\times 1242 = ₹\,1350$$

The selling price (with out tax) of the fan is ₹ 1350.

3. Cost price of stationary is ₹ 900

$$\text{Sales tax} = 6\% = ₹\,900 + \frac{900\times 6}{100} = ₹\,900 + 54 = ₹\,954.$$

4. Marked price of table = ₹ 625

Cost of the soap given free by shopkeeper is equal to discount ₹ 25

Net selling price = ₹ 625 – ₹ 25 = ₹ 600

Gain = 20%

$$\text{C.P.} = \frac{100\times \text{S.P.}}{100+\text{Gain}} = \frac{100\times 600}{100+20} = \frac{60000}{120} = ₹\,500$$

Cost price of a table is ₹ 500.

5. Let M.P. of the sofa set = ₹ 100

Discount = 20%

S.P. of the sofa set = ₹ 100 – ₹ 20 = ₹ 80

If discount = 25%

S.P. of the book = ₹ 100 – ₹ 25 = ₹ 75

Saving = ₹ 80 – ₹ 75 = ₹ 5

In saving is ₹ 5, than M.P. = ₹ 100

If saving is ₹ 1, than M..P = ₹ $\frac{100}{5}$

Saving ₹ 500 then M.P. = ₹ $\frac{100}{5} \times 500$ = ₹ 10000

M.P. = ₹ 10000; discount = 20% of ₹ 10000 = ₹ 2000

S.P. = ₹ 10000 – 2000 = ₹ 8000

Vijay purchase 'Sofa set' for ₹ 8000.

6. Let the C.P. be ₹ 100

M.P. = ₹ 100 + 20% of ₹ 100

$= ₹ 100 + \frac{20}{100} \times 100 = 100 + 20 = ₹ 120$

Discount = 10% of M.P. = ₹ $120 \times \frac{10}{100}$ = ₹ 12

S.P. = M.P. – Discount = ₹ 120 – ₹ 12 = ₹ 108

Gain = S.P. – C.P. = ₹ 108 – 100 = ₹ 8

Gain% = $\frac{8}{100} \times 100 = 8\%$

7. Marked price of the book = ₹ 100

Discount = 10% or ₹ $100 \times \frac{10}{100}$ = ₹ 10

Selling price = ₹ 100 – ₹ 10 = ₹ 90

Let the C.P. is ₹ x

Profit = 20%

profit = ₹ $20 \times \frac{x}{100}$ = ₹ $\frac{20x}{100}$

Selling price = C.P. + profit = ₹ $x + \frac{20x}{100}$

$= ₹ \frac{100x + 20x}{100} = ₹ \frac{120x}{100}$

Selling price = ₹ $\frac{120x}{100}$ = ₹ 90

$\Rightarrow \quad x = ₹\,\frac{90 \times 100}{120} = ₹\,75$

Cost price $= ₹\,75$

Discount given second time $= 15\%$

Now, discount $= 100 \times 15\% = ₹\,15$

S.P. $= ₹\,100 - ₹\,15 = ₹\,85$

Now, Gain $= ₹\,85 - ₹\,75 = ₹\,10$

$$\text{Gain } \% = \frac{10}{75} \times 100 = \frac{100}{75}\% \text{ or } 13.33\%.$$

8. discount $= 10\%$; profit $\% = 26\%$

So, increased percentage of C.P. $= \left(\frac{d+p}{100-d}\right) \times 100\%$

$$= \left(\frac{10+26}{100-10}\right) \times 100\%$$

$$= \left(\frac{36}{90} \times 100\right)\%$$

$$= (4 \times 10)\% = 40\%$$

Hence, 40% is the required percentage of C.P.

9. Let the C.P. be ₹ 100.

$\therefore$ M.P. $= ₹\,100 + 20\%$ of ₹ 100

$$= ₹\,100 + ₹\,\frac{20}{100} \times 100$$

$$= ₹\,100 + ₹\,20 = ₹\,120$$

$$\text{Discount} = 15\% \text{ of M.P.} = ₹\,120 \times \frac{15}{100} = ₹\,18$$

$\therefore$ S.P. $=$ M.P. $-$ Discount $= ₹\,120 - ₹\,18 = 102$

Gain $=$ S.P. $-$ C.P. $= ₹\,102 - ₹\,100 = ₹\,2$

$$\text{Gain } \% = \frac{\text{Gain}}{\text{C.P.}} \times 100 = \frac{2}{100} \times 100 = 2\%.$$

10. Let market price $= ₹\,x$

discount $= 5\%$

$$\text{selling price} = x - \frac{x \times 5}{100} = \frac{100x - 5x}{100} = \frac{95x}{100}$$

selling price of pen $=$ Surbhi bought price.

$$\frac{95x}{100} = ₹\ 23.75 \quad \Rightarrow \quad x = ₹\ \frac{23.75 \times 100}{95} = ₹\ 25.$$

11. Let cost price of sugar $= x$

$$\text{Loss} = 10\% \text{ of } x = \frac{10x}{100}$$

$$\text{Selling price} = x - \frac{10x}{100} = \frac{90x}{100}$$

According to question ; S.P. of sugars = 5.4 kg

$$\frac{90x}{100} = 5.4 \quad \Rightarrow \quad x = \frac{5.4 \times 100}{90} = ₹\ 6$$

If profit percentage = 20%

$$\text{profit} = ₹\ 6.00 \times \frac{20}{100} = ₹\ 1.2$$

$$\text{selling price} = ₹\ 6.00 + 1.20 = ₹\ 7.2.$$

12. Marked price of two set of bowl = ₹ 399

$$\text{Marked price} = 50\% \text{ of } ₹\ 399 = 399 \times \frac{50}{100} = ₹\ 199.50$$

$\therefore$ S.P. = M.P. – Discount = ₹ (399 – 199.5) = ₹ 199.50

Profit = 4%

$$\text{C.P.} = \frac{100 \times \text{S.P.}}{100 + \text{Profit}} = ₹\left(\frac{100 \times 199.50}{100 + 4}\right)$$

$$= ₹\left(\frac{100 \times 199.50}{104}\right) = ₹\ 191.82$$

He pays ₹ 191.82 for one set of bowl.

13. Market price = ₹ 80

Cost of the tooth brush given free by shopkeeper is equal to discount ₹ 11

Net selling price = ₹ 80 – ₹ 11 = ₹ 69

Gain = 15%

If cost price is ₹ 100

$$\text{profit} = ₹\ 15 \times \frac{100}{100} = ₹\ 15$$

S.P. = ₹ 100 + 15 = ₹ 115

If selling price is ₹ 115 then cost price = ₹ 100

If selling price is ₹ 1 then cost price $= ₹ \frac{100}{115}$

If selling price is ₹ 69 then cost price $= ₹ \frac{100}{115} \times 69 = ₹ 60.$

14. In First case : Marked price of article = ₹ 100

Discount = 5%, Discount = ₹ 5

Selling price = ₹ 100 – 5 = ₹ 95

In second case :

Marked price of article = ₹ 100

Discount = 7% = Discount ₹ 7

Selling price = ₹ (100 – 7) = ₹ 93.

Difference in both of the S.P. = 95 – 93 = 2

If Difference is ₹ 2 then M.P. = ₹ 100

If difference is ₹ 1 then M.P. $= ₹ \frac{100}{2}$

If difference is ₹ 15 then M.P. $= ₹ \frac{100}{2} \times 15 = ₹ 750$

Thus, the M.P. of the article is ₹ 750.

15. C.P. of Saree = ₹ 950; gain = 10%

S.P. = ₹ (950 + 95) = ₹ 1045

Let marked price = ₹ 100

Discount = 5%

Profit = ₹ (100 – 5) = ₹ 95

If selling price ₹ 95 then marked price is ₹ 100

If ₹ 1 then marked price $= \frac{100}{95}$

If selling price ₹ 1045 then marked price $= ₹ \frac{100}{95} \times 1045$

$= ₹ 1100.$

Exercise 6.4

1. In which of the following is x in direct variation with y ?

(a) $\frac{x}{y} = \frac{8}{2} = 4 ; \frac{16}{4} = 4 ; \frac{20}{5} = 4 ; \frac{32}{8} = 4 ; \frac{60}{15} = 4.$

(b) $\frac{x}{y}=\frac{3}{5}\neq\frac{5}{3}\neq\frac{6}{10}\neq\frac{9}{15}\neq\frac{10}{6}$

$\frac{x}{y}$ is not equal.

Thus, number of x and number of y is not direct variation.

(c) $\frac{x}{y}=\frac{5}{15}=\frac{1}{3};\frac{8}{24}=\frac{1}{3};\frac{9}{27}=\frac{1}{3};\frac{11}{33}=\frac{1}{3};\frac{x}{y}$ is constant and is equal to $\frac{1}{3}$.

Thus, no of x and no of y are in direct variation.

2. Complete the following tables assuming that x is in direct variation with y:

(a)

x	x_1	9	x_2	15	x_3	26.5
y	3.5	4.5	6.5	y_1	9.25	y_2

Here x and y are vary directly

So, $\frac{x}{y}=K$ (constant)

$\frac{x}{y}=\frac{9}{4.5}=\frac{x_1}{3.5}\Rightarrow x_1=\frac{9\times3.5}{4.5}=7$

$\frac{9}{4.5}=\frac{x_2}{6.5}\Rightarrow x_2=\frac{9\times6.5}{4.5}=13$

$\frac{9}{4.5}=\frac{15}{y_1}\Rightarrow y_1=\frac{15\times4.5}{9}=7.5$

$\frac{9}{4.5}=\frac{x_3}{9.25}\Rightarrow x_3=\frac{9\times9.25}{4.5}=18.5$

$\frac{9}{4.5}=\frac{26.5}{y^2}\Rightarrow y_2=\frac{26.5\times4.5}{9}=13.25$

Here $x_1=7, x_2=13, y_1=7.5, x_3=18.5, y_2=13.25.$

(b)

x	60	x_1	180	x_2	x_3	x_4
y	4	8	12	15	20	25

Here x and y vary directly

So, $\frac{x}{y} = K$ (constant) $\Rightarrow$ $\frac{60}{4} = K$

Now, $\frac{x_1}{8} = \frac{60}{4} \Rightarrow x_1 = \frac{60 \times 8}{4} = 120$

$\frac{x_2}{15} = \frac{60}{4} \Rightarrow x_2 = \frac{15 \times 60}{4} = 225$

$\frac{x_3}{20} = \frac{60}{4} \Rightarrow x_3 = \frac{20 \times 60}{4} = 300$

$\frac{x_4}{25} = \frac{60}{4} \Rightarrow x_4 = \frac{60 \times 25}{4} = 375$

Here, $x_1 = 120, x_2 = 225, x_3 = 300, x_4 = 375$

3. Which of the following show direct variation?

(a) When the height of a child increase, his weight also increase. That means $(x \times 2) = y \times 2$.

$\therefore$ Direct variation

(b) If car is not moving a uniform speed than the distance covered will not change according to time taken.

$\therefore$ It is not a direct variation.

(c) With the number of hours of works wages of worker also increase also increase. It is direct variation.

(d) Number of students increase fee paid them also increase.

$\therefore$ Direct variation.

(e) Number of rainy day not the amount of not rainfall on depend on the those day not direct variation.

4. Let number of note book be x for cost ₹ 240

Number of note books	15	x
Cost	₹ 240	₹ 160

$\frac{15}{x} = \frac{240}{160} \Rightarrow x = \frac{15 \times 160}{240} = 10$

Thus, Vicky bought 10 note books for ₹ 160.

5. Here present us dollars equallent Indian currency.

Let the worth of 250 used dollars be x

Us dollars	150	250
Indian currency	7425	x

$$\frac{150}{7425}=\frac{250}{x} \quad \Rightarrow \quad x=\frac{7425\times 250}{150}=₹\ 12375$$

6. Let the distance covered in 25 min be x.

Distance (km)	70	x
Time (in min)	60	25

$$\frac{70}{60}=\frac{x}{25} \quad \Rightarrow \quad x=\frac{70\times 25}{60}=29.16 \text{ km}$$

7. Let petrol will be needed x*l*.

Distance (in km)	115	345
Petrol (l)	20	x

$$\frac{115}{20}=\frac{345}{x} \quad \Rightarrow \quad x=\frac{345\times 20}{115}=60$$

A car used 60 l of petrol for 345 km.

8. Let Kapil take x time to walk 275 m.

Distance (m)	110	275
Time (min)	130	x

$$\frac{110}{130}=\frac{275}{x} \quad \Rightarrow \quad x=\frac{275\times 130}{110}=325 \text{ min}$$

9. 5 men = 8 women $\Rightarrow$ 1 man $=\frac{8}{5}$ woman

$$8 \text{ men}=\frac{8\times 8}{5} \text{ women}=\frac{64}{5} \text{ women}$$

$$8 \text{ men and } 12 \text{ women}=\frac{64}{5}+12=\frac{64+60}{5}=\frac{124}{5} \text{ women}$$

Let ₹ x be the earning of $\frac{124}{5}$ women in one day.

Number of women	8	$\frac{124}{5}$
Earning in a day	₹ 625	x

$$\frac{8}{124/5}=\frac{625}{x} \quad \Rightarrow \quad \frac{8\times 5}{124}=\frac{625}{x}$$

$$\frac{40}{124}=\frac{625}{x} \quad \Rightarrow \quad x=\frac{625\times 124}{40}=1937.5$$

Thus, earning of 12 women and 8 men = ₹ 1937.50.

10. Let number of bottles required to be x make 32 serving.

Number of bottles	5	x
Servings	8	32

$$\frac{5}{8}=\frac{x}{32} \quad \Rightarrow \quad x=\frac{5\times 32}{8}=20$$

Thus 20 bottles required.

Exercise 6.5

1. (a) In all cases, the product xy is constant for any two pairs of x an y.

$x_1 y_1 = 6\times 10 = 60$; $x_2 y_2 = 4\times 15 = 60$;

$x_3 y_3 = 12\times 5 = 60$; $x_4 y_4 = 30\times 2 = 60$;

$x_5 y_5 = 15\times 4 = 60$

So, in this case of inverse variation.

(b) In all case the product xy is constant for any two pairs of x and y.

$x_1 y_1 = 42\times 2 = 84$; $x_2 y_2 = 4\times 21 = 84$;

$x_3 y_3 = 14\times 6 = 84$; $x_4 y_4 = 8\times 12 = 96$;

$x_5 y_5 = 28\times 3 = 84$

All are not equal

$\therefore$ It is not inverse.

(c) As x and y are not changing in a set pattern in such a way that with decrease in x there in a increa in y. It is not an inverse variation.

2. Which of the following are in inverse variation with each other?

(a) Since on increasing the cost (c), the number of burgers (n) one can buy would decrease, therefore x and y vary inversely.

(b) When we increase the number of men employed, the time taken to finish these work clarets in a similar ratio. Therefore it is in inverse variation.

(c) The distance travelled by a car increases with the increase in amount of petrol used. Thus, it is a direct variation and not an inverse variation.

(d) As with the increase in number of children attending the party, the food consumed also increases, therefore it in not an inverse variation.

(e) When the speed of a car increases, the time taken decreases. Therefore it is an inverse variation.

3.

Time taken (hrs)	24	6
Pump filled	5	x

Time taken = Inverse ratio Pump filling the tank

$$24 : 6 = x : 5 \quad \Rightarrow \quad \frac{24}{6} = \frac{x}{5}$$

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

Required pump are 20.

4.

Number of children	8	10
Number of chocolate	5	x

Number of children = Inverse ratio of number of chocolate

$$8 : 10 = x : 5$$

$$\frac{8}{10} = \frac{x}{5} \quad \Rightarrow \quad 10x = 8 \times 5$$

$$10x = 40 \quad \Rightarrow \quad x = 40 \div 40 = 4$$

So, each child will get 4 chcolates.

5. Number of spraying machines = 5

Break machine = 2

Now, Number of machine used $= 5 - 2 = 3$

Number of machine	5	3
Time taken	36	x

Number of machine = Inverse ratio of time

$$5 : 3 = x : 36 \quad \Rightarrow \quad \frac{5}{3} = \frac{x}{36}$$

$$x \times 3 = 5 \times 36 \quad \Rightarrow \quad x = \frac{5 \times 36}{3} = 60$$

Time taken 60 min for painting house.

6. Number of students = 200

100 students increase in hostel

Now, total student $= 200 + 100 = 300$

Number of days	30	x
Number of students	200	300

The ratio of the number of student = inverse ratio of the number of days

$$200 : 300 = x : 30 = \frac{200}{300} = \frac{x}{30}$$

$$300 \times x = 30 \times 200$$

$$x = \frac{30 \times 200}{300} = 20$$

A hotel mess has provisions for 300 students for 20 days.

7.

Number of pages	8	x
Number of days	15	10

Number of days finish a book = Inverse ratio of the number of days.

$$15 : 10 = x : 8$$

$$\frac{x}{8} = \frac{15}{10} \quad \Rightarrow \quad 10 \times x = 15 \times 8$$

$$x = \frac{15 \times 8}{10} = 12$$

Thus, Kajal reads 12 pages daily.

8.

Quantity of potatoes	10	x
Cost (per/kg)	18	20

Quantity of potatoes = Inverse ratio cost per kg.

$$x : 10 = 18 : 20 \quad \Rightarrow \quad \frac{x}{10} = \frac{18}{20}$$

$$20 \times x = 18 \times 10 \quad \Rightarrow \quad x = \frac{18 \times 10}{20} = 9$$

9.

Speed (km/h)	60	54
Time taken	9	x

Speed = (Time taken = Inverse ratio)

$$60 : 54 = x : 9$$

$$\frac{60}{54} = \frac{x}{9} \quad \Rightarrow \quad 60 \times 9 = 54x \quad \Rightarrow \quad x = \frac{540}{54} = 10$$

Time taken = 10 hrs.

10.

Number of boxes	25	x
Number of bottles	12	20

Number of bottles = Inverse ratio of number of boxes

$$12 : 20 = x : 25 \quad \Rightarrow \quad \frac{x}{25} = \frac{12}{20}$$

$$20 \times x = 12 \times 25 \quad \Rightarrow \quad x = \frac{12 \times 25}{20} = 15$$

Required boxes are 15.

11. If x is in inverse variation with y and :

(a) $x = 4,\ y = 6$, find x, when $y = 12$

$$x_1 : x_2 = y_2 : y_1$$

$$4 : A = 12 : 6 = \frac{4}{A} = \frac{12}{6}$$

$$12A = 4 \times 6 \quad \Rightarrow \quad 12 = 24$$

$$A = \frac{24}{12} = 2$$

(b) $x = 7,\ y = 4$ find y when $x = 2$.

$$x_1 : x_2 = y_2 : y_1 \quad \Rightarrow \quad 7 : 2 = A : 4$$

$$\frac{7}{2} = \frac{A}{4} \quad \Rightarrow \quad 2 \times A = 4 \times 7$$

$$A = \frac{4 \times 7}{2} = 14 \quad \Rightarrow \quad y = 14$$

(c) $x = 20,\ y = ?$

Constant of variation is 300.

$$y = \frac{300}{20} = 15$$

(d) $y = 16, x$

$$\text{Constant of variation} = 176 \quad \Rightarrow \quad x = \frac{176}{16} = 11$$

Exercise 6.6

1. Mohan : Number of pages type in 6 hrs $= 32$ pages

Number of pages type in 1 hr $= \frac{32}{6}$ pages $= \frac{16}{3}$ pages

Sohan : Number of pages type in 5 hrs $= 40$ pages

Number of pages type in 1 hrs $= 40 \div 5 = 8$ pages

Mohan and Sohan work together in 1 hrs $= \frac{16}{3} + 8$ pages

$$= \frac{16 + 24}{3} = \frac{40}{3} \text{ pages}$$

Mohan + Sohan type $\frac{40}{3}$ pages in 1 hrs.

They type 110 page in $110 \div \frac{40}{3} = 110 \times \frac{3}{40} = \frac{33}{4}$ or $8\frac{1}{4}$ hrs.

2. P can do $\frac{1}{4}$ of work in 10 days.

1 work will be completed in $4 \times 10 = 40$ days.

Q can do 40% or $\frac{40}{100}$ or $\frac{2}{5}$ of work in 15 days

1 work will be completed in $5\times\frac{15}{2}=\frac{75}{2}$ days

R can do $\frac{1}{3}$ of work in 13 days

1 work will be completed in $3\times15=39$ days

comparison of work 40, $\frac{75}{2}$, 39

$$\frac{40\times2}{1\times2}=\frac{80}{2};\frac{75}{2};\frac{39\times2}{1\times2}=\frac{39}{2}$$

So, Q will complete the work first.

3. A can do $\frac{1}{3}$ of a work in 5 days

A complete work in $=5\div\frac{1}{3}=5\times3=15$ days.

A's 1 day work $=\frac{1}{15}$

B can do $\frac{2}{3}$ of a work in 10 days

B complete work in $=10\div\frac{2}{3}=10\times\frac{3}{2}=15$ day

B's 1 day work $=\frac{1}{15}$

$(A+B)$'s 1 day work $=\frac{1}{15}+\frac{1}{15}=\frac{2}{15}$

$(A+B)$'s can do 1 work $1\div\frac{2}{15}$ days

$$1\times\frac{15}{2}=\frac{15}{2}\text{ days or }7\frac{1}{2}\text{ days.}$$

4. A can do work in 15 days

$$A\text{'s 1 day work}=\frac{1}{15}$$

B can do work in 20 days

$$B\text{'s 1 day work}=\frac{1}{20}$$

$(A+B)$'s 1 day work $= \frac{1}{15}+\frac{1}{20}=\frac{4+3}{60}=\frac{7}{60}$

$(A+B)$'s 4 day work $= \frac{7}{60}\times 4=\frac{28}{60}$ or $\frac{7}{15}$

Now, work is left $= 1-\frac{7}{15}=\frac{15-7}{15}=\frac{8}{15}$

5. A and B do work in 72 days

$$A\text{'s} + B\text{'s work in 1 day} = \frac{1}{72}$$

B and C do work in 120 days

$$B\text{'s} + C\text{'s work in 1 day} = \frac{1}{120}$$

C and A do work in 90 days

$$C\text{'s} + A\text{'s work in 1 day} = \frac{1}{90}$$

$$2(A+B+C)\text{ work in 1 day} = \frac{1}{72}+\frac{1}{120}+\frac{1}{90}$$

$$= \frac{10+6+8}{720}=\frac{24}{720}\text{ or }\frac{1}{30}$$

$$2(A+B+C)\text{ work in 1 day} = \frac{1}{30}\div 2=\frac{1}{30}\times\frac{1}{2}=\frac{1}{60}$$

$$(A+B+C)\text{ can do 1 work in} = 1\div\frac{1}{60}\text{ days}$$

$$= 1\times\frac{60}{1}=60\text{ days}$$

A's work in 1 days

$= (A+B+C)$ work in 1 day $-(B+C)$ work in 1 day

$= \frac{1}{60}-\frac{1}{120}=\frac{2-1}{120}=\frac{1}{120}$

A's can do 1 work in $1\div\frac{1}{120}$ days $= 1\times\frac{120}{1}=120$ days.

B's work in 1 day

$= (A+B+C)$ work in 1 day $-(A+C)$ work in day

$= \frac{1}{60}-\frac{1}{90}=\frac{3-2}{180}=\frac{1}{180}$

B's can do 1 work $1 \div \frac{1}{180}$ days $= 1 \times \frac{180}{1} = 180$ days.

C's work in 1 days

$= (A + B + C)$ work in 1 day $- (A + B)$ work in 1 day.

$= \frac{1}{60} - \frac{1}{72} = \frac{6-5}{360} = \frac{1}{360}$

C's can do 1 work $1 \div \frac{1}{360}$ days $= 1 \times \frac{360}{1} = 360$ days.

6. A man can do a work in 5 days.

$\therefore$ Man's 1 day work $= \frac{1}{5}$

A man and his son do work in 3 days

$\therefore$ both 1 day work $= \frac{1}{3}$

His son's one day work $= \frac{1}{3} - \frac{1}{5} = \frac{5-3}{15} = \frac{2}{15}$

Son do $\frac{2}{15}$ work in 1 day.

$\therefore$ Son can do 1 work in $1 \div \frac{2}{15}$ days $= 1 \times \frac{15}{2}$ days

$= 7\frac{1}{2}$ days

Hence, his son can alone complete the work in $7\frac{1}{2}$ days.

7. A can do a job in 16 days.

A's 1 day work $= \frac{1}{16}$

B can do a job in 12 days

B's 1 day work $= \frac{1}{12}$

$A + B + C$ can do a job in 4 days.

$(A + B + C)$'s 1 day work $= \frac{1}{4}$

$$C\text{'s 1 day work} = \frac{1}{4} - \left(\frac{1}{16} + \frac{1}{12}\right)$$
$$= \frac{1}{4} - \left(\frac{3+4}{48}\right) = \frac{1}{4} - \frac{7}{48}$$
$$= \frac{12-7}{48} = \frac{5}{48}$$

C do $\frac{5}{48}$ work in 1 day.

C can do 1 work in $1 \div \frac{5}{48}$ days $= \frac{1 \times 48}{5}$ days

Hence, C's can alone complete the work in $9\frac{3}{5}$ days.

8. A can do work in 10 days

$\therefore$ A's 1 day work $= \frac{1}{10}$

B can do work in 15 days

$\therefore$ B's 1 day work $= \frac{1}{15}$

A's and B's 1 day work $= \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30}$ or $\frac{1}{6}$

If A's and B's work together, $\frac{1}{6}$ of the work is completed in 1 day.

1 work will be completed in $1 \div \frac{1}{6}$ day

$$1 \times \frac{6}{1} \text{ days} = 6 \text{ day} = 6 \text{ days}$$

Hence, $A + B$ can together work completed in 6 days.

9. A can finish a work in 18 days

$\therefore$ A's 1 day work $= \frac{1}{18}$

B can finish a work in 9 days

$\therefore$ B's 1 day work $= \frac{1}{9}$

A's and B's 1 day work $= \frac{1}{18} + \frac{1}{9} = \frac{1+2}{18} = \frac{3}{18}$ or $\frac{1}{6}$

If A and B work together $\frac{1}{6}$ of the work is completed in 1 day.

10. Time taken to fill the tank $= 16$ hrs.

Tank can be filled in 1 hrs $= \frac{1}{16}$ part

Due to Leakage in the bottom

Time taken to fill the tank $= 24$ hr.

Tank can be fill in 1 hrs $= \frac{1}{24}$ part

Time taken to leak take to empty it $\frac{1}{16} - \frac{1}{24} = \frac{3-2}{48} = \frac{1}{48}$

Time taken to empty tank $1 \div \frac{1}{48} = 48$ hrs.

11. Time taken to fill the tank $= 6$ hours.

Tank can be filled in 1 hour $= \frac{1}{6}$ part

$$\text{Tank filled} = \frac{1}{2}$$

$\therefore$ Tank remained to fill $= 1 - \frac{1}{2}$

Number of others similar taps $= 3$

Rate of filling the tanks $= 6$ hours.

$\therefore$ Tank can be filled in $\frac{1}{2}$ hours $= \frac{1}{3}$

Time taken to fill the remaining tank $= \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$

$$= \frac{3}{3} \text{ hours} = 1 \text{ hour}$$

Multiple Choice Questions

Tick (✓) the correct answer :

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

Chapter

7 Compound Interest

Exercise 7.1

1. Principal for the first year = ₹ 2000

$$\text{Rate} = 10\%$$

$$\text{Interest for first year} = ₹\ \frac{2000 \times 10 \times 1}{100} = ₹\ 200$$

Amount at end of first year = ₹ 2000 + ₹ 200 = ₹ 2200

$$\text{Rate} = 10\%$$

$$\text{Interest for second year} = ₹\ \frac{2200 \times 10 \times 1}{100} = ₹\ 220$$

Amount at end of second year = ₹ 2200 + ₹ 220 = ₹ 2420.

Compound Interest = ₹ 2420 – 2000 = ₹ 420.

2. Principal = ₹ 3000; Rate = 6% per annum

$$\text{Time} = 1\frac{1}{2} \text{ year or } \frac{3}{2} \text{ year} = \frac{3}{2} \times 2 = 3 \text{ half year}$$

Principal for first six months (first half year) = ₹ 3000

$$\text{Rate for the first half year} = \left(\frac{6}{2}\%\right) = 3\%$$

Time 1 half year

$$\text{Interest} = \frac{3000 \times 3 \times 1}{100} = ₹\ 90$$

Amount at the end of 1st half year = ₹ 3000 + ₹ 90 = ₹ 3090

Principal for the second six months (second half year) = ₹ 3090

$$\text{Rate for the second half year} = \left(\frac{6}{2}\right)\% = 3\%$$

$$\text{Time} = 1 \text{ half for}$$

$$\text{Interest for second year} = ₹\ \frac{3090 \times 3 \times 1}{100} = ₹\ 92.70$$

Amount at the end of 2nd half year = ₹ 3090 + 92.70

= ₹ 3182.70

Principal for the third six months (third half year) = ₹ 3182.70

$$\text{Rate} = \left(\frac{6}{2}\right)\% = 3\%;\ \text{Time} = 1\,\text{half year}$$

$$\text{Interest} = ₹\ \frac{3182.70 \times 3 \times 1}{100} = ₹\ 95.481$$

Amount at the end of third half year $= ₹\ (3182.70 + 95.481)$

$= ₹\ 3278.181$

Final amount to be paid $= ₹\ 3278.181$

C.I. $= ₹\ (3278.81 - 3000) = ₹\ 278.181.$

3. Principal for first six months (first half year) $= ₹\ 20{,}000$

Rate for the first half year $= \left(\frac{4}{2}\right)\% = 2\%$

$$\text{Time} = 1\,\text{half year}$$

$$\text{Interest} = \frac{20{,}000 \times 2 \times 1}{100}$$

$= ₹\ 400$ (for 1st half year)

Amount at the end of 1st half year $= ₹\ 20{,}000 + ₹\ 400 = ₹\ 20400$

Principal for the second six months (second half year) $= ₹\ 20400$

Rate for the second half year $= \left(\frac{4}{2}\right)\% = 2\%$

$$\text{Time} = 1\,\text{half year}$$

Interest for the second year $\frac{20400 \times 2 \times 1}{100} = ₹\ 408$

Amount at the end of second half year $= ₹\ 20400 + ₹\ 408$

$= ₹\ 20808$

Principal for the third six months (third half year) $= ₹\ 20808$

$$\text{Rate} = \left(\frac{4}{2}\right)\% = 2\%$$

$$\text{Time} = 1\,\text{half year}$$

$$\text{Interest} = \frac{20808 \times 2 \times 1}{100} = ₹\ 416.16$$

Amount at the end of third half year $= ₹\ (20808 + 416.16)$

$= ₹\ 21224.16$

Final amount to be paid $= ₹\ 21224.16$

C.I. $= ₹\ 211224.16 - 20000 = ₹\ 11224.16$

4. 9 months = three quarters

$$R = 12\%\text{ p.a.} = \left(\frac{12}{4}\right)\%\text{ per quarter} = 3\%\text{ per quarter}$$

$$\text{Principal for 1st quarter} = ₹\ 8500$$

$$\text{Interest for 1st quarter} = \frac{8500 \times 3 \times 1}{100} = ₹\ 255$$

$$\text{Amount at the end of 1st quarter} = ₹\ 8500 + ₹\ 255 = ₹\ 8755$$

$$\text{Principal for the 2nd quarter} = ₹\ 8755;\ R = 3\%$$

$$\text{Interest for the 2nd quarter} = ₹\ \frac{8755 \times 3 \times 1}{100} = ₹\ 262.65$$

$$\text{Amount at the end of 2nd quarter} = ₹\ 8755 + ₹\ 262.65$$

$$= ₹\ 9017.65$$

$$\text{Principal for 3rd quarter} = ₹\ 9017.65;\ R = 3\%$$

$$\text{Interest for the 3rd quarter} = ₹\ \frac{9017.05 \times 3 \times 1}{100}$$

$$= ₹\ 270.53$$

$$\text{Amount at the end of 3rd quarter} = ₹\ 9017.65 + 270.53$$

$$= ₹\ 9288.18$$

$$\text{C.I.} = ₹\ 9288.18 - 8500$$

$$= ₹\ 788.18$$

5. 9 months = Three quarters

$$R = 6\%\text{ p.a.} = \left(\frac{6}{4}\right)\%\text{ per quarter} = \frac{6}{4}\%\text{ per quarter}$$

$$\text{Principal for 1st quarter} = ₹\ 4000$$

$$\text{Interest for 1st quarter} = \frac{4000 \times 6 \times 1}{100 \times 4} = ₹\ 60$$

$$\text{Amount at the end of 1st quarter} = ₹\ 4000 + ₹\ 60 = ₹\ 4060$$

$$\text{Principal for the 2nd quarter} = ₹\ 4060;\ R = \frac{6}{4}\%$$

$$\text{Interest for the 2nd quarter} = ₹\ \frac{4060 \times 6 \times 1}{100 \times 4} = ₹\ 60.90$$

$$\text{Amount at the end of 2nd quarter} = ₹\ 4060 + ₹\ 60.90$$

$$= ₹\ 4120.9$$

Principal for the 3rd quarter $= ₹\ 4120.9,\ R = \frac{6}{4}\%$

Interest for 3rd quarter $= ₹\ \frac{4120.9 \times 6}{4 \times 100} = ₹\ 61.81$

Amount at the end of 3rd quarter $= ₹\ 4120.90 + ₹\ 61.81$
$= ₹\ 4182.71$

Compound Interest $=$ Amount $-$ Principal
$= ₹\ 4182.71 - 4000$
$= ₹\ 182.71$

6. Principal for the first year $= ₹\ 7000$

Rate $= 12\%$

Interest for first year $₹\ \frac{7000 \times 12 \times 1}{100} = ₹\ 840$

Amount at end of first year $= ₹\ 7000 + ₹\ 840 = ₹\ 7840$

Rate $= 12\%$

Interest for second year $= ₹\ \frac{7840 \times 12 \times 1}{100} = ₹\ 940.80$

Amount at end of second year $= ₹\ 7840 + 940.80 = ₹\ 8780.80$

Compound Interest $= ₹\ (8780.80 - 7000)$
$= ₹\ 1780.80$

7. 1 year $= 4$ quarters

$R = 8\%$ p.a. $= \left(\frac{8}{4}\right)\%$ per quarter $= 2\%$ per quarter

Principal for 1st quarter $= ₹\ 12000$

Interest for 1st quarter $= \frac{12000 \times 2 \times 1}{100} = ₹\ 240$

Amount at the end of 1st quarter $= ₹\ 12000 + ₹\ 240$
$= ₹\ 12240$

Principal for the 2nd quarter $= ₹\ 12240;\ R = 2\%$

Interest for the 2nd quarter $= ₹\ \frac{12240 \times 2 \times 1}{100} = ₹\ 244.8$

Amount at the end of 2nd quarter $= ₹\ 12240 + ₹\ 244.8$
$= ₹\ 12484.8$

Principal for 3rd quarter $= ₹\ 12484.8$

$$\text{Interest for 3rd quarter} = \frac{12484.8 \times 2 \times 1}{100}$$
$$= ₹\ 249.696$$
$$\text{Amount at the end of 3rd quarter} = ₹\ 12484.8 + ₹\ 249.696$$
$$= ₹\ 12734.496$$
$$\text{Principal for the 4th quarter} = ₹\ 12734.500;\ R = 2\%$$
$$\text{Interest for the 4th quarter} = ₹\ \frac{12734.500 \times 2 \times 1}{100}$$
$$= ₹\ 65 \times 4 = ₹\ 254.69$$
$$\text{Amount at the end of 4th quarter} = ₹\ 12734.500 + ₹\ 254.69$$
$$= ₹\ 12989.19$$
$$\text{C.I.} = \text{Final amount} - \text{Original principal}$$
$$= ₹\ 12989.19 - ₹\ 12000 = ₹\ 989.19$$

8. Principal $= ₹\ 32768$

$$\text{Rate} = 12\frac{1}{2}\% = \frac{25}{2}\% \text{ p.a.}$$
$$= \left(\frac{25}{2 \times 4}\right)\% \text{ per quarter} = \frac{25}{8}\% \text{ per quarter}$$
$$\text{Nine month} = 3 \text{ quarter.}$$
$$\text{Principal for 1st quarter} = ₹\ 32768\ ;\ R = \frac{25}{8}\%$$
$$\text{Interest for 1st quarter} = ₹\ \frac{32768 \times 25 \times 1}{8 \times 100} = ₹\ 1024$$
$$\text{Amount for 1st quarter} = ₹\ (32768 + 1024) = ₹\ 33792$$
$$\text{Principal for 2nd quarter} = ₹\ 33792\ ;\ R = \frac{25}{8}\%$$
$$\text{Interest for 2nd quarter} = \frac{33792 \times 25 \times 1}{8 \times 100} = ₹\ 1056$$
$$\text{Amount for 2nd quarter} = ₹\ (33792 + 1056) = ₹\ 34848$$
$$\text{Principal for 3rd quarter} = ₹\ 34848\ ;\ R = \frac{25}{8}\%$$
$$\text{Interest for 3rd quarter} = ₹\ \frac{34848 \times 25 \times 1}{8 \times 100} = ₹\ 1089$$
$$\text{Amount for 3rd quarter} = ₹\ 1089 + ₹\ 34848 = ₹\ 35937.$$

9. Simple Interest

$$\text{Principal} = ₹\ 18000,\ R = 12\%\ \text{Time} = 2\ \text{year}$$

$$\text{S.I.} = \frac{P \times R \times T}{100} = ₹\ \frac{18000 \times 12 \times 2}{100} = ₹\ 4320$$

Compound Interest

$$\text{Principal} = ₹\ 18000;\ R = 12\%$$

$$\text{Interest for 1 year} = ₹\ \frac{18000 \times 12 \times 1}{100} = ₹\ 2160$$

$$\text{Amount of 1 year} = ₹\ 18000 + ₹\ 2160 = ₹\ 20160$$

$$\text{Principal for 2 year} = ₹\ 20160$$

$$\text{Interest for 2 year} = ₹\ \frac{20160 \times 12 \times 1}{100} = ₹\ 2419.20$$

$$\text{Amount of 2 year} = ₹\ 20160 + ₹\ 2419.20$$
$$= ₹\ 22579.20$$

$$\text{Compound Interest} = ₹\ 22579.20 - ₹\ 18000$$
$$= ₹\ 4579.20$$

$$\text{Sonam earn profit} = ₹\ (4579.20 - 4320)$$
$$= ₹\ 259.20$$

10. Nine months = three quarters

$$R = 10\%\ \text{p.a.} = \left(\frac{10}{4}\right)\%\ \text{per quarter} = \frac{25}{10}\%\ \text{per quarter}$$

Principal for 1st quarter = ₹ 25600

$$\text{Interest for 1st quarter} = \frac{25600 \times 25 \times 1}{100 \times 10} = ₹\ 640$$

$$\text{Amount at the end of 1st quarter} = ₹\ 25600 + ₹\ 640$$
$$= ₹\ 26240$$

$$\text{Principal for the 2nd quarter} = ₹\ 26240\ ;\ R = \frac{25}{10}\%$$

$$\text{Interest for the 2nd quarter} = ₹\ \frac{26240 \times 25 \times 1}{100 \times 10} = ₹\ 656$$

$$\text{Amount at the end of 2nd quarter} = ₹\ 26240 + ₹\ 656$$
$$= ₹\ 26896$$

$$\text{Principal for the 3rd quarter} = ₹\ 26896,\ R = \frac{25}{10}\%$$

$$\text{Interest for the 3rd quarter} = ₹\ \frac{26896 \times 25 \times 1}{10 \times 100}$$

$$= ₹\ 672.40$$

$$\text{Amount at the end of 3rd quarter} = ₹\ (26896 + 672.40)$$

$$= ₹\ 27568.40$$

$$\text{C.I.} = \text{Amount} - \text{Principal}$$

$$= ₹\ 27568.40 - 25600 = ₹\ 1968.40$$

11. Principal = ₹ 24000

Nine months = 3 quater

Rate = 20 paisa and rupee per annum 20%

$$\text{Rate} = \frac{20}{4} = 5\%$$

$$\text{Principal for 1 quater} = ₹\ 24000;\ \text{Rate} = 5\%$$

$$\text{Interest fo 1st quater} = ₹\ \frac{24000 \times 5 \times 1}{100} = ₹\ 1200$$

$$\text{Amount for Ist quater} = ₹\ 24000 + ₹\ 1200 = ₹\ 25200$$

$$\text{Principal for 2nd quater} = ₹\ 25200;\ \text{Rate} = 5\%$$

$$\text{Interest fo 2nd quater} = ₹\ \frac{25200 \times 5 \times 1}{100} = ₹\ 1260$$

$$\text{Amount for 2nd quater} = ₹\ 25200 + ₹\ 1260 = ₹\ 26460$$

$$\text{Interest fo 3rd quater} = ₹\ \frac{26460 \times 5 \times 1}{100} = ₹\ 1323$$

$$\text{Amount for 3rd quater} = ₹\ 26460 + ₹\ 1323 = ₹\ 27783$$

$$\text{Compound Interest} = \text{Amount} - \text{Princpal}$$

$$= ₹\ 27783 - ₹\ 24000$$

$$= ₹\ 3783$$

12. Principal for first six months (first half year) = ₹ 64000

$$\text{Rate for the first half year} = \left(\frac{5}{2}\right)\%$$

$$\text{Time} = 1 \text{ half year}$$

$$\text{Interest} = \frac{64{,}000 \times 5 \times 1}{100 \times 2}$$

$$= ₹\ 1600 \text{ (for 1st half year)}$$

Amount at the end of 1st half year $= ₹\ 64{,}000 + ₹\ 1600$
$= ₹\ 65600$

Principal for the second six months (second half year) $= ₹\ 65{,}600$

Rate for the second half year $= \left(\frac{5}{2}\right)\%$

Time $= 1$ half year

Interest for the second year $= \frac{65600 \times 5 \times 1}{100 \times 2} = ₹\ 1640$

Amount at the end of second half year $= ₹\ 65600 + ₹\ 1640$
$= ₹\ 67240$

Principal for the third six months (third half year) $= ₹\ 67240$

Rate $= \left(\frac{5}{2}\right)\%$

Time $= 1$ half year

Interest $= \frac{67240 \times 5 \times 1}{100 \times 2}$ ₹ 1681

Amount at the end of third half year $= ₹\ 67240 + ₹\ 1681$
$= ₹\ 68921$

Final amount to be paid $= ₹\ 68921$

C.I. $= ₹\ 68921 - ₹\ 64{,}000 = ₹\ 4921$

13. Principal for the first year $= ₹\ 15000$

$R = 5\%$

$\therefore$ Interest the first year $= \frac{15000 \times 5 \times 1}{100} = ₹\ 750$

Amount of the end of first year $= ₹\ 15000 + ₹\ 750 = ₹\ 15750$

Principal for the second year $= ₹\ 15750$

$R = 5\%$

Interest for the second year $= \frac{15750 \times 5 \times 1}{100} = ₹\ 787.50$

Amount at the end of second year $= ₹\ 15750 + ₹\ 787.50$
$= ₹\ 16537.50$

Compound interest $= A - P$
$= ₹\ (16537.50 - 15000)$
$= ₹\ 1537.50$

Exercise 7.2

1. Find the compound interest in each of the following using the formulae :

(a) Principal = ₹ 4,000, Rate = 6%, Time = 3 years

$$A = P\left(1+\frac{R}{100}\right)^T$$

$$A = ₹\ 4000\left(1+\frac{6}{100}\right)^3$$

$$= ₹\ 4000 \times \left(1+\frac{3}{50}\right)^3 = ₹\ 4000\left(\frac{53}{50}\right)^3$$

$$= ₹\ 4000 \times \frac{53}{50} \times \frac{53}{50} \times \frac{53}{50} = ₹\ 4764.06$$

C.I. $= A - P$

$= ₹\ 4764.06 - ₹\ 4000 = ₹\ 764.06$

(b) Principal = ₹ 5,000, Rate = 5 paise per rupee per annum, Time = 3 years

$$A = P\left(1+\frac{R}{100}\right)^T$$

$$A = ₹\ 5000\left(1+\frac{5}{100}\right)^3 = ₹\ 5000\left(\frac{21}{20}\right)^3$$

$$= ₹\ 5000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} = ₹\ 5788.13$$

C.I. $= A - P$

C.I. $= ₹\ 5788.13 - ₹\ 5000 = ₹\ 788.13$

(c) Principal = ₹ 3,000, Rate = 10% per annum compounded half-yearly, Time = 2 years

$$r = \frac{10}{2}\% = 5\%$$

Time = 2 years $= 2 \times 2 = 4$ half yearly

$$A = P\left(1+\frac{R}{100}\right)^T$$

$$A = 3000\left(1+\frac{5}{100}\right)^4 = 3000\left(\frac{21}{20}\right)^4$$

$$= 3000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20} = ₹\ 3646.52$$

$$\text{C.I.} = A - P$$

$$= ₹\ (3646.52 - 3000) = ₹\ 646.52$$

(d) Principal = ₹ 20,000, Rate = 20% per annum compounded quarterly, Time = 1 years

$$r = \frac{20}{4}\% \text{ or } 5\%$$

$$\text{Time} = 1 \text{ year} = 4 \text{ quarterly}$$

$$A = ₹\ P\left(1+\frac{r}{100}\right)^T$$

$$= ₹\ 20000\left(1+\frac{5}{100}\right)^4 = ₹\ 20000\left(\frac{105}{100}\right)^4$$

$$= ₹\ 20000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}$$

$$= ₹\ 24310.13$$

$$\text{C.I.} = A - P = ₹\ 24310.13 - ₹\ 20000 = ₹\ 4310.13$$

2. $P = ₹\ 12800;\ T = 3 \text{ year};\ R = 6\frac{1}{2}\%$ p.a. or $\frac{13}{2}\%$

$$A = P\left(1+\frac{R}{100}\right)^T$$

$$A = ₹\ 12800\left(1+\frac{13}{2\times 100}\right)^3$$

$$A = ₹\ 12800\left(\frac{213}{200}\right)^3$$

$$= ₹\ 12800\times\frac{213}{200}\times\frac{213}{200}\times\frac{213}{200}$$

$$= ₹\ 15461.76$$

$$\text{C.I.} = A - P;\ \text{C.I.}$$

$$= ₹\ (15461.76 - 12800) = ₹\ 2661.76$$

3. Principal $= ₹\ 1625$; rate $= 12$ p.a. and $n = 1\frac{1}{4}$ years

$$\text{Amount of } 1\frac{1}{4} \text{ years} = ₹\ p\left(1+\frac{R}{100}\right)^1\left(1+\frac{\frac{1}{4}R}{100}\right)$$

$$= ₹\ 1625\left(1+\frac{12}{100}\right)\left(1+\frac{\frac{1}{4}\times 12}{100}\right)$$

$$= ₹\ 1625\left(\frac{112}{100}\right)\left(\frac{103}{100}\right) = ₹\ 1625\times\frac{112}{100}\times\frac{103}{100}$$

$$= ₹\ \frac{18746000}{10000} = ₹\ 1874.6$$

$$\text{C.I.} = A - P = ₹\ 1874.6 - ₹\ 1625 = ₹\ 249.60$$

4. Principal $= ₹\ 1600$, Time $= 2$ years, $r = 7\frac{1}{4}\%$ or $\frac{29}{4}\%$

$$A = P\left(1+\frac{r}{100}\right)^T \quad \Rightarrow \quad A = ₹\ 1600\left(1+\frac{29}{4\times 100}\right)^2$$

$$A = ₹\ 1600\times\frac{429}{400}\times\frac{429}{400} = ₹\ 1840.400$$

$$\text{C.I.} = A - P = ₹\ (1840.400 - 1600) = ₹\ 240.40$$

5. Principal $= ₹\ 25000$; Time $= 3$ years

$a = 10\%$, $b = 12\%$ $c = 15\%$

$$A = ₹\ P\left(1+\frac{a}{100}\right)\left(1+\frac{b}{100}\right)\left(1+\frac{c}{100}\right)$$

$$= ₹\ 25000\left(1+\frac{10}{100}\right)\left(1+\frac{12}{100}\right)\left(1+\frac{15}{100}\right)$$

$$= ₹\ 25000\left(\frac{11}{10}\right)\left(\frac{112}{100}\right)\left(\frac{115}{100}\right)$$

$$= ₹\ 25000\times\frac{11}{10}\times\frac{112}{100}\times\frac{115}{100} = ₹\ 35420$$

$$\text{C.I.} = A - P \Rightarrow ₹\ 35420 - 25000 = ₹\ 10420$$

6. Principal = ₹ 5000; $n = 3$ year; $a = 10\%$, $b = 12\%$, $c = 14\%$

$$A = P\left(1+\frac{a}{100}\right)\left(1+\frac{b}{100}\right)\left(1+\frac{c}{100}\right)$$

$$A = ₹\ 5000\left(1+\frac{10}{100}\right)\left(1+\frac{12}{100}\right)\left(1+\frac{14}{100}\right)$$

$$= ₹\ 5000 \times \frac{110}{100} \times \frac{112}{100} \times \frac{114}{100} = ₹\ 7022.4$$

$$\text{C.I.} = A - P = ₹\ (7022.4 - 5000) = ₹\ 2022.4$$

7. $P = ₹\ 15000$; $R = 8\% = \frac{8}{4} = 2\%$ quarterly,

$T = 9$ months; $\frac{9}{12}$ year $= \frac{9}{12} \times 4 = 3$ (quarters)

$$A = P\left(1+\frac{R}{100}\right)^T$$

$$A = ₹\ 15000\left(1+\frac{2}{100}\right)^3 = ₹\ 15000 \times \left(\frac{51}{50}\right)^3$$

$$= ₹\ 15000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} = ₹\ 15918.12$$

$$\text{C.I.} = A - P;$$

$$\text{C.I.} = ₹\ 15918.12 - 15000 = ₹\ 918.12$$

8. $P = ₹\ 12500$, $R = 8\%$ p.a. and $n = 1\frac{1}{4}$ years

$$\text{Amount of } 1\frac{1}{4} \text{ years} = ₹\ P\left(1+\frac{R}{100}\right)^1\left(1+\frac{\frac{1}{4}R}{100}\right)$$

$$= ₹\ 12500\left(1+\frac{8}{100}\right)^1\left(1+\frac{\frac{1}{4}\times 8}{100}\right)$$

$$= ₹\ 12500 \times \frac{108}{100} \times \frac{102}{100} = ₹\ 13770$$

$$\text{C.I.} = A - P \quad \Rightarrow ₹\ 13770 - ₹\ 12500 = ₹\ 1270$$

9. S.I. = ₹ 2400; $R = 5\%$, $T = 3$ years

$$\text{S.I.} = \frac{P \times R \times T}{100} \quad \Rightarrow \quad 2400 = \frac{P \times 5 \times 3}{100}$$

$$\Rightarrow \quad P = ₹\ \frac{2400 \times 100}{5 \times 3} = ₹\ 16000$$

Compound interest :

$$A = P\left(1 + \frac{R}{100}\right)^T$$

$$A = ₹\ 16000\left(1 + \frac{5}{100}\right)^3 = ₹\ 16000\left(\frac{21}{20}\right)^3$$

$$= ₹\ 16000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} = ₹\ 18522$$

$$\text{C.I.} = A - P = ₹\ (18522 - 16000) = ₹\ 2522$$

10. $P = ₹\ 2000$; $R = 10\%$ p.a. (half yearly)$= \frac{10}{2}\% = 5\%$

Time $(n) = 1\frac{1}{2}$ year $= \frac{3}{2} \times 2 = 3$ (half yearly)

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$A = ₹\ 2000\left(1 + \frac{5}{100}\right)^3$$

$$A = ₹\ 2000 \times \left(\frac{105}{100}\right)^3$$

$$= ₹\ 2000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100} = ₹\ 2315.25$$

$$\text{C.I.} = A - P$$

$$= ₹\ (2315.25 - 2000) = ₹\ 315.25$$

11. $P = ₹\ 50000$; $r = 10\%$

$n = 1\frac{1}{2}$ year $= \frac{3}{2} \times 2 = 3$ (half yearly) $= \frac{10}{2}\% = 5\%$

$$A = P\left(1 + \frac{R}{100}\right)^n = ₹\ 50000\left(1 + \frac{10}{100}\right)^3$$

$$= ₹\ 50000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} = ₹\ 66550$$

C.I. $= A - P = ₹\ (66550 - 50000) = ₹\ 16550.$

12. $P = ₹\ 57600;\ R = 12\frac{1}{2}\%$ or $\frac{25}{2}\%$ p.a. half year $= \left(\frac{25}{2} \div 2\right) = \frac{25}{4}\%$

$$\text{Time} = 1\frac{1}{2} \text{ year} = \frac{3}{2} \times 2 \text{ half year} = 3 \text{ half year}$$

$$A = P\left(1 + \frac{R}{100}\right)^T$$

$$A = ₹\ 57600\left(1 + \frac{25}{100 \times 4}\right)^3$$

$$= ₹\ 57600\left(\frac{17}{16}\right)^3$$

$$= ₹\ 57600 \times \frac{17}{16} \times \frac{17}{16} \times \frac{17}{16} = ₹\ 69089.06$$

C.I. $= A - P$; C.I.

$= ₹\ (69089.06 - 57600) = ₹\ 11489.06$

Exerciser 7.3

1. $P = ₹\ 20{,}000;\ R_1 = 5\%;\ R_2 = 6\%;\ R_3 = 8\%$

$$A = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right)$$

$$= ₹\ 20000\left(1 + \frac{5}{100}\right)\left(1 + \frac{6}{100}\right)\left(1 + \frac{8}{100}\right)$$

$$= ₹\ 20000 \times \frac{105}{100} \times \frac{106}{100} \times \frac{108}{100} = ₹\ 24040.8$$

2. Let the original principal $= ₹\ x$

then, amount $= ₹\ \frac{9}{4} \times x = ₹\ \frac{9}{4}x$

Time $= 2$ year and Suppose Rate $= R$

$$A = P\left(1 + \frac{R}{100}\right)^n \quad \Rightarrow \quad \frac{9x}{4} = x\left(1 + \frac{R}{100}\right)^2$$

$$\frac{9x}{4} \div x = \left(1+\frac{R}{100}\right)^2 \quad \Rightarrow \quad \frac{9x}{4} \times \frac{1}{x} = \left(1+\frac{R}{100}\right)^2$$

$$\left(\frac{3}{2}\right)^2 = \left(1+\frac{R}{100}\right)^2$$

Comparison the equation; $\frac{3}{2} = 1+\frac{R}{100}$

$$\frac{R}{100} = \frac{3}{2} - 1 \quad \Rightarrow \quad \frac{R}{100} = \frac{3-2}{2}$$

$$\frac{R}{100} = \frac{1}{2} \quad \Rightarrow \quad R = \frac{1}{2} \times 100 = 50\%$$

Rate = 50%.

3. C.I. = ₹ 6781.25; P = ₹ 16000, T = 3 year

A = C.I. + $P \Rightarrow A$ = ₹ 6781.25 + ₹ 16000 = ₹ 22781.25

$$A = P\left(1+\frac{r}{100}\right)^n \quad \Rightarrow \quad 22781.25$$

$$= 16000\left(1+\frac{r}{100}\right)^3$$

$$\frac{2278125}{1600000} = \left(1+\frac{r}{100}\right)^3 \quad \Rightarrow \quad \frac{729}{512} = \left(1+\frac{r}{100}\right)^3$$

$$\left(\frac{9}{8}\right)^3 = \left(1+\frac{r}{100}\right)^3 \quad \Rightarrow \quad \frac{r}{100} = \frac{9}{8} - 1$$

$$\frac{r}{100} = \frac{9-8}{8} \quad \Rightarrow \quad r = \frac{1}{8} \times 100 = 12.5$$

So, Rate = 12.5%.

4. S.I. for 2 years = ₹ 100

S.I for 1 years = ₹ 50

C.I. for 2 years = ₹ 104

For Ist year C.I and S.I. will be same.

So, C.I. for Ist year = ₹ 50

S.I. means

₹ 4 is the C.I. of ₹ 50 for 1 year

So, C.I. = 4, P = 50, T = 1, R = ?

Now, $$R = \frac{C.I. \times 100}{P \times T}$$

$$= \frac{4 \times 100}{50 \times 1} = 8\%.$$

5. Let, the sum be ₹ 100

$$\text{Rate} = 5\% \quad \text{Time} = 2 \text{ year}$$

$$\text{Sum of ₹ } 100 = ₹ \frac{100 \times 5 \times 2}{100} = ₹ 10$$

C.I. of ₹ 100; $A = P\left(1 + \frac{r}{100}\right)^n$

$$A = 100\left(1 + \frac{5}{100}\right)^2 = 100\left(\frac{21}{20}\right)^2$$

$\Rightarrow$ $$A = 100 \times \frac{21}{20} \times \frac{21}{20} = ₹ \ 110.25$$

$$\text{C.I.} = A - P$$

$\Rightarrow$ $$\text{C.I.} = 110.25 - 100 = ₹ \ 10.25$$

Difference of S.I. and C.I. ₹ (10.25 – 10.00) = ₹ 0.25

If difference is ₹ 0.25 then sum = ₹ 100

$$\text{Difference is ₹ 1 then sum} = ₹ \frac{100}{0.25}$$

$$\text{Difference is ₹ 1.50 then sum} = ₹ \frac{100}{0.25} \times 1.50 = ₹ 600$$

$$\text{Principal} = ₹ 600.$$

6. Let the original principal be ₹ x

It amount to ₹ 12100 in 2 years at C.I. of Rate = 10%

$$A = P\left(1 + \frac{R}{100}\right)^n \quad \Rightarrow \quad 12100 = x\left(1 + \frac{10}{100}\right)^2$$

$$12100 = x\left(\frac{11}{10}\right)^2 \quad \Rightarrow \quad 12100 = x \times \frac{11}{10} \times \frac{11}{10}$$

$$x = 12100 \times \frac{10 \times 10}{11 \times 11} = 10000$$

Principal = ₹ 10000.

7. Let, the sum be ₹ 100

Rate = 15% Time = 2 year

$$\text{S.I. on ₹ 100} = ₹\ \frac{100\times 15\times 2}{100} = ₹\ 30$$

C.I. on ₹ 100; $A = P\left(1+\frac{r}{100}\right)^n$

$$A = ₹\ 100\left(1+\frac{15}{100}\right)^2$$

$$= ₹\ 100\times\frac{115}{100}\times\frac{115}{100} = ₹\ 132.25$$

$$\text{C.I.} = A - P \Rightarrow ₹\ (132.25 - 100) = ₹\ 32.25$$

Difference between C.I. and S.I. ₹ 32.25 – ₹ 30 = ₹ 2.25

If difference is ₹ 144 the sum will be $= \frac{100}{2.25}\times 144 = ₹\ 6400.$

Multiple Choice Questions

Tick (✓) the correct answer :

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

BRAIN BOOSTER

1. Let the principal and rate be P and r respectively.

Then, For 2 years, $1210 = P\left(1+\frac{r}{100}\right)^2$ …(i)

For 5 years, $1610.51 = P\left(1+\frac{r}{100}\right)^5$ …(ii)

Divide equation (ii) by (i), we get

$$\frac{1610.51}{1210} = \frac{P\left(1+\frac{r}{100}\right)^5}{P\left(1+\frac{r}{100}\right)^2} \quad \text{or} \quad \left(1+\frac{r}{100}\right)^3 = \frac{161051}{121000}$$

$$\left(1+\frac{r}{100}\right)^3 = \frac{1331}{1000} \quad \Rightarrow \quad \left(1+\frac{r}{100}\right) = \sqrt[3]{\frac{1331}{1000}}$$

$$1+\frac{r}{100}=\frac{11}{10} \qquad \Rightarrow \qquad 10+\frac{10r}{100}=11$$

$$\frac{r}{10}=11-10 \qquad \Rightarrow \qquad r=1\times 10$$

$$r=10\%$$

Putting the value of r in equation (i), we get

$$1210=P\left(1+\frac{10}{100}\right)^2 \qquad \Rightarrow \qquad 1210=P\left(1+\frac{1}{10}\right)^2$$

$$1210=P\times\frac{11\times 11}{100}$$

$$\Rightarrow \qquad P=\frac{1210\times 100}{11\times 11}=10\times 100=₹\ 1000.$$

2. Amount in 1 year = ₹ 8820

Amount in 1 year 6 months = ₹ 9261

Interest in 6 month = ₹ 9261 – ₹ 8820 = ₹ 441

Interest in 1 year = ₹ 441 × 2 = ₹ 882

One year compound Interest equal to one year

Simple interest ₹ 882 = ₹ $\frac{8820\times R\times 1}{100}$

(For 6 month $P = A$ of 1 year)

$$R=\frac{88200}{8820}=10\%$$

Let original principal = ₹ x

Amount ₹ 8820 in 1 year at C.I. half year

$$8820=x\left(1+\frac{10}{100\times 2}\right)^{1\times 2} \Rightarrow \qquad r=10\%\div 2=5\%$$

$$n=1\times 2=2 \qquad \Rightarrow \qquad 8820=x\left(1+\frac{5}{100}\right)^2$$

$$8820=x\times\frac{105}{100}\times\frac{105}{100}$$

$$x=8820\times\frac{100}{105}\times\frac{100}{105}=₹\ 8000.$$

Chapter

8 Algebraic Expressions and Factorization

Exercise 8.1

1. Find the following products :

(a) $\left(-\frac{3}{2}x^2y^2\right)\times\left(-\frac{6}{7}xy^2\right)=\left(\frac{-3}{2}\times\frac{-6}{7}\right)(x^2\times x)(y^2\times y^2)$

$=\frac{9}{7}x^3y^4$

(b) $(-7x^2)\times 2y=-14x^2y$

(c) $3x^2\times 6x^3=18x^5$ (d) $2x\times 7x=14x^2$

2. Multiply the monomials :

(a) Multiply : $3x, -4x^2$ and $7x^3$

$3x^2\times -4x^2\times 7x^3=3\times -4\times 7\times x\times x^2\times x^3=-84x^6$

(b) Multiply : $a^3, -6a^2b$ and $2b^3$

$a^3\times -6a^2b\times 2b^3=-6\times 2\times(a^3\times a^2)\times(b\times b^3)$

$=-12a^5\times b^4=-12a^5b^4$

(c) Multiply : $16x^6, -10xy^2$ and $\frac{3}{5}x^2y^2$

$16x^6\times -10xy^2\times\frac{3}{5}x^2y^2$

$=\left(16\times -10\times\frac{3}{5}\right)\times(x^6\times x\times x^2)\times(y^2\times y^2)$

$=-96\times x^9\times y^4=-96x^9y^4$

(d) Multiply : $-2p^4-4p^2q^2$ and $\frac{3}{8}pq^2$

$=-2p^4\times -4p^2q^2\times\frac{3}{8}pq^2$

$=-2\times -4\times\frac{3}{8}\times p^4\times p^2\times p\times q^2\times q^2$

$=-1\times 3\times p^7\times q^4=-3p^7q^4$

3. Find the following products :

(a) $(-3x)(2x^2 + 6x - 7) = -3x \times 2x^2 + (-3x \times 6x) + (-7 \times -3x)$

$= -6x^3 + (-18x^2) + (+21x)$

$= -6x^3 - 18x^2 + 21x$

(b) $\frac{1}{2}xy(x^2 - 2xy + y^2) = \frac{1}{2}xy \times x^2 - \frac{1}{2}xy \times 2xy + \frac{1}{2}xy \times y^2$

$= \frac{1}{2}x^3y - x^2y^2 + \frac{1}{2}xy^3$

(c) $a^2(a^3 + 3a^2b + b^3 + 3ab^2)$

$= a^2 \times a^3 + a^2 \times 3a^2b + a^2b^3 + a^2 \times 3ab^2$

$= a^5 + 3a^4b + a^2b^3 + 3a^3b^2$

(d) $\left(-\frac{3}{5}p^2q\right)(p^4 + q^4 + 2p^2q^2)$

$= \frac{-3}{5}p^2q \times p^4 + \left(\frac{-3}{5}p^2q \times q^4\right) + \left(\frac{-3}{5}p^2q \times \frac{2}{1}p^2q^2\right)$

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

$= \frac{-3}{5}p^6q - \frac{3}{5}p^2q^5 - \frac{6}{5}p^4q^3$

4. Find the following products :

(a) $\left(\frac{1}{2}x^2 + y^2\right)\left(x^2 - \frac{1}{2}y^2\right)$

$= \frac{1}{2}x^2\left(x^2 - \frac{1}{2}y^2\right) + y^2\left(x^2 - \frac{1}{2}y^2\right)$

$= \left(\frac{1}{2}x^2 \times x^2 - \frac{1}{2}y^2 \times \frac{1}{2}x^2\right) + \left(y^2 \times x^2 - \frac{1}{2}y^2 \times y^2\right)$

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

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

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

(b) $(p+q)(p-q) = p(p-q)+q(p-q)$

$= p^2 - pq + pq - q^2 = p^2 - q^2$

(c) $(3a+2)(2a-5) = 3a(2a-5)+2(2a-5) = 6a^2 - 15a + 4a - 10$

$= 6a^2 - 11a - 10 = 6a^2 - 11a - 10$

(d) Multiply : $(2x-y)(3x-5y)$

$(2x-y)\times(3x-5y) = 2x(3x-5y) - y(3x-5y)$

$= 6x^2 - 10xy - 3xy + 5y^2$

$= 6x^2 - 13xy + 5y^2$

5. Find the following products :

(a) $(p^2+q^2)(p^2 - pq + q^2)$

$= p^2(p^2 - pq + q^2) + q^2(p^2 - pq + q^2)$

$= (p^4 - p^3q + p^2q^2) + (p^2q^2 - pq^3 + q^4)$

$= p^4 - p^3q + p^2q^2 + p^2q^2 - pq^3 + q^4$

$= p^4 - p^3q + 2p^2q^2 - pq^3 + q^4$

(b) $(3y^2+5)(5y^2+3y+1)$

$= 3y^2(5y^2+3y+1) + 5(5y^2+3y+1)$

$= 15y^4 + 9y^3 + 3y^2 + 25y^2 + 15y + 5$

$= 15y^4 + (13y^2 + 25y^2) + 9y^3 + 15y + 5$

$= 15y^4 + 28y^2 + 9y^3 + 15y + 5$

(c) $(2x-1)(x^2+2x+7)$

$= 2x(x^2+2x+7) - 1(x^2+2x+7)$

$= 2x^3 + 4x^2 + 14x - x^2 - 2x - 7$

$= 2x^3 + (4x^2 - x^2) + (14x - 2x) - 7$

$= 2x^3 + 3x^2 + 12x - 7$

(d) $(a+b)(a^2+b^2) = a(a^2+b^2) + b(a^2+b^2)$

$= a^3 + ab^2 + ba^2 + b^3$

6. Multiply and verify the result by taking $x = 1$, $y = 2$ and $z = 3$.

(a) $6x^2y(z^2 - y^2) = 6x^2y \times z^2 - 6x^2y \times y^2$

$$= 6x^2yz^2 - 6x^2y^3$$

Verification :

$6x^2y(z^2 - y^2) = 6x^2yz^2 - 6x^2y^3 \qquad (x = 1,\ y = 2,\ z = 3)$

L.H.S.

$$= 6x^2y(z^2 - y^2) = 6(1)^2 \times 2((3)^2 - (2)^2)$$
$$= 6 \times 1 \times 2(9-4) = 12 \times 5 = 60$$

R.H.S.

$6x^2yz^2 - 6x^2y^3 = 6(1)^2 \times (2)(3)^2 - 6(1)^2(2)^3$

$= 6 \times 1 \times 2 \times 9 - 6 \times 1 \times 8 = 108 - 48 = 60$

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

(b) $(4y + z)(z - 4y) = 4y(z - 4y) + z(z - 4y)$

$= 4yz - 16y^2 + z^2 - 4yz$

$= -16y^2 + z^2$ or $z^2 - 16y^2$

Verification : $(4y + z)(z - 4y) = z^2 - 16y^2 \ (y = 2, z = 3)$

L.H.S. : $(4y + z)(z - 4y) = (4 \times 2 + 3)(3 - 4 \times 2)$

$= (8 + 3)(3 - 8)$

$= 11 \times -5 = -55$

R.H.S. $z^2 - 16y^2 = (3)^2 - 16(2)^2$

$= 9 - 16 \times 4$

$= 9 - 64 = -55$

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

(c) $(2x - 2y)^2$

$(a - b)^2 = a^2 - 2ab + b^2$

$(2x - 2y)^2 = (2x)^2 - 2 \times 2x \times 2y + (2y)^2$

$= 4x^2 - 8xy + 4y^2$

or $= 4x^2 + 4y^2 - 8xy$

Verification :

$(2x - 2y)^2 = 4x^2 + 4y^2 - 8xy \qquad (x = 1, y = 2)$

L.H.S; $(2x - 2y)^2 = (2 \times 1 - 2 \times 2)^2$

$= (2 - 4)^2 = (-2)^2 = 4$

R.H.S.; $4x^2 + 4y^2 - 8xy = 4(1)^2 + 4(2)^2 - 8 \times 1 \times 2$

$= 4 + 4 \times 4 - 8 \times 2$

$= 20 - 16 = 4$

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

(d) $(x + y + z)(x + y + z) = (x + y + z)^2$

$= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

Verification

$(x + y + z)(x + y + z) = x^2 + y^2 + z^2 + 2xy + 2yz$

L.H.S. $= (x + y + z)(x + y + z)$

$= (x + y + z)^2$

$= (1 + 2 + 3)^2 = 36$

R.H.S. $= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

$= 1^2 + 2^2 + 3^2 + 2 \times 1 \times 2 + 2 \times 2 \times 3 + 2 \times 3 \times 1$

$= 1 + 4 + 9 + 4 + 12 + 6 = 36$

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

7. Use the column method to find the following products :

(a) $(a + 2b)(2a + b)$

$(a + 2b)$

$\times (2a + b)$

$ab + 2b^2$ (Multiply by $2a$)

$2a^2 + 4ab$ (Multiply by b)

$2a^2 + 5ab + 2b^2$

(b) $(p^2 + q^2)(p^2 - q^2)$

$(p^2 + q^2)$

$\times (p^2 - q^2)$

$p^4 + p^2q^2$ (Multiply by p^2)

$-p^2q^2 - q^4$ (Multiply by $-q^2$)

$p^4 \quad -q^4$

$(p^2 + q^2)(p^2 - q^2) = (p^4 - q^4)$

(c) $\left(\frac{3}{5}x-\frac{1}{3}y\right)\left(\frac{3}{5}x+\frac{1}{3}y\right)$

$$\begin{array}{rl} & \frac{3}{5}x-\frac{1}{3}y \\ & \times\ \frac{3}{5}x+\frac{1}{3}y \\ \hline & \frac{3}{5}x\times\frac{3}{5}x-\frac{1}{3}y\times\frac{3}{5}x \qquad \left(\text{Multiply by } \frac{3}{5}x\right) \\ & +\frac{3}{5}x\times\frac{1}{3}y-\frac{1}{3}y\times\frac{1}{3}y \qquad \left(\text{Multiply by } \frac{1}{3}y\right) \\ \hline & \frac{9}{25}x^2-\left(\frac{-1}{5}xy+\frac{1}{5}xy\right)-\frac{1}{9}y^2 \\ & =\frac{9}{25}x^2-(0xy)-\frac{1}{9}y^2 \\ & \frac{9}{25}x^2+0-\frac{1}{9}y^2 \end{array}$$

$$\left(\frac{3}{5}x-\frac{1}{5}y\right)\left(\frac{3}{5}x+\frac{1}{3}y\right)=\frac{9}{25}x^2-\frac{1}{9}y^2$$

(d) $(x-y)(x^2+y^2+xy)$

$$\begin{array}{rl} & x^2+y^2+xy \\ & \times\ \ x-y \\ \hline & x^3+xy^2+x^2y \qquad \text{(Multiply by } x\text{)} \\ & -xy^2-x^2y-y^3 \qquad \text{(Multiply by } y\text{)} \\ \hline & x^3+0+0-y^3 \end{array}$$

$$(x-y)(x^2+y^2+xy)=x^3-y^3$$

8. Simplify :

(a) $c(b-a)+b(a-c)-a(b-c)$

$$bc-ac+ba-bc-ab+ac=0$$

(b) $x(x+y^2+z)+y^2(x+y+z)-z(x+y^2)$

$$=x^2+xy^2+zx+y^2x+y^3+zy^2-zx-y^2z$$

$$=x^2+xy^2+y^2x+y^3=x^2+2xy^2+y^3$$

9. Product of $(x^3 + 2x^2 - 5x + 1)$ and $(x^2 + 7x + 1)$

$$\begin{array}{r} x^3 + 2x^2 - 5x + 1 \\ x^2 + 7x + 1 \\ \hline x^5 + 2x^4 - 5x^3 + x^2 \\ 7x^4 + 14x^3 - 35x^2 + 7x \\ x^3 + 2x^2 - 5x + 1 \\ \hline x^5 + 9x^4 + 10x^3 - 32x^2 + 2x + 1 \end{array}$$

$$(x^3 + 2x^2 - 5x + 1)(x^2 + 7x + 1) = x^5 + 9x^4 + 10x^3 - 32x^2 + 2x + 1$$

10. Product of $(2x + 3y)$ and $(x^2 + 2xy + y^2)$

$$\begin{aligned} &(2x + 3y)(x^2 + 2xy + y^2) \\ &= 2x(x^2 + 2xy + y^2) + 3y(x^2 + 2xy + y^2) \\ &= 2x^3 + 4x^2y + 2xy^2 + 3x^2y + 6xy^2 + 3y^3 \\ &= 2x^3 + 7x^2y + 8xy^2 + 3y^3 \end{aligned}$$

Verification :

$$\begin{aligned} &(2x + 3y)(x^2 + 2xy + y^2) = (x = -1,\ y = 2) \\ &= 2x^3 + 7x^2y + 8xy^2 + 3y^2 \end{aligned}$$

L.H.S.; $(2x + 3y)(x^2 + 2xy + y^2)$

$$\begin{aligned} &= ((2 \times -1) + 3 \times 2)((-1)^2 + 2 \times -1 \times 2 + (2)^2) \\ &= (-2 + 6)(1 - 4 + 4) = 4 \times 1 = 4 \end{aligned}$$

R.H.S.; $= 2x^3 + 7x^2y + 8xy^2 + 3y^3$

$$\begin{aligned} &= 2(-1)^3 + 7(1)^2 \times 2 + 8 \times -1 \times (2)^2 + 3(2)^3 \\ &= 2 \times -1 + 7 \times 2 + (-8 \times 4) + 3 \times 8 \\ &= -2 + 14 - 32 + 24 = -34 + 38 = 4 \end{aligned}$$

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

Exercise 8.2

1. Divide :

(a) Divide : $25x^2yz$ by $3xyz$

$$25x^2yz \div 3xyz \quad \Rightarrow \quad \frac{25x^2yz}{3xyz} = \frac{25}{3}x$$

(b) Divide : $(-60p^2q^2r^2)$ by $(-12pqr^2)$

$$-60p^2q^2r^2 \div -12pqr^2 \quad \Rightarrow \quad \frac{-60p^2q^2r^2}{-12pqr^2} = 5pq$$

(c) Divide : $36abc^2$ by $(-9ac)$

$$36abc^2 \div -9ac \quad \Rightarrow \quad \frac{36abc^2}{-9ac} = -4bc$$

(d) Divide : $12x^2y^3$ by $3xy$

$$12x^2y^3 \div 3xy \quad \Rightarrow \quad \frac{12x^2y^3}{3xy} = 4xy^2$$

2. Divide :

(a) $10a^2b - 6ab + 12ab^2$ by $3ab$

$$= \frac{10a^2b - 6ab + 12ab^2}{3ab} = \frac{10a^2b}{3ab} - \frac{6ab}{3ab} + \frac{12ab^2}{3ab}$$

$$= \frac{10}{3}a - 2 + 4b$$

(b) $4x^3 + 8x^2 - x$ by $(-2x)$

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

(c) $8x^2y^2 - 6xy^2 + 10x^2y^3$ by $2xy$

$$\frac{8x^2y^2 - 6xy^2 + 10x^2y^3}{2xy}$$

$$= \frac{8x^2y^2}{2xy} - \frac{6xy^2}{2xy} + \frac{10x^2y^3}{2xy} = 4xy - 3y + 5xy^3.$$

(d) $5x^3 - 30x^2 + 45x$ by $5x$

$$\frac{5x^3 - 30x^2 + 45x}{5x} = \frac{5x^3}{5x} - \frac{30x^2}{5x} + \frac{45x}{5x} = x^2 - 6x + 9$$

3. Which of the following expressions are not polynomials :

(Any algebraic expression with more than one term is called a polynomial. A polynomial is an algebraic expression in which the exponents of the variable are always non-negative integers.)

- **According to rules**

(b) $\sqrt{2}x + x^2 + x^3$,

(c) $\frac{2}{3}x^2 - 4x + 12$ are polynomials.

and (a) $3\sqrt{y} + 4y + 7y^2$,

(d) $2x^{-2} + 3x^{-1} + 5 + 4x$,

(e) $\sqrt{a}x^{\frac{1}{2}} + ax + 7x^2 + 5$,

(f) $x^3 + x^{-3}$ are not polynomials.

4. Divide by long division method :

(a) $(x^2 + 12x + 35)$ divide by $(x + 7)$

$$
\begin{array}{r|l}
 & x + 5 \\
\hline
x + 7 & x^2 + 12x + 35 \\
 & x^2 + 7x \\
 & (-)\quad(-) \\
\hline
 & 5x + 35 \\
 & 5x + 35 \\
 & (-)\quad(-) \\
\hline
 & 0
\end{array}
$$

$$(x^2 + 12x + 35) \div (x + 7) = (x + 5)$$

(b) $6x^2 - 13x + 6$ by $(2x - 3)$

$$
\begin{array}{r|l}
 & 3x - 2 \\
\hline
2x - 3 & 6x^2 - 13x + 6 \\
 & 6x^2 - 9x \\
 & (-)\quad(+) \\
\hline
 & -4x + 6 \\
 & -4x + 6 \\
 & (+)\quad(-) \\
\hline
 & 0
\end{array}
$$

$$(6x^3 - 13x + 6) \div (2x - 3) = (3x - 2)$$

(c) $12x^3 - 20x^2 - 9x + 15$ by $(3x - 5)$

$$
\begin{array}{r}
4x^2 - 3 \\
(3x-5)\overline{)\ 12x^3 - 20x^2 - 9x + 15} \\
12x^3 - 20x^2 \\
\hline
(-)\quad (+) \\
\hline
-9x + 15 \\
-9x + 15 \\
\hline
(-)\quad (+) \\
\hline
0
\end{array}
$$

$$(12x^3 - 20x^2 - 9x + 15) \div (3x - 5) = 4x^2 - 3$$

(d) $a^3 - 6a^2 + 11a - 6$ by $(a^2 - 5a + 6)$

$$
\begin{array}{r}
a - 1 \\
a^2 - 5a + 6\overline{)\ a^3 - 6a^2 + 11a - 6} \\
a^3 - 5a^2 + 6a \\
\hline
(-)\quad (+)\quad (-) \\
\hline
-a^2 + 5a - 6 \\
-a^2 + 5a - 6 \\
\hline
(+)\ (-)\ (+) \\
\hline
0
\end{array}
$$

$$a^3 - 6a^2 + 11a - 6 \div a^2 - 5a + 6 = (a - 1)$$

(e) $(p^4 + p^2 + 1)$ by $(p^2 + p + 1)$

$$
\begin{array}{r}
p^2 - p + 1 \\
p^2 + p + 1\overline{)\ p^4 \quad + p^2 + 1} \\
p^4 + p^3 + p^2 \\
\hline
(-)\quad (-)\quad (-) \\
\hline
-p^3 \qquad +1 \\
-p^3 - p^2 - p \\
\hline
(+)\ (+)\ (+) \\
\hline
p^2 + p + 1 \\
p^2 + p + 1 \\
\hline
(-)\quad (-)\quad (-) \\
\hline
0
\end{array}
$$

$$\therefore \qquad p^4 + p^4 + 1 \div p^2 + p + 1 = p^2 - p + 1$$

(f) $6y^5 + 4y^4 - 3y^3 - 1$ by $(3y^2 - y + 1)$

$$
\begin{array}{r|l}
3y^2 - y + 1 & 2y^3 + 2y^2 - y - 1 \\
\hline
 & 6y^5 + 4y^4 - 3y^3 - 1 \\
 & 6y^5 - 2y^4 + 2y^3 \\
 & (-)\quad (+)\quad (-) \\
\hline
 & 6y^4 - 5y^3 - 1 \\
 & 6y^4 - 2y^3 + 2y^2 \\
 & (-)\quad (+)\quad (-)\quad (+) \\
\hline
 & -3y^3 - 2y^2 - 1 \\
 & -3y^3 + y^2 - y \\
 & (+)\quad (-)\quad (+)\quad (-) \\
\hline
 & -3y^2 + y - 1 \\
 & -3y^2 + y - 1 \\
 & (+)\quad (-)\quad (+) \\
\hline
 & 0
\end{array}
$$

$6y^5 + 4y^4 - 3y^3 - 1 \div (3y^2 - y + 1) = 2y^3 + 2y^2 - y - 1$

5. Find the quotient and the remainder in each of the following :

(a) Divide $2a^3 + 5a^2 + 8a + 4$ by $(2a + 1)$

$$
\begin{array}{r|l}
2a + 1 & a^2 + 2a + 3 \\
\hline
 & 2a^3 + 5a^2 + 8a + 4 \\
 & 2a^3 + a^2 \\
 & (-)\quad (-) \\
\hline
 & 4a^2 + 8a \\
 & 4a^2 + 2a \\
 & (-)\quad (-) \\
\hline
 & 6a + 4 \\
 & 6a + 3 \\
 & (-)\quad (-) \\
\hline
 & 1
\end{array}
$$

Quotient $= a^2 + 2a + 3$, Remainder $= 1$

(b) Divide $4x^3 - x + 1$ by $(2x - 1)$

$$
\begin{array}{r}
2x^2 + x \\
2x-1 \overline{)\,4x^3 \quad - x + 1} \\
4x^3 - 2x^2 \\
\hline
\quad 2x^2 - x + 1 \\
2x^2 - x \\
\hline
\quad\quad 1
\end{array}
$$

Quotient $= 2x^2 + x$, Remainder $= 1$

6. Divide and verify the result :

(a) $x^4 + 1$ divide by $(x - 1)$

$$
\begin{array}{r}
x^3 + x^2 + x + 1 \\
x-1 \overline{)\,x^4 \quad\quad\quad + 1} \\
x^4 - x^3 \\
\hline
\quad + x^3 \quad\quad + 1 \\
x^3 - x^2 \\
\hline
\quad\quad x^2 \quad + 1 \\
x^2 - x \\
\hline
\quad\quad\quad x + 1 \\
x - 1 \\
\hline
\quad\quad\quad\quad 2
\end{array}
$$

Quotient $= x^3 + x^2 + x + 1$; Remainder $= 2$

Verification :

Dividend = Quotient × Division + Remainder

$$x^4 + 1 = (x^3 + x^2 + x + 1) \times (x - 1) + 2$$

$$= x(x^3 + x^2 + x + 1) - 1(x^3 + x^2 + x + 1) + 2$$

$$= x^4 + x^3 + x^2 + x - x^3 - x^2 - x - 1 + 2$$
$$= x^4 - 1 + 2 = x^4 + 1$$

(b) $m^4 + m^3 + m^2$ divide by $m + 1$

$$\begin{array}{r|l} & m^3 + m - 1 \\ \hline m+1 & m^4 + m^3 + m^2 \\ & m^4 + m^3 \\ & (-)\ \ (-) \\ \hline & \quad m^2 \\ & \quad m^2 + m \\ & \quad (-)\ \ (-) \\ \hline & \quad\quad -m \\ & \quad\quad -m - 1 \\ & \quad\quad (+)\ \ (+) \\ \hline & \quad\quad\quad 1 \end{array}$$

Quotient $= m^3 + m - 1$, Remainder $= 1$

Verification : Dividend = Quotient × Division + Remainder

$$m^4 + m^3 + m^2 = (m+1)(m^3 + m - 1) + 1$$
$$= m(m^3 + m - 1) + 1(m^3 + m - 1) + 1$$
$$= m^4 + m^2 - m + m^3 + m - 1 + 1$$
$$= m^4 + m^2 + m^3$$

7. $(x^2 + 1)\overline{)\,x^4 + x^3 + 8x^2 + ax + b}$

$$\begin{array}{r|l} & x^2 + x + 7 \\ \hline x^2+1 & x^4 + x^3 + 8x^2 + ax + b \\ & x^4 \ + \ x^2 \\ & (-)\ \ (-) \\ \hline & \quad x^3 + 7x^2 + ax + b \\ & \quad x^3 + x \\ & \quad (-)\ \ (-) \\ \hline & \quad\quad 7x^2 + (a-1)x + b \\ & \quad\quad 7x^2 \qquad + 7 \\ & \quad\quad (-) \qquad\ \ (-) \\ \hline & \quad\quad (a-1)x + (b-7) \end{array}$$

Since, it is divisible by (x^2+1). So the remainder must be zero.

Therefore, comparing the coefficient of x and constant value with zero.

So, $(a-1)=0$ Similarly,

or $a=1$ $b-7=0 \Rightarrow b=7$

8. $t^3-2t^2+3t-18$ divisible by $(t-3)$

$$
\begin{array}{r}
t^2+t+6 \\
t-3 \overline{)\,t^3-2t^2+3t-18} \\
t^3-3t^2 \\
\hline
t^2+3t \\
t^2-3t \\
\hline
6t-18 \\
-6t-18 \\
\hline
0
\end{array}
$$

Quotient $=t^2+t+6$.

9. Divide $4x^4-2x^3-6x^2+x-5$ by $2x^2+x-2$ and subtract the remainder which you get from the dividend

So,

$$
\begin{array}{r}
2x^2-2x \\
2x^2+x-2 \overline{)\,4x^4-2x^3-6x^2+x-5} \\
4x^4+2x^3-4x^2 \\
\hline
-4x^3-2x^2+x-5 \\
-4x^3-2x^2+4x \\
\hline
-3x-5
\end{array}
$$

Hence, $(-3x-5)$ must be subtracted from $4x^4-2x^3-6x^2+x-5$, so that the result is exactly divisible by $2x^2+x-2$.

Exercise 8.3

1. Find the value of the following :

(a) $9x^2 + 49y^2 + 42xy = (3x)^2 + (7y)^2 + 2 \times 3x \times 7y$

$= (3x + 7y)^2$ when $x = 3$ and $y = 1$

$= (3 \times 3 + 7 \times 1)^2 = (9 + 7)^2 = (16)^2 = 256$

(b) $25x^2 + 64y^2 - 80xy = (5x)^2 + (8y)^2 - 2 \times 5x \times 8y$

$= (5x - 8y)^2$ When $x = 4$ and $y = 2$

$= (5 \times 4 - 8 \times 2)^2 = (20 - 16)^2$

$= (4)^2 = 16$

2. (a) $2x + 3y = 8$

squaring on both side

$$(2x + 3y)^2 = (8)^2$$
$$(2x)^2 + 2 \times 2x \times 3y + (3y)^2 = 64$$
$$4x^2 + 12xy + 9y^2 = 64$$
$$4x^2 + 9y^2 + 12 \times 2 = 64 \qquad (xy = 2)$$
$$4x^2 + 9y^2 + 24 = 64$$
$$4x^2 + 9y^2 = 64 - 24 = 40$$

(b) $3x - 7y = 8$

squaring on both side,

$$(3x - 7y)^2 = (8)^2$$
$$9x^2 + 49y^2 - 42xy = 64$$
$$9x^2 + 49y^2 - 42 \times (-1) = 64 \qquad (xy = -1)$$
$$9x^2 + 49y^2 + 42 = 64$$
$$9x^2 + 49y^2 = 64 - 42$$
$$9x^2 + 49y^2 = 22$$

Thus, $9x^2 + 49y^2 = 22$

3. Expand the following :

(a) $(x - 3y) \times (x - 3y) = x(x - 3y) - 3y(x - 3y)$

$= x^2 - 3xy - 3xy + 9y^2 = x^2 - 6xy + 9y^2$

(b) $\left(\sqrt{3}x-\frac{1}{5}y\right)^2$ $[\because (a-b)^2=a^2-2ab+b^2]$

$$\left(\sqrt{3x}-\frac{1}{5}y\right)^2=(\sqrt{3x})^2-2\times\sqrt{3}\times\frac{1}{5}xy+\left(\frac{1}{5}y\right)^2$$

$$=(3x^2)-\frac{2\sqrt{3}}{5}xy+\frac{1}{25}y^2$$

(c) $(3x-4y)^2$ $[\because (a-b)^2=a^2-2ab+b^2]$

$$(3x-4y)^2=(3x)^2-2\times 3x\times 4y+(4y)^2=9x^2-24xy+16y^2$$

(d) $\left(5x+\frac{1}{5y}\right)^2$ $[\because (a+b)^2=a^2+2ab+b^2]$

$$=5x^2+2\times 5x\times\frac{1}{5y}+\left(\frac{1}{5y}\right)^2=25x^2+\frac{2x}{y}+\frac{1}{25y^2}$$

(e) $(5+12x^2)^2$ $[\because (a+b)^2=a^2+2ab+b^2]$

$$=(5)^2+2\times 5\times 12x^2+(12x^2)^2=25+120x^2+144x^4$$

(f) $(5x+3y)^2$ $[\because (a+b)^2=a^2+2ab+b^2]$

$$(5x+3y)^2=(5x)^2+2\times 5x\times 3y+(3y)^2$$

$$=25x^2+30xy+9y^2$$

4. Find the product of the following :

(a) $(4x+5y)(4x-5y)$ $[\because (a+b)(a-b)=a^2-b^2]$

$$=(4x)^2-(5y)^2=(16x^2-25y)^2$$

(b) $(ab+cd)(ab-cd)$ $[\because (a+b)(a-b)=a^2-b]$

$$=(ab)^2-(cd)^2=a^2b^2-c^2d^2$$

(c) $(x-1)(x+1)(x^2+1)(x^4+1)$

$$=[(x)^2-(1)^2](x^2+1)(x^4+1)$$

$$=(x^2-1)(x^2+1)(x^4+1)$$

$$=[(x^2)^2-(1)^2][x^4+1]=(x^4-1)(x^4+1)$$

$$=(x^4)^2-(1)^2=x^8-1^2=x^8-1$$

(d) $\left(x+\frac{y}{5}-1\right)\left(x+\frac{y}{5}+1\right)$ $[\because (a+b)(a-b)=a^2+b^2]$

$=\left(x+\frac{y}{5}\right)^2-(1)^2$ $[\therefore (a+b)^2=a^2+b^2+2ab]$

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

$=x^2+\frac{y^2}{25}+\frac{2xy}{5}-1$

5. (a) $x^2+\frac{1}{x^2}$ $\left(\text{We have } x+\frac{1}{x}=6 \text{ squaring on both sides}\right)$

$\left(x+\frac{1}{x}\right)^2=(6)^2 \Rightarrow x^2+\frac{1}{x^2}+2\times x\times\frac{1}{x}=36$

$x^2+\frac{1}{x^2}+2=36 \Rightarrow x^2+\frac{1}{x^2}=36-2$

$x^2+\frac{1}{x^2}=34$

Thus, $x^2+\frac{1}{x^2}=34$

(b) $x^4+\frac{1}{x^4}=34$

$\left(\text{We have } x^2+\frac{1}{x^2}=34 \text{ from part (a) squaring on both side again}\right)$

$\left(x^2+\frac{1}{x^2}\right)^2=(34)^2 \Rightarrow x^4+\frac{1}{x^4}+2\times x^2\times\frac{1}{x^2}=1156$

$x^4+\frac{1}{x^4}+2=1156 \Rightarrow x^4+\frac{1}{x^4}=1156-2$

$x^4+\frac{1}{x^4}=1154$

Thus, $x^4+\frac{1}{x^4}=1154.$

6. (a) $x-\frac{1}{x}=5$ (squaring both sides)

(a) $\left(x-\frac{1}{x}\right)^2=(5)^2 \Rightarrow x^2+\frac{1}{x^2}-2\times x\times\frac{1}{x}=25$

$x^2+\frac{1}{x^2}-2=25 \Rightarrow x^2+\frac{1}{x^2}=25+2$

$x^2+\frac{1}{x^2}=27$

Thus, $x^2+\frac{1}{x^2}=27$

(b) Now, we have $x^2+\frac{1}{x^2}=27$, squaring on both side

$\left(x^2+\frac{1}{x^2}\right)^2=(27)^2 \Rightarrow x^4+\frac{1}{x^4}+2\times x^2\times\frac{1}{x^2}=729$

$x^4+\frac{1}{x^4}=729-2 \Rightarrow x^4+\frac{1}{x^4}=727$

Thus, $x^4+\frac{1}{x^4}=727$

7. Simplify the following by using identities :

(a) $(103)^2=(100+3)^2$ $[\because (a+b)^2=a^2+b^2+2ab)]$

$=(100)^2+(3)^2+2\times3\times100$

$=10000+9+600=10609$

(b) $(91)^2=(100-9)^2$ $[\because (a-b)^2=a^2+b^2-2ab]$

$=(100)^2+(9)^2-2\times100\times9$

$=10000+81-1800=10081-1800=8281$

(c) $(0.98)^2=(1-0.02)^2=(1)^2-2\times1\times0.02+(0.02)^2$

$=1-0.04+0.0004=1.0004-0.04=0.9604$

(d) $(97)^2=(100-3)^2$ $[\because (a-b)^2=a^2+b^2-2ab]$

$=(100)^2+(3)^2-2\times3\times100$

$=10000+9-600$

$=10009-600=9409$

(e) 103×97

$= (100+3)(100-3) \qquad [(a+b)(a-b) = a^2 - b^2]$

$= (100)^2 - (3)^2 = 10000 - 9 = 9991$

(f) $104 \times 104 = (104)^2$

$= (100+4)^2 \qquad [\because (a+b)^2 = a^2 + b^2 + 2ab]$

$= (100)^2 + (4)^2 + 2 \times 100 \times 4$

$= 10000 + 16 + 800 = 10816$

(g) $166 \times 166 - 134 \times 134$

$= (166)^2 - (134)^2 \ [\because (a^2 - b^2) = (a+b)(a-b)]$

$= (166+134)(166-134) = 300 \times 32 = 9600$

(h) $0.78 \times 0.78 - 0.22 \times 0.22$

$= (0.78)^2 - (0.22)^2 \ [\because (a^2 - b^2) = (a+b)(a-b)]$

$= (0.78 + 0.22)\ (0.78 - 0.22)$

$= (1.00)\ (0.56) = 0.56$

(i) $0.54 \times 0.54 - 0.46 \times 0.46$

$= (0.54)^2 - (0.46)^2 \ [\because (a^2 - b^2) = (a+b)(a-b)]$

$= (0.54 + 0.46)\ (0.54 - 0.46)$

$= 1 \times 0.08 = 0.08$

Exercise 8.4

1. Simplify the following :

(a) $(2x + p - c)^2 - (2x - p + c)^2$

$((2x)^2 + (p)^2 + (c)^2 + 2 \times 2x \times p - 2 \times p \times c - 2 \times 2x \times c)$

$-((2x)^2 + (p)^2 + (c)^2 - 2 \times 2x \times p - 2 \times p \times c + 2 \times 2x \times c)$

$= (4x^2 + p^2 + c^2 + 4xp - 2pc - 4xc)$

$-(4x^2 + p^2 + c^2 - 4xp - 2pc + 4cx)$

$= (\cancel{4x^2} + \cancel{p^2} + \cancel{c^2} + 4xp - \cancel{2pc} - 4xc - \cancel{4x^2}$

$- \cancel{p^2} - \cancel{c^2} + 4xp + \cancel{2pc} - 4cx)$

$= 4xp + 4xp - 4cx - 4cx$

$= 8px - 8cx = 8x(p - c)$

(b) $(x^2 + y^2 - z^2)^2 - (x^2 - y^2 + z^2)^2$

$= ((x^2)^2 + (y^2)^2 + (z^2)^2 + 2x^2y^2 - 2y^2z^2 - 2x^2z^2)$

$\quad -((x^2)^2 + (y^2)^2 + (z^2)^2 - 2x^2y^2 - 2y^2z^2 + 2x^2z^2)$

$= \cancel{x^4} + \cancel{y^4} + \cancel{z^4} + 2x^2y^2 - \cancel{2y^2z^2} - 2x^2z^2 - \cancel{x^4} - \cancel{y^4} - \cancel{z^4}$

$\quad + 2x^2y^2 + \cancel{2y^2z^2} - 2x^2z^2$

$= 2x^2y^2 + 2x^2y^2 - 2x^2z^2 - 2x^2z^2$

$= 4x^2y^2 - 4x^2z^2 = 4x^2(y^2 - z^2) = 4x^2(y+z)(y-z)$

(c) $(a+b+c)^2 + (a-b+c)^2 + (a+b-c)^2$

$= (a^2 + b^2 + c^2 + 2ab + 2bc + 2ca)$

$\quad + (a^2 + b^2 + c^2 - 2ba - 2bc + 2ca)$

$\quad + (a^2 + b^2 + c^2 + 2ba - 2bc - 2ca)$

$= a^2 + b^2 + c^2 + \cancel{2ab} + \cancel{2bc} + \cancel{2ca} + a^2 + b^2 + c^2$

$\quad - \cancel{2ba} - \cancel{2bc} + 2ca + a^2 + b^2 + c^2 + 2ba - 2bc - \cancel{2ca}$

$= a^2 + b^2 + c^2 + a^2 + b^2 + c^2 + 2ca$

$\quad + a^2 + b^2 + c^2 + 2ba - 2bc$

$= 3a^2 + 3b^2 + 3c^2 + 2ca + 2ba - 2bc$

$= 3(a^2 + b^2 + c^2) + 2ab - 2bc + 2ac$

2. $x + y + z = 12$ (square in both side)

$$(x+y+z)^2 = (12)^2$$

$$x^2 + y^2 + z^2 + 2xy + 2yz + 2xz = 144$$

$$(x^2 + y^2 + z^2) + 2(xy + yz + xz) = 144$$

$$64 + 2(xy + yz + zx) = 144$$

$$2(xy + yz + zx) = 144 - 64$$

$$(xy + yz + zx) = \frac{80}{2} = 40$$

Thus, $xy + yz + zx = 40$

3. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$

In $(x+y+z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$

$(x+y+z)^2 = 35 + 2 \times 23 = 35 + 46 = 81$

$(x+y+z) = \sqrt{81} \Rightarrow x + y + z = 9$

4. $x+y+z=8$ (square in both side)

$$(x+y+z)^2=(8)^2$$
$$x^2+y^2+z^2+2xy+2yz+2zx=64$$
$$x^2+y^2+z^2+2(xy+yz+zx)=64$$
$$x^2+y^2+z^2+2\times 13=64$$
$$\because \quad (xy+yz+zx=13)$$
$$x^2+y^2+z^2=64-26$$
$$x^2+y^2+z^2=38$$

5. Expand each of the following :

(a) $(x-2y-5z)^2$

$(\therefore (a-b-c)^2=a^2+b^2+c^2-2ab+2bc-2ca)$

$$(x-2y-5z)^2$$
$$=x^2+(2y)^2+(5z)^2-2\times x\times 2y+2\times 2y\times 5z-2\times 5z\times x$$
$$=x^2+4y^2+25z^2-4xy+20zy-10zx$$

(b) $\left(\frac{1}{4}x-\frac{1}{2}y+16\right)^2$

$$[\therefore (a-b+c)^2=a^2+b^2+c^2-2ab-2bc+2ca]$$
$$\left[\frac{1}{4}x-\frac{1}{2}y+16\right]^2=\left(\frac{1}{4}x\right)^2+\left(\frac{1}{2}y\right)^2+(16)^2-2$$
$$\times\frac{1}{4}\times\frac{1}{2}xy-2\times\frac{1}{2}\times 16\times y+2\times 16\times\frac{1}{4}x\Bigg]$$
$$=\frac{1}{16}x^2+\frac{1}{4}y^2+256-\frac{xy}{4}-16y+8x$$

(c) $\left(\frac{a}{b}+\frac{b}{c}+\frac{c}{d}\right)^2$

$$[(a+b+c)^2=a^2+b^2+c^2+2ab+2bc+2ca]$$
$$\left(\frac{a}{b}+\frac{b}{c}+\frac{c}{d}\right)^2$$

$$= \left[\left(\frac{a}{b}\right)^2 + \left(\frac{b}{c}\right)^2 + \left(\frac{c}{a}\right)^2 + 2\times\frac{a}{b}\times\frac{b}{c} + 2\times\frac{b}{c}\times\frac{c}{d} + 2\frac{c}{d}\times\frac{a}{b} \right]$$

$$\left(\frac{a}{b}+\frac{b}{c}+\frac{c}{d}\right)^2 = \left[\frac{a^2}{b^2}+\frac{b^2}{c^2}+\frac{c^2}{d^2}+\frac{2a}{c}+\frac{2b}{d}+\frac{2ac}{bd}\right]$$

6. Find the value of :

$$x^2+4y^2+25z^2-4xy+20yz-10xz$$

$$=(x)^2+(2y)^2+(5z)^2-2\times x\times 2y+2\times 2y\times 5z-2\times x\times 5z$$

$$\therefore \quad a^2+b^2+c^2-2ab+2bc-2ca=(-a+b+c)^2$$

$$=(-x+2y+5z)^2$$

Putting value of $x=9,\ y=2$ and $z=1$

$$=(-9+2\times 2+5\times 1)^2=(-9+4+5)^2=(-9+9)^2=0$$

7. $x^2+4y^2+9z^2+4xy+12yz+6xz$

$$=(x)^2+(2y)^2+(3z)^2+2\times x\times 2y+2\times 2y\times 3z+2\times x\times 3z$$

$$=(x+2y+3z)^2$$

(Putting value of $x=8,\ y=7,\ z=6$)

$$=(8+2\times 7+3\times 6)^2=(8+14+18)^2$$

$$=(40)^2=40\times 40=1600$$

Exercise 8.5

1. Expand the following :

(a) $(3x-2y)^3$ $\qquad [\because\ (a-b)^3=a^3-b^3-3ab(a-b)]$

$$(3x-2y)^3=(3x)^3-(2y)^3-3\times 3x\times 2y(3x-2y)$$

$$=27x^3-8y^3-18xy(3x-2y)$$

$$=27x^3-8y^3-54x^2y+36xy^2$$

(b) $\left(\frac{1}{3}x+\frac{5}{3}y\right)^3$

$$[\because\ (a+b)^3=a^3+b^3+3ab(a+b)]$$

$$\left(\frac{1}{3}x+\frac{5}{3}y\right)^3=\left(\frac{1}{3}x\right)^3+\left(\frac{5}{3}y\right)^3+3\times\frac{1}{3}\times\frac{5}{3}\times xy\left(\frac{1}{3}x+\frac{5}{3}y\right)$$

$$= \frac{1}{27}x^3 + \frac{125}{27}y^3 + \frac{5}{3}xy\left(\frac{1}{3}x + \frac{5}{3}y\right)$$
$$= \frac{1}{27}x^3 + \frac{125}{27}y^3 + \frac{5}{9}x^2y + \frac{25}{9}xy^2$$
$$= \frac{1}{27}x^3 + \frac{5}{9}x^2y + \frac{25}{9}xy^2 + \frac{125}{27}y^3$$

(c) $\left(\frac{1}{3x} - \frac{2}{5y}\right)^3$

$[\because\ (a-b)^3 = a^3 - b^3 - 3ab(a-b)]$

$$= \left(\frac{1}{3x}\right)^3 - \left(\frac{2}{5y}\right)^3 - 3 \times \frac{1}{3x} \times \frac{2}{5y}\left(\frac{1}{3x} - \frac{2}{5y}\right)$$
$$= \frac{1}{27x^3} - \frac{8}{125y^3} - \frac{1}{x} \times \frac{2}{5y}\left(\frac{1}{3x} - \frac{2}{5y}\right)$$
$$= \frac{1}{27x^3} - \frac{8}{125y^3} - \frac{2}{5xy}\left(\frac{1}{3x} - \frac{2}{5y}\right)$$
$$= \frac{1}{27x^3} - \frac{8}{125y^3} - \frac{2}{15x^2y} + \frac{4}{25xy^2}$$

2. Solve the following :

(a) $(a-3b)^3 + (a+3b)^3 \quad \Rightarrow (a-3b)^3$

$$= a^3 - (3b)^3 - 3 \times a \times 3b(a-3b)$$
$$= a^3 - 27b^3 - 9ab(a-3b)$$
$$= a^3 - 27b^3 - 9a^2b + 27ab^2 \quad \ldots(i)$$

$(a+3b)^3 = a^3 + (3b)^3 + 3 \times a \times 3b(a+3b)$

$$= a^3 + 27b^3 + 9ab(a+3b)$$
$$= a^3 + 27b^3 + 9a^2b + 27ab^2 \quad \ldots(ii)$$

On adding equation (i) and (ii) we get

$(a-3b)^3 + (a+3b)^3$

$$= a^3 - 27b^3 - 9a^2b + 27ab^2 + a^3 + 27b^3 + 9a^2b + 27ab^2$$
$$= a^3 + a^3 + 27ab^2 + 27ab^2 = 2a^3 + 54ab^2$$

(b) $\left(\frac{1}{3}a+\frac{2}{3}b\right)^3-\left(\frac{1}{3}a-\frac{2}{3}b\right)^3$

$=\frac{1}{27}[(a+2b)^3-(a-2b)^3]$

$=\frac{1}{27}[a^3+8b^3+3\times a\times 2b(a+2b)$

$\qquad -a^3+8b^3+3a\times 2b(a-2b)]$

$=\frac{1}{27}[16b^3+6ab(a+2b+a-2b)]$

$=\frac{1}{27}[16b^3+6ab(2a)]=\frac{1}{27}[16b^3+12a^2b]$

$=\frac{16}{27}b^3+\frac{\cancel{12}^{4}}{\cancel{27}_{9}}a^2b=\frac{4}{9}a^2b+\frac{16}{27}b^3$

3. Solve the following by using identity :

(a) $(1004)^3=(1000+4)^3$

By using identity $[\because\ (a+b)^3=a^3+b^3+3ab(a+b)]$

$(1000+4)^3=(1000)^3+(4)^3+3\times 1000\times 4(1000+4)$

$=1000000000+64+12000\times 1004$

$=1000000000+64+12048000=1012048064$

(b) $(599)^3=(600-1)^3$

By using identity $[\because\ (a-b)^3=a^3-b^3-3ab(a-b)]$

$(600-1)^3=(600)^3-(1)^3-3\times 600\times 1(600-1)$

$=216000000-1-1800\times 599$

$=216000000-1-1078200$

$=216000000-1078201=214921799$

(c) $(9.8)^3=(10-0.2)^3$

By using identity $[\because\ (a-b)^3=a^3-b^3-3ab(a-b)]$

$(10-0.2)^3=(10)^3-(0.2)^3-3\times 10\times 0.2\ (10-0.2)$

$=1000-0.008-6\times 9.8$

$=1000-0.008-58.8$

$=1000-58.808=941.192$

(d) $(8.01)^3 = (8+0.01)^3$

By using identity; [$\therefore\ (a+b)^3 = a^3 + b^3 + 3ab(a+b)$]

$$(8+0.01)^3 = (8)^3 + (0.01)^3 + 3\times 8\times 0.01\ (8+0.01)$$
$$= 512 + 0.000001 + 0.24\times 8.01$$
$$= 512 + 0.000001 + 1.9224$$
$$= 513.922401$$

4. $x + y = 5$ (cube in both side)

$$(x+y)^3 = (5)^3$$
$$x^3 + y^3 + 3xy(x+y) = 125$$
$$x^3 + y^3 + 3\times 6(x+y) = 125 \qquad (xy = 6)$$
$$x^3 + y^3 + 18\times 5 = 125 \qquad (x+y=5)$$
$$x^3 + y^3 + 90 = 125$$
$$x^3 + y^3 = 125 - 90$$
$$x^3 + y^3 = 35$$

5. $x - y = 4$ (cube in both side)

$$(x-y)^3 = (4)^3$$
$$x^3 - y^3 - 3xy(x-y) = 64$$
$$x^3 - y^3 - 3\times 21(x-y) = 64 \qquad (xy = 21)$$
$$x^3 - y^3 - 63(x-y) = 64$$
$$x^3 - y^3 - 63\times 4 = 64 \qquad (x-y=4)$$
$$x^3 - y^3 - 252 = 64$$
$$x^3 - y^3 = 64 + 252 = 316$$

Thus, $x^3 - y^3 = 316$

6. $x + y = 12$ (cube in both side)

$$(x+y)^3 = (12)^3$$
$$x^3 + y^3 + 3xy(x+y) = 1728 \qquad (xy = 27)$$
$$x^3 + y^3 + 3\times 27(x+y) = 1728$$
$$x^3 + y^3 + 81\times 12 = 1728 \qquad (x+y=12)$$

$$x^3 + y^3 + 972 = 1728$$
$$x^3 + y^3 = 1728 - 972$$
$$x^3 + y^3 = 756$$

7. $3x - 2y = 11$ (cube in both side)

$$(3x-2y)^3 = (11)^3$$
$$(3x)^3 - (2y)^3 - 3 \times 3x \times 2y(3x-2y) = 1331$$
$$27x^3 - 8y^3 - 18xy(3x-2y) = 1331$$
$$27x^3 - 8y^3 - 18 \times 12(3x-2y) = 1331 \qquad (xy = 12)$$
$$27x^3 - 8y^3 - 216 \times 11 = 1331$$
$$((3x-2y) = 11)$$
$$27x^3 - 8xy^3 - 2376 = 1331$$
$$27x^3 - 8y^3 = 1331 + 2376 = 3707$$

8. $x + \frac{1}{x} = 7$ (cube of both side)

$$\left(x + \frac{1}{x}\right)^3 = (7)^3$$
$$\Rightarrow \quad x^3 + \frac{1}{x^3} + 3 \times x \times \frac{1}{x}\left(x + \frac{1}{x}\right) = 343$$
$$x^3 + \frac{1}{x^3} + 3 \times 7 = 343 \qquad \left(x + \frac{1}{x} = 7\right)$$
$$x^3 + \frac{1}{x^3} + 21 = 343$$
$$\Rightarrow \quad x^3 + \frac{1}{x^3} = 343 - 21$$
$$x^3 + \frac{1}{x^3} = 322$$

9. $x - \frac{1}{x} = 5$ (cube of both side)

$$\left(x - \frac{1}{x}\right)^3 = (5)^3$$

$$\Rightarrow \quad x^3 - \frac{1}{x^3} - 3 \times x \times \frac{1}{x}\left(x - \frac{1}{x}\right) = 125$$

$$x^3 - \frac{1}{x^3} - 3 \times 5 = 125 \qquad \left(x - \frac{1}{x} = 5\right)$$

$$x^3 - \frac{1}{x^3} = 125 + 15 \Rightarrow \quad x^3 - \frac{1}{x^3} = 140$$

10. We know that $(a+b)^2 = a^2 + b^2 + 2ab$

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

On putting $x^2 + \frac{1}{x^2} = 7$

$$\left(x + \frac{1}{x}\right)^2 = 7 + 2 = 9 \qquad \Rightarrow \qquad \left(x + \frac{1}{x}\right) = 3 \qquad \ldots(i)$$

On cubing both the sides $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$

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

$$\Rightarrow \quad x^3 + \frac{1}{x^3} + 3 \times x \times \frac{1}{x}\left(x + \frac{1}{x}\right) = 27$$

$$x^3 + \frac{1}{x^3} + 3 \times 3 = 27 \qquad \left\{\because x + \frac{1}{x} = 3, \text{ by equation } \ldots(i)\right\}$$

$$x^3 + \frac{1}{x^3} = 27 - 9$$

Thus, $x^3 + \frac{1}{x^3} = 18$

11. We know that $(a-b)^2 = a^2 + b^2 - 2ab)$

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

On putting $x^2 + \frac{1}{x^2} = 27$

$$\left(x-\frac{1}{x}\right)^2 = 27-2 = 25 = 5^2$$

$$\Rightarrow \quad \left(x-\frac{1}{x}\right) = 5 \qquad \ldots(i)$$

On cubing both the sides $\quad (a-b)^3 = a^3 - b^3 - 3ab(a-b)$

$$\left(x-\frac{1}{x}\right)^3 = 5^3$$

$$x^3 - \frac{1}{x^3} - 3 \times x \times \frac{1}{x}\left(x-\frac{1}{x}\right) = 125$$

$$x^3 - \frac{1}{x^3} - 3 \times 5 = 125$$

$$\left\{\because x-\frac{1}{x} = 5, \text{ by equation (i)}\right\}$$

$$x^3 - \frac{1}{x^3} = 125 + 15 = 140$$

Thus, $\quad x^3 - \frac{1}{x^3} = 140$

Exercise 8.6

1. Find all possible factors of the following ;

(a) $12p^2q = 2 \times 2 \times 3 \times p \times p \times q$

(b) $16xy^2z = 2 \times 2 \times 2 \times 2 \times x \times y \times y \times z$

(c) $20a^2b^2c^2 = 2 \times 2 \times 5 \times a \times a \times b \times b \times c \times c$

(d) $21m^2np^2 = 3 \times 7 \times m \times m \times n \times p \times p$

2. Find the common factors of the following monomials :

(a) $2xy, 12x^2y = 2xy(1, 6x)$

Common factors of $2xy$ and $12x^2y = 2xy$

(b) $3m^2, 15m^4 = 3m^2(1, 5m^2)$

Common factors of $3m^2$ and $15m^4 = 3m^2$

(c) $3ax^2y, 18axy = 3axy(x, 6)$

Common factors of $3ax^2y$ and $18axy = 3axy$.

(d) $25p^2q^4, 15pq^2 = 5\,pq^2(5pq^2, 3)$

Common factors of $25p^2q^4$ and $15pq^2 = 5pq^2$

3. Find the common factors of the following expressions :

(a) $6x^2 + 15x^3 + 21x^4 = 3x^2(2 + 3x^1 + 7x^2)$

Common factors $= 3x^2$

(b) $9x^2y^3 + 18x^3y^2 - 36x^2y^2 = 9x^2y^2(y + 2x - 4)$

Common factors $= 9x^2y^2$

(c) $5a^3bc + 15ab^3 + 25a^3 = 5a(a^2bc + 3b^3 + 5a^2)$

Common factors $= 5a$

(d) $8p^3 - 16q^3 + 32r^3 = 8(p^3 - 2q^3 + 4r^3)$

Common factors $= 8$.

4. Factorize the following :

By using $x^2 - y^2 = (x + y)(x - y)$

(a) $x^2 - 16 = (x)^2 - (4)^2 = (x + 4)(x - 4)$

(b) $4 - 36y^2 = (2)^2 - (6y)^2 = (2 + 6y)(2 - 6y)$

(c) $a^4b^4 - c^4 = (a^2b^2)^2 - (c^2)^2$

$= (a^2b^2 + c^2)(a^2b^2 - c^2)$

$= (a^2b^2 + c^2)(ab + c)(ab - c)$

(d) $m^2 - (n + p)^2 = (m)^2 - (n + p)^2 = (m + n + p)(m - n - p)$

(e) $8p^3 - 2p = 2p(4p^2 - 1)$

$= 2p((2p)^2 - (1)^2) = 2p(2p + 1)(2p - 1)$

(f) $16x^4 - (z - x)^4 = (4x^2)^2 - ((z - x)^2)^2$

$= (4x^2 - (z - x)^2)(4x^2 + (z - x)^2)$

$= ((2x)^2 - (z - x)^2)(4x^2 + (z - x)^2)$

$= (2x + z - x)(2x - (z - x))(4x^2 + (z - x)^2)$

$= (x + z)(2x - z + x)(4x^2 + (z^2 + x^2 - 2zx))$

$= (x + z)(3x - z)(4x^2 + x^2 + z^2 - 2zx)$

$= (x + z)(3x - z)(5x^2 + z^2 - 2zx)$

5. Factorize :

(a) $(x+3)x+(x+3)\,y=(x+3)(x+y)$

(b) $3a\,(x-4y)-2b\,(x-4y)=(3a-2b)(x-4y)$

(c) $-4\,(a-2b)+8\,(a-2b)^2=4\,(a-2b)\,(-1+2(a-2b))$

$=4\,(a-2b)(-1+2a-4b)$

(d) $5\,(m-n)^2-6\,(m-n)=(m-n)(5(m-n)-6)$

$=(m-n)(5m-5n-6)$

6. Factorize using suitable grouping :

(a) $abc-ab-c+1=abc-c-ab+1$

$=c\,(ab-1)-1(ab-1)$

$=(c-1)(ab-1)$

(b) $p^2q-pr^2-pq+r^2=p^2q-pq-pr^2+r^2$

$=pq\,(p-1)-r^2\,(p-1)$

$=(p-1)(pq-r^2)$

(c) $4x^2+2y^2+x^2y^2+8=4x^2+x^2y^2+2y^2+8$

$=x^2\,(4+y^2)+2(y^2+4)$

$=(y^2+4)(x^2+2)$

(d) $ax^2+by^2+bx^2+ay^2=ax^2+ay^2+bx^2+by^2$

$=a\,(x^2+y^2)+b\,(x^2+y^2)$

$=(a+b)\,(x^2+y^2)$

7. Factorize by splitting the middle term :

(a) $x^2+9x+20=x^2+5x+4x+20$

$=x\,(x+5)+4\,(x+5)=(x+5)(x+4)$

(b) $x^2-14x+13=x^2-13x-1x+13$

$=x\,(x-13)-1(x-13)=(x-13)(x-1)$

(c) $p^2+2p-15=p^2+3p-5p-15$

$=p\,(p+3)-5(p+3)=(p+3)(p-5)$

(d) $m^2+11mn+18n^2=m^2+9nm+2mn+18m^2$

$=m\,(m+9n)+2n\,(m+9n)$

$=(m+9n)(m+2n)$

(e) $m^2 - 3m - 70 = m^2 - 10m + 7m - 70$

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

(f) $3x^2 - 10x + 8 = 3x^2 - 6x - 4x + 8$

$= 3x(x-2) - 4(x-2) = (3x-4)(x-2)$

(g) $10p^2 + 11p + 3 = 10p^2 + 6p + 5p + 3$

$= 2p(5p+3) + 1(5p+3) = (5p+3)(2p+1)$

(h) $11a^2 + 54a + 63 = 11a^2 + 21a + 33a + 63$

$= a(11a+21) + 3(11+21)$

$= (11a+21)(a+3)$

(i) $12y^2 + 28y - 5 = 12y^2 - 2y + 30y - 5$

$= 2y(6y-1) + 5(6y-1) = (2y+5)(6y-1)$

8. Factorize the following expressions :

(a) $y^2 - 18y + 81 = (y)^2 - 2 \times 9 \times y + (9)^2 = (y-9)^2$

(b) $x^4 + 22x^2 + 121 = (x^2)^2 + 2 \times 11 \times x^2 + (11)^2 = (x^2+11)^2$

(c) $p^6 - 4p^3 + 4 = (p^3)^2 - 2 \times p^3 \times 2 + (2)^2 = (p^3-2)^2$

(d) $a^2 + 2ab + b^2 - 16 = (a+b)^2 - 16$

$= (a+b)^2 - (4)^2 = (a+b+4)(a+b-4)$

(e) $9z^2 - x^2 - 4y^2 + 4xy = 9z^2 - (x^2 + 4y^2 - 4xy)$

$= 9z^2 - (x-2y)^2 = (3z)^2 - (x-2y)^2$

$= (3z - x + 2y)(3z + x - 2y)$

(f) $x^8 - y^8 + x^4 - y^4$

$= (x^4)^2 - (y^4)^2 + (x^2)^2 - (y^2)^2$

$= (x^4 + y^4)(x^4 - y^4) + (x^2 + y^2)(x^2 - y^2)$

$= (x^4 + y^4)(x^2 - y^2)(x^2 + y^2) + (x^2 + y^2)(x+y)(x-y)$

$(x^4 + y^4)(x+y)(x-y)(x^2 + y^2) + (x^2 + y^2)(x+y)(x-y)$

$= (x^4 + y^4 + 1)(x^2 + y^2)(x+y)(x-y)$

Multiple Choice Questions

Tick (✓) the correct answer :

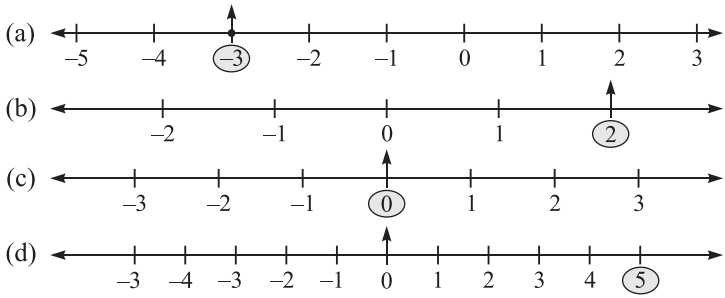
1. (d) **2.** (a) **3.** (b) **4.** (c) **5.** (a) **6.** (d) **7.** (c) **8.** (d) **9.** (a) **10.** (c)

Chapter

9 Introduction to Line Graphs

Exercise 9.1

1. Locate the following points on a number plane :



2. (a) The ordinate of $(1, -2) = -2$

(b) The ordinate of $(-3, -4) = -4$

(c) The ordinate of $(6, 2) = 2$

(d) The ordinate of $(4, -3) = -3$

3. Determine the quadrants in which is the following points lie :

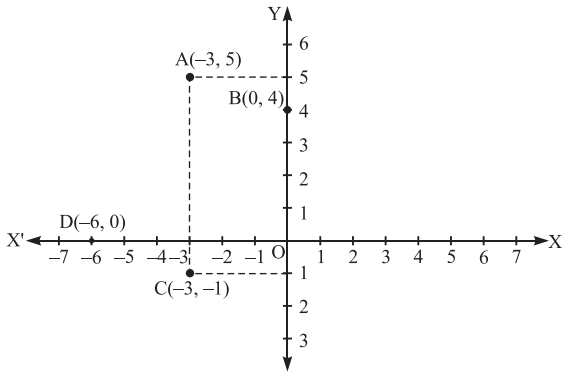
(a) $P(-3, 4)$: coordinate of $(-, +)$ lie in the II quadrant.

(b) $Q(3, -4)$ coordinate of $(+, -)$ line in the IV quadrant.

(c) $R(-1, -2)$ coordinate of $(-, -)$ line in the III quadrant.

(d) $S(1, 1)$ coordinate of $(+, +)$ lie in the I quadrant.

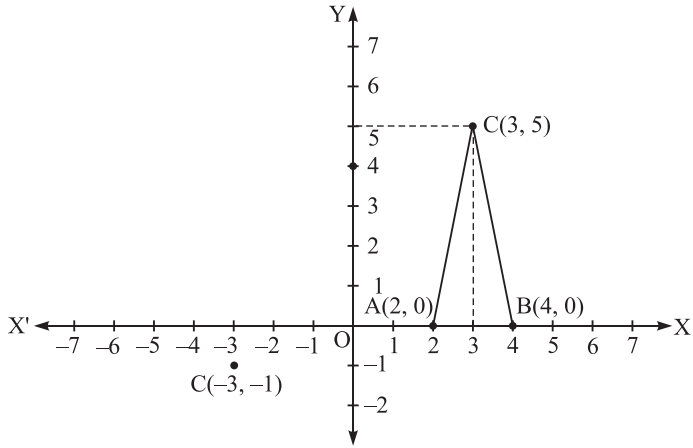
4.



5. (a) Ordered pair : $(-2, 0)$ (b) Ordered pair : $(4, -6)$.

6. (b) (4, 0) points lie on the X-axis.

7.



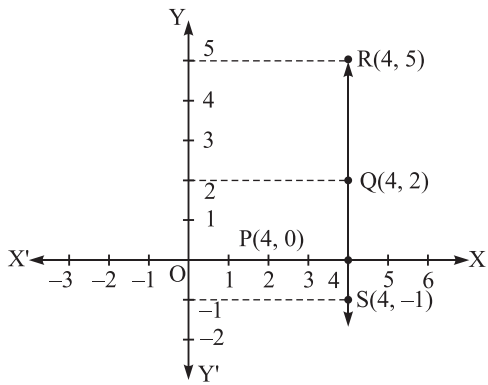
8. The co-ordinates of point $L(3, 1)$

The co-ordinates of point $M(-3, 2)$

The co-ordinates of point $N(-3, -3)$

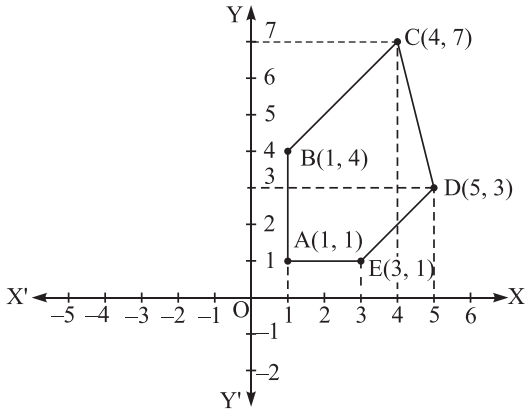
The co-ordinates of point $P(4, -2)$.

9.

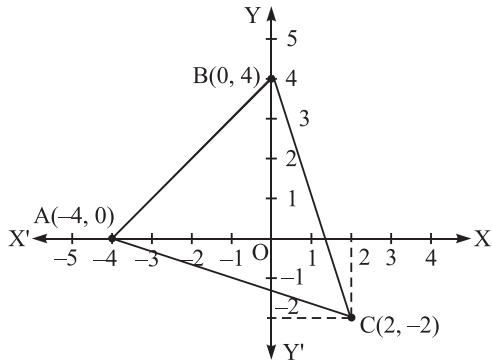


Yes, They are collinear.

10.

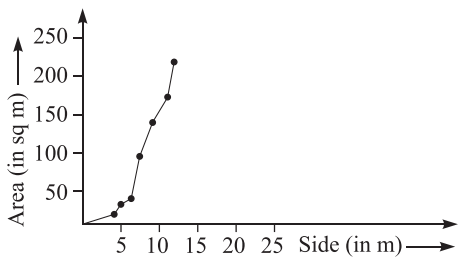


11.

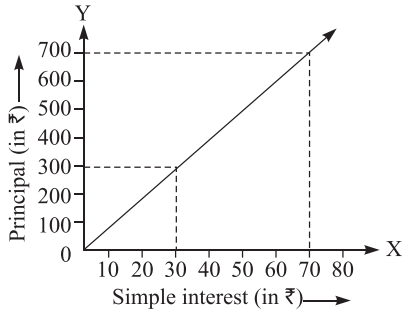


Exercise 9.2

1.



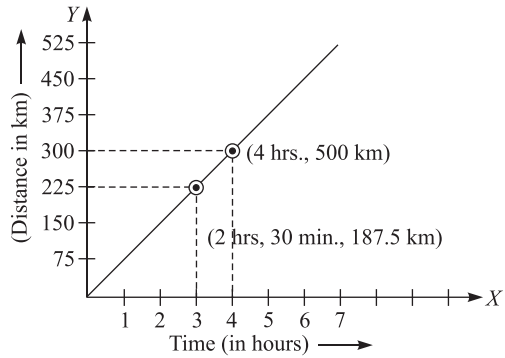
2.



(a) If investment = ₹ 300 then interest = ₹ 30.

(b) If interest = ₹ 70 then investment ₹ 700.

3. Speed = 75 km/h



We know the you a moving object

Distance (d) = Speed (s) × time (t)

Train speed = 75 km/hr

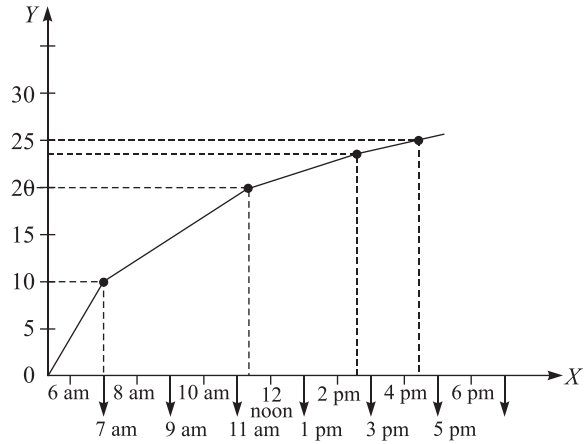
Time hours	1	2	3	4	5
distance (d)	75	150	225	300	375

(a) Distance covered in 2 hrs = 150 km

Distance covered in 2 hrs 30 min = 150 + 37.5 = 187.5 km

(b) Time take to covered 300 km = 4 hrs.

4.



(a) Temperature at 7 am = 10°C.

(b) Temperature at 1 pm = 24°C.

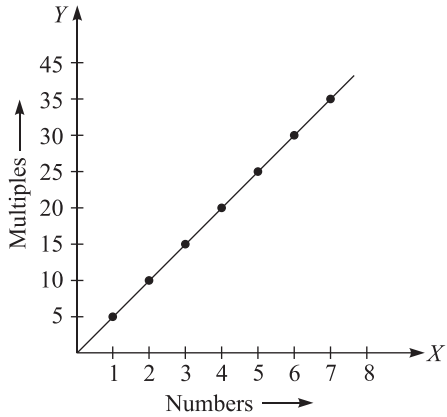
(c) 11 : 24 am when temperature was 20°C.

(d) 2 : 24 pm when temperature was 25°C.

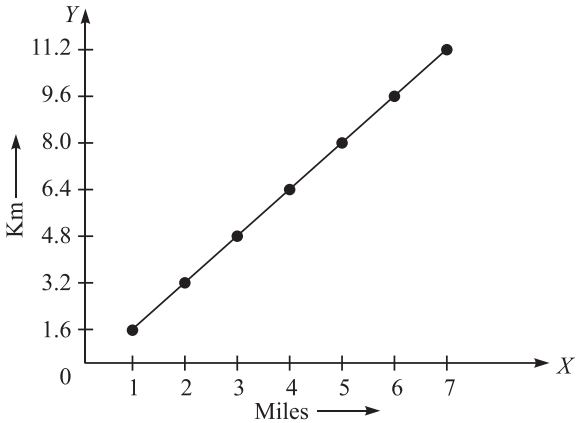
5. Draw table of multiples of 5 :

1	2	3	4	5	6	7
5	10	15	20	25	30	35

Line graph :

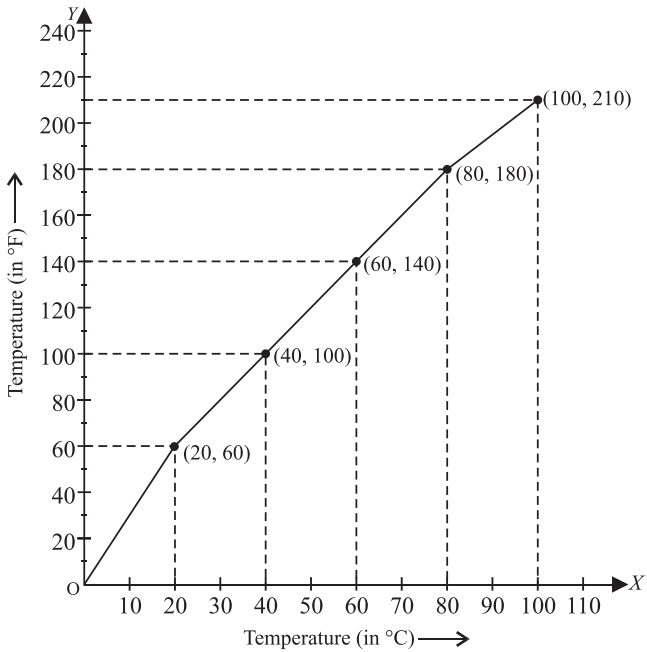


6.

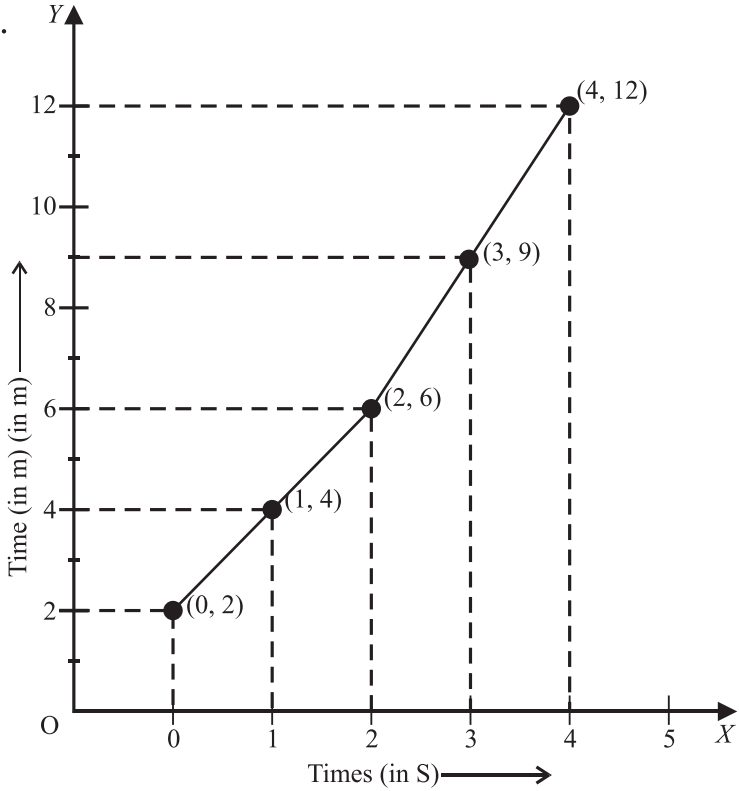


Mile : 1	2	3	4	5	6	7
Km : 1.6	3.2	4.8	6.4	8.0	9.16	11.2

7.



8.



Multiple Choice Questions

Tick (✓) the correct answer.

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

Chapter

10 Data Handling

Exercise10.1

1.

Marks	Tally Marks	Frequency
0-20	𝍸 |	6
20-40	𝍸 𝍸 ||||	14
40-60	𝍸 𝍸 𝍸	15
60-80	𝍸 𝍸 𝍸	15
80-100	𝍸 𝍸	10

(a) Class Mark $= \frac{80+100}{2} = \frac{180}{2} = 90.$

(b) Class size $= 80 - 60 = 20.$

(c) 40 upper limit of class $20 - 40.$

(d) 15 is the frequency of class $40 - 60.$

2.

Ages of patient	Tally marks	Number of patients
3	|	1
4	|	1
5	|	1
8	|	1
9	|	1
12	𝍸	5
13	|	1
14	|	1
15	|	1
16	|	1
21	|	1
24	|	1
25	|	1

26	|	1
30	|	1
32	|	1
34	|	1
35	|	1
38	|	1
39	||	2

(a) The age of youngest patient is 3 year.

(b) 12 age.

(c) Number of patients = 6

3. (a) Ascending order.

2, 5, 8, 10, 10, 10, 11, 12, 14, 15, 16, 16, 17 19, 19, 20, 20, 20, 20, 21, 21, 22, 23, 23, 24, 25, 25, 25, 25, 28, 28, 29, 30, 30, 30

(b) The highest marks = 30

(c) The lowest marks = 2

(d) Range = 30 – 2 = 28

(e) Number of failed student = 7

(f) Number of student scored above 25 marks = 6 students.

4.

No. of Paper Mills	Tally Marks	Frequency
1	𝍸 ||||	9
2	𝍸 𝍸 |||	13
3	|||	3

5.

Heights (in cm)	Tally Marks	Frequency(No. of Workers)
125-130		0
130-135	||||	4
135-140	𝍸 |	6
140-145	𝍸 |||	8
145-150		0

150-155	𝍸	5
155-160	𝍸	5
160-165	||	2

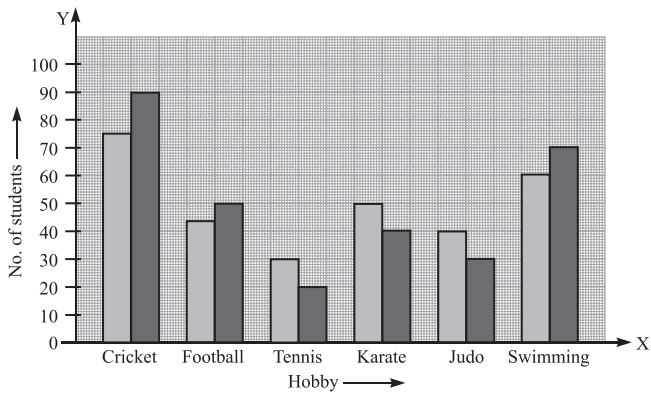
Rage = 162 – 130 = 32

6. (a) Sale of cars in year 2011.
(b) The sale was least in April.
(c) The sale was highest in July.
(d) In the month of January, June, September and December 15 cars were sold.
(e) Total cars sold in the last quarter of the year = 35 + 10 + 15 = 60.

7. (a) Cheetah runs the fastest.
(b) Cheetah 20 km/h (90 – 70) faster then a horse.
(c) Speed of animal of represent vertical axis.
(d) Speed of dog = 60 km/h
Speed of cat = 50 km/h ⇒ Ratio = 60 : 50 = 6 : 5.

8. (a) The performance of the student is better than the class average in English, Sanskrit and Maths.
(b) In Hindi and Social Studies, the performance of the student is worse than the class average.
(c) In Science, the performance of the student is equal to the class average.

9.



(a) Cricket is more popular in school B.

(b) Karate is more popular in school A.

(c) Tennis is least popular in school B.

(d) Total number of students in school A.

$$= 75 + 45 + 30 + 50 + 40 + 60 = 300$$

Total number of students in school B.

$$= 90 + 50 + 20 + 40 + 30 + 70 = 300$$

Student % prefer swinging in school $A = \frac{60}{300} \times 100 = 20\%$.

Student % perefer swinging in school $B = \frac{70}{300} \times 700 = 23.33\%$.

Exercise 10.2

1. (a) 2 students scored less than 10 marks.

(b) class size $= 20 - 10 = 10$.

(c) Number of failures $= 2 + 6 + 10 + 3 = 21$.

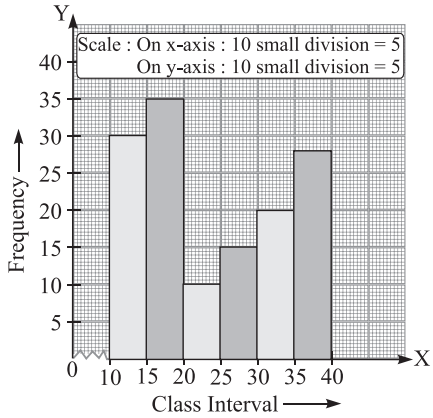
2. (a) Class size $= 40 - 20 = 20$.

(b) Maximum earning group is 60-80 (in ₹).

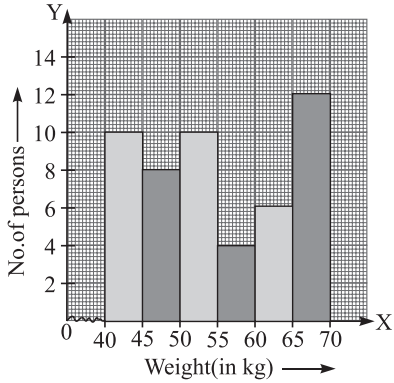
(c) Minimum earning group is 0-20 (in ₹).

(d) 18.

3.



4.



(a) 65-70 (b) 5 (c) 55-60.

5. (a) Kapil spends the largest amount of his pocket money in Enterainment.

(b) Fraction of his pocket money does he save $= \frac{1}{4}$.

(c) 25% percentage of his money is spent on books and stationery.

(d) Saving $= ₹\ 360 \times \frac{1}{4} = ₹\ 90$

Expenditure $= ₹\ (360 - 90) = ₹\ 270$

$\Rightarrow$ Ratio $= 270 : 90 = 3 : 1$.

6. (a) The most scored subject is Maths.

(b) The least scored subject is Hindi.

(c) The central angle of the subject s.st

$$= \frac{20}{100} \text{ of } 360°$$

$$= \frac{20}{100} \times 360 = 72°.$$

(d) For English $= 25\%$ of x

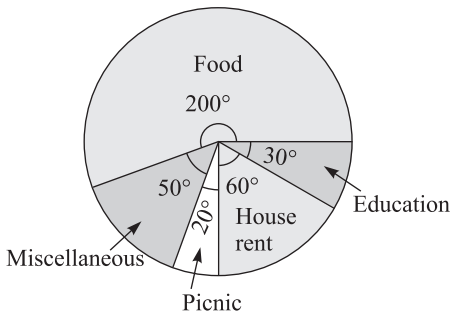
$$x \times \frac{25}{100} = 270$$

$$\Rightarrow \quad x = \frac{270 \times 100}{25} = 1080.$$

In Maths students $= 1080 \times 30\% = 324$.

7. We first have to find out the central angle of each sector.
The total sale is ₹ 7200

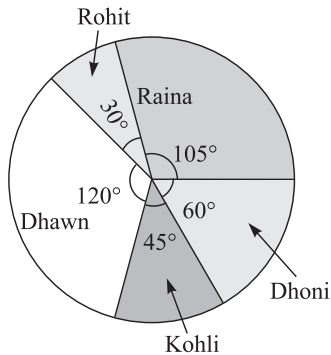
Item	Amount spent	Fraction of the Total	Angle of the sector
Education	600	$\frac{600}{7200}=\frac{1}{12}$	$\frac{1}{12}\times 360^\circ = 30^\circ$
Food	4000	$\frac{4000}{7200}=\frac{5}{9}$	$\frac{5}{9}\times 360^\circ = 200^\circ$
House rent	1200	$\frac{1200}{7200}=\frac{1}{6}$	$\frac{1}{6}\times 360^\circ = 60^\circ$
Picnic	400	$\frac{400}{7200}=\frac{1}{18}$	$\frac{1}{18}\times 360^\circ = 20^\circ$
Miscellaneous items	1000	$\frac{1000}{7200}=\frac{5}{36}$	$\frac{5}{36}\times 360^\circ = 50^\circ$



8.

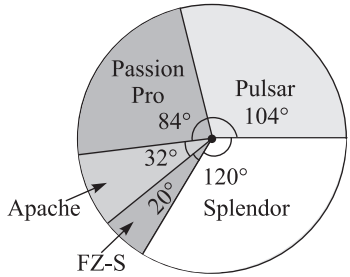
Player	Number of Students	Fraction of the Total	Angle of the sector
Raina	7	$\frac{7}{24}$	$\frac{7}{24}\times 360^\circ = 105^\circ$
Dhoni	4	$\frac{4}{24}$	$\frac{4}{24}\times 360^\circ = 60^\circ$
Kohli	3	$\frac{3}{24}$	$\frac{3}{24}\times 360^\circ = 45^\circ$

Dhawan	8	$\frac{8}{24}$	$\frac{8}{24} \times 360° = 120°$
Rohit	2	$\frac{2}{24}$	$\frac{2}{24} \times 360° = 30°$
	24		360°



9.

Type of bikes	Number of Bikes	Fraction of the Total	Angle of the Sector
Pulsar	26	$\frac{26}{90}$	$\frac{26}{90}$ of $360° = 104°$
Splendor	30	$\frac{30}{90}$	$\frac{30}{90}$ of $360° = 120°$
FZ-S	5	$\frac{5}{90}$	$\frac{5}{90}$ of $360° = 20°$
Apache	8	$\frac{8}{90}$	$\frac{8}{90}$ of $360° = 32°$
Passion Pro	21	$\frac{21}{90}$	$\frac{21}{90}$ of $360° = 84°$
Total	90		360°



Multiple Choice Questions

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

Chapter

11 Probability

Exercise 11

1. Words : CHEMISTRY

Number of letters = 9 $\Rightarrow$ choose letter = Y

$$\text{Probability} = \frac{1}{9}$$

2. Total Number of family = 100

Favourabe out come = 35

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{35}{100} \text{ or } \frac{7}{20}$$

3. (c) buying a bread is not an experiment.

4. (a) When two dice are rolled out together, then sample space

(S) = {(1, 1), (1, 2), (1, 3),(1, 4), (1, 5), (1, 6)
(2, 1), (2, 2), (2, 3), (2, 4), (2, 5) (2, 6),
(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)
(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6)
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

$\therefore$ Total possible outcomes = 36

Favourable outcomes (i.e. sum of both the numbers is more than 10)

$= \{(6, 6), (5, 6), (6, 5)\} = 3$

$\therefore$ Probability of getting sum of more than 10, say $P(A)$,

$$P(A) = \frac{\text{Favourable outcomes}}{\text{Total number of outcomes}} = \frac{3}{36} = \frac{1}{12}$$

Hence, the probability of getting the sum more than 10 is $\frac{1}{12}$.

(b) Total possible outcomes = 36

Favourable Outcome = (sum of both more than 6 and multiple of 3) = {(6, 6) (6, 3), (3, 6), (5, 4) (4, 5)} = 5

$$\text{Probability} = \frac{\text{Favourable outcome}}{\text{Total number of outcome}} = \frac{5}{36}.$$

5. Total balls $= 4 + 6 + 5 = 15$

(a) Getting red balls

Red balls $= 6 \Rightarrow$ Probability $= \frac{6}{15}$ or $\frac{2}{5}$

(b) Getting blue balls; blue balls = 5

Probability balls $= \frac{5}{15}$ or $\frac{1}{3}$.

6. (a) Picking a green ball from a bag containing green is not a random experiment.

7. Total number of family = 400

(a) Favourable outcome (3 children) = 74

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{74}{400} \text{ or } \frac{37}{200}$$

(b) Favourabnle out come (2 children) = 182

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{182}{400} \text{ or } \frac{91}{200}.$$

8. Number = 1, 2, 3, 4, 5, 6, 7, 8

Odd number = 1, 3, 5, 7

Favourable outcomes = 4; total outcomes = 8

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{4}{8} = \frac{1}{2}.$$

9. Number = 1, 2, 3, 4, 5

Total outcomes = 5

Favourable outcome = 1

$$\text{Probability} = \frac{\text{favourable outcome}}{\text{Total outcome}} = \frac{1}{5}.$$

10. Number days in week = 7

Monday = 1

$$\text{Probability of selecting Monday} = \frac{1}{7}.$$

11. Number of blocks = 9

Red block = 4, black block = 3, while block = 2

(a) $\text{Probability of red block} = \frac{4}{9}$

(b) $\text{Probability of black block} = \frac{3}{9} \text{ or } \frac{1}{3}$

(c) $\text{Probability of while block} = \frac{2}{9}$

(d) Probability of red, white or black blocks

$$\text{Probability} = \frac{9}{9} = 1.$$

Multiple Choice Questions

Tick (✓) the correct answer :

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

BRAIN BOOSTER

1. 3 purple sectors and 2 movie sectors

Total sectors = 3 + 2 = 5

$$\text{Probability of purple sectors} = \frac{3}{5}.$$

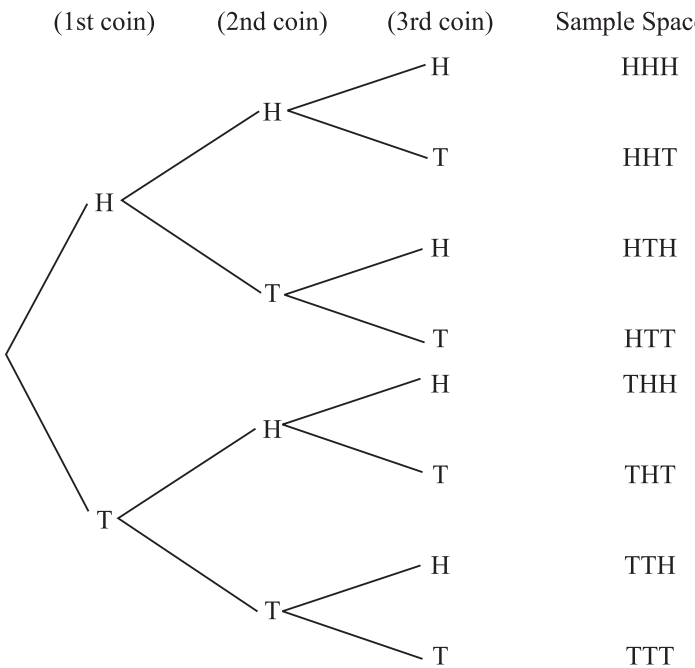
2. In a single throw of a coin, there are only two possible outcomes, *i.e., heads or tails.*

$\therefore$ Sample space $(S) = \{\text{heads, tails}\}$

When a dice is rolled, there are six possible outcomes, *i.e.*, 1, 2, 3, 4, 5 and 6.

$\therefore$ Sample space $(S) = \{1, 2, 3, 4, 5, 6\}$

3. Since three coins are tossed, the total number of possible outcomes will be 2^3, *i.e.*, 8. The tree diagram of the sample space is as follows.



Chapter

12 Quadrilaterals

Exercise 12.1

1. Ratio of four angles of a quadrilateral = 2 : 3 : 4 : 1

Let first angle $= 2x$; second angle $= 3x$;
third angle $= 4x$ and fourth angle $= 1x$
The sum of the angles of a quadrilateral is $360°$

$$2x + 3x + 4x + 1x = 360° \quad \Rightarrow \quad 10x = 360°$$
$$x = 360° \div 10 = 36°$$

Value of first angle $= 2 \times 36 = 72°$;
value of second angle $= 3 \times 36 = 108°$;
value of third angle $= 4 \times 36 = 144°$;
value of fourth angle $= 36°$

2. Ratio of a quadrilateral $= 1 : 3 : 7 : 9$
Let first angle $= x$, second angle $= 3x$
Third angle $= 7x$, fourth angle $= 9x$
Sum of the quadrilateral $= 360°$

$$x + 3x + 7x + 9x = 360° \quad \Rightarrow \quad 20x° = 360°$$
$$x = 360° \div 20 = 18°$$
$$\text{Thus, first angle} = 18° \quad \Rightarrow \text{ second angle} = 3 \times 18 = 54°$$
$$\text{Third angle} = 7 \times 18 = 126° \quad \Rightarrow \text{ fourth angle} = 9 \times 18 = 162°$$

3. Let, the fourth angle of the quadrilateral $= x°$
The Sum of the angles of a quadrilateral is $360°$

$$20° + 90° + 90° + x° = 360°$$
$$200° + x° = 360°$$
$$\Rightarrow \qquad x = 360° - 200° = 160°$$

So, the fourth angle is $160°$.

4. (a) Adjacent sides $= (AB$ and $BC)$ or $(BC$ and $CD)$ or $(CD$ and $DA)$ or $(DA$ and $AB)$
(b) Opposite sides $= (AB$ and $CD)$ or $(BC$ and $AD)$
(c) Adjacent angle $= (\angle A$ and $\angle B)$ or $(\angle B$ and $\angle C)$ or $(\angle C$ and $\angle D)$ or $(\angle D$ and $\angle A)$
(d) Opposite angle $= (\angle A$ and $\angle C)$ or $(\angle B$ and $\angle D)$
(e) Diagonals AC and BD

5. $PQRS$ is a quadrilateral and diagonal QS divides it into two triangles, *i.e.*, ΔPQS and ΔQRS
In ΔPQS ;

$$\angle QPS + \angle PQS + \angle QSP = 180° \qquad \ldots(i)$$

In ΔQRS;

$\angle SQR + \angle QRS + \angle QSR = 180°$ …(ii)

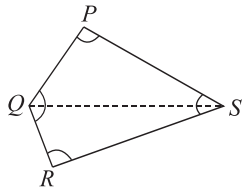
Adding (i) and (ii), we get

$\angle QPS + \angle QRS + (\angle PQS + \angle RQS)$

$+(\angle PSQ + \angle QSR)$

$= 180° + 180°$

$\angle QPS + \angle PSR + \angle SRQ + \angle RQP = 360°$



6. Sum of two angle $= 150°$

Let one angle $= x$ and other angle $= (150 - x)°$

Ratio of other angle $= 2 : 3$

Third angle $= 2x$ $\Rightarrow$ Fourth angle $= 3x$

Sum of quadrilateral $= 360°$

$x + (150 - x)° + 2x + 3x = 360°$

$(150 - x)° + 6x = 360°$ $\Rightarrow$ $150 + 5x = 360°$

$5x = 360° - 150° = 210°$ $\Rightarrow$ $x = 42°$

First angle $= 42°$,

Second angle $= 150° - 42° = 108°$,

Third angle $= 2 \times 42° = 84°$,

Fourth angle $= 3 \times 42° = 126°$.

7. If $ODEC$ is a quadrilateral

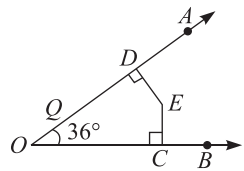
$\angle DOC + \angle OCE + \angle CED + \angle EDO = 360°$

$36° + 90° + x° \; 90° = 360°$

$216° + x = 360°$

$x = 360° - 216° = 144°$

$\angle CED = 144°$.



8. Let equal angles be x

The sum of the angles of a quadrilateral is $360°$

$75° + x° + x° + 75° = 360°$ $\Rightarrow$ $150° + 2x = 360°$

$2x = 360° - 150°$ $\Rightarrow$ $x = \dfrac{210°}{2} = 105°$

So, equal angles of quadrilateral are $= 105°$.

9. Ratio of angles of a quadrilateral $= 3 : 5 : 7 : 9$

Let, first angle $= 3x$ $\Rightarrow$ second angle $= 5x$

third angle $= 7x$, $\Rightarrow$ fourth angle $= 9x$

Sum of quadrilateral $= 360°$

$$3x + 5x + 7x + 9x = 360^\circ \quad \Rightarrow \quad 24x = 360^\circ$$
$$x = 360^\circ \div 24 = 15^\circ$$

Thus, first angle is $3 \times 15 = 45^\circ$,
second angle is $5 \times 15 = 75^\circ$,
third angle is $7 \times 15 = 105^\circ$,
fourth angle is $9 \times 15 = 135^\circ$.

10. Let, equal angle $= x$
Sum of the quadrilateral $= 360^\circ$
$$x \times 3 + 120 = 360^\circ \quad \Rightarrow 3x + 120 = 360^\circ$$
$$3x = 360^\circ - 120^\circ \quad \Rightarrow x = 240^\circ \div 3 = 80^\circ$$
So, equal angle $= 80^\circ$.

11. Let fourth angle $= x$
Other three angle are $= 100^\circ, 50^\circ, 50^\circ$
Sum of angle of quadrilateral $= 360^\circ$
$$100^\circ + 50^\circ + 50^\circ + x = 360^\circ \Rightarrow 200^\circ + x^\circ = 360^\circ$$
$$x = 360^\circ - 200^\circ = 160^\circ.$$

12. Ratio of angles of quadrilateral $= 1 : 2 : 3 : 4$
Let first angle of quadrilateral $= x$
Second angle of quadrilateral $= 2x$
Third angle of quadrilateral $= 3x$
Fourth angle of quadrilateral $= 4x$
Sum of angles of quadrilateral $= 360^\circ$
$$x + 2x + 3x + 4x = 360^\circ$$
$$\Rightarrow \quad 10x = 360^\circ$$
$$x = 360^\circ \div 10 = 36$$
Thus, value of first angle $= 36^\circ$
Value of second angle $= 36^\circ \times 2 = 72^\circ$
Value of third angle $= 36^\circ \times 3 = 108^\circ$
Value of fourth angle $= 36^\circ \times 4 = 144^\circ$.

13. Let equal angles $= x$
Sum of four angle of quadrilateral $= 360^\circ$
$$130^\circ + 30^\circ + x + x = 360^\circ$$
$$160^\circ + 2x = 360^\circ$$
$$x = \frac{360^\circ - 160^\circ}{2} = \frac{200^\circ}{2} = 100^\circ.$$

14. Let equal angles $= x$

Sum of four angle of quadrilateral $= 360°$

$$85° + 115° + x + x = 360° \quad \Rightarrow \quad 200° + 2x = 360°$$

$$2x = 360° - 200 \quad \Rightarrow \quad x = \frac{160}{2} = 80°.$$

Exercise 12.2

1. Long side of a parallelogram $= 8$ cm

Shorter side $= 8 \times \frac{3}{4} = 6$ cm

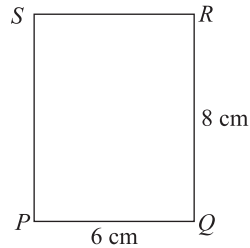
If $PQRS$ is parallelogram

$PQ = RS = 6$ cm; $PS = RQ = 8$ cm

Sum of all sides

$= PQ + RQ + RS + PS$

$= 6 + 8 + 6 + 8 = 28$ cm.



2. Suppose $ABCD$ be parallelogram with $AB = 3x$ and $BC = 2x$

Since, opposite sides of parallelogram are equal

$AB = DC = 3x$

and $AD = BC = 2x$

Now, the perimeter of $ABCD$ is given by

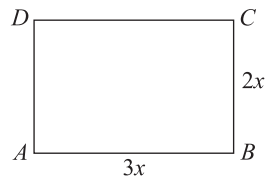
$AB + BC + CD + DA = 60$ cm

$3x + 2x + 3x + 2x = 60$

$10x = 60 \quad \Rightarrow \quad x = 6$

$AB = CD = 3 \times 6 = 18$ cm

$AD = BC = 2 \times 6 = 12$ cm.



3. Suppose $ABCD$ is a parallelogram and measure of $\angle A$ and $\angle B$ are in the ratio 7 : 2.

it $\angle A = 7x$ then $\angle B = 2x$

Now, $\angle A + \angle B = 180°$

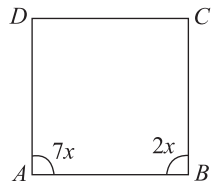
[$\because$ Sum of the interior angles on one side of parallel line is 180°]

$7x + 2x = 180° \quad \Rightarrow \quad 9x = 180°$

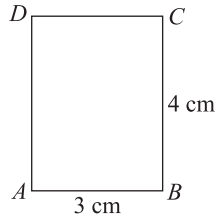
$x = 20°$

$\Rightarrow \quad \angle A = \angle C = 20° \times 7 = 140°$

$\angle D = \angle B = 20° \times 2 = 40°.$



4. $AB = 3\text{ cm}, BC = 4\text{ cm}$



Suppose $ABCD$ be a parallelogram with,

$AB = 3\text{ cm}, CB = 4\text{ cm}$

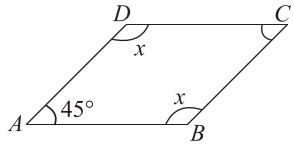
Since, opposite sides of a parallelogram are equal

$3\text{ cm} = AB = DC$; $AD = CB = 4\text{ cm}$

perimeter of $ABCD$ is given by

$$= AB + CD + AD + CB = 3 + 4 + 3 + 4\text{ cm} = 14\text{ cm}$$

5. $ABCD$ is a parallelogram



$$\angle A = 45°, \angle C = 45°$$

Let $\angle B = x$ and $\angle D = x$

Sum of $\angle A + \angle B + \angle C + \angle D = 360°$

$$45° + x + 45° + x = 360°$$

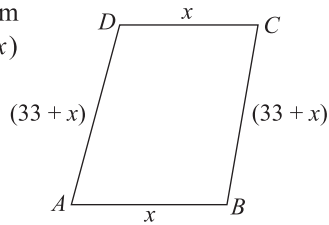
$$90° + 2x = 360° \Rightarrow 2x = 360° - 90°$$

$$2x = 270° \Rightarrow x = \frac{270°}{2} = 135°$$

$\angle B = 135°$; so $= \angle D = 135°$

$\therefore$ $\angle A = 45°, \angle B = 135°, \angle C = 45°, \angle D = 135°$

6. Perimeter of a parallelogram $= 150\text{ cm}$



Let one side is x. other side is $(33 + x)$

If $ABCD$ is parallelogram

$$AB = DC;\ AD + BC$$

Perimeter of a parallelogram $= 150$

$$x + (33 + x) + x + (33 + x) = 150$$

$$66 + 4x = 150$$

$$4x = 150 - 66$$

$$x = \frac{84}{4} = 21$$

one side is 21 cm, other side is $(21 + 33)\text{ cm} = 54\text{ cm}$.

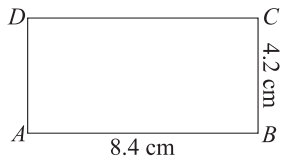
7. Longer side $= 8.4\text{ cm}$

Shorter Sider $= 4.2\text{ cm}$

Suppose $ABCD$ be a parallelogram with

$AB = 8.4\text{ cm}, BC$

$= 4.2\text{ cm}$



Since, opposite sides of a parallelogram are equal.

$$AB = DC = 8.4 \text{ cm}; \; AD = BC = 4.2 \text{ cm}$$

Now, the perimeter of $ABCD$ is given by $AB + BC + CD + DA$

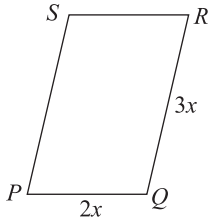
$$8.4 + 4.2 + 8.4 + 4.2 = 25.2 \text{ cm}.$$

8. Suppose $ABCD$ be a parallelogram with

$$AB = 2x \text{ and } BC = 3x$$

Since, opposite sides of a parallelogram are equal

$$\therefore \quad AB = DC = 2x \text{ and } BC = AD = 3x.$$



Now, the perimeter of $ABCD$ is given by

$$AB + BC + CD + DA = 40 \text{ cm}$$

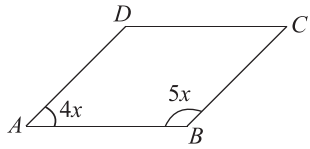
$$\Rightarrow \quad 2x + 3x + 2x + 3x = 40 \text{ cm}$$

$$10x = 40 \text{ cm} \Rightarrow x = 4 \text{ cm}$$

Hence, $AB = CD = 2x = 2 \times 4 = 8 \text{ cm}$

Also, $BC = DA = 3x = 4 \times 3 = 12 \text{ cm}.$

9. Suppose $ABCD$ is a parallelogram and measure of $\angle A$ and $\angle B$ are in the ratio 4 : 5



Let $\angle A = 4x$

then $\angle B = 5x$

Now, $\angle A + \angle B = 180°$

[$\because$ Sum of the interior angles on one side of parallel line is 180°]

$$4x + 5x = 180° \quad \Rightarrow \quad 9x = 180°$$

$$x = 20° \quad \Rightarrow \quad \angle A = \angle C = 20° \times 4 = 80°$$

$$\angle D = \angle B = 20° \times 5 = 100°.$$

10. $AB = DC = 21 \text{ cm}; \; AD = BC = 54 \text{ cm}$

$\angle DAB = 85° \; \angle DBC = 60°$

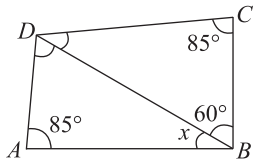
$AB \,||\, DC$ and AB is traversal $\angle A + \angle B = 180°$

(Sum of the interior angles on one side of parallel line 180°)

$$85° + x + 60° = 180°$$

$$145° + x = 180°$$

$$x = 180° - 145 = 35°$$



(a) $\angle CDB = \angle ABD = 35°$ (alternate angle)

(b) $\angle ABD = 35°$.

Exercise 12.3

1. In the given rectangle

$$\angle DOC = \angle AOB = 120°$$

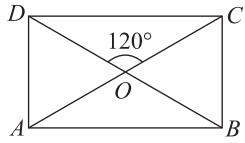
ΔAOB, $OA = OB$

(Diagonals of a rectangle are equal and bisect each other)

$$\angle OBA = \angle OAB = x$$

(Angles opposite to equal sides are equal)

In ΔAOB,



$$\angle AOB + \angle OAB + \angle ABO = 180°$$

$$120° + x + x = 180°$$

$$2x = 180° - 120°$$

$$x = 60° \div 2 = 30°$$

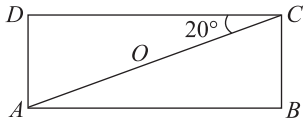
So, $\angle OBA = 30°$.

2. In ΔACD, $\angle ACD = 20°$ (Given)

and $AD = DC$ (Sides of a rhombus)

$\therefore$ $\angle ACD = \angle DAC$

(Angles opposite to equal sides)



Therefore, $\angle DAC = \angle ACD = 20°$

So, $\angle DAC = 20°$

Now, In ΔACD

$$\angle ADC + \angle DAC + \angle ACD = 180°$$

$$\angle ADC + 20° + 20° = 180°$$

$$\angle ADC = 180° - 40° = 140°$$

We know that opposite angles of rhombus are equal.

So, $\angle ABC = \angle ADC = 140°$

Therefore, $\angle ABC = 140°$

$$\angle DCB = \angle DCA + \angle ACB$$

$$= 20° + 20° = 40°$$

$$\angle DCB = \angle DAB = 40°$$

$$\angle A = 40°, \angle B = 140°,$$

$$\angle C = 40°, \angle D = 140°.$$

3. Let diagonal AC = side AB

Now in ΔABC,

$$AB = BC = AC.$$

$\Rightarrow$ ΔABC is an equilateral triangle.

$\Rightarrow$ $\angle ABC = 60°$

Also, $\angle BAC = \angle BCA = 60°$

Similarly ΔADC is an equilateral triangle.

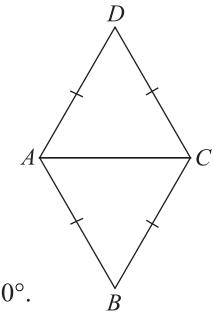
$\Rightarrow$ $\angle ADC = \angle DAC = \angle DCA = 60°$

Now, $\angle DAB$

$= \angle DAC + \angle CAB = 60° + 60° = 120°$

Similarly, $\angle DCB = 120°$

$\therefore$Angles of rhombus are 60°, 120°, 60° and 120°.



4. In the adjoining, $ABCD$ is a rhombus.

Find the measure of the following angles, if $\angle ACB = 30°$

(a) $\angle BOC = 90°$

(Diagonals of rhombus bisect, each other 90°)

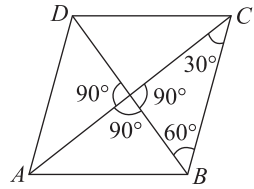
(b) $\angle CBO =$ In, ΔBOC,

$\angle B + \angle C + \angle O = 180°$

$\Rightarrow$ $\angle B + 90° + 30° = 180°$ $\angle B = 180° - 120° = 60°$

(c) $\angle OAD = 30°$ (alternate angles)

(d) $\angle ABO = \angle CBO = 60°$.



5. The diagonals of a parallelogram are not perpendicular to each other. It is not rhombus, because to be a rhombus, it is essential that diagonals of a parallelogram should be perpendicular.

6. (a) Rhombus (b) Rectangle (c) Square.

7. Let, us look at the rectangle once more.

Let, us prove that the diagonals are equal.

In triangles ABD and BAC,

$AB = BA$ (common side)

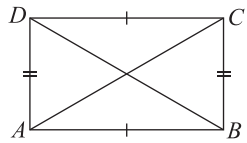
$\angle A = \angle B = 90°$ (already proved)

$AD = BC$ (opposite sides of a parallelogram are equal.)

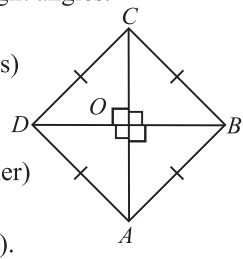
Two sides and the included angle of ΔABD are respectively equal to two sides and the included angle of ΔBAC.

$\therefore$ By S.A.S. property $\Delta ABD \cong \Delta BAC$.

Hence, $BD = AC$, *i.e.*, the diagonals of a rectangle are equal.



8. We will prove that the diagonals bisect at right angles.



Consider ΔABO and ΔBCO

$AB = BC$ (by defination of a rhombus)

BO is common.

$AO = CO$

(dagonals of a parallelogram bisect each other)

So, the two trangles are congruent

(S.S.S. condition for congruence of trangles).

So, $\angle AOB = \angle BOC$

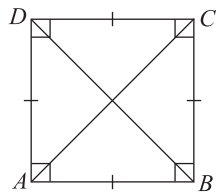
But, $\angle AOB + \angle BOC = 180°$ (straight angle)

$\Rightarrow$ $\angle AOB = \angle BOC = 90°$

$\angle COD$ and $\angle DOA$ are vertcally opposte angles of $\angle AOB$ and $\angle BOC$. So they are also 90° each.

So, the diagonals of a rhombus bisect each other at right angles.

9. Take a rhombus $ABCD$,



where $AB = BC = CD = AD$

and $\angle A = \angle B = \angle C = \angle D = 90°$

To Prove :

A rhombus wth one angle 90° is a square.

Proof : Since, in the rhombus $ABCD$,

Hence, AC and BD bisect each other. (property of parallelogram)

Hence proved (ii).

$AB = BC = CD = AD$,

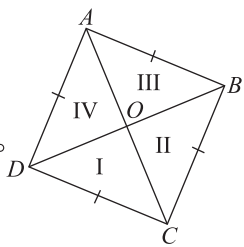
Hence, $AC \perp BD$ (Property of rhombus)

As here Rhombus; opposite sides are parallel.

$\therefore$ All sides equal opposite angles are equal.

So, a rhombus with one angle 90° is square.

10. In figure $\Delta AOD, \Delta AOB, \Delta DOC, \Delta BOC$



Here $AB = BC = CD = AD$

$CA = DB$ common side

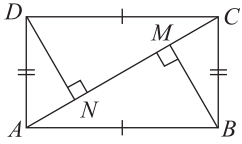
$\angle AOD = \angle AOB = \angle BOC = \angle DOC = 90°$

(Diagonals bisect each other at right angle)

In the rhombus $ABCD$ shown above

$AB \parallel CD$; $BC \parallel AD$
$AB = BC = CD = AD$
$AO = BO$ and $CO = DO$
(diagonals bisect each other in a parallelogram)
So, we can say that four triangle found by dagonals and sides of rohombus are congruent.

11. In ΔAND and ΔCMB, we have



$AD = BC$
Opposite sides of the rectangle $ABCD$
$\angle DNC = \angle BMC$ (90° each)
$\angle DAN = \angle BCM$
($AD \parallel BC$ and AC is transversely and these angles are alternate interior angles)
Therefore, $\Delta AND \cong \Delta CMB$
$\therefore$ $AN = CM$ Hence proved,

12. Which of the following statements is True (T) or False (F) :

(a) F (b) F (c) F (d) T (e) T
(f) F (g) T (h) F (i) T (j) F

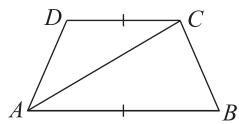
Multiple Choice Questions

Tick (✓) the correct answer :

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

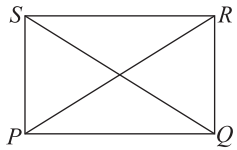
BRAIN BOOSTER

1. $AB \parallel DC$



In the figure alongside quadrilateral $ABCD$ is a trapezium in which $AB \parallel DC$, AC is Diagonal
ΔADC and ΔABC are equal sum of one triangle $= 180°$
Then, Sum of $\Delta ADC + \Delta ABC = 180° + 180° = 360°$
Sum of trapezium is 360°.

2. If $PQRS$, $PQ \parallel RS$



$PQ = RS$; $PR = QS$
$2x + 4 = 3x + 1$
$4 - 1 = 3x - 2x$
$\Rightarrow$ $3 = x$
Value of x is 3.

Chapter

13 Construction of Quadrilaterals

Exercise 13.1

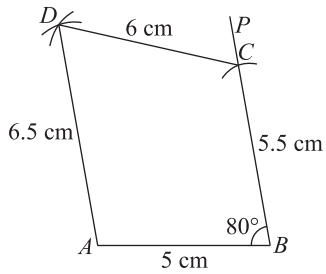
1. Steps of construction :

Step 1. Draw AB 5 cm.

Step 2. Draw an angle of 80° at B.

Step 3. With B as centre and radius 5.5 cm, draw an arc intersecting BP at C.

Step 4. With C as centre and radius 6 cm draw an arc on one side of BC.



Step 5. With A as centre and radius 6.5 cm, draw an arc intersecting the previous arc at D.

Join D to C and A to D.

The figure of $ABCD$, thus drawn, is the required quadrilateral.

2. Steps of construction :

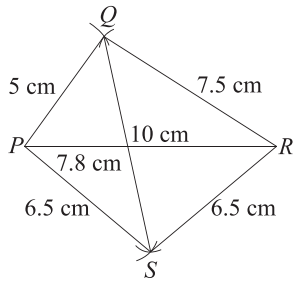
Step 1. Draw diagonal $PR = 10$ cm.

Step 2. With P as centre and radius 5 cm.

Step 3. With R as centre and radius 7.5 cm.

Step 4. Join P to Q and R to Q.

Step 5. With P as centre and radius 6.5 cm, an arc.



Step 6. With R as centre and radius 6.5 cm, draw an arc intersecting the previous arc at S.

Step 7. Join P to Q and R to S.

The figure $PQRS$, thus drawn, is the required quadrilateral.

3. Steps of constructions :

Step 1. Draw diagonal $BD = 6$ cm.

Step 2. With B as centre and radius 5 cm.

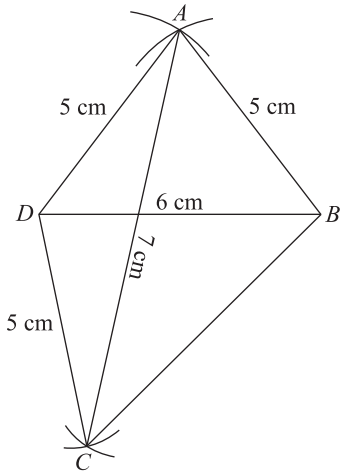
Step 3. With D as centre and radius 5 cm.

Step 4. Join A to B and A to D.

Step 5. With D as centre and radius 5 cm draw an arc on the other side of BD.

Step 6. With A as centre and radius 7 cm, draw an arc intersecting the previous arc at C.

Step 7. Join B to C and D to C.



The $ABCD$ thus drawn, is the required quadrilateral.

4. Steps of construction :

Step 1. Draw diagonal $PR = 4.5$ cm.

Step 2. With P as centre and radius 3.5 cm.

Step 3. With R as centre and radius 4 cm.

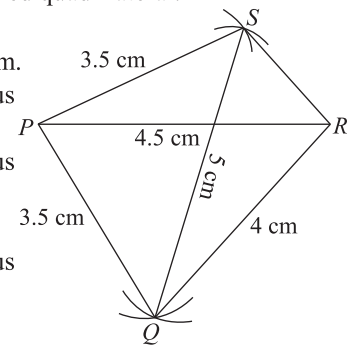
Step 4. Join P to Q and R to Q.

Step 5. With P as centre and radius 3.5 cm draw an arc on the other side of PR.

Step 6. With Q as centre and radius 5 cm, drawn an arc at S.

Step 7. Join P to S and Q to S.

Step 8. Join S to R ; $SR = 2.5$ cm.



The figure $PQRS$, thus drawn, is the require quadrilateral.

5. Steps of construction :

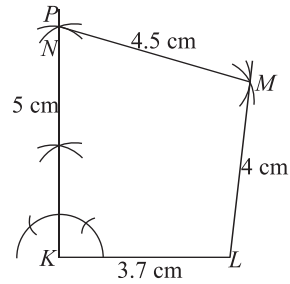
Step 1. Draw KL 3.7 cm.

Step 2. Draw an angle of 90° at K.

Step 3. With K as centre and radius 5 cm, draw an arc intersecting KP at N.

Step 4. With N as centre and radius 4. cm draw an arc on one side of KN.

Step 5. With L as centre and radius 4 cm, draw an arc intersecting the previous arc at M.



Join M to N and M to L.

The figure of $KLMN$, thus drawn, is the required quadrilateral.

6. Steps of construction :

Step 1. Draw diagonal $AC = 7$ cm.

Step 2. With A as center and radius 6.5 cm.

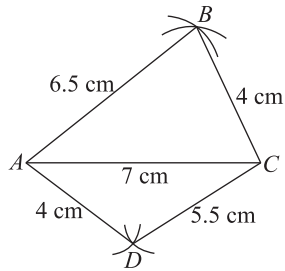
Step 3. With C as center and radius 4 cm and cut previous arc of B.

Step 4. Join AB and BC.

Step 5. With A as center and radius 4 cm draw an arc another side of AC.

Step 6. With C as center and radius 5.5 cm draw an arc intersecting the previous arc at D.

Step 7. Join A to D and C to D.



The figure of $ABCD$ thus drawn is the required quadrilateral.

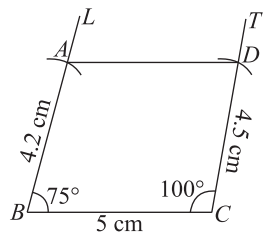
Exercise 13.2

1. Steps of construction :

Step 1. Draw $BC = 5$ cm.

Step 2. Taking B and C a centres, draw angles of 75° and 100° respectively.

Step 3. With B as centre and radius 4.2 cm, draw an arc intersecting BL at A.



Step 4. With C as centre and radius 4.5 cm, draw an arc intersecting at CT at D.

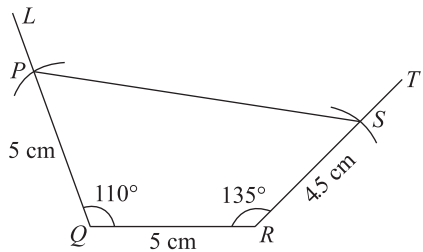
Step 5. Join A to D.

The figure $ABCD$, thus drawn is the required quadrilateral.

2. Steps of construction :

Step 1. Draw $QR = 5$ cm.

Step 2. Taking Q and R as centres, draw angles of 110° and 135° respectively



Step 3. With Q as centre and radius 5 cm, draw an arc intersecting QL at P.

Step 4. With R as centre and radius 4.5 cm, draw an arc intersecting at RT at S.

Step 5. Join P to S.

The figure $PQRS$, thus drawn, is the required quadrilateral.

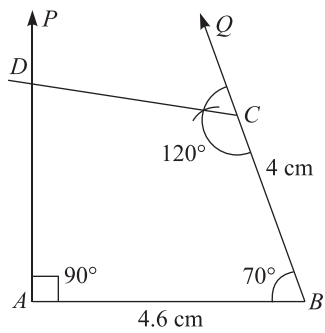
3. Steps of construction :

Step 1. Draw $AB = 4.6$ cm.

Step 2. With A and B as centres, draw angles of 90° and 70° respectively.

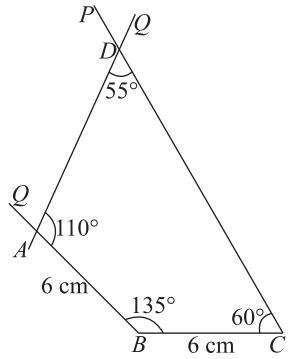
Step 3. With B as centre and radius 4 cm, draw an arc intersecting BQ at C.

Step 4. With C as centre, draw an angle of 120° intersecting AP at D.



Thus $ABCD$ drawn is the required quadrilateral.

4. Steps of construction :



(Find the $\angle A, \angle B = 135°$,
$\angle C = 60°, \angle D = 55°$
Sum of quadrilateral $= 360°$
$135° + 60° + 55° + \angle A = 360°$
$250° + \angle A = 360°$
$\angle A = 360° - 250° = 110°$)

Step 1. Draw $BC = 6$ cm.

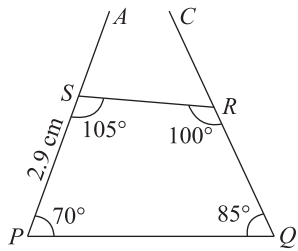
Step 2. With B and C as centres draw angles of 135° and 60° respectively.

Step 3. With B as centre and radius 6 cm draw an arc intersection BQ at A.

Step 4. With A as centre, draw an angle 110° intersecting CP at D; $\angle D = 55°$.

Thus, $ABCD$ drawn is the required quadrilaterals.

5. Steps of construction :



(Sum of quadrilateral $= 360°$
$\angle P = 70°, \angle Q = 85°, \angle R = 100°$
$\angle P + \angle Q + \angle R + \angle S = 360°$
$70° + 85° + 100° + \angle S = 360°$
$\angle S = 360° - 255° = 105°$)

Step 1. Draw $PQ = 5.3$ cm.

Step 2. With P an Q as centres, drawn angle 70° and 85° respectively.

Step 3. With P as centre and radius 2.9 cm draw arc intersecting PA at S.

Step 4. With S as centre and draw $\angle S = 105°$ intersecting QS at R.
$\angle R = 100°$

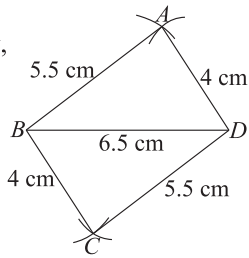
The figure $PQRS$ thus drawn is required quadrilateral.

Exercise 13.3

1. Steps of construction :

Step 1. Draw $BD = 6.5$ cm.

Step2. With B and D as centres, and radii 5.5 cm and 4 cm respectively, draw two arcs on one side of BD intersecting each other at A. Join A to B and A to D.



Step 3. Again, with D and B as centres and radii 4 cm and 5.5 cm respectively, draw two arcs on the other side of BD intersecting each other at C. Join C to B and C to D.

The figure $ABCD$, thus drawn, is the required parallelogram.

2. Steps of construction :

Step 1. Draw $AB = 4.2$ cm.

Step 2. With B as center draw angle 70°.

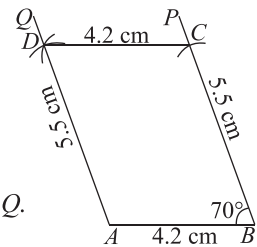
Step 3. With B as centers and radius 5.5 cm draw an arc intersecting BP at C.

Step 4. With A as center and radius 5.5 cm draw an arc intersecting AQ.

Step 5. With C as center and radius 4.2 cm draw an arc which the cut pervious arc as D.

Step 6. Join A to D and B to C.

Thus, $ABCD$ is required parallelogram.



3. Steps of construction :

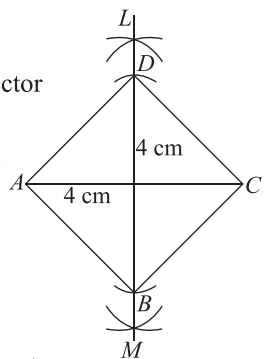
Step 1. Draw $AC = 8$ cm.

Step 2. Draw LM, the perpendicular bisector of AC, intersecting AC at O.

Step 3. With O as centre and radius 4 cm (*i.e.*, half of 8 cm), draw two arcs on either side of AC intersecting LM at B and D respectively.

Step 4. Join AB, CB, CD and DA.

The figure $ABCD$, thus drawn, is the required square.



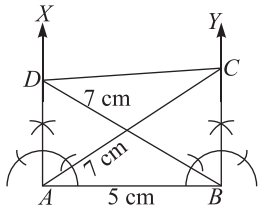
4. Steps of construction :

Step 1. Draw $AB = 5$ cm.

Step 2. With A and B as centres, draw angles of 90° at each point.

Step 3. With A and B as centres and radius 7 cm, draw two arcs intersecting BY and AX at C and D respectively.

Step 4. Join C and D.



The figure $ABCD$, thus drawn, is the required rectangle.

5. Steps of construction :

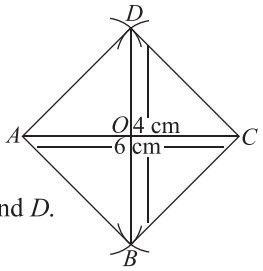
Step 1. Draw $AC = 6$ cm.

Step 2. Draw a perpendicular bisector of AC which cuts AC at O.

Step 3. With O as centre take a radius 2 cm draw two arc which cuts the perpendicular bisector on B and D.

Step 4. Join, AB, BC, CD and DA.

$ABCD$ is the required rhombus.

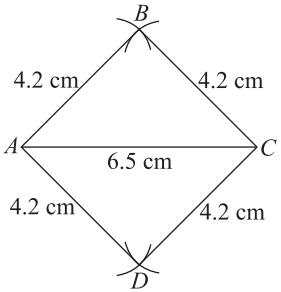


6. Steps of construction :

Step 1. Draw $AC = 6.5$ cm.

Step 2. With A and C as centres, and radius 4.2 cm, draw two arcs on the same side of AC, intersecting each other at B. Join A to B and C to B.

Step 3. With A and C as centres, and radius 4.2 cm, draw two arcs on the other side of AC intersecting each other at D. Join A to D and C to D.



The figure $ABCD$, thus drawn, is the required rhombus.

7. Steps of construction :

Step 1. Draw $AB = 5$ cm.

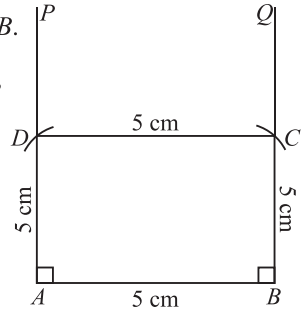
Step 2. Draw an angle of 90° at A.

Step 3. Draw another angle of 90° at B.

Step 4. With A as centre draw on arc of radius 5 cm which cuts AP at D.

Step 5. With B as centre, draw an arc of raidus 5 cm which cuts BQ at C. Join C to D.

The figure $ABCD$, thus drawn, is the required square.



Chapter

14 Vosualising Solid Shapes

Exerciser 14

1. Identity the given solid shapes :
(a) Square pyramid (b) Sphere (c) Cuboid
(d) Cube (e) Cone

2. Which of the following shapes is not a polyhedron?
(a) Yes (b) Yes (c) No

3. Which of these solids is an example of a regular polyhedron?
(a) regular polyhedron.

4. Look at the following polyhedrons and fill in the given table to verify the Euler's formula.

	Solid	V	F	E	$V+F-E$
(a)	Triangular Prism	6	5	9	2
(b)	Hexagonal Prism	12	8	18	2
(c)	Hexagonal Pyramid	7	7	12	2
(d)	Pentagonal pyramid	6	6	10	2
(e)	Cube	8	6	12	2
(f)	Rectangular pyramid	5	5	8	2

5. Number of vertices $(V) = 8$;

Number of faces $(F) = 6$

Let number of edges $(E) = x$;

$$V + F - E = 2$$

As $$8 + 6 - x = 2$$

$$14 - x = 2 \quad \Rightarrow \quad x = 14 - 2 = 12$$

Number of edges $= 12$.

6. Number of vertices $(V) = 20$

Let number of faces $(F) = x$

Number of edges $(E) = 30$

$\Rightarrow$ $$V + F - E = 2$$

$$20 + x - 30 = 2$$

$$x - 10 = 2$$

$$x = 10 + 2$$

$$x = 12$$

Number of faces $= 12$.

7. Let number of vertices $(V) = x$

Number of faces $(F) = 40$

Number of edges $(E) = 60$

$\Rightarrow$ $V + F - E = 2$

As $x + 40 - 60 = 2$

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

$x = 62 - 40 = 22$

Number of vertices $= 22$.

Multiple Choice Questions

Tick (✓) the correct option :

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

Chapter

15 Area of Rectilinear Figures

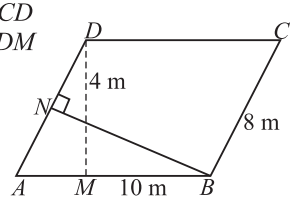
Exercise 15.1

1. Since $AB \parallel DC$

We know that area of parallelogram $ABCD$

$= \text{base} \times \text{height} = AB \times DM$

$= 10 \times 4\ \text{m}^2 = 40\ \text{m}^2$



Also, area of parallelogram $= 40\ \text{m}^2$

$BN \times BC = 40$

$\Rightarrow \quad 8 \times BN = 40$

$\Rightarrow \quad BN = \dfrac{40}{8} = 5\ \text{m}$

Required distance between longer sides is 5 cm.

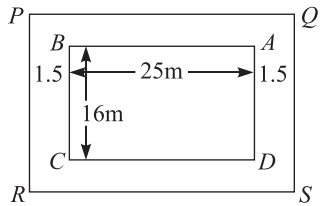
2. Area of $ABCD$ plot

Length of $ABCD = 25\ \text{m}$

Breadth of $ABCE = 16\ \text{m}$

Area of $ABCD = 25 \times 16\ \text{m}$

$= 400\ \text{m}^2$



Area of $PQRS$

Length of $PQRS = 25 + (1.5 \times 2)\ \text{m} = 28\ \text{m}$

Breadth of $PQRS = 16 + (1.5 \times 2)\ \text{m} = 19\ \text{m}$

Area of $PQRS = 28 \times 19\ \text{m}^2 = 532\ \text{m}^2$

Area of foot path $= \text{Area of } PQRS - \text{Area of } ABCD$

$= 532\ \text{m}^2 - 400\ \text{m}^2 = 132\ \text{m}^2$

Side of square tiles $= 20\ \text{cm}$ or $0.2\ \text{m}$

Area of square tiles $= 0.2\ \text{m} \times 0.2\ \text{m} = 0.04\ \text{m}^2$

Number of required tiles $= \dfrac{132}{0.04} = 3300.$

3. Ratio of side of both the squares $= 4 : 5$

Let length of first square $= 4x\ \text{cm}$

Area of first square $= 4x \times 4x = 16x^2\ \text{cm}^2$

Length of second square $= 5x\ \text{cm}$

Area of second square $= 25x^2$ cm^2

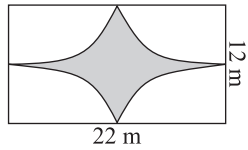
Ratio of both squares $= 16x^2 : 25x^2 = 16 : 25.$

4. Length of rectangular field $= 22$ m

Breadth of rectangular field $= 12$ m

Area of rectangular field $= 22 \times 12$ m^2

$= 264$ m^2



4 quadrants circles = one circle

radius $= 2.5$ m

Area of circle $= \pi r^2 = \frac{22}{7} \times 2.5 \times 2.5 = \frac{137.5}{7}$

Area of shaded part $= 264 + \frac{1375}{70}$

$= \frac{18480 + 1375}{70} = \frac{19855}{70}$ or $\frac{3971}{14}$ m^2

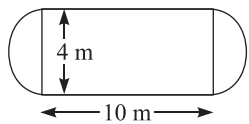
$= 283\frac{9}{14}$ m^2

5. Area of rectangle;

length $= 10$ m, breadth $= 4$ m

Area of rectangle = length × breadth

$= 10 \times 4$ m^2 $= 40$ m^2



Area of semicircular;

Diameter of circular end $= 4$ m

Radius of circular ends $(r) = 4 \times \frac{1}{2} = 2$ m

Area of first semicircular ends $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 2 \times 2 = \frac{44}{7}$ cm^2

Area of second semicircular $= \frac{1}{2} \times \frac{22}{7} \times \frac{2}{1} \times 2 = \frac{44}{7}$ cm^2

Area of figure

= Area of rectangular part + Area of semicircular part

$= 40$ m$^2 + \frac{44}{7}$ cm$^2 + \frac{44}{7}$ m^2

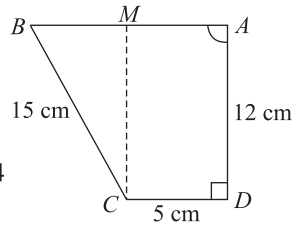
$\therefore \quad \frac{280 + 44 + 44}{7}$ m$^2 = \frac{368}{7}$ m^2 or $52\frac{4}{7}$ m^2 or 52.57 m^2.

6. In the given figure $ABCD$ is quadrilateral in which $AB \parallel DC$, $DC = 5\,\text{cm}$, $AB = 14\,\text{cm}$, $CB = 15\,\text{cm}$ and $DA \perp AB$.

Let $CM \perp AB$

$MB = AB - AM = AB - DC$

$= 14 - 5 = 9$



Now in ΔCMB

$CM^2 = CB^2 - MB^2$

$= 15^2 - 9^2 = 225 - 81 = 144$

$CM = \sqrt{144} = 12\,\text{cm}$

Now, Area of quadrilateral

Area of rectangle $AMCD$ and Area of triangle BMC

$$= 12 \times 5\,\text{cm}^2 + \frac{1}{2} \times 12 \times 9\,\text{cm}^2$$

$60\,\text{cm}^2 + 54\,\text{cm}^2 = 114\,\text{cm}^2$.

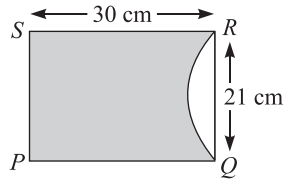
7. In Rectangle $PQRS$

$PQ = 30\,\text{cm}, QR = 21\,\text{cm}$

Area of rectangle = length × breadth

$= 30 \times 21\,\text{cm}^2$

$= 630\,\text{cm}^2$



Diameter of semi circular end $= 21\,\text{cm}$

radius semi circular $= \frac{21}{2} = 10.5$

Area of semi circular $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 10.5 \times 10.5 = 173.25\,\text{cm}^2$

The area of remaining part

= Area of rectangle $PQRS$ − Area of semi circular

$= (630 - 173.25)\,\text{cm}^2 = 456.75\,\text{cm}^2$

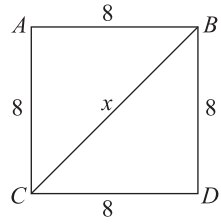
Thus, Area of remaining part is $456.75\,\text{cm}^2$.

8. Side of a square $= 8\,\text{cm}$

Diagonal of a square $= \sqrt{2} \times$ side

$= \sqrt{2} \times 8\,\text{cm}$

$= 8\sqrt{2}\,\text{cm}$ or 11.31 cm.



9. Let old length of a rectangular field $= x$ cm

Area of rectangular field $= x \times y = xy\ \text{cm}^2$

New length of rectangular field $= x + x \times \frac{50}{100} = \frac{3x}{2}$ cm

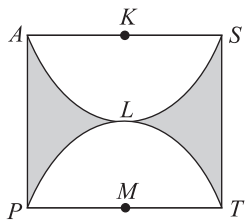
breadth of rectangular field $= y - y \times \frac{50}{100} = \frac{y}{2}$ cm

Area of new rectangular field $= \frac{3x}{2} \times \frac{y}{2} = \frac{3xy}{4}\ \text{cm}^2$

Difference $= xy - \frac{3xy}{4}\ \text{cm}^2 = \frac{4xy - 3xy}{4}\ \text{cm}^2 = \frac{xy}{4}\ \text{cm}^2$

Area decrease $= \frac{xy \times 100}{4 \times xy} = 25\%.$

10. *PAST* is a square



In *PAST*; side $= 14$ cm

Area of square $= (\text{side})^2$

$= 14\ \text{cm} \times 14\ \text{cm} = 196\ \text{cm}^2$

ALS and *PLT* are semi circles.

Area of *ALS*;

Diameter of circular $= 14$ cm

$$\text{radius} = \frac{14}{2} = 7\ \text{cm}$$

Area of semi circle $= \frac{1}{2}\pi r^2$

$$= \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 = 77\ \text{cm}^2$$

Area of semicircle $PLT = 77\ \text{cm}^2$

Area of shaded region = Area of square – Area of semicircle

$= 196 - 77 \times 2\ \text{cm}^2$

$= 196 - 154\ \text{cm}^2 = 42\ \text{cm}^2$

Exercise 15.2

1. Length of canal the bottom $= 8$ m

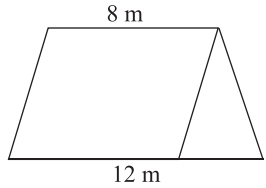
Length of canal at the top $= 12$ m

Let the depth between them $= x$ cm

Area of trapezium

$= \frac{1}{2}$ (sum of length of parallel sides

distance between them)

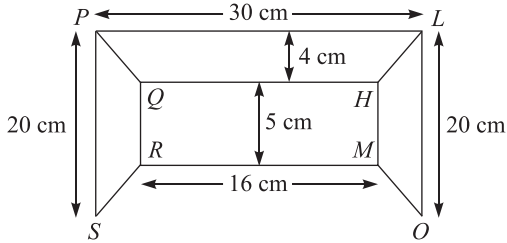


$84 = \frac{1}{2}(8+12) \times x \quad \Rightarrow \quad 84 = \frac{20}{2}x$

$84 = 10x \quad \Rightarrow \quad x = 8.4$ cm

2. In this figure,

PQRS is trapezium, *PQLH* and *LHMO* is are trapezium and *MNQR* is rectangle.



Area of trapezium $= \frac{1}{2}$ (Sum of parallel side) $\times$ distance

Area of $PQLH = \frac{1}{2} \times (30+16) \times 4 = \frac{1}{2} \times 46 \times 4 = 92\,\text{cm}^2$

Area of $PQRS = \frac{1}{2}(20+5) \times \frac{(30-16)}{2}$

$= \frac{1}{2} \times 25 \times \frac{14}{2} = 87.5$

Area of $LHMO = \frac{1}{2}(20+5) \times \frac{(30-16)}{2} = 87.5\ \text{cm}^2$

Area of $QRMH = l \times b = 5 \times 16 = 80\,\text{cm}^2$

Area of given figure $= (92 + 87.5 + 87.5 + 80)\,\text{cm}^2 = 347\,\text{cm}^2$.

3. Find the area of the trapezium whose :

(a) Bases $= 15$ cm and 20 cm; altitude $= 8$ cm

Area of trapezium

$= \frac{1}{2}$ (sum of lengths of parallel sides) $\times$ altitude

$$\text{Area of trapezium} = \frac{1}{2}(15+20)\times 8$$

$$= \frac{1}{2}\times 35\times 8 = 140\,\text{cm}^2$$

(b) Bases = 10 cm and 12 cm; altitude = 5 cm

Area of trapezium

$$= \frac{1}{2}(\text{Sum of lengths of parallel sides}) \times \text{altitude.}$$

$$\text{Area of trapezium} = \frac{1}{2}(10+12)\times 5 = \frac{1}{2}\times 22\times 5 = 55\,\text{cm}^2.$$

4. Ratio of parallel side of trapezium = 3 : 5

Let one side is $3x$ cm

Other side is $5x$ cm

Distance between them = 12 cm

Area of the trapezium = $720\,\text{cm}^2$

We know that,

Area of trapezium

$$= \frac{1}{2}(\text{sum of parallel sides}) \times \text{Distance between them}$$

$$720 = \frac{1}{2}(3x+5x)\times 12 \quad \Rightarrow \quad 720 = 8x\times 6$$

$$720 = 48x \quad \Rightarrow \quad x = \frac{720}{48} = 15$$

Now parallel sides of trapezium =

one side $= 3\times 15 = 45$ cm

and other side $= 5\times 15 = 75$ cm.

5. Parallel sides = 1.5 m and 2 m

perpendicular distance = 1.2 cm

$$\text{Area of trapezium} = \frac{1}{2}(\text{sum of parallel sides} + \text{Distance})$$

$$= \frac{1}{2}(1.5+2)\times 1.2 = 2.1\ \text{m}^2.$$

6. Parallel side = 100 m and 150 m

Distance between them = 125 m

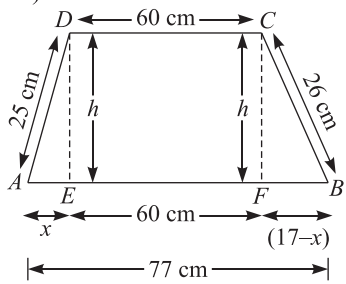
Area of trapezium

$$= \frac{1}{2}(\text{sum of parallel side distance between them})$$

$$= \frac{1}{2}(100+150)\times 125 = \frac{1}{2}\times 250\times 125 = 15625\,\text{m}^2.$$

7. Let $DE = CF = h$ (Because $AB \,||\, DC$)

and $AE = x$ cm, $FB = (17-x)$ cm



In ΔAED,

$AD^2 = AE^2 + DE^2$

(Pythagoras theorem)

$25^2 = x^2 + h^2$

$x^2 + h^2 = 625$ …(i)

Similarly,

In ΔBFC,

$$BC^2 = CF^2 + FB^2$$

$$26^2 = h^2 + (17-x)^2$$

$$676 = h^2 + 289 + x^2 - 34x$$

$$676 - 289 = x^2 + h^2 - 34x$$

$$387 = x^2 + h^2 - 34x$$

$$34x = 625 - 387 \qquad \text{(From equation (i))}$$

$$34x = 238 \Rightarrow x = 7\,\text{cm}$$

putting the value of x in equation (i), we get

$$7^2 + h^2 = 625 \quad \Rightarrow \quad h^2 = 625 - 49$$

$$h^2 = 576 \quad \Rightarrow \quad h = 24\,\text{cm}$$

So, the area of a trapezium $= \frac{1}{2}\times h \times$ (sum of parallel side)

$$= \frac{1}{2}\times 24\times (77+60)\,\text{cm}^2$$

$$= 12\times 137\,\text{cm}^2 = 1644\,\text{cm}^2.$$

8. The area of a trapezium $= 105\,\text{cm}^2$

One of the parallel sides $= 28$ cm

Distance the parallel sides $= 5$ cm

Let, length of the other parallel side $= x$ cm

Area of a trapezium

$= \frac{1}{2}$ (sum of length of parallel sides) × Distance between then

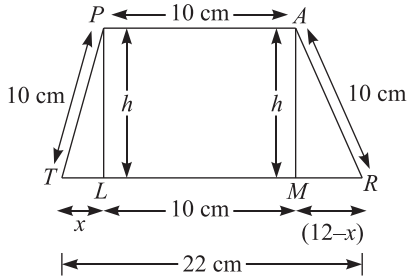
$105 = \frac{1}{2}(28 + x) \times 5 \text{ cm} \quad \Rightarrow \quad 105 \times 2 = 140 + 5x$

$210 = 140 + 5x \quad \Rightarrow \quad 210 - 140 = 5x$

$x = \frac{70}{5} = 14 \text{ cm}.$

Thus, other parallel sides = 14 cm.

9. Let $PART$ be the given trapezium in which
$RT = 25 \text{ cm}, PA = 13 \text{ cm} = LM, PT = RA = 10 \text{ cm}$



Let TL be x cm and the height of the trapezium be h cm.
From the figure,

$$MR = 22 - (LM + TL) = 22 - 10 - x = 12 - x$$

In ΔPTL

$$PL^2 = PT^2 - TL^3 \quad \Rightarrow \quad h^2 = 10^2 - x^2$$

$$h^2 = 100 - x^2 \qquad \ldots(i)$$

In ΔAMR

$$AM^2 = AR^2 - AM^2$$

$$h^2 = 10^2 - (12 - x)^2$$

$$= 100 - (144 - 24x + x^2)$$

$$= 100 - 144 + 24x - x^2$$

$$h^2 = 24x - x^2 - 44 \qquad \ldots(ii)$$

Form (i) and (ii), we have

$$24x - x^2 - 44 = 100 - x^2 \quad \Rightarrow \quad 24x - x^2 + x^2 = 100 + 44$$

$$24x = 144 \quad \Rightarrow \quad x = \frac{144}{24} = 6\,\text{cm}$$

Substituting the value of x in (i) we get

$$h^2 = 100 - 6^2 = 100 - 36 = 64$$

$$h = \sqrt{64} = 8 \quad \Rightarrow \quad h = 8\,\text{cm}$$

Now, Area of trapezium $= \frac{1}{2} \times$ height $\times$ sum of parallel side

$$= \frac{1}{2} \times 8 \times (22 + 10)\,\text{cm}^2$$

$$= 4 \times 32\,\text{cm}^2 = 128\,\text{cm}^2.$$

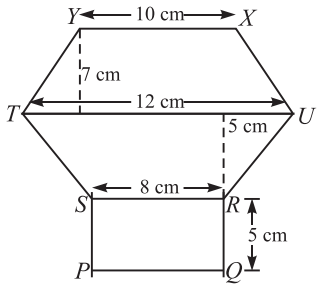
10. In the figure, *YXTU* is trapezium

Area of trapezium

$$= \frac{1}{2}(\text{sum of parallel side}) \times \text{Distance between then}$$

$$= \frac{1}{2}(10 + 12) \times 7$$

$$= \frac{1}{2} \times 22 \times 7 = 77\,\text{cm}^2$$



Second trapezium is *TUSR*

Area $= \frac{1}{2}(12 + 8) \times 5$

$$= \frac{1}{2} \times 20 \times 5 = 50\,\text{cm}^2$$

PQRS is a rectangle

Area of rectangle $=$ length $\times$ breadth $= 8 \times 5\,\text{cm}^2 = 40\,\text{cm}^2$

Now Area of given fiver *YXURQPSTV* $= 77 + 50 + 40\,\text{cm}^2$

$$= 167\,\text{cm}^2.$$

Exercise 15.3

1. In quadrilaterals *PQRS*

Diagonals $QS = 18\,\text{cm}$;

Sum of off sets $= 15\,\text{cm}$

Area of quadrilateral $PQRS = \frac{1}{2}$ Diagonal × sum of off sets

$$= \frac{1}{2} \times 18 \times 15 = 135 \text{ cm}^2.$$

2. Find the are of given quadrilaterals.

(a) Area of quadrilaterals $= \frac{1}{2}$ (sum of parallel sides) × Distance

Area of quadrilaterals $= \frac{1}{2}(11+15) \times 4 = 52 \text{ cm}^2$

(b) Area of quadrilaterals $= \frac{1}{2}$ (sum of parallel sides) × distance

Area of quadrilaterals $= \frac{1}{2}(0.6 + 2) \times 2 = 2.6 \text{ cm}^2$

(c) Area of quadrilateral $= \frac{1}{2}$ (sum of off sets) diagonal

Area a of quadrilateral $= \frac{1}{2}(3+4) \times 8 = 28 \text{ cm}^2$

(d) Area of quadrilaterals $= \frac{1}{2}$ Sum of off sets × diagonal

Area of a quadrilaterals $= \frac{1}{2}(4.5 + 2.5) \times 9 = 31.5 \text{ cm}^2$.

3. Area of rhombus $= 216 \text{ cm}^2$

Length of one diagonal $= 18$ cm

Length of other diagonal $= x$

Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$$216 = \frac{1}{2} \times 18 \times x = \frac{216 \times 2}{18} = x$$

$\Rightarrow \quad x = 24$

Length of other diagonal is 24 cm.

4. Area of triangle $= \frac{1}{2} \times$ base × height

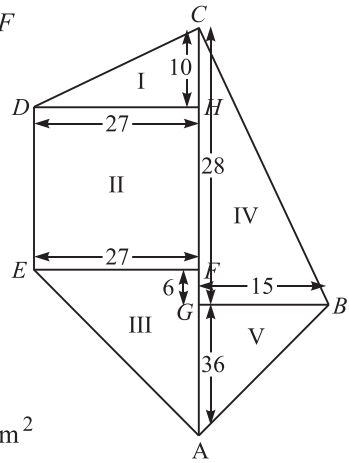
Area of I triangle $DCE = \frac{1}{2} \times CE \times DE$

Area of $\Delta DCE = \frac{1}{2} \times 10 \times 27 = 135\,\text{cm}^2$

Area II rectangle $DEFG$ = length × breadth

Area of $\square DGEF = DH \times HF = 27 \times (28 - 10 - 6) = 27 \times 12 = 324\,\text{m}^2$

Area II triangle $\Delta EFG = \frac{1}{2} FA \times EF$



Area of $\Delta EFG = \frac{1}{2}(6 + 36) \times 27$

$= 567\,\text{m}^2$

Area of $\Delta CGB = \frac{1}{2} CG \times GB$

$= \frac{1}{2} \times 28 \times 15$

$= 210\,\text{m}^2$

Area of $\Delta AGB = \frac{1}{2} \times GA \times GB$

$= \frac{1}{2} \times 15 \times 36 = 270\,\text{m}^2$

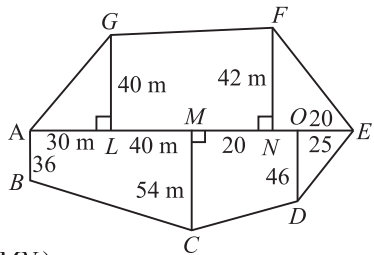
Area of field $\Delta ABCDE$ = Sum of Area of

$\Delta CDH + \square DBFH + \Delta EFA + \Delta AGB + \Delta BFC$

$= 135 + 210 + 270 + 567 + 324\,\text{cm}^2$

$= 1506\,\text{m}^2$.

5. Area of the field $ABCDEFG$



Area of $\Delta AGL = \frac{1}{2} \times GL \times AL$

$= \frac{1}{2} \times 40 \times 30$

$= 600\,\text{m}^2$

Area of $GFLN$ trapezium

$= \frac{1}{2}(GF + LN)(LM + MN)$

$= \frac{1}{2}(40 + 42)(40 + 20) = \frac{1}{2} 82 \times 60 = 2460\,\text{m}^2$

Area of $\Delta FNE = \frac{1}{2} FO \times NE = \frac{1}{2} \times 42 \times (20+25) = 945\,\text{m}^2$

Area of $\Delta OED = \frac{1}{2} \times OE \times ND = \frac{1}{2} \times 25 \times 46 = 575\,\text{m}^2$

Area of trapezium $MOCD = \frac{1}{2}(MC + OD) \times (MN + ON)$

$= \frac{1}{2}(54+46) \times (20+20) = 2000\,\text{m}^2$

Area of trapezium $AMBC = \frac{1}{2}(AB + MC)(AL + LM)$

$= \frac{1}{2}(36+54)(30+40)$

$= \frac{1}{2} \times 90 \times 70 = 3150\,\text{m}^2$

Area of field $ABCDEG$

$= (600 + 2460 + 945 + 2000 + 575 + 3150)\,\text{m}^2$

$= 9730\,\text{m}^2$.

6. In $ABCD$; AC is diagonal 48 cm

off set $= DP = 17.5$ cm and $BQ = 12$ cm

Area of quadrilateral $ABCD = \frac{1}{2} \times AC\,(DP + BQ)$

$= \frac{1}{2} \times 48 \times (17.5 + 12)$

$= 708\,\text{cm}^2$.

7. Diagonals of rhombus $= 18$ cm and 30 cm

Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 18 \times 30 = 270\,\text{cm}^2$.

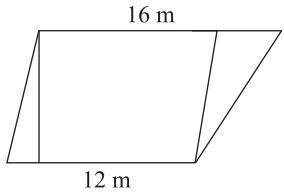
8. Area of cross section $112\,\text{m}^2$

Length of top $= 16$ m

Length of bottom $= 12$ m

$h = ?$

Let distance between them $= x$



$$\text{Area} = \frac{1}{2} \times \text{sum of parallel side} \times \text{distance}$$

$$112 = \frac{1}{2}(16+12) \times x \Rightarrow 112 = \frac{28}{2} \times x$$

$$112 = 14x \Rightarrow x = \frac{112}{4} = 8\,\text{cm}$$

The depth of the pool is 8 cm.

9. Side of a regular hexagon $= 10\,\text{m}$

$$\text{Area of regular hexagon} = \frac{3\sqrt{3}a^2}{2}$$

$$= \frac{3\sqrt{3} \times 10 \times 10}{2}$$

$$= 150\sqrt{3}\,\text{m}^2$$

$$= 150 \times 1.732\,\text{m}^2$$

$$= 259.807\,\text{m}^2.$$

10. Length of one diagonal $= 20\,\text{cm}$ or $0.2\,\text{m}$

Length of other diagonal $= 28\,\text{cm}$ or $0.28\,\text{m}$

$$\text{Area of diagonal} = \frac{1}{2} \times d_1 \times d_2$$

$$= \frac{1}{2} \times 0.2 \times 0.28$$

$$= 0.028\,\text{m}^2$$

$$\text{Number of tiles} = 2550$$

$$\text{Area of total tiles} = 2550 \times 0.0280$$

$$= 71.4\,\text{cm}^2 \text{ or } 71.4\,\text{m}^2$$

$$\text{Cot of polishing} = ₹\ 25 \text{ per m}^2$$

$$\text{Cost of total area polishing} = ₹\ 71.4 \times 25$$

$$= ₹\ 1785.$$

Multiple Choice Questions

Tick (✓) the correct answer :

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

Chapter

16 Surface Area and Volume

Exercise 16.1

1. Length of a class room = 7 m

Breadth of a class room = 6 m

Height of class room = 4 m

Area of roof $= l \times b = 7 \times 6 = 42\,\text{m}^2$

Area of 4 walls $= 2(l + b) \times h$

$= 2(7 + 6) \times 4$

$= 2 \times 13 \times 4 = 104\,\text{m}^2$

Total area of roof and walls $= (42 + 104)\,\text{m}^2 = 146\,\text{m}^2$

Area of doors and windows $= 7\,\text{m}^2$

Remaining area $= 146 - 7\,\text{m}^2 = 139\,\text{m}^2$

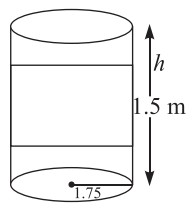
Cost of white washing $= ₹\ 139 \times 15\,\text{m}^2 = ₹\ 2085.$

2. Area of cylindrical pillar whose height = 7.5 m

Height $= 7.5 - (0.25 \times 2) = 7\,\text{m}$

Diameter = 3.5 m

Radius = 1.75 m



Surface area of cylindrical pillar $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 1.75 \times 7 = 77\,\text{m}^2.$

3. length of a room = 150 m, breadth of a room = 25 m,

height of a room = 6 m

Area of a roof $= l \times b = 150 \times 25 = 3750\,\text{m}^2$

Area of the four walls of a room $= 2(l + b) \times h = 2(150 + 25) \times 6$

$= 2 \times 175 \times 6 = 2100\,\text{m}^2$

Area of roof and walls $= 3750 + 2100\,\text{m}^2 = 5850\,\text{m}^2$

Cost paint roof and walls $= ₹\ 5850 \times 20 = ₹\ 117000$

Area of flour $= l \times b = 150 \times 25 = 3750\,\text{m}^2$

Cost of polishing floor $= ₹\ 3750 \times 40 = ₹\ 150000.$

4. Length of a chocolate box = 50 cm or 0.5 m
Breadth of a chocolate box = 35 cm or 0.35
Height of a chocolate box = 10 cm or 0.1 m
Surface area of chocolate box

$$= 2(lb + bh + hl)$$
$$= 2(0.5 \times 0.35 + 0.35 \times 0.1 + 0.1 \times 0.5)$$
$$= 2 \times (0.175 + 0.035 + 0.05)$$
$$= 2 \times 0.26 = 0.52 \text{ m}^2$$

Number of boxes = 60
Required wrapping material $= 60 \times 0.52 = 31.2 \text{ m}^2$.

5. Height of a cylindrical tank = 8 m
radius of a cylindrical tank = 3.5 m
Area of required material sheet $(2\pi r^2 + h\ (2\pi r))$

$$= 2 \times \frac{22}{7} \times (3.5)^2 + 8\left(2 \times \frac{22}{7} \times 3.5\right)$$
$$= 2 \times \frac{22}{7} \times 12.25 + 8 \times 44 \times 0.5 = \frac{539}{7} + 176$$
$$= 77 + 176 \text{ m}^2 = 253 \text{ m}^2$$

Cost of required material sheet = ₹ (253×130) = ₹ 32890.

6. (i) figure is cylinder and (ii) figure is cube.
Area of cylinder $= 2\pi rh = 2 \times \frac{22}{7} \times \frac{9}{2} \times 9 \text{ m}^2 = 254.54 \text{ m}^2$
Area of surface area of cube $= 4 \times \text{side}^2$

$$= 4 \times 9^2 = 4 \times 81 = 324 \text{ m}^2$$

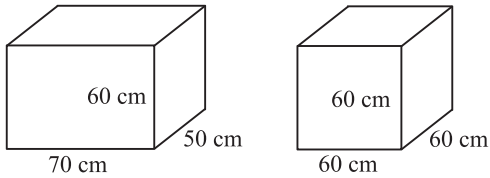
No, the lateral surface areas not same.

7. Diameter of a circular well = 3.5 m; radius $= \frac{3.5}{2} = 1.75$ m
Depth of the well $(h) = 15$ m
Area of circular well $= 2\pi rh = 2 \times \frac{22}{7} \times 1.75 \times 15 \text{ m}^2 = 165 \text{ m}^2$
Cost of plastering inner curved surface = ₹ 165×25 = ₹ 4125.

8. Surface area of first box $= 2(lb + bh + hl)$

$$= 2(70 \times 50 + 50 \times 60 + 60 \times 70)$$

$$= 2(3500 + 3000 + 4200)$$
$$= 2 \times 10700 = 21400\,\text{cm}^2$$



Surface are of a second box $= 6 \times \text{side}^2 = 6 \times (60)^2$

$$= 6 \times 3600 = 21600\,\text{cm}^2$$

Thus, cube required more materials to make 60 cm of side.

9. Dimensions of a cuboidal box $= 8m \times 7.5\text{ m} \times 6\text{ m}$

$$l = 8\,\text{m},\ b = 7.5\text{ m},\ h = 6\,\text{m}$$

Total surface area $= 2(lb + bh + lh)$

$$= 2(8 \times 7.5 + 7.5 \times 6 + 8 \times 6)\,\text{m}^2$$
$$= 2 \times (60 + 45 + 48)\,\text{m}^2$$
$$= 2 \times 153\,\text{m}^2 = 306\,\text{m}^2$$

Area of bottom of the box $= 8 \times 7.5 = 60\,\text{m}^2$

He painted the box $= (306 - 60)\,\text{m}^2 = 246\,\text{m}^2$.

10. Total surface area $= 3750\,\text{m}^2$

We know that; total surface area of a cube $= 6l^2$

$$3750 = 6l^2 \quad \Rightarrow \quad l^2 = \frac{3750}{6}$$

$$l^2 = 625 \quad \Rightarrow \quad l = 25$$

Thus, side of a cube is 25 m.

11. Diameter of the cylindrical wheel of road roller

$$= 98\,\text{cm or } 0.98\text{ m}$$

$$\text{Radius} = (0.98 \div 2) = 0.49\text{ m}$$

Length of the cylindrical wheel of road roller $= 1.25$ m

Surface area of wheel of road roller $= 2\pi r h$

$$= 2 \times \frac{22}{7} \times 0.49 \times 1.25 = 3.85\,\text{m}^2$$

Number of revolutions to more one to level of a road = 900

The area of road $= 3.85 \times 900\ \text{m}^2 = 3465\ \text{m}^2$.

12. Length of rectangular hall = 30 m

breadth of rectangular hall = 25 m

Height of rectangular hall = 18 m

Surface area of rectangular hall $= 2(lb + bh + lh)$

$2(30 \times 25 + 25 \times 18 + 18 \times 30)\ \text{m}^2$

$2 \times (750 + 450 + 540)\ \text{m}^2$

$\Rightarrow \quad 2 \times 1740\ \text{m}^2 = 3480\ \text{m}^2$

Cost of painting outer surface $= 3480 \times 12 =$ ₹ 41760.

Exercise 16.2

1. Find the volume of a cuboid of dimensions :

(a) $l = 30$ cm, $b = 15$ cm and $h = 12$ cm

Volume $= l \times b \times h$

Volume $= 30 \times 15 \times 12\ \text{cm}^3 = 5400\ \text{cm}^3$

(b) $l = 1.5$ cm, $b = 95$ cm or 0.95 m and $h = 0.5$ cm or 0.05

Volume $= l \times b \times h$

Volume $= 0.95 \times 0.5 \times 1.5 = 0.007125\ \text{m}^3$.

2. Find the total surface area curved surface area and volume of a cylinder of dimension.

(a) $r = 7$ cm and $h = 40$ cm

The total surface area $= 2\pi r(h + r)$

Total surface area $= 2 \times \frac{22}{7} \times 7(40 + 7) = 2068\ \text{cm}^2$

Curved surface area $= 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 40\ \text{cm}^2 = 1760\ \text{cm}^2$

Volume of cylinder $= \pi r^2 h = \frac{22}{7} \times (7)^2 \times 40$

$= \frac{22}{7} \times 7 \times 7 \times 40 = 6160\ \text{cm}^3$.

(b) $r = 2.8$ m and $h = 1.5$ m

The total surface area $= 2\pi r(h + r)$

$$= 2 \times \frac{22}{7} \times 2.8\ (2.8 + 1.5)$$

$$= 2 \times 22 \times 0.4 \times 4.3 = 75.68\ \text{cm}^2$$

$$\text{Curved surface area} = 2\pi rh = 2 \times \frac{22}{7} \times 2.8 \times 1.5$$

$$= 2 \times 22 \times 0.4 \times 1.5 = 26.4\ \text{cm}^2$$

$$\text{Volume of cylinder} = \pi r^2 h = \frac{22}{7} \times (2.8)^2 \times 1.5$$

$$= \frac{22}{7} \times 2.8 \times 2.8 \times 1.5$$

$$= 36.96\ \text{cm}^3.$$

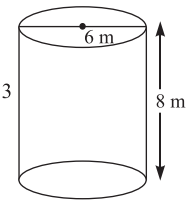
3. Radius of each coin $= 0.75$ cm

Thickness of coin $(h) = 0.2$ cm

$$\text{Volume of each coin} = \pi r^2 h$$

$$= \frac{22}{7} \times 0.75 \times 0.75 \times 0.2\ \text{cm}^3$$

$$= 0.3536\ \text{cm}^3$$



$$\text{Height of cylinder} = 8\ \text{cm}$$

$$\text{Diameter of base} = 6\ \text{cm}$$

$$\text{Radius} = 3\ \text{cm}$$

$$\text{Volume of cylinder} = \pi r^2 h = \frac{22}{7} \times 3 \times 3 \times 8$$

$$= 226.29\ \text{cm}^3 \text{ or } 226.30$$

$$\text{Number of coins required} = \frac{226.29}{0.3536} = 639.96 \text{ or } 640 \text{ coins.}$$

4. Height of cylinder $= 22$ cm

Circumference of cylinder $= 44$ cm

$$2\pi r = 44$$

$$2 \times \frac{22}{7} \times r = 44 \quad \Rightarrow \quad r = \frac{44 \times 7}{44} = 7\ \text{cm}$$

$$\text{Volume} = \pi r^2 h$$

$$= \frac{22}{7} (7)^2 \times 22$$

$$= \frac{22}{7} \times 7 \times 7 \times 22 = 3388\,\text{cm}^3$$

$$\text{Total surface area} = 2\pi r(h + r) = 2 \times \frac{22}{7} \times 7(22 + 7)$$

$$= 2 \times 22 \times 29$$

$$= 44 \times (29) = 1276\,\text{cm}^2.$$

5. Volume of well $= 594\ \text{m}^3$; Diameter of well $= 6\,\text{m}$
Radius of well $(r) = 3\,\text{m}$; Depth of well $(h) = x$
Volume of well $= \pi r^2 h$

$$594 = \frac{22}{7} \times 3 \times 3 \times h \quad \Rightarrow \quad 594 = \frac{198}{7} \times h$$

$$h = \frac{594 \times 7}{198} = 21$$

Depth of well is 21 cm.

6. Clocks size $= 5\,\text{cm} \times 10\ \text{cm} \times 10\ \text{cm}$
Volume of clock $= 0.05 \times 0.1 \times 0.1\ \text{m}^3 = 0.0005\ \text{m}^3$

$$\text{volume of box} = 1\,\text{m} \times \frac{1}{2}m \times \frac{3}{4}m = \frac{3}{8} = 0.375\ \text{m}^3$$

$$\text{Number of clock put in box} = \frac{0.375}{0.0005} = 750\,\text{clock}.$$

7. Side of one cube $= 6\,\text{cm}$
Volume of cube $= (\text{side})^3 = 6 \times 6 \times 6\,\text{cm}^3 = 216\,\text{cm}^3$
Number of cubes $= 6$
Volume of New solid $= 6 \times 216\,\text{cm}^3$

$$= 1296\,\text{cm}^3.$$

8. Find the volume of a cube of.

(a) Side $= 15\,\text{cm}$
Volume of a cube $= (\text{side})^3 = 15 \times 15 \times 15\,\text{cm}^3$

$$= 3375\,\text{cm}^3.$$

(b) Side $= 9.5\,\text{m}$
Volume of cube $= (\text{side})^3 = 9.5 \times 9.5 \times 9.5\ \text{cm}^3$

$$= 857.375\ \text{cm}^3.$$

9. Dimensions of a water tank $= 10\,\text{m} \times 7.5\,\text{m} \times 4\,\text{m}$

Volume of a water tank $= l \times b \times h = 10 \times 7.5 \times 4\,\text{m}^3$

$= 300\,\text{m}^3$

Convert into $l = 300 \times 1000 = 300000\,l$

rate of fill the tank $= 400\,l$ per min

$$\text{Time} = \frac{300000}{400}$$

$= 750$ min or 12 hrs $\frac{1}{2}$ min or $12\frac{1}{2}$ hrs.

10. Volume of external cuboid box $= 36 \times 25 \times 16.5\,\text{cm}^3$

$= 14850\,\text{cm}^3$

length of internal box $= 36 - 1.5 \times 2 = 33\,\text{cm}$

breadth of internal box $= 25 - 1.5 \times 2 = 22\,\text{cm}$

height of internal box $= 16.5 - 1.5 = 15\,\text{cm}$

Volume $= 33 \times 22 = 15\,\text{cm}^3$

$= 10890\,\text{cm}^3$

Volume of aluminium required $= 14850\,\text{cm}^3 - 10890\,\text{cm}^3$

$= 3960\,\text{cm}^3$

So, weight of aluminium $= 3960 \times 4.5$ g

$= 17820$ g

$= 17.820$ kg.

11. Volume of hall $= l \times b \times h = 150 \times 85 \times 12\,\text{m}^3 = 153000\,\text{m}^3$

Number of people can sit in the hall $= 153000 \div 50 = 3060$.

12. Water flows out of a pie in 1 sec $= 30\,\text{cm}$

Area of cross section the tap $= 5\,\text{cm}^2$

Water flows out in 1 hrs $= 30 \times 5 \times 3600$

$= 540000\,\text{cm}^3$ $\quad (\because 1000\text{ cm} = 1L)$

$$\frac{540000}{1000} = 540\,\text{L}.$$

13. Diameter of well $= 7$ m; radius of well $= 7 \div 2 = 3.5$ m

Height of well $= 20$ m

Volume of well $= \pi r^2 h = \frac{22}{7} \times (3.5)^2 \times 20$

$= \frac{22}{7} \times 3.5 \times 3.5 \times 20$

$= 22 \times 0.5 \times 3.5 \times 20 = 770\,\text{m}^3$

Length of rectangular plot $= 14$ m

Breadth of rectangular plot $= 11$ m

Let height of rectangular plot $= x$ m

volume $= l \times b \times h \quad \Rightarrow \quad 770 = 14 \times 11 \times x$

$x = \frac{770}{14 \times 11} = 5$ m.

14. Length of first cube $= 18$ cm

Volume of first cube $= 18 \times 18 \times 18\,\text{cm}^3$

$= 5832\,\text{cm}^3$

Length of second cube $= 24$ cm

Volume of second cube $= 24 \times 24 \times 24\,\text{cm}^3$

$= 13824\,\text{cm}^3$

Length of third cube $= 30$ cm

Volume of third cube $= 30 \times 30 \times 30\,\text{cm}^3$

$= 27000\,\text{cm}^3$

Sum of volume $= 5832 + 13824 + 27000\,\text{cm}^3$

$= 46656\,\text{cm}^3$

Side of cube $= \sqrt[3]{\text{Volume}}$

$= \sqrt[3]{46656} = 36$ cm.

15. Let length of cube II $= x$ cm; cube I $= 2x$ cm

volume of cube II $= x^3$ cm^3

volume of cube I $= 8x^3$ cm^2

Ratio of volume cube I to cube II $= \frac{8x^3}{x^3} = 8 : 1.$

Multiple Choice Questions

Tick (✓) the correct answer :

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

BRAIN BOOSTER

1. Dimensions of cuboid $= a \times b \times c \ (l = a, b = b, c = h)$

volume $= a \times b \times c = abc$ ^{3}

$$\frac{1}{V} = \frac{2}{S}\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right) \qquad V = l \times b \times h;$$

$$S = 2(lb + bh + lh)$$

$$\frac{1}{V} = \frac{2}{S}\left(\frac{bc + ac + ba}{abc}\right)$$

$$= \frac{2(bc + ac + ba)}{S \times abc}$$

$$= \frac{2(bc + ac + ba)}{2(bc + ac + ca) \times abc}$$

$$= \frac{1}{abc} = \frac{1}{V}.$$

2. Dimensions of Box I $= 4\text{ cm} \times 9\text{ cm} \times 15\text{ cm} = 540\text{ cm}^3$

Dimensions of Box II $= 6\text{ cm} \times 6\text{ cm} \times 11.25\text{ cm} = 405\text{ cm}^3$

Box I is more for economical because more chocolates put in it.

Note

Note