1 Rational Numbers

Exercise 1.1

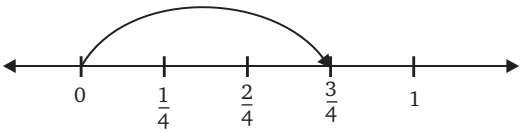
1. (a) $\frac{1}{3}\ \frac{1}{3}\ \frac{2}{2}\ \frac{2}{6}; \frac{1}{3}\ \frac{3}{3}\ \frac{3}{9}; \frac{1}{3}\ \frac{4}{4}\ \frac{4}{12}; \frac{1}{3}\ \frac{5}{5}\ \frac{5}{15}$

(b) $\frac{4}{11}\ \frac{4}{11}\ \frac{2}{2}\ \frac{8}{22}; \frac{4}{11}\ \frac{3}{3}\ \frac{12}{33}; \frac{4}{11}\ \frac{4}{4}\ \frac{16}{44}; \frac{4}{11}\ \frac{5}{5}\ \frac{20}{55}$

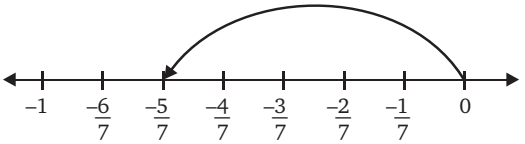
(c) $\frac{2}{13}\ \frac{2}{13}\ \frac{2}{2}\ \frac{4}{26}; \frac{2}{13}\ \frac{3}{3}\ \frac{6}{39}; \frac{2}{13}\ \frac{4}{4}\ \frac{8}{52}; \frac{2}{13}\ \frac{5}{5}\ \frac{10}{45}$

(d) $\frac{5}{9}\ \frac{5}{9}\ \frac{2}{2}\ \frac{10}{18}; \frac{5}{9}\ \frac{3}{3}\ \frac{15}{27}; \frac{5}{9}\ \frac{4}{4}\ \frac{20}{36}; \frac{5}{9}\ \frac{5}{5}\ \frac{25}{45}$

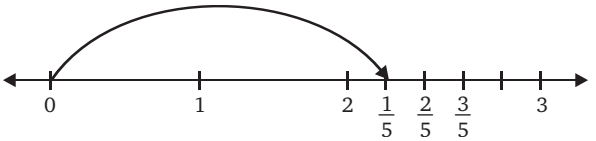
2. (a)



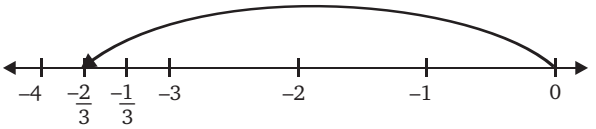
(b)



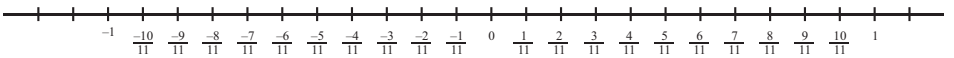
(c)



(d)



3.



Yes, the points are representing them equidistant from the origin.

4. (a) $\frac{3}{5}$ and $\frac{2}{3}$

LCM of 5 and 3 is (5 3) 15

$\frac{3}{5}\ \frac{3\ 3}{5\ 3}\ \frac{9}{15}; \frac{2}{3}\ \frac{2\ 5}{3\ 5}\ \frac{10}{15}$

[Expressing each rational number with LCM as their denominator]

$\frac{9}{15}\ \frac{10}{15}$ (Comparing the numerators)

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

$\frac{3}{5}$ is greater than $\frac{2}{3}$.

(b) $\frac{4}{9}$ and $\frac{5}{12}$

LCM of 9 and 12 is 36

$$\frac{4}{9} \quad \frac{4 \quad 4}{9 \quad 4} \quad \frac{16}{36}; \frac{5}{12} \quad \frac{5 \quad 3}{12 \quad 3} \quad \frac{15}{36}$$

[Expressing each rational number with LCM as their denominator]

$$\frac{16}{36} \quad \frac{15}{36}$$ (Comparing the numerators)

$\frac{15}{36}$ is greater than $\frac{16}{36}$

(c) $\frac{12}{5}$ and 3

LCM of 5 and 1 is 5

$$\frac{12}{5} \quad \frac{12 \quad 1}{5 \quad 1} \quad \frac{12}{5}; \frac{3}{1} \quad \frac{3 \quad 5}{1 \quad 5} \quad \frac{15}{5}$$

[Expressing each rational number with LCM as their denominator]

$$\frac{12}{5} \quad \frac{15}{5}$$ (Comparing the numerators)

$\frac{12}{5}$ is greater than $\frac{15}{5}$.

(d) $\frac{9}{13}$ and $\frac{7}{12}$

$\frac{9}{13} \quad \frac{9}{13}$ and $\frac{7}{12} \quad \frac{7}{12}$

[Expressing both the rational numbers with positive denominators]

LCM of 13 and 12 is 156

$$\frac{9}{13} \quad \frac{9 \quad 12}{13 \quad 12} \quad \frac{108}{156}; \frac{7}{12} \quad \frac{7 \quad 13}{12 \quad 13} \quad \frac{91}{156}$$

Expressing each rational number

$$\frac{108}{56} \quad \frac{91}{56}$$ [comparing the numerators]

$\frac{91}{56}$ is greater than $\frac{91}{56}$

5. (a) $\frac{1}{2}, \frac{2}{3}, \frac{1}{4}, \frac{3}{5}$

LCM of 2, 3, 4 and 5 is 60

$$\frac{1}{2} \quad \frac{1}{2} \quad \frac{30}{30} \quad \frac{30}{60}; \frac{2}{3} \quad \frac{2}{3} \quad \frac{20}{20} \quad \frac{40}{60}; \frac{1}{4} \quad \frac{1}{4} \quad \frac{1}{4} \quad \frac{15}{15} \quad \frac{15}{60} \quad \frac{3}{5} \quad \frac{12}{12} \quad \frac{36}{60}$$

$$\frac{36}{60} \quad \frac{15}{60} \quad \frac{30}{60} \quad \frac{40}{60} \qquad \frac{3}{5} \quad \frac{1}{4} \quad \frac{1}{2} \quad \frac{2}{3}$$

(b) $\frac{2}{3}, \frac{5}{6}, \frac{8}{3}, \frac{6}{9}$

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

LCM of 3, 6, 3 and 9 is 18

$$\frac{2}{3} \quad \frac{2}{3} \quad \frac{6}{6} \quad \frac{12}{18}; \frac{5}{6} \quad \frac{5}{6} \quad \frac{3}{3} \quad \frac{15}{18}; \frac{8}{3} \quad \frac{8}{3} \quad \frac{6}{6} \quad \frac{24}{18} \quad \frac{6}{9} \quad \frac{2}{2} \quad \frac{12}{18}$$

$$\frac{24}{18} \quad \frac{12}{18} \quad \frac{12}{18} \quad \frac{15}{18}$$

$$\frac{8}{3} \quad \frac{6}{9} \quad \frac{2}{3} \quad \frac{5}{6} \quad \text{or} \quad \frac{8}{3} \quad \frac{6}{9} \quad \frac{2}{3} \quad \frac{5}{6}$$

6. (a) $\frac{7}{10}, \frac{5}{8}, \frac{2}{3}$

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

LCM of 10, 8 or 3 is 120

$$\frac{7}{10} \quad \frac{7}{10} \quad \frac{12}{12} \quad \frac{84}{120}; \frac{5}{8} \quad \frac{5}{8} \quad \frac{5}{5} \quad \frac{25}{120}; \frac{2}{3} \quad \frac{2}{3} \quad \frac{40}{40} \quad \frac{80}{120}$$

$$\frac{25}{120} \quad \frac{80}{120} \quad \frac{84}{120}; \frac{5}{8} \quad \frac{2}{3} \quad \frac{7}{10} \text{ or } \frac{5}{8} \quad \frac{2}{3} \quad \frac{7}{10}$$

(b) $\frac{5}{6}, \frac{7}{12}, \frac{11}{24}$

$$\frac{7}{12} \quad \frac{7}{12}; \frac{11}{24} \quad \frac{11}{24}$$

LCM f 6, 12 and 24 is 24

$$\frac{5}{6} \quad \frac{5}{6} \quad \frac{4}{4} \quad \frac{20}{24}, \frac{7}{12} \quad \frac{7}{12} \quad \frac{2}{2} \quad \frac{14}{24}, \frac{11}{24} \quad \frac{11}{24} \quad \frac{1}{1} \quad \frac{11}{24}$$

$$\frac{14}{24} \quad \frac{11}{24} \quad \frac{20}{24}$$

$$\frac{14}{24} \quad \frac{11}{24} \quad \frac{5}{6}$$

$$\frac{7}{12} \quad \frac{11}{24} \quad \frac{5}{6}$$

7. First rational number between $\frac{4}{7}$ and $\frac{2}{7}$.

$$\frac{1}{2} \quad \frac{4}{7} \quad \frac{2}{7} \quad \frac{1}{2} \quad \frac{4}{7} \quad \frac{2}{2} \quad \frac{1}{2} \quad \frac{2}{7} \quad \frac{2}{14} \quad \frac{1}{7}$$

Second rational between $\frac{1}{7}$ and $\frac{4}{7}$ $\quad \frac{1}{2} \quad \frac{1}{7} \quad \frac{4}{7}$

$$\frac{1}{2} \quad \frac{1}{7} \quad \frac{4}{2} \quad \frac{1}{2} \quad \frac{5}{7} \quad \frac{5}{14}$$

Third rational between $\frac{5}{14}$ and $\frac{2}{7}$ $\quad \frac{1}{2} \quad \frac{5}{14} \quad \frac{2}{7}$

$$\frac{1}{2} \quad \frac{5}{14} \quad \frac{4}{2} \quad \frac{1}{2} \quad \frac{1}{14} \quad \frac{1}{28}$$

Fourth rational between $\frac{1}{28}$ and $\frac{4}{7}$

$\frac{1}{2}$ $\frac{1}{28}$ $\frac{4}{7}$

$\frac{1}{2}$ $\frac{1\ 16}{28}$ $\frac{17}{56}$

Fifth rational between $\frac{17}{56}$ and $\frac{2}{7}$ $\frac{1}{2}$ $\frac{17}{56}$ $\frac{2}{7}$

$\frac{1}{2}$ $\frac{17\ 16}{56}$ $\frac{1}{2}$ $\frac{1}{56}$ $\frac{1}{112}$

8. First rational number between $\frac{1}{2}$ and $\frac{1}{4}$.

$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{2\ 1}{4}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{8}$

Second rational number between $\frac{1}{8}$ and $\frac{1}{2}$

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

$\frac{1}{2}$ $\frac{1\ (\ 4)}{8}$ $\frac{1}{2}$ $\frac{1\ 5}{8}$ $\frac{1}{2}$ $\frac{6}{8}$ $\frac{6}{16}$ $\frac{3}{8}$

Third rational number between $\frac{3}{8}$ and $\frac{1}{4}$

$\frac{1}{2}$ $\frac{3}{8}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3\ 2}{8}$ $\frac{1}{2}$ $\frac{1}{8}$ $\frac{1}{16}$

Fourth rational number between $\frac{1}{16}$ and $\frac{1}{2}$

$\frac{1}{2}$ $\frac{1\ 8}{16}$ $\frac{1}{2}$ $\frac{9}{16}$ $\frac{9}{32}$

Fifth rational number between $\frac{9}{32}$ and $\frac{1}{4}$.

$\frac{1}{2}$ $\frac{9\ 8}{32}$ $\frac{1}{2}$ $\frac{1}{32}$ $\frac{1}{64}$

9. Two rational number 2.5 $\frac{25}{10}$ $\frac{5}{20}$; 2.7 $\frac{27}{10}$

First rational number between $\frac{5}{2}$ and $\frac{27}{10}$

$\frac{1}{2}$ $\frac{5}{2}$ $\frac{27}{10}$

$\frac{1}{2}$ $\frac{25\ 27}{10}$

$\frac{1}{2}$ $\frac{52}{10}$ $\frac{26}{10}$

Second rational number between $\frac{26}{10}$ and $\frac{5}{2}$

$$\frac{1}{2}\ \frac{26}{10}\quad \frac{5}{2}\qquad \frac{1}{2}\ \frac{26\quad 25}{10}\qquad \frac{1}{2}\ \frac{51}{10}$$

Third rational number between $\frac{51}{20}$ and $\frac{27}{10}$

$$\frac{1}{2}\ \frac{51}{20}\quad \frac{27}{10}\qquad \frac{1}{2}\ \frac{51\quad 54}{20}\qquad \frac{105}{40}$$

Fourth rational number between $\frac{105}{40}$ and $\frac{5}{2}$

$$\frac{1}{2}\ \frac{105}{40}\quad \frac{5}{2}\qquad \frac{1}{2}\ \frac{105\quad 100}{40}\qquad \frac{1}{2}\quad \frac{205}{40}\quad \frac{205}{80}$$

Fifth rational number between $\frac{205}{80}$ and $\frac{27}{10}$

$$\frac{1}{2}\ \frac{205}{80}\quad \frac{27}{10}\qquad \frac{1}{2}\ \frac{205\quad 216}{80}\qquad \frac{421}{160}$$

10. $x \quad \frac{6}{11}$

$|x| \quad \frac{6}{11}$

Rational number between $\frac{6}{11}$ and $\frac{6}{11}$ is $\quad \frac{5}{11}, \frac{4}{11}, \frac{3}{11}, \frac{2}{11}, \frac{1}{11}, \frac{1}{11}, \frac{2}{11}, \frac{3}{11}, \frac{4}{11}$.

Exercise 1.2

1. (a) Sum of $\frac{7}{13}$ and $\frac{9}{15}\quad \frac{105\quad 117}{195}\qquad \frac{12}{195}\quad \frac{4}{65}$

(b) Sum of $\frac{5}{19}$ and $\frac{6}{57}\quad \frac{(\ 15)\quad (\ 6)}{57}\qquad \frac{21}{57}\quad \frac{7}{9}$

(c) Sum of $\frac{4}{37}$ and $\frac{19}{105}\quad \frac{420\quad 703}{3885}\qquad \frac{1123}{3885}$

(d) Sum of $\frac{11}{17}$ and $\frac{6}{23}\quad \frac{4301\quad 1734}{6647}\qquad \frac{6035}{6647}\quad \frac{355}{391}$

2. (a) $\frac{3}{8}\quad \frac{2}{7}\quad \frac{4}{15}\qquad \frac{315\quad (\ 240)\quad (\ 224)}{840}\qquad \frac{315\quad 240\quad 224}{840}\qquad \frac{315\quad 464}{840}\qquad \frac{149}{840}$

(b) $\frac{6}{19}\quad \frac{2}{57}\quad \frac{12}{38}\qquad \frac{36\quad (\ 4)\quad (\ 36)}{114}\qquad \frac{36\quad 4\quad 36}{114}\qquad \frac{36\quad 40}{114}\qquad \frac{4}{114}\quad \frac{2}{57}$

(c) $\frac{7}{12}\quad \frac{5}{18}\quad \frac{13}{24}\qquad \frac{42\quad (\ 20)\quad 39}{72}\qquad \frac{42\quad 20\quad 39}{72}\qquad \frac{42\quad 59}{72}\qquad \frac{17}{72}$

(d) $\frac{9}{4}\quad \frac{3}{7}\quad \frac{5}{6}\qquad \frac{189\quad 36\quad (\ 70)}{84}\qquad \frac{189\quad 36\quad 70}{84}\qquad \frac{259\quad 36}{84}\qquad \frac{223}{4}$

3. Additive inverse is negative of a rational number $\frac{p}{q}$ is $\frac{p}{q}$.

(a) Additive inverse of $\frac{10}{11}\quad \frac{10}{11}$

(b) Additive inverse of $\frac{2}{7}\quad \frac{2}{7}$

(c) Additive inverse of $\frac{6}{17}\quad \frac{6}{17}$

(d) Additive inverse of $\frac{18}{7}\quad \frac{18}{7}$

(e) Additive inverse of $-\frac{9}{22}$ $\frac{9}{22}$

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

L.H.S. $\frac{7}{2}\ -\frac{4}{3}\ \frac{3}{5}\ \frac{21\ 8}{6}\ \frac{3}{5}\ \frac{13}{6}\ \frac{3}{5}\ \frac{65\ 18}{30}\ \frac{83}{30}$

R.H.S. $\frac{7}{2}\ -\frac{4}{3}\ \frac{3}{5}\ \frac{7}{2}\ \frac{20\ 9}{15}\ \frac{7}{2}\ \frac{11}{15}\ \frac{105\ 22}{30}\ \frac{83}{30}$

$\frac{83}{30}\ \frac{83}{30}$ L.H.S. = R.H.S.

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

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

$\frac{4}{8}\ \frac{13}{8}\ \frac{5}{8}\ \frac{22}{8}\ \frac{17}{8}$ L.H.S. = R.H.S.

5. (a) If $x\ -\frac{7}{18}$

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

$\frac{7}{18}\ \frac{4}{15}\ \frac{4}{15}\ \frac{7}{18}$

$\frac{35\ (\ 24)}{90}\ \frac{24\ (\ 35)}{90}$

$\frac{35\ 24}{90}\ \frac{24\ 35}{90}$

$\frac{59}{90}\ \frac{59}{90}$

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

Hence, $x\ \ y\ \ y\ \ x$.

(b) If $x\ -\frac{5}{12}$

$y\ \frac{2}{9}\ -\frac{5}{12}\ \frac{2}{9}\ \frac{2}{9}\ -\frac{5}{12}$

$\frac{15\ 8}{36}\ \frac{8\ 15}{36}$

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

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

Hence, $x\ \ y\ \ y\ \ x$.

6. (a) If $x\ -\frac{11}{12}\ y\ -\frac{5}{6}\ z\ \ 3$

$-\frac{11}{12}\ -\frac{5}{6}\ \ 3\ \ -\frac{11}{12}\ \ -\frac{5}{6}\ \ 3$

$$\frac{11}{12}\quad\frac{10}{3}\quad\frac{11}{12}\quad\frac{5}{6}\quad\frac{18}{}$$

$$\frac{21}{12}\quad\frac{3}{1}\quad\frac{11}{12}\quad\frac{13}{6}$$

$$\frac{21}{12}\quad\frac{31}{11}\quad\frac{11}{12}\quad\frac{26}{}$$

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

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

(b) $(x \quad y) \quad z \quad x \quad (y \quad z)$

$x \quad \frac{4}{5}, y \quad \frac{3}{6} z \quad \frac{2}{15}$

$$\frac{4}{5}\quad\frac{3}{6}\quad\frac{2}{15}\quad\frac{4}{5}\quad\frac{3}{6}\quad\frac{2}{15}$$

$$\frac{4}{30}\quad\frac{15}{2}\quad\frac{2}{15}\quad\frac{4}{5}\quad\frac{15}{30}\quad\frac{4}{}$$

$$\frac{9}{30}\quad\frac{2}{15}\quad\frac{4}{5}\quad\frac{19}{30}$$

$$\frac{9}{30}\quad\frac{4}{24}\quad\frac{24}{30}\quad\frac{19}{}$$

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

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

7. (a) $10 \quad \frac{17}{12} \quad \frac{17}{12} \quad \mathbf{10}$ (b) $\frac{7}{8} \quad \frac{5}{12} \quad \frac{9}{16} \quad \mathbf{7} \quad \mathbf{8} \quad \frac{5}{12} \quad \frac{9}{16}$

(c) $\frac{2}{3} \quad \mathbf{0} \quad \mathbf{0} \quad \frac{2}{3} \quad \frac{2}{3}$ (d) $\frac{2}{5} \quad \frac{7}{15} \quad \frac{3}{2} \quad \frac{2}{5} \quad \mathbf{7} \quad \mathbf{15} \quad \frac{3}{2}$

Exercise 1.3

1. (a) $\frac{7}{12} \quad \frac{8}{15} \quad \frac{35 \quad (\ 32)}{60} \quad \frac{35 \quad 32}{60} \quad \frac{3}{60} \quad \frac{1}{20}$

(b) $\frac{9}{8} \quad \frac{4}{5} \quad \frac{45 \quad (\ 32)}{40} \quad \frac{45 \quad 32}{40} \quad \frac{77}{40}$

(c) $\frac{3}{8} \quad \frac{1}{16} \quad \frac{6 \quad (\ 1)}{16} \quad \frac{6 \quad 1}{16} \quad \frac{5}{16}$

(d) $\frac{7}{42} \quad \frac{8}{21} \quad \frac{7 \quad 16}{42} \quad \frac{\overset{3}{\cancel{9}}}{\underset{14}{\cancel{42}}} = \frac{3}{14}$

2. (a) $\frac{7}{12}$ from $\frac{5}{18}$

$$\frac{5}{18}\quad\frac{7}{12}\quad\frac{5}{18}\quad\frac{7}{12}\quad\frac{10 \quad 21}{36}\quad\frac{11}{36}$$

(b) $\frac{2}{5}$ from $\frac{1}{15}$

$$\frac{1}{15} \quad \frac{2}{5} \quad \frac{1\ 6}{15} \quad \frac{5}{15} \quad \frac{1}{3}$$

(c) $-\frac{3}{7}$ from $\frac{12}{14}$

$$\frac{12}{14} \quad -\frac{3}{7} \quad \frac{12}{14} \quad \frac{3}{7} \quad \frac{12\ \ 6}{14} \quad \frac{18}{14} \quad \frac{9}{7}$$

3. Sum of two rational numbers $\frac{3}{5}$

One number is $\frac{9}{20}$

Required number is $\frac{3}{5} \quad \frac{9}{20} \quad \frac{12\ \ 9}{20} \quad \frac{3}{20}$

4. Sum of two rational numbers 8

one number $\frac{13}{7}$

Required number is $8 \quad \frac{(\ 13)}{7}$

$$8 \quad \frac{13}{7} \quad \frac{56\ \ 13}{7} \quad \frac{43}{7}$$

5. Let the required number be x.

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

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

$$\frac{15\ \ 4}{10} \quad \frac{19}{10}$$

$$x \quad \frac{19}{10}$$

6. Let the required number be x

$$-\frac{3}{5} \quad x \quad \frac{3}{7}$$

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

$$\frac{15\ \ 21}{35} \quad \frac{36}{35}$$

7. Let the required number be x

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

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

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

8. Let the required number to be x

$$\frac{11}{15} \quad x \quad \frac{3}{15}$$

$x \quad \frac{3}{15} \quad \frac{11}{15}$

$x \quad \frac{3 \quad 11}{15} \quad \frac{8}{15}$

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

Exercise 1.4

1. (a) Zero has **No** reciprocal.

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

(c) Multiplicative inverse of 1 is **1**.

(d) **1** is called the multiplicative identify for rationals.

(e) The reciprocal of a positive rational number is **positive** and that of negative rational number is **negative**.

(f) The numbers **1** and **1** are their own reciprocals.

(g) Then reciprocal of $\frac{1}{x}$, where $x \quad 0$ is **x**.

2. (a) $\frac{-26}{35} \quad \frac{-15}{13} \quad \frac{26 \quad 15}{35 \quad 13} \quad \frac{2 \quad 3}{7 \quad 1} \quad \frac{6}{7}$

(b) $\frac{-3}{14} \quad \frac{24}{35} \quad \frac{-3 \quad 24}{14 \quad 35} \quad \frac{-3 \quad 12}{7 \quad 35} \quad \frac{-36}{245}$

(c) $\frac{-9}{19} \quad (-152) \quad \frac{-9 \quad -152}{19} \quad \frac{9 \quad 152}{19} \quad 78$

(d) $\frac{-12}{5} \quad \frac{105}{-106} \quad \frac{12 \quad 105}{5 \quad 106} \quad \frac{6 \quad 21}{1 \quad 53} \quad \frac{126}{53}$

3. (a) $\frac{2}{3} \quad \frac{15}{16} \quad \frac{7}{12} \quad \frac{24}{35} \quad \frac{2}{3} \quad \frac{\cancel{15}^{5}}{\cancel{16}_{8}} \quad \frac{7}{12} \quad \frac{\cancel{24}^{2}}{\cancel{35}_{5}}$

$\frac{5}{8} \quad \frac{2}{5} \quad \frac{5}{8} \quad \frac{(\ 2)}{5} \quad \frac{25 \quad (\ 16)}{40} \quad \frac{9}{40}$

(b) $\frac{4}{5} \quad \frac{15}{8} \quad \frac{1}{3} \quad \frac{9}{7} \quad \frac{2}{9} \quad \frac{27}{14} \quad \frac{4}{5} \quad \frac{\cancel{15}^{3}}{\cancel{8}_{2}} \quad \frac{1}{3} \quad \frac{\cancel{9}^{3}}{7} \quad \frac{2}{9} \quad \frac{\cancel{27}^{3}}{\cancel{14}_{7}}$

$\frac{3}{2} \quad \frac{3}{7} \quad \frac{3}{7} \quad \frac{21 \quad 6 \quad 6}{14} \quad \frac{21}{14} \quad \frac{3}{2}$

4. (a) $\frac{3}{4} \quad \frac{1}{2} \quad \frac{5}{7} \quad \frac{3}{4} \quad \frac{1}{2} \quad \frac{5}{7}$

$\frac{3}{8} \quad \frac{5}{7} \quad \frac{3}{4} \quad \frac{5}{14}$

$\frac{15}{56} \quad \frac{15}{56}$

Proved

(b) $\frac{7}{6} \quad \frac{2}{5} \quad \frac{3}{8} \quad \frac{7}{6} \quad \frac{2}{5} \quad \frac{3}{8}$

$\frac{\cancel{14}^{7}}{30}\ \frac{\cancel{3}}{\cancel{8}_{4}}\quad \frac{7}{6}\quad \frac{2}{5}\ \frac{\cancel{3}}{\cancel{8}_{4}}$

$\frac{\cancel{21}^{7}}{\cancel{120}_{40}}\quad \frac{7}{\cancel{6}_{2}}\quad \frac{3}{20}$

$\frac{7}{40}\ \frac{7}{40}$ **Proved.**

(c) $\frac{2}{3}\ \frac{4}{5}\ \frac{7}{8}\quad \frac{2}{3}\ \frac{4}{5}\quad \frac{2}{3}\ \frac{7}{8}$

$\frac{2}{3}\ \frac{32\ \ 35}{40}\quad \frac{8}{15}\ \frac{14}{24}$

$\frac{\overset{1}{2}}{3}\ \frac{67}{\cancel{40}_{20}}\ \frac{64\ \ 70}{120}$

$\frac{67}{60}\ \frac{\overset{67}{\cancel{134}}}{\cancel{120}_{60}}\qquad \frac{67}{60}\ \frac{67}{60}$ **Proved**

(d) $\frac{6}{15}\ \frac{7}{8}\ \frac{5}{12}\quad \frac{6}{15}\ \frac{7}{8}\quad \frac{6}{15}\ \frac{5}{12}$

$\frac{6}{15}\ \frac{7}{8}\ \frac{5}{12}\quad \frac{21}{60}\quad \frac{6}{\cancel{18}_{3}}\ \frac{5}{\cancel{12}_{2}}$

$\frac{6}{15}\quad \frac{1\ \ 10}{24}\quad \frac{21}{60}\ \frac{1}{6}$

$\frac{6}{15}\ \frac{11}{24}\quad \frac{11}{60}$

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

$\frac{11}{60}\ \frac{11}{60}$ **Proved**

5. Fill in the blanks :

(a) 19 $\frac{5}{12}\ \frac{5}{12}$ **19**

(b) $\frac{6}{11}\ \frac{20}{21}\quad \frac{7}{8}\ \frac{\mathbf{6}}{\mathbf{11}}\quad \frac{20}{21}\ \frac{7}{8}$

(c) $\frac{1}{8}\quad \frac{2}{5}\ \frac{6}{17}\quad \frac{1}{8}\quad \frac{2}{5}\ \frac{\mathbf{1}}{\mathbf{8}}\ \frac{\mathbf{6}}{\mathbf{17}}$

(d) $\frac{21}{40}\ \frac{3}{7}\ \frac{17}{24}\quad \frac{21}{40}\ \frac{17}{24}\ \frac{\mathbf{3}}{\mathbf{7}}$

6. (a) $\frac{7}{4}\ \frac{5}{8}\ \frac{1}{2}\ \frac{7}{4}\quad \frac{5\ \ 4}{8}\quad \frac{7}{4}\ \frac{9}{8}\ \frac{63}{32}$

(b) $\frac{2}{5}\ \frac{3}{8}\ 25\quad \frac{2}{5}\ \frac{3}{\underset{4}{8}}\ \frac{2}{\underset{1}{5}}\ (\overset{5}{25})\ \frac{3}{20}\ 10\quad \frac{3\ \ 200}{20}\ \frac{197}{20}\ \frac{197}{20}$

(c) $\frac{3}{8}\ \frac{4}{7}\ \frac{11}{7}\quad \frac{3}{8}\ \frac{4}{7}\ \frac{3}{8}\ \frac{11}{7}\quad \frac{12}{56}\ \frac{33}{56}\ \frac{12\ \ 33}{56}\ \frac{21}{56}\ \frac{3}{8}$

7. (a) Reciprocal of $\frac{23}{11}$ $\frac{11}{23}$

(b) Reciprocal of $\frac{15}{27}$ $\frac{27}{15}$

(c) Reciprocal of $\frac{4}{7}$ $\frac{7}{4}$

(d) $\frac{4}{5}$ $\frac{15}{18}$ $\frac{12}{18}$

Reciprocal of $\frac{18}{12}$ $\frac{3}{2}$

(e) 1 $\frac{3}{10} = \frac{3}{10}$

Reciprocal $\frac{10}{3}$

(f) $\frac{4}{5}$ $\frac{2}{7}$ $\frac{8}{35}$

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

8. (a) $x(y \quad z) \quad x \quad y \quad x \quad z$

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

$\frac{3}{4}$ $\frac{4}{6}$ $\frac{5}{6}$ $\frac{1}{2}$ $\frac{5}{8}$

$\frac{3}{4}$ $\frac{9}{6}$ $\frac{4}{8}$ $\frac{5}{8}$

$\frac{9}{8}$ $\frac{9}{8}$

Proved.

(b) $x \quad (y \quad z) \quad x \quad y \quad x \quad z$

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

$\frac{3}{4}$ $\frac{4}{6}$ $\frac{5}{6}$ $\frac{1}{2}$ $\frac{5}{8}$

$\frac{3}{4}$ $\frac{1}{6}$ $\frac{4}{8}$ $\frac{5}{8}$

$\frac{1}{8}$ $\frac{1}{8}$ **Proved.**

(c) $(x \quad y)^{\ 1} \quad x^{\ 1} \quad y^{\ 1}$

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

$\frac{9}{12}$ $\frac{8}{6}^{\ 1}$ $\frac{8}{6}$ $\frac{9}{6}$ $\frac{2}{17}$ $\frac{1}{6}$ **Proved.**

(d) $|x^{\ 1}| \quad |x|^{\ 1}, \quad |y^{\ 1}| \quad |y^{\ 1}| \quad |z^{\ 1}| \quad |z|^{\ 1}$

$\left|\frac{3}{4}^{\ 1}\right| \quad \left|\frac{3}{4}\right|^{\ 1}, \quad \left|\frac{2}{3}^{\ 1}\right| \quad \left|\frac{2}{3}\right|^{\ 1}, \quad \left|\frac{5}{6}^{\ 1}\right| \quad \left|\frac{5}{6}\right|^{\ 1}$

$\left|\frac{4}{3}\right| \quad \frac{3}{4}^{\ 1}, \quad \left|\frac{3}{2}\right| \quad \frac{2}{3}^{\ 1}, \quad \left|\frac{6}{5}\right| \quad \frac{5}{6}^{\ 1}$

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

Verififed

9. (a) (36) $\frac{35}{76}$ $\frac{19}{15}$ $\frac{3}{2}$ ^{1}

$^{12}36$ $\frac{^{7}35}{76}$ $\frac{19}{^{3}15}$ $\frac{2}{3}$

$\frac{^{38}84}{^{2}6}$ 14

(b) $\frac{4}{7}$ $\frac{18}{11}$ $\frac{44}{9}$ (14)

$\frac{4}{7}$ $\frac{^{2}18}{11}$ $\frac{^{4}44}{9}$ $^{2}14$ 4 2 4 2 64

Exercise 1.5

1. (a) $\frac{8}{15}$ divide by $\frac{2}{6}$

$\frac{8}{15}$ $\frac{2}{6}$ $\frac{8}{15}$ $\frac{6}{2}$ $\frac{8}{5}$

(b) 0 divide by $\frac{4}{43}$

0 $\frac{4}{43}$ 0 $\frac{4}{43}$ 0

(c) $\frac{36}{48}$ divide by $\frac{12}{4}$

$\frac{36}{48}$ $\frac{12}{4}$

$\frac{36}{48}$ $\frac{4}{12}$ $\frac{1}{8}$

(d) $\frac{6}{7}$ divide by $\frac{6}{7}$

$\frac{6}{7}$ divide by $\frac{6}{7}$

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

2. (a) $\frac{5}{12}$ $\frac{3}{14}$ $\frac{5}{12}$ $\frac{14}{3}$ $\frac{5}{12}$ $\frac{14}{3}$ $\frac{70}{36}$ $\frac{35}{18}$

(b) $\frac{20}{32}$ $\frac{8}{15}$ $\frac{20}{32}$ $\frac{15}{8}$ $\frac{5}{32}$ $\frac{15}{2}$ $\frac{5}{32}$ $\frac{15}{2}$ $\frac{75}{64}$

(c) $\frac{21}{25}$ $\frac{14}{10}$ $\frac{21}{25}$ $\frac{10}{14}$ $\frac{3}{5}$ $\frac{2}{3}$ $\frac{2}{5}$

(d) $\frac{16}{35}$ $\frac{15}{12}$ $\frac{16}{35}$ $\frac{12}{15}$ $\frac{16}{35}$ $\frac{4}{5}$ $\frac{16}{35}$ $\frac{4}{5}$ $\frac{64}{175}$

3. (a) To prove that : a (b c) (a b) c

given : a $\frac{3}{2}$, b $\frac{7}{6}$, c 5

a, b and c's value put in a (b c) (a b) c

LHS ; a (b c)

$\frac{3}{2}$ $\frac{7}{6}$ 5 $\frac{3}{2}$ $\frac{7}{6}$ $\frac{1}{5}$ $\frac{3}{2}$ $\frac{7}{30}$ $\frac{3}{2}$ $\frac{30}{7}$ $\frac{90}{14}$ $\frac{45}{7}$

RHS ; (a b) c

$$\frac{3}{2}\ \ \frac{7}{6}\quad 5\quad \frac{3}{2}\ \ \frac{6}{7}\quad 5\quad \frac{9}{7}\quad 5\quad \frac{9}{7}\ \ \frac{1}{5}\ \ \frac{9}{35}$$

$$\frac{45}{7}\ \ \frac{9}{35}$$

LHS RHS

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

(b) Proved that : $a\quad (b\quad c)\quad (a\quad b)\quad c$

given : $a\quad \frac{2}{3}; b\quad \frac{1}{2}; c\quad \frac{1}{7}$

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

$$\frac{2}{3}\quad \frac{1}{2}\ \ \frac{1}{7}\quad \frac{2}{3}\quad \frac{1}{2}\ \ \frac{7}{1}\quad \frac{2}{3}\quad \frac{7}{2}\quad \frac{2}{3}\quad \frac{2}{7}\quad \frac{4}{21}$$

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

$$\frac{2}{3}\ \ \frac{1}{2}\quad \frac{1}{7}\quad \frac{2}{3}\ \ \frac{2}{1}\quad \frac{1}{7}\quad \frac{4}{3}\quad \frac{7}{1}\quad \frac{28}{3}$$

$$\frac{4}{21}\quad \frac{28}{3}$$

LHS RHS

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

(c) To proved that : $a\quad (b\quad c)\quad (a\quad b)\quad c$

Given : $a\quad \frac{4}{a}, b\quad \frac{12}{20}, c\frac{3}{5}$

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

$$\frac{4}{9}\quad \frac{12}{20}\ \ \frac{3}{5}\quad \frac{4}{9}\quad \frac{4}{4}\quad \frac{4}{9}\quad 1\quad \frac{4}{9}\ \ \frac{1}{1}\ \ \frac{4}{9}$$

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

$$\frac{4}{9}\quad \frac{12}{20}\quad \frac{3}{5}\quad \frac{4}{9}\quad \frac{20}{12}\quad \frac{3}{5}\ \ \frac{20}{27}\quad \frac{3}{5}\ \ \frac{20}{27}\ \ \frac{5}{3}\quad \frac{100}{81}$$

LHS RHS

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

4. Product of two rational number $\frac{33}{52}$

One of the number is $\frac{9}{13}$

Let, other number be x

$$\frac{9}{13}\quad x\quad \frac{33}{52}$$

$$x\quad \frac{33}{52}\ \ \frac{13}{9}\ \ \frac{11}{12}$$

5. Product of two rational number $\quad 20$

One of the number is $\frac{5}{6}$

Let, other number be x

$$\frac{5}{6}\quad x\quad \quad 20$$

$x \quad 20 \quad \frac{6}{5}$

$6 \quad 6 \quad 36$

6. Let required number x

Given number $\frac{5}{14}$

Product of these $\frac{7}{12}$

$x \quad \frac{5}{14} \quad \frac{7}{12}$

$x \quad \frac{7}{12} \quad \frac{14}{5} \quad \frac{49}{30}$ or $\frac{49}{30}$

7. Let required number x

Given number $\frac{28}{15}$

Product of these $\frac{7}{5}$

$x \quad \frac{28}{15} \quad \frac{7}{5}$

$x \quad \frac{7}{5} \quad \frac{15}{28} \quad \frac{3}{4}$

8. Let $\frac{12}{35}$ divide x to get $\frac{3}{7}$

$\frac{12}{35} \quad x \quad \frac{3}{7}$

$\frac{12}{35} \quad \frac{1}{x} \quad \frac{3}{7}$

$\frac{1}{x} \quad \frac{3}{7} \quad \frac{35}{12} \quad \frac{5}{4}$

$\frac{1}{x} \quad \frac{5}{4}$

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

9. Sum of $\frac{12}{7}$ and $\frac{13}{5}$ $\quad \frac{12}{7} \quad \frac{13}{5} \quad \frac{60 \quad 91}{35} \quad \frac{31}{35}$

Product of $\frac{1}{2}$ and $\frac{31}{7}$ $\quad \frac{1}{2} \quad \frac{31}{7} \quad \frac{1 \quad 31}{2 \quad 7} \quad \frac{31}{14}$

Divide $\frac{31}{35}$ by $\frac{31}{14}$ $\quad \frac{31}{35} \quad \frac{31}{14}$

$\frac{31}{35} \quad \frac{14}{31} \quad \frac{2}{5} \quad \frac{2}{5}$

10. Sum of $\frac{8}{3}$ and $\frac{12}{7}$

$\frac{8}{3} \quad \frac{12}{7} \quad \frac{56 \quad 36}{21} \quad \frac{92}{21}$

Difference between $\frac{8}{3}$ and $\frac{12}{7}$

$\frac{8}{3}$ $\frac{12}{7}$ $\frac{56}{21}$ $\frac{36}{21}$ $\frac{20}{21}$

Divide $\frac{92}{21}$ by $\frac{20}{21}$

$\frac{92}{21}$ $\frac{20}{21}$

$\frac{92}{21}$ $\frac{21}{20}$ $\frac{23}{5}$

Exercise 1.6

1. Length of cloth required for making 1 shirt $\frac{3}{4}$ m

Length of cloth required for making 20 shirt $\frac{3}{4}$ 20 m 15 m

2. Length of piece of pipe $\frac{35}{4}$ m

Number of pieces of equal size $= 4$

Length of each piece $\frac{35}{4}$ $\frac{4}{1}$ $\frac{35}{4}$ $\frac{1}{4}$ $\frac{35}{16}$ $2\frac{3}{16}$ m.

3. $\because$ Cost of 35/2 kg of potatoes $= ₹\frac{665}{4}$

Cost of 1 kg of apples $= ₹\frac{665}{4}$ $\frac{35}{2}$ $\frac{\overset{19}{665}}{4_{2}}$ $\frac{2}{35}$ $\frac{19}{2}$ $₹\,9\frac{1}{2}$.

4. $\because$ Cost of 1 metre ribbon $= ₹\frac{38}{7}$

$\because$ Cost of $\frac{7}{2}$ metre cloth $\frac{38}{7}$ $\frac{7}{2}$ ₹ 19

$\because$ Cost of 1 metre ribbon $= ₹\frac{55}{2}$

$\because$ Cost of $\frac{19}{4}$ metre ribbon $= ₹\frac{55}{2}$ $\frac{19}{4}$ $₹\frac{1045}{8}$

She spent $= ₹$ 19 $\frac{1045}{8}$ $\frac{152}{8}$ $\frac{1045}{8}$ $₹$ $\frac{1197}{8}$ $= ₹\,149\frac{5}{8}$.

5. $\because$ Distance covered by a car in 1 hour $\frac{404}{5}$ km

car will cover the distance in $\frac{19}{4}$ hours $\frac{404}{5}$ $\frac{19}{4}$ km.

$\frac{\overset{101}{404}}{5}$ $\frac{19}{4}$ $\frac{1919}{5}$ km $383\frac{4}{5}$ km

6. Let total number of student x

number of boys $\frac{5}{7}x$

Then, number of girls $x \quad \frac{5}{7}x \quad \frac{2x}{7}$

According to question,

Number of girls 300

$\frac{2x}{7} \quad 300$

$x \quad \frac{300 \quad 7}{2} \quad 1050$

Number of boys $\frac{5}{7}x$

$1050 \quad \frac{5}{7} \quad 750$

7. Let, Aryan coved total distance x

$\frac{3}{8}$ distance coved by Aryan.

Left distance $x \quad \frac{3x}{8} \quad \frac{5x}{8}$

According to question, $\frac{5x}{8} \quad 45$

$x \quad 45 \quad \frac{8}{5}$

72 cm.

8. Length of rectangular park $45\frac{1}{2}$ m $\quad \frac{91}{2}$ m

Breadth of rectangular park $34\frac{3}{4}$ m $\quad \frac{139}{4}$ m

Perimeter of rectangular park $2(l \quad b)$

$2 \quad \frac{91}{2} \quad \frac{139}{4}$ m

$\frac{1}{2} \quad \frac{182 \quad 189}{4}$ m

$2 \quad \frac{321}{4}$ m

$\frac{321}{2}$ m $\quad 160\frac{1}{2}$ m

Area of park $\frac{91}{2} \quad \frac{139}{4}$ m^2

$\frac{12649}{8}$ m$^2 \quad 1581\frac{9}{8}$ m^2

MCQ's

1. (a) 2. (d) 3. (d) 4. (b) 5. (c) 6. (c)
7. (d) 8. (a) 9. (d) 10. (d) 11. (c)

Exercise 21.

1. (a) 6^9 Base 6; Exponents 9

(b) $3^{\ 7}$ Base 3; Exponents 7

(c) $(\ 5)^5$ Base 5; Exponents 5

(d) $(3)^5$ Base 3; Exponents 5

(e) $\left(\frac{2}{5}\right)^{\ 3}$ Base $\frac{2}{5}$; Exponents 3

(f) $\frac{4}{5}$ Base $\frac{4}{5}$; Exponents 2

(g) $\left(\frac{1}{8}\right)^{\frac{1}{3}}$ Base $\frac{1}{8}$; Exponents $\frac{1}{3}$

(h) $(4)^{\frac{3}{2}}$ Base 4; Exponents $\frac{3}{2}$

2. (a) $(9)^{\frac{1}{2}}$ $(3\ \ 3)^{\frac{1}{2}}$ $(3)^{2\ \frac{1}{2}}$ 3

(b) $(121)^{\frac{1}{2}}$ $\left(\frac{1}{121}\right)^{\frac{1}{2}}$ $\left(\frac{1}{11\ \ 11}\right)^{\frac{1}{2}}$ $\frac{1}{(11)^{2\ \frac{1}{2}}}$ $\frac{1}{11}$

(c) $4^{\frac{3}{2}}$ $(2\ \ 2)^{3/2}$ $(2)^{2\ \ 3/2}$ $(2)^3$ 8

(d) $8^{2/3}$ $(2)^{3\ \frac{2}{3}}$ $(2)^2$ 4

(e) $(343)^{2/3}$ $(7)^{3\ \frac{2}{3}}$ $(7)^2$ 49

(f) $(32768)^{1/15}$ $(2)^{15\ \frac{1}{15}}$ 2

(g) $(279936)^{1/7}$ $(6)^{7\ \frac{1}{7}}$ 6

(h) $(343)^{-\ 1/3}$ $\left(\frac{1}{343}\right)^{1/3}$ $\frac{(1)^{\ /3}}{(7)^{3\ \frac{1}{3}}}$ $\frac{1}{7}$

3. (a) $\left(\frac{32}{243}\right)^{4/5}$ $\left(\frac{(2)^5}{(3)^5}\right)^{4/5} = \frac{(2)^{5\ \ 4/5}}{(3)^{5\ \ 4/5}} = \frac{32}{81} = \frac{32}{81}$

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

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

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

4. (a) $(0.04)^{5/2}\ \ (0.2)^2\ \ ^{5/2}\ \ (0.000032)$

(b) $(0.000729)^{5/6}\ \ \{(0.027)^2\}^{5/6}\ \ (0.027)^{2\ \ \frac{5}{6_3}}$

$(0.027)^{5/3} = [(0.3)^3]^{5/3}\ \ (0.3)^5\ \ 0.00243$

(c) $(0.125)^{2/3}\ \ \{(0.5)^3\}^{2/3}\ \ (0.5)^{3\ \ \frac{2}{3}}\ \ 0.25$

(d) $(0.000064)^{5/6}\ \ \{(0.2)^6\}^{5/6}\ \ (0.2)^{6\ \ 5/6}\ \ 0.000032$

5. (a) $(27)^{2/3}\ \ (27)^{1/3}\ \ (27)^{-4/3}\ \ [(3)^3]^{2/3}\ \ [(3)^3]^{1/3}\ \ [(3)^3]^{-4/3}$

$(3)^{3\ \ 2/3}\ \ (3)^{3\ \ 1/3}\ \ (3)^{3\ \ -4/3}$

$(3)^2\ \ (3)^1\ \ (3)^{-4}$

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

(b) $\left(\frac{27}{125}\right)^{\frac{-2}{3}}\ \ \left(\frac{27}{125}\right)^{\frac{-4}{3}}\ \ \left(\frac{27}{125}\right)^{\frac{2}{3}\ \ \frac{4}{3}}$

$\left(\frac{27}{125}\right)^{\frac{2\ \ 4}{3}}\ \ \left(\frac{27}{125}\right)^{\frac{6}{3}}\ \ \left(\frac{27}{125}\right)^{2}\ \ \left(\frac{125}{27}\right)^{2}\ \ \frac{15625}{729}$

(c) $(729)^{\frac{-5}{3}\ \ -1/2}\ \ \left(\frac{1}{729}\right)^{\frac{5}{3}\ \ -1/2}\ \ \left(\frac{1}{(9)^{3\ \ 5/3}}\right)^{-1/2}\ \ (3)^{2\ \ 5\ \ \frac{1}{2}}\ \ 243$

(d) $\left(\frac{2}{3}\right)^{4/3}\ \ \left(\frac{2}{13}\right)^{5/3}\ \ \left(\frac{2}{13}\right)^{\frac{4}{3}\ \ \frac{5}{3}}\ \ \left(\frac{2}{13}\right)^{\frac{9}{3}} = \left(\frac{2}{13}\right)^3$

6. (a) $\{(3)^2\ \ (4)^2\}^{1/2}\ \ (9\ \ 16)\ \ (9\ \ 16)^{1/2}\ \ (25)^{1/2}\ \ 5$

(b) $\{(5)^2\ \ (12)^2\}^{3/2}\ \ (25\ \ 144)^{3/2}\ \ \{(169)\}^{3/2} = (13)^{2\ \ \frac{3}{2}}\ \ 2197$

(c) $(17^2 - 8^2)\ \ (289 - 64)^{1/2}\ \ (225)^{1/2}\ \ (15)^{2\ \ \frac{1}{2}}\ \ 15$

(d) $(1^3\ \ 2^3\ \ 3^3\ \ 4^3)^{3/2}\ \ (1\ \ 8\ \ 27\ \ 64)$

$(100)^{\frac{-3}{2}}\ \ (10)^{2\ \ \frac{-3}{2}}\ \ 10^{-3}\ \ \frac{1}{(1000)}$

Exercise 2.2

1. (a) $3^x\ \ 243$

$3^x\ \ (3)^5$

On-comparison of exponents, $x\ \ 5$

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

$(-2)^{x \quad 2x} \quad (-2)^9$

$(-2)^{3x} \quad (-2)^9$

On comparison of exponents

$3x \quad 9$

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

$\boxed{x \quad 3}$

(c) $5^x \quad 5^{x \quad 1} \quad 125$

$5^{x \quad x \quad 1} \quad 125$

$5^{2x \quad 1} \quad (5)^3$

On comparison of exponents

$2x \quad 1 \quad 3$

$2x \quad 3 \quad 1$

$x \quad \frac{2}{2} \quad 1$ $\qquad \boxed{x \quad 1}$

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

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

$(7)^{\quad 2x} \quad \frac{1}{(7)^4}$

$\frac{1}{(7)^{2x}} \quad \frac{1}{(7)^4}$

On comparison of exponents

$2x \quad 4$

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

$\boxed{x \quad 2}$

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

$2^x \quad (32)^3$

$2^x \quad ((2)^5)^3$

$(2)^x \quad 2^{15}$

On comparison of exponents

$\boxed{x \quad 15}$

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

$3^x \quad \frac{1}{(3)^4}$ $\qquad (3)^x \quad (3)^{\quad 4}$

On comparison of exponents

$x \quad 4$

2. (a) $0.000000375 \quad \frac{3.75}{1000000000}$ $\qquad$ (b) $506.289 \quad \frac{506289}{1000} \quad 506289 \quad 10^{\quad 3}$

(c) $928000000000 \quad 9.28 \quad 1000000000000 \quad 9.28 \quad 10^{12}$

(d) $\frac{3}{100000000} \quad 3 \quad 10^{\quad 8}$

(e) $4603 \quad (10)^{\quad 5} \quad 4603 \quad \frac{1}{100000} \quad 0.04603$

(f) $0.0000478 \quad (10)^4 \quad 0.0000478 \quad 10 \quad 10 \quad 10 \quad 10 \quad 0.478$

3. (a) $3.25 \quad 10^{\quad 8} \quad \frac{3.25}{100000000} \quad 0.0000000325$

(b) $4.083 \quad 10^4 \quad 4.083 \quad 10 \quad 10 \quad 10 \quad 10 \quad 40830$

(c) $9.17 \quad (10)^{\quad 5} \quad \frac{9.17}{100000} \quad 0.0000917$

(d) 2.0001 $(10)^9$ $\frac{2.0001}{1000000000}$

2.0001 10 10 10 10 10 10 10 10 10 2000100000

(e) 8 $(10)^9$ $\frac{8}{1000000000}$ 0.0000000008

(f) 7.9 10^3 7.9 10 10 10 7900

4. (a) $\sqrt{5}$ $5^{1/2}$ (b) $\sqrt[4]{7}$ $7^{1/4}$

(c) $\sqrt[7]{1280}$ $(1280)^{1/7}$ (d) $8\sqrt{\frac{32}{79}}$ $\frac{32}{79}^{8}$

5. (a) $(13)^{1/2}$ $\sqrt{13}$ (b) $(112)^{1/5}$ $\sqrt[5]{112}$

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

6. (a) $2\sqrt{6}$ $\sqrt{4\ 6}$ $\sqrt{24}$ (b) $7\sqrt{6}$ $\sqrt{49\ 6}$ $\sqrt{294}$

(c) $10\sqrt{5}$ $\sqrt{100\ 5}$ $\sqrt{500}$ (d) $\frac{2}{3}\sqrt{40}$ $\sqrt{\frac{4}{9}\ 40}$ $\sqrt{\frac{1600}{9}}$

7. (a) $\sqrt{108}$ $\sqrt{\underline{3\ 3}\ \underline{3\ 2\ 2}}$ 3 $2\sqrt{3}$ $6\sqrt{3}$

(b) $\sqrt{99}$ $\sqrt{\underline{3\ 3}\ 11}$ $3\sqrt{11}$ (c) $\sqrt{405}$ $\sqrt{\underline{3\ 3}\ \underline{3\ 3}\ 5}$ $9\sqrt{5}$

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

MCQ's

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

3 Square and Square Roots

Exercise 3.1

1. (a) 841

29	841
29	29
	1

841 (29 29)

Since, all the factors obtained above are forming the paire.

841 is a perfect square.

(b) 753

3	753
251	251
	1

753 3 251

We can not make pairs frm any of the number

753 is not a perfect square.

(c) 1285

5	1285
257	257
	1

1285 5 257

∵ We can not make pairs from any of the number

1285 is not a perfect square.

(d) 1296

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

1296 (2 2) (2 2) (2 2) (3 3) (3 3)

Since, all the factors obtained above are forming the pairs.

1296 is perfect square.

(e) 325

5	325
5	65
13	13
	1

325 (5 5) 13

Since all the factors are forming.

The pairs we can not make paris from 13 of the numbers.

325 is not a perfect square.

(f) 5625

3	5625
3	1875
5	625
5	125
5	25
5	50
	1

5625 (3 3) (5 5) (5 5) (5 5)
Since all the factors are forming the pairs.
5625 is a perfect square.

(g) 164

2	164
2	82
41	41
	1

164 (2 2) 41
Since all the factors re forming the pairs.
We can not make pairs from 41 of the number.
164 is not a perfect square.

(h) 625

5	625
5	125
5	25
5	5
	1

625 (5 5) (5 5)
Since al the factor are forming the pairs.
625 is a perfect square.

2. (a) 6241

79	6241
79	69
	1

6241 (79 79)
Since all actors are forming the pairs
6241 is a perfect square.

(b) 625

5	625
5	125
5	25
5	5
	1

625 (5 5) (5 5)
Since al the factor are forming the pairs.
625 is a perfect square.

(c) 921

3	921
307	307
	1

921 3 307
We can not make any paire
921 is not a perfect square.

(d) 249

3	249
83	83
	1

249 3 83 We can not make any pairs
249 is not a perfect square.

(e) 1024

2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

1024 (2 2) (2 2) (2 2) (2 2) (2 2)
Since all factors are forming the pairs.
1024 is a perfect square.

(f) 12100

2	12100
2	6050
5	3025
5	605
11	121
11	11
	1

12100 (2 2) (5 5) (11 11)
Since all factors are forming the pairs.
12100 is a perfect square.

(g) 54900

2	54900
2	27450
3	13725
3	4575
5	1525
5	305
61	61
	1

54900 (2 2) (3 3) (5 5) 61
Since all the factors are forming the pairs.
we can not make pairs form 61 of the number.
54900 is not a perfect square.

(h) 903
903 3 7 403
We can not make any pair form 903 number.
903 is not a perfect square.

3	903
7	301
43	43
	1

3. (a) We have
882 2 (3 3) (7 7)
Since, in this prime factorization 2 left unpaired.
By multiplying 882 with 2
882 2 1764
$\sqrt{1764}$ 42
Thus the required number 2

2	882
3	441
3	147
7	49
7	7
	1

(b) We have
432 (2 2) (2 2) (3 3) 3
Since, in this prime factorisation 3 left unpaired.
By multiplying 432 with 3
432 3 1296
$\sqrt{1296}$ 36
Thus the required number 3.

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

(c) We have

1331 (11 11) 11

Since, in this prime factorisation 11 left unpaired.

By multiplying 1331 with 11

133 11 14641

$\sqrt{14641}$ 121

Thus the required number 11.

11	1331
11	121
17	11
	1

(d) We have

845 (13 13) 5

Since in this prime factorisation 5 left unpaired.

By multiplying 845 with 5

845 5 4225

$\sqrt{4225}$ 65

Thus, the required number 5

11	1331
11	121
17	11
	1

(e) We have

3698 2 (43 43)

Since, in this prime factorisation 2 left unpaired.

By multiplying 3698 with 2

3698 2 7396

$\sqrt{7396}$ 86

Thus the required number 2.

2	3698
43	1849
43	43
	1

(f) We have

700 (2 2) (5 5) 7

Since, in this prime factorisation 7 left unpaired.

By multiplying 700 with 7

700 7 4900

$\sqrt{4900}$ 70

Thus, the required number 7.

11	1331
11	121
17	11
	1

(g) We have

156 (2 2) 3 13

Since, in this prime factorisation 3 and 13 are left unpaired.

By multiplying 156 with 3 13, the ungrouped 3 and 13 will also be grouped in paire.

Thus, the required number 3 13 39

2	156
2	78
3	39
13	13
	1

(h) We have

76800 (2 2) (2 2) (2 2)

(2 2) (2 2) 3 (5 5)

Since, in the prime factorisation 3 left unpaired.

By multiplying 76800 with 3

76800 3 230400

$\sqrt{230400}$ 480

Thus, the required number 3.

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

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

4. (a) We get
8112 (2 2) (2 2) 3 (13 13)
In prime factorisation 3 is left unpaired.
Dividing 8112 by 3 ; obtained.
Thus the required number is 3.

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

(b) We get,
3920 (2 2) (2 2) 5 (7 7)
In prime factorisation 5 is left unpaired.
Dividing 3920 by 5 a perfect square is obtained
Thus the required number is 5.

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

(c) We get,
3971 (19 19) 11
In prime factorisation 19 is left unpaired.
Dividing 3971 by 11 a perfect square is obtained.
Thus the required number is 11.

19	3971
19	209
11	11
	1

(d) We get,
10368 (2 2) (2 2) (2 2) 2 (3 3) (3 3)
In prime factorisation 2 is left unpaired.
Dividing 10368 by 2 a perfect square is obtained.
Thus, the required number is

2	10368
2	5184
2	2592
2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

(e) We get,
141148 (2 2) 7 (71 71)
In prime factorisation 7 is left unpaired
dividing 141148 by 7 a perfect square is obtained.
Thus, the required number is 7.

2	141148
2	70574
7	35287
71	5041
71	71
	1

(f) We get,
1568 (2 2) (2 2) 2 (7 7)
In prime fractorization 2 is left unpaired.
Dividing 1568 by 2 a perfect square is obtained.
Thus, the required number is 2.

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

(g) We get,
5184 (2 2) (2 2) (2 2) (3 3) (3 3)
∵ No remainder is left
It itself is a perfect square

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

5. (a) Prime factorization of 9248

2	9248
2	4624
2	2312
2	1156
2	578
17	289
17	17
	1

9248 (2 2) (2 2) 2 (17 17)
9248 is not a perfect square.

(b) Prime factorization of 7396

2	7396
2	3698
43	1849
43	43
	1

7396 (2 2) (43 43)
7396 is square of 2 43 86

(c) Prime factorization of 1944

2	1944
2	972
2	486
3	243
3	81
3	27
3	9
3	3
	1

1944 (2 2) 2 (3 3) (3 3) 3
1944 is not a perfect square.

(d) Prime factorization of 8649

3	8649
3	2883
31	961
31	31
	1

8649 (3 3) (31 31)
8649 is square of 3 31 93

(e) Prime factorization of 15625

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

15625 (5 5) (5 5) (5 5)
15625 is square of 5 5 5 125

(f) Prime factorization of 5292

2	5292
2	2646
3	1323
3	441
3	147
7	49
7	7
	1

5292 (2 2) 3 (3 3) (7 7)
5292 is not a perfect square.

(g) Prime factorization by 415

5	415
83	83
	1

415 is not a perfect square.

(h) Prime factorization by 507

3	507
13	169
13	13
	1

507 3 (13 13)

507 is not a perfect square.

6. 13 13 1, No it is not a perfect square.

25 5 5, yes it is a perfect square

42 2 21, No is not a perfect square.

36 6 6, yes it is a perfect square.

121 11 11 yes it is a perfect square.

64 8 8 yes it is a perfect square.

55 11 5, No it is not a perfect square.

196 14 14, yes it is a perfect square.

529 23 23, yes it is a perfect square.

7. The greatest three digit number 999

square of 999

	31
3	$\overline{999}$
3	9
61	99
1	61
62	38

99 38 961 is largest three digit number is a perfect square.

8. The smallest four digit number 1000

	31
3	$\overline{10}\overline{00}$
3	9
61	100
1	61
62	39

smallest your digit number is $(31)^2$ 1000 $(32)^2$

$(31)^2$ 961 $(32)^2$ 1024

961 1000 1024

So smallest your digit number is 1024 is perfect square.