1. Rational Numbers

Exercise 1.1

1. Question

Add the following rational numbers:

(i) $\frac{-5}{7}$ and $\frac{3}{7}$

(ii) $\frac{-15}{4}$ and $\frac{7}{4}$

(iii) $\frac{-8}{11}$ and $\frac{-4}{11}$

(iv) $\frac{6}{13}$ and $\frac{-9}{13}$

Answer

(i) Clearly,

Denominators of the given numbers are positive

The L.C.M of denominator 7 and 7 is 7

We have,

$\frac{-5}{7} + \frac{3}{7}$

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

$= \frac{-2}{7}$

(ii) Clearly,

Denominators of the given numbers are positive

The L.C.M of denominator 4 and 4 is 4

We have,

$\frac{-15}{4} + \frac{7}{4}$

$= \frac{-15+7}{4}$

$= \frac{-8}{4}$

= -2

(iii) Clearly,

Denominators of the given numbers are positive

The L.C.M of denominator 11 and 11 is 11

We have,

$\frac{-8}{11} + \frac{-4}{11}$

$= \frac{-8-4}{11}$

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

(iv) Clearly,

Denominators of the given numbers are positive

The L.C.M of denominator 13 and 13 is 13

We have,

$\frac{6}{13} + \frac{-9}{13}$

$= \frac{6-9}{13}$

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

2. Question

Add the following rational numbers:

(i) $\frac{3}{4}$ and $\frac{-5}{8}$

(ii) $\frac{5}{-9}$ and $\frac{7}{3}$

(iii) -3 and $\frac{3}{5}$

(iv) $\frac{-7}{27}$ and $\frac{11}{18}$

(v) $\frac{31}{-4}$ and $\frac{-5}{8}$

(vi) $\frac{5}{36}$ and $\frac{-7}{12}$

(vii) $\frac{-5}{16}$ and $\frac{7}{24}$

(viii) $\frac{7}{-18}$ and $\frac{8}{27}$

Answer

(i) The denominator of given rational numbers are 4 and 8 respectively

The L.C.M of 4 and 8 is 8

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{3*2}{4*2} = \frac{6}{8}$ and $\frac{-5}{8}$

Therefore,

$\frac{6}{8} - \frac{5}{8} = \frac{6-5}{8}$

$= \frac{1}{8}$

(ii) The denominator of given rational numbers are 9 and 3 respectively

The L.C.M of 9 and 3 is 9

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{-5*1}{9*1} = \frac{-5}{9}$ and $\frac{7*3}{3*3} = \frac{21}{9}$

Therefore,

$\frac{-5}{9} + \frac{21}{9} = \frac{-5+21}{9}$

$= \frac{16}{9}$

(iii) The denominator of given rational numbers are 1 and 5 respectively

The L.C.M of 1 and 5 is 5

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{-3*5}{1*5} = \frac{-3*5}{5}$ and $\frac{3}{5}$

Therefore,

$\frac{-15}{5} + \frac{3}{5} = \frac{3-15}{5}$

$= \frac{-12}{5}$

(iv) The denominator of given rational numbers are 27 and 18 respectively

The L.C.M of 27 and 18 is 54

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{-7}{27} = \frac{-7*2}{27*2}$

$= \frac{-14}{54}$

And,

$\frac{11}{18} = \frac{11*3}{18*3}$

$= \frac{33}{54}$

Therefore,

$(\frac{-7*2}{27*2}) + \frac{33}{54}$

$= \frac{33}{54} - \frac{14}{54}$

$= \frac{33-14}{54}$

$= \frac{19}{54}$

(v) The denominator of given rational numbers are -4 and 8 respectively

The L.C.M of -4 and 8 is 8

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{31}{4} = \frac{31*2}{-4*2}$

$= \frac{-62}{8}$

And,

$\frac{5}{8}$

Therefore,

$(\frac{-31*2}{4*2}) + (\frac{-5}{8})$

$= \frac{-62}{8} - \frac{5}{8}$

$= \frac{-67}{8}$

(vi) The denominator of given rational numbers are 36 and 12 respectively

The L.C.M of 36 and 12 is 36

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{-7*3}{12*3} = \frac{-21}{36}$

And,

$\frac{5}{36}$

Therefore,

$\frac{5}{36} - \frac{21}{36}$

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

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

(vii) The denominator of given rational numbers are 16 and 24 respectively

The L.C.M of 16 and 24 is 48

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{-5}{16} = \frac{-5*3}{16*3}$

$= \frac{-15}{48}$

And,

$\frac{7}{24} = \frac{7*2}{24*2}$

$= \frac{14}{48}$

Therefore,

$\frac{-5}{16} + \frac{7}{24}$

$= \frac{-15}{48} + \frac{14}{48}$

$= \frac{-1}{48}$

(viii) The denominator of given rational numbers are -4 and 8 respectively

The L.C.M of 18 and 27 is 54

Now, we rewrite the given rational numbers into forms in which both of them have the same denominator

$\frac{7}{-18} = \frac{7*3}{-18*3}$

$= \frac{-21}{54}$

And,

$\frac{8*2}{27*2} = \frac{16}{54}$

Therefore,

$\frac{-21}{54} + \frac{16}{54}$

$= \frac{16-21}{54}$

$= \frac{-5}{54}$

3. Question

Simplify:

(i) $\frac{8}{9} + \frac{-11}{6}$

(ii) $3 + \frac{5}{-7}$

(iii) $\frac{1}{-12} + \frac{2}{-15}$

(iv) $\frac{-8}{19} + \frac{-4}{57}$

(v) $\frac{7}{9} + \frac{3}{-4}$

(vi) $\frac{5}{26} + \frac{11}{-39}$

(vii) $\frac{-16}{9} + \frac{-5}{12}$

(viii) $\frac{-13}{8} + \frac{5}{36}$

(ix) $0+\frac{-3}{5}$

(x) $1+\frac{-4}{5}$

Answer

(i) The L.C.M of 9 and 6 is 18

$\frac{8}{9}=\frac{8*2}{9*2}$

$=\frac{16}{18}$

And,

$\frac{-11}{6}=\frac{-11*3}{6*3}$

$=\frac{-33}{18}$

Therefore,

$\frac{16}{18}-\frac{33}{18}=\frac{-17}{18}$

(ii) $3\frac{1}{7}-\frac{5}{7}$

$\frac{7\times3-5}{7}$

$\frac{21-5}{7}$

$\frac{16}{7}$

(iii) The L.C.M of -12 and -15 is 60

$\frac{-1}{12}=\frac{-1*5}{12*5}$

$=\frac{-5}{60}$

And,

$\frac{2}{-15}=\frac{2*4}{-15*4}$

$=\frac{-8}{60}$

Therefore,

$$\frac{-5}{60} - \frac{8}{60} = \frac{-13}{60}$$

(iv) The L.C.M of 19 and 57 is57

$$\frac{-8}{19} = \frac{-8*3}{19*3}$$

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

And,

$$\frac{-4}{57} = \frac{-4*1}{57*1}$$

$$= \frac{-4}{57}$$

Therefore,

$$\frac{-24}{57} - \frac{4}{57} = \frac{-28}{57}$$

(v) The L.C.M of 9 and 4 is 36

$$\frac{7}{9} = \frac{7*4}{9*4}$$

$$= \frac{28}{36}$$

And,

$$\frac{3}{-4} = \frac{3*9}{-4*9}$$

$$= \frac{-27}{36}$$

Therefore,

$$\frac{28}{36} - \frac{27}{36} = \frac{-1}{36}$$

(vi) The L.C.M of 26 and -39 is 78

$$\frac{5}{26} = \frac{5*3}{26*3}$$

$$= \frac{15}{78}$$

And,

$$\frac{11}{-39} = \frac{11*2}{-39*2}$$

$$= \frac{-22}{78}$$

Therefore,

$$\frac{15}{78} - \frac{22}{78} = \frac{-7}{78}$$

(vii) The L.C.M of 9 and 12 is 108

$$\frac{-16}{9} = \frac{-16 * 12}{9 * 12}$$

$$= \frac{-192}{108}$$

And,

$$\frac{-5}{12} = \frac{-5 * 9}{12 * 9}$$

$$= \frac{-45}{108}$$

Therefore,

$$\frac{-192}{108} - \frac{45}{108} = \frac{-237}{108}$$

$$= \frac{-79}{36}$$

(viii) The L.C.M of 8 and 36 is 72

$$\frac{-13}{8} = \frac{-13 * 9}{8 * 9}$$

$$= \frac{-117}{72}$$

And,

$$\frac{5}{36} = \frac{5 * 2}{36 * 2}$$

$$= \frac{10}{72}$$

Therefore,

$$\frac{-117}{72} + \frac{10}{72} = \frac{-107}{72}$$

(ix) The L.C.M of 0 and 5 is 0

Therefore,

$$0 - \frac{3}{5} = \frac{-3}{5}$$

(x) The L.C.M of 1 and 5 is 5

$$\frac{1}{1} = \frac{1 * 5}{1 * 5}$$

$= \frac{5}{5}$

And,

$\frac{-4}{5} = \frac{-4 * 1}{5 * 1}$

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

Therefore,

$\frac{5}{5} - \frac{4}{5} = \frac{1}{5}$

4. Question

Add and express the sum as a mixed fraction:

(i) $\frac{-12}{5}$ and $\frac{43}{10}$

(ii) $\frac{24}{7}$ and $\frac{-11}{4}$

(iii) $\frac{-31}{6}$ and $\frac{-27}{8}$

(iv) $\frac{101}{6}$ and $\frac{7}{8}$

Answer

(i) The denominators of the given rational numbers 5 and 10 respectively.

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

Now,

We write the given rational numbers into forms in which both of them have the same denominator

$\frac{-12*2}{5*2} = \frac{-24}{10}$

And,

$\frac{43*1}{10*1} = \frac{43}{10}$

Therefore,

$\frac{-24}{10} + \frac{43}{10} = \frac{-24+43}{10}$

$= \frac{19}{10}$

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

(ii) The denominators of the given rational numbers 7 and 4 respectively.

The L.C.M of 7 and 4 is 28

Now,

We write the given rational numbers into forms in which both of them have the same denominator

$$\frac{24*4}{7*4} = \frac{96}{28}$$

And,

$$\frac{-11*7}{4*7} = \frac{-77}{28}$$

Therefore,

$$\frac{96}{28} - \frac{77}{28} = \frac{96-77}{28}$$

$$= \frac{19}{28}$$

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

(iii) The denominators of the given rational numbers 6 and 8 respectively.

The L.C.M of 6 and 8 is 24

Now,

We write the given rational numbers into forms in which both of them have the same denominator

$$\frac{-31*4}{6*4} = \frac{-124}{24}$$

And,

$$\frac{-27*3}{8*3} = \frac{-81}{24}$$

Therefore,

$$\frac{-124}{24} - \frac{81}{24} = \frac{-124-81}{24}$$

$$= \frac{-205}{24}$$

$$= -8\ \frac{13}{24}$$

(iv) The denominators of the given rational numbers 6 and 8 respectively.

The L.C.M of 6 and 8 is 24

Now,

We write the given rational numbers into forms in which both of them have the same denominator

$$\frac{101*4}{6*4} = \frac{404}{24}$$

And,

$$\frac{7*3}{8*3} = \frac{21}{24}$$

Therefore,

$$\frac{404}{24} + \frac{21}{24} = \frac{404+21}{24}$$

$$= \frac{425}{24}$$

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

Exercise 1.2

1. Question

Verify commutativity of addition of rational numbers for each of the following pairson of rational numbers:

(i) $\frac{-11}{5}$ and $\frac{4}{7}$

(ii) $\frac{4}{9}$ and $\frac{7}{-12}$

(iii) $\frac{-3}{5}$and $\frac{-2}{-15}$

(iv) $\frac{2}{-7}$ and $\frac{12}{-35}$

(v) 4 and $\frac{-3}{5}$

(vi) -4and $\frac{4}{-7}$

Answer

(i) The addition of rational number is commutative

i.e, if $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers, then

$$\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$$

Verification: In order to verify this property,

Let us consider two expressions:

$$\frac{-11}{5} + \frac{4}{7}$$

And,

$\frac{4}{7}+\frac{-11}{5}$

We have:

$\frac{-11}{5}+\frac{4}{7}=\frac{-77}{35}+\frac{20}{35}$

$=\frac{-77+20}{35}$

$=\frac{-57}{35}$

And,

$\frac{4}{7}+\frac{-11}{5}=\frac{20}{35}+\frac{-77}{35}$

$=\frac{20-77}{35}$

$=\frac{-57}{35}$

Therefore,

$\frac{-11}{5}+\frac{4}{7}=\frac{4}{7}+\frac{-11}{5}$

(ii) The addition of rational number is commutative

i.e, if $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers, then

$\frac{a}{b}+\frac{c}{d}=\frac{c}{d}+\frac{a}{b}$

Verification: In order to verify this property,

Let us consider two expressions:

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

And,

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

We have:

$\frac{4}{9}+\frac{-7}{12}=\frac{16}{36}+\frac{-21}{36}$

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

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

And,

$\frac{-7}{12} + \frac{4}{9} = \frac{-21}{36} + \frac{16}{36}$

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

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

Therefore,

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

(iii) The addition of rational number is commutative

i.e, if $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers, then

$\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$

Verification: In order to verify this property,

Let us consider two expressions:

$\frac{3}{5} + \frac{-2}{-15}$

And,

$\frac{-2}{-15} + \frac{3}{5}$

We have:

$\frac{3}{5} + \frac{-2}{-15} = \frac{-3}{5} + \frac{2}{15}$

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

$= \frac{-7}{15}$

And,

$\frac{-2}{-15} + \frac{3}{5} = \frac{-2}{-15} + \frac{3}{5}$

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

$= \frac{-7}{15}$

Therefore,

$$\frac{3}{5}+\frac{-2}{-15}=\frac{-2}{-15}+\frac{3}{5}$$

(iv) The addition of rational number is commutative

i.e, if $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers, then

$$\frac{a}{b}+\frac{c}{d}=\frac{c}{d}+\frac{a}{b}$$

Verification: In order to verify this property,

Let us consider two expressions:

$$\frac{2}{-7}+\frac{12}{-35}$$

And,

$$\frac{12}{-35}+\frac{2}{-7}$$

We have:

$$\frac{2}{-7}+\frac{12}{-35}=\frac{-10}{35}+\frac{-12}{35}$$

$$=\frac{-10-12}{35}$$

$$=\frac{-22}{35}$$

And,

$$\frac{12}{-35}+\frac{2}{7}=\frac{-12}{35}+\frac{-10}{35}$$

$$=\frac{-12-10}{35}$$

$$=\frac{-22}{35}$$

Therefore,

$$\frac{2}{-7}+\frac{12}{-35}=\frac{12}{-35}+\frac{2}{-7}$$

(v) The addition of rational number is commutative

i.e, if $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers, then

$$\frac{a}{b}+\frac{c}{d}=\frac{c}{d}+\frac{a}{b}$$

Verification: In order to verify this property,

Let us consider two expressions:

$4 + \frac{-3}{5}$

And,

$\frac{-3}{5} + 4$

We have:

$4 + \frac{-3}{5} = \frac{20}{5} - \frac{3}{5}$

$= \frac{20-3}{5}$

$= \frac{17}{5}$

And,

$\frac{-3}{5} + 4 = \frac{-3}{5} + \frac{20}{5}$

$= \frac{-3+20}{5}$

$= \frac{17}{5}$

Therefore,

$4 + \frac{-3}{5} = \frac{-3}{5} + 4$

(vi) The addition of rational number is commutative

i.e, if $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers, then

$\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$

Verification: In order to verify this property,

Let us consider two expressions:

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

And,

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

We have:

$-4 + \frac{4}{-7} = \frac{-28}{7} - \frac{4}{7}$

$= \frac{-28-4}{7}$

$= \frac{-32}{7}$

And,

$\frac{4}{-7} - 4 = \frac{-4}{7} - \frac{28}{7}$

$= \frac{-4-28}{7}$

$= \frac{-32}{7}$

Therefore,

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

2. Question

Verify associativity of addition of rational numbers i.e., $(x + y) + z = x + (y + z)$, when:

(i) $x = \frac{1}{2}, y = \frac{2}{3}, z = -\frac{1}{5}$

(ii) $x = \frac{-2}{5}, y = \frac{4}{3}, z = -\frac{-7}{10}$

(iii) $x = \frac{-7}{11}, y = \frac{2}{-5}, z = -\frac{-3}{22}$

(iv) $x = -2, y = \frac{3}{5}, z = \frac{-4}{3}$

Answer

(i) In order to verify this property, let us consider the following expressions:

Verification: $\frac{1}{2} + [\frac{2}{3} + (-\frac{1}{5})] = \frac{1}{2} + [\frac{10}{15} - \frac{3}{15}]$

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

$= \frac{15+14}{30}$

$= \frac{29}{30}$

And,

$(\frac{1}{2} + \frac{2}{3}) + (\frac{-1}{5}) = (\frac{3}{6} + \frac{4}{6}) - \frac{1}{5}$

$= \frac{7}{6} - \frac{1}{5}$

$= \frac{35-6}{30}$

$= \frac{29}{30}$

Therefore,

The associative property of additional of rational numbers has been verified

(ii) In order to verify this property, let us consider the following expressions:

Verification: $\frac{-2}{5} + [\frac{4}{3} + (-\frac{7}{10})] = \frac{-2}{5} + [\frac{40}{30} - \frac{21}{30}]$

$= \frac{-12}{30} + \frac{19}{30}$

$= \frac{-12+19}{30}$

$= \frac{7}{30}$

And,

$(\frac{-2}{5} + \frac{4}{3}) + (\frac{-7}{10}) = (\frac{-6}{15} + \frac{20}{15}) - \frac{7}{10}$

$= \frac{14}{15} - \frac{7}{10}$

$= \frac{28-21}{30}$

$= \frac{7}{30}$

Therefore,

The associative property of additional of rational numbers has been verified

(iii) In order to verify this property, let us consider the following expressions:

Verification: $\frac{-7}{11} + [\frac{2}{-5} + (-\frac{3}{22})] = \frac{-7}{11} + [\frac{44}{-110} - \frac{15}{110}]$

$= \frac{-7}{11} - \frac{29}{110}$

$= \frac{-70-29}{110}$

$= \frac{-99}{110}$

And,

$(-\frac{7}{11} + \frac{2}{-5}) + (\frac{-3}{22}) = (\frac{-35}{55} - \frac{22}{35}) - \frac{3}{22}$

$= \frac{-57}{55} - \frac{3}{22}$

$= \frac{-114+15}{110}$

$= \frac{-99}{110}$

Therefore,

The associative property of additional of rational numbers has been verified

(iv) In order to verify this property, let us consider the following expressions:

Verification: $-2 + [\frac{3}{5} + (-\frac{4}{3})] = -2 + [\frac{9}{15} - \frac{20}{15}]$

$= -2 - \frac{11}{15}$

$= \frac{-30-11}{15}$

$= \frac{-41}{15}$

And,

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

$= \frac{-7}{5} - \frac{4}{3}$

$= \frac{-21-20}{15}$

$= \frac{-41}{15}$

Therefore,

The associative property of additional of rational numbers has been verified

3. Question

Write the additive invese of each of the following rational numbers:

(i) $\frac{-2}{17}$

(ii) $\frac{3}{-11}$

(iii) $\frac{-17}{5}$

(iv) $\frac{-11}{-25}$

Answer

(i) The additive inverse of $\frac{-2}{17}$ is $\frac{2}{17}$

(ii) The additive inverse of $\frac{3}{-11}$ is $\frac{3}{11}$

(iii) The additive inverse of $\frac{-17}{5}$ is $\frac{17}{5}$

(iv) The additive inverse of $\frac{-11}{-25}$ is $\frac{-11}{25}$

4. Question

Write the negative (additive inverse) of each of the following:

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

(ii) $\frac{7}{-9}$

(iii) $\frac{-16}{13}$

(iv) $\frac{-5}{1}$

(v) 0

(vi) 1

(vii) -1

Answer

(i) The additive inverse of $\frac{-2}{5}$ is $\frac{2}{5}$

(ii) The additive inverse of $\frac{7}{-9}$ is $\frac{7}{9}$

(iii) The additive inverse of $\frac{-16}{13}$ is $\frac{16}{13}$

(iv) The additive inverse of -5 is 5

(v) The additive inverse of 0 is 0

(vi) The additive inverse of 1 is -1

(vii) The additive inverse of -1 is 1

5. Question

Using commutativity and associativity of addition of rational numbers, express each of the following as a rational number:

(i) $\frac{2}{5}+\frac{7}{3}+\frac{-4}{5}+\frac{-1}{3}$

(ii) $\frac{3}{7}+\frac{-4}{9}+\frac{-11}{7}+\frac{7}{9}$

(iii) $\frac{2}{5}+\frac{8}{3}+\frac{-11}{15}+\frac{4}{5}+\frac{-2}{3}$

(iv) $\frac{4}{7}+0\frac{-8}{9}+\frac{-13}{7}+\frac{17}{21}$

Answer

(i) Reaaranging and grouping the numbers in pairs in such a way that each group contains a pair of rational numbers with equal denominator

We have,

$\frac{2}{5}+\frac{7}{3}+\frac{-4}{5}+\frac{-1}{3}$

$\frac{2}{5}-\frac{4}{5}+\frac{7}{3}-\frac{1}{3}=\frac{-2}{5}+\frac{6}{3}$

$=\frac{-6}{15}+\frac{30}{15}$

$=\frac{24}{15}$

$=\frac{8}{5}$

(ii) Reaaranging and grouping the numbers in pairs in such a way that each group contains a pair of rational numbers with equal denominator

We have,

$\frac{3}{7}+\frac{-4}{9}+\frac{-11}{7}+\frac{7}{9}$

$\frac{3}{7}-\frac{11}{7}+\frac{7}{9}-\frac{4}{9}=\frac{-8}{7}+\frac{3}{9}$

$=\frac{-8}{7}+\frac{1}{3}$

$=\frac{-24}{21}+\frac{7}{21}$

$=\frac{-17}{21}$

(iii) Reaaranging and grouping the numbers in pairs in such a way that each group contains a pair of rational numbers with equal denominator

We have,

$$\frac{2}{5}+\frac{8}{3}+\frac{-11}{15}+\frac{4}{5}+\frac{-2}{3}$$

$$\frac{2}{5}+\frac{4}{5}+\frac{8}{3}-\frac{2}{3}-\frac{11}{15}=\frac{6}{5}+\frac{8-2}{3}-\frac{11}{15}$$

$$=\frac{6}{5}+\frac{6}{3}+\frac{-11}{15}$$

$$=\frac{18}{15}+\frac{30}{15}-\frac{11}{15}$$

$$=\frac{18+30-11}{15}$$

$$=\frac{37}{15}$$

(iv) Reaaranging and grouping the numbers in pairs in such a way that each group contains a pair of rational numbers with equal denominator

We have,

$$\frac{4}{7}+0+\frac{-8}{9}+\frac{-13}{7}+\frac{17}{21}$$

$$\frac{4}{7}-\frac{13}{7}+0+\frac{-8}{9}+\frac{17}{21}=\frac{4-13}{7}+\frac{17}{21}-\frac{8}{9}$$

$$=\frac{-9}{7}+\frac{17}{21}-\frac{8}{9}$$

$$=\frac{-27+17}{21}-\frac{8}{9}$$

$$=\frac{-10*9}{21*9}-\frac{8*21}{9*21}$$

$$=\frac{-90}{189}-\frac{168}{189}$$

$$=\frac{-258}{189}$$

6. Question

Re-arrange sutably and find the sum in each of the following.

(i) $\frac{11}{12}+\frac{-17}{3}+\frac{11}{2}+\frac{-25}{2}$

(ii) $\frac{-6}{7}+\frac{-5}{6}+\frac{-4}{9}+\frac{-15}{7}$

(iii) $\frac{3}{5}+\frac{7}{3}+\frac{9}{5}+\frac{-13}{15}+\frac{-7}{3}$

(iv) $\frac{4}{13}+\frac{-5}{8}+\frac{9}{5}+\frac{-8}{13}+\frac{9}{13}$

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

(vi) $\frac{1}{8}+\frac{5}{12}+\frac{2}{7}+\frac{7}{12}+\frac{9}{7}+\frac{-5}{16}$

Answer

(i) $\frac{11}{12}-\frac{17}{3}-\frac{14}{2}$

$=\frac{11-68-84}{12}$

$=\frac{-141}{12}$

(ii) $\frac{-6}{7}-\frac{-15}{7}-\frac{5}{6}-\frac{4}{9}$

$=\frac{-21}{7}-\frac{5}{6}-\frac{4}{9}$

$=\frac{-3*18-5*3-4*2}{18}$

$=\frac{-77}{18}$

(iii) $\frac{3}{5}+\frac{9}{5}+\frac{7}{3}-\frac{7}{3}-\frac{13}{15}$

$=\frac{12}{5}-\frac{13}{15}$

$=\frac{12*3}{5*3}-\frac{13}{15}$

$=\frac{36-13}{15}$

$=\frac{23}{15}$

(iv) $\frac{4}{13}+\frac{9}{13}-\frac{8}{13}-\frac{5}{8}+\frac{9}{5}$

$=\frac{4+9-8}{13}-\frac{5}{8}+\frac{9}{5}$

$=\frac{5}{13}-\frac{5}{8}+\frac{9}{5}$

$=\frac{200-325+936}{520}$

$=\frac{811}{520}$

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

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

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

$=\frac{15-6}{15}$

$=\frac{9}{15}$

$=\frac{3}{5}$

(vi) $\frac{5}{12}+\frac{7}{12}+\frac{2}{7}+\frac{9}{7}+\frac{1}{8}-\frac{5}{16}$

$=\frac{12}{12}+\frac{11}{7}+\frac{1}{8}-\frac{5}{16}$

$=\frac{336+528+42-105}{336}$

$=\frac{801}{336}$

Exercise 1.3

1. Question

Subtract the first rational number from the second in each of the following:

(i) $\frac{3}{8},\frac{5}{8}$

(ii) $\frac{-7}{9},\frac{4}{9}$

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

(iv) $\frac{11}{13},\frac{-4}{13}$

(v) $\frac{1}{4},\frac{-3}{8}$

(vi) $\frac{-2}{3},\frac{5}{6}$

(vii) $\frac{-6}{7},\frac{-13}{14}$

(viii) $\frac{-8}{33},\frac{-7}{22}$

Answer

(i) $\frac{5}{8} - \frac{3}{8} = \frac{5-3}{8}$

$= \frac{2}{8}$ (Therefore, L.C.M of 8 and 8 is 8)

$= \frac{1}{4}$

(ii) $\frac{4}{9} - \frac{-7}{9} = \frac{4+7}{9}$

$= \frac{11}{9}$ (Therefore, L.C.M of 9 and 9 is 9)

(iii) $\frac{-9}{11} - \frac{-2}{11} = \frac{-9+2}{11}$

$= \frac{-7}{11}$ (Therefore, L.C.M of 11 and 11 is 11)

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

$= \frac{-15}{13}$ (Therefore, L.C.M of 13 and 13 is 13)

(v) $\frac{-3}{8} - \frac{1}{4} = \frac{-3-2}{8}$

$= \frac{-5}{8}$ (Therefore, L.C.M of 8 and 4 is 8)

(vi) $\frac{5}{6} - \frac{-2}{3} = \frac{5+4}{6}$

$= \frac{9}{6}$ (Therefore, L.C.M of 6 and 3 is 6)

$= \frac{3}{2}$

(vii) $\frac{-13}{14} - \frac{-6}{7} = \frac{-13+12}{14}$

$= \frac{-1}{14}$ (Therefore, L.C.M of 14 and 7 is 14)

(viii) $\frac{-7}{22} - \frac{-8}{33} = \frac{-21+16}{66}$

$= \frac{-5}{66}$ (Therefore, L.C.M of 22 and 33 is 66)

2. Question

Evalute each of the following:

(i) $\frac{2}{3} + \frac{-3}{5}$

(ii) $-\frac{4}{7} - \frac{2}{-3}$

(iii) $\frac{4}{7} - \frac{-5}{-7}$

(iv) $-2 - \frac{5}{9}$

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

(vi) $\frac{-4}{13} - \frac{-5}{26}$

(vii) $\frac{-5}{14} - \frac{-2}{7}$

(viii) $\frac{13}{15} - \frac{12}{25}$

(ix) $\frac{-6}{13} - \frac{-7}{13}$

(x) $\frac{7}{24} - \frac{19}{36}$

(xi) $\frac{5}{63} - \frac{-8}{21}$

Answer

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

$= \frac{2*5-3*3}{15}$

$= \frac{10-9}{15}$

$= \frac{1}{15}$

(ii) $\frac{-4}{7} + \frac{2}{3}$

$= \frac{-4*3+2*7}{21}$

$= \frac{-12+14}{21}$

$= \frac{2}{21}$

(iii) $\frac{4}{7} - \frac{5}{7}$

$= \frac{4*1-5*1}{7}$

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

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

(iv) $-2 - \frac{5}{9}$

$= \frac{-2*9-5*1}{9}$

$= \frac{-18-5}{9}$

$= \frac{-23}{9}$

(v) $\frac{3}{8} + \frac{2}{7}$

$= \frac{3*7+2*8}{56}$

$= \frac{21+16}{56}$

$= \frac{37}{56}$

(vi) $\frac{-4}{13} + \frac{5}{26}$

$= \frac{-4*2+5*1}{26}$

$= \frac{-8+5}{26}$

$= \frac{-3}{26}$

(vii) $\frac{-5}{14} + \frac{2}{7}$

$= \frac{-5*1+2*2}{14}$

$= \frac{-5+4}{14}$

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

(viii) $\frac{13}{15} - \frac{12}{25}$

$= \frac{13*5-12*3}{75}$

$= \frac{65-36}{75}$

$= \frac{29}{75}$

(ix) $\frac{-6}{13} + \frac{7}{13}$

$= \frac{-6*1+7*1}{13}$

$= \frac{-6+7}{13}$

$= \frac{1}{13}$

(x) $\frac{7}{24} - \frac{19}{36}$

$= \frac{7*3-19*2}{72}$

$= \frac{21-38}{72}$

$= \frac{-17}{72}$

(xi) $\frac{5}{63} + \frac{8}{21}$

$= \frac{5*1+8*3}{63}$

$= \frac{5+24}{63}$

$= \frac{29}{63}$

3. Question

The sum of the two numbers is $\frac{5}{9}$. If one of the numbers is $\frac{1}{3}$, find the other

Answer

It is given that,

The sum of the two numbers = $\frac{5}{9}$

One of the number = $\frac{1}{3}$

Since, the sum is $\frac{5}{9}$

Therefore,

The other number = Sum of numbers - given number

Other number $= \frac{5}{9} - \frac{1}{3}$

$= \frac{5 - 3}{9}$

$= \frac{2}{9}$

Hence, the other number is 2/9.

4. Question

The sum of two numbers is $\frac{-1}{3}$. If one of the numbers is $\frac{-12}{3}$, find the other

Answer

It is given that,

The sum of the two numbers = $\frac{-1}{3}$

One of the number = $\frac{-12}{3}$

Suppose the other number is x

Since, the sum is $\frac{-1}{3}$

Therefore,

x - $\frac{12}{3}$ = $\frac{-1}{3}$

$\frac{3x-12}{3} = \frac{-1}{3}$

3x = 12 - 1

3x = 11

x = $\frac{11}{3}$

5. Question

The sum of two numbers is $\frac{-4}{3}$. If one of the numbers is -5, find the other

Answer

It is given that,

The sum of the two numbers = $\frac{-4}{3}$

One of the number = -5

Suppose the other number is x

Since, the sum is $\frac{-4}{3}$

Therefore,

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

3x – 15 = -4

3x = -4 + 15

3x = 11

x =$\frac{11}{3}$

6. Question

The sum of two ratinal numbers is -8. If one of the numbers is $\frac{-15}{7}$, find the other

Answer

It is given that,

The sum of the two numbers = -8

One of the number = $\frac{-15}{7}$

Suppose the other number is x

Since, the sum is -8

Therefore,

x +$\frac{-15}{7}$ = -8

$\frac{7x-15}{7}$ = -8

7x - 15 = -56

7x = -56 + 15

7x = -41

$x = \frac{-41}{7}$

7. Question

What should be added to $\frac{-7}{8}$ so as to get $\frac{5}{9}$?

Answer

Suppose x be the rational number to be added to $\frac{-7}{8}$ to get $\frac{5}{9}$

Then,

$\frac{-7}{8} + x = \frac{5}{9}$

$x = \frac{5}{9} + \frac{7}{8}$

$x = \frac{5*8+7*9}{72}$

$x = \frac{40+63}{72}$

$x = \frac{103}{72}$

Therefore,

The required number $x = \frac{103}{72}$

8. Question

What number should be added to $\frac{-5}{11}$ so as to get $\frac{26}{33}$?

Answer

Suppose x be the rational number to be added to $\frac{-5}{11}$ to get $\frac{26}{33}$

Then,

$\frac{-5}{11} + x = \frac{26}{33}$

$x = \frac{26}{33} + \frac{5}{11}$

$x = \frac{26*1+5*3}{33}$

$x = \frac{26+15}{33}$

$x = \frac{41}{33}$

Therefore,

The required number $x = \frac{41}{33}$

9. Question

What number should be addede to $\frac{-5}{7}$ to get $\frac{-2}{3}$?

Answer

Suppose x be the rational number to be added to $\frac{-5}{7}$ to get $\frac{-2}{3}$

Then,

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

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

$x = \frac{5*3-2*7}{21}$

$x = \frac{15-14}{21}$

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

Therefore,

The required number $x = \frac{1}{21}$

10. Question

What number should be subtracted from $\frac{-5}{3}$ to get $\frac{5}{6}$?

Answer

Suppose x be the rational number to be subtracted to $\frac{-5}{3}$ to get $\frac{5}{6}$

Then,

$\frac{-5}{3} - x = \frac{5}{6}$

$\frac{-5}{3} - \frac{x*3}{3} = \frac{5}{6}$

$\frac{-5}{3} - \frac{3x}{3} = \frac{5}{6}$

$\frac{-5-3x}{3} = \frac{5}{6}$

-5 – 3x = $\frac{15}{6}$

-3x = $\frac{15}{6}$ + 5

-3x = $\frac{15*1+5*6}{6}$

-3x = $\frac{15+30}{6}$

-3x = $\frac{45}{6}$

-18x = 45

x = $\frac{-45}{18}$

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

Therefore,

The required number x = $\frac{-5}{2}$

11. Question

What number should be subtracted from $\frac{3}{7}$ to get $\frac{5}{4}$?

Answer

Suppose x be the rational number to be subtracted to $\frac{3}{7}$ to get $\frac{5}{4}$

Then,

$\frac{3}{7}$ - x = $\frac{5}{4}$

$-x = \frac{5}{4} - \frac{3}{7}$

-x = $\frac{5*7-3*4}{28}$

-x = $\frac{35-12}{28}$

x = $-\frac{23}{28}$

Therefore,

The required number x = $-\frac{23}{28}$

12. Question

What should be added to ($\frac{2}{3}+\frac{3}{5}$) to get$\frac{-2}{15}$?

Answer

Let the number be x

It is given that,

x + ($\frac{2}{3}+\frac{3}{5}$) = $\frac{-2}{15}$

$\frac{15x+10+9}{15}=\frac{-2}{15}$

15x = -2 -19

x = $\frac{-21}{15}$

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

13. Question

What should be added to ($\frac{1}{2}+\frac{1}{3}+\frac{1}{5}$) to get 3?

Answer

Let the three numbers be x

It is given that,

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

x + ($\frac{1*15}{2*15}+\frac{1*10}{3*10}+\frac{1*6}{6*1}$) = 3

Therefore, L.C.M of 2, 3 and 5 is 30

$\frac{30x+15+10+6}{30}$ = 3

$30x + 31 = 90$

$30x = 90 - 31$

30x = 59

x = $\frac{59}{30}$

14. Question

What should be subtracted from ($\frac{3}{4}$ - $\frac{2}{3}$) to get $\frac{-1}{6}$?

Answer

Let the number be x

It is given that,

($\frac{3}{4}$ - $\frac{2}{3}$) – x = $\frac{-1}{6}$

-x + [$\frac{3*3}{4*3}$ – $\frac{2*4}{4*3}$] = $\frac{-1}{6}$

-x + [$\frac{9}{12}$ - $\frac{8}{12}$] = $\frac{-1}{6}$

$\frac{-12x+9-8}{12}$ = $\frac{-1}{6}$

- 12x + 1 = -2-12x = -2 - 1-12x = -3

x = $\frac{-3}{-12}$

x = $\frac{1}{4}$

15. Question

Fill in the blanks:

(i) $\frac{-4}{13} - \frac{-3}{26}$ = ... (ii) $\frac{-9}{14}$ + ... = –1

(iii) $\frac{-7}{9}$ + ... = 3 (iv) ..... + $\frac{15}{23}$ = 4

Answer

(i) $\frac{-4}{13} + \frac{3}{26}$

= $\frac{3}{26} - \frac{4*2}{13*2}$

= $\frac{3-8}{26}$

= $\frac{-5}{26}$

(ii) Let x be a rational number. Then,

$\frac{-9}{14}$ + x = -1

$-9 + 14x$ = -14

$14x$ = 9 – 14

$x = \frac{-5}{14}$

(iii) $\frac{-7}{9}$ + x = 3

$\frac{-7}{9} + \frac{9x}{9} = 3$

$9x - 7 = 27$

$9x = 27 + 7$

x = $\frac{34}{9}$

(iv) x + $\frac{15}{23}$ = 4

23x + 15 = 92

23x = 92 – 15

23x = 77

x = $\frac{77}{23}$

Exercise 1.4

1. Question

Simplify each of the following and write as rational number of the form $\frac{P}{Q}$:

(i) $\frac{3}{4} + \frac{5}{6} + \frac{-7}{8}$

(ii) $\frac{2}{3} + \frac{-5}{6} + \frac{-7}{9}$

(iii) $\frac{-11}{2} + \frac{7}{6} + \frac{-5}{8}$

(iv) $\frac{-4}{5} + \frac{-7}{10} + \frac{-8}{15}$

(v) $\frac{-9}{10} + \frac{22}{15} + \frac{13}{-20}$

(vi) $\frac{5}{3} + \frac{3}{-2} + \frac{-7}{3} + 3$

Answer

(i) We have,

$\frac{3}{4}+\frac{5}{6}+(\frac{-7}{8})$

$=\frac{3}{4}+\frac{5}{6}-\frac{7}{8}$

$=\frac{3*6}{4*6}+\frac{5*4}{6*4}+\frac{-7*3}{8*3}$

Therefore,

L.C.M of 4, 6 and 8 is 24

$=\frac{18+20-21}{24}$

$=\frac{17}{24}$

(ii) We have,

$\frac{2}{3}+\frac{-5}{6}+(\frac{-7}{9})$

$=\frac{2}{3}-\frac{5}{6}-\frac{7}{9}$

$=\frac{2*6}{3*6}+\frac{5*3}{6*3}-\frac{7*2}{9*2}$

Therefore,

L.C.M of 3, 6 and 9 is 18

$=\frac{12-15-14}{18}$

$=\frac{-17}{18}$

(iii) We have,

$\frac{-11}{2}+\frac{7}{6}+(\frac{-5}{8})$

$=\frac{7}{6}-\frac{11}{2}-\frac{5}{8}$

$=\frac{7*4}{6*4}-\frac{11*12}{2*12}-\frac{5*3}{8*3}$

Therefore,

L.C.M of 6, 2 and 8 is 24

$=\frac{28-132-15}{24}$

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

(iv) We have,

$\frac{-4}{5} + \frac{-7}{10} + (\frac{-8}{15})$

$= \frac{-4}{5} - \frac{7}{10} - \frac{8}{15}$

$= \frac{-4*6}{5*6} - \frac{7*3}{10*3} - \frac{8*2}{15*2}$

Therefore,

L.C.M of 5, 10 and 15 is 30

$= \frac{-24-21-16}{30}$

$= \frac{-61}{30}$

(v) We have,

$\frac{-9}{10} + \frac{22}{15} + (\frac{-13}{20})$

$= \frac{22}{15} - \frac{9}{10} - \frac{13}{20}$

$= \frac{22*4}{15*4} - \frac{9*6}{10*6} - \frac{13*3}{20*3}$

Therefore,

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

$= \frac{88-54-39}{60}$

$= \frac{-5}{60}$

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

(vi) We have,

$\frac{5}{3} + \frac{-3}{2} + (\frac{-7}{3}) + 3$

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

$= \frac{5*2}{3*2} - \frac{3*3}{2*3} - \frac{7*2}{3*2} + \frac{3*6}{1*6}$

Therefore,

L.C.M of 3, 2, 3 and 1 is 6

$= \frac{10-9-14+18}{6}$

$= \frac{5}{6}$

2. Question

Express each of the following as a rational number of the form $\frac{P}{Q}$:

(i) $\frac{-8}{3}+\frac{-1}{4}+\frac{-11}{6}+\frac{3}{8}-3$

(ii) $\frac{6}{7}+1+\frac{-7}{9}+\frac{19}{21}+\frac{-12}{7}$

(iii) $\frac{15}{2}+\frac{9}{8}+\frac{-11}{3}+6+\frac{-7}{6}$

(iv) $\frac{-7}{4}+0+\frac{-9}{5}+\frac{19}{10}+\frac{11}{14}$

(v) $\frac{-7}{4}+\frac{5}{3}+\frac{-1}{2}+\frac{-5}{6}+2$

Answer

(i) $\frac{-8}{3} + (\frac{-1}{4}) + (\frac{-11}{6}) + \frac{3}{8} - 3$

$= \frac{-8}{3} - \frac{1}{4} - \frac{11}{6} + \frac{3}{8} - 3$

$= \frac{-8*8}{3*8} - \frac{1*6}{4*6} - \frac{11*4}{6*4} + \frac{3*3}{8*3} - \frac{3*24}{1*24}$

$= \frac{-64-6-44+9-72}{24}$

$= \frac{-59*3}{8*3}$

$= \frac{-59}{8}$

(ii) $\frac{6}{7} + 1 + (\frac{-7}{9}) + (\frac{19}{21}) + \frac{-12}{7}$

$= \frac{6*9}{7*9} + \frac{63}{63} - \frac{7*7}{9*7} + \frac{19*3}{21*3} - \frac{12*9}{7*9}$

$= \frac{54}{63} + \frac{63}{63} - \frac{49}{63} + \frac{57}{63} - \frac{108}{63}$

$= \frac{54+63-49+57-108}{63}$

$= \frac{17}{63}$

(iii) $\frac{15}{2} + (\frac{9}{8}) + (\frac{-11}{3}) + 6 + \frac{-7}{6}$

$= \frac{15}{2} + \frac{9}{8} - \frac{11}{3} + 6 - \frac{7}{6}$

$= \frac{15*12}{2*12} + \frac{9*3}{8*3} - \frac{11*8}{3*8} + \frac{6*24}{1*24} - \frac{7*4}{6*4}$

$= \frac{180+27-88+144-28}{24}$

$= \frac{235}{24}$

(iv) $\frac{-7}{4} + 0 + (\frac{-9}{5}) + \frac{19}{10} + \frac{11}{14}$

$= \frac{-7}{4} + 0 - \frac{9}{5} + \frac{19}{10} + \frac{11}{14}$

$= \frac{-7*35}{4*35} - \frac{9*28}{5*28} + \frac{19*14}{10*14} + \frac{11*10}{14*10}$

$= \frac{-245-252+266+110}{140}$

$= \frac{-121}{140}$

(v) $\frac{-7}{4} + (\frac{5}{3}) + (\frac{-1}{2}) + \frac{-5}{6} + 2$

$= \frac{-7}{4} + \frac{5}{3} - \frac{1}{2} - \frac{5}{6} + 2$

$= \frac{-7*6}{4*6} + \frac{5*8}{3*8} - \frac{1*12}{2*12} - \frac{5*4}{6*4} + \frac{2*24}{1*24}$

$= \frac{-42+40-12-20+48}{24}$

$= \frac{14}{24}$

$= \frac{7}{12}$

3. Question

Simplify:

(i) $\frac{-3}{2} + \frac{5}{4} - \frac{7}{4}$

(ii) $\frac{5}{3} - \frac{7}{6} + \frac{-2}{3}$

(iii) $\frac{5}{4} - \frac{7}{6} - \frac{-2}{3}$

(iv) $\frac{-2}{5}-\frac{-3}{10}-\frac{-4}{7}$

(v) $\frac{5}{6}+\frac{-2}{5}-\frac{-2}{15}$

(vi) $\frac{3}{8}-\frac{-2}{9}+\frac{-5}{36}$

Answer

(i) We have,

$\frac{-3}{2}+\frac{5}{4}-\frac{7}{4}=\frac{-3*2+5*1-7*1}{4}$ (L.C.M of 2, 4 and 4 is 4)

$=\frac{-6+5-7}{4}$

$=\frac{-13+5}{4}$

$=\frac{-8}{4}$

= -2

(ii) We have,

$\frac{5}{3}-\frac{7}{6}-\frac{2}{3}=\frac{5*2-7*1-2*2}{6}$ (L.C.M of 3, 6 and 3 is 6)

$=\frac{10-7-4}{6}$

$=\frac{-1}{6}$

(iii) We have,

$\frac{5}{4}-\frac{7}{6}+\frac{2}{3}=\frac{5*6-7*4+2*8}{24}$ (L.C.M of 4, 6 and 3 is 24)

$=\frac{30-28+16}{24}$

$=\frac{2+16}{24}$

$=\frac{18}{24}$

$=\frac{3}{4}$

(iv) We have,

$\frac{-2}{5}+\frac{3}{10}+\frac{4}{7}=\frac{-2*14+3*7+4*10}{70}$ (L.C.M of 5, 10 and 7 is 70)

$= \frac{-28+21+40}{70}$

$= \frac{-28+61}{70}$

$= \frac{33}{70}$

(v) We have,

$\frac{5}{6} - \frac{2}{5} + \frac{2}{15} = \frac{5*5-2*6+2*2}{30}$ (L.C.M of 6, 5 and 15 is 30)

$= \frac{25-12+4}{30}$

$= \frac{13+4}{30}$

$= \frac{17}{30}$

(vi) We have,

$\frac{3}{8} + \frac{2}{9} - \frac{5}{36} = \frac{3*9+2*8-5*2}{72}$ (L.C.M of 8, 9 and 36 is 72)

$= \frac{27+16-10}{72}$

$= \frac{43-10}{72}$

$= \frac{33}{72}$

$= \frac{11}{24}$

Exercise 1.5

1. Question

Multiply:

(i) $\frac{7}{11}$ by $\frac{5}{4}$

(ii) $\frac{5}{7}$ by $\frac{-3}{4}$

(iii) $\frac{-2}{9}$ by $\frac{5}{11}$

(iv) $\frac{-3}{17}$ by $\frac{-5}{-4}$

(v) $\frac{9}{-7}$ by $\frac{36}{-11}$

(vi) $\frac{-11}{13}$ by $\frac{-21}{7}$

(vii) $-\frac{3}{5}$ by $-\frac{4}{7}$

(viii) $-\frac{15}{11}$ by 7

Answer

(i) $\frac{7}{11} * \frac{5}{4}$

$= \frac{7*5}{11*4}$

$= \frac{35}{44}$

(ii) $\frac{5}{7} * \frac{-3}{4}$

$= \frac{5*-3}{7*4}$

$= \frac{-15}{28}$

(iii) $\frac{-2}{9} * \frac{5}{11}$

$= \frac{-2*5}{9*11}$

$= \frac{-10}{99}$

(iv) $\frac{-3}{17} * \frac{-5}{-4}$

$= \frac{-3*-5}{17*4}$

$= \frac{15}{68}$

(v) $\frac{9}{-7} * \frac{36}{-11}$

$= \frac{9*36}{-7*-11}$

$= \frac{324}{77}$

(vi) $\frac{-11}{13} * \frac{-21}{7}$

$= \frac{-11*-21}{13*7}$

$= \frac{231}{91}$

$= \frac{33}{13}$

(vii) $\frac{-3}{5} * \frac{-4}{7}$

$= \frac{-3*-4}{5*7}$

$= \frac{12}{35}$

(viii) $\frac{-15}{11} * 7$

$= \frac{-15*7}{11}$

$= \frac{-105}{11}$

2. Question

Multiply:

(i) $\frac{-5}{17}$ by $\frac{51}{-60}$

(ii) $\frac{-6}{11}$ by $\frac{-55}{36}$

(iii) $\frac{-8}{25}$ by $\frac{-5}{16}$

(iv) $\frac{6}{7}$ by $\frac{-49}{36}$

(v) $\frac{8}{-9}$ by $\frac{-7}{-16}$

(vi) $\frac{8}{-9}$ by $\frac{3}{64}$

Answer

(i) $\frac{-5}{17} * \frac{51}{-60}$

$= \frac{-1*3}{1*-12}$

$= \frac{3}{12}$

$= \frac{1}{4}$

(ii) $\frac{-6}{11} * \frac{-55}{36}$

$= \frac{-1*-5}{1*6}$

$= \frac{5}{6}$

(iii) $\frac{-8}{25} * \frac{-5}{16}$

$= \frac{-1*-1}{5*2}$

$= \frac{1}{10}$

(iv) $\frac{6}{7} * \frac{-49}{36}$

$= \frac{1*-7}{1*6}$

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

(v) $\frac{8}{-9} * \frac{-7}{-16}$

$= \frac{1*-7}{-9*-2}$

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

(vi) $\frac{8}{-9} * \frac{3}{64}$

$= \frac{1*1}{-3*8}$

$= \frac{-1}{24}$

3. Question

Simplify each of the following and express the result as a rational number in standard from:

(i) $\frac{-16}{21} \times \frac{14}{5}$

(ii) $\frac{7}{6} \times \frac{-3}{28}$

(iii) $\frac{-19}{36} \times 16$

(iv) $\frac{-13}{9} \times \frac{27}{-26}$

(v) $\frac{-9}{16} \times \frac{-64}{-27}$

(vi) $\frac{-50}{7} \times \frac{-14}{3}$

(vii) $\frac{-11}{9} \times \frac{-81}{-88}$

(viii) $\frac{-5}{9} \times \frac{72}{-25}$

Answer

(i) $\frac{-16}{21} * \frac{14}{5}$

$= \frac{-16*2}{3*5}$

$= \frac{-32}{15}$

(ii) $\frac{7}{6} * \frac{-3}{28}$

$= \frac{1*-1}{2*4}$

$= \frac{-1}{8}$

(iii) $\frac{-19}{36} * 16$

$= \frac{-19*4}{9}$

$= \frac{-76}{9}$

(iv) $\frac{-13}{9} * \frac{27}{-26}$

$= \frac{-1*3}{1*-2}$

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

$= \frac{3}{2}$

(v) $\frac{-9}{16} * \frac{-64}{-27}$

$= \frac{-1*4}{1*3}$

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

(vi) $\frac{-50}{7} * \frac{-14}{3}$

$= \frac{-50 * -2}{1 * 3}$

$= \frac{100}{3}$

(vii) $\frac{-11}{9} * \frac{81}{88}$

$= \frac{-1 * 9}{1 * 8}$

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

(viii) $\frac{-5}{9} * \frac{72}{-25}$

$= \frac{-1 * 8}{1 * -5}$

$= \frac{-8}{-5}$

$= \frac{8}{5}$

4. Question

Simplify:

(i) $\left(\frac{25}{8} \times \frac{2}{5}\right) - \left(\frac{3}{5} \times \frac{-10}{9}\right)$

(ii) $\left(\frac{1}{2} \times \frac{1}{4}\right) + \left(\frac{1}{2} \times 6\right)$

(iii) $\left(-5 \times \frac{2}{15}\right) - \left(-6 \times \frac{2}{9}\right)$

(iv) $\left(\frac{-9}{4} \times \frac{5}{3}\right) + \left(\frac{13}{2} \times \frac{5}{6}\right)$

(v) $\left(\frac{-4}{3} \times \frac{12}{-5}\right) + \left(\frac{3}{7} \times \frac{21}{15}\right)$

(vi) $\left(\frac{13}{5} \times \frac{8}{3}\right) - \left(\frac{-5}{2} \times \frac{11}{3}\right)$

(vii) $\left(\frac{13}{7} \times \frac{11}{26}\right) - \left(\frac{-4}{3} \times \frac{5}{6}\right)$

(viii) $\left(\frac{8}{5} \times \frac{-3}{2}\right) + \left(\frac{-3}{10} \times \frac{11}{16}\right)$

Answer

(i) $\frac{25*2}{8*5} - \frac{3*-10}{5*9}$

$= \frac{50}{40} + \frac{30}{45}$

$= \frac{5}{4} + \frac{2}{3}$

$= \frac{15+8}{12}$

$= \frac{23}{12}$

(ii) $\frac{1*1}{2*4} + \frac{1*6}{2*1}$

$= \frac{1}{8} + \frac{6}{2}$

$= \frac{1}{8} + 3$

$= \frac{1+24}{8}$

$= \frac{25}{8}$

(iii) $\frac{-5*2}{1*15} + \frac{6*2}{1*9}$

$= \frac{-10}{15} + \frac{12}{9}$

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

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

$= \frac{2}{3}$

(iv) $\frac{-9*5}{4*3} + \frac{13*5}{2*6}$

$= \frac{-45}{12} + \frac{65}{12}$

$= \frac{-45+65}{12}$

$= \frac{20}{12}$

$= \frac{5}{3}$

(v) $\frac{-4*12}{3*-5}+\frac{3*21}{7*15}$

$=\frac{4*4}{1*5}+\frac{1*3}{1*5}$

$=\frac{16}{5}+\frac{3}{5}$

$=\frac{19}{5}$

(vi) $\frac{13*8}{5*3}+\frac{5*11}{2*3}$

$=\frac{104}{15}+\frac{55}{6}$

$=\frac{104*2+55*6}{30}$

$=\frac{483}{30}$

(vii) $\frac{13*11}{7*26}+\frac{4*5}{3*6}$

$=\frac{1*11}{7*2}+\frac{4*5}{3*6}$

$=\frac{11}{14}+\frac{20}{18}$

$=\frac{11*9+20*7}{126}$

$=\frac{99+140}{126}$

$=\frac{239}{126}$

(viii) $\frac{8*-3}{5*2}-\frac{3*11}{10*16}$

$=\frac{-24}{10}-\frac{33}{160}$

$=\frac{-24*16-33*1}{160}$

$=\frac{-384-33}{160}$

$=\frac{-417}{160}$

5. Question

Simplify:

(i) $(\frac{3}{2} \times \frac{1}{6}) + (\frac{5}{3} \times \frac{7}{2}) - (\frac{13}{8} \ \frac{4}{3})$

(ii) $\left(\frac{1}{4} \times \frac{2}{7}\right) - \left(\frac{5}{14} \times \frac{-2}{3}\right) + \left(\frac{3}{7} \times \frac{9}{2}\right)$

(iii) $\left(\frac{13}{9} \times \frac{-15}{2}\right) + \left(\frac{7}{3} \times \frac{8}{5}\right) + \left(\frac{3}{5} \times \frac{1}{2}\right)$

(iv) $\left(\frac{3}{11} \times \frac{5}{6}\right) - \left(\frac{9}{12} \times \frac{4}{3}\right) + \left(\frac{5}{13} \times \frac{6}{15}\right)$

Answer

(i) $(\frac{3}{2} \times \frac{1}{6}) + (\frac{5}{3} \times \frac{7}{2}) - (\frac{13}{8} \ \frac{4}{3}) = \frac{3}{12} + \frac{35}{6} - \frac{52}{24}$

$= \frac{3*2+35*4-52*1}{24}$

$= \frac{6+140-52}{24}$

$= \frac{94}{24}$

$= \frac{47}{12}$

(ii) $\left(\frac{1}{4} \times \frac{2}{7}\right) - \left(\frac{5}{14} \times \frac{-2}{3}\right) + \left(\frac{3}{7} \times \frac{9}{2}\right) \ \frac{2}{28} + \frac{10}{42} + \frac{27}{14}$

$= \frac{3*2+10*2+27*6}{84}$

$= \frac{6+20+162}{84}$

$= \frac{188}{84}$

$= \frac{47}{21}$

(iii) $\left(\frac{13}{9} \times \frac{-15}{2}\right) + \left(\frac{7}{3} \times \frac{8}{5}\right) + \left(\frac{3}{5} \times \frac{1}{2}\right) \ \frac{13*-15}{9*2} + \frac{7*8}{3*5} + \frac{3*1}{5*2}$

$= \frac{-65}{6} + \frac{56}{15} + \frac{3}{10}$

$= \frac{-65*5+56*2+3*3}{30}$

$= \frac{-204}{30}$

(iv) $\left(\frac{3}{11} \times \frac{5}{6}\right) - \left(\frac{9}{12} \times \frac{4}{3}\right) + \left(\frac{5}{13} \times \frac{6}{15}\right) \ \frac{3*5}{11*6} - \frac{36}{36} + \frac{30}{13*15}$

= 15/66 - 1 + 1/13

$= \frac{15 \times 13 - 858 + 66}{858}$

$= \frac{-597}{858}$

Exercise 1.6

1. Question

Verify the property: $X \times Y = y \times x$ by taking:

(i) $x = -\frac{1}{3}, y = \frac{2}{7}$

(ii) $x = \frac{-3}{5}, y = \frac{-11}{13}$

(iii) $x = 2, Y = \frac{7}{-8}$

(iv) $x = 0, Y = \frac{-15}{8}$

Answer

(i) We have,

$x * y = \frac{-1}{3} * (\frac{2}{7})$

$= \frac{-2}{21}$

$y * x = \frac{2}{7} * (\frac{-1}{3})$

$= \frac{-2}{21}$

(ii) We have,

$x * y = \frac{-3}{5} * (\frac{-11}{13})$

$= \frac{33}{65}$

$y * x = \frac{-11}{13} * (\frac{-3}{5})$

$= \frac{33}{65}$

(iii) We have,

$x * y = 2 * (\frac{7}{-8})$

$= \frac{-14}{8} = \frac{-7}{4}$

y * x = $\frac{7}{-8}$ * 2

$= \frac{-14}{8} = \frac{-7}{4}$

(iv) We have,

x * y = 0 * $(\frac{-15}{78})$

= 0

y * x = $\frac{-15}{8}$ * 0

= 0

2. Question

Verify the property: $x \times (y \times z) = (x \times y) \times z$ by taking:

(i) $x = \frac{-7}{3}, y = \frac{12}{5}, z = \frac{4}{9}$

(ii) $x = 0, y = \frac{-3}{5}, z = \frac{-9}{4}$

(iii) $x = \frac{1}{2}, y = \frac{5}{-4}, z = \frac{-7}{5}$

(iv) $x = \frac{5}{7}, y = \frac{-12}{13}, z = \frac{-7}{18}$

Answer

(i) We have,

x = $\frac{-7}{3}$, y = $\frac{12}{5}$ and z = $\frac{4}{9}$

x * (y * z) = $\frac{-7}{3}$ * $(\frac{12}{5} * \frac{4}{9})$

$= \frac{-7}{3} (\frac{48}{45})$

$= \frac{-112}{45}$

(x * y) * z = $(\frac{-7}{3} * \frac{12}{5}) * \frac{4}{9}$

$= \frac{-7}{3} (\frac{48}{45})$

$= \frac{-112}{45}$

(ii) We have,

$x = 0$, $y = \frac{-3}{5}$ and $z = \frac{-9}{4}$

$x * (y * z) = 0 * (\frac{-3}{5} * \frac{-9}{4})$

$= 0$

$(x * y) * z = (0 * \frac{-3}{5}) * \frac{-9}{4}$

$= 0$

(iii) We have,

$x = \frac{1}{2}$, $y = \frac{5}{-4}$ and $z = \frac{-7}{5}$

$x * (y * z) = \frac{1}{2} * (\frac{5}{-4} * \frac{-7}{5})$

$= \frac{1}{2} (\frac{7}{4})$

$= \frac{7}{8}$

$(x * y) * z = (\frac{1}{2} * \frac{5}{-4}) * \frac{-7}{5}$

$= \frac{-5}{8} (\frac{-7}{5})$

$= \frac{7}{8}$

(iv) We have,

$x = \frac{5}{7}$, $y = \frac{-12}{13}$ and $z = \frac{-7}{18}$

$x * (y * z) = \frac{5}{7} * (\frac{-12}{13} * \frac{-7}{18})$

$= \frac{10}{39}$

$(x * y) * z = (\frac{5}{7} * \frac{-12}{13}) * \frac{-7}{18}$

$= \frac{60}{91} (\frac{-7}{18})$

$= \frac{10}{39}$

3. Question

Verify the property: $x \times (y + z) = x \times y + x \times z$ by taking:

(i) $x = \frac{-3}{7}, y = \frac{12}{13}, z = \frac{-5}{6}$

(ii) $x = \frac{-12}{5}, y = \frac{-15}{4}, z = \frac{8}{3}$

(iii) $x = \frac{-8}{3}, y = \frac{5}{6}, z = \frac{-13}{12}$

(iv) $x = \frac{-3}{4}, y = \frac{-5}{2}, z = \frac{7}{6}$

Answer

(i) $(\frac{-3}{7}) * (\frac{12}{13} + \frac{-5}{6})$

$= \frac{-3}{7} * \frac{12}{13} + \frac{-3}{7} * \frac{-5}{6}$

$= \frac{-36}{91} + \frac{15}{42}$

$= \frac{-36*6+15*13}{546}$

$= \frac{196-216}{546}$

$= \frac{-21}{546}$

$x * y + x * z = \frac{-1}{26}$

$(\frac{-3}{7}) * (\frac{12*6-5*13}{78}) = \frac{-3}{7} * \frac{7}{78}$

$= \frac{-1}{26}$

$(\frac{-3}{7}) * (\frac{12}{13} + \frac{-5}{6}) = (\frac{-3}{7}) * (\frac{12}{13}) + (\frac{-3}{7}) * (\frac{-5}{6})$

(ii) $(\frac{-12}{5}) * (\frac{-15}{4} + \frac{8}{3})$

$= \frac{-12}{5} * (\frac{-45+32}{12})$

$= \frac{13}{5}$

$x * y + x * z$

$(\frac{-12}{5}) * (\frac{-15}{4}) + (\frac{-12}{5}) * (\frac{8}{3})$

$\frac{45-32}{5} = \frac{13}{5}$

(iii) $\frac{-8}{3} * (\frac{5}{6} + \frac{-13}{12}) = (\frac{-8}{3}) * (\frac{5}{6}) + (\frac{-8}{3}) * (\frac{-13}{12})$

$\frac{-8}{3} * (\frac{10-13}{12}) = \frac{-40}{18} + \frac{104}{36}$

$\frac{24}{36} = \frac{-80+104}{36}$

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

Therefore,

L.H.S = R.H.S

(iv) $\frac{-3}{4} (\frac{-5}{2} + \frac{7}{6}) = (\frac{-3}{4}) * (\frac{-5}{2}) + (\frac{-3}{4}) * (\frac{7}{6})$

$\frac{-3}{4} * \frac{-5}{2} + \frac{-3}{4} * \frac{7}{6} = \frac{-3}{4} (\frac{-5*6}{2*6} + \frac{7*6}{6*6})$

$\frac{15}{8} + \frac{-21}{24} = \frac{-3}{4} (\frac{7}{6} - \frac{5}{2})$

$\frac{45-21}{24} = \frac{-3}{4} (\frac{7}{6} - \frac{5*3}{2*3})$

$\frac{24}{24} = \frac{-3}{4} (\frac{7-15}{6})$

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

1 = 1

Therefore,

L.H.S = R.H.S

4. Question

Use the distributivity of multiplication of rational numbers over their addition to simplify:

(i) $\frac{3}{5} \times \left(\frac{35}{24} + \frac{10}{1}\right)$

(ii) $\frac{-5}{4} \times \left(\frac{8}{5} + \frac{16}{5}\right)$

(iii) $\frac{2}{7} \times \left(\frac{7}{16} - \frac{21}{4}\right)$

(iv) $\frac{3}{4} \times \left(\frac{8}{9} - 40\right)$

Answer

(i) $\frac{3}{5} * \frac{35}{24} + \frac{3}{5} * 10$

$= \frac{105}{120} + 6$

$= \frac{7}{8} + \frac{6*8}{8}$

$= \frac{55}{8}$

(ii) $\frac{-5}{4} * (\frac{8+16}{5})$

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

= -6

(iii) $\frac{2}{7} * (\frac{7-21*4}{16})$

$= \frac{2}{7} * \frac{-77}{16}$

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

(iv) $\frac{3}{4} * (\frac{8-360}{9})$

$= \frac{3}{4} * \frac{-352}{9}$

$= \frac{-88}{3}$

5. Question

Find the multiplicative inverse (reciprocal) of each of the following rational numbers:

(i) 9

(ii) -7

(iii) $\frac{12}{5}$

(iv) $\frac{-7}{9}$

(v) $\frac{-3}{-5}$

(vi) $\frac{2}{3} \times \frac{9}{4}$

(vii) $\frac{-5}{8} \times \frac{16}{15}$

(viii) $-2 \times \frac{-3}{5}$

(ix) -1

(x) $\frac{0}{3}$

(xi)1

Answer

(i) Reciprocal of 9 is $\frac{1}{9}$

(ii) Reciprocal of –7 is $\frac{-1}{7}$

(iii) Reciprocal of $\frac{12}{5}$ is $\frac{5}{12}$

(iv) Reciprocal of $\frac{-7}{9}$ is $\frac{9}{-7}$

(v) Reciprocal of $\frac{-3}{-5}$ is $\frac{5}{3}$

(vi) $\frac{2}{3} * \frac{9}{4} = \frac{3}{2}$

Reciprocal of $\frac{3}{2}$ is $\frac{2}{3}$

(vii) $\frac{-5}{8} * \frac{16}{15} = \frac{-2}{3}$

Reciprocal of $\frac{-2}{3}$ is $\frac{3}{-2}$

(viii) -2 * $\frac{-3}{5} = \frac{6}{5}$

Reciprocal of $\frac{6}{5}$ is $\frac{5}{6}$

(ix) Reciprocal of -1 is -1

(x) Reciprocal of $\frac{0}{3}$ is not defined as in the form of $\frac{p}{q}$, q = 0, so it is not a rational number

(xi) Reciprocal of 1 is 1

6. Question

Name the property of multiplication of rational numbers illustrated by the following statements:

(i) $\frac{-5}{16} \times \frac{8}{15} = \frac{8}{15} \times \frac{-5}{16}$

(ii) $\frac{-17}{5} \times 9 = 9 \times \frac{-17}{5}$

(iii) $\frac{7}{4} \times \left(\frac{-8}{3} + \frac{-13}{12}\right) = \frac{7}{4} \times \frac{-8}{3} + \frac{7}{4} \times \frac{-13}{12}$

(iv) $\frac{-5}{9} \times \left(\frac{4}{15} + 8\right) = \left(\frac{-5}{9} \times \frac{4}{15} +\right) \times \frac{-9}{8}$

(v) $\frac{13}{-17} \times 1 = \frac{13}{-17} = 1 \times \frac{13}{-17}$

(vi) $\frac{-11}{16} \times \frac{16}{-11} = 1$

(vii) $\frac{2}{13} \times 0 = 0 = 0 \times \frac{2}{13}$

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

Answer

(i) In the above rational number the property of multiplication which is used is cummutativity because:

According to commutative law:

$\frac{a}{b} * \frac{c}{d} = \frac{c}{d} * \frac{a}{b}$, which is mentioned above

(ii) In the above rational number the property of multiplication which is used is cummutativity because:

According to commutative law:

$\frac{a}{b} * \frac{c}{d} = \frac{c}{d} * \frac{a}{b}$, which is mentioned above

(iii) In the above rational number the property of multiplication which is used is distributivity of multiplication over addition because:

According to this law:

$\frac{a}{b} (\frac{c}{d} + \frac{e}{f}) = (\frac{a}{b} * \frac{c}{d}) + (\frac{a}{b} * \frac{e}{f})$, which is mentioned above

(iv) In the above rational number the property of multiplication which is used is associativity of multiplication because:

According to associative law:

$\frac{a}{b} * (\frac{c}{d} * \frac{e}{f}) = (\frac{a}{b} * \frac{c}{d}) * \frac{e}{f}$, which is mentioned above

(v) In the above rational number the property of multiplication which is used is existence of identity for multiplication which is mentioned above

(vi) In the above rational number the property of multiplication which is used is existence of multiplication inverse which is mentioned above

(vii) In the above rational number the property of multiplication which is used is multiplication by zerobecause:

According to this law:

$\frac{a}{b} * 0 = 0 * \frac{a}{b}$, which is mentioned above

(viii) In the above rational number the property of multiplication which is used is distributive law because:

According to distributive law:

$\frac{a}{b} * \frac{c}{d} + \frac{a}{b} * \frac{e}{f} = \frac{a}{b} * (\frac{c}{d} + \frac{e}{f})$, which is mentioned above

7. Question

Fill in the blanks:

(i) The product of two positive rational numbers is always……..

(ii) The product of a positive rational number and a negative rational number is always ……..

(iii) The product of two negative rational numbers is always……..

(iv)The reciprocal of a positive rational numbers is ……..

(v) The reciprocal of a negative rational number is……..

(vi) The product of a rational number and its reciprocal is……..

(vii) Zero has……. reciprocal

(viii) The numbers……. and….. are their own reciprocals.

(ix)If a is reciprocal of b, then the reciprocal of b is ……

(x) The number 0 is …… the reciprocal of any number.

(xi) Reciprocal of $\frac{1}{a}, \neq 0$ is

(xii) $(17 \times 12)^{-1} = 17^{-1} \times .....$

Answer

(i) The product of two positive rational numbers is always positive

(ii) The product of a positive rational number and a negative rational number is always negative

(iii) The product of two negative rational numbers is always positive

(iv) The reciprocal of a positive rational numbers is positive

(v) The reciprocal of a negative rational number is negative

(vi) The product of a rational number and its reciprocal is 1

(vii) Zero has no reciprocal

(viii) The numbers 1 and -1 are their own reciprocals

(ix) If a is reciprocal of b, then the reciprocal of b is a

(x) The number 0 is not the reciprocal of any number

(xi) Reciprocal of $\frac{1}{a}, \neq 0$ is a

(xii) $(17 * 12)^{-1} = 17^{-1} * 12^{-1}$

8. Question

Fill in the blanks:

(i) $-4 \times \frac{7}{9} = \frac{7}{9} \times \ldots\ldots\ldots$ (ii) $\frac{5}{11} \times \frac{-3}{8} = \frac{-3}{8} \times \ldots\ldots\ldots$

(iii) $\frac{1}{2} \times \left(\frac{3}{4} + \frac{-5}{12}\right) = \frac{1}{2} \times \ldots\ldots + \ldots\ldots \times \frac{-5}{12}$

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

Answer

(i) $-4 * \frac{7}{9} = \frac{7}{9} * -4$

This is because of the use of cumutative law

According to commutative law:

$\frac{a}{b} * \frac{c}{d} = \frac{c}{d} * \frac{a}{b}$

(ii) $\frac{5}{11} * \frac{-3}{8} = \frac{-3}{8} * \frac{5}{11}$

This is because of the use of cumutative law

According to commutative law:

$\frac{a}{b} * \frac{c}{d} = \frac{c}{d} * \frac{a}{b}$

(iii) $\frac{1}{2} * (\frac{3}{4} + \frac{-5}{12}) = \frac{1}{2} * \frac{3}{4} + \frac{1}{2} * \frac{-5}{12}$

This is because of the use of distributive law

According to distributive law:

$\frac{a}{b} * \frac{c}{d} + \frac{a}{b} * \frac{e}{f} = \frac{a}{b} * (\frac{c}{d} + \frac{e}{f})$

(iv) $\frac{-4}{5} * (\frac{5}{7} + \frac{-8}{9}) = (\frac{4}{5} * \frac{5}{7}) + \frac{-4}{5} * \frac{-8}{9}$

This is because of the use of distributive law

According to distributive law:

$\frac{a}{b} * \frac{c}{d} + \frac{a}{b} * \frac{e}{f} = \frac{a}{b} * (\frac{c}{d} + \frac{e}{f})$

Exercise 1.7

1. Question

Divide:

(i) $1 \text{ by } \frac{1}{2}$

(ii) $5 \text{ by } \frac{-5}{7}$

(iii) $\frac{-3}{4} \text{ by } \frac{9}{-16}$

(iv) $\frac{-7}{8} \text{ by } \frac{-21}{-16}$

(v) $\frac{7}{-4} \text{ by } \frac{63}{64}$

(vi) $0 \text{ by } \frac{-7}{5}$

(vii) $\frac{-3}{4} \text{ by } -6$

(viii) $\frac{2}{3} \text{ by } \frac{-7}{12}$

(ix) $-4 \text{ by } \frac{-3}{5}$

(x) $\frac{-3}{13} \text{ by } \frac{-4}{65}$

Answer

(i) $1 \text{ by } \frac{1}{2}$

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

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

$= 2$

(ii) 5 by $\frac{-5}{7}$

$= 5 \div \frac{-5}{7}$

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

$= -7$

(iii) $\frac{-3}{4}$ by $\frac{9}{-16}$

$= \frac{3}{4} \div \frac{9}{16}$

$= \frac{3}{4} \times \frac{16}{9}$

$= \frac{4}{3}$

(iv) $\frac{-7}{8}$ by $\frac{21}{-16}$

$= \frac{-7}{8} \div \frac{21}{16}$

$= \frac{-7}{8} \times \frac{16}{21}$

$= \frac{2}{3}$

(v) $\frac{7}{-4}$ by $\frac{63}{864}$

$= \frac{7}{-4} \div \frac{63}{64}$

$= \frac{-7}{4} \times \frac{64}{63}$

$= \frac{-16}{9}$

(vi) 0 by $\frac{-7}{5}$

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

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

= 0

(vii) $\frac{-3}{4}$ by -6

$= \frac{-3}{4} \div -6$

$= \frac{-3}{4} \times \frac{-1}{6}$

$= \frac{1}{8}$

(viii) $\frac{2}{3}$ by $\frac{-7}{12}$

$= \frac{2}{3} \div \frac{-7}{12}$

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

$= \frac{-24}{21}$

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

(ix) -4 by $\frac{-3}{5}$

$= -4 \div \frac{-3}{5}$

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

$= \frac{20}{3}$

(x) $\frac{-3}{13}$ by $\frac{-4}{65}$

$= \frac{-3}{13} \div \frac{-4}{65}$

$= \frac{-3}{13} \times \frac{65}{-4}$

$= \frac{15}{4}$

2. Question

Find the value and express as a rational number in standard from:

(i) $\frac{2}{5} \div \frac{26}{15}$

(ii) $\frac{10}{3} \div \frac{-35}{12}$

(iii) $-6 \div \left(\frac{-8}{17}\right)$

(iv) $\frac{-40}{99} \div (-20)$

(v) $27 \div \frac{-110}{18}$

(vi) $\frac{-36}{125} \div \frac{-3}{75}$

Answer

(i) $\frac{\frac{2}{5}}{\frac{26}{15}}$

$= \frac{\frac{2}{1}}{\frac{26}{3}}$

$= \frac{2}{26} \times \frac{3}{1}$

$= \frac{3}{13}$

(ii) $\frac{\frac{10}{3}}{\frac{-35}{12}}$

$= \frac{\frac{10}{1}}{\frac{-35}{4}}$

$= \frac{10}{1} \times \frac{-35}{4}$

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

(iii) $\frac{-6}{\frac{-8}{17}}$

$= \frac{\frac{-6}{1}}{\frac{-8}{17}}$

$= -6 \times \frac{17}{-8}$

$= \frac{51}{4}$

(iv) $\frac{\frac{-40}{99}}{-20}$

$= \frac{\frac{2}{99}}{\frac{1}{1}}$

$= \frac{2}{99} \times \frac{1}{1}$

$= \frac{2}{99}$

(v) $\frac{\frac{-22}{27}}{\frac{-110}{18}}$

$= \frac{\frac{22}{3}}{\frac{110}{2}}$

$= \frac{22}{3} \times \frac{2}{110}$

$= \frac{2}{15}$

(vi) $\frac{\frac{-36}{125}}{\frac{-3}{75}}$

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

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

$= \frac{36}{5}$

3. Question

The product of two rational numbers is 15. If one of the numbers is -10, find the other.

Answer

It is that the product of two rational numbers is 15

If one of the number is -10

So, the other number is obtained by dividing the product by the given number.

Therefore,

Other number = $\frac{15}{-10}$

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

4. Question

The product of two rational numbers is $\frac{-8}{9}$. If one of the numbers is $\frac{-4}{15}$, find the other.

Answer

It is given that the product of two rational numbers is $\frac{-8}{9}$.

If one of the number is $-\frac{4}{15}$ we have to find the other number.

So, the other number is obtained by dividing the product by the given number.

Therefore,

Other number = $\frac{\frac{-8}{9}}{\frac{-4}{15}}$ = (8 × 15)/(9 × 4) = (2 × 5)/3 = 10/3

5. Question

By what number should we multiply $\frac{-1}{6}$ so that the product may be $\frac{-23}{9}$?

Answer

Let the required number be 'x'

Now,

According to the question,

$$x \times \frac{-1}{6} = \frac{-23}{9}$$

$$x = \frac{\frac{23}{9}}{\frac{-1}{6}}$$

$$x = \frac{23}{9} \times \frac{6}{1}$$

$$x = \frac{46}{3}$$

6. Question

By what number should we multiply $\frac{-15}{28}$ so that the product may be $\frac{-5}{7}$?

Answer

Let the required number be 'x'

Now,

According to the question,

$$x \times \frac{-15}{28} = \frac{-5}{7}$$

$$x = \frac{\frac{-5}{7}}{\frac{-15}{28}}$$

$$x = \frac{-5}{7} \times \frac{28}{-15}$$

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

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

7. Question

By what number should we multiply $\frac{-8}{13}$ so theat the product may be 24?

Answer

Let the required number be 'x'

Now,

According to the question,

$$x \times \frac{-8}{13} = 24$$

$$x = \frac{\frac{24}{1}}{\frac{-8}{13}}$$

$$x = \frac{24}{1} \times \frac{13}{8}$$

$$x = \frac{3}{1} \times \frac{13}{1}$$

$$x = -39$$

8. Question

By what number should $\frac{-3}{4}$ be multiplied in order to produce $\frac{2}{3}$?

Answer

Let the required number be ‘x’

Now,

According to the question,

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

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

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

$$x = \frac{-8}{9}$$

9. Question

Find $(x + y) \div (x - y)$, if

(i) $x = \frac{2}{3}, y = \frac{3}{2}$

(ii) $x = \frac{2}{5}, y = \frac{1}{2}$

(iii) $x = \frac{5}{4}, y = \frac{-1}{3}$

(iv) $x = \frac{2}{7}, y = \frac{4}{3}$

(v) $x = \frac{1}{4}, y = \frac{3}{2}$

Answer

(i) $(x + y) \div (x - y)$

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

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

$$= \frac{\frac{4+9}{6}}{\frac{4-9}{6}}$$

$= \frac{-13}{5}$

(ii) $(x + y) \div (x - y)$

$When, x = \frac{2}{5}, y = \frac{1}{2}$

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

$= \frac{\frac{4+5}{10}}{\frac{4-5}{10}}$

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

$= -9$

(iii) $(x + y) \div (x - y)$

$When, x = \frac{5}{4}, y = \frac{-1}{3}$

$= \frac{\frac{5}{4} + \frac{-1}{3}}{\frac{5}{4} - \frac{-1}{3}}$

$= \frac{\frac{15-4}{12}}{\frac{15+4}{12}} = \frac{11}{19}$

(iv) $(x + y) \div (x - y)$

$When, x = \frac{2}{7}, y = \frac{4}{3}$

$= \frac{\frac{2}{7} + \frac{4}{3}}{\frac{2}{7} - \frac{4}{3}} = \frac{\frac{6+28}{21}}{\frac{6-28}{21}}$

$= \frac{-17}{11}$

(v) $(x + y) \div (x - y)$

$When, x = \frac{1}{4}, y = \frac{3}{2}$

$= \frac{\frac{1}{4} + \frac{3}{2}}{\frac{1}{4} - \frac{3}{2}}$

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

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

10. Question

The cost of $7\frac{2}{3}$ metres of rope is Rs $12\frac{3}{4}$.Find its cost per metre.

Answer

It is given that,

$\frac{7*3+2}{3} = \frac{23}{3}$ metre of rope is Rs. $\frac{12*4+3}{4}$

Let cost of 1 metre be x

So,

$x * \frac{23}{3} = \frac{51}{4}$

$x = \frac{151}{92} = 1\frac{61}{92}$

Therefore,

Cost of rope is Rs. $1\frac{61}{92}$ per metre

11. Question

The cost of $2\frac{1}{3}$ metres of cloth is Rs $75\frac{1}{4}$. Find the cost of cloth per metre

Answer

It is given that,

Cost of $\frac{7}{3}$ metres of cloth is Rs. $\frac{301}{4}$

Let the cost of the cloth per metre be x

So,

$x \times \frac{7}{3} = \frac{301}{4}$

$x = \frac{3 \times 301}{7 \times 4}$

x = 32.55

Therefore,

Cost of cloth is Rs. 32.55 per metre

12. Question

By what number should $\frac{-33}{16}$ be divided to get $\frac{-11}{4}$?

Answer

Let x be the required number

So,

$\frac{\frac{-33}{16}}{x} = \frac{-11}{4}$

$\frac{-33}{16} = x * \frac{-11}{4}$

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

Therefore,

$The\ required\ number\ be\ x = \frac{3}{4}$

13. Question

Divide the sum of $\frac{-13}{5}$ and $\frac{12}{7}$ by the product of $\frac{-31}{7}$ and $\frac{-1}{2}$

Answer

According to question,

$\frac{-13}{5} + \frac{12}{7}$

$= \frac{-91 + 60}{35}$

$= \frac{-30}{35}$

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

And,

$\frac{-31}{7} \times \frac{1}{2}$

$= \frac{-31}{14}$

Now,

We have to divide $\frac{-6}{7}$ by $\frac{-31}{14}$Therefore

$= \frac{-6}{7} \times \frac{14}{31}$

$= \frac{-12}{31}$

14. Question

Divide the sum of $\frac{65}{12}$ and $\frac{12}{7}$ by their difference.

Answer

According to question,

$= \frac{\frac{16}{12}+\frac{12}{7}}{\frac{65}{12}-\frac{12}{7}}$

$= \frac{\frac{455}{84}+\frac{144}{84}}{\frac{455}{84}-\frac{144}{84}}$

$= \frac{599}{311}$

15. Question

If 24 trousers of equal size can be prepared in 54 metres of cloth. What length of cloth is required for each trouser?

Answer

No.of trousers = 24

Total length of cloth = 54

Length of cloth required for each trousers = $\frac{Total\ length\ of\ cloth}{No.of\ trousers}$

$= \frac{54}{12}$

$= \frac{9}{2}$m

Exercise 1.8

1. Question

Find a rational number between -3 and 1

Answer

We know that between two rational numbers x and y

Such that x< y there is a rational number $\frac{x+y}{2}$

$$i.e.\, x < \frac{x+y}{2} < y$$

So, rational number between -3 and 1 is $\frac{-3+1}{2}$= -1

Thus, we have -3 $< -1 <$1

2. Question

Find any five rational numbers less than 2.

Answer

Five rational numbers less than two are:

0, $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$

3. Question

Find two rational numbers between $\frac{-2}{9}$ and $\frac{5}{9}$

Answer

A rational number lying between $\frac{-2}{9}$ and $\frac{5}{9}$

$$= \frac{-\frac{2}{9}+\frac{5}{9}}{2}$$

$$= \frac{3}{18}$$

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

Now,

A rational number between $\frac{-2}{9}\ and\ \frac{5}{9}$

$$= \frac{-\frac{2}{9}+\frac{1}{6}}{2}$$

$$= \frac{-2\times 2+3}{36}$$

$$= \frac{-1}{36}$$

Therefore,

$$\frac{2}{9}, \frac{1}{6}, \frac{-1}{36}, \frac{5}{9}$$

4. Question

Find two rational numbers between $\frac{1}{5}$ and $\frac{1}{2}$

Answer

For finding rational numbers between two numbers:Add the numbers are divide by 2, this will give a number between the numbers. Now take the new number and add with any of the numbers and repeat the process. You can keep on repeating the process and new numbers will be obtained.A rational number lying between $\frac{1}{5}\ and\ \frac{1}{2}$

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

$$= \frac{(\frac{2+5}{10})}{2}$$

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

Now,

A rational number between $\frac{1}{5}\ and\ \frac{1}{2}$

$$= \frac{-\frac{1}{5}+\frac{7}{20}}{2}$$

$$= \frac{\frac{4+7}{20}}{2}$$

$= \frac{11}{40}$

Hence, the two rational numbers lying between $\frac{1}{5}\ and\ \frac{1}{2}$ are $\frac{7}{20} and\ \frac{11}{40}$

5. Question

Find ten rational numbers between $\frac{1}{4}$ and $\frac{1}{2}$

Answer

The LCM of denominators 4 and 2 is 4

Converting the given rational numbers into equivalent rational number having common denominator 4, we get:

$\frac{1}{4} = \frac{1}{4}\ and\ \frac{1}{2} = \frac{2}{4}$

$\frac{1\times20}{4\times20}\ and\ \frac{2\times20}{4\times20}$

$\frac{20}{80}\ and\ \frac{40}{80}$

Clearly,

21, 22, 23,…, 39 are integers between numerators 20 and 40

Hence, the rational numbers between $\frac{1}{4}\ and\ \frac{1}{2}$ are:

$\frac{21}{80}, \frac{22}{80}, \ldots, \frac{39}{80}$

6. Question

Find ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$.

Answer

The LCM of denominators -5 and 2 is -10

Converting the given rational numbers into equivalent rational number having common denominator 10, we get:

$\frac{-2}{5}\times\frac{2}{2} = \frac{-4}{10} and\ \frac{1}{2}\times\frac{5}{5} = \frac{5}{10}$

$\frac{-4\times2}{10\times2}\ and\ \frac{5\times2}{10\times2}$

Clearly,

-7, -6, -5,…, 10 are integers between numerators -8 and 10

Hence, the rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$ are:

$$\frac{-7}{20}, \frac{-6}{20}, \cdots, \frac{9}{20}$$

7. Question

Find ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$

Answer

The L.C.M of denominators 5 and 4 is 20

Converting the given rational numbers into equivalent rational number having common denominator 20, we get:

$$\frac{3}{5} \times \frac{20}{20} = \frac{60}{100}$$

$$\frac{3}{4} \times \frac{25}{25} = \frac{75}{100}$$

Clearly,

61, 62, 63,…, 74 are integers between numerators 60 and 75 of these equivalent rational numbers

Thus, we have

$$\frac{61}{100}, \frac{62}{100}, \cdots, \frac{74}{100}$$

As rational number between $\frac{3}{5}$ and $\frac{3}{4}$

We can take only 10 of these as required rational numbers

$$\frac{61}{100}, \frac{62}{100}, \frac{63}{100}, \cdots, \frac{73}{100}, \frac{74}{100}$$