1 Rational Numbers

Exercises 1.1

1. (i) We have $\frac{3}{8} \quad \frac{12}{5}$

$\frac{13}{8} \quad \frac{12}{5}$

$\frac{65 \quad 96}{40}$

$\frac{161}{40}$

(ii) We have $\frac{11}{5} \quad \frac{17}{15}$

$\frac{11}{5} \quad \frac{17}{15}$

$\frac{11 \quad 3 \quad 17 \quad 1}{15}$

$\frac{16}{15}$

$1\frac{1}{15}$

(iii) We have $\frac{7}{9} \quad \frac{3}{4}$

$\frac{7}{9} \quad \frac{3}{4} \quad \frac{7 \quad 4 \quad 3 \quad 9}{36}$

$\frac{28 \quad 27}{36}$

$\frac{1}{36}$

(iv) We have $\frac{3}{8} \quad \frac{5}{12}$

$\frac{3}{8} \quad \frac{5}{12}$

$\frac{3 \quad 3 \quad 5 \quad 2}{24} \quad \frac{9 \quad 10}{24}$

$\frac{19}{24}$

(v) $\frac{8}{19} \quad \frac{2}{57}$

$\frac{8 \quad 3 \quad 2 \quad 1}{57} \quad \frac{24 \quad 2}{57}$

(vi) We have $\frac{3}{7} \quad \frac{4}{7}$

$\frac{3 \quad 4}{7}$

$\frac{1}{7}$

(vii) We have

$\frac{8}{15} \quad \frac{7}{20} \quad \frac{8 \quad 4 \quad 7 \quad 3}{60}$

$\frac{32 \quad 21}{60}$

$\frac{53}{60}$

(viii) We have

$\frac{9}{33} \quad \frac{5}{9} \quad \frac{9}{33} \quad \frac{5}{9}$

$\frac{9 \quad 3 \quad 5 \quad 11}{99}$

$\frac{27 \quad 55}{99}$

$\frac{9}{33} \quad \frac{5}{9} \quad \frac{82}{99}$

2. (i) We have $\frac{2}{3} \quad \frac{3}{4} \quad \frac{2 \quad 4 \quad 3 \quad 3}{12}$

$\frac{8 \quad 9}{12}$

$\frac{2}{3} \quad \frac{3}{4} \quad \frac{1}{12}$

(ii) We have to find $\frac{17}{5} \quad \frac{9}{5}$

$\frac{17}{5} \quad \frac{9}{5}$

$\frac{17 \quad 9}{5}$

$\frac{8}{5}$

$1\frac{3}{5}$

$\frac{17}{5}$ $\frac{9}{5}$ $1\frac{3}{5}$

(iii) We have to find $\frac{5}{8}$ $\frac{5}{12}$

$\frac{5}{8}$ $\frac{5}{12}$

$\frac{5 \quad 3 \quad 5 \quad 2}{24}$

$\frac{15 \quad 10}{24}$

$\frac{5}{8}$ $\frac{5}{12}$ $\frac{5}{24}$

(iv) We have to find $\frac{8}{63}$ $\frac{5}{21}$

$\frac{8}{63}$ $\frac{5}{21}$

$\frac{8 \quad 1 \quad 5 \quad 3}{63}$

$\frac{8 \quad 15}{63}$

$\frac{8}{63}$ $\frac{5}{21}$ $\frac{23}{63}$

(v) We have to find $\frac{3}{19}$ $\frac{4}{38}$

$\frac{3}{19}$ $\frac{4}{38}$

$\frac{3 \quad 2 \quad 4 \quad 1}{38}$

$\frac{6 \quad 4}{38}$

$\frac{10}{38}$ $\frac{5}{19}$

$\frac{3}{19}$ $\frac{4}{38}$ $\frac{5}{19}$

(vi) We have to find $\frac{5}{8}$ $\frac{13}{12}$

$\frac{5}{8}$ $\frac{13}{32}$

$\frac{5 \quad 4 \quad 13 \quad 1}{32}$

$\frac{20 \quad 13}{32}$ $\frac{33}{32}$

$\frac{5}{8}$ $\frac{13}{32}$ $\frac{33}{32}$

(vii) We have to find $\frac{7}{20}$ $\frac{8}{15}$

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

$\frac{7 \quad 3 \quad 8 \quad 4}{60}$

$\frac{21 \quad 32}{60}$ $\frac{11}{60}$

$\frac{7}{20}$ $\frac{8}{15}$ $\frac{11}{60}$

(vii) We have to find $\frac{7}{15}$ $\frac{6}{3}$

$\frac{7}{15}$ $\frac{6}{3}$

$\frac{7 \quad 1 \quad 6 \quad 5}{15}$

$\frac{7 \quad 30}{15}$ $\frac{23}{15}$

$\frac{7}{15}$ $\frac{6}{3}$ $\frac{23}{15}$

3. (i) We have $\frac{22}{3}$ $\frac{27}{88}$

$\frac{22 \quad \overset{9}{\cancel{27}}}{3 \quad \underset{4}{\cancel{88}}}$

$\frac{22}{3}$ $\frac{27}{88}$ $\frac{9}{4}$

(ii) We have $\frac{3}{5}$ $\frac{4}{7}$

$\frac{12}{35}$

(iii) We have $\frac{14}{9}$ 27

$\frac{14 \quad \overset{3}{\cancel{27}}}{\cancel{9}}$

$\frac{14}{9}$ 27 42

(iv) We have $\frac{9}{8}$ $\frac{32}{3}$

$$\frac{\overset{3}{\cancel{9}}}{\cancel{8}} \quad \frac{\overset{4}{\cancel{32}}}{\cancel{3}}$$

$$\frac{9}{8} \quad \frac{32}{3} \quad 12$$

(v) We have $32 \quad \frac{7}{36}$

$$\frac{\overset{8}{\cancel{32}} \quad 7}{\underset{9}{\cancel{36}}}$$

$$32 \quad \frac{7}{36} \quad \frac{56}{9}$$

(vi) We have $\frac{36}{5} \quad \frac{20}{3}$

$$\frac{\overset{12}{\cancel{36}} \quad \overset{4}{\cancel{20}}}{\cancel{5} \quad \cancel{3}}$$

$$\frac{36}{5} \quad \frac{20}{3} \quad 48$$

(vii) We have $\frac{7}{6} \quad 24$

$$\frac{7}{\cancel{6}} \quad \overset{4}{\cancel{24}}$$

$$\frac{7}{6} \quad 24 \quad 28$$

(viii) We have

$$\frac{9}{8} \quad \frac{16}{3}$$

$$\frac{\overset{3}{\cancel{9}}}{\cancel{8}} \quad \frac{\overset{2}{\cancel{16}}}{\cancel{3}}$$

$$(3 \quad 2)$$

$$6$$

$$\frac{9}{8} \quad \frac{16}{3} \quad 6$$

4. (i) We have to find $4 \quad \frac{3}{5}$

or $4 \quad \frac{5}{3}$

$$\frac{20}{3}$$

$$4 \quad \frac{3}{5} \quad 6\frac{2}{3}$$

(ii) We have to find $\frac{1}{8} \quad \frac{3}{4}$

$$\frac{1}{8} \quad \frac{4}{3}$$

$$\frac{1}{8} \quad \frac{4}{3}$$

$$4 \quad \frac{3}{5} \quad \frac{\overset{2}{1}}{6}$$

(iii) We have to find $\frac{15}{7} \quad \frac{5}{7}$

or $\frac{15}{7} \quad \frac{7}{5}$

$$\frac{\overset{3}{\cancel{15}}}{\cancel{7}} \quad \frac{\cancel{7}}{\cancel{5}}$$

$$(3)$$

$$\frac{15}{7} \quad \frac{5}{7} \quad 3$$

(iv) We have to find $\frac{2}{3} \quad \frac{4}{5}$

or $\frac{2}{3} \quad \frac{5}{4}$

or $\frac{\cancel{2}}{\cancel{3}} \quad \frac{\cancel{5}}{\cancel{4}}$

$$\frac{2}{3} \quad \frac{4}{5} \quad \frac{\overset{2}{5}}{6}$$

(v) We have to find $\frac{3}{13} \quad \frac{4}{65}$

or $\frac{3}{13} \quad \frac{65}{4}$

$$\frac{3}{\cancel{13}} \quad \frac{\overset{5}{\cancel{65}}}{4}$$

$$\frac{3 \quad 5}{4}$$

$\frac{3}{13} \quad \frac{4}{65} \quad \frac{15}{4}$

(vi) We have to find $\frac{6}{7} \quad 15$

or $\frac{6}{7} \quad \frac{1}{15}$

$\frac{6}{7} \quad \frac{1}{15}$

$\frac{6}{7} \quad 15 \quad \frac{6}{105} \quad \frac{2}{35}$

(vii) To find $\frac{3}{5} \quad \frac{2}{7}$

or $\frac{3}{5} \quad \frac{7}{2} \quad \frac{21}{10}$

$\frac{3}{5} \quad \frac{2}{7} \quad 2\frac{1}{10}$

(viii) To find $\frac{1}{6} \quad 1$

or $\frac{1}{6} \quad \frac{1}{1}$

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

5. (i) We have $\frac{11}{12} \quad \frac{3}{8} \quad \frac{1}{4}$

$\frac{11}{12} \quad \frac{3}{8} \quad \frac{1}{4}$

$\frac{11 \quad 2 \quad 3 \quad 3 \quad 1 \quad 6}{24}$

$\frac{22 \quad 9 \quad 6}{24}$

$\frac{25}{24} \quad 1\frac{1}{24}$

(ii) We have $\frac{4}{7} \quad \frac{8}{9} \quad \frac{13}{7} \quad \frac{17}{21}$

$\frac{4}{7} \quad \frac{8}{9} \quad \frac{13}{7} \quad \frac{17}{21}$

LCM of 7, 9, 21 = 63

$\frac{4 \quad 6 \quad 8 \quad 7 \quad 13 \quad 9 \quad 17 \quad 3}{63}$

$\frac{36 \quad 56 \quad 117 \quad 51}{63}$

$\frac{87 \quad 173}{63}$

$\frac{86}{63}$

(iii) We have $\frac{5}{3} \quad \frac{3}{2} \quad \frac{7}{3} \quad 3$

$\frac{5}{3} \quad \frac{3}{2} \quad \frac{7}{3} \quad \frac{3}{1}$

$\frac{5 \quad 2 \quad 3 \quad 3 \quad 7 \quad 2 \quad 3 \quad 6}{6}$

$\frac{10 \quad 9 \quad 14 \quad 18}{6}$

$\frac{28 \quad 23}{6}$

$\frac{5}{6}$

(iv) We have $\frac{4}{13} \quad \frac{5}{8} \quad \frac{8}{13} \quad \frac{9}{13}$

$\frac{4}{13} \quad \frac{5}{8} \quad \frac{8}{13} \quad \frac{9}{13}$

$\frac{4 \quad 8 \quad 5 \quad 13 \quad 8 \quad 8 \quad 9 \quad 8}{13 \quad 8}$

$\frac{32 \quad 65 \quad 64 \quad 72}{13 \quad 18}$

$\frac{25}{104}$

6. (i) We have

$\frac{3}{4} \quad \frac{1}{5} \quad \frac{2}{3}$

$\frac{3}{4} \quad \frac{1}{5} \quad \frac{2}{3}$

$\frac{3 \quad 5 \quad 1 \quad 4}{20} \quad \frac{2}{3}$

$\frac{19}{20} \quad \frac{2}{3} \quad \frac{19 \quad 3 \quad 2 \quad 20}{60}$

$\frac{57 \quad 40}{60}$

$\frac{97}{60}$

$1\frac{37}{60}$

(ii) We have $\frac{3}{4} \quad \frac{1}{5} \quad \frac{2}{3}$

$\frac{3}{4} \quad \frac{1}{5} \quad \frac{2}{3}$

$\frac{3}{4} \quad \frac{3 \quad 10}{15}$

$\frac{3}{4} \quad \frac{7}{15}$

$\frac{3 \quad 15 \quad 7 \quad 4}{60}$

$\frac{45 \quad 28}{60} \quad \frac{17}{60}$

$\frac{3}{4} \quad \frac{1}{5} \quad \frac{2}{3} \quad \frac{17}{60}$

(iii) We have $\frac{1}{6} \quad \frac{2}{5} \quad \frac{2}{15}$

$\frac{1}{6} \quad \frac{2}{5} \quad \frac{2}{15}$

$\frac{1 \quad 5 \quad 2 \quad 6 \quad 2 \quad 2}{30}$

$\frac{5 \quad 12 \quad 4}{30} \quad \frac{9 \quad 12}{30}$

$\frac{3}{30}$

$\frac{1}{10}$

(iv) We have $\frac{3}{8} \quad \frac{2}{3} \quad \frac{5}{36}$

$\frac{3}{8} \quad \frac{2}{3} \quad \frac{5}{36}$

$\frac{3 \quad 9 \quad 2 \quad 24 \quad 5 \quad 2}{72}$

$\frac{27 \quad 48 \quad 10}{72}$

$\frac{75 \quad 10}{72} \quad \frac{65}{72}$

$\frac{3}{8} \quad \frac{2}{3} \quad \frac{5}{36} \quad \frac{65}{72}$

7. (i) We have

$\frac{3}{7} \quad \frac{7}{5} \quad \frac{17}{15} \quad \frac{3}{34}$

$\frac{3}{5} \quad \frac{\cancel{17} \quad 3}{15 \quad \cancel{34}_{2}}$

$\frac{3}{5} \quad \frac{3}{30}$

$\frac{3 \quad 6 \quad 3 \quad 1}{30}$

$\frac{18 \quad 3}{30} \quad \frac{21}{30} \quad \frac{7}{10}$

$\frac{3}{7} \quad \frac{7}{5} \quad \frac{17}{15} \quad \frac{3}{34} \quad \frac{7}{10}$

(ii) We have $\frac{7}{21} \quad \frac{3}{14} \quad \frac{5}{14} \quad \frac{4}{15}$

$\frac{\cancel{7} \quad \cancel{3}}{\cancel{21}_{7} \quad \cancel{14}_{2}} \quad \frac{5 \quad \overset{2}{\cancel{4}}}{\cancel{14}_{7} \quad \cancel{15}_{3}}$

$\frac{1}{14} \quad \frac{2}{21}$

$\frac{1 \quad 3 \quad 2 \quad 2}{42}$

$\frac{3 \quad 4}{42}$

$\frac{7}{42} \quad \frac{1}{6}$

$\frac{7}{21} \quad \frac{3}{14} \quad \frac{5}{14} \quad \frac{4}{15} \quad \frac{1}{6}$

(iii) We have $\frac{3}{2} \quad \frac{7}{4} \quad \frac{5}{2} \quad \frac{3}{4}$

$\frac{21}{8} \quad \frac{15}{8}$

$\frac{21 \quad 15}{8}$

$\frac{6}{8}$

$\frac{3}{2} \quad \frac{7}{4} \quad \frac{5}{2} \quad \frac{3}{4} \quad \frac{3}{4}$

(iv) We have

$\frac{9}{2} \quad \frac{8}{3} \quad \frac{4}{3} \quad \frac{5}{24} \quad \frac{3}{5} \quad \frac{7}{6}$

$\frac{9 \quad 3 \quad 8 \quad 2}{6} \quad \frac{\cancel{4} \quad 5}{3 \quad \cancel{24}_{6}} \quad \frac{\cancel{3} \quad 7}{5 \quad \cancel{6}_{2}}$

$\frac{27 \quad 16}{6} \quad \frac{5}{18} \quad \frac{7}{5 \quad 2}$

$\frac{43}{6} \quad \frac{5}{18} \quad \frac{7}{10}$

$$\frac{43 \quad 15 \quad 5 \quad 5 \quad 7 \quad 9}{90}$$

$$\frac{645 \quad 25 \quad 63}{90}$$

$$\frac{670 \quad 63}{90}$$

$$\frac{607}{90}$$

8. (i) $(x \quad y) \quad (x \quad y) \qquad x \quad \frac{2}{5}, y \quad \frac{1}{2}$

$$\frac{2}{5} \quad \frac{1}{2} \qquad \frac{2}{5} \quad \frac{1}{2}$$

$$\frac{2 \quad 2 \quad 1 \quad 5}{10} \qquad \frac{2 \quad 2 \quad 1 \quad 5}{10}$$

$$\frac{4 \quad 5}{10} \qquad \frac{4 \quad 5}{10}$$

$$\frac{9}{10} \qquad \frac{1}{10}$$

$$\frac{9}{10} \qquad \frac{10}{1}$$

$(x \quad y) \quad (x \quad y) \qquad 9$

If $x \quad \frac{2}{5} y \quad \frac{1}{2}$

(ii) To find $(x \quad y) \quad (x \quad y)$ If $x \quad \frac{5}{4}$

$y \quad \frac{1}{3}$

$$\frac{5}{4} \quad \frac{1}{3} \qquad \frac{5}{4} \quad \frac{1}{3}$$

$$\frac{5 \quad 3 \quad 1 \quad 4}{12} \qquad \frac{5 \quad 3 \quad 1 \quad 4}{12}$$

$$\frac{15 \quad 4}{12} \qquad \frac{15 \quad 4}{12}$$

$$\frac{11}{12} \quad \frac{19}{12}$$

$$\frac{11}{12} \quad \frac{12}{19}$$

$(x \quad y) \quad (x \quad y) \quad \frac{11}{19}$

If $x \quad \frac{5}{4} y \quad \frac{1}{3}$

(iii) To find $(x \quad y) \quad (x \quad y)$

If $x \quad \frac{2}{3} y \quad \frac{3}{2}$

$$\frac{2}{3} \quad \frac{3}{2} \qquad \frac{2}{3} \quad \frac{3}{2}$$

$$\frac{2 \quad 2 \quad 3 \quad 3}{6} \qquad \frac{2 \quad 2 \quad 3 \quad 3}{6}$$

$$\frac{4 \quad 9}{6} \qquad \frac{4 \quad 9}{6}$$

$$\frac{13}{6} \quad \frac{5}{6}$$

$$\frac{13}{6} \quad \frac{6}{5}$$

$(x \quad y) \quad (x \quad y) \quad \frac{13}{5}$

If $x \quad \frac{2}{3} y \quad \frac{3}{2}$

9. Additive inverse of $\frac{3}{7} \quad \frac{3}{7}$

Additive inverse of $\frac{6}{13} \quad \frac{6}{13}$

Additive inverse of $\frac{9}{11} \quad \frac{9}{11}$

Additive inverse of $\frac{2}{5} \quad \frac{2}{5}$

Additive inverse of $\frac{13}{8} \quad \frac{13}{8}$

10. Multiplicative inverse of $\frac{11}{7} \quad \frac{7}{11}$

Multiplicative inverse of $\frac{4}{9} \quad \frac{9}{4}$

Multiplicative inverse of

$$\frac{15}{22} \quad 1 \quad \frac{22}{15 \quad 1}$$

$$\frac{22}{15}$$

Multiplicative inverse of $\frac{11}{13} \quad \frac{13}{11}$

Multiplicative inverse of

$$\frac{3}{11} \quad \frac{2}{5} \quad \frac{11 \quad 5}{3 \quad 2}$$

$$\frac{55}{6} \quad \frac{55}{6}$$

11. We have to find

$\frac{61}{12} \quad \frac{11}{3} \qquad \frac{61}{12} \quad \frac{11}{3}$

$\frac{61 \quad 1 \quad 11 \quad 4}{12} \qquad \frac{61 \quad 1 \quad 11 \quad 4}{12}$

$\frac{61 \quad 44}{12} \qquad \frac{61 \quad 44}{12}$

$\frac{105}{2} \quad \frac{17}{12}$

$\frac{105}{12} \quad \frac{12}{17} \quad \frac{105}{17}$

12. $2\frac{1}{4} \quad 5\frac{1}{5} \qquad 2\frac{1}{4} \quad \frac{2}{3}$

$\frac{9}{4} \quad \frac{26}{5} \qquad \frac{\cancel{9}^{3}}{\cancel{4}_{2}} \quad \frac{\cancel{2}}{\cancel{3}}$

$\frac{9 \quad 5 \quad 26 \quad 4}{20} \qquad \frac{3}{2}$

$\frac{149}{\cancel{20}_{10}} \quad \frac{\cancel{2}}{3}$

$\frac{149}{30}$

$4\frac{29}{30}$

13. Cost of $3\frac{1}{2}$ litres of milk ₹ $3\frac{1}{2} \quad 16\frac{1}{2}$

$\frac{7}{2} \quad \frac{33}{2}$

$\frac{231}{4}$

Money left with Prateek $100 \quad \frac{231}{4}$

$= ₹ \ \frac{400 \quad 231}{4}$

$₹ \frac{169}{4} \quad ₹ 42\frac{1}{4}$

14. Area of Rectangle $l \quad b$

$85\frac{5}{6} \quad 52\frac{2}{3} \quad b$

$b \quad 85\frac{5}{6} \quad 52\frac{2}{3}$

$\frac{515}{6} \quad \frac{158}{3}$

$\frac{515}{\cancel{6}_{2}} \quad \frac{3}{158} \quad \frac{515}{316}$

Breadth of Rectangle $1\frac{199}{316}$ m

15. (i) True (ii) False (iii) True (iv) False (v) False (vi) False.

Exercise 1.2

1. (i) $\frac{5}{7} \quad \frac{2}{7} \quad \frac{2}{7} \qquad \frac{5}{7}$

(ii) $\frac{15}{14} \quad \frac{18}{23} \quad \frac{18}{23} \qquad \frac{15}{19}$

(iii) $\frac{5}{6} \quad \frac{4}{9} \qquad \frac{4}{9} \quad \frac{5}{6}$

(iv) $\frac{1}{3} \quad \frac{6}{5} \qquad \frac{6}{5} \quad \frac{1}{3}$

(v) $\frac{7}{26} \quad \frac{16}{39} \quad \frac{16}{39} \qquad \frac{7}{26}$

(vi) $\frac{11}{29} \quad \frac{6}{31} \qquad \frac{6}{31} \qquad \frac{11}{29}$

2. (i) $\frac{1}{11} \quad \frac{1}{3} \quad \frac{5}{6} \quad \frac{1}{11} \qquad \frac{1}{3} \quad \frac{5}{6}$

(ii) $\frac{2}{5} \quad \frac{11}{5} \quad \frac{3}{4}$

$\frac{2}{5} \quad \frac{11}{5} \qquad \frac{3}{4}$

(iii) $\frac{3}{11} \quad \frac{1}{7} \qquad \frac{5}{13} \quad \frac{3}{11} \qquad \frac{1}{7} \qquad \frac{5}{13}$

(iv) $\frac{21}{28} \quad \frac{9}{14} \quad \frac{6}{19}$

$\frac{21}{38} \quad \frac{9}{14} \qquad \frac{6}{19}$

(v) $\frac{3}{4} \quad \frac{5}{6} \quad \frac{4}{9}$

$\frac{3}{4} \quad \frac{5}{6} \qquad \frac{4}{5}$

(vi) $\frac{11}{29} \qquad \frac{16}{19} \quad \frac{8}{11}$

$\frac{11}{29} \quad \frac{6}{19} \qquad \frac{8}{11}$

3. (i) LHS

$$\frac{5}{8} \quad \frac{9}{13}$$

$$\frac{5 \quad 13 \quad 9 \quad 8}{104}$$

$$\frac{65 \quad 72}{104}$$

$$\frac{137}{104}$$

RHS

$$\frac{9}{13} \quad \frac{5}{8}$$

$$\frac{9 \quad 8 \quad 5 \quad 13}{104}$$

$$\frac{72 \quad 65}{104}$$

$$\frac{137}{104}$$

LHS = RHS

(ii) LHS

$$3 \quad \frac{7}{12}$$

$$\frac{3 \quad 12 \quad 7 \quad 1}{12}$$

$$\frac{36.7}{12}$$

$$\frac{29}{12}$$

RHS

$$\frac{7}{12} \quad 3$$

$$\frac{7 \quad 3 \quad 12}{12}$$

$$\frac{7 \quad 36}{12}$$

$$\frac{29}{12}$$

$$3 \quad \frac{7}{12} \quad \frac{7}{12} \quad 3$$

(iii) LHS

$$\frac{2}{7} \quad \frac{12}{35}$$

$$\frac{2 \quad 5 \quad 12 \quad 1}{35}$$

$$\frac{10 \quad 12}{15}$$

$$\frac{22}{35}$$

RHS

$$\frac{12}{35} \quad \frac{2}{7}$$

$$\frac{12 \quad 1 \quad 2 \quad 5}{35}$$

$$\frac{12 \quad 10}{35}$$

$$\frac{22}{15}$$

LHS = RHS

(iv) LHS

$$\frac{3}{4} \quad \frac{2}{5} \quad \frac{7}{10}$$

$$\frac{3 \quad 5 \quad 2 \quad 4}{20} \quad \frac{7}{10}$$

$$\frac{15 \quad 8}{20} \quad \frac{7}{10}$$

$$\frac{7}{20} \quad \frac{7}{10}$$

$$\frac{7 \quad 7 \quad 2}{20}$$

$$\frac{7 \quad 14}{20}$$

$$\frac{7}{20}$$

RHS

$$\frac{3}{4} \quad \frac{2}{5} \quad \frac{7}{10}$$

$$\frac{3}{4} \quad \frac{2 \quad 2 \quad 7 \quad 1}{10}$$

$$\frac{3}{4} \quad \frac{4 \quad 7}{10}$$

$$\frac{3}{4} \quad \frac{11}{10}$$

$$\frac{3 \quad 5 \quad 11 \quad 2}{20}$$

$$\frac{15 \quad 22}{20} \quad \frac{7}{20}$$

LHS = RHS

(v) LHS

$$\frac{7}{11} \quad \frac{2}{5} \quad \frac{13}{22}$$

$$\frac{7 \quad 5 \quad 2 \quad 11}{55} \quad \frac{13}{22}$$

$$\frac{35 \quad 22}{5} \quad \frac{13}{22}$$

$$\frac{57}{55} \quad \frac{13}{22}$$

$$\frac{57 \quad 2 \quad 13 \quad 5}{110}$$

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

$$\frac{179}{110}$$

RHS

$$\frac{7}{11} \quad \frac{2}{5} \quad \frac{13}{22}$$

$$\frac{7}{11} \quad \frac{2 \quad 22 \quad 13 \quad 5}{110}$$

$$\frac{7}{11} \quad \frac{44 \quad 65}{110}$$

$$\frac{7}{11} \quad \frac{109}{110}$$

$$\frac{7 \quad 10 \quad 109}{110}$$

$$\frac{70 \quad 109}{110}$$

$$\frac{179}{110}$$

LHS = RHS

(vi) LHS

$$1 \quad \frac{2}{3} \quad \frac{3}{4}$$

$$1 \quad \frac{2 \quad 4 \quad 3 \quad 3}{12}$$

$$1 \quad \frac{2 \quad 4 \quad 3 \quad 3}{12}$$

$$1 \quad \frac{8 \quad 9}{12}$$

$$1 \quad \frac{17}{12} \quad \frac{29}{12}$$

RHS

$$1 \quad \frac{2}{3} \quad \frac{3}{4}$$

$$1 \quad \frac{2}{3} \quad \frac{3}{4}$$

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

$$\frac{5 \quad 4 \quad 3 \quad 3}{12}$$

$$\frac{29}{12}$$

LHS = RHS

4. (i) $\frac{5}{6} \quad \frac{6}{7} \quad \square \quad \frac{5}{9} \quad \frac{6}{7} \quad \frac{9}{8}$

(ii) $\frac{5}{4} \quad \frac{7}{9} \quad \frac{7}{9} \quad \square$

(iii) $\frac{18}{15} \quad \frac{9}{13} \quad \frac{7}{15}$

$\square \quad \frac{9}{13} \quad \frac{7}{15}$

(iv) $\frac{6}{11} \quad \frac{9}{13} \quad \frac{5}{9} \quad \frac{6}{11} \quad \frac{9}{13} \quad \square$

5. $a \quad \frac{3}{4} \quad b \quad \frac{2}{5}$

(i) $a \quad b$

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

$$\frac{3 \quad 5 \quad 2 \quad 4}{20}$$

$$\frac{15 \quad 8}{20}$$

$$\frac{23}{20}$$

$b \quad a$

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

$$\frac{2 \quad 4 \quad 3 \quad 5}{20}$$

$$\frac{8 \quad 15}{20}$$

$$\frac{23}{20}$$

$a \quad b \quad b \quad a$ if $a \quad \frac{3}{4} b \quad \frac{2}{5}$

(ii) $a \quad \frac{7}{3} \quad b \quad \frac{7}{9}$

$a \quad b$

$$\frac{7}{3} \quad \frac{7}{9}$$

$$\frac{7 \quad 3 \quad 7 \quad 1}{9}$$

$$\frac{21 \quad 7}{9}$$

$$\frac{14}{9}$$

$b \quad a$

$$\frac{7}{9} \quad \frac{7}{3}$$

$$\frac{7 \quad 1 \quad 7 \quad 3}{9}$$

$$\frac{7 \quad 21}{9}$$

$$\frac{14}{9}$$

$a \quad b \quad b \quad a$ if $a \quad \frac{7}{3} b \quad \frac{7}{9}$

6. (i) $a \quad \frac{4}{5} b \quad \frac{2}{3} c \quad \frac{8}{9}$

$(a \quad b) \quad c$

$$\frac{4}{5} \quad \frac{2}{3} \quad \frac{8}{9}$$

$$\frac{4 \quad 3 \quad 2 \quad 5}{15} \quad \frac{8}{9}$$

$$\frac{12 \quad 10}{15} \quad \frac{8}{9}$$

$$\frac{2}{15} \quad \frac{8}{9}$$

$$\frac{2 \quad 3 \quad 8 \quad 5}{45}$$

$$\frac{6 \quad 45}{45}$$

$$\frac{46}{45}$$

$a \quad (b \quad c)$

$$\frac{4}{5} \quad \frac{2}{3} \quad \frac{8}{9}$$

$$\frac{4}{5} \quad \frac{2 \quad 3 \quad 8 \quad 1}{9}$$

$$\frac{4}{5} \quad \frac{6 \quad 8}{9}$$

$$\frac{4}{5} \quad \frac{2}{9}$$

$$\frac{4 \quad 9 \quad 2 \quad 5}{45}$$

$$\frac{36 \quad 10}{45} \quad \frac{46}{45}$$

$(a \quad b) \quad c \quad a \quad (b \quad c)$

If $a \quad \frac{4}{5}, b \quad \frac{2}{3}, c \quad \frac{8}{9}$

(ii) $a \quad \frac{1}{9} b \quad \frac{5}{6}, c \quad \frac{7}{9}$

$(a \quad b) \quad c$

$$\frac{1}{9} \quad \frac{5}{6} \quad \frac{7}{9}$$

$$\frac{1 \quad 2 \quad 5 \quad 3}{18} \quad \frac{7}{9}$$

$$\frac{2 \quad 15}{18} \quad \frac{7}{9}$$

$$\frac{17}{18} \quad \frac{7}{9}$$

$$\frac{17 \quad 7 \quad 2}{18}$$

$$\frac{17 \quad 14}{18}$$

$$\frac{3}{18} \quad \frac{1}{6}$$

$a \quad (b \quad c)$

$$\frac{1}{9} \quad \frac{5}{6} \quad \frac{7}{9}$$

$$\frac{1}{9} \quad \frac{5 \quad 3 \quad 7 \quad 2}{18}$$

$$\frac{1}{9} \quad \frac{15 \quad 14}{18}$$

$$\frac{1}{9} \quad \frac{1}{18}$$

$$\frac{2 \quad 1}{18}$$

$$\frac{3}{18} \quad \frac{1}{6}$$

$(a \quad b) \quad c \quad a \quad (b \quad c)$

If $a \quad \frac{1}{9}, b \quad \frac{5}{6}, c \quad \frac{7}{9}$

7. (i) To prove

$$\frac{3}{8} \quad \frac{9}{14} \quad \frac{5}{16} \quad \frac{3}{8} \quad \frac{9}{14} \quad \frac{5}{16}$$

LHS $\frac{3}{8} \quad \frac{9}{14} \quad \frac{5}{16}$

$$\frac{3 \quad 7 \quad 9 \quad 4}{56}$$

$$\frac{21 \quad 28}{56} \quad \frac{5}{16}$$

$$\frac{49}{56} \quad \frac{5}{16}$$

$$\frac{49 \quad 2 \quad 5 \quad 7}{112}$$

$$\frac{98 \quad 35}{112}$$

$$\frac{63}{112}$$

RHS $\frac{3}{8} \quad \frac{9}{14} \quad \frac{5}{16}$

$$\frac{3}{8} \quad \frac{9 \quad 8 \quad 5 \quad 7}{112}$$

$$\frac{3}{8} \quad \frac{72 \quad 35}{112}$$

$$\frac{3}{8} \quad \frac{107}{112}$$

$$\frac{3 \quad 14 \quad 107 \quad 1}{112}$$

$$\frac{42 \quad 107}{112}$$

$$\frac{147}{112}$$

LHS RHS

(ii) To prove

$$\frac{5}{6} \quad \frac{4}{9} \quad \frac{11}{12} \quad \frac{5}{6} \quad \frac{4}{9} \quad \frac{11}{12}$$

LHS $\frac{5}{6} \quad \frac{4}{9} \quad \frac{11}{12}$

$$\frac{5 \quad 3 \quad 4 \quad 2}{18} \quad \frac{11}{12}$$

$$\frac{15 \quad 8}{18} \quad \frac{11}{12}$$

$$\frac{23 \quad 2 \quad 11 \quad 3}{36}$$

$$\frac{46 \quad 33}{36}$$

$$\frac{13}{36}$$

RHS $\frac{5}{6} \quad \frac{4}{9} \quad \frac{11}{12}$

$$\frac{5}{6} \quad \frac{4 \quad 4 \quad 11 \quad 3}{36}$$

$$\frac{5}{6} \quad \frac{16 \quad 33}{36}$$

$$\frac{5}{6} \quad \frac{49}{36}$$

$$\frac{5 \quad 6 \quad 49 \quad 1}{36}$$

$$\frac{30 \quad 49}{36}$$

$$\frac{79}{36}$$

LHS RHS

8. (i) LHS

$$\frac{4}{7} \quad \frac{7}{8}$$

$$\frac{4 \quad 8 \quad 7 \quad 7}{56}$$

$$\frac{32 \quad 49}{56}$$

$$\frac{81}{56}$$

RHS

$$\frac{7}{8} \quad \frac{4}{7}$$

$$\frac{7}{8} \quad \frac{4}{7}$$

$$\frac{7 \quad 7 \quad 4 \quad 8}{56}$$

$$\frac{49 \quad 32}{56}$$

$$\frac{17}{56}$$

LHS RHS

(ii) LHS

$$\frac{5}{6} \quad \frac{2}{9} \quad \frac{7}{12}$$

$$\frac{5}{6} \quad \frac{2 \quad 4 \quad 7 \quad 3}{36}$$

$$\frac{5}{6} \quad \frac{8 \quad 21}{36}$$

$$\frac{5}{6} \quad \frac{29}{36}$$

$$\frac{5 \quad 6 \quad 29}{36}$$

$$\frac{30 \quad 29}{36}$$

$$\frac{1}{36}$$

RHS

$$\frac{5}{6} \quad \frac{2}{9} \quad \frac{7}{12}$$

$$\frac{5 \quad 3 \quad 2 \quad 2}{18} \quad \frac{7}{12}$$

$$\frac{15 \quad 14}{18} \quad \frac{7}{12}$$

$$\frac{11}{18} \quad \frac{7}{12}$$

$$\frac{11 \quad 2 \quad 7 \quad 3}{36}$$

$$\frac{22 \quad 21}{36}$$

$$\frac{1}{36}$$

LHS RHS

$$\frac{5}{6} \quad \frac{2}{9} \quad \frac{7}{12} \qquad \frac{5}{6} \quad \frac{2}{9} \quad \frac{7}{12}$$

9. (i) To prove

$$\frac{7}{9} \quad \frac{7}{12}$$

$$\frac{7 \quad 4 \quad 7 \quad 3}{36}$$

$$\frac{28 \quad 21}{36}$$

$$\frac{7}{36}$$

RHS

$$\frac{7}{12} \quad \frac{7}{9}$$

$$\frac{7 \quad 3 \quad 7 \quad 4}{36}$$

$$\frac{21 \quad 28}{36}$$

$$\frac{7}{36}$$

LHS RHS

(ii) LHS

$$\frac{3}{14} \quad \frac{9}{42}$$

$$\frac{3 \quad 3 \quad 19 \quad 1}{42}$$

$$\frac{9 \quad 19}{42}$$

$$\frac{28}{42}$$

RHS

$$\frac{19}{42} \quad \frac{3}{14}$$

$$\frac{19 \quad 1 \quad 3 \quad 3}{42}$$

$$\frac{19 \quad 9}{42}$$

$$\frac{10}{42}$$

LHS RHS

(iii) LHS

$$\frac{6}{7} \quad \frac{8}{11}$$

$$\frac{6 \quad 11 \quad 8 \quad 7}{77}$$

$$\frac{66 \quad 56}{77}$$

$$\frac{122}{77}$$

RHS

$$\frac{8}{11} \quad \frac{6}{7}$$

$$\frac{8 \quad 7 \quad 6 \quad 11}{77}$$

$$\frac{56 \quad 66}{77}$$

$$\frac{122}{77}$$

LHS RHS

(iv) LHS

$$\frac{3}{4} \quad \frac{4}{6}$$

$$\frac{3 \quad 3 \quad 4 \quad 2}{12}$$

$$\frac{9 \quad 8}{12}$$

$$\frac{17}{12}$$

RHS

$$\frac{4}{6} \quad \frac{3}{4}$$

$$\frac{4 \quad 2 \quad 3 \quad 3}{12}$$

$$\frac{8 \quad 9}{12}$$

$$\frac{17}{12}$$

LHS RHS

10. Given $a \quad \frac{2}{5}, b \quad \frac{7}{15}$

$a \quad b$

$$\frac{2}{5} \quad \frac{7}{15}$$

$$\frac{2 \quad 3 \quad 7 \quad 1}{15}$$

$$\frac{6 \quad 7}{15}$$

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

$b \quad a$

$$\frac{7}{15} \quad \frac{2}{5}$$

$$\frac{7 \quad 1 \quad 2 \quad 3}{15}$$

$$\frac{7 \quad 6}{15}$$

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

$a \quad b \quad b \quad a$

Exercise 1.3

1. (i) We have $\frac{4}{9} \quad \frac{3}{20}$

$$\frac{\cancel{4} \quad \cancel{3}}{\underset{3}{\cancel{9}} \quad \underset{5}{\cancel{20}}}$$

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

(ii) We have $\frac{84}{25} \quad \frac{15}{8}$

$$\frac{\overset{21}{\cancel{84}} \quad \overset{3}{\cancel{15}}}{\underset{5}{\cancel{25}} \quad \underset{2}{\cancel{8}}}$$

$$\frac{21 \quad 3}{5 \quad 2}$$

$$\frac{63}{10}$$

(iii) We have

$$\frac{12}{7} \quad \frac{10}{3}$$

$$\frac{\overset{4}{\cancel{12}}}{7} \quad \frac{10}{\cancel{3}}$$

$$\frac{4 \quad 10}{7}$$

$$\frac{40}{7}$$

(iv) We have

$$\frac{\cancel{5}}{9} \quad \frac{\cancel{6}}{\cancel{30}_{6}}$$

$$\frac{1}{9}$$

(v) We have

$$\frac{18}{4} \quad \frac{22}{24}$$

$$\frac{\overset{3}{\cancel{18}}}{\underset{2}{\cancel{4}}} \quad \frac{\overset{11}{\cancel{22}}}{\underset{4}{\cancel{24}}}$$

$$\frac{3}{2}\ \frac{11}{4}$$

$$\frac{33}{8}$$

(vi) We have $\frac{6}{7}\ \frac{77}{9}$

$$\frac{\overset{2}{\cancel{6}}}{\cancel{7}}\ \frac{\overset{11}{\cancel{77}}}{\underset{3}{\cancel{9}}}$$

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

$$\frac{22}{3}$$

2. (i) LHS

$$\frac{4}{\cancel{3}}\ \frac{\overset{2}{\cancel{6}}}{29}$$

$$\frac{8}{29}$$

RHS

$$\frac{\overset{2}{\cancel{6}}}{29}\ \frac{4}{\underset{1}{\cancel{3}}}$$

$$\frac{8}{29}$$

$$\frac{4}{3}\ \frac{6}{29}\ \frac{6}{29}\ \frac{4}{3}$$

(ii) LHS

$$\frac{3}{7}\ \frac{14}{27}$$

$$\frac{\cancel{3}}{7}\ \frac{\overset{2}{\cancel{14}}}{\underset{9}{\cancel{27}}}$$

$$\frac{2}{9}$$

RHS

$$\frac{14}{27}\ \frac{3}{7}$$

$$\frac{\overset{2}{\cancel{14}}}{\underset{9}{\cancel{27}}}\ \frac{\cancel{3}}{\cancel{7}}$$

$$\frac{2}{9}$$

$$\frac{3}{7}\ \frac{14}{27}\ \frac{14}{27}\ \frac{3}{7}$$

(iii) LHS

$$\frac{1}{3}\ \frac{2}{5}\ \frac{3}{7}$$

$$\frac{1}{3}\ \frac{14}{35}\ \frac{15}{}$$

$$\frac{1}{3}\ \frac{29}{35}$$

$$\frac{29}{105}$$

RHS

$$\frac{1}{3}\ \frac{2}{5}\ \frac{1}{3}\ \frac{3}{7}$$

$$\frac{2}{15}\ \frac{1}{7}$$

$$\frac{2}{}\ \frac{7}{}\ \frac{1}{}\ \frac{15}{105}$$

$$\frac{14}{}\ \frac{15}{105}$$

$$\frac{29}{105}$$

LHS RHS

(iv) LHS

$$\frac{3}{4}\ \frac{1}{2}\ \frac{2}{3}$$

$$\frac{3}{4}\ \frac{1}{}\ \frac{3}{}\ \frac{2}{}\ \frac{2}{6}$$

$$\frac{3}{4}\ \frac{3}{}\ \frac{4}{6}$$

$$\frac{\cancel{3}}{4}\ \frac{1}{\underset{2}{\cancel{6}}}$$

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

RHS

$$\frac{3}{4}\ \frac{1}{2}\ \frac{\cancel{3}}{\underset{2}{\cancel{4}}}\ \frac{\cancel{2}}{3}$$

$$\frac{3}{8}\ \frac{1}{2}$$

$$\frac{3}{}\ \frac{1}{}\ \frac{4}{8}$$

$$\frac{3}{}\ \frac{4}{8}\ \frac{1}{8}$$

LHS = RHS

(v) LHS

$$\frac{16}{15} \quad \frac{5}{2} \quad \frac{1}{2}$$

$$\frac{\overset{4}{\cancel{16}}}{15} \quad \frac{5}{\cancel{4}} \quad \frac{20}{15}$$

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

RHS

$$\frac{\overset{8}{\cancel{16}}}{\underset{5}{\cancel{15}}} \quad \frac{\overset{1}{\cancel{5}}}{\cancel{2}} \quad \frac{1}{2}$$

$$\frac{8}{5} \quad \frac{1}{2} \quad \frac{1}{2}$$

$$\frac{8}{5} \quad \frac{1}{2}$$

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

LHS = RHS

3. (i) To prove

$$\frac{3}{4} \quad \frac{6}{7} \quad \frac{2}{5}$$

LHS

$$\frac{3}{4} \quad \frac{6 \quad 5 \quad 2 \quad 7}{35}$$

$$\frac{3}{4} \quad \frac{30 \quad 14}{35}$$

$$\frac{3}{4} \quad \frac{16}{35}$$

$$\frac{3}{\cancel{4}} \quad \frac{\overset{4}{\cancel{16}}}{35}$$

$$\frac{12}{35}$$

RHS

$$\frac{3}{4} \quad \frac{6}{7} \quad \frac{3}{\underset{2}{\cancel{4}}} \quad \frac{\cancel{2}}{5}$$

$$\frac{3}{4} \quad \frac{6}{7} \quad \frac{3}{\underset{2}{\cancel{4}}} \quad \frac{\cancel{2}}{5}$$

$$\frac{3}{4} \quad \frac{6}{7} \quad \frac{3}{10}$$

$$\frac{8}{28} \quad \frac{3}{10}$$

$$\frac{9}{14} \quad \frac{3}{10}$$

$$\frac{9 \quad 5 \quad 3 \quad 7}{70}$$

$$\frac{45 \quad 21}{70}$$

$$\frac{24}{70}$$

$$\frac{12}{35}$$

LHS = RHS

(ii) LHS

$$\frac{5}{2} \quad \frac{1 \quad 11 \quad 6 \quad 9}{99}$$

$$\frac{5}{2} \quad \frac{11 \quad 54}{99}$$

$$\frac{5}{2} \quad \frac{43}{99}$$

$$\frac{215}{198}$$

$$\frac{5}{2} \quad \frac{1}{9} \qquad \frac{5}{2} \quad \frac{6}{11}$$

RHS

$$\frac{5}{18} \quad \frac{5 \quad 3}{11}$$

$$\frac{5}{18} \quad \frac{15}{11}$$

$$\frac{5 \quad 11 \quad 15 \quad 18}{198}$$

$$\frac{55 \quad 270}{198}$$

$$\frac{215}{198}$$

LHS = RHS

(iii) LHS

$$\frac{2}{7} \quad \frac{4}{5} \quad \frac{7}{9}$$

$$\frac{2}{7} \quad \frac{4 \quad 9 \quad 7 \quad 5}{45}$$

$$\frac{2}{7} \quad \frac{36 \quad 35}{45}$$

$\frac{2}{7} \quad \frac{71}{45}$

$\frac{142}{315}$

RHS

$\frac{2}{7} \quad \frac{4}{5} \quad \frac{2}{7} \quad \frac{7}{9}$

$\frac{8}{35} \quad \frac{2}{9}$

$\frac{8 \quad 9 \quad 2 \quad 35}{315}$

$\frac{72 \quad 70}{315}$

$\frac{142}{315}$

LHS = RHS

(iv) To prove

$\frac{1}{2} \quad \frac{2}{3} \quad \frac{3}{4}$

$\frac{1}{2} \quad \frac{2}{3} \quad \frac{1}{2} \quad \frac{3}{4}$

LHS

$\frac{1}{2} \quad \frac{2 \quad 4 \quad 3 \quad 3}{12}$

$\frac{1}{2} \quad \frac{8 \quad 9}{12}$

$\frac{1}{2} \quad \frac{17}{12}$

$\frac{17}{24}$

RHS

$\frac{1}{2} \quad \frac{2}{3} \quad \frac{1}{2} \quad \frac{3}{4}$

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

$\frac{1 \quad 8 \quad 3 \quad 3}{24}$

$\frac{8 \quad 9}{24}$

$\frac{17}{24}$

4. (i) To prove

$\frac{5}{4} \quad \frac{7}{6} \quad \frac{3}{5}$

$\frac{5}{4} \quad \frac{7}{6} \quad \frac{5}{4} \quad \frac{3}{5}$

LHS

$\frac{5}{4} \quad \frac{7 \quad 5 \quad 3 \quad 6}{30}$

$\frac{5}{4} \quad \frac{35 \quad 18}{30}$

$\frac{5}{4} \quad \frac{53}{30}$

$\frac{26}{120} \quad \frac{53}{24}$

RHS

$\frac{5}{4} \quad \frac{7}{6} \quad \frac{5}{4} \quad \frac{3}{5}$

$\frac{35}{24} \quad \frac{3}{4}$

$\frac{35 \quad 5 \quad 3 \quad 30}{120}$

$\frac{175 \quad 90}{120}$

$\frac{265}{120} \quad \frac{53}{24}$

LHS RHS

(ii) To prove

$\frac{7}{4} \quad \frac{3}{10} \quad \frac{7}{9}$

LHS

$\frac{7}{4} \quad \frac{3 \quad 9 \quad 7 \quad 10}{90}$

$\frac{7}{4} \quad \frac{27 \quad 70}{90}$

$\frac{301}{360}$

RHS

$\frac{7}{4} \quad \frac{3}{10} \quad \frac{7}{4} \quad \frac{7}{9}$

$\frac{21}{40} \quad \frac{49}{36}$

$\frac{21 \quad 9 \quad 49 \quad 10}{360}$

$\frac{189 \quad 490}{360}$

$\frac{301}{360}$

LHS = RHS

(iii) To prove

$\frac{7}{9} \quad \frac{4}{5} \quad \frac{3}{7}$

$\frac{7}{9} \quad \frac{4 \quad 7 \quad 3 \quad 5}{35}$

$\frac{7}{9} \quad \frac{28 \quad 15}{35}$

$\frac{\cancel{7}}{9} \quad \frac{13}{\cancel{35}_{5}}$

$\frac{13}{45}$

RHS

$\frac{7}{9} \quad \frac{4}{5} \quad \frac{\cancel{7}}{\cancel{9}_{3}} \quad \frac{\cancel{3}}{\cancel{7}}$

$\frac{28}{45} \quad \frac{1}{3}$

$\frac{28 \quad 1 \quad 1 \quad 15}{45}$

$\frac{28 \quad 15}{45} \quad \frac{13}{45}$

LHS RHS

(iv) LHS

$\frac{1}{2} \quad \frac{2}{3} \quad \frac{3}{5}$

$\frac{1}{2} \quad \frac{2 \quad 5 \quad 3 \quad 3}{15}$

$\frac{1}{2} \quad \frac{10 \quad 9}{15}$

$\frac{1}{2} \quad \frac{1}{15}$

$\frac{1}{30}$

RHS

$\frac{1}{2} \quad \frac{2}{3} \quad \frac{1}{2} \quad \frac{3}{5}$

$\frac{1}{3} \quad \frac{3}{10}$

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

$\frac{10 \quad 9}{30} \quad \frac{1}{30}$

LHS RHS

5. (i) $\frac{23}{17} \quad \frac{18}{35} \quad \frac{18}{35} \quad \square$

(ii) $38 \quad \frac{7}{19} \quad \frac{7}{19} \quad \square$

(iii) $\frac{15}{7} \quad \frac{21}{10} \quad \frac{5}{6}$

$\square \quad \frac{21}{10} \quad \frac{5}{6}$

(iv) $\frac{12}{15} \quad \frac{4}{15} \quad \frac{25}{16}$

$\frac{12}{15} \quad \frac{4}{15} \quad \square$

(v) $\frac{4}{5} \quad \frac{5}{7} \quad \frac{8}{9} \quad \frac{4}{5} \quad \square \quad \frac{8}{9}$

(vi) $\frac{2}{5} \quad \frac{2}{5} \quad \square$

(vii) $\frac{4}{11} \quad \square \quad 1$

(viii) $\square \quad 1 \quad \frac{7}{16}$

(ix) $\frac{11}{15} \quad \square \quad 1$

(x) $\frac{4}{9} \quad \square \quad \frac{4}{9}$

6. To prove $x \quad y \quad y \quad x$

If $x \quad \frac{2}{5}, y \quad \frac{3}{7}$

(i) LHS | RHS

$\frac{2}{5} \quad \frac{3}{7}$ | $\frac{3}{7} \quad \frac{2}{5}$

$\frac{6}{35}$ | $\frac{6}{35}$

$x \quad y \quad y \quad x$

If $x \quad \frac{2}{5} \; y \quad \frac{3}{7}$

To prove

(ii) $x \quad y \quad y \quad x$ If $x \quad \frac{12}{15} \; y \quad \frac{15}{4}$

LHS	RHS
$\frac{12}{25} \quad \frac{15}{4}$	$\frac{15}{4} \quad \frac{12}{25}$
$\frac{\overset{3}{\cancel{12}}}{\underset{5}{\cancel{25}}} \quad \frac{\overset{3}{\cancel{15}}}{\cancel{4}}$	$\frac{\overset{3}{\cancel{15}}}{\cancel{4}} \quad \frac{\overset{3}{\cancel{12}}}{\underset{5}{\cancel{25}}}$
$\frac{3 \quad 3}{5}$	$\frac{3 \quad 3}{5}$
$\frac{9}{5}$	$\frac{9}{5}$

$x \quad y \quad y \quad x$ if $x \quad \frac{12}{25}, y \quad \frac{15}{4}$

7. (i) To prove $(x \quad y) \quad z \quad x \quad (y \quad z)$

If $x \quad \frac{7}{23}, y \quad \frac{5}{19}, z \quad \frac{1}{2}$

LHS $\frac{7}{23} \quad \frac{5}{19} \quad \frac{1}{2}$

$\frac{35}{437} \quad \frac{1}{2}$

$\frac{35}{874}$

RHS $\frac{7}{23} \quad \frac{5}{19} \quad \frac{1}{2}$

$\frac{7}{23} \quad \frac{5}{38}$

$\frac{35}{874}$

LHS = RHS

(ii) To prove $(x \quad y) \quad z \quad x \quad (y \quad z)$

If $x \quad \frac{9}{28}, y \quad \frac{7}{5}, z \quad \frac{5}{3}$

LHS $\frac{9}{28} \quad \frac{7}{5} \quad \frac{5}{3}$

$\frac{9 \quad \cancel{7}}{\underset{4}{\cancel{28}} \quad 5} \quad \frac{5}{3}$

$\frac{9}{20} \quad \frac{5}{3}$

$\frac{\overset{3}{\cancel{39}} \quad \cancel{5}}{\underset{4}{\cancel{20}} \quad 3}$

$\frac{3}{4}$

RHS

$\frac{9}{28} \quad \frac{7}{5} \quad \frac{5}{3}$

$\frac{9}{28} \quad \frac{7 \quad \cancel{5}}{\cancel{5} \quad 3}$

$\frac{9}{28} \quad \frac{7}{3}$

$\frac{\overset{3}{\cancel{9}} \quad 7}{\underset{4}{\cancel{28}} \quad \cancel{3}}$

$\frac{3}{4}$

LHS RHS

8. (i) To prove

$\frac{3}{5} \quad \frac{7}{12} \quad \frac{5}{18} \quad \frac{3}{5} \quad \frac{7}{12} \quad \frac{5}{18}$

LHS

$\frac{3}{5} \quad \frac{7}{12} \quad \frac{5}{18}$

$\frac{3}{5} \quad \frac{12}{7} \quad \frac{18}{5}$

$\frac{36}{35} \quad \frac{18}{5}$

$\frac{648}{175}$

RHS

$\frac{3}{5} \quad \frac{7}{\underset{2}{12}} \quad \frac{\overset{6}{18}}{5}$

$\frac{3}{5} \quad \frac{42}{10}$

$\frac{3}{5} \quad \frac{10}{42}$

$\frac{\overset{1}{\cancel{3}} \quad \overset{2}{\cancel{10}}}{\cancel{5} \quad \underset{14}{\cancel{42}}}$

$\frac{2}{14}$

$\frac{1}{7}$

LHS RHS

(ii) To prove

$$2 \quad \frac{25}{8} \quad \frac{35}{12} \qquad 2 \quad \frac{25}{8} \quad \frac{35}{12}$$

LHS

$$2 \quad \frac{25}{8} \quad \frac{35}{12}$$

$$2 \quad \frac{8}{25} \quad \frac{12}{35}$$

$$\frac{2 \quad 8}{25} \quad \frac{12}{35}$$

$$\frac{16}{25} \quad \frac{12}{35}$$

$$\frac{192}{875}$$

RHS

$$2 \quad \frac{25}{8} \quad \frac{12}{35}$$

$$2 \quad \frac{\overset{5}{\cancel{25}} \quad \overset{6}{\cancel{12}}}{\underset{2}{\cancel{8}} \quad \underset{7}{\cancel{35}}}$$

$$2 \quad \frac{5 \quad \overset{3}{\cancel{6}}}{\cancel{2} \quad 7}$$

$$2 \quad \frac{15}{7}$$

$$2 \quad \frac{7}{15}$$

$$\frac{14}{15}$$

$\because$ LHS RHS

Exercise 1.4

1. (i) 5 Rational numbers between 0 and 1 are
0.1, 0.2, 0.3, 0.4, 0.5

(ii) 5 rational numbers between 1, 2 are
– 1.1, – 1.2, – 1.3, – 1.4, – 1.5

2. Three rational number between
2 are 3 are
– 2.1 – 2.2, – 2.3

3. We have $\frac{3}{2}, \frac{4}{3}$ or $\frac{3 \quad 3}{2 \quad 3}, \frac{4 \quad 2}{3 \quad 2}$

$$\frac{9}{6}, \frac{8}{6}$$

five rational numbers between
$\frac{3}{2}$ and $\frac{4}{3}$ are $\frac{8}{6}, \frac{7}{6}, \frac{6}{6}, \frac{5}{6}, \frac{4}{6}$

4. We have 1 and $\frac{1}{2}$

or 1 and – 0.5
four rational numbers between
1 and – 0.5 are – 0.6, – 0.7, – 0.8, – 0.9

5. We have $\frac{3}{4}$ and $\frac{2}{3}$

Ist R. No. $\frac{1}{2} \quad \frac{3}{4} \quad \frac{2}{3}$

$$\frac{1}{2} \quad \frac{9 \quad 8}{12}$$

$$\frac{17}{24}$$

IInd R. No. $\frac{1}{2} \quad \frac{3}{4} \quad \frac{17}{24}$

$$\frac{1}{2} \quad \frac{18 \quad 17}{24}$$

$$\frac{35}{48}$$

3rd R. No. $\frac{1}{2} \quad \frac{17}{24} \quad \frac{2}{3}$

$$\frac{1}{2} \quad \frac{17 \quad 16}{24}$$

$$\frac{33}{48}$$

$$\frac{3}{4}, \frac{35}{48}, \frac{17}{24}, \frac{33}{48}, \frac{2}{3}$$

4th Rational No. $\frac{1}{2} \quad \frac{3}{4} \quad \frac{35}{48}$

$$\frac{1}{2} \quad \frac{3 \quad 12 \quad 35}{48}$$

$$\frac{1}{2} \quad \frac{12 \quad 35}{48}$$

$$\frac{47}{96}$$

four R. No. between $\frac{3}{4}$ and $\frac{2}{3}$ are

$$\frac{47}{96}, \frac{35}{48}, \frac{17}{24}, \frac{33}{48}$$

6. We have $\frac{3}{8}, \frac{1}{2}$

or $\frac{3}{8}\ \frac{1}{1}, \frac{1}{2}\ \frac{4}{4}$

$\frac{3}{8}, \frac{4}{8}$

Six Rational numbers between $\frac{3}{8}, \frac{1}{2}$ are

$\frac{2}{8}, \frac{1}{8}, 0, \frac{1}{8}, \frac{2}{8}, \frac{3}{8}$

7. We have x and $|x|$

$\frac{5}{11}$ and $\left|\frac{5}{11}\right|$

$\frac{5}{11}$ and $\frac{5}{11}$

Eight R. No between $\frac{5}{11}$ and $\frac{5}{11}$ are

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

8. Three R. No. between 5 and 5.6 can be 5.1, 5.2, 5.3

9. R. No between $\frac{5}{7}$ and $\frac{4}{9}$ $\frac{1}{2}\ \frac{5}{7}\ \frac{4}{9}$

$\frac{1}{2}\ \frac{5\ \ 9\ \ 4\ \ 7}{63}$

$\frac{1}{2}\ \frac{45\ \ 28}{63}$

$\frac{73}{126}$

$\frac{5}{7}, \frac{73}{126}, \frac{4}{9}$

$\frac{5\ \ 18, 73, 4\ \ 14}{126}$

$\frac{90, 73, 56}{126}$

Ascending order is $\frac{4}{9}\ \ \frac{73}{126}\ \ \frac{5}{7}$

10. R. No. between $\frac{2}{9}$ and $\frac{3}{8}$ $\frac{1}{2}\ \frac{2}{9}\ \frac{3}{8}$

$\frac{1}{2}\ \frac{2\ \ 8\ \ 3\ \ 9}{72}$

$\frac{1}{2}\ \frac{16\ \ 27}{72}$

$\frac{43}{144}$

$\frac{2}{9}, \frac{43}{144}, \frac{3}{8}$

or $\frac{2\ \ 16, 43, 3\ \ 18}{144}$

$\frac{32, 43, 54}{144}$

descending order $\frac{3}{8}\ \ \frac{43}{144}\ \ \frac{2}{9}$

2 Squares and Square Roots

Exercise 2.1

1. We have

(i) 49 7 7 Yes it is a perfect square

(ii) 64 8 8 Yes it as a perfect square

(iii) 110 2 5 11 No it is not a perfect square

(iv) 121 11 11 Yes 121 is a perfect square

(v) 256 16 16 Yes 216 is a perfect square

(vi) 321 3 107 No 321 is a not a perfect square

(vii) 351 3 13 3 3 No 351 is not a perfect square

(viii) 400 20 20 Yes 400 is a perfect square

(ix) 120 2 2 2 3 5 No 120 is not a perfect square

(x) 215 5 43 No 215 is not a perfect square

2. (i) 16 4^2 Yes it is a square of even no,

(ii) 121 11^2 No it is not a square of even no

(iii) 256 16^2 Yes it is a square of even number

(iv) 169 13^2 No it is not a square of even number

(v) 324 18^2 Yes it is a square of even number

(vi) 400 20^2 Yes it is a square of even number

(vii) 676 26^2 Yes it is a square of even number

(viii) 841 29^2 No it is not a square even number

(ix) 333 It is not a square of even number

(x) 225 15^2 It is not a square of even number

3. (i) 9 3^2 Yes it is a square of odd number

(ii) 36 6^2 No it is not a square of odd number

(iii) 100 10^2 No it is not a square of odd number

(iv) 164 13^2 Yes it is a square of odd number

(v) 225 15^2 Yes it is a square of odd number

(vi) 289 17^2 Yes it is a square of odd number

(vii) 484 22^2 Not is a not a square of odd no.

(viii) 729 27^2 Yes it is not a square of odd no.

(ix) 576 24^2 Yes it is not a square of odd no.

(x) 6400 80^2 Not is it not a square of odd no.

4. (i) 140 2 2 5 7

No 140 is not a perfect square

(ii) 360 2 2 2 3 5

No 360 is not a perfect square

(iii) 625 5 5 5 5

Yes 625 is a perfect square

(iv) 1296

2 2 2 2 3 3 3

Yes 1296 is a perfect square

5. (i) (3, 4, 5)

3^2 9, 4^2 16, 5^2 25

$\because$ 3^2 4^2 5^2

Yes (3, 4 5) are pythagorean triplet

(ii) (6, 7, 8)

6^2 36, 7^2 49, 8^2 64

$\because$ 8^2 6^2 7^2

(6, 7, 8) are not pythagorean triplet

(iii) We have (12, 35, 37)

12^2 144, 35^2 1225, 37^2 1369

$\because$ 37^2 35^2 12^2

(12, 35, 37) are pythagorean triplet

(iv) We have (8, 15, 17)

17^2 289, 15^2 225, 8^2 64

$\because$ 17^2 15^2 8^2

(8, 15, 17) is pythagorean triplet

6. (i) 37^2 36^2 (37 36)(37 36)

73 1

73

(ii) 93^2 92^2 (93 92)(93 92)

185 1

185

(iii) 107^2 106^2

(107 106) (107 106)

213 1

213

(iv) 649^2 648^2

(649 648)(649 648)

1297 1

1297

(v) 403^2 402^2

(403 402)(403 402)

805 1

805

(vi) 188^2 187^2

(188 187)(188 187)

375 1

375

7. 1764 2 2 3 3 7 7

Yes 1764 is perfect square

8. 1228 $\underline{2\ \ 2}$ $\underline{2\ \ 2}$ $\underline{2\ \ 2}$

$\underline{2\ \ 2}$ $\underline{2\ \ 2}$ 2

No 1228 is not a perfect square

9. Greatest two digit number = 99

	9
9	99
	81
	18

99 18 81 is largest two digit number is a perfect square

10. Least five digit number 10000

100 100

100^2

10000 is a least five digit number which is a perfect square

11. 1 3 5 7 4^2 16

1 3 5 .. 15 8^2 64

1 3 5 … 21 11^2 121

12. 7^2 49

67^2 4489

667^2 444889

6667^2 44448889

13. We have 12168

Prime factors of 12168 are

2	12168
2	6084
2	3042
3	1521
3	507
13	169
13	13
	1

$\underline{2\ \ 2}$ 2 $\underline{3\ \ 3}$ $\underline{13\ \ 13}$

12168 should be divided by 2 to make it a perfect square.

15. We have 6598

	82
8	6598
	64
162	198
	324
	126

126 should be added to make it a perfect square

6598 126 6724 is a perfect square

Exercise 2.2

1. (i) $\sqrt{625}$

5	625
5	125
5	5
	5

$\sqrt{5\ \ 5\ \ 5\ \ 5}$

5 5

$\sqrt{625}$ 25

(ii) $\sqrt{1296}$

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

$\sqrt{\underline{2\ \ 2}\ \ \underline{2\ \ 2}\ \ \underline{3\ \ 3}\ \ \underline{3\ \ 3}}$

2 2 3 3

$\sqrt{1296}$ 36

(iii) $\sqrt{1764}$

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

$\sqrt{\underline{2\ \ 2}\ \ \underline{3\ \ 3}\ \ \underline{7\ \ 7}}$

2 3 7 42

(iv) $\sqrt{4096}$

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
	2

$\sqrt{\underline{2\ \ 2}\ \ \underline{2\ \ 2}\ \ \underline{2\ \ 2}\ \ \underline{2\ \ 2}}$

$\sqrt{\ \ \underline{2\ \ 2}\ \ \underline{2\ \ 2}}$

2 2 2 2 2 2

64

(v) $\sqrt{5929}$

7	5929
7	847
11	121
11	11
	1

$\sqrt{\underline{7\ \ 7}\ \ \underline{11\ \ 11}}$

7 11 77

(vi) $\sqrt{1521}$

3	1521
3	507
13	169
	13

$\sqrt{\underline{3\ \ 3}\ \ \underline{13\ \ 13}}$

3 13 39

(vii) $\sqrt{11664}$

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

$\sqrt{\underline{2\ \ 2}\ \ \underline{2\ \ 2}\ \ \underline{3\ \ 3}}$

$\sqrt{\ \ \underline{3\ \ 3}\ \ \underline{3\ \ 3}}$

2 2 3 3 3

108

(viii) $\sqrt{47089}$

7	47089
7	6727
31	961
	31

$\sqrt{\underline{7\ \ 7}\ \ \underline{31\ \ 31}}$

7 31 217

2. (i) $\sqrt{\frac{625}{1296}}$

$\sqrt{\overline{2\ 2\ 2\ 2\ 3\ 3\ 3\ 3}}$ $\quad$ 5 5 5 5

$\overline{2\ 2\ 3\ 3}$ $\quad$ 5 5

$\frac{25}{36}$

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

$\sqrt{\frac{23\ \ 23}{29\ \ 29}}$

$\frac{23}{29}$

(iii) $\sqrt{2\frac{14}{25}}$

$\sqrt{\frac{65}{25}}$

$\sqrt{\overline{2\ 2\ 2\ 2\ 2\ 2}}$ $\quad$ 5 5

$\overline{5}$ $\quad$ 2 2 2

$\frac{8}{5}$

$1\frac{3}{5}$

(iv) $\sqrt{23\frac{26}{121}}$

$\sqrt{\frac{2809}{121}}$

$\sqrt{\frac{53\ \ 53}{11\ \ 11}}$

$\frac{53}{11}$

$4\frac{9}{11}$

(v) $\sqrt{\frac{2025}{169}}$

$\sqrt{\overline{3\ 3\ 3\ 3\ 5\ 5}}$ $\quad$ 13 13

$\overline{13}$ $\quad$ 3 3 5

$\frac{45}{13}$

(vi) $\sqrt{\frac{1156}{2025}}$

$\sqrt{\overline{3\ 3\ 3\ 3\ 5\ 5}}$ $\quad$ 2 2 17 17

$\overline{3\ 3\ 5}$ $\quad$ 2 17

$\frac{34}{45}$

(vii) $\sqrt{144\ \ 676}$

$\sqrt{(2\ 2\ 2\ 2\ 3\ 3)}$ $\quad$ (2 2 13 13)

2 2 3 2 13

312

(viii) $\sqrt{135\ \ 60}$

$\sqrt{(3\ 3\ 3\ 5)}$ $\quad$ (2 2 3 5

2 3 3 5

90

3	135
3	45
3	15
5	5
	1

3. Let number of rows x

$x^2 \quad 1764$

$x \quad \sqrt{1764}$

$\sqrt{6\ \ 6\ \ 7\ \ 7}$

6 7

No. of rows = 42

4. Let number of soldiers in a row x

$x \quad x \quad 6400$

$x^2 \quad 6400$

$x \quad \sqrt{6400}$

$\sqrt{80\ \ 80}$

number of soldiers in a row = 80

5. Let number of rows in a garden x

$x \quad x \quad 2304$

$x^2 \quad 2304$

$x \quad \sqrt{2304}$

$\sqrt{48\ \ 48}$

number of rows = 48

Exercise 2.3

1. (i) We have 54756

	234
2	$5\overline{47}\,\overline{56}$
	4
43	147
	129
46	1856
	1856
	×

$\sqrt{54756}$ 234

(ii) We have 390625

	625
6	$\overline{39}\,\overline{06}\,\overline{25}$
	36
122	306
	244
1245	6225
	6225
	×

$\sqrt{390625}$ 625

(iii) We have 18225

	135
1	$1\overline{82}\,\overline{25}$
23	1
	82
26	69
	1325
	– 1325
	×

$\sqrt{18225}$ 135

(iv) We have 291600

	540
5	$\overline{29}\,\overline{16}\,\overline{00}$
	25
104	416
	416

$\sqrt{291600}$ 540

(v) We have 62504836

	7906
7	$\overline{62}\,\overline{50}\,\overline{48}\,\overline{36}$
	49
149	1350
	1341
1580	94836
	– 94836

$\sqrt{62504836}$ 7906

(vi) We have 20421361

	4519
4	$\overline{20}\,\overline{42}\,\overline{13}\,\overline{67}$
	16
85	442
	425
901	1713
	901
9029	81261
	81261
	×

$\sqrt{20421361}$ 4519

(vii) We have 11025

	105
1	$1\overline{10}\,\overline{25}$
	1
205	1025
	1025
	×

$\sqrt{11025}$ 105

(viii) We have 97344

	3 1 2
3	$9\,\overline{73}\,\overline{44}$
	9
61	7 3
	– 6 1
622	1 2 4 4
	– 1 2 4 4

$\sqrt{97344}$ 312

(ix) We have 974169

	987
9	$\overline{97}\,\overline{41}\,\overline{69}$
	81
188	1641
	1504
1967	13769
	–13769
	×

$\sqrt{974169}$ 987

(x) We have 1745041

	1321
1	$1\overline{74}\,\overline{50}\,\overline{41}$
	1
23	7 4
	6 9
262	5 5 0
	– 5 2 4
2641	2 6 4 1
	– 2 6 4 1
	×

$\sqrt{1745041}$ 1321

(xi) We have 4008004

	2002
2	$4\,\overline{00}\,\overline{80}\,\overline{04}$
	4
4002	0 0 8 0 0 4
	8 0 0 4
	×

$\sqrt{4008004}$ 2002

(xii) We have 720801

	849
8	$\overline{72}\,\overline{08}\,\overline{01}$
	6 4
164	8 0 8
	6 5 6
1689	1 4 2 0 1
	– 1 4 2 0 1
	×

$\sqrt{720801}$ 849

2. (i) $\sqrt{\dfrac{36}{225}}$

	6
6	36
	36
	×

	15
1	225
	1
25	125
	125
	×

$\sqrt{\dfrac{36}{225}}$ $\dfrac{\sqrt{36}}{\sqrt{225}}$

$\dfrac{6}{15}$

(ii) $\sqrt{\dfrac{1681}{4225}}$

	41
4	1681
	16
8	81
	– 81
	×

	65
6	$\overline{42}\,\overline{25}$
	36
125	625
	– 625

$\sqrt{\dfrac{1681}{4225}}$ $\dfrac{\sqrt{1681}}{\sqrt{4225}}$ $\dfrac{41}{65}$

(iii) $\sqrt{\dfrac{1764}{121}}$

	42
4	1764
	16
82	164
	162
	×

	11
1	121
	1
2	21
	21
	0

$\sqrt{\dfrac{1714}{14}}$ $\dfrac{\sqrt{1764}}{\sqrt{121}}$ $\dfrac{42}{11}$

(iv) $\sqrt{\dfrac{2704}{1681}}$

	52
5	2704
	25
102	204
	204
	×

	41
4	1681
	16
81	81
	81
	×

$\sqrt{\dfrac{2704}{1681}}$ $\dfrac{\sqrt{2704}}{\sqrt{1681}}$ $\dfrac{52}{41}$

(v) $\sqrt{\dfrac{7725}{2704}}$

	85
8	7725
	64
165	825
	825
	×

	52
8	2704
	25
102	204
	204
	×

$\dfrac{\sqrt{7725}}{\sqrt{2704}}$

$\dfrac{85}{52}$

(vi) $\sqrt{\dfrac{3364}{2704}}$

	58
5	3364
	25
108	864
	864
	×

	52
5	2704
	25
102	204
	204
	×

$\dfrac{\sqrt{3364}}{\sqrt{2704}}$ $\dfrac{58}{52}$

(vii) $\sqrt{17\frac{16}{25}}$ $\sqrt{\frac{441}{25}}$

	21
5	441
	4
108	41
	41
	×

	5
5	25
	25
	×

$\frac{\sqrt{441}}{\sqrt{25}}$ $\frac{21}{5}$

$6\frac{1}{5}$

(viii) $\sqrt{33\frac{1}{16}}$ $\sqrt{\frac{529}{16}}$

	23
2	529
	4
43	129
	129
	×

	4
4	16
	16
	×

$\frac{\sqrt{529}}{\sqrt{16}}$

$\frac{23}{4}$

(ix) $\sqrt{205\frac{4}{9}}$ $\sqrt{\frac{1849}{9}}$

	43
4	1849
	16
83	249
	249
	×

$\frac{43}{3}$

$14\frac{1}{3}$

(x) $\sqrt{104\frac{1}{25}}$ $\sqrt{\frac{2601}{25}}$

	51
4	2601
	25
83	101
	101
	×

	5
5	25
	25
	×

$\frac{\sqrt{2601}}{\sqrt{25}}$

$\frac{51}{5}$

$10\frac{1}{5}$

(xi) $\sqrt{38\frac{11}{25}}$ $\sqrt{\frac{961}{25}}$

	31
3	961
	9
61	61
	61
	×

	5
3	25
	25
	×

$\frac{\sqrt{961}}{\sqrt{25}}$

$\frac{31}{5}$

$6\frac{1}{5}$

(xii) $\sqrt{10\frac{151}{225}}$ $\sqrt{\frac{2401}{225}}$

	49
4	2401
	16
89	801
	801
	×

	15
1	225
	1
25	125
	125
	×

$\sqrt{\frac{2401}{225}}$

$\frac{\sqrt{2401}}{\sqrt{225}}$

$\frac{49}{15}$

$3\frac{4}{15}$

3. Ar of square field = 729 m^2

Side^2 729

Side $= \sqrt{729}$

	27
2	729
	4
47	329
	329
	×

Side = 27 m.

4. Ar of square field = $205\frac{4}{9}$

Side^2 $\frac{1849}{9}$

Side $\sqrt{\frac{1849}{9}}$

$\frac{\sqrt{1849}}{\sqrt{9}}$

	43
4	1849
	16
83	249
	249
	×

Side of square field $\frac{43}{3}$

Perimeter of square field $\frac{43}{3}$ 4

$\frac{172}{3}$ m

Perimeter of Square field $57\frac{1}{3}$ m

Exercise 2.4

1. We have $\sqrt{445.21}$

	21.1
2	$\overline{4}\,\overline{45}.\overline{21}$
	4
41	45
	41
421	421
	421
	×

$\sqrt{445.21}$ 21.1

(ii) We have $\sqrt{1043.29}$

	32.3
3	$\overline{10}\,\overline{43}.\ \overline{29}$
	9
62	143
	124
643	1929
	1929
	×

$\sqrt{1043.29}$ 32.3

(iii) We have $\sqrt{425.5969}$

	20.63
2	$\overline{4}\,\overline{25}.\overline{59}\,\overline{69}$
	2
406	2559
	2436
4123	12369
	–12369
	×

$\sqrt{425.5969}$ 20.63

(iv) We have $\sqrt{8103.6004}$

	90.02
9	$\overline{81}\,\overline{03}.\overline{60}\,\overline{04}$
	81
1800	036004
	– 36004
	×

$\sqrt{8103.6004}$ 90.02

(v) We have $\sqrt{0.053824}$

	0.232
2	$0.\overline{05}\,\overline{38}\,\overline{24}$
	4
43	138
	129
462	924
	924
	×

$\sqrt{0.053824}$ 0.232

(vi) We have 0.00367236

	0.00606
6	$0.\overline{00}\,\overline{36}\,\overline{72}\,\overline{36}$
	36
1206	7236
	– 7236
	×

$\sqrt{0.00367236}$ 0.0606

(vii) We have $\sqrt{225.6004}$

	15.02
1	$\overline{22}\,5.\overline{60}\,\overline{04}$
	1
25	125
	125
3002	6004
	– 6004
	×

$\sqrt{225.6004}$ 15.02

(viii) We have $\sqrt{99.980001}$

	9.999
9	99.980001
	81
188	1898
	1701
1989	18700
	17901
19989	179901
	179901
	×

$\sqrt{99.980001}$ 9.999

(ix) We have $\sqrt{0.038809}$

	0.197
1	$0.\overline{03}\,\overline{88}\,\overline{09}$
	1
29	288
	261
387	1709
	1709
	×

$\sqrt{0.038809}$ 0.197

(ix) We have $\sqrt{10302.25}$

	101 . 5
1	10 302 . 25
	1
201	0302
	201
2025	101 25
	– 101 25
	×

$\sqrt{10302.25}$ 101.5

Exercise 2.4

2. (i) We have $\sqrt{9.068}$

	3.0113
3	9.068000
	9
601	0 0680
	601
6021	7900
	6021
60223	187900
	180669
	7231

$\sqrt{9.068}$ 3.0113

or 3.011(correct to three decimal places)

(ii) $\sqrt{65.78}$

	8.1004
8	65.78
	64
161	178
	161
162	1700
	1621
162204	790000
	648816
	41184

$\sqrt{65.78}$ 8.1104

8.110

(correct to three decimal places)

(iii) We have, $\sqrt{750.8978}$

	27.4025
2	750.8978
	4
47	350
	329
544	2189
	2176
54802	137800
	109604
548045	2819600
	2740225
	78375

$\sqrt{750.8978}$ 27.403

(correct to three decimal places)

(iv) $\sqrt{89.05}$

	9.4366
9	89.05
	81
184	805
	736
1883	6900
	5649
18866	125100
	113196
188726	1190400
	1132356
	58044

$\sqrt{89.05}$ 9.437

(correct to three decimal places)

(v) $\sqrt{35.3869}$

	5.9486
5	35.3869
	25
109	1038
	981
1184	5769
	4736
11888	103300
	95104
118966	819600
	– 713796
	105804

$\sqrt{35.3869}$ 5.949
correct to three decimal places

(vi) $\sqrt{12.0145}$

	3.4661
9	12.0145
	9
64	301
	256
686	4554
	4116
6926	42900
	41556
69321	134400
	69321
	65079

$\sqrt{12.0145}$ 3.466
(correct to three decimal places)

(vii) $\sqrt{2.333}$

	1.5274
1	2.333
	1
25	133
	125
302	830
	604
3047	22600
	21329
30544	127100
	122176
	4924

$\sqrt{2.333}$ 1.527
(correct to three decimal places)

(viii) $\sqrt{0.012312}$

	0.1109
1	$\overline{0}.\overline{01}\,\overline{23}\,\overline{12}$
	1
21	023
	21
2209	21200
	19881
	1319

$\sqrt{0.012312}$ 0.111
(correct to three decimal places)

(ix) $\sqrt{0.221}$

	0.4701
4	$0.\overline{22}\,\overline{10}$
	16
87	610
	609
9401	10000
	9401
	599

$\sqrt{0.221}$ 0.470

(correct to three decimal places)

(x) $\sqrt{2.49}$

	1.5779
1	2.49
	1
25	149
	125
307	2400
	2149
3147	25100
	22029
	3071

$\sqrt{2.49}$ 1.578

(correct to three decimal places)

3. (i) $\sqrt{7}$

	2.645
2	7.000000
	4
46	300
	276
524	2400
	2096
5285	30400
	26425
	3975

$\sqrt{7}$ 2.65

(correct to two decimal places)

(ii) $\sqrt{17}$

	4.123
4	17.000000
	16
81	100
	81
822	1900
	1644
8243	25600
	24729
	871

$\sqrt{17}$ 4.12

(correct to two decimal places)

(iii) $\sqrt{20}$

	4.472
4	20.000000
	16
84	400
	336
887	6400
	6209
8942	19100
	17884
	1216

$\sqrt{20}$ 4.47
(correct to two decimal places)

(iv) $\sqrt{66}$

	8.124
8	66.000000
	64
161	200
	161
1622	3900
	3244
16244	65600
	64976
	624

$\sqrt{66}$ 8.12
(correct to two decimal places)

(v) $\sqrt{427}$

	20.663
2	427.000000
	4
4061	02700
	2436
4126	26400
	24756
41323	164400
	123969
	40431

$\sqrt{427} = 20.66$
(correct to two places of decimal)

(vi) $\sqrt{1000}$

	31.622
3	1000.000000
	9
61	100
	61
626	3900
	3756
6322	14400
	12644
63242	175600
	126482
	49318

$\sqrt{1000}$ 31.62
(correct to two places of decimal)

4. To find $\sqrt{2}$

	1.414
1	2.000000
	1
24	100
	96
281	400
	281
2824	11900
	11296
	604

$\sqrt{2}$ 1.41
(correct to two places of decimal)
$\sqrt{2}$ 1.4
(correct to two significant figures)

5. $\sqrt{253.6}$

	15.92
1	253.60000000
	1
25	153
	125
309	860
	2781
31821	7900
	6364
	1536

$\sqrt{253.6}$ 15.9

(correct to three significant figure)

6. $\sqrt{15625}$

	125
1	15625
	1
22	56
	44
245	1225
	1225
	×

$\sqrt{15625}$ 125

$\sqrt{156.25}$ $\sqrt{1.5625}$

= 12.5 1.25

13.75

7. We have $\sqrt{99225}$

	315
3	99225
	9
61	92
	61
625	3125
	3125
	×

$\sqrt{99225}$ 315

$\sqrt{992.25}$ $\sqrt{9.9225}$

31.5 3.15

28.35

8. We have $\sqrt{5929}$

	77
7	5929
	49
147	1029
	1029
	×

	23
2	529
	4
43	129
	129
	×

$\sqrt{5929}$ 77

We have

$\sqrt{59.29}$ $\sqrt{5.29}$

$\sqrt{59.29}$ $\sqrt{5.29}$

7.7 - 2.3

7.7 2.3

5.4

10

= 0.54

(ii) $\sqrt{2304}$

	48
4	2304
	16
88	704
	704
	×

$\sqrt{1764}$

	42
4	1764
	16
982	164
	164
	×

$\sqrt{0.2304}$ $\sqrt{0.1764}$

$\sqrt{0.2304}$ $\sqrt{0.1764}$

0.48 0.42

0.48 0.42

0.06

0.90

$\frac{6}{90}$ $\frac{1}{15}$

9. $\sqrt{3}$

	1.732
1	3.000000
	1
26	200
	189
323	1100
	969
3262	13100
	6524
	6576

$\sqrt{3}$ 1.73

Correct to 3 significant figure

10. $\sqrt{\frac{3}{8}}$ $\sqrt{\frac{3\ \ 2}{8\ \ 2}}$ $\frac{\sqrt{6}}{4}$

$\sqrt{6}$

	2.449
2	6.000000
	4
44	200
	176
484	2400
	1936
4889	46400
	44001
	2399

$\sqrt{6}$ 2.449

$\frac{\sqrt{6}}{4}$ $\frac{2.449}{4}$

0.6122

0.61

(Correct to two places of decimal)

3 Cubes and Cube Roots

Exercise 3.1

1. (i) 22^3 22 22 22 10648

(ii) 39^3 39 39 39 59319

(iii) 82^3 82 82 82 551368

(iv) 92^3 92 92 92 778688

(v) 125^3 125 125 125 1953125

(vi) $(21)^3$ 21 21 21 9261

(vii) $(41)^3$ 41 41 41 6821

(viii) $(0.1)^3$ 0.1 0.1 0.1 0.001

(ix) $(0.02)^3$ 0.02 0.02 0.02

0.000008

(x) $(1.2)^3$ 1.2 1.2 1.2 1.728

(xi) $(2.5)^3$ 2.5 2.5 2.5 15.625

(xii) $\frac{2}{3}^3$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{2}{3}$ $\frac{8}{27}$

(xiii) $\frac{3}{4}^3$ $\frac{3}{4}$ $\frac{3}{4}$ $\frac{3}{4}$ $\frac{27}{64}$

(xiv) $\frac{1}{5}^3$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{125}$

(xv) $\frac{2}{7}^3$ $\frac{2}{7}$ $\frac{2}{7}$ $\frac{2}{7}$ $\frac{8}{343}$

2. (i) 216 6 6 6 6^3 Yes cube of even number

(ii) 125 5 5 5 5^3 Not it is not cube of even number

(iii) 512 8 8 8 8^3 Yes it is cube even number

(iv) 343 7 7 7 7^3 Not is it not cube of even number

(v) 1000 10 10 10 10^3 Yes it is cube of even number

(vi) 13824 24 24 24 24^3 Yes it is cube of even number

(vii) 6859 19 19 19 19^3 No it is not cube of even number

(viii) 38945 = No it is not cube of even number

(ix) 9261 21 21 21 21^3 No it is not cube of even number

(x) 42875 35 35 35 35^3 No it is not cube of even number

3. (i) 8 2 2 2 2^3 No it is not cube of odd number

(ii) 27 3 3 3 3^3 Yes it is cube of odd number

(iii) 729 9 9 9 9^3 Yes it is cube of odd number

(iv) 1000 10 10 10 10^3 Not it is not cube of odd number

(v) 6859 19 19 19 19^3 Yes it is cube of odd number

(vi) 531441 81 81 81 81^3 Yes it is cube of odd number

(vii) 8000 20 20 20 20^3 Yes it is not cube of odd number

(viii) 2389 No it is not cube of odd number

(ix) 10648 22 22 2 22^3 No it is not cube of odd number

(x) 46656 36 36 36 36^3 No it is not cube of odd number

4. (i) 1331 11 11 11 Yes it is a perfect cube

(ii)

2	728
2	864
2	432
2	266
1	133

1728 2 2 2 13 is not perfect cube

(iii)

2	4000
2	2000
2	1000
2	500
2	250
5	125
5	25
	5

4000 2 2 2 2 2 2

5 5 5

Yes 4000 is perfect cube

(iv)

2	5400
2	2700
2	1350

5	675
5	135
3	27
3	9
	3

$\because$ 5400 2 2 2 5 5 3 3 3

5400 is not a perfect cube

(v)

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

3375 3 3 3 5 5 5

3375 is perfect cube

(vi)

19	6859
19	361
	19

$\because$ 6859 19 19 19

Yes 6859 is perfect cube

(vii)

2	74088
2	37544
2	18772
2	9386
13	4693
19	361
19	19
	1

$\because$ 74088 2 2 2 2 13 19 19

It is not a perfect cube

(viii)

2	373248
2	186624
2	93312
2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
9	729
9	81
	9

$\because$ 373248 2 2 2 2 2 2

2 2 2 9 9 9

Yes 373248 is a perfect cube

5. (i)

2	392
2	196
2	98
7	49
7	7
	1

392 2 2 2 7 7

392 should be multiplied by 7 to make it a perfect cube

(ii)

3	675
3	225
3	75
5	25
5	5
	1

675 3 3 3 5 5

675 should be multiplied by 5 to make it a perfect cube

(iii)

2	2560
2	1280
2	640
2	320
2	160
2	80
2	40
2	20
2	10
	5

2560 2 2 2 2 2 2

2 2 5

2560 should be multiplied by 5 5
25 tomake it a perfect cube

(iv)

2	8788
2	4394
13	2197
13	169
13	13
	1

8788 2 2 13 13 13
8788 should be multiplied by 2 to make it a perfect cube

6. (i)

2	540
2	270
3	135
3	45
3	15
5	5
	1

540 2 2 3 3 3 5
540 should be divided by 2 2 5
20 to make it a perfect cube

(ii) 2000 2 2 2 2 5 5 5
2000 should be divided by 2 to make it a perfect cube

2	2000
2	1000
2	500
2	250
5	125
5	25
	5

(iii)

2	8640
2	4320
2	2160
2	1050
2	540
2	270
3	135
3	45
3	15
5	5
	1

8640 2 2 2 2 2 2

3 3 3 5

8640 should be divided by 5 to make it perfect cube

(iv)

2	27648
2	13824
2	6912
2	3456
2	1728

2	864
2	432
6	216
6	36
6	6

27648 $\underline{2 \quad 2 \quad 2}$ $\underline{2 \quad 2 \quad 2}$

$\underline{2 \quad 6 \quad 6 \quad 6}$

27648 should be divided by 2 to make it perfect cube

7. To find $5\frac{1}{7}^{3}$

$\frac{35 \quad 1}{7}^{3}$

$\frac{34}{7}^{3}$ $\frac{34 \quad 34 \quad 34}{7 \quad 7 \quad 7}$

$\frac{39304}{343}$ $114\frac{202}{343}$

8. (i) $[(13^2 \quad 5^2)^{1/2}]^3$

$[(169 \quad 25)^{1/2}]^3$ $[(144)^{1/2}]^3$

$[(12^2)^{1/2}]^3$

$(12)^3$

12 12 12

1728

(ii) $[(10^2 \quad 8^2)^{1/2}]^3$

$[(100 \quad 64)^{1/2}]^3$ $[(36)^{1/2}]^3$

$[(6^2)^{1/2}]^3$

$(6)^3$ 216

Exercise 3.2

1. (i) $\sqrt[3]{729}$

$\sqrt[3]{9 \quad 9 \quad 9}$ 9

(ii) $\sqrt[3]{343}$

$\sqrt[3]{7 \quad 7 \quad 7}$ 7

(iii) $\sqrt[3]{2197}$

$\sqrt[3]{13 \quad 13 \quad 13}$ 13

(iv) $\sqrt[3]{10648}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 11 \quad 11 \quad 11}$

2 11

22

(v) $\sqrt[3]{27000}$

$\sqrt[3]{27 \quad 1000}$

$\sqrt[3]{3 \quad 3 \quad 3 \quad 10 \quad 10 \quad 10}$

3 10

30

(vi) $\sqrt[3]{8000}$

$\sqrt[3]{8 \quad 1000}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 10 \quad 10 \quad 10}$

2 10

20

(vii) $\sqrt[3]{5832}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3 \quad 3}$

3 3 2 3 3

2 3 3 18

(viii) $\sqrt[3]{2744000}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 7 \quad 7 \quad 7}$

10 10 10

2 7 10

140

(ix) $\sqrt[3]{4096}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2}$

2 2 2 2 2 2

2 2 2 2

16

(x) $\sqrt[3]{50653}$

$\sqrt[3]{37 \quad 37 \quad 37}$

37

(xi) $\sqrt[3]{15625}$

$\sqrt[3]{5 \quad 5 \quad 5 \quad 5 \quad 5 \quad 5}$

5 5

25

(xii) $\sqrt[3]{35937}$

$\sqrt[3]{3 \quad 3 \quad 3 \quad 11 \quad 11 \quad 11}$

3 11

33

(xiii) $\sqrt[3]{9261000}$

$\sqrt[3]{9261000 \quad 1000}$

$\sqrt[3]{3 \quad 3 \quad 3 \quad 7 \quad 7 \quad 7}$

10 10 10

3 7 10 210

(xiv) $\sqrt[3]{1331}$

$\sqrt[3]{11 \quad 11 \quad 11}$

11

(xv) $\sqrt[3]{1728000}$ $\sqrt[3]{1728 \quad 1000}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3 \quad 10 \quad 10 \quad 10}$

2 2 3 10

120

2. (i) $\sqrt[3]{74088}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3 \quad 7 \quad 7 \quad 7}$

2 3 7

42

(ii) $\sqrt[3]{175616}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 7 \quad 7 \quad 7}$

2 2 2 7

56

(iii) $\sqrt[3]{125000}$

$\sqrt[3]{125 \quad 1000}$

$\sqrt[3]{5 \quad 5 \quad 5 \quad 10 \quad 10 \quad 10}$

5 10

50

(iv) $\sqrt[3]{157464}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3}$

2 3 3 3

54

(v) $\sqrt[3]{262144}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2}$

2 2 2 2 2

64

(vi) $\sqrt[3]{46656}$

$\sqrt[3]{2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3}$

2 2 3 3

36

3. (i) $\sqrt[3]{3^6 \quad 5^9}$

$\sqrt[3]{3^3 \quad 3^3 \quad 5^3 \quad 5^3 \quad 5^3}$

3 3 5 5 5

9 125

1125

(ii) $\sqrt[3]{7^3 \quad 5^3 \quad 2^3}$

7 5 3

35 3

105

(iii) $\sqrt[3]{11^3 \quad 3^3 \quad 2^6}$

$\sqrt[3]{11^3 \quad 3^3 \quad 2^3 \quad 2^3}$

11 3 2 2

11 12

132

(iv) $\sqrt[3]{7^6 \quad 5^3 \quad 3^3}$

$\sqrt[3]{7^3 \quad 7^3 \quad 5^3 \quad 3^3}$

7 7 5 3

49 25

735

(v) $\sqrt[3]{(6)^3 \quad (3)^6}$

$\sqrt[3]{(6)^3 \quad (3)^3 \quad (3)^3}$

6 3 3

18 3

54

(vi) $\sqrt[3]{(5)^6 \quad (2)^3 \quad (3)^3}$

$\sqrt[3]{(5)^3 \quad (5)^3 \quad (2)^3 \quad (3)^3}$

5 5 2 3

25 6

150

4. (i) $\sqrt[3]{64 \quad 343}$

$\sqrt[3]{64} \quad \sqrt[3]{343}$

$\sqrt[3]{4 \quad 4 \quad 4} \quad \sqrt[3]{7 \quad 7 \quad 7}$

4 7

28

(ii) $\sqrt[3]{125 \quad 27}$

$\sqrt[3]{125} \quad \sqrt[3]{27}$

$\sqrt[3]{5 \quad 5 \quad 5} \quad \sqrt[3]{3 \quad 3 \quad 3}$

5 3 15

(iii) $\sqrt[3]{216 \quad 1000}$

$\sqrt[3]{216} \quad \sqrt[3]{1000}$

$\sqrt[3]{6 \quad 6 \quad 6} \quad \sqrt[3]{10 \quad 10 \quad 10}$

$6 \quad 10$

60

(iv) $\sqrt[3]{2744 \quad 3375}$

$\sqrt[3]{2744} \quad \sqrt[3]{3375}$

$\sqrt[3]{\begin{matrix} 2 & 2 & 2 \\ 7 & 7 & 7 \end{matrix}} \quad \sqrt[3]{\begin{matrix} 3 & 3 & 3 \\ 5 & 5 & 5 \end{matrix}}$

$2 \quad 7 \quad 3 \quad 5$

210

(v) $\sqrt[3]{9261 \quad 512}$

$\sqrt[3]{9261} \quad \sqrt[3]{512}$

$\sqrt[3]{\begin{matrix} 3 & 3 & 3 \\ 7 & 7 & 7 \end{matrix}}$

$\sqrt[3]{\begin{matrix} 2 & 2 & 2 & 2 \\ 2 & 2 & 2 & 2 & 2 \end{matrix}}$

$3 \quad 7 \quad 2 \quad 2 \quad 2$

$21 \quad 8$

168

(vi) $\sqrt[3]{27000 \quad 42875}$

$\sqrt[3]{27000} \quad \sqrt[3]{42875}$

$\sqrt[3]{27 \quad 1000} \; \sqrt[3]{42875}$

$\sqrt[3]{27} \quad \sqrt[3]{1000} \quad \sqrt[3]{\begin{matrix} 5 & 5 & 5 \\ 7 & 7 & 7 \end{matrix}}$

$\sqrt[3]{3 \quad 3 \quad 3} \quad \sqrt[3]{10 \quad 10 \quad 10}$

$\sqrt[3]{\begin{matrix} 5 & 5 & 5 \\ 7 & 7 & 7 \end{matrix}}$

$3 \quad 10 \quad 5 \quad 7$

$30 \quad 35$

1050

5. (i) $\sqrt[3]{\dfrac{2744}{2197}}$

$\dfrac{\sqrt[3]{2744}}{\sqrt[3]{197}}$

$\dfrac{\sqrt[3]{2 \quad 2 \quad 2 \quad 7 \quad 7 \quad 7}}{\sqrt[3]{13 \quad 13 \quad 13}}$

$\dfrac{2 \quad 7}{13} \quad \dfrac{14}{13}$

(ii) $\sqrt[3]{\dfrac{216}{2197}}$

$\dfrac{\sqrt[3]{216}}{\sqrt[3]{2197}}$

$\dfrac{\sqrt[3]{6 \quad 6 \quad 6}}{\sqrt[13]{13 \quad 13 \quad 13}}$

$\dfrac{6}{13}$

(iii) $\sqrt[3]{\dfrac{125}{1728}}$

$\dfrac{\sqrt[3]{125}}{\sqrt[3]{1728}}$

$\dfrac{\sqrt[3]{5 \quad 5 \quad 5}}{\sqrt[3]{3 \quad 3 \quad 3 \quad 4 \quad 4 \quad 4}}$

$\dfrac{5}{3 \quad 4}$

$\dfrac{5}{12}$

(iv) $\sqrt[3]{\dfrac{343}{3375}}$

$\dfrac{\sqrt[3]{343}}{\sqrt[3]{3375}}$

$\dfrac{\sqrt[3]{7 \quad 7 \quad 7}}{\sqrt[3]{3 \quad 3 \quad 3 \quad 5 \quad 5 \quad 5}}$

$\dfrac{7}{3 \quad 5}$

$\dfrac{7}{15}$

(v) $\sqrt[3]{\dfrac{1331}{3375}}$

$\dfrac{\sqrt[3]{1331}}{\sqrt[3]{3375}}$

$\dfrac{\sqrt[3]{11 \quad 11 \quad 11}}{\sqrt[3]{3 \quad 3 \quad 3 \quad 5 \quad 5 \quad 5}}$

$\dfrac{11}{3 \quad 5}$

$\dfrac{11}{15}$

(vi) $\sqrt[3]{\dfrac{729}{3375}}$

$$\frac{\sqrt[3]{729}}{\sqrt[3]{3375}} \quad \frac{\sqrt[3]{9 \quad 9 \quad 9}}{\sqrt[3]{15 \quad 15 \quad 15}}$$

$$\frac{9}{15} \quad \frac{3}{5}$$

(vii) $\sqrt[3]{\dfrac{343}{166375}}$

$$\frac{\sqrt[3]{343}}{\sqrt[3]{166375}}$$

$$\frac{\sqrt[3]{7 \quad 7 \quad 7}}{\sqrt[3]{5 \quad 5 \quad 5 \quad 11 \quad 11 \quad 11}}$$

$$\frac{7}{5 \quad 11}$$

$$\frac{7}{55}$$

(viii) $\sqrt[3]{\dfrac{9261}{42875}}$

$$\frac{\sqrt[3]{9261}}{\sqrt[3]{42875}}$$

$$\frac{\sqrt[3]{\begin{matrix}3 & 3 & 3\\ 7 & 7 & 7\end{matrix}}}{\sqrt[3]{\begin{matrix}5 & 5 & 5\\ 7 & 7 & 7\end{matrix}}}$$

$$\frac{3 \quad 7}{5 \quad 7}$$

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

6. (i) We have to find $\sqrt[3]{4\dfrac{17}{27}}$

$$\sqrt[3]{\frac{125}{27}}$$

$$\frac{\sqrt[3]{125}}{\sqrt[3]{27}}$$

$$\frac{\sqrt[3]{5 \quad 5 \quad 5}}{\sqrt[3]{3 \quad 3 \quad 3}}$$

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

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

(ii) $\sqrt[3]{5\dfrac{1182}{2197}}$

$$\sqrt[3]{\frac{12167}{2197}}$$

$$\frac{\sqrt[3]{12167}}{\sqrt[3]{2197}}$$

$$\frac{\sqrt[3]{23 \quad 23 \quad 23}}{\sqrt[3]{13 \quad 13 \quad 13}}$$

$$\frac{23}{13}$$

$$1\frac{10}{13}$$

(iii) $\sqrt[3]{10\dfrac{81}{125}}$

$$\sqrt[3]{\frac{1331}{125}}$$

$$\frac{\sqrt[3]{1331}}{\sqrt[3]{125}}$$

$$\frac{\sqrt[3]{11 \quad 11 \quad 11}}{\sqrt[3]{5 \quad 5 \quad 5}}$$

$$\frac{11}{5}$$

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

(iv) $\sqrt[3]{29\dfrac{791}{1000}}$

$$\sqrt[3]{\frac{29791}{1000}}$$

$$\frac{\sqrt[3]{29791}}{\sqrt[3]{1000}}$$

$$\frac{\sqrt[3]{31 \quad 31 \quad 31}}{\sqrt[3]{10 \quad 10 \quad 10}}$$

$$\frac{31}{10}$$

$$3\frac{1}{10}$$

7. (i) $\sqrt[3]{0.003375}$

$$\sqrt[3]{\frac{3375}{1000000}}$$

$$\frac{\sqrt[3]{3375}}{\sqrt[3]{1000000}}$$

$$\frac{\sqrt[3]{15 \quad 15 \quad 15}}{\sqrt[3]{100 \quad 100 \quad 100}} \quad \frac{15}{100}$$

(ii) $\sqrt[3]{19.683}$ $\quad 0.15$

$$\frac{\sqrt[3]{19683}}{\sqrt[3]{1000}}$$

$$\frac{\sqrt[3]{\begin{array}{l} 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \\ \quad 3 \quad 3 \quad 3 \end{array}}}{\sqrt[3]{10 \quad 10 \quad 10}}$$

$$\frac{3 \quad 3 \quad 3}{10}$$

$$\frac{27}{10}$$

(iii) $\sqrt[3]{0.000729}$ $\quad 27$

$$\sqrt[3]{\frac{729}{1000000}}$$

$$\frac{\sqrt[3]{729}}{\sqrt[3]{1000000}}$$

$$\frac{\sqrt[3]{9 \quad 9 \quad 9}}{\sqrt{100 \quad 100 \quad 100}}$$

$$\frac{9}{100}$$

(iv) $\sqrt[3]{0.085184}$ $\quad 0.09$

$$\sqrt[3]{\frac{85184}{1000000}}$$

$$\frac{\sqrt[3]{85184}}{\sqrt[3]{1000000}}$$

$$\frac{\sqrt[3]{\begin{array}{l} 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \\ \quad 11 \quad 11 \quad 11 \end{array}}}{\sqrt[3]{100 \quad 100 \quad 100}}$$

$$\frac{2 \quad 2 \quad 11}{100}$$

$$\frac{44}{100}$$

(v) $\sqrt[3]{373.248}$ $\quad 0.44$

$$\sqrt[3]{\frac{373248}{1000}}$$

$$\frac{\sqrt[3]{373248}}{\sqrt[3]{1000}}$$

$$\frac{\sqrt[3]{\begin{array}{l} 2 \quad 2 \quad 2 \quad 2 \quad 2 \\ 2 \quad 2 \quad 2 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \end{array}}}{\sqrt[3]{10 \quad 10 \quad 10}}$$

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

$$\frac{72}{10}$$

(vi) $\sqrt[3]{0.046656}$ $\quad 7.2$

$$\sqrt[3]{\frac{46656}{1000000}}$$

$$\frac{\sqrt[3]{46656}}{\sqrt[3]{1000000}}$$

$$\frac{\sqrt[3]{\begin{array}{l} 2 \quad 2 \quad 2 \quad 2 \quad 2 \quad 2 \\ \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \quad 3 \end{array}}}{\sqrt[3]{100 \quad 100 \quad 100}}$$

$$\frac{2 \quad 2 \quad 3 \quad 3}{100} \quad \frac{36}{100} \quad 0.36$$

8. (i) $\dfrac{V_1}{V_2} \quad \dfrac{\text{Side}_1^3}{\text{Side}_2^3}$

$$\frac{125}{720} \quad \frac{\text{Side}_1}{\text{Side}_2}^{\,3}$$

$$\sqrt[3]{\frac{125}{729}} \quad \frac{\text{Side}_1}{\text{Side}_2}$$

$$\sqrt[3]{\frac{5 \quad 5 \quad 5}{9 \quad 9 \quad 9}}$$

$$\frac{5}{9} \quad \frac{\text{Side}_1}{\text{Side}_2}$$

$$\frac{\text{S.A}_1}{\text{S.A}_2} \quad \frac{6\text{Side}_1^2}{6\text{Side}^2}$$

$$\frac{\text{Side}_1}{\text{Side}_2}^{\,2}$$

$$\frac{5}{9}^{\,2}$$

$$\frac{25}{81}$$

Ratio of their SA = 25 : 81

Exercise-4.1

1. (i) $[(2^3)^4]^5$

$[2^{3\ 4}]^5$

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

2^{60}

(ii) $[3^6\quad 3^4]^3$

$[3^{6\ 4}]^3$

$(3^2)^3$

$3^{2\ 3}$

3^6

(iii) $(2^4)^3\quad 2\quad 3^0$

$2^{4\ 3}\quad 2\quad 1$

$2^2\quad 2^1$

$2^{12\ 1}$

2^{13}

(iv) $81^{\ 1}\quad 3^5$

$(3^4)^{\ 1}\quad 3^5$

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

$3^{\ 4}\quad 3^5$

$3^{\ 4\ 5}$

3^1

(v $\frac{2}{3}\quad \frac{2}{3}^{\ 2}$

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

$1\quad \frac{9}{4}$

$\frac{4\quad 9}{4}$

$\frac{13}{4}$

(vi) $(3^{\ 2}\quad 5^3)^4$

$\frac{1}{3^2}\quad 5^3\ ^{\ 4}$

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

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

$\frac{5^{12}}{3^8}\quad 3^{\ 8}\quad 5^{12}$

2. (i) $7^4\quad 7^8\quad (7^5)^2$

$7^4\quad 7^8\quad 7^{10}$

$7^4\quad 7^{8\ 10}$

$7^4\quad 7^{\ 2}$

$7^{4\ 2}$

7^2

49

(ii) $5^0\quad 8^3\quad 4^{\ 2}$

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

$1\quad 2^9\quad 2^{\ 4}$

$2^{9\ 4}$

$2^5\quad 25$

(iii) $[(\ \ 2)^3]^{\ 1}$

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

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

$\frac{1}{2}^{\ 3}\quad \frac{1}{2\quad 2\quad 2}\quad \frac{1}{8}$

(iv) $\frac{2}{5}^{\ 3}$

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

$\frac{125}{8}$

$15\frac{5}{8}$

(v) $\frac{3^{\ 5}\quad 3^7}{3^{\ 2}}$

$\frac{3^2\quad 3^7}{3^5}$

$$\frac{3^{2\ \ 7}}{3^5}$$

$$3^{2\ \ 7\ \ 5}$$

$$3^4 \quad 81$$

(vi) $[3^{\ 4} \quad 3^{\ 3}]^3$

$$[3^{\ 4\ \ (\ \ 3)}]^3$$

$$[3^{\ 4\ \ 3}]^3$$

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

$$3^3$$

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

$$\frac{1}{27}$$

3. (i) $\dfrac{(\ \ 2)^5 \quad (3^5)^2}{12 \quad 3^7}$

$$\frac{(\ \ 2)^5 \quad 3^{5\ \ 2}}{2^2 \quad 3^1 \quad 3^7}$$

$$2^{5\ \ 2} \quad 3^{10\ \ 7\ \ 1}$$

$$2^3 \quad 3^2$$

$$8 \quad 9$$

$$72$$

(ii) $\dfrac{(2^3 \quad 3^4) \quad (\ \ 5)^3}{60 \quad (\ \ 2)^5}$

$$\frac{2^{3\ \ 3} \quad 3^{4\ \ 3} \quad (5)^3}{60 \quad 2^5}$$

$$\frac{(2^9 \quad 3^{12} \quad 5^3)}{(60 \quad 2^5)}$$

$$\frac{2^9 \quad 3^{12} \quad 5^3}{(5^1 \quad 2^2 \quad 3) \quad 2^5}$$

$$2^{9\ \ 2\ \ 5}3^{12\ \ 1}5^{3\ \ 1}$$

$$2^2 \quad 3^{11} \quad 5^2$$

(iii) $\dfrac{(2^{\ 4})^2 \quad 2^{\ 5}}{2^{\ 6}}$

$$\frac{2^{\ 4\ \ 2} \quad 2^{\ 5}}{2^{\ 6}}$$

$$\frac{2^{\ 8} \quad 2^{\ 5}}{2^{\ 6}}$$

$$\frac{2^6}{2^8 \quad 2^5}$$

$$\frac{2^6}{2^{8\ \ 5}}$$

$$\frac{2^6}{2^{13}}$$

$$2^{6\ \ 13}$$

$$2^{\ 7}$$

$$\frac{1}{2^7} \quad \frac{1}{128}$$

(iv) $\dfrac{(2^3 \quad 3^2)^3 \quad 6^{\ 2}}{(\ \ 2)^3 \quad 3^3}$

$$\frac{2^{3\ \ 3} \quad 3^{2\ \ 3} \quad 6^{\ 2}}{(2)^3 \quad 3^3}$$

$$\frac{2^9 \quad 3^6 \quad 2^{\ 2} \quad 3^{\ 2}}{2^3 \quad 3^3}$$

$$2^{9\ \ 2\ \ 3}3^{6\ \ 2\ \ 3}$$

$$2^4 \quad 3$$

$$16 \quad 3$$

$$48$$

(v) $\dfrac{3^4 \quad 3^{\ 2} \quad 5^2}{120 \quad (\ \ 6)^2}$

$$\frac{3^{4\ \ 2} \quad 5^2}{(2^3 \quad 3 \quad 5) \quad 6^2}$$

$$\frac{3^2 \quad 5^2}{2^3 \quad 3 \quad 5 \quad 6^2}$$

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

$$\frac{3^1 \quad 5}{2^3 \quad 2^2 \quad 3^2}$$

$$\frac{5}{8 \quad 2^2 \quad 3}$$

$$\frac{5}{96}$$

(vi) $\dfrac{5^{\ 6} \quad (\ \ 2)^3}{20 \quad 5^{\ 4}}$

$$\frac{5^{6} \quad (2^{3})}{20 \quad 5^{4}}$$

$$\frac{5^{6} \quad 2^{3}}{20 \quad 5^{4}}$$

$$\frac{5^{6 \quad (4)} \quad (2^{3})}{20}$$

$$\frac{5^{2} \quad 2^{3}}{2^{2} \quad 5^{1}}$$

$$5^{2 \quad 1} \quad 2^{3 \quad 2}$$

$$5^{3} \quad 2^{1} \quad 5^{3} \quad 2$$

$$\frac{2}{5^{3}} \quad \frac{2}{125}$$

4. (i) $[(2)^{3}]^{2} \quad 5^{3} \quad 5^{5} \quad \frac{1}{2}^{0}$

$$(2)^{6} \quad 5^{3 \quad (5)} \quad 1$$

$$(2)^{6} \quad 5^{3 \quad 5} \quad 1$$

$$(2)^{6} \quad 5^{2} \quad 1$$

$$64 \quad 25 \quad 1$$

$$64 \quad 24$$

$$88 \quad 8 \quad 11$$

$$2^{3} \quad 11$$

(ii) $2^{3} \quad 3^{2} \quad (11)^{2} \quad 2^{5}$

$$2^{8} \quad \frac{2}{5}^{0}$$

$$2^{3} \quad 3^{2} \quad 121 \quad 2^{5 \quad (8)} \quad 1$$

$$2^{3} \quad 3^{2} \quad 121 \quad 2^{5 \quad 8} \quad 1$$

$$2^{3} \quad 3^{2} \quad 121 \quad 2^{3} \quad 1$$

$$8 \quad 9 \quad 121 \quad 8 \quad 1$$

$$72 \quad 129 \quad 1$$

$$72 \quad 128$$

$$200$$

$$8 \quad 2^{5}$$

$$2^{3} \quad 5^{2}$$

(iii) $3^{5} \quad 3^{2} \quad 3^{6} \quad (2^{2} \quad 3)^{2}$

$$\frac{2}{3}^{1} \quad 2^{1} \quad \frac{1}{19}^{1}$$

$$\frac{1}{3^{5}} \quad 3^{2 \quad 1 \quad 6} \quad 2^{4} \quad 3^{2}$$

$$\frac{3}{2}^{1} \quad \frac{1}{2} \quad 19$$

$$\frac{1}{3^{5}} \quad 3^{8} \quad 2^{4} \quad 9 \quad \frac{3}{2} \quad \frac{1}{2} \quad 19$$

$$3^{3} \quad 16 \quad 9 \quad 2$$

$$27 \quad 144 \quad 21$$

$$192 \quad 64 \quad 3$$

$$2^{6} \quad 3$$

5. (i) $\dfrac{3^{5} \quad 5^{7} \quad (2)^{3}}{3^{4} \quad 5^{2} \quad (2)^{3}}$

$$3^{5 \quad 4} 5^{7 \quad (2)} (2)^{3 \quad (3)}$$

$$3^{9} 5^{7 \quad 2} (2)^{3 \quad 3}$$

$$3^{9} 5^{5} (2)^{6}$$

$$\frac{(2)^{6}}{3^{9} \quad 5^{5}} \quad \frac{2^{6}}{3^{9} \quad 5^{5}}$$

(ii) $(4^{2} \quad 3^{3})^{2} \quad 6^{4}$

$$4^{2 \quad 2} \quad 3^{3 \quad 2} \quad 6^{4}$$

$$4^{4} \quad 3^{6} \quad (2 \quad 3)^{4}$$

$$\frac{4^{4} \quad 3^{6}}{2^{4} \quad 3^{4}}$$

$$\frac{(2^{2})^{4} \quad 3^{6 \quad 4}}{2^{4}}$$

$$\frac{2^{8} \quad 3^{2}}{2^{4}}$$

$$2^{8} \quad (4) \quad 3^{2}$$

$$2^{8} \quad 4 \quad 3^{2}$$

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

$$\frac{1}{24 \quad 3^{2}}$$

(iii) $\dfrac{a^{4} \quad b^{7} \quad c^{3} \quad d^{3}}{a^{7} \quad b^{9} \quad c^{3} \quad d^{3}}$

$$a^{4 \quad (7)} b^{7 \quad (9)} c^{3 \quad 3} d^{3 \quad 3}$$

$$a^{4 \quad 7} b^{7 \quad 9} c^{6} d^{0}$$

$$a^{3} \quad b^{2} c^{6} \quad 1$$

$$\frac{a^{3} b^{2}}{c^{6}}$$

(iv) $\dfrac{5^{3} \quad 7^{4} \quad 11^{4}}{5^{5} \quad 7^{6} \quad 11^{3}}$

$5^{3\ (\ 5)}7^{4\ \ 6} \quad 11^{4\ \ 3}$

$5^{3\ \ 5}7^{\ 2}11^{\ 7}$

$5^{2}7^{\ 2}11^{\ 7}$

$\dfrac{5^{2}}{7^{2} \quad 11^{7}}$

(v) $\dfrac{3^{4} \quad 3^{2} \quad 5^{3}}{3^{6} \quad 5^{4} \quad 5^{7}}$

$\dfrac{3^{4\ \ 2} \quad 5^{3}}{3^{6} \quad 5^{4\ \ 7}}$

$\dfrac{3^{2} \quad 5^{3}}{3^{6} \quad 3^{3}}$

$3^{2\ \ 6}5^{3\ \ 3}$

$3^{4} \quad 5^{6}$

$\dfrac{3^{4}}{5^{6}}$

6. (i) $\dfrac{\cancel{3}x^{4}y^{3}}{\cancel{18}_{6}x^{3}y^{5}}$

$\dfrac{1}{6}\dfrac{x^{4\ \ 3}}{y^{5\ \ 3}}$

$\dfrac{x}{6y^{2}}$

(ii) $\left(\dfrac{2x^{2}}{y^{3}}\right)^{3}$

$\dfrac{8 \quad x^{2\ \ 3}}{y^{3\ \ 3}}$

$\dfrac{8x^{6}}{y^{9}}$

(iii) $\dfrac{5^{n\ \ 2} \quad 5^{n\ \ 1}}{5^{n\ \ 3}}$

$\dfrac{5^{n\ \ 2}}{5^{n\ \ 3}} \quad \dfrac{5^{n\ \ 1}}{5^{n\ \ 3}}$

$5^{(n\ \ 2)\ \ (n\ \ 3)} \quad 5^{(n\ \ 1)\ \ (n\ \ 3)}$

$5^{n\ \ 2\ \ n\ \ 3} \quad 5^{n\ \ 1\ \ n\ \ 3}$

$5^{1} \quad 5^{2}$

$\dfrac{1}{5} \quad \dfrac{1}{5^{2}}$

$\dfrac{5\ \ 1}{2^{5}}$

$\dfrac{4}{25}$

(iv) $2g^{2} \quad g^{3} \quad g \quad \dfrac{1}{g}\ \dfrac{1}{g^{3}}$

$2g^{2}g^{3} \quad 2g^{2} \quad g \quad \dfrac{2g^{2}}{g} \quad \dfrac{2g^{2}}{g^{3}}$

$2g^{5} \quad 2g^{3} \quad 2g \quad \dfrac{2}{g}$

(v) $(6xy^{2}z^{\ 3})^{\ 1} \quad x^{\ 2}y^{2}$

$\dfrac{x^{\ 2}y^{2}}{6xy^{2}z^{\ 3}}$

$\dfrac{1}{6}x^{\ 2\ \ 1}y^{2\ \ 2}z^{3}$

$\dfrac{1}{6}x^{\ 3}y^{0}z^{3}$

$\dfrac{x^{\ 3}z^{3}}{6}$

$\dfrac{z^{3}}{6x^{3}}$

(vi) $(5x^{\ 2}y^{\ 3})^{\ 2} \quad x^{\ 5}$

$\dfrac{5^{\ 2}(x^{\ 2})^{\ 2}(y^{\ 3})^{\ 2}}{x^{\ 5}}$

$\dfrac{5^{\ 2}x^{4}y^{6}}{x^{\ 5}}$

$5^{\ 2}x^{4\ \ (\ 5)}y^{6}$

$5^{\ 2}x^{4\ \ 5}y^{6}$

$\dfrac{x^{9}y^{6}}{5^{2}} \quad \dfrac{x^{9}y^{6}}{25}$

7. (i) $\dfrac{x^{2n\ \ 3} \quad (x^{2})^{n\ \ 1}}{x^{3n\ \ 5}}$

$\dfrac{x^{2n\ \ 3} \quad x^{2n\ \ 2}}{x^{3n\ \ 5}}$

$\dfrac{x^{2n\ \ 3\ \ 2n\ \ 2}}{x^{3n\ \ 5}}$

$$\frac{x^{4n \quad 1}}{x^{3n \quad 5}}$$

$$x^{4n \quad 1 \quad 3n \quad 5}$$

$$x^{n \quad 6}$$

(ii) $$\frac{5^{2(n \quad 6)} \quad (25)^{2n \quad 7}}{(125)^{2n}}$$

$$\frac{5^{2n \quad 12}(5^2)^{2n \quad 7}}{(5^3)^{2n}}$$

$$\frac{5^{2n \quad 12} \quad 5^{4n \quad 14}}{5^{6n}}$$

$$\frac{5^{2n \quad 12 \quad 4n \quad 14}}{5^{6n}}$$

$$\frac{5^{6n \quad 2}}{5^{6n}}$$

$$5^{6n \quad 2 \quad 6n}$$

$$5^{\quad 2}$$

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

$$\frac{1}{25}$$

(iii) $$\frac{x^{m \quad n} \quad x^{n \quad l} \quad x^{l \quad m}}{[x^m \quad x^n \quad x^l]^2}$$

$$\frac{x^{m \quad n \quad n \quad l \quad l \quad m}}{[x^{m \quad n \quad l}]^2}$$

$$\frac{x^{2m \quad 2m \quad 2l}}{x^{2m \quad 2n \quad 2l}}$$

$$1$$

8. $2^{11} \quad 2^5 \quad 2^{\quad 3} \quad 2n \quad 1$

$$2^{11 \quad 5} \quad 2^{\quad 3 \quad 2n \quad 1}$$

$$2^6 \quad 2^{\quad 4 \quad 2n}$$

$$6 \quad 4 \quad 2n$$

$$10 \quad 2n$$

$$5 \quad n$$

9. $9^{x \quad 2} \quad 240 \quad 9^x$

$$9^{x \quad 2} \quad 9^x \quad 240$$

$$9^x(9^2 \quad 1) \quad 240$$

$$9^x(81 \quad 1) \quad 240$$

$$9^x \quad 80 \quad 240$$

$$9^x \quad 3$$

$$(3^2)^x \quad 3^1$$

$$3^{2x} \quad 1^1$$

$$2x \quad 1$$

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

To find $(8x)^x$

$$8 \quad \frac{1}{2}^{\frac{1}{2}}$$

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

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

10. (i) $$\frac{x^m}{x^n}^{m \quad n} \quad \frac{x^n}{x^l}^{n \quad l} \quad \frac{x^l}{x^m}^{l \quad m}$$

$$(x^{m \quad n})^{m \quad n}(x^{n \quad l})^{n \quad l}$$

$$(x^{l \quad m})^{l \quad m}$$

$$x^{(m \quad n)(m \quad n)}x^{(n \quad l)(n \quad l)}$$

$$x^{(l \quad m)(l \quad m)}$$

$$x^{m^2 \quad n^2}x^{n^2 \quad l^2}x^{l^2 \quad m^2}$$

$$x^{(m^2 \quad n^2) \quad (n^2 \quad l^2) \quad (l^2 \quad m^2)}$$

$$x^0$$

$$1$$

(ii) $$(x^{a \quad b})^{a \quad b} \quad (x^{b \quad c})^{b \quad c}$$

$$(x^{c \quad a})^{(c \quad a)}$$

$$x^{(a \quad b)(a \quad b)} \quad x^{(b \quad c)(b \quad e)}$$

$$(x^{c \quad a})^{(c \quad a)}$$

$$x^{a^2 \quad b^2} \quad x^{b^2 \quad c^2}$$

$$x^{c^2 \quad a^2}$$

$$x^{(a^2 \quad b^4) \quad (b^2 \quad c^4) \quad (c^2 \quad a^4)}$$

$$x^0$$

$$1$$