Rational Numbers

Exercise 1.1 :-

1.

i) $\frac{4}{7} + \frac{5}{7}$

$\frac{4+5}{7}$

$\frac{9}{7}$

ii) $\frac{7}{-13}$ and $\frac{4}{-13}$

$\frac{7}{-13} + \frac{4}{-13}$

$\frac{7\times(-1)}{-13\times(-1)} + \frac{4\times(-1)}{-13\times(-1)}$ Make denominator as +ve number

$\frac{-7}{13} + \frac{-4}{13}$

$\frac{-7+(-4)}{13} = \frac{-11}{13}$

2. To verify $\frac{5}{11} + \frac{3}{9}$

$\frac{5}{11} + \frac{34}{9}$

$\frac{5\times9+39\times11}{99}$ L.C.M of 11, 9 = 99

$\frac{45+429}{99}$

$\frac{474}{99} = \frac{158}{33}$

ii) $-\frac{4}{9} + 2\frac{12}{13}$

$\frac{-4}{9} + \frac{38}{13}$

$\frac{-4\times13 + 38\times9}{117}$ LCM of 9, 13 = 117

$\frac{-52 + 342}{117}$

$\frac{290}{117}$

3. To verify the commutative property of addition, we have to

Show $-\frac{4}{3} + \frac{3}{7} = \frac{3}{7} + \left(\frac{-4}{3}\right)$

L.H.S = $-\frac{4}{3} + \frac{3}{7}$

$\frac{-4\times7 + 3\times3}{21}$ LCM of 3, 7 = 21

$\frac{-28 + 9}{21}$

L.H.S = $\frac{-19}{21}$

R.H.S = $\frac{3}{7} + \left(\frac{-4}{3}\right)$

$= \frac{3\times3 + (-4)\times7}{21}$ LCM of 3, 7 = 21

$= \frac{9 - 28}{21}$

R.H.S = $\frac{-19}{21}$

L.H.S = R.H.S

$\therefore -\frac{4}{3} + \frac{3}{7} = \frac{3}{7} + \left(\frac{-4}{3}\right)$

ii) To verify Commutative law of addition, we have to show $\left(\frac{-2}{-5}\right)+\frac{1}{3} = \frac{1}{3}+\left(\frac{-2}{-5}\right)$

$$L.H.S = \frac{-2}{-5}+\frac{1}{3}$$

$$= \frac{-2\times(-1)}{-5\times(-1)}+\frac{1}{3}$$ Make denominator +ve number

$$= \frac{2}{5}+\frac{1}{3}$$

$$= \frac{2\times3+1\times5}{15}$$ LCM of 5, 3 = 15

$$= \frac{6+5}{15}$$

$$L.H.S = \frac{11}{15}$$

$$R.H.S = \frac{1}{3}+\left(\frac{-2}{-5}\right)$$

$$= \frac{1}{3}+\left(\frac{-2\times-1}{-5\times-1}\right)$$ L.C.M Make denominator +ve

$$= \frac{1}{3}+\frac{2}{5}$$

$$= \frac{1\times5+2\times3}{15}$$ LCM of 3, 5 = 15

$$= \frac{5+6}{15}$$

$$R.H.S = \frac{11}{15}$$

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

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

∴ Commutative law of addition is verified

iii) $\frac{9}{11}$ and $\frac{2}{13}$

To verify the commutative law of addition, we have to

Show $\frac{9}{11} + \frac{2}{13} = \frac{2}{13} + \frac{9}{11}$

$L.H.S = \frac{9}{11} + \frac{2}{13}$

$= \frac{(9\times13)+(2\times11)}{143}$ LCM of 11, 13 = 143

$= \frac{117+22}{143}$

$L.H.S = \frac{139}{143}$

$R.H.S = \frac{2}{13} + \frac{9}{11}$

$= \frac{(2\times11)+(9\times13)}{143}$ LCM of 13, 11 = 143

$= \frac{22+117}{143}$

$R.H.S = \frac{139}{143}$

$\therefore L.H.S = R.H.S$

$\frac{9}{11} + \frac{2}{13} = \frac{2}{13} + \frac{9}{11}$

$\therefore$ Commutative law of addition is verified.

4.

i) The additive inverse of $\frac{2}{-3} = -\left(\frac{2}{-3}\right)$

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

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

$= \frac{2}{3}$

ii) The additive inverse of $\frac{-7}{-12} = -\left(\frac{-7}{-12}\right)$

$= -\left(\frac{-7\times(-1)}{-12\times(-1)}\right)$

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

$= -\frac{7}{12}$

$= \frac{-7}{12}$

5.

$x = \frac{10}{13}$

$-x = -\frac{10}{13}$

$-(-x) = -\left(-\frac{10}{3}\right)$

$= \frac{-1\times(-10)}{3}$

$-(-x) = \frac{10}{3}$

$-(-x) = x$

ii) $x = \frac{-5}{17}$

$-x = -1 \times \frac{-5}{17}$

$= \frac{(-1)\times(-5)}{17}$

$-x = \frac{5}{17}$

$-(-x) = -\left(\frac{5}{17}\right)$

$-(-x) = -\frac{5}{17} \quad \frac{-1\times 5}{17}$

$-(-x) = \frac{-5}{17}$

$-(-x) = x.$

6.

i) $\frac{4}{5} + \frac{11}{7} + \left(\frac{-7}{5}\right) + \left(\frac{-2}{7}\right)$

$\left[\frac{4}{5} + \left(\frac{-7}{5}\right)\right] + \left[\frac{11}{7} + \left(\frac{-2}{7}\right)\right]$

(using Commutative and associativity of addition)

$\left[\frac{4-7}{5}\right] + \left[\frac{11-2}{7}\right]$

$\left[\frac{-3}{5}\right] + \left[\frac{9}{7}\right]$

$\frac{(-3\times 7)+(9\times 5)}{35}$ LCM of $5, 7 = 35$

$\frac{-21+45}{35} = \frac{24}{35}$

ii) $\frac{3}{7} + \frac{4}{9} + \left(\frac{-5}{21}\right) + \frac{2}{3}$

$\left[\frac{3}{7} + \left(\frac{-5}{21}\right)\right] + \left[\frac{4}{9} + \frac{2}{3}\right]$

(By using the Commutative and associativity of addition)

$\left[\frac{(3\times3)+(-5\times1)}{21}\right] + \left[\frac{4\times1+2\times3}{9}\right]$

LCM of $7, 21 = 21$

LCM of $9, 3 = 9$

$\left[\frac{9-5}{21}\right] + \left[\frac{4+6}{9}\right]$

$\frac{4}{21} + \frac{10}{9}$

$\frac{(4\times3)+(10\times7)}{63}$

LCM of $21, 9 = 63$

$\frac{12+70}{63}$

$\frac{82}{63}$

$1\frac{19}{63}$

7.

i. $\left(\frac{-4}{9}\right) + \frac{2}{3}$ is a Rational number

ii) $\frac{43}{89} + \left(\frac{-51}{47}\right) = \left(\frac{-51}{47}\right) + \frac{43}{89}$

iii) $\frac{2}{7} + 0 = \frac{2}{7} = 0 + \frac{2}{7}$

iv) $\frac{4}{11} + \left[\left(\frac{-7}{12}\right) + \frac{9}{10}\right] = \left[\frac{4}{11} + \left(\frac{-7}{12}\right)\right] + \frac{9}{10}$

v) $\frac{5}{9} + \left(\frac{-5}{9}\right) = 0 = \left(\frac{-5}{9}\right) + \frac{5}{9}$

8. Given $a = \frac{-11}{27}$

$b = \frac{4}{9}$

$c = \frac{-5}{18}$

L.H.S $a+(b+c) = \frac{-11}{27} + \left(\frac{4}{9} + \left(\frac{-5}{18}\right)\right)$

$= \frac{-11}{27} + \left[\frac{4\times2 + (-5\times1)}{18}\right]$ LCM of 9, 18 = 18

$= \frac{-11}{27} + \left[\frac{8-5}{18}\right]$

$= \frac{-11}{27} + \frac{3}{18}$

$= \frac{(-11\times2) + (3\times3)}{54}$ LCM of 27, 18 = 54

$= \frac{-22+9}{54}$

L.H.S $= \frac{-13}{54}$

R.H.S $(a+b)+c = \left(\frac{-11}{27} + \frac{4}{9}\right) + \left(\frac{-5}{18}\right)$

$= \frac{(-11\times1)+(4\times3)}{27} + \left(\frac{-5}{18}\right)$

LCM of 27, 9 = 27

$= \frac{-11+12}{27} + \left(\frac{-5}{18}\right)$

$= \frac{1}{27} + \left(\frac{-5}{18}\right)$

$= \frac{(1\times2)+(-5\times3)}{54}$

LCM of 27, 18 = 54

$= \frac{2-15}{54}$

R.H.S $= \frac{-13}{54}$

$\therefore$ L.H.S = R.H.S

$a+(b+c) = (a+b)+c$

Exercise - 1.2

i) $2\frac{2}{3} = \frac{2\times3+2}{3} = \frac{8}{3}$

$2\frac{2}{3} - \left(-\frac{3}{7}\right)$

$\frac{8}{3} - \left(-\frac{3}{7}\right)$

$\frac{8}{3} + \frac{3}{7}$

$\frac{(8\times7)+(3\times3)}{21}$ LCM of 3,7 = 21

$\frac{56+9}{21}$

$\frac{65}{21}$

ii) $-\frac{4}{9} - \left(3\frac{5}{8}\right)$

$-\frac{4}{9} - \left(\frac{29}{8}\right)$

$-\frac{4}{9} - \frac{29}{8}$

$\frac{-4\times8-(29\times9)}{72}$ LCM of 9,8 = 72

$-\frac{293}{72}$

iii) $-3\frac{1}{5} - \left(-4\frac{7}{9}\right)$

$-\frac{16}{5} - \left(\frac{-43}{9}\right)$

$-\frac{16}{5} + \frac{43}{9}$

$\frac{(-16\times9)+(43\times5)}{45}$ LCM of 9,5 = 45

$$\frac{-144+215}{45}$$

$$\frac{71}{45}$$

8. Let the unknown number as x.

$$-\frac{5}{11}+x=-\frac{7}{8}$$

$$x=-\frac{7}{8}-\left(-\frac{5}{11}\right)$$

$$=-\frac{7}{8}+\frac{5}{11}$$

$$=\frac{(-7\times11)+(8\times5)}{88} \quad \text{LCM of } 11,8 = 88$$

$$=\frac{-77+45}{88}$$

$$x=\frac{-32}{88}$$

$$x=-\frac{4}{11}$$

9. Let the unknown number be x

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

$$x=\frac{3}{5}-\left(-\frac{2}{7}\right)$$

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

$$=\frac{(3\times7)+(2\times5)}{35} \quad (\because \text{LCM of } 5,7=35)$$

$$=\frac{21+10}{35}$$

$$x=\frac{31}{35}$$

4. Let the unknown number be x

$$-4\frac{3}{5} - x = -3\frac{1}{2}$$

$$\frac{-23}{5} - x = -\frac{7}{2}$$

$$\frac{-23}{5} = -\frac{7}{2} + x$$

$$x = \frac{-23}{5} + \frac{7}{2}$$

$$= \frac{(-23\times2)+(7\times5)}{10} \quad \text{LCM of } 5,2 = 10$$

$$= \frac{-46+35}{10}$$

$$x = \frac{-11}{10}$$

5. $$\left[\frac{-5}{7} + \left(\frac{-8}{3}\right)\right] - \left[\frac{5}{2} + \left(\frac{-11}{12}\right)\right]$$

$$\left[\frac{(-5\times3)+(-8\times7)}{21}\right] - \left[\frac{5\times6+(-11\times1)}{12}\right]$$

$$\left[\frac{-15-56}{21}\right] - \left[\frac{30-11}{12}\right]$$

$$\left[\frac{-71}{21}\right] - \left[\frac{19}{12}\right]$$

$$\frac{(-71\times4)-(19\times7)}{84}$$

$$\frac{-284-133}{84}$$

$$-\frac{417}{84} = \frac{-139}{28} = -\frac{139}{28} //$$

6. $x = \frac{4}{9}$; $y = \frac{-7}{12}$

Consider

$$x - y = \frac{4}{9} - \left(\frac{-7}{12}\right)$$

$$= \frac{4}{9} + \frac{7}{12}$$

$$= \frac{(4\times4)+(7\times3)}{36} \quad (\because \text{LCM of } 9,12 = 36)$$

$$= \frac{16+21}{36}$$

$$x - y = \frac{37}{36}$$

Consider

$$y - x = -\frac{7}{12} - \left(\frac{4}{9}\right)$$

$$= \frac{-7}{12} - \frac{4}{9}$$

$$= \frac{(-7\times3)-(4\times4)}{36} \quad \text{LCM of } 9,12 = 36$$

$$= \frac{-21-16}{36}$$

$$y - x = \frac{-37}{36}$$

$\therefore x - y \neq y - x.$

7. $x = \frac{4}{9}$; $y = \frac{2}{5}$; $y = -\frac{7}{12}$; $z = -\frac{2}{3}$

Consider

$$x-(y-z) = \frac{4}{9} - \left(-\frac{7}{12} - \left(-\frac{2}{3}\right)\right)$$

$$= \frac{4}{9} - \left(-\frac{7}{12} + \frac{2}{3}\right)$$

$$= \frac{4}{9} - \left(\frac{(-7\times1)+(2\times4)}{12}\right)$$

$$= \frac{4}{9} - \left(\frac{-7+8}{12}\right)$$

$$= \frac{4}{9} - \frac{1}{12}$$

$$= \frac{(4\times4)-(1\times3)}{36}$$

$$= \frac{16-3}{36}$$

$$x-(y-z) = \frac{13}{36}$$

Consider

$$(x-y)-z = \left[\frac{4}{9} - \left(-\frac{7}{12}\right)\right] - \left(-\frac{2}{3}\right)$$

$$= \left[\frac{4}{9} + \frac{7}{12}\right] + \frac{2}{3}$$

$$= \left[\frac{(4\times4)+(7\times3)}{36}\right] + \frac{2}{3}$$

$$= \frac{16+21}{36} + \frac{2}{3}$$

$$= \frac{37}{36} + \frac{2}{3}$$

$$= \frac{(37\times1)+(2\times12)}{36}$$

$$= \frac{37+24}{36}$$

$$(x-y)-z = \frac{61}{36}$$

$$\therefore \quad x-(y-z) \neq (x-y)-z$$

8.

i) $\frac{2}{3} - \frac{4}{5}$

$\frac{(2\times5)-(4\times3)}{15}$ LCM of 3, 5 = 15

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

$\frac{-2}{5}$ It is a Rational Number

So. given statement is False

ii) True

$-\frac{5}{7} + \frac{5}{7} = 0$

Exercise 1.3

1.

i. $\frac{6}{-7} \times \frac{14}{30}$

$\frac{6 \times 14}{-7 \times 30}$

$-\frac{84}{210}$

$-\frac{2}{5}$

ii. $6\frac{2}{3} \times 1\frac{2}{7}$

$\frac{20}{3} \times \frac{9}{7}$

$\frac{20 \times 9}{3 \times 7}$

$\frac{180}{21}$

$\frac{60}{7}$

iii) $\frac{25}{-9} \times \frac{-3}{10}$

$\frac{25 \times (-3)}{-9 \times 10}$

$\frac{-75}{-90}$

$\frac{-5}{-6}$

$\frac{5}{6}$

12.

i. To Verify Commutative property of multiplication we have to show $\frac{4}{5} \times \frac{-7}{8} = \frac{-7}{8} \times \frac{4}{5}$

$$L.H.S = \frac{4 \times -7}{5 \times 8}$$

$$= \frac{-28}{40}$$

$$L.H.S = \frac{-7}{10}$$

$$R.H.S = \frac{-7}{8} \times \frac{4}{5}$$

$$= \frac{-7 \times 4}{8 \times 5}$$

$$= \frac{-28}{40}$$

$$R.H.S = \frac{-7}{10}$$

$\therefore$ L.H.S = R.H.S

$\therefore$ Commutative property of multiplication is Verified.

ii. To Verify Commutative property of multiplication we have to show $13\frac{1}{3} \times 1\frac{1}{8} = 1\frac{1}{8} \times 13\frac{1}{8}$

$$L.H.S = 13\frac{1}{3} \times 1\frac{1}{8}$$

$$= \frac{40}{3} \times \frac{9}{8}$$

$$= \frac{40 \times 9}{3 \times 8}$$

$$= \frac{360}{24}$$

$$L.H.S = 15$$

$$R.H.S = 1\frac{1}{8} \times 13\frac{1}{3}$$

$$= \frac{9}{8} \times \frac{40}{3}$$

$$= \frac{360}{24}$$

$$R.H.S = 15$$

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

$\therefore$ Commutative property of multiplication is verified

iii) To verify Commutative property of multiplication we have to show $\frac{-7}{-20} \times \frac{5}{-14} = \frac{5}{-14} \times \left(\frac{-7}{-20}\right)$

$$L.H.S = \frac{-7}{-20} \times \frac{5}{-14}$$

$$= \frac{-7 \times 5}{-20 \times (-14)}$$

$$= \frac{-35}{280}$$

$$L.H.S = \frac{-1}{8}$$

$$R.H.S = \frac{5}{-14} \times \frac{-7}{-20}$$

$$= \frac{5 \times (-7)}{-14 \times (-20)}$$

$$= \frac{-35}{280}$$

$$R.H.S = \frac{-1}{8}$$

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

$\therefore$ Commutative property of multiplication is verified.

3.

i. $\frac{3}{5} \times \left(\frac{-4}{7} \times \frac{-8}{9}\right) = \left(\frac{3}{5} \times \frac{-4}{7}\right) \times \frac{-8}{9}$

L.H.S $= \frac{3}{5} \times \left(\frac{-4}{7} \times \frac{-8}{9}\right)$

$= \frac{3}{5} \times \left(\frac{-4 \times (-8)}{7 \times 9}\right)$

$= \frac{3}{5} \times \left(\frac{32}{63}\right)$

$= \frac{3 \times 32}{5 \times 63}$

$= \frac{96}{315}$

L.H.S $= \frac{32}{105}$

R.H.S $= \left(\frac{3}{5} \times \frac{-4}{7}\right) \times \left(\frac{-8}{9}\right)$

$= \left(\frac{3 \times (-4)}{5 \times 7}\right) \times \left(\frac{-8}{9}\right)$

$= \frac{-12}{35} \times \frac{-8}{9}$

$= \frac{-12 \times (-8)}{35 \times 9}$

$= \frac{96}{315}$

R.H.S $= \frac{32}{105}$

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

∴ This law is called "Associative property of multiplication"

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

L.H.S $= \frac{5}{9} \times \left(\frac{-3}{2} + \frac{7}{5}\right)$

$= \frac{5}{9} \times \left(\frac{(-3\times5)+(7\times2)}{10}\right)$ LCM of 2,5 = 10

$= \frac{5}{9} \times \left(\frac{-15+14}{10}\right)$

$= \frac{5}{9} \times \left(\frac{-1}{10}\right)$

L.H.S $= \frac{-1}{18}$

R.H.S $= \left(\frac{5}{9} \times \frac{-3}{2}\right) + \left(\frac{5}{9} \times \frac{7}{5}\right)$

$= \left[\frac{5\times(-3)}{18}\right] + \left[\frac{5\times7}{9\times5}\right]$

$= \frac{-15}{18} + \frac{35}{45}$

$= \frac{(-15\times5)+(35\times2)}{90}$

$= \frac{-75+70}{90}$

$= \frac{-5}{90}$

R.H.S $= \frac{-1}{18}$

$\therefore$ L.H.S = R.H.S, Hence proved

This is law is called "Distributive law of multiplication over addition"

4.

i) 12. reciprocal of $12 = \frac{1}{12}$

$\therefore \frac{1}{12}$ is multiplicative inverse of 12

ii) reciprocal of $\frac{2}{3} = \frac{3}{2}$

$\therefore \frac{3}{2}$ is multiplicative inverse of $\frac{2}{3}$

iii) reciprocal of $\frac{-4}{7} = \frac{7}{-4}$ or $-\frac{7}{4}$

$\therefore -\frac{7}{4}$ is multiplicative inverse of $-\frac{4}{7}$

iv) $\frac{-3}{8} \times \left(\frac{-7}{13}\right) = \frac{-3\times(-7)}{8\times13} = \frac{21}{104}$

reciprocal of $\frac{21}{104}$ is $\frac{104}{21}$

$\therefore \frac{104}{21}$ is multiplicative inverse of $\frac{-3}{8} \times \left(\frac{-7}{13}\right)$

5.

i) $\frac{2}{5} \times \frac{-3}{7} - \frac{1}{14} = \frac{3}{7} \times \frac{3}{5}$

$\frac{2\times(-3)}{5\times7} - \frac{1}{14} = \frac{(3\times3)}{7\times5}$

$\frac{-6}{35} - \frac{1}{14} = \frac{9}{35}$

$\frac{(-6\times2)-(1\times5)-(9\times2)}{70}$ LCM of 35, 14, 35 = 70

$\frac{-12-5-18}{70}$

$\frac{-35}{70}$

$\frac{-1}{2}$

ii) $\frac{8}{9} \times \frac{4}{5} + \frac{5}{6} - \frac{9}{5} \times \frac{8}{9}$

$\frac{(8\times4)}{9\times5} + \frac{5}{6} - \frac{(9\times8)}{(5\times9)}$

$\frac{32}{45} + \frac{5}{6} - \frac{72}{45}$

$\frac{(32\times2)+(5\times15)-(72\times2)}{90}$ LCM of 45, 6, 45 = 90

$\frac{64+75-144}{90}$

$\frac{-5}{90}$

$\frac{-1}{18}$

$\frac{-1}{18}$ =

iii) $\frac{-3}{7} \times \frac{14}{15} \times \frac{7}{12} \times \left(\frac{-30}{35}\right)$

$\frac{-3\times14\times7}{7\times15\times12} \times \left(\frac{-30}{35}\right)$

$\frac{-294}{1260} \times \left(\frac{-30}{35}\right)$

$\frac{-294\times(-30)}{1260\times35}$

$\frac{1}{5}$ =

6. $P = \frac{-8}{27}$, $q = \frac{3}{4}$, $r = \frac{-12}{15}$

i) $P \times (q \times r) = (P \times q) \times r$

L.H.S $= P \times (q \times r)$

$= \frac{-8}{27} \times \left(\frac{3}{4} \times \left(\frac{-12}{15} \right) \right)$

$= \frac{-8}{27} \times \left(\frac{3 \times (-12)}{4 \times 15} \right)$

$= \frac{-8}{27} \times \left(\frac{-36}{60} \right)$

$= \frac{-8 \times (-36)}{27 \times 60}$

L.H.S $= \frac{8}{45}$

R.H.S $= (P \times q) \times r$

$= \left(\frac{-8}{27} \times \frac{3}{4} \right) \times \left(\frac{-12}{15} \right)$

$= \left(\frac{-8 \times 3}{27 \times 4} \right) \times \left(\frac{-12}{15} \right)$

$= \frac{-24}{108} \times \left(\frac{-12}{15} \right)$

$= \frac{-24 \times -12}{108 \times 15}$

R.H.S $= \frac{8}{45}$

$\therefore$ L.H.S = R.H.S, Hence verified.

ii) $P \times (q - r) = P \times q - P \times r$

L.H.S = $P \times (q - r)$

$= \frac{-8}{27} \times \left(\frac{3}{4} - \left(\frac{-12}{15}\right)\right)$

$= \frac{-8}{27} \times \left(\frac{3}{4} + \frac{12}{15}\right)$

$= \frac{-8}{27} \times \left(\frac{(3\times15)+(12\times4)}{60}\right)$

$= \frac{-8}{27} \times \left(\frac{45+48}{60}\right)$

$= \frac{-8}{27} \times \frac{93}{60}$

$= \frac{-8}{27} \times \frac{31}{20}$

L.H.S = $-\frac{62}{135}$

R.H.S = $P \times q - P \times r$

$= \frac{-8}{27} \times \frac{3}{4} - \left(\frac{-8}{27} \times \left(-\frac{12}{15}\right)\right)$

$= \frac{-8\times3}{27\times4} - \left(\frac{-8\times(-12)}{27\times15}\right)$

$\frac{-24}{27\times4} - \left(\frac{96}{405}\right)$

$= \frac{-24}{108} - \frac{96}{405}$

$= -\frac{2}{9} - \frac{32}{135}$

$= \frac{(-2\times15)-(32\times1)}{135}$

$$= \frac{-30-32}{135}$$

$$R.H.S = \frac{-62}{135}$$

$\therefore$ LHS = RHS ; Hence Verified.

7. i) $\frac{2}{3} \times \frac{-4}{5}$ is a Rational number

ii) $\frac{54}{81} \times \frac{-63}{108} = \frac{-63}{108} \times \frac{54}{81}$

iii) $\frac{4}{5} \times 1 = \frac{4}{5} = 1 \times \frac{4}{5}$

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

v) $\frac{3}{7} \times \left(\frac{-2}{8} \times \frac{5}{9}\right) = \left(\frac{3}{7} \times \frac{-2}{8}\right) \times \frac{5}{9}$

vi) $\frac{-8}{9} \times \left[\frac{4}{13} + \frac{5}{17}\right] = \left[\frac{-8}{9} \times \frac{4}{13}\right] + \left(\frac{-8}{9} \times \frac{5}{17}\right)$

vii) $\frac{-6}{13} \times \left[\frac{8}{9} - \frac{4}{7}\right] = \frac{-6}{13} \times \frac{8}{9} - \left(\frac{-6}{13} \times \frac{4}{7}\right)$

viii) $\frac{16}{25} \times 0 = 0$

ix) Not defined

x) 1, -1

xi) x^2

xii) 1

xiii) negative

8. No,

$$\frac{4}{5} \times \left(-1\frac{1}{4}\right)$$

$$\frac{4}{5} \times \left(-\frac{5}{4}\right)$$

$$-1 \neq 1$$

$\therefore -1\frac{1}{4}$ is not multiplicative inverse of $\frac{4}{5}$

$\therefore$ multiplicative inverse of $\frac{4}{5}$ should be $\frac{5}{4}$

9. i. $\left\{\frac{7}{5} \times \left(\frac{-3}{12}\right)\right\} + \left\{\frac{7}{5} + \frac{5}{12}\right\}$

$\frac{7}{5} \times \left\{\frac{-3}{12} + \frac{5}{12}\right\}$ (∵ distributive property)

$\frac{7}{5} \times \left\{\frac{-3+5}{12}\right\}$

$\frac{7}{5} \times \frac{2}{12}$

$\frac{7}{30}$

ii) $\left\{\frac{9}{16} \times \frac{4}{12}\right\} + \left\{\frac{9}{16} \times \left(\frac{-3}{9}\right)\right\}$

$\frac{9}{16} \times \left\{\frac{4}{12} + \left(\frac{-3}{9}\right)\right\}$ (∵ distributive property)

$\frac{9}{16} \times \left\{\frac{1}{3} + \left(\frac{-1}{3}\right)\right\}$

$\frac{9}{16} \left\{\frac{1}{3} - \frac{1}{3}\right\}$

$\frac{9}{16} \times 0 = 0$

10. Additive inverse of $9 = -9$

Multiplicative inverse of $9 = \frac{1}{9}$

Required Sum $= -9 + \frac{1}{9}$

$= -\frac{81+1}{9}$

$= -\frac{80}{9}$

Required Sum $= -8\frac{8}{9}$

11. Additive inverse of $-\frac{2}{7} = \frac{2}{7}$

Multiplicative inverse of $-\frac{2}{7} = -\frac{7}{2}$

Required product $= \frac{2}{7} \times -\frac{7}{2}$

$= -1$

Exercise 1.4

1. $-\frac{3}{7} \div 4$

$-\frac{3}{7} \div \frac{4}{1}$

$\frac{-3}{7} \times \frac{1}{4}$

$\frac{-3\times1}{7\times4}$

$\frac{-3}{28}$

ii) $4\frac{5}{8} \div \left(\frac{-4}{9}\right)$

$\frac{37}{8} \div \left(\frac{-4}{9}\right)$

$\frac{37}{8} \times \left(\frac{9}{-4}\right)$

$\frac{37\times9}{8\times(-4)}$

$-\frac{333}{32}$

$-10\frac{13}{32}$

iii) $-\frac{8}{9} \div \frac{-3}{5}$

$-\frac{8}{9} \times \frac{5}{-3}$

$\frac{-8\times5}{9\times-3}$

$\frac{-40}{-27}$

$\frac{40}{27} = 1\frac{13}{27}$

Q2.

i. True

ii. False

iii. False

iv. True

v. True

vi. False

3. Let unknown number be 'x'

$$x \times 2\frac{4}{9} = \frac{-11}{12}$$

$$x \times \frac{22}{9} = \frac{-11}{12}$$

$$x = \frac{-11}{12} \div \frac{22}{9}$$

$$= \frac{-11}{12} \times \frac{9}{22}$$

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

Ans. Other number $= \frac{-3}{8}$

4. Let unknown number be 'x'

$$x \times \left(\frac{-7}{12}\right) = \frac{5}{14}$$

$$x = \frac{5}{14} \div \left(\frac{-7}{12}\right)$$

$$= \frac{5}{14} \times \frac{12}{-7}$$

$$= \frac{5 \times 12}{14 \times (-7)}$$

$$= \frac{60}{-98}$$

$$= -\frac{30}{49}$$

5. Let unknown number be x

$$\frac{-3}{x} = \frac{-9}{13}$$

$$x = -\frac{3}{1} \div \left(\frac{-9}{13}\right)$$

$$= -\frac{3}{1} \times \frac{13}{-9}$$

$$\boxed{x = \frac{13}{3}} = 4\frac{1}{3}$$

6.

Sum of numbers $= -\frac{13}{8} + \frac{5}{12}$

$= \frac{(-13\times3)+(5\times2)}{24}$ LCM of 8, 12 = 24

$= \frac{-39+10}{24}$

$= \frac{-29}{24}$

Sum of numbers $= \frac{-29}{24}$

Difference of numbers $= -\frac{13}{8} - \frac{5}{12}$

$= \frac{(-13\times3)-(5\times2)}{24}$

$= \frac{-39-10}{24}$

Difference of numbers $= -\frac{49}{24}$

∴ Required product = Sum of numbes ÷ difference of numbers

$= -\frac{29}{24} \div \left(-\frac{49}{24}\right)$

$= -\frac{29}{24} \times \frac{24}{-49}$

$= \frac{29}{49}$

7. Sum of two numbers $= \frac{8}{3} + \frac{4}{7}$

$= \frac{(8\times7)+(3\times4)}{21}$ LCM of 3,7 = 21

$= \frac{56+12}{21}$

Sum of two numbers $= \frac{68}{21}$

Product of given numbers $= \frac{-3}{7} \times \frac{14}{9}$

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

Required product $= \frac{\text{Sum of } \frac{8}{3} \text{ and } \frac{4}{7}}{\text{Product of } \frac{-3}{7} \text{ and } \frac{14}{9}}$

$= \frac{68}{21} \div \left(\frac{-2}{3}\right)$

$= \frac{68}{21} \times \frac{3}{-2}$

$= -\frac{34}{7}$

8. Given $p = \frac{-3}{2}$, $q = \frac{4}{5}$, $r = \frac{-7}{12}$

$(p \div q) \div r = p \div (q \div r)$

L.H.S $= (p \div q) \div r$

$= \left(\frac{-3}{2} \div \frac{4}{5}\right) \div \left(\frac{-7}{12}\right)$

$= \left(\frac{-3}{2} \times \frac{5}{4}\right) \div \left(\frac{-7}{12}\right)$

$= \left(\frac{-15}{8}\right) \div \left(\frac{-7}{12}\right)$

$= \frac{-15}{8} \times \frac{12}{-7}$

$$= \frac{-15}{8} \times \frac{12}{-7}$$

$$L.H.S = +\frac{45}{7}$$

$$R.H.S = P \div (Q \div R)$$

$$= \frac{-3}{2} \div \left(\frac{4}{5} \div \left(-\frac{7}{12}\right)\right)$$

$$= \frac{-3}{2} \div \left(\frac{4}{5} \times \frac{12}{-7}\right)$$

$$= \frac{-3}{2} \div \left(-\frac{48}{35}\right)$$

$$= \frac{-3}{2} \times -\frac{35}{48}$$

$$R.HS = \frac{35}{32}$$

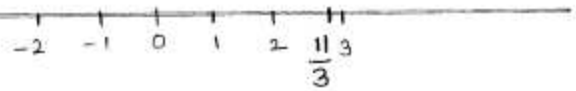
$$L.H.S \neq R.H.S$$

$$(P \div Q) \div R \neq P \div (Q \div R)$$

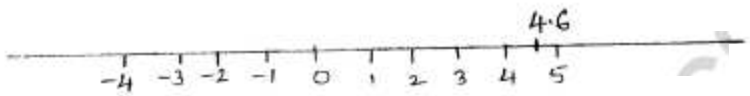
Exercise 1.5

1.

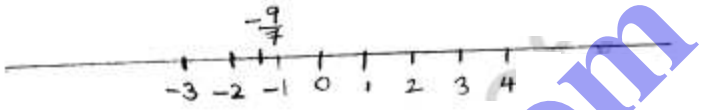
i. $\frac{11}{4} = 2.75$



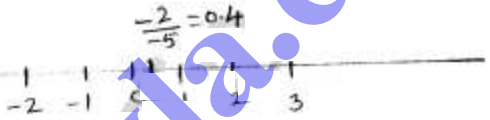
ii) $4\frac{8}{5} = \frac{23}{5} = 4.6$



iii) $\frac{-9}{7} = -1\frac{2}{7}$



iv) $\frac{-2}{-5} = \frac{2}{5} = 0.4$



2. i)

$A = \frac{3}{7}$

$B = \frac{7}{7} = 1$

$C = \frac{8}{7}$

$D = \frac{12}{7}$

$E = \frac{13}{7}$

ii)

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

$Q = \frac{-4}{8} = \frac{-1}{2}$

$R = \frac{-7}{8}$

$S = \frac{-11}{8}$

$T = \frac{-12}{8} = \frac{-3}{2}$

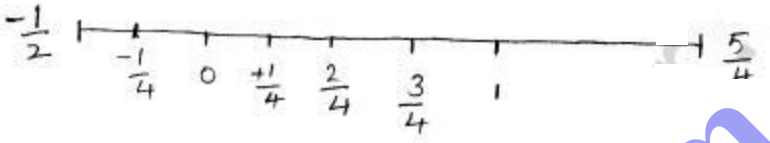
3.

$-\frac{3}{7}$ $-\frac{2}{7}$ $-\frac{1}{4}$ $-\frac{1}{7}$ 0 $\frac{1}{7}$ $\frac{1}{4}$ $\frac{2}{7}$ $\frac{3}{7}$ $\frac{1}{2}$ $\frac{4}{7}$

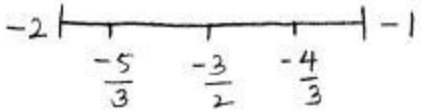
9) $-\frac{3}{7}$ $-\frac{3}{10}$ $-\frac{5}{20}$ $-\frac{2}{10}$ $-\frac{3}{20}$ $-\frac{1}{10}$ $-\frac{1}{20}$ 0 $\frac{1}{20}$ $\frac{1}{10}$ $\frac{3}{20}$ $\frac{2}{10}$ $\frac{5}{20}$ $\frac{3}{10}$

$\frac{7}{20}$ $\frac{4}{10}$ $\frac{9}{20}$ $\frac{5}{10}$ $\frac{11}{20}$ $\frac{6}{10}$ $\frac{2}{3}$

4)



5)



6) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

7) -5, -6, -7, -8, -9

8) $-\frac{7}{3}$, Numerator is greater than denominator (Numerically.)

$-\frac{7}{3} < -1$; $-\frac{5}{11}, -\frac{1}{2}, -\frac{4}{9} > -1$.

$\therefore -\frac{7}{3}$ is different among all four rational numbers

Exercise 1.6

1. Total fruits = 20kg

Oranges = $7\frac{1}{6}$ kg

Apples = $8\frac{2}{3}$ kg

Let grapes = x

$$7\frac{1}{6} + 8\frac{2}{3} + x = 20$$

$$\frac{43}{6} + \frac{26}{3} + x = 20$$

$$\frac{(43\times1)+(26\times2)}{6} + x = 20$$

$$\frac{43+52}{6} + x = 20$$

$$\frac{95}{6} + x = 20$$

$$x = \frac{20}{1} - \frac{95}{6}$$

$$x = \frac{120-95}{6}$$

$$x = \frac{25}{6} \text{ kg}$$

$\therefore$ Bag contain $4\frac{1}{6}$ kg of grapes.

2. Total population of city = 6,63,432

Adult male = $\frac{1}{2}$ of total population

Adult females = $\frac{1}{3}$ of total population

$\therefore$ Adult male + Adults females + children = Total city

$$\frac{1}{2}(6,63,432) + \frac{1}{3}(663432) + \text{Children} = 6,63432$$

$$\frac{5}{6}(663432) + \text{children} = 663432$$

$$\text{children} = 663432\left(1-\frac{5}{6}\right)$$

$= 663432 \times \frac{1}{6}$

Children $= 110572$

$\therefore$ no. of children in city $= 110,572$

3.

Total votes $= 30$

no. of votes for Mr. X $= \frac{2}{5}$ of $30 = \frac{2}{5}(30)$

no. of votes for Mr. Z $= \frac{1}{3}$ of $30 = \frac{1}{3}(30)$

Let Mr. Y votes $= x$

$\therefore \quad \frac{2}{5}(30) + x + \frac{1}{3}(30) = 30$

$12 + x + 10 = 30$

$x + 22 = 30$

$x = 30 - 22$

$x = 8$

no. of votes for Mr. Y $= 8$

4.

Total earnings $= ₹ 100$

Rupees spent on food $= ₹ 14\frac{2}{7}$

Rupees spent on petrol $= ₹ 30\frac{2}{3}$

Let Savings on that day $= x$

$14\frac{2}{7} + 30\frac{2}{3} + x = 100$

$\frac{100}{7} + \frac{92}{3} + x = 100$

$\frac{(100 \times 3) + (92 \times 7)}{21} + x = 100$

$x = 100 - \frac{944}{21}$

$x = \frac{1156}{21} = 55\frac{1}{21}$

$\therefore$ Savings $= ₹ 55\frac{1}{21}$

5. Total students = 400

no. of girls = 130

no. of boys appeared for exam = 400 − 130

= 270

no. of boys passed in exam = $\frac{2}{3}(270)$

= 180

no. of boys failed in exam = Total boys − passed boys

= 270 − 180

= 90

∴ no. of boys failed in exam = 90.

6. Speed of Car = $40\frac{2}{3}$ km/h

time = $\frac{9}{10}$ hr

Distance travelled by Car = Speed × time

= $40\frac{2}{3} \times \frac{9}{10}$

= $\frac{122}{3} \times \frac{9}{10}$

= $\frac{183}{5}$

= $36\frac{3}{5}$ km

7. Side of Square = $5.\frac{7}{9}$ m

S = $\frac{52}{9}$ m

Area of Square = S^2

= $\frac{52}{9} \times \frac{52}{9}$

= $\frac{2704}{81}$

Area of Square = $33\frac{31}{81}$ m^2

8. Perimeter of rectangle = $15\frac{3}{7}$ m

Length of rectangle (l) = $4\frac{2}{7}$ m

perimeter = $2(l+b)$

$15\frac{3}{7} = 2\left(4\frac{2}{7}+b\right)$

$\frac{108}{7} = 2\left(\frac{30}{7}+b\right)$

$\frac{30}{7}+b = \frac{108}{7\times2}$

$\frac{30}{7}+b = \frac{54}{7}$

$b = \frac{54}{7} - \frac{30}{7}$

$b = \frac{24}{7}$

$b = 3\frac{3}{7}$ m

breadth of rectangle = $3\frac{3}{7}$ m.

9. Total length of rope = $325\frac{4}{5}$ m

Rahul cut down

Rahul cut off $150\frac{3}{5}$ m of rope

∴ Remaining length of rope = $325\frac{4}{5} - 150\frac{3}{5}$

$= \frac{1629}{5} - \frac{753}{5}$

$= \frac{876}{5}$ m

Rahul made Remaining rope into 3 equal parts

∴ length of each part = $\frac{876}{5} \div \frac{3}{1}$

$= \frac{876}{5} \times \frac{1}{3} = \frac{292}{5} = 58\frac{2}{5}$ m

∴ length of each part = $58\frac{2}{3}$ m

10. $3\frac{1}{2}$ liters of petrol cost = ₹ $270.\frac{3}{8}$

Cost for 1 liter of petrol = $\frac{270\frac{3}{8}}{3\frac{1}{2}}$

$= \frac{2163}{8} \times \frac{2}{7}$

Cost for 1 liter of petrol = $\frac{309}{4}$

Cost for 4 liters of petrol = $\frac{309}{4} \times 4$

∴ Cost for 4 liters of petrol = ₹ 309

11. ₹ Ramesh total earings = ₹ 40,000

Ramesh spends $\frac{3}{8}$ of income on food = $\frac{3}{8} \times 40000$

= 15000

Remaining money = 40000 − 15000

= 25000

Ramesh spends $\frac{1}{5}$ of remaining on LIC

= $\frac{1}{5}(25000)$

= ₹5000

Remaining money = ₹25000 − ₹5000

= ₹20000

Other expenses are $\frac{1}{2}$ of remaining money

= $\frac{1}{2} \times 20000$

= 10,000/−

Remaining money = 20,000 − 10,000

= 10,000/−

12. Let total bill Amount as x

Amount paid A will be $= \frac{x}{2}$

Amount paid B, C, D will be $= x - \frac{x}{2}$

$= \frac{x}{2}$

Given bot bill is shared equally among Three

Let bill paid by each one $= y$

$y + y + y = \frac{x}{2}$

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

$y = \frac{x}{6}$

∴ Each paid $\frac{1}{6}$ th of total bill.

13. Given

$\frac{1}{3} \times 24$

Let total no. of Student s $= x$

no. of Students of school Come by car $= \frac{2}{5}x$

no. of Students of School come by bus $= \frac{1}{4}x$

no. of Students of School Come by walk $= x - \left(\frac{2}{5}x + \frac{1}{4}x\right)$

$= x - \left(\frac{(2\times4)+(1\times5)}{20} \cdot x\right)$

$= x - \frac{13}{20} \cdot x$

no. of Students of school Come by walk $= \frac{7}{20} \cdot x$

no. of Students of School Come by walk on Their own

$= \frac{1}{3}$ of $\left(\frac{7}{20}x\right)$

$= \frac{7}{60} \cdot x$

$\therefore \quad \frac{7}{60} \cdot x = 224$

$x = \frac{224}{1} \times \frac{60}{7}$

$x = 1920$

$\therefore$ Total Students in School = 1920

14. Total cost of Room = ₹ 60,000

Let Mother's Contribution = ₹ x

Edder Son Contribution = ₹ $\frac{3}{8}x$

Younger Son Contribution = ₹ $\frac{1}{2}x$

$\therefore \quad x + \frac{3}{8}x + \frac{1}{2}x = 60,000$

$\frac{(1\times 8)+(3\times 1)+(1\times 4)}{8} \cdot x = 60,000$

$\frac{8+3+4}{8} \cdot x = 60,000$

$\frac{15}{8} \cdot x = 60000$

$x = 60000 \times \frac{8}{15}$

$x = 32000$

$\therefore$ Mother's Contribution = ₹ 32,000

$\therefore$ Elder Son's Contribution = $\frac{3}{8} \times 32000$ = ₹ 12,000/-

$\therefore$ Younger Son's Contribution = $\frac{1}{2} \times 32000$ = ₹ 16,000/-

15. Total Students = 56

let no. of girls = x

no. of boys = $\frac{2}{5}x$

$\therefore x + \frac{2}{5}x = 56$

$\frac{7}{5}x = 56$

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

$x = 40$

$\therefore$ no. of girls = 40

$\therefore$ no. of boys = $56 - 40 = 16$

16. let my money posses by man = ₹ x

$\frac{1}{10}$ th of money donated to school = $\frac{x}{10}$

Remaining money = $x - \frac{x}{10} = \frac{9x}{10}$

$\frac{1}{6}$ th of remaining money to church = $\left(\frac{9x}{10}\right) \times \frac{1}{6}$

Remaining money = $\frac{9x}{10} - \frac{9x}{10 \times 6}$

$= \frac{45x}{60}$

Now, the man distributed this money equally to his three sons and each one gets = ₹ 50,000

$\frac{45x}{60} \div 3 = 50{,}000$

$\frac{45x}{60} \times \frac{1}{3} = 50000$

$\frac{3}{4}x \times \frac{1}{3} = 50000$

$x = 50000 \times 4$

$x = 2{,}00{,}000/-$ $\therefore$ Man posses originally ₹ 2,00,000

17. Let a number be 'x'

$\frac{1}{4}$ of a number is added to $\frac{1}{3}$ of number

$\frac{x}{4} + \frac{x}{3}$ is 15 greater than half of number

$$\frac{x}{4} + \frac{x}{3} = 15 + \frac{x}{2}$$

$$\frac{7x}{12} = 15 + \frac{x}{2}$$

$$\frac{7x}{12} - \frac{x}{2} = 15$$

$$\frac{x}{12} = 15$$

$$x = 15 \times 12$$

$$x = 180$$

18. Let the number be 'x'

$$x \div \frac{4}{5} = 36 + \left(x \times \frac{4}{5}\right)$$

$$\frac{5x}{4} = 36 + \frac{4x}{5}$$

$$\frac{5x}{4} - \frac{4x}{5} = 36$$

$$\frac{(5\times5) - (4\times4)}{20} \cdot x = 36$$

$$\frac{25-16}{20} \cdot x = 36$$

$$\frac{9}{20} \cdot x = 36$$

$$x = \frac{36}{9} \times 20$$

$$\boxed{x = 80}$$

∴ The given number is 80