Rational Numbers

EXERCISE : 3.1

1. A rational number is called a positive rational number if its numerator and denominator are either both positive integer or negative integers.

$\frac{5}{8}, \frac{0}{5}, 7, \frac{-3}{-13}, \frac{-17}{-6}$ are positive integer rational numbers

2 A rational number is called a negative rational number if its numerator and denominator are such that one of them is a positive integer and other is a negative integer

$\frac{-5}{7}, \frac{4}{-3}, -6, \frac{-28}{5}$ are negative rational numbers

3.

i) we have

$$\frac{+3}{-7} = \frac{3\times2}{-7\times2} = \frac{3\times3}{-7\times3} = \frac{3\times4}{-7\times4} = \frac{3\times5}{-7\times5}$$

$$\frac{3}{7} = \frac{6}{-14} = \frac{9}{-21} = \frac{12}{-28} = \frac{15}{-35}$$

Thus, four rational numbers equivalent to $\frac{3}{-7}$ are $\frac{6}{-14}, \frac{9}{-21}, \frac{12}{-28}, \frac{15}{-35}$

ii) $\frac{-5}{-9} = \frac{(-5)\times(-1)}{(-9)\times(-1)} = \frac{(-5)\times(-2)}{(-9)\times(-2)} = \frac{(-5)\times(-3)}{(-9)\times(-3)} = \frac{(-5)\times(-4)}{(-9)\times(-4)}$

$\frac{-5}{9} = \frac{5}{9} = \frac{10}{18} = \frac{15}{27} = \frac{20}{36}$.

Thus, four rational number equivalent to $\frac{-5}{-9}$ are $\frac{5}{9}, \frac{10}{18}, \frac{15}{27}, \frac{20}{36}$

4. Multiply the numerator and the denominator of each rational number by -1

i) $\frac{4}{-9} = \frac{4\times(-1)}{(-9)\times(-1)} = \frac{-4}{9} \Rightarrow \frac{4}{-9} = \frac{-4}{9}$

ii) $\frac{17}{-33} = \frac{17\times(-1)}{(-33)\times(-1)} = \frac{-17}{33} \Rightarrow \frac{17}{-33} = \frac{-17}{33}$

iii) $\frac{-15}{-38} = \frac{(-15)\times(-1)}{(-38)\times(-1)} = \frac{15}{38} \Rightarrow \frac{-15}{-38} = \frac{15}{38}$

5 The next four number in the given pattern are

i) $\frac{-5}{20}, \frac{-6}{24}, \frac{-7}{28}, \frac{-8}{32}$

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

$\frac{-10}{15}, \frac{-12}{18}, \frac{-14}{21}, \frac{-16}{24}$

6. i) Given rational numbers are $\frac{-3}{-7}$ and $\frac{15}{35}$

We have $(-3) \times (-5) = 15$

and $(-7) \times (-5) = 35$

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

$$\therefore \frac{-3}{-7} = \frac{15}{35}$$

ii) $\frac{-6}{8}$ and $\frac{10}{-15}$

we have $(-6) \times (-15) = 90$

and $8 \times 10 = 80$

As $90 \neq 80$, $-6 \times -15 \neq 8 \times 10$

$$\frac{-6}{8} \neq \frac{10}{-15}$$

iii) $\frac{6}{-10}$ and $\frac{-12}{20}$

We have $6 \times 20 = 120$ and $-10 \times -12 = 120$

As $120 = 120$, $6 \times 20 = -10 \times -12$

$$\therefore \frac{6}{-10} = \frac{-12}{20}$$

7 Given rational numbers are

i) $\frac{-7}{21}, \frac{3}{9}$

We have $(-7) \times 9 = -63$, $21 \times 3 = 63$

As $-63 \neq 63$: $(-7 \times 9) \neq 21 \times 3$

$\therefore \frac{-7}{21} \neq \frac{3}{9}$.

ii) $\frac{-16}{20}, \frac{20}{-25}$

We have $-16 \times -25 = 400$; $20 \times 20 = 400$

As $400 = 400$, $-16 \times -25 = 20 \times 20$

$\therefore \frac{-16}{20} = \frac{20}{-25}$.

iii) $\frac{-3}{5}, \frac{-12}{20}$

We have $-3 \times 20 = -60$; $5 \times -12 = -60$

As $-60 = -60$, $-3 \times 20 = -12 \times 5$

$\therefore \frac{-3}{5} = \frac{-12}{20}$.

iv. $\frac{8}{-5}, \frac{-24}{15}$.

We have $8 \times 15 = 120$; $-24x - 5 = 120$

Both are equal i.e $8 \times 15 = -24x - 5$

$\therefore \frac{8}{-5} = \frac{-24}{15}$ are equal

8.

i) $\frac{5}{4} = \frac{9}{16} = \frac{25}{9} = \frac{-15}{9}$

$\frac{5}{4} = \frac{x}{16}$

$16 \times 5 = 4 \times x$

$x = \frac{16 \times 5}{4}$

$x = 20$

$\frac{5}{4} = \frac{25}{y}$

$5 \times y = 25 \times 4$

$y = \frac{25 \times 4}{5}$

$y = 20$

$\frac{5}{4} = \frac{-15}{z}$

$5 \times z = -15 \times 4$

$z = \frac{-15 \times 4}{5}$

$z = -12$

ii) $\frac{-3}{7} = \frac{9}{14} = \frac{9}{y} = \frac{-6}{9}$

$\frac{-3}{7} = \frac{x}{14}$

$7 \times x = 14 \times -3$

$7x = -42$

$x = -42/7$

$x = -6$

$\frac{-3}{7} = \frac{9}{y}$

$-3 \times y = 9 \times 7$

$y = \frac{9 \times 7}{-3}$

$y = -21$

$\frac{-3}{7} = \frac{-6}{z}$

$-3 \times z = -6 \times 7$

$z = \frac{-6 \times 7}{-3}$

$z = 14$

9.

i) The given rational number is $\frac{-45}{30}$

Its denominator is positive

HCF of 45, 30 is 15

So divide its numerator and denominator by 9

$$\therefore \frac{-45}{30} = \frac{(-45) \div 15}{30 \div 15} = \frac{-3}{2}$$

Thus $\frac{-45}{30} = \frac{-3}{2}$, which is in standard form

ii) $\frac{16}{-36}$

Convert rational with positive denominator

i.e $\frac{16 \times (-1)}{(-36) \times (-1)} = \frac{-16}{36}$.

Now denominator is positive

HCF of 16 and 36 is 4

So divide its numerator and denominator by 4.

$$\therefore \frac{-16}{36} = \frac{-16 \div 4}{36 \div 4} = \frac{-4}{9}$$

Thus $\frac{-16}{36} = \frac{-4}{9}$, which is in standard form

iii) $\frac{-3}{-15}$

Convert above rational number with positive denominator

i.e $\frac{-3}{-15} = \frac{-3 \times -1}{-15 \times -1} = \frac{3}{15}$.

HCF of 3, 15 is 3

So Divide its numerator and Denominator by 3.

i.e $\frac{3}{15} = \frac{3 \div 3}{15 \div 3} = \frac{1}{5}$

$\therefore \frac{3}{15} = \frac{1}{5}$ which is in standard form

iv) $\frac{68}{-119}$

Convert rational number with positive denominator

i.e $\frac{68}{-119} = \frac{68 \times (-1)}{-119 \times (-1)} = \frac{-68}{119}$

HCF of 68, 119 is 17

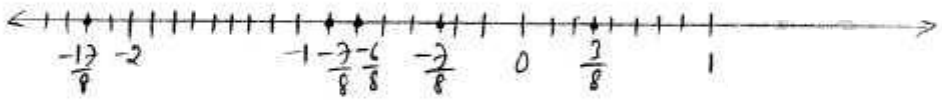
So divide its numerator and denominator by 17

i.e $\frac{-68}{119} = \frac{-68 \div 17}{119 \div 17} = \frac{-4}{7}$

Thus $\frac{-68}{119} = \frac{-4}{7}$ which is in standard form

EXERCISE: 3.2

1. Draw a number line and divide each unit length into 8 equal parts.



2

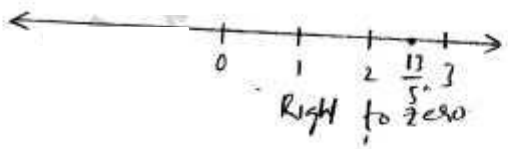
$AP = PQ = QB$; $TR = RS = US$

$P = \frac{7}{3}$ $R = \frac{-4}{3}$

$Q = \frac{8}{3}$ $S = \frac{-5}{3}$

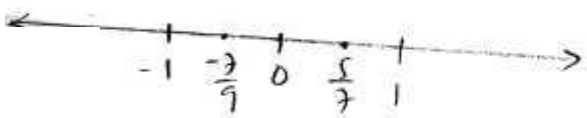
3.

i) True



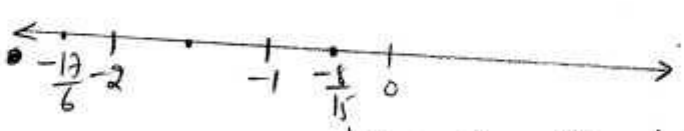
Right to zero

ii) True



opposite to zero

iii) False



lies on same side of zero.

4.

i) $0 > \frac{-4}{7}$, since $\frac{-4}{7}$ lies left to zero in numbers line

ii) $\frac{5}{-9} = \frac{5\times-1}{-9\times-1} = \frac{-5}{9}$, $\frac{3}{7}$

$\frac{3}{7} > \frac{-5}{9}$ because in number line $\frac{-5}{9}$ lies left to zero and $\frac{3}{7}$ lies right to zero.

iii) $\frac{-9}{-5} = \frac{-9\times-1}{-5\times-1} = \frac{9}{5}$; 0

$\frac{9}{5} > 0$ Since $\frac{9}{5}$ lies right to zero in number line

iv) $\frac{7}{-5}$, $\frac{-21}{-23}$

$\frac{7}{-5} = \frac{7\times-1}{-5\times-1} = \frac{-7}{5}$; $\frac{-21}{-23} = \frac{-21\times-1}{-23\times-1} = \frac{21}{23}$.

$\frac{21}{23} > \frac{-7}{5}$ Since negative numbers is always less than positive numbers

5.

i) $-4\times7 = -28$; $-5\times5 = -25$

As $-25 > -28$

So $-5\times5 > -4\times7$

i.e $\frac{-4}{5} < \frac{-5}{7}$.

ii) $-8 \times 4 = -32$; $-7 \times 5 = -35$

As $-32 > -35$

i.e $-8 \times 4 > -7 \times 5$

$\therefore \frac{-8}{5} > \frac{-7}{4}$

iii) $-7 \times -48 = 336$; $42 \times 8 = 336$

As $336 = 336$

$\therefore \frac{-7}{8} = \frac{42}{-48}$

iv) $\frac{1}{-3}$; $\frac{-1}{4}$

$1 \times 4 = 4$; $-3 \times -1 = 3$

As $4 > 3$

i.e $\frac{1}{-3} > \frac{-1}{4}$

v) $-\frac{3}{8}$; $\frac{-2}{7}$

$-3 \times 7 = -21$; $-2 \times 8 = -16$

As $-16 > -21$

i.e $-\frac{3}{8} < -\frac{2}{7}$.

vi) $\frac{-4}{3}$; $\frac{-3}{2}$

$-4 \times 2 = -8$; $-3 \times 3 = -9$

As $-8 > -9$

$\therefore \frac{-4}{3} > \frac{-3}{2}$

6. i) Writing each numbers with positive Denominator

Already there are positive

So the given rational numbers are $\frac{-3}{7}, \frac{-3}{2}, \frac{-3}{4}$.

LCM of their denominators ie 2, 4, 7

$= 28$

To write the rational numbers with this LCM 28 as their denominators, we have;

$\frac{-3}{7} = \frac{-3 \times 4}{7 \times 4} = \frac{-12}{28}$

$\frac{-3}{2} = \frac{-3 \times 14}{2 \times 14} = \frac{-42}{28}$

$\frac{-3}{4} = \frac{-3 \times 7}{4 \times 7} = \frac{-21}{28}$

$-42 < -21 < -12$

Hence the given rational numbers in ascending order are

$\frac{-3}{2}, \frac{-3}{4}, \frac{-3}{7}$.

$2 \mid 2, 4, 7$

$1, 2, 7$

LCM $= 2 \times 2 \times 7 = 28$

ii) Write each number with positive denominator.

$$\frac{5}{-12} = \frac{5\times(-1)}{-12\times-1} = \frac{-5}{12}$$

$$\frac{9}{-24} = \frac{9\times(-1)}{-24\times-1} = \frac{-9}{24}$$

Lcm of their denominators i.e 4, 12, 16, 24 is 48.

To write the rational numbers with this Lcm i.e 48 as their denominator, we have:

4	4, 12, 16, 24
3	1, 3, 4, 6
2	1, 1, 4, 2
	1, 1, 2, 1

Lcm = $4\times3\times2\times2 = 48$

$$\frac{-3}{4} = \frac{-3\times12}{4\times12} = \frac{-36}{48}$$

$$\frac{-5}{12} = \frac{-5\times4}{12\times4} = \frac{-20}{48}$$

$$\frac{-9}{24} = \frac{-9\times2}{24\times2} = \frac{-18}{48}$$

$$\frac{-7}{16} = \frac{-7\times3}{16\times3} = \frac{-21}{48}$$

As $-36 < -21 < -20 < -18$

$\therefore$ Ascending order is $\frac{-3}{4} < \frac{-7}{16} < \frac{-5}{12} < \frac{-9}{24}$.

7

i) Write each number with positive denominator

$$\frac{17}{-30} = \frac{17\times(-1)}{-30\times-1} = \frac{-17}{30}.$$

Lcm of their denominators 10, 20, 15, 30 is 60

To write rational number with Lcm i.e 60 as their denominators

5	10, 20, 15, 30
2	2, 4, 3, 6
3	1, 2, 3, 3
	1, 2, 1, 1

Lcm $= 5 \times 2 \times 3 \times 6 = 60$

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

$$\frac{-11}{20} = \frac{-11 \times 3}{20 \times 3} = \frac{-33}{60}$$

$$\frac{-7}{15} = \frac{-7 \times 4}{15 \times 4} = \frac{-28}{60}$$

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

As $-18 > -28 > -33 > -34$

Descending order is $\frac{-3}{10} > \frac{-7}{15} > \frac{-11}{20} > \frac{-17}{30}$.

ii. Write each number with positive denominator

i.e $\frac{2}{-5} = \frac{2 \times -1}{-5 \times -1} = \frac{-2}{5}$; $\frac{19}{-30} = \frac{19 \times -1}{-30 \times -1} = \frac{-19}{30}$.

Lcm of their denominators 5, 10, 15, 30 is 30

To write rational number with Lcm i.e 30 as their denominators

5	5, 10, 15, 30
3	1, 2, 3, 6
2	1, 2, 1, 2
	1, 1, 1, 1

Lcm = 30.

$$\frac{-7}{10} = \frac{-7 \times 3}{10 \times 3} = \frac{-21}{30}.$$

$\frac{-11}{15} = \frac{-11\times 2}{15\times 2} = \frac{-22}{30}$. $\frac{-19}{30} = \frac{-19\times 1}{30\times 1} = \frac{-19}{30}$.

$\frac{-2}{5} = \frac{-2\times 6}{5\times 6} = \frac{-12}{30}$

As $-12 > -19 > -21 > -22$

Descending order is $\frac{-2}{5} > \frac{-19}{30} > \frac{-7}{10} > \frac{-11}{15}$.

8.

i) Given rational numbers $\frac{-3}{1}$ and $\frac{-2}{1}$ have same denominator

To insert 5 rational numbers,

Multiply both numerator and denominator of each number by $(5+1)$ i.e 6

We have $\frac{-3}{1} = \frac{-3\times 6}{1\times 6} = \frac{-18}{6}$ and $\frac{-2}{1} = \frac{-2\times 6}{1\times 6} = \frac{-12}{6}$.

$\because -18 < -17 < -16 < -15 < -14 < -13 < -12$.

$\frac{-18}{6} < \frac{-17}{6} < \frac{-16}{6} < \frac{-15}{6} < \frac{-14}{6} < \frac{-13}{6} < \frac{-12}{6}$

5 rational numbers between -3 and -2 are.

$\frac{-17}{6}, \frac{-16}{6}, \frac{-15}{6}, \frac{-14}{6}, \frac{-13}{6}$.

i.e $\frac{-17}{6}, \frac{-8}{3}, \frac{-5}{2}, \frac{-7}{3}, \frac{-13}{6}$.

ii) Given rational numbers $\frac{-2}{3}$ and $\frac{-1}{3}$ have same denominator

To insert 5 rational numbers, multiply both numerator and denominator of each number by (5+1) i.e 6

We have $-\frac{2}{3} = \frac{-2\times 6}{3\times 6} = \frac{-12}{18}$; $\frac{-1}{3} = \frac{-1\times 6}{3\times 6} = \frac{-6}{18}$.

$\because -12 < -11 < -10 < -9 < -8 < -7 < -6$.

$\therefore \frac{-12}{18} < \frac{-11}{18} < \frac{-10}{18} < \frac{-9}{18} < \frac{-8}{18} < \frac{-7}{18} < \frac{-6}{18}$

$\therefore$ 5 rational numbers between $\frac{-2}{3}$ and $\frac{-1}{3}$ are

$\frac{-11}{18}, \frac{-10}{18}, \frac{-9}{18}, \frac{-8}{18}, \frac{-7}{18}$ i.e

$\frac{-11}{18}, \frac{-5}{9}, \frac{-1}{2}, \frac{-4}{9}, \frac{-7}{18}$.

9

i) Given rational number $\frac{-4}{5}$ and $\frac{-2}{3}$ have different denominators.

Lcm of denominators 5 and 3 is 15

To convert the rational numbers with same denominator we have

$\frac{-4}{5} = \frac{-4\times 3}{5\times 3} = \frac{-12}{15}$; $\frac{-2}{3} = \frac{-2\times 5}{3\times 5} = \frac{-10}{15}$.

We have only one integer between -12 and -10 i.e -11. Thus writting the rational numbers with denominator 15 is not Sufficient.

To insert 5 rational numbers, multiply both numerator and denominator by $(5+1)$ i.e 6.

$$-\frac{12}{15} = \frac{-12\times 6}{15\times 6} = \frac{-72}{90} \quad \text{and} \quad \frac{-10}{15} = \frac{-10\times 6}{15\times 6} = \frac{-60}{90}.$$

$$\therefore -72 < -71 < -70 < -69 < -68 < -67 < -66 < -65 < -64 < -63 < -62 < -61 < -60$$

We can choose any 5 rational numbers from these.

i.e $\frac{-71}{90}, \frac{-70}{90}, \frac{-68}{90}, \frac{-67}{90}, \frac{-65}{90}$.

ii) Given rational numbers $\frac{-1}{2}$ and $\frac{2}{3}$ have different denominators

Lcm of denominators 2 and 3 = 6.

To convert these rational numbers with same denominator we have

$$\frac{-1}{2} = \frac{-1\times 3}{2\times 3} = \frac{-3}{6} \quad \text{and} \quad \frac{2}{3} = \frac{2\times 2}{3\times 2} = \frac{4}{6}.$$

As $-3 < -2 < -1 < 0 < 1 < 2 < 3 < 4$

We can choose any 5 rational numbers

i.e $-\frac{2}{6}, -\frac{1}{6}, \frac{1}{6}, \frac{2}{6}, \frac{3}{6}$.

i.e $-\frac{1}{3}, -\frac{1}{6}, \frac{1}{6}, \frac{1}{3}, \frac{1}{2}$ are 5 rational number between $-\frac{1}{2}$ and $\frac{2}{3}$.

EXERCISE - 3.3

1

i) First express $\frac{-5}{11}$ as a rational numbers with positive denominator

It is already with positive denominator

$$\text{Sum} = \frac{3}{11} + \frac{-5}{11} = \frac{3+(-5)}{11} = \frac{-2}{11}$$

ii) We have $\frac{5}{-9} = \frac{5\times(-1)}{-9\times(-1)} = \frac{-5}{9}$.

$$\text{Sum} = \frac{4}{9} + \frac{-5}{9} = \frac{4+(-5)}{9} = \frac{4-5}{9} = \frac{-1}{9}.$$

iii) We have $\frac{5}{-7} = \frac{5\times(-1)}{-7\times-1} = \frac{-5}{7}$

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

$$\text{Sum} = \frac{-5}{7} + \frac{2}{7} = \frac{-5+2}{7} = \frac{-3}{7}.$$

iv) $\frac{-2}{5}, \frac{3}{4}$

Given rational numbers have different denominators

Lcm of their denominator 5 and 4 is 20.

To write the rational numbers with this Lcm is 20 as their denominator, we have

$$\frac{-2}{5} = \frac{-2\times4}{5\times4} = \frac{-8}{20} \quad \text{and} \quad \frac{3}{4} = \frac{3\times5}{4\times5} = \frac{15}{20}.$$

$$\therefore \text{Sum} = \frac{-8}{20} + \frac{15}{20} = \frac{-8+15}{20} = \frac{7}{20}.$$

2

i) Given rational numbers have different denominators.

LCM of denominators 4 and 8 is 8.

In order to have their denominators as LCM i.e 8 we have

$$+\frac{27}{-4} = \frac{27\times(-1)}{-4\times(-1)} = \frac{-27}{4}$$

$$\frac{-27}{4} + \frac{-15}{8} = \frac{-27\times2}{4\times2} + \frac{-15}{8}$$

$$= \frac{-54}{8} + \frac{-15}{8}$$

$$= \frac{-54-15}{8} = \frac{-69}{8}.$$

ii) LCM of denominators 8 and 18 is 72

In order to have their denominators as LCM i.e 72, we have

$$\frac{-1}{18} + \frac{-3}{8} = \frac{-1\times4}{18\times4} + \frac{-3\times9}{8\times9}$$

$$= \frac{-4}{72} + \frac{-27}{72}$$

$$= \frac{-4 + (-27)}{72}$$

$$= \frac{-31}{72}.$$

iii) $-3\frac{1}{6} + 2\frac{3}{8}$

$-3\frac{1}{6} = \frac{-19}{6}$; $2\frac{3}{8} = \frac{19}{8}$.

Lcm of 6 and 8 is 24

In order to have their denominator is their Lcm ie 24 we have

$$-3\frac{1}{6} + 2\frac{3}{8} = \frac{-19}{6} + \frac{19}{8} = \frac{-19 \times 4}{6 \times 4} + \frac{19 \times 3}{8 \times 3}$$

$$= \frac{-76}{24} + \frac{57}{24}$$

$$= \frac{-76 + 57}{24}$$

$$= \frac{-19}{24}.$$

iv) $-2\frac{4}{5} + 4\frac{3}{10}$

$-2\frac{4}{5} = -\frac{14}{5}$ and $4\frac{3}{10} = \frac{43}{10}$

Lcm of 5 and 10 is 10.

In order to have their denominators is their Lcm i.e 10

we have

$$-2\frac{4}{5} + 4\frac{3}{10} = \frac{-14}{5} + \frac{43}{10} = \frac{-14\times 2}{5\times 2} + \frac{43\times 1}{10\times 1}$$

$$= \frac{-28}{10} + \frac{43}{10}$$

$$= \frac{-28+43}{10}$$

$$= \frac{15}{10} = \frac{3}{2}.$$

3

i) $\frac{4}{13} - \frac{-6}{13} = \frac{4}{13}$ + additive inverse of $(\frac{-6}{13})$

$$= \frac{4}{13} + \frac{6}{13} = \frac{4+6}{13} = \frac{10}{13}.$$

ii) $\frac{-2}{3} - \frac{-1}{2} = \frac{-2}{3}$ + additive inverse of $(\frac{-1}{2})$

$$= \frac{-2}{3} + \frac{1}{2} \quad (\text{lcm of } 3 \text{ and } 2 \text{ is } 6)$$

$$= \frac{-2\times 2 + 1\times 3}{6}$$

$$= \frac{-4+3}{6} = \frac{-1}{6}.$$

iii) $\frac{-2}{3} - \frac{5}{9} = \frac{-2}{3}$ + additive inverse of $(\frac{+5}{9})$

$$= \frac{-2}{3} + \frac{-5}{9} \quad (\text{lcm of } 3, 9 \text{ is } 9$$

$= \frac{-2\times3 + (-5\times1)}{9}$

$= \frac{-6-5}{9} = \frac{-11}{9}$.

4

i) $\frac{5}{63} - \left(\frac{-6}{21}\right)$

$= \frac{5}{63} + \frac{6}{21}$

lcm of 21, 63 is 63

$= \frac{5\times1 + 6\times3}{63} = \frac{5+18}{63} = \frac{23}{63}$.

ii) $-\frac{6}{3} - \left(\frac{-7}{15}\right)$

$= -\frac{6}{3} + \frac{7}{15}$

lcm of 3, 15 is 15

$= \frac{-6\times5 + 7\times1}{15} = \frac{-30+7}{15} = \frac{-23}{15}$

iii) $3\frac{1}{8} - \left(-1\frac{5}{6}\right)$

$= \frac{25}{8} + \frac{11}{6}$

lcm of 8, 6 is 24

$= \frac{25\times3 + 11\times4}{24}$

$$= \frac{35+44}{24}$$

$$= \frac{119}{24}$$

5. Let the other rational number be "x"

Given Sum $= \frac{2}{5}$

i.e $x + \frac{-4}{9} = \frac{2}{5}$

$$x = \frac{2}{5} - \left(\frac{-4}{9}\right)$$

$$x = \frac{2}{5} + \frac{4}{9}$$

LCM of 5, 9 is 45

$$x = \frac{2\times9 + 4\times5}{45}$$

$$x = \frac{18+20}{45}$$

$$x = \frac{38}{45}$$

∴ The other rational number is $\frac{38}{45}$

6. Let the rational added to $\frac{-5}{12}$ is 'x'

Given the result of sum is $-\frac{7}{8}$.

i.e $x + \left(\frac{-5}{12}\right) = \frac{-7}{8}$

$$x = \frac{-7}{8} - \left(\frac{-5}{12}\right)$$

$$x = \frac{-7}{8} + \frac{5}{12}$$

LCM of 8, 12 is 24

$$x = \frac{-7 \times 3 + 5 \times 2}{24}$$

$$x = \frac{-21 + 10}{24}$$

$$x = \frac{-11}{24}$$

∴ Therefore $\frac{-11}{24}$ is to be added to $\frac{-5}{12}$ to get $-\frac{7}{8}$.

7. Let the rational number to be substracted from $-\frac{2}{3}$ be 'x'

The result is $-\frac{5}{6}$.

i.e $x - \left(\frac{-2}{3}\right) = \frac{-5}{6}$

$$x = \frac{-5}{6} + \left(\frac{-2}{3}\right).$$

LCM of 3 and 6 is 6.

$$x = \frac{-5 \times 1 + -2 \times 2}{6}$$

$$x = \frac{-5 + (-4)}{6}$$

$$x = \frac{-5-4}{6} = \frac{-9}{6}$$

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

$\therefore \frac{-3}{2}$ should be substracted from $\frac{-2}{3}$ to get $\frac{-5}{6}$.

8.

i) $\frac{2}{3} \times \frac{-7}{8} = \frac{2 \times -7}{3 \times 8} = \frac{-7}{12}$

ii) $\frac{-6}{7} \times \frac{5}{7} = \frac{-6 \times 5}{7 \times 7} = \frac{-30}{49}$

iii) $\frac{-2}{9} \times (-5) = \frac{-2 \times -5}{9} = \frac{10}{9}$.

iv) $\frac{-5}{11} \times \frac{11}{-5} = \frac{+8 \times 11}{11 \times 5} = 1$

v) $\frac{8}{35} \times \frac{21}{-32} = \frac{{}^{1}8 \times 21^{3}}{{}_{5}35 \times -{}_{4}32} = \frac{3}{-20}$.

vi) $\frac{-105}{128} \times \left(-1\frac{29}{35}\right) = -\frac{{}^{3}105}{{}_{2}128} \times -\frac{64}{{}_{1}35}$

$= \frac{3}{2}$.

9.

i) $(-6) \div \frac{2}{5}$

$= \frac{(-6)}{(2/5)} = -\frac{\overset{3}{\cancel{6}} \times 5}{\underset{1}{\cancel{2}}} = -15$

ii) $-\frac{1}{10} \div \frac{-8}{5}$

$= \frac{(-1/10)}{(-8/5)} = +\frac{1}{\cancel{10}_2} \times \frac{\overset{1}{\cancel{8}}}{\cancel{+8}}$

$= \frac{1}{2 \times 8} = \frac{1}{16}$.

iii) $\frac{-65}{14} \div \frac{13}{-7}$

$= \frac{-65/14}{13/-7} = -\frac{\overset{5}{\cancel{65}}}{\cancel{14}_2} \times \frac{\overset{1}{\cancel{-7}}}{\cancel{13}_1}$

$= \frac{5}{2}$

iv) $(-6) \div 3\frac{3}{5}$

$= (-6) \div \frac{18}{5}$

$= \frac{-6}{(18/5)} = -\frac{\overset{1}{\cancel{6}} \times 5}{\cancel{18}_3} = \frac{-5}{3}$.

v) $-\frac{48}{49} \div \frac{72}{-35}$

$= -\frac{48/49}{72/-35} = -\frac{\overset{\cancel{8}2}{\cancel{48}}}{\underset{7}{\cancel{49}}} \times \frac{-\cancel{35}^{5}}{\cancel{72}_{3}} = \frac{10}{21}$.

vi) $3\frac{1}{7} \div \left(\frac{-33}{34}\right)$

$= \frac{22}{7} \div \left(\frac{-33}{34}\right)$

$= \frac{22/7}{-33/34} = \frac{22^{2}}{7} \times \frac{34}{-33_{3}}$

$= \frac{68}{-21}$

10. Let the other rational number be x.

product of them is $\frac{18}{35}$

ie $\frac{-2}{5} \times x = \frac{18}{35}$

$x = {}^{9}\frac{18 \times 8}{35 \times -7_{1}}$
$_{7}$

$x = \frac{9}{-7} = \frac{-9}{7}$.

∴ The other rational number is $\frac{-9}{7}$.

11.

i) $\left(\frac{13}{21} \div \frac{39}{42}\right) \times \left(\frac{-3}{5}\right)$

$= \frac{13/21}{39/42} \times \frac{-3}{5}$

$= \frac{1}{\cancel{13}} \times \frac{\cancel{42}^{2}}{\cancel{39}_{3_{1}}} \times \frac{-\cancel{3}^{1}}{5} = \frac{-2}{5}$

ii) $\left(-5\frac{5}{21}\right) \div \left(\frac{7}{11} \times \frac{5}{12}\right)$

$= -\frac{110}{21} \div \frac{35}{132}$

$= \frac{-110/21}{35/132} = -\frac{\cancel{110}^{22}}{\cancel{21}_{3}} \times \frac{\cancel{132}^{44}}{\cancel{35}_{7}}$

$= -\frac{22 \times 44}{3 \times 7} = -\frac{968}{49}$

12

i) $\frac{3}{13} \div \frac{-4}{65}$

$= \frac{13/13)}{(-4/65)} = \frac{3}{13} \times \frac{\cancel{65}^{5}}{-4}$

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

∴ The reciprocal is $-\frac{4}{15}$.

ii) $\left(-\cancel{8}^{1} \times \frac{\cancel{12}^{4}}{\cancel{15}_{5}}\right) - \left(-3 \times \frac{2}{9_3}\right)$

$= (-4) - \left(-\frac{2}{3}\right)$

$= -4 + \frac{2}{3} = -\frac{12+2}{3}$

$= -\frac{10}{3}$.