

Exericse 4.2

1. (i) $(64)^{\frac{1}{6}}$

$$(2^6)^{\frac{1}{6}}$$

$$2^{\frac{6}{6}}$$

$$2^1$$

(ii) $(243)^{\frac{4}{5}}$

$$(3^5)^{\frac{4}{5}}$$

$$3^{\frac{5}{5} \cdot \frac{4}{5}}$$

$$3^4$$

$$81$$

(iii) $(256)^{\frac{2}{4}}$

$$(4^4)^{\frac{2}{4}}$$

$$4^{\frac{4}{4} \cdot \frac{2}{4}}$$

$$4^2$$

$$16$$

(iv) $9^{\frac{1}{2}}$

$$(3^2)^{\frac{1}{2}}$$

$$3^{\frac{2}{2} \cdot \frac{1}{2}}$$

$$3^1$$

$$\frac{1}{3}$$

(v) $(16)^{\frac{3}{2}}$

$$(4^2)^{\frac{3}{2}}$$

$$4^{\frac{2}{2} \cdot \frac{3}{2}}$$

$$4^3$$

$$\frac{1}{4^3}$$

2. (i) $\frac{32}{243}^{\frac{4}{5}}$

$$\frac{1}{64}$$

$$\frac{2}{3}^{\frac{4}{5}}$$

$$\frac{2}{3}^{\frac{4}{5}}$$

$$\frac{2}{3}^4$$

$$\frac{16}{81}$$

(ii) $\frac{25}{49}^{\frac{7}{2}}$

$$\frac{5}{7}^{\frac{7}{2}}$$

$$\frac{5}{7}^{\frac{7}{2}}$$

$$\frac{5}{7}^7$$

$$\frac{78125}{823543}$$

(iii) $\frac{625}{81}^{\frac{1}{4}}$

$$\frac{5}{3}^{\frac{1}{4}}$$

$$\frac{5}{3}^{\frac{1}{4}}$$

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

$$\frac{3}{5}$$

(iv) $\frac{1}{9}^{\frac{1}{2}}$



$$\begin{aligned}
 & (9)^{\frac{1}{2}} \\
 & (3^2)^{\frac{1}{2}} \\
 & 3^{\frac{2}{2}} \\
 & 3^1 \\
 & 3 \\
 3. \text{ (i)} & \quad 6^{\frac{1}{2}} \quad 6^{\frac{5}{2}} \\
 & \quad 6^{\frac{1}{2} + \frac{5}{2}} \\
 & \quad 6^{\frac{6}{2}} \\
 & \quad 6^3 \\
 & \quad 216 \\
 \text{(ii)} & \quad 5^{\frac{8}{3}} \quad 5^{\frac{4}{3}} \\
 & \quad 5^{\frac{5}{3} + \frac{4}{3}} \\
 & \quad 5^{\frac{9}{3}} \\
 & \quad 5^3 \\
 & \quad 125 \\
 \text{(iii)} & \quad 7^{\frac{8}{5}} \quad 7^{\frac{3}{5}} \quad 7^2 \\
 & \quad 7^{\frac{8}{5} + \frac{3}{5} + 2} \\
 & \quad 7^{\frac{8}{5} + \frac{3}{5} + \frac{10}{5}} \\
 & \quad 7^{\frac{15}{5}} \\
 & \quad 7^3 \\
 & \quad 343 \\
 \text{(iv)} & \quad 3^{\frac{1}{3}} \quad 3^{\frac{2}{3}} \quad 3^1 \\
 & \quad 3^{\frac{1}{3} + \frac{2}{3} + 1} \\
 & \quad 3^{\frac{1}{3} + \frac{2}{3} + \frac{3}{3}} \\
 & \quad 3^0 \quad 1
 \end{aligned}$$

$$\begin{aligned}
 4. \text{ (i)} & \quad 10^{\frac{6}{5}} \quad 10^{\frac{1}{5}} \\
 & \quad 10^{\frac{6}{5} + \frac{1}{5}} \\
 & \quad 10^{\frac{7}{5}} \\
 & \quad 10^1 \\
 & \quad 10 \\
 \text{(ii)} & \quad 5^{\frac{8}{3}} \quad 5^{\frac{2}{3}} \\
 & \quad 5^{\frac{8}{3} + \frac{2}{3}} \\
 & \quad 5^{\frac{10}{3}} \\
 & \quad 5^{\frac{6}{3}} \\
 & \quad 5^2 \\
 & \quad 25 \\
 \text{(iii)} & \quad (9^4)^{\frac{5}{4}} \\
 & \quad 9^{\frac{5}{4} \cdot 4} \\
 & \quad 9^5 \\
 & \quad 9^1 \\
 & \quad 9 \\
 \text{(iv)} & \quad (16)^{\frac{3}{2}} \quad 16^{\frac{1}{3}} \\
 & \quad 16^{\frac{3}{2} + \frac{1}{3}} \\
 & \quad 16^{\frac{1}{2}} \\
 & \quad (4^2)^{\frac{1}{2}} \\
 & \quad 4^{\frac{2}{2}} \\
 & \quad 4^1 \\
 & \quad 4
 \end{aligned}$$

$$(v) \quad (343)^{\frac{7}{5}}$$

$$(3^5)^{\frac{7}{5}} = 3^{5 \cdot \frac{7}{5}} = 3^7$$

$$5. (i) \quad 4(27)^{\frac{1}{3}} \cdot 64^{\frac{1}{3}}$$

$$4 \cdot 3^3 \cdot \frac{1}{3} \cdot 4^3 \cdot \frac{1}{3} = 4 \cdot 3^2 \cdot 4^2 = 4 \cdot 9 \cdot 16 = 576$$

$$(ii) \quad (0.256)^{\frac{3}{4}}$$

$$[(0.4)^4]^{\frac{3}{4}} = (0.4)^3 = 0.064$$

$$(iii) \quad 5(729)^{\frac{5}{3}} \cdot 729^{\frac{2}{3}}$$

$$5 \cdot 9^3 \cdot \frac{5}{3} \cdot 9^3 \cdot \frac{2}{3} = 5 \cdot 9^5 \cdot 9^2 = 5 \cdot 9^7 = 5 \cdot 81(9^3 \cdot 1) = 405(729 \cdot 1) = 405 \cdot 728 = 294840$$

$$(iv) \quad 9 \cdot 343^{\frac{1}{3}} \cdot 7^2$$

$$9 \cdot 7^3 \cdot \frac{1}{3} \cdot 7^2 = 9 \cdot 7^3 \cdot 7^2 = 9 \cdot 7^5 = 9 \cdot 16807 = 151263$$

$$6. (i) \quad (x^5 \cdot x^3)^0$$

$$(x^8)^0 = x^0 = 1$$

$$(ii) \quad (x^{\frac{5}{2}})^4$$

$$x^{\frac{5}{2} \cdot 4} = x^{10}$$

$$(iii) \quad 5x^{\frac{7}{8}} \cdot 6x^{\frac{1}{8}} \cdot 7x$$

$$5 \cdot 6 \cdot 7 \cdot x^{\frac{7}{8} + \frac{1}{8} + 1} = 210x^2$$

$$(iv) \quad x^{\frac{3}{4}} \cdot y^{\frac{3}{4}} \cdot x^{\frac{1}{2}} \cdot y^2 \cdot x \cdot y^{\frac{1}{4}}$$

$$x^{\frac{3}{4} + \frac{1}{2} + 1} \cdot y^{\frac{3}{4} + 2 + \frac{1}{4}} = x^{\frac{9}{4}} \cdot y^{\frac{13}{4}}$$

$$(v) \quad x^{\frac{12}{7}} \cdot x^{\frac{5}{7}} \cdot 4x$$

$$x^{\frac{12}{7} + \frac{5}{7}} \cdot 4x = x^{\frac{17}{7}} \cdot 4x = x^{\frac{17}{7} + 1} \cdot 4 = x^{\frac{24}{7}} \cdot 4 = 4x^{\frac{24}{7}}$$

$$7. (i) (0.25)^{\frac{1}{2}}$$

$$[(0.5)^2]^{\frac{1}{2}}$$

$$= (0.5)^{2 \times \frac{1}{2}}$$

$$= (0.5)^1$$

$$= 0.5$$

$$(ii) (0.0256)^{\frac{1}{2}}$$

$$= [(0.16)^2]^{\frac{1}{2}}$$

$$= (0.16)^{2 \times \frac{1}{2}}$$

$$= 0.16$$

$$(iii) (0.0009)^{\frac{1}{2}}$$

$$= [(0.03)^2]^{\frac{1}{2}}$$

$$= (0.03)^{2 \times \frac{1}{2}}$$

$$= 0.03$$

$$(iv) (0.0625)^{\frac{3}{2}} (0.16)^{\frac{1}{2}} (0.0256)^{\frac{1}{4}}$$

$$= [(0.25)^2]^{\frac{3}{2}} [(0.4)^2]^{\frac{1}{2}}$$

$$[(0.5)^4]^{\frac{1}{4}}$$

$$= (0.25)^{2 \times \frac{3}{2}} (0.4)^{2 \times \frac{1}{2}}$$

$$(0.5)^{4 \times \frac{1}{4}}$$

$$= (0.25)^3 \times (0.4)^1 \times (0.5)^1$$

$$= 0.01562 \times 0.20$$

$$= 0.003125$$

$$8. (i) \frac{64^{\frac{2}{3}} \cdot 64^{\frac{1}{2}}}{64^{\frac{2}{3}}}$$

$$= \frac{64^{\frac{2}{3}} \cdot 64^{\frac{1}{2}}}{64^{\frac{2}{3}}}$$

$$= \frac{(4^3)^{\frac{2}{3}} \cdot (8^2)^{\frac{1}{2}}}{(4^3)^{\frac{2}{3}}}$$

$$= \frac{4^2 \cdot 8}{4^2}$$

$$\frac{4^{\frac{3}{2}} \cdot 8^{\frac{2}{3}} \cdot 8^{\frac{1}{2}}}{4^{\frac{3}{2}} \cdot 8^{\frac{2}{3}}}$$

$$= \frac{4^{\frac{3}{2}} \cdot 8^{\frac{2}{3}} \cdot 8^{\frac{1}{2}}}{4^{\frac{3}{2}} \cdot 8^{\frac{2}{3}}}$$

$$= \frac{4^2 \cdot 8^1}{4^2 \cdot 8^1}$$

$$= \frac{16 \cdot 8}{16 \cdot 8}$$

$$= \frac{128}{128}$$

$$= 1$$

$$= 1$$

$$= 1$$

$$= 1$$

$$= 1$$

$$(ii) \frac{(243)^{\frac{2}{5}} \cdot (243)^{\frac{1}{5}}}{(243)^{\frac{1}{5}}}$$

$$= \frac{(243)^{\frac{2}{5}} \cdot (243)^{\frac{1}{5}}}{(243)^{\frac{1}{5}}}$$

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

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

$$= \frac{3^5 \cdot 3^1}{3^1}$$

$$= \frac{3^6}{3^1}$$

$$= \frac{3^2 \cdot 3^1}{3^1}$$

$$= \frac{9 \cdot 3}{3}$$

$$= \frac{27}{3}$$

$$= 9$$

$$(iii) \frac{(343)^{\frac{2}{3}} \cdot (343)^{\frac{4}{3}} \cdot (343)^{\frac{1}{3}}}{7^2}$$

$$= \frac{(7^3)^{\frac{2}{3}} \cdot (7^3)^{\frac{4}{3}} \cdot (7^3)^{\frac{1}{3}}}{7^2}$$

$$= \frac{7^2 \cdot 7^4 \cdot 7}{7^2}$$

$$= \frac{7^2 \cdot 7^4 \cdot 7}{7^2}$$

$$= \frac{7^2 \cdot 7^4 \cdot 7}{7^2}$$

$$= 7^2 \cdot 7^4 \cdot 7$$

$$\frac{1}{7} \cdot 49 \cdot \frac{1}{7}$$

$$50 \cdot \frac{1}{7}$$

$$\frac{350}{7} \cdot \frac{1}{7} \cdot \frac{349}{7}$$

9. To find

$$x^{\frac{4}{3}} \cdot y^{\frac{2}{3}} \cdot \frac{1}{2} \quad \text{If } x = 8, y = 27$$

$$8^{\frac{4}{3}} \cdot 27^{\frac{2}{3}} \cdot \frac{1}{2}$$

$$(2^3)^{\frac{4}{3}} \cdot (3^3)^{\frac{2}{3}} \cdot \frac{1}{2}$$

$$[2^4 \cdot 3^2]^{\frac{1}{2}}$$

$$(16 \cdot 9)^{\frac{1}{2}}$$

$$(25)^{\frac{1}{2}}$$

$$(5^2)^{\frac{1}{2}}$$

$$5^2 \cdot \frac{1}{2}$$

10. To find

$$d \cdot \frac{b^2}{\frac{1}{c^2}} \cdot \frac{a}{3^5} [a \cdot b \cdot \sqrt{c}]^{\frac{1}{3}}$$

$$\frac{27^2}{64^{\frac{1}{2}}} \cdot \frac{8}{3^5} [8 \cdot 27 \cdot \sqrt{64}]^{\frac{1}{3}}$$

$$\frac{(3^3)^2}{(2^6)^{\frac{1}{2}}} \cdot \frac{2^3}{3^5} [8 \cdot 27 \cdot \sqrt{8^2}]^{\frac{1}{3}}$$

$$\frac{3^6 \cdot 2^3}{2^3 \cdot 3^5} [8 \cdot 27 \cdot 8]^{\frac{1}{3}}$$

$$3^6 \cdot 5 \cdot [27]^{\frac{1}{3}}$$

$$3 \cdot (3^3)^{\frac{1}{3}}$$

$$3 \cdot 3^1$$

$$3 \cdot \frac{1}{3}$$

$$1$$

Exercise 4.3

Radical form

1. (i) $13^{\frac{1}{2}} \cdot \sqrt{13}$

(ii) $(112)^{\frac{1}{5}} \cdot \sqrt[5]{112}$

(iii) $\frac{7}{19} \cdot \frac{1}{9} \cdot \sqrt[9]{\frac{7}{19}}$

(iv) $\frac{516}{63} \cdot \frac{1}{14} \cdot \frac{63}{516} \cdot \frac{1}{14} \cdot \sqrt[14]{\frac{63}{516}}$

2. Exponential form

(i) $\sqrt{5} \cdot 5^{\frac{1}{2}}$

(ii) $\sqrt[4]{7} \cdot 7^{\frac{1}{4}}$

(iii) $\sqrt[7]{1280} \cdot (1280)^{\frac{1}{7}}$

(iv) $\sqrt[8]{\frac{32}{79}} \cdot \frac{32}{79} \cdot \frac{1}{8}$

3. Pure Radical

(i) $2\sqrt{6} \cdot \sqrt{6 \cdot 2^2} \cdot \sqrt{6 \cdot 4} \cdot \sqrt{24}$

(ii) $7\sqrt{6} \cdot \sqrt{6 \cdot 7^2} \cdot \sqrt{6 \cdot 49} \cdot \sqrt{294}$

(iii) $10\sqrt{5} \cdot \sqrt{5 \cdot 10^2} \cdot \sqrt{5 \cdot 100} \cdot \sqrt{500}$

(iv) $\frac{2}{3}\sqrt{40} \cdot \sqrt{40 \cdot \frac{2}{3} \cdot 2}$

4. (i) $\sqrt{108} \cdot \sqrt[2]{\frac{4}{9}} \cdot \sqrt[3]{\frac{160}{9}}$
 $\frac{2}{3} \cdot \sqrt{40} \cdot \sqrt[2]{\frac{4}{9}} \cdot \sqrt[3]{\frac{160}{9}}$

$$\begin{aligned}
 & \text{(ii)} \quad \frac{\sqrt{99}}{\sqrt{405}} \frac{\sqrt{3 \cdot 3 \cdot 11}}{\sqrt{3 \cdot 3 \cdot 3 \cdot 3 \cdot 5}} \frac{3\sqrt{11}}{3 \cdot 3\sqrt{5} \cdot 9\sqrt{5}} \\
 & \text{(iii)} \quad \frac{\sqrt{162}}{\sqrt{32}} \frac{\sqrt{2 \cdot 3 \cdot 3 \cdot 3 \cdot 3}}{2 \cdot 2\sqrt{2} \cdot 4\sqrt{2}} \\
 5. & \text{(i)} \quad \frac{\sqrt{32}}{2 \cdot 2\sqrt{2} \cdot 4\sqrt{2}} \frac{\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}}{2 \cdot 2\sqrt{2} \cdot 4\sqrt{2}} \\
 & \text{(ii)} \quad \frac{4\sqrt{25}}{4\sqrt{5} \cdot 5} \frac{4 \cdot 5}{4 \cdot 5} \cdot 20 \\
 & \text{(iii)} \quad \frac{2}{\sqrt{3}} \frac{2 \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} \frac{2\sqrt{3}}{3} \\
 & \text{(iv)} \quad \frac{\sqrt{25}}{\sqrt{4}} \frac{\sqrt{5 \cdot 5}}{\sqrt{2 \cdot 2}} \frac{5}{2} \\
 & \text{(v)} \quad \frac{8\sqrt{32}}{8 \cdot 2 \cdot 2\sqrt{2}} \frac{8\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}}{8 \cdot 2 \cdot 2\sqrt{2}} \\
 & \qquad \qquad \qquad \frac{32\sqrt{2}}{32\sqrt{2}} \\
 6. & \text{(i)} \quad \frac{\sqrt{16}}{\sqrt{25}} \frac{\sqrt{4 \cdot 4}}{\sqrt{5 \cdot 5}} \frac{4}{5} \\
 & \text{(ii)} \quad \frac{5}{13} \frac{5 \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} \frac{5\sqrt{3}}{3} \\
 & \text{(iii)} \quad \frac{1}{\sqrt{5}} \frac{1}{\sqrt{5}} \frac{\sqrt{5}}{\sqrt{5}} \frac{\sqrt{5}}{5} \\
 & \text{(iv)} \quad \frac{\sqrt{2}}{\sqrt{32}} \frac{\sqrt{2}}{\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}} \\
 & \qquad \qquad \qquad \frac{\sqrt{2}}{2 \cdot 2\sqrt{2}} \frac{1}{4} \\
 7. & \text{(i)} \quad \frac{2\sqrt{2}}{\sqrt{5}} \frac{2\sqrt{2}}{\sqrt{5}} \frac{\sqrt{5}}{\sqrt{5}} \frac{2\sqrt{10}}{5} \\
 & \text{(ii)} \quad \frac{1}{3 \cdot \sqrt{2}} \frac{1}{3 \cdot \sqrt{2}} \frac{3 \cdot \sqrt{2}}{3 \cdot \sqrt{2}} \\
 & \qquad \qquad \qquad \frac{3 \cdot \sqrt{2}}{3^2 \cdot (\sqrt{2})^2} \\
 & \qquad \qquad \qquad \frac{3 \cdot \sqrt{2}}{9 \cdot 2} \\
 & \qquad \qquad \qquad \frac{3 \cdot \sqrt{2}}{7} \\
 & \qquad \qquad \qquad \frac{3}{7} \frac{\sqrt{2}}{7}
 \end{aligned}$$

$$\begin{aligned}
 & \text{(iii)} \quad \frac{4}{2 \cdot \sqrt{3}} \frac{4}{2 \cdot \sqrt{3}} \frac{2 \cdot \sqrt{3}}{2 \cdot \sqrt{3}} \\
 & \qquad \qquad \qquad \frac{4(2 \cdot \sqrt{3})}{2^2 \cdot (\sqrt{3})^2} \\
 & \qquad \qquad \qquad \frac{4(2 \cdot \sqrt{3})}{4 \cdot 3} \\
 & \qquad \qquad \qquad \frac{4(2 \cdot \sqrt{3})}{4(2 \cdot \sqrt{3})} \\
 & \text{(iv)} \quad \frac{3}{5 \cdot \sqrt{13}} \frac{3(5 \cdot \sqrt{13})}{(5 \cdot \sqrt{13})(5 \cdot \sqrt{13})} \\
 & \qquad \qquad \qquad \frac{3(5 \cdot \sqrt{13})}{5^2 \cdot (\sqrt{13})^2} \\
 & \qquad \qquad \qquad \frac{3(5 \cdot \sqrt{13})}{25 \cdot 13} \\
 & \qquad \qquad \qquad \frac{3(5 \cdot \sqrt{13})}{\frac{125}{4}} \\
 & \qquad \qquad \qquad \frac{5 \cdot \sqrt{13}}{4} \\
 & \text{(v)} \quad \frac{17}{3\sqrt{2} \cdot 1} \frac{17(3\sqrt{2} \cdot 1)}{(3\sqrt{2} \cdot 1)(3\sqrt{2} \cdot 1)} \\
 & \qquad \qquad \qquad \frac{17(3\sqrt{2} \cdot 1)}{(3\sqrt{2})^2 \cdot 12} \frac{17(3\sqrt{2} \cdot 1)}{9 \cdot 2 \cdot 1} \\
 & \qquad \qquad \qquad \frac{17(3\sqrt{2} \cdot 1)}{17(3\sqrt{2} \cdot 1)} \\
 & \qquad \qquad \qquad \frac{17}{3\sqrt{2} \cdot 1} \\
 & \text{(vi)} \quad \frac{1}{\sqrt{3} \cdot \sqrt{2}} \frac{1 \cdot (\sqrt{3} \cdot \sqrt{2})}{(\sqrt{3} \cdot \sqrt{2})(\sqrt{3} \cdot \sqrt{2})} \\
 & \qquad \qquad \qquad \frac{\sqrt{3} \cdot \sqrt{2}}{(\sqrt{3})^2 \cdot (\sqrt{2})^2} \\
 & \qquad \qquad \qquad \frac{\sqrt{3} \cdot \sqrt{2}}{3 \cdot 2} \\
 & \qquad \qquad \qquad \frac{\sqrt{3} \cdot \sqrt{2}}{\sqrt{3} \cdot \sqrt{2}} \\
 8. & \text{(i)} \quad \frac{\sqrt{27}}{\sqrt{3} \cdot 3} \frac{\sqrt{48}}{3 \cdot 3} \frac{\sqrt{75}}{3 \cdot 3} \frac{\sqrt{12}}{\sqrt{4} \cdot 4 \cdot 3} \\
 & \qquad \qquad \qquad \frac{\sqrt{5 \cdot 5 \cdot 3}}{\sqrt{2 \cdot 2 \cdot 3}} \\
 & \qquad \qquad \qquad \frac{3\sqrt{3} \cdot 4\sqrt{3} \cdot 5\sqrt{3} \cdot 2\sqrt{3}}{\sqrt{3}(3 \cdot 4 \cdot 5 \cdot 2)} \\
 & \qquad \qquad \qquad \frac{\sqrt{3}(9 \cdot 5)}{\sqrt{3}(4)} \quad \text{or} \quad 4\sqrt{3}
 \end{aligned}$$

$$(ii) \frac{\sqrt{28} \sqrt{63} \sqrt{112} \sqrt{175}}{\sqrt{2} \sqrt{2} \sqrt{7} \sqrt{3} \sqrt{3} \sqrt{7}} \\ \frac{\sqrt{7} \sqrt{4} \sqrt{4} \sqrt{5} \sqrt{5} \sqrt{7}}{2\sqrt{7} \ 3\sqrt{7} \ 4\sqrt{7} \ 5\sqrt{7}} \\ \frac{\sqrt{7}(2 \ 3 \ 4 \ 5)}{\sqrt{7}(4)} \\ 4\sqrt{7}$$

$$(iii) \frac{\sqrt{5} \sqrt{3} \sqrt{10} \sqrt{6}}{\sqrt{5} \sqrt{3} \sqrt{10} \sqrt{6}} \\ \frac{\sqrt{5} \sqrt{3} \sqrt{2} \sqrt{5} \sqrt{2} \sqrt{3}}{5 \ 3 \ 2}$$

$$(iv) \frac{3\sqrt{4} \ 4\sqrt{3} \ 2\sqrt{16} \ 5\sqrt{2}}{3 \ 4 \ 2 \ 5\sqrt{4} \ 3 \ 6 \ 2} \\ \frac{120\sqrt{2} \ 2 \ 3 \ 2 \ 3 \ 2}{120 \ 2 \ 3 \ 2} \\ \frac{120 \ 12}{1440}$$

$$(v) \frac{\sqrt{80} \sqrt{12}}{\sqrt{12}} \\ \frac{\sqrt{80}}{\sqrt{12}} \\ \frac{\sqrt{2 \ 2 \ 2 \ 2 \ 5}}{\sqrt{2 \ 2 \ 3}} \\ \frac{2\sqrt{15}}{3} \ 2\frac{\sqrt{5}}{3}$$

$$9. (i) (5\sqrt{3} \ 2\sqrt{2})(5\sqrt{3} \ 2\sqrt{2}) \\ (5\sqrt{3})^2 \ (2\sqrt{2})^2 \\ 25 \ 3 \ 4 \ 2 \\ 75 \ 8 \\ 67$$

$$(ii) (6 \sqrt{5})(6 \sqrt{5}) \\ 6^2 \ (\sqrt{5})^2 \\ 36 \ 5 \\ 31$$

$$(iii) (8\sqrt{6} \ 3\sqrt{2})(8\sqrt{6} \ 3\sqrt{2}) \\ (8\sqrt{6})^2 \ (3\sqrt{2})^2 \\ 64 \ 6 \ 9 \ 2 \\ 384 \ 18 \\ 366$$

$$(iv) (5\sqrt{3} \ 2)(5\sqrt{3} \ 2) \\ (5\sqrt{3})^2 \ 2^2 \\ 25 \ 3 \ 4 \\ 75 \ 4 \\ 71$$

$$10. (i) \frac{\sqrt{20} \sqrt{50} \sqrt{72}}{\sqrt{14} \sqrt{35} \sqrt{10}} \\ \frac{\sqrt{2 \ 10 \ 36}}{\sqrt{2 \ 5 \ 7}} \\ \frac{\sqrt{14 \ 35 \ 10}}{\sqrt{2 \ 10 \ 36}} \\ \frac{\sqrt{2 \ 10 \ 36}}{\sqrt{7 \ 7}} \\ \frac{\sqrt{2 \ (2 \ 5) \ 6 \ 6}}{\sqrt{7 \ 7}} \\ \frac{2 \ 6 \sqrt{5}}{7}$$

$$(ii) \frac{\sqrt{112} \sqrt{28} \sqrt{63}}{\sqrt{15} \sqrt{27} \sqrt{5}} \\ \frac{\sqrt{112 \ 28 \ 63}}{\sqrt{15 \ 27 \ 5}} \\ \frac{\sqrt{2 \ 2 \ 28 \ 28 \ 7}}{\sqrt{5 \ 3 \ 3 \ 5}} \\ \frac{2 \ 28 \sqrt{7}}{5 \ 3} \\ \frac{56 \sqrt{7}}{15}$$

5

Playing With Numbers

Exercise 5.1

- 1. (i) $0.000006 = 6.0 \times 10^{-6}$
- (ii) $0.00000012 = 1.2 \times 10^{-7}$

- (iii) $50300000000 = 5.03 \times 10^{11}$
- (iv) $0.0000000054 = 5.44 \times 10^{-9}$
- (v) $1689000000 = 1.689 \times 10^9$

2. (i) $5.2 \times 10^{-2} = 0.052$
(ii) $3 \times 10^{-5} = 0.00003$
(iii) $1.8 \times 10^3 = 1800$
(iv) $2.005 \times 10^8 = 200500000$
(v) $2.41532 \times 10^6 = 2415320$
3. (i) $1,49,60,00,00,000 \text{ m}$
 $= 1.496 \times 10^{11} \text{ m}$
(ii) 6023000000000000000000
 $= 6.023 \times 10^{22}$
(iii) $0.0015 \text{ cm} = 1.5 \times 10^{-3} \text{ cm}$
(iv) $0.000005 \text{ m} = 5.0 \times 10^{-6}$
(v) $0.00001535 \text{ m} = 1.535 \times 10^{-5}$
(vi) $0.0005 \text{ cm} = 5.0 \times 10^{-4}$
4. $3.21 \times 10^8 \times 0.49 \times 10^{10}$
 $10^8 [3.21 \times 0.49 \times 10^2]$
 $10^8 [3.21 \times 49]$
 $10^8 (52.21)$
 52.21×10^8
 $5.221 \times 10 \times 10^8$
 5.221×10^9
- (ii) $4.6 \times 10^{24} \times 18 \times 10^{23}$
 $10^{23} [4.6 \times 10 \times 18]$
 $10^{23} (46 \times 18)$
 $10^{23} (28)$
 $10^{23} \times 2.8 \times 10$
 2.8×10^{24}
5. thickness of 500 sheets
 500×0.0016
 $5 \times 10^2 \times 1.6 \times 10^{-3}$
 $5 \times 1.6 \times 10^{2-3}$
 $8.0 \times 10^{-1} \text{ cm}$

Exercise 5.2

1. (i) 13890 is divisible by 2 because it has even number at unit place
(ii) $8315 \div 8 = 3 \text{ R } 1 \text{ 5 } 17$
8315 is not divisible by 3 because sum of its digits is not divisible by 3
- (iii) $17926 \div 9 = 1 \text{ 7 } 9 \text{ 2 } 6 \text{ 25}$
17926 is not divisible by 9 because the sum of digits is not divisible by 9
- (iv) $8316 \div 8 = 3 \text{ 1 } 6 \text{ 18}$
8316 is divisible by 3
8316 is divisible by 2 also because it has even number at unit place.
8316 is divisible by 6 because it is divisible by 2 and 3 both.
- (v) 47320 is divisible by 5 because it has zero at unit place.
- (vi) 81525 is not divisible by 10 because it has no zero at unit place.
2. For $523a4$ to be divisible by 3 then sum of its digits must be multiple of 3
 $5 + 2 + 3 + a + 4 = 3 \text{ or } 6 \text{ or } 9 \text{ or } 15 \dots$
 $a = 14 - 3 \text{ or } 6 \text{ or } 9 \text{ or } 15 \dots$
 $a = 14 - 3 \text{ or } a = 14 - 6 \text{, or } a = 14 - 9 \text{ or } a = 14 - 15$
 $a = 11, a = 8, a = 5, a = 1$
 $a = 11, 8, 5$ (not possible)
 $a = 1$
3. For $24b35$ to be divisible by 9 then sum of its digits must be multiple of 9
 $2 + 4 + b + 3 + 5 = 9 \text{ or } 18 \text{ or } 27 \dots$
 $14 + b + 9 \text{ or } 18 \text{ or } 27$
 $14 + b + 9, 14 + b + 18, 14 + b + 27$
 $b + 5 \text{ or } b + 4 \text{ or } b + 13$
(not possible) (least)
least value of $b = 4$
4. $4lm6$ to be divisible by 6 it must be divisible by 2 and 3. It is divisible by 2 because it has even number at unit place. $4lm6$ to be divisible by three, its sum of digits should be divisible by 3
 $4 + 1 + m + 6 + 3 = 3 \text{ or } 9 \text{ or } 12 \text{ or } 15$
 $11 + m = 3 \text{ or } 9 \text{ or } 12 \text{ or } 15 \dots$
 $11 + m = 3, 11 + m = 9, 11 + m = 12 \dots$
 $m = 8, m = 2, m = 1$
(not possible) (not possible)
least value of $m = 1$
5. When a number is divided by 2 giving remainder 1 therefore digits at unit place must be an odd number other than 1 i.e. 3, 5, 7, 9

6. When a natural number divided by 5 leaves a remainder 3 therefore digits at unit place must be 3 or 8 because for a number to be divisible by 5 it must have 0 or 5 at unit place

7. $38x$ is divisible by 11 then difference of sum of digits at odd places and sum of digits at even places must be divisible by 11.

$$(\text{sum of digits at odd places}) - (\text{sum of digits at even places}) = 0 \text{ or } 11 \text{ or } 22, \dots$$

$$(3 \ x) \ (8) \ 0 \text{ or } 11 \text{ or } 22, \dots$$

$$x \ 5 \ 0 \ \text{or} \ 11 \ \text{or} \ 22$$

$$x \ 5 \ 0 \ \text{or} \ x \ 5 \ 11 \ \text{or} \ x \ 5 \ 22$$

$$x \ 5 \ \ \ x \ 16 \ \text{or} \ x \ 27, \dots$$

(Not possible)

$$x \ 5 \ (\text{because digit should be from } 0 \text{ to } 9).$$

8. $93y235$ is divisible by 11 then difference of sum of digits at odd places and sum of digits at even places must be divisible by 11

$$(9 \ y \ 3) \ (3 \ 2 \ 5) \ 0$$

or 11 or 22,.....

$$12 \ y \ 10 \ 0 \ \text{or} \ 11 \ \text{or} \ 22$$

$$y \ 2 \ 0 \ \text{or} \ 11 \ \text{or} \ 22, \dots$$

$$y \ 2 \ 0, \ y \ 2 \ 11, \ y \ 2 \ 22$$

$$y \ 2 \ y \ 9 \ y \ 20$$

$$y \ 9$$

(because digit should be 0 to 9).

9. 81 and 18 (9, 11)

Since 81 and 18 are formed by reversing the digits of one another

$$\frac{81 \ 18}{9} \ \frac{99}{9} \ 11$$

$$\text{and} \ \frac{81 \ 18}{11} \ \frac{99}{11} \ 9$$

10. 72 and 27 (5, 9)

Since 72 and 27 are formed by reversing the digits of one another

Since $\frac{7 \ 2}{5} \ \frac{5}{9}$ (difference of digits)

$$\frac{72 \ 27}{5} \ \frac{45}{9} \ 9$$

$$\frac{72 \ 27}{9} \ \frac{45}{9} \ 5$$

Exercise 5.3

$$1. \ (i) \ \begin{array}{r} 64 \\ + a \ b \\ \hline 92 \end{array}$$

here $4 \ b \ 2$ addition of $4 \ 8$ gives 12

$b \ 8$ and 1 is carried to the tens digit

Now $1 \ 6 \ a \ 9 \ a \ 3$

$a \ 3$ and $b \ 8$

$$(ii) \ \begin{array}{r} 45 \\ \frac{3a}{b2} \end{array}$$

here $5 \ a \ 2$ addition of $5 \ 7$ gives 12

$a \ 7$ and 1 is carried to the tens digit

Now $4 \ 3 \ 1 \ b \ b \ 8$

$a \ 7 \ b \ 8$

$$(iii) \ \begin{array}{r} 3a \\ \frac{b6}{81} \end{array}$$

here $a \ 6 \ 1$ addition of 5 and 6 gives

here $a \ 5$ and 1 is carried to tens place

$1 \ 3 \ b \ 8 \ b \ 4$

$a \ 5 \ b \ 4$

$$2. \ (i) \ \begin{array}{r} 2a \ b \\ \frac{c \ 7 \ 8}{7 \ 1 \ 3} \end{array}$$

here $b \ 8 \ 3$ addition of $5 \ 8 \ 13$

$b \ 5$ and 1 is carried to tens place

$1 \ a \ 7 \ 1 \ a \ 7 \ 1$ sum of 4 to 7 gives 11 $a \ 4$ and 1 is carried to hundred place

$1 \ 2 \ c \ 7 \ \ \ \ c \ 4$

$a \ 4 \ b \ 5 \ c \ 4$

$$3. \ (i) \ \begin{array}{r} 41 \\ \frac{ba}{14} \end{array}$$

here $1 \ a \ 4$ here is 1 smaller than

than $a \ 1$ is carried for tens place

$11 \ a \ 4 \ a \ 7$

At tens place $4 \ 1 \ b \ 1 \ 3 \ b \ 1$

$b \ 2$

$a \ 7 \ b \ 2$

$$(ii) \ \begin{array}{r} 91 \\ \frac{6a}{b7} \end{array}$$

here 1 is smaller than a therefore

1 is carried from tens place

$$\begin{array}{r} 1\ 10\ a\ 7\ 11\ a\ 7 \\ a\ 4 \end{array}$$

At tens place $a\ 1\ 6\ b\ 2\ b$

$$\begin{array}{r} a\ 4, b\ 2 \end{array}$$

(iii)
$$\begin{array}{r} a\ 2 \\ 3\ b \\ \hline 4\ 7 \end{array}$$

here b is greater than 2 therefore
 1 is carried from tens place

$$\begin{array}{r} 10\ 2\ b\ 7\ b\ 5 \end{array}$$

 At tens place $a\ 1\ 3\ 4$

(iv)
$$\begin{array}{r} a\ 8 \\ a\ 8, b\ 5 \\ a\ 5 \\ \hline 1\ b \\ 3\ 1 \end{array}$$

here $5\ b\ 1\ b\ 4$
 and $a\ 1\ 3\ a\ 4$

4. (i)
$$\begin{array}{r} 5\ 3\ a \\ 1\ b\ 5 \\ \hline c\ 9\ 5 \end{array}$$

1 is carried from tens place therefore

$$\begin{array}{r} 10\ a\ 5\ 5\ a\ 0 \end{array}$$

At tens place

$$\begin{array}{r} 3\ 1\ b\ 9 \end{array}$$

 2 $b\ 9$ here b is greater
 We borrow 1 from hundred place

$$\begin{array}{r} 10\ 2\ b\ 9 \\ 12\ b\ 9 \\ b\ 3 \end{array}$$

At hundred place

$$\begin{array}{r} 5\ 1\ 1\ c \\ 3\ c \\ a\ 0\ b\ 3\ c\ 3 \end{array}$$

(iii)
$$\begin{array}{r} c\ 3\ a \\ 2\ b\ 1 \\ \hline 5\ 6\ 4 \end{array}$$

here $a\ 1\ 4\ a\ 5$
 At tens place $3\ b\ 6$ ∴ b is greater

1 is carried from hundred place

$$\begin{array}{r} 10\ 3\ b\ 6\ b\ 7 \end{array}$$

At hundred place

$$\begin{array}{r} c\ 1\ 2\ 5\ c\ 8 \\ a\ 5\ b\ 7\ c\ 8 \end{array}$$

5.
$$\begin{array}{r} b\ 3 \\ c\ a \\ \hline 1\ 1\ 5 \\ 9\ 2\ 0\ 0 \\ \hline 1\ 0\ 3\ 0\ 5 \end{array}$$

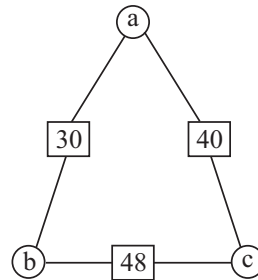
we have 5 at unit place ∴ $3\ 5\ 15$
 $a\ 5$ and 1 is carried to tens place

Now
$$\begin{array}{r} a\ b\ 1\ 11 \\ 5\ b\ 1\ 11 \\ 5b\ 10 \\ b\ 2 \end{array}$$

Now product of c and 3 contain 2 at unit place.

$$\begin{array}{r} c\ 3\ 12 \\ c\ 4 \\ a\ 5b\ 2c\ 4 \end{array}$$

6. (i)



here $a\ b\ 30 \dots(1)$
 $a\ c\ 40 \dots(2)$
 $b\ c\ 48 \dots(3)$

Multiply (1) (2) (3)

$$\begin{array}{r} a\ b\ a\ c\ b\ c\ 30\ 40\ 48 \\ a^2b^2c^2\ 1200\ 48 \end{array}$$

$$\begin{array}{r} (abc)^2\ 12\ 10\ 10\ 12\ 4 \\ abc\ \sqrt{12\ 10\ 10\ 12\ 2\ 2} \\ abc\ 12\ 10\ 2 \\ abc\ 240 \dots(4) \end{array}$$

divide (4) by 1

$$\begin{array}{r} abc\ 240 \\ ab\ 30 \\ c\ 8 \end{array}$$

divide (4) by (2)

$$\frac{abc}{ac} = \frac{240}{40}$$

$$b = 6$$

divide (4) by (3)

$$\frac{abc}{bc} = \frac{240}{48}$$

$$\frac{a}{a \ 5b \ 6c} = \frac{5}{8}$$

(ii) try yourself

$$\begin{array}{r} 7. \quad \quad \quad 3 \ 0 \ 4 \ 6 \\ \quad \quad \quad \times 3 \ 7 \ 1 \\ \hline \quad \quad \quad \boxed{3} \ \boxed{0} \ \boxed{4} \ \boxed{6} \\ \quad \boxed{2} \ \boxed{1} \ 3 \ \boxed{2} \ 2 \ 0 \\ \quad \boxed{9} \ 1 \ 3 \ 8 \ 0 \ 0 \\ \hline \boxed{1} \ \boxed{1} \ \boxed{3} \ \boxed{0} \ 0 \ 6 \ \boxed{6} \end{array}$$

$$\begin{array}{r} 8. \ 10 \ 5 \ 3 \ 2 \ 3 \\ \quad 10 \ 5 \ 2 \ 2 \ 3 \\ \quad \quad 2 \ 2 \ 2 \ 3 \\ \quad \quad \quad 2 \ 4 \ 3 \\ \quad \quad \quad \quad 6 \ 3 \ 3 \end{array}$$

9. (i)

4	8	20
9	3	15
6	5	x

$$\begin{array}{r} \therefore 4 \ 8 \ 12 \ 20 \\ \quad 9 \ 3 \ 12 \ 15 \\ \quad 6 \ 5 \ 12 \ x \\ \quad \quad 18 \ x \end{array}$$

x	9
6	16
4	36
3	64

$$\begin{array}{r} \therefore \quad 6^2 \ 36 \\ \quad \quad 4^2 \ 16 \\ \quad \quad 3^2 \ 9 \\ \therefore \quad x^2 \ 64 \\ \quad \quad x \ 8 \end{array}$$

10. (i)

6	9	7	3	2	4	8	1	5
5	1	4	6	8	9	7	3	2
8	3	2	7	1	5	4	9	6
4	5	1	8	3	2	6	7	4
5	8	3	5	6	7	9	2	1
2	7	6	4	9	1	5	8	3
7	2	8	1	5	6	3	4	9
1	4	5	9	7	3	2	6	8
3	6	9	2	4	8	1	5	7

(ii)

5	7	9	8	1	3	6	4	2
1	3	6	2	4	9	5	8	7
8	4	2	5	6	7	9	3	1
2	5	4	1	8	6	7	9	3
3	9	8	7	5	4	2	1	6
7	6	1	9	3	2	8	5	4
9	2	5	4	7	1	3	6	8
6	1	7	3	9	8	4	2	5
4	8	3	6	2	5	1	7	9

6

Profit, Loss and Discount

1. (i) S.P. = ₹ 400 C.P. = ₹ 468
 Profit = S.P. - C.P.
 468 - 400 = 68

$$P\% = \frac{P}{C.P.} \times 100$$

$$= \frac{68}{400} \times 100 = 17\%$$

$$(ii) \text{ C.P.} = ₹ 580 \text{ S.P.} = ₹ 536.50$$

$$\text{loss} = \text{C.P.} - \text{S.P.}$$

$$= 580 - 536.50$$

$$₹ 43.50$$

$$l\% \frac{l}{\text{C.P.}} 100$$

$$\frac{43.50}{580} 100$$

$$\frac{4350}{580}$$

$$l\% 7.5\%$$

$$(iii) \text{ C.P.} = ₹ 13600 \text{ S.P.} = ₹ 12104$$

$$l \text{ C.P. S.P.}$$

$$13600 \quad 12104$$

$$₹ 1496$$

$$l\% \frac{1496}{13600} 100$$

$$l\% 11\%$$

$$(iv) \text{ C.P.} = ₹ 1560 \text{ S.P.} = ₹ 1690$$

$$\text{Profit} = \text{S.P.} - \text{C.P.}$$

$$1690 \quad 1560$$

$$= ₹ 130$$

$$\text{Profit \%} \frac{\text{Profit}}{\text{C.P.}} 100$$

$$\frac{130}{1560} 100$$

$$8\frac{1}{3}\%$$

$$2. (i) \text{ C.P.} = ₹ 2360 \text{ P } 8\%$$

$$\text{S.P.} \frac{100 \text{ g \%}}{100} \text{ C.P.}$$

$$\frac{100 \text{ 8}}{100} 2360$$

$$\frac{108}{100} 2360$$

$$\text{S.P.} = ₹ 2548.80$$

$$(ii) \text{ C.P.} = ₹ 380 \text{ l } 7.5\%$$

$$\text{S.P.} \frac{100 \text{ l \%}}{100} \text{ C.P.}$$

$$\frac{100 \text{ 7.5}}{100} 380$$

$$\frac{92.5}{100} 380$$

$$= ₹ 351.5$$

$$(iii) \text{ C.P.} = ₹ 1440 \text{ P } 16\frac{2}{3}\%$$

$$\frac{50}{3}\%$$

$$\text{S.P.} \frac{100 \frac{50}{3}}{100} 1440$$

$$\frac{350}{300} 1440$$

$$\text{S.P.} = ₹ 1680$$

$$(iv) \text{ C.P.} = ₹ 360 \text{ l } 8\frac{3}{4}\%$$

$$\frac{35}{4}\%$$

$$\text{S.P.} \frac{100 \frac{35}{4}}{100} 360$$

$$\frac{365}{4} 100 \quad 360$$

$$\text{S.P.} = ₹ 328.5$$

$$3. (i) \text{ S.P.} = ₹ 450 \text{ l } 10\%$$

$$\text{C.P.} \frac{\text{S.P.} 100}{100 \text{ l \%}}$$

$$\frac{450 \text{ 100}}{100 \text{ 10}} \frac{45000}{90}$$

$$\text{C.P.} = ₹ 500$$

$$(ii) \text{ S.P.} = ₹ 690 \text{ P } 15\%$$

$$\text{C.P.} \frac{\text{S.P.} 100}{100 \text{ P \%}}$$

$$\frac{690 \text{ 100}}{100 \text{ 15}} \frac{69000}{115}$$

$$\text{C.P.} = ₹ 600$$

$$(iii) \text{ S.P.} = ₹ 444 \text{ l } 7.5\%$$

$$\text{C.P.} \frac{444 \text{ 100}}{100 \text{ 7.5}} \frac{44400}{92.5}$$

$$\text{C.P.} = ₹ 480$$

$$(iv) \text{ S.P.} = ₹ 6077.50 \text{ P } 6\frac{1}{4}\%$$

$$\frac{25}{4}\%$$

$$\text{C.P.} \frac{6077.50 \text{ 100}}{100} \frac{25}{4}$$

$$\text{C.P.} \frac{607750 \text{ 4}}{425}$$

$$\text{C.P.} ₹ 5720$$

4. T.C.P. of safe 5580 170 ₹ 5750

S.P. of safe = ₹ 6440

Profit = 6440 - 5750 = ₹ 690

Profit % earned by Ranjit $\frac{690}{5750} \times 100$

12%

5. T.C.P. of car for Robin

73500 10300 2600

= ₹ 86400

S.P. of car = ₹ 84240

loss 2160

loss % for Robin $\frac{2160}{86400} \times 100$

= 2.5%

6. T.C.P. of scooter = ₹ (9800 + 600)

= ₹ 10400

Profit = 8%

S.P. of Scooter $\frac{100}{100} \times 10400$

$\frac{108}{100} \times 10400$

108 104

S.P. of scooter = ₹ 11232

7. T.C.P. of computer 16800 + 1200

= ₹ 18000

S.P. of computer = ₹ 19200

Profit 19200 - 18000

= ₹ 1200

Profit % $\frac{1200}{18000} \times 100$

$6\frac{2}{3}\%$

8. Let S.P. of 20 oranges = 1

S.P. of 1 orange $\frac{1}{20}$

C.P. of 15 oranges = 1

C.P. of 1 orange $\frac{1}{15}$

loss = C.P. - S.P.

$\frac{1}{15} - \frac{1}{20}$

$\frac{4}{60} - \frac{3}{60}$

$\frac{1}{60}$

loss % $\frac{1}{60} \times 100$
 $\frac{1}{15}$

$\frac{1}{60} \times \frac{15}{1} \times \frac{25}{100}$

loss = 25%

9. Let C.P. of 18 biscuits = 1

C.P. of 1 biscuit $\frac{1}{18}$

S.P. of 16 biscuits = 1

S.P. of 1 biscuit $\frac{1}{16}$

Profit $\frac{1}{16} - \frac{1}{18}$

$\frac{9}{144} - \frac{8}{144}$

$\frac{1}{144}$

Profit % $\frac{1}{144} \times 100$

$\frac{1}{18}$

$\frac{1}{144} \times \frac{18}{1} \times 100$

$\frac{100}{8} \times \frac{25}{2}$

Profit $12\frac{1}{2}\%$

10. C.P. of 5 dozen eggs 5 × 20 = ₹ 100

Remaining eggs = 5 dozen - $\frac{1}{2}$ dozen

$4\frac{1}{2}$ dozens

S.P. of $4\frac{1}{2}$ dozen eggs 24 × $4\frac{1}{2}$

$\frac{12}{24} \times \frac{9}{2}$

108

Profit = S.P. - C.P.

108 - 100 = ₹ 8

Profit % $\frac{8}{100} \times 100$

Profit = 8%

11. S.P. of doll = ₹ 300, loss = 10%

C.P. of doll = $\frac{300}{100} \times \frac{100}{90} = \frac{30000}{90}$

$$= ₹ \frac{1000}{3} \text{ How to gain 10\%}$$

$$\begin{array}{l} \text{S.P. of doll} \quad \frac{100}{100} \quad \frac{g\%}{10} \quad \text{C.P.} \\ \frac{100}{100} \quad \frac{10}{100} \quad \frac{1000}{3} \\ = ₹ 366.66 \end{array}$$

12. S.P. of Ist cycle = ₹ 1955 gain = 10%

$$\begin{array}{l} \text{C.P. of Ist cycle} \\ \frac{1955}{100} \quad \frac{100}{10} \quad \frac{195500}{110} \\ = 1777.27 \end{array}$$

S.P. of IInd cycle = ₹ 1955, loss = 10%

$$\begin{array}{l} \text{C.P. of IInd cycle} \\ \frac{1955}{100} \quad \frac{100}{10} \quad \frac{195500}{90} \\ = 2172.22 \end{array}$$

T.S.P. = 1955 + 1955 = ₹ 3910

T.C.P. = 1777.27 + 2172.22 = ₹ 3949.49

$$\begin{array}{l} \text{loss} = \text{T.C.P.} - \text{T.S.P.} \\ = 3949.50 - 3910 \\ = 39.50 \end{array}$$

$$\begin{array}{l} \text{loss \%} \quad \frac{39.50}{3949.50} \quad 100 \\ = 1\% \text{ (App.)} \end{array}$$

13. S.P. of 30 pens = ₹ 150 loss = 20%

$$\begin{array}{l} \text{C.P. of 30 pens} \quad \frac{150}{100} \quad \frac{100}{20} \quad \frac{15000}{80} \\ = 187.5 \end{array}$$

Now to get 20% Profit S.P.

$$\begin{array}{l} \frac{100}{100} \quad \frac{g\%}{20} \quad \text{C.P.} \\ \frac{100}{100} \quad \frac{20}{100} \quad 187.5 \end{array}$$

$$\frac{120}{100} \quad 187.5 \quad 225$$

S.P. of 30 pens to get 20% profit = ₹ 225

14. Let C.P. of watch = x gain = 10%

$$\text{S.P.} \quad \frac{100}{100} \quad \frac{10}{100} \quad x$$

$$\frac{110}{100} \quad x$$

$$\text{S.P.} \quad \frac{11x}{10}$$

Now S.P. = $\frac{11x}{10}$ Now gain = 14%

$$\text{S.P.} \quad \frac{100}{100} \quad \frac{g\%}{100} \quad \text{C.P.}$$

$$\frac{11x}{10} \quad 65 \quad \frac{114}{100} \quad x$$

$$\frac{114x}{100} \quad \frac{11x}{10} \quad 65$$

$$\frac{114x}{100} \quad \frac{110x}{100} \quad 65$$

$$4x \quad 65 \quad 100$$

$$x \quad 65 \quad 25$$

$$x \quad ₹ 1625$$

C.P. of watch = ₹ 1625

15. C.P. of 100 kg of rice = 25 × 100

₹ 2500

S.P. of 100 kg of rice at 8% profit

$$\frac{100}{100} \quad \frac{8}{100} \quad 2500$$

$$\frac{108}{100} \quad 2500$$

= ₹ 2700

C.P. of 60 kg of Rice = 60 × 25 = 1500

S.P. of 60 kg of Rice at 10% Profit

$$\frac{100}{100} \quad \frac{10}{100} \quad 1500 \quad \frac{110}{100} \quad 1500$$

= 1650

C.P. of 10 kg of Rice = 25 × 10 = ₹ 250

S.P. of 10 kg of Rice 4% loss

$$\frac{(100 - 4)}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

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$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

$$\frac{96}{100} \quad 250$$

16. C.P. of 4 Note book = ₹ 35

C.P. of 1 Note book = ₹ 35 ÷ 4

= ₹ 8.75

S.P. of 5 Note books = ₹ 58

S.P. of 1 Note book = 58 ÷ 5 = ₹ 11.60

$$\text{gain} = \frac{11.60 - 8.75}{8.75} \times 100 = 32\frac{4}{7}\%$$

$$(i) \quad \text{g\%} = \frac{2.85}{8.75} \times 100$$

$$= 32\frac{4}{7}\%$$

(ii) For a gain of ₹ 2.85 Notebooks sold = 1

$$\text{For a gain of ₹ 1 Notebooks sold} = \frac{1}{2.85}$$

For a gain of ₹ 17 notebooks sold

$$\frac{171}{2.85} = 60$$

17. C.P. of 4 bananas = ₹ 1

$$\text{C.P. of 1 banana} = \frac{1}{4}$$

$$\text{S.P. of 3 bananas} = 1$$

$$\text{S.P. of 1 banana} = \frac{1}{3}$$

$$\text{Profit} = \frac{1}{3} - \frac{1}{4} = \frac{4 - 3}{12}$$

$$= \frac{1}{12}$$

$$\text{Profit \%} = \frac{P}{\text{C.P.}} \times 100$$

$$= \frac{1}{12} \times 100$$

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

$$= \frac{1}{3} \times 100$$

$$= 33\frac{1}{3}\%$$

$$\text{Profit} = 33\frac{1}{3}\%$$

18. C.P. of cow = ₹ 6000 loss = 10%

$$\text{S.P.} = \frac{100 - 10}{100} \times 6000$$

$$= \frac{90}{100} \times 6000$$

$$= ₹ 5400$$

C.P. of buffalo = ₹ 12000, profit = 15%

$$\text{S.P. of buffalo} = \frac{100 + 15}{100} \times 12000$$

$$= \frac{115}{100} \times 12000$$

$$= ₹ 13800$$

$$\therefore \text{T.C.P.} = 6000 + 12000 + 18000$$

$$\text{T.S.P.} = 5400 + 13800 + 19200$$

$$\text{Profit} = 19200 - 18000 = ₹ 1200$$

$$\text{Profit \%} = \frac{1200}{18000} \times 100$$

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

19. C.P. of 40 chairs = 40 × 175 = ₹ 7000

S.P. of 40 chairs at 10% profit

$$= \frac{100 + 10}{100} \times 7000$$

$$= \frac{110}{100} \times 7000$$

$$= ₹ 7700$$

Now C.P. of $\frac{1}{4}$ of 40 (10 chairs)

$$= 10 \times 175$$

$$= ₹ 1750$$

$$\text{S.P. of 10 chairs} = \frac{100 + 8}{100} \times 1750$$

$$= \frac{108}{100} \times 1750$$

$$= ₹ 1875$$

S.P. of Remaining 30 chairs

$$= 30 \times 1610$$

$$= ₹ 48300$$

S.P. of Remaining 1 chair = ₹ 203

20. S.P. of almirah = ₹ 3920

$$\text{gain} = 12\%$$

$$\text{C.P. of almirah} = \frac{3920}{100 + 12}$$

$$= \frac{392000}{112}$$

$$\text{C.P.} = ₹ 3500$$

Now S.P. = ₹ 4375

$$\text{Profit} = 4375 - 3500$$

$$= ₹ 875$$

$$\text{Profit \%} = \frac{875}{3500} \times 100 = 25\%$$

Exercise 6.2

1. (i) M.P. = ₹ 575, Discount = 12%

Discount = 12% of 575s

$$= \frac{12}{100} \times 575$$

$$= ₹ 69$$

$$\text{S.P.} = \text{M.P.} - \text{D}$$

$$\begin{array}{r} 575 \quad 69 \\ \hline ₹ 506 \end{array}$$

(ii) M.P. = ₹ 12750 $D = 8\frac{1}{3}\%$

$$\frac{25}{3}\%$$

$$\text{Discount} = \frac{25}{3}\% \text{ of } 12750$$

$$\frac{25}{300} \times 12750$$

$$= 1062.50$$

$$\text{S.P.} = \text{M.P.} - D$$

$$12750 - 1062.50$$

$$= ₹ 11687.50$$

2. (i) M.P. = ₹ 780 S.P. = ₹ 721.50

$$\text{Discount} = \text{M.P.} - \text{S.P.}$$

$$780 - 721.50 = ₹ 58.5$$

$$\text{Discount \%} = \frac{D}{\text{M.P.}} \times 100$$

$$\frac{58.5}{780} \times 100$$

$$= 7.5\%$$

(ii) M.P. = ₹ 28500

$$\text{S.P.} = ₹ 24510$$

$$\text{Discount} = \text{M.P.} - \text{S.P.}$$

$$= 28500 - 24510$$

$$= ₹ 3990$$

$$\text{Discount \%} = \frac{3990}{28500} \times 100$$

$$= 14\%$$

3. (i) S.P. = ₹ 735 $D = 4\%$

$$\therefore \text{S.P.} = \text{M.P.} \times \left(1 - \frac{D}{100}\right)$$

$$735 = \text{M.P.} \times \left(1 - \frac{4}{100}\right)$$

$$735 = \text{M.P.} \times \frac{96}{100}$$

$$\text{M.P.} = \frac{735 \times 100}{96}$$

$$= ₹ 765.63$$

(ii) S.P. = ₹ 204, Discount = 15%

$$\text{S.P.} = \text{M.P.} \times \left(1 - \frac{D}{100}\right)$$

$$204 = \text{M.P.} \times \left(1 - \frac{15}{100}\right)$$

$$204 = \text{M.P.} \times \frac{85}{100}$$

$$\text{M.P.} = \frac{204 \times 100}{85}$$

$$\text{M.P.} = ₹ 240$$

4. M.P. of article = ₹ 800 $D = 20\%$

$$\text{S.P.} = \text{M.P.} \times \frac{100 - D}{100}$$

$$800 \times \frac{100 - 20}{100}$$

$$= \frac{800 \times 80}{100}$$

$$= ₹ 640$$

$$\text{S.P. of article} = ₹ 640$$

$$\text{Now profit} = 25\%$$

$$\text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{Profit \%}}$$

$$= \frac{640 \times 100}{125}$$

$$= ₹ 512$$

5. M.P. of a good = ₹ 2250

$$D = 12\%$$

$$\text{S.P.} = \text{M.P.} \times \frac{100 - D}{100}$$

$$2250 \times \frac{88}{100}$$

$$\text{S.P.} = ₹ 1980$$

$$\text{Profit} = 10\%$$

$$\text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{Profit \%}}$$

$$= \frac{1980 \times 100}{110}$$

$$= ₹ 1800$$

6. C.P. of Calculator = ₹ 650

$$\text{Profit} = 20\%$$

$$\text{S.P. of Calculator} = \frac{\text{C.P.} \times 100}{100 - \text{Profit \%}}$$

$$= \frac{650 \times 100}{80}$$

$$= ₹ 812.50$$

$$\text{S.P.} = ₹ 812.50$$

$$\text{Now discount} = 20\%$$

$$\text{S.P.} = \text{M.P.} \times \frac{100 - D}{100}$$

$$812.50 = \text{M.P.} \times \frac{100 - 20}{100}$$

$$812.50 = \text{M.P.} \times \frac{80}{100}$$

$$\begin{aligned} \text{S.P.} &= \text{M.P.} \times \frac{100 - 20}{100} \times \frac{100 - 15}{100} \\ &= 100 \times \frac{80}{100} \times \frac{85}{100} \\ \text{S.P.} &= 68 \\ \text{Single discount \%} &= (100 - 68)\% \\ &= 32\% \end{aligned}$$

14. I case

$$\begin{aligned} \text{S.P. LCD} &= \text{M.P.} \times \frac{100 - D_1}{100} \times \frac{100 - D_2}{100} \times \frac{100 - D_3}{100} \\ 45400 &= \text{M.P.} \times \frac{100 - 10}{100} \times \frac{100 - 5}{100} \times \frac{100 - 2}{100} \\ 45400 &= \text{M.P.} \times \frac{90}{100} \times \frac{95}{100} \times \frac{98}{100} \\ \text{S.P. of LCD} &= ₹ 38040.66 \end{aligned}$$

II Case

$$\begin{aligned} \text{S.P. of LCD} &= \frac{100 - 10}{100} \times 45400 \\ &= \frac{90}{100} \times 45400 = 40860 \end{aligned}$$

Let C.P. of Mobile be x

$$\begin{aligned} 40860 - x &= 38040.66 \\ x &= ₹ 2819.34 \end{aligned}$$

15. S.P. of article = ₹ 380

$$\begin{aligned} \therefore \text{S.P.} &= \text{M.P.} \times \frac{100 - D_1}{100} \times \frac{100 - D_2}{100} \\ 380 &= \text{M.P.} \times \frac{100 - 20}{100} \times \frac{100 - 5}{100} \\ 380 &= \text{M.P.} \times \frac{80}{100} \times \frac{95}{100} \\ \frac{380 \times 100 \times 100}{80 \times 95} &= \text{M.P. of article} \\ \frac{3800000}{7600} &= \text{M.P.} \\ ₹ 500 &= \text{M.P.} \end{aligned}$$

7

Simple and Compound Interest

Exercise 7.1

1. (i) $P = ₹ 72000$, $r = 33\frac{1}{3}\%$, $t = 9$ months

$$\begin{aligned} \text{S.I.} &= \frac{Prt}{100} \\ &= \frac{72000 \times 100 \times \frac{3}{4}}{100 \times 3 \times 12} \\ &= ₹ 18000 \end{aligned}$$

(ii) $P = ₹ 7,250$, $r = 12\%$, $t = 145$ days

$$\begin{aligned} \text{S.I.} &= \frac{Prt}{100} \\ &= \frac{7250 \times 12 \times 145}{100 \times 365} \\ \text{S.I.} &= ₹ 345.61 \end{aligned}$$

(iii) $P = ₹ 4000$, $r = 16\%$
time = 22 Feb. (March) 31 April 20 73 days
 $\frac{73}{365}$ year
 $\frac{1}{5}$ year

$$\begin{aligned} \text{S.I.} &= \frac{Prt}{100} = \frac{4000 \times 16 \times \frac{1}{5}}{100} \\ \text{S.I.} &= ₹ 128 \end{aligned}$$

(iv) $P = ₹ 1200$, $r = 6\%$, $t = 6\frac{2}{3}$ months

$$\begin{aligned} \text{S.I.} &= \frac{Prt}{100} = \frac{1200 \times 6 \times \frac{20}{3 \times 12}}{100} \\ \text{S.I.} &= ₹ 480 \end{aligned}$$

(v) $P = ₹ 5000$ $t = 1$ year 3 months

$$= 1\frac{3}{12} \text{ year}$$

$$1\frac{1}{4} \text{ year } \frac{5}{4} \text{ year}$$

$$\text{rate} = 7 \text{ paise/₹}$$

$$= 7\% \text{ P.a.}$$

$$\text{S.I.} = \frac{Prt}{100} = \frac{5000 \times 7 \times 5}{100 \times 4}$$

$$= \frac{1750}{4}$$

$$= ₹ 437.50$$

2. We have principal = ₹ 3675

$$\text{rate } 8\frac{1}{3}\% = \frac{25}{3}\%$$

$$\text{time } \begin{array}{ccc} 21 & 3 & 28 \\ (\text{Dec}) & (\text{Jan}) & (\text{Feb}) \\ & 31 & 30 & 4 \\ & (\text{Mar}) & (\text{April}) & (\text{May}) \end{array}$$

$$= 145 \text{ days.}$$

$$\text{time } \frac{145}{365} \text{ year}$$

$$\text{S.I.} = \frac{3675 \times 25 \times 145}{100 \times 3 \times 365}$$

$$\text{S.I.} = ₹ 122.50$$

3. Let Principal x S.I. = 170.10

$$r = 6\% t = 2\frac{3}{12} \text{ year}$$

$$2\frac{1}{4}$$

$$\frac{9}{4} \text{ year}$$

$$\text{S.I.} = \frac{Prt}{100}$$

$$170.10 = \frac{x \times 6 \times 9}{100 \times 4}$$

$$\frac{170.10 \times 400}{54} = x$$

$$1260 = x$$

$$\text{Principal} = ₹ 1260$$

$$\text{Principal} = ₹ 800 \text{ S.I.} = ₹ 130$$

$$t = 2\frac{6}{12} \text{ year}$$

$$2\frac{1}{2} \text{ year}$$

$$\frac{5}{2} \text{ years}$$

$$\therefore \text{S.I.} = \frac{Prt}{100}$$

$$130 = \frac{800 \times r \times \frac{5}{2}}{100 \times 2}$$

$$\frac{130 \times 100 \times 2}{800 \times 5} = r$$

$$6.5\% = r$$

5. Principal = ₹ 330000, $r = 6.5\%$

$$\text{S.I.} = ₹ 75075$$

$$\therefore \text{S.I.} = \frac{Prt}{100}$$

$$75075 = \frac{330000 \times 6.5 \times t}{100 \times 100}$$

$$t = \frac{75075 \times 100}{214500}$$

$$t = 3\frac{1}{2} \text{ years}$$

6. Principal = ₹ 1500 $A = ₹ 1572$

$$I = 1572 - 1500$$

$$\text{S.I.} = 72$$

$$\text{time} = 29 + 31 + 13 = 73 \text{ days}$$

$$(\text{April}) (\text{May}) (\text{June})$$

$$\frac{73}{365} \text{ years}$$

$$\frac{1}{5} \text{ years}$$

$$\therefore \text{S.I.} = \frac{Prt}{100}$$

$$72 = \frac{1500 \times r \times \frac{1}{5}}{100 \times 5}$$

$$\frac{72 \times 3}{r} = 24\%$$

7. I case

$$\text{Principal} = ₹ 5000 t = 5 \text{ years } r = 9\%$$

$$\text{S.I.} = \frac{5000 \times 9 \times 5}{100} = 2250$$

II Case

$$\text{S.I.} = ₹ 2250 r = 7.5\% t = 4 \text{ years}$$

$$\begin{aligned} \text{S.I.} & \frac{Prt}{100} \\ 2250 & \frac{P \cdot 7.5 \cdot 4}{100} \\ \frac{225000}{7.5 \cdot 4} & P \\ ₹ 7500 & P \\ ₹ 7500 & \text{ will yield same interest in 4} \\ & \text{years at 7.5\% as ₹ 5000 at 9\% in 5} \\ & \text{years} \end{aligned}$$

8. In case $P = ₹ 4000$, $r = 12\%$, $t = 4\frac{1}{2}$ years
 $\frac{9}{2}$ years

$$\text{S.I.} = \frac{4000 \cdot 12 \cdot \frac{9}{2}}{100}$$

$$\text{S.I.} = 20 \cdot 12 \cdot 9$$

$$\text{S.I.} = ₹ 2160$$

Now

$$\text{S.I.} = \frac{2 \cdot 2160 \cdot r \cdot 9\%}{4320 \cdot t \cdot 3 \text{ years}}$$

$$\begin{aligned} \therefore \text{S.I.} & \frac{Prt}{100} \\ 4320 & \frac{P \cdot 9 \cdot 3}{100} \\ \frac{4320 \cdot 100}{9 \cdot 3} & P \\ 16000 & P \end{aligned}$$

₹ 16000 produce twice interest as
 ₹ 4000 in $4\frac{1}{2}$ years at 12%

9. Let ₹ x invested at 7.5% for 2 years
 ₹ $(7000 - x)$ invested at 8.5% for 3 years

$$\text{Now Interest on } x = \frac{x \cdot 7.5 \cdot 2}{100}$$

Now Interest on

$$(7000 - x) \cdot \frac{(7000 - x) \cdot 8.5 \cdot 3}{100}$$

$$\frac{x \cdot 7.5 \cdot 2}{100} = \frac{(7000 - x) \cdot 8.5 \cdot 3}{100}$$

$$\begin{aligned} \frac{15x}{100} & \frac{(7000 - x) \cdot 8.5 \cdot 3}{100} & 1470 \\ 15x & 178500 & 25.5 \\ & x & 1470 & 100 \end{aligned}$$

$$10.5x = 178500 - 147000$$

$$10.5x = 147000 - 178500$$

$$10.5x = 31500$$

$$x = ₹ 3000$$

investment at 8.5% = ₹ 3000

investment at 8.5% = ₹ 4000

10. We have principal = ₹ 2450
 Amount = ₹ 2528.40

$$\text{S.I.} = 78.4$$

$$\begin{aligned} \therefore \text{S.I.} & \frac{Prt}{100} \\ 78.4 & \frac{2450 \cdot 8 \cdot t}{100} \\ \frac{78.4 \cdot 100}{2450 \cdot 8} & \text{year } t \\ \frac{7840}{2450 \cdot 8} & 365 \text{ days} \end{aligned}$$

146 days = time

₹ 2450 will amount to 2528.40 in
 146 days therefore we move
 forward 146 from 9th October
 2004

Oct. Nov. Dec. Jan. Feb. March
 22 30 31 31 28 4 146 days
 day is 4th March 2005.

11. Let sum lent to Rohit be x
 sum lent to Sumit is $(1200 - x)$ 8%
 $t = 4$ years, $r = 4\%$

$$\text{Interest paid by Rohit} = \frac{x \cdot 8 \cdot 4}{100}$$

$$\text{Interest paid by Sumit} = \frac{(1200 - x) \cdot 8 \cdot 4}{100}$$

$$\frac{x \cdot 8 \cdot 4}{100} = \frac{(1200 - x) \cdot 8 \cdot 4}{100} \quad 448$$

$$\frac{32x}{100} = \frac{1200 \cdot 32}{100} \quad 448$$

$$\frac{32x}{100} = \frac{38400}{100} \quad 448$$

$$32x = 38400 \quad 44800$$

$$32x = 44800 - 38400$$

$$6400$$

$$x = ₹ 200$$

Money lent to Rohit is ₹ 200.

12. We have
 $P = ₹ 890$, $A = ₹ 1068$
 $I = 1068 - 890$

$$I = \frac{Prt}{100}$$

$$178 = \frac{890 \cdot r \cdot 4}{100}$$

$$\frac{178 \cdot 10}{89 \cdot 4} = r$$

$$5\% = r$$

Let ₹ x becomes ₹ 1620 in 7 years at 5%

$$\text{S.I.} = \frac{1620 \cdot x \cdot r}{100}$$

$$\therefore \text{S.I.} = \frac{P \cdot r \cdot t}{100}$$

$$(1620 - x) = \frac{x \cdot 5 \cdot 7}{100}$$

$$162000 - 100x = 35x$$

$$162000 = 135x$$

$$₹ 1200 = x$$

₹ 1200 becomes ₹ 1620 in 7 years at 5%.

13. Let rate $r\%$, $P = ₹ 2000$, $t = \frac{3}{2}$ years

$$I_1 = \frac{2000 \cdot r \cdot \frac{3}{2}}{100}$$

for $30r$

$$I_2, P = ₹ 1600, t = \frac{3}{2}$$

$$I_2 = \frac{1600 \cdot r \cdot \frac{3}{2}}{100}$$

$$24r$$

$$\therefore 30r = 24r = 24$$

$$6r = 24$$

$$r = 4\%$$

14. Let Principal x , $A = 2x$

$$I = \frac{2x \cdot x \cdot r}{100}$$

$$\therefore I = \frac{Prt}{100}$$

$$x = \frac{x \cdot 4 \cdot t}{100}$$

$$\frac{100x}{x \cdot 4} = t$$

$$25 \text{ years} = t$$

In 25 years sum becomes double at 4% p.a.

15. Let $P = x$, $A = 2800$ in 2 years

$$\text{S.I.} = \frac{2800 \cdot x \cdot r}{100}$$

$$\therefore \text{S.I.} = \frac{P \cdot r \cdot t}{100}$$

$$2800 \cdot x = \frac{x \cdot r \cdot 2}{100}$$

$$\frac{100(2800 - x)}{2} = rx \quad \dots(1)$$

Similarly

for $P = x$, $A = 3250$ in 5 year

$$\text{S.I.} = \frac{3250 \cdot x \cdot r}{100}$$

$$3250 \cdot x = \frac{x \cdot r \cdot 5}{100}$$

$$\frac{100(3250 - x)}{5} = xr \quad \dots(2)$$

for (1) (2)

$$\frac{100(2800 - x)}{2} = \frac{(3250 - x)100}{5}$$

$$5(2800 - x) = 2(3250 - x)$$

$$14000 - 5x = 6500 - 2x$$

$$14000 - 6500 = 5x - 2x$$

$$7500 = 3x$$

$$₹ 2500 = x$$

Put in (1)

$$\frac{100(2800 - 2500)}{2} = r \cdot 2800$$

$$\frac{100 \cdot 300}{2} = r \cdot 2800$$

$$\frac{150}{28} = r$$

$$6\% = r$$

Exercise 7.2

1. $P = 6000$, $r = 5\%$, $t = 2$

$$A = P \left(1 + \frac{r}{100}\right)^n$$

$$6000 \left(1 + \frac{5}{100}\right)^2 = 6000 \left(1 + \frac{1}{20}\right)^2$$

$$6000 \frac{21}{20}$$

$$6000 \frac{441}{400}$$

$$₹ 6615$$

$$\text{C.I.} = A - P$$

$$6615 - 6000 = ₹ 615$$

11. P ₹ 7500 r 6% t 2

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$7500 \left(1 + \frac{6}{100} \right)^2$$

$$7500 \frac{106}{100}^2$$

$$7500 \frac{106}{100} \frac{106}{100}$$

$$\frac{842700}{100}$$

A 8427

C.I. A P 8427 7500 ₹ 927

(iii) P ₹ 4800, r $\frac{15}{2}$ % t 2 years

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$4800 \left(1 + \frac{15}{2 \times 100} \right)^2$$

$$4800 \left(1 + \frac{15}{200} \right)^2 \quad 4800 \frac{215}{200}^2$$

$$\frac{4800 \times 215 \times 215}{200 \times 200}$$

$$\frac{24 \times 43 \times 215}{40}$$

A 5547

C.I. A P
5547 4800

C.I. ₹ 747

(iv) P ₹ 6750, r $\frac{20}{3}$ % t 3 years

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$6750 \left(1 + \frac{20}{3 \times 100} \right)^3$$

$$6750 \left(1 + \frac{2}{30} \right)^3 \quad 6750 \frac{32}{30}^3$$

$$\frac{6750 \times 32 \times 32 \times 32}{30 \times 30 \times 30}$$

A ₹ 8192

C.I. A P
8192 6750
₹ 1442

(vi) P ₹ 8000 r 5 paise/re
 t 2 years = 5%

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$8000 \left(1 + \frac{5}{100} \right)^2$$

$$8000 \left(1 + \frac{1}{20} \right)^2 \quad 8000 \frac{21}{20}^2$$

$$8000 \frac{21}{20} \frac{21}{20}$$

$$80 \frac{441}{4}$$

$$20 \times 441$$

A 8820

C.I. A P
8820 8000
₹ 820

2. P ₹ 12500 r 6% t 2 years

$$A = P \left(1 + \frac{r}{100} \right)^n$$

$$12500 \left(1 + \frac{6}{100} \right)^2$$

$$12500 \frac{106}{100}^2$$

$$12500 \frac{106}{100} \frac{106}{100}$$

A ₹ 4045

C.I. 14045 12500
₹ 1545

3. Swati's principal ₹ 8000 r 12.5%
 t 3 years

Amount after 3 years

$$8000 \frac{1 + 12.5}{100}^3$$

$$8000 \left(1 + \frac{12.5}{100} \right)^3$$

$$8000 \left(1 + \frac{1}{8} \right)^3$$

$$8000 \frac{9}{8}^3$$

= 11390.625

Amount Swati have to pay after 3 years

= ₹ 11391 (App.)

C.I. A P
11391 8000
₹ 3391

$$4. P \text{ ₹ } 10000, r_1 = 8\%, r_2 = 9\%$$

$$A = P \left(1 + \frac{r_1}{100} \right) \left(1 + \frac{r_2}{100} \right)$$

$$10000 \left(1 + \frac{8}{100} \right) \left(1 + \frac{9}{100} \right)$$

$$10000 \frac{108}{100} \frac{109}{100}$$

$$A \text{ ₹ } 11772$$

$$\text{C.I. } 1172 \text{ ₹ } 10000$$

$$\text{₹ } 1772$$

$$5. P \text{ ₹ } 12000, r = 10\%, t = 3 \text{ years}$$

$$A = 12000 \left(1 + \frac{10}{100} \right)^3$$

$$12000 \frac{11}{10}^3$$

$$12000 \frac{11 \cdot 11 \cdot 11}{10 \cdot 10 \cdot 10}$$

$$A \text{ ₹ } 15972$$

$$\text{C.I. } A - P$$

$$15972 - 12000$$

$$\text{C.I. ₹ } 3972$$

$$6. \text{ S.I. ₹ } 900, r = 6\%, t = 2 \text{ years}$$

$$\text{S.I. } \frac{Prt}{100}$$

$$900 = \frac{P \cdot 6 \cdot 2}{100}$$

$$\frac{900 \cdot 100}{6 \cdot 2} = P$$

$$P \text{ ₹ } 7500, r = 6\%, t = 2 \text{ year}$$

$$A = 7500 \left(1 + \frac{6}{100} \right)^2$$

$$7500 \frac{106}{100}^2$$

$$7500 \frac{106}{100} \frac{106}{100}$$

$$A \text{ ₹ } 8427$$

$$\text{C.I. } A - P$$

$$8427 - 7500$$

$$\text{C.I. ₹ } 927$$

$$7. P \text{ ₹ } 1000, r = 8\% \text{ p.a. } t = 1\frac{1}{2} \text{ years}$$

$$r = 4\% \text{ half yearly } t = 3 \text{ half years}$$

$$A = 1000 \left(1 + \frac{4}{100} \right)^3$$

$$1000 \left(1 + \frac{1}{25} \right)^3 = 1000 \frac{26}{25}^3$$

$$1000 \frac{26 \cdot 26 \cdot 26}{25 \cdot 25 \cdot 25}$$

$$A \text{ ₹ } 1124.86$$

$$\text{C.I. } 1124.86 - 1000$$

$$\text{C.I. ₹ } 124.86$$

$$8. P \text{ ₹ } 64000, r = 10\% t = 1\frac{1}{2} \text{ years}$$

$$r = 5\% \text{ half yearly } t = 3 \text{ half years}$$

$$A = 64000 \left(1 + \frac{5}{100} \right)^3$$

$$64000 \left(1 + \frac{1}{20} \right)^3$$

$$64000 \frac{21}{20}^3$$

$$64000 \frac{21 \cdot 21 \cdot 21}{20 \cdot 20 \cdot 20}$$

$$8 \cdot 21 \cdot 21 \cdot 21$$

$$A \text{ ₹ } 74088$$

$$\text{C.I. paid by Neena after } 1\frac{1}{2} \text{ years}$$

$$= 74088$$

$$- 64000$$

$$\text{₹ } 10088$$

$$9. P \text{ ₹ } 50000, r = 8\% \text{ p.a.}$$

$$r = 4\% \text{ half yearly, } t = 2 \text{ years}$$

$$t = 4 \text{ half years}$$

Amount received by woman

$$50000 \left(1 + \frac{4}{100} \right)^4$$

$$50000 \frac{104}{100} \frac{104}{100} \frac{104}{100} \frac{104}{100}$$

$$\frac{50000 \cdot 104 \cdot 104 \cdot 104 \cdot 104}{100 \cdot 100 \cdot 100 \cdot 100}$$

$$\frac{20 \cdot 26 \cdot 26 \cdot 104 \cdot 104}{5 \cdot 25}$$

$$A \text{ ₹ } 56243.20$$

C.I. she received
 $56243.20 - 50000 = 6243.20$

10. $P = ₹ 9000, r = 12\% \text{ p.a.}$
 $r = \frac{12}{4}\% \text{ quarterly } t = 9 \text{ months}$

$= 3\% \text{ or } t = 3 \text{ quaters}$

$$\therefore A = 9000 \left(1 + \frac{3}{100} \right)^3$$

$$= 9000 \frac{103}{100} \frac{103}{100} \frac{103}{100}$$

Nitin will get ₹ 9834.54

11. $P = ₹ 1600, r = 10\% \text{ p.a. } t = 6 \text{ months}$

$\frac{10}{4}\% \text{ quarterly or } t = 2 \text{ quaters}$

$= 2.5\% \text{ quarterly}$

$$A = 1600 \left(1 + \frac{2.5}{100} \right)^2$$

$$= 1600 \frac{102.5}{100} \frac{102.5}{100}$$

$$= 1600 \frac{102.5 \times 102.5}{100 \times 100}$$

1681

C.I. 1681 - 1600

C.I. ₹ 81

12. $P = ₹ 46875, r = 16\% \text{ p.a.}$

$t = 9 \text{ months}$

$r = 4\% \text{ quarterly } t = 3 \text{ quaters}$

$$A = 46875 \left(1 + \frac{4}{100} \right)^3$$

$$= 46875 \frac{104}{100}^3$$

$$= 46875 (1.04)^3$$

$$= 46875 \times 1.124864$$

$A = ₹ 52728$

C.I. $A - P$

$$= 52728 - 46875$$

C.I. ₹ 5853

13. $P = ₹ 10000, r_1 = 10\%, r_2 = 15\%, r_3 = 20\%$

$$A = P \left(1 + \frac{r_1}{100} \right) \left(1 + \frac{r_2}{100} \right) \left(1 + \frac{r_3}{100} \right)$$

$$10000 \left(1 + \frac{10}{100} \right) \left(1 + \frac{15}{100} \right) \left(1 + \frac{20}{100} \right)$$

$$= 10000 \frac{110}{100} \frac{115}{100} \frac{120}{100}$$

$A = ₹ 15180$

C.I. 15180 - 10000

C.I. ₹ 5180

14. $P = ₹ 12000, r_1 = 10\%, r_2 = 12\%, r_3 = 14\%$

$$A = P \left(1 + \frac{r_1}{100} \right) \left(1 + \frac{r_2}{100} \right) \left(1 + \frac{r_3}{100} \right)$$

$$= 12000 \left(1 + \frac{10}{100} \right) \left(1 + \frac{12}{100} \right) \left(1 + \frac{14}{100} \right)$$

$$= 12000 \frac{110}{100} \frac{112}{100} \frac{114}{100}$$

$$= 12 \times 1.10 \times 1.12 \times 1.14$$

$A = 16853.76$

C.I. 16853.76 - 12000

C.I. ₹ 4853.76

15. $A = ₹ 676, r = 4\%, t = 2 \text{ year}$

$$A = P \left(1 + \frac{r}{100} \right)^t$$

$$676 = P \left(1 + \frac{4}{100} \right)^2$$

$$676 = P \left(1 + \frac{4}{100} \right)^2$$

$$676 = P \frac{26}{25}^2$$

$$676 = P \frac{676}{625}$$

₹ 625 = P

₹ 625 Amounts to ₹ 676 in 2 years.

16. $A = ₹ 9826, r = 12.5\% \text{ p.a. } t = 1\frac{1}{2} \text{ years}$

$$r = \frac{12.5}{2}\% \text{ } t = 3 \text{ half years}$$

$$\frac{12.5}{20} \text{ half yearly}$$

$$\frac{25}{4}\%$$

3

$$9826 = P \left(1 + \frac{25}{4} \right)^3$$

$$P \left(1 + \frac{r}{16}\right)^4$$

$$9826 = P \frac{17^3}{16}$$

$$9826 = P \frac{4913}{4096}$$

$$P = \frac{9826 \cdot 4096}{4913} \quad P = ₹ 8192$$

17. A ₹ 8192 P ₹ 750 r $\frac{20}{3}\%$ t ?

$$8192 = 750 \left(1 + \frac{20}{300}\right)^t$$

$$\frac{8192}{750} = \left(1 + \frac{20}{300}\right)^t$$

$$\frac{4096}{3375} = \left(\frac{16}{15}\right)^t$$

$$\frac{16^3}{15^3} = \left(\frac{16}{15}\right)^t$$

$$t = 3 \text{ years.}$$

18. P ₹ 800 A ₹ 926 r 10% p.a. 5% half yearly

$$A = P \left(1 + \frac{r}{100}\right)^t$$

$$926 = 800 \left(1 + \frac{5}{100}\right)^t$$

$$\frac{926 \cdot 10}{800} = \frac{105^t}{100}$$

$$\frac{92610}{80000} = \frac{21^t}{20}$$

$$\frac{9261}{8000} = \frac{21^t}{20}$$

$$\frac{21^3}{20} = \frac{21^t}{20}$$

$$t = 3 \text{ half years}$$

$$t = 1\frac{1}{2} \text{ years.}$$

19. P ₹ 20000 A ₹ 24200 t 2 years

$$24200 = 20000 \left(1 + \frac{r}{100}\right)^2$$

$$\frac{24200}{20000} = \left(1 + \frac{r}{100}\right)^2$$

$$\frac{121}{100} = \left(1 + \frac{r}{100}\right)^2$$

$$\frac{11^2}{10^2} = \left(1 + \frac{r}{100}\right)^2$$

$$\frac{11}{10} = 1 + \frac{r}{100}$$

$$\frac{11}{10} - 1 = \frac{r}{100}$$

$$\frac{1}{10} = \frac{r}{100}$$

$$10\% = r$$

20. P ₹ 31250 A ₹ 35152 rate $\frac{r}{2}\%$ half

yearly

$$t = 1\frac{1}{2} \text{ years}$$

$$t = 3 \text{ half years}$$

$$35152 = 31250 \left(1 + \frac{r}{200}\right)^3$$

$$\frac{35152}{31250} = \left(1 + \frac{r}{200}\right)^3$$

$$\frac{17576}{15625} = \left(1 + \frac{r}{200}\right)^3$$

$$\frac{26^3}{25^3} = \left(1 + \frac{r}{200}\right)^3$$

$$\frac{26}{25} = 1 + \frac{r}{200}$$

$$\frac{26}{25} - 1 = \frac{r}{200}$$

$$\frac{1}{25} = \frac{r}{200}$$

$$\frac{200}{25} = r$$

$$8\% = r$$

Exercise 8.1

1. (i)
- $\therefore a$
- and
- b
- vary directly

$$\frac{2}{8} = \frac{a_1}{32} = \frac{12}{48} = \frac{16}{b_1}$$

$$\frac{2}{8} = \frac{a_1}{32} \Rightarrow a_1 = \frac{2 \times 32}{8} = 8$$

$$\frac{12}{48} = \frac{16}{b_1} \Rightarrow b_1 = \frac{16 \times 48}{12} = 64$$

a	2	8	12	16
b	8	32	48	64

- (ii)
- $\therefore a$
- and
- b
- vary directly

$$\frac{2}{5} = \frac{6}{b_1} = \frac{a_1}{17.5} = \frac{8}{20}$$

$$\frac{6}{b_1} = \frac{8}{20} \Rightarrow b_1 = \frac{6 \times 20}{8} = 15$$

$$\frac{a_1}{17.5} = \frac{8}{20} \Rightarrow a_1 = \frac{8 \times 17.5}{20} = 7$$

a	2	6	15	8
b	5	7	17.5	20

- 2.
- $\therefore p$
- and
- q
- vary directly

$$\frac{p}{q} = \frac{282}{5.1}$$

$$\frac{p}{6.8} = \frac{282}{5.1}$$

$$p = \frac{282 \times 6.8}{5.1} = 376$$

3. Books Cartons
-
- 72 4
-
- 540
- x
- vary directly

$$\frac{72}{540} = \frac{4}{x}$$

$$x = \frac{4 \times 540}{72} = 30$$

540 books can be packed in 30 cartons.

4. Cloth (mts.) Cost (₹)

$$\frac{8}{5.8} = \frac{x}{250} \quad \text{vary directly}$$

$$\frac{8}{5.8} = \frac{x}{250}$$

$$x = \frac{250 \times 5.8}{8}$$

$$x = ₹ 181.25$$

5.8 m cloth cost ₹ 181.25.

5. Days payment (₹)

$$\frac{5}{24} = \frac{x}{1200} \quad \text{direct variation}$$

$$\frac{5}{24} = \frac{x}{1200}$$

$$x = \frac{1200 \times 5}{24}$$

$$x = 5760$$

₹ 5760 is paid for 24 days.

6. Persons quantity (kg)

$$\frac{5}{23} = \frac{95}{x} \quad \text{vary directly}$$

$$\frac{5}{23} = \frac{95}{x}$$

$$x = \frac{95 \times 23}{5}$$

$$x = 437$$

437 kg is required for 23 persons.

7. distance (km) fair (₹)

$$\frac{650}{1950} = \frac{130}{x} \quad \text{vary directly}$$

$$\frac{650}{1950} = \frac{130}{x}$$

$$x = \frac{130 \times 1950}{650}$$

$$x = ₹ 390$$

fair for 1950 km is ₹ 390.

8. (i) distance hours

$$\frac{126}{x} = \frac{3}{7} \quad \text{vary directly}$$

$$\frac{126}{x} = \frac{3}{7}$$

$$x = \frac{126 \times 7}{3}$$

$$x = 294$$

$$\begin{array}{r}
 294 \quad x \\
 294 \text{ km is covered in 7 hours.} \\
 \text{(ii) distance (km) \quad hours} \\
 126 \quad 3 \\
 462 \quad x \\
 \hline
 126 \quad 3 \\
 462 \quad x \\
 x \quad \frac{3 \quad 462}{126} \\
 x \quad 11
 \end{array}$$

In 11 hours distance travelled is 462 km.

9. Pole (m) Shadow (m)

11.5	3	
34.5	x	vary directly

$$\begin{array}{r}
 11.5 \quad 3 \\
 34.5 \quad x \\
 \hline
 x \quad \frac{3 \quad 34.5}{11.5} \\
 x \quad 9
 \end{array}$$

length of shadow = 9 m.

10. Steps Distance (m)

125	100	
875	x	vary directly

$$\begin{array}{r}
 125 \quad 100 \\
 875 \quad x \\
 \hline
 x \quad \frac{875 \quad 100}{125} \\
 x \quad 700
 \end{array}$$

In 875 steps 700 m distance is covered.

11. No of bottles time (hours)

950	5	
x	4	vary directly

$$\begin{array}{r}
 950 \quad 5 \\
 x \quad 4 \\
 \hline
 950 \quad 4 \\
 5 \quad x \\
 760 \quad x
 \end{array}$$

In 4 hours 760 bottles is fills.

12. Rice (kg) Cost (₹)

8	117.20	
x	703.20	vary directly

$$\begin{array}{r}
 8 \quad 117.20 \\
 x \quad 703.20
 \end{array}$$

$$\begin{array}{r}
 703.20 \quad 8 \\
 x \quad 117.20
 \end{array}$$

$$x \quad 48$$

Cost of 48 kg of rice is ₹ 703.20

13. Weight (g) No. of sheets

162	6	
13500	x	vary directly

$$\begin{array}{r}
 162 \quad 6 \\
 13500 \quad x \\
 \hline
 x \quad \frac{6 \quad 13500}{162} \\
 x \quad 500
 \end{array}$$

500 sheets weighs 13.5 kg.

14. days payment (₹)

13	806	
x	1798	vary directly

$$\begin{array}{r}
 13 \quad 806 \\
 x \quad 1798 \\
 \hline
 x \quad \frac{13 \quad 1798}{806} \\
 x \quad 29
 \end{array}$$

₹ 1798 is paid for 29 days.

15. Men trench (m)

13	117	
x	225	

$$\begin{array}{r}
 13 \quad 117 \\
 x \quad 225 \\
 \hline
 x \quad \frac{13 \quad 225}{117} \\
 x \quad 25
 \end{array}$$

25 men dig trench of 225 metres.

Exercise 8.2

1. (i) $\therefore a$ and b vary inversely

$$\begin{array}{r}
 \frac{8}{a_1} \quad \frac{12}{15} \quad \frac{4}{2} \quad \frac{60}{b_1} \\
 a_1 \quad \frac{8 \quad 15}{12} \quad b_1 \quad \frac{60 \quad 2}{4} \\
 a_1 \quad 10 \quad b_1 \quad 30
 \end{array}$$

(ii) $\therefore a$ and b vary inversely

$$\begin{array}{r}
 \frac{a_1}{3} \quad \frac{12 \quad 3}{18 \cdot 4} \quad \frac{b_1 \cdot 3}{12 \cdot a_2} \quad \frac{6}{12} \\
 a_1 \quad \frac{12 \quad 3}{18}, b_1 \quad \frac{3 \quad 12}{4} a_2 \quad \frac{3 \quad 12}{6} \\
 a_1 \quad 2, b_1 \quad 9, a_2 \quad 6
 \end{array}$$

$$\begin{array}{r}
 \text{Men} \quad \text{days} \\
 15 \quad 24 \\
 9 \quad x \quad \text{inverse variations} \\
 \frac{15}{9} \quad \frac{x}{24} \\
 15 \quad 24 \\
 \hline
 9 \quad x \\
 40 \quad x
 \end{array}$$

9 men can repair road in 40 days.

$$\begin{array}{r}
 \text{Cows} \quad \text{days} \\
 33 \quad 12 \\
 x \quad 9 \quad \text{inverse variation} \\
 \frac{33}{x} \quad \frac{9}{12} \\
 x \quad \frac{33 \cdot 12}{9} \\
 x \quad 44
 \end{array}$$

44 cows graze a field in 9 days.

$$\begin{array}{r}
 \text{Speed} \quad \text{time} \\
 (\text{km/hr}) \quad (\text{minutes}) \\
 40 \quad 45 \\
 x \quad 25 \quad \text{inverse variation} \\
 \frac{40}{x} \quad \frac{25}{45} \\
 x \quad \frac{40 \cdot 45}{25} \\
 x \quad 72
 \end{array}$$

bus should go at 72 km/hr to cover the journey in 25 minutes.

$$\begin{array}{r}
 \text{workers} \quad \text{days} \\
 40 \quad 15 \\
 x \quad 8 \quad \text{inverse variation} \\
 \frac{40}{x} \quad \frac{8}{15} \\
 x \quad \frac{40 \cdot 15}{8} \\
 x \quad 75
 \end{array}$$

75 workers complete a job in 8 days.

$$\begin{array}{r}
 \text{Speed} \quad \text{Time} \\
 (\text{km/hr}) \quad (\text{hours}) \\
 48 \quad 8 \\
 x \quad 6 \\
 \therefore \text{inverse variation} \\
 \frac{48}{x} \quad \frac{6}{8}
 \end{array}$$

$$\begin{array}{r}
 x \quad \frac{48 \cdot 8}{6} \\
 x \quad 64
 \end{array}$$

To cover the distance in 6 hours speed of car should be 64 km/hr.

$$\begin{array}{r}
 \text{Speed} \quad \text{time} \\
 (\text{km/hr}) \quad (\text{minutes}) \\
 35 \quad 16 \\
 40 \quad x \quad \text{inverse variation} \\
 \frac{35}{40} \quad \frac{x}{16} \\
 x \quad \frac{35 \cdot 16}{40} \quad x \quad 14
 \end{array}$$

at speed of 40 km/hr Niharika will take 14 minutes.

$$\begin{array}{r}
 \text{men} \quad \text{days} \\
 1200 \quad 35 \\
 x \quad 25 \quad \text{inverse variation} \\
 \frac{1200}{x} \quad \frac{25}{35} \\
 x \quad \frac{1200 \cdot 35}{25} \quad x \quad 1680
 \end{array}$$

(91680 - 1200) 480 more men should join them.

$$\begin{array}{r}
 \text{girls} \quad \text{days} \\
 50 \quad 40 \\
 200(50 \cdot 30) \quad 80 \quad x \\
 \text{inverse variation} \\
 \frac{50}{80} \quad \frac{x}{40} \\
 x \quad \frac{50 \cdot 40}{80} \\
 x \quad 25
 \end{array}$$

provision will last for 25 days.

$$\begin{array}{r}
 \text{10. Let } x \text{ soldiers left the fort} \\
 \text{soldiers} \quad \text{days} \\
 1200 \quad (28 \cdot 4) \quad 24 \\
 1200 \quad x \quad 32 \\
 \text{inverse variation}
 \end{array}$$

$$\begin{array}{r}
 \frac{1200}{1200} \quad \frac{32}{x} \quad \frac{24}{24} \\
 \frac{1200}{1200} \quad \frac{4}{x} \quad \frac{4}{3} \\
 3600 \quad 4800 \quad 4x \\
 4x \quad 1200 \\
 x \quad 300
 \end{array}$$

300 soldiers left the fort.

Exercise 8.3

1. 1 day work of James $\frac{1}{4}$
 1 day work of Julie $\frac{1}{6}$
 1 day work of (James + Julie) $\frac{1}{4} + \frac{1}{6}$
- $$\frac{\frac{6}{24} + \frac{4}{24}}{\frac{10}{24}}$$
- 1 day work of both $\frac{5}{12}$
 James and Julie can do the work in $\frac{12}{5}$ days
 $2\frac{2}{5}$ days
2. 1 day work of Neel $\frac{1}{10}$
 1 day work of Nikki $\frac{1}{15}$
 1 day work of Neel + Nikki $\frac{1}{10} + \frac{1}{15}$
- $$\frac{\frac{3}{30} + \frac{2}{30}}{\frac{5}{30}}$$
- $$\frac{1}{6}$$
- Neel and Nikki can do the work in 6 days.
3. 1 day work of Tom + Dick + Herry $\frac{1}{4}$
 1 day work of Tom $\frac{1}{12}$
 1 day work of Henry $\frac{1}{10}$
 1 day work of Dick $\frac{1}{4} + \frac{1}{12} + \frac{1}{10}$
- $$\frac{\frac{15}{60} + \frac{5}{60} + \frac{6}{60}}{\frac{4}{60} + \frac{1}{15}}$$
- Dick can do the work in 15 days.

4. 1 minute work of Bunty + Bubbly $\frac{1}{15}$
 10 minute work of Bunty + Bubbly $10 \times \frac{1}{15}$
 $\frac{2}{3}$
 remaining work $1 - \frac{2}{3} = \frac{1}{3}$
 1 work is done by Bubbly in 40 minutes
 $\frac{1}{3}$ work as done by Bubbly in $40 \times \frac{1}{3}$ minutes
 Remaining work done by Bubbly in $13\frac{1}{3}$ minutes.
5. 1 hr work of Maria $\frac{1}{4}$ of basket
 1 hr work of Julia $\frac{1}{6}$ of basket
 1 hr work of (Maria + Julia) $\frac{1}{4} + \frac{1}{6}$
- $$\frac{\frac{3}{12} + \frac{2}{12}}{\frac{5}{12}}$$
- $\frac{5}{12}$ of basket
 $\frac{5}{12}$ of basket weaved in 1 hr
 1 of basket weaved in $\frac{12}{5}$
 15 baskets weaved in $\frac{12}{5} \times 15 = 36$ hours
6. 1 day work of (A + B) $\frac{1}{25}$
 15 days work of A $\frac{1}{3}$
 1 days work of A $\frac{1}{45}$
 1 days work of B $\frac{1}{25} + \frac{1}{45}$
- $$\frac{\frac{9}{225} + \frac{5}{225}}{\frac{4}{225}}$$

B can polish the floor in $\frac{225}{4}$ days

i.e., $56\frac{1}{4}$ days.

7. 12 hours work of A $\frac{1}{5}$
 1 hours work of A $\frac{1}{60}$
 15 hours work of B $\frac{1}{6}$
 1 hours work of B $\frac{1}{90}$
 1 hour work of (A B) $\frac{1}{60} \frac{1}{90}$

$$\frac{\frac{3}{180} \frac{2}{180}}{\frac{5}{180} + \frac{1}{36}}$$

(A B) can do the work in 36 hours.

8. 1 day work of A B $\frac{1}{20}$
 2 days work of A B $\frac{2}{20} \frac{1}{10}$
 remaining work $1 - \frac{1}{10} - \frac{9}{10}$
 1 of work is done by B in 15 days
 $\frac{9}{10}$ of work is done by B in $15 \times \frac{9}{10}$

$$\frac{27}{2}$$

B can finish the remaining work in $13\frac{1}{2}$ days.

9. 1 day work of A B C $\frac{1}{15}$
 1 day work of B C $\frac{1}{30} \frac{1}{40}$
 $\frac{4}{120} \frac{3}{120} \frac{7}{120}$
 1 day work of A $\frac{1}{15} \frac{7}{120}$

$$\frac{8}{120} \frac{7}{120} \frac{1}{120}$$

A can do the work in 120 days.

10. day work of A B C $\frac{5}{24}$
 1 day work of A C $\frac{1}{8}$
 1 day work of B $\frac{5}{24} \frac{1}{8}$
 $\frac{5}{24} \frac{3}{24}$
 $\frac{2}{24}$
 $\frac{1}{12}$

B can plough a field in 12 days.

11. 1 day work of A B $\frac{1}{10}$
 1 day work of B C $\frac{1}{15}$
 1 day work of A C $\frac{1}{12}$
 1 day work of
 $2(A$ B $C)$ $\frac{1}{10} \frac{1}{15} \frac{1}{12}$
 $\frac{6}{60} \frac{4}{60} \frac{5}{60}$
 $\frac{15}{60}$
 1 day work of A B C $\frac{15}{2 \cdot 60}$
 $\frac{1}{8}$

A B C can do the work in 8 days.

- 1 day work of C $\frac{1}{8} \frac{1}{10}$
 $\frac{5}{40} \frac{1}{40}$
 $\frac{1}{40}$
 $\frac{1}{8} \frac{1}{15}$
 $\frac{15}{120} \frac{8}{120}$
 $\frac{7}{120}$

A can do the work in $\frac{120}{7}$ days or

$17\frac{1}{7}$ days.

1 day work of B $\frac{1}{8} \frac{1}{12}$
 $\frac{3}{24} \frac{2}{24} \frac{1}{24}$

B can do the work in 24 days.

12. 1 hour work of Ist tap $\frac{1}{15}$

1 hour work of IInd tap $\frac{1}{12}$

1 hour work of (Ist + IInd) tap

$$\frac{1}{15} \frac{1}{12}$$

$$\frac{4}{60} \frac{5}{60}$$

$$\frac{9}{60}$$

Both the taps fill the tank in $\frac{60}{9}$ hours

$6\frac{2}{3}$ hours.

13. In 1 hour tap A fill the tap $\frac{1}{8}$

In 1 hour tap B emptied tap $\frac{1}{10}$

In 1 hour taps A and B fill the tank

$$\frac{1}{8} \frac{1}{10}$$

$$\frac{5}{40} \frac{4}{40}$$

$$\frac{1}{40}$$

Tank can be filled in 40 hours.

14. In 1 minute (A B) fill $\frac{1}{15}$ of tank

In 1 minute C emptied $\frac{1}{10}$ of tank

$$\text{In 1 minute } \frac{1}{10} \frac{1}{15}$$

$$\frac{3}{30} \frac{2}{30}$$

$$\frac{1}{30}$$

tank is filled in 30 minutes if all taps work together.

15. 1 hour work of 3 taps $\frac{1}{3}$

1 hour work of Ist tap $\frac{1}{10}$

1 hour work of IInd tap $\frac{1}{15}$

1 hour work of all taps $\frac{1}{3} \frac{1}{10} \frac{1}{15}$

$$\frac{10}{30} \frac{3}{30} \frac{2}{30}$$

$$\frac{10}{30} \frac{5}{30}$$

1 hour work of all taps $\frac{5}{30}$

tank filled in $\frac{30}{5}$ 6 hours.

Exercise 8.4

1. speed 15 m/s

$$\frac{3}{15} \frac{18}{5} \text{ km/hr}$$

speed of train = 54 km/hr

2. d 18 km = 18000 m

t 6 hr = 6 3600 sec

$$\text{speed } \frac{d}{t} = \frac{18000}{3600} \text{ m/s}$$

$$\frac{5}{6} \text{ m/s}$$

3. speed of train = 25 m/s

$$25 \frac{18}{5} \text{ km/hr}$$

$$5 \frac{18}{5}$$

$$= 90 \text{ km/hr}$$

time taken = 12 hr 20 min

$$12 \frac{20}{60} \text{ hr}$$

$$12\frac{1}{3} \text{ hr } \frac{37}{3} \text{ hr}$$

distance s t

$$90 \frac{37}{3} \text{ km}$$

$$30 \frac{37}{3}$$

distance between cities = 1110 km.

4. Time = 10 hr, speed = 40 km/hr

$$d = 40 \times 10 = 400 \text{ km}$$

Now speed = 50 km/hr

$$\text{time taken} = \frac{d}{s} = \frac{400}{50}$$

$$\text{time taken} = 8 \text{ hr.}$$

5. Speed of train = $\frac{225}{10}$ m/s

$$= 22.5 \text{ m/s.}$$

Now distance to travel

$$225 + 405 = 630 \text{ m}$$

$$\text{speed} = 22.5 \text{ m/s}$$

$$t = \frac{d}{s} = \frac{630}{22.5} \text{ seconds}$$

$$28 \text{ seconds}$$

time taken to pass platform

$$= 28 \text{ seconds}$$

6. Distance travelled by train

$$540 + 180$$

$$= 720 \text{ m}$$

speed = 54 km/hr

$$354 \times \frac{5}{18} \text{ m/s}$$

$$= 15 \text{ m/s}$$

time taken to cross the tunnel

$$\frac{d}{s} = \frac{720}{15} \text{ sec.}$$

$$48 \text{ seconds}$$

7. Distance travelled by train = 16 + 200

$$= 360 \text{ m}$$

$$\text{time} = 18 \text{ sec.}$$

$$\text{speed of train} = \frac{d}{s} = \frac{360}{18} \text{ m/s}$$

$$= 20 \text{ m/s}$$

$$20 \times \frac{18}{5} \text{ km/hr}$$

$$= 72 \text{ km/hr}$$

8. Distance travelled = 150 + 180 + 330 m

Relative speed = (30 + 24) km/hr

$$54 \text{ km/hr}$$

$$54 \times \frac{5}{18} \text{ m/s}$$

$$\text{time taken} = \frac{d}{s} = 15 \text{ m/s}$$

$$\frac{330}{15} \text{ sec.}$$

$$= 22 \text{ seconds.}$$

9. distance travelled = 110 + 10 + 120 m

Relative speed = 46 + 39

$$= 7 \text{ km/hr} = 7 \times \frac{5}{18} \text{ m/s}$$

$$t = \frac{d}{s} = \frac{210}{7 \times \frac{5}{18}} \text{ sec.}$$

$$18$$

$$\frac{120 \times 8}{7 \times 5} \text{ sec.}$$

$$= 6.17 \text{ sec.}$$

$$= 6 \text{ min } 1.7 \text{ sec.}$$

10. Distance travelled = 220 m

Relative speed = (60 + 6) km/h

$$= 66 \text{ km/hr}$$

$$66 \times \frac{5}{18} \text{ m/s}$$

$$\frac{11 \times 5}{3}$$

time taken to cross each other = $\frac{d}{s}$

$$\frac{220 \times 3}{11 \times 15}$$

$$= 12 \text{ sec.}$$

11. Distance travelled = 135 m

Relative speed = (62 + 8) km/hr

$$= 54 \text{ km/hr}$$

$$54 \times \frac{5}{18} \text{ m/s}$$

$$= 15 \text{ m/s}$$

$$t = \frac{d}{s} = \frac{135}{15}$$

$$= 9 \text{ seconds.}$$

12. Let speed of stream = x km/hr

I case

speed of Boat in still water = (15 + x)

II Case

speed of Boat in still water = (12 + x)

$$15 + x = 12 + x$$

$$3 = 2x$$

$$1.5 = x$$

speed of stream = 1.5 km/hr

13. Let speed of current = x km/hr

speed of boat down stream

$$(6 + x) \text{ km/hr}$$

$$\frac{d}{s} = t$$

$$22.5 = (6 + x) \times 3$$

$$\begin{array}{r} 7.5 - 6x \\ 1.5 - x \end{array}$$

speed of current = 1.5 km/hr.

14. Let speed of boat in still water = x km/hr
 speed of boat in upstream = $(x - 2)$ km/hr

d	s	t
21	$(x - 2)$	2
21	$2x$	4
25	$2x$	
12.5	x	

speed of boat in still water is 12.5 km/hr

15. Speed of boat downstream = $9 - 3$

$$= 12 \text{ km/hr}$$

$$\text{time taken} = 3\frac{1}{2} \text{ hours}$$

distance = speed \times time

$$12 \times \frac{7}{2}$$

$$= 42 \text{ km}$$

Now speed for Returning (upstream)

$$9 - 3$$

$$= 6 \text{ km/hr}$$

Now time taken upstream = $\frac{d}{s}$

$$\frac{42}{6}$$

$$= 7 \text{ hours.}$$

9

Special Products and Expansions

Exercise 9.1

1. (i) $(x - 2)(x - 3)$
 $x(x - 3) - 2(x - 3)$
 $x^2 - 3x - 2x + 6$
 $x^2 - 5x + 6$

(ii) $(x - 3)(x - 7)$ or
 $x(x - 7) - 3(x - 7)$
 $x^2 - 7x - 3x + 21$
 $x^2 - 10x + 21$

2. (i) $(3x - 4)(3x - 6)$
 $3x(3x - 6) - 4(3x - 6)$
 $9x^2 - 18x - 12x + 24$
 $9x^2 - 30x + 24$

(ii) $(2x - 1)(2x - 7)$
 $2x(2x - 7) - 1(2x - 7)$
 $4x^2 - 14x - 2x + 7$
 $4x^2 - 16x + 7$

3. (i) $(y - 6)y + \frac{5}{12}$
 $y^2 - 6y + \frac{5}{12}$
 $y^2 - \frac{5y}{12} - 6y + \frac{30}{12}$
 $y^2 - \frac{5y}{12} - 72y + \frac{5}{2}$

$$y^2 - \frac{77y}{12} + \frac{5}{2}$$

(ii) $b^2 - \frac{2}{5}b + \frac{2}{3}$
 $b^2 - \frac{2b}{3} + \frac{2b}{5} - \frac{2}{3}$

$$b^2 - \frac{2b}{3} + \frac{2b}{5} - \frac{4}{15}$$

$$b^2 - \frac{10b}{15} + \frac{6b}{15} - \frac{4}{15}$$

$$b^2 - \frac{4b}{15} - \frac{4}{15}$$

4. (i) $(x - 3)x + \frac{2}{7}$
 $x^2 - 3x + \frac{2}{7}$

$$x^2 - \frac{2x}{7} - 3x + \frac{6}{7}$$

$$x^2 - \frac{2x}{7} - \frac{21x}{7} + \frac{6}{7}$$

$$x^2 - \frac{19x}{7} - \frac{6}{7}$$

(ii) $(x - 0.4)(x - 0.7)$
 $x(x - 0.7) - 0.4(x - 0.7)$
 $x^2 - 0.7x - 0.4x + 0.28$

$$x^2 - 1.1x + 0.28$$

5. (i) $(8 - x)(5 - x)$

- $$\begin{array}{l} 8(5x-x) \quad x(5-x) \\ 40 \quad 8x \quad 5x \quad x^2 \\ 40 \quad 3x \quad x^2 \end{array}$$
- (ii) $(3-z)(11-z)$
 $3(11-z) \quad z(11-z)$
 $33 \quad 3z \quad 11z \quad z^2$
 $33 \quad 14z \quad z^2$
6. (i) $(2x-3)(2x-7)$
 $2x(2x-7) \quad 3(2x-7)$
 $4x^2 \quad 14x \quad 6x \quad 21$
 $4x^2 \quad 20x \quad 21$
- (ii) $(5y-2)(5y-9)$
 $5y(5y-9) \quad 2(5y-9)$
 $25y^2 \quad 35y \quad 10y \quad 18$
 $25y^2 \quad 35y \quad 18$
7. (i) $(7c-1)(7c-3)$
 $7c(7c-3) \quad 1(7c-3)$
 $49c^2 \quad 21c \quad 7c \quad 3$
 $49c^2 \quad 28c \quad 3$
- or $(7c)^2 - (1-3)(7c) + (1)(3)$
 $49c^2 - 4 \quad 7c - 3$
 $49c^2 \quad 28c \quad 3$
- (ii) $(p^2-3)(p^2-5)$
 $p^2(p^2-5) \quad 3(p^2-5)$
 $p^4 \quad 5p^2 \quad 3p^2 \quad 15$
 $p^4 \quad 2p^2 \quad 15$
- or $(p^2)^2 - (3+5)p^2 + 3 \cdot 5$
 $p^4 \quad 2p^2 \quad 15$
8. (i) $(3x^2-7)(3x^2-5)$
 $3x^2(3x^2-5) \quad 7(3x^2-5)$
 $9x^4 \quad 15x^2 \quad 21x^2 \quad 35$
 $9x^4 \quad 6x^2 \quad 35$
- (ii) $(3-xy)(7-xy)$
 $3(7-xy) \quad xy(7-xy)$
 $21 \quad 3xy \quad xy \quad x^2y^2$
 $21 \quad 4xy \quad x^2y^2$
9. (i) $\frac{y}{3} - 2 \quad \frac{y}{3} - 7$
- $$\begin{array}{l} \frac{y}{3} - \frac{y}{3} - 7 \quad 2 \quad \frac{y}{3} - 7 \\ \frac{y^2}{9} - \frac{7y}{3} - \frac{2y}{3} - 14 \\ \frac{y^2}{9} - \frac{7y-2y}{3} - 14 \\ \frac{y^2}{9} - \frac{9y}{3} - 14 \\ \frac{y^2}{9} - 3y - 14 \end{array}$$
- (ii) $(5x-2y)(2x-5y)$
 $5x(2x-5y) \quad 2y(2x-5y)$
 $10x^2 \quad 25xy \quad 4xy \quad 10y^2$
 $10x^2 \quad 29xy \quad 10y^2$
10. (i) $(3a-5b)(7a-2b)$
 $3a(7a-2b) \quad 5b(7a-2b)$
 $21a^2 \quad 6ab \quad 35ab \quad 10b^2$
 $21a^2 \quad 29ab \quad 10b^2$
- (ii) $(3mn-5)(4mn-6)$
 $3mn(4mn-6) \quad 5(4mn-6)$
 $12m^2n^2 \quad 18mn \quad 20mn \quad 30$
 $12m^2n^2 \quad 2mn \quad 30$
11. (i) $(3x^2-2y^2)(4x-5y^2)$
 $3x^2(4x-5y^2) \quad (4x-5y^2)$
 $12x^4 \quad 15x^2y^2 \quad 8x^2y^2 \quad 10y^4$
 $12x^4 \quad 7x^2y^2 \quad 10y^4$
- (ii) $(2c^2-3d^2)(7c^2-2d^2)$
 $2c^2(7c^2-2d^2) \quad 3d^2(7c^2-2d^2)$
 $14c^4 \quad 4c^2d^2 \quad 21c^2d^2 \quad 6d^4$
 $14c^4 \quad 25c^2d^2 \quad 6d^4$
12. (i) $(ab-2c)(3ab-5c)$
 $ab(3ab-5c) \quad 2c(3ab-5c)$
 $3a^2b^2 \quad 5abc \quad 6abc \quad 10c^2$
 $3a^2b^2 \quad abc \quad 10c^2$
- (ii) $(x-1)(2x-5)(3x-1)$
 $[x(2x-1) - 1(2x-5)](3x-1)$
 $[2x^2 - x - 2x + 5](3x-1)$
 $(2x^2 - 3x + 5)(3x-1)$

$$\begin{array}{l}
 2x^2(3x-1) + 3x(3x-1) \\
 6x^3 - 2x^2 + 9x^2 - 3x + 15x - 5 \\
 6x^3 + 7x^2 + 12x - 5 \\
 \text{13. (i) } 56 \quad 48 \\
 \quad (50-6)(50-2) \\
 \quad (50)^2 - (6-2)50 + (6-2) \\
 \quad 2500 - 4 + 50 - 12 \\
 \quad 2500 - 200 + 12 \\
 \quad 2700 - 12 \\
 \quad 2688 \\
 \text{(ii) } 95 \quad 97 \\
 \quad (100-5)(100-3) \\
 \quad 100^2 - (5+3)100 + (5)(3) \\
 \quad 10000 - 8 + 100 - 15 \\
 \quad 10000 - 800 + 15 \\
 \quad 10015 - 800 \\
 \quad 9215 \\
 \text{(iii) } 107 \quad 103 \\
 \quad (100-7)(100-3) \\
 \quad 100^2 - (7+3)100 + 7 \cdot 3 \\
 \quad 10000 - 10 + 100 - 21 \\
 \quad 10000 - 1000 + 21 \\
 \quad 11021 \\
 \text{(iv) } 35 \quad 37 \\
 \quad (30-5)(30-7) \\
 \quad (30)^2 - (5+7)30 + 5 \cdot 7 \\
 \quad 900 - 12 + 30 - 35 \\
 \quad 900 - 360 + 35 \\
 \quad 1295 \\
 \text{(v) } 103 \quad 96 \\
 \quad (100-3)(100-4) \\
 \quad 100^2 - (3+4)100 + 3 \cdot 4 \\
 \quad 10000 - (1)100 + 12 \\
 \quad 1000 - 100 + 12 \\
 \quad 10000 - 112 \\
 \quad 9988 \\
 \text{(vi) } 994 \quad 1006 \\
 \quad (1000-6)(1000-6) \\
 \quad (1000)^2 - (6+6)1000 + 6 \cdot 6 \\
 \quad 100000 - 0 + 36 \\
 \quad 999964
 \end{array}$$

Exercise 9.2

1. (i) $(x-7)(x-7)$

$$\begin{array}{l}
 x^2 - 7^2 \\
 x^2 - 49 \\
 \text{(ii) } (5x-9)(5x-9) \\
 \quad (5x)^2 - 9^2 \\
 \quad 25x^2 - 81 \\
 \text{2. (i) } y \frac{2}{3} - y \frac{2}{3} \\
 \quad y^2 - \frac{2}{3}^2 \\
 \quad y^2 - \frac{4}{9} \\
 \text{(ii) } (4-3x)(4-3x) \\
 \quad 4^2 - (3x)^2 \\
 \quad 16 - 9x^2 \\
 \text{3. (i) } (4x-11y)(4x-11y) \\
 \quad (4x)^2 - (11y)^2 \\
 \quad 16x^2 - 121y^2 \\
 \text{(ii) } \frac{2}{3}p - \frac{4}{5}q \quad \frac{2}{3}p - \frac{4}{5}q \\
 \quad \frac{2}{3}p^2 - \frac{4}{5}q^2 \\
 \quad \frac{4}{9}p^2 - \frac{16}{25}q^2 \\
 \text{4. (i) } (3-ab)(3-ab) \\
 \quad 3^2 - (ab)^2 \\
 \quad 9 - a^2b^2 \\
 \text{(ii) } p \frac{1}{q} - p \frac{1}{q} \\
 \quad p^2 - \frac{1}{q}^2 \quad p^2 - \frac{1}{q^2} \\
 \text{5. (i) } \frac{2}{a} - \frac{5}{b} \quad \frac{2}{a} - \frac{5}{b} \\
 \quad \frac{2}{a}^2 - \frac{5}{b}^2 \\
 \quad \frac{4}{a^2} - \frac{25}{b^2} \\
 \text{(ii) } \frac{1}{5x} - \frac{3}{2y} \quad \frac{1}{5x} - \frac{3}{2y} \\
 \quad \frac{1}{5x}^2 - \frac{3}{2y}^2
 \end{array}$$

$$6. \quad (i) \quad \frac{1}{25x^2} \cdot \frac{9}{4y^2} \\ 3x^2 \cdot \frac{2}{5}y^2 \quad 3x^2 \cdot \frac{2}{5}y^2 \\ (3x^2)^2 \cdot \frac{2}{5}y^2 \\ 9x^4 \cdot \frac{4}{25}y^4$$

$$(ii) \quad (1.4a \ 0.3b)(1.4a \ 0.3b) \\ = (1.4a)^2 \ (0.3b)^2 \\ = 1.96a^2 \ 0.09b^2$$

$$7. \quad (i) \quad (x \ 3)(x \ 3)(x^2 \ 9) \\ (x^2 \ 3^2)(x^2 \ 9) \\ (x^2 \ 9)(x^2 \ 9) \\ (x^2)^2 \ 9^2 \\ x^4 \ 81$$

$$(iii) \quad (3p \ 2q)(3p \ 2q)(9p^2 \ 4q^2) \\ [(3p)^2 \ (2q)^2](9p^2 \ 4q^2) \\ (9p^2 \ 4q^2)(9p^2 \ 4q^2) \\ (9p^2)^2 \ (4q^2)^2 \\ 81p^4 \ 16q^4$$

$$8. \quad (i) \quad (x \ a)(x \ a)(x^2 \ a^2) \\ (x^2 \ a^2)(x^2 \ a^2) \\ (x^2)^2 \ (a^2)^2 \\ x^4 \ a^4$$

$$(ii) \quad (x \ yz)(x \ yz)(x^2 \ y^2z^2) \\ [x^2 \ (yz)^2][x^2 \ y^2z^2] \\ [x^2 \ y^2z^2][x^2 \ y^2z^2] \\ (x^2)^2 \ (y^2z^2)^2 \\ x^4 \ y^4z^4$$

$$9. \quad (i) \quad 507 \ 493 \\ (500 \ 7)(500 \ 7) \\ (500)^2 \ 7^2 \\ 25000 \ 49 \ 249951$$

$$(ii) \quad 25.3 \ 24.7 \\ (25 \ 0.3) \ (25 \ 0.3) \\ (25)^2 \ (0.3)^2 \\ 625 \ 0.09 \\ 624.91$$

$$(iii) \quad 108 \ 92 \\ (100 \ 8)(100 \ 8) \\ 100^2 \ 8^2 \\ 10000 \ 64 \\ 9936$$

$$(iv) \quad 306 \ 294 \\ (300 \ 6)(300 \ 6) \\ (300)^2 \ 6^2 \\ 90000 \ 36 \\ 89964$$

$$(v) \quad 10.4 \ 9.6 \\ (10 \ 0.4)(10 \ 0.4) \\ 10^2 \ (0.4)^2 \\ 100 \ 0.16 \\ 99.84$$

$$(vi) \quad 14.7 \ 15.3 \\ (15 \ 0.3)(15 \ 0.3) \\ 15^2 \ (0.3)^2 \\ 225 \ 0.09 \\ 224.91$$

Exercise 9.3

$$1. \quad (i) \quad (3x \ 2)^2 \\ (3x)^2 \ 2^2 \ 2(3x)(2) \\ 9x^2 \ 4 \ 12x$$

$$(ii) \quad (6a \ 5b)^2 \\ (6a)^2 \ (5b)^2 \ 2(6a)(5b) \\ 36a^2 \ 25b^2 \ 60ab$$

$$(iii) \quad (5x \ 3y)^2 \\ (5x)^2 \ (3y)^2 \ 2(5x)(3y) \\ 25x^2 \ 9y^2 \ 30xy$$

$$(iv) \quad x \ \frac{3}{x} \\ x^2 \ \frac{3^2}{x^2} \ 2(x) \ \frac{3}{x} \\ x^2 \ \frac{9}{x^2} \ 6$$

$$(v) \quad \frac{4x}{3} \ \frac{3y}{2} \\ \frac{4x}{3}^2 \ \frac{3y}{2}^2 \ 2 \ \frac{4x}{3} \ \frac{3y}{2}$$

$$\begin{aligned} & \frac{16x^2}{9} - \frac{9y^2}{4} + 4xy \\ \text{(vi)} \quad & (\sqrt{2x} - \sqrt{3y})^2 \\ & (\sqrt{2x})^2 - (\sqrt{3y})^2 + 2(\sqrt{2x})(\sqrt{3y}) \end{aligned}$$

$$\begin{aligned} & 2x^2 - 3y^2 + 2\sqrt{6}xy \\ \text{(vii)} \quad & (2x - 3y)^2 \\ & (2x)^2 - (3y)^2 + 2(2x)(3y) \\ & 4x^2 - 9y^2 + 12xy \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad & (a^2 - b^2)^2 \\ & (a^2)^2 - (b^2)^2 + 2(a^2)(b^2) \\ & a^4 - b^4 + 2a^2b^2 \end{aligned}$$

$$\begin{aligned} \text{(ix)} \quad & (5 - 12x^2)^2 \\ & 5^2 - (12x^2)^2 + 2(5)(12x^2) \\ & 25 - 144x^4 + 120x^2 \end{aligned}$$

$$\begin{aligned} \text{(x)} \quad & 5x - \frac{1}{5y} \\ & (5x)^2 - \frac{1}{5y} + 2(5x) \frac{1}{5y} \end{aligned}$$

$$\begin{aligned} & 25x^2 - \frac{1}{25y^2} + \frac{2x}{y} \\ \text{(xi)} \quad & \sqrt{3x} - \frac{1}{5}y \\ & (\sqrt{3x})^2 - \frac{1}{5}y + 2(\sqrt{3x}) \frac{1}{5}y \end{aligned}$$

$$\begin{aligned} & 3x^2 - \frac{1}{25}y^2 + \frac{2}{5}\sqrt{3xy} \\ \text{(xii)} \quad & \frac{x}{5} - \frac{y}{6} \\ & \frac{x}{5}^2 - \frac{y}{6}^2 + 2 \frac{x}{5} \frac{y}{6} \end{aligned}$$

$$\begin{aligned} & \frac{x^2}{25} - \frac{y^2}{36} + \frac{xy}{15} \\ \text{(xiii)} \quad & \frac{3x}{4} - \frac{4y}{5} \\ & \frac{3x}{4}^2 - \frac{4y}{5}^2 + 2 \frac{3x}{4} \frac{4y}{5} \end{aligned}$$

$$\begin{aligned} & \frac{9x^2}{16} - \frac{16y^2}{25} + \frac{6xy}{5} \\ \text{(xiv)} \quad & (4ab - 5cd)^2 \\ & (4ab)^2 - (5cd)^2 + 2(4ab)(5cd) \\ & 16a^2b^2 - 25c^2d^2 + 40abcd \end{aligned}$$

$$\begin{aligned} \text{(xv)} \quad & (x - 3y)(x + 3y) \\ & (x - 3y)^2 \\ & x^2 - (3y)^2 + 2(x)(3y) \\ & x^2 - 9y^2 + 6xy \end{aligned}$$

$$\begin{aligned} \text{2. (i)} \quad & (501)^2 \\ & (500 + 1)^2 \\ & 500^2 + 1^2 + 2(500)(1) \\ & 250000 + 1 + 1000 \\ & 251001 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & (1005)^2 \\ & (1000 + 5)^2 \\ & 1000^2 + 5^2 + 2(1000)(5) \\ & 1000000 + 25 + 10000 \\ & 1010025 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & (103)^2 \\ & (100 + 3)^2 \\ & 100^2 + 3^2 + 2(100)(3) \\ & 10000 + 9 + 600 \\ & 10609 \end{aligned}$$

$$\begin{aligned} \text{3. (i)} \quad & 199^2 \\ & (200 - 1)^2 \\ & (200)^2 - 1^2 + 2(200)(-1) \\ & 40000 - 1 - 400 \\ & 39601 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & 997^2 \\ & (1000 - 3)^2 \\ & 1000^2 - 3^2 + 2(1000)(-3) \\ & 1000000 - 9 - 6000 \\ & 994009 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & (9.8)^2 \\ & (10 - 0.2)^2 \\ & 10^2 - (0.2)^2 + 2(10)(-0.2) \\ & 100 - 0.04 - 4 \end{aligned}$$

$$\begin{aligned}
 & 96 \quad 0.04 \\
 & 96.04 \\
 4. \text{ (i)} \quad & 16x^2 \quad 40xy \quad 25y^2 \\
 & (4x)^2 \quad 2(4x)(5y) \quad (5y)^2 \\
 & (4x \quad 5y)^2 \\
 \text{(ii)} \quad & 4p^2 \quad 44p \quad 121 \\
 & (2p)^2 \quad 2(2p)(11) \quad 11^2 \\
 & (2p \quad 11)^2 \\
 \text{(iii)} \quad & 9a^2 \quad 42ab \quad 49b^2 \\
 & (3a)^2 \quad 2(3a)(7b) \quad (7b)^2 \\
 & (3a \quad 7b)^2 \\
 \text{(iv)} \quad & 25m^2 \quad \frac{10}{3}mn \quad \frac{n^2}{9} \\
 & (5m)^2 \quad 2 \cdot 5m \cdot \frac{n}{3} \quad \frac{n^2}{3} \\
 & 5m \quad \frac{n}{3} \quad 2
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & x \quad \frac{1}{x} \quad 6 \\
 & \text{Squaring both sides} \\
 & x \quad \frac{1}{x} \quad 6^2 \\
 & x^2 \quad \frac{1}{x^2} \quad 2(x) \quad \frac{1}{x} \quad 36 \\
 & x^2 \quad \frac{1}{x^2} \quad 2 \quad 36 \\
 & x^2 \quad \frac{1}{x^2} \quad 34 \\
 & \text{Squaring both sides} \\
 & x^2 \quad \frac{1}{x^2} \quad (34)^2 \\
 & x^4 \quad \frac{1}{x^4} \quad 2(x^2) \quad \frac{1}{x^2} \quad 1156 \\
 & x^4 \quad \frac{1}{x^4} \quad 2 \quad 1156 \\
 & x^4 \quad \frac{1}{x^4} \quad 1154
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & x \quad \frac{1}{x} \quad 5 \\
 & \text{Squaring both sides}
 \end{aligned}$$

$$\begin{aligned}
 & x \quad \frac{1}{x} \quad 5^2 \\
 & x^2 \quad \frac{1}{x^2} \quad 2(x) \quad \frac{1}{x} \quad 25 \\
 & x^2 \quad \frac{1}{x^2} \quad 2 \quad 25 \\
 & x^2 \quad \frac{1}{x^2} \quad 27 \\
 & \text{Squaring both sides} \\
 & x^2 \quad \frac{1}{x^2} \quad 27^2 \\
 & x^4 \quad \frac{1}{x^4} \quad 2(x^2) \quad \frac{1}{x^2} \quad 729 \\
 & x^4 \quad \frac{1}{x^4} \quad 2 \quad 729 \\
 & x^4 \quad \frac{1}{x^4} \quad 727
 \end{aligned}$$

$$\begin{aligned}
 7. \quad & a \quad b \quad 7, ab \quad 10 \\
 & \text{Squaring}
 \end{aligned}$$

$$\begin{aligned}
 & (a \quad b)^2 \quad 7^2 \\
 & a^2 \quad b^2 \quad 2ab \quad 49 \\
 & a^2 \quad b^2 \quad 2(10) \quad 49 \\
 & a^2 \quad b^2 \quad 20 \quad 49 \\
 & a^2 \quad b^2 \quad 29
 \end{aligned}$$

$$8. \quad a \quad b \quad 9$$

Squaring both sides

$$\begin{aligned}
 & (a \quad b)^2 \quad 9^2 \\
 & a^2 \quad b^2 \quad 2ab \quad 81 \\
 & 51 \quad 2(ab) \quad 81 \\
 & 2ab \quad 30 \\
 & ab \quad 15
 \end{aligned}$$

$$9. \quad a \quad b \quad 5$$

Squaring both sides

$$\begin{aligned}
 & (a \quad b)^2 \quad 5^2 \\
 & a^2 \quad b^2 \quad 2ab \quad 25 \\
 & a^2 \quad b^2 \quad 2(4) \quad 25 \\
 & a^2 \quad b^2 \quad 8 \quad 25 \\
 & a^2 \quad b^2 \quad 33
 \end{aligned}$$

$$10. \quad a \quad b \quad 6$$

Squaring both sides

$$(a \quad b)^2 \quad 6^2$$

$$\begin{array}{r}
 a^2 \quad b^2 \quad 2ab \quad 36 \\
 42 \quad 2ab \quad 36 \\
 42 \quad 36 \quad 2ab \\
 \quad \quad \quad 6 \quad 2ab \\
 \quad \quad \quad 3 \quad ab \\
 \mathbf{11. (i)} \quad (a \quad b)^2 \quad a^2 \quad b^2 \quad 2ab \\
 \quad \quad \quad 41 \quad 2(4)
 \end{array}$$

$$\begin{array}{r}
 (a \quad b)^2 \quad 49 \\
 (a \quad b)^2 \quad 7^2
 \end{array}$$

$$\begin{array}{r}
 a \quad b \quad 7 \\
 \mathbf{(ii)} \quad (a \quad b)^2 \quad a^2 \quad b^2 \quad 2ab \\
 (a \quad b)^2 \quad 41 \quad 2(4) \\
 (a \quad b)^2 \quad 33 \\
 a \quad b \quad \sqrt{33}
 \end{array}$$

$$\mathbf{12.} \quad 2a \quad \frac{1}{2a} \quad 5$$

Squaring both sides

$$\begin{array}{r}
 2a \quad \frac{1}{2a} \quad 5^2 \\
 (2a)^2 \quad \frac{1}{2a} \quad 2(2a) \quad \frac{1}{2a} \quad 25 \\
 4a^2 \quad \frac{1}{4a^2} \quad 2 \quad 25 \\
 4a^2 \quad \frac{1}{4a^2} \quad 23
 \end{array}$$

Squaring both sides

$$\begin{array}{r}
 4a^2 \quad \frac{1}{4a^2} \quad 23^2 \\
 (4a^2)^2 \quad \frac{1}{4a^2} \\
 2(4a^2) \quad \frac{1}{4a^2} \quad 529
 \end{array}$$

$$16a^4 \quad \frac{1}{16a^4} \quad 2 \quad 529$$

$$16a^4 \quad \frac{1}{16a^4} \quad 527$$

$$\mathbf{13.} \quad 3p \quad \frac{1}{3p} \quad 1$$

Squaring both sides

$$\begin{array}{r}
 3p \quad \frac{1}{3p} \quad 1^2 \\
 (3p)^2 \quad \frac{1}{3p} \quad 2(3p) \quad \frac{1}{3p} \quad 1 \\
 9p^2 \quad \frac{1}{9q^2} \quad 2 \quad 1
 \end{array}$$

$$9p^2 \quad \frac{1}{9q^2} \quad 3$$

Squaring both sides

$$\begin{array}{r}
 9p^2 \quad \frac{1}{9q^2} \quad 3^2 \\
 81p^4 \quad \frac{1}{81q^4} \quad 2(9p^2) \quad \frac{1}{9q^2} \quad 9 \\
 81p^4 \quad \frac{1}{81q^4} \quad 2 \quad 9 \\
 81p^4 \quad \frac{1}{81q^4} \quad 7
 \end{array}$$

$$\mathbf{14.} \quad x \quad y \quad 12$$

Squaring both sides

$$\begin{array}{r}
 (x \quad y)^2 \quad 12^2 \\
 x^2 \quad y^2 \quad 2xy \quad 144 \\
 x^2 \quad y^2 \quad 2(25) \quad 144 \\
 x^2 \quad y^2 \quad 144 \quad 50 \\
 \quad \quad \quad 74 \\
 (x \quad y)^2 \quad x^2 \quad y^2 \quad 2xy \\
 \quad \quad \quad 74 \quad 2(35) \\
 \quad \quad \quad 74 \quad 70 \\
 (x \quad y)^2 \quad 4 \\
 (x \quad y)^2 \quad 2^2 \\
 x \quad y \quad 2
 \end{array}$$

$$\mathbf{15. (i)} \quad 3x \quad 2y \quad 12$$

Squaring both sides

$$\begin{array}{r}
 (3x \quad 2y)^2 \quad 12^2 \\
 (3x)^2 \quad (2y)^2 \quad 2(3x)(2y) \quad 144 \\
 9x^2 \quad 4y^2 \quad 12xy \quad 144 \\
 9x^2 \quad 4y^2 \quad 12(5) \quad 144 \\
 9x^2 \quad 4y^2 \quad 60 \quad 144 \\
 9x^2 \quad 4y^2 \quad 84
 \end{array}$$

$$\begin{array}{l}
 \text{(ii) } 3x \quad 7y \quad 10 \\
 \text{Squaring both sides} \\
 (3x \quad 7y)^2 \quad 10^2 \\
 (3x)^2 \quad (7y)^2 \quad 2(3x)(7y) \quad 100 \\
 9x^2 \quad 49y^2 \quad 42xy \quad 100 \\
 9x^2 \quad 49y^2 \quad 42 \quad 100 \\
 9x^2 \quad 49y^2 \quad 58
 \end{array}$$

Exercise 9.4

$$\begin{array}{l}
 \text{1. (i) } (2x \quad 3y \quad 4z)^2 \\
 (2x)^2 \quad (3y)^2 \quad (4z)^2 \\
 2(2x)(3y) \quad 2(3y)(4z) \\
 2(4z)(2x) \\
 4x^2 \quad 9y^2 \quad 16z^2 \quad 12xy \\
 24yz \quad 16zx
 \end{array}$$

$$\begin{array}{l}
 \text{(ii) } (3x \quad 4y \quad 2z)^2 \\
 (3x)^2 \quad (4y)^2 \quad (2z)^2 \\
 2(3x)(4y) \quad 2(4y)(2z) \\
 2(2z)(3x) \\
 9x^2 \quad 16y^2 \quad 4z^2 \quad 24xy \\
 16yz \quad 12zx
 \end{array}$$

$$\begin{array}{l}
 \text{(iii) } (x^2 \quad y^2 \quad z^2)^2 \\
 (x^2)^2 \quad (y^2)^2 \quad (z^2)^2 \\
 2(x^2)(y^2) \quad 2(y^2)(z^2) \\
 2(z^2)(x^2) \\
 x^4 \quad y^4 \quad z^4 \quad 2x^2y^2 \\
 2y^2z^2 \quad 2z^2x^2
 \end{array}$$

$$\begin{array}{l}
 \text{(iv) } (ab \quad bc \quad ca)^2 \\
 (ab)^2 \quad (bc)^2 \quad (ca)^2 \\
 2(ab)(bc) \quad 2(bc)(ca) \\
 2(ca)(ab) \\
 a^2b^2 \quad b^2c^2 \quad c^2a^2 \quad 2ab^2c \\
 2abc^2 \quad 2a^2bc
 \end{array}$$

$$\begin{array}{l}
 \text{(v) } (2x \quad 3)^3 \\
 (2x)^3 \quad 3^3 \quad 3(2x)^2(3) \\
 3(2x)(3)^2 \\
 8x^3 \quad 27 \quad 36x^2 \quad 54x
 \end{array}$$

$$\begin{array}{l}
 \text{(vi) } (3x \quad 5y)^3 \\
 (3x)^3 \quad (5y)^3 \quad 3(3x)^2(5y) \\
 3(3x)(5y)^2
 \end{array}$$

$$\begin{array}{l}
 27x^3 \quad 125y^3 \quad 135x^2y \\
 225xy^2
 \end{array}$$

$$\begin{array}{l}
 \text{(vii) } (1 \quad 3a)^3 \\
 1^3 \quad (3a)^3 \quad 3(1)^2(3a) \\
 3(1)(3a)^2 \\
 1 \quad 27a^3 \quad 9a \quad 27a^2
 \end{array}$$

$$\begin{array}{l}
 \text{(viii) } (3x \quad 4y)^3 \\
 (3x)^3 \quad (4y)^3 \quad 3(3x)^2(4y) \\
 3(3x)(4y)^2 \\
 27x^3 \quad 64y^3 \quad 108x^2y \quad 144xy^2
 \end{array}$$

$$\begin{array}{l}
 \text{(ix) } a \quad \frac{3}{a} \\
 a^3 \quad \frac{3}{a}^3 \quad 3(a)^2 \frac{3}{a} \\
 3(a) \frac{3}{a}^2
 \end{array}$$

$$\begin{array}{l}
 a^3 \quad \frac{27}{a^3} \quad 9a \quad \frac{27}{a} \\
 \frac{1}{2a}^3
 \end{array}$$

$$\begin{array}{l}
 \text{(x) } 5 \quad \frac{1}{2a} \\
 5^3 \quad \frac{1}{2a}^3 \quad 3(5)^2 \frac{1}{2a} \\
 3(5) \frac{1}{2a}^2
 \end{array}$$

$$\begin{array}{l}
 125 \quad \frac{1}{8a^3} \quad \frac{75}{2a} \quad \frac{15}{4a^2}
 \end{array}$$

$$\text{2. } (x \quad y \quad z) \quad 10$$

$$\begin{array}{l}
 \text{Squaring both sides} \\
 x^2 \quad y^2 \quad z^2 \quad 2(xy \quad yz \quad zx) \quad 100 \\
 x^2 \quad y^2 \quad z^2 \quad 2(24) \quad 100 \\
 x^2 \quad y^2 \quad z^2 \quad 100 \quad 48 \\
 x^2 \quad y^2 \quad z^2 \quad 52
 \end{array}$$

$$\begin{array}{l}
 \text{3. (i) } (x \quad y \quad z)^2 \quad x^2 \quad y^2 \quad z^2 \\
 2(xy \quad yz \quad zx) \\
 29 \quad 2(12 \quad 8 \quad 6) \\
 29 \quad 2(26) \\
 29 \quad 52 \\
 (x \quad y \quad z)^2 \quad 81
 \end{array}$$

$$(ii) \quad \begin{array}{r} x^2 \quad y^2 \quad z^2 \\ (x \ y \ z)^2 \end{array} \begin{array}{r} 9 \\ 9 \\ 2(xy \ yz \ zx) \\ 29 \quad 2(12 \ 8 \ 6) \\ 29 \quad 2(10) \\ 29 \quad 20 \end{array}$$

$$(x \ y \ z)^2 \begin{array}{r} 9 \\ 3^2 \\ x^2 \quad y^2 \quad z^2 \end{array}$$

$$(iii) \quad \begin{array}{r} x^2 \quad y^2 \quad z^2 \\ (x \ y \ z)^2 \end{array} \begin{array}{r} 3 \\ 2(xy \ yz \ zx) \\ 29 \quad 2(12 \ 8 \ 6) \\ 29 \quad 2(2) \\ 29 \quad 4 \end{array}$$

$$(x \ y \ z)^2 \begin{array}{r} 29 \quad 4 \\ 5^2 \end{array}$$

$$(iv) \quad \begin{array}{r} x^2 \quad y^2 \quad z^2 \\ (x \ y \ z)^2 \end{array} \begin{array}{r} 5 \\ 2(xy \ yz \ zx) \\ 29 \quad 2(12 \ 8 \ 6) \\ 29 \quad 2(20 \ 6) \\ 29 \quad 2(14) \end{array}$$

$$(x \ y \ z)^2 \begin{array}{r} 1^2 \\ x^2 \quad y^2 \quad z^2 \end{array}$$

$$4. \quad (i) \quad \begin{array}{r} (2x \ p \ c)^2 \\ (2x \ p \ c)^2 \end{array} \begin{array}{r} 1 \\ (2x)^2 \quad p^2 \quad c^2 \quad 2(2x)(p) \\ 2(p)(c) \quad 2(c)(2x) \\ [(2x) \ (p)^2 \quad c^2 \quad 2(2x)(p) \\ 2(p)(c) \quad 2(c)(2x)] \\ [4x^2 \quad p^2 \quad c^2 \quad 4xp \\ 2pc \quad 4cx] [4x^2 \quad p^2 \quad c^2 \\ 4xp \quad 2pc \quad 4cx] \end{array}$$

$$(ii) \quad \begin{array}{r} (x^2 \ y^2 \ z^2)^2 \\ (x^2 \ y^2 \ z^2)^2 \end{array} \begin{array}{r} 8xp \quad 4pc \\ 4p(2x \ c) \\ (x^2 \ y^2 \ z^2)^2 \end{array}$$

$$[(x^2) \ (y^2)^2 \ (z^2)^2] \begin{array}{r} 2(x^2)(y^2) \quad 2(y^2)(z^2) \\ 2(z^2)(x^2) \end{array} [(x^2)^2]$$

$$\begin{array}{r} (y^2)^2 \quad (z^2)^2 \quad 2(x^2)^2 \quad (y^2) \\ 2(y^2)(z^2) \quad 2(z^2)(x^2) \\ [x^4 \quad y^4 \quad z^4 \quad 2x^2y^2 \\ 2y^2z^2 \quad 2z^2x^2] [x^4 \quad y^4 \quad z^4 \\ 2x^2y^2 \quad 2y^2z^2 \quad 2z^2x^2] \\ x^4 \quad y^4 \quad 2x^2y^2 \quad 2y^2z^2 \\ 2z^2x^2 \quad x^4 \quad y^4 \quad z^4 \quad 2x^2y^2 \end{array}$$

$$(iii) \quad \begin{array}{r} (a \ b \ c)^2 \\ (a \ b \ c)^2 \end{array} \begin{array}{r} 2zx^2 \\ 2y^2z^2 \quad 2zx^2 \\ 4x^2y^2 \quad 4z^2x^2 \quad 4x^2(y^2 \ z^2) \end{array}$$

$$(a^2 \ b^2 \ c^2 \ 2ab \ 2bc \ 2ca)$$

$$(a^2 \ b^2 \ c^2 \ 2ab \ 2bc \ 2ca)$$

$$(a^2 \ b^2 \ c^2 \ 2ab \ 2bc \ 2ca)$$

$$5. \quad x \ \frac{1}{x} \ 12$$

Cubing both sides

$$x^3 \ \frac{1}{x^3} \ 3x \ \frac{1}{x} \ x \ \frac{1}{x} \ 12^3$$

$$x^3 \ \frac{1}{x^3} \ 3 \ x \ \frac{1}{x} \ 1728$$

$$x^3 \ \frac{1}{x^3} \ 3(12) \ 1728$$

$$x^3 \ \frac{1}{x^3} \ 1728 \ 36$$

$$1764$$

$$6. \quad x \ \frac{1}{x} \ 7$$

Cubing both sides

$$x \ \frac{1}{x} \ 7^3$$

$$x^3 \ \frac{1}{x^3} \ 3(x) \ \frac{1}{x} \ x \ \frac{1}{x} \ 343$$

$$x^3 \ \frac{1}{x^3} \ 3(7) \ 343$$

$$x^3 \ \frac{1}{x^3} \ 21 \ 343$$

$$x^3 \ \frac{1}{x^3} \ 322$$

$$7. \because x \frac{1}{x}^2 x^2 \frac{1}{x^2} 2$$

$$x \frac{1}{x}^2 7 2$$

$$x \frac{1}{x}^2 9$$

$$x \frac{1}{x} 3$$

Cubing both sides

$$x^3 \frac{1}{x^3} 3(x) \frac{1}{x} x \frac{1}{x} 27$$

$$x^3 \frac{1}{x^3} 3 x \frac{1}{x} 27$$

$$x^3 \frac{1}{x^3} 3(3) 27$$

$$x^3 \frac{1}{x^3} 9 27$$

$$x^3 \frac{1}{x^3} 18$$

$$8. \because x \frac{1}{x}^2 x^2 \frac{1}{x^2} 2$$

$$x \frac{1}{x}^2 27 2$$

$$x \frac{1}{x}^2 25$$

$$5^2$$

$$x \frac{1}{x} 5$$

Cubing both sides

$$x^3 \frac{1}{x^3} 3x \frac{1}{x} x \frac{1}{x} 125$$

$$x^3 \frac{1}{x^3} 3(5) 125$$

$$x^3 \frac{1}{x^3} 15 125$$

$$x^3 \frac{1}{x^3} 140$$

$$9. (x+y)^3 x^3 y^3 3xy(x+y)$$

$$11^3 x^3 y^3 3(30)(11)$$

$$1331 x^3 y^3 990$$

$$1331 990 x^3 y^3$$

$$341 x^3 y^3$$

$$10. (4x-9y)^3 13$$

Cubing both sides

$$(4x)^3 (9y)^3 3(4x)(9y)(4x-9y)$$

$$13^3$$

$$64x^3 729y^3 108xy(13) 2197$$

$$64x^3 729y^3 108(30)(13) 2197$$

$$64x^3 729y^3 42120 2197$$

$$64x^3 729y^3 44317$$

$$11. \because x^2 \frac{1}{x^2}^2 \frac{1}{x^4} x^4 2$$

$$47 2$$

$$49$$

$$x^2 \frac{1}{x^2}^2 7^2$$

$$x^2 \frac{1}{x^2} 7$$

$$\because x \frac{1}{x}^2 x^2 \frac{1}{x^2} 2$$

$$7 2$$

$$9$$

$$x \frac{1}{x}^2 3^2$$

$$x \frac{1}{x} 3$$

Cubing both sides

$$x \frac{1}{x}^3 3^3$$

$$x^3 \frac{1}{x^3} 3 x \frac{1}{x} 27$$

$$x^3 \frac{1}{x^3} 3(3) 27$$

$$x^3 \frac{1}{x^3} 18$$

$$12. \because x \frac{1}{x}^2 x^2 \frac{1}{x^2} 2$$

$$23 2$$

$$25$$

$$x \frac{1}{x} 5^2$$

$$x \frac{1}{x} 5$$

Cubing both sides

$$x^3 \frac{1}{x^3} 3 x \frac{1}{x} 5^3$$

$$x^3 \frac{1}{x^3} 3(51) 125$$

$$x^3 \frac{1}{x^3} 15 125$$

$$125 15$$

$$x^3 \frac{1}{x^3} 110$$

$$13. (i) (a + 3b)^3 - (a - 3b)^3$$

$$[a^3 + (3b)^3 + 3(a)^2(3b) - 3(a)(3b)^2]$$

$$[a^3 + (3b)^3 + 3a^2(3b) - 3(a)(3b)^2]$$

$$[a^3 + 27b^3 + 9a^2b - 27ab^2]$$

$$[a^3 + 27b^3 + 9a^2b - 27ab^2]$$

$$2a^3 + 54ab^2$$

$$(ii) \frac{1}{3}a + \frac{2}{3}b^3 - \left(\frac{1}{3}a - \frac{2}{3}b^3 \right)$$

$$\frac{1}{3}a + \frac{2}{3}b^3 - \frac{1}{3}a + \frac{2}{3}b^3$$

$$3 \frac{1}{3}a + \frac{2}{3}b^2$$

$$\frac{1}{3}a^3 + \frac{2}{3}b^3 - 3 \frac{1}{3}a + \frac{2}{3}b$$

$$3 \frac{1}{3}a + \frac{2}{3}b^2$$

$$\frac{1}{27}a^3 + \frac{8}{27}b^3 - \frac{2}{9}a^2b + \frac{4a}{b^2}$$

$$\frac{1}{27}a^3 + \frac{8}{27}b^3 - \frac{2}{9}a^2b + \frac{4a}{b^2}$$

$$\frac{1}{27}a^3 + \frac{8}{27}b^3 - \frac{2}{9}a^2b + \frac{4a}{b^2}$$

$$\frac{1}{27}a^3 + \frac{8}{27}b^3 - \frac{2}{9}a^2b + \frac{4a}{b^2}$$

$$\frac{16b^3}{27} - \frac{4a^2b}{9}$$

$$(iii) x \frac{2}{x}^3 - x \frac{2}{x}^3$$

$$x^3 \frac{8}{x^3} - 3x^2 \frac{2}{x} - 3x \frac{4}{x^2}$$

$$x^3 \frac{8}{x^3} - 3x^2 \frac{2}{x} - 3x \frac{4}{x^2}$$

$$x^3 \frac{12}{x} - x^3 \frac{12}{x}$$

$$2x^2 \frac{24}{x}$$

$$(iv) x^3 + y^3 - 3x^2y - 3xy^2$$

$$x^3 + y^3 - 3xy(x + y)$$

$$(x + y)^3$$

10

Factorisation

Exercise 10.1

$$1. (i) a^2 - a$$

$$a(a - 1)$$

$$(ii) abc - ab$$

$$ab(c - 1)$$

$$2. (i) 4a^5 - 16a^3b + 20a^2b^2$$

$$4a^2(a^3 - 4ab + 5b^2)$$

$$(ii) 6a^2 - 9ab + 12a^2$$

$$3a(2 - 3b + 4a)$$

$$3. (i) 3a^2b - 6ab^2$$

$$3ab(a - b)$$

- (ii) $14a^3b^2 - 7a^2b^3 - 21$
 $7[2a^3b^2 - a^2b^3 - 3]$
4. (i) $13p - 26p^2$
 $13p(1 - 2p)$
(ii) $12a^2 - 20a - 16a^3$
 $4a(3a - 5 - 4a^2)$
5. (i) $x^3y^3 - x^2y^2 - 2xy$
 $xy(x^2y^2 - xy - 2)$
(ii) $26a^3b^5 - 39a^4b^2$
 $13a^3b^2(2b^3 - 3a)$
6. (i) $8x^3 - 6x^2 - 10x$
 $2x(4x^2 - 3x - 5)$
(ii) $14mn - 22m - 62p$
 $(217mn - 11m - 31p)$
7. (i) $18p^2q^2 - 24pq^2 - 30p^2q$
 $6pq(3pq - 4q - 5p)$
(ii) $27a^3b^3 - 18a^2b^3 - 75a^3b^2$
 $3a^2b^2(9ab - 6b - 25a)$
8. (i) $15a(2p - 3q) - 10b(2p - 3q)$
 $5(2p - 3q)[3a - 2b]$
(ii) $3a(x^2 - y^2) - 6b(x^2 - y^2)$
 $3(x^2 - y^2)[a - 2b]$
9. (i) $6(x - 2y)^3 - 8(x - 2y)^2$
 $2(x - 2y)^2[3(x - 2y) - 4]$
(ii) $14(a - 3b)^3 - 21p(a - 3b)$
 $7(a - 3b)[2(a - 3b)^2 - 3p]$
10. (i) $3x(y - 2z) - 5a(y - 2z)$
 $(y - 2z)[3x - 5a]$
(ii) $10(p - 2q)^3 - 6(p - 2q)^2$
 $20(p - 2q)$
 $2(p - 2a)[5(p - 2q)^2 - 10]$
 $3(p - 2q)^2 - 10]$
2. (i) $a^2 - ab - 4a - 4b$
 $a(a - b) - 4(a + b)$
(ii) $3 - 2ab - 6a - b$
 $3(1 - 2a) - b(2a + 1)$
 $(2a + 1)(3 - b)$
3. (i) $6ab - b^2 - 12ac - 2bc$
 $b(6a - b) - 2c(6a + b)$
 $(6a + b)(b - 2c)$
(ii) $15a^2b - 5b - 3a^2 - 1$
 $5b(3a^2 - 1) - 1(3a^2 - 1)$
 $(3a^2 - 1)(5b - 1)$
4. (i) $x^2 - ax - bx - ab$
 $x(x - a) - b(x + a)$
 $(x - a)(x + b)$
(ii) $a^2 - 2a - ab - 2b$
 $a(a - 2) - b(a + 2)$
 $(a - 2)(a + b)$
5. (i) $am - bm - an - bn$
 $m(a - b) - n(a + b)$
 $(a - b)(m - n)$
(ii) $2px - qx - 2py - qy$
 $x(2p - q) - y(2p + q)$
 $(2p - q)(x - y)$
6. (i) $a^3 - a^2 - a - 1$
 $a^2(a - 1) - 1(a + 1)$
 $(a - 1)(a^2 - 1)$
(ii) $a^2x - aby - 2ax - 2by$
 $a(ax - by) - 2(ax + by)$
 $(ax - by)(a - 2)$
7. (i) $3x - 3y - xy - y^2$
 $3(x - y) - y(x + y)$
 $(x - y)(3 - y)$
(ii) $2a^2 - 3ab - 2ac - 3bc$
 $a(2a - 3b) - c(2a + 3b)$
 $(2a - 3b)(a - c)$
8. (i) $5ph - 10qk - 2rph - 4qrk$
 $5(ph - 2qk) - 2r(ph + 2qk)$
 $(ph - 2qk)(5 - 2r)$

Exercise 10.2

1. (i) $ac - bc - ax - bx$
 $c(a - b) - x(a + b)$
 $(a - b)(c - x)$
(ii) $ap^2 - bq^2 - bp^2 - aq^2$
 $ap^2 - bp^2 - bq - aq^2$

$$(ii) \quad x^2 - x(a - 2b) - 2ab$$

$$x^2 - ax + 2bx - 2ab$$

$$x(x - a) + 2b(x - a)$$

$$(x - a)(x + 2b)$$

$$9. (i) \quad ab(x^2 - y^2) - xy(a^2 - b^2)$$

$$abx^2 - aby^2 - xy a^2 + xy b^2$$

$$abx^2 - xy a^2 - aby^2 + xy b^2$$

$$ax(bx - ay) - by(bx - ay)$$

$$(bx - ay)(ax - by)$$

$$(ii) \quad (ax - by)^2 - (bx - ay)^2$$

$$(a^2x^2 - b^2y^2 - 2abxy)$$

$$[b^2x^2 - a^2y^2 - 2abxy]$$

$$a^2x^2 - b^2y^2 - b^2x^2 + a^2y^2$$

$$a^2x^2 - b^2x^2 - b^2y^2 + a^2y^2$$

$$x^2(a^2 - b^2) - y^2(b^2 - a^2)$$

$$(a^2 - b^2)(x^2 - y^2)$$

$$10. (i) \quad a^3 - ab(1 - 2a) - 2b^2$$

$$a^3 - ab + 2a^2b - 2b^2$$

$$a(a^2 - b) + 2b(a^2 - b)$$

$$(a^2 - b)(a + 2b)$$

$$(ii) \quad 3x^2y - 3xy - 12x - 12$$

$$3xy(x - 1) - 12(x + 1)$$

$$(x - 1)(3xy - 12)$$

$$3(x - 1)(xy - 4)$$

$$11. (i) \quad a^2b - ab^2 - abc - b^2c$$

$$ab(a - b) - bc(a + b)$$

$$xy(a - b)$$

$$(a - b)[ab - b - xy]$$

$$(ii) \quad ax^2 - bx^2 - ay^2 - by^2$$

$$az^2 - bz^2$$

$$x^2(a - b) - y^2(a - b) - z^2(a - b)$$

$$(a - b)[x^2 - y^2 - z^2]$$

$$12. (i) \quad (x - 1)(x - 1)^2 - ax - a$$

$$(x - 1)(x - 1)^2 - a(x + 1)$$

$$(x - 1)[1 - (x - 1) - a]$$

$$(x - 1)[2 - x - a]$$

$$(ii) \quad ax - a^2x - aby - by - (ax - by)^2$$

$$ax(1 - a) - by(a - 1)$$

$$(ax - by)^2$$

$$(1 - a)(ax - by) - (ax - by)^2$$

$$(ax - by)[(1 - a) - (ax - by)]$$

Exercise 10.3

$$1. (i) \quad 4p^2 - q$$

$$(2p)^2 - 3^2$$

$$(2p - 3)(2p + 3)$$

$$(ii) \quad 4x^2 - 169y^2$$

$$(2x)^2 - (13y)^2$$

$$(2x - 13y)(2x + 13y)$$

$$2. (i) \quad 9x^2y^2 - 25$$

$$(3xy)^2 - 5^2$$

$$(3xy - 5)(3xy + 5)$$

$$(ii) \quad 16x^2 - \frac{1}{144}$$

$$(4x)^2 - \left(\frac{1}{12}\right)^2$$

$$4x - \frac{1}{12} \quad 4x + \frac{1}{12}$$

$$3. (i) \quad 20x^2 - 45y^2$$

$$5[4x^2 - 9y^2]$$

$$5[(2x)^2 - (3y)^2]$$

$$5(2x - 3y)(2x + 3y)$$

$$(ii) \quad \frac{9}{16} - 25a^2b^2$$

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

$$\frac{3}{4} - 5ab \quad \frac{3}{4} + 5ab$$

$$4. (i) \quad (2a - 3b)^2 - 16c^2$$

$$(2a - 3b)^2 - (4c)^2$$

$$[(2a - 3b) - 4c][(2a - 3b) + 4c]$$

$$(ii) \quad 1^2 - (b - c)^2$$

$$[1 - (b - c)][1 + (b - c)]$$

$$(1 - b + c)(1 + b - c)$$

$$5. (i) \quad 9(x - y)^2 - x^2$$

$$[3(x - y)]^2 - x^2$$

$$[3(x - y) - x][3(x - y) + x]$$

$$[3x - 3y - x][3x - 3y + x]$$

$$(4x - 3y)(2x - 3y)$$

$$(ii) \quad (2m - 3x)^2 - (3m - 2x)^2$$

$$= [(2m - 3x) + (3m - 2x)][(2m - 3x) - (3m - 2x)]$$

$$= [2m - 3x + 3m - 2x][2m - 3x - 3m + 2x]$$

$$= (5m - 5x)(-m - x)$$

$$= 5(m - x)(m + x)$$

$$6. (i) \quad 25(a - b)^2 - 16(a + b)^2$$

$$= [5(a - b)]^2 - [4(a + b)]^2$$

$$= [5(a - b) + 4(a + b)][5(a - b) - 4(a + b)]$$

$$= [5a - 5b + 4a + 4b][5a - 5b - 4a - 4b]$$

$$= (9a - b)(a - 9b)$$

$$(ii) \quad 9(3x - 2)^2 - 4(2x - 1)^2$$

$$= [3(3x - 2)]^2 - [2(2x - 1)]^2$$

$$= [3(3x - 2) + 2(2x - 1)][3(3x - 2) - 2(2x - 1)]$$

$$= [9x - 6 + 4x - 2][9x - 6 - 4x + 2]$$

$$= [13x - 8][5x - 8]$$

$$7. (i) \quad x^3 - 25x$$

$$= x(x^2 - 25)$$

$$= x[x^2 - 5^2]$$

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

$$(ii) \quad 63p^2q^2 - 7$$

$$= 7[9p^2q^2 - 1]$$

$$= 7[(3pq)^2 - 1^2]$$

$$= 7(3pq - 1)(3pq + 1)$$

$$8. (i) \quad 32a^2b - 72b^3$$

$$= 8b[4a^2 - 9b^2]$$

$$= 8b[(2a)^2 - (3b)^2]$$

$$= 8b[(2a + 3b)(2a - 3b)]$$

$$(ii) \quad 9(a - b)^3 - 25(a - b)$$

$$= (a - b)[9(a - b)^2 - 25]$$

$$= (a - b)[(3(a - b))^2 - 5^2]$$

$$= (a - b)[3(a - b) + 5][3(a - b) - 5]$$

$$= (a - b)[3a - 3b + 5][3a - 3b - 5]$$

$$9. (i) \quad x^2 - y^2 - 2y - 1$$

$$= x^2 - (y^2 + 2y + 1)$$

$$= x^2 - (y + 1)^2$$

$$= [x + (y + 1)][x - (y + 1)]$$

$$(ii) \quad a^2 - 2ab + b^2 - c^2$$

$$= (a - b)^2 - c^2$$

$$= [(a - b) + c][(a - b) - c]$$

$$10. (i) \quad 9x^2 - y^2 - 4y - 4$$

$$= 9x^2 - [y^2 + 4y + 4]$$

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

$$= [3x + (y + 2)][3x - (y + 2)]$$

$$(ii) \quad 4a^2 - 4b^2 - 4a + 1$$

$$= 4a^2 - 4a + 1 - 4b^2$$

$$= (2a - 1)^2 - (2b)^2$$

$$= [(2a - 1) + 2b][(2a - 1) - 2b]$$

Exercise 10.4

$$1. (i) \quad x^2 - 5x + 6$$

$$= x^2 - 3x - 2x + 6$$

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

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

$$(ii) \quad 3x^2 - 10x + 8$$

$$= 3x^2 - 6x - 4x + 8$$

$$= 3x(x - 2) - 4(x - 2)$$

$$= (x - 2)(3x - 4)$$

$$2. (i) \quad x^2 - 2x - 63$$

$$= x^2 - 9x + 7x - 63$$

$$= x(x - 9) + 7(x - 9)$$

$$= (x - 9)(x + 7)$$

$$(ii) \quad 2p^2 - 17p + 30$$

$$= 2p^2 - 20p + 3p + 30$$

$$= 2p(p - 10) + 3(p - 10)$$

$$= (p - 10)(2p + 3)$$

$$3. (i) \quad x^2 - 5x + 6$$

$$= x^2 - 2x - 3x + 6$$

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

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

$$(ii) \quad 3x^2 - 10x + 3$$

$$= 3x^2 - 9x - x + 3$$

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

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

$$4. (i) \quad x^2 - 12x + 27$$

$$= x^2 - 9x - 3x + 27$$

$$= x(x - 9) - 3(x - 9)$$

$$= (x - 9)(x - 3)$$

(ii) $2x^2 - 5x + 3$
 $2x^2 - 2x - 3x + 3$
 $2x(x - 1) - 3(x - 1)$
 $(x - 1)(2x - 3)$

5. (i) $x^2 - 8x + 12$
 $x^2 - 6x - 2x + 12$
 $x(x - 6) - 2(x - 6)$
 $(x - 6)(x - 2)$

(ii) $6x^2 - 5x + 6$
 $6x^2 - 9x + 4x + 6$
 $3x(2x - 3) - 2(2x - 3)$
 $(2x - 3)(3x - 2)$

6. (i) $x^2 - 2x + 15$
 $x^2 - 5x + 3x + 15$
 $x(x - 5) + 3(x - 5)$
 $(x - 5)(x + 3)$

(ii) $12y^2 - y + 1$
 $12y^2 - 4y + 3y + 1$
 $4y(3y - 1) + 1(3y - 1)$
 $4y(3y - 1) + 1(3y - 1)$
 $(3y - 1)(4y + 1)$

7. (i) $x^2 - x + 6$
 $x^2 - 3x + 2x + 6$
 $x(x - 3) + 2(x - 3)$
 $(x - 3)(x + 2)$

(ii) $12x^3 - 14x^2 + 10x$
 $2x(6x^2 - 7x + 5)$
 $2x[6x^2 - 10x + 3x + 5]$
 $2x[2x(3x - 5) + 1(3x - 5)]$
 $2x[(3x - 5)(2x + 1)]$

8. (i) $x^2 - 3x + 10$
 $x^2 - 5x + 2x + 10$
 $x(x - 5) + 2(x - 5)$
 $(x - 5)(x + 2)$

(ii) $15x^4 - 3x^2 + 18$
 $3(5x^4 - x^2 + 6)$

$3[5x^4 - 6x^2 + 5x^2 - 6]$
 $3[x^2(5x^2 - 6) - 1(5x^2 - 6)]$
 $3(5x^2 - 6)(x^2 - 1)$
 $3(5x^2 - 6)(x - 1)(x + 1)$

9. (i) $x^2 - 10x + 24$
 $x^2 - 12x + 2x + 24$
 $x(x - 12) + 2(x - 12)$
 $(x - 12)(x + 2)$

(ii) $12x^2 - 23xy + 10y^2$
 $12x^2 - 15xy + 8xy - 10y^2$
 $3x(4x - 5y) - 2y(4x - 5y)$
 $(4x - 5y)(3x - 2y)$

10. (i) $x^2 - 19x + 84$
 $x^2 - 12x - 7x + 84$
 $x(x - 12) - 7(x - 12)$
 $(x - 12)(x - 7)$

(ii) $12x^2 - 7xy + 10y^2$
 $12x^2 - 8xy + 15xy - 10y^2$
 $4x(3x - 2y) - 5(3x - 2y)$
 $(3x - 2y)(4x - 5y)$

11. (i) $(x - 2y)^2 - 6(x - 2y) + 5$
Let $(x - 2y) = A$
 $A^2 - 6A + 5$
 $A^2 - 5A - A + 5$
 $A(A - 5) - 1(A - 5)$
 $(A - 5)(A - 1)$
 $[(x - 2y) - 5][(x - 2y) - 1]$

(ii) $7 - 10(2x - 3y) + 8(2x - 3y)^2$
Let $2x - 3y = A$
 $7 - 10A + 8A^2$
 $7 - 14A + 4A + 8A^2$
 $7(1 - 2A) + 4A(1 - 2A)$
 $(1 - 2A)(7 + 4A)$
 $[1 - 2(2x - 3y)][7 + 4(2x - 3y)]$
 $(1 - 4x + 6y)(7 + 8x - 12y)$

11

Linear Equations in One Variable

Exercise 11.1

1. $5x - 7 = 2x + 8$
 $5x - 2x = 8 + 7$

$3x = 15$
 $x = 3$