

### EXERCISE 1.1

1. Since, the number which can be written in the form  $\frac{p}{q}$ , where  $p$  and  $q$  are integers and  $q \neq 0$  are called rational numbers.

$\therefore \frac{0}{5}, 2, \frac{3}{4}$  are rational numbers, and in  $\frac{-1}{\sqrt{2}}, \sqrt{2}$  is

not an integer and in  $\frac{5}{0}, q(0) = 0$ , are not rational numbers.

2.  $\frac{-2}{3}$  : Numerator = -2  
: Denominator = 3

$\frac{4}{1}$  : Numerator = 4  
: Denominator = 1

$\frac{0}{3}$  : Numerator = 0  
: Denominator = 3

5 : Numerator = 5  
: Denominator = 1

$\frac{3}{-1}$  : Numerator = 3  
: Denominator = -1

3. (i)  $\frac{-5}{3} = \frac{-5 \times (-1)}{3 \times (-1)} = \frac{5}{-3}$

(ii)  $\frac{-5}{3} = \frac{(-5) \times (-7)}{3 \times (-7)} = \frac{35}{-21}$

(iii)  $\frac{-5}{3} = \frac{-5 \times 4}{3 \times 4} = \frac{-20}{12}$

(iv)  $\frac{-5}{3} = \frac{(-5) \times (-3)}{3 \times (-3)} = \frac{15}{-9}$

4. (i)  $\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

(ii)  $\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

(iii)  $\frac{3}{4} = \frac{3 \times (-4)}{4 \times (-4)} = \frac{-12}{-16}$

(iv)  $\frac{3}{4} = \frac{3 \times 7}{4 \times 7} = \frac{21}{28}$

5. (i)  $\frac{15}{65} = \frac{15 \div 5}{65 \div 5} = \frac{3}{13}$  ( $\because$  H.C.F. of 15 and 65 is 5)

(ii)  $\frac{33}{-77} = \frac{33 \div (-11)}{-77 \div (-11)} = \frac{-3}{7}$

(iii)  $\frac{-13}{-78} = \frac{(-13) \div (-13)}{(-78) \div (-13)} = \frac{1}{6}$

( $\because$  H.C.F. of 13 and 78 is 13)

(iv)  $\frac{-21}{15} = \frac{-21 \div 3}{15 \div 3} = \frac{-7}{5}$

6. (i)  $\left| \frac{3}{-5} \right| = \frac{|3|}{|-5|} = \frac{3}{5}$

(ii)  $\left| \frac{-4}{7} \right| = \frac{|-4|}{|7|} = \frac{4}{7}$

(iii)  $\left| \frac{8}{9} \right| = \frac{|8|}{|9|} = \frac{8}{9}$

(iv)  $\left| \frac{-6}{-11} \right| = \frac{|-6|}{|-11|} = \frac{6}{11}$

7. (i)  $\left| \frac{1}{3} \right| + \left| \frac{-3}{2} \right| = \frac{|1|}{|3|} + \frac{|-3|}{|2|}$   
 $= \frac{1}{3} + \frac{3}{2} = \frac{2+9}{6} = \frac{11}{6}$

(ii)  $\left| \frac{4}{7} \right| - \left| \frac{-3}{5} \right| = \frac{|4|}{|7|} - \frac{|-3|}{|5|}$   
 $= \frac{4}{7} - \frac{3}{5} = \frac{(4 \times 5) - (3 \times 7)}{35}$

( $\because$  L.C.M. of 7 and 5 is 35)

$= \frac{20 - 21}{35} = \frac{-1}{35}$

$$\begin{aligned}
 \text{(iii)} \quad \left| \frac{-2}{3} \right| - \left| \frac{-1}{6} \right| &= \left| \frac{-2}{3} \right| - \left| \frac{-1}{6} \right| \\
 &= \frac{2}{3} - \frac{1}{6} = \frac{(2 \times 2) - (1 \times 1)}{6} \\
 &= \frac{4-1}{6} = \frac{3}{6} = \frac{1}{2}
 \end{aligned}$$

8. When  $x = 9, y = \frac{1}{5}$

$$\begin{aligned}
 |x - y| &= \left| 9 - \frac{1}{5} \right| = \left| \frac{9}{1} - \frac{1}{5} \right| \\
 &= \left| \frac{9 \times 5 - 1 \times 1}{5} \right| = \left| \frac{45 - 1}{5} \right| \\
 &\quad (\because \text{L.C.M. of 1 and 5 is 5}) \\
 &= \left| \frac{44}{5} \right| = \frac{44}{5}
 \end{aligned}$$

And,  $|y - x| = \left| \frac{1}{5} - 9 \right| = \left| \frac{1}{5} - \frac{9}{1} \right|$

$$\begin{aligned}
 &= \left| \frac{1 \times 1 - 9 \times 5}{5} \right| = \left| \frac{1 - 45}{5} \right| \\
 &= \left| \frac{-44}{5} \right| = \frac{44}{5}
 \end{aligned}$$

Hence,  $|x - y| = \frac{44}{5}$  and  $|y - x| = \frac{44}{5}$

9.  $|x + y|$ , when  $x = -7, y = 3$

$$\begin{aligned}
 |x + y| &= |-7 + 3| = |-(7 - 3)| = |-4| = 4 \\
 \therefore |x + y| &= 4
 \end{aligned}$$

10. (i) Three equivalent rational numbers of  $\frac{-2}{3}$ .

$$\frac{-2}{3} = \frac{-2 \times 2}{3 \times 2} = \frac{-4}{6}$$

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

$$\frac{-2}{3} = \frac{-2 \times 4}{3 \times 4} = \frac{-8}{12}$$

Hence, three equivalent rational numbers of  $\frac{-2}{3}$

are  $\frac{-4}{6}, \frac{-6}{9}, \frac{-8}{12}$

(ii) Three equivalent rational numbers of  $\frac{3}{5}$

$$\frac{3}{5} = \frac{3 \times 2}{5 \times 2} = \frac{6}{10}$$

$$\frac{3}{5} = \frac{3 \times 3}{5 \times 3} = \frac{9}{15}$$

$$\frac{3}{5} = \frac{3 \times 4}{5 \times 4} = \frac{12}{20}$$

Hence, three equivalent rational numbers of  $\frac{3}{5}$  are

$$\frac{6}{10}, \frac{9}{15}, \frac{12}{20}$$

(iii) Three equivalent rational numbers of  $\frac{7}{-6}$ .

$$\frac{7}{-6} = \frac{7 \times 2}{-6 \times 2} = \frac{14}{-12}$$

$$\frac{7}{-6} = \frac{7 \times 3}{-6 \times 3} = \frac{21}{-18}$$

$$\frac{7}{-6} = \frac{7 \times 4}{-6 \times 4} = \frac{28}{-24}$$

Hence, three equivalent rational numbers of  $\frac{7}{-6}$  are

$$\frac{14}{-12}, \frac{21}{-18}, \frac{28}{-24}$$

### EXERCISE 1.2

1. (i)  $\frac{3}{4}$  and 0

clearly,  $\frac{3}{4} > 0$

(ii)  $\frac{-1}{2}$  and  $\frac{4}{-7}$

L.C.M. of 2 and 7 is 14.

$$\frac{-1}{2} = \frac{-1 \times 7}{2 \times 7} = \frac{-7}{14}$$

$$\frac{4}{-7} = \frac{4 \times (-2)}{(-7) \times (-2)} = \frac{-8}{14}$$

$$\frac{-7}{14} > \frac{-8}{14} \quad (\because -7 > -8)$$

$$\therefore \frac{-1}{2} > \frac{4}{-7}$$

(iii)  $\frac{8}{15}$  and  $\frac{3}{10}$

L.C.M. of 15 and 10 is 30.

$$\frac{8}{15} = \frac{8 \times 2}{15 \times 2} = \frac{16}{30}$$

$$\frac{3}{10} = \frac{3 \times 3}{10 \times 3} = \frac{9}{30}$$

$$\frac{16}{30} > \frac{9}{30} \quad (\because 16 > 9)$$

$$\Rightarrow \frac{8}{15} > \frac{3}{10}$$

(iv)  $\frac{-1}{2}$  and  $\frac{8}{-5}$

L.C.M. of 2 and 5 is 10.

$$\frac{-1}{2} = \frac{-1 \times 5}{2 \times 5} = \frac{-5}{10}$$

$$\frac{8}{-5} = \frac{8 \times (-2)}{(-5) \times (-2)} = \frac{-16}{10}$$

$$\frac{-5}{10} > \frac{-16}{10} \quad (\because -5 > -16)$$

$$\Rightarrow \frac{-1}{2} > \frac{8}{-5}$$

2. Make the denominator positive and write the rational numbers as

$$\frac{5}{7}, \frac{-11}{2}, \frac{-2}{7}, \frac{-3}{14}$$

Now, L.C.M. of 7, 2, 7 and 14 is 14.

$$\frac{5}{7} = \frac{5 \times 2}{7 \times 2} = \frac{10}{14}$$

$$\frac{-11}{2} = \frac{-11 \times 7}{2 \times 7} = \frac{-77}{14}$$

$$\frac{-2}{7} = \frac{-2 \times 2}{7 \times 2} = \frac{-4}{14}$$

$$\frac{-3}{14} = \frac{-3 \times 1}{14 \times 1} = \frac{-3}{14}$$

$$\therefore \frac{10}{14} > \frac{-3}{14} > \frac{-4}{14} > \frac{-77}{14}$$

$$\Rightarrow \frac{5}{7} > \frac{-3}{14} > \frac{-2}{7} > \frac{-11}{2}$$

Hence,  $\frac{5}{7}, \frac{-3}{14}, \frac{-2}{7}$  and  $\frac{-11}{2}$  are in descending order.

3. (i)  $\frac{8}{-15}, \frac{-3}{10}, \frac{-13}{20}, \frac{17}{-30}$

Make the denominator positive and write the rational number as  $\frac{-8}{15}, \frac{-3}{10}, \frac{-13}{20}, \frac{-17}{30}$

L.C.M. of 15, 10, 20, 30 is 60.

$$\frac{-8}{15} = \frac{-8 \times 4}{15 \times 4} = \frac{-32}{60}$$

$$\frac{-3}{10} = \frac{-3 \times 6}{10 \times 6} = \frac{-18}{60}$$

$$\frac{-13}{20} = \frac{-13 \times 3}{20 \times 3} = \frac{-39}{60}$$

$$\frac{-17}{30} = \frac{-17 \times 2}{30 \times 2} = \frac{-34}{60}$$

$$\therefore \frac{-39}{60} < \frac{-34}{60} < \frac{-18}{60} < \frac{-17}{60}$$

$$\Rightarrow \frac{-13}{20} < \frac{-17}{30} < \frac{-8}{15} < \frac{-3}{10}$$

Hence,  $\frac{-13}{20}, \frac{17}{-30}, \frac{8}{-15}, \frac{-3}{10}$  are in ascending order.

(ii)  $\frac{-13}{5}, -2, \frac{7}{-3}, \frac{2}{3}$

Make the denominator positive and write the

rational number as  $\frac{-13}{5}, \frac{-2}{1}, \frac{-7}{3}, \frac{2}{3}$

Now, L.C.M. of 5, 1, 3 and 3 is 15.

$$\frac{-13}{5} = \frac{-13 \times 3}{5 \times 3} = \frac{-39}{15}$$

$$\frac{-2}{1} = \frac{-2 \times 15}{1 \times 15} = \frac{-30}{15}$$

$$\frac{-7}{3} = \frac{-7 \times 5}{3 \times 5} = \frac{-35}{15}$$

$$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$$

$$\therefore \frac{-39}{15} < \frac{-35}{15} < \frac{-30}{15} < \frac{10}{15}$$

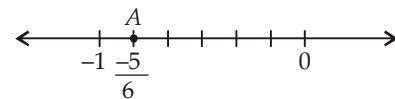
$$\Rightarrow \frac{-13}{5} < \frac{-7}{3} < \frac{-2}{1} < \frac{2}{3}$$

Hence,  $\frac{-13}{5}, \frac{7}{-3}, -2, \frac{2}{3}$  are in ascending order.

4. (i)  $\frac{-5}{6}$

To represent rational number  $\frac{-5}{6}$ , we divided the distance between 0 and -1 into six equal parts. Starting from 0, move towards left (-1) and the 5<sup>th</sup>

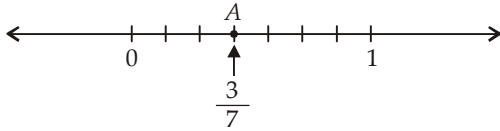
mark will represent  $\frac{-5}{6}$ .



(ii)  $\frac{3}{7}$

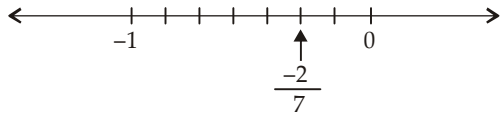
To represent rational number  $\frac{3}{7}$ , we divided the distance between 0 and 1 into seven equal parts. Starting from 0, move towards right (1) and the 3<sup>rd</sup>

mark will represent  $\frac{3}{7}$ .



(iii)  $\frac{-2}{7}$

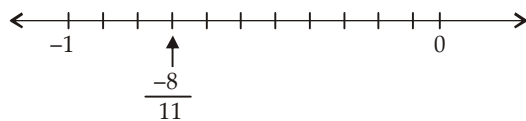
To represent rational number  $\frac{-2}{7}$ , we divided the distance between 0 and -1 into seven equal parts.



Starting from 0, moves towards left (-1) and 2<sup>nd</sup> mark will represent  $\frac{-2}{7}$ .

(iv)  $\frac{-8}{11}$

To represent rational number  $\frac{-8}{11}$ , we divided the distance between 0 and -1 into eleven equal parts starting from 0, moves towards left (-1) and 8<sup>th</sup> mark will represent  $\frac{-8}{11}$ .



5. (i)  $\frac{-2}{13} \square \frac{3}{-7}$

Make the denominator positive.

$$\frac{-2}{13} \times \frac{-3}{7} \text{ (By cross-multiplication)}$$

$$-14 > -39$$

$$\therefore \frac{-2}{13} \square > \frac{3}{-7}$$

(ii)  $\frac{-13}{6} \square \frac{-2}{1}$

$$\frac{-13}{6} \times \frac{-2}{1} \text{ (By cross multiplication)}$$

$$-13 < -12$$

$$\therefore \frac{-13}{6} \square < -2$$

(iii)  $\frac{-3}{2} \square \frac{6}{-5}$

Make the denominator positive.

$$\frac{-13}{2} \times \frac{-6}{5} \text{ (By cross-multiplication)}$$

$$-15 < -12$$

$$\therefore \frac{-3}{2} \square < \frac{6}{-5}$$

(iv)  $\frac{-3}{10} \square \frac{6}{-20}$

Make the denominator positive,

$$\frac{-13}{10} \times \frac{-6}{20} \text{ (By cross multiplication)}$$

$$-60 = -60$$

$$\therefore \frac{-3}{10} \square = \frac{6}{-20}$$

(v)  $0 \square \frac{-2}{-3}$

Make denominator positive.

$$\frac{0}{1} \times \frac{2}{3}$$

Clearly,  $0 < 2$

$$\text{Hence, } 0 \square < \frac{-2}{-3}$$

(vi)  $\frac{-7}{12} \square \frac{-13}{9}$

$$\Rightarrow \frac{-7}{12} \times \frac{-13}{9}$$

$$\Rightarrow -63 > -156$$

$$\therefore \frac{-7}{12} \square > \frac{-13}{9}$$

6. (i)  $\frac{-5}{12}, \frac{-7}{6}, \frac{3}{-8}, \frac{-11}{7}$

Make the denominator positive, and write the rational number as

$$\frac{-5}{12}, \frac{-7}{6}, \frac{-3}{8}, \frac{-11}{7}$$

Now, L.C.M of 12, 6, 8 and 7 is 168.

$$\frac{-5}{12} = \frac{-5 \times 14}{12 \times 14} = \frac{-70}{168}$$

$$\frac{-7}{6} = \frac{-7 \times 28}{6 \times 28} = \frac{-196}{168}$$

$$\frac{-3}{8} = \frac{-3 \times 21}{8 \times 21} = \frac{-63}{168}$$

$$\frac{-11}{7} = \frac{-11 \times 24}{7 \times 24} = \frac{-264}{168}$$

$$\therefore \frac{-63}{168} > \frac{-70}{168} > \frac{-196}{168} > \frac{-264}{168}$$

$$\Rightarrow \frac{-3}{8} > \frac{-5}{12} > \frac{-7}{6} > \frac{-11}{7}$$

Hence,  $\frac{3}{-8} > \frac{-5}{12} > \frac{-7}{6} > \frac{-11}{7}$  are in descending order.

$$(ii) \frac{-17}{11}, \frac{7}{-5}, \frac{-11}{9}, \frac{13}{-8}$$

Make the denominator positive, and write the rational number as  $\frac{-17}{11}, \frac{-7}{5}, \frac{-11}{9}, \frac{-13}{8}$ .

L.C.M. of 11, 5, 9 and 8 is 3960.

$$\frac{-17}{11} = \frac{-17 \times 360}{11 \times 360} = \frac{-6120}{3960}$$

$$\frac{-7}{5} = \frac{-7 \times 792}{5 \times 792} = \frac{-5544}{3960}$$

$$\frac{-11}{9} = \frac{-11 \times 440}{9 \times 440} = \frac{-4840}{3960}$$

$$\frac{-13}{8} = \frac{-13 \times 495}{8 \times 495} \times \frac{8}{8} = \frac{-6435}{3960}$$

$$\therefore \frac{-4850}{3960} > \frac{-5544}{3960} > \frac{-6120}{3960} > \frac{-6435}{3960}$$

$$\Rightarrow \frac{-11}{9} > \frac{-7}{5} > \frac{-17}{11} > \frac{-13}{8}$$

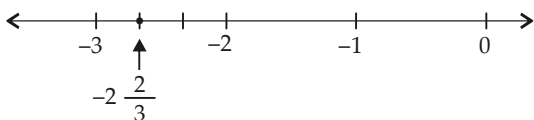
Hence,  $\frac{-11}{9}, \frac{-7}{5}, \frac{-17}{11}, \frac{-13}{8}$  are in descending order.

$$7. (i) \frac{-8}{3} = -2\frac{2}{3}$$

The given rational number lies between -2 and -3, divided the distance between -2 and -3 three equal parts, starting from -2, move towards left (-3) and

2<sup>nd</sup> mark will represent  $\frac{-8}{3}$ .

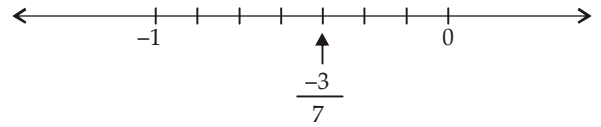
$$\frac{-8}{3} = -2\frac{2}{3}$$



$$(ii) \frac{3}{-7}$$

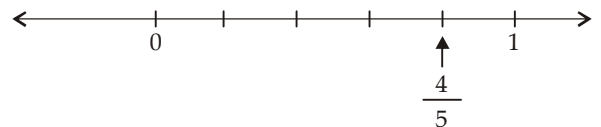
Make denominator positive, Therefore, the rational number is  $\frac{-3}{7}$ .

To represent  $\frac{-3}{7}$  on number line, divide the distance, between 0 and -1 into seven equal parts, starting from 0, move towards (left) -1, the 7<sup>th</sup> mark will represent  $\frac{-3}{7}$ .



$$(iii) \frac{4}{5}$$

To represent  $\frac{4}{5}$ , divide the distances between 0 and 1 into five equal parts, starting from 0, move towards right (1), the 4<sup>th</sup> mark will represent  $\frac{4}{5}$ .



8. Five rational numbers smaller than -1 are  $\frac{-3}{2}, \frac{-5}{2}, \frac{-7}{2}, -2$  and  $\frac{-9}{2}$ .

9. Five rational number greater than  $\frac{-3}{2}$  are  $-1, \frac{-1}{2}, 0, \frac{1}{2}$  and  $1\frac{3}{2}$ .

### EXERCISE 1.3

$$1. (i) \frac{5}{8} \text{ and } \frac{3}{-10}$$

L.C.M. of 8 and 10 is 40.

$$\frac{5}{8} = \frac{5 \times 5}{8 \times 5} = \frac{25}{40}$$

$$\frac{3}{-10} = \frac{-3}{10} = \frac{-3 \times 4}{10 \times 4} = \frac{-12}{40}$$

$$\frac{5}{8} + \left(\frac{-3}{10}\right) = \frac{25}{40} + \left(\frac{-12}{40}\right) = \frac{25 + (-12)}{40}$$

$$= \frac{25 - 12}{40} = \frac{13}{40}$$

$$(ii) \frac{-3}{10} \text{ and } \frac{7}{-15}$$

L.C.M of 10 and 15 is 30

$$\frac{-3}{10} = \frac{-3 \times 3}{10 \times 3} = \frac{-9}{30}$$

$$\frac{7}{-15} = \frac{-7}{15} = \frac{-7 \times 2}{15 \times 2} = \frac{-14}{30}$$

$$\begin{aligned} \left(\frac{-3}{10}\right) + \left(\frac{-7}{15}\right) &= \left(\frac{-9}{30}\right) + \left(\frac{-14}{30}\right) \\ &= \frac{-9-14}{30} = \frac{-23}{30} \end{aligned}$$

(iii) 4 and  $\frac{5}{6}$

L.C.M. of 1 and 6 is 6.

$$\frac{4}{1} = \frac{4 \times 6}{1 \times 6} = \frac{24}{6}$$

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

$$4 + \frac{5}{6} = \frac{24}{6} + \frac{5}{6} = \frac{24+5}{6} = \frac{29}{6}$$

(iv)  $\frac{15}{-7}$  and  $\frac{8}{3}$

L.C.M. of 7 and 3 is 21.

$$\frac{15}{-7} = \frac{-15}{7} = \frac{-15 \times 3}{7 \times 3} = \frac{-45}{21}$$

$$\frac{8}{3} = \frac{8 \times 7}{3 \times 7} = \frac{56}{21}$$

$$\begin{aligned} \left(\frac{-15}{7}\right) + \frac{8}{3} &= \left(\frac{-45}{21}\right) + \frac{56}{21} = \frac{(-45)+56}{21} \\ &= \frac{-45+56}{21} = \frac{11}{21} \end{aligned}$$

2. (i)  $\frac{8}{3}$  from  $\frac{13}{7}$

L.C.M of 3 and 7 is 21.

$$\frac{8}{3} = \frac{8 \times 7}{3 \times 7} = \frac{56}{21}$$

$$\frac{13}{7} = \frac{13 \times 3}{7 \times 3} = \frac{39}{21}$$

$$\frac{13}{7} - \frac{8}{3} = \frac{39}{21} - \frac{56}{21} = \frac{39-56}{21} = \frac{-17}{21}$$

(ii)  $\frac{-4}{13}$  from  $\frac{6}{-7}$

L.C.M. of 13 and 7 is 91.

$$\frac{-4}{13} = \frac{-4 \times 7}{13 \times 7} = \frac{-28}{91}$$

$$\frac{6}{-7} = \frac{-6}{7} = \frac{-6 \times 13}{7 \times 13} = \frac{-78}{91}$$

$$\begin{aligned} \left(\frac{-6}{7}\right) - \left(\frac{-4}{13}\right) &= \left(\frac{-78}{91}\right) - \left(\frac{-28}{91}\right) \\ &= \frac{-78 - (-28)}{91} = \frac{-78 + 28}{91} = \frac{-50}{91} \end{aligned}$$

(iii)  $\frac{11}{6}$  from  $\frac{-2}{9}$

L.C.M of 6 and 9 is 18.

$$\frac{11}{6} = \frac{11 \times 3}{6 \times 3} = \frac{33}{18}$$

$$\frac{-2}{9} = \frac{-2 \times 2}{9 \times 2} = \frac{-4}{18}$$

$$\left(\frac{-2}{9}\right) - \frac{11}{6} = \left(\frac{-4}{18}\right) - \frac{33}{18} = \frac{(-4)-33}{18} = \frac{-37}{18}$$

(iv)  $\frac{-7}{10}$  from  $\frac{2}{5}$

L.C.M of 10 and 5 is 10.

$$\frac{-7}{10} = \frac{-7 \times 1}{10 \times 1} = \frac{-7}{10}$$

$$\frac{2}{5} = \frac{2 \times 2}{5 \times 2} = \frac{4}{10}$$

$$\begin{aligned} \frac{2}{5} - \left(\frac{-7}{10}\right) &= \frac{4}{10} - \left(\frac{-7}{10}\right) = \frac{4 - (-7)}{10} \\ &= \frac{11}{10} \end{aligned}$$

3. (i)  $\frac{5}{6} - \frac{3}{8} + \frac{7}{12}$

L.C.M of 6, 8 and 12 is 24.

$$\frac{5}{6} = \frac{5 \times 4}{6 \times 4} = \frac{20}{24}$$

$$\frac{3}{8} = \frac{3 \times 3}{8 \times 3} = \frac{9}{24}$$

$$\frac{7}{12} = \frac{7 \times 2}{12 \times 2} = \frac{14}{24}$$

$$\frac{5}{6} - \frac{3}{8} + \frac{7}{12} = \frac{20}{24} - \frac{9}{24} + \frac{14}{24}$$

$$= \frac{20-9+14}{24} = \frac{11+14}{24} = \frac{25}{24}$$

$$(ii) \frac{11}{-18} - \frac{5}{16} + \frac{4}{9}$$

L.C.M. of 18, 16 and 9 is 144.

$$\frac{11}{-18} = \frac{-11}{18} = \frac{-11 \times 8}{18 \times 8} = \frac{-88}{144}$$

$$\frac{5}{16} = \frac{5 \times 9}{16 \times 9} = \frac{45}{144}$$

$$\frac{4}{9} = \frac{4 \times 16}{9 \times 16} = \frac{64}{144}$$

$$\frac{11}{-18} - \frac{5}{16} + \frac{4}{9} = \frac{-88}{144} - \frac{45}{144} + \frac{64}{144}$$

$$= \frac{-88-45+64}{144} = \frac{-69}{144}$$

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

L.C.M. of 3 and 5 is 15.

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

$$\frac{-2}{3} = \frac{-2 \times 5}{3 \times 5} = \frac{-10}{15}$$

$$\frac{-4}{5} = \frac{-4 \times 3}{5 \times 3} = \frac{-12}{15}$$

$$2 + \left(\frac{-2}{3}\right) + \left(\frac{-4}{5}\right) = \frac{30}{15} + \left(\frac{-10}{15}\right) + \left(\frac{-12}{15}\right)$$

$$= \frac{30 + (-10) + (-12)}{15}$$

$$= \frac{30-10-12}{15} = \frac{8}{15}$$

$$(iv) \frac{-9}{2} + \left(\frac{-8}{3}\right) + \frac{11}{6}$$

$$\frac{-9}{2} = \frac{-9 \times 3}{2 \times 3} = \frac{-27}{6}$$

$$\frac{-8}{3} = \frac{-8 \times 2}{3 \times 2} = \frac{-16}{6}$$

$$\frac{11}{6} = \frac{11 \times 1}{6 \times 1} = \frac{11}{6}$$

$$\frac{-9}{2} + \left(\frac{-8}{3}\right) + \frac{11}{6} = \frac{-27}{6} + \left(\frac{-16}{6}\right) + \frac{11}{6}$$

$$= \frac{-27 + (-16) + 11}{6}$$

$$= \frac{-27-16+11}{6} = \frac{-43+11}{6}$$

$$= \frac{-32}{6} = \frac{-16}{3}$$

$$4. \text{ If } x = \frac{3}{7}, y = \frac{5}{3}$$

$$\text{Taking, L.H.S} = (x + y) = \frac{3}{7} + \frac{5}{3} = \frac{9}{21} + \frac{35}{21}$$

$$= \frac{9+35}{21} = \frac{44}{21}$$

Again taking R.H.S = (y + x)

$$= \frac{5}{3} + \frac{3}{7} = \frac{35}{21} + \frac{9}{21}$$

$$= \frac{35+9}{21} = \frac{44}{21}$$

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

Commutative law of addition on rational number.

$$5. \text{ If } x = \frac{4}{7}, y = \frac{-5}{21}, z = \frac{1}{3}$$

Taking, L.H.S = (x + y) + z

$$= \left\{ \frac{4}{7} + \left(\frac{-5}{21}\right) \right\} + \frac{1}{3}$$

$$= \left\{ \frac{4 \times 3}{7 \times 3} + \left(\frac{-5}{21}\right) \right\} + \frac{1 \times 7}{3 \times 7}$$

$$= \left\{ \frac{12}{21} + \left(\frac{-5}{21}\right) \right\} + \frac{7}{21}$$

$$= \left\{ \frac{12+(-5)}{21} \right\} + \frac{7}{21}$$

$$= \left( \frac{12-5}{21} \right) + \frac{7}{21}$$

$$= \frac{7}{21} + \frac{7}{21} = \frac{14}{21} = \frac{2}{3}$$

Again, taking R.H.S. = x + (y + z)

$$= \frac{4}{7} + \left\{ \left(\frac{-5}{21}\right) + \frac{1}{3} \right\}$$

$$\begin{aligned}
&= \frac{4 \times 3}{7 \times 3} + \left\{ \left( \frac{-5}{21} \right) + \frac{1 \times 7}{3 \times 7} \right\} \\
&= \frac{12}{21} + \left\{ \left( \frac{-5}{21} \right) + \frac{7}{21} \right\} \\
&= \frac{12}{21} + \left\{ \frac{(-5) + 7}{21} \right\} \\
&= \frac{12}{21} + \left( \frac{-2}{21} \right) = \frac{12 + (-2)}{21} \\
&= \frac{12 - 2}{21} = \frac{10}{21}
\end{aligned}$$

Associative law of addition on rational number.

6. (i)  $\frac{3}{5}$  from  $\frac{5}{6} = \frac{5}{6} - \frac{3}{5} = \frac{5 \times 5}{6 \times 5} - \frac{3 \times 6}{5 \times 6}$

$\therefore$  L.C.M of 6 and 5 is 30.

$$= \frac{25 - 18}{30} = \frac{7}{30}$$

(ii)  $\frac{-5}{8}$  from  $\frac{-4}{3} = \frac{-4}{3} - \left( \frac{-5}{8} \right)$

L.C.M of 3 and 8 is 24.

$$\begin{aligned}
&= \left( \frac{-4 \times 8}{3 \times 8} \right) - \left( \frac{-5 \times 3}{8 \times 3} \right) = \frac{-32}{24} - \left( \frac{-15}{24} \right) \\
&= \frac{-32 - (-15)}{24} \\
&= \frac{-32 + 15}{24} = \frac{-17}{24}
\end{aligned}$$

7. (i)  $\frac{3}{7} + \frac{(-2)}{9} + \frac{7}{9}$

L.C.M of 7, 9 and 9 is 63.

$$\begin{aligned}
&= \frac{3 \times 9}{7 \times 9} + \frac{(-2) \times 7}{9 \times 7} + \frac{7 \times 7}{9 \times 7} \\
&= \frac{27}{63} + \frac{(-14)}{63} + \frac{49}{63} = \frac{27 + (-14) + 49}{63} \\
&= \frac{62}{63}
\end{aligned}$$

Hence,  $\frac{3}{7} + \frac{(-2)}{9} + \frac{7}{9} = \frac{62}{63}$

(ii)  $\frac{7}{12} - \frac{5}{6} + \frac{1}{8} - \frac{5}{12}$

L.C.M of 12, 6, 8 and 12 is 24.

$$\begin{aligned}
&= \frac{7 \times 2}{12 \times 2} - \frac{5 \times 4}{6 \times 4} + \frac{1 \times 3}{8 \times 3} - \frac{5 \times 2}{12 \times 2} \\
&= \frac{14}{24} - \frac{20}{24} + \frac{3}{24} - \frac{10}{24} \\
&= \frac{14 - 20 + 3 - 10}{24} = \frac{-13}{24}
\end{aligned}$$

Hence,  $\frac{7}{12} - \frac{5}{6} + \frac{1}{8} - \frac{5}{12} = \frac{-13}{24}$

(iii)  $\frac{-4}{3} - 2 + \frac{2}{5} + 1$

L.C.M of 3 and 5 is 15.

$$\begin{aligned}
&= \frac{-4 \times 5}{3 \times 5} - \frac{2 \times 15}{1 \times 15} + \frac{2 \times 3}{5 \times 3} + \frac{1 \times 15}{1 \times 15} \\
&= \frac{-20}{15} - \frac{30}{15} + \frac{6}{15} + \frac{15}{15} \\
&= \frac{-20 - 30 + 6 + 15}{15} = \frac{-29}{15}
\end{aligned}$$

Hence,  $\frac{-4}{3} - 2 + \frac{2}{5} + 1 = \frac{-29}{15}$

8. (i) Additive inverse of  $\frac{-3}{7} = \frac{3}{7}$

$$\therefore \frac{-3}{7} + \frac{3}{7} = \frac{-3 + 3}{7} = \frac{0}{7} = 0$$

(ii) Additive inverse of  $\frac{16}{-3} = -\left( \frac{-16}{3} \right) = \frac{16}{3}$

$$\therefore \frac{-16}{3} + \frac{16}{3} = 0$$

(iii) Additive inverse of  $\frac{7}{9} = -\frac{7}{9}$

$$\therefore \frac{7}{9} + \left( -\frac{7}{9} \right) = 0$$

(iv) Additive inverse of  $-\frac{11}{-5} = -\left( \frac{11}{5} \right) = -\frac{11}{5}$

9. Let the other number be  $x$ .

Then,

$$\left( \frac{-12}{3} \right) + x = \frac{-5}{3}$$

$$\Rightarrow x = \frac{-5}{3} - \left( \frac{-12}{3} \right) = \frac{-5 - (-12)}{3} = \frac{-5 + 12}{3} = \frac{7}{3}$$

Hence, the other number is  $\frac{7}{3}$ .



10. Let the other number be  $x$ , then

$$\begin{aligned}\frac{5}{9} + x &= \frac{-23}{9} \\ \Rightarrow x &= \frac{-23}{9} - \frac{5}{9} \\ &= \frac{-23-5}{9} = \frac{-28}{9}.\end{aligned}$$

Hence, other number is  $\frac{-28}{9}$ .

11. Let the number to be added be  $x$ .

$$\begin{aligned}\text{Then, } \left(\frac{1}{3} + \frac{1}{4} + \frac{1}{6}\right) + x &= 1 \\ \Rightarrow x &= 1 - \frac{1}{3} - \frac{1}{4} - \frac{1}{6} \\ &= \frac{12-4-3-2}{12} = \frac{3}{12} = \frac{1}{4}\end{aligned}$$

Hence, the required number is  $\frac{1}{4}$ .

12. Let the number to be subtracted be  $x$ .

$$\begin{aligned}\text{Then, } \frac{3}{5} - x &= \frac{5}{3} \\ \Rightarrow x &= \frac{3}{5} - \frac{5}{3} = \frac{3 \times 3}{5 \times 3} - \frac{5 \times 5}{3 \times 5} \\ &= \frac{9}{15} - \frac{25}{15} = \frac{9-25}{15} \\ &\quad (\because \text{L.C.M. of 3 and 5 is 15}) \\ &= \frac{-16}{15}\end{aligned}$$

Hence,  $\frac{-16}{15}$  should be subtracted from  $\frac{3}{5}$  to get  $\frac{5}{3}$ .

13. Let the number to be subtracted be  $x$ .

$$\begin{aligned}\text{Then, } \left(\frac{3}{4} - \frac{1}{3}\right) - x &= -\frac{1}{4} \\ \Rightarrow x &= \left(\frac{3}{4} - \frac{1}{3}\right) + \frac{1}{4} \\ &= \left(\frac{9-4}{12}\right) + \frac{1}{4} \\ &\quad (\because \text{L.C.M. of 4 and 3 is 12.}) \\ &= \frac{5}{12} + \frac{1}{4} = \frac{5+3}{12} = \frac{8}{12} = \frac{2}{3}\end{aligned}$$

Hence,  $\frac{2}{3}$  should be subtracted.

$$\begin{aligned}14. \text{ (i) } \frac{7}{3} + \left(\frac{-8}{5}\right) + \frac{3}{5} + \left(\frac{2}{-3}\right) \\ \text{or } \frac{7}{3} + \left(\frac{-8}{5}\right) + \frac{3}{5} + \left(\frac{-2}{3}\right) \\ &= \left\{\frac{7}{3} + \left(\frac{-2}{3}\right)\right\} + \left\{\left(\frac{-8}{5}\right) + \frac{3}{5}\right\} \\ &= \left\{\frac{7+(-2)}{3}\right\} + \left\{\frac{-8+3}{5}\right\} \\ &= \frac{5}{3} + \left(\frac{-5}{5}\right) = \frac{25+(-15)}{15} = \frac{25-15}{15} \\ &= \frac{10}{15} = \frac{2}{3}\end{aligned}$$

$$\begin{aligned}\text{(ii) } \frac{-9}{5} + \left(\frac{2}{-3}\right) + \frac{1}{5} + \frac{3}{5} \\ \text{or } \frac{-9}{5} + \left(\frac{-2}{3}\right) + \frac{1}{5} + \frac{3}{5} \\ &= \left(\frac{-9}{5} + \frac{1}{5} + \frac{3}{5}\right) + \left(\frac{-2}{3}\right) \\ &= \left\{\frac{(-9)+1+3}{5}\right\} + \left(\frac{-2}{3}\right) \\ &= \left(\frac{-5}{5}\right) + \left(\frac{-2}{3}\right) \\ &= \frac{(-15)+(-10)}{15} = \frac{-15-10}{15} \\ &= \frac{-25}{15} = \frac{-5}{3}\end{aligned}$$

$$\begin{aligned}\text{(iii) } \frac{3}{4} + \left(\frac{2}{-3}\right) + \left(\frac{-3}{5}\right) + 1 \\ \text{or } \frac{3}{4} + \left(\frac{-2}{3}\right) + \left(\frac{-3}{5}\right) + 1 \\ &= \left\{\frac{3}{4} + \left(\frac{-3}{5}\right)\right\} + \left\{\left(\frac{-2}{3}\right) + 1\right\} \\ &= \left\{\frac{15+(-12)}{20}\right\} + \left\{\frac{-2+3}{3}\right\} \\ &= \frac{3}{20} + \frac{1}{3} = \frac{9+20}{60} = \frac{29}{60}\end{aligned}$$

15. The sum of  $\frac{-5}{6}$  and  $\frac{4}{5} = \left(\frac{-5}{6}\right) + \frac{4}{5} = \frac{-25+24}{30}$

( $\therefore$  L.C.M of 6 and 5 is 30)

$$= \frac{-1}{30}$$

The sum of  $\frac{-3}{5}$  and  $\frac{7}{15} = \frac{-3}{5} + \frac{7}{15}$

$$= \frac{-9+7}{15} = \frac{-2}{15}$$

Now,  $\left(\frac{-2}{15}\right) - \left(\frac{-1}{30}\right) = \frac{-4-(-1)}{30}$

$$= \frac{-4+1}{30} = \frac{-3}{30} = -\frac{1}{10}$$

16. (i)  $\left[\frac{2}{3} + \left(\frac{-2}{5}\right)\right] + \frac{7}{10} = \frac{2}{3} + \left[\left(\frac{-2}{5}\right) + \frac{7}{10}\right]$

Taking L.H.S. =  $\left[\frac{2}{3} + \left(\frac{-2}{5}\right)\right] + \frac{7}{10}$

$$= \left[\frac{2 \times 5}{3 \times 5} + \left(\frac{-2 \times 3}{5 \times 3}\right)\right] + \frac{7}{10}$$

$$= \left[\frac{10}{15} + \left(\frac{-6}{15}\right)\right] + \frac{7}{10} = \left[\frac{10+(-6)}{15}\right] + \frac{7}{10}$$

$$= \left[\frac{10-6}{15}\right] + \frac{7}{10} = \frac{4}{15} + \frac{7}{10}$$

$$= \frac{4 \times 2}{15 \times 2} + \frac{7 \times 3}{10 \times 3}$$

$$= \frac{8}{30} + \frac{21}{30} = \frac{8+21}{30} = \frac{29}{30}$$

Now, taking

R.H.S. =  $\frac{2}{3} + \left[\left(\frac{-2}{5}\right) + \frac{7}{10}\right] = \frac{2}{3} + \left[\left(\frac{-2 \times 2}{5 \times 2}\right) + \frac{7}{10}\right]$

$$= \frac{2}{3} + \left[\left(\frac{-4}{10}\right) + \frac{7}{10}\right] = \frac{2}{3} + \left[\frac{-4+7}{10}\right]$$

$$= \frac{2}{3} + \frac{3}{10} = \frac{2 \times 10}{3 \times 10} + \frac{3 \times 3}{10 \times 3}$$

$$= \frac{20}{30} + \frac{9}{30} = \frac{20+9}{30} = \frac{29}{30}$$

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

(ii)  $-2 + \left[\frac{3}{5} + \left(\frac{-1}{6}\right)\right] = \left[-2 + \frac{3}{5}\right] + \frac{-1}{6}$

Taking, L.H.S. =  $-2 + \left[\frac{3}{5} + \left(\frac{-1}{6}\right)\right]$

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

$$= -2 + \left[\frac{18}{30} + \left(\frac{-5}{30}\right)\right] = -2 + \left[\frac{18-5}{30}\right]$$

$$= -2 + \left(\frac{13}{30}\right) = \frac{-2 \times 30}{1 \times 30} + \frac{13}{30}$$

$$= \frac{-60}{30} + \frac{13}{30} = \frac{-60+13}{30} = \frac{-47}{30}$$

Now, taking, R.H.S. =  $\left[-2 + \frac{3}{5}\right] + \left(\frac{-1}{6}\right)$

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

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

$$= \left[\frac{-10+3}{5}\right] + \left(\frac{-1}{6}\right) = \left(\frac{-7}{5}\right) + \left(\frac{-1}{6}\right)$$

$$= \left(\frac{-7 \times 6}{5 \times 6}\right) + \left(\frac{-1 \times 5}{6 \times 5}\right) = \left(\frac{-42}{30}\right) + \left(\frac{-5}{30}\right)$$

$$= \frac{(-42)+(-5)}{30} = \frac{-42-5}{30} = \frac{-47}{30}$$

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

(iii)  $\left[\frac{5}{8} + \left(\frac{-7}{12}\right)\right] + \frac{1}{6} = \frac{5}{8} + \left[-\frac{7}{12} + \frac{1}{6}\right]$

Taking, L.H.S =  $\left[\frac{5}{8} + \left(\frac{-7}{12}\right)\right] + \frac{1}{6}$

$$= \left[\frac{5 \times 3}{8 \times 3} + \left(\frac{-7 \times 2}{12 \times 2}\right)\right] + \frac{1}{6}$$

$$= \left[\frac{15}{24} + \left(\frac{-14}{24}\right)\right] + \frac{1}{6} = \left[\frac{15+(-14)}{24}\right] + \frac{1}{6}$$

$$= \left[\frac{15-14}{24}\right] + \frac{1}{6} = \frac{1}{24} + \frac{1}{6}$$

$$= \frac{1}{24} + \frac{1 \times 4}{6 \times 4} = \frac{1}{24} + \frac{4}{24}$$

$$= \frac{1+4}{24} = \frac{5}{24}$$

$$\begin{aligned}
 \text{Now, taking, R.H.S} &= \frac{5}{8} + \left[ \frac{-7}{12} + \frac{1}{6} \right] \\
 &= \frac{5}{8} + \left[ \frac{-7}{12} + \frac{1 \times 2}{6 \times 2} \right] = \frac{5}{8} + \left[ \frac{-7}{12} + \frac{2}{12} \right] \\
 &= \frac{5}{8} + \left[ \frac{-7+2}{12} \right] = \frac{5}{8} + \left( \frac{-5}{12} \right) \\
 &= \frac{5 \times 3}{8 \times 3} + \left[ \frac{-5 \times 2}{12 \times 2} \right] = \frac{15}{24} + \left( \frac{-10}{24} \right) \\
 &= \frac{15+(-10)}{24} = \frac{15-10}{24} = \frac{5}{24}
 \end{aligned}$$

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

#### EXERCISE 1.4

$$1. (i) \frac{-3}{2} \times \frac{6}{7} = \frac{(-3) \times 6}{2 \times 7} = \frac{-18}{14} = \frac{-9}{7}$$

$$(ii) \frac{-12}{15} \times \frac{20}{-3} = \frac{(-12) \times 20}{15 \times (-3)} = \frac{-240}{-45} = \frac{16}{3}$$

$$(iii) \frac{17}{-5} \times (-10) = \frac{17 \times (-10)}{(-5)} = \frac{-170}{-5} = 34$$

$$(iv) \frac{7}{26} \times \left( \frac{-52}{28} \right) = \frac{7 \times (-52)}{26 \times 28} = \frac{-364}{728} = \frac{-1}{2}$$

$$(v) \frac{-15}{13} \times \frac{39}{-25} = \frac{(-15) \times 39}{13 \times (-25)} = \frac{-585}{-325} = \frac{9}{5}$$

$$(vi) -8 \times \frac{-17}{24} = \frac{(-8) \times (-17)}{24} = \frac{136}{24} = \frac{17}{3}$$

$$2. (i) \frac{2}{7} \times \frac{-3}{8} = \frac{-3}{8} \times \frac{2}{7}$$

$$\text{Taking, L.H.S} = \frac{2}{7} \times \frac{-3}{8} = \frac{2 \times (-3)}{7 \times 8} = \frac{-6}{56} = \frac{-3}{28}$$

$$\text{Taking, R.H.S} = \frac{-3}{8} \times \frac{2}{7} = \frac{-3 \times 2}{8 \times 7} = \frac{-6}{56} = \frac{-3}{28}$$

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

$$(ii) -6 \times \frac{-26}{12} = \frac{-26}{12} \times (-6)$$

$$\text{Taking, L.H.S} = -6 \times \frac{-26}{12} = \frac{(-6) \times (-26)}{12} = \frac{156}{12} = 13$$

$$\begin{aligned}
 \text{Now, Taking, R.H.S} &= -6 \times \frac{-26}{12} = \frac{(-26) \times (-6)}{12} = \frac{156}{12} \\
 &= \frac{156}{12}
 \end{aligned}$$

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

$$(iii) \frac{-9}{7} \times \frac{13}{3} = \frac{13}{3} \times \frac{-9}{7}$$

$$\text{L.H.S} = \frac{-9}{7} \times \frac{13}{3} = \frac{-9 \times 13}{7 \times 3} = \frac{-117}{21} = \frac{-39}{7}$$

$$\text{R.H.S} = \frac{13}{3} \times \left( \frac{-9}{7} \right) = \frac{13 \times (-9)}{3 \times 7} = \frac{-117}{21} = \frac{-39}{7}$$

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

$$3. (i) \text{ Multiplicative inverse of } \frac{3}{7} = \frac{1}{3/7} = \frac{7}{3}$$

$$(ii) \text{ Multiplicative inverse of } -9 = \frac{-1}{9}$$

$$(iii) \text{ Multiplicative inverse of } \frac{1}{-2} = \frac{1}{1/-2} = -2$$

$$(iv) \text{ Multiplicative inverse of } -\frac{4}{5} = \frac{1}{-4/5} = -\frac{5}{4}$$

$$\begin{aligned}
 4. (i) \frac{-3}{5} \times \left( \frac{25}{12} + \frac{5}{4} \right) &= \frac{-3}{5} \times \left( \frac{25}{12} + \frac{5 \times 3}{4 \times 3} \right) \\
 &= \frac{-3}{5} \times \left( \frac{25}{12} + \frac{15}{12} \right) = \frac{-3}{5} \times \left( \frac{25+15}{12} \right) \\
 &= \frac{-3}{5} \times \left( \frac{40}{12} \right) = \frac{-3 \times 40}{5 \times 12} = \frac{-120}{60} = -2
 \end{aligned}$$

$$\begin{aligned}
 (ii) \frac{2}{7} \times \left( \frac{7}{9} - \frac{35}{18} \right) &= \frac{2}{7} \times \left( \frac{7 \times 2}{9 \times 2} - \frac{35}{18} \right) \\
 &= \frac{2}{7} \times \left( \frac{14}{18} - \frac{35}{18} \right) = \frac{2}{7} \times \left( \frac{14-35}{18} \right) \\
 &= \frac{2}{7} \times \left( \frac{-21}{18} \right) = \frac{2 \times (-21)}{7 \times 18} \\
 &= \frac{-42}{126} = \frac{-1}{3}
 \end{aligned}$$

$$\begin{aligned}
 (iii) \frac{3}{5} \times \left( \frac{6}{9} - 30 \right) &= \frac{3}{5} \times \left( \frac{6-270}{9} \right) \\
 &= \frac{3}{5} \times \left( \frac{-264}{9} \right) = \frac{-792}{45} = \frac{-88}{5}
 \end{aligned}$$

$$5. (i) \frac{2}{5} \times \left( \frac{4}{9} \times \frac{3}{1} \right) = \left( \frac{2}{5} \times \frac{4}{9} \right) \times \frac{3}{1}$$

$$\begin{aligned}
 \text{L.H.S} &= \frac{2}{5} \times \left( \frac{4}{9} \times \frac{3}{1} \right) = \frac{2}{5} \times \left( \frac{4 \times 3}{9 \times 1} \right) \\
 &= \frac{2}{5} \times \frac{12}{9} = \frac{2 \times 12}{5 \times 9} \\
 &= \frac{24}{45} = \frac{8}{15}
 \end{aligned}$$

$$\begin{aligned} \text{R.H.S} &= \left(\frac{2}{5} \times \frac{4}{9}\right) \times \frac{3}{1} = \left(\frac{2 \times 4}{5 \times 9}\right) \times \frac{3}{1} \\ &= \frac{8}{45} \times \frac{3}{1} = \frac{8 \times 3}{45} = \frac{24}{45} = \frac{8}{15} \end{aligned}$$

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

$$(ii) \frac{-10}{9} \times \left(\frac{3}{-5} \times 6\right) = \left(\frac{-10}{9} \times \frac{3}{-5}\right) \times 6$$

$$\begin{aligned} \text{L.H.S} &= \frac{-10}{9} \times \left(\frac{3 \times 6}{-5}\right) = \frac{-10}{9} \times \left(\frac{18}{-5}\right) \\ &= \frac{-10 \times 18}{9 \times (-5)} = \frac{-180}{-45} = 4 \end{aligned}$$

$$\begin{aligned} \text{R.H.S} &= \left(\frac{-10}{9} \times \frac{3}{-5}\right) \times 6 = \left\{\frac{-10 \times 3}{9 \times (-5)}\right\} \times 6 \\ &= \frac{-30}{-45} \times 6 = \frac{(-30) \times 6}{-45} \\ &= \frac{-180}{-45} = 4 \end{aligned}$$

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

$$(iii) \frac{-5}{7} \times \left(\frac{11}{3} \times \frac{14}{33}\right) = \left(\frac{-5}{7} \times \frac{11}{3}\right) \times \frac{14}{33}$$

$$\begin{aligned} \text{L.H.S} &= \frac{-5}{7} \times \left(\frac{11}{3} \times \frac{14}{33}\right) = \frac{-5}{7} \times \left(\frac{11 \times 14}{3 \times 33}\right) \\ &= \frac{-5}{7} \times \frac{154}{99} = \frac{-770}{693} = \frac{-10}{9} \end{aligned}$$

$$\begin{aligned} \text{R.H.S} &= \left(\frac{-5}{7} \times \frac{11}{3}\right) \times \frac{14}{33} \\ &= \left(\frac{-5 \times 11}{7 \times 3}\right) \times \frac{14}{33} = \left(\frac{-55}{21}\right) \times \frac{14}{33} \\ &= \left(\frac{-55 \times 14}{21 \times 33}\right) = \frac{-770}{693} = \frac{-10}{9} \end{aligned}$$

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

$$6. (i) \frac{5}{7} \times \frac{-7}{16} = \frac{5 \times (-7)}{7 \times 16} = \frac{-35}{112} = \frac{-5}{16}$$

$\therefore$  Reciprocal of  $\frac{5}{7} \times \left(\frac{-7}{16}\right)$  = Reciprocal of

$$\left(\frac{-5}{16}\right) = \frac{-16}{5}$$

$$(ii) \frac{-5}{4} \times \frac{1}{2} = \frac{-5 \times 1}{4 \times 2} = \frac{-5}{8}$$

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

$$(iii) \frac{-4}{9} \times \left(\frac{-3}{5}\right) = \frac{-4 \times (-3)}{9 \times 5} = \frac{12}{45} = \frac{4}{15}$$

Reciprocal of  $\left(\frac{-4}{9}\right) \times \left(\frac{-3}{5}\right)$  = Reciprocal of  $\frac{4}{15} = \frac{15}{4}$

$$(iv) \frac{-3}{7} \times \frac{4}{9} = \frac{-3 \times 4}{7 \times 9} = \frac{-12}{63} = \frac{-4}{21}$$

Reciprocal of  $\left(\frac{-3}{7} \times \frac{4}{9}\right)$  = Reciprocal of  $\left(\frac{-4}{21}\right) = \frac{-21}{4}$

$$7. (i) \frac{8}{14} \times \frac{5}{4} \times \left(\frac{-49}{15}\right) + \frac{8}{5} \times \frac{15}{7}$$

$$= \frac{8 \times 5 \times (-49)}{14 \times 4 \times 15} + \frac{8 \times 15}{5 \times 7}$$

$$= \frac{-1960}{840} + \frac{120}{35}$$

$$= \frac{-7}{3} + \frac{24}{7}$$

$$= \frac{-7 \times 7}{3 \times 7} + \frac{24 \times 3}{7 \times 3} = \frac{-49}{21} + \frac{72}{21}$$

$$= \frac{-49 + 72}{21} = \frac{23}{21}$$

Hence,  $\frac{8}{14} \times \frac{5}{4} \times \left(\frac{-49}{15}\right) + \frac{8}{5} \times \frac{15}{7} = \frac{23}{21}$

$$(ii) \frac{15}{-13} \times \frac{-7}{3} + (-5) \times \frac{4}{13}$$

$$= \frac{15 \times (-7)}{(-13) \times 3} + \frac{(-5) \times 4}{1 \times 13}$$

$$= \frac{-105}{-39} + \frac{-20}{13} = \frac{105}{39} + \frac{-20 \times 3}{13 \times 3}$$

$$= \frac{105}{39} + \frac{-60}{39} = \frac{105 + (-60)}{39}$$

$$= \frac{105 - 60}{39} = \frac{45}{39} = \frac{15}{13}$$

$$(iii) \frac{4}{99} \times \frac{9}{5} - \frac{3}{5} \times \frac{4}{99}$$

$$\frac{4 \times 9}{99 \times 5} - \frac{3 \times 4}{5 \times 99} = \frac{36}{495} - \frac{12}{495}$$

$$= \frac{36 - 12}{495} = \frac{24}{495} = \frac{8}{165}$$

$$8. (i) \frac{9}{13} \times 3\frac{1}{5} - 2\frac{1}{3} \times \frac{9}{13} = \frac{9}{13} \times \left(3\frac{1}{5} - 2\frac{1}{3}\right)$$

(By distributive law of multiplication over subtraction)

$$\begin{aligned} &= \frac{9}{13} \times \left(\frac{16}{5} - \frac{7}{3}\right) \\ &= \frac{9}{13} \times \left(\frac{16 \times 3}{5 \times 3} - \frac{7 \times 5}{3 \times 5}\right) \\ &= \frac{9}{13} \times \left(\frac{48}{15} - \frac{35}{15}\right) \\ &= \frac{9}{13} \times \left(\frac{48 - 35}{15}\right) = \frac{9}{13} \times \frac{13}{15} \\ &= \frac{9 \times 13}{13 \times 15} = \frac{3}{5} \end{aligned}$$

$$(ii) 6\frac{2}{5} \times \frac{3}{7} + \frac{4}{7} \times 6\frac{2}{5} = 6\frac{2}{5} \times \left(\frac{3}{7} + \frac{4}{7}\right)$$

(By distributive law of multiplication over addition)

$$\begin{aligned} &= 6\frac{2}{5} \times \left(\frac{3+4}{7}\right) \\ &= \frac{32}{5} \times \frac{7}{7} = \frac{32 \times 7}{5 \times 7} = \frac{32}{5} \end{aligned}$$

$$(iii) 6\frac{2}{3} \times \frac{3}{2} + \frac{5}{2} \times 6\frac{2}{3} + \frac{7}{2} \times 6\frac{2}{3} = 6\frac{2}{3} \times \left(\frac{3}{2} + \frac{5}{2} + \frac{7}{2}\right)$$

(By distributive law of multiplication over addition)

$$\begin{aligned} &= \frac{20}{3} \times \left(\frac{3+5+7}{2}\right) \\ &= \frac{20}{3} \times \frac{15}{2} = \frac{20 \times 15}{3 \times 2} = 50 \end{aligned}$$

$$9. (i) \frac{-4}{3} \times \left(\frac{6}{-5} \times \frac{8}{9}\right) = \left(\frac{4}{-3} \times \frac{6}{-5}\right) \times \frac{8}{9}$$

$$\begin{aligned} \text{L.H.S} &= \frac{-4}{3} \times \left(\frac{6}{-5} \times \frac{8}{9}\right) = \frac{-4}{3} \times \left(\frac{-6 \times 8}{5 \times 9}\right) \\ &= \frac{-4}{3} \times \left(\frac{-6 \times 8}{5 \times 9}\right) \\ &= \frac{-4}{3} \times \frac{-16}{15} = \frac{-4 \times (-16)}{3 \times 15} = \frac{64}{45} \end{aligned}$$

$$\text{R.H.S} = \left(\frac{-4}{3} \times \frac{6}{-5}\right) \times \frac{8}{9}$$

$$= \frac{-4 \times 6}{3 \times (-5)} \times \frac{8}{9} = \frac{-8}{-5} \times \frac{8}{9} = \frac{64}{45}$$

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

$$(ii) \frac{-9}{5} \times \left(\frac{7}{9} \times \frac{2}{-3}\right) = \left(-\frac{9}{5} \times \frac{7}{9}\right) \times \frac{2}{-3}$$

$$\begin{aligned} \text{L.H.S} &= \frac{-9}{5} \times \left(\frac{7}{9} \times \frac{2}{-3}\right) \\ &= \frac{-9}{5} \times \frac{7 \times 2}{9 \times (-3)} = \frac{-9}{5} \times \frac{14}{-27} \\ &= \frac{(-9) \times 14}{5 \times (-27)} = \frac{14}{15} \end{aligned}$$

$$\begin{aligned} \text{R.H.S} &= \left(-\frac{9}{5} \times \frac{7}{9}\right) \times \frac{2}{-3} \\ &= \frac{(-9) \times 7}{5 \times 9} \times \frac{2}{-3} \\ &= \frac{-7}{5} \times \left(\frac{2}{-3}\right) = \frac{-7 \times 2}{5 \times (-3)} \\ &= \frac{-14}{-15} = \frac{14}{15} \end{aligned}$$

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

$$(iii) \frac{-5}{9} \times \left(\frac{3}{26} + \frac{-2}{13}\right) = \left(\frac{-5}{9} \times \frac{3}{26}\right) + \left(\frac{-5}{9} \times \frac{-2}{13}\right)$$

$$\begin{aligned} \text{L.H.S} &= \frac{-5}{9} \times \left(\frac{3}{26} + \frac{-2}{13}\right) \\ &= \frac{-5}{9} \times \left\{\frac{3}{26} + \left(\frac{-2 \times 2}{13 \times 2}\right)\right\} \\ &= \frac{-5}{9} \times \left\{\frac{3}{26} + \left(\frac{-4}{26}\right)\right\} \\ &= \frac{-5}{9} \times \left\{\frac{3 + (-4)}{26}\right\} \\ &= \frac{-5}{9} \times \left(\frac{-1}{26}\right) = \frac{-5 \times (-1)}{9 \times 26} = \frac{5}{234} \end{aligned}$$

$$\begin{aligned} \text{R.H.S} &= \left(\frac{-5}{9} \times \frac{3}{26}\right) + \left(\frac{-5}{9} \times \frac{-2}{13}\right) \\ &= \frac{(-5) \times 3}{9 \times 26} + \left\{\frac{(-5) \times (-2)}{9 \times 13}\right\} \\ &= \frac{-15}{234} + \frac{10}{117} = \frac{-15}{234} + \frac{10 \times 2}{117 \times 2} \\ &= \frac{-15}{234} + \frac{20}{234} = \frac{-15 + 20}{234} = \frac{5}{234} \end{aligned}$$

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

$$(iv) \frac{6}{13} \times \frac{-2}{5} + \frac{1}{5} \times \frac{6}{13} = \frac{6}{13} \left( \frac{-2}{5} + \frac{1}{5} \right)$$

$$\begin{aligned} \text{L.H.S} &= \frac{6}{13} \times \frac{-2}{5} + \frac{1}{5} \times \frac{6}{13} \\ &= \frac{6 \times (-2)}{13 \times 5} + \frac{1 \times 6}{5 \times 13} \\ &= \frac{-12}{65} + \frac{6}{65} = \frac{-12+6}{65} = \frac{-6}{65} \end{aligned}$$

$$\begin{aligned} \text{R.H.S} &= \frac{6}{13} \times \left( \frac{-2}{5} + \frac{1}{5} \right) \\ &= \frac{6}{13} \times \left( \frac{-2+1}{5} \right) = \frac{6}{13} \times \left( \frac{-1}{5} \right) \\ &= \frac{6 \times (-1)}{13 \times 5} = \frac{-6}{65} \end{aligned}$$

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

10. Side of a square field =  $7\frac{1}{4}$  m =  $\frac{29}{4}$  m

$$\begin{aligned} \text{Area of a square field} &= (\text{Side})^2 \\ &= \left( \frac{29}{4} \text{ m} \right)^2 = \left( \frac{29}{4} \times \frac{29}{4} \right) \text{ m}^2 \\ &= \frac{841}{16} \text{ m}^2 = 52\frac{9}{16} \text{ m}^2 \end{aligned}$$

Hence, area of the square field =  $52\frac{9}{16}$  m<sup>2</sup>

### EXERCISE 1.5

1. (i)  $\frac{5}{13} \div \frac{10}{39} = \frac{5}{13} \times \frac{39}{10} = \frac{5 \times 39}{13 \times 10} = \frac{3}{2}$

(ii)  $\frac{3}{-15} \div \frac{7}{5} = \frac{3}{-15} \times \frac{5}{7} = \frac{1}{-7} = \frac{-1}{7}$

(iii)  $8\frac{2}{3} \div \frac{13}{3} = \frac{26}{3} \div \frac{13}{3} = \frac{26}{3} \times \frac{3}{13} = 2$

(iv)  $\frac{25}{36} \div \frac{15}{12} = \frac{25}{36} \times \frac{12}{15} = \frac{25 \times 12}{36 \times 15} = \frac{5}{9}$

(v)  $\frac{36}{44} \div \frac{4}{11} = \frac{36}{44} \times \frac{11}{4} = \frac{36 \times 11}{44 \times 4} = \frac{9}{4}$

(vi)  $\frac{35}{63} \div \frac{7}{21} = \frac{35}{63} \times \frac{21}{7} = \frac{35 \times 21}{63 \times 7} = \frac{5}{3}$

2. Let the required number be  $x$ .

$$\text{Then, } \frac{-4}{35} \times x = \frac{8}{105}$$

$$\begin{aligned} \Rightarrow x &= \frac{8}{105} \div \left( \frac{-4}{35} \right) = \frac{8}{105} \times \left( \frac{35}{-4} \right) \\ &= \frac{8 \times (-35)}{105 \times 4} = \frac{-2}{3} \end{aligned}$$

Hence, the required number is  $\frac{-2}{3}$ .

3. Let the required number be  $x$ .

Then,

$$\frac{5}{7} \div x = \frac{-15}{56}$$

$$\Rightarrow \frac{5}{7} \times \frac{1}{x} = \frac{-15}{56}$$

$$\Rightarrow \frac{1}{x} = \frac{-15}{56} \div \frac{5}{7}$$

$$\Rightarrow \frac{1}{x} = \frac{-15}{56} \times \frac{7}{5} = \frac{-15 \times 7}{56 \times 5}$$

$$\Rightarrow \frac{1}{x} = \frac{3}{8}$$

$$\Rightarrow x = \frac{-8}{3}$$

Hence, the required number is  $\frac{-8}{3}$ .

4.  $x + y = \frac{5}{4} + \left( \frac{-1}{3} \right) = \frac{5 \times 3}{4 \times 3} + \left( \frac{-1 \times 4}{3 \times 4} \right)$

$$= \frac{15}{12} - \left( \frac{4}{12} \right) = \frac{15 - (-4)}{12}$$

$$= \frac{15 - 4}{12} = \frac{11}{12}$$

$$\therefore x + y = \frac{11}{12} \quad \dots(i)$$

and  $x - y = \frac{5}{4} - \left( \frac{-1}{3} \right) = \frac{5 \times 3}{4 \times 3} = \left( \frac{-1 \times 4}{3 \times 4} \right)$

$$= \frac{15 - (-4)}{12} = \frac{15}{12} - \left( \frac{-4}{12} \right)$$

$$= \frac{15 + 4}{12}$$

$$\therefore x - y = \frac{19}{12} \quad \dots(ii)$$

Now,

$$(x + y) \div (x - y) = \frac{11}{12} \div \frac{19}{12} = \frac{11}{12} \times \frac{12}{19} = \frac{11}{19}$$

$$\text{Hence, } (x + y) \div (x - y) = \frac{11}{19}$$

$$\begin{aligned} 5. \text{ Sum of } \frac{3}{11} \text{ and } \frac{2}{5} &= \frac{3}{11} + \frac{2}{5} \\ &= \frac{15+22}{55} = \frac{37}{55} \end{aligned}$$

$$\text{Product of } \frac{3}{11} \text{ and } \frac{2}{5} = \frac{3}{11} \times \frac{2}{5} = \frac{3 \times 2}{11 \times 5} = \frac{6}{55}$$

Now, dividing the sum by product, we get

$$\frac{37}{55} \div \frac{6}{55} = \frac{37}{55} \times \frac{55}{6} = \frac{37}{6}$$

Hence, required quotient is  $\frac{37}{6}$ .

6. Let the other number be  $x$ .

Then,

$$\frac{56}{3} \times x = \frac{92}{3}$$

$$\Rightarrow x = \frac{92}{3} \div \frac{56}{3}$$

$$\Rightarrow x = \frac{92}{3} \times \frac{3}{56} = \frac{92 \times 3}{3 \times 56}$$

$$x = \frac{23}{14}$$

Hence, the required number is  $\frac{23}{14}$ .

$$\begin{aligned} 7. (i) \frac{4}{7} \div \left( \frac{2}{9} \div \frac{14}{27} \right) &= \frac{4}{7} \div \left( \frac{2}{9} \times \frac{27}{14} \right) = \frac{4}{7} \div \left( \frac{2 \times 27}{9 \times 14} \right) \\ &= \frac{4}{7} \div \frac{3}{7} = \frac{4}{7} \times \frac{7}{3} = \frac{4 \times 7}{7 \times 3} = \frac{4}{3} \end{aligned}$$

$$\begin{aligned} (ii) \left( \frac{-5}{39} \div \frac{20}{13} \right) \div \frac{-5}{3} &= \left( \frac{-5}{39} \times \frac{13}{20} \right) \div \frac{-5}{3} \\ &= \frac{-1}{12} \div \left( \frac{-5}{3} \right) = \frac{-1}{12} \times \left( \frac{-3}{5} \right) \\ &= \frac{(-1) \times (-3)}{12 \times 5} = \frac{1}{20} \end{aligned}$$

$$\begin{aligned} (iii) \left( \frac{1}{5} \div 3 \right) \div \frac{1}{6} &= \left( \frac{1}{5} \times \frac{1}{3} \right) \div \frac{1}{6} \\ &= \frac{1}{15} \div \frac{1}{6} = \frac{1}{15} \times \frac{6}{1} = \frac{2}{5} \end{aligned}$$

$$\begin{aligned} (iv) \left( \frac{-3}{26} \div \frac{6}{33} \right) \div \frac{11}{13} &= \left( \frac{-3}{26} \times \frac{33}{6} \right) \div \frac{11}{13} \\ &= \frac{-33}{52} \times \frac{13}{11} = \frac{-3}{4} \end{aligned}$$

8. Let the required number be  $x$ . Then,

$$\frac{4}{5} \div x = \frac{8}{125}$$

$$\frac{4}{5} \times \frac{1}{x} = \frac{8}{125}$$

$$\Rightarrow \frac{1}{x} = \frac{8}{125} \div \frac{4}{5}$$

$$\frac{1}{x} = \frac{8}{125} \times \frac{5}{4}$$

$$\frac{1}{x} = \frac{8 \times 5}{125 \times 4} = \frac{2}{25}$$

$$\Rightarrow x = \frac{25}{2}$$

Hence, the required number is  $\frac{25}{2}$ .

$$\begin{aligned} 9. \text{ The sum of } \frac{78}{12} \text{ and } \frac{8}{3} &= \frac{78}{12} + \frac{8}{3} \\ &= \frac{78}{12} + \frac{8 \times 4}{3 \times 4} = \frac{78}{12} + \frac{32}{12} \\ &= \frac{78+32}{12} = \frac{110}{12} = \frac{55}{6} \end{aligned}$$

$$\begin{aligned} \text{difference of } \frac{78}{12} \text{ and } \frac{8}{3} &= \frac{78}{12} - \frac{8}{3} \\ &= \frac{78}{12} - \frac{32}{12} = \frac{78-32}{12} = \frac{46}{12} = \frac{23}{6} \end{aligned}$$

Now, divide the sum by their difference

$$= \frac{55}{6} \div \frac{23}{6}$$

$$= \frac{55}{6} \times \frac{6}{23} = \frac{55}{23}$$

$$\begin{aligned} 10. (i) \frac{-3}{5} \div \left( \frac{-12}{35} \div \frac{1}{28} \right) &= \frac{-3}{5} \div \left( \frac{-12}{35} \times \frac{28}{1} \right) \\ &= \frac{-3}{5} \div \left( \frac{-12 \times 28}{35} \right) = \frac{-3}{5} \div \left( \frac{-12 \times 4}{5} \right) \\ &= \frac{-3}{5} \div \left( \frac{-48}{5} \right) \\ &= \frac{-3}{5} \times \frac{5}{-48} = \frac{3}{48} = \frac{1}{16} \end{aligned}$$

$$(ii) \left(\frac{-2}{3} \div \frac{9}{7}\right) \div \left(\frac{5}{-9}\right) = \left(\frac{-2}{3} \times \frac{7}{9}\right) \div \left(\frac{5}{-9}\right)$$

$$= \frac{-14}{27} \div \left(\frac{5}{-9}\right) = \frac{-14}{27} \times \frac{-9}{5} = \frac{14}{15}$$

11. Let the other number be  $x$ .

$$\text{Then, } \frac{2}{3} \times x = \frac{28}{121}$$

$$\Rightarrow x = \frac{28}{121} \div \frac{2}{3} = \frac{28}{121} \times \frac{3}{2} = \frac{42}{121}$$

Hence, the required number is  $\frac{42}{121}$ .

12. Let the required number be  $x$ .

$$\text{Then, } \frac{44}{-7} \div x = \frac{-11}{3}$$

$$\Rightarrow \frac{44}{-7} \times \frac{1}{x} = \frac{-11}{3}$$

$$\Rightarrow \frac{1}{x} = \frac{-11}{3} \div \left(\frac{-44}{7}\right)$$

$$= \frac{-11}{3} \times \frac{-7}{44}$$

$$\frac{1}{x} = \frac{7}{12}$$

$$\Rightarrow x = \frac{12}{7}$$

Hence, the required number is  $\frac{12}{7}$ .

13. Breadth of a rectangular field =  $12\frac{5}{8}$  m,

Length of a rectangular field = ?

Area of a rectangular field =  $75\frac{3}{4}$  sq.m

$$\Rightarrow 75\frac{3}{4} \text{ sq.m} = \text{length} \times 12\frac{5}{8} \text{ m}$$

$$\Rightarrow \text{length} \times \frac{101}{8} \text{ m} = \frac{303}{4} \text{ sq.m}$$

$$\Rightarrow \text{length} = \left(\frac{303}{4} \div \frac{101}{8}\right) \text{ m}$$

$$= \left(\frac{303}{4} \times \frac{8}{101}\right) \text{ m} = 3 \times 2 = 6 \text{ m}$$

length = 6m

Hence, length of a rectangular field is 6m.

### EXERCISE 1.6

1. The given rational number are  $\frac{-3}{7}$  and  $\frac{-2}{7}$ .

The rational number between  $\frac{-3}{7}$  and  $\frac{-2}{7}$

$$= \frac{1}{2} \times \left\{ \frac{-3}{7} + \left(\frac{-2}{7}\right) \right\}$$

$$= \frac{1}{2} \times \left\{ \frac{-3+(-2)}{7} \right\}$$

$$= \frac{1}{2} \times \left(\frac{-5}{7}\right) = \frac{-5}{14}$$

Now, the rational number between  $\frac{-5}{14}$  and  $\frac{-2}{7}$

$$= \frac{1}{2} \times \left\{ \frac{-5}{14} + \left(\frac{-2}{7}\right) \right\}$$

$$= \frac{1}{2} \times \left\{ \frac{-5+(-4)}{14} \right\} = \frac{1}{2} \times \left(\frac{-9}{14}\right) = \frac{-9}{28}$$

The rational number between  $\frac{-9}{28}$  and  $\frac{-2}{7}$

$$= \frac{1}{2} \times \left\{ \frac{-9}{28} + \left(\frac{-2}{7}\right) \right\} = \frac{1}{2} \times \left(\frac{-9+(-8)}{28}\right)$$

$$= \frac{1}{2} \times \left(\frac{-17}{28}\right) = \frac{-17}{56}$$

Hence, three rational numbers between  $\frac{-3}{7}$  and  $\frac{-2}{7}$

are  $\frac{-5}{14}, \frac{-9}{28}, \frac{-17}{56}$ .

2. The given rational numbers are  $\frac{-3}{5}$  and  $\frac{-2}{5}$ .

The rational number between  $\frac{-3}{5}$  and  $\frac{-2}{5}$ .

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

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

Now, the rational number between  $\frac{-3}{5}$  and  $\frac{-1}{2}$ .

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

$$= \frac{1}{2} \times \left(\frac{-11}{10}\right) = \frac{-11}{20}$$



The rational number between  $\frac{-1}{2}$  and  $\frac{-11}{20}$ .

$$= \frac{1}{2} \times \left\{ \frac{-1}{2} + \frac{-11}{20} \right\} = \frac{1}{2} \times \left\{ \frac{-10 + (-11)}{20} \right\}$$

$$= \frac{1}{2} \times \left( \frac{-21}{20} \right) = \frac{-21}{40}$$

The rational number between  $\frac{-21}{40}$  and  $\frac{-1}{2}$ .

$$= \frac{1}{2} \times \left\{ \frac{-21}{40} + \frac{-1}{2} \right\} = \frac{1}{2} \times \left\{ \frac{-21 + (-20)}{40} \right\}$$

$$= \frac{1}{2} \times \left( \frac{-41}{40} \right) = \frac{-41}{80}$$

Hence, four rational numbers between  $\frac{-3}{5}$  and  $\frac{-2}{5}$

are  $\frac{-1}{2}, \frac{-11}{20}, \frac{-21}{40}, \frac{-41}{80}$ .

3. The rational number between 0 and 1

$$= \frac{1}{2} \times (0+1) = \frac{1}{2}$$

The rational number between 0 and  $\frac{1}{2}$

$$= \frac{1}{2} \times \left( 0 + \frac{1}{2} \right) = \frac{1}{2} \times \left( \frac{1}{2} \right) = \frac{1}{4}$$

The rational number between  $\frac{1}{2}$  and 1

$$= \frac{1}{2} \times \left( \frac{1}{2} + 1 \right)$$

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

Hence, rational number between 0 and 1 are  $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$

4. (i) The rational number between  $\frac{2}{3}$  and 3.

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

$$= \frac{1}{2} \times \left( \frac{2+9}{3} \right) = \frac{1}{2} \times \frac{11}{3} = \frac{11}{6}$$

The rational number between  $\frac{2}{3}$  and  $\frac{11}{6}$

$$= \frac{1}{2} \times \left( \frac{2}{3} + \frac{11}{6} \right) = \frac{1}{2} \times \left( \frac{4+11}{6} \right)$$

$$= \frac{1}{2} \times \frac{15}{6} = \frac{15}{12}$$

The rational number between  $\frac{11}{6}$  and 3

$$= \frac{1}{2} \times \left( \frac{11}{6} + 3 \right) = \frac{1}{2} \times \left( \frac{11+18}{6} \right)$$

$$= \frac{1}{2} \times \left( \frac{29}{6} \right) = \frac{29}{12}$$

Hence, three rational number between  $\frac{2}{3}$  and

$\frac{11}{6}, \frac{15}{12}, \frac{29}{12}$ .

(ii)  $\frac{-1}{3}$  and  $\frac{1}{2}$

The rational number between  $\frac{-1}{3}$  and  $\frac{1}{2}$ .

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

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

The rational number between  $\frac{-1}{3}$  and  $\frac{1}{12}$ .

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

$$= \frac{1}{2} \times \left( \frac{3}{12} \right) = \frac{-3}{24} = \frac{-1}{8}$$

The rational number between  $\frac{1}{12}$  and  $\frac{1}{2}$ .

$$= \frac{1}{2} \times \left\{ \frac{1}{12} + \left( \frac{1}{2} \right) \right\} = \frac{1}{2} \times \left( \frac{1+6}{12} \right)$$

$$= \frac{1}{2} \times \frac{7}{12} = \frac{7}{24}$$

Hence, three rational number between  $\frac{-1}{3}$  and  $\frac{1}{2}$

are  $\frac{-1}{8}, \frac{1}{12}, \frac{7}{24}$ .

(iii) The rational number between  $\frac{1}{6}$  and  $\frac{5}{7}$

$$= \frac{1}{2} \times \left( \frac{1}{6} + \frac{5}{7} \right) = \frac{1}{2} \times \left( \frac{7+30}{42} \right) = \frac{37}{84}$$

Rational number between  $\frac{1}{6}$  and  $\frac{37}{84}$

$$= \frac{1}{2} \times \left( \frac{1}{6} + \frac{37}{84} \right) = \frac{1}{2} \times \left( \frac{14+37}{84} \right) = \frac{51}{168}$$

Rational number between  $\frac{37}{84}$  and  $\frac{5}{7}$

$$= \frac{1}{2} \times \left( \frac{37}{84} + \frac{5}{7} \right) = \frac{1}{2} \times \left( \frac{37+60}{84} \right) = \frac{97}{168}$$

Hence, three rational numbers are  $\frac{51}{168}, \frac{37}{84}, \frac{97}{168}$ .

(iv) The rational number between  $\frac{-1}{9}$  and  $\frac{2}{9}$

$$= \frac{1}{2} \times \left( \frac{-1}{9} + \frac{2}{9} \right) = \frac{1}{2} \times \left( \frac{-1+2}{9} \right) = \frac{1}{18}$$

The rational number between  $\frac{-1}{9}$  and  $\frac{1}{18}$

$$= \frac{1}{2} \times \left( \frac{-1}{9} + \frac{1}{18} \right) = \frac{1}{2} \times \left( \frac{-2+1}{18} \right) = \frac{-1}{36}$$

The rational number between  $\frac{1}{18}$  and  $\frac{2}{9}$

$$= \frac{1}{2} \times \left( \frac{1}{18} + \frac{2}{9} \right) = \frac{1}{2} \times \left( \frac{1+4}{18} \right) = \frac{5}{36}$$

Hence, three rational numbers between  $\frac{-1}{9}$  and  $\frac{2}{9}$  are  $\frac{-1}{36}, \frac{1}{18}, \frac{5}{36}$ .

### MULTIPLE CHOICE QUESTIONS

1.  $\frac{14}{32}$  and  $\frac{21}{35}$

$$\frac{14}{32} = \frac{14 \div 2}{32 \div 2} = \frac{7}{16} = \frac{7 \times 3}{16 \times 3} = \frac{21}{48}$$

Thus,  $\frac{14}{32} \neq \frac{21}{48}$

$\frac{-15}{21}$  and  $\frac{20}{-28}$

$$\frac{-15}{21} = \frac{-15 \div 3}{21 \div 3} = \frac{-5}{7} = \frac{-5 \times 4}{7 \times 4} = \frac{-20}{28}$$

Thus,  $\frac{-15}{21} = \frac{-20}{28}$

$\frac{-5}{7}$  and  $\frac{-20}{26}$

$$\frac{-5}{7} = \frac{-5 \times 4}{7 \times 4} = \frac{-20}{28}$$

Thus,  $\frac{-5}{7} \neq \frac{-20}{26}$

$\frac{6}{-16}$  and  $\frac{-9}{36}$

$$\frac{6}{-16} = \frac{-6 \div 2}{-16 \div 2} = \frac{-3}{8} = \frac{-3 \times 3}{8 \times 3} = \frac{-9}{24}$$

Thus,  $\frac{6}{-16} \neq \frac{-9}{24}$

Hence (b) is correct.

2.  $\frac{14}{27}$

H.C.F of 14 and 27 is 1.

So,  $\frac{14}{27}$  already in standard form.

Hence Option (a) is correct

3.  $\frac{3}{-7}, \frac{-5}{14}, \frac{-16}{56}, \frac{-13}{28}$  or  $\frac{-3}{7}, \frac{-5}{14}, \frac{-16}{56}, \frac{-13}{28}$

L.C.M of 7, 14, 56, and 28 is 56.

$$\frac{-3}{7} = \frac{-3 \times 8}{7 \times 8} = \frac{-24}{56}$$

$$\frac{-5}{14} = \frac{-5 \times 4}{14 \times 4} = \frac{-20}{56}$$

$$\frac{-16}{56} = \frac{-16 \times 1}{56 \times 1} = \frac{-16}{56}$$

$$\frac{-13}{28} = \frac{-13 \times 2}{28 \times 2} = \frac{-26}{56}$$

$$\therefore \frac{-16}{56} > \frac{-20}{56} > \frac{-24}{56} > \frac{-26}{56}$$

$$\Rightarrow \frac{-16}{56} > \frac{-5}{14} > \frac{-3}{7} > \frac{-13}{28}$$

Hence, option (c) is correct.

4. Let the number to be added be  $x$ . Then,

$$\frac{-7}{3} + x = -2$$

$$\begin{aligned} \Rightarrow x &= -2 - \left( \frac{-7}{3} \right) = \frac{-2}{1} - \left( \frac{-7}{3} \right) \\ &= \frac{-2 \times 3}{1 \times 3} - \left( \frac{-7}{3} \right) = \frac{-6}{3} - \left( \frac{-7}{3} \right) \\ &= \frac{(-6) - (-7)}{3} = \frac{-6+7}{3} \end{aligned}$$

$$x = \frac{1}{3}$$

Hence, option (c) is correct.

5. Let the other number be  $x$ . Then

$$x + \frac{2}{3} = \frac{29}{21}$$

$$\Rightarrow x = \frac{29}{21} - \frac{2}{3} = \frac{29}{21} - \frac{2 \times 7}{3 \times 7}$$

$$= \frac{29}{21} - \frac{14}{21} = \frac{29-14}{21}$$

$$x = \frac{15}{21} = \frac{5}{7}$$

Hence, option (c) is correct.

6. Let the other number be  $x$ . Then,

$$\frac{7}{5} \times x = \frac{-21}{40}$$

$$\Rightarrow x = \frac{-21}{40} \div \frac{7}{5} = \frac{-21}{40} \times \frac{5}{7}$$

$$= \frac{-21 \times 5}{40 \times 7} = \frac{-3}{8}$$

Hence, option (c) is correct.

7.  $\frac{21}{5} = 4.2$

Thus, 4.2 is additive inverse of  $-4.2$   
hence, option (a) is correct.

### MENTAL MATHS CORNER

A. 1.  $\left(\frac{-3}{7}\right) + \frac{4}{6} = \frac{4}{6} + \left(\frac{-3}{7}\right)$

Commutative law of addition

2.  $\frac{2}{3} \times \frac{1}{7} = \frac{1}{7} \times \frac{2}{3}$

Commutative law of multiplication

3.  $\frac{3}{2} \times \left(\frac{7}{5} + \frac{1}{2}\right) = \frac{3}{2} \times \frac{7}{5} + \frac{3}{2} \times \frac{1}{2}$

Distributive law of multiplication over addition.

4.  $\frac{3}{5} \times \left(\frac{4}{3} + \frac{1}{5}\right) = \left(\frac{3}{5} \times \frac{4}{3}\right) \times \frac{1}{5}$

Associative law of multiplication

5.  $\frac{5}{2} \times \left(\frac{-7}{3} \times \frac{-8}{3}\right) = \left(\frac{5}{2} \times \frac{-7}{3}\right) \times \left(\frac{-8}{3}\right)$

Associative law of multiplication

### B. Fill in the blanks:

- $\frac{2}{5}$  is the multiplicative inverse of  $2\frac{1}{2}$ .
- For a rational number to be positive, the numerator and denominator should be **of same sign**.
- Between two given numbers we may not get an **integer** but always a **rational** number.

- The product of rational number and its reciprocal is **1**.
- If  $x$  is reciprocal of  $y$ , then reciprocal of  $y$  is  $x$ .
- Between two rational numbers  $x$  and  $y$ , there is a rational number  $\frac{x+y}{2}$ .
- The negative of negative rational number is the **number itself**.
- The reciprocal of  $-7$  is  $\frac{1}{-7}$ .
- The two rational numbers which are equal to their reciprocals are **1** and **-1**.
- The rational number that does not have its reciprocal is **zero**.

### C. True or False:

- 4 is the smallest composite number. (**True**)
- All whole numbers are natural numbers. (**False**)
- The rational numbers between 3 and 2 is  $\frac{3-2}{2}$ . (**False**)
- Every integers is a rational number. (**True**)
- Every rational number is an integer. (**False**)
- There exists a rational number which is equal to its negative. (**False**)
- Between any two rational numbers there are infinite rational numbers. (**True**)
- Every whole number is a rational number. (**True**)
- Rational numbers are closed under the operation division. (**False**)
- The difference of two rational numbers is a rational numbers. (**True**)

### REVIEW EXERCISE

- Additive inverse of  $\frac{-6}{-5} = -\left(\frac{-6}{-5}\right)$   
 $= -\left(\frac{6}{5}\right) = \frac{-6}{5}$
  - Additive inverse of  $\left(\frac{2}{-7}\right) = \left(\frac{-2}{7}\right) = \frac{2}{7}$
  - Additive inverse of  $\left(\frac{-5}{11}\right) = -\left(\frac{-5}{11}\right) = \frac{5}{11}$
- Multiplicative inverse of  $(-17) = \frac{1}{(-17)} = \frac{-17}{12}$
  - Multiplicative inverse of  $\frac{-12}{17} = \frac{-17}{12}$
  - $\frac{-3}{8} \times \frac{-5}{2} = \frac{(-3) \times (-5)}{8 \times 2} = \frac{15}{16}$   
Multiplicative inverse of  $\frac{15}{16} = \frac{16}{15}$ .

4. Three rational numbers greater than  $-3$  are  $-2, \frac{-3}{2}, -1$ .

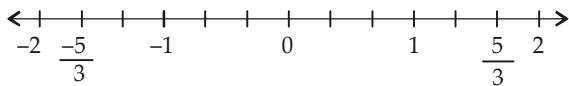
5.  $\left[ \frac{-2}{3} - \left( \frac{4}{-5} \right) \right] - \frac{1}{2} = \frac{-11}{30}$

$$\begin{aligned} \text{L.H.S} &= \left[ \frac{-2}{3} - \left( \frac{4}{-5} \right) \right] - \frac{1}{2} = \left[ \frac{-2}{3} - \left( \frac{-4}{5} \right) \right] - \frac{1}{2} \\ &= \left[ \frac{-2 \times 5}{3 \times 5} - \left( \frac{-4 \times 3}{5 \times 3} \right) \right] - \frac{1}{2} \\ &= \left[ \frac{-10}{15} - \left( \frac{-12}{15} \right) \right] - \frac{1}{2} \\ &= \left[ \frac{-10 - (-12)}{15} \right] - \frac{1}{2} \\ &= \left( \frac{-10 + 12}{15} \right) - \frac{1}{2} = \frac{2}{15} - \frac{1}{2} \\ &= \frac{2 \times 2}{15 \times 2} - \frac{1 \times 15}{2 \times 15} = \frac{4}{30} - \frac{15}{30} \\ &= \frac{4 - 15}{30} = \frac{-11}{30} \\ &= \text{R.H.S} \end{aligned}$$

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

6.  $\frac{5}{3} = 1\frac{2}{3}$ : lie between 1 and 2, divide the distance between 1 and 2 into three equal parts. Starting from 1 moves towards to (right) 2, 2<sup>nd</sup> mark will represent  $\left( \frac{5}{3} = 1\frac{2}{3} \right)$ .

$\frac{-5}{3} = -1\frac{2}{3}$  lies between  $-1$  to  $-2$ , divide the distance between  $-1$  to  $-2$  into three equal parts starting from  $-1$ , moves towards left ( $-2$ ), 2<sup>nd</sup> mark will represent  $\frac{-5}{3}$  on the number line



7. Let the required number be  $x$ . Then

$$\begin{aligned} \frac{-8}{13} \times x &= 32 \\ \Rightarrow x &= 32 \div \left( \frac{-8}{13} \right) = 32 \times \left( \frac{-13}{8} \right) \\ x &= \frac{32 \times (-13)}{8} \\ x &= -52 \end{aligned}$$

Hence, required number is  $-52$ .

8.  $\frac{91}{41} \left( \frac{-2}{3} \right) + \left( \frac{4}{3} \right) \frac{91}{41} + \left( \frac{-2}{3} \right) \frac{91}{41} = \frac{91}{41} \times \left\{ \left( \frac{-2}{3} \right) + \frac{4}{3} + \left( \frac{-2}{3} \right) \right\}$   
(distributive law of multiplication over addition)

$$\begin{aligned} &= \frac{91}{41} \times \left\{ \frac{-2 + 4 - 2}{3} \right\} = \frac{91}{41} \times \left( \frac{-4 + 4}{3} \right) \\ &= \frac{91}{41} \times \left( \frac{0}{3} \right) = \frac{91}{41} \times 0 = 0 \end{aligned}$$

9. L.H.S =  $x \times (y + z) = \frac{1}{7} \times \left\{ \frac{2}{3} + \left( \frac{-1}{3} \right) \right\}$   
 $= \frac{1}{7} \times \left\{ \frac{2 + (-1)}{3} \right\} = \frac{1}{7} \times \frac{1}{3} = \frac{1}{21}$

R.H.S =  $x \times y + y \times z = \left( \frac{1}{7} \times \frac{2}{3} \right) + \left\{ \frac{1}{7} \times \left( \frac{-1}{3} \right) \right\}$   
 $= \frac{2}{21} + \left( \frac{-1}{21} \right) = \frac{2 + (-1)}{21} = \frac{1}{21}$

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

10. Length of remaining cord = Total length of cord - sum of length of two pieces

$$\begin{aligned} &= 16 \text{ m} - \left( 3\frac{1}{3} \text{ m} + 2\frac{2}{5} \text{ m} \right) \\ &= \left\{ 16 - \left( 3\frac{1}{3} + 2\frac{2}{5} \right) \right\} \text{ m} \\ &= \left\{ 16 - \left( \frac{10}{3} + \frac{12}{5} \right) \right\} \text{ m} \\ &= \left\{ 16 - \left( \frac{50 + 36}{15} \right) \right\} \text{ m} = \left( 16 - \frac{86}{15} \right) \text{ m} \\ &= \left( \frac{240 - 86}{15} \right) \text{ m} = \frac{154}{15} \text{ m} = 10\frac{4}{15} \text{ m} \end{aligned}$$

Hence, the length of remaining cord =  $10\frac{4}{15}$  m

11.  $\left| \frac{9}{7} \right| - \left| \frac{-2}{7} \right| + \frac{3}{7} - \left| \frac{4}{-7} \right| = \frac{9}{7} - \frac{2}{7} + \frac{3}{7} - \frac{4}{7}$   
 $= \frac{9 - 2 + 3 - 4}{7} = \frac{12 - 6}{7} = \frac{6}{7}$

12. (i) If  $a = \frac{-3}{2}$ ,  $b = \frac{4}{5}$ ,  $|a \times b| = |a| \times |b|$

$$\begin{aligned} \text{L.H.S } |a \times b| &= \left| \frac{-3}{2} \times \frac{4}{5} \right| = \left| \frac{-3 \times 4}{2 \times 5} \right| \\ &= \frac{|-12|}{|10|} = \frac{12}{10} \\ \text{R.H.S } |a \times b| &= |a| \times |b| \\ &= \left| \frac{-3}{2} \right| \times \left| \frac{4}{5} \right| = \frac{3}{2} \times \frac{4}{5} = \frac{12}{10} \end{aligned}$$

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

$$(ii) |a-b| \geq |a|-|b|$$

$$\begin{aligned} \text{L.H.S } |a-b| &= \left| \frac{-3}{2} - \frac{4}{5} \right| \\ &= \left| \frac{-15-8}{10} \right| = \left| \frac{-23}{10} \right| = \frac{23}{10} \end{aligned}$$

$$\begin{aligned} \text{R.H.S } = |a|-|b| &= \left| \frac{-3}{2} \right| - \left| \frac{4}{5} \right| \\ &= \frac{3}{2} - \frac{4}{5} = \frac{15-8}{10} = \frac{7}{10} \end{aligned}$$

$$\text{Thus, } |a-b| > |a|-|b|$$

$$\text{Hence, } |a-b| \not\geq |a|-|b|$$

$$13. \quad \frac{4}{9} \div x = \frac{-10}{3}$$

$$\frac{4}{9} \times \frac{1}{x} = \frac{-10}{3}$$

$$\Rightarrow \quad \frac{1}{x} = \frac{-10}{3} \div \frac{4}{9}$$

$$\frac{1}{x} = \frac{-10}{3} \times \frac{9}{4}$$

$$\frac{1}{x} = \frac{-10 \times 9}{3 \times 4} = \frac{-15}{2}$$

$$x = \frac{-2}{15}$$

### HOTS QUESTION

1. The Cost of  $3\frac{2}{5}$  m of cloth = ₹ 442

$$\therefore \text{The cost of 1m of cloth} = ₹ \left( 442 \div 3\frac{2}{5} \right)$$

$$= ₹ \left( 442 \div \frac{17}{5} \right)$$

$$= ₹ \left( 442 \times \frac{5}{17} \right) = ₹ \left( \frac{442 \times 5}{17} \right)$$

$$= ₹ 130$$

Hence, the cost of per metre of cloth is ₹ 130.

2. Additive inverse of 5 is -5 and multiplicative inverse of 5 =  $\frac{1}{5}$

$$\text{Now, required sum} = -5 + \frac{1}{5}$$

$$= \frac{-5}{1} + \frac{1}{5} = \frac{-25+1}{5}$$

$$= \frac{-24}{5} = -4\frac{4}{5}$$

$$\text{Hence, required sum} = -4\frac{4}{5}.$$

3. Let the number be  $x$ . Then,

$$\frac{2}{3}x - \frac{3}{5}x = 1$$

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

$$\Rightarrow \left( \frac{10-9}{15} \right)x = 1$$

$$\Rightarrow \frac{1}{15}x = 1$$

$$\Rightarrow \boxed{x=15}$$

Hence, the required number is 15.

## VALUE BASED QUESTION SUMMATIVE ASSESSMENT

(a) Rational number between -3 and 0

$$= \frac{1}{2} \times (-3 + 0)$$

$$= \frac{1}{2} \times (-3) = \frac{-3}{2}$$

Rational number between -3 and  $\frac{-3}{2}$

$$= \frac{1}{2} \times \left\{ -3 + \left( \frac{-3}{2} \right) \right\}$$

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

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

$$= \frac{1}{2} \times \left( \frac{-9}{2} \right) = \frac{-9}{4}$$

Rational number between  $\frac{-3}{2}$  and 0

$$= \frac{-1}{2} \times \left( \frac{-3}{2} + 0 \right) = \frac{-1}{2} \times \left( \frac{-3}{2} \right)$$

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

Hence, three rational numbers between -3 and 0

are  $\frac{-9}{4}$ ,  $\frac{-3}{2}$ ,  $\frac{3}{4}$ .

(b) Yes, we get infinite opportunities in our life.

God gives infinite opportunities to each person in the life to achieve their goals.