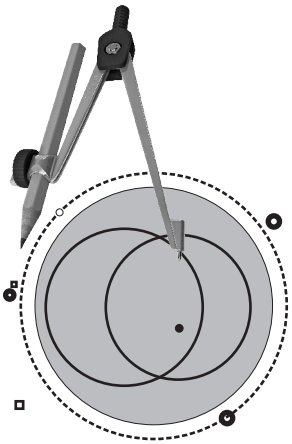
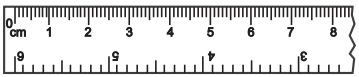
Progress With Maths

Teachers Manual





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1. Rational Numbers

Exercise 1.1

1. (a) $\frac{15}{9}+\frac{(-6)}{6}=\frac{30-18}{18}=\frac{12}{18}=\frac{2}{3}$ Hence, $\frac{15}{9}+\frac{(-6)}{6}=\mathbf{\frac{2}{3}}$ **Ans.**

(b) $\frac{3}{7}+\frac{16}{21}=\frac{9+16}{21}=\frac{25}{21}=1\frac{4}{21}$ Hence, $\frac{3}{7}+\frac{16}{21}=\mathbf{1\frac{4}{21}}$ **Ans.**

(c) $\frac{-15}{17}+\frac{-27}{20}=\frac{-300-459}{340}=\frac{-759}{340}=-2\frac{79}{340}$

Hence, $\frac{-15}{17}+\frac{-27}{20}=\mathbf{-2\frac{79}{340}}$ **Ans.**

(d) $\frac{-26}{21}+\frac{19}{15}=\frac{-130+133}{105}=\frac{3}{105}=\frac{1}{35}$

Hence, $\frac{-26}{21}+\frac{19}{15}=\mathbf{\frac{1}{35}}$ **Ans.**

2. (a) $\frac{-21}{18}+\left(\frac{7}{16}+\frac{13}{4}\right)=\frac{-21}{18}+\left(\frac{7+52}{16}\right)=\frac{-21}{18}+\frac{59}{16}$

$=\frac{-168+531}{144}=\frac{363}{144}=\frac{121}{48}=2\frac{25}{48}$

Hence, $\frac{-21}{18}+\left(\frac{7}{16}+\frac{13}{4}\right)=\mathbf{2\frac{25}{48}}$ **Ans.**

(b) $\frac{-3}{25}+\left[\frac{6}{5}+\frac{(-8)}{15}\right]=\frac{-3}{25}+\left[\frac{18-8}{15}\right]=\frac{-3}{25}+\frac{10}{15}=\frac{-9+50}{75}=\frac{41}{75}$

Hence, $\frac{-3}{25}+\left[\frac{6}{5}+\frac{(-8)}{15}\right]=\mathbf{\frac{41}{75}}$ **Ans.**

(c) $\left(\frac{1}{12}+\frac{2}{15}\right)+\frac{7}{16}=\left(\frac{5+8}{60}\right)+\frac{7}{16}=\frac{13}{60}+\frac{7}{16}=\frac{52+105}{240}=\frac{157}{240}$

Hence, $\left(\frac{1}{12}+\frac{2}{15}\right)+\frac{7}{16}=\mathbf{\frac{157}{240}}$ **Ans.**

(d) $\frac{25}{34}+\left(\frac{-7}{14}+\frac{13}{8}\right)=\frac{25}{34}+\left(\frac{-28+91}{56}\right)=\frac{25}{34}+\frac{63}{56}$

$=\frac{700+1071}{952}=\frac{1771}{952}=\frac{253}{136}=1\frac{117}{136}$

Hence, $\frac{25}{34}+\left(\frac{-7}{14}+\frac{13}{8}\right)=\mathbf{1\frac{117}{136}}$ **Ans.**

3. (a) $\frac{13}{7}+\left(\frac{-13}{7}\right)=\frac{13}{7}-\frac{13}{7}=\frac{13-13}{7}=\frac{0}{7}=0$

$\therefore \frac{13}{7}+\left(\frac{-13}{7}\right)=0$

Hence, **it is additive property of addition.** **Verified**

(b) $\frac{3}{6}+\left(\frac{5}{2}+\frac{2}{3}\right)=\frac{3}{6}+\left(\frac{15+4}{6}\right)=\frac{3}{6}+\frac{19}{6}=\frac{3+19}{6}=\frac{22}{6}=\frac{11}{3}$

Also, $\left(\frac{3}{6}+\frac{5}{2}\right)+\frac{2}{3}=\left(\frac{3+15}{6}\right)+\frac{2}{3}=\frac{18}{6}+\frac{2}{3}=\frac{18+4}{6}=\frac{22}{6}=\frac{11}{3}$

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

Hence, **it is associative property of addition.** **Verified**

(c) $\frac{15}{12}+\frac{3}{24}=\frac{60+6}{48}=\frac{66}{48}$, also $\frac{3}{24}+\frac{15}{12}=\frac{6+60}{48}=\frac{66}{48}$

$\therefore \frac{15}{12}+\frac{3}{24}=\frac{3}{24}+\frac{15}{12}$

Hence, **it is commutative property of addition.** **Verified**

(d) We know that when zero is added to any rational number, the sum is the rational number itself.

$\therefore \quad \frac{2}{21}+0=0+\frac{2}{21}=\frac{2}{21}$

Hence, **it is the additive identity.** **Verified**

(e) $\frac{15}{24}+\frac{-6}{7}=\frac{105-144}{168}=\frac{-39}{168}$ also $\frac{-6}{7}+\frac{15}{24}=\frac{-144+105}{168}=\frac{-39}{168}$

$\therefore \quad \frac{15}{24}+\frac{-6}{7}=\frac{-6}{7}+\frac{15}{24}$

Hence, **it is commutative property of addition.** **Verified**

(f) $\frac{5}{6}+\frac{4}{9}=\frac{15+8}{18}=\frac{23}{18}$, which is a rational number.

Hence, **it is closure property of addition.** **Verified**

(g) $\frac{3}{18}+\left[\frac{(-13)}{4}+\frac{17}{12}\right]=\frac{3}{18}+\left[\frac{-39+17}{12}\right]$

$=\frac{3}{18}+\frac{-22}{12}=\frac{6-66}{36}=\frac{-60}{36}=\frac{-5}{3}$

also, $\left[\frac{3}{18}+\frac{(-13)}{4}\right]+\frac{17}{12}=\left(\frac{6-117}{36}\right)+\frac{17}{12}$

$=\frac{-111}{36}+\frac{17}{12}=\frac{-111+51}{36}=\frac{-60}{36}=\frac{-5}{3}$

$\therefore \frac{3}{18}+\left[\frac{(-13)}{4}+\frac{17}{12}\right]=\left[\frac{3}{18}+\frac{(-13)}{4}\right]+\frac{17}{12}$

Hence, **it is associative property of addition.** **Verified**

(h) $\frac{25}{-7}+\left[\frac{(-5)}{8}+\frac{21}{4}\right]=\left[\frac{25}{-7}+\frac{(-5)}{8}\right]+\frac{21}{4}$

$\frac{25}{-7}+\left[\frac{-5}{8}+\frac{21}{4}\right]=\frac{25}{-7}+\left[\frac{-5+42}{8}\right]=\frac{25}{-7}+\frac{37}{8}$

$=\frac{-200+259}{56}\quad\left[\because\ \frac{25}{-7}=\frac{-25}{7}\right]=\frac{59}{56}$

Also, $\left[\frac{25}{-7}+\frac{-5}{8}\right]+\frac{21}{4}$

$=\left[\frac{-200-35}{56}\right]+\frac{21}{4}$

$=\frac{-235}{56}+\frac{21}{4}=\frac{-235+294}{56}=\frac{59}{56}$

Hence, **it is associative property of addition.** **Verified**

4. (a) $\left(\frac{25}{19}+\frac{6}{-7}\right)+\frac{\mathbf{9}}{\mathbf{-8}}=\frac{25}{19}+\left(\frac{6}{-7}+\frac{9}{-8}\right)$

(b) $\frac{5}{4}+\frac{17}{-9}=\frac{17}{-9}+\frac{\mathbf{5}}{\mathbf{4}}$

(c) $\frac{28}{15}+\frac{19}{-13}+\frac{-7}{15}=\frac{\mathbf{28}}{\mathbf{15}}+\left(\frac{19}{-13}+\frac{-7}{15}\right)$

(d) $\left(\frac{16}{11}+\frac{9}{23}\right)+\frac{5}{-9}=\frac{16}{11}+\left(\frac{9}{23}+\frac{\mathbf{5}}{\mathbf{-9}}\right)$

5. (a) Additive inverse of $\frac{5}{2} = -\left(\frac{5}{2}\right) = \mathbf{-2\frac{1}{2}}$ **Ans.**

(b) Additive inverse of $\frac{-7}{15} = -\left(\frac{-7}{15}\right) = \mathbf{\frac{7}{15}}$ **Ans.**

(c) Additive inverse of $\frac{2}{23} = -\left(\frac{2}{23}\right) = \mathbf{\frac{-2}{23}}$ **Ans.**

(d) Additive inverse of $\frac{12}{-7}$ $\because \left[\frac{12}{-7} = \frac{-12}{7}\right] = -\left(\frac{-12}{7}\right) = \frac{12}{7} = \mathbf{1\frac{5}{7}}$ **Ans.**

(e) Additive inverse of $\frac{25}{17} = -\left(\frac{25}{17}\right) = \frac{-25}{17} = \mathbf{-1\frac{8}{17}}$ **Ans.**

(f) Additive inverse of $\frac{-3}{34} = -\left(\frac{-3}{34}\right) = \mathbf{\frac{3}{34}}$ **Ans.**

6. (a) $\because a = \frac{3}{5}, b = \frac{-2}{3}$ and $c = \frac{6}{9}$

$$\therefore (a+b)+c = \left[\frac{3}{5} + \frac{(-2)}{3}\right] + \frac{6}{9} = \left(\frac{9-10}{15}\right) + \frac{6}{9} = \frac{-1}{15} + \frac{6}{9}$$

$$= \frac{-3+30}{45} = \frac{27}{45} = \frac{3}{5}$$

$$\text{Also, } a+(b+c) = \frac{3}{5} + \left[\frac{-2}{3} + \frac{6}{9}\right] = \frac{3}{5} + \left[\frac{-6+6}{9}\right] = \frac{3}{5} + 0 = \frac{3}{5}$$

Hence, $\boldsymbol{(a+b)+c = a+(b+c) = \frac{3}{5}}$ **Verified**

(b) $(a+b)+c = \left(\frac{7}{9} + \frac{5}{6}\right) + \frac{(-11)}{9} = \left(\frac{14+15}{18}\right) + \frac{(-11)}{9}$

$$= \frac{29}{18} + \frac{-11}{9} = \frac{29-22}{18} = \frac{7}{18}$$

$$\text{Also, } a+(b+c) = \frac{7}{9} + \left(\frac{5}{6} + \frac{-11}{9}\right) = \frac{7}{9} + \left(\frac{15-22}{18}\right) = \frac{7}{9} + \frac{-7}{18}$$

$$= \frac{14-7}{18} = \frac{7}{18}$$

Hence, $\boldsymbol{(a+b)+c = a+(b+c) = \frac{7}{18}}$ **Verified**

7. (a) $\because a = \frac{1}{4}$ and $b = \frac{2}{5}$

$\therefore \quad a + b = \frac{1}{4} + \frac{2}{5} = \frac{5+8}{20} = \frac{13}{20}$

also, $\quad b + a = \frac{2}{5} + \frac{1}{4} = \frac{8+5}{20} = \frac{13}{20}$

Hence, $\boldsymbol{a + b = b + a = \frac{13}{20}}$ **Verified**

(b) $a + b = \frac{6}{3} + \frac{-7}{9} = \frac{18-7}{9} = \frac{11}{9}$

also, $b + a = \frac{-7}{9} + \frac{6}{3} = \frac{-7+18}{9} = \frac{11}{9}$

Hence, $\boldsymbol{a + b = b + a = \frac{11}{9}}$ **Verified**

Exercise 1.2

1. (a) $\frac{14}{15} - \left(\frac{-7}{8}\right) = \frac{14}{15} + \frac{7}{8} = \frac{112+105}{120} = \frac{217}{120}$, which is a rational number.

And $\frac{-7}{8} - \frac{14}{15} = \frac{-105-112}{120} = \frac{-217}{120}$, which is a rational number.

Hence, **closure property for subtraction of rational number is verified.** **Verified**

(b) $\frac{3}{-8} - \frac{29}{14} = \frac{-3}{8} - \frac{29}{14} = \frac{-21-116}{56} = \frac{-137}{56}$, which is rational number.

And $\frac{29}{14} - \left(-\frac{3}{8}\right) = \frac{29}{14} + \frac{3}{8}$

$= \frac{116+21}{56} = \frac{137}{56}$, which is a rational number.

Hence, **closure property for subtraction of rational number is verified.** **Verified**

(c) $\frac{-5}{6} - \frac{12}{9} = \frac{-15-24}{18} = \frac{-39}{18}$, which is a rational number.

And $\frac{12}{9}-\left(-\frac{5}{6}\right)=\frac{12}{9}+\frac{5}{6}=\frac{24+15}{18}=\frac{39}{18}$, which is a rational number.

Hence, **closure property for subtraction of rational number is verified.** **Verified**

(d) $\frac{12}{3}-\left(\frac{-3}{15}\right)=\frac{12}{3}+\frac{3}{15}=\frac{60+3}{15}=\frac{63}{15}$, which is a rational number.

And $\frac{-3}{15}-\frac{12}{3}=\frac{-3-60}{15}=\frac{-63}{15}$, which is a ratonal number.

Hence, **closure property for subtraction of rational number is verified.** **Verified**

2. (a) $\frac{42}{-9}-\left(\frac{-7}{12}\right)=\frac{-42}{9}+\frac{7}{12}=\frac{-168+21}{36}=\frac{-147}{36}$

also, $\frac{-7}{12}-\left(\frac{42}{-9}\right)=\frac{-7}{12}+\frac{42}{9}=\frac{-21+168}{36}=\frac{147}{36}$

Now, $\frac{-147}{36}\neq\frac{147}{36}$ Thus, $\frac{42}{-9}-\left(\frac{-7}{2}\right)\neq\frac{-7}{12}-\left(\frac{42}{-9}\right)$

Therefore, **subtraction of rational numbers is not commutative.** **Verified**

(b) $\frac{-3}{24}-\left(\frac{19}{-48}\right)=\frac{-3}{24}+\frac{19}{48}=\frac{-6+19}{48}=\frac{13}{48}$

Also, $\frac{19}{-48}-\left(\frac{-3}{24}\right)=\frac{-19}{48}+\frac{3}{24}=\frac{-19+6}{48}=\frac{-13}{48}$

Now, $\frac{13}{48}\neq\frac{-13}{48}$

Thus $\frac{-3}{24}-\left(\frac{19}{-48}\right)\neq\frac{19}{-48}-\left(\frac{-3}{24}\right)$

Therefore, **subtraction of rational numbers is not commutative.** **Verified**

(c) $\frac{16}{7}-\left(\frac{8}{-11}\right)=\frac{16}{7}+\frac{8}{11}=\frac{176+56}{77}=\frac{232}{77}$

Also, $\frac{8}{-11}-\frac{16}{7}=\frac{-8}{11}-\frac{16}{7}=\frac{-56-176}{77}=\frac{-232}{77}$

Now, $\frac{232}{77} \neq \frac{-232}{77}$. Thus, $\frac{16}{7} - \left(\frac{8}{-11}\right) \neq \frac{8}{-11} - \frac{16}{7}$

Therefore, **subtraction of rational numbers is not commutative.** **Verified**

(d) $\frac{23}{24} - \left(\frac{-4}{6}\right) = \frac{23}{24} + \frac{4}{6} = \frac{23+16}{24} = \frac{39}{24} = \frac{13}{8}$

Also, $\frac{-4}{6} - \frac{23}{24} = \frac{-16-23}{24} = \frac{-39}{24} = \frac{-13}{8}$

Now, $\frac{13}{8} \neq \frac{-13}{8}$, Thus $\frac{23}{24} - \left(\frac{-4}{6}\right) \neq \frac{-4}{6} - \frac{23}{24}$

Therefore, **subtraction of rational numbers is not commutative.** **Verified**

3. (a) $\left[\frac{3}{18} - \left(\frac{9}{-14}\right)\right] - \frac{5}{16} = \left(\frac{3}{18} + \frac{9}{14}\right) - \frac{5}{16} = \left(\frac{21+81}{126}\right) - \frac{5}{16}$

$= \frac{102}{126} - \frac{5}{16} = \frac{816-315}{1008} = \frac{501}{1008}$

Also, $\frac{3}{18} - \left[\left(\frac{9}{-14}\right) - \frac{5}{16}\right] = \frac{3}{18} - \left[\frac{-9}{14} - \frac{5}{16}\right] = \frac{3}{18} - \left(\frac{-72-35}{112}\right)$

$= \frac{3}{18} - \left(\frac{-107}{112}\right) = \frac{3}{18} + \frac{107}{112} = \frac{168+963}{1008} = \frac{1131}{1008}$

Now, $\frac{501}{1008} \neq \frac{1131}{1008}$,

Thus, $\left[\frac{3}{18} - \left(\frac{9}{-14}\right)\right] - \frac{5}{16} \neq \frac{3}{18} - \left[\left(\frac{9}{-14}\right) - \frac{5}{16}\right]$

Therefore, **subtraction of rational numbers is not associative.** **Verified**

(b) $\left[\left(\frac{-5}{6}\right) - \frac{14}{9}\right] - \left(\frac{21}{-12}\right) = \left(\frac{-5}{6} - \frac{14}{9}\right) + \frac{21}{12} = \left(\frac{-15-28}{18}\right) + \frac{21}{12}$

$= \frac{-43}{18} + \frac{21}{12} = \frac{-86+63}{36} = -\frac{23}{36}$

Also, $\frac{-5}{6} - \left[\frac{14}{9} - \left(\frac{21}{-12}\right)\right] = \frac{-5}{6} - \left(\frac{14}{9} + \frac{21}{12}\right) = -\frac{5}{6} - \left(\frac{56+63}{36}\right)$

$$= -\frac{5}{6} - \frac{119}{36} = \frac{-30-119}{36} = \frac{-149}{36}$$

Now, $\frac{-23}{36} \neq \frac{-149}{36}$,

Thus, $\left[\left(\frac{-5}{6}\right) - \frac{14}{9}\right] - \left(\frac{21}{-12}\right) \neq \frac{-5}{6} - \left[\frac{14}{9} - \left(\frac{21}{-12}\right)\right]$

Therefore, **subtraction of rational numbers is not associative.**

Verified

(c) $\left[\frac{2}{3} - \left(\frac{-3}{4}\right)\right] - \left(\frac{-5}{8}\right) = \left(\frac{2}{3} + \frac{3}{4}\right) + \frac{5}{8} = \left(\frac{8+9}{12}\right) + \frac{5}{8}$

$$= \frac{17}{12} + \frac{5}{8} = \frac{34+15}{24} = \frac{49}{24}$$

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

$= \frac{2}{3} - \left(\frac{-1}{8}\right) = \frac{2}{3} + \frac{1}{8} = \frac{16+3}{24} = \frac{19}{24}$

Now, $\frac{49}{24} \neq \frac{19}{24}$, Thus, $\left[\frac{2}{3} - \left(\frac{-3}{4}\right)\right] - \left(\frac{-5}{8}\right) \neq \frac{2}{3} - \left[\left(\frac{-3}{4}\right) - \left(\frac{-5}{8}\right)\right]$

Therefore, **subtraction of rational numbers is not associative.**

Verified

4. (a) L.H.S. $= \frac{-24}{7} - \frac{9}{8} = \frac{-192-63}{56} = \frac{-255}{56}$

R.H.S. $= \frac{9}{8} - \frac{-24}{7} = \frac{9}{8} + \frac{24}{7} = \frac{63+192}{56} = \frac{255}{56}$

Now, L.H.S. $\neq$ R.H.S., Thus, $\frac{-24}{7} - \frac{9}{8} \neq \frac{9}{8} - \frac{-24}{7}$

Therefore, **statement is not true.** **Ans.**

(b) L.H.S. $= \frac{-15}{6} - \left(\frac{2}{9} - \frac{37}{12}\right) = \frac{-15}{6} - \left(\frac{8-111}{36}\right)$

$$= \frac{-15}{6} - \left(\frac{-103}{36}\right) = \frac{-15}{6} + \frac{103}{36} = \frac{-90+103}{36} = \frac{11}{36}$$

R.H.S. $= \left(\frac{-15}{6} - \frac{2}{9}\right) - \frac{37}{12} = \left(\frac{-45-4}{18}\right) - \frac{37}{12} = \frac{-49}{18} - \frac{37}{12}$

$$= \frac{-98-111}{36} = \frac{-209}{36}$$

Now, L.H.S. $\neq$ R.H.S., Thus, $\frac{-15}{6} - \left(\frac{2}{9} - \frac{37}{12}\right) \neq \left(\frac{-15}{6} - \frac{2}{9}\right) - \frac{37}{12}$

Therefore, **the statement is not true.** **Ans.**

5. (a) $\frac{-5}{4} - \frac{17}{3} = \frac{-5\times3-17\times4}{12} = \frac{-15-68}{12} = -\frac{83}{12} = -6\frac{11}{12}$

Hence, $\mathbf{\frac{-5}{4} - \frac{17}{3} = -6\frac{11}{12}}$ **Ans.**

(b) $\frac{16}{5} - \frac{1}{5} = \frac{16-1}{5} = \frac{15}{5} = 3$ Hence, $\mathbf{\frac{16}{5} - \frac{1}{5} = 3}$ **Ans.**

(c) $\frac{41}{3} - \frac{2}{9} = \frac{123-2}{9} = \frac{121}{9} = 13\frac{4}{9}$ Hence, $\mathbf{\frac{41}{3} - \frac{2}{9} = 13\frac{4}{9}}$ **Ans.**

(d) $\frac{9}{14} - \frac{23}{126} = \frac{9\times9-23\times1}{126} = \frac{81-23}{126} = \frac{58}{126} = \frac{29}{63}$

Hence, $\mathbf{\frac{9}{14} - \frac{23}{126} = \frac{29}{63}}$ **Ans.**

(e) $\frac{43}{-32} - \frac{19}{42} = \frac{-43}{32} - \frac{19}{42} = \frac{-903-304}{672} = \frac{-1207}{672} = -1\frac{535}{672}$

Hence, $\mathbf{\frac{43}{-32} - \frac{19}{42} = -1\frac{535}{672}}$ **Ans.**

(f) $\frac{12}{13} - \frac{4}{7} = \frac{84-52}{91} = \frac{32}{91}$ Hence, $\mathbf{\frac{12}{13} - \frac{4}{7} = \frac{32}{91}}$ **Ans.**

6. (a) Additive inverse of $-\frac{7}{24}$ is $\frac{7}{24}$.

$$\therefore \frac{5}{12} - \left(\frac{-7}{24}\right) = \frac{5}{12} + \frac{7}{24} = \frac{5\times2+7\times1}{24} = \frac{10+7}{24} = \frac{17}{24}$$

Hence, $\mathbf{\frac{5}{12} - \left(\frac{-7}{24}\right) = \frac{17}{24}}$ **Ans.**

(b) Additive inverse of $\frac{17}{15}$ is $\frac{-17}{15}$.

$$\therefore \frac{-8}{5} - \left(\frac{17}{15}\right) = \frac{-8}{5} - \frac{17}{15} = \frac{-8\times3-17\times1}{15}$$

$$= \frac{-24-17}{5} = \frac{-41}{15} = -2\frac{11}{15}$$

Hence, $\frac{-8}{5}-\left(\frac{17}{15}\right)=-2\frac{11}{15}$ **Ans.**

(c) Additive inverse of $-\frac{9}{16}$ is $\frac{9}{16}$.

$\therefore \frac{21}{48}-\left(\frac{-9}{16}\right)=\frac{21}{48}+\frac{9}{16}=\frac{21\times1+9\times3}{48}=\frac{21+27}{48}=\frac{48}{48}=1$

Hence, $\frac{21}{48}-\left(\frac{-9}{16}\right)=1$ **Ans.**

(d) Additive inverse of $\frac{6}{9}$ is $-\frac{17}{8}$

$\therefore \frac{17}{8}-\frac{6}{9}=\frac{17\times9-6\times8}{72}=\frac{153-48}{72}=\frac{105}{72}=\frac{35}{24}=1\frac{11}{24}$

Hence, $\frac{17}{8}-\frac{6}{9}=1\frac{11}{24}$ **Ans.**

7. (a) $\frac{2}{6}-\frac{19}{24}-\frac{22}{27}=\frac{2\times72-19\times18-22\times16}{432}$

$=\frac{144-342-352}{432}=\frac{144-694}{432}=\frac{-550}{432}=\frac{-275}{216}=-1\frac{59}{216}$

Hence, $\frac{2}{6}-\frac{19}{24}-\frac{22}{27}=-1\frac{59}{216}$ **Ans.**

(b) $\frac{23}{42}-\frac{11}{42}+\frac{1}{17}=\frac{23\times17-11\times17+1\times42}{714}=\frac{391-187+42}{714}$

$=\frac{433-187}{714}=\frac{246}{714}=\frac{41}{119}$

Hence, $\frac{23}{42}-\frac{11}{42}+\frac{1}{17}=\frac{41}{119}$ **Ans.**

(c) $\frac{2}{3}-\frac{17}{22}+\frac{8}{27}=\frac{2\times198-17\times27+8\times22}{594}=\frac{396-459+176}{594}$

$=\frac{572-459}{594}=\frac{113}{594}$

Hence, $\frac{2}{3}-\frac{17}{22}+\frac{8}{27}=\frac{113}{594}$ **Ans.**

8. $\because a = \frac{12}{5}$ and $b = \frac{2}{15}$

$\therefore \; a - b = \frac{12}{5} - \frac{2}{15} = \frac{12\times 3 - 2\times 1}{15} = \frac{36-2}{15} = \frac{34}{15}$

$b - a = \frac{2}{15} - \frac{12}{5} = \frac{2-36}{15} = \frac{-34}{15}$

Hence, $\boldsymbol{a - b = \frac{34}{15}}$, $\boldsymbol{b - a = \frac{-34}{15}}$, **But** $\boldsymbol{a - b \neq b - a}$ **Ans.**

Exercise 1.3

1. (a) $\left(-\frac{9}{11}\right)\times \mathbf{1} = -\frac{9}{17}$ (b) $\mathbf{0}\times\left(\frac{-15}{9}\right) = 0$

(c) $\left(\frac{-28}{5}\right)\times\frac{5}{14} = \frac{5}{4}\times\frac{\mathbf{-28}}{\mathbf{5}}$ (d) $\frac{\mathbf{17}}{\mathbf{14}}\times\left(-\frac{26}{17}\right) = \frac{-26}{17}\times\frac{17}{14}$

(e) $-\frac{5}{7}\times\left[\frac{17}{2}+\left(\frac{-9}{5}\right)\right] = \frac{-5}{7}\times\frac{\mathbf{17}}{\mathbf{2}} + \frac{-5}{7}\times\frac{\mathbf{-9}}{\mathbf{5}}$

(f) $-\frac{29}{17}\times\left(\frac{40}{9}\times\frac{7}{10}\right) = \left(\frac{-29}{17}\times\frac{40}{9}\right)\times\frac{\mathbf{7}}{\mathbf{10}}$

2. (a) $\frac{13}{4}\times\left(\frac{-6}{7}+\frac{22}{5}\right) = \frac{13}{4}\times\left(\frac{-6\times 5+22\times 7}{7\times 5}\right) = \frac{13}{4}\times\left(\frac{-30+154}{35}\right)$

$= \frac{13}{4}\times\frac{124}{35} = \frac{13\times 124}{4\times 35} = \frac{13\times 31}{35} = \frac{403}{35} = 11\frac{18}{35}$

Also, $\frac{13}{4}\times\left(\frac{-6}{7}+\frac{22}{5}\right) = \frac{13}{4}\times\frac{-6}{7} + \frac{13}{4}\times\frac{22}{5} = \frac{-78}{28} + \frac{286}{20}$

$= \frac{-78\times 5+286\times 7}{140} = \frac{-390+2002}{140} = \frac{1612}{140} = \frac{403}{35} = 11\frac{18}{35}$

Hence, $\boldsymbol{\frac{13}{4}\times\left(-\frac{6}{7}+\frac{22}{5}\right) = \frac{13}{4}\times\frac{-6}{7} + \frac{13}{4}\times\frac{22}{5} = 11\frac{18}{35}}$, **and verify the distributive property of multiplication over addition.** **Ans.**

(b) $\frac{15}{2}\times\left[\frac{11}{9}\times\left(\frac{-6}{11}\right)\right] = \frac{15}{2}\times\left[\frac{11}{9}\times\frac{-6}{11}\right] = \frac{15}{2}\times\frac{-2}{3} = \frac{15\times(-2)}{2\times 3} = -5$

Also, $\frac{15}{2}\times\left[\frac{11}{9}\times\left(\frac{-6}{11}\right)\right]=\frac{15}{2}\times\frac{11}{9}\times\frac{-6}{11}=\frac{15\times11\times(-6)}{2\times9\times11}=-5$

Hence, $\mathbf{\frac{15}{2}\times\left[\frac{11}{9}\times\left(\frac{-6}{11}\right)\right]=\frac{15}{2}\times\frac{11}{9}\times\frac{-6}{11}=-5}$ **and verify the distributive property of multiplication.** **Ans.**

(c) $\frac{12}{7}\times\left(\frac{41}{5}+\frac{7}{9}\right)=\frac{12}{7}\times\left(\frac{41\times9+7\times5}{5\times9}\right)=\frac{12}{7}\times\left(\frac{369+35}{45}\right)$

$=\frac{12}{7}\times\frac{404}{45}=\frac{12\times404}{7\times45}=\frac{4848}{315}=\frac{1616}{105}=15\frac{41}{105}$

Also, $\frac{12}{7}\times\left(\frac{41}{5}+\frac{7}{9}\right)=\frac{12}{7}\times\frac{41}{5}+\frac{12}{7}\times\frac{7}{9}=\frac{492}{35}+\frac{84}{63}$

$=\frac{4428+420}{315}=\frac{4848}{315}=\frac{1616}{105}=15\frac{41}{105}$

Hence, $\mathbf{\frac{12}{7}\times\left(\frac{41}{5}+\frac{7}{9}\right)=\frac{12}{7}\times\frac{41}{5}+\frac{12}{7}\times\frac{7}{9}=15\frac{41}{105}}$ **and verify the distributive property of multiplication over addition.** **Ans.**

(d) $1\frac{1}{2}\times\left(\frac{25}{3}+\frac{3}{4}\right)=\frac{3}{2}\times\left(\frac{25}{3}+\frac{3}{4}\right)=\frac{3}{2}\times\left(\frac{100+9}{12}\right)$

$=\frac{3}{2}\times\frac{109}{12}=\frac{3\times109}{2\times12}=\frac{109}{8}=13\frac{5}{8}$

Also, $1\frac{1}{2}\times\left(\frac{25}{3}+\frac{3}{4}\right)=\frac{3}{2}\times\left(\frac{25}{3}+\frac{3}{4}\right)=\frac{3}{2}\times\frac{25}{3}+\frac{3}{2}\times\frac{3}{4}$

$=\frac{3\times25}{2\times3}+\frac{3\times3}{2\times4}=\frac{75}{6}+\frac{9}{8}=\frac{300+27}{24}=\frac{327}{24}=\frac{109}{8}=13\frac{5}{8}$

Hence, $\mathbf{\frac{3}{2}\times\left(\frac{25}{3}+\frac{3}{4}\right)=\frac{3}{2}\times\frac{25}{3}+\frac{3}{2}\times\frac{3}{4}=13\frac{5}{8}}$ **and verify the distributive property of multiplication over additionAns.**

3. (a) L.H.S. $=\frac{14}{3}\times\frac{6}{29}=\frac{14\times6}{3\times29}=\frac{14\times2}{29}=\frac{28}{29}$

R.H.S. $=\frac{6}{29}\times\frac{14}{3}=\frac{6\times14}{29\times3}=\frac{2\times14}{29}=\frac{28}{29}$

$\therefore$ L.H.S. = R.H.S.

The property is the commutative property of multiplication.

Proved

(b) $\text{L.H.S.} = \frac{13}{7} \times \left(-\frac{14}{37}\right) = \frac{13}{7} \times \frac{(-14)}{37} = \frac{13 \times (-14)}{7 \times 37} = \frac{-182}{259}$

$\text{R.H.S.} = \left(-\frac{14}{37}\right) \times \frac{13}{7} = \frac{-14 \times 13}{37 \times 7} = \frac{-182}{259}$

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

The property is the commutative property of multiplication. **Proved**

(c) $\text{L.H.S.} = \frac{8}{3} \times \left(\frac{2}{5} + \frac{4}{7}\right) = \frac{8}{3} \times \left(\frac{2 \times 7 + 4 \times 5}{5 \times 7}\right) = \frac{8}{3} \times \left(\frac{14 + 20}{35}\right)$

$= \frac{8}{3} \times \frac{34}{35} = \frac{8 \times 34}{3 \times 35} = \frac{272}{105}$

$\text{R.H.S.} = \frac{8}{3} \times \frac{2}{5} + \frac{8}{3} \times \frac{4}{7} = \frac{8 \times 2}{3 \times 5} + \frac{8 \times 4}{3 \times 7} = \frac{16}{15} + \frac{32}{21}$

$= \frac{16 \times 7 + 32 \times 5}{105} = \frac{112 + 160}{105} = \frac{272}{105}$

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

The property is the distributive property of multiplication over addition. **Proved**

(d) $\text{L.H.S.} = \frac{13}{4} \times \left(\frac{41}{2} - \frac{2}{3}\right) = \frac{13}{4} \times \left(\frac{41 \times 3 - 2 \times 2}{2 \times 3}\right)$

$= \frac{13}{4} \times \left(\frac{123 - 4}{6}\right) = \frac{13}{4} \times \frac{119}{6} = \frac{13 \times 119}{4 \times 6} = \frac{1547}{24}$

$\text{R.H.S.} = \frac{13}{4} \times \frac{41}{2} - \frac{13}{4} \times \frac{2}{3} = \frac{533}{8} - \frac{26}{12}$

$= \frac{533 \times 3 - 26 \times 2}{24} = \frac{1599 - 52}{24}$

$= \frac{1547}{24}$

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

The property is the distributive property of multiplication over subtraction. **Proved.**

4. (a) Reciprocal of $\frac{13}{4} = \mathbf{\frac{4}{13}}$ **Ans.**

(b) Reciprocal of $-9 = \mathbf{-\frac{1}{9}}$ **Ans.**

(c) Reciprocal of $4 = \mathbf{\frac{1}{4}}$ **Ans.**

(d) Reciprocal of $-\frac{8}{9} = \mathbf{-\frac{9}{8}}$ **Ans.**

(e) Reciprocal of $\frac{45}{29} = \mathbf{\frac{29}{45}}$ **Ans.**

(f) Reciprocal of $\frac{71}{-7} = \mathbf{\frac{-7}{71}}$ **Ans.**

5. (a) $\because x = \frac{1}{2}, y = \frac{-2}{3}$ and $z = \frac{13}{7}$

$$\therefore x \times (y \times z) = \frac{1}{2} \times \left(\frac{-2}{3} \times \frac{13}{7}\right) = \frac{1}{2} \times \left(\frac{-2 \times 13}{3 \times 7}\right)$$

$$= \frac{1}{2} \times \frac{-26}{21} = \frac{-26}{2 \times 21} = \frac{-13}{21}$$

$$\text{Now, } (x \times y) \times z = \left(\frac{1}{2} \times \frac{-2}{3}\right) \times \frac{13}{7} = \left(\frac{1 \times (-2)}{2 \times 3}\right) \times \frac{13}{7}$$

$$= \frac{-2 \times 13}{6 \times 7} = \frac{-13}{3 \times 7} = \frac{-13}{21}$$

Hence, $\boldsymbol{x \times (y \times z) = (x \times y) \times z = \frac{-13}{21}}$ **Verified**

(b) $\because x = \frac{13}{2}, y = \frac{4}{7}$ and $z = \frac{11}{6}$

$$\therefore x \times (y \times z) = \frac{13}{2} \times \left(\frac{4}{7} \times \frac{11}{6}\right) = \frac{13}{2} \times \left(\frac{4 \times 11}{7 \times 6}\right) = \frac{13}{2} \times \frac{44}{42}$$

$$= \frac{13 \times 44}{2 \times 42} = \frac{13 \times 22}{2 \times 21} = \frac{286}{42} = \frac{143}{21}$$

$$\text{Now, } (x \times y) \times z = \left(\frac{13}{2} \times \frac{4}{7}\right) \times \frac{11}{6} = \left(\frac{13 \times 4}{2 \times 7}\right) \times \frac{11}{6} = \frac{26}{7} \times \frac{11}{6}$$

$$= \frac{13 \times 11}{7 \times 3} = \frac{143}{21}$$

Hence, $\boldsymbol{x \times (y \times z) = (x \times y) \times z = \frac{143}{21}}$ **Verified**

(c) $\because x = \frac{27}{23}$, $y = \frac{5}{19}$ and $z = \frac{21}{2}$

$$\therefore x \times (y \times z) = \frac{27}{23} \times \left(\frac{5}{19} \times \frac{21}{2}\right) = \frac{27}{23} \times \left(\frac{5 \times 21}{19 \times 2}\right) = \frac{27}{23} \times \frac{105}{38}$$

$$= \frac{27 \times 105}{23 \times 38} = \frac{2835}{874}$$

$$\text{Now, } (x \times y) \times z = \left(\frac{27}{23} \times \frac{5}{19}\right) \times \frac{21}{2} = \left(\frac{27 \times 5}{23 \times 19}\right) \times \frac{21}{2} = \frac{135}{437} \times \frac{21}{2}$$

$$= \frac{135 \times 21}{437 \times 2} = \frac{2835}{874}$$

Hence, $\boldsymbol{x \times (y \times z) = (x \times y) \times z}$ **Verified**

(d) $\because x = \frac{12}{5}$, $y = \frac{-7}{2}$ and $z = \frac{16}{11}$

$$\therefore x \times (y \times z) = \frac{12}{5} \times \left(\frac{-7}{2} \times \frac{16}{11}\right) = \frac{12}{5} \times \left(\frac{-7 \times 16}{2 \times 11}\right)$$

$$= \frac{12}{5} \times \left(\frac{-7 \times 8}{11}\right) = \frac{12}{5} \times \frac{(-56)}{11} = \frac{12 \times (-56)}{55} = \frac{-672}{55}$$

$$\text{Now, } (x \times y) \times z = \left[\frac{12}{5} \times \left(\frac{-7}{2}\right)\right] \times \frac{16}{11} = \left(\frac{12 \times (-7)}{5 \times 2}\right) \times \frac{16}{11}$$

$$= \left(\frac{6 \times (-7)}{5}\right) \times \frac{16}{11}$$

$$= \frac{-42}{5} \times \frac{16}{11} = \frac{-42 \times 16}{55} = \frac{-672}{55}$$

Hence, $\boldsymbol{x \times (y \times z) = (x \times y) \times z}$ **Verified**

(e) $\because x = \frac{-9}{28}$, $y = \frac{-27}{15}$ and $z = \frac{-5}{3}$

$$\therefore x \times (y \times z) = \frac{-9}{28} \times \left(\frac{-27}{15} \times \frac{-5}{3}\right) = \frac{-9}{28} \times \left(\frac{-27 \times (-5)}{15 \times 3}\right)$$

$$= \frac{-9}{28} \times 3 = \frac{-9 \times 3}{28} = \frac{-27}{28}$$

Now, $(x \times y) \times z = \left(\frac{-9}{28} \times \frac{-27}{15}\right) \times \frac{-5}{3} = \left(\frac{-9 \times (-27)}{28 \times 15}\right) \times \frac{-5}{3}$

$= \frac{9 \times 9}{28 \times 5} \times \frac{-5}{3} = \frac{9 \times 9 \times (-5)}{28 \times 5 \times 3} = \frac{-27}{28}$

Hence, $\boldsymbol{x \times (y \times z) = (x \times y) \times z}$ **Verified**

(f) $\because x = \frac{12}{1}$, $y = \frac{1}{9}$ and $z = \frac{-61}{11}$

$\therefore x \times (y \times z) = \frac{12}{1} \times \left(\frac{1}{9} \times \frac{-61}{11}\right) = \frac{12}{1} \times \left(\frac{1 \times (-61)}{9 \times 11}\right)$

$= \frac{12}{1} \times \frac{-61}{99} = \frac{-732}{99}$

Now, $(x \times y) \times z = \left(\frac{12}{1} \times \frac{1}{9}\right) \times \frac{-61}{11} = \left(\frac{12 \times 1}{1 \times 9}\right) \times \frac{-61}{11}$

$= \frac{12}{9} \times \frac{-61}{11} = \frac{12 \times (-61)}{9 \times 11} = \frac{-732}{99}$

Hence, $\boldsymbol{x \times (y \times z) = (x \times y) \times z}$ **Verified**

6. (a) $\frac{15}{7} \times \frac{3}{20} = \frac{15 \times 3}{7 \times 20} = \frac{3 \times 3}{7 \times 4} = \frac{9}{28}$

Also, $\frac{3}{20} \times \frac{15}{7} = \frac{3 \times 15}{20 \times 7} = \frac{3 \times 3}{4 \times 7} = \frac{9}{28}$

Hence, $\boldsymbol{\frac{15}{7} \times \frac{3}{20} = \frac{3}{20} \times \frac{15}{7} = \frac{9}{28}}$ **Verified**

(b) $\frac{-4}{6} \times \frac{7}{20} = \frac{(-4) \times 7}{6 \times 20} = \frac{-7}{6 \times 5} = \frac{-7}{30}$

Also, $\frac{7}{20} \times \frac{-4}{6} = \frac{7 \times (-4)}{20 \times 6} = \frac{-7}{5 \times 6} = \frac{-7}{30}$

Hence, $\boldsymbol{\frac{-4}{6} \times \frac{7}{20} = \frac{7}{20} \times \frac{-4}{6} = \frac{-7}{30}}$ **Verified**

(c) $\frac{13}{5} \times \left(\frac{-7}{18}\right) = \frac{13 \times (-7)}{5 \times 18} = \frac{-91}{90} = -1\frac{1}{90}$

Also, $\left(\frac{-7}{18}\right) \times \frac{13}{5} = \frac{(-7) \times 13}{18 \times 5} = \frac{-91}{90} = -1\frac{1}{90}$

Hence, $\mathbf{\frac{13}{5}\times\left(\frac{-7}{18}\right)=\left(\frac{-7}{18}\right)\times\frac{13}{5}=-1\frac{1}{90}}$ **Verified**

(d) $\frac{14}{9}\times\frac{5}{24}=\frac{14\times5}{9\times24}=\frac{7\times5}{9\times12}=\frac{35}{108}$

Also, $\frac{5}{24}\times\frac{14}{9}=\frac{5\times14}{24\times9}=\frac{5\times7}{12\times9}=\frac{35}{108}$

Hence, $\mathbf{\frac{14}{9}\times\frac{5}{24}=\frac{5}{24}\times\frac{14}{9}=\frac{35}{108}}$ **Verified**

(e) $\frac{-64}{25}\times\frac{15}{28}=\frac{(-64)\times15}{25\times28}=\frac{-16\times3}{5\times7}=\frac{-48}{35}=-1\frac{13}{35}$

Also, $\frac{15}{28}\times\frac{-64}{25}=\frac{15\times(-64)}{28\times25}=\frac{3\times(-16)}{7\times5}=\frac{-48}{35}=-1\frac{13}{35}$

Hence, $\mathbf{\frac{-64}{25}\times\frac{15}{28}=\frac{15}{28}\times\frac{-64}{25}=-1\frac{13}{35}}$ **Verified**

(f) $\frac{-18}{14}\times\left(\frac{-21}{24}\right)=\frac{-18\times(-21)}{14\times24}=\frac{3\times3}{2\times4}=\frac{9}{8}=1\frac{1}{8}$

Also, $\left(\frac{-21}{24}\right)\times\frac{-18}{14}=\frac{(-21)\times(-18)}{24\times14}=\frac{3\times3}{4\times2}=\frac{9}{8}=1\frac{1}{8}$

Hence, $\mathbf{\frac{-18}{14}\times\left(\frac{-21}{24}\right)=\left(\frac{-21}{24}\right)\times\frac{-18}{14}=1\frac{1}{8}}$ **Verified**

(g) $\frac{6}{8}\times\left(\frac{-37}{9}\right)=\frac{6\times(-37)}{8\times9}=\frac{-37}{12}=-3\frac{1}{12}$

Also, $\left(\frac{-37}{9}\right)\times\frac{6}{8}=\frac{(-37)\times6}{9\times8}=\frac{-37}{12}=-3\frac{1}{12}$

Hence, $\mathbf{\frac{6}{8}\times\left(\frac{-37}{9}\right)=\left(\frac{-37}{9}\right)\times\frac{6}{8}=-3\frac{1}{12}}$ **Verified**

(h) $\frac{18}{17}\times\left(\frac{-14}{26}\right)=\frac{18\times(-14)}{17\times26}=\frac{9\times(-14)}{17\times13}=\frac{-126}{221}$

Also, $\left(\frac{-14}{26}\right)\times\frac{18}{17}=\frac{(-14)\times18}{26\times17}=\frac{-14\times9}{13\times17}=-\frac{126}{221}$

Hence, $\mathbf{\frac{18}{17}\times\left(\frac{-14}{26}\right)=\left(\frac{-14}{26}\right)\times\frac{18}{17}=\frac{-126}{221}}$ **Verified**

7. (a) $\frac{15}{4}\times\left(\frac{27}{6}-\frac{3}{5}\right)=\frac{15}{4}\times\left(\frac{135-18}{30}\right)=\frac{15}{4}\times\frac{117}{30}$

$$=\frac{15\times117}{4\times30}=\frac{117}{4\times2}=\frac{117}{8}=14\frac{5}{8}$$

Also, $\frac{15}{4}\times\left(\frac{27}{6}-\frac{3}{5}\right)=\frac{15}{4}\times\frac{27}{6}-\frac{15}{4}\times\frac{3}{5}=\frac{15\times27}{4\times6}-\frac{15\times3}{4\times5}$

$$=\frac{135}{8}-\frac{9}{4}=\frac{135-18}{8}=\frac{117}{8}=14\frac{5}{8}$$

Hence, $\mathbf{\frac{15}{4}\times\left(\frac{27}{6}-\frac{3}{5}\right)=\frac{15}{4}\times\frac{27}{6}-\frac{15}{4}\times\frac{3}{5}=14\frac{5}{8}}$ **Verified**

(b) $\frac{7}{4}\times\left(\frac{13}{10}-\frac{7}{9}\right)=\frac{7}{4}\times\left(\frac{117-70}{90}\right)=\frac{7}{4}\times\left(\frac{47}{90}\right)=\frac{7\times47}{4\times90}=\frac{329}{360}$

Also, $\frac{7}{4}\times\left(\frac{13}{10}-\frac{7}{9}\right)=\frac{7}{4}\times\frac{13}{10}-\frac{7}{4}\times\frac{7}{9}=\frac{91}{40}-\frac{49}{36}$

$$=\frac{819-490}{360}=\frac{329}{360}$$

Hence, $\mathbf{\frac{7}{4}\times\left(\frac{13}{10}-\frac{7}{9}\right)=\frac{7}{4}\times\frac{13}{10}-\frac{7}{4}\times\frac{7}{9}=\frac{329}{360}}$ **Verified**

(c) $\frac{7}{9}\times\left(\frac{4}{5}-\frac{5}{7}\right)=\frac{7}{9}\times\left(\frac{28-25}{35}\right)=\frac{7}{9}\times\frac{3}{35}=\frac{7\times3}{9\times35}=\frac{1}{15}$

Also, $\frac{7}{9}\times\left(\frac{4}{5}-\frac{5}{7}\right)=\frac{7}{9}\times\frac{4}{5}-\frac{7}{9}\times\frac{5}{7}=\frac{28}{45}-\frac{35}{63}$

$$=\frac{196-175}{315}=\frac{21}{315}=\frac{1}{15}$$

Hence, $\mathbf{\frac{7}{9}\times\left(\frac{4}{5}-\frac{5}{7}\right)=\frac{7}{9}\times\frac{4}{5}-\frac{7}{9}\times\frac{5}{7}=\frac{1}{15}}$ **Verified**

(d) $\frac{1}{2}\times\left(\frac{12}{13}-\frac{3}{5}\right)=\frac{1}{2}\times\left(\frac{60-39}{65}\right)=\frac{1}{2}\times\frac{21}{65}=\frac{1\times21}{2\times65}=\frac{21}{130}$

Also, $\frac{1}{2}\times\left(\frac{12}{13}-\frac{3}{5}\right)=\frac{1}{2}\times\frac{12}{13}-\frac{1}{2}\times\frac{3}{5}=\frac{1\times12}{2\times13}-\frac{1\times3}{2\times5}$

$$=\frac{12}{26}-\frac{3}{10}=\frac{60-39}{130}=\frac{21}{130}$$

Hence, $\frac{1}{2}\times\left(\frac{12}{13}-\frac{3}{5}\right)=\frac{1}{2}\times\frac{12}{13}-\frac{1}{2}\times\frac{3}{5}=\frac{21}{130}$ **Verified**

8. (a) $\frac{3}{11}\div\frac{7}{24}=\frac{3}{11}\times\frac{24}{7}=\frac{3\times24}{11\times7}=\frac{72}{77}$

Hence, $\frac{3}{11}\div\frac{7}{24}=\frac{72}{77}$ **Ans.**

(b) $\frac{25}{19}\div\frac{15}{6}=\frac{25}{19}\times\frac{6}{15}=\frac{25\times6}{19\times15}=\frac{10}{19}$

Hence, $\frac{25}{19}\div\frac{15}{6}=\frac{10}{19}$ **Ans.**

(c) $\frac{25}{8}\div\frac{3}{14}=\frac{25}{8}\times\frac{14}{3}=\frac{25\times14}{8\times3}=\frac{175}{12}=14\frac{7}{12}$

Hence, $\frac{25}{8}\div\frac{3}{14}=14\frac{7}{12}$ **Ans.**

(d) $\frac{24}{11}\div\frac{18}{11}=\frac{24}{11}\times\frac{11}{18}=\frac{24\times11}{11\times18}=\frac{4}{3}=1\frac{1}{3}$

Hence, $\frac{24}{11}\div\frac{18}{11}=1\frac{1}{3}$ **Ans.**

9. Let the other number be x.

$\because$ $\frac{-18}{9}\times x=\frac{-60}{27}$ or $\frac{18x}{9}=\frac{60}{27}$

$\therefore$ $x=\frac{60}{27}\times\frac{9}{18}=\frac{60\times9}{27\times18}=\frac{10}{9}=1\frac{1}{9}$

Hence, **the other number is $1\frac{1}{9}$.** **Ans.**

10. Let the rational number be x.

$\because$ $x\div\frac{12}{7}=\frac{-41}{24}$ or $x=\frac{-41}{24}\times\frac{12}{7}=\frac{-41}{14}=-2\frac{13}{14}$

(By cross-multiplication)

$x=-2\frac{13}{14}$ **Ans.**

11. Sum of $2\frac{1}{4}$ and $5\frac{1}{5}=\frac{9}{4}+\frac{26}{5}=\frac{45+104}{20}=\frac{149}{20}$

Now, product of $2\frac{1}{4}$ and $\frac{2}{3} = \frac{9}{4} \times \frac{2}{3} = \frac{9 \times 2}{4 \times 3} = \frac{3}{2}$

$\therefore \quad \frac{149}{20} \div \frac{3}{2} = \frac{149}{20} \times \frac{2}{3} = \frac{149}{30} = \mathbf{4\,\frac{29}{30}}$ **Ans.**

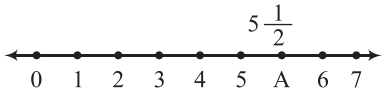
12. Sum of $\frac{71}{42}$ and $\frac{21}{5} = \frac{71}{42} + \frac{21}{5} = \frac{355 + 882}{210} = \frac{1237}{210}$

Now, difference of $\frac{71}{42}$ and $\frac{21}{5} = \frac{71}{42} - \frac{21}{5} = \frac{355 - 882}{210} = \frac{-527}{210}$

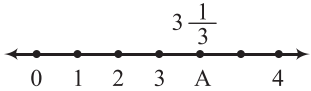
$\therefore \frac{1237}{210} \div \left(\frac{-527}{210}\right) = \frac{1237}{210} \times \frac{210}{(-527)} = -\frac{1237}{527} = \mathbf{-2\,\frac{183}{527}}$ **Ans.**

Exercise 1.4

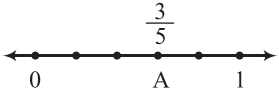
1. (a) $\frac{11}{2} = 5\frac{1}{2} = 5 + \frac{1}{2}$



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

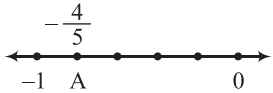


(c) $\frac{3}{5} =$



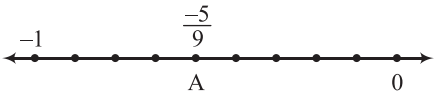
(d) $\frac{5}{6} =$

2. (a) $-\frac{4}{5} =$



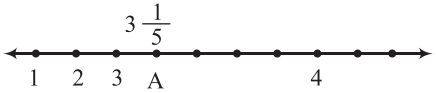
(b) $-\frac{6}{8} =$

(c) $-\frac{5}{9} =$

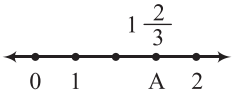


(d) $-\frac{7}{8} =$

3. (a) $\frac{16}{5} = 3\frac{1}{5} = 3 + \frac{1}{5}$

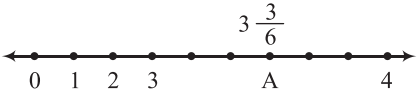


(b) $\frac{5}{3} = 1\frac{2}{3} =$

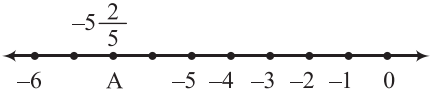


(c) $4 =$

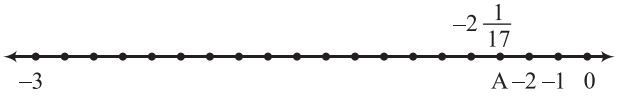
(d) $\frac{21}{6} = 3\frac{3}{6} =$



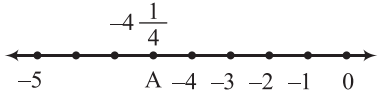
4. (a) $-\frac{27}{5} = -5\frac{2}{5} = -5 - \frac{2}{5}$



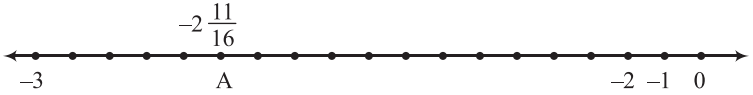
(b) $-\frac{35}{17} = -2\frac{1}{17} = -2 - \frac{1}{17}$



(c) $-\frac{17}{4} = -4\frac{1}{4} = -4 - \frac{1}{4}$



(d) $-\frac{43}{16} = -2\frac{11}{16} = -2 - \frac{11}{16}$



5. (a) Absolute value of $-\frac{7}{9} = \left|-\frac{7}{9}\right| = \mathbf{\frac{7}{9}}$ **Ans.**

(b) Absolute value of $\frac{12}{9} = \left|\frac{12}{9}\right| = \mathbf{\frac{12}{9}}$ **Ans.**

(c) Absolute value of $\frac{-16}{-7} = \left|\frac{-16}{-7}\right| = \frac{|-16|}{|-7|} = \mathbf{\frac{16}{7}}$ **Ans.**

(d) Absolute value of $\frac{27}{-5} = \left|\frac{27}{-5}\right| = \frac{|27|}{|-5|} = \mathbf{\frac{27}{5}}$ **Ans.**

(e) Absolute value of $\frac{19}{13} = \left|\frac{19}{13}\right| = \mathbf{\frac{19}{13}}$ **Ans.**

(f) Absolute value of $\frac{29}{-17} = \left|\frac{29}{-17}\right| = \frac{|29|}{|-17|} = \mathbf{\frac{29}{17}}$ **Ans.**

(g) Absolute value of $\frac{49}{19} = \left|\frac{49}{19}\right| = \mathbf{\frac{49}{19}}$ **Ans.**

(h) Absolute value of $\frac{-8}{-15} = \left|\frac{-8}{-15}\right| = \frac{|-8|}{|-15|} = \mathbf{\frac{8}{15}}$ **Ans.**

Exercise 1.5

1. (a) We write $\frac{6}{8}=\frac{6\times10}{8\times10}=\frac{60}{80}$ and $\frac{9}{8}=\frac{9\times10}{8\times10}=\frac{90}{80}$

Clearly, $\frac{60}{80}<\frac{61}{80}<\frac{62}{80}<\frac{63}{80}<\frac{64}{80}<\frac{65}{80}<\ ...<\frac{90}{80}$

$\Rightarrow \quad \frac{60}{80}<\frac{61}{80}<\frac{62}{80}<\frac{63}{80}<\frac{64}{80}<\frac{65}{80}<...<\frac{90}{80}$

$\Rightarrow$ Five rational numbers between $\frac{60}{80}$ and $\frac{90}{80}$ are,

$$\frac{61}{80},\frac{62}{80},\frac{63}{80},\frac{64}{80},\frac{65}{80},...$$

Hence, $\mathbf{\frac{61}{80}, \frac{62}{80}, \frac{63}{80}, \frac{64}{80}, \frac{65}{80}}$**, ... are the required five rational numbers between** $\mathbf{\frac{6}{8}}$ **and** $\mathbf{\frac{9}{8}}$**.** **Ans.**

(b) Here the given rational numbers with same denominators.

$\therefore \quad \frac{591}{900}<\frac{592}{900}<\frac{593}{900}<\frac{594}{900}<\frac{595}{900}<\frac{596}{900}<...<\frac{599}{900}.$

Clearly, $\frac{591}{900}<\frac{592}{900}<\frac{593}{900}<\frac{594}{900}<\frac{595}{900}<\frac{596}{900}<...>\frac{599}{900}.$

$\Rightarrow$ Five rational numbers between $\frac{591}{900}$ and $\frac{599}{900}$ are,

$\mathbf{\frac{592}{900}, \frac{593}{900}, \frac{594}{900}, \frac{595}{900}, \frac{596}{900}}$**, ... are the required five rational numbers between** $\mathbf{\frac{591}{590}}$ **and** $\mathbf{\frac{599}{900}}$**.** **Ans.**

(c) Here the given rational numbers with same denominators.

$\therefore \quad \frac{20}{180}<\frac{21}{180}<\frac{22}{180}<\frac{23}{180}<\frac{24}{180}<\frac{25}{180}<...<\frac{60}{180}$

Clearly, $\frac{20}{180}<\frac{21}{180}<\frac{22}{180}<\frac{23}{180}<\frac{24}{180}<\frac{25}{180}<...<\frac{59}{180}<\frac{60}{180}$

Hence, $\mathbf{\frac{21}{180}, \frac{22}{180}, \frac{23}{180}, \frac{24}{180}, \frac{25}{180}}$**, ... are the required five rational numbers between** $\mathbf{\frac{20}{180}}$ **and** $\mathbf{\frac{60}{180}}$**.** **Ans.**

(d) Here the given numbers with same denominators.

$\therefore \frac{415}{831} < \frac{416}{831} < \frac{417}{831} < \frac{418}{831} < \frac{419}{831} < \ldots < \frac{804}{831}$

Hence, $\mathbf{\frac{416}{831}, \frac{417}{831}, \frac{418}{831}, \frac{419}{831}, \frac{420}{831}}$, **… are the required five rational numbers between** $\mathbf{\frac{415}{831}}$ **and** $\mathbf{\frac{804}{831}}$**.** **Ans.**

2. (a) L.C.M. of denominator 12 and 6 is 12.

Now, $\frac{7}{12} = \frac{7 \times 1}{12 \times 1} = \frac{7}{12}$ and $\frac{-3}{6} = \frac{-3 \times 2}{6 \times 2} = \frac{-6}{12}$

But $7 > -6$, so $\frac{7}{12} > \frac{-6}{12}$

Thus, $\frac{7}{12} > \frac{-3}{6}$ Hence, $\mathbf{\frac{7}{12} > \frac{-3}{6}}$ **Ans.**

(b) L.C.M. of denominator 2 and 4 is 4.

Now, $\frac{9}{2} = \frac{9 \times 2}{2 \times 2} = \frac{18}{4}$ and $\frac{5}{4} = \frac{5 \times 1}{4 \times 1} = \frac{5}{4}$

But $18 > 5$, so $\frac{18}{4} > \frac{5}{4}$

Thus, $\frac{9}{2} > \frac{5}{4}$ Hence, $\mathbf{\frac{9}{2} > \frac{5}{4}}$ **Ans.**

(c) L.C.M. of denominator 6 and 7 is 42.

Now, $\frac{1}{6} = \frac{1 \times 7}{6 \times 7} = \frac{7}{42}$ and $\frac{1}{7} = \frac{1 \times 6}{7 \times 6} = \frac{6}{42}$

But $7 > 6$, so $\frac{7}{42} > \frac{6}{42}$

Thus, $\frac{1}{6} > \frac{1}{7}$ Hence, $\mathbf{\frac{1}{6} > \frac{1}{7}}$ **Ans.**

(d) L.C.M. of denominator 18 and 54 is 54.

Now, $\frac{217}{18} = \frac{217 \times 3}{18 \times 3} = \frac{651}{54}$

and $\frac{41}{54} = \frac{41 \times 1}{54 \times 1} = \frac{41}{54}$

But $651 > 41$, so $\frac{651}{54} > \frac{41}{54}$ Hence, $\mathbf{\frac{217}{18} > \frac{41}{54}}$ **Ans.**

3. First write these denominator in positive denominators.

$$\frac{7}{-15}=\frac{7\times(-1)}{-15\times(-1)}=\frac{-7}{15} \text{ and } \frac{-6}{-10}=\frac{-6\times(-1)}{-10\times(-1)}=\frac{6}{10}$$

The L.C.M. of 5, 2, 15 and 10 is 30.

Now, $\frac{4}{5}=\frac{4\times6}{5\times6}=\frac{24}{30}, \frac{-1}{2}=\frac{-1\times15}{2\times15}=\frac{-15}{30}, \frac{-7}{15}=\frac{-7\times2}{15\times2}=\frac{-14}{30}$

and $\frac{6}{10}=\frac{6\times3}{10\times3}=\frac{18}{30}$

But $24>18>-14>-15$, So, $\frac{-15}{30}<\frac{-14}{30}<\frac{18}{30}<\frac{24}{30}$

Thus, $\frac{-1}{2}<\frac{7}{-15}<\frac{-6}{-10}<\frac{4}{5}$

Hence, **the ascending order is $\frac{-1}{2}, \frac{7}{-15}, \frac{-6}{-10}, \frac{4}{5}$.** **Ans.**

4. (a) $\frac{7}{25}+\frac{14}{25}=\frac{7+14}{25}=\frac{21}{25}$ Hence, $\frac{7}{25}+\frac{14}{25}=\frac{21}{25}$ **Ans.**

(b) $\frac{91}{14}-\frac{15}{28}=\frac{91\times2-15\times1}{28}=\frac{182-15}{28}=\frac{167}{28}=5\frac{27}{28}$

Hence, $\frac{91}{14}-\frac{15}{28}=5\frac{27}{28}$ **Ans.**

(c) $\frac{-7}{38}+\frac{25}{76}=\frac{-7\times2+25\times1}{76}=\frac{-14+25}{76}=\frac{11}{76}$

Hence, $\frac{-7}{38}+\frac{25}{76}=\frac{11}{76}$ **Ans.**

(d) $\frac{7}{8}\times\frac{6}{21}=\frac{7\times6}{8\times21}=\frac{1}{4}$ **Ans.** (e) $\frac{6}{9}\div\frac{18}{9}=\frac{6}{9}\times\frac{9}{18}=\frac{1}{3}$ **Ans.**

(f) $\frac{6}{7}\div\left(\frac{18}{7}\div\frac{16}{17}\right)=\frac{6}{7}\div\left(\frac{18\times17}{7\times16}\right)=\frac{6}{7}\div\frac{9\times17}{7\times8}$

$=\frac{6}{7}\times\frac{7\times8}{9\times17}=\frac{6\times7\times8}{7\times9\times17}=\frac{16}{51}$ **Ans.**

(g) $\left(\frac{9}{18}\div\frac{6}{7}\right)\div\frac{7}{18}=\left(\frac{9}{18}\times\frac{7}{6}\right)\div\frac{7}{18}=\frac{7}{12}\div\frac{7}{18}$

$=\frac{7}{12}\times\frac{18}{7}=\frac{7\times18}{12\times7}=\frac{3}{2}=1\frac{1}{2}$ **Ans.**

(h) $\left(\frac{28}{9}\div\frac{3}{4}\right)\div\frac{14}{5}=\left(\frac{28}{9}\times\frac{4}{3}\right)\div\frac{14}{5}=\frac{112}{27}\div\frac{14}{5}$

$=\frac{112}{27}\times\frac{5}{14}=\frac{112\times5}{27\times14}=\frac{40}{27}=\mathbf{1\,\frac{13}{27}}$ **Ans.**

5. (a) $\frac{3}{5}\times\left(\frac{5}{24}+\frac{17}{18}\right)=\frac{3}{5}\times\left(\frac{15+68}{72}\right)=\frac{3}{5}\times\frac{83}{72}$

$=\frac{3\times83}{5\times72}=\frac{249}{360}=\mathbf{\frac{83}{120}}$ **Ans.**

(b) $\left(\frac{12}{8}+\frac{-9}{16}\right)\div\frac{3}{4}=\left(\frac{24-9}{16}\right)\div\frac{3}{4}=\frac{15}{16}\div\frac{3}{4}$

$=\frac{15}{16}\times\frac{4}{3}=\frac{15\times4}{16\times3}=\frac{5}{4}=\mathbf{1\,\frac{1}{4}}$ **Ans.**

(c) $\left(\frac{17}{8}-\frac{5}{12}\right)\div\frac{-8}{15}=\left(\frac{51-10}{24}\right)\div\frac{-8}{15}=\frac{41}{24}\times\frac{15}{-8}$

$=\frac{41\times15}{24\times(-8)}=-\frac{615}{192}=-\frac{205}{64}=\mathbf{-3\,\frac{13}{64}}$ **Ans.**

(d) $\frac{6}{7}\div\left(-\frac{18}{21}+\frac{19}{24}\right)=\frac{6}{7}\div\left(\frac{-144+133}{168}\right)=\frac{6}{7}\div\frac{-11}{168}$

$=\frac{6}{7}\div\frac{-11}{168}=\frac{-6}{7}\times\frac{168}{11}=-\frac{144}{11}=\mathbf{-13\,\frac{1}{11}}$ **Ans.**

6. (a) $\left(\frac{3}{21}\times\frac{-5}{6}\right)-\left(\frac{9}{42}\div\frac{3}{4}\right)-\left(\frac{15}{42}\times\frac{-6}{15}\right)$

$=\left[\frac{3\times(-5)}{21\times6}\right]-\left(\frac{9}{42}\times\frac{4}{3}\right)-\left[\frac{15\times(-6)}{42\times15}\right]$

$=\left(-\frac{5}{42}\right)-\left(\frac{2}{7}\right)-\left(-\frac{1}{7}\right)=\frac{-5}{42}-\frac{2}{7}+\frac{1}{7}$

$=\frac{-5-12+6}{42}=\frac{-17+6}{42}=-\mathbf{\frac{11}{42}}$ **Ans.**

(b) $\left(\frac{13}{19}\div\frac{2}{15}\right)\times\left(\frac{7}{13}\div\frac{5}{8}\right)+\left(\frac{3}{15}\times\frac{7}{2}\right)=\left(\frac{13}{19}\times\frac{15}{2}\right)\times\left(\frac{7}{13}\times\frac{8}{5}\right)$

$+\left(\frac{3\times7}{15\times2}\right)=\frac{195}{38}\times\frac{56}{65}+\frac{21}{30}=\frac{10920}{2470}+\frac{21}{30}=\frac{84}{19}+\frac{7}{10}$

$$= \frac{840+133}{190} = \frac{973}{190} = \mathbf{5\,\frac{23}{190}}$$ **Ans.**

7. (a) $(a+b)+c = \left(\frac{5}{24}+\frac{3}{24}\right)+\frac{11}{24} = \left(\frac{5+3}{24}\right)+\frac{11}{24}$

$$= \frac{8}{24}+\frac{11}{24} = \frac{8+11}{24} = \frac{19}{24}$$

Also, $a+(b+c) = \frac{5}{24}+\left(\frac{3}{24}+\frac{11}{24}\right) = \frac{5}{24}+\left(\frac{3+11}{24}\right)$

$$= \frac{5}{24}+\frac{14}{24} = \frac{5+14}{24} = \frac{19}{24}$$

Hence, $\boldsymbol{(a+b)+c = a+(b+c)}$ **Verified**

(b) $(a+b)+c = \left(\frac{1}{9}+\frac{4}{19}\right)+\frac{17}{19} = \left(\frac{19+36}{171}\right)+\frac{17}{19} = \frac{55}{171}+\frac{17}{19}$

$$= \frac{55+153}{171} = \frac{208}{171}$$

Also, $a+(b+c) = \frac{1}{9}+\left(\frac{4}{19}+\frac{17}{19}\right) = \frac{1}{9}+\left(\frac{4+17}{19}\right) = \frac{1}{9}+\frac{21}{19}$

$$= \frac{19+189}{171} = \frac{208}{171}$$

Hence, $\boldsymbol{(a+b)+c = a+(b+c)}$ **Verified**

8. (a) $\frac{12}{15}-\left(-\frac{3}{10}\right)-\frac{24}{15} = \frac{12}{15}+\frac{3}{10}-\frac{24}{15} = \frac{24+9-48}{30}$

$$= \frac{33-48}{30} = \frac{-15}{30} = -\mathbf{\frac{1}{2}}$$ **Ans.**

(b) $\frac{15}{4}-\frac{7}{6}-\left(-\frac{2}{6}\right) = \frac{15}{4}-\frac{7}{6}+\frac{2}{6} = \frac{45-14+4}{12}$

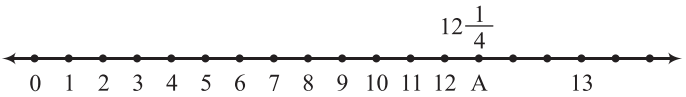
$$= \frac{49-14}{12} = \frac{35}{12} = \mathbf{2\,\frac{11}{12}}$$ **Ans.**

9. (a) $\frac{13}{7} = 1\frac{6}{7} = 1+\frac{6}{7}$

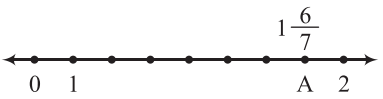
(b)

(c)

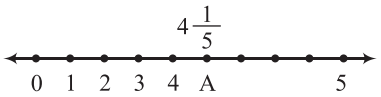
(d) $\frac{49}{4} = 12\frac{1}{4} = 12 + \frac{1}{4}$



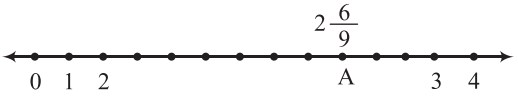
(e) $\frac{13}{7} = 1\frac{6}{7} = 1 + \frac{6}{7}$



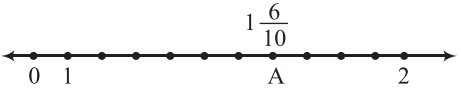
(f) $\frac{21}{5} = 4\frac{1}{5} = 4 + \frac{1}{5}$



10. (a) $\frac{24}{9} = 2\frac{6}{9} = 2 + \frac{6}{9}$

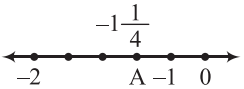


(b) $\frac{16}{10} = 1\frac{6}{10} = 1 + \frac{6}{10}$

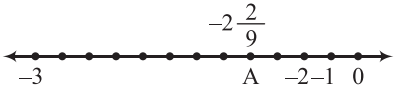


(c) $\frac{27}{42}$

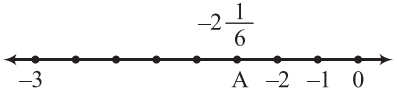
(d) $-\frac{5}{4} = -1\frac{1}{4} = -1 - \frac{1}{4}$



(e) $-\frac{20}{9} = -2\frac{2}{9} = -2 - \frac{2}{9}$



(f) $-\frac{13}{6} = -2\frac{1}{6} = -2 - \frac{1}{6}$



11. (a) Absolute value of $-\frac{19}{8} = \left|-\frac{19}{8}\right| = \mathbf{\frac{19}{8}}$ **Ans.**

(b) Absolute value of $-4 = |-4| = \mathbf{4}$ **Ans.**

(c) Absolute value of $2 = |2| = \mathbf{2}$ **Ans.**

(d) Absolute value of $\frac{13}{7} = \left|\frac{13}{7}\right| = \mathbf{\frac{13}{7}}$ **Ans.**

(e) Absolute value of $\frac{-9}{-6} = \left|\frac{-9}{-6}\right| = \frac{|-9|}{|-6|} = \mathbf{\frac{9}{6}}$ **Ans.**

(f) Absolute value of $\frac{7}{-16} = \frac{|7|}{|-16|} = \mathbf{\frac{7}{16}}$ **Ans.**

12. (a) L.H.S. $= \frac{25}{17} + \frac{-9}{10} = \frac{250 - 153}{170} = \frac{97}{170}$

R.H.S. $= \frac{-9}{10} + \frac{25}{17} = \frac{-153 + 250}{170} = \frac{97}{170}$

Hence, **L.H.S. = R.H.S.** $= \mathbf{\frac{97}{170}}$ **Verified**

(b) L.H.S. $= \frac{19}{26} + \frac{12}{23} = \frac{437 + 312}{598} = \frac{749}{598}$

R.H.S. $= \frac{12}{23} + \frac{19}{26} = \frac{312 + 437}{598} = \frac{749}{598}$

Hence, **L.H.S. = R.H.S.** $= \mathbf{\frac{749}{598}}$ **Verified**

(c) L.H.S. $= \frac{36}{7} \times \frac{8}{15} = \frac{36}{7} \times \frac{8}{15} = \frac{288}{105} = \frac{96}{35}$

R.H.S. $= \frac{8}{15} \times \frac{36}{7} = \frac{8 \times 36}{15 \times 7} = \frac{288}{105} = \frac{96}{35}$

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

(d) L.H.S. $= \frac{19}{8} \times \left(\frac{3}{4} \times \frac{35}{7}\right) = \frac{19}{8} \times \left(\frac{3 \times 35}{4 \times 7}\right) = \frac{19}{8} \times \frac{105}{28}$

$= \frac{19 \times 105}{8 \times 28} = \frac{1995}{224}$

R.H.S. $= \left(\frac{19}{8} \times \frac{3}{4}\right) \times \frac{35}{7} = \left(\frac{19 \times 3}{8 \times 4}\right) \times \frac{35}{7} = \frac{57}{32} \times \frac{35}{7} = \frac{1995}{224}$

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

(e) L.H.S. $= \frac{9}{28} \times \left(\frac{13}{4} + \frac{5}{7}\right) = \frac{9}{28} \times \left(\frac{91+20}{28}\right) = \frac{9}{28} \times \frac{111}{28} = \frac{9 \times 111}{28 \times 28}$

$= \frac{999}{784}$

R.H.S. $= \frac{9}{28} \times \frac{13}{4} + \frac{9}{28} \times \frac{5}{7} = \frac{117}{112} + \frac{45}{196} = \frac{819+180}{784} = \frac{999}{784}$

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

(f) L.H.S. $= \frac{13}{4} \times \left(\frac{9}{8} - \frac{25}{7}\right) = \frac{13}{4} \times \left(\frac{63-200}{56}\right) = \frac{13}{4} \times \frac{-137}{56}$

$= \frac{13 \times (-137)}{4 \times 56} = \frac{-1781}{224}$

R.H.S. $= \frac{13}{4} \times \frac{9}{8} - \frac{13}{4} \times \frac{25}{7} = \frac{117}{32} - \frac{325}{28} = \frac{819-2600}{224} = \frac{-1781}{224}$

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

13. (a) First rational number between $\frac{1}{5}$ and $\frac{1}{6} = \left(\frac{1}{5} + \frac{1}{6}\right) \div 2$

$= \left(\frac{6+5}{30}\right) \div 2 = \frac{11}{30} \div 2 = \frac{11}{30} \times \frac{1}{2} = \frac{11}{60}$

$\therefore \quad \frac{1}{5} < \frac{11}{60} < \frac{1}{6}$

Let us now find the rational number between $\frac{1}{6}$ and $\frac{11}{60}$.

The second rational number between $\frac{1}{6}$ and $\frac{11}{60} = \left(\frac{1}{6} + \frac{11}{60}\right) \div 2$

$$= \left(\frac{10+11}{60}\right) \div 2 = \frac{21}{60} \div 2 = \frac{21}{60} \times \frac{1}{2} = \frac{21}{120} = \frac{7}{40}$$

Hence, **two rational numbers between $\frac{1}{5}$ and $\frac{1}{6}$ are $\frac{11}{60}$ and $\frac{7}{40}$.** **Ans.**

14. First rational number between -7 and $\frac{2}{5} = \left(-7 + \frac{2}{5}\right) \div 2$

$$= \left(\frac{-35+2}{5}\right) \div 2 = \frac{-33}{5} \div 2 = \frac{-33}{5} \times \frac{1}{2} = \frac{-33}{10} = -3\frac{3}{10}$$

Let us find the rational number between -7 and $-\frac{33}{10}$.

Second rational number between -7 and $-\frac{33}{10} = \left(-7 + \frac{-33}{10}\right) \div 2$

$$= \left(\frac{-70-33}{10}\right) \div 2 = \frac{-103}{10} \div 2 = \frac{-103}{10} \times \frac{1}{2} = \frac{-103}{20} = -5\frac{3}{20}$$

$$\therefore \quad -7 < \frac{-33}{10} < \frac{-103}{20} < \frac{2}{5}$$

Third rational number between $\frac{-103}{20}$ and $\frac{2}{5} = \left(\frac{-103}{20} + \frac{2}{5}\right) \div 2$

$$= \left(\frac{-103+8}{20}\right) \div 2 = \frac{-95}{20} \div 2$$

$$= \frac{-95}{20} \times \frac{1}{2} = \frac{-95}{40} = \frac{-19}{8} = -2\frac{3}{8}$$

$$\therefore \quad -7 < \frac{-33}{10} < \frac{-103}{20} < \frac{-19}{8} < \frac{2}{5}$$

Let us find the rational number between $\frac{-103}{20}$ and $\frac{-19}{8}$.

Fourth rational number between $\frac{-103}{20}$ and $\frac{-19}{8}$

$$= \left(\frac{-103}{20} + \frac{(-19)}{8}\right) \div 2$$

$$=\left(\frac{-206+(-95)}{40}\right)\div 2=\frac{-301}{40}\div 2=\frac{-301}{40}\times\frac{1}{2}=\frac{-301}{80}=-3\frac{61}{80}$$

Hence, **$-3\frac{3}{10}$, $-5\frac{3}{20}$, $-2\frac{3}{8}$ and $-3\frac{61}{80}$ are the four rational numbers between -7 and $\frac{2}{5}$.** **Ans.**

15. First rational number between $\frac{6}{7}$ and $\frac{5}{9}=\left(\frac{6}{7}+\frac{5}{9}\right)\div 2$

$$=\left(\frac{54+35}{63}\right)\div 2=\left(\frac{89}{63}\right)\div 2=\frac{89}{63}\times\frac{1}{2}=\frac{89}{126}$$

$\therefore$ $$\frac{6}{7}<\frac{89}{126}<\frac{5}{9}$$

Let us find a rational number between $\frac{6}{7}$ and $\frac{89}{126}$.

Then second rational number between $\frac{6}{7}$ and $\frac{89}{126}$

$$=\left(\frac{6}{7}+\frac{89}{126}\right)\div 2$$

$$=\left(\frac{108+89}{126}\right)\div 2=\frac{197}{126}\div 2=\frac{197}{126}\times\frac{1}{2}=\frac{197}{252}$$

$\therefore$ $$\frac{6}{7}<\frac{197}{252}<\frac{89}{126}<\frac{5}{9}$$

Let us find a rational number between $\frac{89}{126}$ and $\frac{5}{9}$.

The third rational number between $\frac{89}{126}$ and $\frac{5}{9}=\left(\frac{89}{126}+\frac{5}{9}\right)\div 2$

$$=\left(\frac{89+70}{126}\right)\div 2=\frac{159}{126}\div 2=\frac{159}{126}\times\frac{1}{2}=\frac{159}{252}=\frac{53}{84}$$

Hence, **$\frac{89}{126}$, $\frac{197}{252}$ and $\frac{53}{84}$ are the required three rational numbers between $\frac{6}{7}$ and $\frac{5}{9}$.** **Ans.**

16. First rational number between $\frac{1}{6}$ and $\frac{2}{9} = \left(\frac{1}{6}+\frac{2}{9}\right)\div 2$

$$= \left(\frac{3+4}{18}\right)\div 2 = \frac{7}{18}\div 2 = \frac{7}{18}\times\frac{1}{2} = \frac{7}{36}$$

$\therefore \quad \frac{1}{6} < \frac{7}{36} < \frac{2}{9}$

Let us find a rational number between $\frac{1}{6}$ and $\frac{7}{36}$.

Second rational number between $\frac{1}{6}$ and $\frac{7}{36} = \left(\frac{1}{6}+\frac{7}{36}\right)\div 2$

$$= \left(\frac{6+7}{36}\right)\div 2 = \frac{13}{36}\div 2 = \frac{13}{36}\times\frac{1}{2} = \frac{13}{72}$$

Hence, **two rational numbers between $\frac{1}{6}$ and $\frac{2}{9}$ are $\frac{7}{36}$ and $\frac{13}{72}$.** **Ans.**

17. First rational number between $-\frac{1}{3}$ and $\frac{-1}{4} = \left[-\frac{1}{3}+\left(\frac{-1}{4}\right)\right]\div 2$

$$= \left[\frac{-4+(-3)}{12}\right]\div 2 = \frac{-7}{12}\div 2 = -\frac{7}{12}\times\frac{1}{2} = -\frac{7}{24}$$

$\therefore \quad -\frac{1}{3} < -\frac{7}{24} < -\frac{1}{4}$

Let us find a rational number between $-\frac{1}{3}$ and $\frac{-7}{24}$.

Second rational number between $-\frac{1}{3}$ and $\frac{-7}{24} = \left[-\frac{1}{3}+\left(\frac{-7}{24}\right)\right]\div 2$

$$= \left[\frac{-8+(-7)}{24}\right]\div 2 = \frac{-15}{24}\div 2 = \frac{-15}{24}\times\frac{1}{2} = \frac{-15}{48} = \frac{-5}{16}$$

$\therefore -\frac{1}{3} < \frac{-5}{16} < \frac{-7}{24} < \frac{-1}{4}$

Now, we find a rational number between $-\frac{7}{24}$ and $\frac{-5}{16}$.

The third rational number between $\frac{-7}{24}$ and $\frac{-5}{16}$

$$=\left[\frac{-7}{24}+\left(\frac{-5}{16}\right)\right]\div 2$$

$$=\left[\frac{-14+(-15)}{48}\right]\div 2=\left(\frac{-29}{48}\right)\div 2=\frac{-29}{48}\times\frac{1}{2}=-\frac{29}{96}$$

Hence, $\frac{-7}{24}$, $\frac{-5}{16}$ **and** $\frac{-29}{96}$ **are the required three rational numbers between** $\frac{-1}{3}$ **and** $\frac{-1}{4}$. **Ans.**

18. First rational number between $\frac{-1}{2}$ and $\frac{-7}{4}=\left[-\frac{1}{2}+\left(\frac{-7}{4}\right)\right]\div 2$

$$=\left[\frac{-2+(-7)}{4}\right]\div 2=-\frac{9}{4}\div 2=-\frac{9}{4}\times\frac{1}{2}=-\frac{9}{8}=-1\frac{1}{8}$$

$\therefore\quad -\frac{1}{2}<-\frac{9}{8}<-\frac{7}{4}$

Let us find a rational number between $-\frac{1}{2}$ and $-\frac{9}{8}$.

Second rational number between $-\frac{1}{2}$ and $-\frac{9}{8}=\left[-\frac{1}{2}+\left(-\frac{9}{8}\right)\right]\div 2$

$$=\left[\frac{-4+(-9)}{8}\right]\div 2=\frac{-13}{8}\div 2=\frac{-13}{8}\times\frac{1}{2}=\frac{-13}{16}$$

$\therefore\quad \frac{-1}{2}<\frac{-13}{16}<\frac{-9}{8}<\frac{-7}{4}$

The third rational number between $\frac{-9}{8}$ and $\frac{-7}{4}$

$$=\left[\frac{-9}{8}+\left(\frac{-7}{4}\right)\right]\div 2=\left(\frac{-9-14}{8}\right)\times\frac{1}{2}=-\frac{23}{61}=-1\frac{7}{16}$$

Hence, $-1\frac{1}{8}$, $-\frac{13}{16}$ **and** $-1\frac{7}{16}$ **are the required three rational numbers between** $-\frac{1}{2}$ **and** $-\frac{7}{4}$. **Ans.**

19. First rational number between $\frac{1}{3}$ and $\frac{4}{5} = \left(\frac{1}{3}+\frac{4}{5}\right)\div 2$

$$= \left(\frac{5+12}{15}\right)\div 2 = \frac{17}{15}\times\frac{1}{2} = \frac{17}{30}$$

$\therefore$ $\frac{1}{3} < \frac{17}{30} < \frac{4}{5}$

Second rational number between $\frac{1}{3}$ and $\frac{17}{30} = \left(\frac{1}{3}+\frac{17}{30}\right)\div 2$

$$= \left(\frac{10+17}{30}\right)\div 2 = \frac{27}{30}\times\frac{1}{2} = \frac{27}{60}$$

$\therefore$ $\frac{1}{3} < \frac{27}{60} < \frac{17}{30} < \frac{4}{5}$

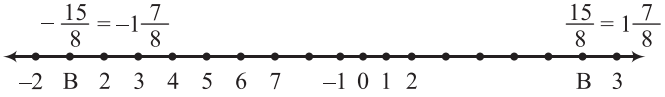
Now third rational number between $\frac{17}{30}$ and $\frac{4}{5}$

$$= \left(\frac{17}{30}+\frac{4}{5}\right)\div 2 = \left(\frac{17+24}{30}\right)\div 2 = \frac{41}{30}\div 2 = \frac{41}{30}\times\frac{1}{2} = \frac{41}{60}$$

$\therefore$ $\frac{1}{3} < \frac{27}{60} < \frac{17}{30} < \frac{41}{60} < \frac{4}{5}$

$\therefore$ **The three rational numbers between $\frac{1}{3}$ and $\frac{4}{5}$ are $\frac{27}{60}$, $\frac{17}{30}$ and $\frac{41}{60}$.** **Ans.**

20. Here $\frac{15}{8} = 1\frac{7}{8} = 1+\frac{7}{8}$ and $\frac{-15}{8} = -1\frac{7}{8} = -1-\frac{7}{8}$



21. Distance travels by a train $= 1000$ km 400 m $= 1000.400$ km

$$= \left(1000+\frac{400}{1000}\right)\text{km} = 1000\frac{2}{5}\text{ km} = \frac{5002}{5}\text{ km}$$

Time taken by the train $= 17$ hours 40 minutes

$$= 17+\frac{40}{60} = 17\frac{2}{3}\text{ hours} = \frac{53}{3}\text{ hours}$$

$\because$ Speed $= \dfrac{\text{Distance}}{\text{Time}}$

$\therefore$ Speed $= \dfrac{5002/5\,\text{km}}{53/3\,\text{hours}} = \dfrac{5002}{5} \times \dfrac{3}{53}$

$= \dfrac{15006}{265}$ km/h $= 56\dfrac{166}{265}$ km/h

Hence, **the speed of the train is $56\dfrac{166}{265}$ km/hour** **Ans.**

22. $\because$ Product of two rational numbers $= -9$

$\therefore$ One of the rational number $= -\dfrac{27}{8}$

$\therefore$ Other number $= -9 \div \left(-\dfrac{27}{8}\right) = -9 \times \dfrac{8}{-27} = \dfrac{8}{3} = 2\dfrac{2}{3}$

Hence, **the other number is $2\dfrac{2}{3}$.** **Ans.**

23. $\because$ Product of two numbers $= \dfrac{28}{27}$

$\therefore$ One rational number $= \dfrac{18}{7}$

$\therefore$ Other rational number $= \dfrac{28}{27} \div \dfrac{18}{7} = \dfrac{28}{27} \times \dfrac{7}{18} = \dfrac{98}{243}$

Hence, **the other rational number is $\dfrac{98}{243}$.** **Ans.**

Multiple Choice Questions

1. (i) Absolute value of $\dfrac{-6}{-7} = \left|\dfrac{-6}{-7}\right| = \dfrac{|-6|}{|-7|} = \dfrac{6}{7}$

Hence, the answer **(d)** is correct. **Ans.**

(ii) The additive element of addition of rational number is 0.

Hence, the answer **(c)** is correct. **Ans.**

(iii) Absolute value of $\dfrac{-5}{9} = \left|\dfrac{-5}{9}\right| = \dfrac{5}{9}$

Hence, the answer **(c)** is correct. **Ans.**

(iv) Answer **(a)** is correct. **Ans.**

(v) Additive inverse of $\frac{a}{b} = -\left(\frac{a}{b}\right) = \frac{-a}{b}$

Hence, the answer **(d)** is correct. **Ans.**

(vi) Answer **(b)** is correct. **Ans.**

(vii) Absolute value of $-1 = |-1| = 1$

Hence, the answer **(c)** is correct. **Ans.**

(viii) Absolute value of $1 = |1| = 1$

Hence, the answer **(c)** is correct. **Ans.**

2. Squares and Square Roots

Exercise 2.1

1. (a) $9^2 - 8^2 = 9 + 8 = \mathbf{17}$ **Ans.**

(b) $29^2 - 28^2 = 29 + 28 = \mathbf{57}$ **Ans.**

(c) $35^2 - 34^2 = 35 + 34 = \mathbf{69}$ **Ans.**

(d) $146^2 - 145^2 = 146 + 145 = \mathbf{291}$ **Ans.**

2. $100001^2 = \mathbf{10000200001}$ **Ans.**

and $10000001^2 = \mathbf{100000020000001}$ **Ans.**

(b) $1010101^2 = \mathbf{1020304030201}$ **Ans.**

and $101010101^2 = \mathbf{10203040504030201}$ **Ans.**

3. (a) The square of a prime number is prime. **False**

(b) The number of digits in a square number is even. **False**

(c) The sum of two square numbers is a square number. **False**

(d) The difference of two square numbers is a square number. **False**

(e) The product of two square number is a square number. **True**

(f) No square number is negative. **True**

4. (a) $810^2 = (640 + 2 \times 8)$ thousands $+ 10^2 = 656000 + 100 = \mathbf{656100}$ **Ans.**

(b) $108^2 = (100 + 2 \times 8)$ hundreds $+ 8^2 = 11600 + 64 = \mathbf{11664}$ **Ans.**

(c) $725^2 = 72 \times (72 \times 1)$ hundreds $+ 25$

$= 72 \times 7300 + 25 = 525600 + 25 = \mathbf{525625}$ **Ans.**

(d) $590^2 = (250 + 90)$ thousands $+ 90^2 = \mathbf{348100}$ **Ans.**

5. (a) $72^2 = (7^2 \times 10 + 2 \times 7 \times 2)$ tens $+ 2^2$

$= (490 + 28)$ tens $+ 4 = 5180 + 4 = \mathbf{5184}$ **Ans.**

(b) $57^2 = (5^2 + 7)$ hundreds $+ 7^2 = \mathbf{3249}$ **Ans.**

(c) $51^2 = (5^2 + 1)$ hundreds $+ 1^2 = \mathbf{2601}$ **Ans.**

(d) $68^2 = (6^2 \times 10 + 2 \times 6 \times 8)$ tens $+ 64$

$= (360 + 96)$ tens $+ 64$

$= 456 \times 10 + 64 = 4560 + 64 = \mathbf{4624}$ **Ans.**

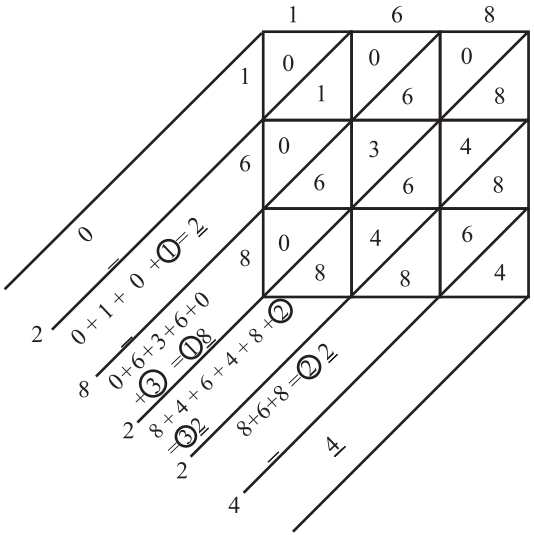
6. (a) $35^2 = 3 \times (3 + 1)$ hundreds $+ 25 = \mathbf{1225}$ **Ans.**

(b) $75^2 = 7 \times (7 + 1)$ hundreds $+ 25 = \mathbf{5625}$ **Ans.**

(c) $115^2 = 11 \times (11 + 1)$ hundreds $+ 25 = \mathbf{13225}$ **Ans.**

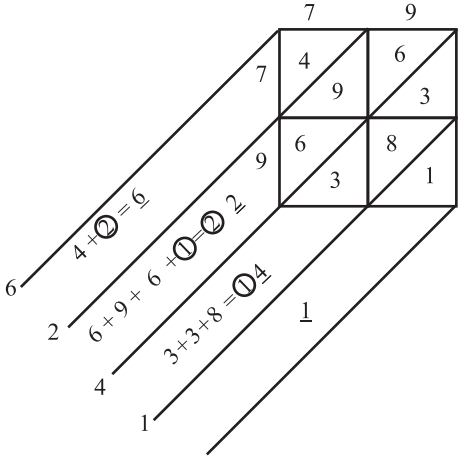
(d) $205^2 = 20 \times (20 + 1)$ hundreds $+ 25 = \mathbf{42025}$ **Ans.**

7. (a) Square of 168 by diagonal method.



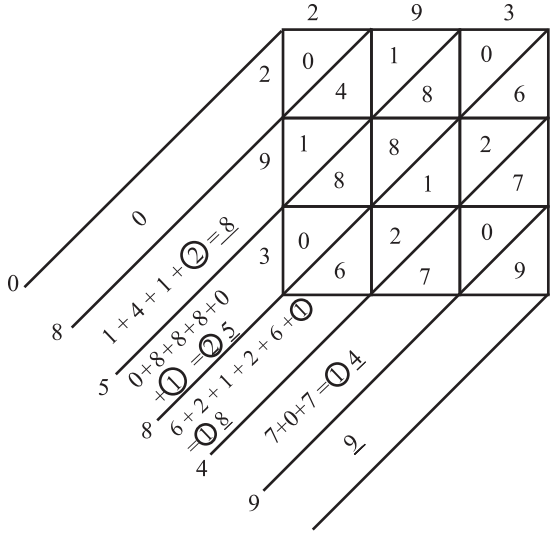
Hence, $\mathbf{168^2 = 28224}$ **Ans.**

(b) Square of 79 by diagonal method.



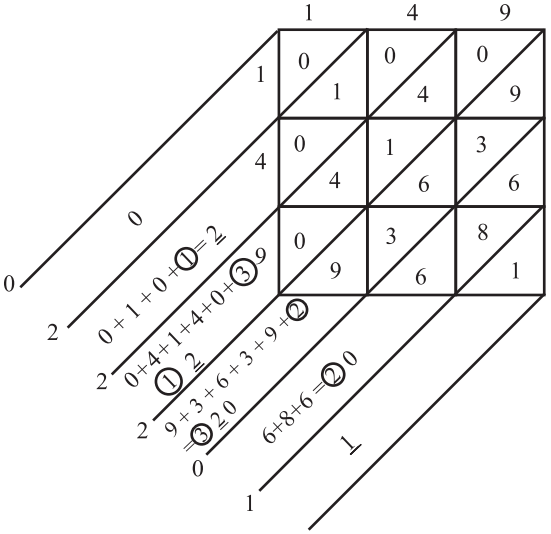
Hence, $79^2 = 6241$ **Ans.**

(c) Square of 293 by diagonal method.



Hence, $293^2 = 85849$ **Ans.**

(d) Square of 149 by diagonal method.



Hence, $\mathbf{149^2 = 22201}$ **Ans.**

8. (a) In number 46, let $a = 4$ and $b = 6$

Column I	Column II	Column III
a^2	$2ab$	b^2
4^2	$2 \times 4 \times 6$	6^2
16	48	36
5	+3	
21	51	

The number obtained from underline digit is the square.

Hence, $\mathbf{46^2 = 2116}$ **Ans.**

(b) In number 57, let $a = 5$ and $b = 7$

Column I	Column II	Column III
a^2	$2ab$	b^2
5^2	$2 \times 5 \times 7$	7^2
25	70	49
+7	+4	
32	74	

The number obtained from underline digit is the square.

Hence, $\mathbf{57^2 = 3249}$ **Ans.**

(c) In number 91, let $a = 9$ and $b = 1$

Column I	Column II	Column III
a^2	$2ab$	b^2
9^2	$2 \times 9 \times 1$	1^2
81	18	1
+1	+0	
8 2	1 8	

The number obtained from underline digit is the square.

Hence, $\mathbf{91^2 = 8281}$ **Ans.**

(d) In number 86, let $a = 8$ and $b = 6$

Column I	Column II	Column III
a^2	$2ab$	b^2
8^2	$2 \times 8 \times 6$	6^2
64	96	3 6
9	+3	
7 3	9 9	

The number obtained from underline is the square.

Hence, $\mathbf{86^2 = 7396}$ **Ans.**

9. We know that the square of n is equal to the sum of first n odd number. We haw $n^2 =$ sum of the first n odd number.

(a) $1 + 3 + 5 + 7 + 9 =$ Sum of first 5 odd number.

Sum of first 5 odd numbers $= 5^2 = \mathbf{25}$ **Ans.**

(b) $1 + 3 + 5 + 7 + 9 + 11 + 13 =$ Sum of first 7 odd numbers

$= 7^2 = 49$

$\therefore$ Sum of first 7 odd numbers $= \mathbf{49}$ **Ans.**

(c) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 23 =$ Sum of first 11 odd numbers.

$\therefore$ Sum of first 11 odd numbers $= 11^2 = \mathbf{121}$ **Ans.**

10. We know that three natural numbers m, n and p are Pythagorian triplet, if $m^2 + n^2 = p^2$

(a) Let $m=3$, $n=4$ and $p=5$

$\therefore \quad m^2+n^2=3^2+4^2=9+16=25$

$p^2=5^2=25$

Thus, $m^2+n^2=p^2$

Hence, **3, 4 and 5 are Pythagorian triplet.** **Ans.**

(b) Let $m=6$, $n=7$ and $p=8$

$\therefore \quad m^2+n^2=6^2+7^2=36+49=85$ and $p^2=8^2=64$

Thus, $m^2+n^2 \neq p^2$

Hence, **6, 7 and 8 are not Pythagorian triplet.** **Ans.**

(c) Let $m=12$, $n=25$ and $p=27$

$m^2+n^2=12^2+25^2=144+625=769$ and $p^2=27^2=729$

Thus, $m^2+n^2 \neq p^2$

Hence, **12, 25 and 27 are not Pythagorian triplet.** **Ans.**

(d) Let $m=8$, $n=15$ and $p=17$

$\therefore \quad m^2+n^2=8^2+15^2=64+225=289$

and $p^2=17^2=289$

Thus, $m^2+n^2=p^2$

Hence, **8, 15 and 17 are Pythagorian triplet.** **Ans.**

11. (a) First of all, we find the prime factors of 240.

2	240
2	120
2	60
2	30
3	15
5	5
	1

$\because \quad 240=2\times2\times2\times2\times3\times5$

$\therefore \quad 240=\underline{2\times2}\times\underline{2\times2}\times3\times5$

Here, we found the pair 2×2 and another pair of 2×2 and 3 and 5 are remain unpaired, which has no any pair.

Hence, **240 is not a perfect square.** **Ans.**

(b) First of all, we find the prime factors of 160.

2	160
2	80
2	40
2	20
2	10
	5

$\because 160=2\times2\times2\times2\times2\times5$

$\therefore 160=\underline{2\times2}\times\underline{2\times2}\times2\times5$

Here, we found the pair 2×2 and another pair 2×2 and 2 and 5 are remain unpaired, which has no any pair.

Hence, **160 is not a perfect square.** **Ans.**

(c) First of all, we find the prime factors of 625.

$\because \quad 625 = 5 \times 5 \times 5 \times 5$

$\therefore \quad 625 = \underline{5 \times 5} \times \underline{5 \times 5}$

$\therefore \quad 625 = 5^2 \times 5^2 = 25^2$

Here, on grouping the factors into pairs of equal factors, we find a pair of 5×5 and the other pair of 5×5 and no prime factor left along.

Hence, **625 is a prefect square.** **Ans.**

5	625
5	125
5	25
5	5
	1

(d) First of all, we find the prime factors of 1296.

$\because 1296 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3$

$\therefore 1296 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3}$

$\therefore \sqrt{1296} = 2 \times 2 \times 3 \times 3 = 36$

Here, on grouping the factors into pairs of equal factors, we find two pairs of 2×2 and 2×2, and other two pairs of 3×3 and 3×3 and no prime factor left along.

Hence, **1296 is a perfect square of 36.**

Ans.

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

12. We know that squares of odd numbers are always odd.

Thus, (a) 361, (b) 441, (d) 169, (e) 225, (f) 289 and (h) 729 are perfect square of odd numbers. **Ans.**

And the numbers (c) 100 and (g) 484 are not the perfect square of odd numbers. **Ans.**

13. We know that squares of even numbers are always even.

Thus, (a) 16, (c) 256, (e) 324, (f) 400 and (g) 676 are perfect square of even numbers. **Ans.**

And (b) 121, (d) 169 and (h) 841 are not perfect square of even numbers. **Ans.**

14. We know that the square of natural number n is equal to the sum of the first n odd numbers.

(a) $49 = 7^2 \Rightarrow$ Sum of first 7 odd numbers.

$= 1 + 3 + 5 + 7 + 9 + 11 + 13$ **Ans.**

(b) $64 = 8^2 \Rightarrow$ Sum of first 8 odd numbers.

$= 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15$ **Ans.**

(c) $100 = 10^2 \Rightarrow$ Sum of first 10 odd numbers.

$= 1+3+5+7+9+11+13+15+17+19$ **Ans.**

(d) $25 = 5^2 \Rightarrow$ Sum of first 5 odd numbers.

$= 1+3+5+7+9$ **Ans.**

15. We know that a number ending is 2, 3, 7 or 8 and an odd number of zeroes are never a perfect square.

Thus, (a) 49, (b) 64, (d) 169, (e) 256 and (h) 400 numbers are perfect squares. **Ans.**

And (c) 210, (f) 621 and (g) 351 numbers are not perfect squares. **Ans.**

16. First of all, we find the prime factors of 1328.

$\because 1328 = 2\times2\times2\times2\times83$

$\therefore 1328 = \underline{2\times2}\times\underline{2\times2}\times83$

Here, we formed a pair of 2×2 and another pair of 2×2 and 83 is remain unpaired, which has no any pair.

Hence, **1328 is not a perfect square.** **Ans.**

2	1328
2	664
2	332
2	166
	83

17. First of all, we find the prime factors of 1764.

$\because 1764 = 2\times2\times3\times3\times7\times7$

$\therefore 1764 = \underline{2\times2}\times\underline{3\times3}\times\underline{7\times7}$

$\therefore \sqrt{1764} = 2\times3\times7 = 42$

Here, on grouping the factors into pairs of equal factors, we find a pair of 2×2 and two pairs of 3×3 and 7×7 and no prime factor left along.

Hence, **1764 is a perfect square of 42.** **Ans.**

2	1764
2	882
3	441
3	147
7	49
7	7
	1

Exercise 2.2

1. (a)

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

$\because 400 = 2\times2\times2\times2\times5\times5$
or $400 = \underline{2\times2}\times\underline{2\times2}\times\underline{5\times5}$
$\therefore \sqrt{400} = 2\times2\times5 = 20$Hence,
$\sqrt{\mathbf{400}} = \mathbf{20}$ **Ans.**

(b)

3	729
3	243
3	81
3	27
3	9
3	3
	1

$\because 729 = 3\times3\times3\times3\times3\times3$ or
$729 = \underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}$
$\therefore \sqrt{729} = 3\times3\times3 = 27$
Hence, $\sqrt{\mathbf{729}} = \mathbf{27}$ **Ans.**

(c)

5	625
5	125
5	25
5	5
	1

$\because \quad 625 = 5\times5\times5\times5$
or $\quad 625 = \underline{5\times5}\times\underline{5\times5}$
$\therefore \sqrt{625} = 5\times5 = 25$
Hence, $\sqrt{\mathbf{625}} = \mathbf{25}$ **Ans.**

(d)

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	1

$\therefore 4096 = 2\times2\times2\times2\times$
$2\times2\times2\times2\times2\times2\times2\times2$
or $4096 = \underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}$
$\times\underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}$
$\therefore \sqrt{4096} = 2\times2\times2\times2$
$\times2\times2 = 64$
Hence, $\sqrt{\mathbf{4096}} = \mathbf{64}$ **Ans.**

(e)

2	1764
2	882
3	441
3	147
7	49
7	7
	1

$\because 1764 = 2\times2\times3\times3\times7\times7$
or $1764 = \underline{2\times2}\times\underline{3\times3}\times\underline{7\times7}$
$\therefore \sqrt{1764} = 2\times3\times7 = 42$
Hence, $\sqrt{\mathbf{1764}} = \mathbf{42}$ **Ans.**

(f)

2	2704
2	1352
2	676
2	338
13	169
13	13
	1

$\because 2704 = 2\times2\times2\times2\times13\times13$
or
$2704 = \underline{2\times2}\times\underline{2\times2}\times\underline{13\times13}$
$\therefore \sqrt{2704} = 2\times2\times13 = 52$
Hence, $\sqrt{\mathbf{2704}} = \mathbf{52}$ **Ans.**

(g)

53	2809
53	53
	1

$\because 2809 = 53\times53$
or $2809 = \underline{53\times53}$
$\therefore \sqrt{2809} = 53$
Hence, $\sqrt{\mathbf{2809}} = \mathbf{53}$ **Ans.**

(h)

7	5929
7	847
11	121
11	11
	1

$\because 5929 = 7\times7\times11\times11$
or $5929 = \underline{7\times7}\times\underline{11\times11}$
$\therefore \sqrt{5929} = 7\times11 = 77$ Hence,
$\sqrt{\mathbf{5929}} = \mathbf{77}$ **Ans.**

(i)

59	3481
59	59
	1

$\because 3481 = 59\times59$
or $3481 = \underline{59\times59}$
$\therefore \sqrt{3481} = 59$
Hence, $\sqrt{\mathbf{3481}} = \mathbf{59}$ **Ans.**

(j)

2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

$\because 11664 = 2\times2\times2\times2\times3$
$\times3\times3\times3\times3\times3$
or $11664 = \underline{2\times2}\times\underline{2\times2}$
$\times\underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}$
$\therefore \sqrt{11664} = 2\times2$
$\times3\times3\times3 = 108$
Hence, $\sqrt{\mathbf{11664}} = \mathbf{108}$ **Ans.**

(k)

3	56169
3	18723
79	6241
79	79
	1

$\because 56169 = 3 \times 3 \times 79 \times 79$

or $56169 = \underline{3 \times 3} \times \underline{79 \times 79}$

$\therefore \sqrt{56169} = 3 \times 79 = 237$

Hence, $\sqrt{\mathbf{56169}} = \mathbf{237}$ **Ans.**

(l)

2	298116
2	149058
3	74529
3	24843
7	8281
7	1183
13	169
13	13
	1

$\because 298116 = 2 \times 2 \times 3 \times 3 \times 7 \times 7 \times 13 \times 13$

or $298116 = \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7} \times \underline{13 \times 13}$

$\therefore \sqrt{298116} = 2 \times 3 \times 7 \times 13 = 546$

Hence, $\sqrt{\mathbf{298116}} = \mathbf{546}$ **Ans.**

2. (a) (i) $49 - 1 = 48$ (ii) $48 - 3 = 45$ (iii) $45 - 5 = 40$
(iv) $40 - 7 = 33$ (v) $33 - 9 = 24$ (vi) $24 - 11 = 13$
(vii) $13 - 13 = 0$

This subtracting process is done in (vii) times $\therefore \sqrt{\mathbf{49}} = \mathbf{7}$ **Ans.**

(b) (i) $64 - 1 = 63$ (ii) $63 - 3 = 60$ (iii) $60 - 5 = 55$
(iv) $55 - 7 = 48$ (v) $48 - 9 = 39$ (vi) $39 - 11 = 28$
(vii) $28 - 13 = 15$ (viii) $15 - 15 = 0$

This subtracting process is done in (viii) times $\therefore \sqrt{\mathbf{64}} = \mathbf{8}$ **Ans.**

(c) (i) $361 - 1 = 360$ (ii) $360 - 3 = 357$ (iii) $357 - 5 = 352$
(iv) $352 - 7 = 345$ (v) $1345 - 9 = 336$ (vi) $336 - 11 = 325$
(vii) $325 - 13 = 312$ (viii) $312 - 15 = 297$ (ix) $297 - 17 = 280$
(x) $280 - 19 = 261$ (xi) $261 - 21 = 240$ (xii) $240 - 23 = 217$
(xiii) $217 - 25 = 192$ (xiv) $192 - 27 = 165$ (xv) $165 - 29 = 136$
(xvi) $136 - 31 = 105$ (xvii) $105 - 33 = 72$ (xviii) $72 - 35 = 37$
(xix) $37 - 37 = 0$

This subtracting process is done in (xix) times $\therefore \sqrt{\mathbf{361}} = \mathbf{19}$ **Ans.**

(d) (i) $169 - 1 = 168$ (ii) $168 - 3 = 165$ (iii) $165 - 5 = 160$
(iv) $160 - 7 = 153$ (v) $153 - 9 = 144$ (vi) $144 - 11 = 133$
(vii) $133 - 13 = 120$ (viii) $120 - 15 = 105$ (ix) $105 - 17 = 88$

(x) $88-19=69$ (xi) $69-21=48$ (xii) $48-23=25$

(xiii) $25-25=0$

This subtracting process is done in (xiii) times.

$\therefore \sqrt{\mathbf{169}}=\mathbf{13}$ **Ans.**

3. (a) $\sqrt{\frac{25}{1296}}$

5	25
5	25
	1

and

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

$\because 25=5\times5$ and $\because 1296=2\times2\times2\times2\times3\times3\times3\times3$

or $25=\underline{5\times5}$ or $1296=\underline{2\times2}\times\underline{2\times2}\times\underline{3\times3}\times\underline{3\times3}$

$\therefore \sqrt{25}=5$ $\therefore \sqrt{1296}=2\times2\times3\times3=36$

Hence, $\sqrt{\frac{\mathbf{25}}{\mathbf{1296}}}=\frac{\mathbf{5}}{\mathbf{36}}$ **Ans.**

(b) $\sqrt{\frac{529}{841}}$

23	529
23	23
	1

and

29	841
29	29
	1

$\therefore 529=23\times23$ $\therefore 841=29\times29$

or $529=\underline{23\times23}$ or $841=\underline{29\times29}$

$\therefore \sqrt{529}=23$ $\therefore \sqrt{841}=29$

Hence, $\sqrt{\frac{\mathbf{529}}{\mathbf{841}}}=\frac{\mathbf{23}}{\mathbf{29}}$ **Ans.**

(c) $\sqrt{2\frac{14}{25}} = \sqrt{\frac{64}{25}}$

2	64
2	32
2	16
2	8
2	4
2	2
	1

and

5	25
5	5
	1

$\therefore 64 = 2\times2\times2\times2\times2\times2$ $\qquad$ $\therefore 25 = 5\times5$

or $64 = \underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}$ $\qquad$ or $25 = \underline{5\times5}$

$\therefore \sqrt{64} = 2\times2\times2 = 8$ $\qquad$ $\therefore \sqrt{25} = 5$

Hence, $\sqrt{\mathbf{2\frac{14}{25}}} = \sqrt{\frac{64}{25}} = \frac{8}{5} = \mathbf{1\frac{3}{5}}$ **Ans.**

(d) $\sqrt{23\frac{26}{121}} = \sqrt{\frac{2809}{121}}$

53	2809
53	53
	1

and

11	121
11	11
	1

$\because 2809 = 53\times53$ $\qquad$ $\because 121 = 11\times11$

or $2809 = \underline{53\times53}$ $\qquad$ or $121 = \underline{11\times11}$

$\therefore \sqrt{2809} = 53$ $\qquad$ $\therefore \sqrt{121} = 11$

Hence, $\sqrt{\mathbf{23\frac{26}{121}}} = \sqrt{\frac{2809}{121}} = \frac{53}{11} = \mathbf{4\frac{9}{11}}$ **Ans.**

4. Number of rows in garden $= \sqrt{1764}$

2	1764
2	882
3	441
3	147
7	49
7	7
	1

$1764 = \underline{2\times 2}\times \underline{3\times 3}\times \underline{7\times 7}$

Thus, $\sqrt{1764} = 2\times 3\times 7 = 42$

Hence, **number of rows in garden are 42.** **Ans.**

5. Here, the given number is 2400.

$\because 2400 = 2\times 2\times 2\times 2\times 2\times 3\times 5\times 5$

or $2400 = \underline{2\times 2}\times \underline{2\times 2}\times 2\times 3\times \underline{5\times 5}$

After making pairs of similar factors, we observe that 2 and 3 remains unpaired.

Therefore, the number should be divide by $2\times 3 = 6$ to make the given number a perfect square.

2	2400
2	1200
2	600
2	300
2	150
3	75
5	25
5	5
	1

$$2400 \div 6 = \frac{2400}{6} = 400$$

$400 = 2\times 2\times 2\times 2\times 5\times 5$

or $400 = \underline{2\times 2}\times \underline{2\times 2}\times \underline{5\times 5}$; $\sqrt{400} = 2\times 2\times 5 = 20$

Hence, **the number is 6 and the square root of remaining number, after dividing is 20.** **Ans.**

6. Here, the given number is 1725.

$\because 1725 = 3\times 5\times 5\times 23$

or $1725 = 3\times \underline{5\times 5}\times 23$

After making pairs of similar factors, we observe that 3 and 23 remains unpaired.

Therefore, the given number should be divided by $3\times 23 = 69$ to make the given number a perfect square.

3	1725
5	575
5	115
23	23
	1

$\because 1725 \div 69 = 25 \qquad \therefore \sqrt{25} = 5$

Hence, the number is 69 and the **square root of remaining number, after dividing is 5.** **Ans.**

7. Here, the given number is 9408.

2	9408
2	4704
2	2352
2	1176
2	588

2	294
3	147
7	49
7	7
	1

$\because 9408 = 2\times2\times2\times2\times2\times2\times3\times7\times7$

or $9408 = \underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times3\times\underline{7\times7}$

After making pairs of similar factors, we observe that 3 remains unpaired.

Therefore, the given number should be divided by 3 to make the quotient a perfect square.

Hence, **the number is 3.** **Ans.**

8. Total number of soldiers $= 8160$

After observe soldiers remains left $= 60$

Arrange the soilders in rows in the form of a square $= 8160 - 60$

$= 8100$ soilders.

$\therefore$ Number of soldiers in each row $= \sqrt{8100}$

$\because 8100 = 2\times2\times5\times5\times3\times3\times3\times3$

or $8100 = \underline{2\times2}\times\underline{5\times5}\times\underline{3\times3}\times\underline{3\times3}$

$\therefore \sqrt{8100} = 2\times3\times3\times5 = 90$

Hence, **number of soldiers in each row= 90**

2	8100
2	4050
5	2025
5	405
3	81
3	27
3	9
3	3
	1

Ans.

9. Number of soldiers in each team $= \sqrt{6561}$

3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

$\because 6561 = 3\times3\times3\times3\times3\times3\times3\times3$

or $6561 = \underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}$

$\therefore \sqrt{6561} = 3\times3\times3\times3 = 81$

There **were 81 soldiers in each team.** **Ans.**

10. Number of students in the class $= \sqrt{5184}$

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

$\because 5184 = 2\times2\times2\times2\times2\times2\times3\times3\times3\times3$

or $5184 = \underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{3\times3}\times\underline{3\times3}$

$\therefore \sqrt{5184} = 2\times2\times2\times3\times3 = 72$

Hence, **72 students are in the class.** **Ans.**

11. Here, the given number is class.

2	1890
3	945
3	315
3	105
5	35
7	7
	1

$\because 1890 = 2\times3\times3\times3\times5\times7$

or $1890 = 2\times\underline{3\times3}\times3\times5\times7$

After making pairs of similar factors we observe that 2, 3, 5 and 7 remains unpaired so, the given number be multiplied by $2\times3\times5\times7 = 210$ to make the product become a perfect square.

Hence, **the number is 210.** **Ans.**

12. Number of rows in the garden $= \sqrt{2304}$

2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

$\because 2304 = 2\times2\times2\times2\times2\times2\times2\times2\times3\times3$

or $2304 = \underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{2\times2}\times\underline{3\times3}$

Thus,

$\sqrt{2304} = 2 \times 2 \times 2 \times 2 \times 3$

$= 48$

Hence, **48 rows in the garden.** **Ans.**

13. Number of soilders in each row $= \sqrt{6400}$

2	6400
2	3200
2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

$\because 6400 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$

or $6400 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{5 \times 5}$

$\sqrt{6400} = 2 \times 2 \times 2 \times 2 \times 5 = 80$

Hence, **80 soilders in each row.** **Ans.**

Exercise 2.3

1. (a) Square root of $71289 = \sqrt{71289}$

	267
2	7 12 89
+2	−4
46	312
+6	−276
527	3689
	−3689
	0

$\therefore \sqrt{\mathbf{71289}} = \mathbf{267}$ **Ans.**

(b) Square root of $690561 = \sqrt{690561}$

	831
8	69 05 61
+8	−64
163	505
+3	−489
1661	16 61
	−16 61
	0

$\therefore \sqrt{\mathbf{690561}} = \mathbf{831}$ **Ans.**

(c) Square root of $18225 = \sqrt{18225}$

	135
1	1 82 25
+1	−1
23	82
+3	−69
265	13 25
	−13 25
	0

$\therefore \sqrt{\mathbf{18225}} = \mathbf{135}$ **Ans.**

(d) Square root of
$792100 = \sqrt{792100}$

	890
8	$\overline{79}\ \overline{21}\ \overline{00}$
+8	−64
169	1521
	−1521
	0

$\therefore \sqrt{\mathbf{792100}} = \mathbf{890}$ **Ans.**

(e) Square root of
$82101721 = \sqrt{82101721}$

	9061
9	$\overline{82}\ \overline{10}\ \overline{17}\ \overline{21}$
+9	−81
1806	1 10 17
+6	−1 08 36
18121	1 81 21
	−1 81 21
	0

$\therefore \sqrt{\mathbf{82101721}} = \mathbf{9061}$ **Ans.**

(f) Square roof of
$40819321 = \sqrt{40819321}$

	6389
6	40 81 93 21
+6	−36
123	4 81
+3	−3 69
1268	1 12 93
+8	−1 01 44
12769	11 49 21
	−11 49 21
	0

$\therefore \sqrt{\mathbf{40819321}} = \mathbf{6389}$ **Ans.**

2. (a) Square root of
$46.24 = \sqrt{46.24}$

	6.8
6	$\overline{46}.\overline{24}$
+6	−36
128	10 24
	−10 24
	0

$\therefore \sqrt{\mathbf{46.24}} = \mathbf{6.8}$ **Ans.**

(b) Square roots of
$57.1536 = \sqrt{57.1536}$

	7.56
7	$\overline{57}.\overline{15}\ \overline{36}$
+7	−49
145	8 15
+5	7 25
1506	90 36
	−90 36
	0

$\therefore \sqrt{\mathbf{57.1536}} = \mathbf{7.56}$ **Ans.**

(c) Square roots of
$377.5249 = \sqrt{377.5249}$

	19.43
1	$\overline{3}\ \overline{77}.\overline{52}\ \overline{49}$
+1	−1
29	2 77
9	−261
384	16 52
+4	−15 36
3883	1 16 49
	−1 16 49
	0

$\therefore \sqrt{377.5249} = 19.43$ **Ans.**

(d) Square root of
$250.2724 = \sqrt{250.2724}$

	15.82
1	$2\overline{50}.\overline{27}\ \overline{24}$
+1	-1
25	150
+5	-125
308	25 27
+8	$-24\ 64$
3162	63 24
	$-63\ 24$
	0

$\therefore \sqrt{250.2724} = 15.82$ **Ans.**

(e) Square root of
$0.00001024 = \sqrt{0.00001024}$

	0.0032
3	$0.\overline{00}\ \overline{00}\ \overline{10}\ \overline{24}$
+3	-9
62	1 24
	$-1\ 24$
	0

$\therefore \sqrt{0.00001024} = 0.0032$ **Ans.**

(f) Square root of
$0.000169 = \sqrt{0.000169}$

	0.013
1	$0.\overline{00}\ \overline{01}\ \overline{69}$
+1	-1
23	69
	-69
	0

$\therefore \sqrt{0.000169} = 0.013$ **Ans.**

3. (a) $\sqrt{\dfrac{256}{441}} = \dfrac{\sqrt{256}}{\sqrt{441}}$

	16
1	$\overline{2}\ \overline{56}$
+1	-1
26	156
	-156
	0

	21
2	$\overline{4}\ \overline{41}$
+2	-4
4	41
1	-41
	0

$\therefore \sqrt{256} = 16$ and $\sqrt{441} = 21$

Hence, $\sqrt{\dfrac{\mathbf{256}}{\mathbf{441}}} = \dfrac{\mathbf{16}}{\mathbf{21}}$ **Ans.**

(b) $\sqrt{\dfrac{361}{841}} = \dfrac{\sqrt{361}}{\sqrt{841}}$

	19		29
1	$\overline{3}\ \overline{61}$	2	$\overline{8}\ \overline{41}$
+1	-1	+2	-4
29	261	49	441
	-261		-441
	0		0

$\therefore \sqrt{361} = 19$ and $\sqrt{841} = 29$

Hence, $\sqrt{\dfrac{\mathbf{361}}{\mathbf{841}}} = \dfrac{\mathbf{19}}{\mathbf{29}}$ **Ans.**

(c) $75\dfrac{46}{49} = \dfrac{75 \times 49 + 46}{49}$

$= \dfrac{3675 + 46}{49} = \dfrac{3721}{49}$

	61
6	$\overline{37}\ \overline{21}$
+6	−36
12	121
1	−121
	0

	7
7	$\overline{49}$
	49
	0

$\therefore \quad \sqrt{\dfrac{3721}{49}} = \dfrac{\sqrt{3721}}{\sqrt{49}}$

$\therefore \quad \sqrt{3721} = 61 \text{ and } \sqrt{49} = 7$

Hence, $\sqrt{\dfrac{\mathbf{3721}}{\mathbf{49}}} = \dfrac{\mathbf{61}}{\mathbf{7}} = \mathbf{8}\dfrac{\mathbf{5}}{\mathbf{7}}$ **Ans.**

(d) $10\dfrac{151}{225} = \dfrac{10 \times 225 + 151}{225} = \dfrac{2250 + 151}{225} = \dfrac{2401}{225}$

	49
4	$\overline{24}\ \overline{01}$
+4	−16 ↓↓
89	8 01
	−8 01
	0

	15
1	$\overline{2}\ \overline{25}$
+1	−1 ↓↓
25	1 25
	−1 25
	0

$\therefore \quad \sqrt{\dfrac{2401}{225}} = \dfrac{\sqrt{2401}}{\sqrt{225}}$

$\therefore \quad \sqrt{2401} = 49 \text{ and } \sqrt{225} = 15$

Hence, $\sqrt{\dfrac{\mathbf{2401}}{\mathbf{225}}} = \dfrac{49}{15} = \mathbf{3}\dfrac{\mathbf{4}}{\mathbf{15}}$ **Ans.**

4. (a) $\dfrac{\sqrt{59.29} - \sqrt{5.29}}{\sqrt{59.29} + \sqrt{5.29}}$

	7.7
7	$\overline{59}.\overline{29}$
+7	−49 ↓↓
147	10 29
	−10 29
	0

	2.3
2	$\overline{5}.\overline{29}$
+2	−4 ↓↓
43	1 29
	−1 29
	0

$\therefore \quad \sqrt{59.29} = 7.7$ and $\sqrt{5.29} = 2.3$

$\therefore \quad \dfrac{\sqrt{59.29} - \sqrt{5.29}}{\sqrt{59.29} + \sqrt{5.29}} = \dfrac{7.7 - 2.3}{7.7 + 2.3} = \dfrac{5.4}{10} = \mathbf{0.54}$ **Ans.**

(b) $\dfrac{\sqrt{0.2304} - \sqrt{0.1764}}{\sqrt{0.2304} + \sqrt{0.1764}}$

	0.48
4	$0.\overline{23}\ \overline{04}$
+4	−16 ↓↓
88	7 04
	−7 04
	0

	0.42
4	$0.\overline{17}\ \overline{64}$
+4	−16 ↓↓
82	1 64
	−1 64
	0

$\because \sqrt{0.2304} = 0.48$ and $\sqrt{0.1764} = 0.42$

$\therefore \dfrac{\sqrt{0.2304} - \sqrt{0.1764}}{\sqrt{0.2304} + \sqrt{0.1764}} = \dfrac{0.48 - 0.42}{0.48 + 0.42} = \dfrac{0.06}{0.90} = \dfrac{6 \times 100}{90 \times 100} = \dfrac{6}{90} = \mathbf{\dfrac{1}{15}}$

Ans.

5. (a) Since we have to find square root of 3 correct to two places of decimal, we affix six zeroes to the right of the decimal point to make three pairs.

$\because$ The square root there is 2 on third place which is less than 5.

$\therefore$ The correct square root up to two places of decimal is 1.73.

Hence, $\sqrt{3} = \mathbf{1.73}$ **Ans.**

	1.732
1	$\overline{3}.\overline{00}\ \overline{00}\ \overline{00}$
+1	−1 ↓↓↓↓↓
27	2 00
+7	−1 89 ↓↓↓
343	11 00
+3	−10 29 ↓↓
3462	71 00
	−69 24
	1 76

(b) First of all affix six zeroes to the right of the decimal point to make three pairs.

Square root of $5 = \sqrt{5}$

	2.236
2	$\overline{5}.\overline{00}\ \overline{00}\ \overline{00}$
+2	-4
42	1 00
+2	-84
443	16 00
+3	$-13\ 29$
4466	2 71 00
	$-2\ 67\ 96$
	3 04

$\because$ There is 6 on the third place of decimal which is more than 5.

$\therefore$ The nearest square root upto two places of decimal will be

$= 2.23 + 0.01 = 2.24$

Hence, $\sqrt{\mathbf{5}} = \mathbf{2.24}$ **Ans.**

(c) First of all affix five zeroes to right of the decimal to make three pairs.

Square root of $4.7 = \sqrt{4.7}$

	2.167
2	$\overline{4}.\overline{70}\ \overline{00}\ \overline{00}$
+2	-4
41	70
+1	-41
426	29 00
+6	$-25\ 56$
4327	3 44 00
	$-3\ 02\ 89$
	41 11

$\because$ There is 7 on the third place of decimal which is more than 5.

$\therefore$ The nearest square root up to two places of decimal will be
$= 2.16 + 0.01 = 2.17$

Hence, $\sqrt{\mathbf{4.7}} = \mathbf{2.17}$ **Ans.**

(d) First of all affix five zeroes to the right of the decimal point to make three pairs.

Square root of $0.2 = \sqrt{0.2}$

$\because$ There is 7 on the third place of decimal which is more than 5.

$\therefore$ The nearest square root up to two place of decimal will be
$= 0.44 + 0.01 = 0.45$

Hence, $\sqrt{\mathbf{0.2}} = \mathbf{0.45}$ **Ans.**

	0.447
4	$0.\overline{20}\ \overline{00}\ \overline{00}$
+4	−16
84	4 00
+4	−3 36
887	64 00
	−62 09
	1 91

6. Square root of $\sqrt{306452}$

The given number $(553)^2 < 306452 < (554)^2$

	553
5	$\overline{30}\ \overline{64}\ \overline{52}$
+5	−25
105	5 64
+5	−5 25
1103	39 52
	−33 09
	6 43

Number should be added $= (554)^2 - 306452$

$= 306916 - 306452 = 464$

Hence, **the number to be added is 464.** **Ans.**

7. First, we try to find the square root of $294492 = \sqrt{294492}$, we get remainder 728 from the number. It show that 542^2 is less than 294492 by 728. This means if we subtract the remainder from the number, we get a perfect square.

Therefore, the required perfect square is

$294492 - 728 = 293764$ and $\sqrt{293764} = 542$

	542
5	$\overline{29}\ \overline{44}\ \overline{92}$ -25
104 $+4$	$4\ 44$ $-4\ 16$
1082	$28\ 92$ $-21\ 64$
	$7\ 28$

Therefore, the required perfect square is $294492 - 728 = 293764$ and $\sqrt{293764} = 542$

Hence, **728 subtract from the number and perfect square is 542.** **Ans.**

8. Greatest four digit number $= 9999$

Square root of $9999 = \sqrt{9999}$

On finding square root, we observe that the remainder is 198. This show 99^2 is less than 9999 by 198. This means, if we subtract the remainder from the number, we get the perfect square.

	99
9 $+9$	$\overline{99}\ \overline{99}$ -81
189	$18\ 99$ $-17\ 01$
	$1\ 98$

Hence, **the greatest number is $= 9999 - 198 = 9801$** **Ans.**

9. Greatest five digit number $= 99999$

Square root of $99999 = \sqrt{99999}$

On finding square root, we observe that the remainder is 143. This show 316^2 is less than 99999 by 143.

This means, if we subtract the remainder from the number, we get a perfect square.

Hence, the greatest number is $= 99999 - 143 =$ **99856** **Ans.**

	316
3 $+3$	$\overline{9}\ \overline{99}\ \overline{99}$ -9
61 $+1$	99 -61
626	$38\ 99$ $-37\ 56$
	$1\ 43$

Exercise 2.4

1. (a) If there are n digits in a perfect square, then its square root will contain $\frac{n}{2}$ digits, when n is even:

2304, digits are 4 or $(n) = 4$ which is an even number.

$\therefore \quad \frac{n}{2} = \frac{4}{2} = 2$

Hence, **the number of digits are 2.** **Ans.**

(b) 75625, digits are 5 or $n = 5$ which is odd number.

$\therefore \quad \frac{n+1}{2} = \frac{5+1}{2} = \frac{6}{2} = 3$

Hence, **the number of digits are 3.** **Ans.**

(c) 166464, digits are 6 or $n = 6$ which is an even number.

$\therefore \quad \frac{n}{2} = \frac{6}{2} = 3$

Hence, **the number of digits are 3.** **Ans.**

(d) 32901696, digit are 8 or $n = 8$ which is an even number.

$\therefore \quad \frac{n}{2} = \frac{8}{2} = 4$

Hence, **the number of digits are 4.** **Ans.**

(e) 64432729, digits are 8 or $n = 8$ which is an even number.

$\therefore \quad \frac{n}{2} = \frac{8}{2} = 4$

Hence, **the number of digits are 4.** **Ans.**

(f) 123454321, digits are 9 or $n = 9$, which is an odd number.

$\therefore \quad \frac{n+1}{2} = \frac{9+1}{2} = \frac{10}{2} = 5$

Hence, **the number of digits are 5.** **Ans.**

2. $\because$ Number of digit in the square root $= 6$.

Which is an even number.

or $\quad n = 6$

$\therefore \quad \frac{n}{2} = \frac{6}{2} = 3$

Hence, **the number of digits are 3.** **Ans.**

3. 289, digits are 3 or $n = 3$ which is an odd number.

$$\therefore \quad \frac{n+1}{2} = \frac{3+1}{2} = \frac{4}{2} = 2$$

Hence, **the number of digits are 2.** **Ans.**

4. There are three least number in the square of any two digit number. **Ans.**

5. Six greatest number are present in the square of any three digit number. **Ans.**

6. 15625, digit are 5 or $n = 5$ which is an odd number.

$$\therefore \quad \frac{n+1}{2} = \frac{5+1}{2} = \frac{6}{2} = 3$$

Hence, **the number of digits are 3.** **Ans.**

7. (i) 1809025, digit are 7 or $n = 7$ which is an odd number.

$$\therefore \quad \frac{n+1}{2} = \frac{7+1}{2} = \frac{8}{2} = 4$$

$\therefore$ Number of digits $= 4$

Hence, the answer **(c)** is correct. **Ans.**

(ii) Number of digits from 120 to 999 are 3 or $n = 3$ which is an odd number.

$$\therefore \quad \frac{n+1}{2} = \frac{3+1}{2} = \frac{4}{2} = 2$$

$\therefore$ Number of digits $= 2$

Hence, the answer **(a)** is correct. **Ans.**

(iii) Number of digit in the square root $= 7$ or $n = 7$ which is an odd number.

$$\therefore \quad \frac{n+1}{2} = \frac{7+1}{2} = 4$$

$\therefore$ Number of digit $= 4$

Hence, the answer **(c)** is correct. **Ans.**

(iv) Answer **(c)** is correct. **Ans.**

Exercise 2.5

1. (a) Square root of $4225 = \sqrt{4225}$

	65
6	$\overline{42}\ \overline{25}$
+6	-36 ↓↓
125	6 25
	$-6\ 25$
	0

$\therefore \sqrt{4225} = \mathbf{65}$ **Ans**

(b) Square root of $91809 = \sqrt{91809}$

	303
3	$\overline{9}\ \overline{18}\ \overline{09}$
+3	-9 ↓↓↓
603	18 09
	$-18\ 09$
	0

$\therefore \sqrt{91809} = \mathbf{303}$ **Ans.**

(c) Square root of $4915412100 = \sqrt{4915412100}$

	70110
7	$\overline{49}\ \overline{15}\ \overline{41}\ \overline{21}\ \overline{00}$
+7	-49 ↓↓↓
1401	15 41 ↓↓
+1	$-14\ 01$ ↓↓
14021	1 40 21 ↓
	$-1\ 40\ 21$ ↓
	0
	-0

$\therefore \sqrt{4915412100} = \mathbf{70110}$ **Ans.**

(d) Square root of $2085474889 = \sqrt{2085474889}$

	45667
4	$\overline{20}\ \overline{85}\ \overline{47}\ \overline{48}\ \overline{89}$
$+4$	-16
85	4 85
$+5$	$-4\ 25$
906	60 47
$+6$	$-54\ 36$
9126	6 11 48
$+6$	$-5\ 47\ 56$
91327	63 92 89
	$-63\ 92\ 89$
	0

$\therefore \sqrt{2085474889} = \mathbf{45667}$ **Ans.**

2. (a) $26^2 - 25^2 = 26 + 25 = \mathbf{51}$ **Ans.**

(b) $651^2 - 650^2 = 651 + 650 = \mathbf{1301}$ **Ans.**

(c) $101^2 - 100^2 = 101 + 100 = \mathbf{201}$ **Ans.**

(d) $1001^2 - 1000 = 1001 + 1000 = \mathbf{2001}$ **Ans.**

3. (a) $\dfrac{625}{144} = \sqrt{\dfrac{625}{144}} = \dfrac{\sqrt{625}}{\sqrt{144}}$

	25
2	$\overline{6}\ \overline{25}$
$+2$	-4
45	2 25
	$-2\ 25$
	0

	12
1	$\overline{1}\ \overline{44}$
$+1$	-1
22	44
	-44
	0

$\therefore \sqrt{625} = 25$ and $\sqrt{144} = 12$

Hence, $\sqrt{\dfrac{625}{144}} = \dfrac{25}{12} = \mathbf{2\,\dfrac{1}{12}}$ **Ans.**

(b) $38\dfrac{139}{169} = \dfrac{38 \times 169 + 139}{169} = \dfrac{6422 + 139}{169} = \dfrac{6561}{169}$

$\therefore \quad \sqrt{\frac{6561}{169}} = \frac{\sqrt{6561}}{\sqrt{169}}$

	81
8	$\overline{65}\,\overline{61}$
+8	-64 ↓↓
161	161
	-161
	0

	13
1	$\overline{1}\,\overline{69}$
+1	-1 ↓↓
23	69
	-69
	0

$\therefore \quad \sqrt{6561} = 81$ and $\sqrt{169} = 13$

Hence, $\sqrt{38\frac{139}{169}} = \frac{81}{13} = \mathbf{6\,\frac{3}{13}}$ **Ans.**

(c) $28\frac{189}{289} = \frac{28 \times 289 + 189}{289} = \frac{8092 + 189}{289} = \frac{8281}{289}$

	91
9	$\overline{82}\,\overline{81}$
+9	-81 ↓↓
181	181
	-181
	0

	17
1	$\overline{2}\,\overline{89}$
+1	-1 ↓↓
27	189
	-189
	0

$\therefore \quad \sqrt{\frac{8281}{289}} = \frac{\sqrt{8281}}{\sqrt{289}}$

$\therefore \quad \sqrt{8281} = 91$ and $\sqrt{289} = 17$

Hence, $\sqrt{28\frac{189}{289}} = \frac{91}{17} = \mathbf{5\,\frac{6}{17}}$ **Ans.**

(d) $51\frac{30}{169} = \frac{51 \times 169 + 30}{169}$

$= \frac{8619 + 30}{169} = \frac{8649}{169}$

	93
9	$\overline{86}\ \overline{49}$
+9	−81 ↓↓
183	5 49
	−5 49
	0

	13
1	$\overline{1}\ \overline{69}$
+1	−1 ↓↓
23	69
	−69
	0

$\therefore \quad \sqrt{\frac{8649}{169}} = \frac{\sqrt{8649}}{\sqrt{169}}$

$\therefore \quad \sqrt{8649} = 93$ and $\sqrt{169} = 13$

$\therefore \quad \sqrt{51\frac{30}{169}} = \frac{93}{13} = \mathbf{7\ \frac{2}{13}}$ **Ans.**

4. (a) $5^2 + (-5)^2 = 25 + 25 = \mathbf{50}$ **Ans.**

(b) $60 + \sqrt{900} = 60 + 30 \qquad [\because \sqrt{\mathbf{900}} = \mathbf{30}] = \mathbf{90}$ **Ans.**

(c) $\sqrt{(5^2 + 12^2)} = \sqrt{25 + 144} = \sqrt{169} = 13$

	13
1	169
+1	−1 ↓↓
23	69
	−69
	0

Hence, $\sqrt{5^2 + 12^2} = \mathbf{13}$ **Ans.**

(d) $\sqrt{900} + \sqrt{0.04} + \sqrt{0.000004} = 30 + 0.2 + 0.002 = \mathbf{30.202}$ **Ans.**

5. (a)

2	15876
2	7938
3	3969
3	1323
3	441
3	147
7	49
7	7
	1

$\because\ 15876 = 2\times2\times3\times3 \times3\times3\times7\times7$

or $15876 = \underline{2\times2}\times \underline{3\times3}\times\underline{3\times3}\times\underline{7\times7}$

$\therefore\ \sqrt{15876} = 2\times3\times3\times7 = 126$

Hence, $\sqrt{15876} = \mathbf{126}$ **Ans.**

(b)

5	148225
5	29645
7	5929
7	847
11	121
11	11
	1

$\because\ 148225 = 5\times5\times7\times7\times11\times11$

or $148225 = \underline{5\times5}\times\underline{7\times7}\times\underline{11\times11}$

$\therefore \sqrt{148225} = 5\times7\times11 = 385$

Hence, $\sqrt{148225} = \mathbf{385}$ **Ans.**

(c)

2	69696
2	34848
2	17424
2	8712
2	4356
2	2178
3	1089
3	363
11	121
11	11
	1

$\because\ 69696 = 2\times2\times2\times2\times2\times2 \times3\times3\times11\times11$

or $69696 = \underline{2\times2}\times\underline{2\times2}\times \underline{2\times2}\times\underline{3\times3}\times\underline{11\times11}$

$\therefore \sqrt{69696} = 2\times2\times2\times3\times11 = 264$

Hence, $\sqrt{69696} = \mathbf{264}$ **Ans.**

(d)

2	87616
2	43808
2	21904
2	10952
2	5476
2	2738
37	1369
37	37
	1

$\because\ 87616 = 2\times2\times2\times2 \times2\times2\times37\times37$

or $87616 = \underline{2\times2}\times\underline{2\times2} \times\underline{2\times2}\times\underline{37\times37}$

$\therefore \sqrt{87616} = 2\times2\times2\times37 = 296$

$\therefore \sqrt{87616} = \mathbf{296}$ **Ans.**

6. $\sqrt{61^2 - 60^2} = \sqrt{61+60}$

$= \sqrt{121} = \mathbf{11}$ **Ans.**

7. First of all, we find the prime factors of 2700

2	2700
2	1350
3	675

3	225
3	75
5	25
5	5
	1

$\because 2700 = 2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 5$

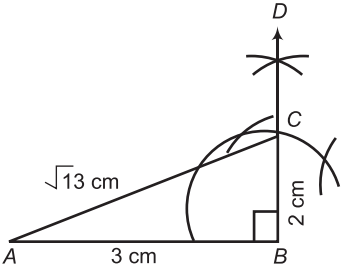
or $2700 = \underline{2 \times 2} \times \underline{3 \times 3} \times 3 \times \underline{5 \times 5}$

Here, we found a pair of 2×2 and another pairs are 3×3 and 5×5 and 3 is remain unpaired, which has no any pair.

Hence, **2700 is not a perfect square.** **Ans.**

8. We know that $\sqrt{13} = \sqrt{3^2 + 2^2}$

Firstly we construct a right angle triangle ABC, whose arms which form right angle are 3 cm and 2 cm respectively.



Construction :

(a) Draw line segment $AB = 3$ cm

(b) Draw a perpendicular DB at point B.

(c) Bisect a line segment $BC = 2$ cm.

(d) Meet the line segment AC.

Calculation: In right angle triangle ABC, $\angle B = 90°$

According to the Pythagoras theorem

$AC^2 = AB^2 + CB^2 = (3^2 + 2^2)\,\text{cm}^2$

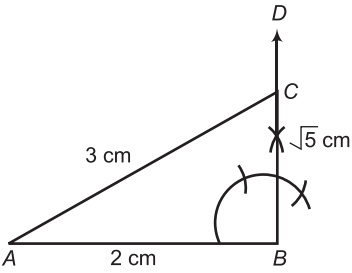
On measuring the length of hypotenuse $AC = \sqrt{13}$ cm 3.6 cm (approx)

$\therefore \sqrt{13} =$ **3.6 cm**

Now $\sqrt{5}$, we know that

$\sqrt{5} = \sqrt{3^2 - 2^2}$

Firstly, we construct a right angle triangle in which hypotenuse is of 3 cm and the one of arms which form right angle is of 2 cm.



Construction :

(a) Draw a line segment $AB = 2$ cm.

(b) Draw a perpendicular BD at point B of line segment AB.

(c) Draw an arc of 3 cm with centre A which bisects to the BD at point C.

Calculation: In right angle triangle ABC, $\angle B = 90°$

According to Pythagoras theorem,

$BC^2 = AC^2 - AB^2 = (3^2 - 2^2)\text{ cm}^2 = (9-4)\text{ cm}^2 = 5\text{ cm}^2$

Thus, $BC = \sqrt{5}$ cm

On measuring the length of $BC = 2.24$ cm (approx)

$\therefore \sqrt{5} = \mathbf{2.2\text{ cm}}$ **Ans.**

9. Number of flowers in a basket $= 1250$

Number of flowers is 8 baskets $= 1250 \times 8 = 10000$ flowers.

$\therefore$ Number of temples are in the city $= \sqrt{10000}$

$\because 10000 = 2\times2\times2\times2\times5\times5\times5\times5$

or $10000 = \underline{2\times2}\times\underline{2\times2}\times\underline{5\times5}\times\underline{5\times5}$

$\sqrt{10000} = 2\times2\times5\times5 = 100$

Hence, **100 temples in the city. Ans.**

2	10000
2	5000
2	2500
2	1250
5	625
5	125
5	25
5	5
	1

10. First we find the smallest common multiple of 16, 18 and 45.

2	16, 18, 45
2	8, 9, 45
2	4, 9, 45
2	2, 9, 45
3	1, 9, 45
3	1, 3, 15
5	1, 1, 5
	1, 1, 1

Thus, the common multiple is $2\times2\times2\times2\times3\times3\times5 = 720$

Prime factorization of $720 = \underline{2\times2}\times\underline{2\times2}\times\underline{3\times3}\times5$ in which 5 is unpaired. Each of 720 must be required to get a perfect square. So, 720 should be multiplied by 5.

Hence, the required number is $720\times5 = \mathbf{3600}$ **Ans.**

11. Greatest four digit number $= 9999$

Square root of $9999 = \sqrt{9999}$

On finding square root, we observe that the remainder is 198. This show 99^2 is less than 9999 by 198. This means, if we subtract the remainder from the number, we get the perfect square.

	99
9	$\overline{99}\ \overline{99}$
+9	−81 ↓↓
189	18 99
	−17 01
	1 98

Hence, **the greatest number is $= 9999 - 198 = 9801$** **Ans.**

12. Smallest four digit number $= 1000$.

Square root of $1000 = \sqrt{1000}$

On squaring, we find that

$(31)^2 < 1000 < (32)^2 = (32)^2$

Least four digit number $=$ **1024**

Ans.

	31
3	$\overline{10}\ \overline{00}$
+3	−9 ↓↓
61	1 00
	−61
	39

13. Square root of $3645 = \sqrt{3645}$

3	3645
3	1215
3	405
3	135
3	45
3	15
5	5
	1

$\because 3645 = 3\times3\times3\times3\times3\times3\times5$

$\therefore 3645 = \underline{3\times3}\times\underline{3\times3}\times\underline{3\times3}\times5$

5 is unpair.

$\therefore$ **5 is the least number.** **Ans.**

14.

$\because 4896 = \underline{2\times2}\times\underline{2\times2}\times2\times\underline{3\times3}\times17$

Here, we observe that prime numbers 2 and 17 are in unpaired. Thus 4896 is not a perfect square. So, the given number should be multiplied by $2\times17=34$ to make the product a perfect square.

Hence, **the least number is 34.** **Ans.**

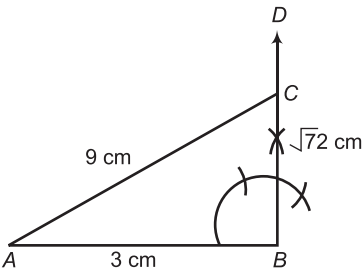
2	4896
2	2448
2	1224
2	612
2	306
3	153
3	51
17	17
	1

15. (a) $\sqrt{72}$, we know that

$\sqrt{72}=\sqrt{9^2-3^2}$

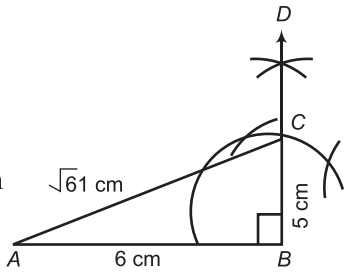
Firstly, we construct a right angle triangle in which hypotenuse is of 9 cm and the one of arms which form right angle is of 3 cm.

Hence, $\sqrt{72}$ cm $=8.5$ cm. **Ans.**



(b) We know that $\sqrt{61}=\sqrt{6^2+5^2}$

Firstly we construct a right angle triangle ABC, whose arms which form right angle are 6 cm and 5 cm respectively.



Construction :

(a) Draw line segment $AB=6$ cm.

(b) Draw a perpendicular DB at point B.

(c) Bisect a line segment $BC=5$ cm.

(d) Meet the line segment AC.

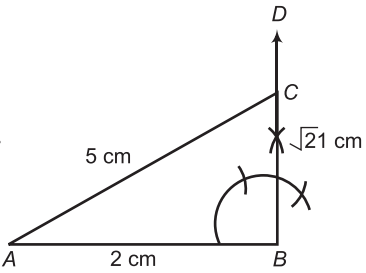
Calculation: In right angle triangle ABC, $\angle B=90°$

According to the Pythagoras theorem

$AC^2=AB^2+CB^2=(6^2+5^2)\,\text{cm}^2$

On measuring the length of hypotenuse $AC = \sqrt{61}$ cm $= 7.8$ cm (approx)

$\therefore \sqrt{61}$ cm $=$ **7.8 cm** **Ans.**



(c) $\sqrt{21}$, we know that

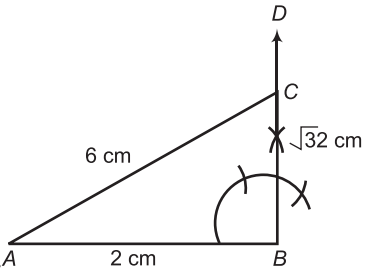
$\sqrt{21} = \sqrt{5^2 - 2^2}$

Firstly, we construct a right angle triangle in which hypotenuse is of 5 cm and the one of arms which form right angle is of 2 cm. $\therefore \sqrt{21}$ cm $= 4.6$ cm **Ans.**

(d) $\sqrt{32}$, we know that

$\sqrt{32} = \sqrt{6^2 - 2^2}$

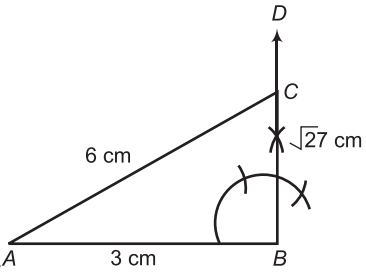
Firstly, we construct a right angle triangle in which hypotenuse is of 6 cm and the one of arms which form right angle is of 2 cm. $\therefore \sqrt{32}$ cm $= 5.6$ cm **Ans.**



(e) $\sqrt{27}$, we know that

$\sqrt{27} = \sqrt{6^2 - 3^2}$

Firstly, we construct a right angle triangle in which hypotenuse is of 6 cm and the one of arms which form right angle is of 3 cm. $\therefore \sqrt{27}$ cm $= 5.2$ cm **Ans.**

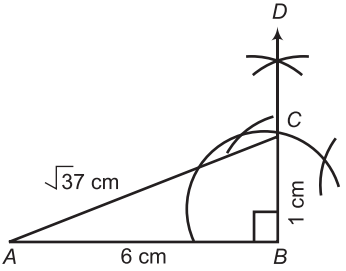


(f) We know that $\sqrt{37} = \sqrt{6^2 + 1^2}$

Firstly we construct a right angle triangle ABC, whose arms which form right angle are 6 cm and 1 cm respectively.

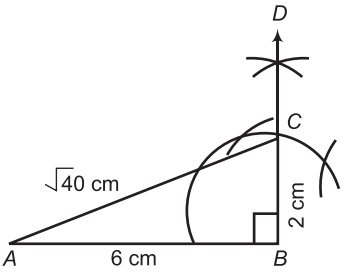
Construction :

(a) Draw line segment $AB = 6$ cm.



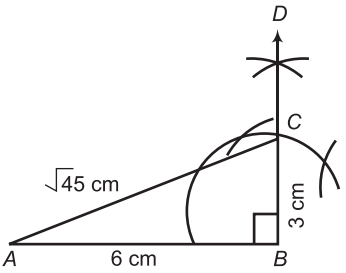
(b) Draw a perpendicular DB at point B.
(c) Bisect a line segment $BC = 1$ cm.
(d) Meet the line segment AC.
Calculation: In right angle triangle ABC, $\angle B = 90°$
According to the Pythagoras theorem
$AC^2 = AB^2 + CB^2 = (6^2 + 1^2)\,\text{cm}^2$
On measuring the length of hypotenuse $AC = \sqrt{37}$ cm $= 6.1$ cm (approx)
$\therefore \sqrt{37}$ cm $=$ **6.1 cm** **Ans.**

(g) We know that $\sqrt{40} = \sqrt{6^2 + 2^2}$
Firstly we construct a right angle triangle ABC, whose arms which form right angle are 6 cm and 2 cm respectively.



Construction :
(a) Draw line segment $AB = 6$ cm.
(b) Draw a perpendicular DB at point B.
(c) Bisect a line segment $BC = 2$ cm.
(d) Meet the line segment AC.
Calculation: In right angle triangle ABC, $\angle B = 90°$
According to the Pythagoras theorem
$AC^2 = AB^2 + CB^2 = (6^2 + 2^2)\,\text{cm}^2$
On measuring the length of hypotenuse $AC = \sqrt{40}$ cm $= 6.3$ cm (approx)
$\therefore \sqrt{40} =$ **6.3 cm** **Ans.**

(h) We know that $\sqrt{45} = \sqrt{6^2 + 3^2}$
Firstly we construct a right angle triangle ABC, whose arms which form right angle are 6 cm and 3 cm respectively.



Construction :
(a) Draw line segment $AB = 6$ cm
(b) Draw a perpendicular DB at point B.

(c) Bisect a line segment $BC = 3$ cm.

(d) Meet the line segment AC.

Calculation: In right angle triangle ABC, $\angle B = 90°$

According to the Pythagoras theorem

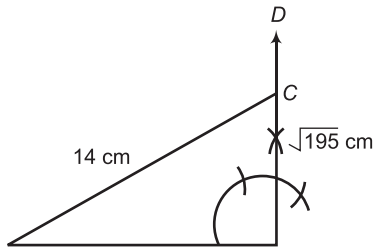
$AC^2 = AB^2 + CB^2 = (6^2 + 3^2)\ \text{cm}^2$

On measuring the length of hypotenuse $AC = \sqrt{45}$ cm $= 6.7$ cm (approx) $\therefore \sqrt{45} =$ **6.7 cm** **Ans.**

(i) $\sqrt{195}$, we know that

$\sqrt{195} = \sqrt{196 - 1} = \sqrt{14^2 - 1^2}$

Firstly, we construct a right angle triangle in which hypotenuse is of 14 cm and the one of arms which form right angle is of 1 cm.

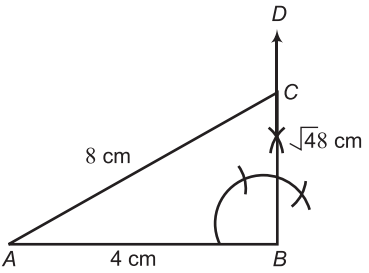


$\therefore \sqrt{195}$ cm $= 13.96$ cm **Ans.**

(j) $\sqrt{48}$, we know that

$\sqrt{48} = \sqrt{64 - 16} = \sqrt{8^2 - 4^2}$

Firstly, we construct a right angle triangle in which hypotenuse is of 8 cm and the one of arms which form right angle is of 2 cm.



$\therefore \sqrt{48}$ cm $= 6.9$ cm **Ans.**

16. Square root $594 = \sqrt{594}$

	24
2	$\overline{5}\ \overline{94}$
+2	-4 ↓↓
44	1 94
	-1 76
	18

We observe that $24^2 < 594 < 25^2$

The required number to be be added

$= 25^2 - 594 = 625 - 594 =$ **31** **Ans.**

17. Square root of $26260 = \sqrt{26260}$

To find the square root of 26260. We get remainder 16 from the number. It shows that 162^2 is less than 26260 by 16. This means if we subtract the remainder from the number, we get a perfect square.

$\therefore 26260 - 16 = 26244$ or $\sqrt{26244} = 162$

Hence, **the least natural number is 16.** **Ans.**

	162
1	$\overline{2}\ \overline{62}\ \overline{60}$
+1	-1 ↓↓
26	1 62
+6	−1 56 ↓↓
322	6 60
	−6 44
	16

18. Total number of students = Sweet get each student.

$= 3.6\text{ kg} = 3600$ grams

Hence, total number of students = 60 and 60 gram sweet get each student.

Ans.

	60
6	$\overline{36}\ \overline{00}$
+6	-36 ↓↓
	00

Multiple Choice Questions

1. (i) $305^2 - 304^2 = 305 + 304 = 609$

Hence, the answer **(d)** is correct. **Ans.**

(ii) 625 is a perfect square.

Hence, the answer **(a)** is correct. **Ans.**

(iii) Square root of a negative number is not possible.

Hence, the answer **(d)** is correct. **Ans.**

(iv) $21^2 - 20^2 = 21 + 20 = 41$

Hence, the answer **(b)** is correct. **Ans.**

(v) $\sqrt{x \times y} = \sqrt{x} \times \sqrt{y}$

Hence, the answer **(c)** is correct. **Ans.**

(vi) Answer **(c)** is correct. **Ans.**

(vii) $\therefore 6^2 + 8^2 = 36 + 64 = 100$ and $10^2 = 100$

$\therefore 6^2 + 8^2 = 10^2 = 100$

Hence, the answer **(d)** is correct. **Ans.**

(viii) Answer **(d)** is correct. **Ans.**

(ix) Answer **(c)** is correct. **Ans.**

(x) Answer **(b)** is correct. **Ans.**

3. Cubes and Cube Roots

Exercise 3.1

1. We know that cubes of all even natural numbers are even.
Thus, (a) 216, (c) 512, (e) 1000 and (f) 13824 are the cubes of even numbers. **Ans.**
And, (b) 125, (d) 343, (g) 6859, (h) 19683, (i) 9261 and (j) 42875 are not the cubes of even numbers. **Ans.**

2. (a) On prime factorization of 36, we find that resolving 36 as a product of prime factor we get $36 = 2 \times 2 \times 3 \times 3$
Now, when we group together the equal factors taking three times, we are left with double factor 2 and 3.
Hence, **36 is not a perfect cube.** **Ans.**

2	36
2	18
3	9
3	3
	1

(b) Resolving 27 into prime factors.
we get $27 = \underline{3 \times 3 \times 3}$.
Here the prime factors are grouped in triplets.
$\therefore$ Cube root of $27 = 3$
Hence, **27 is a perfect cube.** **Ans.**

3	27
3	9
3	3
	1

(c) Resolving 81 into prime factors
We get, $81 = \underline{3 \times 3 \times 3} \times 3$
Now, when we group together the equal factors taking three times, we are left with a factor 3.
Hence, **81 is not a perfect cube.** **Ans.**

3	81
3	27
3	9
3	3
	1

(d) Resolving 216 into prime factors, we get

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

$\therefore 216 = 2\times2\times2\times3\times3\times3$ or $216 = \underline{2\times2\times2}\times\underline{3\times3\times3}$

Here the prime factors are grouped in triplets.

Hence, **216 is a perfect cube.** **Ans.**

(e) Resolving 312 into prime factors, we get

$312 = 2\times2\times2\times3\times13$

or $312 = \underline{2\times2\times2}\times3\times13$

Now, when we group together the equal factors taking three times, we are left with factors 3 and 13.

2	312
2	156
2	78
3	39
13	13
	1

Hence, **312 is not a perfect cube.** **Ans.**

(f) Resolving 729 into prime factors, we get

$729 = 3\times3\times3\times3\times3\times3$

or $729 = \underline{3\times3\times3}\times\underline{3\times3\times3}$

Here, the prime factors grouped in triplets.

Hence, **729 is a perfect cube.** **Ans.**

3	729
3	243
3	81
3	27
3	9
3	3
	1

(g) Resolving 1000 into prime factors, we get

$1000 = 2\times2\times2\times5\times5\times5$

or $1000 = \underline{2\times2\times2}\times\underline{5\times5\times5}$

Here, the prime factors grouped in triplets.

Hence, **1000 is a perfect cube. Ans.**

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

(h) Resolving 512 into prime factors, we get

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$512 = 2\times2\times2\times2\times2\times2\times2\times2\times2$

or $512 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}$

Here, the prime factors grouped in triplets.

Hence, **512 is a perfect cube.** **Ans.**

(i) Resolving 3087 into prime factors, we get

3	3087
3	1029
7	343
7	49
7	7
	1

$3087 = 3\times3\times7\times7\times7$

or $3087 = 3\times3\times\underline{7\times7\times7}$

Now, when we group together the equal factors taking three times, we are left with double factor 3.

Hence, **3087 not a perfect cube.** **Ans.**

(j) Resolving 2600 into prime factors, we get

2	2600
2	1300
2	650
5	325
5	65
13	13
	1

$2600 = 2\times2\times2\times5\times5\times13$

or $2600 = 2\times2\times2\times5\times5\times13$

Now, when we group together the equal factors taking three times, we are left with a double factors 5 and one factor 13.

Hence, **2600 not a perfect cube.** **Ans.**

(k) 29683 is **not a perfect cube.** **Ans.**

(l) 431441 is **not a perfect cube.** **Ans.**

3. (a) $(32)^3 = 32\times32\times32$

$= \mathbf{32768}$ **Ans.**

(b) $(30)^3 = 30\times30\times30$

$= \mathbf{27000}$ **Ans.**

(c) $52^3 = 52\times52\times52$

$= \mathbf{140608}$ **Ans.**

(d) $(-23)^3 = (-23)\times(-23)\times(-23)$

$= \mathbf{-12167}$ **Ans.**

(e) $(-27)^3 = (-27)\times(-27)\times(-27) = \mathbf{-19683}$ **Ans.**

(f) $(0.6)^3 = 0.6\times 0.6\times 0.6 = \mathbf{0.216}$ **Ans.**

(g) $(3.5)^3 = 3.5\times 3.5\times 3.5 = \mathbf{42.875}$ **Ans.**

(h) $(0.06)^3 = 0.06\times 0.06\times 0.06 = \mathbf{0.000216}$ **Ans.**

(i) $\left(\frac{24}{7}\right)^3 = \frac{24}{7}\times\frac{24}{7}\times\frac{24}{7} = \frac{13824}{343} = \mathbf{40\,\frac{104}{343}}$ **Ans.**

(j) $\left(\frac{41}{12}\right)^3 = \frac{41}{12}\times\frac{41}{12}\times\frac{41}{12} = \mathbf{\frac{68921}{1728}}$ **Ans.**

(k) $\left(-\frac{2}{9}\right)^3 = \left(-\frac{2}{9}\right)\times\left(-\frac{2}{9}\right)\times\left(-\frac{2}{9}\right) = \mathbf{-\frac{8}{729}}$ **Ans.**

(l) $\left(\frac{-5}{9}\right)^3 = \left(\frac{-5}{9}\right)\times\left(\frac{-5}{9}\right)\times\left(\frac{-5}{9}\right) = \mathbf{\frac{-125}{729}}$ **Ans.**

4. We know that cubes of all odd natural numbers are odd.

Thus, (b) 27, (c) 729 and (f) 531441 are cubes of odd integers. **Ans.**

And (d) 1000, (e) 1728, (g) 8000, (i) 10648 and (j) 512 are not cube of odd integers. **Ans.**

5. (a) To find 40^3 by alternative method we prepare the following table :

Here, $a = 4$ and $b = 0$

Column I	Column II	Column III	Column IV
a^3	$3\times a^2\times b$	$3\times a\times b^2$	b^3
$4^2 = 64$	$3\times(4)^2\times 0$	$3\times 4\times(0)^2$	0^2
64	0	0	0
64	0	0	0

Hence, $\mathbf{40^3 = 64000}$ **Ans.**

(b) To find 77^3 by alternative method, we prepare the following table.

Here $a = 7$ and $b = 7$

Column I	Column II	Column III	Column IV
a^3	$3\times a^2\times b$	$3\times a\times b^2$	b^3
7^3	$3\times 7^2\times 7$	$3\times 7\times 7^2$	7^3
343	1029	1029	
+113	+106	+34	34 3
456	113 5	106 3	
456	5	3	3

Hence, $\mathbf{77^3 = 456533}$ **Ans.**

(c) To find 56^3 by alternative method we prepare the following table.

Here, $a = 5$ and $b = 6$

Column I	Column II	Column III	Column IV
a^3	$3\times a^2\times b$	$3\times a\times b^2$	b^3
5^3	$3\times 5^2\times 6$	$3\times 5\times 6^2$	6^3
125	450	540	
+50	+56	+21	216
175	506	561	
175	6	1	6

Hence, $\mathbf{56^3 = 175616}$ **Ans.**

(d) To find 92^3 by alternative method we prepare the following table.

Here, $a = 9$ and $b = 2$

Column I	Column II	Column III	Column IV
a^3	$3\times a^2\times b$	$3\times a\times b^2$	b^3
9^3	$3\times 9^2\times 2$	$3\times 9\times 2^2$	2^3
729	486	108	
+49	+10	+0	8
778	496	108	
778	6	8	8

Hence, $\mathbf{92^3 = 778688}$ **Ans.**

6. Volume of cuboid tank = Length × breadth × height
$= 4.8\text{ m} \times 4.8\text{ m} \times 4.8\text{ m}$
$= 110.592\text{ m}^3$
$\therefore$ Volume of cuboid tank = Volume of the water to filled in the tank.
$= 110.592\text{ m}^3$
Hence, **the volume of the water to filled in the tank** $= \mathbf{110.592\text{ m}^3}$ **Ans.**

7. $\because$ Given number $= 13122$
$\therefore 23^3 < 13122 < 24^3$
or $12167 < 13122 < 13824$
$\therefore$ Subtracted number
$= 13122 - 12167 = \mathbf{955}$ **Ans.**

8. $\because$ Given number $= 43200$
$\therefore 35^3 < 43200 < 36^3$
or $42875 < 43200 < 46656$
$\therefore$ Subtracted number
$= 43200 - 42875 = \mathbf{325}$ **Ans.**

Exercise 3.2

1. (a) Here, factors of 15552 are given below :

2	15552
2	7776
2	3888
2	1944
2	972
2	486
3	243
3	81
3	27
3	9
3	3
	1

Resolving 15552 as a product of prime factors, we get,
$15552 = 2\times2\times2\times2\times2\times 2\times3\times3\times3\times3\times3$
or $15552 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3}\times\underline{3\times3}\times3$
Thus, it is clear to make it a perfect cube it must be divide by $3\times3 = \mathbf{9}$ **Ans.**

(b)

3	3087
3	1029
7	343
7	49
7	7
	1

Resolving 3087 as a product of prime factors, we get
$3087 = 3\times3\times7\times7\times7$
or $3087 = 3\times3\times\underline{7\times7\times7}$
Thus, it is clear that to make it a perfect cube it must be divide by $3\times3 = \mathbf{9}$ **Ans.**

(c)

2	31250
5	15625
5	3125
5	625
5	125
5	25
5	5
	1

Resolving 31250 as a product of prime factors, we get,

$31250 = 2 \times \underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5}$

Thus, it is clear that to make it a perfect cube it must be divide by 2. **Ans.**

(d)

2	240786
3	120393
3	40131
3	13377
7	4459
7	637
7	91
13	13
	1

Resolving 240786 as a product of prime factors, we get

$240786 = 2 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7 \times 13$

or $240786 = 2 \times \underline{3 \times 3 \times 3} \times \underline{7 \times 7 \times 7} \times 13$

Thus, it is clear that to make it a perfect cube it must be divide by $2 \times 13 = \mathbf{26}$ **Ans.**

2. (a) Resolving 43200 into prime factors, we get

2	43200
2	21600
2	10800
2	5400
2	2700
2	1350
5	675
5	135
3	27
3	9
3	3
	1

$43200 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 3 \times 3 \times 3$

or $43200 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 5 \times 5 \times \underline{3 \times 3 \times 3}$

Grouping the factors in triplets of equal factors and 5×5 become left. Thus, if we multiply by 5 in the given number, the number will become perfect cube.

Thus, the number to be multiplied is 5.

Thus, the perfect cube number

$= 43200 \times 5 = 216000$

Now,

$216000 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5}$

Thus,

$= \sqrt[3]{216000} = 2 \times 2 \times 3 \times 5$

$= 60$

Hence, **the number to be multiplied is 5 and the perfect cube number is 60.**

Ans.

(b) Resolving into prime factors, we get

$33275 = 5 \times 5 \times 11 \times 11 \times 11$ or

$33275 = 5 \times 5 \times \underline{11 \times 11 \times 11}$

Grouping the factors in triplets of equal factors and 5×5 become left. Thus, if we multiply by 5 in the given number the number will become perfect cube.

5	33275
5	6655
11	1331
11	121
11	11
	1

Thus, the number to be multiplied is 5.

Thus, the perfect cube number $= 33275 \times 5 = 166375$

Now, $166375 = \underline{5 \times 5 \times 5} \times \underline{11 \times 11 \times 11}$

or $\sqrt[3]{166375} = 5 \times 11 = 55$

Hence, **the number to be multiplied is 5 and the perfect cube number is 55.** **Ans.**

(c) Resolving 6750 into prime factors, we get

$6750 = 2 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5$

or $6750 = 2 \times \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5}$

Grouping the factors in triplets to equal factors and 2 become left. Thus, if we multiply by $2 \times 2 = 4$ in the given number, the number will become perfect cube.

2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

Thus, the number to be multiplied is 4.

Thus, the perfect cube number $= 6750 \times 4 = 27000$

Now, $27000 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5}$

Thus, $\sqrt[3]{27000} = 2 \times 3 \times 5 = 30$

Hence, **the number to be multiplied is 4 and the perfect cube number is 30.** **Ans.**

(d) Resolving 3087 into prime factors, we get

Grouping the factors in triplets to equal factors and 3×3 become left. Thus, if we multiply by 3 in the given number, the number will become perfect cube.

3	3087
3	1029
7	343
7	49
7	7
	1

Thus, the number to be multiplied is 3.

Thus, the perfect cube number

$= 3087 \times 3 = 9261$

Now, $9261 = \underline{3\times3\times3}\times\underline{7\times7\times7}$

Thus, $\sqrt[3]{9261} = 3\times7 = 21$

Hence, **the number to be multiplied is 3 and the perfect cube number is 21.** **Ans.**

3. $\sqrt[3]{0.000729} = \sqrt[3]{\dfrac{729}{1000000}} = \dfrac{\sqrt[3]{729}}{\sqrt[3]{1000000}}$

3	729
3	243
3	81
3	27
3	9
3	3
	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

$\therefore \sqrt[3]{729} = \sqrt[3]{\underline{3\times3\times3}\times\underline{3\times3\times3}} = 3\times3 = 9$

And $\sqrt[3]{1000000} = \sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{5\times5\times5}\times\underline{5\times5\times5}}$

$= 2\times2\times5\times5 = 100$

$\therefore \sqrt[3]{0.000729} = \sqrt[3]{\dfrac{729}{1000000}} = \dfrac{9}{100} = \mathbf{0.09}$ **Ans.**

(b) $\sqrt[3]{0.085184} = \sqrt[3]{\dfrac{85184}{1000000}} = \dfrac{\sqrt[3]{85184}}{\sqrt[3]{1000000}}$

2	85184
2	42592
2	21296
2	10648
2	5324
2	2662
11	1331
11	121
11	11
	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

$\therefore \sqrt[3]{85184} = \sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{11\times11\times11}} = 2\times2\times11 = 44$

$\therefore \sqrt[3]{1000000} = \sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{5\times5\times5}\times\underline{5\times5\times5}}$

$= 2\times2\times5\times5 = 100$

$\therefore \sqrt[3]{0.085184} = \sqrt[3]{\dfrac{85184}{1000000}} = \dfrac{44}{100} = \mathbf{0.44}$ **Ans.**

(c) $\sqrt[3]{373.248} = \sqrt[3]{\dfrac{373248}{1000}} = \dfrac{\sqrt[3]{373248}}{\sqrt[3]{1000}}$

2	373248
2	186624
2	93312
2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

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

$\therefore \sqrt[3]{373.248} = \sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{3\times3\times3}}$

$= 2\times2\times2\times3\times3 = 72$

$\therefore \sqrt[3]{1000} = \sqrt[3]{\underline{2\times2\times2}\times\underline{5\times5\times5}} = 2\times5 = 10$

$\therefore \sqrt[3]{373.248} = \sqrt[3]{\frac{373248}{1000}} = \frac{72}{10} = \mathbf{7.2}$ **Ans.**

(d) $\sqrt[3]{0.003375} = \sqrt[3]{\frac{3375}{1000000}} = \frac{\sqrt[3]{3375}}{\sqrt[3]{1000000}}$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$\therefore \sqrt[3]{3375} = \sqrt[3]{\underline{3\times3\times3}\times\underline{5\times5\times5}} = 3\times5 = 15$

$\sqrt[3]{1000000} = \sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{5\times5\times5}\times\underline{5\times5\times5}}$

$= 2\times2\times5\times5 = 100$

$\therefore \sqrt[3]{0.003375} = \sqrt[3]{\frac{3375}{1000000}} = \frac{15}{100} = \mathbf{0.15}$ **Ans.**

4. (a) (i) $64-1=63$ (ii) $63-7=56$ (iii) $56-19=37$
(iv) $37-37=0$
This subtracting process is done in 4 times.
$\therefore \sqrt[3]{\mathbf{64}} = \mathbf{4}$ **Ans.**

(b) (i) $216-1=215$ (ii) $215-7=208$ (iii) $208-19=189$
(iv) $189-37=152$ (v) $151-61=91$ (vi) $91-91=0$
Thus subtracting process is done in 6 times.
$\therefore \sqrt[3]{\mathbf{216}} = \mathbf{6}$ **Ans.**

(c) (i) $729-1=728$ (ii) $728-7=721$ (iii) $721-19=702$
(iv) $702-37=665$ (v) $665-61=604$ (vi) $604-91=513$
(vii) $513-127=386$ (viii) $386-169=217$ (ix) $217-217=0$
This subtracting process is done in 9 times.
$\therefore \sqrt[3]{\mathbf{729}} = \mathbf{9}$ **Ans.**

(d) (i) $1728-1=1727$ (ii) $1727-7=1720$

(ii) $1720-19=1701$ (iv) $1701-37=1664$

(v) $1664-61=1603$ (vi) $1603-91=1512$

(vii) $1512-127=1385$ (viii) $1385-169=1216$

(ix) $1216-217=999$ (x) $999-271=728$

(xi) $728-331=397$ (xii) $397-397=0$

This subtracting process is done in 12 times.

$\therefore \sqrt[3]{\mathbf{1728}} = \mathbf{12}$

5. (a) $\sqrt[3]{\dfrac{5832}{4096}} = \dfrac{\sqrt[3]{5832}}{\sqrt[3]{4096}}$

$5832 =$	2	5832
	2	2916
	2	1458
	3	729
	3	243
	3	81
	3	27
	3	9
	3	3
		1

$4096 =$	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

$\therefore 5832 = 2\times2\times2\times3\times3\times3\times3\times3\times3$

or $5832 = \underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{3\times3\times3}$

$\sqrt[3]{5832} = 2\times3\times3 = 18$

$\therefore 4096 = 2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2$

or $4096 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}$

$\sqrt[3]{4096} = 2\times2\times2\times2 = 16$

Hence, $\sqrt[3]{\dfrac{5832}{4096}} = \dfrac{\sqrt[3]{5832}}{\sqrt[3]{4096}} = \dfrac{18}{16} = \mathbf{\dfrac{9}{8}}$ **Ans.**

(b) $\sqrt[3]{\frac{17576}{1331}} = \frac{\sqrt[3]{17576}}{\sqrt[3]{1331}}$

$17576 =$	2	17576
	2	8788
	2	4394
	13	2197
	13	169
	13	13
		1

$1331 =$	11	1331
	11	121
	11	11
		1

$\therefore \quad 17576 = 2 \times 2 \times 2 \times 13 \times 13 \times 13$

or $17576 = \underline{2 \times 2 \times 2} \times \underline{13 \times 13 \times 13}$

$\therefore \quad \sqrt[3]{17576} = 2 \times 13 = 26$

And $1331 = 11 \times 11 \times 11$ or $1331 = \underline{11 \times 11 \times 11}$

$\therefore \sqrt[3]{1331} = 11$

Hence, $\sqrt[3]{\frac{17576}{1331}} = \frac{\sqrt[3]{17576}}{\sqrt[3]{1331}} = \mathbf{\frac{26}{11}}$ **Ans.**

(c) $\sqrt[3]{\frac{-512}{166375}} = -\frac{\sqrt[3]{512}}{\sqrt[3]{166375}}$

$512 =$	2	512
	2	256
	2	128
	2	64
	2	32
	2	16
	2	8
	2	4
	2	2
		1

$166375 =$	5	166375
	5	33275
	5	6655
	11	1331
	11	121
	11	11
		1

$\therefore 512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

or $512 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$

$\therefore \sqrt[3]{512} = 2 \times 2 \times 2 = 8$ And $166375 = 5 \times 5 \times 5 \times 11 \times 11 \times 11$

or $166375 = \underline{5 \times 5 \times 5} \times \underline{11 \times 11 \times 11}$

$\therefore \sqrt[3]{166375} = 5 \times 11 = 55$

Hence, $\sqrt[3]{\dfrac{-512}{166375}} = -\dfrac{\sqrt[3]{512}}{\sqrt[3]{166375}} = \mathbf{\dfrac{-8}{55}}$ **Ans.**

(d) $\sqrt[3]{\dfrac{-9261}{10648}} = -\dfrac{\sqrt[3]{9261}}{\sqrt[3]{10648}}$

$9261 =$	3	9261
	3	3087
	3	1029
	7	343
	7	49
	7	7
		1

$10648 =$	2	10648
	2	5324
	2	2662
	11	1331
	11	121
	11	11
		1

$\therefore 9261 = 3 \times 3 \times 3 \times 7 \times 7 \times 7$ or $9261 = \underline{3 \times 3 \times 3} \times \underline{7 \times 7 \times 7}$

$\sqrt[3]{9261} = 3 \times 7 = 21$

And $10648 = 2 \times 2 \times 2 \times 11 \times 11 \times 11$ or $10648 = \underline{2 \times 2 \times 2} \times \underline{11 \times 11 \times 11}$

$\therefore \sqrt[3]{10648} = 2 \times 11 = 22$

Hence, $\sqrt[3]{\dfrac{-9261}{10648}} = -\dfrac{\sqrt[3]{9261}}{\sqrt[3]{10648}} = \mathbf{\dfrac{-21}{22}}$ **Ans.**

6. (a)

3	91125
3	30375
3	10125
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$\because 91125 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5 \times 5$

or $91125 = \underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{5\times5\times5}$

$\therefore \sqrt[3]{91125} = 3\times3\times5 = 45$

Hence, $\sqrt[3]{91125} = \mathbf{45}$ **Ans.**

(b)

3	531441
3	177147
3	59049
3	19683
3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

$\because 531441 = 3\times3\times3\times3\times3\times3\times3\times3\times3\times3\times3\times3$

or $531441 = \underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{3\times3\times3}$

$\sqrt[3]{531441} = 3\times3\times3\times3 = 81$

Hence, $\sqrt[3]{\mathbf{531441}} = \mathbf{81}$ **Ans.**

(c)

3	250047
3	83349
3	27783
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

$\because 250047 = 3\times3\times3\times3\times3\times3\times7\times7\times7$

or $250047 = \underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{7\times7\times7}$

$\therefore \sqrt[3]{250047} = 3\times3\times7 = 63$

Hence, $\sqrt[3]{250047} = \mathbf{63}$ **Ans.**

(d)

3	658503
3	219501
3	73167
29	24389
29	841
29	29
	1

$\because 658503 = 3\times3\times3\times29\times29\times29$

or $658503 = \underline{3\times3\times3}\times\underline{29\times29\times29}$

$\therefore \sqrt[3]{658503} = 3\times29 = 87$

Hence, $\sqrt[3]{658503} = \mathbf{87}$ **Ans.**

(e) $\sqrt[3]{-97336} = -\sqrt[3]{97336}$

2	97336
2	48668
2	24334
23	12167
23	529
23	23
	1

$\because 97336 = \underline{2\times2\times2}\times\underline{23\times23\times23}$

$\therefore \sqrt[3]{97336} = 2\times23 = 46$

Hence, $\sqrt[3]{-97336} = -\sqrt[3]{97336} = \mathbf{-46}$ **Ans.**

(f) $\sqrt[3]{-287496} = -\sqrt[3]{287496}$

2	287496
2	143748
2	71874
3	35937
3	11979
3	3993
11	1331
11	121
11	11
	1

$\because 287496 = 2\times2\times2\times3\times3\times3\times11\times11\times11$

or $287456 = \underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{11\times11\times11}$

$\sqrt[3]{287496} = 2\times3\times11 = 66$

Hence, $-\sqrt[3]{287436} = \mathbf{-66}$ **Ans.**

7. (a) Here the units digit is 6. Thus the units digit of cube root will be 6. After striking the last three from the right we are left with the number 175, because $5^3 = 125 < 175$ and $6^3 = 216 > 175$

Hence, the cube root of $175616 = \mathbf{56}$ **Ans.**

(b) Here the units digit is 7. Thus the units digit of cube root will be 3. After striking the last three form the right we are left with the number 571, because $8^3 = 512 < 573$ and $9^3 = 573 > 729$.

Hence, **cube root of 571787 = 83** **Ans.**

(c) Here the units digit is 6. Thus the units digit of cube root will be 6. After striking the last three form the right we are left with the number 46, because $3^3 = 27 < 46$ and $4^3 = 64 > 46$

Hence, cube root of $46656 = \mathbf{36}$ **Ans.**

(d) Here the units digit is 7. Thus the units digit of cube root will be 3. After striking the last three from the right we are left with the number 389, because $7^3 = 343 < 389$ and $8^3 = 512 < 389$

Hence, cube root of $389017 = \mathbf{73}$ **Ans.**

Exercise 3.3

1. (i) $\because$ Volume of a cube $= 6859\ \text{cm}^3$

$\therefore$ Edge of cube $= \sqrt[3]{6859}$

$\sqrt[3]{6859}\ \text{cm} = \sqrt[3]{19 \times 19 \times 19}\ \text{cm} = 19\ \text{cm}$

19	6859
19	361
19	19
	1

Hence, the answer **(d)** is correct.

(ii)

$$-(-343 \times 512)^{\frac{1}{3}} = -\sqrt[3]{-343 \times 512} = \sqrt[3]{343} \times \sqrt[3]{512}$$

$$= 7 \times 8 = 56$$

Hence, the answer **(d)** is correct. **Ans.**

(iii) First we find the smallest common multiples of 12, 18 and 25.

Thus, the common multiple is $2 \times 2 \times 3 \times 3 \times 5 \times 5 = 900$

Prime factorization of $900 = 2 \times 2 \times 3 \times 3 \times 5 \times 5$

2	12, 18, 25
2	6, 9, 25
3	3, 9, 25
3	1, 3, 25
5	1, 1, 25
5	1, 1, 5
	1, 1, 1

If we multiply by $2 \times 3 \times 5$ in the 900, the number will become perfect cube.

Thus, the perfect cube number which divisible by 12, 18 and 25 is $900 \times 30 = 27000$.

Hence, the answer **(d)** is correct. **Ans.**

(iv) Resolving 10000 into prime factors, we get

2	10000
2	5000
2	2500
2	1250
5	625
5	125
5	25

5	5
	1

$10000 = \underline{2\times2\times2}\times2\times5$
$\times\underline{5\times5\times5}$

Grouping the factors in triplets of equal factors and 2×5 become left. Thus, if we multiply be $2\times2\times5\times5$ in the given number, the number will become perfect cube.

Thus, the number to be multiplied
$=2\times2\times5\times5=100$

Hence, the answer **(c)** is correct. **Ans.**

(v) Resolving 8192 into prime factors, we get

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

$8192 = \underline{2\times2\times2}\times\underline{2\times2\times2}$
$\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times2$

After grouping the factors in triplets to equal factors, we get three factors 2 left.

Thus, if the given number we divide by 2, the quotient will be perfect cube.

Hence, the answer **(a)** is correct. **Ans.**

2. (a) T, (b) F, (c) T,
(d) T, (e) F (f) F,
(g) F, (h) T

3. Total number of pears
$=1728$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

Queue a pears in the box
$=\sqrt[3]{1728}$

$=\sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}}$

$=2\times2\times3=12$

Hence, **the queue of pears in the box are 12.** **Ans.**

4. The number of total chalk-box $= 10648$

Layers of chalk-box $= \sqrt[3]{10648}$

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

$= \sqrt[3]{2\times2\times2\times11\times11\times11} = 2\times11 = 22$

Hence, **22 layers of chalk-box are present in a truck.** **Ans.**

5. $\because$ Capacity of a cubical tank $= 1331$ litre $= \frac{1331}{1000}$ metre

$\therefore$ Measurement of tank $= \sqrt[3]{\frac{1331}{1000}} = \sqrt[3]{\frac{11\times11\times11}{2\times2\times2\times5\times5\times5}}$ metre

$= \frac{11}{2\times5}$ metre $= \frac{11}{10}$ metre $=$ **1.1 metre**

Ans.

6. Total number of apples arranged $= 2744$

Number of apples are kept in each row

$= \sqrt[3]{2744}$

$= \sqrt{2\times2\times2\times7\times7\times7} = 14$ apples

Hence, **14 apples are kept in each row. Ans.**

2	2744
2	1372
2	686
7	343
7	49
7	7
	1

7. $\because$ Total number of boxes $= 2197$

$\therefore$ Queue of chalk-box in box $= \sqrt[3]{2197}$

13	2197
13	169
13	13
	1

$= \sqrt[3]{13\times13\times13} = 13$ queue

Hence, **13 queue of chalk-box are arranged in box.** **Ans.**

8. Number of layers $= \sqrt[3]{216}$

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

$= \sqrt[3]{\underline{2\times2\times2}\times\underline{3\times3\times3}} = 2\times3 = 6$ layers

Hence, **the number of layers are 6.** **Ans.**

9. Volume of solid rectangular block $= 20\text{ cm}\times8\text{ cm}\times3.2\text{ cm} = 512\text{ cm}^3$

Let the side of new block $= x$ cm

Then the volume $= x^3$ cm

According to question, $x^3 = 512\text{ cm}^3$ or $x^3 = 512$

$x = \sqrt[3]{512}\text{ cm} = 8\text{ cm}$

Hence, **the side of new block = 8 cm.** **Ans.**

10. On prime factorization of 1048576, we find that

2	1048576
2	524288
2	262144
2	131072
2	65536
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

$\because 512 = \underline{2\times2\times2}\times\underline{2\times2\times2}$
$\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times$
$\underline{2\times2\times2}\times\underline{2\times2\times2}\times2\times2$

Now, when we group together the equal factors taking three times, we are left with a double factor 2.

Hence, **1048576 is not a perfect cube.** **Ans.**

11. Volume of three cubes
$= (3^3 + 4^3 + 5^3)\ \text{cm}^3$
$= (27 + 64 + 125)$
$= 216\ \text{cm}^3$

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

$\therefore$ Edge of new cube
$= \sqrt[3]{216\ \text{cm}^3} =$ **6 cm** **Ans.**

12. Volume of new cube
$= (10\ \text{cm})^3 + (9\ \text{cm})^3$
$-(1\ \text{cm})^3$
$= (1000 + 729 - 1)\ \text{cm}^3$
$= 1728\ \text{cm}^3$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

$\therefore$ Core of this cube
$\sqrt[3]{1728\ \text{cm}^3} =$ **12 cm** **Ans.**

13. Resolving 3906250 as a product of prime factors, we get

2	3906250
5	1953125
5	390625
5	78125
5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$3906250 = 2\times\underline{5\times5\times5}$
$\times\underline{5\times5\times5}\times\underline{5\times5\times5}$

From the above factors, it is clear that 2 is a factor which is not in the form of triples. Clearly, to make it a perfect cube, it must be divide by 2.

Hence, **we must divide 3906250 by 2 so that the quotient is a perfect cube.** **Ans.**

14. Resolving 202612 as a product of prime factors, we get

$202616 = 2 \times 2 \times \underline{37 \times 37 \times 37}$

Thus, to make it a perfect cube, it must be multiplied by 2.

Hence, **we must multiply 202612 by 2, so that the product become a perfect cube.** **Ans.**

2	202612
2	101306
37	50653
37	1369
37	37
	1

15. $20^3 + x^3 = 2^3 + 24^3$ or $8000 + x^3 = 8 + 13824$

or $8000 + x^3 = 13832$ or $x^3 = 13832 - 8000 = 5832$

or $x = \sqrt[3]{5832} = \sqrt[3]{\underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3}}$

or $x = 2 \times 3 \times 3 = 18$

Hence, **the value of $x = 18$** **Ans.**

16. $\because$ Inner volume of cubical box $= 32.768\ \text{m}^3$

$\therefore$ Length inner side $= \sqrt[3]{32.768} = \sqrt[3]{\dfrac{32768}{1000}} = \dfrac{\sqrt[3]{32768}}{\sqrt[3]{1000}}$

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

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

$\because 32768 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}$

$\therefore \sqrt[3]{32768} = 2\times2\times2\times2\times2 = 32$

And $1000 = \underline{2\times2\times2}\times\underline{5\times5\times5} = 2\times5 = 10$

$\therefore \sqrt[3]{32.768} = \sqrt[3]{\frac{32768}{1000}} = \frac{32}{10} = 3.2$

Hence, **the inner side of box = 3.2 metre** **Ans.**

17. $\because$ Volume of cuboid gas chamber = 6028.568 cubic cm.

$\therefore$ The side of cuboid gas chamber $= \sqrt[3]{6028.568} = \sqrt[3]{\frac{6028568}{1000}}$

$= \frac{\sqrt[3]{6028568}}{\sqrt[3]{1000}}$

2	6028568
2	3014284
2	1507142
7	753571
7	107653
7	15379
13	2197
13	169
13	13
	1

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

$\frac{\sqrt[3]{6028568}}{\sqrt[3]{1000}} = \frac{\sqrt[3]{\underline{2\times2\times2}\times\underline{7\times7\times7}\times\underline{13\times13\times13}}}{\sqrt[3]{\underline{2\times2\times2}\times\underline{5\times5\times5}}}$

$= \frac{2\times7\times13}{2\times5}\text{ cm} = \frac{182}{10}\text{ cm} = 18.2\text{ cm}$

Hence, **the side of cuboid gas chamber is 18.2 cm.** **Ans.**

18. $\because$ Number of marbles of glass = 42875

$\therefore$ Layers of marble $= \sqrt[3]{42875}$

5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

$= \sqrt[3]{\underline{5\times5\times5}\times\underline{7\times7\times7}} = 5\times7 = 35$

Hence, **35 layers of marble will be present in the box.** **Ans.**

19. (a) $\sqrt[3]{5832}\times\sqrt[3]{15625} = \sqrt[3]{(18)^3\times(25)^3}$

(b) $\sqrt[3]{17576}\div\sqrt[3]{2197} = \sqrt[3]{\dfrac{17576}{2197}}$

(c) $(13824)^{\frac{1}{3}}\times(27000)^{\frac{1}{3}} = (13824\times27000)^{\frac{1}{3}}$

(d) $(729)^{\frac{1}{3}}\times(1728)^{\frac{1}{3}}\times(4096)^{\frac{1}{3}} = (729\times1728\times4096)^{\frac{1}{3}}$

20. (a)

3	250047
3	83349
3	27783
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

$\because 250047 = \underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{7\times7\times7}$

$\therefore \sqrt[3]{250047} = 3\times3\times7 = 63$

Hence, $\sqrt[3]{\mathbf{250047}} = \mathbf{63}$ **Ans.**

(b)

2	110592
2	55296
2	27648
2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

$\because 110952 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}$

$\therefore \sqrt[3]{110952} = 2\times2\times2\times2\times3 = 48$

Hence, $\sqrt[3]{\mathbf{110952}} = \mathbf{48}$ **Ans.**

(c)

2	1404928
2	702464
2	351232
2	175616
2	87808
2	43904
2	21952
2	10976
2	5488
2	2744
2	1372
2	686
7	343
7	49
7	7
	1

$\because 1404928 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{7\times7\times7}$

$\therefore \sqrt[3]{1404928} = 2\times2\times2\times2\times7 = 112$

$\therefore \sqrt[3]{\mathbf{1404928}} = \mathbf{112}$ **Ans.**

(d)

2	4741632
2	2370816
2	1185408
2	592704
2	296352
2	148176
2	74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

$\because\ 4741632 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{7\times7\times7}$

$\therefore \sqrt[3]{4741632} = 2\times2\times2\times3\times7 = 168$

Hence, $\sqrt[3]{\mathbf{4741632}} = \mathbf{168}$ **Ans.**

21. (a) $3\frac{920}{1331} = \frac{3\times1331+920}{1331} = \frac{4913}{1331} = \sqrt[3]{\frac{4913}{1331}} = \frac{\sqrt[3]{4913}}{\sqrt[3]{1331}}$

17	4913
17	289
17	17
	1

11	1331
11	121
11	11
	1

$= \frac{\sqrt[3]{17\times17\times17}}{\sqrt[3]{11\times11\times11}} = \frac{17}{11} = 1\frac{6}{11}$

Hence, $\sqrt[3]{3\frac{920}{1331}} = \sqrt[3]{\frac{4913}{1331}} = \frac{17}{11} = \mathbf{1\,\frac{6}{11}}$ **Ans.**

(b) $1\frac{13084}{29791} = \frac{1\times29791+13084}{29791} = \frac{29791+13084}{29791} = \frac{42875}{29791}$

5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

31	29791
31	961
31	31
	1

$= \sqrt[3]{\frac{42875}{29791}} = \frac{\sqrt[3]{42875}}{\sqrt[3]{29791}} = \frac{\sqrt[3]{5\times5\times5\times7\times7\times7}}{\sqrt[3]{31\times31\times31}}$

$= \frac{5\times7}{31} = \frac{35}{31} = 1\frac{4}{31}$

Hence, $\sqrt[3]{1\frac{13084}{29791}} = \mathbf{1\,\frac{4}{31}}$ **Ans.**

(c) $3\frac{2042}{3375} = \frac{3\times3375+2042}{3375} = \frac{10125+2042}{3375} = \frac{12167}{3375}$

23	12167
23	529
23	23
	1

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$$= \sqrt[3]{\frac{12167}{3375}} = \frac{\sqrt[3]{12167}}{\sqrt[3]{3375}} = \frac{\sqrt[3]{23\times23\times23}}{\sqrt[3]{3\times3\times3\times5\times5\times5}}$$

$$= \frac{23}{3\times5} = \frac{23}{15} = 1\frac{8}{15}$$

Hence, $\sqrt[3]{3\frac{2042}{3375}} = \frac{\sqrt[3]{12167}}{\sqrt[3]{3375}} = \mathbf{1\,\frac{8}{15}}$ **Ans.**

(d) $132\frac{651}{1000} = \frac{132\times1000+651}{1000}$

3	132651
3	44217
3	14739
17	4913
17	289
17	17
	1

$$= \frac{132000+651}{1000} = \frac{132651}{1000}$$

$$= \sqrt[3]{\frac{132651}{1000}} = \frac{\sqrt[3]{132651}}{\sqrt[3]{1000}} = \frac{\sqrt[3]{3\times3\times3\times17\times17\times17}}{2\times2\times2\times5\times5\times5}$$

$$= \frac{3\times17}{2\times5} = \frac{51}{10} = 5\frac{1}{10}$$

Hence, $\sqrt[3]{132\frac{651}{1000}} = \frac{\sqrt[3]{132651}}{\sqrt[3]{1000}} = \mathbf{5\,\frac{1}{10}}$ **Ans.**

22. (a) $\sqrt[3]{226.981} = \sqrt[3]{\frac{226981}{1000}}$

61	226981
61	3721
61	61
	1

$$= \frac{\sqrt[3]{226981}}{\sqrt[3]{1000}} = \frac{\sqrt[3]{61\times61\times61}}{\sqrt[3]{2\times2\times2\times5\times5\times5}} = \frac{61}{2\times5} = \frac{61}{10} = \mathbf{6.1}$$ **Ans.**

(b) $\sqrt[3]{0.389017} = \sqrt[3]{\frac{389017}{1000000}} = \frac{\sqrt[3]{389017}}{\sqrt[3]{1000000}}$

73	389017
73	5329
73	73
	1

$$= \frac{\sqrt[3]{73 \times 73 \times 73}}{\sqrt[3]{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}}$$

$$= \frac{73}{2 \times 2 \times 5 \times 5} = \frac{73}{100} = 0.73$$

Hence, $\sqrt[3]{0.389017} = \frac{\sqrt[3]{389017}}{\sqrt[3]{1000000}} = \mathbf{0.73}$ **Ans.**

(c) $\sqrt[3]{0.000884736} = \sqrt[3]{\frac{884736}{1000000000}} = \frac{\sqrt[3]{884736}}{\sqrt[3]{1000000000}}$

2	884736
2	442368
2	221184
2	110592
2	55296
2	27648
2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

$$= \frac{\sqrt[3]{\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 3 \times 3 \times 3}}{\sqrt[3]{\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5}}}$$

$$= \frac{2\times2\times2\times2\times2\times3}{2\times2\times2\times5\times5\times5} = \frac{96}{1000} = 0.096$$

Hence, $\sqrt[3]{0.000884736} = \frac{\sqrt[3]{884736}}{\sqrt[3]{1000000000}} = \mathbf{0.096}$ **Ans.**

(d) $\sqrt[3]{0.000002460375}$

$$= \sqrt[3]{\frac{2460375}{1000000000000}} = \frac{\sqrt[3]{2460375}}{\sqrt[3]{1000000000000}}$$

$$= \frac{\sqrt[3]{3\times3\times3\times3\times3\times3\times3\times3\times3\times5\times5\times5}}{\sqrt[3]{2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times5\times5\times5 \times5\times5\times5\times5\times5\times5\times5\times5\times5}}$$

$$= \frac{3\times3\times3\times5}{2\times2\times2\times2\times5\times5\times5\times5} = \frac{135}{10000} = 0.0135$$

Hence,

$\sqrt[3]{0.000002460375} = \frac{\sqrt[3]{2460375}}{\sqrt[3]{1000000000000}} = \mathbf{0.0135}$ **Ans.**

3	2460375
3	820125
3	273375
3	91125
3	30375
3	10125
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

Multiple Choice Questions

1. (i) Answer **(b)** is correct. **Ans.**

(ii) Answer **(b)** correct. **Ans.**

(iii) Answer **(d)** is correct. **Ans.**

(iv) $\sqrt[3]{x^3y^3} = \sqrt[3]{x\times x\times x\times y\times y\times y} = x\times y = xy$

Hence, the answer **(d)** is correct. **Ans.**

(v) Answer **(d)** is correct. **Ans.**

(vi) Answer **(a)** is correct. **Ans.**

(vii) Answer **(b)** is correct. **Ans.**

(viii) $\sqrt[3]{\frac{x^3}{y^3}} = \frac{\sqrt[3]{x^3}}{\sqrt[3]{y^3}} = \frac{\sqrt[3]{x\times x\times x}}{\sqrt[3]{y\times y\times y}} = \frac{x}{y}$

Hence, the answer **(a)** correct. **Ans.**

(ix) Answer **(a)** is correct. **Ans.**

(x) Answer **(b)** is correct. **Ans.**

4. Exponents and Powers

Exercise 4.1

1. (a) $(4^2+3^2)^{-\frac{1}{3}} = (16+9)^{-\frac{1}{2}} = (25)^{-\frac{1}{2}} = \left(\frac{1}{25}\right)^{\frac{1}{2}}$

$$= \left(\frac{1}{5^2}\right)^{\frac{1}{2}} = \left(\frac{1}{5^{2\times\frac{1}{2}}}\right)^1 = \left(\frac{1}{5}\right)^1 = \mathbf{\frac{1}{5}}$$

Ans.

(b) $\left(5^2+12^2\right)^{\frac{5}{2}} = (25+144)^{\frac{5}{2}} = (169)^{\frac{5}{2}} = \left[(13)^2\right]^{\frac{5}{2}} = \left[13^{2\times\frac{1}{2}}\right]^5$

$= (13)^5 = 13\times13\times13\times13\times13 = \mathbf{371293}$ **Ans.**

(c) $(17^2-8^2)^{\frac{1}{2}} = [(17+8)(17-8)]^{\frac{1}{2}} = (25\times9)^{\frac{1}{2}} = (225)^{\frac{1}{2}}$

$= (3\times3\times5\times5)^{\frac{1}{2}}$

$= (3^2\times5^2)^{\frac{1}{2}} = 3^{2\times\frac{1}{2}}\times5^{2\times\frac{1}{2}} = 3\times5 = \mathbf{15}$ **Ans.**

(d) $(1^3+2^3+3^3+4^3)^{-\frac{5}{2}} = (1+8+27+64)^{-\frac{5}{2}} = (100)^{-\frac{5}{2}}$

$= \left(\frac{1}{100}\right)^{\frac{5}{2}}$

$= \left(\frac{1}{10^2}\right)^{\frac{5}{2}} = \left(\frac{1}{10^{2\times\frac{1}{2}}}\right)^5 = \left(\frac{1}{10}\right)^5 = \frac{1}{10}\times\frac{1}{10}\times\frac{1}{10}\times\frac{1}{10}\times\frac{1}{10}$

$= \frac{1}{100000} = \mathbf{0.00001}$

Ans.

2. (a) $\left(\frac{32}{243}\right)^{\frac{6}{5}} = \left[\left(\frac{32}{243}\right)^{\frac{1}{5}}\right]^6 = \left[\left(\frac{2\times2\times2\times2\times2}{3\times3\times3\times3\times3}\right)^{\frac{1}{5}}\right]^6$

$= \left[\left(\frac{2^5}{3^5}\right)^{\frac{1}{5}}\right]^6 = \left[\frac{2^{5\times\frac{1}{5}}}{3^{5\times\frac{1}{5}}}\right]^6 = \left(\frac{2}{3}\right)^6 = \frac{2\times2\times2\times2\times2\times2}{3\times3\times3\times3\times3\times3} = \mathbf{\frac{64}{729}}$

Ans.

(b) $\left(\frac{25}{49}\right)^{\frac{8}{4}} = \left[\left(\frac{25}{49}\right)^{\frac{1}{4}}\right]^8 = \left[\left(\frac{5\times5}{7\times7}\right)^{\frac{1}{4}}\right]^8 = \left[\left(\frac{5^2}{7^2}\right)^{\frac{1}{4}}\right]^8 = \left(\frac{5^{2\times\frac{1}{4}}}{7^{2\times\frac{1}{4}}}\right)^8$

$= \left(\frac{5^{\frac{1}{2}}}{7^{\frac{1}{2}}}\right)^8 = \frac{5^{\frac{1}{2}\times8}}{7^{\frac{1}{2}\times8}} = \frac{5^4}{7^4} = \frac{5\times5\times5\times5}{7\times7\times7\times7} = \mathbf{\frac{625}{2401}}$ **Ans.**

(c) $\left(\frac{625}{81}\right)^{-\frac{3}{4}} = \left(\frac{81}{625}\right)^{\frac{3}{4}} = \left(\frac{3\times3\times3\times3}{5\times5\times5\times5}\right)^{\frac{3}{4}} = \left(\frac{3^4}{5^4}\right)^{\frac{3}{4}}$

$= \left[\left(\frac{3}{5}\right)^4\right]^{\frac{3}{4}} = \left(\frac{3}{5}\right)^{4\times\frac{3}{4}} = \left(\frac{3}{5}\right)^3 = \frac{3\times3\times3}{5\times5\times5} = \mathbf{\frac{27}{125}}$ **Ans.**

(d) $\left(\frac{1}{81}\right)^{-\frac{1}{2}} = (81)^{\frac{1}{2}} = (3\times3\times3\times3)^{\frac{1}{2}} = (3^4)^{\frac{1}{2}} = 3^{4\times\frac{1}{2}}$

$= 3^2 = 3\times3 = \mathbf{9}$ **Ans.**

3. (a) $27^{\frac{4}{3}} \times 27^{\frac{1}{3}} \times 27^{-\frac{2}{3}} = (27)^{\frac{4}{3}+\frac{1}{3}-\frac{2}{3}}$

$= (27)^{\frac{4+1-2}{3}} = 27^{\frac{5-2}{3}} = 27^{\frac{3}{3}} = 27^1 = \mathbf{27}$ **Ans.**

(b) $\left(\frac{27}{125}\right)^{-\frac{1}{3}} \times \left(\frac{27}{125}\right)^{-\frac{5}{3}} = \left(\frac{27}{125}\right)^{-\frac{1}{3}-\frac{5}{3}} = \left(\frac{27}{125}\right)^{\frac{-1-5}{3}}$

$= \left(\frac{27}{125}\right)^{-\frac{6}{3}} = \left(\frac{3\times3\times3}{5\times5\times5}\right)^{-\frac{6}{3}} = \left(\frac{3^3}{5^3}\right)^{-\frac{6}{3}} = \left(\frac{3}{5}\right)^{3\times\frac{-6}{3}}$

$= \left(\frac{3}{5}\right)^{-6} = \left(\frac{5}{3}\right)^6 = \frac{5\times5\times5\times5\times5\times5}{3\times3\times3\times3\times3\times3} = \mathbf{\frac{15625}{729}}$ **Ans.**

(c) $\left[(512)^{-\frac{6}{3}}\right]^{-\frac{1}{2}} = \left[(2\times2\times2\times2\times2\times2\times2\times2\times2)^{-\frac{6}{3}}\right]^{-\frac{1}{2}}$

$= \left[(2^9)^{-\frac{6}{3}}\right]^{-\frac{1}{2}} = \left[2^{9\times\left(\frac{-6}{3}\right)}\right]^{-\frac{1}{2}} = (2^{-18})^{-\frac{1}{2}} = 2^{-18\times\left(\frac{-1}{2}\right)}$

$= 2^9 = 2\times2\times2\times2\times2\times2\times2\times2\times2 = \mathbf{512}$ **Ans.**

(d) $\left(\frac{12}{13}\right)^{\frac{8}{3}} \times \left(\frac{12}{13}\right)^{\frac{13}{3}} = \left(\frac{12}{13}\right)^{\frac{8}{3}+\frac{13}{3}} = \left(\frac{12}{13}\right)^{\frac{21}{3}} = \left(\frac{\mathbf{12}}{\mathbf{13}}\right)^{7}$ **Ans.**

4. (a) 7^3, Base $= \mathbf{7}$ and exponents $= \mathbf{3}$ **Ans.**

(b) 3^{-5}, Base $= \mathbf{3}$ and exponents $= \mathbf{-5}$ **Ans.**

(c) $(-9)^4$, Base $= \mathbf{-9}$ and exponents $= \mathbf{4}$ **Ans.**

(d) $(13)^5$, Base $= \mathbf{13}$ and exponents $= \mathbf{5}$ **Ans.**

(e) $\left(-\frac{4}{5}\right)^3$, Base $= -\frac{\mathbf{4}}{\mathbf{5}}$ and exponents $= \mathbf{3}$ **Ans.**

(f) $\left(\frac{4}{15}\right)^{-2}$, Base $= \frac{\mathbf{4}}{\mathbf{15}}$ and exponents $= \mathbf{-2}$ **Ans.**

5. (a) $(0.16)^{\frac{5}{2}} = \left(\frac{16}{100}\right)^{\frac{5}{2}} = \left[\left(\frac{4\times4}{10\times10}\right)\right]^{\frac{5}{2}} = \left(\frac{4^2}{10^2}\right)^{\frac{5}{2}} = \left(\frac{4}{10}\right)^{2\times\frac{5}{2}}$

$= \left(\frac{4}{10}\right)^5 = \left(\frac{2}{5}\right)^5 = \frac{2\times2\times2\times2\times2}{5\times5\times5\times5\times5} = \frac{32}{3125}$ **Ans.**

(b) $(0.000729)^{\frac{5}{6}} = \left(\frac{729}{1000000}\right)^{\frac{5}{6}} = \left(\frac{3\times3\times3\times3\times3\times3}{10\times10\times10\times10\times10\times10}\right)^{\frac{5}{6}}$

$= \left(\frac{3^6}{10^6}\right)^{\frac{5}{6}}$

$\left[\left(\frac{3}{10}\right)^6\right]^{\frac{5}{6}} = \left(\frac{3}{10}\right)^{6\times\frac{5}{6}} = \left(\frac{3}{10}\right)^5 = \frac{3\times3\times3\times3\times3}{10\times10\times10\times10\times10} = \mathbf{\frac{243}{100000}}$

Ans.

(c) $(0.0625)^{\frac{3}{4}} = \left(\frac{625}{10000}\right)^{\frac{3}{4}} = \left(\frac{5\times5\times5\times5}{10\times10\times10\times10}\right)^{\frac{3}{4}}$

$= \left(\frac{5^4}{10^4}\right)^{\frac{3}{4}} = \left[\left(\frac{5}{10}\right)^4\right]^{\frac{3}{4}}$

$= \left(\frac{5}{10}\right)^{4\times\frac{3}{4}} = \left(\frac{5}{10}\right)^3 = \frac{5\times5\times5}{10\times10\times10} = \frac{125}{1000} = \mathbf{0.125}$ **Ans.**

(d) $(0.000064)^{\frac{5}{6}} = \left(\frac{64}{1000000}\right)^{\frac{5}{6}} = \left(\frac{2\times2\times2\times2\times2\times2}{10\times10\times10\times10\times10\times10}\right)^{\frac{5}{6}}$

$= \left(\frac{1}{5\times5\times5\times5\times5\times5}\right)^{\frac{5}{6}}$

$= \left(\frac{1}{5^6}\right)^{\frac{5}{6}} = \left[\left(\frac{1}{5}\right)^6\right]^{\times\frac{5}{6}} = \left(\frac{1}{5}\right)^{6\times\frac{5}{6}} = \left(\frac{1}{5}\right)^5 = \frac{1}{5\times5\times5\times5\times5} = \frac{\mathbf{1}}{\mathbf{3125}}$ **Ans.**

6. (a) $4^{\frac{5}{2}} = (2\times2)^{\frac{5}{2}} = (2^2)^{\frac{5}{2}} = 2^{2\times\frac{5}{2}} = 2^5 = 2\times2\times2\times2\times2 = \mathbf{32}$ **Ans.**

(b) $8^{\frac{7}{3}} = (2\times2\times2)^{\frac{7}{3}} = (2^3)^{\frac{7}{3}} = 2^{3\times\frac{7}{3}}$

$= 2^7 = 2\times2\times2\times2\times2\times2\times2 = \mathbf{128}$ **Ans.**

(c) $(343)^{\frac{8}{3}} = (7\times7\times7)^{\frac{8}{3}} = (7^3)^{\frac{8}{3}} = 7^{3\times\frac{8}{3}}$

$= 7^8 = 7\times7\times7\times7\times7\times7\times7\times7 = \mathbf{5764801}$ **Ans.**

(d) $(32768)^{\frac{2}{15}}$

$= (2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2\times2)^{\frac{2}{15}} = (2^{15})^{\frac{2}{15}}$

$= 2^{15\times\frac{2}{15}} = 2^2 = 2\times2 = \mathbf{4}$ **Ans.**

(e) $(279936)^{\frac{9}{7}}$

$= (2\times2\times2\times2\times2\times2\times2\times3\times3\times3\times3\times3\times3\times3)^{\frac{9}{7}}$

$= (2^7\times3^7)^{\frac{9}{7}}$

$= (6^7)^{\frac{9}{7}} = 6^{7\times\frac{9}{7}} = 6^9 = 6\times6\times6\times6\times6\times6\times6\times6\times6 = \mathbf{10027696}$ **Ans.**

(f) $\left(\frac{1}{27}\right)^{-\frac{1}{3}} = (27)^{\frac{1}{3}} = (3\times3\times3)^{\frac{1}{3}} = (3^3)^{\frac{1}{3}} = 3^{3\times\frac{1}{3}} = 3^1 = \mathbf{3}$ **Ans.**

Exercise 4.2

1. (a) $\sqrt{72} + \sqrt{18} + \sqrt{112} = \sqrt{2\times2\times2\times3\times3}$

$+\sqrt{2\times3\times3} + \sqrt{2\times2\times2\times2\times7}$

$= 2\times 3\sqrt{2} + 3\sqrt{2} + 2\times 2\sqrt{7} = 6\sqrt{2} + 3\sqrt{2} + 4\sqrt{7}$

$= (6+3)\sqrt{2} + 4\sqrt{7} = \mathbf{9\sqrt{2} + 4\sqrt{7}}$ **Ans.**

(b) $\sqrt{25} + \sqrt{18} - \sqrt{60} + \sqrt{28} + \sqrt{5} - \sqrt{2}$

$= \sqrt{5\times 5} + \sqrt{2\times 3\times 3} - \sqrt{2\times 2\times 3\times 5} + \sqrt{2\times 2\times 7} + \sqrt{5} - \sqrt{2}$

$= 5 + 3\sqrt{2} - 2\sqrt{15} + 2\sqrt{7} + \sqrt{5} - \sqrt{2}$

$= \mathbf{5 + 2\sqrt{2} - 2\sqrt{15} + 2\sqrt{7} + \sqrt{5}}$ **Ans.**

2. (a) $2\sqrt{5} = \sqrt{2^2\times 5} = \sqrt{2\times 2\times 5} = \mathbf{\sqrt{20}}$ **Ans.**

(b) $7\sqrt{6} = \sqrt{7^2\times 6} = \sqrt{7\times 7\times 6} = \mathbf{\sqrt{294}}$ **Ans.**

(c) $8\sqrt{5} = \sqrt{8^2\times 5} = \sqrt{8\times 8\times 5} = \mathbf{\sqrt{320}}$ **Ans.**

(d) $\frac{9}{4}\cdot\sqrt{40} = \sqrt{\left(\frac{9}{4}\right)^2\times 40} = \sqrt{\frac{9}{4}\times\frac{9}{4}\times 40} = \sqrt{\frac{405}{2}} = \mathbf{\sqrt{202\frac{1}{2}}}$ **Ans.**

3. (a) $\frac{9}{\sqrt{5}} = \frac{9}{\sqrt{5}}\times\frac{\sqrt{5}}{\sqrt{5}} = \mathbf{\frac{9\sqrt{5}}{5}}$ **Ans.**

(b) $\frac{12}{6\sqrt{3}} = \frac{12}{6\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}} = \frac{12\sqrt{3}}{6\times 3} = \mathbf{\frac{2\sqrt{3}}{3}}$ **Ans.**

(c) $\frac{5}{\sqrt{27}} = \frac{5}{\sqrt{3\times 3\times 3}} = \frac{5}{3\sqrt{3}} = \frac{5}{3\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{3\times 3} = \mathbf{\frac{5\sqrt{3}}{9}}$ **Ans.**

(d) $\frac{\sqrt{2}}{\sqrt{7}} = \frac{\sqrt{2}}{\sqrt{7}}\times\frac{\sqrt{7}}{\sqrt{7}} = \mathbf{\frac{\sqrt{14}}{7}}$ **Ans.**

(e) $\frac{26}{4-\sqrt{10}} = \frac{26}{(4-\sqrt{10})}\times\frac{(4+\sqrt{10})}{(4+\sqrt{10})}$

$= \frac{104+26\sqrt{10}}{(4)^2-(\sqrt{10})^2} = \frac{2(52+13\sqrt{10})}{16-10} = \frac{2(52+13\sqrt{10})}{6} = \mathbf{\frac{52+13\sqrt{10}}{3}}$ **Ans.**

(f) $\frac{1}{2\sqrt{5}-\sqrt{6}} = \frac{1}{2\sqrt{5}-\sqrt{6}}\times\frac{2\sqrt{5}+\sqrt{6}}{2\sqrt{5}+\sqrt{6}} = \frac{2\sqrt{5}+\sqrt{6}}{(2\sqrt{5})^2-(\sqrt{6})^2}$

$= \frac{2\sqrt{5}+\sqrt{6}}{4\times 5-6} = \frac{2\sqrt{5}+\sqrt{6}}{20-6} = \mathbf{\frac{2\sqrt{5}+\sqrt{6}}{14}}$ **Ans.**

(g) $\frac{12}{\sqrt{7}-2} = \frac{12}{\sqrt{7}-2}\times\frac{(\sqrt{7}+2)}{(\sqrt{7}+2)} = \frac{12\sqrt{7}+24}{(\sqrt{7})^2-(2)^2}$

$= \dfrac{3(4\sqrt{7}+8)}{7-4} = \dfrac{3(4\sqrt{7}+8)}{3} = \mathbf{4\sqrt{7}+8}$ **Ans.**

(h) $\dfrac{1}{\sqrt{7}-\sqrt{4}} = \dfrac{1}{(\sqrt{7}-\sqrt{4})} \times \dfrac{\sqrt{7}+\sqrt{4}}{(\sqrt{7}+\sqrt{4})} = \dfrac{\sqrt{7}+\sqrt{4}}{(\sqrt{7})^2-(\sqrt{4})^2}$

$= \dfrac{\sqrt{7}+\sqrt{2\times 2}}{7-4} = \dfrac{\sqrt{7}+2}{3} = \dfrac{\mathbf{2}+\sqrt{\mathbf{7}}}{\mathbf{3}}$ **Ans.**

4. (a) $\sqrt{108} = \sqrt{2\times2\times3\times3\times3} = 2\times3\sqrt{3} = 6\sqrt{3} = \mathbf{6\sqrt{3}}$ **Ans.**

(b) $\sqrt{99} = \sqrt{3\times3\times11} = 3\times\sqrt{11} = \mathbf{3\sqrt{11}}$ **Ans.**

(c) $\sqrt{204} = \sqrt{2\times2\times51} = 2\times\sqrt{51} = \mathbf{2\sqrt{51}}$ **Ans.**

(d) $\sqrt{112} = \sqrt{2\times2\times2\times2\times7} = 2\times2\times\sqrt{7} = \mathbf{4\sqrt{7}}$ **Ans.**

5. (a) $15^{\frac{1}{2}} = \mathbf{\sqrt{15}}$ **Ans.** (b) $211^{\frac{1}{5}} = \mathbf{\sqrt[5]{211}}$ **Ans.**

(c) $\left(\dfrac{17}{12}\right)^{\frac{1}{9}} = \mathbf{\sqrt[9]{\dfrac{17}{12}}}$ **Ans.** (d) $\left(\dfrac{516}{64}\right)^{-\frac{1}{14}} = \left(\dfrac{64}{516}\right)^{\frac{1}{14}} = \mathbf{\sqrt[14]{\dfrac{64}{516}}}$ **Ans.**

6. (a) $\sqrt{7} = \mathbf{7^{\frac{1}{2}}}$ **Ans.** (b) $\sqrt[4]{6} = \mathbf{6^{\frac{1}{4}}}$ **Ans.**

(c) $\sqrt[7]{1280} = \mathbf{(1280)^{\frac{1}{7}}}$ **Ans.** (d) $\sqrt[8]{\dfrac{32}{79}} = \left(\dfrac{\mathbf{32}}{\mathbf{79}}\right)^{\frac{1}{8}}$ **Ans.**

7. (a) $5^x = 625$ or $5^x = 5^4$

$\therefore$ On comparison of exponents, $\therefore\ \boldsymbol{x = 4}$ **Ans.**

(b) $3^{4x} = \dfrac{1}{729}$ or $3^{4x} = \dfrac{1}{3^6}$ or $3^{4x} = 3^{-6}$

On comparison exponents, $\therefore\ 4x = -6$ or $\boldsymbol{x} = \dfrac{\mathbf{-6}}{\mathbf{4}} = \dfrac{\mathbf{-3}}{\mathbf{2}}$ **Ans.**

(c) $4^x = \dfrac{1}{64}$ or $4^x = \dfrac{1}{4^3}$ or $4^x = 4^{-3}$

On comparison exponents, $\therefore \boldsymbol{x = -3}$ **Ans.**

(d) $7^{2x-1} = 343$ or $7^{2x-1} = 7^3$

On comparison exponents, $2x - 1 = 3$ or $2x = 3 + 1 = 4$

$$x = \frac{4}{2} = 2 \quad \therefore \boldsymbol{x = 2}$$

Ans.

(e) $2^x = \sqrt{2^2} \times (128)^{\frac{1}{7}}$ or $2^x = 2 \times (2\times2\times2\times2\times2\times2\times2)^{\frac{1}{7}}$

or $2^x = 2 \times (2^7)^{\frac{1}{7}}$ or $2^x = 2 \times 2^{7 \times \frac{1}{7}}$ or $2^x = 2 \times 2$ or $2^x = 2^2$

On comparison of exponents, $\boldsymbol{x = 2}$ **Ans.**

(f) $4^x \times 2^x = (32)^{\frac{1}{5}} \times (64)^{\frac{1}{3}}$ or $(2^2)^x \times 2^x = (2^5)^{\frac{1}{5}} \times (4^3)^{\frac{1}{3}}$

or $2^{2x} \times 2^x = 2^{5 \times \frac{1}{5}} \times 4^{3 \times \frac{1}{3}}$

or $2^{2x+x} = 2 \times 4$ or $2^{3x} = 2 \times 2 \times 2 = 2^3$

On comparison of exponents,

$3x = 3$ or $x = \dfrac{3}{3}$ $\quad \therefore \boldsymbol{x = 1}$

Ans.

Multiple Choice Questions

1. (i) $a^m \times a^n = a^{m+n}$

Hence, the answer **(c)** is correct. **Ans.**

(ii) $\left(\dfrac{p}{q}\right)^3 = \dfrac{p^3}{q^3}$ $\quad \left[\because \left(\dfrac{\boldsymbol{a}}{\boldsymbol{b}}\right)^{\boldsymbol{n}} = \dfrac{\boldsymbol{a^n}}{\boldsymbol{b^n}}\right]$

Hence, the answer **(a)** is correct. **Ans.**

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

Hence, the answer **(b)** is correct. **Ans.**

(iv) $-\dfrac{343}{729} = -\dfrac{7 \times 7 \times 7}{9 \times 9 \times 9} = -\dfrac{7^3}{9^3} = \left(-\dfrac{7}{9}\right)^3$

Hence, the answer **(d)** is correct. **Ans.**

(v) $a^m \div a^n = \dfrac{a^m}{a^n} = a^{m-n}$

Hence, the answer **(d)** is correct. **Ans.**

(vi) $(-4)^3 = (-4) \times (-4) \times (-4) = -64$

Hence, the answer **(c)** is correct. **Ans.**

(vii) $\left[\left(\dfrac{1}{2}\right)^2 - \left(\dfrac{1}{4}\right)^3\right] \times 2^3 = \left[\dfrac{1}{4} - \dfrac{1}{64}\right] \times 2^3 = \left(\dfrac{16-1}{64}\right) \times 8$

$= \dfrac{15}{64} \times 8 = \dfrac{15 \times 8}{64} = \dfrac{15}{8}$

Hence, the answer **(d)** is correct. **Ans.**

(viii) $(-3)^2 \div 3^2 = 9 \div 9 = \dfrac{9}{9} = 1$

Hence, the answer **(c)** is correct. **Ans.**

5. Playing With Numbers

Exercise 5.1

1. (a)
$$\begin{array}{r} 3\,a\,b \\ +\,c\,4\,8 \\ \hline 7\,1\,3 \end{array}$$

Here, $b+8=3$, addition of $5+8$ will given 13.

Thus, $b=5$ and 1 is carried to the tens digit.

Now, at tens place $a+1+4=1$ or $a+5=1$, again addition of $6+5$ will give 11. Thus $a=6$ and 1 is carried to hundreds digit.

and hundred place $3+1+c=7$ or $4+c=7$ or $c=7-4=3$

Hence, $\boldsymbol{a=6, b=5}$ **and** $\boldsymbol{c=3}$ **Ans.**

(b)
$$\begin{array}{r} 4\,3\,1 \\ +\,a\,b\,c \\ \hline 8\,0\,2 \end{array}$$

Here, $1+c=2$, addition of $c=1$ will give 2.

Now, at ten place $3+b=0$, addition of $3+7$ will given 10.

Thus, $b=7$ and 1 is carried to hundreds digit.

Now hundreds place, $4+1+a=8$ or $5+a=8$ or $a=8-5=3$

Hence, $\boldsymbol{a=3, b=7}$ **and** $\boldsymbol{c=1}$ **Ans.**

2. (a)
$$\begin{array}{r} 7\,4 \\ +\,a\,b \\ \hline 9\,2 \end{array}$$

Here, $4+b=2$, addition of $4+8$ will give 12.

Thus, $b=8$ and 1 is carried to the tens digit.

Now, at tens place,

$7+1+a=9$ or $8+a=9$ or $a=9-8=1$

Hence, $\boldsymbol{a=1}$ **and** $\boldsymbol{b=8}$ **Ans.**

(b)
$$\begin{array}{r} 2\,5 \\ +\,3\,a \\ \hline b\,3 \end{array}$$

Here, $5+a=3$, addition of $5+8$ will given 13.

Thus, $a=8$ and 1 is carried to the tens digit.

Now, $1+2+3=b$ or $b=6$

Hence, $\boldsymbol{a=8}$ **and** $\boldsymbol{b=6}$ **Ans.**

(c) $\begin{array}{r} 4\,a \\ +\,b\,6 \\ \hline 8\,2 \end{array}$

Here, $a+6=2$, addition of $6+6$ will given 12.

Thus, $a=6$ and 1 is carried to the tens digit.

Now, $1+4+b=8$ or $5+b=8$ or $b=8-5=3$

Hence, $\boldsymbol{a=6}$ **and** $\boldsymbol{b=3}$ **Ans.**

3. (a) $\begin{array}{r} 5\,3\,a \\ -\,1\,b\,5 \\ \hline c\,9\,6 \end{array}$

Here, at ones place $a-5=6$

Hence, a is less than 5, so we borrow 1 from ten place, thus

$10+a-5=6$

$10+a-5=6$ or $5+a=6$ or $a=6-5$ or $a=1$

$3-1-b=9$ or $2-b=9$

Again we borrow from the hundreds place.

$10+2-b=9$ or $12-b=9$

or $-b=9-12$ or $-b=-3$ or $b=3$

At hundred place, $5-1-1=c$ or $c=5-2=3$

Hence, $\boldsymbol{a=1, b=3}$ **and** $\boldsymbol{c=3}$ **Ans.**

(b) $\begin{array}{r} c\,3\,a \\ -\,1\,b\,1 \\ \hline 2\,2\,4 \end{array}$

At one place, here a is greater than 1.

$a-1=4$ or $a=4+1$ or $a=5$

Now, at tens place, $3-b=2$

$-b=2-3$ or $-b=-1$ or $b=1$

At hundreds place,

$c-1=2$

$\therefore \quad c=2+1=3$

Hence, $\boldsymbol{a=5, b=1}$ **and** $\boldsymbol{c=3}$ **Ans.**

4. (a) $\begin{array}{r} 8\,1 \\ -\,b\,a \\ \hline 1\,2 \end{array}$

At ones place, $1-a=2$

Here, a is less than 1, so we borrow 1 from tens place, thus

$10+1-a=2$ or $11-a=2$ or $-a=2-11=-9$

$\therefore \quad a=9$

At tens place, $8-1-b=1$ or $7-b=1$

or $\quad -b=1-7=-6$

$\therefore \quad b=6$

Hence, $\boldsymbol{a=9}$ **and** $\boldsymbol{b=6}$ **Ans.**

(b)
$$\begin{array}{r} 7\ 1 \\ -\ 3\ a \\ \hline b\ 3 \end{array}$$

Here, at ones place $1-a=3$

Hence, a is less than 1, so we borrow 1 from ten place, thus

$10+1-a=3$ or $11-a=3$ or $-a=3-11=-8$

$\therefore \quad a=8$

Now, at tens place, $7-1-3=b$ or $7-4=b$

$\therefore \quad b=3$

Hence, $\boldsymbol{a=8}$ **and** $\boldsymbol{b=3}$ **Ans.**

(c)
$$\begin{array}{r} a\ 4 \\ -\ 3\ b \\ \hline 4\ 6 \end{array}$$

Here, at ones place $4-b=6$

Hence, b is less than 4, so we borrow 1 form ten place, thus

$10+4-b=6$ or $14-b=6$ or $-b=6-14=-8$

$\therefore \quad b=8$

Now, at tens place, $a-1-3=4$ or $a-4=4$

$a=4+4 \quad \therefore a=8$

Hence, $\boldsymbol{a=8}$ **and** $\boldsymbol{b=8}$ **Ans.**

(d)
$$\begin{array}{r} a\ 9 \\ -\ 1\ b \\ \hline 2\ 1 \end{array}$$

Here, at ones place $9-b=1$, here b is greater than 9, so

$9-b=1$ or $\quad -b=1-9=-8$

$\therefore \quad b=8$

At tens place,

$a-1=2$ or $a=1+2=3$

Hence, $\boldsymbol{a=3}$ **and** $\boldsymbol{b=8}$ **Ans.**

5. (a)
$$\begin{array}{r} b\,9 \\ \times\, c\,a \\ \hline 3\,4\,5 \\ 6\,9\,0 \\ \hline 1\,0\,3\,5 \end{array} = \begin{array}{r} 6\,9 \\ \times\, 1\,5 \\ \hline 3\,4\,5 \\ 6\,9\,0 \\ \hline 1\,0\,3\,5 \end{array}$$

(b)
$$\begin{array}{r} b\,2\,a \\ \times\, c\,0\,7 \\ \hline 8\,6\,8 \\ 0\,0\,0\,0 \\ 2\,4\,8\,0\,0 \\ \hline 2\,5\,6\,6\,8 \end{array} = \begin{array}{r} 1\,2\,4 \\ \times\, 2\,0\,7 \\ \hline 8\,6\,8 \\ 0\,0\,0\,0 \\ 2\,4\,8\,0\,0 \\ \hline 2\,5\,6\,6\,8 \end{array}$$

6. We have, $p - q = 420$ ...(i)

and $p + q = 920$ ...(ii)

Add equations (i) and (ii), $2p = 1340$

or $p = \dfrac{1340}{2} = 670$

$\therefore$ $p = 670$

Put the value of p in equation (ii),

$p + q = 920$ or $670 + q = 920$ or $q = 920 - 670$

$\therefore q = 250$

Hence, $\boldsymbol{p = 670}$ **and** $\boldsymbol{q = 250}$ **Ans.**

7. We have, $a + b = 1640$ ...(i)

and $a = 200 + b$

Put the value of a in equation (i),

$200 + b + b = 1640$

or $200 + 2b = 1640$

or $2b = 1640 - 200 = 1440$

or $b = \dfrac{1440}{2} = 720$

$\therefore$ $a = 200 + b = 200 + 720 = 920$

Hence, $\boldsymbol{a = 920}$ **and** $\boldsymbol{b = 720}$ **Ans.**

8. (a)

7	6	1	9	2	3	5	4	8
2	9	4	1	8	5	3	7	6
8	3	5	7	6	4	9	1	2
4	8	2	5	1	7	6	3	9
5	7	6	8	3	9	1	2	4
9	1	3	2	4	6	8	5	7
1	4	8	6	5	2	7	9	3
6	2	9	3	7	1	4	8	5
3	5	7	4	9	8	2	6	1

7	6	1	9	2	3	5	4	8
2	9	4	1	8	5	3	7	6
8	3	5	7	6	4	9	1	2
4	8	2	5	1	7	6	3	9
5	7	6	8	3	9	1	2	4
9	1	3	2	4	6	8	5	7
1	4	8	6	5	2	7	9	3
6	2	9	3	7	1	4	8	5
3	5	7	4	9	8	2	6	1

9.

Start →								Finish ↑
	24 ↓	486 →	36 ↓	44 →	76 ↓	87 →	46 ↓	(410)
	23	39	78	61	36	78	138	(165)
	43	87	125	65	35	60	53	(95)
	(10)	25	70	26	96	25	327	(85)
	(15)	46	90	76	89	20	22	(100)
	54	47	56	90	40	55	228	(50)
	76	34	37	115	54	178	32	(55)
	97 →	72 ↑	27 →	(170) ↑	(75) →	(435) ↑	(30) →	(80) ↑

10. Let the numbers be a and b.

$\because$ $a + b = 9$ ...(i)

and $a - b = 7 \Rightarrow a = b + 7$

Put the value of 'a' in equation (i),

$b + 7 + b = 9$ or $2b = 9 - 7 = 2$

$\therefore$ $b = \frac{2}{2} = 1$

Now, put the value of 'a' in equation (i).

$a + 1 = 9$ or $a = 9 - 1 = 8$

Hence, sum of numbers $= 8 + 1 = 9$, difference $= 8 - 1 = 7$,
Product $= 8 \times 1 = 8$

Hence,

	Numbers	
	8	1
	⑨	⑦ ⑧
	Sum	Difference Product

11.

$$\begin{array}{r} 3046 \\ \times\ 371 \\ \hline 3046 \\ 21324\times \\ 91388\times\times \\ \hline 1130066 \end{array}$$

Ans.

12. (a) $\because n = a, \therefore n + 20 = 22$ or $n = 22 - 20 = 2$ $\therefore \boldsymbol{a = 2}$

$\because n = b, \quad \therefore n + 20 = 40$ or $n = 40 - 20 = 20$ $\therefore \boldsymbol{b = 20}$

$\because n = 30, \quad \therefore n + 20 = c$ or $30 + 20 = c$ $\therefore \boldsymbol{c = 50}$

$\because n = 40, \quad \therefore n + 20 = d$ or $40 + 20 = d$ $\therefore \boldsymbol{d = 60}$

Hence, $\boldsymbol{a = 2, b = 20, c = 50}$ **and** $\boldsymbol{d = 60}$

Thus,

n	$n + 20$
2	22
20	40
30	50
40	60

(b) Here, $\because n = 10, \quad \therefore a = 7n + 20 = 7 \times 10 + 20 = 70 + 20 = 90$

$\because n = b, \quad \therefore 7n + 20 = 48$ or $7n = 48 - 20 = 28$

or $n = \dfrac{28}{7} = 4, \qquad \therefore b = 4$

$\because n = c \quad \therefore 7n + 20 = 90$ or $7n = 90 - 20 = 70$

or $n = \dfrac{70}{7} = 10, \qquad \therefore c = 10$

$n = 4, \qquad \therefore d = 7n + 20 = 7 \times 4 + 20 = 28 + 20 = 48$

$a = 90,\ b = 4,\ c = 10$ and $d = 48$

Hence,

n	$7n+20$
10	90
4	48
10	90
4	48

Exercise 5.2

1. We know that a number is divisible by 2, if the ones digit of the number is 0, 2, 4, 6 or 8.

Thus,

(a) 182 is **divisible** by 2. **Ans.**

(b) 699 is **not divisible** by 2. **Ans.**

(c) 210 is **divisible** by 2. **Ans.**

(d) 407 is **not divisible** by 2. **Ans.**

(e) 1284 is **divisible** by 2. **Ans.**

(f) 1362 is **divisible** by 2. **Ans.**

(g) 1562 is **divisible** by 2. **Ans.**

(h) 4100 is **divisible** by 2. **Ans.**

(i) 3621 is **not divisible** by 2. **Ans.**

(j) 4698 is **divisible** by 2. **Ans.**

2. We know that a number is divisible by 10, if its units digit is 0.

$\therefore$The numbers divisible by 10 are:

(b) 2510, (d) 1750 and (e) 2060 **Ans.**

Thus, the numbers not divisible by 10 are:

(a) 462, (c) 1655 and (f) 2508 **Ans.**

3. We know that a number is divisible by 3, if the sum of its digits is divisible by 3.

(a) The number is 763.

Sum of it digit $= 7+6+3=16$

Which is not divisible by 3. $\therefore$763 is **not divisible** by 3. **Ans.**

(b) The number is 783.

Sum of its digits $= 7+8+3=18$

Which is divisible by 3. $\therefore$783 is **divisible** by 3. **Ans.**

(c) The number is 4537.

Sum of its digits $= 4+5+3+7=19$

Which is not divisible by 3. $\therefore$4537 is **not divisible** by 3. **Ans.**

(d) The number is 3059.

Sum of its digits $= 3+0+5+9 = 17$

Which is not divisible by 3. $\therefore$3059 is **not divisible by** 3. **Ans.**

(e) The number is 8012.

Sum of its digits $= 8+0+1+2 = 11$

Which is not divisible by 3. $\therefore$8012 is **not divisible** by 3. **Ans.**

(f) The number is 6120.

Sum of its digits $= 6+1+2+0 = 9$

Which is divisible by 3. $\therefore$6120 is **divisible** by 3. **Ans.**

(g) The number is 3148.

Sum of its digits $= 3+1+4+8 = 16$

Which is not divisible by 3. $\therefore$3148 is **not divisible** by 3. **Ans.**

(h) The number is 1567.

Sum of its digits $= 1+5+6+7 = 19$

Which is not divisible by 3. $\therefore$1567 is **not divisible** by 3. **Ans.**

(i) The number is 4650.

Sum of its digits $= 4+6+5+0 = 15$

Which is not divisible by 3. $\therefore$4650 is **divisible** by 3. **Ans.**

(j) The number is 3563.

Sum of its digits $= 3+5+6+3 = 17$

Which is not divisible by 3. $\therefore$3563 is **not divisible** by 3. **Ans.**

4. (a) The given number is 718.

$\therefore$Its unit digit is 8, so it is divisible by 2.

$\Rightarrow$ Now, its unit digit is not 0,so it is not divisible by 10.

$\Rightarrow$ Sum of digits $= 7+1+8 = 16$, which is not divisible by 9.

$\therefore$It is not divisibly by 9.

Hence, **718 is divisible by only 2.** **Ans.**

(b) The given number is 204.

$\therefore$Its unit digit is 4, so it is divisible by 2.

$\Rightarrow$ Its unit digit not 0, so it is not divisible by 10.

$\Rightarrow$ Sum of digits $= 2+0+4 = 6$, which is not divisible by 9.

$\therefore$204 is not divisible by 9.

Hence, **204 is divisible only 2.** **Ans.**

(c) The given number is 944.

$\therefore$Its unit digit is 4, so it is divisible by 2.

$\Rightarrow$ Its unit digit is not 0, so it is not divisible by 10.

$\Rightarrow$ Sum of digits $= 9 + 4 + 4 = 17$, which is not divisible by 9.

$\therefore$944 is not divisible by 9.

Hence, **944 is divisible only 2.** **Ans.**

(d) The given number is 400.

$\therefore$It unit digit is 0, so it is divisible by 2 and 10.

Sum of digits $= 4 + 0 + 0 = 4$, which is not divisible by 9.

Hence, **400 is divisible by 2 and 10.** **Ans.**

(e) The given number is 2268.

$\therefore$Its unit digit is 8, so it is divisible by 2.

$\Rightarrow$ It unit digit is not 0, so it is not divisible by 10.

$\Rightarrow$ Sum of digits $= 2 + 2 + 6 + 8 = 18$, which is divisible by 9.

$\therefore$2268 is divisible by 9.

Hence, **2268 is divisible by 2 and 9.** **Ans.**

(f) The given number is 1170.

$\therefore$Its unit digit is 0, so it is divisible by 2 and 10.

Now, sum of digits $= 1 + 1 + 7 + 0 = 9$, which is divisible by 9.

$\therefore$1170 is divisible by 9.

Hence, **1170 is divisible by 2, 9 and 10.** **Ans.**

5. We know that a number is divisible by 9, if its digits adds up to a multiple of 9.

(a) The number is 474.

Sum of digits $= 4 + 7 + 4 = 15$, which is not divisible by 9.

$\therefore$**474 is not divisible by 9.** **Ans.**

(b) The number is 257.

Sum of digits $= 2 + 5 + 7 = 14$, which is not divisible by 9.

$\therefore$**257 is not divisible by 9.** **Ans.**

(c) The number is 7061.

Sum of digits $= 7 + 0 + 6 + 1 = 14$, which is not divisible by 9.

$\therefore$**7061 is not divisible by 9.** **Ans.**

(d) The number is 60548. of digits $= 6 + 0 + 5 + 4 + 8 = 23$, which is not divisible by 9.

$\therefore$**60548 is not divisible by 9.** **Ans.**

(e) The number is 9972.

Sum of digits $= 9+9+7+2 = 27$, which is divisible by 9.

$\therefore$ **9972 is divisible by 9.** **Ans.**

(f) The number is 522.

Sum of digits $= 5+2+2 = 9$, which is divisible by 9.

$\therefore$ **522 is divisible by 9.** **Ans.**

6. We know that the number which is divisible by 5 has 0 or 5 as ones digits.

$\therefore$ The number which are divisible by 5 are:

(a) 420, (b) 495, (d) 3310, (e) 2105 and (i) 9985 **Ans.**

The number which are not divisible by 5 are:

(c) 963, (f) 4568, (g) 6697, (h) 9899 and (j) 2568 **Ans.**

7. (a)
$$\begin{array}{r} 4\,a \\ +\,b\,9 \\ \hline 9\,8 \end{array}$$

At ones place,

Here $a+9=8$, addition of $9+9$ will give 18.

Thus, $a=9$ and 1 carried to the ten digit.

At tens place, $1+4+b=9$ or $5+b=9$ or $b=9-5=4$

$\therefore b=4$

Hence, $\boldsymbol{a=9}$ **and** $\boldsymbol{b=4}$ **Ans.**

(b)
$$\begin{array}{r} 7\,3\,6 \\ +\,a\,b\,c \\ \hline 9\,0\,9 \end{array}$$

At ones place,

Here, $6+c=9$, 6 is less than c.

$\therefore \quad c=9-6$ or $c=3$

At tens place, $3+b=0$, addition of $3+7$ will give 10. i.e. $b=7$

Thus, a, 7 and 1 is carried on the hundreds digit.

$1+7+a=9$ or $8+a=9$ or $a=9-8=1$

$\therefore \quad a=1$

Hence, $\boldsymbol{a=1, b=7}$ **and** $\boldsymbol{c=3}$ **Ans.**

(c)
$$\begin{array}{r} 3\,a\,1 \\ +\,b\,5\,c \\ \hline 6\,7\,4 \end{array}$$

At ones place, $1+c=4$, addition $1+3$ will give 4.

$\therefore \quad c = 3$

At tens place, $a + 5 = 7$, addition $2 + 5$ will given 7.

$\therefore \quad a = 2$

At hundreds place, $3 + b = 6$ or $b = 6 - 3 = 3$

$\therefore \quad b = 3$

Hence, $\boldsymbol{a = 2, b = 3}$ **and** $\boldsymbol{c = 3}$ **Ans.**

6. Algebraic Expressions and Identities

Exercise 6.1

1. We know that to write the polynomials in the standard form, we write it in descending order.

(a) We have, $5y^2 + 6y + 4 + 3y^5$

Thus, $\boldsymbol{3y^5 + 5y^2 + 6y + 4}$ **is the standard form and its power is 5.** **Ans.**

(b) We have, $9x^2 - 27x + 42x^3$

Thus, $\boldsymbol{42x^3 + 9x^2 - 27x}$ **is the standard form and its power is 3.** **Ans.**

(c) We have, $(a^3 - 2)(a^3 - 9) = a^6 - 9a^3 - 2a^3 + 18$

$= a^6 - 11a^3 + 18$

Thus, $\boldsymbol{a^6 - 11a^3 + 18}$ **is its standard form and its power is 6.** **Ans.**

(d) $\left(p^5 - \frac{1}{8}\right)\left(p^5 + \frac{16}{19}\right) = p^{10} + \frac{16}{19}p^5 - \frac{1}{8}p^5 - \frac{1}{8} \times \frac{16}{19}$

$= p^{10} + \left(\frac{16}{19} - \frac{1}{8}\right)p^5 - \frac{2}{19} = p^{10} + \left(\frac{128 - 19}{152}\right)p^5 - \frac{2}{19}$

$= p^{10} + \frac{109}{152}p^2 - \frac{2}{19}$

Hence, $\boldsymbol{p^{10} + \frac{109}{152}p^2 - \frac{2}{19}}$ **is its standard form and its power is 10.** **Ans.**

2. (a) $(24x^5 + 20x^4 + 8x^2 + 4x) \div 4x = \frac{24x^5 + 20x^4 + 8x^2 + 4x}{4x}$

$= \frac{24x^5}{4x} + \frac{20x^4}{4x} + \frac{8x^2}{4x} + \frac{4x}{4x} = \mathbf{6x^4 + 5x^3 + 2x + 1}$ **Ans.**

(b) $(18x^4y^2z - 15xy^3z + 24x^2yz^4) \div 4xyz$

$$= \frac{18x^4y^2z - 15xy^3z + 24x^2yz^4}{4xyz}$$

$$= \frac{18x^4y^2z}{4xyz} - \frac{15xy^3z}{4xyz} + \frac{24x^2yz^4}{4xyz} = \mathbf{\frac{9}{2}x^3y - \frac{15}{4}y^2 + 6xz^3}$$ **Ans.**

(c) $(19x^2y^2 - 6xy^2 + 12xy^3) \div \frac{-3}{2}xy = \frac{19x^2y^2 - 6xy^2 + 12xy^3}{-\frac{3}{2}xy}$

$$= \frac{19x^2y^2}{-\frac{3}{2}xy} - \frac{6xy^2}{-\frac{3}{2}xy} + \frac{12xy^3}{-\frac{3}{2}xy}$$

$$= -\frac{19 \times 2x^2y^2}{3xy} + \frac{6 \times 2xy^2}{3xy} - \frac{12 \times 2xy^3}{3xy} = \mathbf{-\frac{38}{3}xy + 4y - 8y^2}$$ **Ans.**

(d) $(\sqrt{3}x^5 + 2\sqrt{3}x^3) \div 3x^2 = \frac{\sqrt{3}x^5 + 2\sqrt{3}x^3}{3x^2} = \frac{\sqrt{3}x^5}{3x^2} + \frac{2\sqrt{3}x^3}{3x^2}$

$$= \frac{\sqrt{3}}{3}x^3 + \frac{2\sqrt{3}x}{3} = \frac{\sqrt{3} \times \sqrt{3}}{3 \times \sqrt{3}}x^3 + \frac{2\sqrt{3}x^3}{3}$$

$$= \frac{3}{3\sqrt{3}}x^3 + \frac{2\sqrt{3}}{\sqrt{3} \times \sqrt{3}}x = \mathbf{\frac{1}{\sqrt{3}}x^3 + \frac{2}{\sqrt{3}}x}$$ **Ans.**

3. (a) $-72x^3y^2 \div 8xy^2 = -\frac{72x^3y^2}{8xy^2} = \mathbf{-9x^2}$ **Ans.**

(b) $108x^2y^3 \div (-3xy) = -\frac{108x^2y^3}{3xy} = \mathbf{-36xy^2}$ **Ans.**

(c) $-145x^3yz^3 \div (-5xyz^2) = \frac{-145x^3yz^3}{-5xyz^2} = \mathbf{29x^2z}$ **Ans.**

(d) $\frac{8}{3}a^2 \div 2a = \frac{\frac{8}{3}a^2}{2a} = \frac{8a^2}{3 \times 2a} = \mathbf{\frac{4}{3}a}$ **Ans.**

(e) $8a^5 \div (-4\sqrt{2}a^2) = \frac{8a^5}{-4\sqrt{2}a^2} = -\frac{2}{\sqrt{2}}a^3 = -\frac{2 \times \sqrt{2}}{\sqrt{2} \times \sqrt{2}}a^3$

$$= -\frac{2\sqrt{2}}{2}a^3 = \mathbf{-\sqrt{2}a^3}$$ **Ans.**

(f) $80a^3b^3c^3 \div (-16a^2b^2c^2) = \dfrac{80a^3b^3c^3}{-16a^2b^2c^2} = -\dfrac{80a^3b^3c^3}{16a^2b^2c^2}$

$= \boldsymbol{-5abc}$ **Ans.**

4. (a) $5\sqrt{y} + 6y + 7y^2$ is not a polynomial, because it contain $\dfrac{1}{2}$ as the power of variable y which is not a positive integer. **Ans.**

(b) $2\sqrt{2}x + x^2 + x^4$ is *a* polynomial in variable x. **Ans.**

(c) $\dfrac{5}{3}x^2 - 6x + 10$ is a polynomial in variable x. **Ans.**

(d) $4x^{-2} + 9x^{-1} + 6 + 4x$ is not a polynomial, because it contain -2 and -1 as the power of variable x which is not a positive integer. **Ans.**

(e) $\sqrt{a}x^{\frac{3}{2}} + ax + 9x^2 + 4$ is not a polynomial, because it contain $\dfrac{3}{2}$ as the power of variable x which is not a positive integer. **Ans.**

(f) $3x^3 + x^{-3}$ is not a polynomial, because it contain -3 as the power of variable x which is not a positive integer. **Ans.**

5. (a)

$$
\begin{array}{r|l}
3x - 1 & 3x + \dfrac{4}{3} \\
\cline{2-2}
 & 9x^2 + x - 3 \\
 & 9x^2 - 3x \\
 & - \quad + \\
\hline
 & 4x - 3 \\
 & 4x - \dfrac{4}{3} \\
 & - \quad + \\
\hline
 & -\dfrac{5}{3} \\
\hline
\end{array}
$$

Because the remainder is not zero.

Hence, $\boldsymbol{3x - 1}$ **is not a factor of** $\boldsymbol{9x^2 + x - 3}$**.** **Ans.**

(b)
$$
\begin{array}{r}
4x^3 - 10x + 5 \\
2x - 5 \overline{)\ 8x^4 - 20x^3 - 20x^2 + 60x - 30} \\
\underline{8x^4 - 20x^3} \\
\quad - 20x^2 + 60x - 30 \\
\quad \underline{- 20x^2 + 50x} \\
\quad\quad 10x - 30 \\
\quad\quad \underline{10x - 25} \\
\quad\quad\quad - 5
\end{array}
$$

Because the remainder is not zero.

Hence, **$2x - 5$ is not a factor of $8x^4 - 20x^3 - 20x^2 + 60x - 30$.** **Ans.**

(c)
$$
\begin{array}{r}
3x - 2 \\
2x^2 + 4x - 6 \overline{)\ 6x^3 + 8x^2 - 26x + 12} \\
\underline{6x^3 + 12x^2 - 18x} \\
\quad - 4x^2 - 8x + 12 \\
\quad \underline{- 4x^2 - 8x + 12} \\
\quad\quad 0
\end{array}
$$

Because the remainder is zero.

Hence, **$2x^2 + 4x - 6$ is the factor of $6x^3 - 26x + 12 + 8x^2$.** **Ans.**

(d)
$$
\begin{array}{r}
x^3 - 4x \\
x^2 + 4 \overline{)\ x^5 - 16x} \\
\underline{x^5 + 4x^3} \\
\quad - 4x^3 - 16x \\
\quad \underline{- 4x^3 - 16x} \\
\quad\quad 0
\end{array}
$$

Because the remainder is zero.

Hence, **$x^2 + 4$ is a factor of $x^5 - 16x$.** **Ans.**

6. (a)

$$
\begin{array}{r}
-2x-10 \\
2x+3\overline{)\,-4x^2-26x+24} \\
-4x^2-6x \\
+\quad + \\
\hline
-20x+24 \\
-20x-30 \\
+\quad + \\
\hline
54 \\
\hline
\end{array}
$$

Hence, $(-4x^2-26x+24)\div(2x+3)=-2x-10$ and remainder $=54$ **Ans.**

Verification: $\therefore$ Divisor $\times$ quotient + remainder = dividend

$=(2x+3)\times(-2x-10)+54=2x(-2x-10)+3(-2x-10)+54$

$=-4x^2-20x-6x-30+54=-4x^2-26x+24=$ **dividend**

Verified

(b)

$$
\begin{array}{r}
4y^3-2y+\dfrac{3}{2} \\
2y^2-6\overline{)\,8y^5-28y^3+3y^2+30y-9} \\
-8y^5-24y^3 \\
-\quad + \\
\hline
-4y^3+3y^2+30y-9 \\
-4y^3\qquad +12y \\
+\qquad\quad - \\
\hline
3y^2+18y-9 \\
3y^2\qquad -9 \\
-\qquad\quad + \\
\hline
18y \\
\hline
\end{array}
$$

Verification: $\because$ Divisor $\times$ quotient + remainder = dividend

$$=(2y^2-6)\times\left(4y^3-2y+\frac{3}{2}\right)+18y$$

$$=2y^2\left(4y^3-2y+\frac{3}{2}\right)-6\left(4y^3-2y+\frac{3}{2}\right)+18y$$

$$=8y^5-4y^3+3y^2-24y^3+12y-9+18y$$

$=8y^5-28y^3+3y^2+30y-9=$ **Dividend** **Verified**

(c)

$$
\begin{array}{r}
-\frac{32}{3}x^3+\frac{98}{9}x^2-\frac{506}{27}x+\frac{4460}{81} \\
3x+7\overline{)\,-32x^4-42x^3+20x^2+34x-75} \\
-32x^4-\frac{224}{3}x^3 \\
+\quad\quad + \\
\hline
-\frac{98}{3}x^3+20x^2+34x-75 \\
-\frac{98}{3}x^3+\frac{686}{9}x^2 \\
-\quad\quad - \\
\hline
-\frac{506}{9}x^2+34x-75 \\
-\frac{506}{9}x^2-\frac{3542}{27}x \\
+\quad\quad + \\
\hline
-\frac{4460}{27}x-75 \\
-\frac{4460}{27}x+\frac{31220}{81} \\
-\quad\quad - \\
\hline
-\frac{37295}{81} \\
\hline
\end{array}
$$

Verification: $\therefore$ Divisor $\times$ quotient + remainder = dividend

$$=(3x+7)\times\left(-\frac{32}{3}x^3+\frac{98}{9}x^2-\frac{506}{27}x+\frac{4460}{81}\right)-\frac{37295}{81}$$

$$=3x\left(-\frac{32}{3}x^3+\frac{98}{9}x^2-\frac{506}{27}x+\frac{4460}{81}\right)+7$$

$$\left(-\frac{32}{3}x^3+\frac{98}{9}x^2-\frac{506}{27}x+\frac{4460}{81}\right)-\frac{37295}{81}$$

$$=-32x^4+\frac{98}{3}x^3-\frac{506}{9}x^2+\frac{4460}{27}x-\frac{224}{3}x^3+\frac{686}{9}x^2$$

$$-\frac{3542}{27}x+\frac{31220}{81}-\frac{37295}{81}$$

$$= -32x^4 + \frac{98}{3}x^3 - \frac{224}{3}x^3 - \frac{506}{9}x^2 + \frac{686}{9}x^2 + \frac{4460}{27}x$$
$$- \frac{3542}{27}x + \frac{31220}{81} - \frac{37295}{81}$$
$$= -32x^4 + \left(\frac{98-224}{3}\right)x^3 + \frac{-506+686}{9}x^2 + \left(\frac{4460-3542}{27}\right)x$$
$$+ \left(\frac{31220-37295}{81}\right)$$
$$= -32x^4 + \left(\frac{-126}{3}\right)x^3 + \frac{180}{9}x^2 + \frac{918}{27}x + \frac{6075}{81}$$
$$= -32x^4 - 42x^3 + 20x^2 + 34x - 75 = \text{dividend}$$ **Verified**

(d)

$$3y-2 \;\overline{)\; 30y^4 - 32y^3 + 18y^2 - \frac{10}{3}y + 6 \;}\; 10y^3 - 4y^2 + \frac{10}{3}y + \frac{10}{9}$$

$30y^4 - 20y^3$ (− +)

$-12y^3 + 18y^2 - \frac{10}{3}y + 6$

$-12y^3 + 8y^2$ (+ −)

$10y^2 - \frac{10}{3}y + 6$

$10y^2 - \frac{20}{3}y + 6$ (− +)

$\frac{10}{3}y + 6$

$\frac{10}{3}y - \frac{20}{9}$ (− +)

$\frac{74}{9}$

Verification: Divisor × Quotient + Remainder = Dividend

$$= (3y-2) \times \left(10y^3 - 4y^2 + \frac{10}{3}y + \frac{10}{9}\right) + \frac{74}{9}$$

$$= 3y\left(10y^3 - 4y^2 + \frac{10}{3}y + \frac{10}{9}\right) - 2\left(10y^3 - 4y^2 + \frac{10}{3}y + \frac{10}{9}\right) + \frac{74}{9}$$

$$= 30y^4 - 12y^3 + 10y^2 + \frac{10}{3}y - 20y^3 + 8y^2 - \frac{20}{3}y - \frac{20}{9} + \frac{74}{9}$$

$$= 30y^4 - 32y^3 + 18y^2 - \frac{10}{3}y + \frac{54}{9}$$

$$= 30y^4 - 32y^3 + 18y^2 - \frac{10}{3}y + 6 = \textbf{Dividend}$$

Verified

Exercise 6.2

1. (a) $(6x + 8y)(6x - 8y) = (6x)^2 - (8y)^2$

$[\because (a+b)(a-b) = a^2 - b^2]$

$= \mathbf{36x^2 - 64y^2}$ **Ans.**

(b) $(ab + cd)(ab - cd) = (ab)^2 - (cd)^2$

$[\because (a+b)(a-b) = a^2 - b^2]$

$= \mathbf{a^2b^2 - c^2d^2}$ **Ans.**

(c) $(x-2)(x+2)(x^2+4)(x^2+16)$

$= [(x)^2 - (2)^2](x^2+4)(x^4+16)$

$[\because (a+b)(a-b) = a^2 - b^2]$

$= (x^2-4)(x^2+4)(x^4+16) = [(x^2)^2 - (4)^2](x^4+16)$

$= (x^4-16)(x^4+16)$ $[\because (a+b)(a-b) = a^2 - b^2]$

$= (x^4)^2 - (16)^2 = \mathbf{x^8 - 256}$ **Ans.**

(d) $\left(x - \frac{y}{5} - 2\right)\left(x + \frac{y}{5} + 2\right) = (x)^2 - \left(\frac{y}{5} + 2\right)^2$

$[\because (a+b)(a-b) = a^2 - b^2]$

$= x^2 - \left[\left(\frac{y}{5}\right)^2 + 4 + 2 \times \frac{y}{5} \times 2\right]$ $[\because (a+b)^2 = a^2 + b^2 + 2ab]$

$= x^2 - \left(\frac{y^2}{25} + 4 + \frac{4y}{5}\right) = \mathbf{x^2 - \frac{y^2}{25} - 4 - \frac{4y}{5}}$ **Ans.**

2. (a) $(6x+4y)^2 = (6x)^2 + 2\times 6x \times 4y + (4y)^2$

$[\because (a+b)^2 = a^2 + b^2 + 2ab]$

$= \mathbf{36x^2 + 48xy + 16y^2}$ **Ans.**

(b) $(8+22x^2)^2 = (8)^2 + 2\times 8 \times 22x^2 + (22x^2)^2$

$[\because (a+b)^2 = a^2 + b^2 + 2ab]$

$= \mathbf{64 + 352x^2 + 484x^4}$ **Ans.**

(c) $\left(6x + \frac{1}{6x}\right)^2 = (6x)^2 + 2\times 6x \times \frac{1}{6x} + \left(\frac{1}{6x}\right)^2$

$[\because (a+b)^2 = a^2 + b^2 + 2ab]$

$= \mathbf{9x^2 - 30xy + 25y^2}$ **Ans.**

(d) $(3x-5y)^2 = (3x)^2 - 2\times 3x \times 5y + (5y)^2$

$[\because (a-b)^2 = a^2 + b^2 - 2ab]$

$= \mathbf{9x^2 - 30xy + 25y^2}$ **Ans.**

(e) $\left(\sqrt{3}x - \frac{1}{4}y\right)^2 = (\sqrt{3}x)^2 - 2\times \sqrt{3}x \times \frac{1}{4}y + \left(\frac{1}{4}y\right)^2$

$[\because (a-b)^2 = a^2 + b^2 - 2ab]$

$= \mathbf{3x^2 - \frac{\sqrt{3}}{2}xy + \frac{y^2}{16}}$ **Ans.**

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

$[\because (a-b)^2 = a^2 + b^2 - 2ab]$

$= \mathbf{\frac{x^2}{16} - \frac{xy}{6} + \frac{y^2}{9}}$ **Ans.**

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

$[\because (a-b)^2=a^2+b^2-2ab]$

$=\frac{25x^2}{36}-\frac{20}{9}xy+\frac{16y^2}{9}$ **Ans.**

(h) $(2ab-5cd)^2=(2ab)^2-2\times 2ab\times 5cd+(5cd)^2$

$[\because (a-b)^2=a^2+b^2-2ab]$

$=4a^2b^2-20abcd+25c^2d^2$ **Ans.**

3. (a) $\left(x+\frac{1}{x}\right)^2=8$, on squaring both sides,

$\left(x+\frac{1}{x}\right)^2=(8)^2$ or $x^2+\frac{1}{x^2}+2\times x\times\frac{1}{x}=64$

or $x^2+\frac{1}{x^2}+2=64$ or $x^2+\frac{1}{x^2}=64-2$

Thus, $x^2+\frac{1}{x^2}=62$ **Ans.**

(b) $\because x^2+\frac{1}{x^2}=62$, on squaring both sides,

$\left(x^2+\frac{1}{x^2}\right)^2=(62)^2$ or $(x^2)^2+\left(\frac{1}{x^2}\right)^2+2\times x^2\times\frac{1}{x^2}=3844$

or $x^4+\frac{1}{x^4}+2=3844$ or $x^4+\frac{1}{x^4}=3844-2$

Thus, $x^4+\frac{1}{x^4}=3842$ **Ans.**

4. $2x+3y=8$

Squaring on both sides, $(2x+3y)^2=8^2$

or $(2x)^2+2\times 2x\times 3y+(3y)^2=64$

$[\because (a+b)^2=a^2+b^2+2ab]$

or $4x^2+12xy+9y^2=64$

or $4x^2+12\times 1+9y^2=64$ $[\because xy=1]$

or $4x^2+12+9y^2=64$

$\therefore 4x^2 + 9y^2 = 64 - 12 = 52$

Thus, $\mathbf{4x^2 + 9y^2 = 52}$ **Ans.**

5. $(4x - 9y) = 10$

Squaring on both sides, $(4x - 9y)^2 = (10)^2$

or $(4x)^2 - 2 \times 4x \times 9y + (9y)^2 = 100$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

or $16x^2 - 72xy + 81y^2 = 100$

or $16x^2 - 72 \times (-1) + 81y^2 = 100$ $[\because xy = -1]$

or $16x^2 + 72 + 81y^2 = 100$

$\therefore$ $16x^2 + 81y^2 = 100 - 72 = 28$

Thus, $\mathbf{16x^2 + 81y^2 = 28}$ **Ans.**

6. (a) $4x^2 + 9y^2 + 12xy = (2x)^2 + (3y)^2 + 2 \times 2x \times 3y$

$= (2x + 3y)^2$

Now, putting the value $x = 3$ and $y = 1$

$= (2 \times 3 + 3 \times 1)^2 = (6 + 3)^2 = (9)^2 = 81$

Thus, **required value = 81** **Ans.**

(b) $25x^2 + 16y^2 - 40xy = (5x)^2 + (4y)^2 - 2 \times 5x \times 4y$

$= (5x - 4y)^2$

Now, putting the value of $x = 4$ and $y = 2$

$= (5 \times 4 - 4 \times 2)^2 = (20 - 8)^2 = (12)^2 = 144$

Thus, **required value = 144** **Ans.**

(c) $36x^2 + 121y^2 + 132xy = (6x)^2 + (11y)^2 + 2 \times 6x \times 11y$

$= (6x + 11y)^2$

Now, putting the value of $x = -7$ and $y = 12$

$= [6 \times (-7) + 11 \times 12]^2 = (-42 + 132)^2 = (90)^2 = 8100$

Thus, **required value = 8100** **Ans.**

7. (a) $(104)^2 = (100 + 4)^2$

$= (100)^2 + 2 \times 100 \times 4 + (4)^2$ $[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= 10000 + 800 + 16 = 10816$

Hence, $\mathbf{(104)^2 = 10816}$ **Ans.**

(b) $(92)^2 = (100-8)^2$

$= (100)^2 - 2\times 100\times 8 + (64)^2$ $[\because (a-b)^2 = a^2 - 2ab + b^2]$

$= 10000 - 1600 + 64 = 10064 - 1600 = 8464$

Hence, $\mathbf{(92)^2 = 8464}$ **Ans.**

(c) $(0.96)^2 = (1-0.04)^2$

$= (1)^2 - 2\times 1\times 0.04 + (0.04)^2$ $[\because (a-b)^2 = a^2 - 2ab + b^2]$

$= 1 - 0.08 + 0.0016 = 1.0016 - 0.08 = 0.9216$

Hence, $\mathbf{(0.96)^2 = 0.9216}$ **Ans.**

(d) $(98)^2 = (100-2)^2$

$= (100)^2 - 2\times 100\times 2 + (2)^2$ $[\because (a-b)^2 = a^2 - 2ab + b^2]$

$= 10000 - 400 + 4 = 10004 - 400 = 9604$

Hence, $\mathbf{(98)^2 = 9604}$ **Ans.**

(e) $104\times 96 = (100+4)(100-4)$

$= (100)^2 - (4)^2$ $[\because (a+b)(a-b) = (a^2 - b^2)]$

$= 10000 - 16 = 9984$

Hence, $\mathbf{104\times 96 = 9984}$ **Ans.**

(f) $105\times 105 = (105)^2 = (100+5)^2$

$= (100)^2 + 2\times 100\times 5 + (5)^2$ $[\because (a+b)^2 = a^2 + 2ab + b^2]$

$= 10000 + 1000 + 25 = 11025$

Hence, $\mathbf{105\times 105 = 11025}$ **Ans.**

(g) $156\times 156 - 144\times 144 = (156)^2 - (144)^2$

$= (156+144)(156-144)$ $[\because a^2 - b^2 = (a+b)(a-b)]$

$= 300\times 12 = 3600$

Hence, $156\times 156 - 144\times 144 = \mathbf{3600}$ **Ans.**

(h) $0.68\times 0.68 - 0.32\times 0.32 = (0.68)^2 - (0.32)^2$

$= (0.68+0.32)(0.68-0.32) = 1\times 0.36 = \mathbf{0.36}$ **Ans.**

(i) $0.84\times 0.84 - 0.66\times 0.66 = (0.84)^2 - (0.66)^2$

$= (0.84+0.66)(0.84-0.66) = 1.5\times 0.18 = \mathbf{0.27}$ **Ans.**

8. (a) $x - \frac{1}{x} = 7$, squaring on both sides.

$\left(x - \frac{1}{x}\right)^2 = (7)^2$ or $(x)^2 - 2\times x\times \frac{1}{x} + \left(\frac{1}{x}\right)^2 = 49$

or $x^2 - 2 + \frac{1}{x^2} = 49$ or $x^2 + \frac{1}{x^2} = 49 + 2 = 51$

Thus, $\boldsymbol{x^2 + \frac{1}{x^2} = 51}$ **Ans.**

(b) $\because x^2 + \frac{1}{x^2} = 51$

Squaring on both sides,

$\left(x^2 + \frac{1}{x^2}\right)^2 = (51)^2$ or $(x^2)^2 + 2 \times x^2 \times \frac{1}{x^2} + \left(\frac{1}{x^2}\right)^2 = 2601$

or $x^4 + 2 + \frac{1}{x^4} = 2601$ or $x^4 + \frac{1}{x^4} = 2601 - 2 = 2599$

Thus, $\boldsymbol{x^4 + \frac{1}{x^4} = 2599}$ **Ans.**

Exercise 6.3

1. On using identity $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

(a) $(4x + p - c)^2 - (4x - p + c)^2$

$= [4x + p + (-c)]^2 - [4x + (-p) + c]^2$

$= (4x)^2 + (p)^2 + (-c)^2 + 2 \times (4x) \times p + 2 \times p \times (-c) + 2 \times (-c) \times 4x - [(4x)^2 + (-p)^2 + (c)^2 + 2 \times 4x \times (-p) + 2 \times (-p) \times c + 2 \times c \times 4x]$

$= (16x^2 + p^2 + c^2 + 8px - 2pc - 8xc)$

$\quad -(16x^2 + p^2 + c^2 - 2 \times 4x \times p - 2 \times pc + 8xc)$

$= 16x^2 + p^2 + c^2 + 8px - 2pc - 8xc$

$\quad -16x^2 - p^2 - c^2 + 8px + 2pc - 8xc$

$= 16xp - 16xc = \boldsymbol{16x(p - c)}$ **Ans.**

(b) $(x^2 + y^2 - z^2)^2 - (x^2 - y^2 + z^2)^2 = [x^2 + y^2 + (-z)^2]^2 - [x^2 + (-y)^2 + z^2]^2$

$= [(x^2)^2 + (y^2)^2 + [(-z)^2]^2 + 2 \times x^2 \times y^2 + 2 \times y^2 \times (-z)^2 + 2 \times (-z^2) \times x^2] - [(x^2)^2 + (-y^2)^2 + (z^2)^2 + 2 \times x^2 \times (-y^2) + 2 \times (-y^2) \times (z^2) + 2 \times z^2 \times x^2$

$= x^4 + y^4 + z^4 + 2x^2y^2 - 2y^2z^2 - 2x^2z^2$
$-[x^4 + y^4 + z^4 - 2x^2y^2 - 2y^2z^2 + 2x^2z^2]$
$= x^4 + y^4 + z^4 + 2x^2y^2 - 2y^2z^2 - 2x^2z^2 - x^4 - y^4 - z^4$
$+2x^2y^2 + 2y^2z^2 - 2x^2z^2$
$= 4x^2y^2 - 4x^2z^2 = \mathbf{4x^2(y^2 - z^2)}$ **Ans.**

(c) $(a+b+c)^2 + (a-b+c)^2 + (a+b-c)^2$
$= (a+b+c)^2 + [a+(-b)+c]^2 + [a+b+(-c)]^2$
$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
$+[a^2 + b^2 + c^2 + 2\times a\times(-b) + 2\times(-b)\times c + 2\times c\times a]$
$+[a^2 + b^2 + c^2 + 2\times a\times b + 2\times b\times(-c) + 2\times(-c)\times a]$
$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca + a^2 + b^2 + c^2$
$-2ab - 2bc + 2ca + a^2 + b^2 + c^2 + 2ab - 2bc - 2ca$
$= 3a^2 + 3b^2 + 3c^2 + 2ab - 2bc + 2ca$
$= \mathbf{3(a^2 + b^2 + c^2) + 2(ab - bc + ca)}$ **Ans.**

2. $x^2 + 16y^2 + 9z^2 + 8xy + 24yz + 6xz$
$= (x)^2 + (4y)^2 + (3z)^2 + 2\times x\times 4y + 2\times 4y\times 3z + 2\times 3z\times x$
$= (x + 4y + 3z)^2$
$[\because (a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca]$

Now, on putting the value of $x = 8$, $y = 7$ and $z = 5$.
$(x + 4y + 3z)^2 = (8 + 4\times 7 + 3\times 5)^2$
$= (8 + 28 + 15)^2 = (51)^2 = \mathbf{2601}$ **Ans.**

3. On using the identity
$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

(a) $(3x + 4y + 5z)^2 = (3x)^2 + (4y)^2 + (5z)^2$
$+2\times 3x\times 4y + 2\times 4y\times 5z + 2\times 5z\times 3x$
$= \mathbf{9x^2 + 16y^2 + 25z^2 + 24xy + 40yz + 30zx}$ **Ans.**

(b) $(x - 4y + 3z)^2 = (x)^2 + (-4y)^2 + (3z)^2 + 2\times x\times(-4y) + 2\times$
$(-4y)\times 3z + 2\times 3z\times x = \mathbf{x^2 + 16y^2 + 9z^2 - 8xy - 24yz + 6zx}$
Ans.

(c) $(-6p + q + 4r)^2 = [(-6p) + q + 4r]^2$
$= (-6p)^2 + (q)^2 + (4r)^2 + 2\times$
$(-6p)\times q + 2\times q\times 4r + 2\times 4r\times(-6p)$
$= \mathbf{36p^2 + q^2 + 16r^2 - 12pq + 8qr - 48rp}$ **Ans.**

(d) $(x-3y-4z)^2=[x+(-3y)+(-4z)]^2$

$=x^2+(-3y)^2+(-4z)^2+2\times x\times(-3y)+2\times(-3y)$

$\times(-4z)+2\times(-4z)\times(x)$

$=\boldsymbol{x^2+9y^2+16z^2-6xy+24yz-8zx}$ **Ans.**

(e) $\left(\frac{1}{6}x-\frac{1}{2}y+16\right)^2=\left[\frac{1}{6}x+\left(-\frac{1}{2}y\right)+16\right]^2$

$=\left(\frac{1}{6}x\right)^2+\left(-\frac{1}{2}y\right)^2+(16)^2+2\times\frac{1}{6}x\times\left(-\frac{1}{2}y\right)+$

$2\times\left(-\frac{1}{2}y\right)\times16+2\times16\times\frac{1}{6}x$

$=\boldsymbol{\frac{x^2}{36}+\frac{y^2}{4}+256-\frac{xy}{6}-16y+\frac{16}{3}x}$ **Ans.**

(f) $\left(\frac{a}{b}+\frac{b}{c}+\frac{c}{a}\right)^2$

$=\left(\frac{a}{b}\right)^2+\left(\frac{b}{c}\right)^2+\left(\frac{c}{a}\right)^2+2\times\frac{a}{b}\times\frac{b}{c}+2\times\frac{b}{c}\times\frac{c}{a}+2\times\frac{c}{a}\times\frac{a}{b}$

$=\boldsymbol{\frac{a^2}{b^2}+\frac{b^2}{c^2}+\frac{c^2}{a^2}+\frac{2a}{c}+\frac{2b}{a}+\frac{2c}{b}}$ **Ans.**

4. $x^2+36y^2+25z^2-12xy+60yz-10xz$

$=(x)^2+(6y)^2+(5z)^2+2\times(-x)$

$\times6y+2\times6y\times5z+2\times(-x)\times5z$

$=(-x+6y+5z)^2$

$[\because(-a+b+c)^2=a^2+b^2+c^2-2ab+2bc-2ca]$

Now, on putting the value $x=8$, $y=3$ and $z=2$

$(-x+6y+5z)^2=(-8+6\times3+5\times2)^2=(-8+18+10)^2$

$=(28-8)^2=(20)^2=\boldsymbol{400}$ **Ans.**

5. On putting identity

$(x+y+z)^2=x^2+y^2+z^2+2xy+2yz+2zx$

or $(x+y+z)^2=x^2+y^2+z^2+2(xy+yz+zx)$

or $(x+y+z)^2=15+2(33)$

$(x+y+z)^2 = 15+66 = 81$

or $x+y+z = \sqrt{81} = \pm 9$

Hence, $\boldsymbol{x+y+z = \pm 9}$ **Ans.**

6. On using identity $(x+y+z)^2 = x^2+y^2+z^2+2yx+2yz+2zx$

or $(6)^2 = x^2+y^2+z^2+2(xy+yz+zx)$

or $36 = x^2+y^2+z^2+2\times 23$

or $36 = x^2+y^2+z^2-46$

or $x^2+y^2+z^2 = 36-46 = -10$

Hence, $\boldsymbol{x^2+y^2+z^2 = -10}$ **Ans.**

7. On using identity $(x+y+z)^2 = x^2+y^2+z^2+2(xy+yz+zx)$

or $(24)^2 = 132+2(xy+yz+zx)$

or $576 = 132+2(xy+yz+zx)$

or $576-132 = 2(xy+yz+zx)$

or $444 = 2(xy+yz+zx)$

$\therefore \quad xy+yz+zx = \dfrac{444}{2} = 222$

Hence, $\boldsymbol{xy+yz+zx = 222}$ **Ans.**

Exercise 6.4

1. (a) $(a-4b)^3+(a+4b)^3$

$(a-4b)^3 = (a)^3-(4b)^3-3\times a\times 4b(a-4b)$

$[\because (a-b)^3 = a^3-b^3-3ab(a-b)]$

$= a^3-64b^3-12ab(a-4b)$

$= a^3-64b^3-12a^2b+48ab^2$ ...(i)

and $(a+4b)^3 = (a)^3+(4b)^3+3\times a\times 4b(a+4b)$

$[\because (a+b)^3 = a^3+b^3+3ab(a+b)]$

$= a^3+64b^3+12ab(a+4b)$

$= a^3+64b^3+12a^2b+48ab^2$ ...(ii)

On adding equations (i) and (ii), we get,

$(a-4b)^3+(a+4b)^3 = a^3-64b^3-12a^2b+48ab^2$

$+a^3+64b^3+12a^2b+48ab^2$

$= 2a^3+96ab^2 = \boldsymbol{2a(a^2+48b^2)}$ **Ans.**

(b) $x^3 + y^3 + 3x^2y + 3xy^2 = (x)^3 + (y)^3 + 3xy(x + y)$

$= \boldsymbol{(x + y)^3}$ **Ans.**

(c) $\left(\frac{1}{6}a + \frac{5}{3}b\right)^3 - \left(\frac{1}{6}a - \frac{5}{3}b\right)^3$

$\left(\frac{1}{6}a + \frac{5}{3}b\right)^3 = \left(\frac{1}{6}a\right)^3 + \left(\frac{5}{3}b\right)^3 + 3 \times \frac{1}{6}a \times \frac{5}{3}b\left(\frac{1}{6}a + \frac{5}{3}b\right)$

$= \frac{a^3}{216} + \frac{125}{27}b^3 + \frac{5ab}{6}\left(\frac{1}{6}a + \frac{5}{3}b\right)$

$= \frac{a^3}{216} + \frac{125}{27}b^3 + \frac{5a^2b}{36} + \frac{25ab^2}{18}$ ...(i)

and $\left(\frac{1}{6}a - \frac{5}{3}b\right)^3 = \left(\frac{1}{6}a\right)^3 - \left(\frac{5}{3}b\right)^3 - 3 \times \frac{1}{6}a \times \frac{5}{3}b\left(\frac{1}{6}a - \frac{5}{3}b\right)$

$= \frac{a^3}{216} - \frac{125}{27}b^3 - \frac{5ab}{6}\left(\frac{1}{6}a - \frac{5}{3}b\right)$

$= \frac{a^3}{216} - \frac{125}{27}b^3 - \frac{5a^2b}{36} + \frac{25ab^2}{18}$ ...(ii)

On adding equations (i) and (ii), we get

$\left(\frac{1}{6}a + \frac{5}{3}b\right)^3 - \left(\frac{1}{6}a - \frac{5}{3}b\right)^3 = \frac{a^3}{216} + \frac{125}{27}b^3 + \frac{5a^2b}{36} + \frac{25ab^2}{18}$

$- \left[\frac{a^3}{216} - \frac{125}{27}b^3 - \frac{5a^2b}{36} + \frac{25ab^2}{18}\right]$

$= \frac{a^3}{216} + \frac{125}{27}b^3 + \frac{5a^2b}{36} + \frac{25ab^2}{18} - \frac{a^3}{216} + \frac{125}{27}b^3 + \frac{5a^2b}{36} - \frac{25ab^2}{18}$

$= \frac{125}{27}b^3 + \frac{125}{27}b^3 + \frac{5a^2b}{36} + \frac{5a^2b}{36}$

$= \frac{250}{27}b^3 + \frac{10a^2b}{36} = \boldsymbol{\frac{10b}{3}\left(\frac{25b^2}{9} + \frac{a^2}{12}\right)}$ **Ans.**

(d) $\left(x + \frac{9}{x}\right)^3 + \left(x - \frac{9}{x}\right)^3$

$$\left(x+\frac{9}{x}\right)^3=(x)^3+\left(\frac{9}{x}\right)^3+3\times x\times\frac{9}{x}\left(x+\frac{9}{x}\right)$$

$$=x^3+\frac{729}{x^3}+27\left(x+\frac{9}{x}\right)=x^3+\frac{729}{x^3}+27x+\frac{243}{x} \quad ...(i)$$

and $\left(x-\frac{9}{x}\right)^3=(x)^3-\left(\frac{9}{x}\right)^3-3\times x\times\frac{9}{x}\left(x-\frac{9}{x}\right)$

$$=x^3-\frac{729}{x^3}-27\left(x-\frac{9}{x}\right)=x^3-\frac{729}{x^3}-27x+\frac{243}{x} \quad ...(ii)$$

On adding equations (i) and (ii), we get

$$\left(x+\frac{9}{x}\right)^3+\left(x-\frac{9}{x}\right)^3=x^3+\frac{729}{x^3}+27x+\frac{243}{x}+x^3$$
$$-\frac{729}{x^3}-27x+\frac{243}{x}$$

$$=2x^3+\frac{486}{x}=\mathbf{2x\left(x^2+\frac{243}{x^2}\right)}$$ **Ans.**

2. On using identity $(a+b)^3=a^3+b^3+3ab(a+b)$

(a) $(x+6)^3=(x)^3+(6)^3+3\times x\times 6(x+6)$

$=x^3+216+18x(x+6)=\mathbf{x^3+216+18x^2+108x}$ **Ans.**

(b) $(x+3y)^3=(x)^3+(3y)^3+3\times x\times 3y(x+3y)$

$=x^3+27y^3+9xy(x+3y)=\mathbf{x^3+27y^3+9x^2y+27xy^2}$ **Ans.**

(c) On using identity $(a-b)^3=a^3-b^3-3ab(a-b)$

$\therefore(9a-6b)^3=(9a)^3-(6b)^3-3\times 9a\times 6b(9a-6b)$

$=729a^3-216b^3-162ab(9a-6b)$

$=\mathbf{729a^3-216b^3-1458a^2b+972ab^2}$ **Ans.**

(d) On using identity $(a-b)^3=a^3-b^3-3ab(a-b)$

$(4x-3y)^3=(4x)^3-(3y)^3-3\times 4x\times 3y(4x-3y)$

$=64x^3-27y^3-36xy(4x-3y)$

$=\mathbf{64x^3-27y^3-144x^2y+108xy^2}$ **Ans.**

(e) On using identity $(a+b)^3=a^3+b^3+3ab(a+b)$

$$\left(\frac{1}{6}x+\frac{5}{6}y\right)^3=\left(\frac{1}{6}x\right)^3+\left(\frac{5}{6}y\right)^3+3\times\frac{1}{6}x\times\frac{5}{6}y\left(\frac{1}{6}x+\frac{5}{6}y\right)$$

$$=\frac{x^3}{216}+\frac{125}{216}y^3+\frac{5}{12}xy\left(\frac{1}{6}x+\frac{5}{6}y\right)$$

$$=\boldsymbol{\frac{x^3}{216}+\frac{125}{216}y^3+\frac{5}{72}x^2y+\frac{25}{72}xy^2}$$ **Ans.**

(f) On using identity $(a-b)^3=a^3-b^3-3ab(a-b)$

$$\therefore\left(\frac{1}{3x}-\frac{3}{4y}\right)^3=\left(\frac{1}{3x}\right)^3-\left(\frac{3}{4y}\right)^3-3\times\frac{1}{3x}\times\frac{3}{4y}\left(\frac{1}{3x}-\frac{3}{4y}\right)$$

$$=\frac{1}{27x^3}-\frac{27}{64y^3}-\frac{3}{4xy}\left(\frac{1}{3x}-\frac{3}{4y}\right)$$

$$=\boldsymbol{\frac{1}{27x^3}-\frac{27}{64y^3}-\frac{1}{4x^2y}+\frac{9}{16xy^2}}$$ **Ans.**

3. We know that

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

On putting $x^2+\frac{1}{x^2}=51$ or $\left(x-\frac{1}{x}\right)^2=51-2$

or $\left(x-\frac{1}{x}\right)^2=49$ or $\left(x-\frac{1}{x}\right)^2=(7)^2$

or $\left(x-\frac{1}{x}\right)=7$

On cubing both the sides, $\left(x-\frac{1}{x}\right)^3=(7)^3$

or $x^3-\frac{1}{x^3}-3\times x\times\frac{1}{x}\left(x-\frac{1}{x}\right)=343$ or $x^3-\frac{1}{x^3}-3\times7=343$

$x^3-\frac{1}{x^3}-21=343$

$$x^3 - \frac{1}{x^3} = 343 + 21 = 364$$

Hence, $\boldsymbol{x^3 - \frac{1}{x^3} = 364}$ **Ans.**

4. $x - \frac{1}{x} = 4$

On cubing both the sides, $\left(x - \frac{1}{x}\right)^3 = (4)^3$

or $x^3 - \frac{1}{x^3} - 3 \times x \times \frac{1}{x}\left(x - \frac{1}{x}\right) = 64$

or $x^3 - \frac{1}{x^3} - 3 \times 4 = 64$ or $x^3 - \frac{1}{x^3} = 64 + 12$

or $x^3 - \frac{1}{x^3} = 76$

Hence, $\boldsymbol{x^3 - \frac{1}{x^3} = 76}$ **Ans.**

5. $x + y = 4$

On cubing both the sides, $(x + y)^3 = (4)^3$

or $x^3 + y^3 + 3 \times x \times y(x + y) = 64$

or $x^3 + y^3 + 3xy(x + y) = 64$

or $x^3 + y^3 + 3 \times 3 \times 4 = 64$ or $x^3 + y^3 + 36 = 64$

or $x^3 + y^3 = 64 - 36 = 28$

Hence, $\boldsymbol{x^3 + y^3 = 28}$ **Ans.**

6. $x + \frac{1}{x} = 8$

On cubing both the sides, $\left(x + \frac{1}{x}\right)^3 = 8^3$

or $(x)^3 + \left(\frac{1}{x}\right)^3 + 3 \times x \times \frac{1}{x}\left(x + \frac{1}{x}\right) = 512$

or $x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right) = 512$ or $x^3 + \frac{1}{x^3} + 3 \times 8 = 512$

or $x^3 + \frac{1}{x^3} + 24 = 512$ or $x^3 + \frac{1}{x^3} = 512 - 24$

or $x^3 + \frac{1}{x^3} = 488$

Hence, $\boldsymbol{x^3 + \frac{1}{x^3} = 488}$ **Ans.**

7. $3x - 2y = 21$

On cubing both the sides, $(3x - 2y)^3 = (21)^3$

or $(3x)^3 - (2y)^3 - 3 \times 3x \times 2y(3x - 2y) = 9261$

or $27x^3 - 8y^3 - 18xy(3x - 2y) = 9261$

or $27x^3 - 8y^3 - 18 \times 12 \times 21 = 9261$

or $27x^3 - 8y^3 - 4536 = 9261$

or $27x^3 - 8y^3 = 9261 + 4536 = 13797$

Hence, $\boldsymbol{27x^3 - 8y^3 = 13797}$ **Ans.**

8. $x + y = 42$

On cubing both the sides, $(x + y)^3 = (42)^3$

or $x^3 + y^3 + 3 \times x \times y(x + y) = 74088$

or $x^3 + y^3 + 3xy(x + y) = 74088$

or $x^3 + y^3 + 3 \times 27 \times 42 = 74088$

or $x^3 + y^3 + 3402 = 74088$

or $x^3 + y^3 = 74088 - 3402 = 70686$

Hence, $\boldsymbol{x^3 + y^3 = 70686}$ **Ans.**

9. (a) $(1006)^3 = (1000 + 6)^3$

$= (1000)^3 + (6)^3 + 3 \times 1000 \times 6(1000 + 6)$

$= 1000000000 + 216 + 18000(1000 + 6)$

$= 1000000000 + 216 + 18000000 + 108000 = 1018108216$

Hence, $\boldsymbol{(1006)^3 = 1018108216}$ **Ans.**

(b) $(499)^3 = (500 - 1)^3$

$= (500)^3 - (1)^3 - 3 \times 500 \times 1(500 - 1)$

$= 125000000 - 1 - 1500(500 - 1)$

$= 125000000 - 1 - 750000 + 1500$

$= 125001500 - 750001 = 124251499$

Hence, $\mathbf{(499)^3 = 124251499}$ **Ans.**

(c) $(8.8)^3 = (10 - 1.2)^3$

$= (10)^3 - (1.2)^3 - 3 \times 10 \times 1.2(10 - 1.2)$

$= 1000 - 1.728 - 36(10 - 1.2) = 1000 - 1.728 - 360 + 43.2$

$= 1043.2 - 361.728 = 681.472$

Hence, $\mathbf{(8.8)^3 = 681.472}$ **Ans.**

(d) $(601)^3 = (600 + 1)^3$

$= (600)^3 + (1)^3 + 3 \times 600 \times 1(600 + 1)$

$= 216000000 + 1 + 1800(600 + 1)$

$= 216000000 + 1 + 1080000 + 1800 = 217081801$

Hence, $\mathbf{(601)^3 = 217081801}$ **Ans.**

10. We know that

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

$\because \quad x^2 + \frac{1}{x^2} = 7 \qquad$ or $\left(x + \frac{1}{x}\right)^2 = 7 + 2$

or $\left(x + \frac{1}{x}\right)^2 = 9 \qquad$ or $\left(x + \frac{1}{x}\right)^2 = 3^2$

or $\quad x + \frac{1}{x} = 3$

Now, on cubing both the sides, $\left(x + \frac{1}{x}\right)^3 = (3)^3$

or $(x)^3 + \left(\frac{1}{x}\right)^3 + 3 \times x \times \frac{1}{x}\left(x + \frac{1}{x}\right) = 27$

or $x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right) = 27$ or $x^3 + \frac{1}{x^3} = 27 - 9 = 18$

Hence, $\boldsymbol{x^3 + \frac{1}{x^3} = 18}$ **Ans.**

11. $x - y = 16$

On cubing both the sides, $(x - y)^3 = (16)^3$

or $(x)^3-(y)^3-3\times x\times y(x-y)=4096$

or $x^3-y^3-3xy(x-y)=4096$

or $x^3-y^3-3\times 42\times 16=4096$

or $x^3-y^3-2016=4096$

or $x^3-y^3=4096+2016=6112$

Hence, $\boldsymbol{x^3-y^3=6112}$ **Ans.**

Exercise 6.5

1. (a) $46\times 48=(40+6)(40+8)$

$=(40)^2+(6+8)\times 40+6\times 8=1600+560+48=\mathbf{2208}$ **Ans.**

(b) $95\times 97=(90+5)(90+7)$

$=(90)^2+(5+7)\times 90+5\times 7=8100+12\times 90+35$

$=8100+1080+35=\mathbf{9215}$ **Ans.**

(c) $207\times 203=(200+7)(200+3)$

$=(200)^2+(7+3)\times 200+7\times 3=40000+2000+21=\mathbf{42021}$ **Ans.**

(d) $45\times 47=(40+5)(40+7)$

$=(40)^2+(5+7)\times 40+5\times 7=1600+12\times 40+35$

$=1600+480+35=\mathbf{2115}$ **Ans.**

(e) $203\times 196=(200+3)(200-4)=(200+3)[200+(-4)]$

$=(200)^2+[3+(-4)]\times 200+3\times(-4)$

$=40000+(-1)\times 200-12=40000-200-12$

$=40000-212=\mathbf{39788}$ **Ans.**

(f) $1947\times 2006=(2000-53)(2000+6)$

$=[2000+(-53)](2000+6)$

$=(2000)^2+[(-53)+6]\times 2000+(-53)\times 6$

$=4000000+(-47)\times 2000-318$

$=4000000-94000-318=4000000-94318=\mathbf{3905682}$ **Ans.**

2. We know that $(x+a)(x+b)=x^2+(a+b)x+ab$

(a) $(x+4)(x+5)=x^2+(4+5)x+4\times 5=\boldsymbol{x^2+9x+20}$ **Ans.**

(b) $(x-6)(x+7)=[x+(-6)](x+7)$

$=x^2+[(-6)+7]x+(-6)\times 7=\boldsymbol{x^2+x-42}$ **Ans.**

(c) $(2x+5)(2x-6)=(2x+5)[2x+(-6)]$

$=(2x)^2+[5+(-6)]\times 2x+5\times(-6)=\mathbf{4x^2-2x-30}$ **Ans.**

(d) $(4x-1)(4x-8)=[4x+(-1)][4x+(-8)]$

$=(4x)^2+[(-1)+(-8)]4x+(-1)\times(-8)$

$=\mathbf{16x^2-36x+8}$ **Ans.**

(e) $(y+7)\left(y+\frac{6}{14}\right)=(y)^2+\left(7+\frac{6}{14}\right)y+7\times\frac{6}{14}$

$=y^2+\left(\frac{98+6}{14}\right)y+\frac{7\times 6}{14}=y^2+\frac{104}{14}y+3=\mathbf{y^2+\frac{52}{7}y+3}$ **Ans.**

(f) $\left(a^3-\frac{4}{6}\right)\left(a^3+\frac{26}{17}\right)=\left[a^3+\left(-\frac{4}{6}\right)\right]\left(a^3+\frac{26}{17}\right)$

$=(a^3)^2+\left[\left(-\frac{4}{6}\right)+\frac{26}{17}\right]a^3+\left(-\frac{4}{6}\right)\times\frac{26}{17}$

$=a^6+\left(\frac{-68+156}{102}\right)a^3-\frac{4}{6}\times\frac{26}{17}=a^6+\frac{88}{102}a^3-\frac{104}{102}$

$=\mathbf{a^6+\frac{44}{51}a^3-\frac{52}{51}}$ **Ans.**

3. (a) $\because a^3+b^3+c^3-3abc=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)$

$\therefore a^3+b^3+c^3=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)+3abc$

Let $a=28$, $b=-48$ and $c=50$

$\therefore(28)^3-(48)^3+(50)^3=(28)^3+(-48)^3+(50)^3$

$=a^3+b^3+c^3$

$=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)+3abc$

$=(28-48+50)[(28)^2+(-48)^2+(50)^2-28\times(-48)-(-48)$

$\times 50-50\times 28]+3\times 28\times(-48)\times 50$

$=30(784+2304+2500+1344+2400-1400)-201600$

$=30(9332-1400)-201600=30\times 7932-201600$

$=237960-201600=\mathbf{36360}$ **Ans.**

(b) Let $a=4.8$, $b=-1.3$ and $c=3.5$

$\therefore(4.8)^3-(1.3)^3+(3.5)^3=(4.8)^3+(-1.3)^3+(3.5)^3$

$=a^3+b^3+c^3$

$=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)+3abc$

$= (4.8 - 1.3 + 3.5)[(4.8)^2 + (-1.3)^2 + (3.5)^2 - 4.8 \times (-1.3) - (-1.3)$
$\times 3.5 - 3.5 \times 4.8] + 3 \times 4.8 \times (-1.3) \times 3.5$
$= 7\,[23.04 + 1.69 + 12.25 + 6.24 + 4.55 - 16.80] - 65.52$
$= 7\,(47.77 - 16.80) - 65.52 = 7 \times 30.97 - 65.52$
$= 216.79 - 65.52 = \mathbf{151.27}$ **Ans.**

(c) Let $a = 20$, $b = 60$ and $c = 40$

$\therefore \quad (20)^3 + (60)^3 - (40)^3 = (20)^3 + (60)^3 + (-40)^3$

$= a^3 + b^3 + c^3$

$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca) + 3abc$

$= (20 + 60 - 40)[(20)^2 + (60)^2 + (-40)^2 - 20 \times 60 - 60 \times (-40)$
$-(-40) \times 20] + 3 \times 20 \times 60 \times (-40)$
$= 40 \times [400 + 3600 + 1600 - 1200 + 2400 + 800] - 144000$
$= 40 \times (8800 - 1200) - 144000 = 40 \times 7600 - 144000$
$= 304000 - 144000 = \mathbf{160000}$ **Ans.**

(d) Let $a = 68$, $b = -40$ and $c = -48$

$\therefore (68)^3 - (40)^3 - (48)^3 = (68)^3 + (-40)^3 + (-48)^3$

$= a^3 + b^3 + c^3$

$= (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca) + 3abc$

$= (68 - 40 - 48)[(68)^2 + (-40)^2 + (-48)^2 - 68 \times (-40)$
$-(-40) \times (-48) - (-48) \times 68] + 3 \times 68 \times (-40) \times (-48)$
$= -20 \times [4624 + 1600 + 2304 + 2720 - 1920 + 3264] + 391680$
$= -20 \times (14512 - 1920) + 391680 = -20 \times 12592 + 391680$
$= -251840 + 391680 = \mathbf{139840}$ **Ans.**

4. By identity $(a + b)(a^2 - ab + b^2) = a^3 + b^3$

(a) $\because (5x + 4y)(25x^2 - 20xy + 16y^2)$

$= (5x + 4y)[(5x)^2 - 5x \times 4y + (4y)^2]$

$= (5x)^3 + (4y)^3 = \mathbf{125x^3 + 64y^3}$ **Ans.**

(b) By identity $(a - b)(a^2 + ab + b^2) = a^3 - b^3$

$\therefore \quad (2x - 5y)(4x^2 + 10xy + 25y^2)$

$= (2x - 5y)[(2x)^2 + 2x \times 5y + (5y)^2]$

$= (2x)^3 - (5y)^3 = \mathbf{8x^3 - 125y^3}$ **Ans.**

(c) By identity $(a + b)(a^2 - ab + b^2) = a^3 + b^3$

$\therefore (0.9x+0.7y)(0.81x^2-0.63xy+0.49y^2)$

$=(0.9x+0.7y)[(0.9x)^2-0.9x\times 0.7y+(0.7y)^2]$

$=(0.9x)^3+(0.7y)^3=\mathbf{0.729x^3+0.343y^3}$ **Ans.**

(d) By identity $(a-b)(a^2-ab+b^2)=a^3-b^3$

$\therefore \quad \left(\frac{2x}{5}-\frac{3y}{7}\right)\left(\frac{9y^2}{49}+\frac{4x^2}{25}+\frac{6xy}{35}\right)$

$=\left(\frac{2x}{5}-\frac{3y}{7}\right)\left[\left(\frac{3y}{7}\right)^2+\left(\frac{2x}{5}\right)^2+\frac{3y}{7}\times\frac{2x}{5}\right]$

$=\left(\frac{2x}{5}\right)^3-\left(\frac{3y}{7}\right)^3=\mathbf{\frac{8x^3}{125}-\frac{27y^3}{343}}$ **Ans.**

5. $\because (a+b+c)(a^2+b^2+c^2-ab-bc-ca)=a^3+b^3+c^3-3abc$

(a) $\therefore (x+y+3z)(x^2+y^2+9z^2-xy-3yz-3zx)$

$=(x+y+3z)[(x)^2+(y)^2+(3z)^2-x\times y-y\times 3z-3z\times x]$

$=(x)^3+(y)^3+(3z)^3-3\times x\times y\times 3z$

$=\mathbf{x^3+y^3+27z^3-9xyz}$ **Ans.**

(b) $(5x-y+3z)(25x^2+y^2+9z^2+5xy+3yz-15xz)$

$=[5x+(-y)+3z][(5x)^2+(-y)^2+(3z)^2$

$-(5x)\times(-y)-(-y)\times 3z-3z\times 5x]$

$=(5x)^3+(-y)^3+(3z)^3-3\times 5x\times(-y)\times 3z$

$=\mathbf{125x^3+y^3+27z^3+45xyz}$ **Ans.**

6. (a) Let $a=4x-3y$, $b=3y-4z$ and $c=4z-4x$

Then, $a+b+c=(4x-3y)+(3y-4z)+(4z-4x)$

$=4x-3y+3y-4z+4z-4x=0$

$\because \quad a^3+b^3+c^3=3abc$

$\therefore \quad \mathbf{(4x-3y)^3+(3y-4z)^3+(4z-4x)^3}$

$\mathbf{=3(4x-3y)(3y-4z)(4z-4x)}$ **Proved**

(b) Let $x=(a^2-b^2)$, $y=(b^2-c^2)$ and $z=(c^2-a^2)$

Then, $x+y+z=(a^2-b^2)+(b^2-c^2)+(c^2-a^2)$

$=a^2-b^2+b^2-c^2+c^2-a^2=0$

$\because \quad x^3+y^3+z^3=3xyz$

$\therefore \quad (a^2-b^2)^3+(b^2-c^2)^3+(c^2-a^2)^3$

$=3(a^2-b^2)(b^2-c^2)(c^2-a^2)$ **Proved**

Multiple Choice Questions

1. (i) $\dfrac{2.25\times 2.25-1.40\times 1.40}{2.25+1.40}=\dfrac{(2.25)^2-(1.40)^2}{(2.25+1.40)}$

$=\dfrac{(2.25+1.40)(2.25-1.40)}{(2.25+1.40)}=2.25-1.40=0.85$

Hence, the answer **(b)** is correct. **Ans.**

(ii) $\dfrac{45\times 45-2\times 45\times 5+5\times 5}{45\times 45+2\times 45\times 5+5\times 5}=\dfrac{(45)^2-2\times 45\times 5+(5)^2}{(45)^2+2\times 45\times 5+(5)^2}$

$=\dfrac{(45-5)^2}{(45+5)^2}=\dfrac{(40)^2}{(50)^2}=\dfrac{1600}{2500}$

Hence, the answer **(d)** is correct. **Ans.**

(iii) $2x^2y^2\times 6x^3y=2\times 6\times x^2y^2\times x^3y=12x^5y^3$

Hence, the answer **(a)** is correct. **Ans.**

(iv) $(403)^2=(400+3)^2$

$=(400)^2+2\times 400\times 3+(3)^2=160000+2400+9=162409$

Hence, the answer **(c)** is correct. **Ans.**

(v) $(101)^2-(100)^2=(101+100)(101-100)$

$[\because a^2-b^2=(a+b)(a-b)]$

$=201\times 1=201$

Hence, the answer **(d)** is correct. **Ans.**

(vi) $(498)^2=(500-2)^2=(500)^2-2\times 500\times 2+(2)^2$

$=250000-2000+4=250004-2000=248004$

Hence, the answer **(a)** is correct. **Ans.**

(vii) $22^2-21^2=(22+21)(22-21)$ $[\because a^2-b^2=(a+b)(a-b)]$

$=43\times 1=43$

Hence, the answer **(c)** is correct. **Ans.**

(viii) $2ab\times 3a^2b^3\times\dfrac{4}{3}a=2\times 3\times\dfrac{4}{3}\times ab\times a^2b^3\times a=8a^4b^4$

Hence, the answer **(b)** is correct. **Ans.**

7. Factorization

Exercise 7.1

1. (a) $36a^2 - 25 = (6a)^2 - (5)^2$ $[\because \boldsymbol{a^2 - b^2 = (a+b)(a-b)}]$

$= \boldsymbol{(6a+5)(6a-5)}$ **Ans.**

(b) $9a^3 - 81a = 9a(a^2 - 9) = 9a[(a)^2 - (3)^2]$

$= \boldsymbol{9a(a+3)(a-3)}$ **Ans.**

(c) $8x^2 - 50y^2 = 2(4a^2 - 25y^2) = 2[(2a)^2 - (5y)^2]$

$= \boldsymbol{2(2a+5y)(2a-5y)}$ **Ans.**

(d) $\frac{a^4}{16} - \frac{81}{64} = \left(\frac{a^2}{4}\right)^2 - \left(\frac{9}{8}\right)^2 = \left(\frac{\boldsymbol{a^2}}{\boldsymbol{4}} + \frac{\boldsymbol{9}}{\boldsymbol{8}}\right)\left(\frac{\boldsymbol{a^2}}{\boldsymbol{4}} - \frac{\boldsymbol{9}}{\boldsymbol{8}}\right)$ **Ans.**

(e) $(a+b)^2 - 4c^2 = (a+b)^2 - (2c)^2$

$= \boldsymbol{(a+b+2c)(a+b-2c)}$ **Ans.**

(f) $x^2 - (a^2 - 2ab + b^2) = x^2 - (a-b)^2$

$[\because \boldsymbol{a^2 - 2ab + b^2 = (a-b)^2}]$

$= [x + (a-b)][x - (a-b)] = \boldsymbol{(x+a-b)(x-a+b)}$ **Ans.**

2. (a) $16a^2 - 20ab + 4a = \boldsymbol{4a(4a-5b+1)}$ **Ans.**

(b) $21x^2y + 14xy^2 - 35xy = \boldsymbol{7xy(3x+2y-5)}$ **Ans.**

(c) $4a(x+y) - 5b(x+y) = \boldsymbol{(x+y)(4a-5b)}$ **Ans.**

(d) $a^6 + a^2 - 3a^4 - 3 = a^2(a^4+1) - 3(a^4+1)$

$= \boldsymbol{(a^4+1)(a^2-3)}$ **Ans.**

(e) $x^2 - y + xy - x = x^2 - x + xy - y = x(x-1) + y(x-1)$

$= \boldsymbol{(x-1)(x+y)}$ **Ans.**

(f) $x^5 + x^4 + x + 1 = x^4(x+1) + 1(x+1) = \boldsymbol{(x+1)(x^4+1)}$ **Ans.**

(g) $xyz - yz^2 - xz^2 + z^3 = z(xy - yz - xz + z^2)$

$= z[y(x-z) - z(x-z)] = \boldsymbol{z(x-z)(y-z)}$ **Ans.**

(h) $x^2 + (a+b+c)x + ab + bc = x^2 + ax + bx + cx + ab + bc$

$= x^2 + ax + cx + bx + ab + bc = x(x+a+c) + b(x+a+c)$

$= \boldsymbol{(x+a+c)(x+b)}$ **Ans.**

3. (a) $16x^2 + 25y^2 + 40xy = (4x)^2 + (5y)^2 + 2 \times 4x \times 5y$

$= (4x+5y)^2$ $[\because \boldsymbol{a^2 + b^2 + 2ab = (a+b)^2}]$

$= \boldsymbol{(4x+5y)(4x+5y)}$ **Ans.**

(b) $x^2+64y^2-16xy=(x)^2+(8y)^2-2\times x\times 8y$

$=(x-8y)^2$ $[\because a^2+b^2-2ab=(a-b)^2]$

$=\mathbf{(x-8y)(x-8y)}$ **Ans.**

(c) $4x^4+4+\frac{1}{x^4}=(2x^2)^2+2\times 2x^2\times\frac{1}{x^2}+\left(\frac{1}{x^2}\right)^2$

$=\left(2x^2+\frac{1}{x^2}\right)^2$ $[\because a^2+2ab+b^2=(a+b)^2]$

$=\mathbf{\left(2x^2+\frac{1}{x^2}\right)\left(2x^2+\frac{1}{x^2}\right)}$ **Ans.**

(d) $1-16x^2+64x^4=(1)^2-2\times 1\times 8x^2+(8x^2)^2$

$=(1-8x^2)^2$ $[\because a^2-2ab+b^2=(a-b)^2]$

$=\mathbf{(1-8x^2)(1-8x^2)}$ **Ans.**

(e) $81x^2+144xy+64y^2=(9x)^2+2\times 9x\times 8y+(8y)^2$

$=(9x+8y)^2$ $[\because a^2+2ab+b^2=(a+b)^2]$

$=\mathbf{(9x+8y)(9x+8y)}$ **Ans.**

(f) $144x^2-72xy+9y^2=(12x)^2-2\times 12x\times 3y+(3y)^2$

$=(12x-3y)^2$ $[\because a^2-2ab+b^2=(a-b)^2]$

$=\mathbf{(12x-3y)(12x-3y)}$ **Ans.**

Exercise 7.2

1. (a) $64x^3+8y^3=8(8x^3+y^3)=8[(2x)^3+(y)^3]$

$=8[(2x+y)(2x)^2-2x\times y+(y)^2]=\mathbf{8(2x+y)(4x^2-2xy+y^2)}$ **Ans.**

(b) $512x^3y^3+729z^3=(8xy)^3+(9z)^3$

$=(8xy+9z)[(8xy)^2-8xy\times 9z+(9z)^2]$

$=\mathbf{(8xy+9z)(64x^2y^2-72xyz+81z^2)}$ **Ans.**

(c) $64p^3-8q^3=8(8p^3-q^3)=8[(2p)^3-(q)^3]$

$=8[(2p-q)(2p)^2+2p\times q+(q)^2]$

$=\mathbf{8[(2p-q)(4p^2+2pq+q^2)]}$ **Ans.**

(d) $27x^4y-xy^4=xy(27x^3-y^3)=xy[(3x)^3-(y)^3]$

$=xy[(3x-y)\{(3x)^2+3x\times y+(y)^2\}]$

$=\mathbf{xy(3x-y)(9x^2+3xy+y^2)}$ **Ans.**

(e) $\frac{1}{216}+729y^3=\left(\frac{1}{6}\right)^3+(9y)^3$

$=\left(\frac{1}{6}+9y\right)\left[\left(\frac{1}{6}\right)^2-\frac{1}{6}\times 9y+(9y)^2\right]=\left(\frac{1}{6}+9y\right)\left(\frac{1}{36}-\frac{3}{2}y+81y^2\right)$ **Ans.**

(f) $8x^9+8y^9=8(x^9+y^9)=8[(x^3)^3+(y^3)^3]$

$=8[(x^3+y^3)\{(x^3)^2-x^3\times y^3+(y^3)^2\}]$

$=8(x^3+y^3)(x^6-x^3y^3+y^6)$

$=\mathbf{8(x+y)(x^2-xy+y^2)(x^6-x^3y^3+y^6)}$ **Ans.**

(g) $(x+2)^3+(x-2)^3=[x+2+(x-2)]$

$[(x+2)^2-(x+2)(x-2)+(x-2)^2]$

$=(x+2+x-2)[x^2+2\times x\times 2+4-(x^2-2^2)+x^2-2\times 2\times x+4]$

$=(2x)(x^2+4x+4-x^2+4+x^2-4x+4)=\mathbf{2x(x^2+12)}$ **Ans.**

(h) $(x+3)^3-(x-3)^3=[x+3-(x-3)]$

$[(x+3)^2+(x+3)(x-3)+(x-3)^2]=(x+3-x+3)$

$[x^2+2\times x\times 3+(3)^2+x^2-9+x^2-2\times x\times 3+(3)^2]$

$=(6)(x^2+6x+9+x^2-9+x^2-6x+9)$

$=6(3x^2+9)=6\times 3(x^2+3)=\mathbf{18(x^2+3)}$ **Ans.**

2. (a) $8x^3+8y^3+24x^2y+24xy^2=8(x^3+y^3+3x^2y+3xy^2)$

$=8[x^3+y^3+3xy(x+y)]=8(x+y)^3=\mathbf{8(x+y)(x+y)(x+y)}$ **Ans.**

(b) $8x^3-27y^3-36x^2y+54xy^2$

$=(2x)^3-(3y)^3-3\times(2x)^2\times 3y+3\times 2x\times(3y)^2$

$=(2x-3y)^3$ $\quad[\because \mathbf{a^3-b^3-3a^2b+3ab^2=(a-b)^3}]$

$=\mathbf{(2x-3y)(2x-3y)(2x-3y)}$ **Ans.**

(c) $\frac{x^3}{27}+\frac{x^2y}{9}+\frac{xy^2}{9}+\frac{y^3}{27}$

$=\left(\frac{x}{3}\right)^3+3\times\left(\frac{x}{3}\right)^2\times\frac{y}{3}+3\times\frac{x}{3}\times\left(\frac{y}{3}\right)^2+\left(\frac{y}{3}\right)^3$

$=\left(\frac{x}{3}+\frac{y}{3}\right)^3$ $\quad[\because \mathbf{a^3+3a^2b+3ab^2+b^3=(a+b)^3}]$

$$= \left(\frac{x}{3}+\frac{y}{3}\right)\left(\frac{x}{3}+\frac{y}{3}\right)\left(\frac{x}{3}+\frac{y}{3}\right)$$ **Ans.**

(d) $27x^3 - \frac{1}{216} - \frac{9}{2}x^2 + \frac{1}{4}x$

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

$= \left(3x - \frac{1}{6}\right)^3 \qquad [\because a^3 - b^3 - 3a^2b + 3ab^2 = a^3 - b^3]$

$= \left(\mathbf{3x - \frac{1}{6}}\right)\left(\mathbf{3x - \frac{1}{6}}\right)\left(\mathbf{3x - \frac{1}{6}}\right)$ **Ans.**

3. (a) $x^3 + 27y^3 + 64z^3 - 36xyz$

$= (x)^3 + (3y)^3 + (4z)^3 - 3\times x \times 3y \times 4z = (x + 3y + 4z)$

$\{(x)^2 + (3y)^2 + (4z)^2 - x\times 3y - 3y \times 4z - 4z \times x\}$

$= \mathbf{(x + 3y + 4z)(x^2 + 9y^2 + 16z^2 - 3xy - 12yz - 4xz)}$ **Ans.**

(b) $x^3 + 27y^3 - 216z^3 + 54xyz$

$= (x)^3 + (3y)^3 + (-6z)^3 - 3\times x \times 3y \times (-6z)$

$= [x + 3y + (-6z)][(x)^2 + (3y)^2 + (-6z)^2 - x\times 3y - 3y$

$\times(-6z) - (-6z)\times x]$

$= \mathbf{(x + 3y - 6z)(x^2 + 9y^2 + 36z^2 - 3xy + 18yz + 6xz)}$ **Ans.**

(c) $729 + 8x^3 - 27y^3 + 162xy$

$= (9)^3 + (2x)^3 + (-3y)^3 - 3\times 9\times 2x \times (-3y) = \{9 + 2x + (-3y)\}$

$\{(9)^2 + (2x)^2 + (-3y)^2 - 9\times 2x - 2x \times (-3y) - (-3y)\times 9\}$

$= \mathbf{(9 + 2x - 3y)(81 + 4x^2 + 9y^2 - 18x + 6xy + 27y)}$ **Ans.**

(d) $\frac{1}{27}x^3 - 8y^3 + 125z^3 + 12xyz$

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

$= \left\{\frac{1}{3}x + (-2y) + 5z\right\}\left\{\begin{array}{l}\left(\frac{1}{3}x\right)^2 + (-2y)^2 + (5z)^2 - \frac{1}{3}x \\ \times(-2y) - (-2y)\times 5z - 5z \times \frac{1}{3}x\end{array}\right\}$

$$= \left(\frac{x}{3} - 2y + 5z\right)\left(\frac{x^2}{9} + 4y^2 + 25z^2 + \frac{2}{3}xy + 10yz - \frac{5}{3}xz\right)$$ **Ans.**

(e) $(x-4y)^3 + (4y-2z)^3 + (2z-x)^3$

Let $a = x - 4y,\ b = 4y - 2z$ and $c = 2z - x$

Then, $a + b + c = x - 4y + 4y - 2z + 2z - x = 0$

$\therefore \quad a^3 + b^3 + c^3 = 3abc$

$\Rightarrow \quad (x-4y)^3 + (4y-2z)^3 + (2z-x)^3$

$$= \mathbf{3(x-4y)(4y-2z)(2z-x)}$$ **Ans.**

(f) $(3x-2y)^3 + (2y-2z)^3 + (2z-3x)^3$

Let $a = 3x - 2y,\ b = 2y - 2z$ and $c = 2z - 3x$

Then, $a + b + c = 3x - 2y + 2y - 2z + 2z - 3x = 0$

$\therefore \quad a^3 + b^3 + c^3 = 3abc$

$\Rightarrow \quad \mathbf{(3x-2y)^3 + (2y-2z)^3 + (2z-3x)^3}$

$$= \mathbf{3(3x-2y)(2y-2z)(2z-3x)}$$ **Ans.**

4. (a) $\dfrac{0.51 \times 0.51 \times 0.51 + 0.49 \times 0.49 \times 0.49}{0.51 \times 0.51 - 0.51 \times 0.49 + 0.49 \times 0.49}$

Let $a = 0.51$ and $b = 0.49$

$$= \frac{a \times a \times a + b \times b \times b}{a \times a - a \times b + b \times b} = \frac{a^3 + b^3}{a^2 - ab + b^2}$$

$$= \frac{(a+b)(a^2 - ab + b^2)}{(a^2 - ab + b^2)} = a + b$$

Now, put $a = 0.51$ and $b = 0.49$

$$= a + b = 0.51 + 0.49 = \mathbf{1}$$ **Ans.**

(b) $\dfrac{147 \times 147 \times 147 - 53 \times 53 \times 53}{147 \times 147 + 147 \times 53 + 53 \times 53}$

Let $a = 147$ and $b = 53$

$$= \frac{a \times a \times a - b \times b \times b}{a \times a + a \times b + b \times b} = \frac{a^3 - b^3}{a^2 + ab + b^2}$$

$$= \frac{(a-b)(a^2 + ab + b^2)}{(a^2 + ab + b^2)} = a - b$$

Now, put $a = 147$ and $b = 53$

$$= a - b = 147 - 53 = \mathbf{94}$$ **Ans.**

5. (a) $9x^2+4y^2+25+12xy+20y+30x$

$=(3x)^2+(2y)^2+(5)^2+2\times3x\times2y+2\times2y\times5+2\times5\times3x$

$=\mathbf{(3x+2y+5)^2}$ **Ans.**

(b) $64x^2+4y^2+25z^2-32xy-20yz+80zx$

$=(8x)^2+(-2y)^2+(5z)^2+2\times(8x)\times(-2y)$

$+2\times(-2y)\times5z+2\times8x\times5z$

$=[8x+(-2y)+5z]^2=\mathbf{(8x-2y+5z)^2}$ **Ans.**

(c) $2x^2+y^2+8z^2-2\sqrt{2}xy-4\sqrt{2}yz+8xz$

$=(\sqrt{2}x)^2+(-y)^2+(2\sqrt{2}z)^2+2\times\sqrt{2}x\times(-y)$

$+2\times(-y)\times2\sqrt{2}z+2\sqrt{2}z\times\sqrt{2}x$

$=[\sqrt{2}x+(-y)+2\sqrt{2}z]^2=\mathbf{(\sqrt{2}x-y+2\sqrt{2}z)^2}$ **Ans.**

(d) $3x^2+3y^2+z^2+6xy+2\sqrt{3}yz+2\sqrt{3}zx$

$=(\sqrt{3}x)^2+(\sqrt{3}y)^2+(z)^2+2\times\sqrt{3}x\times\sqrt{3}y$

$+2\times\sqrt{3}y\times z+2\times z\times\sqrt{3}x=\mathbf{(\sqrt{3}x+\sqrt{3}y+z)^2}$ **Ans.**

Exercise 7.3

1. (a) $3x^2+7x+4$

Here we split 7 up into to two parts, whose sum is 7 and the product is $3\times4=12$. Clearly $3+4=7$ and $3\times4=12$

$\therefore3x^2+7x+4=3x^2+3x+4x+4=3x(x+1)+4(x+1)$

$=(x+1)(3x+4)$ Hence, $3x^2+7x+4=\mathbf{(x+1)(3x+4)}$ **Ans.**

(b) $5x^2+12x+4$

Here we split 12 up into two parts, whose sum is 12 and the product is $5\times4=20$. Clearly $10+2=12$ and $10\times2=20$

$\therefore5x^2+12x+4=5x^2+10x+2x+4$

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

Hence, $\mathbf{5x^2+12x+4=(x+2)(5x+2)}$ **Ans.**

(c) $6x^2+5x-6$

Here, we split 5 up into two parts, whose sum is 5 and the product is $6\times(-6)=-36$. Clearly $9+(-4)=5$ and $9\times(-4)=-36$

$\therefore6x^2+5x-6=6x^2+9x-4x-6$

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

Hence, $\mathbf{6x^2+5x-6=(2x+3)(3x-2)}$ **Ans.**

(d) $12y^2 - 2y - 4$

Here, we split -2 up into two parts, whose sum is -2 and the product is $12 \times (-4) = -48$. Clearly $-8 + 6 = -2$ and $-8 \times 6 = -48$

$\therefore 12y^2 - 2y - 4 = 12y^2 - 8y + 6y - 4$

$= 4y(3y - 2) + 2(3y - 2) = (3y - 2)(4y + 2)$

Hence, $\mathbf{12y^2 - 2y - 4 = (3y - 2)(4y + 2)}$ **Ans.**

(e) $12x^3 - 14x^2 - 10x = x(12x^2 - 14x - 10)$

Here, we split -14 into two parts, whose sum is -14 and the product is $12 \times (-10) = -120$. Clearly $-20 + 6 = -14$ and $-20 \times 6 = -120$

$\therefore x(12x^2 - 14x - 10) = x(12x^2 - 20x + 6x - 10)$

$= x[4x(3x - 5) + 2(3x - 5)] = x(3x - 5)(4x + 2)$

Hence, $\mathbf{12x^3 - 14x^2 - 10x = x(3x - 5)(4x + 2)}$ **Ans.**

(f) $15x^4 + 3x^2 - 18 = 3(5x^4 + x^2 - 6)$

Here, we split 1 up into two parts, whose sum is 1 and the product is $5 \times (-6) = -30$. Clearly $6 + (-5) = 1$ and $6 \times (-5) = -30$

$3(5x^4 + x^2 - 6) = 3[5x^4 + 6x^2 - 5x^2 - 6]$

$= 3\{x^2(5x^2 + 6) - 1(5x^2 + 6)\} = 3(5x^2 + 6)(x^2 - 1)$

$= \mathbf{3(5x^2 + 6)(x + 1)(x - 1)}$ **Ans.**

(g) $12x^2 - 24xy + 12y^2 = 12(x^2 - 2xy + y^2)$

Here, we split -2 up into two parts, whose sum is -2 and the product is $1 \times 1 = 2$. Clearly, $-1 + (-1) = -2$ and $-1 \times (-1) = 1$

$12(x^2 - 2xy + y^2) = 12(x^2 - xy - xy + y^2)$

$= 12\{x(x - y) - y(x - y)\} = 12(x - y)(x - y) = 12(x - y)^2$

Hence, $\mathbf{12x^2 - 24xy + 12y^2 = 12(x - y)^2}$ **Ans.**

(h) $16x^2 - 24xy + 9y^2$

Here, we split -24 up into two parts, whose sum is -24 and the product is $16 \times 9 = 144$. Clearly $-12 + (-12) = -24$ and $-12 \times (-12) = -144$

$16x^2 - 24xy + 9y^2 = 16x^2 - 12xy - 12xy + 9y^2$

$= 4x(4x - 3y) - 3y(4x - 3y)$

$= (4x - 3y)(4x - 3y) = (4x - 3y)^2$

Hence, $\mathbf{16x^2 - 24xy + 9y^2 = (4x - 3y)^2}$ **Ans.**

2. (a) $x^2 - 12x + 36$

Here, first we split -12 into two parts, whose sum is -12 and product is 36. Clearly $-6 + (-6) = -12$ and $(-6) \times (-6) = 36$

$\therefore x^2 - 12x + 36 = x^2 - 6x - 6x + 36$

$= x(x-6) - 6(x-6) = (x-6)(x-6) = (x-6)^2$

Hence, $\boldsymbol{x^2 - 12x + 36 = (x-6)^2}$ **Ans.**

(b) $x^2 + 8x + 16$

Here, first we split 8 into two parts, whose sum is 8 and product is 16. Clearly $4 + 4 = 8$ and $4 \times 4 = 16$

$x^2 + 8x + 16 = x^2 + 4x + 4x + 16$

$= x(x+4) + 4(x+4) = (x+4)(x+4) = (x+4)^2$

Hence, $\boldsymbol{x^2 + 8x + 16 = (x+4)^2}$ **Ans.**

(c) $x^2 + 9x + 18$

Here, first we split 9 into two parts, whose sum is 9 and the product is 18. Clearly $3 + 6 = 9$ and $3 \times 6 = 9$

$\therefore x^2 + 9x + 18 = x^2 + 3x + 6x + 18$

$= x(x+3) + 6(x+3) = (x+3)(x+6)$

Hence, $\boldsymbol{x^2 + 9x + 18 = (x+3)(x+6)}$ **Ans.**

(d) $x^2 + 2x - 35$

Here, first we split 2 into two pars, whose sum 2 and the product is -35. Clearly, $7 + (-5) = 2$ and $7 \times (-5) = -35$

$\therefore x^2 + 2x - 35 = x^2 + 7x - 5x - 35$

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

Hence, $\boldsymbol{x^2 + 2x - 35 = (x+7)(x-5)}$ **Ans.**

(e) $x^2 - x - 42$

Here, first we split -1 into two parts, whose sum is -1 and the product is -42. Clearly $-7 + 6 = -1$ and $(-7) \times 6 = -42$

$\therefore x^2 - x - 42 = x^2 - 7x + 6x - 42$

$= x(x-7) + 6(x-7) = (x-7)(x+6)$

Hence, $\boldsymbol{x^2 - x - 42 = (x-7)(x+6)}$ **Ans.**

(f) $x^2 - 3x - 10$

Here, first we split -3 into two parts, whose sum is -3 and the product is -10. Clearly $-5 + 2 = -3$ and $(-5) \times 2 = -10$

$\therefore x^2 - 3x - 10 = x^2 - 5x + 2x - 10$

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

Hence, $\boldsymbol{x^2 - 3x - 10 = (x-5)(x+2)}$ **Ans.**

(g) $x^2 - 10x - 24$

Here, first we split -10 into two parts, whose sum is -10 and the product is -24. Clearly $(-12)+(2) = -10$ and $-12 \times 2 = -24$

$\therefore x^2 - 10x - 24 = x^2 - 12x + 2x - 24$

$= x(x-12)+2(x-12) = (x-12)(x+2)$

Hence, $\boldsymbol{x^2 - 10x - 24 = (x-12)(x+2)}$ **Ans.**

(h) $x^2 - 19x + 84$

Here, first we split -19 into two parts whose sum is -19 and the product is 84. Clearly $(-12)+(-7) = -19$ and $(-12) \times (-7) = 84$

$\therefore x^2 - 19x + 84 = x^2 - 12x - 7x + 84$

$= x(x-12) - 7(x-12) = (x-12)(x-7)$

Hence, $\boldsymbol{x^2 - 19x + 84 = (x-12)(x-7)}$ **Ans.**

Multiple Choice Questions

1. (i) One of the factor of $25x^2$ is $5x$.

Hence, the answer **(d)** is correct. **Ans.**

(ii) $\because a^2 - b^2 = (a+b)(a-b)$

$\therefore$ One of the factor of $a^2 - b^2$ is $(a+b)$.

Hence, the answer **(a)** is correct. **Ans.**

(iii) Factor of $x^3 y^4 = x \times x \times x \times y \times y \times y \times y$

Factor of $x^5 y^7 = x \times x \times x \times x \times x \times x \times y \times y \times y \times y \times y \times y \times y$

H.C.F. $= x \times x \times x \times y \times y \times y \times y = x^3 y^4$

Hence, the answer **(b)** is correct. **Ans.**

(iv) Factor of $7xy = 7 \times x \times y$

Factor of $49x^2 y = 7 \times 7 \times x \times x \times y$

Common factor $= 7 \times x \times y = 7xy$

Hence, the answer **(b)** is correct. **Ans.**

8. Linear Equations in One Variable

Exercise 8.1

1. (a) $\frac{9x+8}{4x+3}=6$ or $6(4x+3)=9x+8$ (By cross multiplication)

or $24x+18=9x+8$ or $24x-9x=8-18$

or $15x=-10$ or $x=\frac{-10}{15}$

$\therefore$ $\boldsymbol{x=\frac{-2}{3}}$ **Ans.**

Check : On putting $x=-\frac{2}{3}$ in the equation.

$$\text{L.H.S.}=\frac{9x+8}{4x+3}=\frac{9\times\left(\frac{-2}{3}\right)+8}{4\times\left(\frac{-2}{3}\right)+3}=\frac{-6+8}{\frac{-8}{3}+3}$$

$$=\frac{2}{\frac{-8+9}{3}}=\frac{2}{\frac{1}{3}}=2\times3=6=\text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(b) $\frac{8y-3}{3y+2}=\frac{-2}{3}$ or $3(8y-3)=-2(3y+2)$

(By cross multiplication)

or $24y-9=-6y-4$ or $24y+6y=-4+9$

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

$\therefore$ $\boldsymbol{y=\frac{1}{6}}$ **Ans.**

Check : On putting $y=\frac{1}{6}$ in the equation.

$$\text{L.H.S.}=\frac{8y-3}{3y+2}=\frac{8\times\frac{1}{6}-3}{3\times\frac{1}{6}+2}=\frac{\frac{4}{3}-3}{\frac{1}{2}+2}$$

$$= \frac{\frac{4-9}{3}}{\frac{1+4}{2}} = \frac{\frac{-5}{3}}{\frac{5}{2}} = \frac{-5\times 2}{3\times 5} = \frac{-2}{3} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(c) $\dfrac{3x-\frac{3}{4}}{6x+\frac{14}{7}} = \dfrac{9}{4}$

or $4\left(3x-\frac{3}{4}\right) = 9\left(6x+\frac{14}{7}\right)$ [By cross multiplication]

or $12x - 4\times\frac{3}{4} = 9\times 6x + 9\times\frac{14}{7}$

or $12x - 3 = 54x + 18$ or $12x - 54x = 18 + 3$

or $-42x = 21$ or $x = -\frac{21}{42} = -\frac{\mathbf{1}}{\mathbf{2}}$ **Ans.**

Check : On putting $x = \frac{-1}{2}$ in the equation.

$$\text{L.H.S.} = \frac{3x-\frac{3}{4}}{6x+\frac{14}{7}} = \frac{3\times\left(-\frac{1}{2}\right)-\frac{3}{4}}{6\times\left(-\frac{1}{2}\right)+2} = \frac{\frac{-3}{2}-\frac{3}{4}}{-3+2} = \frac{\frac{-6-3}{4}}{-1}$$

$$= \frac{\frac{-9}{4}}{-1} = \frac{-9}{4\times(-1)} = \frac{-9}{-4} = \frac{9}{4} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(d) $\dfrac{5x+4}{2x+3} = \dfrac{42}{7}$ or $\dfrac{5x+4}{2x+3} = 6$

or $6(2x+3) = 5x+4$ [By cross multiplication]

$12x + 18 = 5x + 4$ or $12x - 5x = 4 - 18$

$7x = -14$ or $x = \frac{-14}{7} = -2$

$\therefore \quad x = -2$ **Ans.**

Check : On putting $x = -2$ in equation.

$$\text{L.H.S.} = \frac{5x+4}{2x+3} = \frac{5\times(-2)+4}{2\times(-2)+3} = \frac{-10+4}{-4+3}$$

$$= \frac{-6}{-1} = 6 = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(e) $\dfrac{\frac{4}{3}x+1}{x+\frac{1}{4}} = \dfrac{6}{7}$ or $7\left(\dfrac{4}{3}x+1\right) = 6\left(x+\dfrac{1}{4}\right)$

[By cross multiplication]

or $\quad \dfrac{28}{3}x+7 = 6x+\dfrac{6}{4} \quad$ or $\dfrac{28}{3}x-6x = \dfrac{6}{4}-7$

or $\quad \dfrac{28x-18x}{3} = \dfrac{6-28}{4} \quad$ or $\dfrac{10x}{3} = \dfrac{-22}{4}$

or $40x = -66 \quad$ or $x = \dfrac{-66}{40} = -\dfrac{33}{20}$

$\therefore \quad \boldsymbol{x = -\dfrac{33}{20}}$ **Ans.**

Check : On putting $x = -\dfrac{33}{20}$ in the equation.

$$\text{L.H.S.} = \frac{\frac{4}{3}x+1}{x+\frac{1}{4}} = \frac{\frac{4}{3}\times\left(-\frac{33}{20}\right)+1}{\frac{-33}{20}+\frac{1}{4}} = \frac{-\frac{22}{10}+1}{\frac{-33}{20}+\frac{1}{4}} = \frac{\frac{-22+10}{10}}{\frac{-33+5}{20}}$$

$$= \frac{\frac{-12}{10}}{\frac{-28}{20}} = \frac{-12\times 20}{10\times(-28)} = \frac{24}{28} = \frac{6}{7} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(f) $\dfrac{42-z}{z+16} = \dfrac{3}{15} = \dfrac{1}{5}$ or $15(42-z) = 3(z+16)$

[By cross multiplication]

or $630-15z = 3z+48$ or $-15z-3z = 48-630$

or $-18z = -582 \quad$ or $z = \dfrac{-582}{-18} = \dfrac{97}{3}$

$\therefore \quad z = \dfrac{\mathbf{97}}{\mathbf{3}}$ **Ans.**

Check : On putting $z = \dfrac{97}{3}$ in the equation.

$$\text{L.H.S.} = \frac{42 - \frac{97}{3}}{\frac{97}{3} + 16} = \frac{\frac{126 - 97}{3}}{\frac{97 + 48}{3}} = \frac{\frac{29}{3}}{\frac{145}{3}} = \frac{29 \times 3}{145 \times 3} = \frac{1}{5} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(g) $\dfrac{6x + 2}{2x - 4} = \dfrac{3}{4}$ or $4(6x + 2) = 3(2x - 4)$ [By cross multiplication]

or $24x + 8 = 6x - 12$ or $24x - 6x = -12 - 8$

or $18x = -20$ or $x = \dfrac{-20}{18} = \dfrac{-10}{9}$

$\therefore \boldsymbol{x = -\dfrac{10}{9}}$ **Ans.**

Check : On putting $x = -\dfrac{10}{9}$ in the equation.

$$\text{L.H.S.} = \frac{6x + 2}{2x - 4} = \frac{6 \times \frac{-10}{9} + 2}{2 \times \frac{-10}{9} - 4} = \frac{\frac{-20}{3} + 2}{\frac{-20}{9} - 4} = \frac{\frac{-20 + 6}{3}}{\frac{-20 - 36}{9}}$$

$$= \frac{\frac{-14}{3}}{\frac{-56}{9}} = \frac{-14 \times 9}{3 \times (-56)} = \frac{9}{12} = \frac{3}{4} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(h) $\dfrac{7 - y}{y + 5} = \dfrac{15}{7}$ or $7(7 - y) = 15(y + 5)$ [By cross multiplication]

or $49 - 7y = 15y + 75$ or $-7y - 15y = 75 - 49$

or $-22y = 26$ or $y = -\dfrac{26}{22} = -\dfrac{13}{11}$

$\therefore \quad \boldsymbol{y = -\dfrac{13}{11}}$ **Ans.**

Check : On putting $y = -\frac{13}{11}$ in the equation.

$$\text{L.H.S.} = \frac{7-y}{y+5} = \frac{7-\left(-\frac{13}{11}\right)}{\frac{-13}{11}+5} = \frac{7+\frac{13}{11}}{\frac{-13}{11}+5} = \frac{\frac{77+13}{11}}{\frac{-13+55}{11}} = \frac{\frac{90}{11}}{\frac{42}{11}}$$

$$= \frac{90\times 11}{11\times 42} = \frac{45}{21} = \frac{15}{7} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(i) $\frac{5-2y}{4+9y} = \frac{-8}{17}$ or $17(5-2y) = -8(4+9y)$

[By cross multiplication]

or $85-34y = -32-72y$ or $-34y+72y = -32-85$

or $38y = -117$ $\therefore$ $\boldsymbol{y = \frac{-117}{38}}$ **Ans.**

Check : On putting $x = -\frac{117}{38}$ in the equation.

$$\text{L.H.S.} = \frac{5-2y}{4+9y} = \frac{5-2\times\left(-\frac{117}{38}\right)}{4+9\times\left(\frac{-117}{38}\right)} = \frac{5+\frac{117}{19}}{4-\frac{1053}{38}} = \frac{\frac{95+117}{19}}{\frac{152-1053}{38}}$$

$$= \frac{\frac{212}{19}}{\frac{-901}{38}} = -\frac{212\times 38}{19\times 901} = -\frac{424}{901} = \frac{-8}{17} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(j) $\frac{3x+4}{3x-2} = \frac{9}{20}$ or $20(3x+4) = 9(3x-2)$

[By cross multiplication]

or $60x+80 = 27x-18$ or $60x-27x = -18-80$

or $33x = -98$ $\therefore x = \frac{-98}{33}$ **Ans.**

Check : On putting $x = \frac{-98}{33}$ in the equation.

$$\text{L.H.S.} = \frac{3x+4}{3x-2} = \frac{3\times\frac{-98}{33}+4}{3\times\frac{-98}{33}-2} = \frac{\frac{-98}{11}+4}{\frac{-98}{11}-2} = \frac{\frac{-98+44}{11}}{\frac{-98-22}{11}}$$

$$= \frac{\frac{-54}{11}}{\frac{-120}{11}} = \frac{54\times11}{120\times11} = \frac{54}{120} = \frac{9}{20} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(k) $\dfrac{8x-5-\frac{1}{4}(8x-4)}{3x-2-\frac{1}{3}(6x-3)} = \dfrac{16}{25}$ or $\dfrac{8x-5-2x+1}{3x-2-2x+1} = \dfrac{16}{25}$

or $\dfrac{6x-4}{x-1} = \dfrac{16}{25}$

$\therefore \dfrac{6x-4}{x-1} = \dfrac{16}{25}$ or $25(6x-4) = 16(x-1)$ [By cross multiplication]

or $150x-100 = 16x-16$ or $150x-16x = -16+100$

or $134x = 84$ or $x = \dfrac{84}{134}$

$\therefore x = \dfrac{42}{67}$ **Ans.**

Check : On putting $x = \dfrac{42}{67}$ in the equation.

$$\text{L.H.S.} = \frac{6x-4}{x-1} = \frac{6\times\frac{42}{67}-4}{\frac{42}{67}-1} = \frac{\frac{252}{67}-4}{\frac{42}{67}-1} = \frac{\frac{252-268}{67}}{\frac{42-67}{67}}$$

$$= \frac{\frac{-16}{67}}{\frac{-25}{67}} = \frac{16\times67}{25\times67} = \frac{16}{25} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(l) $\dfrac{5x+2}{x-6} = \dfrac{10x}{2x-3}$ or $(5x+2)(2x-3) = 10x(x-6)$

or $5x(2x-3)+2(2x-3) = 10x\times x - 10x\times 6$

or $10x^2 - 15x + 4x - 6 = 10x^2 - 60x$

or $10x^2 - 11x - 6 = 10x^2 - 60x$

or $10x^2 - 11x - 10x^2 + 60x = 6$

$49x = 6 \therefore \boldsymbol{x = \frac{6}{49}}$ **Ans.**

Check : On putting $x = \frac{6}{49}$ in the equation.

$$\text{L.H.S.} = \frac{5x+2}{x-6} = \frac{5\times\frac{6}{49}+2}{\frac{6}{49}-6} = \frac{\frac{30}{49}+2}{\frac{6}{49}-6} = \frac{\frac{30+98}{49}}{\frac{6-294}{49}}$$

$$= \frac{\frac{128}{49}}{\frac{-288}{49}} = -\frac{128\times 49}{288\times 49} = -\frac{128}{288} = -\frac{4}{9}$$

$$\text{R.H.S.} = \frac{10x}{2x-3} = \frac{10\times\frac{6}{49}}{2\times\frac{6}{49}-3} = \frac{\frac{60}{49}}{\frac{12}{49}-3} = \frac{\frac{60}{49}}{\frac{12-147}{49}} = \frac{\frac{60}{49}}{\frac{-135}{49}}$$

$$= -\frac{90\times 49}{49\times 135} = -\frac{60}{135} = -\frac{4}{9}$$

$\therefore$ L.H.S. = R.H.S.

Hence, **the answer is correct.** **Ans.**

(m) $\frac{2-7x}{1-3x} = \frac{3+14x}{4+6x} = (4+6x)(2-7x) = (1-3x)(3+14x)$

or $4(2-7x)+6x(2-7x) = 1(3+14x)-3x(3+14x)$

or $8-28x+12x-42x^2 = 3+14x-9x-42x^2$

or $-42x^2 - 16x + 8 = -42x^2 + 5x + 3$

or $-42x^2 - 16x + 42x^2 - 5x = 3 - 8$

$-21x = -5$ or $x = \frac{-5}{-21}$

$\therefore \quad x = \frac{5}{21}$ **Ans.**

Check : On putting $x = \frac{5}{21}$ in the equation.

$$\text{L.H.S.} = \frac{2-7x}{1-3x} = \frac{2-7\times\frac{5}{21}}{1-3\times\frac{5}{21}} = \frac{2-\frac{5}{3}}{1-\frac{5}{7}} = \frac{\frac{6-5}{3}}{\frac{7-5}{7}} = \frac{\frac{1}{3}}{\frac{2}{7}} = \frac{1\times 7}{3\times 2} = \frac{7}{6}$$

$$\text{R.H.S.} = \frac{3+14x}{4+6x} = \frac{3+14\times\frac{5}{21}}{4+6\times\frac{5}{21}} = \frac{3+\frac{10}{3}}{4+\frac{10}{7}} = \frac{\frac{9+10}{3}}{\frac{28+10}{7}} = \frac{\frac{19}{3}}{\frac{38}{7}}$$

$$= \frac{19\times 7}{3\times 38} = \frac{7}{6} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(n) $\dfrac{2(1-x)+3(2x+1)}{4-3x} = \dfrac{-7}{4}$ or $\dfrac{2-2x+6x+3}{4-3x} = \dfrac{-7}{4}$

or $\dfrac{4x+5}{4-3x} = \dfrac{-7}{4}$

$\therefore$ $\dfrac{4x+5}{4-3x} = \dfrac{-7}{4}$ or $4(4x+5) = -7(4-3x)$

[By cross multiplication]

or $16x+20 = -28+21x$ or $16x-21x = -28-20$

$-5x = -48$ or $x = \dfrac{-48}{-5}$

$\therefore$ $x = \dfrac{48}{5}$ **Ans.**

Check : On putting $x = \dfrac{48}{5}$ on the equation.

$$\text{L.H.S.} = \frac{4x+5}{4-3x} = \frac{4\times\frac{48}{5}+5}{4-3\times\frac{48}{5}} = \frac{\frac{192}{5}+5}{4-\frac{144}{5}} = \frac{\frac{192+25}{5}}{\frac{20-144}{5}}$$

$$= \frac{\frac{217}{5}}{-\frac{124}{5}} = \frac{217\times 5}{5\times(-124)} = -\frac{217}{124} = \frac{-7}{4} = \text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(o) $\frac{x^2-(x+1)(x+2)}{5x+1}=10$ or $\frac{x^2-[x^2+2x+x+2]}{5x+1}=10$

or $\frac{x^2-x^2-3x-2}{5x+1}=10$

$\therefore \frac{-3x-2}{5x+1}=10$ or $50x+10=-3x-2$ [By cross multiplication]

$50x+3x=-2-10$ or $53x=-12$

$\therefore \quad \boldsymbol{x=-\frac{12}{53}}$ **Ans.**

Check : On putting $x=\frac{-12}{53}$ in the equation.

$$\text{L.H.S.}=\frac{-3x-2}{5x+1}=\frac{-3\times\left(\frac{-12}{53}\right)-2}{5\times\left(\frac{-12}{53}\right)+1}=\frac{\frac{36}{53}-2}{-\frac{60}{53}+1}=\frac{\frac{36-106}{53}}{\frac{-60+53}{53}}$$

$$=\frac{\frac{-70}{53}}{\frac{-7}{53}}=\frac{70\times 53}{53\times 7}=\frac{70}{7}=10=\text{R.H.S.}$$

Hence, **the answer is correct.** **Ans.**

(p) $\frac{(2x+3)-(5x-7)}{6x+11}=\frac{-4}{9}$ or $\frac{2x+3-5x+7}{6x+11}=\frac{-4}{9}$

$\therefore \frac{-3x+10}{6x+11}=\frac{-4}{9}$ or $9(-3x+10)=-4(6x+11)$

$-27x+90=-24x-44$ or $-27x+24x=-44-90$

or $-3x=-134 \quad \therefore \boldsymbol{x=\frac{134}{3}}$ **Ans.**

Check : On putting $x=\frac{134}{3}$ in the equation.

$$\text{L.H.S.}=\frac{-3x+10}{6x+11}=\frac{-3\times\frac{134}{3}+10}{6\times\frac{134}{3}+11}=\frac{-134+10}{268+11}=\frac{-124}{279}$$

$= \frac{-4}{9} = \text{R.H.S.}$

Hence, **the answer is correct.** **Ans.**

2. $\frac{x^2+1}{x^2-1} - \frac{10}{8}$ or $8(x^2+1) = 10(x^2-1)$ [By cross multiplication]

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

or $-2x^2 = -18$ or $x^2 = \frac{-18}{-2} = 9$ or $x = \sqrt{9} = \pm 3$

Hence, **the positive value of variable x is 3.** **Ans.**

Exercise 8.2

1. Suppose the numerator of a rational number $= x$
and denominator $= x + 8$

Then, the given rational number $= \frac{x}{x+8}$

According to question, $\frac{x+10}{x+8+10} = \frac{3}{4}$

or $\frac{x+10}{x+18} = \frac{3}{4}$

$4(x+10) = 3(x+18)$ [By cross multiplication]

or $4x + 40 = 3x + 54$ or $4x - 3x = 54 - 40$

$\therefore \quad x = 14$

$\therefore$ The given rational number $= \frac{x}{x+8} = \frac{14}{14+8} = \frac{14}{22}$

Hence, **the rational number is $\frac{14}{22}$.** **Ans.**

2. Let the units digit $= x$ and tens digit $= 7 - x$

$\therefore$ Number $= 10 \times (7-x) + x = 70 - 10x + x = 70 - 9x$

Reversing the digits, the units digit become $(7-x)$ and the tens digit become x.

$\therefore$ New number $= 10x + 7 - x = 9x + 7$

According to question,

$(9x + 7) - (70 - 9x) = 27$

or $9x + 7 - 70 + 9x = 27$ or $18x - 63 = 27$

or $15x = 27 + 63$ or $18x = 90$

$\therefore \quad x = \frac{90}{18}$ or $x = 5$

$\therefore$ Units digit $= x = 5$ and tens digits $= 7 - 5 = 2$

Hence, **the required number = 25** **Ans.**

3. Let the smaller number $= x$

and the greater number $= x + 99$

According to question,

$$\frac{x + 99}{x} = 10$$

or $x + 99 = 10x$ or $x - 10x = -99$

or $-9x = -99$ or $x = \frac{-99}{-9}$

$\therefore \quad x = 11$

Thus, smaller number $= 11$

and the greater number $= 11 + 99 = 110$

Hence, **the required number = 11, 110** **Ans.**

4. Let units digit $= x$ and tens digit $= 2x$

$\therefore$ Number $= 10 \times 2x + x = 20x + x = 21x$

Interchanging the digits, the unit digit become $2x$ and the tens digit become x.

New number $= 10 \times x + 2x = 10x + 2x = 12x$

According to question, $12x + 3 = 21x \times \frac{5}{7}$

or $12x + 3 = 15x$ or $12x - 15x = -3$

$-3x = -3$ or $x = \frac{-3}{-3}$ $\therefore x = 1$

$\therefore$ Units digit $= x = 1$ and tens digit $= 2x = 2 \times 1 = 2$

Hence, **the required number = 21** **Ans.**

5. Let the present age of Ravi $= 9x$ years

and the present age of Om $= 10x$ years

6 years later the age of Ravi $= (9x + 6)$ years

and 6 years later the age of Om $= (10x + 6)$ years

According to question, $\frac{9x + 6}{10x + 6} = \frac{12}{13}$

or $13(9x + 6) = 12(10x + 6)$ [By cross multiplication]

or $117x + 78 = 120x + 72$ or $117x - 120x = 72 - 78$

or $-3x = -6$ or $x = \frac{-6}{-3}$ $\therefore x = 2$

Thus, age of Ravi $= 9x = 9 \times 2$ years $= 18$ years

Age of Om $= 10x = 10 \times 2$ years $= 20$ years

Hence, **the age of Ravi is 18 years and age of Om = 20 years.**

Ans.

6. Let the first number $= x$ and the second number $= x + 9$ and the third number $= x + 18$

According to question, $x + x + 9 + x + 18 = 999$

or $3x + 27 = 999$ or $3x = 999 - 27$

or $3x = 972$ or $x = \frac{972}{3} = 324$

Thus, first number $= x = 324$

second number $= x + 9 = 324 + 9 = 333$

and third number $= x + 18 = 324 + 18 = 342$

Hence, **required multiples are 324, 333 and 342.** **Ans.**

7. Let the first number is x. Since the sum of the number is 26. therefore, the other number will be $26 - x$.

It is given that the ratio of the number is 4 : 9, therefore

$\frac{x}{26 - x} = \frac{4}{9}$ or $9x = 4(26 - x)$ [By cross multiplication]

or $9x = 104 - 4x$ or $9x + 4x = 104$

or $13x = 104$ or $x = \frac{104}{13} = 8$

$\therefore x = 8$

Thus, one number $= 8$ and another number $= 26 - x = 26 - 8 = 18$

Hence, **the numbers are 8 and 18.** **Ans.**

8. Let 280 of one part x and second part $280 - x$.

According to questions,

$\frac{x}{3} = 280 - x + 44$ or $\frac{x}{3} + x = 280 + 44$

or $\frac{x + 3x}{3} = 324$ or $\frac{4x}{3} = 324$

or $x = \frac{324 \times 3}{4}$ or $x = 81 \times 3 = 243$

Thus, one part $= x = 243$ and second part $= 280 - 243 = 37$

Hence, **two parts of 280 are 243 and 37.** **Ans.**

9. Let the breadth of rectangle $= x$ cm, then

Length of rectangle $= (x + 9)$ cm

$\because$ Area of rectangle = length $\times$ breadth

$\therefore$ Area of rectangle $= x \times (x + 9)\ \text{cm}^2 = (x^2 + 9x)\ \text{cm}^2$

When length and breadth both are exceeds by 26 cm, then

length $= (x + 26)$ cm and breadth $= (x + 9 + 26)$ cm $= (x + 35)$ cm.

Area of rectangle $= (x + 26)(x + 35)\ \text{cm}^2$

According to question,

$(x + 26)(x + 35) - (x^2 + 9x) = 3042$

or $x^2 + 35x + 26x + 910 - x^2 - 9x = 3042$

or $52x = 3042 - 910 = 2132$

or $x = \dfrac{2132}{52}$ cm $\qquad \therefore x = 41$ cm

Thus, breadth of rectangle $= x$ cm $= 41$ cm

and length of rectangle $= (x + 9)$ cm $= (41 + 9)$ cm $= 50$ cm

Hence, **length of rectangle is 50 cm and breadth is 41 cm.**

Ans.

10. Let the speed of car $= x$ km/h and speed of second car $= (x + 15)$ km/h

Then the distance travel by first car in 5 hours $= 5x$ km

The distance travel by second car in 5 hours $= 5(x + 15)$ km/h

According to questions,

or $5x + 5(x + 15) = 450$ $\qquad$ or $5x + 5x + 75 = 450$

or $10x = 450 - 75$ $\qquad$ or $10x = 375$

or $x = \dfrac{375}{10}$ km/h $= \dfrac{75}{2}$ km/h $= 37\dfrac{1}{2}$ km/h

Thus, the speed of first car $= 37\dfrac{1}{2}$ km/h

and the speed of second car $= 37\dfrac{1}{2}$ km/h $+ 15$ km/h $= 52\dfrac{1}{2}$ km/h

Hence, **the speed of first car is $37\frac{1}{2}$ km/h and second car is $52\frac{1}{2}$ km/h.** **Ans.**

11. Let the age of Amit $= x$ years and age of Amit's mother $= 4x$ years

After 10 years age of mother $= (4x + 10)$ years

After 10 years age of Amit $= (x + 10)$ years

According to question,

$4x + 10 = 3(x + 10)$ or $4x + 10 = 3x + 30$

or $4x - 3x = 30 - 10$ or $x = 20$

Thus, age of Amit $= x$ years $= 20$ years and age of mother

$= 4x = 4 \times 20$ years $= 80$ years

Hence, **age of Amit = 20 years and age of Amit's mother = 80 years.** **Ans.**

12. Let the speed of stream $= x$ km/h

and speed of race-boat $= 34.5$ kkm/h

Speed of boat in downstream $= (34.5 + x)$ km/h

Speed of boat in up stream $= (34.5 - x)$ km/h

$\because$ Speed $= \frac{\text{Distance}}{\text{Time}}$

or Distance = Speed $\times$ Time

First Condition :

or $66 = (34.5 + x) \times \frac{110}{60}$ **[$\because$ 1 hours = 60 minutes]**

or $66 = \frac{11}{6}(34.5 + x)$ ...(i)

Second Condition :

$66 = (34.5 - x)\frac{120}{60}$ **[$\because$ 1 hour = 60 minutes]**

or $66 = 2(34.5 - x)$ ...(ii)

From equations (i) and (ii), we get

$2(34.5 - x) = \frac{11}{6}(34.5 + x)$

or $12(34.5 - x) = 11(34.5 + x)$

or $414 - 12x = 379.5 + 11x$

or $12x + 11x = 414 - 379.5$

or $23x = 34.5$

or $x = \frac{34.5}{23} = 1.5$

Hence, **speed of the stream = 1.5 km/h** **Ans.**

13. Let the speed of the motorboat in still water be x km/h.

We have, speed of the water $= 2$ km/h

Speed of motor boat in downstream $= (x + 2)$ km/h

Speed of motor boat in up stream $= (x - 2)$ km/h

Distance covered in 5 hours while going downstream $= 5(x + 2)$ km

Distance covered in 6 hours while going upstream $= 6(x - 2)$ km

But, each one of these distance is the same distance between the two parts.

Therefore, $5(x + 2) = 6(x - 2)$ or $5x + 10 = 6x - 12$

or $5x - 6x = -12 - 10$ or $-x = -22$

$\therefore x = 22$ km/h

Hence, **the speed of motorboat in still water is 22 km/hour.** **Ans.**

14. Let the note of ₹ $5 = 7x$

$\therefore$ Amount of note ₹ $5 =$ ₹ $5 \times 7x =$ ₹ $35x$

And the note of ₹ $10 = 5x$

And amout of note ₹ $10 =$ ₹ $10 \times 5x =$ ₹ $50x$

$\therefore$ Total amount = ₹ $35x +$ ₹ $50x =$ ₹ 850

or $85x = 850$ or $x = \frac{850}{85} = 10$

$\therefore$ Note of ₹ $5 = 7 \times 10 = 70$

And note of ₹ $10 = 5 \times 10 = 50$

Hence, **note of ₹ 5 = 70 and note of ₹ 10 = 50** **Ans.**

Multiple Choice Questions

1. (i) $x + 4 = 4$ or $x = 4 - 4$ $\therefore x = 0$

Hence, the answer **(c)** is correct. **Ans.**

(ii) $x + 5 = 5$ or $x = 5 - 5 \therefore x = 0$

Hence, the answer **(d)** is correct. **Ans.**

(iii) The answer **(a)** is correct. **Ans.**

(iv) $3x + 4 = 10$ or $3x = 10 - 4$

or $3x = 6$ or $x = \frac{6}{3}$ or $x = 2$

Hence, the answer **(b)** is correct. **Ans.**

9. Comparing Quantities

Exercise 9.1

1. Rate of increase in population = 5% every year.

$\therefore$ Present population = 100

Let the population after a year be 105.

If present population is 100, population after a year = 105

If present population is 1, population after a year = $\frac{105}{100}$

If present population is 180800, population after a year

$= \frac{105}{100} \times 180800 = 105 \times 1808 = 189840$

Hence, **the population of a town after a year will 189840.**

Ans.

2. Let polled votes = 100

Winner got votes = 63

$\therefore$ Other candidate got votes $= 100 - 63 = 37$

$\therefore$ Difference $= 63 - 37 = 26$

$\therefore$ Difference 26, then polled votes = 100

$\therefore$ Difference 1, then polled votes = $\frac{100}{26}$

Difference 9620, then polled votes $= \frac{100}{26} \times 9620 =$ **37000** **Ans.**

3. Number of apple trees in the garden = 15% of 320

$$= \frac{15}{100} \times 320 = 48$$

Number of lemon trees in the garden = 72.5% of 320

$$= \frac{72.5}{100} \times 320 = 232$$

And number of mango trees in the garden

$$= 320 - (48 + 232) = 320 - 280 = 40$$

Hence, **apple 48, lemon 232 and mango 40 trees in the garden.** **Ans.**

4. S.P. = ₹ 1200, Loss = 20%

$$\therefore \quad \text{C.P.} = ₹ \frac{\text{S.P.} \times 100}{(100 - \text{loss}\,\%)} = ₹ \frac{1200 \times 100}{100 - 20}$$

$$= ₹ \frac{1200 \times 100}{80} = ₹ 1500$$

Now, shopkeeper should sold the article to gain = 20%

$$\text{S.P.} = \frac{100 + \text{gain}\,\%}{100} \times \text{C.P.} = ₹ \frac{100 + 20}{100} \times 1500$$

$$= ₹ \frac{120}{100} \times 1500 = ₹ 1800$$

Hence, **shopkeeper sold the article ₹ 1800 to gain 20%.** **Ans.**

5. Total number of students in the school = 3600

$\because$ Percentage of girls = 65%

$\therefore$ Percentage of boys = $(100 - 65)\% = 35\%$

$\therefore$ Number of boys in the school = 3600 of 35%

$$= 3600 \times \frac{35}{100} = 36 \times 35 = 1260 \text{ boys}$$

Hence, **1260 boys are in the school.** **Ans.**

6. Monthly save = 10%

Monthly saving income = $₹ \frac{32400}{12} = ₹ 2700$

$\therefore$ 10% of income is ₹ 2700.

Let the monthly income be x.

$\therefore$ 10% of x = ₹ 2700 or $\frac{10}{100} \times x = ₹ 2700$

$\therefore x = ₹ \frac{2700 \times 100}{10}$ or $x = ₹ 27000$

Hence, **monthly income of a man is ₹ 27000.** **Ans.**

7. Let the value of land before increased = ₹ 100

Value of a land increased = 30%

$\therefore$ Present value of land = ₹ (100 + 30) = ₹ 130

If present value of land is ₹ 130, price of land before increase

= ₹ 100

If present value of land ₹ 130, price of land before increased

$= ₹ \frac{100}{130}$

If present value of land is ₹ 13000, price of land before increase

$= ₹ \frac{100}{130} \times 13000 = ₹ 10000$

Hence, **the price of land before increase is ₹ 10000.** **Ans.**

8. Percentage of men in a town $= 40\%$

Percentage of women in a town $= 35\%$

$\therefore$ Percentage of children $= 100\% - (40 + 35)\%$

$= 100\% - 75\% = 25\%$

Hence, **the percentage of children is 25%.** **Ans.**

9. (a) $52\% = \frac{52}{100} = \mathbf{0.52}$ **Ans.**

(b) $7\frac{2}{9} = \frac{65}{9} = \left(\frac{65}{9} \times 100\right)\% = \frac{6500}{9}\% = \mathbf{722\frac{2}{9}\%}$ **Ans.**

(c) $81 : 9 = \frac{81}{9} \times 100\% = \mathbf{900\%}$ **Ans.**

(d) $1\frac{3}{5}\% = \frac{8}{5}\% = \frac{8}{5} \times \frac{1}{100} = \mathbf{\frac{2}{125}}$ **Ans.**

10. (a) 40% of $x = 60$ or $x \times \frac{40}{100} = 60$

or $x = \frac{60 \times 100}{40}$ or $x = 150$

Hence, $\boldsymbol{x = 150}$ **Ans.**

(b) 20% of $x = 5$ or $x \times \frac{20}{100} = 5$ or $x = \frac{5 \times 100}{20} = 25$

Hence, $\boldsymbol{x = 25}$ **Ans.**

(c) 160% of $x = 360$ or $x \times \frac{160}{100} = 360$ or $x = \frac{360 \times 100}{160} = 225$

Hence, $\boldsymbol{x = 225}$ **Ans.**

(d) 72% of $x = 24$ or $x \times \frac{72}{100} = 24$

or $x = \frac{24 \times 100}{72} = \frac{100}{3} = 33\frac{1}{3}$ Hence, $\boldsymbol{x = 33\frac{1}{3}}$ **Ans.**

11. (a) Let 65 of $x\% = 20$

$\Rightarrow \frac{x}{100} \times 65 = 20$ or $x = \frac{20 \times 100}{65}$ or $x = \frac{400}{13}\% = 30\frac{10}{13}\%$

Hence, **65 of $30\frac{10}{13}$% is 20.** **Ans.**

(b) Let 50 of $x\% = 20$

$\Rightarrow \frac{x}{100} \times 50 = 20$ or $x = \frac{20 \times 100}{50} = 40$

Hence, **50 of 40% is 20.** **Ans.**

(c) Let $\frac{2}{9}$ of $x\% = \frac{4}{3}$

$\Rightarrow \frac{x}{100} \times \frac{2}{9} = \frac{4}{3}$ or $\frac{2x}{100 \times 9} = \frac{4}{3}$ or $x = \frac{4 \times 9 \times 100}{3 \times 2} = 600$

Hence, **$\frac{2}{9}$ of 600% is $\frac{4}{3}$.** **Ans.**

(d) Let ₹ 7.50 of $x\%$ = ₹ 8

$\Rightarrow \frac{x}{100} \times 7.50 = 8$

or $x = \frac{8 \times 100}{7.50}\% = \frac{8 \times 100 \times 100}{750}\% = \frac{320}{3}\% = 106\frac{2}{3}\%$

Hence, **₹ 7.50 of $106\frac{2}{3}$% is ₹ 8.** **Ans.**

Exercise 9.2

1. Total number of eggs $= 400$

Number of rotten eggs $= 28$

Remaining eggs $= (400 - 28) = 372$

Number of eggs in dozen $= \frac{372}{12} = 31$

$\therefore$ Selling price of eggs = ₹ 31×48 = ₹ 1488, gain $= 4\%$

$\therefore$ Cost price $= \left(\frac{100}{100 + \text{gain}\%}\right) \times$ selling price

$= ₹\ \frac{100}{100 + 4} \times 1488 = ₹\ \frac{100}{104} \times 1488$

$= ₹\ 100 \times 14.3077 = ₹\ 1430.77$

Hence, **the cost price of eggs is ₹ 1430.77.** **Ans.**

2. Cost price of 140 oranges = ₹ 538.

Number of rotten oranges $= 26$

Remaining oranges $= 140 - 26 = 114$

Selling price of 5 dozen (60) oranges = ₹ 62×5 = ₹ 310

Remaining oranges after sell 5 dozen $= 114 - 60 = 54$

Now, selling price of 4 oranges = ₹ 22.50

Selling price of 1 orange = ₹ $\frac{22.50}{4}$

Selling price of 54 oranges = ₹ $\frac{22.50}{4} \times 54$ = ₹ $\frac{1215}{4}$ = ₹ 303.75

$\therefore$ Total selling price = ₹ $(310 + 303.75)$ = ₹ 613.75

Profit = Selling price − Cost price = ₹ $(613.75 - 538)$ = ₹ 75.75

Profit % $= \frac{\text{Proifit}}{\text{C.P.}} \times 100 = \frac{75.75 \times 100}{538} = \frac{7575}{538} = 14\frac{43}{538}$

Hence, **the Profit % is $14\frac{43}{538}$.** **Ans.**

3. Cost price of 80 quintal rice = ₹ 3200×80 = ₹ 256000

Amount expand overhead charges = ₹ 3200

Total cost price of 80 quintal rice = ₹ $(256000 + 3200)$

= ₹ 259200

$\therefore$ Cost price of 1 quintal rice = ₹ $\frac{259200}{80}$ = ₹ 3240

Gain $= 10\%$

Selling price $= \frac{100 + \text{gain}}{100} \times$ cost price

= ₹ $\frac{100 + 10}{100} \times 3240$ = ₹ $\frac{110}{100} \times 3240$ = ₹ 3564

Hence, **dealer should sell the rice for ₹ 3564 per quintal to gain 10%.** **Ans.**

4. Cost price of a old bike = ₹ 14000, Gain $= 30\%$

$\therefore$ Selling price $= \frac{100 + \text{gain}}{100} \times$ cost price

= ₹ $\frac{100 + 30}{100} \times 14000$ = ₹ $\frac{130}{100} \times 14000$ = ₹ 18200

Hence, **bike should sell in ₹ 18200 to get gain 30%.** **Ans.**

5. Let the cost price of first shirt = ₹ x

Then, cost price of second shirt = ₹ $(1000-x)$

and lost first shirt = 12%

$\therefore$ Selling price of first shirt = ₹ $\left(\frac{100-12}{100}\right)\times x$ = ₹ $\frac{88x}{100}$

$\because$ Gain of second shirt = 8%

$\therefore$ Selling price of second shirt = ₹ $\left(\frac{100+8}{100}\right)\times(1000-x)$

= ₹ $\frac{108(1000-x)}{100}$

According to question, ₹ $\frac{88x}{100}$ + ₹ $\frac{108}{100}(1000-x)=1000$

or $\quad 88x+108(1000-x)=$ ₹ 1000×100

or $\quad 88x +$ ₹ $108000-108x =$ ₹ 100000

or $\quad -20x =$ ₹ $100000 -$ ₹ 108000

or $\quad -20x = -$ ₹ 8000

or $\quad x = \frac{₹\ 8000}{20}$ = ₹ 400

Hence, the cost price of one shirt is ₹ **400** and the cost price of other shirt = ₹ $1000 -$ ₹ $400 =$ ₹ **600** **Ans.**

6. Let S.P. of one table = ₹ x

$\therefore$ S.P. of 40 tables = ₹ $40x$

And profit = ₹ $8x$

$\because$ C.P. of 40 tables = ₹ 24000

$\therefore$ S.P. = C.P. + Profit

or $\quad$ ₹ $40x =$ ₹ $24000 +$ ₹ $8x$

or $\quad$ ₹ $(40x-8x) =$ ₹ 24000

or $\quad$ ₹ $32x =$ ₹ 24000

or $\quad x = \frac{₹\ 24000}{32}$ = ₹ **750** **Ans.**

7. $\because$ C.P. of 11 toffees = ₹ 20

C.P. of 9 toffees = ₹ 20

L.C.M of 11,9 = 99

C.P. of 99 toffees of Ist $\frac{99}{11} \times 20$

$= ₹180$

C.P. of 99 toffees of IIst $\frac{99}{9} \times 20$

$= ₹220$

C.P. of 198 toffees $= 180 + 220$

$= ₹400$

C.P. of 198 toffees $= 198 \times 2$

$= ₹396$

$$\text{Loss \%} = \frac{\text{C.P - S.P}}{\text{C.P}} \times 100$$

$$= \frac{400\text{-}396}{400} \times 100$$

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

Hence, **loss = 1 %** **Ans.**

8. Let the cost price for Rajesh = ₹ 100

Gain = ₹ 40

$\therefore$C.P. for Vikash = ₹ 100 + ₹ 40 = ₹ 140

Gain = 20%

$\therefore$C.P. for Vishal = ₹ 140 + ₹ $\frac{140 \times 20}{100}$ = ₹ 168

$\because$ If S.P. of plot ₹ 168, then C.P. = ₹ 100

If S.P. of plot ₹ 1, then C.P. = ₹ $\frac{100}{168}$

If S.P. of plot ₹ 2310000, then C.P. = ₹ $\frac{100}{168} \times 2310000$

= ₹ 100×13750 = ₹ **1375000** **Ans.**

9. $\because$ C.P. = ₹ 36500

And sales tax = 8%

$\therefore$Bill amount = ₹ $\frac{36500 \times (100+8)}{100}$ = ₹ 365×108

= ₹ **39420** **Ans.**

10. The original price of the DVD player = ₹ $\frac{5400\times100}{(100+8)}$

= ₹ $\frac{5400\times100}{108}$ = ₹ 50×100 = ₹ **5000** **Ans.**

Exercise 9.3

1. Let the marked price of the instrument = ₹ x

Discount = ₹ $x\times\frac{40}{100}$ = ₹ $\frac{2x}{5}$

$\therefore$Selling price = ₹ x – ₹ $\frac{2x}{5}$ = ₹ $\frac{5x-2x}{5}$ = ₹ $\frac{3x}{5}$

Profit = 20%

$\therefore$C.P. = ₹ $\frac{100}{100+20}\times\frac{3x}{5}$ = ₹ $\frac{100}{120}\times\frac{3x}{5}$ = ₹ $\frac{x}{2}$

According to question, Selling price – Cost price = Profit

or ₹ $\frac{3x}{5}$ – ₹ $\frac{x}{2}$ = ₹ 300

or ₹ $\frac{6x-5x}{10}$ = ₹ 300

or x = ₹ 300×10 = ₹ **3000** **Ans.**

2. S.P. of a pair of shoes = ₹ $\frac{3120\times100}{(100+5+15)}$ = ₹ $\frac{3120\times100}{120}$

= ₹ 26×100 = ₹ **2600** **Ans.**

3. M.P. of a machine = ₹ 3760

S.P. of a machine = ₹ 3008

$\therefore$Discount = ₹ 3760 – ₹ 3008 = ₹ 752

$\therefore$Discount % = $\frac{₹\ 752\times100}{₹\ 3760}\%=\frac{100}{5}\%$ = **20%** **Ans.**

4. S.P. of almirah = ₹ $\frac{4416\times100}{(100-4)}$

= ₹ $\frac{4416\times100}{96}$ = ₹ 46×100 = ₹ **4600** **Ans.**

5. Cost price = ₹ 1480

Profit = ₹ $1480 \times \frac{10}{100}$ = ₹ 148

Price = ₹ 1480 + ₹ 148 = ₹ 1628

Marked price = ₹ $\frac{1628 \times (100 + 12.5)}{100}$ = ₹ **1831.50** **Ans.**

6. Marked price of watch = ₹ 3500

Discount = ₹ $3500 \times \frac{10}{100}$ = ₹ 350

∴Selling price = ₹ 3500 – ₹ 350 = ₹ 3150

Sales tax = ₹ $3150 \times \frac{10}{100}$ = ₹ 315

∴Amount will be pay to customer = ₹ 3150 + ₹ 315 = ₹ **3465**

Ans.

7. Saree cost = ₹ 2200

Gain = 12%

∴Gain = ₹ $2200 \times \frac{12}{100}$ = ₹ 264

∴Price = ₹ 2200 + ₹ 264 = ₹ 2464

Discount = 26%

∴Marked price = ₹ $\frac{2464 \times (100 + 26)}{100}$

= ₹ **3104.64** **Ans.**

8. Marked price of scooter = ₹ 17500

Discount = 12%

∴Selling price = ₹ $\frac{17500 \times (100 - 12)}{100}$

= ₹ 175×88 = ₹ **15400** **Ans.**

Exercise 9.4

1. Principal of first year = ₹ 3600

Rate of interest (R) = $5\frac{1}{2}$ % per annum = $\frac{11}{2}$ % per annum

and time (T) = 3 years

Interest for the first year $= \frac{P \times R \times T}{100} = ₹ \frac{3600 \times 11 \times 1}{100 \times 2}$

$= ₹ 18 \times 11 = ₹ 198$

$\therefore$ Amount at the end of first year $= ₹ 3600 + ₹ 198 = ₹ 3798$

Thus, principal for the second year (P) $= ₹ 3798$

Interest for the second year $= ₹ \frac{3798 \times 11 \times 1}{100 \times 2} = ₹ 208.89$

$\therefore$ Amount at the end of second year

$= ₹ 3798 + 208.89 = ₹ 4006.89$

Thus, principal for the third year (P) $= ₹ 4006.89$

Interest for the second year

$= ₹ \frac{4006.89 \times 11 \times 1}{100 \times 2} = ₹ \frac{44075.79}{200} = ₹ 220.38$

$\therefore$ Amount at the end of third year $= ₹ 4006.89 + ₹ 220.38$

$= ₹ 4227.27$

$\therefore$ Compound interest of 3 years $= ₹ 4227.27 - ₹ 3600$

$= ₹$ **627.27**

Hence, **the interest Rajan will have to pay after three years** $= ₹$ **627.27** **Ans.**

2. (a) Principal of first year $= ₹ 183750$, Rate of interest $= 7.6\%$ per annum and time $= 2$ years

Interest for the first year $= ₹ \frac{183750 \times 7.6 \times 1}{100} = ₹ \frac{183750 \times 76}{100 \times 10}$

$= ₹ \frac{13965000}{1000} = ₹ 13965$

$\therefore$ Amount at the end of first year

$= ₹ 183750 + ₹ 13965 = ₹ 197715$

Thus, principal for the second year (P) $= ₹ 197715$

Interest for the second year $= ₹ \frac{197715 \times 7.6 \times 1}{100} = ₹ \frac{197715 \times 76}{100 \times 10}$

$= ₹ \frac{15026340}{1000} = ₹ 1502.634$

$\therefore$ Amount at the end of second year $= ₹ 197715 + ₹ 1502.634$

$= ₹$ **212741.34** **Ans.**

(b) Principal for the third year (P) = ₹ 21274.34

Interest for third year = ₹ $\frac{21274.34 \times 7.6 \times 1}{100}$ = ₹ $\frac{21274134 \times 76}{100 \times 1000}$

= ₹ $\frac{1616834184}{100000}$ = ₹ 16168.34

Hence, **the interest for third year is ₹ 16168.34.** **Ans.**

3. Principal of the first year (P) = ₹ 4000

Rate of interest = 20% and time = 2 years

Interest for the first year = ₹ $\frac{4000 \times 20 \times 1}{100}$ = ₹ 800

Amount at the end of first year = ₹ 4000 + ₹ 800 = ₹ 4800

∵ Principal for the second year (P) = ₹ 4800

Interest for the second year = ₹ $\frac{4800 \times 20 \times 1}{100}$ = ₹ 960

∴ Amount at the end of second year = ₹ 4800 + ₹ 960 = ₹ **5760**

Compound interest = ₹ 5760 – ₹ 4000 = ₹ 1760

Hence, the amount is 5760 and compound interest is **1760. Ans.**

4. Principal (P) = ₹ 5000, Rate = 20% per annum

and Time = 3 years

Simple Interest : S.I. = $\frac{PRT}{100}$ = ₹ $\frac{5000 \times 20 \times 3}{100}$ = ₹ 3000

Compound Interest : Principal of the first year (P) = ₹ 5000

Interest for the first year = ₹ $\frac{5000 \times 20 \times 1}{100}$ = ₹ 1000

Amount at the end of first year = ₹ 5000 + ₹ 1000 = ₹ 6000

∴ Principal for the second year (P) = ₹ 6000

Interest for the second year = ₹ $\frac{6000 \times 20 \times 1}{100}$ = ₹ 1200

Amount at the end of second year = ₹ 6000 + ₹ 1200 = ₹ 7200

Interest for the third year = ₹ $\frac{7200 \times 20 \times 1}{100}$ = ₹ 1440

Amount at the end third year = ₹ 7200 + ₹ 1440 = ₹ 8640

Compound Interest = ₹ 8640 – ₹ 5000 = ₹ 3640

∴ Difference in compound interest and simple interest

= ₹ 3640 – ₹ 3000 = ₹ 640

Hence, **the difference in simple interest and compound interest is ₹ 640.** **Ans.**

5. Principal (P) = ₹ 3650, Rate = 20% per annum

Number of days 4 January to 31 January = $31 - 4 = 27$

Number of days in February = 28

Number of days in March = 18

∴Total number of days from 4, January 2015 to 18 March 2015

$= (27 + 28 + 18) = 73$ day.

$\therefore \text{Time} = \frac{73}{365}$ year

$\therefore \text{Interest} = \frac{PRT}{100} = ₹\ \frac{3650 \times 20 \times 73}{100 \times 365} = ₹\ 146$

Hence, **the interest is ₹ 146.** **Ans.**

6. Principal of first year = ₹ 2500

Rate of interest = 6% per annum and Time = 2 years.

Interest for the first year = $₹\ \frac{2500 \times 6 \times 1}{100} = ₹\ 150$

∴Amount at the end of first year = ₹ 2500 + ₹ 150 = ₹ 2650

Thus, principal for the second year = ₹ 2650

Interest at the end of second year = $₹\ \frac{2650 \times 6 \times 1}{100} = ₹\ 159$

∴Amount at the end of second year = ₹ 2650 + ₹ 159 = ₹ 2809

Hence, **the amount that Radha got = ₹ 2809.** **Ans.**

7. Principal of first year = ₹ 20000

Rate of interest = 20% per annum and Time = 2 years

Interest for the first year = $₹\ \frac{20000 \times 20 \times 1}{100} = ₹\ 4000$

∴Amount at the end of first year = ₹ 20000 + ₹ 4000 = ₹ 24000

Thus, principal for the second year (T) = ₹ 24000

Interest for the second year = $₹\ \frac{24000 \times 20 \times 1}{100} = ₹\ 4800$

∴Amount at the end of second year

= ₹ 24000 + ₹ 4800 = ₹ 28800

∴Compound interest of 2 years = ₹ 28800 − ₹ 20000 = ₹ 8800

Hence, **the compound interest of 2 years = ₹ 8800** **Ans.**

8. Rate of interest = 6% per annum = $\frac{6}{2}$% half-yearly = 3% per half yearly

Time = $1\frac{1}{2}$ years = $\frac{3}{2}$ years = $\frac{3}{2} \times 2$ half-yearly = 3 half-yearly

Principal for first half-year = ₹ $\frac{2000 \times 3 \times 1}{100}$ = ₹ 20×3 = ₹ 60

Amount at the end of first half-year = ₹ 2000 + ₹ 60 = ₹ 2060

Principal for the second half-year = ₹ 2060

$\therefore$ Interest for the second half years = ₹ $\frac{2060 \times 3 \times 1}{100}$ = ₹ $\frac{206 \times 3}{10}$

= ₹ $\frac{618}{10}$ = ₹ 61.80

Amount at the end of second half year

= ₹ 2060 + ₹ 61.80 = ₹ 2121.80

Principal for the third half year = ₹ 2121.80

$\therefore$ Interest for the third half year = ₹ $\frac{2121.80 \times 3 \times 1}{100}$

= ₹ $\frac{212180 \times 3}{100 \times 100}$

= ₹ $\frac{636540}{10000}$ = ₹ 63.654

Amount at the end of third half year

= ₹ 2121.80 + ₹ 63.654 = ₹ 2185.454

$\therefore$ Compound interest of $1\frac{1}{2}$ years = ₹ 2185.454 – ₹ 2000

= ₹ 185.454

Hence, **the compound interest of $1\frac{1}{2}$ years = ₹ 185.454** **Ans.**

9. Here, P = ₹ 4000, A = ₹ 5400, $T = 4$ years

$\because A = P\left(1 + \frac{r}{100}\right)^T$

$\therefore \quad ₹\,5400 = ₹\,4000\left(1+\frac{r}{100}\right)^4$

or $\quad \frac{5400}{4000} = \left(1+\frac{r}{100}\right)^4$

or $\quad \frac{27}{20} = \left(1+\frac{r}{100}\right)^4$

or $\quad 1+\frac{r}{100} = \left(\frac{27}{20}\right)^{\frac{1}{4}}$

or $\quad 1+\frac{r}{100} = 1.078$

or $\quad \frac{r}{100} = 0.78$

or $\quad r = 7.8\%$

Here $P = ₹\,8600$, $T = 3$ years, $r = 7.8\%$

$$A = P\left(1+\frac{r}{100}\right)^T$$

$$= ₹\,8600\left(1+\frac{7.8}{100}\right)^3$$

$$= ₹\,8600\left(1.078\right)^3$$

$$= ₹\,8600 \times 1.252726552$$

$$= ₹\,\mathbf{10773.44}$$ **Ans.**

10. Rate of interest $= 20\%$ per annum $= \frac{20}{4}$ per quarter $= 5\%$ per quarter and Time $= \frac{3}{4}$ years $= \frac{3}{4} \times 4$ quarters $= 3$ quarters

$\because$ Principal for first quarter $= ₹\,40000$

$\therefore$ Interest for first quarter $= ₹\,\frac{40000 \times 5 \times 1}{100} = ₹\,2000$

Amount at the end of first quarter
$= ₹\,40000 + ₹\,2000 = ₹\,42000$

$\therefore$ Principal for second quarter $= ₹\,42000$

Interest for second quarter = ₹ $\frac{42000 \times 5 \times 1}{100}$ = ₹ 2100

Amount at the end of second quarter
= ₹ 42000 + ₹ 2100 = ₹ 44100

∴Principal for third quarter = ₹ 44100

Interest for third quarter = ₹ $\frac{44100 \times 5 \times 1}{100}$ = ₹ 2205

∴Amount at the and of third quarter
= ₹ 44100 + ₹ 2205 = ₹ 46305

Compound interest = ₹ 46305 – ₹ 40000 = ₹ 6305

Hence, **the compound interest** = ₹ **6305** **Ans.**

11. Rate of interest $= 12\frac{1}{2}\%$ per annum $= \frac{25}{2}\%$ per annum

Time = 2 years

Principal for first year = ₹ 16000

Interest for first year = ₹ $\frac{16000 \times 25 \times 1}{100 \times 2}$ = ₹ 80 × 25 = ₹ 2000

Intersect at the end of first year = ₹ 16000 + ₹ 2000 = ₹ 18000

∴Principal for second year = ₹ 18000

Interest for second year = ₹ $\frac{18000 \times 25 \times 1}{100 \times 2}$ = ₹ 90 × 25 = ₹ 2250

∴Amount at the end of second = ₹ 18000 + ₹ 2250 = ₹ 20250

Compound interest = ₹ 20250 – ₹ 16000 = ₹ 4250

Hence, **the compound interest** = ₹ **4250** **Ans.**

12. Interest = ₹ 1680, Rate of interest (R) $= 2\frac{1}{2}\%$ per annum $= \frac{5}{2}\%$ per annum.

Time (T) = 2 years

In $I = \frac{PRT}{100}$

$\therefore P = \frac{I \times 100}{RT}$ = ₹ $\frac{1680 \times 100 \times 2}{5 \times 2}$ = ₹ 1680 × 20 = ₹ 33600

Hence, **the principal is ₹ 33600.** **Ans.**

13. (a) Amount = $P + I$ = ₹ 7040 + ₹ 500 = ₹ **7540** **Ans.**

(b) Interest $= A - P =$ ₹ 6240 − ₹ 5780 = ₹ **460** **Ans.**

(c) $I = \dfrac{PRT}{100} =$ ₹ $\dfrac{2750 \times 20 \times 4}{100} =$ ₹ $275 \times 8 =$ ₹ **2200** **Ans.**

And amount $= P + I =$ ₹ 2750 + ₹ 2200 = ₹ **4950** **Ans.**

(d) $I = \dfrac{PRT}{100} =$ ₹ $\dfrac{9600 \times 8 \times 3}{100 \times 12} =$ ₹ $96 \times 2 =$ ₹ **192** **Ans.**

And amount $= P + I =$ ₹ 9600 + ₹ 192 = ₹ **9792** **Ans.**

(e) $P = \dfrac{I \times 100}{RT} =$ ₹ $\dfrac{4500 \times 100}{6 \times 3} =$ ₹ $500 \times 50 =$ ₹ **25000** **Ans.**

And amount $= P + I =$ ₹ 25000 + ₹ 4500 = ₹ **29500** **Ans.**

(f) $I = \dfrac{PRT}{100} =$ ₹ $\dfrac{4750 \times 49 \times 3}{100 \times 2} =$ ₹ **3491.25** **Ans.**

And amount $= P + I =$ ₹ $4750 + 3491.25 =$ ₹ **8241.25** **Ans.**

(g) $P = \dfrac{I \times 100}{RT} =$ ₹ $\dfrac{500 \times 100 \times 365}{20 \times 73} =$ ₹ $500 \times 5 \times 5 =$ ₹ **12500** **Ans.**

Amount $= P + I =$ ₹ 12500 + ₹ 500 = ₹ **13000** **Ans.**

(h) $T = \dfrac{I \times 100}{P \times R} =$ ₹ $\dfrac{5400 \times 100}{5000 \times 9} =$ **12 years** and

Amount $= P + I =$ ₹ 5000 + ₹ 5400 = ₹ **10400** **Ans.**

	Principal (₹)	Rate % (p.a.)	Time	Interest (₹)	Amount (₹)
(a)	₹ 7040	—	—	₹ 500	₹ **7540**
(b)	₹ 5780	—	—	₹ **460**	₹ **6240**
(c)	₹ 2750	20%	4 years	₹ **2200**	₹ **4950**
(d)	₹ 9600	8%	3 months	₹ **192**	₹ **9792**
(e)	₹ **25000**	6%	3 years	₹ 4500	₹ **29500**
(f)	₹ 4750	$24\frac{1}{2}\%$	3 years	₹ **3491.25**	₹ **8241.25**
(g)	₹ **12500**	20%	73 days	₹ 500	₹ **13000**
(h)	₹ 5000	9%	**12 years**	₹ 5400	₹ **10400**

Exercise 9.5

1. Principal (P) = ₹ 31250, Amount (A) = ₹ 35152,

Time $= 1\frac{1}{2}$ years $= \frac{3}{2}$ years

Let the Rate $= R\%$ per annum

We know that $A = P\left(1+\frac{R}{200}\right)^{2n}$

or $\quad$ ₹ $35152 =$ ₹ $31250\left(1+\frac{R}{200}\right)^{2\times\frac{3}{2}}$

or $\quad \frac{35152}{31250} = \left(1+\frac{R}{200}\right)^{3}$ $\quad$ or $\frac{17576}{15625} = \left(1+\frac{r}{200}\right)^{3}$

$\left(\frac{26}{25}\right)^{3} = \left(1+\frac{R}{200}\right)^{3}$ $\quad$ or $\frac{26}{25} = 1+\frac{R}{200}$ [On comparing the powers]

or $\quad \frac{R}{200} = \frac{26}{25} - 1$ $\quad$ or $\frac{R}{200} = \frac{26-25}{25} = \frac{1}{25}$

or $\quad 25R = 200$ $\quad$ or $R = \frac{200}{25} = 8$

$\therefore \quad R = 8$

Hence, **the rate percent = 8% per annum.** **Ans.**

2. Present cost of motorcycle (A) =₹ 20160

Reduction in the rate (R) = 6% per annum

and time (T) = 2 years

Let the rate of motorcycle before two years $= P$

$\therefore A = P\left(1-\frac{R}{100}\right)^{n}$ $\quad$ or ₹ $20160 = P\left(1-\frac{6}{100}\right)^{2}$

or ₹ $20160 = P\left(\frac{94}{100}\right)^{2}$ $\quad$ or ₹ $20160 = P\left(\frac{47}{50}\right)^{2}$

or ₹ $20160 = \frac{P\times 47\times 47}{50\times 50}$

or $P =$ ₹ $\frac{20160\times 50\times 50}{47\times 47} =$ ₹ $\frac{50400000}{2209} =$ ₹ 22815.75

Hence, **the cost of motor cyclebefore two years is ₹ 22815.75.** **Ans.**

3. Principal (P) = ₹ 3200

Rate (R) = 20% per annum, Time = 6 months = $\frac{6}{12}$ year = $\frac{1}{2}$ year

$\therefore A = P\left(1+\frac{R}{400}\right)^{4n}$ or $A = ₹\ 3200\left(1+\frac{20}{400}\right)^{4\times\frac{1}{2}}$

or $A = ₹\ 3200\left(1+\frac{1}{20}\right)^{2}$ or $A = ₹\ 3200\left(\frac{21}{20}\right)^{2}$

or $A = ₹\ 3200\times\frac{21}{20}\times\frac{21}{20} = ₹\ \frac{3200\times21\times21}{20\times20} = ₹\ 3528$

Compound interest = Amount − Principal

= ₹ 3528 − ₹ 3200 = ₹ 328

Hence, **compound interest = ₹ 328** **Ans.**

4. Let the principal = ₹ 100

Simple interest of ₹ 100 $= \frac{PRT}{100} = ₹\ \frac{100\times10\times2}{100} = ₹\ 20$

Compound interest of ₹ 100 $= \left[100\left(1+\frac{10}{100}\right)^{2}-100\right]$

$= ₹\left[100\left(\frac{11}{10}\right)^{2}-100\right]$

$= ₹\left[100\times\frac{121}{100}-100\right] = ₹\ (121-100) = ₹\ 21$

Difference between compound interest and simple interest on ₹ 100 = ₹ (21 − 20) = ₹ 1

If difference is ₹ 1, then principal = ₹ 100

If difference is ₹ 600, then principal = ₹ 100 × 600 = ₹ 60000

Hence, **the sum is ₹ 60000.** **Ans.**

5. Principal (P) = ₹ 6250, Rate (R) = 6% per annum

and Time (n) = 3 years

$\therefore A = P\left(1+\frac{R}{100}\right)^n$ or $A = ₹\ 6250\left(1+\frac{6}{100}\right)^3$

or $A = ₹\ 6250\left(\frac{106}{100}\right)^3$ or $A = ₹\ 6250\left(\frac{53}{50}\right)^3$

or $A = ₹\ 6250 \times \frac{53\times53\times53}{50\times50\times50} = ₹\ \frac{53\times53\times53}{20}$

$\therefore A = ₹\ 7443.85$

Compound interest = Amount – Principal

= ₹ 7443.85 – ₹ 6250 = ₹ 1193.85

Hence, **amount = ₹ 7443.85 and compound interest = ₹ 1193.85** **Ans.**

6. Amount (A) = ₹ 11664, Rate (R) = 8% per annum and Time (n) = 2 years

$\therefore A = P\left(1+\frac{R}{100}\right)^n$ or ₹ $11664 = P\left(1+\frac{8}{100}\right)^2$

or ₹ $11664 = P\left(\frac{108}{100}\right)^2$ or ₹ $11664 = P\left(\frac{27}{25}\right)^2$

or ₹ $11664 = P \times \frac{27\times27}{25\times25}$

or $P = ₹\ \frac{11664\times25\times25}{27\times27} = ₹\ 16\times625 = ₹\ 10000$

Hence, **the sum = ₹ 10000** **Ans.**

7. Present population (P) = 1000000

Population after 3 years (A) = 1225043

Time (n) = 3 years, Rate (R) = ?

$A = P\left(1+\frac{R}{100}\right)^n$ or $1225043 = 1000000\left(1+\frac{R}{100}\right)^3$

or $\frac{1225043}{1000000} = \left(1+\frac{R}{100}\right)^3$ or $\left(\frac{107}{100}\right)^3 = \left(1+\frac{R}{100}\right)^3$

or $\frac{107}{100} = 1+\frac{R}{100}$ or $\frac{R}{100} = \frac{107}{100} - 1$

or $\frac{R}{100}=\frac{107-100}{100}=\frac{7}{100}$ or $R=\frac{100\times 7}{100}=7\%$

Hence, **the rate of growth = 7% per annum** **Ans.**

8. Principal (P) = ₹ 3200, Amount (A) = ₹ 3395.87

Rate (R) = 4% per annum, and Time = n years

We know that $A=P\left(1+\frac{R}{200}\right)^{2n}$

or $\text{₹ } 3395.87 = \text{₹ } 3200\left(1+\frac{4}{200}\right)^{2n}$

or $\frac{\text{₹ } 3395.8656}{\text{₹ } 3200}=\left(1+\frac{1}{50}\right)^{2n}$

or $\frac{33958656}{32000000}=\left(\frac{51}{50}\right)^{2n}$

or $\frac{132651}{125000}=\left(\frac{51}{50}\right)^{2n}$

or $\left(\frac{51}{50}\right)^{3}=\left(\frac{51}{50}\right)^{2n}$

or $2n=3$

or $n=\frac{3}{2}$ years $=\mathbf{1\frac{1}{2}}$ **years** **Ans.**

9. Present production (P) = 60000

After production (A) = 79860

Increased production = 10% per annum

We know that $A=P\left(1+\frac{r}{100}\right)^{n}$ or $79860=60000\left(1+\frac{10}{100}\right)^{n}$

or $\frac{79860}{60000}=\left(\frac{11}{10}\right)^{n}$ or $\frac{1331}{1000}=\left(\frac{11}{10}\right)^{n}$ or $\left(\frac{11}{10}\right)^{3}=\left(\frac{11}{10}\right)^{n}$

On comparing the power, $n=3$

Hence, **after 3 years the production will be 79860.** **Ans.**

10. Principal (P) = ₹ 4000, interest of the rate = 8% per annum,

Time (n) = 1 year

$\therefore$ Compound amount $(A) = P\left(1+\frac{r}{200}\right)^{2n} = ₹\ 4000\left(1+\frac{8}{200}\right)^{2\times1}$

$= ₹\ 4000\left(1+\frac{1}{25}\right)^{2} = ₹\ 4000\left(\frac{26}{25}\right)^{2}$

$= ₹\ 4000\times\frac{26}{25}\times\frac{26}{25} = ₹\ \frac{32\times26\times26}{5} = ₹\ 4326.40$

$\therefore$ Compound interest = Amount $-$ Principal

$= ₹\ 4326.40 - ₹\ 4000 = ₹\ 326.40$

Hence, **the interest after one year = ₹ 326.40** **Ans.**

11. Principal $(P) = ₹\ 4000$, Rate $(r) = 20\%$ per annum

Time $(n) = 18$ months $= \frac{18}{12}$ years $= \frac{3}{2}$ years

$\therefore$ Compound amount $(A) = P\left(1+\frac{r}{200}\right)^{2n} = ₹\ 4000\left(1+\frac{20}{200}\right)^{2\times\frac{3}{2}}$

$= ₹\ 4000\left(1+\frac{1}{10}\right)^{3} = ₹\ 4000\left(\frac{11}{10}\right)^{3}$

$= ₹\ 4000\times\frac{11}{10}\times\frac{11}{10}\times\frac{11}{10} = ₹\ 4\times1331 = ₹\ 5324$

Compound interest = Amount $-$ Principal

$= ₹\ 5324 - ₹\ 4000 = ₹\ 1324$

Hence, **compound interest is ₹ 1324.** **Ans.**

12. Principal (P) = ₹ 40000, Time (n) = 3 years

Rate (r) = 6.5 per annum $= \frac{65}{10} = \frac{13}{2}$ per annum

$\therefore$ Compound amount (A)

$= P\left(1+\frac{r}{100}\right)^{n} = ₹\ 40000\left(1+\frac{13}{2\times100}\right)^{3}$

$= ₹\ 40000\left(1+\frac{13}{200}\right)^{3} = ₹\ 40000\left(\frac{213}{200}\right)^{3}$

$= ₹\ 40000\times\frac{213}{200}\times\frac{213}{200}\times\frac{213}{200} = ₹\ \frac{9663597}{200}$

$= ₹\ 48317.99$

Compound interest = Amount − Principal

= ₹ 48317.99 − ₹ 40000 = ₹ 8317.99

Hence, **amount = ₹ 48317.99 and compound interest**

= ₹ 8317.99 **Ans.**

13. Principal (P) = ₹ 1000, Amount (A) = ₹ 1102.50

Time (n) = 2 years, Rate (R) = ?

We know that $A = P\left(1+\frac{r}{100}\right)^n$

or ₹ 1102.50 = ₹ $1000\left(1+\frac{r}{100}\right)^2$

or $\frac{1102.50}{1000} = \left(1+\frac{r}{100}\right)^2$ or $\frac{110250}{1000\times100} = \left(1+\frac{r}{100}\right)^2$

or $\frac{11025}{10000} = \left(1+\frac{r}{100}\right)^2$ or $\frac{441}{100} = \left(1+\frac{r}{100}\right)^2$

or $\left(\frac{21}{20}\right)^2 = \left(1+\frac{r}{100}\right)^2$ or $\frac{21}{20} = 1+\frac{r}{100}$

or $\frac{r}{100} = \frac{21}{20} - 1 = \frac{21-20}{20} = \frac{1}{20}$

or $\frac{r}{100} = \frac{1}{20}$ or $r = \frac{100}{20}\% = 5\%$

Hence, **the percent per annum will be 5%.** **Ans.**

14. Principal (P) = ₹ 1300 Rate (r) = 10%

Amount (A) = $P + I$ = ₹ 1300 + ₹ 273 = ₹ 1573

We know that $A = P\left(1+\frac{r}{100}\right)^n$

or ₹ 1573 = ₹ $1300\left(1+\frac{10}{100}\right)^n$ or $\frac{1573}{1300} = \left(1+\frac{1}{10}\right)^n$

or $\frac{1573}{1300} = \left(\frac{11}{10}\right)^n$ or $\frac{121}{100} = \left(\frac{11}{10}\right)^n$ or $\left(\frac{11}{10}\right)^2 = \left(\frac{11}{10}\right)^n$

On comparing the power $n = 2$

Hence, **the required time = 2 years.** **Ans.**

Exercise 9.6

1. Here, $P = ₹\ 42000$, $R = 8\% = \frac{8}{2}\%$ half-yearly $= 4$ half-yearly

and $n = 1$ years $= 1 \times 2$ half years $= 2$ half years

We know that, $A = P\left(1 + \frac{R}{100}\right)^n$

$\therefore A = ₹\ 42000\left(1 + \frac{4}{100}\right)^2 = ₹\ 42000\left(1 + \frac{1}{25}\right)^2$

$= ₹\ 42000 \times \left(\frac{26}{25}\right)^2 = ₹\ 42000 \times \frac{26}{25} \times \frac{26}{25}$

$= ₹\ \frac{336 \times 26 \times 26}{5} = ₹\ \frac{227136}{5} = ₹\ 45427.20$

$\therefore$ Compound interest = Amount − Principal

$= ₹\ 45427.20 - ₹\ 42000 = ₹\ 3427.20$

Hence, **the compound interest is ₹ 3427.20.** **Ans.**

2. (a) Here, $P = ₹\ 7500$, $R = 8\%$ and $n = 2$ years

We know that, $A = P\left(1 + \frac{R}{100}\right)^n = ₹\ 7500\left(1 + \frac{8}{100}\right)^2$

$= ₹\ 7500\left(1 + \frac{2}{25}\right)^2 = ₹\ 7500\left(\frac{27}{25}\right)^2$

$= ₹\ 7500 \times \frac{27}{25} \times \frac{27}{25} = ₹\ 12 \times 27 \times 27 = ₹\ 8748$

$\therefore$ Compound interest = Amount − Principal

$= ₹\ 8748 - ₹\ 7500 = ₹\ 1248$

Hence, **the compound interest = ₹ 1248** **Ans.**

(b) Here, $P = ₹\ 8000$, $R = 15\%$ and $n = 4$ years

We know that, $A = P\left(1 + \frac{R}{100}\right)^n = ₹\ 8000\left(1 + \frac{15}{100}\right)^4$

$= ₹\ 8000\left(1 + \frac{3}{20}\right)^4 = ₹\ 8000\left(\frac{23}{20}\right)^4$

$= ₹\ 8000 \times \frac{23}{20} \times \frac{23}{20} \times \frac{23}{20} \times \frac{23}{20}$

$= ₹\ \frac{23 \times 23 \times 23 \times 23}{20} = ₹\ \frac{279841}{20} = ₹\ 13992.05$

$\therefore$ Compound interest = Amount $-$ Principal

$= ₹\ 13992.05 - ₹\ 8000 = ₹\ 5992.05$

Hence, **the compound interest** = ₹ **5992.05** **Ans.**

(c) Here, $P = ₹\ 20000$, $R = 10\%$ per annum and $n = 2$ years

We know that,

$A = P\left(1 + \frac{R}{100}\right)^n = ₹\ 20000\left(1 + \frac{10}{100}\right)^2$

$= ₹\ 20000\left(1 + \frac{1}{10}\right)^2 = ₹\ 20000\left(\frac{11}{10}\right)^2$

$= ₹\ 20000 \times \frac{11}{10} \times \frac{11}{10} = ₹\ 200 \times 121 = ₹\ 24200$

$\therefore$ Compound interest = Amount $-$ Principal

$= ₹\ 24200 - ₹\ 20000 = ₹\ 4200$

Hence, **the compound interest** = ₹ **4200** **Ans.**

(d) Here, $P = ₹\ 18000$, $R = 22\%$ and $n = 2$ years

$\therefore\ A = P\left(1 + \frac{R}{100}\right)^n = ₹\ 18000\left(1 + \frac{22}{100}\right)^2$

$= ₹\ 18000\left(1 + \frac{11}{50}\right)^2 = ₹\ 18000\left(\frac{61}{50}\right)^2$

$= ₹\ 18000 \times \frac{61}{50} \times \frac{61}{50} = ₹\ \frac{36 \times 61 \times 61}{5}$

$= ₹\ \frac{133956}{5} = ₹\ 26791.20$

$\therefore$ Intenrest $= ₹\ 26791.20 - ₹\ 18000 = ₹$ **8791.20** **Ans.**

3. (a) Here, $P = ₹\ 3500$, $R = 6\%$ and $n = 4$ years

We know that,

Amount (A)$= P\left(1 + \frac{R}{100}\right)^n = ₹\ 3500\left(1 + \frac{6}{100}\right)^4$

$= ₹\ 3500\left(1+\frac{3}{50}\right)^4 = ₹\ 3500\left(\frac{53}{50}\right)^4$

$= ₹\ 3500\times\frac{53}{50}\times\frac{53}{50}\times\frac{53}{50}\times\frac{53}{50}$

$= ₹\ \frac{7\times53\times53\times53\times53}{12500} = ₹\ \frac{55233367}{12500} = ₹\ 4418.67$

Hence, **the amount is ₹ 4418.67.** **Ans.**

(b) Here, $P = ₹\ 9450$, $n = 3$ years and $R = 7\%$

We know that,

Amount (A) $= P\left(1+\frac{R}{100}\right)^n = ₹\ 9450\left(1+\frac{7}{100}\right)^3$

$= ₹\ 9450\left(\frac{107}{100}\right)^3 = ₹\ 9450\times\frac{107}{100}\times\frac{107}{100}\times\frac{107}{100}$

$= ₹\ \frac{378\times107\times107\times107}{4\times100\times100} = ₹\ \frac{463066254}{40000} = ₹\ 11576.66$

Hence, **the amount is ₹ 11576.66.** **Ans.**

(c) Here, $P = ₹\ 9360$, $R = 2\%$ and $n = 4$ years

$\therefore$ $A = P\left(1+\frac{R}{100}\right)^n$

$= ₹\ 9360\left(1+\frac{2}{100}\right)^4$

$= ₹\ 9360\left(1+\frac{1}{50}\right)^4$

$= ₹\ 9360\left(\frac{51}{50}\right)^4$

$= ₹\ 9360\times\frac{51}{50}\times\frac{51}{50}\times\frac{51}{50}\times\frac{51}{50}$

$= ₹\ \frac{117\times51\times51\times51\times51}{5\times25\times25\times25}$

$= ₹\ \frac{791528517}{78125} = ₹\ \mathbf{10131.57}$ **Ans.**

4. Principal (P) = ₹ 32000, Time (n) = 2 years
and Rate (R) = 5% per annum

$\therefore$ Amount (A) $= P\left(1+\frac{R}{100}\right)^n = ₹\ 32000\left(1+\frac{5}{100}\right)^2$

$= ₹\ 32000\left(1+\frac{1}{20}\right)^2 = ₹\ 3200\left(\frac{21}{20}\right)^2$

$= ₹\ 32000 \times \frac{21}{20} \times \frac{21}{20} = ₹\ 80 \times 441 = ₹\ 35280$

Compound interest = Amount − Principal
= ₹ 35280 − ₹ 32000 = ₹ 3280
Hence, **the amount = ₹ 35280 and compound interest = ₹ 3280.** **Ans.**

5. Principal (P) = ₹ 150000, Time (n) = 3 years
and Rate = 6% per annum
We know that,

Amount (A) $= P\left(1+\frac{R}{100}\right)^n = ₹\ 150000\left(1+\frac{6}{100}\right)^3$

$= ₹\ 150000\left(1+\frac{3}{50}\right)^3 = ₹\ 150000\left(\frac{53}{50}\right)^3$

$= ₹\ 150000 \times \frac{53}{50} \times \frac{53}{50} \times \frac{53}{50}$

$= ₹\ \frac{6 \times 53 \times 53 \times 53}{5} = ₹\ \frac{893262}{5} = ₹\ 178652.40$

Compound interest = Amount − Principal
= ₹ 178652.40 − ₹ 150000 = ₹ 28652.40
Hence, **compound interest = ₹ 28652.40** **Ans.**

6. Principal (P) = ₹ 80000, Amount (A) = ₹ 88200
Rate (R) = 5% annual and Time (n) = ?
We know that, $A = P\left(1+\frac{R}{100}\right)^n$ or ₹ 88200 = ₹ $80000\left(1+\frac{5}{100}\right)^n$

or $\frac{88200}{80000} = \left(1+\frac{1}{20}\right)^n$ or $\frac{441}{400} = \left(\frac{21}{20}\right)^n$

$$\left(\frac{21}{20}\right)^2 = \left(\frac{21}{20}\right)^n$$

On comparing the power, $n = 2$

Hence, **the required time = 2 years.** **Ans.**

7. Amount (A) = ₹ 7290, Rate (R) = 8% per annum

Time (n) = 2 years, and Principal (P) = ?

We know that,

$A = P\left(1 + \frac{R}{100}\right)^n$ or ₹ $7290 = P\left(1 + \frac{8}{100}\right)^2$

or ₹ $7290 = P\left(1 + \frac{2}{25}\right)^2$ or ₹ $7290 = P\left(\frac{27}{25}\right)^2$

or ₹ $7290 = P \times \frac{27}{25} \times \frac{27}{25}$ or $P = \frac{7290 \times 25 \times 25}{27 \times 27}$ = ₹ 6250

Hence, **the sum invested = ₹ 6250** **Ans.**

8. Principal (P) = ₹ 10000, Rate = 5% per annum

Time (n) $= 2\frac{1}{2}$ years $= \frac{5}{2}$ years $= 2$ years $+ \frac{1}{2}$ years

$$A = P\left(1 + \frac{r}{100}\right)^n = ₹\ 10000\left(1 + \frac{5}{100}\right)^{2\frac{1}{2}}$$

$$= ₹\ 10000\left(1 + \frac{1}{20}\right)^2 \left(1 + \frac{1}{40}\right)$$

$$= ₹\ 10000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{41}{40}$$

$$= ₹\ \frac{5 \times 21 \times 21 \times 41}{8} = ₹\ \frac{90405}{8} = ₹\ 11300.63$$

$\therefore$ **Compound interest** = ₹ 11300.63 − ₹ 10000 = ₹ **1300.63** **Ans.**

9. Principal (P) = ₹ 15000, Rate = 6% per annum $= \frac{6}{2}$ per half yearly = 3% half yearly

Time (n) $= 1\frac{1}{2}$ years $= \frac{3}{2} \times 2$ half-years $= 3$ half years.

We know that,

$A = P\left(1+\frac{R}{100}\right)^n = ₹\ 15000\left(1+\frac{3}{100}\right)^3$

$= ₹\ 15000\left(\frac{103}{100}\right)^3 = ₹\ 15000 \times \frac{103}{100} \times \frac{103}{100} \times \frac{103}{100}$

$= ₹\ \frac{3 \times 1092727}{200} = ₹\ \frac{3278181}{200} = ₹\ 16390.91$

$\therefore$ Compound interest = Amount − Principal

= ₹ 16390.91 − ₹ 15000 = ₹ 1390.91

Hence, **the compound interest = ₹ 1390.91** **Ans.**

10. Simple interest = ₹ 1000, $R = 10\%$ per annum

Time (T) = 2 years, principal (P) = ?

$\therefore$ S.I. $= \frac{PRT}{100}$ or $P = \frac{\text{S.I.} \times 100}{\text{RT}}$

$\therefore P = ₹\ \frac{1000 \times 100}{10 \times 2}$ or $P = ₹\ 5000$

Now, Principal (P) = ₹ 5000, Rate (R) = 8%

Time (n) = 2 years

We know that, $A = P\left(1+\frac{R}{100}\right)^n = ₹\ 5000\left(1+\frac{8}{100}\right)^2$

$= ₹\ 5000\left(1+\frac{2}{25}\right)^2 = ₹\ 5000\left(\frac{27}{25}\right)^2$

$= ₹\ 5000 \times \frac{27}{25} \times \frac{27}{25} = ₹\ 8 \times 27 \times 27 = ₹\ 5832$

Compound interest = Amount − Principal

= ₹ 5832 − ₹ 5000 = ₹ 832

Hence, **the compound interest = ₹ 832 and amount = ₹ 5832.**

Ans.

11. Principal (P) = ₹ 6750, Amount (A) = ₹ 8192

Rate $= 6\frac{2}{3}\%$ per annum $= \frac{20}{3}$ per annum

Time (n) = ?

We know that,

$A = P\left(1+\frac{R}{100}\right)^n$ or ₹ 8192 = ₹ 6750$\left(1+\frac{20}{3\times100}\right)^n$

or $\frac{8192}{6750}=\left(1+\frac{1}{15}\right)^n$ or $\frac{4096}{3375}=\left(\frac{16}{15}\right)^n$

or $\left(\frac{16}{15}\right)^3=\left(\frac{16}{15}\right)^n$

On comparing power, $n=3$

Hence, **the required time = 3 years.** **Ans.**

12. Amount (A) = ₹ 4177.20, Rate (R) = 18% per annum

Time (n) = 2 years, P = ?

We know that,

$A = P\left(1+\frac{R}{100}\right)^n$ or ₹ 4177.20 $= P\left(1+\frac{18}{100}\right)^2$

or ₹ 4177.20 $= P\left(1+\frac{9}{50}\right)^2$ or ₹ 4177.20 $= P\left(\frac{59}{50}\right)^2$

or ₹ 4177.20 $= \frac{P\times59\times59}{50\times50}$

or $P = \frac{4177.20\times50\times50}{59\times59}$ = ₹ $\frac{417720\times50\times50}{59\times59\times100}$

= ₹ 120 × 25 = ₹ 3000

Hence, **the invested money = ₹ 3000** **Ans.**

13. Principal (P) = ₹ 15625

Rate (R) = 16% per annum = $\frac{16}{4}$% quarterly = 4% quarterly

Time (n) = 9 months = $\frac{9}{12}$ years = $\frac{3}{4}$ years = $\frac{3}{4}\times4$ quarterly = 3 quarterly

We know that,

$A = P\left(1+\frac{R}{100}\right)^n$ = ₹ 15625$\left(1+\frac{4}{100}\right)^3$

= ₹ 15625$\left(1+\frac{1}{25}\right)^3$ = ₹ 15625$\left(\frac{26}{25}\right)^3$

$= ₹\ 15625 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25} = ₹\ 26 \times 26 \times 26 = ₹\ 17576$

Hence, **the amount is ₹ 17576.** **Ans.**

14. Let the Principal = ₹ 100

$\therefore$Simple interest of ₹ 100 $= \frac{PRT}{100} = ₹\ \frac{100 \times 5 \times 3}{100} = ₹\ 15$

Compound interest of

$₹\ 100 = ₹\left[100\left(1+\frac{5}{100}\right)^3 - 100\right] = ₹\left[100\left(1+\frac{1}{20}\right)^3 - 100\right]$

$= ₹\left[100 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} - 100\right]$

$= ₹\left[\left(\frac{9261}{80}\right) - 100\right] = ₹\ (115.7625 - 100) = ₹\ 15.7625$

Difference between compound interest and simple interest on ₹ 100 = ₹ (15.7625 − 15) = ₹ 0.7625

If difference is ₹ 0.7625, then principal = ₹ 100

If difference is ₹ 289, then principal = $₹\ \frac{100 \times 289}{0.7625}$

$= ₹\ \frac{100 \times 289 \times 10000}{7625} = ₹\ \frac{1000 \times 289000}{7625}$

= ₹ 37901.64

Hence, the sum is = **₹ 37901.64.** **Ans.**

15. Amount (A) = ₹ 12167, Time (n) = 3 years

Rate (R) = 15% per annum, $P = ?$

We know that,

$A = P\left(1+\frac{R}{100}\right)^n$ or $₹\ 12167 = P\left(1+\frac{15}{100}\right)^3$

or $₹\ 12167 = P\left(1+\frac{3}{20}\right)^3$ or $₹\ 12167 = P\left(\frac{23}{20}\right)^3$

or $₹\ 12167 = P \times \frac{23}{20} \times \frac{23}{20} \times \frac{23}{20}$

$\therefore P = ₹\ \frac{12167 \times 20 \times 20 \times 20}{23 \times 23 \times 23} = ₹\ 8000$

Hence, **the sum is ₹ 8000.** **Ans.**

16. Principal (P) = ₹ 6400, Time = 2 years

Rate (R) $= 6\frac{1}{4}\%$ per annum $= \frac{25}{4}\%$ per annum

Simple interest : S.I. $= \frac{PRT}{100} =$ ₹ $\frac{6400 \times 25 \times 2}{100 \times 4}$

$=$ ₹ $32 \times 25 =$ ₹ 800

Compound interest : We know that

$$A = P\left(1 + \frac{R}{100}\right)^n$$

$$A = ₹\ 6400\left(1 + \frac{25}{4 \times 100}\right)^2 = ₹\ 6400\left(1 + \frac{1}{16}\right)^2$$

$$= ₹\ 6400\left(\frac{17}{16}\right)^2 = ₹\ 6400 \times \frac{17}{16} \times \frac{17}{16} = ₹\ 25 \times 289 = ₹\ 7225$$

Compound interest = ₹ 7225 – ₹ 6400 = ₹ 825

Difference between simple interest and compound interest

= ₹ 825 – ₹ 800 = ₹ **25** **Ans.**

17. Principal (P) = ₹ 6250, Amount (A) = ₹ 6760

Rate (R) = 4%, Time (n) = ?

We know that,

$A = P\left(1 + \frac{R}{100}\right)^n$ or ₹ $6760 =$ ₹ $6250\left(1 + \frac{4}{100}\right)^n$

or $\frac{6760}{6250} = \left(1 + \frac{1}{25}\right)^n$ or $\frac{676}{625} = \left(\frac{26}{25}\right)^n$

or $\left(\frac{26}{25}\right)^2 = \left(\frac{26}{25}\right)^n$

On comparing power, $n = 2$

Hence, **the required time = 2 years** **Ans.**

18. Simple interest = ₹ 4800, Time (T) = 3 years, Rate (R) = 10%

$P = ?$

S.I. $= \frac{PRT}{100}$ or $P = \frac{\text{S.I.} \times 100}{\text{R} \times \text{T}}$

$P = ₹\ \frac{4800 \times 100}{10 \times 3} = ₹\ 16000$

Now, Principal (P) = ₹ 16000, Rate (R) = 10% and Time (n) = 3 years

We know that,

$A = P\left(1 + \frac{R}{100}\right)^n = ₹\ 16000\left(1 + \frac{10}{100}\right)^n$

$= ₹\ 16000 \times \left(1 + \frac{1}{10}\right)^3 = ₹\ 16000\left(\frac{11}{10}\right)^3$

$= ₹\ 16000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10} = ₹\ 16 \times 1331 = ₹\ 21296$

Compound interest = Amount − Principal

= ₹ 21296 − ₹ 16000 = ₹ 5296

Hence, **compound interest = ₹ 5296** **Ans.**

19. ₹ 7396 on 1 year's simple interest = ₹ 7950.70 − ₹ 7396

= ₹ 554.70

$\therefore$ Rate of interest $= \frac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}} = \frac{₹\ 554.70 \times 100}{₹\ 7396 \times 1}$

$= \frac{55470 \times 100}{7396 \times 1 \times 100} = 7.5\%$

Hence, **Rate of interest is 7.5%.** **Ans.**

Exercise 9.7

1. (a) We know that a and b vary directly.

Therefore, the ratio $\frac{a}{b}$ will remain constant.

We have, $\frac{5}{10} = \frac{1}{2}$

So, constant variation is $\frac{1}{2}$.

$\therefore \frac{a_1}{30} = \frac{1}{2}$ or $a_1 = \frac{30}{2} = 15$ and $\frac{16}{b_1} = \frac{1}{2}$ or $b_1 = 16 \times 2 = 32$

and $\frac{a_2}{420} = \frac{1}{2}$ or $a_2 = \frac{420}{2} = 210$

Hence, $a_1 = 15, b_1 = 32$ and $a_2 = 210$ **Ans.**

(b) We know that a and b vary directly.

Therefore, the ratio $\frac{a}{b}$ will remain constant.

We have, $\frac{2}{8} = \frac{1}{4}$

So, constant variation is $\frac{1}{4}$.

$\therefore \frac{a_1}{32} = \frac{1}{4}$ or $a_1 = \frac{32}{4} = 8$ and $\frac{32}{b_1} = \frac{1}{4}$ or $b_1 = 32 \times 4 = 128$

Hence, $a_1 = 8$ and $b_1 = 128$ **Ans.**

(c) We know a and b vary directly.

Therefore, the ratio $\frac{a}{b}$ will remain constant

We have, ratio $= \frac{2}{5}$

So, constant variable is $\frac{2}{5}$.

$\therefore \frac{6}{b_1} = \frac{2}{5}$ or $b_1 = \frac{6 \times 5}{2} = 15$ and $\frac{a_1}{17.5} = \frac{2}{5}$ or $a_1 = \frac{2 \times 17.5}{5} = 7$

Hence, $a_1 = 7$ and $b_1 = 15$ **Ans.**

(d) We know that a and b vary directly.

Therefore, the ratio $\frac{a}{b}$ will remain constant.

We have, $\frac{9}{36} = \frac{1}{4}$

So, constant variation is $\frac{1}{4}$.

$\therefore \frac{4}{b_1} = \frac{1}{4}$ or $b_1 = 4 \times 4 = 16$ and $\frac{a_1}{84} = \frac{1}{4}$ or $a_1 = \frac{84}{4} = 21$

and $\frac{25}{b_2} = \frac{1}{4}$ or $b_2 = 25 \times 4 = 100$

and $\frac{a_2}{2880} = \frac{1}{12}$ or $a_2 = \frac{2880}{4} = 720$

Hence, $b_1 = 48, b_2 = 300$ **and** $a_2 = 240$ **Ans.**

(e) We know that a and b vary directly.

Therefore, the ratio $\frac{a}{b}$ will remain constant.

We have, $\frac{8}{24} = \frac{1}{3}$

So, constant variation is $\frac{1}{3}$.

$\therefore \frac{a_1}{9} = \frac{1}{3}$ or $a_1 = \frac{9}{3} = 3$ and $\frac{5}{b_1} = \frac{1}{3}$ or $b_1 = 5 \times 3 = 15$

$\frac{12}{b_2} = \frac{1}{3}$ or $b_2 = 12 \times 3 = 36$ and $\frac{24}{b_3} = \frac{1}{3}$ or $b_3 = 24 \times 3 = 72$

$\frac{a_2}{180} = \frac{1}{3}$ or $a_2 = \frac{180}{3} = 60$ and $\frac{a_3}{390} = \frac{1}{3}$ or $a_3 = \frac{390}{3} = 130$

Hence, $a_1 = 3, a_2 = 60, a_3 = 130, b_1 = 15, b_2 = 36$ **and** $b_3 = 72$ **Ans.**

2. (a) $\frac{a}{b} = \frac{6}{36} = \frac{1}{6}, \frac{5}{30} = \frac{1}{6}, \frac{7}{42} = \frac{1}{6}, \frac{9}{54} = \frac{1}{6}, \frac{10}{60} = \frac{1}{6}, \frac{12}{76} = \frac{1}{6}$ and $\frac{8}{48} = \frac{1}{6}$

We see that, $\frac{a}{b}$ in constant variation.

Hence, ***a* and *b* vary directly.** **Ans.**

(b) $\frac{a}{b} = \frac{3}{24} = \frac{1}{8}, \frac{6}{48} = \frac{1}{8}, \frac{7}{56} = \frac{1}{8}, \frac{12}{96} = \frac{1}{8}, \frac{30}{240} = \frac{1}{8}, \frac{22}{176} = \frac{1}{8}$ and $\frac{29}{232} = \frac{1}{8}$ We see that, $\frac{a}{b}$ in constant variation.

Hence, ***a* and *b* vary directly.** **Ans.**

(c) $\frac{a}{b} = \frac{9}{18} = \frac{1}{2}, \frac{10}{20} = \frac{1}{2}, \frac{15}{30} = \frac{1}{2}, \frac{30}{40} = \frac{3}{4}, \frac{40}{80} = \frac{1}{2}, \frac{80}{150} = \frac{8}{15}, \frac{100}{200} = \frac{1}{2}$

We see that, $\frac{a}{b}$ is not in constant variation.

Hence, ***a* and *b* not vary directly.** **Ans.**

(d) $\frac{a}{b}=\frac{3}{10}, \frac{6}{20}=\frac{3}{10}, \frac{12}{40}=\frac{3}{10}, \frac{24}{100}=\frac{6}{25}, \frac{50}{150}=\frac{1}{3}, \frac{60}{200}=\frac{3}{10}, \frac{100}{300}=\frac{1}{3}$

We see that, $\frac{a}{b}$ is not in constant variation.

Hence, ***a* and *b* not vary directly.** **Ans.**

3. Let the cost of 2, 3, 4, 5, 6 and 7 pencils be x_1, x_2, x_3, x_4, x_5 and x_6. Then the given information can be written in the following form :

Number of pencils	8	2	3	4	5	6	7
Cost (in ₹)	48	x_1	x_2	x_3	x_4	x_5	x_6

∴Number of pencils and cost (in ₹) are in direct variation with each other.

$\therefore \quad \frac{8}{48}=\frac{2}{x_1}$ or $x_1 = ₹\ \frac{2\times 48}{8} = ₹\ 12$

Hence, **the cost of 2 pencils is ₹ 12.** **Ans.**

$\therefore \quad \frac{8}{48}=\frac{3}{x_2}$ or $x_2 = ₹\ \frac{48\times 3}{8} = ₹\ 18$

Hence, **the cost of 3 pencils is ₹ 18.** **Ans.**

$\therefore \quad \frac{8}{48}=\frac{4}{x_3}$ or $x_3 = ₹\ \frac{48\times 4}{8} = ₹\ 24$

Hence, **the cost of 4 pencils is ₹ 24.** **Ans.**

$\therefore \quad \frac{8}{48}=\frac{5}{x_4}$ or $x_4 = ₹\ \frac{48\times 5}{8} = ₹\ 30$

Hence, **the cost of 5 pencils is ₹ 30.** **Ans.**

$\therefore \quad \frac{8}{48}=\frac{6}{x_5}$ or $x_5 = ₹\ \frac{48\times 6}{8} = ₹\ 36$

Hence, **the cost of 6 pencils is ₹ 36.** **Ans.**

and $\frac{8}{48}=\frac{7}{x_6}$ or $x_6 = ₹\ \frac{48\times 7}{8} = ₹\ 42$

Hence, **the cost of 7 pencils is ₹ 42.** **Ans.**

4. Let the paid for 14 days be ₹ x. Then the given information are be written in the following form :

Paid (in ₹)	1200	x
Number of days	8	14

Number of days and paid (in ₹) are in direct variation with each other.

$\therefore \quad \frac{₹\,1200}{8} = \frac{x}{14}$ or $x = \frac{₹\,1200 \times 14}{8}$

$\therefore \quad x = ₹\,2100$

Hence, **the paid for 14 days is ₹ 2100.** **Ans.**

5. Quantity of food and number of person are in direct variation with each other

$\therefore \frac{\text{quantity of food } (k)}{\text{Number of person } (p)} = k \Rightarrow \frac{k_1}{p_1} = \frac{k_2}{p_2} \Rightarrow \frac{65}{5} = \frac{k_2}{13}$

or $\quad k_2 = \frac{65 \times 13}{5}\,\text{kg} = 169\,\text{kg}$

Hence, **the quantity of food required for 13 persons is 169 kg.** **Ans.**

6. $\because$ x and y vary directly.

$\therefore \quad \frac{x}{y} = \text{constant } k$ or $\frac{x}{y} = k$

or $\quad \frac{x}{1000} = 10$ or $x = 1000 \times 10 = 10000$

Hence, $\boldsymbol{x = 10000}$

7. $\because$ x and $5y$ are vary directly, therefore

$$\frac{x_1}{x_2} = \frac{5y_1}{5y_2} \text{ or } \frac{20}{x} = \frac{5 \times 4}{5 \times 14} \text{ or } \frac{20}{x} = \frac{20}{70}$$

$\therefore \quad x = \frac{20 \times 70}{20}$ or $x = 70$

Hence, $\boldsymbol{x = 70}$ **Ans.**

8. $\because$ p and q are vary directly, therefore,

$$\frac{p_1}{p_2} = \frac{q_1}{q_2} \text{ or } \frac{284}{p} = \frac{7.1}{9.8}$$

$\therefore \quad p = \dfrac{284 \times 9.8}{7.1} = \dfrac{284 \times 98}{71} = 392$

Hence, $\boldsymbol{p = 392}$ **Ans.**

9. $\because$ y and x are vary directly, therefore

$$\frac{y}{x} = \text{constant } (k) \text{ or } \frac{16}{4} = k$$

Hence, **constant of variation is 4.** **Ans.**

10. Let the required cartoon be x. Let us write the information in the table given below:

Number of books	72	420
Number of cartons	6	x

Clearly, number of books and number of cartons are in direct variation with each other

$\therefore \quad \dfrac{72}{6} = \dfrac{420}{x}$ or $x = \dfrac{6 \times 420}{72}$

$\therefore \quad x = 35$

Hence, **the required cartons are 35.** **Ans.**

11. Let the cost of 4.8 metres cloths be ₹ x. Then the given information can be written in the following form :

Cost (in ₹)	500	x
Number of meters	8	4.8

$$\therefore \frac{₹\ 500}{8} = \frac{x}{4.8} \text{ or } x = ₹\ \frac{500 \times 4.8}{8} \text{ or } x = ₹\ \frac{500 \times 48}{8 \times 10} = ₹\ 300$$

Hence, **the cost of 4.8 metres clothes = ₹ 300** **Ans.**

12. As the fare increase, the distance increase thus the fare and distance vary directly with each other.

$$\therefore \frac{\text{fare } (f)}{\text{distance } (d)} = k \Rightarrow \frac{f_1}{d_1} = \frac{f_2}{d_2} \Rightarrow \frac{₹\ 675}{250} = \frac{₹\ 750}{d_2}$$

$$\text{or } d_2 = \frac{750 \times 250}{675} \text{ km} = \frac{2500}{9} \text{ km} = \mathbf{277\ \frac{7}{9}\ km}$$ **Ans.**

13. As the paid ₹ increase, the number of days increase, thus the paid ₹ and number of day vary directly with each other.

$$\therefore \frac{\text{Paid } ₹\,(p)}{\text{Number of days } (d)} = k \Rightarrow \frac{p_1}{d_1} = \frac{p_2}{d_2} \Rightarrow \frac{₹\,1209}{26} = \frac{₹\,1953}{d_2}$$

$$d_2 = \frac{26 \times 1953}{1209} = 42$$

Hence, **number of days = 42** **Ans.**

14. Number of chairs and number days are in direct variation with each other.

$$\therefore \quad \frac{\text{Chair}\,(c)}{\text{Number of days } (d)} = k \Rightarrow \frac{c_1}{d_1} = \frac{c_2}{d_2} \Rightarrow \frac{32}{8} = \frac{56}{d_2}$$

or $d_2 = \frac{56 \times 8}{32} = 14$ days

Hence, **carpenter prepares 56 chair in 14 days.** **Ans.**

15. Run and overs are in direct variation with other.

$$\therefore \frac{\text{Run}\,(R)}{\text{Overs}\,(O)} = k \Rightarrow \frac{R_1}{O_1} = \frac{R_2}{O_2} \Rightarrow \frac{210}{35} = \frac{360}{O_2}$$

or $O_2 = \frac{360 \times 35}{210} = 60$ overs

Hence, **the required overs are 60.** **Ans.**

Exercise 9.8

1. (a) Since a varies inversely as b. Therefore,

$$100 \times 2 = 25 \times b_1 \Rightarrow b_1 = \frac{100 \times 2}{25} = 8$$

$$\text{Also, } 100 \times 2 = a_1 \times 10 \Rightarrow a_1 = \frac{100 \times 2}{10} = 20$$

$$\text{and } 100 \times 2 = a_2 \times 200 \Rightarrow a_2 = \frac{100 \times 2}{200} = 1$$

$$\text{and } 100 \times 2 = 40 \times b_2 \Rightarrow b_2 = \frac{100 \times 2}{40} = 5$$

Hence, $\boldsymbol{a_1 = 20, a_2 = 1, b_1 = 8}$ **and** $\boldsymbol{b_2 = 5}$ **Ans.**

(b) Since a varies in inversely as b. Therefore,

$$120 \times 600 = 72 \times b_1 \Rightarrow b_1 = \frac{120 \times 600}{72} = 1000$$

$$\text{Also } 120 \times 600 = a_1 \times 240 \Rightarrow a_1 = \frac{120 \times 600}{240} = 300$$

$$\text{and } 120 \times 600 = 60 \times b_2 \Rightarrow b_2 = \frac{120 \times 600}{60} = 1200$$

Also $120 \times 600 = a_2 \times 90 \Rightarrow a_2 = \dfrac{120 \times 600}{90} = 800$

Hence, $\boldsymbol{a_1 = 300, a_2 = 800, b_1 = 1000}$ **and** $\boldsymbol{b_2 = 1200}$ **Ans.**

(c) Since a varies inversely as b. Therefore,

$8 \times 15 = a_1 \times 12 \Rightarrow a_1 = \dfrac{8 \times 15}{12} = 10$

Also $8 \times 15 = 24 \times b_1 \Rightarrow b_1 = \dfrac{8 \times 15}{24} = 5$

and $8 \times 15 = 16 \times b_2 \Rightarrow b_2 = \dfrac{8 \times 15}{16} = 7.5$

and $8 \times 15 = a_2 \times 60 \Rightarrow a_2 = \dfrac{8 \times 15}{60} = 2$

Hence, $\boldsymbol{a_1 = 10, a_2 = 2, b_1 = 5}$ **and** $\boldsymbol{b_2 = 7.5}$ **Ans.**

(d) Since a varies inversely as b. Therefore,

$3 \times 12 = a_1 \times 36 \Rightarrow a_1 = \dfrac{3 \times 12}{36} = 1$

Also $3 \times 12 = 18 \times b_1 \Rightarrow b_1 = \dfrac{3 \times 12}{18} = 2$

and $3 \times 12 = 9 \times b_2 \Rightarrow b_2 = \dfrac{3 \times 12}{9} = 4$

and $3 \times 12 = a_2 \times 12 \Rightarrow a_2 = \dfrac{3 \times 12}{12} = 3$

Hence, $\boldsymbol{a_1 = 1, a_2 = 3, b_1 = 2}$ **and** $\boldsymbol{b_2 = 4}$ **Ans.**

2. Since a varies inversely as b. Therefore,

(a) $4 \times 16 = 8 \times 8 = 64$, $4 \times 16 = 16 \times 4 = 64$, $4 \times 16 = 32 \times 2 = 64$ and $4 \times 16 = 64 \times 1 = 64$

$\therefore$ The product ab for the various values of a and the corresponding values of b is constant.

Hence, ***a* and *b* very inversely.** **Ans.**

(b) $\dfrac{2}{20} = \dfrac{1}{10}, \dfrac{5}{50} = \dfrac{1}{10}, \dfrac{10}{100} = \dfrac{1}{10}, \dfrac{20}{200} = \dfrac{1}{10}, \dfrac{50}{500} = \dfrac{1}{10}$

It is a direct varations.

Hence, it is not inversely vary.

(c) $4 \times 6 = 3 \times 8 = 24$, $4 \times 6 = 5 \times 4.8 = 24$, $4 \times 6 = 2 \times 12 = 24$, $4 \times 6 = 24 \times 1 = 24$

$\therefore$The product ab for the various values of a and the corresponding value of b is constant.

Hence, ***a* and *b* vary inversely.** **Ans.**

(d) $9\times3\neq20\times4.5,\ 9\times3\neq32\times3.75$ and $9\times3\neq25\times5$

$\therefore$To product ab for the various values of a and the corresponding value of b not constant.

Hence, ***a* and *b* not vary inversely.** **Ans.**

(e) $4\times7=28\neq2\times4.5=9$

$4\times7=28\neq3\times1.5=4.5$

$4\times7=28\neq13\times11=143$

$4\times7=28\neq21\times12=252$

Hence, **it is not vary inversely.** **Ans.**

3. $\because$ Food enough for 28 days $=4200$ soldiers

$\therefore$Food enough for $(28-4=24)$ days $=4200$ soldiers

Let the number of transferred soldiers $=x$

Days		Soldiers
24	↑	4200
32		x ↓

$$\frac{x}{4200}=\frac{24}{32} \quad \text{or } x=\frac{4200\times24}{32}=3150$$

$\therefore$Transfer soldiers $=4200-3150=$ **1050** **Ans.**

4. Let x man be engaged for reaping the field in 48 days. We but the data in table format as follow :

Number of days	60	48
Number of men	8	x

It is clear the more number of days, the lesser will be the number of men to reaping the field. So, number of days and the number of men are in inverse variation.

$$\therefore 60\times8=48\times x\Rightarrow x=\frac{60\times8}{48}=10\text{ men}$$

Ans.

5. Let food enough for 625 persons for x day. The more the number of person the lesser will be the number of days to enough food. So, number of person and the number of days are in inverse variation.

Number of persons	600	625
Number of days	42	x

$\therefore \quad 600 \times 42 = 625 \times x \Rightarrow x = \dfrac{600 \times 42}{625}$

$$x = \frac{24 \times 42}{25} = \frac{1008}{25} = \mathbf{40\,\frac{8}{25}\ days.}$$ **Ans.**

6. Let 18 men take x day to repair the road. We put the data in table format as follow:

Number of men	30	18
Number of days	24	x

It is clear lesser the number of men, the more will be the number of days to complete the work.

So, we have inverse variation case.

$\therefore \quad 30 \times 24 = 18 \times x \Rightarrow x = \dfrac{30 \times 24}{18} = \mathbf{40\ days}$ **Ans.**

7. Let for the $(1600 - 600) = 1100$ men x day will the food last. We put the data in table format as follow :

Number of men	1600	1000
Number of weeks	20	x

It is clear lesser the number of men, the more will be the number of days to the food last.

So, we have inverse variation case.

$\therefore 1600 \times 20 = 1000 \times x \Rightarrow x = \dfrac{1600 \times 20}{1000} = \mathbf{32\ weeks.}$ **Ans.**

8. Let x cows graze the field in 9 days. We put the data in table format as below :

Number of cows	36	x
Number of days	10	9

We know that more the number of case, less in the number of days to graze a field. So it is a case of inverse variation.

$\therefore 36 \times 10 = x \times 9 \Rightarrow x = \dfrac{36 \times 10}{9}\ \text{cows} = 40\ \text{cows}$

$\boldsymbol{x = 40\ cows}$ **Ans.**

9. Let the speed of car x km/h to complete the journey. We put the data in table format as follow :

Time (in minutes)	45	35
Speed (in km/h)	40	x

It is clear lesser the time, the more speed will be to complete the journey. So, we have inverse variation case.

$\therefore 45 \times 40 = 35 \times x \Rightarrow x = \dfrac{45 \times 40}{35} = \dfrac{360}{7} = 51\dfrac{3}{7}$ km/h **Ans.**

10. Let for the $(105 - 84) = 21$ soldiers, x days will the food lent.
We put the data in table format as follow :

Number of soilders	105	21
Number of days	42	x

It is clear lesser the number of soldiers, the more will be the number of days to food last.
So, we have inverse variation case.

$\therefore 105 \times 42 = 21 \times x \Rightarrow x = \dfrac{105 \times 42}{21} =$ **210 days** **Ans.**

Exercise 9.9

1. Let 9 labours larn ₹ x in 16 days.

Number of labours	earn (in ₹)	Number of days
24	₹ 3600	10
9	₹ x	16

We know that less labour, earn less amount.

$$\frac{x}{3600} = \frac{9}{24} \times \frac{16}{10}$$

or $$x = \frac{₹\ 3600 \times 9 \times 16}{24 \times 10}$$

$$= ₹\ 15 \times 9 \times 16 = ₹\ \mathbf{2160}$$ **Ans.**

2. Astha and Sakshi both do a work in 6 days.

$\therefore$ (Astha + Sakshi)'s 1 day work $= \dfrac{1}{6}$

Sakshi along can do the same work in 9 days.

$\therefore$Sakshi's 1 day work $= \frac{1}{9}$

Now Astha's 1 day work = (Astha + Sakshi)'s one day work − Sakshi's one day work

$$= \frac{1}{6} - \frac{1}{9} = \frac{3-2}{18} = \frac{1}{18}$$

Hence, **Astha along can do a piece of work in 18 days.** **Ans.**

3. Amit finishes a piece of work in 16 days.

$\therefore$Amit's one day work $= \frac{1}{16}$

Dushyant finishes the same work in 20 days.

$\therefore$Dushyant's one day work $= \frac{1}{20}$

In one day (Amit + Dushyant)'s work $= \frac{1}{16} + \frac{1}{20} = \frac{5+4}{80} = \frac{9}{80}$

Hence, both will finish the work in $\frac{80}{9} = \mathbf{8\frac{8}{9}}$ **days.** **Ans.**

4. $\because$ Time taken by A, B and C to do a work = 2 days

$\therefore$A's, B's and C's 1 day work $= \frac{1}{2}$

A and B together do the same work in 10 days.

$\therefore$A's and B's one day work $= \frac{1}{10}$

Now, C's 1 day work = $(A + B + C)$'s one day work − (A + B)'s one day work

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

Hence, C along can do the work $= \frac{5}{2}$ days $= \mathbf{2\frac{1}{2}}$ **days.** **Ans.**

5. $\because$ Amit complete $\frac{1}{40}$ part of the work in 1 day.

$\therefore$Amit can do complete the work in $1 \times 40 =$ **40 days** **Ans.**

6. A along do a piece of work in 24 days.

$\therefore$A's one day work $= \frac{1}{24}$

B along can do the same work in 15 days.

$\therefore$B's one day work $= \frac{1}{15}$

A's and B's one day work $= \frac{1}{24} + \frac{1}{15} = \frac{5+8}{120} = \frac{13}{120}$

So, (A + B)'s 8 days work $= 8 \times \frac{13}{120} = \frac{13}{15}$

Remaining work $= 1 - \frac{13}{15} = \frac{15-13}{15} = \frac{2}{15}$

The remaining work is done by A.

Now, the whole work is done by A in 24 days.

$\therefore \frac{2}{15}$ the work is done by A in $\left(24 \times \frac{2}{15}\right)$ days $= \frac{16}{5}$ days $= 3\frac{1}{5}$ days

Hence, **the remaining work is done by A in $3\frac{1}{5}$ days.** **Ans.**

7. Prem and Yogesh can do a piece of work in 10 days.

$\therefore$(Prem + Yogesh)'s 1 day work $= \frac{1}{10}$

Prem along can do the same work in 40 days.

Prem's 1 day work $= \frac{1}{40}$

Now, Yogesh's one day work $= \frac{1}{10} - \frac{1}{40} = \frac{4-1}{40} = \frac{3}{40}$

Hence, **Yogesh can do the work $\frac{40}{3}$ day is $13\frac{1}{3}$ days.** **Ans.**

8. Manoj can reap a field in 20 days.

$\therefore$Manoj's 1 day work $= \frac{1}{20}$

Prashant can reap the same field in 60 days.

$\therefore$Prashant's one day work $= \frac{1}{60}$

Now, (Manoj + Prashant)'s 1 day work

$= \frac{1}{20} + \frac{1}{60} = \frac{3+1}{60} = \frac{4}{60} = \frac{1}{15}$

Hence, **Manoj and Prashant can reap the field in 15 days.**

Ans.

9. People Days

$16 \downarrow$ $15 \uparrow$

$x \downarrow$ $10 \uparrow$

Here, is inversely variations.

Let x peoples food consumed in 10 days.

$$\frac{x}{16} = \frac{15}{10}$$

or $x = \dfrac{15 \times 16}{10} = \dfrac{240}{10} = 24$ people

Hence, **guests joined the family $= 24 - 16 = 8$** **Ans.**

10. Pipe A fill a tank in 48 minutes.

$\therefore$Pipe A fill in 1 minute $= \dfrac{1}{48}$ tank

Pipe B fill the tank in 96 minutes.

$\therefore$Pipe B fill in 1 minute $= \dfrac{1}{96}$ tank

Pipe C empty the tank in 64 minutes

$\therefore$Pipe C empty in 1 minutes $= \dfrac{1}{64}$ tank

Open the A, B and C pipe tanks filling in 1 minute

$$= \frac{1}{48} + \frac{1}{96} - \frac{1}{64} = \frac{4+2-3}{192} = \frac{3}{192} \text{ tank} = \frac{1}{64}$$

Hence, **open the pipe A, B and C time taken to fill the tanks 64 minutes.** **Ans.**

11. $\because$ 3 boys $= 4$ girls

Then, 3 boys and 2 girls $= 4$ girls $+ 2$ girls $= 6$ girls

$\therefore 4$ girls do a work $= 8$ hours

$\therefore 1$ girl do a work $= 8 \times 4$ hours

$\therefore 6$ girls do a work $= \dfrac{8 \times 4}{6}$ hours $= \dfrac{16}{3}$ hours $= 5\dfrac{1}{3}$ hours

Hence, **3 boys and 2 girls clean the compound in $5\dfrac{1}{3}$ hours.** **Ans.**

12. Let the number of days $= x$, then

Men	Hours	Days
480 ↑	9 ↑	20 ↓
300	6	x

$\therefore \quad \frac{x}{20} = \frac{9}{6} \times \frac{480}{300}$

or $x = 20 \times \frac{9}{6} \times \frac{480}{300} = \mathbf{48\ days}$ **Ans.**

Exercise 9.10

1. Speed of truck $= 72\ \text{km/h} = 72 \times \frac{5}{18}\ \text{m/s}$ **[$\because$ 1 km/h $= \frac{5}{18}$ m/s]**

$= 20\ \text{m/s}$

Time $= 18$ seconds

Now, distance $=$ speed $\times$ time $= 20 \times 18\ \text{m} =$ **360 m** **Ans.**

2. Speed of aeroplane $= 720\ \text{km/h}$

$= 720 \times \frac{5}{18}\ \text{m/s}$ **[$\because$ 1 km/h $= \frac{5}{18}$ m/s]**

$= 200\ \text{m/s}$

Time $= 6$ hour $= 6 \times 60 \times 60$ second $= 21600\ \text{s}$

$\therefore$ Distance cover $=$ speed $\times$ time $= 200 \times 21600\ \text{m} = 4320000\ \text{m}$

Hence, **the distance cover by the aeroplane = 4320000 m Ans.**

3. Distance $= 48$ km, Time $= 5$ hours

$\therefore \text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{48\ \text{km}}{5\ \text{hours}} = 9.6\ \text{km/h}$

Speed in m/s $= 9.6 \times \frac{5}{18}\ \text{m/s}$ **[$\because$ 1 km/h $= \frac{5}{18}$ m/s]**

$= \frac{48}{18}\ \text{m/s} = \frac{8}{3}\ \text{m/s} = 2\frac{2}{3}\ \text{m/s}$

Hence, **the speed of bullock-cart is $2\frac{2}{3}$ m/s.** **Ans.**

4. Speed of train $= 25\ \text{m/s}$

Speed in km/h $= 25 \times \frac{18}{5}\ \text{km/h}$ **[$\because$ 1 m/s $= \frac{18}{5}$ km/h]**

$=$ **90 km/h** **Ans.**

5. Speed of train $= 15$ m/s

Speed in km/h $= 15 \times \frac{18}{5}$ km/h $\quad$ [$\because$ **1 m/s** $= \frac{\mathbf{18}}{\mathbf{5}}$ **km/h**]

$=$ **54 km/h** **Ans.**

6. Time $= 24$ hours and 40 minutes

$= 24$ hours $+ \frac{40}{60}$ hours $= 24\frac{2}{3}$ hours $= \frac{74}{3}$ hours

Speed $= 25$ m/s $= 25 \times \frac{18}{5}$ km/h $\quad$ [$\because$ **1 m/s** $= \frac{\mathbf{18}}{\mathbf{5}}$ **km/h**]

$= 90$ km/h

Distance $=$ speed $\times$ time $= 90 \times \frac{74}{3}$ km $= 30 \times 74$ km $= 2220$ km

Hence, **the distance between the cities A and B = 2220 km.**

Ans.

7. 72 km/h $= 72 \times \frac{5}{18}$ m/s $\quad$ [$\because$ **1 k/m** $= \frac{\mathbf{18}}{\mathbf{5}}$ **m/s**]

$= 4 \times 5$ m/s $= 20$ m/s

Hence, **72 km/h = 20 m/s** **Ans.**

8. (a) 27 km/h $= 27 \times \frac{5}{18}$ m/s $= \frac{15}{2}$ m/s $= 7\frac{1}{2}$ m/s

Hence, **27 km/h** $= \mathbf{7\frac{1}{2}}$ **m/s**

Ans.

(b) 462 km/h $= 462 \times \frac{5}{18}$ m/s $\quad$ [$\because$ 1 km/h $= \frac{18}{5}$ m/s]

$= \frac{77 \times 5}{3}$ m/s $= \frac{385}{3}$ m/s $= 128\frac{1}{3}$ m/s

Hence, **462 km/h** $= \mathbf{128\frac{1}{3}}$ **m/s**

Ans.

(c) 130 m/s $= 130 \times \frac{18}{5}$ km/h $\quad$ [$\because$ **1 m/s** $= \frac{\mathbf{18}}{\mathbf{5}}$ **km/h**]

$= 26 \times 18$ km/h $= 468$ km/h

Hence, **130 m/s = 468 km/h** **Ans.**

(d) 175 m/s $= 175 \times \frac{18}{5}$ km/h $= 35 \times 18$ km/h $= 630$ km/h

Hence, **175 m/s = 630 km/h** **Ans.**

9. Speed of cycle $= 54\text{ km/h} = 54 \times \frac{5}{18}\text{ m/s} = 3 \times 5\text{ m/s} = \mathbf{15\ m/s}$ **Ans.**

10. Distance travelled by the train = Its own length $= 125\text{ m}$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{125\text{ m}}{20\text{ s}} = \frac{125}{20}\text{ m/s} = \frac{125}{20} \times \frac{18}{5}\text{ km/h}$$

$$= \frac{45}{2}\text{ km/h} = 22\frac{1}{2}\text{ km/h}$$ **Ans.**

Now, distance travelled by the train = Its own length + platform length $= 125\text{ m} + 205\text{ m} = 330\text{ m}$

$$\text{Time taken} = \frac{\text{Distance}}{\text{Speed}} = \frac{330}{\frac{125}{20}} = \frac{330 \times 20}{125}\text{ s} = \mathbf{52\frac{4}{5}\ s}$$ **Ans.**

11. $\because$ Speed $= 80\text{ km/h}$ and time $= 20$ hours

$\therefore$ Distance = speed $\times$ time $= 80 \times 20\text{ km} = 1600\text{ km}$

Now, speed $= 80\text{ km/h} + 10\text{ km/h} = 90\text{ km/h}$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$= \frac{1600\text{ km}}{90\text{ km/h}} = \frac{160}{9}\text{ h} = \mathbf{17\frac{7}{9}\ hours}$$ **Ans.**

12. Distance travelled by the train = Its own length $= 210\text{ m}$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{210\text{ m}}{4\text{ sec}} = \frac{105}{2}\text{ m/s} = \frac{105}{2} \times \frac{18}{5}\text{ km/h}$$

$$= 21 \times 9\text{ km/h} = 189\text{ km/h}$$

Hence, **the speed of the train = 189 km/h** **Ans.**

Multiple Choice Questions

1. (i) Answer **(b)** correct. **Ans.**

(ii) Answer **(c)** is correct. **Ans.**

(iii) Answer (b) is correct. **Ans.**

(iv) Direct tax is collected in the form of income tax.
Hence, the answer **(a)** is correct. **Ans.**

(v) Discount per cent is always calculated on M.P.
Hence, the answer **(c)** is correct. **Ans.**

(vi) Per cent means out of 100.
Hence, the answer **(d)** is correct. **Ans.**

(vii) Answer **(a)** is correct. **Ans.**

10. Understanding Shapes (Quadrilaterals)

Exercise 10.1

1. (a) Two lines parallel to the same line intersect to each other. **[True]**

(b) Two lines parallel to the same line are parallel to each other. **[True]**

(c) Two lines parallel to the same line are perpendicular to each other. **[False]**

(d) Two lines perpendicular to the same line intersects to each other. **[False]**

(e) Two lines perpendicular to same given line are perpendicular to each other. **[False]**

(f) Two lines perpendicular to the same given line are parallel to each other. **[True]**

2. $\because OA \parallel FC$ and $OB \parallel FD$

$\therefore \angle AOB = \angle CFD$

3. (a) Yes, $b \parallel c$ because $a \parallel b$ and $a \parallel c$.

(b) $x = 65°$ [Alternate interior angle]

4. $\because x \parallel y$ and $y \parallel z$

$\therefore x \parallel z$

$\because \angle 1 = 110°$

$\therefore \angle 2 = 180° - 110° = \mathbf{70°}$ [Coin terior angle] **Ans.**

5. $\because m \parallel n$

$\therefore \angle 1 = \angle 2$

$\therefore \angle 2 = \mathbf{70°}$ $[\because \angle \mathbf{1} = \mathbf{70°}]$ **Ans.**

6. $\because x \parallel y$ and $z \parallel y$

$\therefore x \parallel y \parallel z$

$\because t \perp z$

(a) $\therefore x \parallel y$

Yes, $x \parallel y$ **Ans.**

(b) $\angle \text{t o} y = \angle \text{t o} z = 90°$

$\therefore \boldsymbol{t \perp x}$

7. There are six parallel line segment.

They are: $\boldsymbol{AB \parallel DE}$, $\boldsymbol{DE \parallel FG}$, $\boldsymbol{FG \parallel HI}$, $\boldsymbol{AB \parallel HI}$, $\boldsymbol{DE \parallel HI}$ **and** $\boldsymbol{AB \parallel EG}$. **Ans.**

8. Since $CE \parallel BA$ and AC is a transversal line.

$\therefore \angle ACE = \angle BAC = 60°$ [Alternate angles]

$\therefore \angle ACD = \angle ACE + \angle ECD = 60° + 45° = 105°$

Now, $\angle ACB$ and $\angle ACD$ form a linear pair.

$\therefore \angle ACB + \angle ACD = 180°$ or $\angle ACB = 180° - \angle ACD$

or $\angle ACB = 180° - 105°$ $\therefore \angle ACB = 75°$

Hence, $\angle \boldsymbol{ACB} = \mathbf{75°}$ **Ans.**

9. $\because AB \parallel EF \parallel CD$

According to figure $\angle BOF = 40°$

and $\angle FOD = 50°$

$\therefore \angle BOD = \angle BOF + \angle FOD = 40° + 50° = \mathbf{90°}$ **Ans.**

10. $\because PO \parallel RS$ and $QR \parallel RT$

$\therefore \angle RSQ = \angle POS = 50°$

$\therefore \angle TRS = 180° - 50° = \mathbf{130°}$ **Ans.**

11. $\angle BCD = 26° + 24° = 50°$

$\therefore AB \parallel CD$

And $CD \parallel EF$

$\therefore$ $\boldsymbol{AB \parallel EF}$ **Proved**

12. According to figure,

$\angle AOF = 180° - 108° = 72°$

And $\angle COF = 180° - 110° = 70°$

$\therefore \angle AOC = 72° + 70° = \mathbf{142°}$ **Ans.**

Exercise 10.2

1. According to figure DC $\dfrac{BE}{EA} = \dfrac{BF}{FD} = \dfrac{2}{3}$

$$\frac{EA}{BE} = \frac{3}{2} = \frac{DK}{BD}$$

$$= \frac{3}{2} BD = \frac{3}{2} \times 5 \text{ cm} = \mathbf{7.5 \text{ cm}}$$

$\therefore BC = BF + FD + DC = 2 \text{ cm} + 3 \text{ cm} + 7.5 \text{ cm} = \mathbf{12.5 \text{ cm}}$ **Ans.**

2. Let $AE = x$ cm

$\because$ $AD = 4$ cm, $BD = 8$ cm and $EC = 10$ cm

$\therefore$ $\dfrac{AD}{BD} = \dfrac{AE}{EC}$ or $\dfrac{4 \text{cm}}{8 \text{ cm}} = \dfrac{x \text{ cm}}{10 \text{cm}}$ or $x = \dfrac{4 \times 10}{8}$ cm

or $x = 5$ cm

Hence, $\boldsymbol{AE} = \mathbf{5 \text{ cm}}$ **Ans.**

3. In ΔPQR, we know that $\angle P + \angle Q + \angle R = 180°$

$\Rightarrow \quad 80° + \angle Q + 35° = 180° \Rightarrow \angle Q + \angle 115° = 180°$

$\Rightarrow \quad \angle Q = 180° - 115°$

$\angle Q = 65°$

$\therefore S$ and T are the mid point of PQ and PR.

$$ST \parallel QR \text{ and } ST = \frac{1}{2}QR$$

Now, $ST \parallel QR$ and PR is a transversal line.

$\therefore \quad \angle TSQ + \angle Q = 180°$

$\Rightarrow \quad \angle TSQ + 65° = 180° \Rightarrow \angle TSQ = 180° - 65°$

$\Rightarrow \quad \angle TSQ = 115°$

$$\text{And } ST = \frac{1}{2}QR \text{ or } QR = 2 \times ST$$

or $\quad QR = 2 \times 2.9 \text{ cm} = 5.8 \text{ cm}$

Hence, $\angle \boldsymbol{TSQ} = \mathbf{115°}$ **and** $\boldsymbol{QR} = \mathbf{5.8\ cm}$ **Ans.**

4. (a) According to figure, $\frac{PM}{QM} = \frac{OP}{OR} = \frac{2.4}{3.6}$

$\frac{PM}{QM} = \frac{2}{3}$ **Ans.**

(b) $\frac{SO}{OQ} = \frac{2}{3} = \frac{PM}{QM}$

$\therefore \frac{SO}{3 \text{ cm}} = \frac{2}{3}$

or $\boldsymbol{SO} = \mathbf{2\ cm}$ **Ans.**

5. $\because AD \perp l, BF \perp l$ and $CE \perp l$

(a) $\therefore AD \parallel CE \qquad [\because \boldsymbol{\angle ADE = \angle CEF = 90°}]$ **Ans.**

(b) $AD \parallel BF \qquad [\because \boldsymbol{\angle ADE = \angle BFl = 90°}]$ **Ans.**

(c) $\because AD \parallel CE$ and $AD \parallel BF$

$\therefore \ \boldsymbol{AD \parallel CE \parallel BF}$ **Ans.**

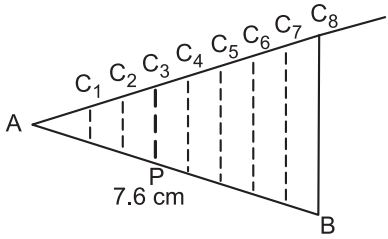
(d) $\because C$ is the mid point of AB and $AD \perp l, BF \perp l$ and $CE \perp l$.

$\therefore$ $\boldsymbol{E}$ **is the mid-point of line segment** $\boldsymbol{DF}$**.** **Ans.**

6. (a) Draw $AB = 7.6$ cm.

(b) Draw a ray AC such that AC is not in the same line AB.

(c) On ray AC mark eight $(3 + 5 = 8)$



equal line segments
$AC_1, C_1C_2, C_2C_3, C_3C_4, C_4C_5, C_5C_6, C_6C_7$ and C_7C_8 using compasses.

(d) Join C_8B.

(e) Starting from A and counting three line segments just down. We draw reach C_3, draw a line parallel to C_7B interesting AB at a point P.

Then, $\frac{AP}{PB} = \frac{3}{5}$

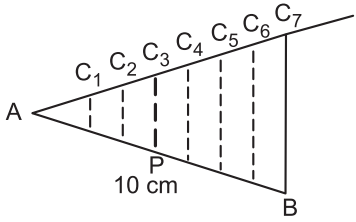
By measuring $AP = 2.85$ cm and $PB = 4.75$ cm

$\therefore \quad \frac{AP}{PB} = \frac{2.85}{4.75} = \frac{3}{5}$ **Proved**

7. (a) Draw $AB = 10$ cm.

(b) Draw a ray AC such that AC is not in the same line AB.

(c) On ray AC mark seven $(3 + 4 = 7)$



equal line segments
$AC_1, C_1C_2, C_2C_3, C_3C_4, C_4C_5, C_5C_6$ and C_6C_7 using compasses.

(d) Join C_7B.

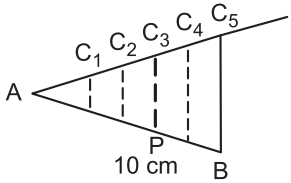
(e) Starting from A and counting three line segments just down. We draw reach C_3, draw a line paraller to C_7B interesting AB at a point P.

Then, $\frac{AP}{PB} = \frac{3}{4}$ or $\boldsymbol{AP : PB = 3 : 4}$ **Proved**

8. (a) Draw $AB = 10$ cm.

(b) Draw a ray AC such that AC is not in the same line AB.

(c) On ray AC mark five.



equal line segments

$AC_1, C_1C_2, C_2C_3, C_3C_4$ and C_4C_5 using compasses.

(d) Join C_5B.

(e) Starting from A and counting three line segments just down.

Here $AC_1 = C_1C_2$

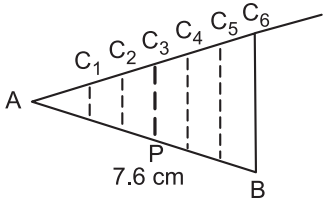
$= C_2C_3 = C_3C_4$

$= C_4C_5$ **Proved**

9. (a) Draw $AB = 8.6$ cm.

(b) Draw a ray AC such that AC is not in the same line AB.

(c) On ray AC mark six



equal line segments

$AC_1, C_1C_2, C_2C_3, C_3C_4, C_4C_5$ and C_5C_6 using compasses.

(d) Join C_6B.

(e) Starting from A and counting six line segments just down.

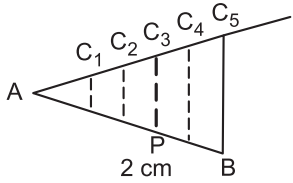
Hence, $AC_1 = C_1C_2 = C_2C_3$

$= C_3C_4 = C_4C_5 = C_5C_6$ **Proved**

10. (a) Draw $MN = 2$ cm.

(b) Draw a ray AC such that AC is not in the same line AB.

(c) On ray AC mark five $(2 + 3 = 5)$



equal line segments
$MC_1, C_1C_2, C_2C_3, C_3C_4$ and C_4C_5 using compasses.
(d) Join C_5N.
(e) Starting from M and counting two line segments just down. We draw reach C_2, draw a line paallel to C_5N interesting MN at a point P.

Then, $$\frac{MP}{PN} = \frac{2}{3}$$

or $$MP : PN = 2 : 3$$ **Proved**

11. $\because$ E is the mid-point of line segment AD and $l \parallel DG \parallel BF \parallel m$.

(a) $\because$ $l \parallel DG \parallel EF$

$\therefore$ $\boldsymbol{FG = GC}$ **Ans.**

(b) $\because$ $M \parallel EF \parallel DG$

$\therefore \boldsymbol{AF = FG}$ **Ans.**

(c) $\because$ $FG = GC = AF$

$\therefore AF = \frac{1}{3}AC = \frac{1}{3} \times 4.5 \text{ cm} = \mathbf{1.5\ cm}$ **Ans.**

12. $\because$ E is the mid point of AB.

$\therefore$ $AE = EB$

$\because$ F is the mid point of BC.

$\therefore$ $BF = FC$

$\because$ G is the mid point of DC.

$\therefore$ $CG = DG$

And H is the point of AD $\therefore$ $HD = AH$

Draw BD.

Then $HE \parallel DB \parallel GF$

Similarly, draw AC.

$\therefore$ $EF \parallel AC \parallel HG$

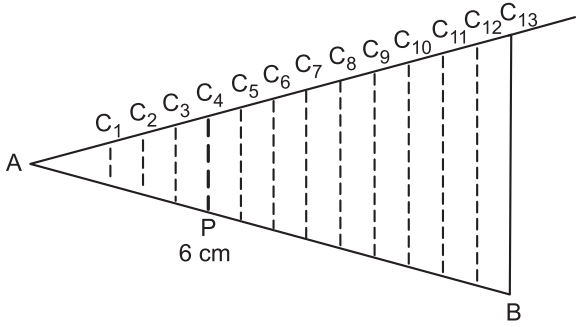
And $\angle E = \angle G$ and $\angle E = \angle H$

$\therefore$ ***EFGH*** **is a parallelogram.** **Proved**

13. (a) Draw $AB = 7.6$ cm

(b) Draw a ray AC such that AC is not in the same line AB.

(c) On ray AC mark thirteen $(4+9=13)$



equal line segments

$AC_1, C_1C_2, C_2C_3, C_3C_4, C_4C_5, C_5C_6, C_6C_7, C_7C_8, C_8C_9,$ $C_9C_{10}, C_{10}C_{11}, C_{11}C_{12}$ and $C_{12}C_{13}$ using compasses.

(d) Join $C_{13}B$.

(e) Starting from A and counting four line segments just down. We draw reach C_4, draw a line paallel to $C_{13}B$ interesting AB at a point P.

Then, $$\frac{AP}{PB} = \frac{4}{9}$$

By measuring $AP = 1.85$ cm

And $PB = 4.15$ cm

$\therefore$ $$\frac{\boldsymbol{AP}}{\boldsymbol{PB}} = \frac{\mathbf{1.85}}{\mathbf{4.15}} = \frac{\mathbf{4}}{\mathbf{9}}$$ **(Approximate)** **Proved**

14. $\because$ O is the mid point of BC.

Draw a ray AX from A.

$\because$ BM, CN and DL are pendiculars an ray AX,

Which are meet M, N and L respectively on AX.

(a) **Yes,** AX is a transversal for BM, LD and NC. **Ans.**

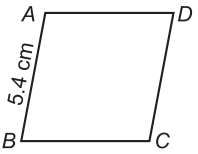
(b) **Yes,** CB is a transversal for BM, LD and NC. **Ans.**

(c) **Yes,** BM, LD and NC are parallel to each other. **Ans.**

(d) **Yes,** $ML = LN$ **Ans.**

Exercise 10.3

1. Let $ABCD$ is a parallelogram, it one side $AB = 5.4$ cm



Thus, other side $AD = AB \times \frac{3}{2}$ cm $= 5.4 \times \frac{3}{2} = 8.1$ cm

$\because AB = 5.4$ cm and $AD = 8.1$ cm

We know that in a parallelogram opposite side are equal.

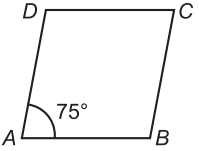
$\therefore AB = CD = 5.4$ cm and $BC = AD = 8.1$ cm

Perimeter of parallelogram $= AB + BC + CD + AD$

$= 5.4$ cm $+ 8.1$ cm $+ 5.4$ cm $+ 8.1$ cm $= 27$ cm

Hence, **the perimeter of parallelogram is 27 cm.** **Ans.**

2. Let $ABCD$ is a parallelogram, its one angle $\angle A = 75°$



We know that, in a parallelogram opposite angle are equal.

$\therefore \angle A = \angle C = 75°$

$\because \angle A + \angle B = 180°$ [Adjacent angle]

$\therefore 75° + \angle B = 180°$

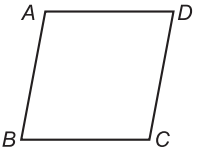
$\angle B = 180° - 75° = 105°$

$\because \angle D = \angle B$ [$\because$ opposite angles are equal]

$\therefore \angle D = 105°$

Hence, **the angles are 105°, 75° and 105°.** **Ans.**

3. Let $ABCD$ is a parallelogram, its two adjacent angles $\angle B$ and $\angle C$ are in the ratio 3 : 9.



$\because \angle B + \angle C = 180°$

According to question,

$\angle B + \angle C = 3 : 9$

Let $\angle B = 3x$ and $\angle C = 9x$

$3x + 9x = 180°$ or $12x = 180°$

$x = \frac{180°}{12} = 15°$

$\therefore \angle B = 3 \times x = 3 \times 15° = 45°$

$\angle C = 9 \times x = 9 \times 15° = 135°$

Now, $\because$ Opposite angles are equal in the parallelogram.

$\therefore \angle B = \angle D = 45°$

$\angle C = \angle A = 135°$

Hence, **the angles are 135°, 45°, 135° and 45°.** **Ans.**

4. $\because$ $PQRS$ is a trapezium.

$\therefore PQ \parallel SR$

$\because \angle P + \angle S = 180°$

$\therefore 40° + \angle S = 180°$

$\therefore \angle S = 180° - 40° = 140°$

$\because \angle Q + \angle R = 180°$

$\therefore 40° + \angle R = 180°$

$\Rightarrow \angle R = 180° - 40° = 140°$

Hence, $\boldsymbol{\angle S = 140°}$ **and** $\boldsymbol{\angle R = 140°}$ **Ans.**

5. $PQRS$ is a rhombus and its diagonals bisects at O.

$\therefore$ $RO = OP$ and $SO = OQ$

$\angle ROQ = \angle QOP = \angle POS = \angle SOR = 90°$

$\therefore$ $\Delta SOR \cong \Delta ROQ \cong \Delta POQ \cong \Delta POS$

(a) $\because$ O is the bisects SQ.

$\therefore$ $\boldsymbol{OQ = OS}$ **Ans.**

(b) $\because$ $\Delta SOR \cong \Delta ROQ$

$\therefore$ $\boldsymbol{QR = SR}$ **Ans.**

(c) In ΔQOR and ΔSOR

$\because$ $SO = OQ$

$SR = RQ$ (SSS)

$RO = OR$

$\therefore$ $\boldsymbol{\Delta QOR \cong \Delta SOR}$ **Ans.**

(d) $\because$ $\Delta QOR \cong \Delta SOR$

$\therefore$ $\boldsymbol{\angle QRO = \angle SRO}$ **Ans.**

(e) In $\Delta QPO \cong \Delta SOR$

$\because$ O is the mid point of SQ.

$\therefore$ $QO = OQ$

$\because$ O is the mid point of PR.

$\therefore$ $RO = PO;\ \angle ROS = \angle QOP$

$\therefore$ $\boldsymbol{\Delta QPO \cong \Delta SOR}$ **Ans.**

(f) $\because$ $\Delta POQ \cong \Delta POQ$

$\therefore \quad \angle \boldsymbol{QPO} = \angle \boldsymbol{SPO}$ **Ans.**

(g) $\because \Delta SOR \cong \Delta ROQ \cong \Delta POQ \cong \Delta POS$

$\therefore \quad \angle SPO = \angle QPO$

And $\angle \boldsymbol{SRO} = \angle \boldsymbol{QRO}$ **Ans.**

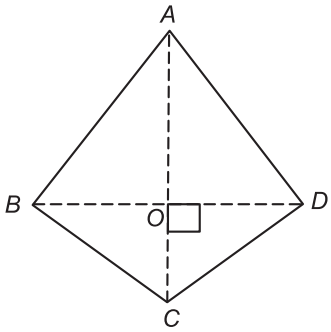
6. In ΔSOR, $\angle OSR + \angle SRO + \angle SOR = 180°$

$\therefore \quad x + 30° + 90° = 180°$ $[\because \angle \boldsymbol{SOR} = \mathbf{90°}]$

or $x = 180° - 120° = 60°$

$\therefore \angle PSR = 90° + 30° = \mathbf{120°}$ **Ans.**

7. $\because AC = 16 \text{ cm}$



$\therefore \quad AO = OC = \dfrac{16}{2} \text{ cm} = 8 \text{ cm}$

$\because \quad BD = 12 \text{ cm}$

$\therefore \quad BO = OD = \dfrac{12}{2} \text{ cm} = 6 \text{ cm}$

Now in ΔCOD,

$\angle COD = 90°$

$\because \quad OD = 6 \text{ cm}$

And $OC = 8 \text{ cm}$

$\therefore \quad CD = \sqrt{(6 \text{ cm})^2 + (8 \text{ cm})^2} = \sqrt{36 \text{ cm}^2 + 64 \text{ cm}^2}$

$= \sqrt{100 \text{ cm}^2} = \mathbf{10 \text{ cm}}$ **Ans.**

8. $PR = 2PO = 2 \times 6 \text{ cm} = \mathbf{12 \text{ cm}}$ **Ans.**

$QS = PR = \mathbf{12 \text{ cm}}$ **Ans.**

9. Let small side of a parallelogram $= x$ cm

They big side of a parallelogram $= (x + 25)$ cm

$\because$ Perimeter $= 2[x + (x + 25)]$ cm

$\therefore$ $250 \text{ cm} = 2(2x + 25)$

or $2x + 25 \text{ cm} = 125 \text{ cm}$

$\therefore$ $2x = 125 \text{ cm} - 25 \text{ cm} = 100 \text{ cm}$

$\therefore$ $x = \frac{100}{2} \text{ cm} = 50 \text{ cm}$

Big side $= 50 \text{ cm} + 25 \text{ cm} = 75 \text{ cm}$

Hence, **the lengths of all the sides of the parallelogram are 50 cm, 75 cm, 50 cm and 75 cm.** **Ans.**

10. According to figure,

$$\angle a = \frac{1}{2}(180° - 70°) = \frac{1}{2} \times 110° = 55°$$

In ΔAOD, $\angle AOD = 180° - 70° = 110°$

$\therefore$ $\angle b = \frac{1}{2}(180° - 110°) = \frac{1}{2} \times 70° = 35°$

Hence, $\angle a = 55°$ **and** $\angle b = 35°$ **Ans.**

11. $\because$ $ABCD$ is a parallelogram.

And AE is bisect $\angle A$.

$\therefore$ $\angle DAE = \angle EAD = \frac{1}{2} \angle A$

$\because$ CF is a bisect $\angle C$.

$\therefore$ $\angle BCF = \angle FCE = \frac{1}{2} \angle C$ and $\angle B = \angle D$

$\therefore AF = CE$ and $AF \parallel EC$; $AE = FC$ and $AE \parallel FC$

Hence, $\boldsymbol{AE \parallel CF}$ **Proved**

12. (a) F, (b) T, (c) T, (d) T, (e) F, (f) F, (g) F, (h) F.

Multiple Choice Questions

(i) Answer **(d)** is correct. **Ans.**

(ii) Answer **(b)** is correct. **Ans.**

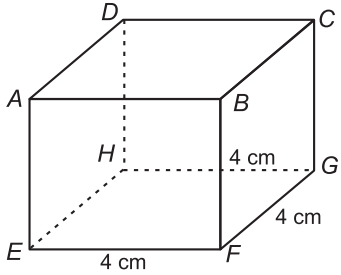
(iii) Answer **(d)** is correct. **Ans.**

(iv) Answer **(a)** is correct. **Ans.**

11. Visualising Solid Shapes

Exercise 11.1

1. (a)



Step I:- Draw a rhombus ABCD of side 4 cm horizontally with AB as the base.

Step II:- Draw vertical lines from the verticles A, B and C each equal to 4 cm.

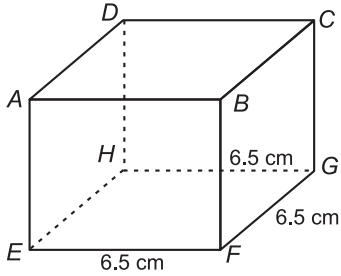
Step III:- Name the three end points of these vertical lines E, F and G respectively. Join EF and FG.

Step IV:- This is the required cubes but there are three hidden faces which to 4 cm. We name this end point as H.

Step V:- Join HE and GH with dotted lines.

So, **the required cube is ABCDEFGH.** **Ans.**

(b)



Step I:- Drw a rhombus ABCD of side 6.5 cm horizontally with AB as the base.

Step II:- Draw vertical lines from the vertices A, B and C each equal to 6.5 cm.

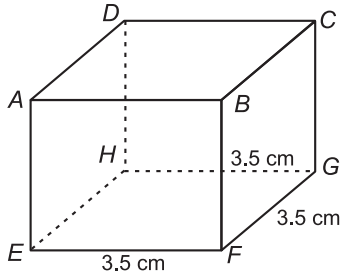
Step III:- Name the three end points of these vertical lines E, F and G respectively. Join EF and FG.

Step IV:- This is the required cube, but there are three hidden faces which we cannot see. So we drop a vertical dotted line from D equal to 6.5 cm. We name this end point as H.

Step V:- Join HE and GH with dotted lines.

So, **the required cube is ABCDEFGH.** **Ans.**

(c)



Step I:- Draw a rhombus ABCD of side 3.5 cm horizontally with AB as the base.

Step II:- Draw vertically line from the vertices A, B and C each equal to 3.5 cm.

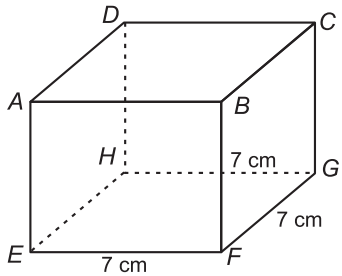
Step III:- Name the three end points of these vertical lines E, F and G respectively. Join EF and FG.

Step IV:- This is the required cube, but there are three hidden faces which we cannot see. So we drop a vertical dotted line from D, equal to 3.5 cm. We name this end point as H.

Step V:- Join HE and GH with dotted lines.

So, **the required cube is ABCDEFGH.** **Ans.**

(d)



Step I:- Draw a rhombus ABCD of side 7 cm horizontally with AB as the base.

Step II:- Draw vertically line from the vertices A, B and C each equal to 7 cm.

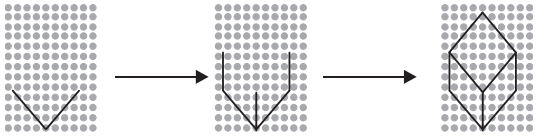
Step III:- Name the three end points of these vertical lines E, F and G respectively. Join EF and FG.

Step IV:- This is the required cube, but there are three hidden faces which we cannot see. So we drop a vertical dotted line from D, equal to 7 cm. We name this end point as H.

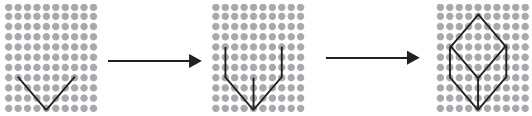
Step V:- Join HE and GH with dotted lines.

So, **the required cube is ABCDEFGH.** **Ans.**

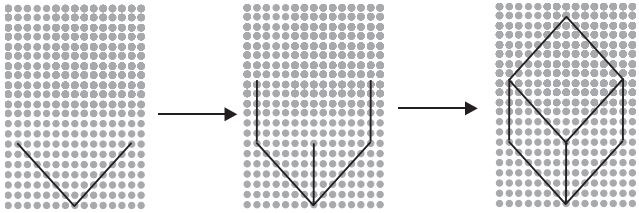
2. (a)



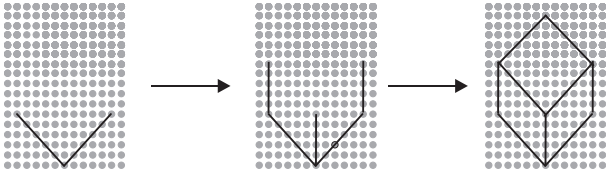
(b)



(c)



(d)

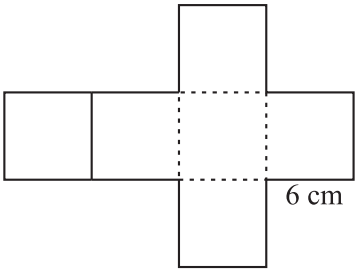


3. (a) Cone **Ans.** (b) Cuboid **Ans.**
(c) Cube **Ans.** (d) Cylinder **Ans.**
(e) Triangular prism **Ans.** (f) Rectangular pyramids **Ans.**

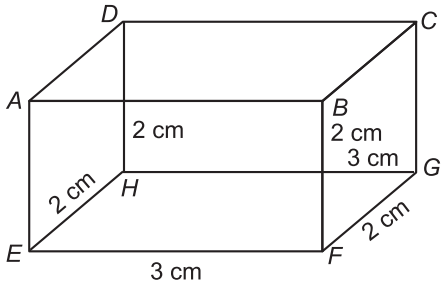
4. (a) Two examples of sphere:- (i) A football, (ii) Marbles
(b) Two examples of cone:- (i) Ice-cream cone, (ii) A clown's cap
(c) Two examples of triangular prism:- (i) prism, (ii) and rod
(d) Two examples of cuboid:- (i) A brick, (ii) A match box

5. (a) Five **Ans.** (b) Three **Ans.** (c) Two **Ans.**
(d) Three **Ans.**

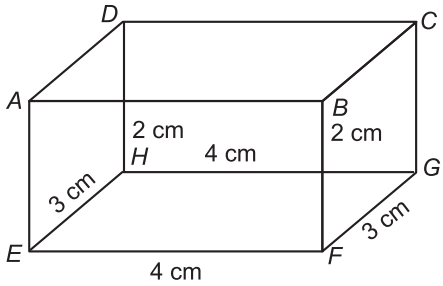
6.



7. (a)

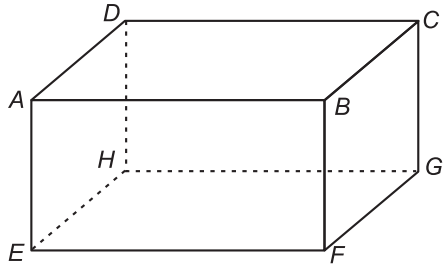


(b)



8. **Thirty cubes** are used to make the figure. **Ans.**

9. (a)



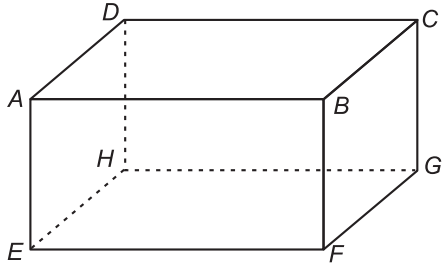
Step I:- Draw a parallelogram with length $AB = 2.5$ cm and the starting height $BC = 2$ cm having any acute or obtuse angle.

Step II:- Draw these vertical lines from A, B and C equal to 2 cm. Name the three end points of these lines as E, F and G. Join EF and FG.

Step III:- From D, drop a vertical dotted line DH equal to 1 cm.

Step IV:- Join HE and HG by dotted lines. So, the required cuboid is ABCDEFGH. **Ans.**

(b)



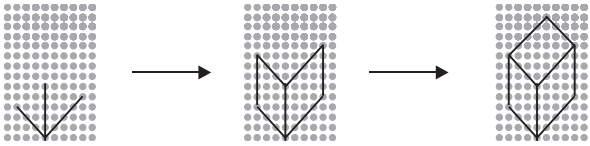
Step I:- Draw a parallelogram with length AB = 5.5 cm and the starting height AB = 5.5 cm having any acute or obtuse angle.

Step II:- Draw these vertical lines form A, B and C equal to 2.5 cm. Name the three end points of these line as EF and join EF and FG.

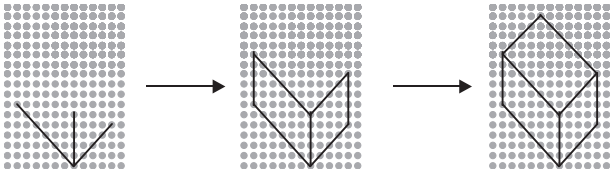
Step III:- From D, drop a dotted line DH equal 2.5 cm.

Step IV:- Join HE and HG by dotted lines. So, the required cuboid is ABCDEFGH. **Ans.**

10. (a)



(b)



11. All the faces of net are $3.5 \times 2.5 \times 8$ cm.

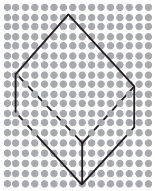
Exercise 11.2

1.	(a) 6 faces	**Ans.**	(b) 5 faces	**Ans.**
	(c) 1 face	**Ans.**	(d) 3 faces	**Ans.**
2.	(a) 12 edges	**Ans.**	(b) 9 edges	**Ans.**
	(c) 0 edge	**Ans.**	(d) 8 edges	**Ans.**
3.	(a)12 edges	**Ans.**	(b) 6 edges	**Ans.**
	(c) 12 edges	**Ans.**	(d) 18 edges	**Ans.**
	(e) 12 edges	**Ans.**	(f) 8 edges	**Ans.**
4.	(a) 2 faces	**Ans.**	(b) 6 faces	**Ans.**
	(c) 9 faces	**Ans.**	(d) 3 faces	**Ans.**
5.	(a) 6 vertices	**Ans.**	(b) 4 vertices	**Ans.**
	(c) 6 vertices	**Ans.**	(d) 12 vertices	**Ans.**
	(e) 6 vertices	**Ans.**	(f) 9 vertices	**Ans.**

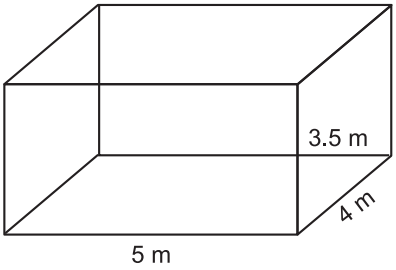
6.

Name of soild	**F**	**E**	**V**	$F + V - E$
Hexagonal prism	8	18	12	$8+12-18=2$
Quadrilateral pyramid	5	8	5	$5+5-8=2$
Hexagonal pyramid	7	12	7	$7+7-12=2$
Pentagonal prism	7	15	10	$7+10-15=2$
Cube	6	12	8	$6+8-12=2$

7.



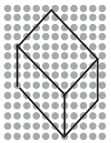
8. Six faces :



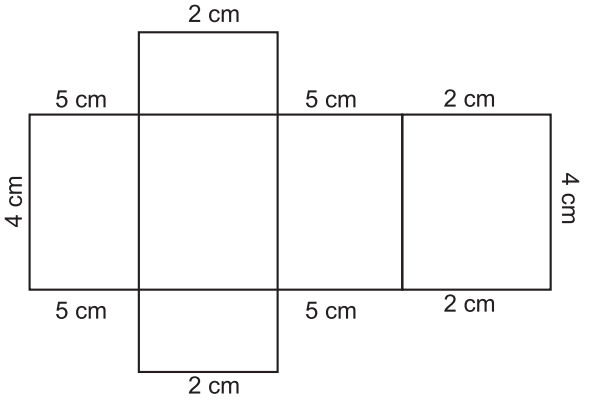
9. (a) A prism has : $n+2$ faces, $3n$ edges and $2n$ vertices

(b) A pyramid has $n+1$ faces , $2n$ edges and $n+1$ vertices

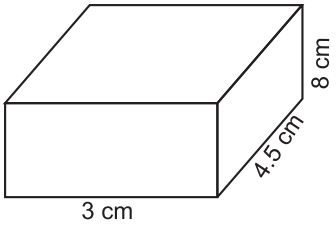
10.



11.



12.



13. (a) 5 vertices (b) 2 vertices
(c) 6 vertices (d) 8 vertices

14.

Solid	V	E	F	$V+F$	$E+2$
(a)	6	10	6	$6+6=12$	$10+2=12$
(b)	8	12	6	$8+6=14$	$12+2=14$
(c)	5	8	5	$5+5=10$	$8+2=10$
(d)	6	9	5	$6+5=11$	$9+2=11$
(e)	4	6	4	$4+4=8$	$6+2=8$
(f)	7	12	7	$7+7=14$	$12+2=14$

We observe that in each case $V+F=E+2$
Hence, **Euler's formula is verified.** **Ans.**

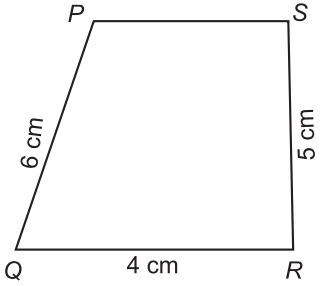
Multiple Choice Questions

1. (i) The number of edges in pentagonal pyramid is 10.
Hence, the answer **(c)** is correct. **Ans.**
(ii) The number of faces in a cuboid is 6.
Hence, the answer **(c)** is correct. **Ans.**
(iii) The number of vertices in a cylinder is 0.
Hence, the answer **(a)** is correct. **Ans.**
(iv) The number of edges a triangular pyramid has 6.
Hence, the answer **(c)** is correct. **Ans.**
(v) The Euler's formula is $F+V-E=2$
Hence, the answer **(b)** is correct. **Ans.**

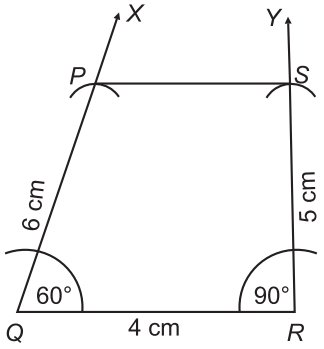
12. Practical Geometry

Exercise 12

1. **Given:-** The three sides of a quadrilateral PQRS as QR = 4 cm, PQ = 6 cm, RS = 5 cm and two includes angle $\angle Q = 60°$ and $\angle R = 90°$

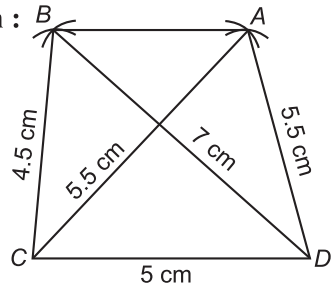


Steps of Construction :



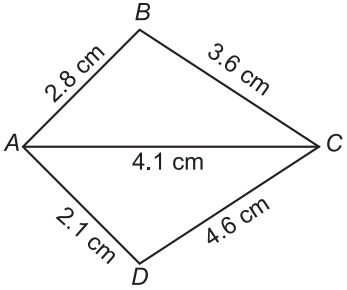
(a) Draw a line QR = 4 cm.
(b) Construct $\angle RQX = 60°$.
(c) With Q as centre and radius PQ = 6 cm, draw an arc to intersect ray QX at P.
(d) Construct $\angle QRY = 90°$
(e) With R as centre and radius RS = 5 cm, draw an arc to intersect ray RY at S.
(f) Join PS.
Then, the quadrilateral PQRS is the required quadrilateral.

2. Steps of Construction :

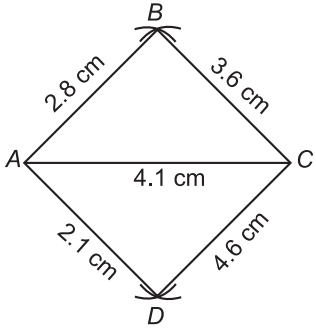


(a) Draw CD = 5 cm.
(b) With C as centre and CB = 4.5 cm as radius, draw an arc.
(c) With D as centre and BD = 7 cm radius, draw another arc to intersect the arc of step (b) at B.
(d) With C as centre and AC = 5.5 cm as radius, draw an arc.
(e) With D as centre and AD = 5.5 cm as radius, draw another arc to intersect the arc of step (d) at A.
(f) Join AD, AB and CB.
Then, ABCD the required quadrilateral.

3. First draw a rough sketch of the quadrilateral ABCD and draw diagonal AC = 4.1 cm, indicates the length of the four sides and the given diagonal.



Steps of Construction :



(a) Draw AC = 4.1 cm.

(b) With A as centre AB = 2.8 cm as radius, draw an arc.

(c) With C as center and BC = 3.6 cm as radius draw another arc intersect the arc of step (b) at B.

(d) With A as centre and AD = 2.1 cm as radius draw an arc so that the arc opposite sides of AC.

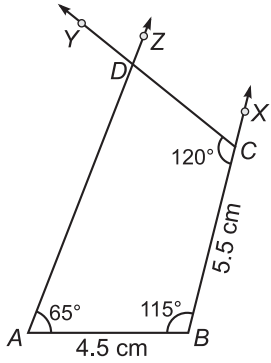
(e) With C as centre and DC = 4.6 cm as radius draw an arc to intersect the arc of step (d) at D.

(f) Join AB, BC, CD and AD.

Then ABCD is the required quadrilateral.

4. Given:- To adjacent sides of a quadrilateral ABCD, AB = 4.5 cm, BC = 5.5 cm and three angles are $\angle A = 65°$, $\angle B = 115°$ and $\angle C = 120°$.

Steps of Construction :



(a) Draw AB = 4.5 cm.

(b) At B, draw an angle $\angle XBA = 115°$.

(c) From ray BX, cut BC = 5.5 cm.

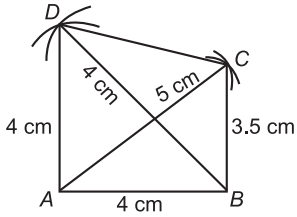
(d) At C, draw an angle $\angle YCB = 120°$.

(e) At A draw an angle $\angle ZAB = 65°$. Let rays CY and AZ intersects each other at D.

Then, ABCD is the required quadrilateral.

5. Given:- Quadrilateral ABCD in which AB = AD = 4 cm, BC = 3.5 cm, AC = 5 cm and BD = 4 cm

Steps of Construction:



(a) Draw AB = 4 cm.

(b) With A as centre and AD = 4 cm as radius, draw an arc.

(c) With B as centre and BD = 4 cm radius, draw another arc to intersect the arc of step (b) at D.

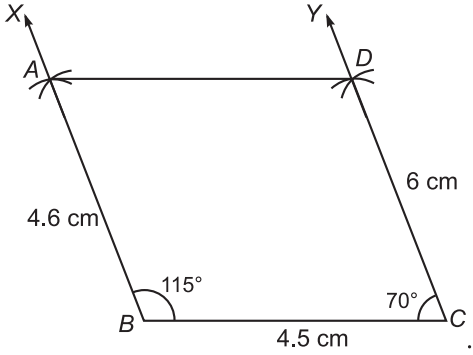
(d) With A as centre and AC = 5 cm, draw an arc.

(e) With B as centre and BC = 3.5 cm as radius draw another arc to intersect the arc of step (d) at C.

(f) Join BC, DC and AD.

6. Given:- The three sides of a quadrilateral, AB = 4.6 cm, BC = 4.5 cm, CD = 6 cm, $\angle B = 115°$ and $\angle C = 70°$.

Steps of Construction:



(a) Draw BC = 4.5 cm.

(b) Draw $\angle XBC = 115°$.

(c) With B as centre and radius AB = 4.6 cm, draw an arc to intersect ray BX at A.

(d) At C, draw $\angle YCB = 70°$

(e) With C as centre and radius CD = 6 cm, draw an arc to intersect ray CY at D.

(f) Join AD.

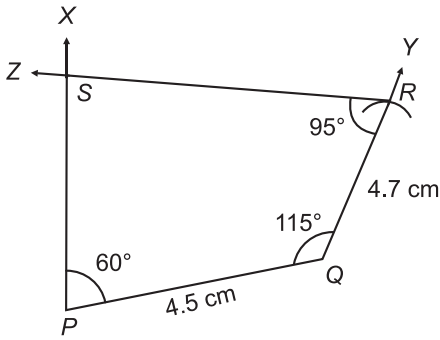
Then, the quadrilateral ABCD is the required quadrilateral.

7. **Given:** In a quadrilateral $PQRS$, $PQ = 4.5$ cm, $QR = 4.7$ cm, $\angle P = 60°$, $\angle Q = 115°$ and $\angle S = 90°$

Calculation: $\angle R = 360° - \angle P - \angle Q - \angle S$

$= 360° - 60° - 115° - 90° = 360° - 265° = 95°$

Steps of construction:



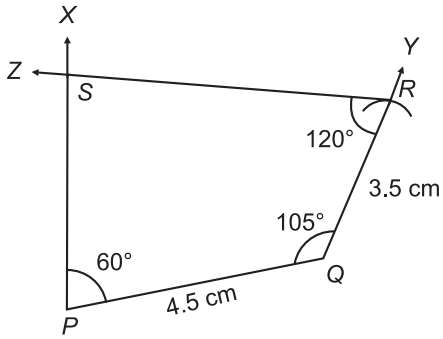
(a) Draw $PQ = 4.5$ cm.
(b) At P, draw $\angle QPX = 60°$.
(c) At Q, draw $\angle PQY = 115°$.
(d) At Q, draw an arc, $QR = 4.7$ cm.
(e) At R, draw a $\angle QRZ = 95°$.
(f) Meet RS.
Hence, $PQRS$ is a quadrilateral.

8. **Given:** In a quadrilateral $PQRS$, $PQ = 4.5$ cm, $QR = 3.5$ cm, $\angle P = 60°$, $\angle Q = 105°$ and $\angle S = 75°$

Calculation: $\angle R = 360° - \angle P - \angle Q - \angle S$

$= 360° - 60° - 105° - 75° = 360° - 240° = 120°$

Steps of construction:

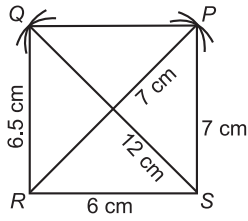


(a) Draw $PQ = 4.5$ cm.
(b) At P, draw $\angle QPX = 60°$.

(c) At Q, draw $\angle PQY = 105°$.
(d) At Q, draw an arc, $QR = 3.5$ cm.
(e) At R, draw a $\angle QRZ = 120°$.
(f) Meet RS.
Hence, $PQRS$ is a quadrilateral.

9. Given:- Quadrilateral PQRS in which, QR = 6.5 cm, PR = PS = 7 cm, RS = 6 cm and QS = 12 cm.

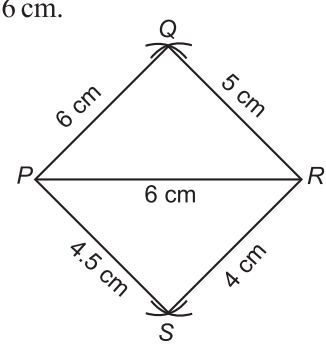
Steps of Construction:



(a) Draw RS = 6 cm.
(b) With R as center and QR = 6.5 cm as radius, draw an arc.
(c) With S as centre and QS = 12 cm radius, draw another arc intersect the arc of step (b) at Q.
(d) With R as centre and PR = 7 cm as radius, draw an arc
(e) With S as centre and PS = 7 cm as radius, draw another arc to intersect the arc of step (d) at P.
(f) Join SP, PQ and QR.
Then, PQRS is required quadrilateral.

10. Given:- In a quadrilateral PQRS, PQ = 6 cm, QR = 5 cm, RS = 4 cm, PS = 4.5 cm and a diagonal PR = 6 cm.

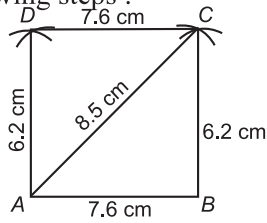
Steps of Construction:



(a) Draw PR = 6 cm.
(b) Which P as centre and QP = 6 cm as radius, draw as arc.
(c) With R as centre and QR = 5 cm as radius draw another arc intersect the arc of step (b) at Q.
(d) With P as centre and PS = 4.5 cm as radius, draw an arc so that the arc opposite side of PR.
(e) With R as centre and RS = 4 cm as radius an arc to intersect the arc of step (d) at S.
(f) Join PQ, QR, SP and RS
Then, PQRS is the required quadrilateral.

11. Step of Construction:

We construct a parallelogram in the following steps :



(a) Draw AB = 7.6 cm.

(b) With A as centre draw an arc of radius 8.5 cm.

(c) With B as centre draw an arc with radius 6.2 cm to intersect the arc of step (b) at C.

(d) Join BC and AC.

(e) With A as centre draw an arc with radius 6.2 cm.

(f) With C as centre an arc with 7.6 cm intersect the arc of step (e) at D.

(g) Join DC and AD.

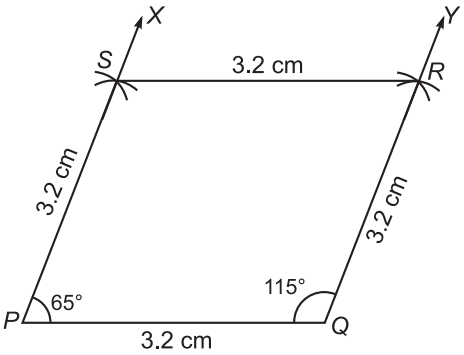
Then, the parallelogram ABCD is the required parallelogram.

12. Suppose PQRS is the required in which PQ = 3.2 cm and $\angle P = 65°$

Thus, $\angle Q = 180° - \angle P = 180° - 65° = 115°$

Hence, we work according to following steps.

Steps of Construction :



(a) Draw PQ = 3.2 cm.

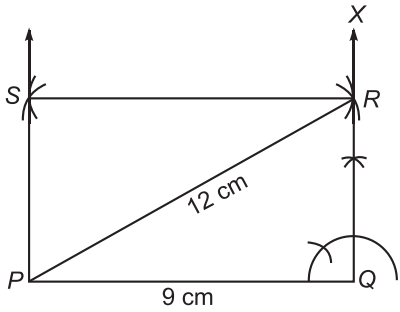
(b) Draw $\angle XPQ = 65°$ and $\angle PQY = 115°$.

(c) Intersect PS = 3.2 cm at PX and QR = 3.2 cm at QY.

(d) Thus, the obtained rhombus PQRS is the required rhombus.

13. Let PQRS is a required rectangle, whose side PQ = 9 cm and hypotenuse PR = 12 cm. We follow the following steps to construct such type of rectangle.

Steps of Construction:



(a) Draw PQ = 9 cm

(b) Draw QX ⊥ PQ.

(c) Draw an arc PR = 12 cm with P as centre to intersect QX at R.

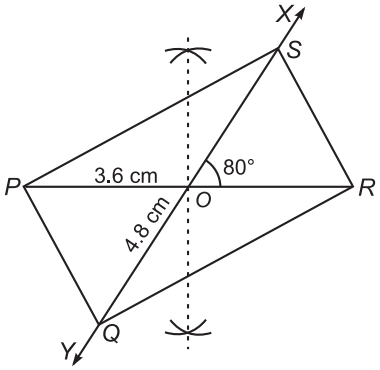
(d) With R as centre RS = 9 cm as radius draw an arc.

(e) With R as centre RS = 9 cm as radius an arc which bisect at S.

(f) By joining PS and SR the required rectangle is obtained.

14. In PQRS is required quadrilateral is such that PR = 3.6 cm and QS = 4.8 cm

Steps of Construction:



(a) Draw PR = 3.6 cm.

(b) Bisects PR at O.

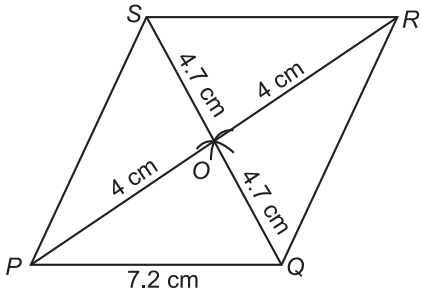
(c) Draw $\angle ROX = 80°$ and XO to Y.

(d) With O as centre intersect $OQ = \frac{1}{2}QS = 2.4$ cm at OX.

(e) On joining PQ, QR, RS and SP the required parallelogram obtained.

15. We know that the diagonals of parallelogram intersect to each other.

Steps of Construction :



(a) Draw PQ = 7.2 cm.

(b) With P as centre draw an arc with radius 4 cm.

(c) With Q s centre draw another arc of radius 4.7 cm which intersect to last arc at O.

(d) Join OP and OQ.

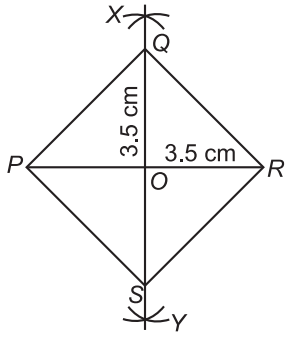
(e) Extend PO to R such that PO = OR and extend QO to S such that QO = OS.

(f) Join PS, QR and RS.

Then, the quadrilateral is the required parallelogram.

16. Let PQRS is a square; with hypotenuse PR = 7 cm. Because of the hypotenuse of square bisects to each other at right angle. Thus we follow the following steps:

Steps of Construction:



(a) Draw PR = 7 cm.

(b) Draw XY which bisects PR at O.

(c) Bisects $QO = \frac{1}{2} \times 7 \text{ cm} = 3.5 \text{ cm}$

from O at OX and OS = 3.5 cm at OY.

(d) Joining PQ, QR, RS and SP the required square is obtained.

Hence, *PQRS* is a square.

13. Mensuration

Exercise 13.1

1. (a) Let $a = 12$ cm, $b = 10$ cm and $c = 10$ cm

Now, $s = \dfrac{a+b+c}{2} = \dfrac{12+10+10}{2}\text{ cm} = \dfrac{32}{2}\text{ cm} = 16\text{ cm}$

$\therefore$ Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{16(16-12)(16-10)(16-10)}$ sq cm

$= \sqrt{16\times 4\times 6\times 6}$ sq cm $= \sqrt{2304}$ sq cm $= 48$ sq cm.

Hence, **the area of triangle is 48 sq cm.** **Ans.**

(b) Let $a = 17$ cm, $b = 25$ cm and $c = 26$ cm

Now, $s = \dfrac{a+b+c}{2} = \dfrac{17+25+26}{2}\text{ cm} = \dfrac{68}{2}\text{ cm} = 34\text{ cm}$

$\therefore$ Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{34(34-17)(34-25)(34-26)}$ sq cm

$= \sqrt{34\times 17\times 9\times 8}$ sq cm $= \sqrt{41616}$ sq cm $= 204$ sq cm.

Hence, **the area of triangle is 204 sq cm.** **Ans.**

2. $\because$ Area of $\Delta ABC = 0.08$ sq m $= 0.08\times 100\times 100$ sq cm $= 800$ sq cm and base $= 80$ cm

$\therefore$ Height of $\Delta ABC = 2\times \dfrac{\text{Area of } \Delta ABC}{\text{Base}} = \dfrac{2\times 800}{80}\text{ cm} = 20\text{ cm}$

Hence, **the height of $\Delta ABC = 20$ cm** **Ans.**

3. $\because$ Base of triangle $= 24$ cm and height $= 14$ cm

$\therefore$ Area of triangle $= \dfrac{1}{2}\times \text{base}\times \text{height}$

$= \dfrac{1}{2}\times 24\text{ cm}\times 14\text{ cm} = 168$ sq cm.

Hence, **the area of triangle $= 168$ sq cm.** **Ans.**

4. $\because$ Area of triangle $ABC = 96$ sq cm and height $= 12$ cm

$\therefore$ Base of triangle $ABC = 2\times \dfrac{\text{Area of trianlge}}{\text{Height of triangle}}$

$= \dfrac{2\times 96}{12}\text{ cm} = 16\text{ cm}$

Hence, **the base of triangle ABC is 16 cm.** **Ans.**

5. In the given figure,

$\because AB = 13$ cm, $DC = 7$ cm and $AM = DC$

[$\because$ *AB* || *DC* and *DA* $\perp$ *AB*]

$\therefore MB = AB - AM = (13 - 7)$ cm $= 6$ cm **[$\because$ *AM* = *DC*]**

Now, in ΔCMB, by Pythagoras theoram,

$BC^2 = MC^2 + MB^2$ or $10^2 = MC^2 + 6^2$

or $MC^2 = 10^2 - 6^2 = 100 - 36 = 64$

or $MC = \sqrt{64}$ cm or $MC = 8$ cm

$\therefore$ Area of quadrilateral $ABCD = \frac{1}{2} \times (AB + DC) \times MC$

$= \frac{1}{2} \times (13 + 7) \times 8$ sq cm $= \frac{1}{2} \times 20 \times 8$ sq cm $= 80$ sq cm

Hence, **the area of quadrilateral *ABCD* = 80 sq cm.** **Ans.**

6. Let the sides of triangle be $a = 13x$, $b = 14x$ and $c = 15x$, we have perimeter $= 84$ cm

$\therefore 13x + 14x + 15x = 84$ cm

or $42x = 84$ cm or $x = \frac{84}{42}$ cm or $x = 2$ cm

Sides of triangle a $= 13x = 13 \times 2$ cm $= 26$ cm

b $= 14x = 14 \times 2$ cm $= 28$ cm

and c $= 15x = 15 \times 2$ cm $= 30$ cm

Now, $s = \frac{a+b+c}{2} = \frac{26+28+30}{2}$ cm $= \frac{84}{2}$ cm $= 42$ cm

$\therefore$ Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{42(42-26)(42-28)(42-30)}$ sq cm

$= \sqrt{42 \times 16 \times 14 \times 12}$ sq cm $= \sqrt{112896}$ sq cm $= 336$ sq cm

Hence, **the area of triangle = 336 sq cm.** **Ans.**

7. $\because$ Area of trapezium $= 0.55$ sq m and perpendicular $= 11$ cm $= \frac{11}{100}$ m $= 0.11$ m

$\therefore$ Area of trapezium $= \frac{1}{2} \times$ sum of parallel side $\times$ perpendicular

or 0.55 sq m $= \frac{1}{2} \times$ Sum of parallel side $\times 0.11$ m

or Sum of parallel side $= \frac{0.55 \times 2}{0.11}$ m $= 10$ m

Hence, **the sum of base of trapezium = 10 m** **Ans.**

8. $\because$ Area of parallelogram $= 480$ sq cm

Height $= 16$ cm

$\therefore$ Base of parallelogram $= \frac{\text{Area}}{\text{Height}} = \frac{480}{16}$ cm $= 30$ cm

Hence, **the base of parallelogram is 30 cm.** **Ans.**

9. $\because$ Parallel sides of trapezium $= 20$ m and 15 m

Distance between two parallel sides $= 10$ m

$\therefore$ Area of trapezium $= \frac{1}{2} \times$ (sum of parallel sides $\times$ distance between to parallel sides)

$= \frac{1}{2} \times [(20 + 15) \times 10]$ sq m

$= \frac{1}{2} \times 35 \times 10$ sq m $= 175$ sq m

Hence, **the area of trapezium is 175 sq m.** **Ans.**

10. $\because$ Base of parallelogram $= 12$ cm and height $= 5$ cm

$\therefore$ Area of parallelogram = base $\times$ height

$= 12$ cm $\times 5$ cm $= 60$ sq cm

Hence, **the area of parallelogram is 60 sq cm.** **Ans.**

11. $\because$ Each side of equilateral triangle $= 20$ cm

$\therefore$ Area of equilateral triangle $= \frac{\sqrt{3}}{4} \times (\text{side})^2$

$= \frac{\sqrt{3}}{4} \times (20)^2$ sq cm $= \frac{\sqrt{3}}{4} \times 400$ sq cm $= 100\sqrt{3}$ sq cm

Hence, **the area of equilateral triangle $= 100\sqrt{3}$ sq cm.** **Ans.**

12. $\because$ Area of trapezium $= 65$ sq cm and base $= 13$ cm and 26 cm.

$\therefore$ Area of trapezium $= \frac{1}{2} \times$ sum of parallel side $\times$ height

or 65 sq cm $= \frac{1}{2} \times (13 + 26)$ cm $\times$ height

or 65 cm $= \frac{1}{2} \times 39 \times$ height

or height $= \frac{65 \times 2}{39}$ cm $= \frac{130}{39}$ cm $= \frac{10}{3}$ cm $= 3\frac{1}{3}$ cm

Hence, **the height of trapezium** $= \mathbf{\frac{10}{3}}$ **cm** $= \mathbf{3\frac{1}{3}}$ **cm** **Ans.**

13. We know that isosceles triangle has two equal sides.

$\because$ Equal sides of isosceles triangle $= 40$ cm

$\therefore$ Area of isosceles triangle $= \frac{1}{2} \times 40 \text{ cm} \times 40 \text{ cm}$

$= 800$ sq cm

Hence, **the area of triangle is 800 sq cm.** **Ans.**

14. One of the parallel side $= 25$ cm

Let the other parallel side be x cm.

Area of trapezium $= 140$ sq cm and height $= 7$ cm

$\therefore$ Area of trapezium $= \frac{1}{2} \times$ sum of parallel sides $\times$ distance between parallel lines

$140 \text{ sq cm} = \frac{1}{2} \times [(25 + x) \times 7]$ or $140 \text{ cm} = \frac{1}{2} \times (25 + x) \times 7$

or $25 + x = \frac{140 \times 2}{7}$ or $25 + x = 40$

or $x = 40 \text{ cm} - 25 \text{ cm} = 15 \text{ cm}$

Hence, **the other parallel side is 15 cm.** **Ans.**

15. (a) $\because$ Diagonals of rhombus shaped tiles $= 24$ cm and 10 cm

$\therefore$ Area of rhombus shaped tile $= \frac{1}{2} \times$ product of diagonals

$= \frac{1}{2} \times (24 \times 10)$ sq cm $=$ **120 sq cm.**

Ans.

(b) $\because$ Diagonals of rhombus shaped tiles $= 50$ cm and 100 cm

$\therefore$ Area of rhombus shaped tile $= \frac{1}{2} \times$ product of diagonals

$= \frac{1}{2} \times (50 \times 100)$ sq cm $=$ **2500 sq cm**

Ans.

16. $\because$ Area of parallelogram $= 360$ sq cm and base $= 18$ cm

$\therefore$ Height of parallelogram $= \frac{\text{area}}{\text{base}} = \frac{360}{18}$ cm $= 20$ cm

Hence, **the height of parallelogram** $=$ **20 cm** **Ans.**

Exercise 13.2

1. Here, diameter $= 35$ cm

Circumference of the circle $= \pi \times$ diameter

$$= \frac{22}{7} \times 35 \text{ cm} = 110 \text{ cm}$$

Hence, **the circumference of the circle is 110 cm.** **Ans.**

2. Here, $r = 3.5$ cm

Circumference of the circle $= 2\pi r = 2 \times \frac{22}{7} \times 3.5 \text{ cm} = 22 \text{ cm}$

Hence, **the circumference of the circle is 22 cm.** **Ans.**

3. Circumference of first circle $= 2\pi r_1 = 2\pi \times 3 = 6\pi$ cm

Circumference of second circle $= 2\pi r_2 = 2\pi \times 4 \text{ cm} = 8\pi$ cm

Ratio of both circle circumferences $= \frac{6\pi \text{ cm}}{8\pi \text{ cm}} = \frac{6}{8} = \frac{3}{4} = 3 : 4$

Hence, **the ratio of their circumference = 3 : 4** **Ans.**

4. Radius of wheel $(r) = 7$ cm

$\therefore$ Circumference of wheel $= 2\pi r = 2 \times \frac{22}{7} \times 7 \text{ cm} = 44 \text{ cm}$

Hence, **the circumference of the wheel is 44 cm.** **Ans.**

5. Diameter of a circular head of a person $= 22.75$ cm

Bandage will required in one incircle $= \pi d$

$= \frac{22}{7} \times 22.75 \text{ cm} = 22 \times 3.25 \text{ cm} = 71.5 \text{ cm}$

$\therefore$ Bandage will required to circle 8 around times $= \frac{71.5 \times 8}{100}$ m

$= 5.72$ m

Hence, **5.72 m long bandage will required.** **Ans.**

6. Length of silver wire $= 66$ cm

Wire required in one ring $= \frac{66}{10} \text{ cm} = 6.6 \text{ cm}$

Let the diameter of each ring $= d$ cm

Circumference of each ring $= 6.6$ cm

$\therefore \frac{22}{7} \times d = 6.6$ or $d = \frac{6.6 \times 7}{22} = 2.1 \text{ cm}$

Hence, **the diameter of each ring = 2.1 cm** **Ans.**

7. Diameter of the wheel of cycle $= 77$ cm

Circumference of wheel $= \pi d = \frac{22}{7} \times 77 \text{ cm} = 242 \text{ cm} = 2.42 \text{ m}$

$\therefore$ Number of revolution $= \frac{242 \times 1000}{242} =$ **1000 rotation** **Ans.**

8. Circumference of race track $= 110$ m

Let the diameter of race track be x.

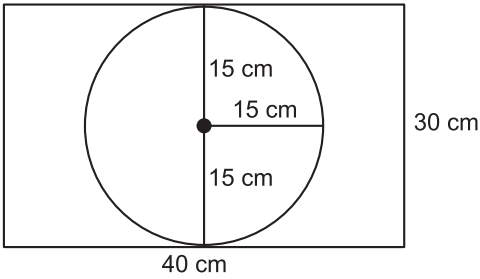
$\therefore \pi d = 110 \text{ m}$ or $\frac{22}{7} \times d = 110 \text{ m}$ or $d = \frac{110 \times 7}{22}$ m

or $d = 5 \times 7$ m or $d = 35$ m

Hence, **the diameter of race track is 35 m.** **Ans.**

Exercise 13.3

1.



Area of rectangular metal sheet $= 40 \text{ cm} \times 30 \text{ cm} = 1200 \text{ sq cm}$

Area of circular sheet $= \pi r^2$

$= \frac{22}{7} \times (15 \text{ cm})^2$ **[$\because$ r = 15 cm]**

$= \frac{22}{7} \times 225 \text{ sq cm} = \frac{4950}{7} \text{ sq cm} = 707.14 \text{ sq cm}$

$\therefore$ Area of the remaining sheet $= (1200 - 707.14) \text{ sq cm}$

$=$ **492.86 sq cm** **Ans.**

2. $\because$ Area of circle $= \pi r^2$

$\therefore \pi r^2 = 616 \text{ cm}^2$ or $\frac{22}{7} \times r^2 = 616 \text{ cm}^2$

or $r^2 = \frac{616 \times 7}{22} \text{ cm}^2$ or $r^2 = 28 \times 7 \text{ cm}^2$

or $r^2 = 196 \text{ cm}^2$ or $r = \sqrt{196} \text{ cm}$ $r = 14 \text{ cm}$

Hence, **the radius of circle is 14 cm.** **Ans.**

3. $\because$ Perimeter of the circle = circumference of the circle.

$\therefore 2\pi r = 44 \text{ cm}$ or $2 \times \frac{22}{7} \times r = 44 \text{ cm}$

or $r = \frac{44 \times 7}{2 \times 22} \text{ cm}$ or $r = 7 \text{ cm}$

$\therefore \text{Area of circle} = \pi r^2 = \frac{22}{7} \times (7 \text{ cm})^2 = \frac{22}{7} \times 7 \times 7 \text{ sq cm}$

$= 154 \text{ sq cm}$

Now, $\therefore$ Perimeter of square = Perimeter of circle

$4 \times \text{side} = 44 \text{ cm}$ or side $= \frac{44}{4} \text{ cm}$ or side $= 11 \text{ cm}$

$\therefore \text{Area of square} = (\text{side})^2 = (11 \text{ cm})^2 = 121 \text{ cm}^2$

Thus, area of circle is greater.

Difference of area $= 154 \text{ cm}^2 - 121 \text{ cm}^2 = 33 \text{ sq cm}$

Hence, **area of circle is greater, it is 33 sq cm.** **Ans.**

4. Let r_1 is the radius of given circle and area is A_1

$\therefore \text{Area of circle } A_1 = \pi r_1^2$

Now, radius of a circle is to be doubled $= 2 \times r_1 = 2r_1$

Let the area of obtained circle be A_2

$\therefore A_2 = \pi(2r_1)^2 = 4\pi r_1^2$

Ratio of given and obtained circle $= \frac{A_1}{A_2} = \frac{\pi r_1^2}{4\pi r_1^2} = \frac{1}{4} = 1 : 4$

Hence, **the ratio between the areas of both the circle = 1 : 4**

Ans.

5. Length of string $(r) = 10 \text{ m}$

$\therefore \text{Area were the cow can graze} = \pi r^2$

$= \frac{22}{7} \times (10 \text{ m})^2 = \frac{22}{7} \times 100 \text{ sq m} = \frac{2200}{7} \text{ sq m} = 314.29 \text{ sq m}$

Hence, **the area where the cow can graze = 314.29 sq cm.**

Ans.

6. $\because$ Diameter of the circle = 9.8 cm

$\therefore \text{Radius of circle } (r) = \frac{9.8}{2} \text{ cm} = 4.9 \text{ cm}$

$\therefore$ Area of circle $= \pi r^2 = \frac{22}{7} \times (4.9\text{cm})^2$

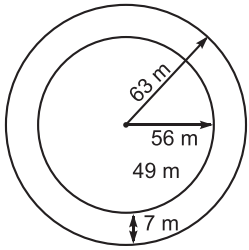
$= \frac{22}{7} \times 4.9 \times 4.9$ sq cm $= 22 \times 0.7 \times 4.9$ sq cm $= 75.46$ sq cm

Hence, **the area of circle is 75.46 sq cm.** **Ans.**

7. $\because$ Radius of field $= 56$ m

$\therefore$ Area of field $= \pi r^2 = \frac{22}{7} \times (56\text{ m})^2 = \frac{22}{7} \times 56 \times 56$ sq m

$= 9856$ sq m



$\therefore$ Radius of bigger circle $= (56 + 7)$ m $= 63$ m

Area of bigger circle $= \pi r^2 = \pi \times (63\text{ m})^2$

$= \frac{22}{7} \times 63 \times 63$ sq m $= 12474$ sq m

$\therefore$ Area of road = Area of bigger circle $-$ Area of field

$= 12474$ sq m $- 9856$ sq m $= 2618$ sq m

Hence, **the area of the road = 2618 sq m.** **Ans.**

8. $\because$ Radius of circle $(r) = 14$ cm

$\therefore$ Area of circle $= \pi r^2 = \frac{22}{7} \times (14\text{cm})^2$

$= \frac{22}{7} \times 14 \times 14$ sq cm $= 44 \times 14$ sq cm $= 616$ sq cm

Hence, **the area of circle is 616 sq cm.** **Ans.**

9. $\because$ Circumference of a circle $= 66$ cm

$\therefore 2\pi r = 66$ cm or $2 \times \frac{22}{7} \times r = 66$ cm

or $r = \frac{66 \times 7}{2 \times 22}$ cm or $r = \frac{21}{2}$ cm

$\therefore$ Area of the circle $= \pi r^2 = \frac{22}{7} \times \left(\frac{21}{2}\text{cm}\right)^2$

$= \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}$ sq cm $= \frac{693}{2}$ sq cm $= 346.5$ sq cm

Hence, **the area of a circle is 346.5 sq cm.** **Ans.**

10. $\because$ Area of circle $= \pi r^2$

$\therefore \pi r^2 = \frac{2200}{7}$ sq cm or $\frac{22}{7} \times r^2 = \frac{2200}{7}$ sq cm

or $r^2 = \frac{2200}{7} \times \frac{7}{22}$ or $r^2 = 100$ sq cm

or $r = \sqrt{100}$ cm or $r = 10$ cm

$\therefore$ Diameter $= 2 \times r = 2 \times 10$ cm $= 20$ cm

Hence, **the diameter of the circle is 20 cm.** **Ans.**

Exercise 13.4

1. Height of cylinder $(h) = 18$ cm and radius $= 10.5$ cm

(a) Volume of cylinder $= \pi r^2 h = \frac{22}{7} \times (10.5\text{cm})^2 \times 18$ cm

$= \frac{22}{7} \times 10.5 \times 10.5 \times 18$ cm^3

$= 22 \times 1.5 \times 10.5 \times 18$ cm^3 $= 6237$ cm^3

Hence, **the volume of cylinder is 6237 cm^3.** **Ans.**

(b) Curved surface area of cylinder $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 10.5 \times 18$ cm^2 $= 44 \times 1.5 \times 18$ cm^2 $= 1188$ cm^2

Hence, **the curved surface area of a cylinder is 1188 cm^2.** **Ans.**

(c) Total surface area of cylinder $= 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 10.5$ cm $(18 + 10.5)$ cm $= 44 \times 1.5$ cm $\times 28.5$ cm

$= 1881$ cm^2

Hence, **the total surface area of a cylinder is 1881 cm^2.** **Ans.**

2. The internal radius of metallic cylinder $(r_1) = 3$ cm

The external radius of metallic cylinder $(r_2) = 3.5$ cm

Length of the pipe $= 56$ cm

$\therefore$ Total surface area of pipe $= 2\pi(r_1 + r_2)(h + r_1 - r_2)$

$= 2 \times 3.14(3 + 3.5)(56 + 3 - 3.5)$ cm^2

$= 6.28 \times 6.5 \times 55.5$ cm^2 $=$ **2265.51 cm^2**

Hence, **the total surface area of pipe is 2265.51 cm^2.** **Ans.**

3. $\because$ Diameter of the pipe $= 1$ cm

$\therefore$ Radius of pipe $(r) = \frac{1}{2}$ cm

$\therefore$ Volume of cylinder $= \pi r^2 h$

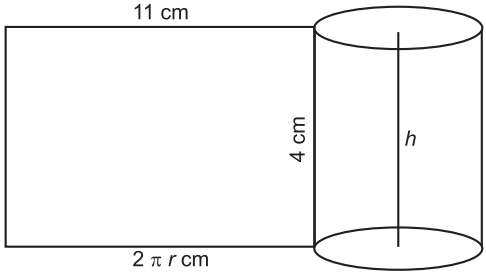
$\therefore \pi r^2 h = 550 \text{ cm}^3$ or $\frac{22}{7} \times \left(\frac{1}{2}\right)^2 \times h = 550 \text{ cm}^3$

or $\frac{22}{7} \times \frac{1}{4} \times h = 550 \text{ cm}^3$ or $h = \frac{550 \times 4 \times 7}{22}$ cm

or $h = 700$ cm or $h = \frac{700}{100}$ m $= 7$ m

Hence, **the length of pipe is 7 m.** **Ans.**

4. It is clear that $h = 4$ cm and it base diameter is 11 cm



Let the radius be r.

Then, $2\pi r = 11 \text{ cm}$ or $2 \times \frac{22}{7} \times r = 11 \text{ cm}$

or $r = \frac{11 \times 7}{2 \times 22}$ cm or $r = \frac{7}{4}$ cm

$\therefore h = 4$ cm and $r = \frac{7}{4}$ cm

Now, volume of cylinder $= \pi r^2 h = \frac{22}{7} \times \left(\frac{7}{4} \text{cm}\right)^2 \times 4 \text{ cm}$

$= \frac{22}{7} \times \frac{7}{4} \times \frac{7}{4} \times 4 \text{ cm}^3 = \frac{77}{2} \text{ cm}^3 = 38.5 \text{ cm}^3$

Hence, **the volume of cylinder is 38.5 cm^3.** **Ans.**

5. $\because$ Area of base $(\pi r^2) = 100$ sq cm and height $= 10$ cm.

$\therefore$ Volume of cylinder $=$ Area of base $(\pi r^2) \times$ height (h)

$= 100 \text{ sq cm} \times 10 \text{ cm} = 1000 \text{ cm}^3$

Hence, **the volume of cylinder is 1000 cm^3.** **Ans.**

6. Height of cylinder $(h) = 7$ cm

Curved surface area of cylinder $(2\pi rh) = 88$ sq cm

$\therefore 2\pi rh = 88 \text{ sq cm}$ or $2 \times \frac{22}{7} \times r \times 7 \text{ cm} = 88 \text{ sq cm}$

or $r = \frac{88 \times 7}{2 \times 22 \times 7}$ cm or $r = 2$ cm

Hence, **the radius of cylinder is 2 cm.** **Ans.**

7. Height of the cylinder is $(h) = 25$ cm.

Circumference of cylinder $(2\pi r) = 132$ cm

$\therefore 2\pi r = 132 \text{ cm}$ or $2 \times \frac{22}{7} \times r = 132 \text{ cm}$

or $r = \frac{132 \times 7}{2 \times 22}$ cm or $r = 3 \times 7$ cm

or $r = 21$ cm

$\therefore$Capacity or volume of the cylinder $= \pi r^2 h$

$= \frac{22}{7}(21\text{cm})^2 \times 25 \text{ cm} = \frac{22}{7} \times 21 \times 21 \times 25 \text{ cm}^3$

$= 34650 \text{ cm}^3 = \frac{34650}{1000}$ litre $= 34.65$ litre

Hence, **the capacity of cylinder is 34.65 litre.** **Ans.**

Exercise 13.5

1. $\therefore$Height $(h) = 21$ cm and slant height $(l) = 28$ cm

$\therefore$slant height $l^2 = r^2 + h^2$ or $(28)^2 = r^2 + (21)^2$

or $784 = r^2 + 441$ or $r^2 = 784 - 441$

or $r = 7\sqrt{7}$ or $r = \sqrt{343} = \sqrt{7 \times 7 \times 7}$

or $r = 7\sqrt{7}$ cm.

(a) The area of base of cone $= \pi r^2$

$= \pi \times (7\sqrt{7} \text{ cm})^2 = \frac{22}{7} \times 343 \text{ cm}^2$

$= 22 \times 49 \text{ cm}^2 = 1078 \text{ cm}^2$

Hence, **the area of base of cone is 1078 cm^2.** **Ans.**

(b) Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (7\sqrt{7}\text{ cm})^2 \times 21\text{ cm}$

$= \frac{1}{3} \times \frac{22}{7} \times 343 \times 21$ cubic cm

$= 22 \times 343$ cubic cm $= 7546$ cubic cm

Hence, **the volume of cone is 7546 cubic cm.** **Ans.**

2. (a) $\because$ Curved surface area of cone $(\pi rl) = 308$ sq cm

$\therefore \pi rl = 308$ sq cm or $\frac{22}{7} \times r \times 14\text{ cm} = 308$ sq cm

or $r = \frac{308 \times 7}{22 \times 14}$ cm or $r = 7$ cm

Hence, **the radius of base of cone is 7 cm.** **Ans.**

(b) Total surface area of cone $= \pi r(l + r)$

$= \frac{22}{7} \times 7(14 + 7)$ sq cm $= \frac{22}{7} \times 7 \times 21$ sq cm

$= 22 \times 21$ sq cm $= 462$ sq cm

Hence, **the total surface area of cone is 462 sq cm.** **Ans.**

3. Radius $(r) = 3.5$ cm and height $(h) = 12$ cm

(a) The slant height of cone $l = \sqrt{r^2 + h^2}$

or $l = \sqrt{(3.5)^2 + (12)^2}$ cm or $l\sqrt{12.25 + 144}$ cm

or $l = \sqrt{156.25}$ or $l = \sqrt{156.25}$ cm or $l = 12.5$ cm

Hence, **the slant height of cone is 12.5 cm.** **Ans.**

(b) Curved surface area of cone $= \pi rl$

$= \frac{22}{7} \times 3.5\text{ cm} \times 12.5\text{ cm} = 11 \times 12.5\text{ sq cm} = 137.5\text{ sq cm}$

Hence, **the curved surface area of cone is 137.5 sq cm.** **Ans.**

(c) Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times (3.5\text{ cm})^2 \times 12\text{ cm}$

$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 12\text{ cm}^3 = 154\text{ cm}^3$

Hence, **the volume of cone is 154 cm^3.** **Ans.**

(d) Total surface area of cone $= \pi r(l + r)$

$= \frac{22}{7} \times 3.5\text{ cm}\,(12.5 + 3.5)\text{ cm}$

$= \frac{22}{7} \times 3.5 \times 16\text{ cm}^2 = 176\text{ cm}^2$

Hence, **the total surface area of cone is 176 cm^2.** **Ans.**

4. Height of cone $= 16$ cm and diameter $= 24$ cm

Radius of cone $= \dfrac{\text{diameter}}{2} = \dfrac{24}{2}$ cm $= 12$ cm

$\therefore$ Slant height $(l) = \sqrt{r^2 + h^2} = \sqrt{(12)^2 + (16)^2}$ cm

$= \sqrt{144 + 256}$ cm $= \sqrt{400}$ cm $= 20$ cm

$\therefore$ Curved surface area of cone $= \pi rl$

$= 3.14 \times 12$ cm $\times 20$ cm $=$ **753.6 cm**

Total surface area $= \pi r(l + r) = 3.14 \times 12$ cm $(20 + 12)$ cm

$= 3.14 \times 12 \times 32$ cm^2 $= 1205.76$ cm^2

Hence, **the curved surface area of cone is 753.6 cm^2 and total surface area of cone is 1205.76 cm^2.** **Ans.**

5. Slant height $(l) = 12$ cm

$\because$ Curved surface area of ice-cream cone $\pi rl = 113.04$ sq cm

$\therefore \pi rl = 113.04$ sq cm

or $3.14 \times r \times 12$ cm $= 113.04$ sq cm

or $r = \dfrac{113.04}{3.14 \times 12}$ cm or $r = \dfrac{36}{12}$ cm or $r = 3$ cm

Hence, **the required of ice-cream cone base is 3 cm.** **Ans.**

6. Area of cone base $(\pi r^2) = 154$ sq metre

$\therefore \pi r^2 = 154$ sq m or $\dfrac{22}{7} \times r^2 = 154$ sq m

or $r^2 = \dfrac{154 \times 7}{22}$ metre^2 or $r^2 = 49$ metre^2

$r = \sqrt{49}$ m or $r = 7$ metre

Now, volume of conical tent $= \dfrac{1}{3}\pi r^2 h = 1232$ cubic metre

$\therefore \dfrac{1}{3}\pi r^2 h = 1232$ m^3 or $\dfrac{1}{3} \times \dfrac{22}{7} \times (7\text{ m})^2 \times h = 1232$ m^3

or $\dfrac{1}{3} \times \dfrac{22}{7} \times 7$ m $\times 7$ m $\times h = 1232$ m^3

or $\dfrac{1}{3} \times 22$ m $\times 7$ m $\times h = 1232$ m^3

or $h = \frac{1232 \times 3}{22 \times 7}$ m or $h = 24$ m

$\therefore$ Slant height $(l) = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2} = \sqrt{(49 + 576)}$ m

$l = \sqrt{625}$ m or $l = 25$ m

$\therefore$ Curved surface area of conical tent $= \pi rl$

$= \frac{22}{7} \times 7 \times 25\,\text{m}^2 =$ **550 sq m** **Ans.**

7. (a) Radius of sphere $(r) = \frac{14}{2}$ cm $= 7$ cm

Volume of sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (7)^3$ cm^3

$= \frac{4}{3} \times \frac{22}{7} \times 7 \times 7 \times 7$ cm$^3 = \frac{88 \times 49}{3}$ cm^3

$= \frac{4312}{3}$ cm$^3 = 1437.33$ cm^3

Hence, **the volume of sphere is 1437.33 cm^3.** **Ans.**

(b) Surface area of sphere $= 4\pi r^2 = 4 \times \frac{22}{7} \times (7)^2$ cm^2

$= 4 \times \frac{22}{7} \times 7 \times 7$ cm$^2 = 88 \times 7$ cm$^2 = 616$ cm^2

Hence, **the surface area of sphere is 616 cm^2.** **Ans.**

8. Surface area of sphere $(4\pi r^2) = 616$ cm^2

$\therefore 4\pi r^2 = 616$ cm^2 or $4 \times \frac{22}{7} \times r^2 = 616$ cm^2

or $r^2 = \frac{616 \times 7}{4 \times 22}$ cm^2 or $r^2 = 49$ cm^2

or $r = \sqrt{49}$ cm or $r = 7$ cm

Now, volume of the sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times (7)^3$ cm^3

$= \frac{4}{3} \times \frac{22}{7} \times 7 \times 7 \times 7$ cm$^3 = 1437.33$ cm^3

Hence, **the volume of the sphere is 1437.33 cm^3.** **Ans.**

9. Radius of base $= 7$ cm and height $= 24$ cm

$\therefore$ Slant height $(l) = \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625}$

$l = 25$ cm

Area is of cardboard required to make 1 cap = surface area of cone cap $= \pi rl$

$= \frac{22}{7} \times 7 \times 25 \text{ cm}^2 = 550 \text{ cm}^2$

$\therefore$ Area is of cardboard required to make 10 cap $= 550 \times 10 \text{ cm}^2$

$=$ **5500 cm^2** **Ans.**

10. Radius of base of a cone shaped tent $= 12$ metre and height $= 9$ metre

$\therefore$ Slant height $(l) = \sqrt{r^2 + h^2} = \sqrt{12^2 + 9^2}$

$= \sqrt{144 + 81} = \sqrt{225} = 15$ metre

Length of the canvas required

= Surface area of cone shaped tent

$= \pi rl = 3.14 \times 12 \times 15$ sq metre $= 565.2$ sq metre.

$\therefore$ Cost of canvas = ₹ 565.2×120 = ₹ 67824

Hence, **the cost of canvas is ₹ 67824.** **Ans.**

11. $\because$ Circular base of cylinder = Circular base of cone $= \pi r^2$

Height of cylinder = 7 cm

$\therefore$ Volume of cylinder $= \pi r^2 h = \pi r^2 \times 7 = 7\pi r^2$

Volume of cone $= \frac{1}{3}\pi r^2 h$

$\therefore$ Volume of cone = Volume of cylinder

$$\frac{1}{3}\pi r^2 h = 7\pi r^2 \text{ or } \quad h = \frac{7\pi r^2 \times 3}{\pi r^2} = 21 \text{ cm}$$

Hence, **the height of cone is 21 cm.** **Ans.**

12. Circumference of the base of conical tent $(2\pi r) = 44$ metre

$\therefore \quad 2\pi r = 44 \text{ m} \qquad \text{or } 2 \times \frac{22}{7} \times r = 44 \text{ m}$

or $\quad r = \frac{44 \times 7}{2 \times 22} \text{ m} \qquad \text{or } r = 7 \text{ m}$

$\therefore$ Slant height of tent $(l) = \sqrt{r^2 + h^2} = \sqrt{7^2 + 15^2} = \sqrt{(49 + 225)}$ m

$= \sqrt{274}$ m $= 16.55$ m

Required canvas of tent = surface area of conical tant

$= \pi rl = \frac{22}{7} \times 7 \times 16.55\ \text{m}^2 = 22 \times 16.55\ \text{cm}^2 = 364.1\ \text{m}^2$

Now, volume of air occupied in the tent $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times (7)^2 \times 15\ \text{m}^3 = \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 15\ \text{m}^3$

$= 110 \times 7\ \text{m}^3 = 770\ \text{m}^3$

Hence, **the required canvas is 364.1 m^2 and volume of air occupied is 770 m^3.** **Ans.**

Multiple Choice Questions

1. (i) Answer **(b)** is correct. **Ans.**

(ii) $\because$ $1\ \text{m} = 100\ \text{cm}$

$\therefore 1\ \text{m}^2 = 100\ \text{cm} \times 100\ \text{cm} = 10000\ \text{cm}^2$

Hence, the answer **(d)** is correct. **Ans.**

(iii) $1\ \text{cm} = 10\ \text{mm}$

$\therefore 1\ \text{cm}^2 = 10\ \text{mm} \times 10\ \text{mm} = 100\ \text{mm}^2$

Hence, the answer **(c)** is correct. **Ans.**

(iv) The volume of cuboid is $l \times b \times h$.

Hence, the answer **(d)** is correct. **Ans.**

(v) Answer **(b)** is correct. **Ans.**

(vi) Answer **(b)** is correct. **Ans.**

(vii) Area of trapezium $= \frac{1}{2}(a + b)h$

Hence, the answer **(a)** is correct. **Ans.**

(viii) Total surface area of cuboid $= 2(lb + bh + hl)$

Hence, the answer **(a)** is correct. **Ans.**

(ix) Total surface area of a cylinder $= 2\pi r(r + h)$

Hence, the answer **(a)** is correct. **Ans.**

(x) Answer **(d)** is correct. **Ans.**

14. Data Handling

Exercise 14

1. First of all we arranged the age of all these teachers in ascending order.

23, 24, 26, 27, 28, 31, 32, 33, 34, 35, 38, 40, 41, 43, 54

(a) The age of oldest teacher = **54 years.** **Ans.**

(b) The age of younger teacher = **23 years.** **Ans.**

(c) The range of the age = 54 years − 23 years = **31 years** **Ans.**

(d) Mean age of the teachers

$$= \frac{23+24+26+27+28+31+32+33+34+35+38+40+41+43+54}{15}$$

$$= \frac{509}{15} = \textbf{33.93 years}$$

Ans.

2. The first six prime number are: 2, 3, 5, 7, 11, 13

$$\text{Mean} = \frac{\text{Sum of all observations}}{\text{Total number of observation}}$$

$$= \frac{2+3+5+7+11+13}{6} = \frac{41}{6} = 6.83$$

Hence, **the mean of first six prime numbers is 6.83.** **Ans.**

3. The first ten natural number are: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$$\text{Mean} = \frac{\text{Sum of all observations}}{\text{Total number of observation}}$$

$$= \frac{1+2+3+4+5+6+7+8+9+10}{10} = \frac{55}{10} = 5.5$$

Hence, **the mean of first ten natural numbers is 5.5.** **Ans.**

4. Mean marks

$$= \frac{81+45+45+56+61+31+56+33+70+61+76+36+56+59+64+56+88+28+56+70+64+74+74+70+28}{25}$$

$$= \frac{1418}{25} = 56.72 \text{ marks}$$

Hence, **the mean of the marks = 56.72** **Ans.**

5. $\because$ $\text{Mean} = \frac{\text{Sum of all observations}}{\text{Total number of observation}}$

$\therefore 3 = \frac{2+3+x}{3}$ or $3 = \frac{5+x}{3}$

or $5 + x = 3 \times 3 = 9$ or $x = 9 - 5 = 4$

Hence, **the value of $x = 4$** **Ans.**

6. Frequency distribution table :

Class-Interval	Tally marks	Frequency
0-10	𝍸 𝍸	10
10-20	𝍸 𝍸 |	11
20-30	𝍸 𝍸	10
30-40	|||	3
40-50	𝍸	5
50-60	|	1
Total		40

(a) Range of the given data $= 50 - 0 =$ **50** **Ans.**

(b) In class-interval (10-20) the number of students is maximum. **Ans.**

7. (a) Mean weight $= \dfrac{\text{Sum of the weight of students}}{\text{Total number of students}}$

$= \dfrac{48.5 + 50 + 44.5 + 49.5 + 50.5 + 45 + 51 + 43 + 64 + 70.5}{10}$

$= \dfrac{516.5}{10}\text{ kg} = 51.65\text{ kg}$

Hence, **the mean weight is 51.65 kg.** **Ans.**

(b) The arithmetic mean, it the 62 kg weight of a teacher also included,

Arithmetic mean $= \dfrac{516.5 + 62}{11}\text{ kg} = \dfrac{578.5}{11}\text{ kg} =$ **52.59 kg** **Ans.**

8. (a) This histogram shown **the height of 16 girls in cm**. **Ans.**

(b) In class-interval **140-145** the number of girls is maximum. **Ans.**

(c) The number of girls are equal in the class-intervals **125-130, 155-160; 130-135, 150-155 and 135-140, 145-150.** **Ans.**

(d) $3 + 2 + 1 =$ **6 girls** height is145 cm or the above. **Ans.**

9. (a) This histogram shown **the age of number** of literate females. **Ans.**

(b) In the age group **(15-20)**, the number of literate females is maximum. **Ans.**

(c) In the age group **(45-50)**, the number of literate females is minimum. **Ans.**

(d) The width of each class interval is $15 - 10 =$ **5**. **Ans.**

(e) The class marks of all the class intervals are **12.5, 17.5, 22.5, 27.5, 32.5, 37.5, 42.5, 47.5** **Ans.**

(f) $200 + 800 + 700 + 650 + 600 =$ **2950** female below 30 years in age are literate. **Ans.**

10.

Weight in kg (x)	**Frequency** (f)	**Weight** $\times$ **Frequency** (f)
40	6	$40 \times 6 = 240$
41	4	$41 \times 4 = 164$
42	6	$42 \times 6 = 252$
43	20	$43 \times 20 = 860$
44	16	$44 \times 16 = 704$
45	6	$45 \times 6 = 270$
Total	$\sum f = 58$	$\sum fx = 2490$

$$\therefore \text{Arithmetic mean} = \frac{\sum fx}{\sum f} = \frac{2490}{58} = 42.93 \text{ kg}$$

Hence, the arithmetic mean of weight of students = **42.93 kg** **Ans.**

11. Frequency distribution table.

Class Interval	**Tally marks**	**Frequency**
0-5	||	2
5-10	||||	4
10-15	|||	3
15-20	|||	3
20-25	||||	4
25-30	|||	3
30-35	||	2
35-40	—	0
40-45	|	1
45-50	|	1
Total		23

12. Frequency distribution table :

Class Interval	Tally marks	Frequency
25-30	𝍸 |||	8
30-35	𝍸	5
35-40	𝍸 𝍸 |	11
40-45	𝍸 |||	8
45-50	|||	3
Total		35

13. Frequency distribution table :

Height	Tally marks	Frequency
138	||	2
139	|	1
140	𝍸	5
146	|||	3
148	𝍸 𝍸	10
150	𝍸 |||	8
152	||||	4
153	𝍸	5
154	|	1
160	|||	3
Total		42

Multiple Choice Questions

1. (i) Width of the interval $= u - l$

Hence, the answer **(d)** is correct. **Ans.**

(ii) A pie chart is circular graph.

Hence, the answer **(d)** is correct. **Ans.**

(iii) First six natural number are: 1, 2, 3, 4, 5, 6

$$\text{Average} = \frac{1+2+3+4+5+6}{6} = \frac{21}{6} = 3.5$$

Hence, the answer **(c)** is correct. **Ans.**

(iv) The bigger number of each class is called upper limit.

Hence, the answer **(a)** is correct. **Ans.**

(v) The mid point of class interval is class mark.

Hence, the answer **(c)** is correct. **Ans.**

(vi) Range of data = Highest value – lowest value = $a - b$

Hence, the answer **(a)** is correct. **Ans.**

(vii) The lower number of each class is called lower limit.

Hence, the answer **(c)** is correct. **Ans.**

(viii) First five whole numbers are: 0, 1, 2, 3, 4

$$\text{Average} = \frac{0+1+2+3+4}{5} = \frac{10}{5} = 2$$

Hence, the answer **(b)** is correct. **Ans.**

15. Introduction to Graphs

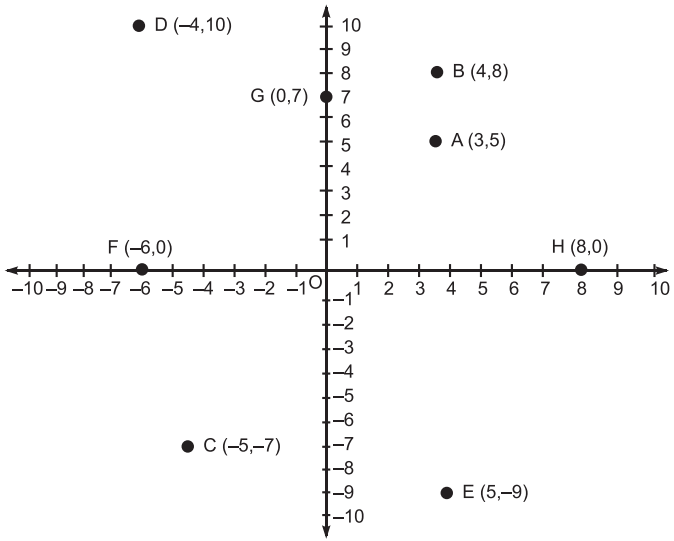
Exercise 15.1

1. (i) (a) B, (b) J, (c) A, (d) C

(ii) (a) D(6, 6) (b) K(8, 2) (c) F(3, 4)

(d) I(0, 3) (e) C(5, 3) **Ans.**

2.



3. A point lies on the y-axis if its x coordinate is 0 ie, the point of the type $(0, y)$ lie on the y-axis.

So, the points (b) (0, –6), (d) (0, 12) and (f) (0, –10) lie on the y-axis. **Ans.**

4. A point lies on the x-axis, if its y coordinate is 0 ie, the point of the type $(x, 0)$ lie on the x-axis.
So, the point (a) (5, 0), (c) (–7, 0) and (f) (10, 0) lie on the x-axis. **Ans.**

5. (a) The given point is (6, 10). Here, both the coordinates are positive.
Hence, the point (6, 10) lies in **Ist quadrant.** **Ans.**
(b) The given point is (–2, 5). Here, x coordinate is negative and y-coordinate is positive.
Hence, point (–2, 5) lies in **IInd quadrant.** **Ans.**
(c) The given point is (8, –8). Here, x coordinate is positive and y-coordinate is negative.
Hence, point (8, –8) lies in **IVth quadrant.** **Ans.**
(d) The given point is (4, 6). Here, both the coordinates are positive. Hence, point (4, 6) lies in **Ist quadrant.** **Ans.**
(e) The given point is (–8, –12). Here, both the coordinates are negative. Hence, the point (–8, –12) lies in **IIIrd quadrant.** **Ans.**
(f) The given point is (7, –9). Here, x-coordinate is positive and y-coordinate is negative.
Hence, point (7, –9) lies in **IVth quadrant.** **Ans.**
(g) The given point is (–5, 10). Here, x coordinate is negative and y-coordinate is positive.
Hence, point (–5, 10) lies in **IInd quadrant.** **Ans.**
(h) The given point is (–1, –3). Here, both the coordinates are negative.
Hence, point is (–1, –3) lies in **IIIrd quadrant.** **Ans.**

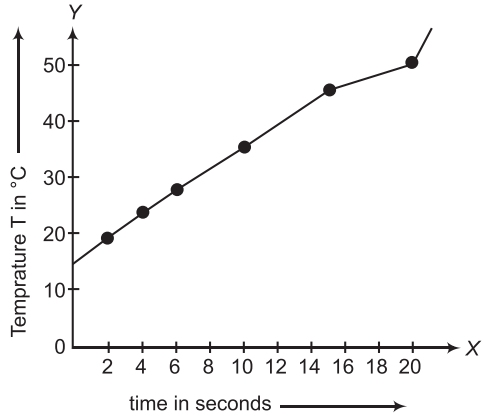
6. (a) 0, (b) 6, (c) 5, (d) –6 **Ans.**

7. (a) 7, (b) 0, (c) –2, (d) –4 **Ans.**

Exercise 15.2

1. Draw coordinate axis and mark $t = 0, 2, 4, 6, 10, 15$ and 20 at the intervals of 1 cm on the horizontal axis. Mark $T = 15, 19, 23, 27, 35, 45$ and 50 at the interval of 1 cm on the vertical axis.
Scale:- 1 cm = 2 second on horizontal axis.

1 cm = 10°C on the vertical axis.



Plot points (0, 15), (2, 19), (4, 23), (6, 27), (10, 35), (15, 45) and (20, 50) on the graph paper. Join these points and extend the line joining them. **From the graph:**

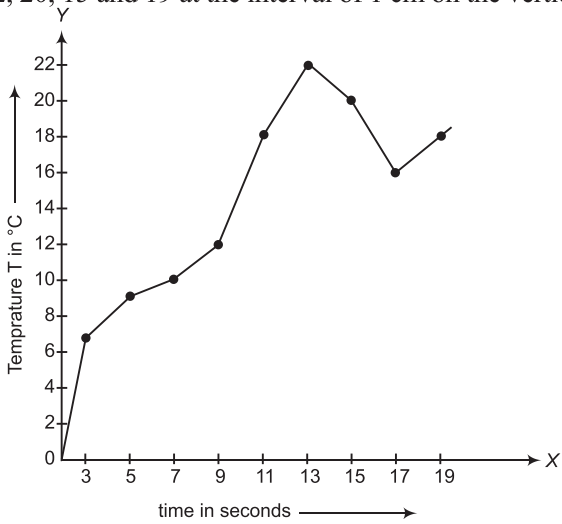
(a) Temperature of the ball after 7 seconds = **29°C** **Ans.**

(b) Temperature of the ball after 10 seconds = **35°C** **Ans.**

(c) After **8 seconds** the temperature of the ball is 30°C **Ans.**

(d) t = **15** seconds, when $T = 45°C$ **Ans.**

2. Draw coordinate axis and mark $t = 3, 5, 7, 9, 11, 13, 15, 17, 19$ at the interval of 1 cm on the horizonal axis. Mark $T = 7, 9, 10, 12, 18, 22, 20, 15$ and 19 at the interval of 1 cm on the vertical axis.



Scale:- 1 cm = 2 hour on horizontal axis.
1 cm = 2°C on the vertical axis.
Plot points (3, 7), (5, 9), (7, 10), (9, 12), (11, 18), (13, 22), (15, 20), (17, 15), (19, 19) on the graph paper. Join these point and extend the line joing them.

From the graph:-

(a) Temperature at 8 am is **11°C.** **Ans.**

(b) Temperature at 12 noon is **20°C.** **Ans.**

(c) **7 am** the temperature was 10°C. **Ans.**

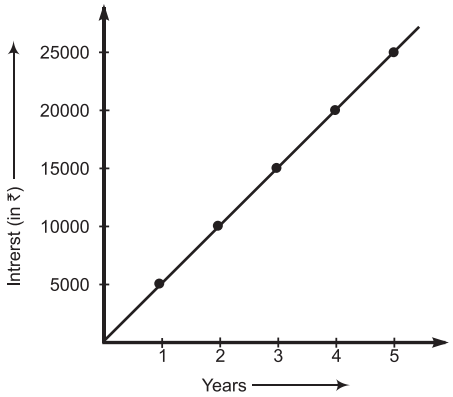
(d) Temperature was 20°C at **12 noon.** **Ans.**

3.

Number of years	**Interest**
1	$₹ \frac{25000 \times 20 \times 1}{100} = ₹ 5000$
2	$₹ \frac{25000 \times 20 \times 2}{100} = ₹ 10000$
3	$₹ \frac{25000 \times 20 \times 3}{100} = ₹ 15000$
4	$₹ \frac{25000 \times 20 \times 4}{100} = ₹ 20000$
5	$₹ \frac{25000 \times 20 \times 5}{100} = ₹ 25000$

Table of values

years	1	2	3	4	5
Interest (in ₹)	5000	10000	15000	20000	25000

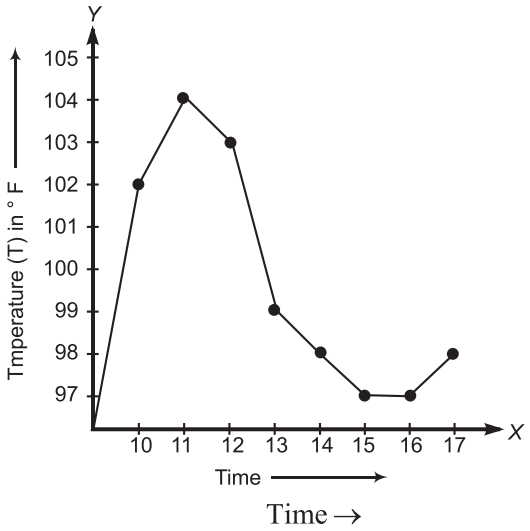


Scale: 1 cm = 1 year on horizontal axis.

1 cm = ₹ 5000 on the vertical axis.

Plot the point (1, 5000), (2, 10000), (3, 15000), (4, 20000) and (5, 25000), ... on the graph paper. Join these points and extent the line joining them. **Ans.**

4. Draw coordinate axis mark $t = 10, 11, 12, 13, 14, 15, 16$ and 17 at the interval of 1 cm on the horizonal axis. Mark $F = 102$, 104, 103, 100, 98, 97, 97 and 98 at the interval of 1 cm on the vertical axis.



Scale: 1 cm = 1 hour on horizontal axis.

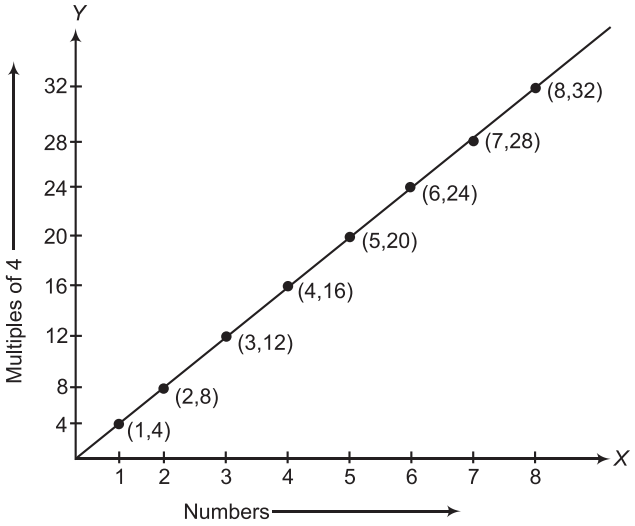
1 cm = 1°F on the vertical axis.

Plot point (10, 102), (11, 104), (12, 103), (13, 100), (14, 98), (15, 97), (16, 97) and (17, 98) on the graph paper. Join these points and extend the line joining them.

5. (a) The equation representing products and the number 4 is $y = 4x$

The table is as below

x	1	2	3	4	5	6	7	8
$y = 4x$	4	8	12	16	20	24	28	32



We table scale as :

1 unit of x-coordinate $= 1$ cm on graph paper.

4 unit of y-coordinate $= 1$ cm on graph paper.

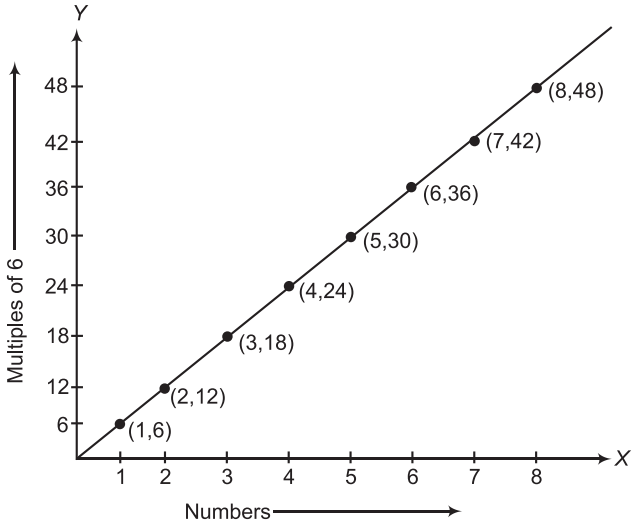
Let us draw coordinate axis.

We plot the point on the graph paper. Join the points we find that it is straight line.

(b) The equation representing products and the numbers 6 is $y = 6x$.

The table is as below :

x	1	2	3	4	5	6	7	8
$y = 6x$	6	12	18	24	30	36	42	48



We take scale as :

1 unit of x-coordinate $= 1$ cm on graph paper.

6 unit of y-coordinate $= 1$ cm on graph paper.

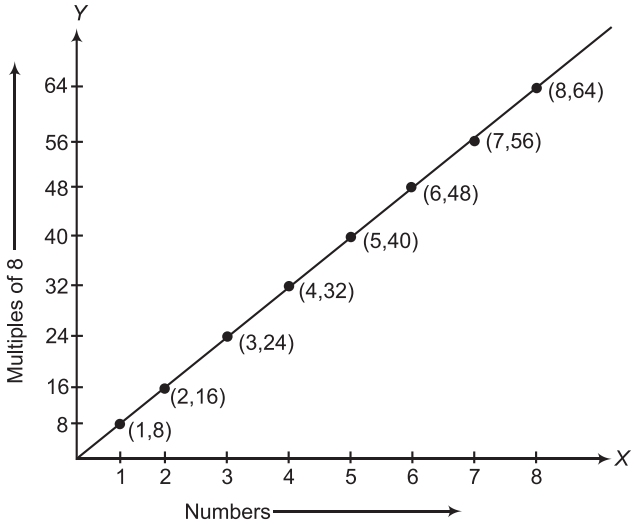
Let us draw coordinate axis.

We plot the point on the graph paper. Join the points. We find that it is straight line. **Ans.**

(c) The equation representing products and the numbers 8 is $y = 8x$

The table is as below :

x	1	2	3	4	5	6	7	8
$y = 8x$	8	16	24	32	40	48	56	64



We take scale as :

1 unit of x-coordinate $= 1$ cm on graph paper.

8 unit of y-coordinate $= 1$ cm on graph paper.

Let us draw coordinate axis.

We plot the point on the graph paper. Join the points. We find that it is straight line. **Ans.**

6. Let x be the breadth of rectangle then $2x$ be its length. Them the relation between length and perimeter be given as:

$y = 6x \quad [\because \text{Perimeter} = 2(l + b) = 2(2x + x) = 6x]$

Putting $x = 1$, we get $y = 6 \times 1 = 6$

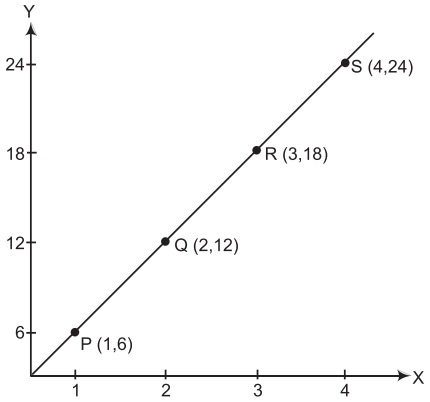
Putting $x = 2$, we get $y = 6 \times 2 = 12$

Putting $x = 3$, we get $y = 6 \times 3 = 18$

Putting $x = 4$, we get $y = 6 \times 4 = 24$

Thus, **we get the following table:**

x	1	2	3	4
y	6	12	18	24



Draw x-axis and y-axis on a graph paper.
Plot points P(1, 6), Q(2, 12), R(3, 18) and S(4, 24).
Join these points PQRS and extent the line joining.

Exercise 15.3

1. (a) The speed between 0 to 2 seconds is $\frac{35-20}{2} = 7.5$ **m\s** **Ans.**

(b) The speed between 2 to 4 seconds is $\frac{50-35}{2} = 7.5$ **m\s** **Ans.**

(c) The speed between 4 to 8 seconds is **5 m/s.** **Ans.**

(d) Average speed between 0 to 8 seconds $= \frac{20+30}{8}$ m/s

$= \frac{25}{4}$ m/s $= 6.25$ m/s

Ans.

2. (a) The speed between 0 to 10 seconds in **3 m/s.** **Ans.**

(b) 15 to 20 seconds speed is **zero.** **Ans.**

(c) At **20** th **second** speed abruptly too hight. **Ans.**

(d) Total distance travelled by the body in 25 seconds is **90 m.**

Ans.

3.

x	0	1	2	3
y	0	0.5	1	1.5

The relation between x and y is $\boldsymbol{y = \frac{x}{2}}$. **Ans.**

4. $A(-4, -3)$, $B(-2, -5)$, $C(2, -5)$, $D(4, -3)$, $E(2, 2)$, $F(-2, 0)$, $G(0, -3)$, $H(2, -2)$ **Ans.**

5.

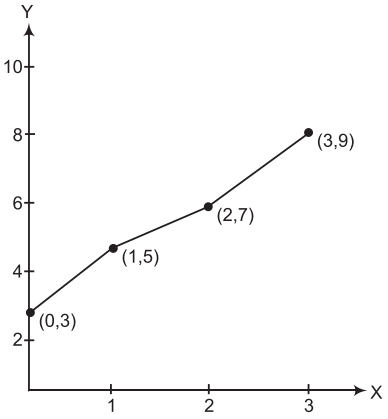
x	2	3	4	5
y	0	1	2	3

The relation between x and y is $y = x - 2$ **Ans.**

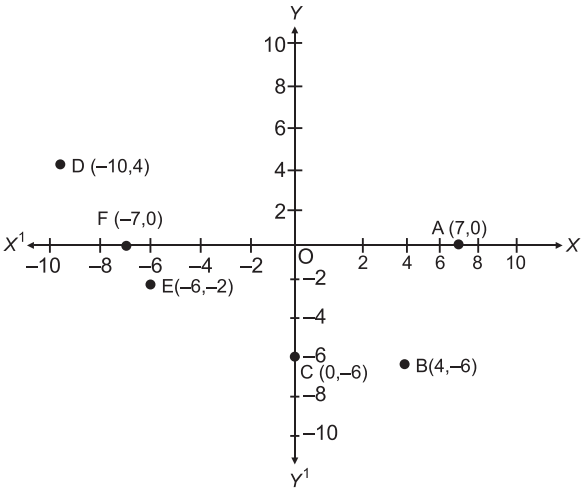
6.

x	0	1	2	3
$y = 2x + 3$	3	5	7	9

Putting $x = 0$, we get
$y = 2 \times 0 + 3 = 3$
Putting $x = 1$, we get
$y = 2 \times 1 + 3 = 2 + 3 = 5$
Putting $x = 2$, we get
$y = 2 \times 2 + 3 = 4 + 3 = 7$
Putting $x = 3$, we get
$y = 2 \times 3 + 3 = 6 + 3 = 9$
Now, draw x-axis and y-axis on a graph paper. Plot point (0, 3), (1, 5), (2, 7) and (3, 9) on graph paper. Join these points and extend the line joining them.



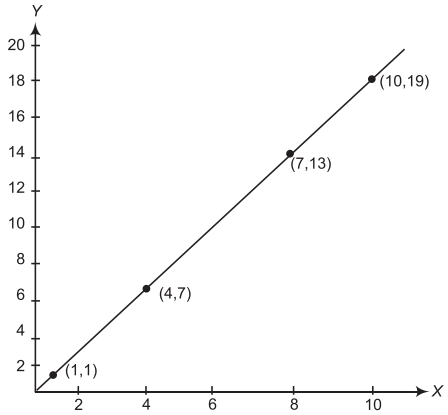
7.



8. (a) 4, (b) 9, (c) –10, (d) 0 **Ans.**

9. (a) 0, (b) 6, (c) –5, (d) –6 **Ans.**

10. Do yourself. **11.** Do yourself.



12. Putting $x = 1$, we get $y = 2 \times 1 - 1 = 2 - 1 = 1$
Putting $x = 4$, we get $y = 2 \times 4 - 1 = 7$
Putting $x = 7$, we get $y = 2 \times 7 - 1 = 13$
Putting $x = 10$, we get $y = 2 \times 10 - 1 = 19$
Thus, we following table:

x	1	4	7	10
$y = 2x - 1$	1	7	13	19

Draw x-axis and y-axis on graph-paper.
Plot point (1, 1), (4, 7), (7, 13) and (10, 19) on the graph paper.
Join these points and extend the line joining them.

13. Do your self.

Multiple Choice Questions

1. (i) The coordinates of origin are (0, 0).
Hence, the answer **(c)** is correct. **Ans.**
(ii) Points of the type $(-,-)$ lie in the IIIrd quadrant.
Hence, the answer **(a)** is correct. **Ans.**
(iii) Point of the type $(+, +)$ lie in the Ist quadrant.
Hence, the answer **(d)** is correct. **Ans.**
(iv) Point to the type $(-, +)$ lie in the IInd quadrant.
Hence, the answer **(c)** is correct. **Ans.**
(v) Point of the type $(+, -)$ lie in the IVth quadrant.
Hence, the answer **(b)** is correct. **Ans.**