1. Rational Numbers

Exercise 1A

1. Question

Express $\frac{-3}{5}$ as a rational number with denominator

(i) 20 (ii) -30 (iii) 35 (iv) -40

Answer

For a fraction, $\frac{a}{b}$

$$\frac{a}{b}=\frac{a\times n}{b\times n}$$

Where, $n \neq 0$

(i) We have to express $\frac{-3}{5}$ as a rational number with denominator 20.

In order to make the denominator 20, multiply 5 by 4.

Therefore,

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

$$\Rightarrow \frac{-3}{5}=\frac{-12}{20}$$

(ii) We have to express $\frac{-3}{5}$ as a rational number with denominator -30.

In order to make the denominator -30, multiply 5 by -6.

Therefore,

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

$$\Rightarrow \frac{-3}{5}=\frac{18}{-30}$$

(iii) We have to express $\frac{-3}{5}$ as a rational number with denominator 35.

In order to make the denominator 35, multiply 5 by 7.

Therefore,

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

$$\Rightarrow \frac{-3}{5}=\frac{-21}{35}$$

(iv) We have to express $\frac{-3}{5}$ as a rational number with denominator -40.

In order to make the denominator 20, multiply 5 by -8.

Therefore,

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

$\Rightarrow \frac{-3}{5} = \frac{24}{-40}$

2. Question

Express $\frac{-42}{98}$ as a rational number with denominator 7.

Answer

For a fraction, $\frac{a}{b}$

$\frac{a}{b} = \frac{a \div n}{b \div n}$

Where, n ≠ 0 and n divides both a and b

(i) We have to express $\frac{-42}{98}$ as a rational number with denominator 7.

In order to make the denominator 7, divide 98 by 14.

Therefore,

$\frac{-42}{98} = \frac{-42 \div 14}{98 \div 14}$

$\Rightarrow \frac{-42}{98} = \frac{-3}{7}$

3. Question

Express $\frac{-48}{60}$ as a rational number with denominator 5.

Answer

For a fraction, $\frac{a}{b}$

$\frac{a}{b} = \frac{a \div n}{b \div n}$

Where, n ≠ 0 and n divides both a and b

We have to express $\frac{-48}{60}$ as a rational number with denominator 5.

In order to make the denominator 5, divide 60 by 12.

Therefore,

$\frac{-48}{60} = \frac{-48 \div 12}{60 \div 12}$

$\Rightarrow \frac{-48}{60} = \frac{-4}{5}$

4. Question

Express each of the following rational numbers in standard form:

(i) $\frac{-12}{30}$ (ii) $\frac{-14}{49}$ (iii) $\frac{24}{-64}$ (iv) $\frac{-36}{-63}$

Answer

A rational number is in standard or simplest or lowest form when-

1. Numerator and denominator have only 1 as its highest common factor.

2. Denominator is a positive integer.

(i) The HCF of 12 and 30 is 6

Therefore,

$$\frac{-12}{30}=\frac{-12\div 6}{30\div 6}$$

$$\Rightarrow \frac{-12}{30}=\frac{-2}{5}$$

(ii) The HCF of 49 and 14 is 7

Therefore,

$$\frac{-14}{49}=\frac{-14\div 7}{49\div 7}$$

$$\Rightarrow \frac{-14}{49}=\frac{-2}{7}$$

(iii) The HCF of 24 and 64 is 8

Therefore,

$$\frac{24}{-64}=\frac{24\div 8}{-64\div 8}$$

$$\Rightarrow \frac{24}{-64}=\frac{3}{-8}$$

In order, to make the denominator positive, multiply both numerator and denominator by -1

$$\Rightarrow \frac{24}{-64}=\frac{3}{-8}=\frac{3\times -1}{-8\times -1}$$

$$\Rightarrow \frac{24}{-64}=\frac{-3}{8}$$

(iv) The HCF of 36 and 63 is 9

Therefore,

$$\frac{-36}{-63}=\frac{-36\div 9}{-63\div 9}$$

$$\Rightarrow \frac{-36}{-63}=\frac{-4}{-7}$$

In order, to make the denominator positive, multiply both numerator and denominator by -1

$$\Rightarrow \frac{-36}{-63}=\frac{-4}{-7}=\frac{-4\times -1}{-7\times -1}$$

$$\Rightarrow \frac{-36}{-63}=\frac{4}{7}$$

5. Question

Which of the two rational numbers is greater in the given pair?

(i) $\frac{3}{8}$ or 0 (ii) $\frac{-2}{9}$ or 0 (iii) $\frac{-3}{4}$ or $\frac{1}{4}$

(iv) $\frac{-5}{7}$ or $\frac{-4}{7}$ (v) $\frac{2}{3}$ or $\frac{3}{4}$ (vi) $\frac{-1}{2}$ or -1

Answer

(i) $\frac{3}{8}$ is a positive number and all positive numbers are greater than 0.

Therefore, $\frac{3}{8} > 0$

(ii) $\frac{-2}{9}$ is a negative number and all negative numbers are less than 0.

Therefore, $0 > \frac{-2}{9}$

(iii) Both $\frac{-3}{4}$ and $\frac{1}{4}$ have the same denominator 4.

Therefore, we can directly compare both the numbers.

Since, 1 > -3

Therefore, $\frac{-3}{4} > \frac{1}{4}$

(iv) Both $\frac{-5}{7}$ and $\frac{-4}{7}$ have the same denominator 7.

Therefore, we can directly compare both the numbers.

Since, -4 > -5

Therefore, $\frac{-4}{7} > \frac{-5}{7}$

(v) $\frac{2}{3}$ and $\frac{3}{4}$ have different denominators.

Therefore, we take LCM of 3 and 4 that is 12.

Now,

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

And,

$$\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$$

Since, 9 > 8

Therefore, $\frac{9}{12} > \frac{8}{12}$

Hence, $\frac{2}{3} > \frac{3}{4}$

(vi) We can write $-1 = \frac{-1}{1}$

$\frac{-1}{2}$ and $\frac{-1}{1}$ have different denominators.

Therefore, we take LCM of 1 and 2 that is 2.

Now,

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

And,

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

Since, -1 > -2

Therefore, $\frac{-1}{2} > \frac{-2}{2}$

Hence, $\frac{-1}{2} > -1$

6. Question

Which of the two rational numbers is greater in the given pair?

(i) $\frac{-4}{3}$ or $\frac{-8}{7}$ (ii) $\frac{7}{-9}$ or $\frac{-5}{8}$ (iii) $\frac{-1}{3}$ or $\frac{4}{-5}$

(iv) $\frac{9}{-13}$ or $\frac{7}{-12}$ (v) $\frac{4}{-5}$ or $\frac{-7}{10}$ (vi) $\frac{-12}{5}$ or -3

Answer

(i) $\frac{-4}{3}$ and $\frac{-8}{7}$ have different denominators.

Therefore, we take LCM of 3 and 7 that is 21.

Now,

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

And,

$\frac{-8}{7} = \frac{-8 \times 3}{7 \times 3} = \frac{-24}{21}$

Since, -24 > -28

Therefore, $\frac{-24}{21} > \frac{-28}{21}$

Hence, $\frac{-8}{7} > \frac{-4}{3}$

(ii)

$\frac{7}{-9} = \frac{7 \times -1}{-9 \times -1} = \frac{-7}{9}$

$\frac{-7}{9}$ and $\frac{-5}{8}$ have different denominators.

Therefore, we take LCM of 9 and 8 that is 72.

Now,

$\frac{-7}{9} = \frac{-7 \times 8}{9 \times 8} = \frac{-56}{72}$

And,

$\frac{-5}{8} = \frac{-5 \times 9}{8 \times 9} = \frac{-45}{72}$

Since, -45 > -56

Therefore, $\frac{-45}{72} > \frac{-56}{72}$

Hence, $\frac{-5}{8} > \frac{-7}{9}$

(iii)

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

$\frac{-1}{3}$ and $\frac{-4}{5}$ have different denominators.

Therefore, we take LCM of 3 and 5 that is 15.

Now,

$$\frac{-1}{3} = \frac{-1 \times 5}{3 \times 5} = \frac{-5}{15}$$

And,

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

Since, -5 > -12

Therefore, $\frac{-5}{15} > \frac{-12}{15}$

Hence, $\frac{-1}{3} > \frac{-4}{5}$

(iv)

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

And,

$$\frac{7}{-12} = \frac{7 \times -1}{-12 \times -1} = \frac{-7}{12}$$

$\frac{-9}{13}$ and $\frac{-7}{12}$ have different denominators.

Therefore, we take LCM of 13 and 12 that is 156.

Now,

$$\frac{-9}{13} = \frac{-9 \times 12}{13 \times 12} = \frac{-108}{156}$$

And,

$$\frac{-7}{12} = \frac{-7 \times 13}{12 \times 13} = \frac{-91}{156}$$

Since, -91 > -108

Therefore, $\frac{-91}{156} > \frac{-108}{156}$

Hence, $\frac{-7}{12} > \frac{-9}{13}$

(v)

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

$\frac{-7}{10}$ and $\frac{-4}{5}$ have different denominators.

Therefore, we take LCM of 10 and 5 that is 10.

Now,

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

And,

$$\frac{-4}{5}=\frac{-4\times 2}{5\times 2}=\frac{-8}{10}$$

Since, -7 > -8

Therefore, $\frac{-7}{10}>\frac{-8}{10}$

Hence, $\frac{-7}{10}>\frac{-4}{5}$

(vi)

We can write $-3=\frac{-3}{1}$

$\frac{-3}{1}$ and $\frac{-12}{5}$ have different denominators.

Therefore, we take LCM of 1 and 5 that is 5.

Now,

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

And,

$$\frac{-3}{1}=\frac{-3\times 5}{1\times 5}=\frac{-15}{5}$$

Since, -12 > -15

Therefore, $\frac{-12}{5}>\frac{-15}{5}$

Hence, $\frac{-12}{5}>-3$

7. Question

Fill in the blanks with the correct symbol out of >, = and <:

(i) $\frac{6}{-13}....\frac{6}{-13}$ (ii) $\frac{5}{-13}....\frac{-35}{91}$ (iii) $-2....\frac{-13}{5}$

(iv) $\frac{-2}{3}....\frac{5}{-8}$ (v) $0....\frac{-3}{-5}$ (vi) $\frac{-8}{9}....\frac{-9}{10}$

Answer

(i) Clearly,

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

(ii)

$$\frac{5}{-13}=\frac{5\times -1}{-13\times -1}=\frac{-5}{13}$$

$\frac{-5}{13}$ and $\frac{-35}{91}$ have different denominators.

Therefore, we take LCM of 13 and 91 that is 91.

Now,

$$\frac{-5}{13} = \frac{-5 \times 7}{13 \times 7} = \frac{-35}{91}$$

And,

$$\frac{-35}{91} = \frac{-35 \times 1}{91 \times 1} = \frac{-35}{91}$$

Clearly, $\frac{-35}{91} = \frac{-35}{91}$

Hence,

$$\frac{5}{-13} = \frac{-35}{91}$$

(iii) We can write $-2 = \frac{-2}{1}$

$\frac{-2}{1}$ and $\frac{-13}{5}$ have different denominators.

Therefore, we take LCM of 1 and 5 that is 5.

Now,

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

And,

$$\frac{-13}{5} = \frac{-13 \times 1}{5 \times 1} = \frac{-13}{5}$$

Since, -10 > -13

Therefore, $\frac{-10}{5} > \frac{-13}{5}$

Hence, $-2 > \frac{-13}{5}$

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

$\frac{-2}{3}$ and $\frac{-5}{8}$ have different denominators.

Therefore, we take LCM of 3 and 8 that is 24.

Now,

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

And,

$$\frac{-5}{8} = \frac{-5 \times 3}{8 \times 3} = \frac{-15}{24}$$

Since, -16 < -15

Therefore, $\frac{-16}{24} < \frac{-15}{24}$

Hence, $\frac{-2}{3} < \frac{-5}{8}$

(v)

$$\frac{-3}{-5} = \frac{-3 \times -1}{-5 \times -1} = \frac{3}{5}$$

$\frac{3}{5}$ is a positive number and all positive numbers are greater than 0.

Therefore, $0 < \frac{3}{5}$

Hence, $0 < \frac{-3}{-5}$

(vi) $\frac{-8}{9}$ and $\frac{-9}{10}$ have different denominators.

Therefore, we take LCM of 9 and 10 that is 90.

Now,

$$\frac{-8}{9} = \frac{-8 \times 10}{9 \times 10} = \frac{-80}{90}$$

And,

$$\frac{-9}{10} = \frac{-9 \times 9}{10 \times 9} = \frac{-81}{90}$$

Since, -80 > -81

Therefore, $\frac{-80}{90} > \frac{-81}{90}$

Hence, $\frac{-8}{9} > \frac{-9}{10}$

8. Question

Arrange the following rational numbers in ascending order:

(i) $\frac{4}{-9}, \frac{-5}{12}, \frac{7}{-18}, \frac{-2}{3}$ (ii) $\frac{-3}{4}, \frac{5}{-12}, \frac{-7}{16}, \frac{9}{-24}$

(iii) $\frac{3}{-5}, \frac{-7}{10}, \frac{-11}{15}, \frac{-13}{20}$ (iv) $\frac{-4}{7}, \frac{-9}{14}, \frac{13}{-28}, \frac{-23}{42}$

Answer

(i)

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

And,

$$\frac{7}{-18} = \frac{7 \times -1}{-18 \times -1} = \frac{-7}{18}$$

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 9, 12, 18 and 3 = 36

$$\frac{-4}{9} = \frac{-4 \times 4}{9 \times 4} = \frac{-16}{36}$$

$$\frac{-5}{12} = \frac{-5 \times 3}{12 \times 3} = \frac{-15}{36}$$

$$\frac{-7}{18} = \frac{-7 \times 2}{18 \times 2} = \frac{-14}{36}$$

$$\frac{-2}{3} = \frac{-2 \times 12}{3 \times 12} = \frac{-24}{36}$$

Clearly,

-24 < -16 < -15 < -14

Therefore,

$$\frac{-24}{36} < \frac{-16}{36} < \frac{-15}{36} < \frac{-14}{36}$$

Hence,

$$\frac{-2}{3} < \frac{4}{-9} < \frac{-5}{12} < \frac{7}{-18}$$

(ii)

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

And,

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

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 4, 12, 16 and 24 = 48

$$\frac{-3}{4} = \frac{-3 \times 12}{4 \times 12} = \frac{-36}{48}$$

$$\frac{-5}{12} = \frac{-5 \times 4}{12 \times 4} = \frac{-20}{48}$$

$$\frac{-7}{16} = \frac{-7 \times 3}{16 \times 3} = \frac{-21}{48}$$

$$\frac{-9}{24} = \frac{-9 \times 2}{24 \times 2} = \frac{-18}{48}$$

Clearly,

-36 < -21 < -20 < -18

Therefore,

$$\frac{-36}{48} < \frac{-21}{48} < \frac{-20}{48} < \frac{-18}{48}$$

Hence,

$$\frac{-3}{4} < \frac{-7}{16} < \frac{5}{-12} < \frac{-9}{24}$$

(iii)

$$\frac{3}{-5} = \frac{3 \times -1}{-5 \times -1} = \frac{-3}{5}$$

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 5, 10, 15 and 20 = 60

$$\frac{-3}{5}=\frac{-3\times 12}{5\times 12}=\frac{-36}{60}$$

$$\frac{-7}{10}=\frac{-7\times 6}{10\times 6}=\frac{-42}{60}$$

$$\frac{-11}{15}=\frac{-11\times 4}{15\times 4}=\frac{-44}{60}$$

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

Clearly,

-44 < -42 < -39 < -36

Therefore,

$$\frac{-44}{60}<\frac{-42}{60}<\frac{-39}{60}<\frac{-36}{60}$$

Hence,

$$\frac{-11}{15}<\frac{-7}{10}<\frac{-13}{20}<\frac{3}{-5}$$

(iv)

$$\frac{13}{-28}=\frac{13\times -1}{-28\times -1}=\frac{-13}{28}$$

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 7, 14, 28 and 42 = 84

$$\frac{-4}{7}=\frac{-4\times 12}{7\times 12}=\frac{-48}{84}$$

$$\frac{-9}{14}=\frac{-9\times 6}{14\times 6}=\frac{-54}{84}$$

$$\frac{-13}{28}=\frac{-13\times 3}{28\times 3}=\frac{-39}{84}$$

$$\frac{-23}{42}=\frac{-23\times 2}{42\times 2}=\frac{-46}{84}$$

Clearly,

-54 < -48 < -46 < -39

Therefore,

$$\frac{-54}{84}<\frac{-48}{84}<\frac{-46}{84}<\frac{-39}{84}$$

Hence,

$$\frac{-9}{14}<\frac{-4}{7}<\frac{-23}{42}<\frac{13}{-28}$$

9. Question

Arrange the following rational numbers in descending order:

(i) $-2, \frac{-13}{6}, \frac{8}{-3}, \frac{1}{3}$ (ii) $\frac{-3}{10}, \frac{7}{-15}, \frac{-11}{20}, \frac{17}{-30}$

(iii) $\frac{-5}{6}, \frac{-7}{12}, \frac{-13}{18}, \frac{23}{-24}$ (iv) $\frac{-10}{11}, \frac{-19}{22}, \frac{-23}{33}, \frac{-39}{44}$

Answer

(i)

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

And,

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

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 1, 6and 3 = 6

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

$\frac{-13}{6} = \frac{-13 \times 1}{6 \times 1} = \frac{-13}{6}$

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

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

Clearly,

2 > -12 > -13 > -16

Therefore,

$\frac{2}{6} > \frac{-12}{6} > \frac{-13}{6} > \frac{-16}{6}$

Hence,

$\frac{1}{3} > \frac{-2}{1} > \frac{-13}{6} > \frac{-8}{3}$

(ii)

$\frac{7}{-15} = \frac{7 \times -1}{-15 \times -1} = \frac{-7}{15}$

And,

$\frac{17}{-30} = \frac{17 \times -1}{-30 \times -1} = \frac{-17}{30}$

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 10, 15, 20 and 30 = 60

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

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

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

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

Clearly,

-18>-28>-33>-34

Therefore,

$$\frac{-18}{60}>\frac{-28}{60}>\frac{-33}{60}>\frac{-34}{60}$$

Hence,

$$\frac{-3}{10}>\frac{-7}{15}>\frac{-11}{20}>\frac{-17}{30}$$

(iii)

$$\frac{23}{-24}=\frac{23\times -1}{-24\times -1}=\frac{-23}{24}$$

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 6, 12, 18 and 24 = 72

$$\frac{-5}{6}=\frac{-5\times 12}{6\times 12}=\frac{-60}{72}$$

$$\frac{-7}{12}=\frac{-7\times 6}{12\times 6}=\frac{-42}{72}$$

$$\frac{-13}{18}=\frac{-13\times 4}{18\times 4}=\frac{-52}{72}$$

$$\frac{-23}{24}=\frac{-23\times 3}{24\times 3}=\frac{-69}{72}$$

Clearly,

-42>-52>-60>-69

Therefore,

$$\frac{-42}{72}>\frac{-52}{72}>\frac{-60}{72}>\frac{-69}{72}$$

Hence,

$$\frac{-7}{12}>\frac{-13}{18}>\frac{-5}{6}>\frac{-23}{24}$$

(iv)

Since, the denominators of all the numbers are different therefore we will take LCM of the denominators.

LCM of 11, 22, 33 and 44 = 132

$$\frac{-10}{11}=\frac{-10\times 12}{11\times 12}=\frac{-120}{132}$$

$$\frac{-19}{22}=\frac{-19\times 6}{22\times 6}=\frac{-114}{132}$$

$$\frac{-23}{33}=\frac{-23\times 4}{33\times 4}=\frac{-92}{132}$$

$$\frac{-39}{44}=\frac{-39\times 3}{44\times 3}=\frac{-117}{132}$$

Clearly,

-92>-114>-117>-120

Therefore,

$$\frac{-92}{132}>\frac{-114}{132}>\frac{-117}{132}>\frac{-120}{132}$$

Hence,

$$\frac{-23}{33}>\frac{-19}{22}>\frac{-39}{44}>\frac{-10}{11}$$

10. Question

Which of the following statements are true and which are false?

(i) Every whole number is a rational number.

(ii) Every integer is a rational number.

(iii) 0 is a whole number but it is not a rational number.

Answer

(i) Every whole number a can be represented as $\frac{a}{1}$

Therefore, every whole number is a rational number.

(ii) Every integer a can be represented as $\frac{a}{1}$

Therefore, every integer is a rational number.

(iii) 0 can be represented as $\frac{0}{1}$

Therefore, 0 is a whole number and a rational number.

Exercise 1B

1. Question

Represent each of the following numbers on the number line:

(i) $\frac{1}{3}$ (ii) $\frac{2}{7}$ (iii) $1\frac{3}{4}$ (iv) $2\frac{2}{5}$

(v) $3\frac{1}{2}$ (vi) $5\frac{5}{7}$ (vii) $4\frac{2}{3}$ (viii) 8

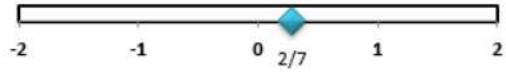
Answer

(i) $\frac{1}{3}$ is greater than 0 and less than 1.

Therefore, it lies between 0 and 1

(ii) $\frac{2}{7}$ is greater than 0 and less than 1.

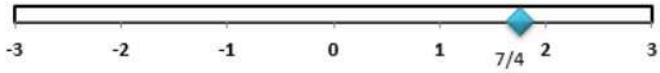
Therefore, it lies between 0 and 1



(iii) $1\frac{3}{4} = \frac{(4\times1)+3}{4} = \frac{4+3}{4} = \frac{7}{4}$

$\frac{7}{4}$ is greater than 1 and less than 2.

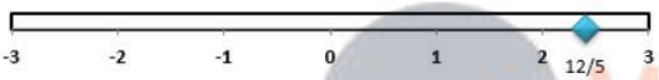
Therefore, it lies between 1 and 2



(iv) $2\frac{2}{5} = \frac{(5\times2)+2}{5} = \frac{10+2}{5} = \frac{12}{5}$

$\frac{12}{5}$ is greater than 2 and less than 3.

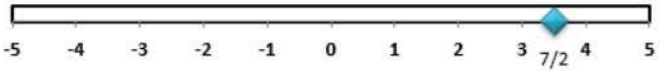
Therefore, it lies between 2 and 3.



(v) $3\frac{1}{2} = \frac{(2\times3)+1}{2} = \frac{6+1}{2} = \frac{7}{2}$

$\frac{7}{2}$ is greater than 3 and less than 4.

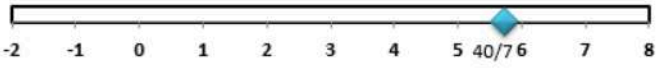
Therefore, it lies between 3 and 4.



(vi) $5\frac{5}{7} = \frac{(7\times5)+5}{7} = \frac{35+5}{7} = \frac{40}{7}$

$\frac{40}{7}$ is greater than 5 and less than 6.

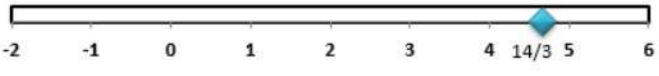
Therefore, it lies between 5 and 6.



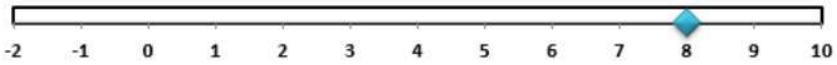
(vii) $4\frac{2}{3} = \frac{(3\times4)+2}{3} = \frac{12+2}{3} = \frac{14}{3}$

$\frac{14}{3}$ is greater than 4 and less than 5.

Therefore, it lies between 4 and 5.



(viii) The number line representation of 8 is



2. Question

Represent each of the following numbers on the number line:

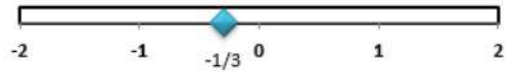
(i) $\frac{-1}{3}$ (ii) $\frac{-3}{4}$ (iii) $-1\frac{2}{3}$ (iv) $-3\frac{1}{7}$

(v) $-4\frac{3}{5}$ (vi) $-2\frac{5}{6}$ (vii) -3 (viii) $-2\frac{7}{8}$

Answer

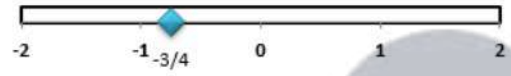
(i) $\frac{-1}{3}$ is greater than -1 and less than 0.

Therefore, it lies between -1 and 0



(ii) $\frac{-3}{4}$ is greater than -1 and less than 0.

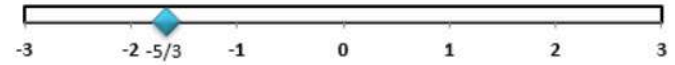
Therefore, it lies between -1 and 0



(iii) $-1\frac{2}{3} = -\frac{(3\times1)+2}{3} = -\frac{3+2}{3} = \frac{-5}{3}$

$\frac{-5}{3}$ is greater than -2 and less than -1`.

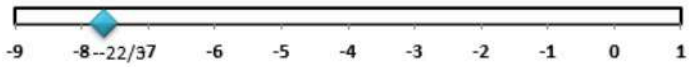
Therefore, it lies between -2 and -1



(iv) $-3\frac{1}{7} = -\frac{(7\times3)+1}{3} = -\frac{21+1}{3} = \frac{-22}{3}$

$\frac{-22}{3}$ is greater than -8 and less than -7`.

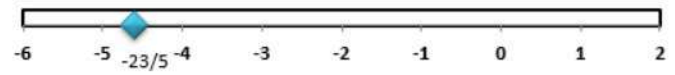
Therefore, it lies between -8 and -7



(v) $-4\frac{3}{5} = -\frac{(5\times4)+3}{5} = -\frac{20+3}{5} = \frac{-23}{5}$

$\frac{-23}{5}$ is greater than -5 and less than -4.

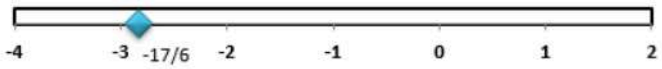
Therefore, it lies between -5 and -4



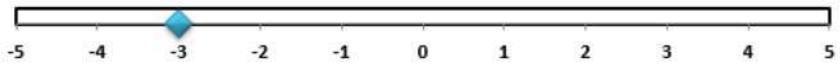
(vi) $-2\frac{5}{6} = -\frac{(6\times2)+5}{6} = -\frac{12+5}{6} = \frac{-17}{6}$

$\frac{-17}{6}$ is greater than -3 and less than -2.

Therefore, it lies between -3 and -2



(vii) The number line representation of -3 is



(viii) $-2\frac{7}{8} = -\frac{(8\times2)+7}{8} = -\frac{16+7}{8} = \frac{-23}{8}$

$\frac{-23}{8}$ is greater than -3 and less than -2.

Therefore, it lies between -3 and -2

3. Question

Which of the following statements are true and which are false?

(i) $\frac{-3}{5}$ lies to the left of 0 on the number line.

(ii) $\frac{-12}{7}$ lies to the right of 0 on the number line.

(iii) The rational numbers $\frac{1}{3}$ and $\frac{-5}{2}$ are on opposite sides of 0 on the number line.

(iv) The rational number $\frac{-18}{-13}$ lies to the left of 0 on the number line.

Answer

(i) True

$\frac{-3}{5}$ is a negative number.

All negative numbers are less than 0 and therefore, lie to the left of 0 on the number line.

Hence, $\frac{-3}{5}$ lies to the left of 0 on the number line.

(iii) False

$\frac{-12}{7}$ is a negative number.

All negative numbers are less than 0 and therefore, lie to the left of 0 on the number line.

Hence, $\frac{-12}{7}$ lies to the left of 0 on the number line.

(iii)True

$\frac{1}{3}$ is a positive number.

All positive numbers are greater than 0 and therefore, lie to the right of 0 on the number line.

Hence, $\frac{1}{3}$ lies to the right of 0 on the number line.

$\frac{-5}{2}$ is a negative number.

All negative numbers are less than 0 and therefore, lie to the left of 0 on the number line.

Hence, $\frac{-5}{2}$ lies to the left of 0 on the number line.

Therefore, the rational numbers, $\frac{1}{3}$ and $\frac{-5}{2}$ are on opposite sides of 0 on the number line.

(iv) False

$$\frac{-18}{-13}=\frac{-18\times-1}{-13\times-1}=\frac{18}{13}$$

$\frac{18}{13}$ is a positive number.

All positive numbers are greater than 0 and therefore, lie to the right of 0 on the number line.

Hence, $\frac{18}{13}$ lies to the right of 0 on the number line.

Exercise 1C

1. Question

Add the following rational numbers:

(i) $\frac{-2}{5}$ and $\frac{4}{5}$ (ii) $\frac{-6}{11}$ and $\frac{-4}{11}$ (iii) $\frac{-11}{8}$ and $\frac{5}{8}$

(iv) $\frac{-7}{3}$ and $\frac{1}{3}$ (v) $\frac{5}{6}$ and $\frac{-1}{6}$ (vi) $\frac{-17}{15}$ and $\frac{-1}{15}$

Answer

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

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

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

(ii) $\frac{-6}{11}+\frac{-4}{11}$

$$=\frac{-6+(-4)}{11}$$

$$=\frac{-6-4}{11}$$

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

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

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

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

To convert it into lowest terms, divide both numerator and denominator by common divisor of both 6 and 8 that is, 2

$= \frac{-6 \div 2}{8 \div 2}$

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

(iv) $\frac{-7}{3} + \frac{1}{3}$

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

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

To convert it into lowest terms, divide both numerator and denominator by common divisor of both 6 and 3 that is, 3.

$= \frac{-6 \div 3}{3 \div 3}$

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

=2

(v) $\frac{5}{6} + \frac{-1}{6}$

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

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

$= \frac{4}{6}$

To convert it into lowest terms, divide both numerator and denominator by common divisor of both 4 and 6 that is, 2.

$= \frac{4 \div 2}{6 \div 2}$

$= \frac{2}{3}$

(vi) $\frac{-17}{15} + \frac{-1}{15}$

$= \frac{-17 + (-1)}{15}$

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

To convert it into lowest terms, divide both numerator and denominator by common divisor of both 18 and 15 that is, 3.

$= \frac{-18 \div 3}{15 \div 3}$

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

2. Question

Add the following rational numbers:

(i) $\frac{3}{4}$ and $\frac{-3}{5}$ (ii) $\frac{5}{8}$ and $\frac{-7}{12}$ (iii) $\frac{-8}{9}$ and $\frac{11}{6}$

(iv) $\frac{-5}{16}$ and $\frac{7}{24}$ (v) $\frac{7}{-18}$ and $\frac{8}{27}$

(vi) $\frac{1}{-12}$ and $\frac{2}{-15}$ (vii) -1 and $\frac{3}{4}$

(viii) 2 and $\frac{-5}{4}$ (ix) 0 and $\frac{-2}{5}$

Answer

(i) Since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 4 and 5 = 20

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

And

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

Now,

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

$= \frac{15}{20} + \frac{-12}{20}$

$= \frac{15 + (-12)}{20}$

$= \frac{15 - 12}{20}$

$= \frac{3}{20}$

(ii) Since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 8 and 12 = 24

$\frac{5}{8} = \frac{5 \times 3}{8 \times 3} = \frac{15}{24}$

And

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

Now,

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

$$=\frac{15}{24}+\frac{-14}{24}$$

$$=\frac{15+(-14)}{24}$$

$$=\frac{15-14}{24}$$

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

(iii) Since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 9 and 6 = 18

$$\frac{-8}{9}=\frac{-8\times 2}{9\times 2}=\frac{-16}{18}$$

And

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

Now,

$$\frac{-8}{9}+\frac{11}{6}$$

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

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

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

(iv) Since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 16 and 24 = 48

$$\frac{-5}{16}=\frac{-5\times 3}{16\times 3}=\frac{-15}{48}$$

And

$$\frac{7}{24}=\frac{7\times 2}{24\times 2}=\frac{14}{48}$$

Now,

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

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

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

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

(v) Since, the denominators of given rational numbers are negative therefore, we will make them positive.

$$\frac{7}{-18}=\frac{7\times-1}{-18\times-1}=\frac{-7}{18}$$

Now, since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 18 and 27 = 54

$$\frac{-7}{18}=\frac{-7\times3}{18\times3}=\frac{-21}{54}$$

And

$$\frac{8}{27}=\frac{8\times2}{27\times2}=\frac{16}{54}$$

Now,

$$\frac{-7}{18}+\frac{8}{27}$$

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

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

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

(vi) Since, the denominators of given rational numbers are negative therefore, we will make them positive.

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

And,

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

Now, since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 12 and 15 = 60

$$\frac{-1}{12}=\frac{-1\times5}{12\times5}=\frac{-5}{60}$$

And

$$\frac{-2}{15}=\frac{-2\times4}{15\times4}=\frac{-8}{60}$$

Now,

$$\frac{-5}{60}+\frac{-8}{60}$$

$$=\frac{-5+(-8)}{60}$$

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

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

(vii) We can write -1 as $\frac{-1}{1}$.

Now, since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 1 and 4 = 4

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

And

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

Now,

$$-1+\frac{3}{4}$$

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

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

(viii) We can write 2 as $\frac{2}{1}$.

Now, since, the denominators of given rational numbers are different therefore, we take their LCM.

LCM of 1 and 4 = 4

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

And

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

Now,

$$2+\frac{-5}{4}$$

$$=\frac{8+(-5)}{4}$$

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

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

(ix) $0+\frac{-2}{5}$

On adding, any number to 0 we get the same number.

Therefore,

$$0+\frac{-2}{5}=\frac{-2}{5}$$

3. Question

Verify the following:

(i) $\frac{-12}{5}+\frac{2}{7}=\frac{2}{7}+\frac{-12}{5}$ (ii) $\frac{-5}{8}+\frac{-9}{13}=\frac{-9}{13}+\frac{-5}{8}$

(iii) $3+\frac{-7}{12}=\frac{-7}{12}+3$ (iv) $\frac{2}{-7}+\frac{12}{-35}=\frac{12}{-35}+\frac{2}{-7}$

Answer

(i)LCM of 5 and 7 = 35

$\frac{-12}{5}=\frac{-12\times 7}{5\times 7}=\frac{-84}{35}$

And,

$\frac{2}{7}=\frac{2\times 5}{7\times 5}=\frac{10}{35}$

$\text{LHS}=\frac{-12}{5}+\frac{2}{7}=\frac{-84}{35}+\frac{10}{35}=\frac{-84+10}{35}=\frac{-74}{35}$

Similarly,

LCM of 7 and 5 = 35

$\frac{2}{7}=\frac{2\times 5}{7\times 5}=\frac{10}{35}$

And,

$\frac{-12}{5}=\frac{-12\times 7}{5\times 7}=\frac{-84}{35}$

$\text{RHS}=\frac{2}{7}+\frac{-12}{5}=\frac{10}{35}+\frac{-84}{35}=\frac{10+(-84)}{35}=\frac{10-84}{35}=\frac{-74}{35}$

i.e., LHS = RHS

Hence,

$\frac{-12}{5}+\frac{2}{7}=\frac{2}{7}+\frac{-12}{5}$

Verified

(ii)LCM of 13 and 8 = 104

$\frac{-5}{8}=\frac{-5\times 13}{8\times 13}=\frac{-65}{104}$

And,

$\frac{-9}{13}=\frac{-9\times 8}{13\times 8}=\frac{-72}{104}$

$\text{LHS}=\frac{-5}{8}+\frac{-9}{13}=\frac{-65}{104}+\frac{-72}{104}=\frac{-65+(-72)}{104}=\frac{-65-72}{104}=\frac{-137}{104}$

Similarly,

LCM of 8 and 13 = 104

$\frac{-9}{13}=\frac{-9\times 8}{13\times 8}=\frac{-72}{104}$

And,

$$\frac{-5}{8} = \frac{-5 \times 13}{8 \times 13} = \frac{-65}{104}$$

$$\text{RHS} = \frac{-9}{13} + \frac{-5}{8} = \frac{-72}{104} + \frac{-65}{104} = \frac{-72 + (-65)}{35} = \frac{-72 - 65}{35} = \frac{-137}{104}$$

i.e., LHS = RHS

Hence,

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

Verified

(iii) 3 can be written as $\frac{3}{1}$

LCM of 1 and 12 = 12

$$\frac{3}{1} = \frac{3 \times 12}{1 \times 12} = \frac{36}{12}$$

And,

$$\frac{-7}{12} = \frac{-7 \times 1}{12 \times 1} = \frac{-7}{12}$$

$$\text{LHS} = \frac{3}{1} + \frac{-7}{12} = \frac{36}{12} + \frac{-7}{12} = \frac{36 + (-7)}{12} = \frac{36 - 7}{12} = \frac{29}{12}$$

Similarly,

LCM of 1 and 12 = 12

$$\frac{-7}{12} = \frac{-7 \times 1}{12 \times 1} = \frac{-7}{12}$$

And,

$$\frac{3}{1} = \frac{3 \times 12}{1 \times 12} = \frac{36}{12}$$

$$\text{RHS} = \frac{-7}{12} + \frac{3}{1} = \frac{-7}{12} + \frac{36}{12} = \frac{-7 + 36}{12} = \frac{29}{12}$$

i.e., LHS = RHS

Hence,

$$3 + \frac{-7}{12} = \frac{-7}{12} + 3$$

Verified

(iv) Since, the denominators are negative we will make them positive.

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

And,

$$\frac{12}{-35} = \frac{12 \times -1}{= 35 \times -1} = \frac{-12}{35}$$

LCM of 7 and 35 = 35

$$\frac{-2}{7} = \frac{-2 \times 5}{7 \times 5} = \frac{-10}{35}$$

And,

$$\frac{-12}{35}=\frac{-12\times 1}{35\times 1}=\frac{-12}{35}$$

$$\text{LHS}=\frac{-2}{7}+\frac{-12}{35}=\frac{-10}{35}+\frac{-12}{35}=\frac{-10+(-12)}{35}=\frac{-10-12}{35}=\frac{-22}{35}$$

Similarly,

LCM of 7 and 5 = 35

$$\frac{-12}{35}=\frac{-12\times 1}{35\times 1}=\frac{-12}{35}$$

And,

$$\frac{-2}{7}=\frac{-2\times 5}{7\times 5}=\frac{-10}{35}$$

$$\text{RHS}=\frac{-12}{35}+\frac{-2}{7}=\frac{-12}{35}+\frac{-10}{35}=\frac{-12+(-10)}{35}=\frac{-12-10}{35}=\frac{-22}{35}$$

i.e., LHS = RHS

Hence,

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

Verified

4. Question

Verify the following:

(i) $\left(\frac{3}{4}+\frac{-2}{5}\right)+\frac{-7}{10}=\frac{3}{4}+\left(\frac{-2}{5}+\frac{-7}{10}\right)$

(ii) $\left(\frac{-7}{11}+\frac{2}{-5}\right)+\frac{-13}{22}=\frac{-7}{11}+\left(\frac{2}{-5}+\frac{-13}{22}\right)$

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

Answer

(i)

$$\left(\frac{3}{4}+\frac{-2}{5}\right)+\frac{-7}{10}=\frac{3}{4}+\left(\frac{-2}{5}+\frac{-7}{10}\right)$$

$$\text{LHS}=\left(\frac{3}{4}+\frac{-2}{5}\right)+\frac{-7}{10}$$

$$=\left(\frac{3\times 5+(-2)\times 4}{20}\right)+\frac{-7}{10}$$

$$=\left(\frac{15-8}{20}\right)+\frac{-7}{10}$$

$$=\frac{7}{20}+\frac{-7}{10}$$

$$= \frac{7 \times 1 + (-7) \times 2}{20}$$

$$= \frac{7 \times 1 + (-7) \times 2}{20}$$

$$= \frac{7 - 14}{20}$$

$$= \frac{-7}{20}$$

$$\text{RHS} = \frac{3}{4} + \left(\frac{-2}{5} + \frac{-7}{10}\right)$$

$$= \frac{3}{4} + \left(\frac{(-2) \times 2 + (-7) \times 1}{10}\right)$$

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

$$= \frac{3}{4} + \frac{-11}{10}$$

$$= \frac{3 \times 5 + (-11) \times 2}{20}$$

$$= \frac{15 - 22}{20}$$

$$= \frac{-7}{20}$$

RHS = LHS

Verified

(ii)

$$\left(\frac{-7}{11} + \frac{2}{-5}\right) + \frac{-13}{22} = \frac{-7}{11} + \left(\frac{2}{-5} + \frac{-13}{22}\right)$$

$$\text{LHS} = \left(\frac{-7}{11} + \frac{2}{-5}\right) + \frac{-13}{22}$$

$$= \left(\frac{-7}{11} + \frac{-2}{5}\right) + \frac{-13}{22}$$

$$= \left(\frac{-7 \times 5 + (-2) \times 11}{55}\right) + \frac{-13}{22}$$

$$= \left(\frac{-35 - 22}{55}\right) + \frac{-13}{22}$$

$$= \frac{-57}{55} + \frac{-13}{22}$$

$$= \frac{-57 \times 2 + (-13) \times 5}{110}$$

$$= \frac{-114 - 65}{110}$$

$$= \frac{-179}{110}$$

$$\text{RHS} = \frac{-7}{11} + \left(\frac{2}{-5} + \frac{-13}{22}\right)$$

$$= \frac{-7}{11} + \left(\frac{-2}{5} + \frac{-13}{22}\right)$$

$$= \frac{-7}{11} + \left(\frac{(-2) \times 22 + (-13) \times 5}{-110}\right)$$

$$= \frac{-7}{11} + \left(\frac{-44 - 65}{-110}\right)$$

$$= \frac{-7}{11} + \frac{-109}{110}$$

$$= \frac{-7 \times 10 + (-109) \times 1}{110}$$

$$= \frac{-70 - 109}{20}$$

$$= \frac{-179}{110}$$

RHS = LHS

Verified

(iii)

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

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

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

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

$$= \frac{-1}{1} + \left(\frac{-8 - 9}{12}\right)$$

$$= \frac{-1}{1} + \frac{-17}{12}$$

$$= \frac{-1 \times 12 + (-17) \times 1}{12}$$

$$= \frac{-12 - 17}{12}$$

$$= \frac{-29}{12}$$

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

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

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

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

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

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

$= \frac{-20-9}{20}$

$= \frac{-29}{12}$

RHS = LHS

Verified

5. Question

Fill in the blanks:

(i) $\left(\frac{-3}{17}\right) + \left(\frac{-12}{5}\right) = \left(\frac{-12}{5}\right) + (....)$

(ii) $-9 + \frac{-21}{8} = (....) + (-9)$

(iii) $\left(\frac{-8}{13} + \frac{3}{7}\right) + \left(\frac{-13}{4}\right) = (....) + \left[\frac{3}{7} + \left(\frac{-13}{4}\right)\right]$

(iv) $-12 + \left(\frac{7}{12} + \frac{-9}{11}\right) = \left(-12 + \frac{7}{12}\right) + (....)$

(v) $\frac{19}{-5} + \left(\frac{-3}{11} + \frac{-7}{8}\right) = \left\{\frac{19}{-5} + (....)\right\} + \frac{-7}{8}$

(vi) $\frac{-16}{7} + ... = ... + \frac{-16}{7} = \frac{-16}{7}$

Answer

(i) $\frac{-3}{17}$

By Commutative property, i.e., a+b=b+a

Therefore,

$\frac{-3}{17} + \frac{-12}{5} = \frac{-12}{5} + \frac{-3}{17}$

(ii) $\frac{-21}{8}$

By Commutative property, i.e., a+b=b+a

Therefore,

$$-9+\frac{-21}{8}=\frac{-21}{8}+(-9)$$

(iii) $\frac{-8}{13}$

By Associative property, i.e., (a+b)+c=a+(b+c)

Therefore,

$$\left(\frac{-8}{13}+\frac{3}{7}\right)+\left(\frac{-13}{4}\right)=\left(\frac{-8}{13}\right)+[\frac{3}{7}+\left(\frac{-13}{4}\right)]$$

(iv) $\frac{-9}{11}$

By Associative property, i.e., (a+b)+c=a+(b+c)

Therefore,

$$-12+\left(\frac{7}{12}+\frac{-9}{11}\right)=\left(-12+\frac{7}{12}\right)+\left(\frac{-9}{11}\right)$$

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

By Associative property, i.e., (a+b)+c=a+(b+c)

Therefore,

$$\frac{19}{-5}+\left(\frac{-3}{11}+\frac{-7}{8}\right)=\left(\frac{19}{-5}+\frac{-3}{11}\right)+\left(\frac{-7}{8}\right)$$

(vi) 0,0

0 is the additive identity that is, if we add 0 to any number the result will be the number itself.

a+0=0+a

Also, By Commutative property, i.e., a+b=b+a

We get,

$$\frac{-16}{7}+0=0+\frac{-16}{7}=\frac{-16}{7}$$

6. Question

Find the additive inverse of each of the following:

(i) $\frac{1}{3}$ (ii) $\frac{23}{9}$ (iii) -18 (iv) $\frac{-17}{8}$ (v) $\frac{15}{-4}$

(vi) $\frac{-16}{-5}$ (vii) $\frac{-3}{11}$ (viii) 0 (ix) $\frac{19}{-6}$ (x) $\frac{-8}{-7}$

Answer

Additive inverse of a number $\frac{a}{b}$ is the number $-\frac{a}{b}$ such that, $\frac{a}{b}+\left(\frac{-a}{b}\right)=0$

Therefore,

(i) Additive inverse of $\frac{1}{3}$ is $\frac{-1}{3}$

(ii) Additive inverse of $\frac{23}{9}$ is $\frac{-23}{9}$

(iii) Additive inverse of -18 is 18

(iv) Additive inverse of $\frac{-17}{8}$ is $\frac{17}{8}$

(v)

$$\frac{15}{-4}=\frac{15\times-1}{-4\times-1}=\frac{-15}{4}$$

Therefore, Additive inverse of $\frac{-15}{4}$ is $\frac{15}{4}$

(vi)

$$\frac{-16}{-5}=\frac{-16\times-1}{-5\times-1}=\frac{16}{5}$$

Additive inverse of $\frac{16}{5}$ is $\frac{-16}{5}$

(vii) Additive inverse of $\frac{-3}{11}$ is $\frac{3}{11}$

(viii) Additive inverse of 0 is 0

(ix)

$$\frac{19}{-6}=\frac{19\times-1}{-6\times-1}=\frac{-19}{6}$$

Therefore, Additive inverse of $\frac{-19}{6}$ is $\frac{19}{6}$

(x)

$$\frac{-8}{-7}=\frac{-8\times-1}{-7\times-1}=\frac{8}{7}$$

Additive inverse of $\frac{8}{7}$ is $\frac{-8}{7}$

7. Question

Subtract:

(i) $\frac{3}{4}$ from $\frac{1}{3}$ (ii) $\frac{-5}{6}$ from $\frac{1}{3}$

(iii) $\frac{-8}{9}$ from $\frac{-3}{5}$ (iv) $\frac{-9}{7}$ from -1

(v) $\frac{-18}{11}$ from 1 (vi) $\frac{-13}{9}$ from 0

(vii) $\frac{-32}{13}$ from $\frac{-6}{5}$ (viii) -7 from $\frac{-4}{7}$

Answer

(i)

Since the denominators of both the numbers are different therefore, we will take their LCM

LCM 0f 3 and 4 = 12

$$\frac{3}{4}=\frac{3\times 3}{4\times 3}=\frac{9}{12}$$

And,

$$\frac{1}{3}=\frac{1\times 4}{3\times 4}=\frac{4}{12}$$

Therefore,

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

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

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

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

(ii)

Since the denominators of both the numbers are different therefore, we will take their LCM

LCM 0f 6 and 3 = 6

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

And,

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

Therefore,

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

$$=\frac{2}{6}-\left(\frac{-5}{6}\right)$$

$$=\frac{2-(-5)}{6}$$

$$=\frac{2+5}{6}$$

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

(iii)

Since the denominators of both the numbers are different therefore, we will take their LCM

LCM 0f 9 and 5 = 45

$$\frac{-8}{9}=\frac{-8\times 5}{9\times 5}=\frac{-40}{45}$$

And,

$$\frac{-3}{5} = \frac{-3 \times 9}{5 \times 9} = \frac{-27}{45}$$

Therefore,

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

$$= \frac{-27}{45} - \left(\frac{-40}{45}\right)$$

$$= \frac{-27 - (-40)}{45}$$

$$= \frac{-27 + 40}{45}$$

$$= \frac{13}{45}$$

(iv)

We can write, $-1 = \frac{-1}{1}$

Since the denominators of both the numbers are different therefore, we will take their LCM

LCM 0f 1 and 7 =7

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

And,

$$\frac{-9}{7} = \frac{-9 \times 1}{7 \times 1} = \frac{-9}{7}$$

Therefore,

$$-1 - \left(\frac{-9}{7}\right)$$

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

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

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

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

(v)

We can write, $1 = \frac{1}{1}$

Since the denominators of both the numbers are different therefore, we will take their LCM

LCM 0f 1 and 11 = 11

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

And,

$$\frac{-18}{11} = \frac{-18 \times 1}{11 \times 1} = \frac{-18}{11}$$

Therefore,

$$1 - \left(\frac{-18}{11}\right)$$

$$= \frac{11}{11} - \left(\frac{-18}{11}\right)$$

$$= \frac{11 - (-18)}{11}$$

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

$$= \frac{29}{11}$$

(vi)

$$0 - \left(\frac{-13}{9}\right)$$

$$= 0 + \frac{13}{9}$$

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

(vii)

Since the denominators of both the numbers are different therefore, we will take their LCM

LCM 0f 13 and 5 = 65

$$\frac{-6}{5} = \frac{-6 \times 13}{5 \times 13} = \frac{-78}{65}$$

And,

$$\frac{-32}{13} = \frac{-32 \times 5}{13 \times 5} = \frac{-160}{65}$$

Therefore,

$$\frac{-6}{5} - \left(\frac{-32}{13}\right)$$

$$= \frac{-78}{65} - \left(\frac{-160}{65}\right)$$

$$= \frac{-78 - (-160)}{65}$$

$$= \frac{-78 + 160}{65}$$

$$= \frac{82}{65}$$

(viii)

We can write, $-7 = \frac{-7}{1}$

Since the denominators of both the numbers are different therefore, we will take their LCM

LCM 0f 1 and 7 = 7

$$\frac{-7}{1}=\frac{-7\times 7}{1\times 7}=\frac{-49}{7}$$

And,

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

Therefore,

$$=\frac{-4}{7}-(-7)$$

$$=\frac{-4}{7}-\left(\frac{-49}{7}\right)$$

$$=\frac{-4-(-49)}{7}$$

$$=\frac{-4+49}{7}$$

$$=\frac{45}{7}$$

8. Question

Using the rearrangement property find the sum:

(i) $\frac{4}{3}+\frac{3}{5}+\frac{-2}{3}+\frac{-11}{5}$

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

(iii) $\frac{-13}{20}+\frac{11}{14}+\frac{-5}{7}+\frac{3}{10}$

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

Answer

Rearrangement property says that, the numbers in an addition expression may be arranged and grouped in any order.

Therefore,

(i) $\frac{4}{3}+\frac{3}{5}+\frac{-2}{3}+\frac{-11}{5}$

We arrange the numbers with same denominators together,

$$=\left(\frac{4}{3}+\frac{-2}{3}\right)+\left(\frac{3}{5}+\frac{-11}{5}\right)$$

$$=\left(\frac{4+(-2)}{3}\right)+\left(\frac{3+(-11)}{5}\right)$$

$$=\left(\frac{2}{3}\right)+\left(\frac{-8}{5}\right)$$

Now, we take LCM of 3 and 5=15

$$\frac{2}{3}=\frac{2\times5}{3\times5}=\frac{10}{15}$$

And,

$$\frac{-8}{5}=\frac{-8\times3}{5\times3}=\frac{-24}{15}$$

Therefore,

$$\left(\frac{2}{3}\right)+\left(\frac{-8}{5}\right)$$

$$=\left(\frac{10}{15}\right)+\left(\frac{-24}{15}\right)$$

$$=\frac{10+(-24)}{15}$$

$$=\frac{10-24}{15}$$

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

(ii)

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

We arrange the numbers,

$$=\left(\frac{-8}{3}+\frac{-11}{6}\right)+\left(\frac{-1}{4}+\frac{3}{8}\right)$$

LCM of 3 and 6 =6

$$\frac{-8}{3}=\frac{-8\times2}{3\times2}=\frac{-16}{6}$$

And,

$$\frac{-11}{6}=\frac{-11\times1}{6\times1}=\frac{-11}{6}$$

LCM of 4 and 8 =8

$$\frac{-1}{4}=\frac{-1\times2}{4\times2}=\frac{-2}{8}$$

And,

$$\frac{3}{8}=\frac{3\times1}{8\times1}=\frac{3}{8}$$

Now,

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

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

$$=\left(\frac{-27}{6}\right)+\left(\frac{1}{8}\right)$$

Now, we take LCM of 6 and 8=24

$$\frac{-27}{6}=\frac{-27\times 4}{6\times 4}=\frac{-108}{24}$$

And,

$$\frac{1}{8}=\frac{1\times 3}{8\times 3}=\frac{3}{24}$$

Therefore,

$$\left(\frac{-27}{6}\right)+\left(\frac{1}{8}\right)$$

$$=\left(\frac{-108}{24}\right)+\left(\frac{3}{24}\right)$$

$$=\frac{-108+3}{24}$$

$$=\frac{-105}{24}$$

In lowest terms,

$$\frac{-105}{24}=\frac{-105\div 3}{24\div 3}=\frac{-35}{8}$$

(iii)

$$\frac{-13}{20}+\frac{11}{14}+\frac{-5}{7}+\frac{7}{10}$$

We arrange the numbers,

$$=\left(\frac{-13}{20}+\frac{7}{10}\right)+\left(\frac{11}{14}+\frac{-5}{7}\right)$$

LCM of 20 and 10 =20

$$\frac{-13}{20}=\frac{-13\times 1}{20\times 1}=\frac{-13}{20}$$

And,

$$\frac{7}{10}=\frac{7\times 2}{10\times 2}=\frac{14}{20}$$

LCM of 14 and 7 =14

$$\frac{11}{14}=\frac{11\times 1}{14\times 1}=\frac{11}{14}$$

And,

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

Now,

$$\left(\frac{-13}{20}+\frac{14}{20}\right)+\left(\frac{11}{14}+\frac{-10}{14}\right)$$

$$=\left(\frac{-13+14}{20}\right)+\left(\frac{11+(-10)}{14}\right)$$

$= \left(\frac{1}{20}\right) + \left(\frac{1}{14}\right)$

Now, we take LCM of 20 and 14=140

$\frac{1}{20} = \frac{1 \times 7}{20 \times 7} = \frac{7}{140}$

And,

$\frac{1}{14} = \frac{1 \times 10}{14 \times 10} = \frac{10}{140}$

Therefore,

$\left(\frac{1}{20}\right) + \left(\frac{1}{14}\right)$

$= \left(\frac{7}{140}\right) + \left(\frac{10}{140}\right)$

$= \frac{7 + 10}{140}$

$= \frac{17}{140}$

(iv)

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

We arrange the numbers,

$= \left(\frac{-6}{7} + \frac{-15}{7}\right) + \left(\frac{-5}{6} + \frac{-4}{9}\right)$

LCM of 4 and 9 =18

$\frac{-4}{9} = \frac{-4 \times 2}{9 \times 2} = \frac{-8}{18}$

And,

$\frac{-5}{6} = \frac{-5 \times 3}{6 \times 3} = \frac{-15}{18}$

Now,

$\left(\frac{-6}{7} + \frac{-15}{7}\right) + \left(\frac{-8}{18} + \frac{-15}{18}\right)$

$= \left(\frac{-6 + (-15)}{7}\right) + \left(\frac{-8 + (-15)}{18}\right)$

$= \left(\frac{-6 - 15}{7}\right) + \left(\frac{-8 - 15}{18}\right)$

$= \left(\frac{-21}{7}\right) + \left(\frac{-23}{18}\right)$

In lowest terms,

$\frac{-21}{7} = \frac{-21 \div 7}{7 \div 7} = \frac{-3}{1}$

Now, we take LCM of 1 and 18=18

$$\frac{-3}{1} = \frac{-3 \times 18}{1 \times 18} = \frac{-54}{18}$$

And,

$$\frac{-23}{18} = \frac{-23 \times 1}{18 \times 1} = \frac{-23}{18}$$

Therefore,

$$= \left(\frac{-3}{1}\right) + \left(\frac{-23}{18}\right)$$

$$= \left(\frac{-54}{18}\right) + \left(\frac{-23}{18}\right)$$

$$= \frac{-54 + (-23)}{18}$$

$$= \frac{-54 - 23}{18}$$

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

9. Question

The sum of two rational numbers is -2. If one the numbers is $\frac{-14}{5}$, find the other.

Answer

Sum of two rational numbers = -2

One number = $\frac{-14}{5}$

Let the other rational number = x

Now,

According to question,

$$\frac{-14}{5} + x = -2$$

$$\Rightarrow x = -2 - \frac{-14}{5}$$

$$\Rightarrow x = \frac{-10 - (-14)}{5}$$

$$\Rightarrow x = \frac{-10 + 14}{5}$$

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

Therefore, the other rational number is $\frac{4}{5}$

10. Question

The sum of two rational numbers is $\frac{-1}{2}$. If one of the numbers is $\frac{5}{6}$, find the other.

Answer

Sum of two rational numbers = $\frac{-1}{2}$

One number = $\frac{5}{6}$

Let the other rational number = x

Now,

According to question,

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

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

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

$$\Rightarrow x=\frac{-8}{6}$$

In lowest terms,

$$x=\frac{-8\div 2}{6\div 2}=\frac{-4}{3}$$

Therefore, the other rational number is $\frac{-4}{3}$

11. Question

What number should be added to $\frac{-5}{8}$ so as to get $\frac{-3}{2}$?

Answer

Let the number = x

Now,

According to question,

$$\frac{-5}{8}+x=\frac{-3}{2}$$

$$\Rightarrow x=\frac{-3}{2}-\frac{-5}{8}$$

$$\Rightarrow x=\frac{-12-(-5)}{8}$$

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

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

Therefore, $\frac{-7}{8}$ should be added to $\frac{-5}{8}$ so as to get $\frac{-3}{2}$

12. Question

What number should be added to -1 so as to get $\frac{5}{7}$?

Answer

Let the number = x

Now,

According to question,

$$-1 + x = \frac{5}{7}$$

$$\Rightarrow x = \frac{5}{7} - (-1)$$

$$\Rightarrow x = \frac{5 - (-7)}{7}$$

$$\Rightarrow x = \frac{5 + 7}{7}$$

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

Therefore, $\frac{12}{7}$ should be added to -1 so as to get $\frac{5}{7}$

13. Question

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

Answer

Let the number = x

Now,

According to question,

$$\frac{-2}{3} - x = \frac{-1}{6}$$

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

$$\Rightarrow x = \frac{-4 - (-1)}{6}$$

$$\Rightarrow x = \frac{-4 + 1}{6}$$

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

In lowest terms,

$$x = \frac{-3 \div 3}{6 \div 3} = \frac{-1}{2}$$

Therefore, $\frac{-1}{2}$ should be subtracted from $\frac{-2}{3}$ so as to get $\frac{-1}{6}$

14. Question

(i) Which rational number is its own additive inverse?

(ii) Is the difference of two rational numbers a rational number?

(iii) Is addition commutative on rational numbers?

(iv) Is addition associative on rational numbers?

(v) Is subtraction commutative on rational numbers?

(vi) Is subtraction associative on rational numbers?

(vii) What is the negative of a negative rational number?

Answer

(i) A Additive inverse of a number $\frac{a}{b}$ is the number $-\frac{a}{b}$ such that, $\frac{a}{b}+\left(\frac{-a}{b}\right)=0$

0 is the rational number that is its own additive inverse

(ii) Let there be 2 rational numbers, $\frac{a}{b}$ and $\frac{c}{d}$ where, b≠0 and d≠0

$$\frac{a}{b}-\frac{c}{d}$$

LCM of b and d = bd

$$=\frac{ad-bc}{bd}$$

Where, bd ≠ 0

Therefore, $\frac{ad-bc}{bd}$ is a rational number

Hence,

Yes, the difference of two rational numbers a rational number

(iii) Yes, addition is commutative on rational numbers

Let there be 2 rational numbers, $\frac{a}{b}$ and $\frac{c}{d}$ where, b≠0 and d≠0

Then,

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

(iv) Yes, addition is associative on rational numbers

Let there be 3 rational numbers, $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ where, b≠0 , d≠0 and f≠0

Then,

$$\frac{a}{b}+\left(\frac{c}{d}+\frac{e}{f}\right)=\left(\frac{a}{b}+\frac{c}{d}\right)+\frac{e}{f}$$

(v) No, subtraction is not commutative on rational numbers

Let there be 2 rational numbers, $\frac{a}{b}$ and $\frac{c}{d}$ where, b≠0 and d≠0

Then,

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

(vi) No, addition is not associative on rational numbers

Let there be 3 rational numbers, $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ where, b≠0 , d≠0 and f≠0

Then,

$$\frac{a}{b}+\left(\frac{c}{d}+\frac{e}{f}\right) \neq \left(\frac{a}{b}+\frac{c}{d}\right)+\frac{e}{f}$$

(vii) Negative of a negative rational number is the number itself without the negative sign.

Exercise 1D

1. Question

Find each of the following products:

(i) $\frac{3}{5}\times\frac{-7}{8}$ (ii) $\frac{-9}{2}\times\frac{5}{4}$ (iii) $\frac{-6}{11}\times\frac{-5}{3}$

(iv) $\frac{-2}{3}\times\frac{6}{7}$ (v) $\frac{-12}{5}\times\frac{10}{-3}$ (vi) $\frac{25}{-9}\times\frac{3}{-10}$

(vii) $\frac{5}{-18}\times\frac{-9}{20}$ (viii) $\frac{-13}{15}\times\frac{-25}{26}$ (ix) $\frac{16}{-21}\times\frac{14}{5}$

(x) $\frac{-7}{6}\times 24$ (xi) $\frac{7}{24}\times(-48)$

(xii) $\frac{-13}{5}\times(-10)$

Answer

(i)

$$\frac{3}{5}\times\frac{-7}{8}$$

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

$$=\frac{-21}{40}$$

(ii)

$$\frac{-9}{2}\times\frac{5}{4}$$

$$=\frac{-9\times 5}{2\times 4}$$

$$=\frac{-45}{8}$$

(iii)

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

$$=\frac{-6\times -5}{11\times 3}$$

$= \frac{30}{33}$

In lowest terms,

$\frac{30}{33} = \frac{30 \div 3}{33 \div 3} = \frac{10}{11}$

(iv)

$\frac{-2}{3} \times \frac{6}{7}$

$= \frac{-2 \times 6}{3 \times 7}$

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

In lowest terms,

$\frac{-12}{21} = \frac{-12 \div 3}{21 \div 3} = \frac{-4}{7}$

(v)

$\frac{-12}{5} \times \frac{10}{-3}$

$= \frac{-12 \times 10}{5 \times -3}$

$= \frac{-120}{-15} = \frac{-120 \times -1}{-15 \times -1} = \frac{120}{15}$

In lowest terms,

$\frac{120}{15} = \frac{120 \div 3}{15 \div 3} = \frac{40}{5}$

Further,

$\frac{40}{5} = \frac{40 \div 5}{5 \div 5} = \frac{8}{1} = 8$

(vi)

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

$= \frac{25 \times 3}{-9 \times -10}$

$= \frac{75}{90}$

In lowest terms,

$\frac{75}{90} = \frac{75 \div 15}{90 \div 15} = \frac{5}{6}$

(vii)

$\frac{5}{-18} \times \frac{-9}{20}$

$$= \frac{5 \times -9}{-18 \times 20}$$

$$= \frac{-45}{-360} = \frac{-45 \times -1}{-360 \times -1} = \frac{45}{360}$$

In lowest terms,

$$\frac{45}{360} = \frac{45 \div 45}{360 \div 45} = \frac{1}{8}$$

(viii)

$$\frac{-13}{15} \times \frac{-25}{26}$$

$$= \frac{-13 \times -25}{15 \times 26}$$

$$= \frac{325}{390}$$

In lowest terms,

$$\frac{325}{390} = \frac{325 \div 5}{390 \div 5} = \frac{65}{78}$$

Further,

$$\frac{65}{78} = \frac{65 \div 13}{78 \div 13} = \frac{5}{6}$$

(ix)

$$\frac{16}{-21} \times \frac{14}{5}$$

$$= \frac{16 \times 14}{-21 \times 5}$$

$$= \frac{224}{-105} = \frac{224 \times -1}{-105 \times -1} = \frac{-224}{105}$$

In lowest terms,

$$\frac{-224}{105} = \frac{-224 \div 7}{105 \div 7} = \frac{-32}{15}$$

(x)

$$\frac{-7}{6} \times 24$$

$$= \frac{-7}{6} \times \frac{24}{1}$$

$$= \frac{-7 \times 24}{6 \times 1}$$

$$= \frac{-168}{6}$$

In lowest terms,

$$\frac{-168}{6} = \frac{-168 \div 2}{6 \div 2} = \frac{-84}{3}$$

Further,

$$\frac{-84}{3}=\frac{-84\div 3}{3\div 3}=\frac{-28}{1}=-28$$

(xi)

$$\frac{7}{24}\times -48$$

$$=\frac{7}{24}\times\frac{-48}{1}$$

$$=\frac{7\times -48}{24\times 1}$$

$$=\frac{-336}{24}$$

In lowest terms,

$$\frac{-336}{24}=\frac{-336\div 4}{24\div 4}=\frac{-84}{6}$$

Further,

$$\frac{-84}{6}=\frac{-84\div 6}{6\div 6}=\frac{-14}{1}=-14$$

(xii)

$$\frac{-13}{5}\times -10$$

$$=\frac{-13}{5}\times\frac{-10}{1}$$

$$=\frac{-13\times -10}{5\times 1}$$

$$=\frac{130}{5}$$

In lowest terms,

$$\frac{130}{5}=\frac{130\div 5}{5\div 5}=\frac{26}{1}=26$$

2. Question

Verify each of the following:

(i) $\frac{3}{5}\times\frac{-5}{9}=\frac{-5}{9}\times\frac{3}{7}$ (ii) $\frac{-8}{7}\times\frac{13}{9}=\frac{13}{9}\times\frac{-8}{7}$

(iii) $\frac{-12}{5}\times\frac{7}{-36}=\frac{7}{-36}\times\frac{-12}{5}$

(iv) $-8\times\frac{-13}{12}=\frac{-13}{12}\times(-8)$

Answer

(i)

$$\text{LHS} = \frac{3}{7} \times \frac{-5}{9}$$

$$= \frac{3 \times -5}{7 \times 9}$$

$$= \frac{-15}{63}$$

In lowest terms,

$$\frac{-15}{63} = \frac{-15 \div 3}{63 \div 3} = \frac{-5}{21}$$

$$\text{RHS} = \frac{-5}{9} \times \frac{3}{7}$$

$$= \frac{-5 \times 3}{9 \times 7}$$

$$= \frac{-15}{63}$$

In lowest terms,

$$\frac{-15}{63} = \frac{-15 \div 3}{63 \div 3} = \frac{-5}{21}$$

LHS=RHS

Verified

(ii)

$$\text{LHS} = \frac{-8}{7} \times \frac{13}{9}$$

$$= \frac{-8 \times 13}{7 \times 9}$$

$$= \frac{-104}{63}$$

$$\text{RHS} = \frac{13}{9} \times \frac{-8}{7}$$

$$= \frac{13 \times -8}{9 \times 7}$$

$$= \frac{-104}{63}$$

LHS=RHS

Verified

(iii)

$$\text{LHS} = \frac{-12}{5} \times \frac{7}{-36}$$

$$= \frac{-12 \times 7}{5 \times -36}$$

$$= \frac{-84}{-180} = \frac{-84 \times -1}{-180 \times -1} = \frac{84}{180}$$

In lowest terms,

$$\frac{84}{180}=\frac{84\div 12}{180\div 12}=\frac{7}{15}$$

$$\text{RHS}=\frac{7}{-36}\times\frac{-12}{5}$$

$$=\frac{7\times -12}{-36\times 5}$$

$$=\frac{-84}{-180}=\frac{-84\times -1}{-180\times -1}=\frac{84}{180}$$

In lowest terms,

$$\frac{84}{180}=\frac{84\div 12}{180\div 12}=\frac{7}{15}$$

LHS=RHS

Verified

(iv)

$$\text{LHS}=-8\ \times\frac{-13}{12}$$

$$=\frac{-8\times -13}{12}$$

$$=\frac{104}{12}$$

In lowest terms,

$$\frac{104}{12}=\frac{104\div 4}{12\div 4}=\frac{26}{3}$$

$$\text{RHS}=\frac{-13}{12}\times -8$$

$$=\frac{-13\times -8}{12}$$

$$=\frac{104}{12}$$

In lowest terms,

$$\frac{104}{12}=\frac{104\div 4}{12\div 4}=\frac{26}{3}$$

LHS=RHS

Verified

3. Question

Verify each of the following:

$$\text{(i)}\left(\frac{5}{7}\times\frac{12}{13}\right)\times\frac{7}{18}=\frac{5}{7}\times\left(\frac{12}{13}\times\frac{7}{18}\right)$$

(ii) $\frac{-13}{24}\times\left(\frac{-12}{5}\times\frac{35}{36}\right)=\left(\frac{-13}{24}\times\frac{-12}{5}\right)\times\frac{35}{36}$

(iii) $\left(\frac{-9}{5}\times\frac{-10}{3}\right)\times\frac{21}{-4}=\frac{-9}{5}\times\left(\frac{-10}{3}\times\frac{21}{-4}\right)$

Answer

(i)

$\left(\frac{5}{7}\times\frac{12}{13}\right)\times\frac{7}{18}=\frac{5}{7}\times\left(\frac{12}{13}\times\frac{7}{18}\right)$

$\text{LHS}=\left(\frac{5}{7}\times\frac{12}{13}\right)\times\frac{7}{18}$

$=\frac{5\times12}{7\times13}\times\frac{7}{18}$

$=\frac{60}{91}\times\frac{7}{18}$

$=\frac{60\times7}{91\times18}$

$=\frac{420}{1638}$

In lowest terms,

$\frac{420}{1638}=\frac{420\div42}{1638\div42}=\frac{10}{13}$

$\text{RHS}=\frac{5}{7}\times\left(\frac{12}{13}\times\frac{7}{18}\right)$

$=\frac{5}{7}\times\frac{12\times7}{13\times18}$

$=\frac{5}{7}\times\frac{84}{234}$

$=\frac{420}{1638}$

In lowest terms,

$\frac{420}{1638}=\frac{420\div42}{1638\div42}=\frac{10}{13}$

LHS=RHS

Verified

(ii)

$\frac{-13}{24}\times\left(\frac{-12}{5}\times\frac{35}{36}\right)=\left(\frac{-13}{24}\times\frac{-12}{5}\right)\times\frac{35}{36}$

$\text{LHS}=\frac{-13}{24}\times\left(\frac{-12}{5}\times\frac{35}{36}\right)$

$=\frac{-13}{24}\times\frac{-12\times35}{5\times36}$

$= \frac{-13}{24} \times \frac{-420}{180}$

$= \frac{60 \times 7}{24 \times 180}$

$= \frac{5460}{4320}$

In lowest terms,

$\frac{5460}{4320} = \frac{5460 \div 10}{4320 \div 10} = \frac{546}{432}$

Further,

$\frac{546}{432} = \frac{546 \div 6}{432 \div 6} = \frac{91}{72}$

$\text{RHS} = \left(\frac{-13}{24} \times \frac{-12}{5}\right) \times \frac{35}{36}$

$= \frac{-13 \times -12}{24 \times 5} \times \frac{35}{36}$

$= \frac{156}{120} \times \frac{35}{36}$

$= \frac{156 \times 35}{120 \times 36}$

$= \frac{5460}{4320}$

In lowest terms,

$\frac{5460}{4320} = \frac{5460 \div 10}{4320 \div 10} = \frac{546}{432}$

Further,

$\frac{546}{432} = \frac{546 \div 6}{432 \div 6} = \frac{91}{72}$

LHS=RHS

Verified

(iii)

$\left(\frac{-9}{5} \times \frac{-10}{3}\right) \times \frac{21}{-4} = \frac{-9}{5} \times \left(\frac{-10}{3} \times \frac{21}{-4}\right)$

$\text{LHS} = \left(\frac{-9}{5} \times \frac{-10}{3}\right) \times \frac{21}{-4}$

$= \frac{-9 \times -10}{5 \times 3} \times \frac{21}{-4}$

$= \frac{90}{15} \times \frac{21}{-4}$

$= \frac{90 \times 21}{15 \times -4}$

$$= \frac{1890}{-60} = \frac{1890 \times -1}{-60 \times -1} = \frac{-1890}{60}$$

In lowest terms,

$$\frac{-1890}{60} = \frac{-1890 \div 10}{60 \div 10} = \frac{-189}{6}$$

Further,

$$\frac{-189}{6} = \frac{-189 \div 3}{6 \div 3} = \frac{-63}{2}$$

$$\text{RHS} = \frac{-9}{5} \times \left(\frac{-10}{3} \times \frac{21}{-4}\right)$$

$$= \frac{-9}{5} \times \frac{-10 \times 21}{3 \times -4}$$

$$= \frac{-9}{5} \times \frac{-210}{-12}$$

$$= \frac{-9 \times -210}{5 \times -12}$$

$$= \frac{1890}{-60} = \frac{1890 \times -1}{-60 \times -1} = \frac{-1890}{60}$$

In lowest terms,

$$\frac{-1890}{60} = \frac{-1890 \div 10}{60 \div 10} = \frac{-189}{6}$$

Further,

$$\frac{-189}{6} = \frac{-189 \div 3}{6 \div 3} = \frac{-63}{2}$$

LHS=RHS

Verified

4. Question

Fill in the blanks:

(i) $\frac{-23}{17} \times \frac{18}{35} = \frac{18}{35} \times (....)$

(ii) $-38 \times \frac{-7}{19} = \frac{-7}{19} \times (....)$

(iii) $\left(\frac{15}{7} \times \frac{-21}{10}\right) \times \frac{-5}{6} = (....) \times \left(\frac{-21}{10} \times \frac{-5}{6}\right)$

(iv) $\frac{-12}{5} \times \left(\frac{4}{15} \times \frac{25}{-16}\right) = \left(\frac{-12}{5} \times \frac{4}{15}\right) \times (....)$

Answer

(i)

By Commutative Property, i.e, a × b = b × a

$$\frac{-23}{17}\times\frac{18}{35}=\frac{18}{35}\times\frac{-23}{17}$$

(ii)

By Commutative Property, i.e, a × b = b × a

$$-38\times\frac{-7}{19}=\frac{-7}{19}\times-38$$

(iii)

By Associative Property, i.e, (a × b) × c = a × (b × c)

$$\left(\frac{15}{7}\times\frac{-21}{10}\right)\times\frac{-5}{6}=\frac{15}{7}\times\left(\frac{-21}{10}\times\frac{-5}{6}\right)$$

(iv)

By Associative Property, i.e, (a × b) × c = a × (b × c)

$$\frac{-12}{5}\times\left(\frac{4}{15}\times\frac{25}{-16}\right)=\left(\frac{-12}{5}\times\frac{4}{15}\right)\times\frac{25}{-16}$$

5. Question

Find the multiplicative inverse (i.e., reciprocal) of:

(i) $\frac{13}{25}$ (ii) $\frac{-17}{12}$ (iii) $\frac{-7}{24}$ (iv) 18 (v) -6

(vi) $\frac{-3}{-5}$ (vii) -1 (viii) $\frac{0}{2}$ (ix) $\frac{2}{-5}$ (x) $\frac{-1}{8}$

Answer

A multiplicative inverse for a number x, is a number which when multiplied by x yields the multiplicative identity, 1

The multiplicative inverse of a rational number $\frac{a}{b}$ is $\frac{b}{a}$.

Therefore,

(i) The multiplicative inverse of $\frac{13}{25}=\frac{25}{13}$.

(ii) The multiplicative inverse of $\frac{-17}{12}=\frac{12}{-17}$.

In standard form,

$$\frac{12}{-17}=\frac{12\times-1}{-17\times-1}=\frac{-12}{17}$$

(iii) The multiplicative inverse of $\frac{-7}{24}=\frac{24}{-7}$.

In standard form,

$$\frac{24}{-7}=\frac{24\times-1}{-7\times-1}=\frac{-24}{7}$$

.

(iv) The multiplicative inverse of $18=\frac{1}{18}$.

(v) The multiplicative inverse of $-6=\frac{1}{-6}$.

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

(vi) The multiplicative inverse of $\frac{-3}{-5}=\frac{-5}{-3}$.

In standard form,

$$\frac{-5}{-3}=\frac{-5\times-1}{-3\times-1}=\frac{3}{5}$$

(vii) The multiplicative inverse of -1 =-1.

(viii) The multiplicative inverse of $\frac{0}{2}$ is undefined.

Since, $\frac{2}{0}$ is undefined.

(ix) The multiplicative inverse of $\frac{2}{-5}=\frac{-5}{2}$.

(x) The multiplicative inverse of $\frac{-1}{8}=\frac{8}{-1}$.

In standard form,

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

6. Question

Find the value of:

(i) $\left(\frac{5}{8}\right)^{-1}$ (ii) $\left(\frac{-4}{9}\right)^{-1}$ (iii) $(-7)^{-1}$ (iv) $\left(\frac{1}{-3}\right)^{-1}$

Answer

Let there be a rational number $\frac{a}{b}$ then $(\frac{a}{b})^{-1}=\frac{b}{a}$

Therefore,

(i)

$$\left(\frac{5}{8}\right)^{-1}=\frac{8}{5}$$

(ii)

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

(iii)

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

(iv)

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

7. Question

Verify the following:

(i) $\frac{3}{7}\times\left(\frac{5}{6}+\frac{12}{13}\right)=\left(\frac{3}{7}\times\frac{5}{6}\right)+\left(\frac{3}{7}\times\frac{12}{13}\right)$

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

(iii) $\left(\frac{-8}{3}+\frac{-13}{12}\right)\times\frac{5}{6}=\left(\frac{-8}{3}\times\frac{5}{6}\right)+\left(\frac{-13}{12}\times\frac{5}{6}\right)$

(iv) $\frac{-16}{7}\times\left(\frac{-8}{9}+\frac{-7}{6}\right)=\left(\frac{-16}{7}\times\frac{-8}{9}\right)+\left(\frac{-16}{7}\times\frac{-7}{6}\right)$

Answer

(i)

$\frac{3}{7}\times\left(\frac{5}{6}+\frac{12}{13}\right)=\left(\frac{3}{7}\times\frac{5}{6}\right)+\left(\frac{3}{7}\times\frac{12}{13}\right)$

$\text{LHS}=\frac{3}{7}\times\left(\frac{5}{6}+\frac{12}{13}\right)$

$=\frac{3}{7}\times\left(\frac{5\times13+12\times6}{78}\right)$

$=\frac{3}{7}\times\left(\frac{65+72}{78}\right)$

$=\frac{3}{7}\times\left(\frac{137}{78}\right)$

$=\frac{3\times137}{7\times78}$

$=\frac{411}{546}$

In lowest terms,

$\frac{411}{546}=\frac{411\div3}{546\div3}=\frac{137}{182}$

$\text{RHS}=\left(\frac{3}{7}\times\frac{5}{6}\right)+\left(\frac{3}{7}\times\frac{12}{13}\right)$

$=\left(\frac{3\times5}{7\times6}\right)+\left(\frac{3\times12}{7\times13}\right)$

$=\frac{15}{42}+\left(\frac{36}{91}\right)$

$=\frac{15\times13+36\times6}{546}$

$=\frac{195+216}{546}$

$=\frac{411}{546}$

In lowest terms,

$$\frac{411}{546}=\frac{411\div 3}{546\div 3}=\frac{137}{182}$$

LHS=RHS

Verified

(ii)

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

$$\text{LHS}=\frac{-15}{4}\times\left(\frac{3}{7}+\frac{-12}{5}\right)$$

$$=\frac{-15}{4}\times\left(\frac{3\times 5+(-12)\times 7}{35}\right)$$

$$=\frac{-15}{4}\times\left(\frac{15-84}{35}\right)$$

$$=\frac{-15}{4}\times\left(\frac{-69}{35}\right)$$

$$=\frac{-15\times -69}{4\times 35}$$

$$=\frac{1035}{140}$$

In lowest terms,

$$\frac{1035}{140}=\frac{1035\div 5}{140\div 5}=\frac{207}{28}$$

$$\text{RHS}=\left(\frac{-15}{4}\times\frac{3}{7}\right)+\left(\frac{-15}{4}\times\frac{-12}{5}\right)$$

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

$$=\frac{-45}{28}+\left(\frac{180}{20}\right)$$

$$=\frac{-45\times 5+180\times 7}{140}$$

$$=\frac{-225+1260}{140}$$

$$=\frac{1035}{140}$$

In lowest terms,

$$\frac{1035}{140}=\frac{1035\div 5}{140\div 5}=\frac{207}{28}$$

LHS=RHS

Verified

(iii)

$$\left(\frac{-8}{3}+\frac{-13}{12}\right)\times\frac{5}{6}=\left(\frac{-8}{3}\times\frac{5}{6}\right)+\left(\frac{-13}{12}\times\frac{5}{6}\right)$$

$$\text{LHS} = \left(\frac{-8}{3} + \frac{-13}{12}\right) \times \frac{5}{6}$$

$$= \left(\frac{-8 \times 4 + (-13) \times 1}{12}\right) \times \left(\frac{5}{6}\right)$$

$$= \left(\frac{-32 - 13}{12}\right) \times \left(\frac{5}{6}\right)$$

$$= \frac{-45}{12} \times \frac{5}{6}$$

$$= \frac{-45 \times 5}{12 \times 6}$$

$$= \frac{-225}{72}$$

In lowest terms,

$$\frac{-225}{72} = \frac{-225 \div 9}{72 \div 9} = \frac{-25}{8}$$

$$\text{RHS} = \left(\frac{-8}{3} \times \frac{5}{6}\right) + \left(\frac{-13}{12} \times \frac{5}{6}\right)$$

$$= \left(\frac{-8 \times 5}{3 \times 6}\right) + \left(\frac{-13 \times 5}{12 \times 6}\right)$$

$$= \frac{-40}{18} + \left(\frac{-65}{72}\right)$$

$$= \frac{-40 \times 4 + (-65) \times 1}{72}$$

$$= \frac{-160 - 65}{72}$$

$$= \frac{-225}{72}$$

In lowest terms,

$\frac{-225}{72} = \frac{-225 \div 9}{72 \div 9} = \frac{-25}{8}$

LHS=RHS

Verified

(iv)

$$\frac{-16}{7} \times \left(\frac{-8}{9} + \frac{-7}{6}\right) = \left(\frac{-16}{7} \times \frac{-8}{9}\right) + \left(\frac{-16}{7} \times \frac{-7}{6}\right)$$

$$\text{LHS} = \frac{-16}{7} \times \left(\frac{-8}{9} + \frac{-7}{6}\right)$$

$$= \frac{-16}{7} \times \left(\frac{-8 \times 2 + (-7) \times 3}{18}\right)$$

$$= \frac{-16}{7} \times \left(\frac{-16 - 21}{18}\right)$$

$$= \frac{-16}{7} \times \left(\frac{-37}{18}\right)$$

$= \frac{-16 \times -37}{7 \times 18}$

$= \frac{592}{126}$

In lowest terms,

$\frac{592}{126} = \frac{592 \div 2}{126 \div 2} = \frac{296}{63}$

$\text{RHS} = \left(\frac{-16}{7} \times \frac{-8}{9}\right) + \left(\frac{-16}{7} \times \frac{-7}{6}\right)$

$= \left(\frac{-16 \times -8}{7 \times 9}\right) + \left(\frac{-16 \times -7}{7 \times 6}\right)$

$= \frac{128}{63} + \left(\frac{112}{42}\right)$

$= \frac{128 \times 2 + 112 \times 3}{126}$

$= \frac{256 + 336}{126}$

$= \frac{592}{126}$

In lowest terms,

$\frac{592}{126} = \frac{592 \div 2}{126 \div 2} = \frac{296}{63}$

LHS=RHS

Verified

8. Question

Name the property of multiplication illustrated by each of the following statements:

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

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

(iii) $\frac{-3}{4} \times \left(\frac{-5}{6} + \frac{7}{8}\right) = \left(\frac{-3}{4} \times \frac{-5}{6}\right) + \left(\frac{-3}{4} \times \frac{7}{8}\right)$

(iv) $\frac{-16}{9} \times 1 = 1 \times \frac{-16}{9} = \frac{-16}{9}$

(v) $\frac{-11}{15} \times \frac{15}{-11} = \frac{15}{-11} \times \frac{-11}{15} = 1$

(vi) $\frac{-7}{5} \times 0 = 0$

Answer

(i) Commutative law i.e., a b = b a

(ii) Associative law i.e., a(bc) = (ab)c

(iii) Distributive law i.e., a(b + c) = ab + ac

(iv) Property of multiplicative identity i.e., a× 1=1× a

(v) Property of multiplicative inverse i.e., $\frac{a}{b} \times \frac{b}{a}=1$

(vi) Multiplicative property of 0 i.e., a× 0=0

9. Question

Fill in the blanks:

(i) The product of a rational number and its reciprocal is.....

(ii) Zero has.....reciprocal.

(iii) The numbers..... and....are their own reciprocals.

(iv) Zero is.....the reciprocal of any number.

(v) The reciprocal of a, where $a \neq 0$, is.....

(vi) The reciprocal of $\frac{1}{a}$, where $a \neq 0$, is.....

(vii) The reciprocal of a positive rational number is.....

(viii) The reciprocal of a negative rational number is.....

Answer

(i) 1

(ii) No

(iii) 1 and -1

(iv) Not

(v) $\frac{1}{a}$

(vi) a

(vii) Positive

(viii) Negative

Exercise 1E

1. Question

Simplify:

(i) $\frac{4}{9} \div \frac{-5}{12}$ (ii) $-8 \div \frac{-7}{16}$ (iii) $\frac{-12}{7} \div (-18)$ (iv) $\frac{-1}{10} \div \frac{-8}{5}$ (v) $\frac{-16}{35} \div \frac{-15}{14}$ (vi) $\frac{-65}{14} \div \frac{13}{7}$

Answer

(i)

$\frac{4}{9} \div \frac{-5}{12}$

$$= \frac{4}{9} \times \frac{12}{-5}$$

$$= \frac{4 \times 12}{9 \times -5}$$

$$= \frac{48}{-45} = \frac{48 \times -1}{-45 \times -1} = \frac{-48}{45}$$

In lowest terms,

$$\frac{-48}{45} = \frac{-48 \div 3}{45 \div 3} = \frac{-16}{15}$$

(ii)

$$-8 \div \frac{-7}{16}$$

$$= \frac{-8}{1} \div \frac{-7}{16}$$

$$= \frac{-8}{1} \times \frac{16}{-7}$$

$$= \frac{-8 \times 16}{1 \times -7}$$

$$= \frac{-128}{-7} = \frac{-128 \times -1}{-7 \times -1} = \frac{128}{7}$$

(iii)

$$\frac{-12}{7} \div -18$$

$$= \frac{-12}{7} \div \frac{-18}{1}$$

$$= \frac{-12}{7} \times \frac{1}{-18}$$

$$= \frac{-12 \times 1}{7 \times -18}$$

$$= \frac{-12}{-126} = \frac{-12 \times -1}{-126 \times -1} = \frac{12}{126}$$

In lowest terms,

$$\frac{12}{126} = \frac{12 \div 6}{126 \div 6} = \frac{2}{21}$$

(iv)

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

$$= \frac{-1}{10} \times \frac{5}{8}$$

$$= \frac{-1 \times 5}{10 \times -8}$$

$$= \frac{-5}{-80} = \frac{-5 \times -1}{-80 \times -1} = \frac{5}{80}$$

In lowest terms,

$$\frac{5}{80}=\frac{5\div 5}{80\div 5}=\frac{1}{16}$$

(v)

$$\frac{-16}{35}\div\frac{-15}{14}$$

$$=\frac{-16}{35}\times\frac{14}{-15}$$

$$=\frac{-16\times 14}{35\times -15}$$

$$=\frac{-224}{-525}=\frac{-224\times -1}{-525\times -1}=\frac{224}{525}$$

In lowest terms,

$$\frac{224}{525}=\frac{224\div 7}{525\div 7}=\frac{32}{75}$$

(vi)

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

$$=\frac{-65}{14}\times\frac{7}{13}$$

$$=\frac{-65\times 7}{14\times 13}$$

$$=\frac{-455}{182}=\frac{-455\times -1}{182\times -1}=\frac{-455}{182}$$

In lowest terms,

$$\frac{-455}{182}=\frac{-455\div 7}{182\div 7}=\frac{-65}{26}$$

Further,

$$\frac{-65}{26}=\frac{-65\div 13}{26\div 13}=\frac{-5}{2}$$

2. Question

Verify whether the given statement is true or false:

(i) $\frac{13}{5}\div\frac{26}{10}=\frac{26}{10}\div\frac{13}{5}$

(ii) $-9\div\frac{3}{4}=\frac{3}{4}\div(-9)$

(iii) $\frac{-8}{9}\div\frac{-4}{3}=\frac{-4}{3}\div\frac{-8}{9}$

(iv) $\frac{-7}{24}\div\frac{3}{-16}=\frac{3}{-16}\div\frac{-7}{24}$

Answer

(i)

$\frac{13}{5} \div \frac{26}{10} = \frac{26}{10} \div \frac{13}{5}$

$\text{LHS} = \frac{13}{5} \div \frac{26}{10}$

$= \frac{13}{5} \times \frac{10}{26}$

$= \frac{13 \times 10}{5 \times 26}$

$= \frac{130}{130} = 1$

$\text{RHS} = \frac{26}{10} \div \frac{13}{5}$

$= \frac{26}{10} \times \frac{5}{13}$

$= \frac{26 \times 5}{10 \times 13}$

$= \frac{130}{130} = 1$

Since, RHS = LHS

Therefore, True

(ii)

$-9 \div \frac{3}{4} = \frac{3}{4} \div (-9)$

$\text{LHS} = -9 \div \frac{3}{4}$

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

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

$= \frac{-36}{3} = -12$

$\text{RHS} = \frac{3}{4} \div (-9)$

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

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

$= \frac{3}{-36} = \frac{-1}{12}$

Since, RHS ≠ LHS

Therefore, False

(iii)

$$\frac{-8}{9} \div \frac{-4}{3} = \frac{-4}{3} \div \frac{-8}{9}$$

$$\text{LHS} = \frac{-8}{9} \div \frac{-4}{3}$$

$$= \frac{-8}{9} \times \frac{3}{-4}$$

$$= \frac{-8 \times 3}{9 \times -4}$$

$$= \frac{-24}{-36} = \frac{2}{3}$$

$$\text{RHS} = \frac{-4}{3} \div \frac{-8}{9}$$

$$= \frac{-4}{3} \times \frac{9}{-8}$$

$$= \frac{-4 \times 9}{3 \times -8}$$

$$= \frac{-36}{-24} = \frac{3}{2}$$

Since, RHS ≠ LHS

Therefore, False

(iv)

$$\frac{-7}{24} \div \frac{3}{-16} = \frac{3}{-16} \div \frac{-7}{24}$$

$$\text{LHS} = \frac{-7}{24} \div \frac{3}{-16}$$

$$= \frac{-7}{24} \times \frac{-16}{3}$$

$$= \frac{-7 \times -16}{24 \times 3}$$

$$= \frac{112}{72} = \frac{14}{9}$$

$$\text{RHS} = \frac{3}{-16} \div \frac{-7}{24}$$

$$= \frac{3}{-16} \times \frac{24}{-7}$$

$$= \frac{3 \times 24}{-16 \times -7}$$

$$= \frac{72}{112} = \frac{9}{14}$$

Since, RHS ≠ LHS

Therefore, False

3. Question

Verify whether the given statement is true or false:

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

(ii) $\left\{(-16)\div\frac{6}{5}\right\}\div\frac{-9}{10}=(-16)\div\left\{\frac{6}{5}\div\frac{-9}{10}\right\}$

(iii) $\left(\frac{-3}{5}\div\frac{-12}{35}\right)\div\frac{1}{14}=\frac{-3}{5}\div\left(\frac{-12}{35}\div\frac{1}{14}\right)$

Answer

(i)

$\left(\frac{5}{9}\div\frac{1}{3}\right)\div\frac{5}{2}=\frac{5}{9}\div\left(\frac{1}{3}\div\frac{5}{2}\right)$

$\text{LHS}=\left(\frac{5}{9}\div\frac{1}{3}\right)\div\frac{5}{2}$

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

$=\left(\frac{5\times3}{9\times1}\right)\div\frac{5}{2}$

$=\frac{15}{9}\div\frac{5}{2}$

$=\frac{15}{9}\times\frac{2}{5}$

$=\frac{15\times2}{9\times5}$

$=\frac{30}{45}=\frac{30\div15}{45\div15}=\frac{2}{3}$

$\text{RHS}=\frac{5}{9}\div\left(\frac{1}{3}\div\frac{5}{2}\right)$

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

$=\frac{5}{9}\div\frac{2}{15}$

$=\frac{5}{9}\times\frac{15}{2}$

$=\frac{5\times15}{9\times2}$

$=\frac{75}{18}=\frac{75\div3}{18\div3}=\frac{25}{6}$

RHS ≠ LHS

Hence, False

(ii)

$$\left(-16 \div \frac{6}{5}\right) \div \frac{-9}{10} = -16 \div \left(\frac{6}{5} \div \frac{-9}{10}\right)$$

$$\text{LHS} = \left(-16 \div \frac{6}{5}\right) \div \frac{-9}{10}$$

$$= \left(\frac{-16}{1} \div \frac{6}{5}\right) \div \frac{-9}{10}$$

$$= \left(\frac{-16}{1} \times \frac{5}{6}\right) \div \frac{-9}{10}$$

$$= \left(\frac{-16 \times 5}{1 \times 6}\right) \div \frac{-9}{10}$$

$$= \frac{-80}{6} \div \frac{-9}{10}$$

$$= \frac{-80}{6} \times \frac{10}{-9}$$

$$= \frac{-80 \times 10}{6 \times -9}$$

$$= \frac{-800}{-54} = \frac{800}{54} = \frac{800 \div 2}{54 \div 2} = \frac{400}{27}$$

$$\text{RHS} = -16 \div \left(\frac{6}{5} \div \frac{-9}{10}\right)$$

$$= \frac{-16}{1} \div \left(\frac{6}{5} \div \frac{-9}{10}\right)$$

$$= \frac{-16}{1} \div \left(\frac{6}{5} \times \frac{10}{-9}\right)$$

$$= \frac{-16}{1} \div \frac{60}{-45}$$

$$= \frac{-16}{1} \times \frac{-45}{60}$$

$$= \frac{-16 \times -45}{1 \times 60}$$

$$= \frac{720}{60} = \frac{720 \div 60}{60 \div 60} = 12$$

RHS ≠ LHS

Hence, False

(iii)

$$\left(\frac{-3}{5} \div \frac{-12}{35}\right) \div \frac{1}{14} = \frac{-3}{5} \div \left(\frac{-12}{35} \div \frac{1}{14}\right)$$

$$\text{LHS} = \left(\frac{-3}{5} \div \frac{-12}{35}\right) \div \frac{1}{14}$$

$$= \left(\frac{-3}{5} \times \frac{35}{-12}\right) \div \frac{1}{14}$$

$= \left(\frac{-3 \times 35}{5 \times -12}\right) \div \frac{1}{14}$

$= \frac{-105}{-60} \div \frac{1}{14}$

$= \frac{-105}{-60} \times \frac{14}{1}$

$= \frac{-105 \times 14}{-60 \times 1}$

$= \frac{-1470}{-60} = \frac{-1470}{-60} = \frac{1470 \div 30}{60 \div 30} = \frac{49}{2}$

$\text{RHS} = \frac{-3}{5} \div \left(\frac{-12}{35} \div \frac{1}{14}\right)$

$= \frac{-3}{5} \div \left(\frac{-12}{35} \times \frac{14}{1}\right)$

$= \frac{-3}{5} \div \left(\frac{-12 \times 1 + 14 \times 35}{35}\right)$

$= \frac{-3}{5} \div \frac{-12 + 490}{35}$

$= \frac{-3}{5} \div \frac{478}{35}$

$= \frac{-3}{5} \times \frac{35}{478}$

$= \frac{-3 \times 35}{5 \times 478}$

$= \frac{-105}{2390} = \frac{-105 \div 5}{2390 \div 5} = \frac{-21}{478}$

RHS ≠ LHS

Hence, False

4. Question

The product of two rational numbers is -9. If one of the numbers is -12, find the other.

Answer

Product of two rational numbers = -9

One rational number = -12

Let the other rational number = x

Now,

According to the question,

-12 × x = -9

$\Rightarrow x = \frac{-9}{-12}$

$\Rightarrow x = \frac{-9}{-12} = \frac{-9 \times -1}{-12 \times -1} = \frac{9}{12}$

$\Rightarrow x = \frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$

Hence, the other rational number is $\frac{3}{4}$

5. Question

The product of two rational numbers is $\frac{-16}{9}$ .If one of the numbers is $\frac{-4}{3}$, find the other.

Answer

Product of two rational numbers = $\frac{-16}{9}$

One rational number = $\frac{-4}{3}$

Let the other rational number = x

Now,

According to the question,

$\frac{-4}{3} \times x = \frac{-16}{9}$

$\Rightarrow x = \frac{-16}{9} \div \frac{-4}{3}$

$\Rightarrow x = \frac{-16}{9} \times \frac{3}{-4}$

$\Rightarrow x = \frac{-16 \times 3}{9 \times -4}$

$\Rightarrow x = \frac{-48}{-36} = \frac{-48 \times -1}{-36 \times -1} = \frac{48}{36}$

$\Rightarrow x = \frac{48}{36} = \frac{48 \div 12}{36 \div 12} = \frac{4}{3}$

Hence, the other rational number is $\frac{4}{3}$

6. Question

By what rational number should we multiply $\frac{-15}{56}$ to get $\frac{-5}{7}$?

Answer

Let x be multiplied by $\frac{-15}{56}$ to get $\frac{-5}{7}$

It can be written as,

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

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

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

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

$$\Rightarrow x = \frac{-280}{-105} = \frac{-280 \times -1}{-105 \times -1} = \frac{280}{105}$$

$$\Rightarrow x = \frac{280}{105} = \frac{280 \times 35}{105 \times 35} = \frac{8}{3}$$

Hence, it should be multiplied by is $\frac{8}{3}$

7. Question

By what rational number should $\frac{-8}{39}$ be multiplied to obtain $\frac{1}{26}$?

Answer

Let x be multiplied by $\frac{-8}{39}$ to get $\frac{1}{26}$

It can be written as,

$$\frac{-8}{39} \times x = \frac{1}{26}$$

$$\Rightarrow x = \frac{1}{26} \div \frac{-8}{39}$$

$$\Rightarrow x = \frac{1}{26} \times \frac{39}{-8}$$

$$\Rightarrow x = \frac{1 \times 39}{26 \times -8}$$

$$\Rightarrow x = \frac{39}{-208} = \frac{39 \times -1}{-208 \times -1} = \frac{-39}{208}$$

$$\Rightarrow x = \frac{-39}{208} = \frac{-39 \div 13}{208 \div 13} = \frac{-3}{16}$$

Hence, it should be multiplied by is $\frac{-3}{16}$

8. Question

By what number should $\frac{-33}{8}$ be divided to get $\frac{-11}{2}$?

Answer

Let $\frac{-33}{8}$ be divided by x to get $\frac{-11}{2}$

It can be written as,

$$\frac{-33}{8} \div x = \frac{-11}{2}$$

$$\Rightarrow x = \frac{-33}{8} \div \frac{-11}{2}$$

$$\Rightarrow x = \frac{-33}{8} \times \frac{2}{-11}$$

$$\Rightarrow x = \frac{-33 \times 2}{8 \times -11}$$

$$\Rightarrow x = \frac{-66}{-88} = \frac{-66 \times -1}{-88 \times -1} = \frac{66}{88}$$

$$\Rightarrow x = \frac{66}{88} = \frac{66 \div 22}{88 \div 22} = \frac{3}{4}$$

Hence, it should be multiplied by is $\frac{3}{4}$

9. Question

Divide the sum of $\frac{13}{5}$ and $\frac{-12}{7}$ by the product of $\frac{-31}{7}$ and $\frac{1}{-2}$.

Answer

Sum of $\frac{13}{5}$ and $\frac{-12}{7}$ -

$$\frac{13}{5} + \frac{-12}{7}$$

$$= \frac{13 \times 7 + (-12) \times 5}{35}$$

$$= \frac{91 - 60}{35}$$

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

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

$$\frac{-31}{7} \times \frac{1}{-2}$$

$$= \frac{-31 \times 1}{7 \times -2}$$

$$= \frac{-31}{-14}$$

$$= \frac{31}{14}$$

Now,

According to the question,

$$\frac{31}{35} \div \frac{31}{14}$$

$$= \frac{31}{35} \times \frac{14}{31}$$

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

10. Question

Divide the sum of $\frac{65}{12}$ and $\frac{8}{3}$ by their differ-renice.

Answer

According to the question,

$$\left(\frac{65}{12}+\frac{8}{3}\right)\div\left(\frac{65}{12}-\frac{8}{3}\right)$$

$$=\left(\frac{65\times 1+8\times 4}{12}\right)\div\left(\frac{65\times 1-8\times 4}{12}\right)$$

$$=\left(\frac{65+32}{12}\right)\div\left(\frac{65-32}{12}\right)$$

$$=\left(\frac{97}{12}\right)\div\left(\frac{33}{12}\right)$$

$$=\frac{97}{12}\times\frac{12}{33}$$

$$=\frac{97}{33}$$

11. Question

Fill in the blanks:

(i) $\frac{9}{8}\div(....)=\frac{-3}{2}$ (ii) $(....)\div\left(\frac{-7}{5}\right)=\frac{10}{19}$

(iii) $(....)\div(-3)=\frac{-4}{15}$ (iv) $(-12)\div(....)=\frac{-6}{5}$

Answer

(i)

$$\frac{9}{8}\div \text{x(let)}=\frac{-3}{2}$$

$$\Rightarrow \text{x}=\frac{9}{8}\div\frac{-3}{2}$$

$$\Rightarrow \text{x}=\frac{9}{8}\times\frac{2}{-3}$$

$$\Rightarrow \text{x}=\frac{9\times 2}{8\times -3}$$

$$\Rightarrow \text{x}=\frac{18}{-24}=\frac{18\times -1}{-24\times -1}=\frac{-18}{24}$$

$$\Rightarrow \text{x}=\frac{-18}{24}=\frac{-18\div 6}{24\div 6}=\frac{-3}{4}$$

Therefore,

$$\frac{9}{8}\div\frac{-3}{4}=\frac{-3}{2}$$

(ii)

$$\text{x(let)}\div\frac{-7}{5}=\frac{10}{19}$$

$$\Rightarrow x = \frac{10}{19} \times \frac{-7}{5}$$

$$\Rightarrow x = \frac{10 \times -7}{19 \times 5}$$

$$\Rightarrow x = \frac{-70}{95} = \frac{-70 \div 5}{95 \div 5} = \frac{-14}{19}$$

Therefore,

$$\frac{-14}{19} \div \frac{-7}{5} = \frac{10}{19}$$

(iii)

$$x(\text{let}) \div (-3) = \frac{-4}{15}$$

$$\Rightarrow x = \frac{-4}{15} \times (-3)$$

$$\Rightarrow x = \frac{-4 \times -3}{15 \times 1}$$

$$\Rightarrow x = \frac{12}{15} = \frac{12 \div 3}{15 \div 3} = \frac{4}{5}$$

Therefore,

$$\frac{4}{5} \div (-3) = \frac{-4}{15}$$

(iv)

$$-12 \div x(\text{let}) = \frac{-6}{5}$$

$$\Rightarrow x = -12 \div \frac{-6}{5}$$

$$\Rightarrow x = -12 \times \frac{5}{-6}$$

$$\Rightarrow x = \frac{-12 \times 5}{1 \times -6}$$

$$\Rightarrow x = \frac{-60}{-6} = \frac{-60 \times -1}{-6 \times -1} = \frac{60}{6}$$

$$\Rightarrow x = \frac{60}{6} = \frac{60 \div 6}{6 \div 6} = 10$$

Therefore,

$$-12 \div 10 = \frac{-6}{5}$$

12. Question

(i) Are rational numbers always closed under division?

(ii) Are rational numbers always commutative under division?

(iii) Are rational numbers always associative under division?

(iv) Can we divide 1 by 0?

Answer

(i) No rational numbers are not always closed under division,

Since, $\frac{a}{0} = \infty$ which is not a rational number

(ii) No rational numbers are not always commutative under division,

Let $\frac{a}{b}$ and $\frac{c}{d}$ be two rational numbers.

$$\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$$

And

$$\frac{c}{d} \div \frac{a}{b} = \frac{bc}{ad}$$

Therefore,

$$\frac{a}{b} \div \frac{c}{d} \neq \frac{c}{d} \div \frac{a}{b}$$

Hence, rational numbers are not always commutative under division

(iii) No rational numbers are not always associative under division,

Let $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ be two rational numbers.

$$\frac{a}{b} \div \left(\frac{c}{d} \div \frac{e}{f}\right) = \frac{ade}{bcf}$$

And

$$\left(\frac{a}{b} \div \frac{c}{d}\right) \div \frac{e}{f} = \frac{adf}{bce}$$

Therefore,

$$\frac{a}{b} \div \left(\frac{c}{d} \div \frac{e}{f}\right) \neq \left(\frac{a}{b} \div \frac{c}{d}\right) \div \frac{e}{f}$$

Hence, rational numbers are not always associative under division.

(iv) No we cannot divide 1 by 0.

Since, $\frac{a}{0} = \infty$ which is not defined.

Exercise 1F

1. Question

Find a rational number between $\frac{1}{4}$ and $\frac{1}{3}$.

Answer

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$$

Therefore, to find rational number x (let) between $\frac{1}{4}$ and $\frac{1}{3}$

$$x = \frac{1}{2}\left(\frac{1}{4} + \frac{1}{3}\right)$$

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

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

$$\Rightarrow x = \frac{1}{2} \times \frac{7}{12}$$

$$\Rightarrow x = \frac{7}{24}$$

2. Question

Find a rational number between 2 and 3.

Answer

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$$

Therefore, to find rational number x (let) between 2 and 3

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

$$\Rightarrow x = \frac{1}{2} \times 5$$

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

3. Question

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

Answer

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$$

Therefore, to find rational number x (let) between $\frac{-1}{3}$ and $\frac{1}{2}$

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

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

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

$$\Rightarrow x = \frac{1}{2} \times \frac{1}{6}$$

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

4. Question

Find two rational numbers between -3 and -2.

Answer

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$

Therefore, to find rational number x (let) between -3 and -2

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

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

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

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

Now if we find a rational number between $\frac{-5}{2}$ and -2 it will also be between -3 and -2 since $\frac{-5}{2}$ lies between -3 and -2

Therefore, to find rational number y (let) between $\frac{-5}{2}$ and -2

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

$\Rightarrow y = \frac{1}{2}(\frac{-5}{2} - 2)$

$\Rightarrow y = \frac{1}{2}(\frac{-5-4}{2})$

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

5. Question

Find three rational numbers between 4 and 5.

Answer

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$

Therefore, to find rational number x (let) between 4 and 5

$x = \frac{1}{2}(4 + 5)$

$\Rightarrow x = \frac{1}{2} \times 9$

$\Rightarrow x = \frac{9}{2}$

Now if we find a rational number between 4 and $\frac{9}{2}$ it will also be between 4 and 5 since $\frac{9}{2}$ lies between 4 and 5

Therefore, to find rational number y (let) between 4 and $\frac{9}{2}$

$y = \frac{1}{2}\left(4 + \frac{9}{2}\right)$

$\Rightarrow y = \frac{1}{2}\left(\frac{8+9}{2}\right)$

$\Rightarrow y = \frac{1}{2} \times \frac{17}{2}$

$\Rightarrow y = \frac{17}{4}$

Now if we find a rational number between $\frac{9}{2}$ and 5 it will also be between 4 and 5 since $\frac{9}{2}$ lies between 4 and 5

Therefore, to find rational number z (let) between $\frac{9}{2}$ and 5

$z = \frac{1}{2}\left(\frac{9}{2} + 5\right)$

$\Rightarrow z = \frac{1}{2}\left(\frac{9+10}{2}\right)$

$\Rightarrow z = \frac{1}{2} \times \frac{19}{2}$

$\Rightarrow z = \frac{19}{4}$

6. Question

Find three rational numbers between $\frac{2}{3}$ and $\frac{3}{4}$.

Answer

To find a rational number x between two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$, we use

$x = \frac{1}{2}\left(\frac{a}{b} + \frac{c}{d}\right)$

Therefore, to find rational number x (let) between $\frac{2}{3}$ and $\frac{3}{4}$

$x = \frac{1}{2}\left(\frac{2}{3} + \frac{3}{4}\right)$

$\Rightarrow x = \frac{1}{2}\left(\frac{8+9}{12}\right)$

$\Rightarrow x = \frac{1}{2} \times \frac{17}{12}$

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

Now if we find a rational number between $\frac{2}{3}$ and $\frac{17}{24}$ it will also be between $\frac{2}{3}$ and $\frac{3}{4}$ since $\frac{17}{24}$ lies between $\frac{2}{3}$ and $\frac{3}{4}$

Therefore, to find rational number y (let) between $\frac{2}{3}$ and $\frac{17}{24}$

$$y = \frac{1}{2}\left(\frac{2}{3} + \frac{17}{24}\right)$$

$$\Rightarrow y = \frac{1}{2}\left(\frac{16 + 17}{24}\right)$$

$$\Rightarrow y = \frac{1}{2} \times \frac{33}{24}$$

$$\Rightarrow y = \frac{33}{48}$$

Now if we find a rational number between $\frac{17}{24}$ and $\frac{3}{4}$ it will also be between $\frac{2}{3}$ and $\frac{3}{4}$ since $\frac{17}{24}$ lies between $\frac{2}{3}$ and $\frac{3}{4}$

Therefore, to find rational number z (let) between $\frac{17}{24}$ and $\frac{3}{4}$

$$z = \frac{1}{2}\left(\frac{17}{24} + \frac{3}{4}\right)$$

$$\Rightarrow z = \frac{1}{2}\left(\frac{17 + 18}{24}\right)$$

$$\Rightarrow z = \frac{1}{2} \times \frac{35}{24}$$

$$\Rightarrow z = \frac{35}{48}$$

7. Question

Find 10 rational numbers between $\frac{-3}{4}$ and $\frac{5}{6}$.

Answer

We can write $\frac{-3}{4}$ as $\frac{-9}{12}$ (Since, $\frac{-3}{4} = \frac{-3\times3}{4\times3} = \frac{-9}{12}$)

And,

We can write $\frac{5}{6}$ as $\frac{10}{12}$ (Since, $\frac{5}{6} = \frac{5\times2}{6\times2} = \frac{10}{12}$)

Now clearly, rational numbers between them are,

$$\frac{-8}{12}, \frac{-7}{12}, \frac{-7}{12}, \frac{-6}{12}, \frac{-5}{12}, \frac{-4}{12}, \frac{-3}{12}, \frac{-2}{12}, \frac{-1}{12}, 0, \frac{1}{12}, \frac{2}{12}, \frac{3}{12}, \frac{4}{12}, \frac{5}{12}, \frac{6}{12}, \frac{7}{12}, \frac{8}{12} \text{ and } \frac{9}{12}$$

Any 10 rational numbers are,

$$\frac{-8}{12}, \frac{-7}{12}, \frac{-7}{12}, \frac{-6}{12}, \frac{-5}{12}, \frac{-4}{12}, \frac{-3}{12}, \frac{-2}{12}, \frac{-1}{12}, 0, \text{and} \frac{1}{12}$$

8. Question

Find 12 rational numbers between -1and 2.

Answer

We can write -1 as $\frac{-10}{10}$ (Since, $\frac{-1}{1} = \frac{-1\times10}{1\times10} = \frac{-10}{10}$)

And,

We can write 2 as $\frac{20}{10}$ (Since, $2 = \frac{2\times10}{1\times10} = \frac{20}{10}$)

Now clearly any 12 rational numbers between -1 and 2 are,

$\frac{-9}{10}, \frac{-8}{10}, \frac{-7}{10}, \frac{-6}{10}, \frac{-5}{10}, \frac{-4}{10}, \frac{-3}{10}, \frac{-2}{10}, \frac{-1}{10}, 0, \frac{1}{10}$ and $\frac{2}{10}$

Exercise 1G

1. Question

From a rope 11 m long. two pieces of lengths $2\frac{3}{5}$ m and $3\frac{3}{10}$ m are cut off. What is the length of remaining rope?

Answer

Length of rope = 11 m

Length of first piece cut = $2\frac{3}{5}$m

Length of second piece cut = $3\frac{3}{10}$m

Total length cut = Length of first piece cut + Length of second piece cut

$= 2\frac{3}{5}\text{m} + 3\frac{3}{10}\text{m}$

$= \frac{13}{5}\text{m} + \frac{33}{10}\text{m}$

$= \frac{26+33}{10}\text{m}$

$= \frac{59}{10}\text{m}$

Length of remaining rope = Length of rope - Total length cut

$= 11\text{m} - \frac{59}{10}\text{m}$

$= \frac{110-59}{10}\text{m}$

$= \frac{51}{10}\text{m}$

$= 5\frac{1}{10}\text{m}$

Hence, Length of remaining rope = $5\frac{1}{10}$m

2. Question

A drum full of rice weight $40\frac{1}{6}$ kg. If the empty drum weight $13\frac{3}{4}$ kg. Find the weight of rice in the drum.

Answer

Weight of drum full of rice = $40\frac{1}{6}$ kg

Weight of empty drum = $13\frac{3}{4}$ kg

Weight of rice Weight of drum full of rice - Weight of empty drum

$= 40\frac{1}{6}\text{kg} - 13\frac{3}{4}\text{kg}$

$= \frac{241}{6}\text{kg} - \frac{55}{4}\text{kg}$

$= \frac{482 - 165}{12}\text{kg}$

$= \frac{317}{12}\text{kg}$

$= 26\frac{5}{12}\text{kg}$

Hence, Weight of rice = $26\frac{5}{12}$ kg

3. Question

A basket contains three types of fruits weight $19\frac{1}{3}$ kg in all. If $8\frac{1}{9}$ kg of these be apples, $3\frac{1}{6}$ kg be oranges and the rest pears, what is the weight of the pears in the basket?

Answer

Weight of basket with three types of fruits = $19\frac{1}{3}$kg

Weight of apples = $8\frac{1}{9}$kg

Weight of oranges = $3\frac{1}{6}$kg

Weight of pears = Weight of basket with three types of fruits – (Weight of apples + Weight of oranges)

$= 19\frac{1}{3}\text{kg} - (8\frac{1}{9}\text{kg} + 3\frac{1}{6}\text{kg})$

$= \frac{58}{3}\text{kg} - (\frac{73}{9}\text{kg} + \frac{19}{6}\text{kg})$

$= \frac{58}{3}\text{kg} - (\frac{146 + 57}{18}\text{kg})$

$= \frac{58}{3}\text{kg} - \frac{203}{18}\text{kg}$

$= \frac{348 - 203}{18}\text{kg}$

$= \frac{145}{18}\text{kg}$

$= 8\frac{1}{18}\text{kg}$

Hence, Weight of pears = $8\frac{1}{18}$kg

4. Question

On one day a rickshaw puller earned Rs. 160. Out of his earnings he spent $26\frac{3}{5}$ on tea and snacks, Rs. $50\frac{1}{2}$ on food and Rs. $16\frac{2}{5}$ on repairs of the rickshaw. How much did he save on that day?

Answer

Total Earnings = Rs 160

Spend on tea and snacks = Rs $26\frac{3}{5}$

Spend on food = Rs $50\frac{1}{2}$

Spend on repairs = Rs $16\frac{2}{5}$

Total Expenditure = Spend on tea and snacks + Spend on food + Spend on repairs

$= \text{Rs } 26\frac{3}{5} + \text{ Rs } 50\frac{1}{2} + \text{ Rs } 16\frac{2}{5}$

$= \text{Rs } \frac{133}{5} + \text{ Rs } \frac{101}{2} + \text{ Rs } \frac{82}{5}$

$= \text{Rs } \frac{266 + 505 + 164}{10}$

$= \text{Rs } \frac{935}{10}$

Savings= Total Earnings - Total Expenditure

$= \text{ Rs } 160 - \text{ Rs } \frac{935}{10}$

$= \text{ Rs } \frac{1600 - 935}{10}$

$= \text{ Rs } \frac{665}{10}$

$= \text{ Rs } 66\frac{1}{2}$

Hence, Savings = Rs $66\frac{1}{2}$

5. Question

Find the cost of $3\frac{2}{5}$ meters of cloth at Rs. $63\frac{3}{4}$ per meter.

Answer

Cost of cloth per meter = Rs $63\frac{3}{4}$

Total meters = $3\frac{2}{5}$m

Cost of total cloth = Cost of cloth per meter × Total meters

$= \text{ Rs } 63\frac{3}{4} \times 3\frac{2}{5}\text{m}$

$= \text{Rs}\ \frac{255}{4} \times \frac{17}{5}$

$= \text{Rs}\ \frac{4335}{20} = \frac{4335 \div 5}{20 \div 5} = \frac{867}{4}$

$= \text{Rs}\ 216\frac{3}{4}$

Therefore, total cost $= \text{Rs}\ 216\frac{3}{4}$

6. Question

A car is moving at an average speed of $60\frac{2}{5}$ km/hr. How much distance will it cover in $6\frac{1}{4}$ hours?

Answer

Speed of car $= 60\frac{2}{5}\text{km/hr}$

Total hours $= 6\frac{1}{4}\text{hrs}$

Total Distance = Speed of car × Total hours

$= 60\frac{2}{5}\text{km/hr} \times 6\frac{1}{4}\text{hrs}$

$= \frac{302}{5}\text{km/hr} \times \frac{25}{4}\text{hrs}$

$= \frac{7550}{20}\text{km}$

$= \frac{755}{2}\text{km}$

$= 377\frac{1}{2}\text{km}$

Therefore, Total Distance $= 377\frac{1}{2}\text{km}$

7. Question

Find the area of a rectangular park which is $36\frac{3}{5}$ m long and $16\frac{2}{3}$ m board.

Answer

Length of park $= 36\frac{3}{5}\text{m}$

Breadth of park $= 16\frac{2}{3}\text{m}$

Area of park = Length of park × Breadth of park

$= 36\frac{3}{5}\text{m} \times 16\frac{2}{3}\text{m}$

$= \frac{183}{5}\text{m} \times \frac{50}{3}\text{m}$

$= \frac{183 \times 50}{5 \times 3}\text{m}$

$= \frac{9150}{15} \text{m}^2$

$= 610 \text{ m}^2$

Hence, Area of park $= 610 \text{ m}^2$

8. Question

Find the area of square plot of land whose each side measure $8\frac{1}{2}$ meters.

Answer

Side of plot $= 8\frac{1}{2}\text{m}$

Area of plot = Side of plot × Side of plot

$= 8\frac{1}{2}\text{m} \times 8\frac{1}{2}\text{m}$

$= \frac{17}{2}\text{m} \times \frac{17}{2}\text{m}$

$= \frac{17 \times 17}{2 \times 2}\text{m}$

$= \frac{289}{4}\text{m}^2$

$= 72\frac{1}{4}\text{ m}^2$

Hence, Area of plot $= 72\frac{1}{4}\text{ m}^2$

9. Question

One liters of petrol costs Rs. $63\frac{3}{4}$. What is the cost of 34 liters of petrol?

Answer

Cost of one litre petrol $= \text{Rs } 63\frac{3}{4} = \text{Rs}\frac{255}{4}$

Cost of 34 litre petrol = 34 × Cost of one litre petrol

$= 34 \times \text{Rs}\frac{255}{4}$

$= \text{Rs}\frac{34 \times 255}{4}$

$= \text{Rs}\frac{8670}{4}$

$= \text{Rs}\frac{4335}{2}$

$= \text{Rs } 2167\frac{1}{2}$

Cost of 34 litre petrol $= \text{Rs } 2167\frac{1}{2}$

10. Question

An aeroplane covers 1020 km in an hour. How much distance will it cover in $4\frac{1}{6}$ hours?

Answer

Distance covered in one hour = 1020 km

Distance covered in $4\frac{1}{6}$ hours = $4\frac{1}{6}$ × Distance covered in one hour

$= 4\frac{1}{6} \times 1020\ \text{km}$

$= \frac{25}{6} \times 1020\ \text{km}$

$= \frac{25 \times 1020}{6}\text{km}$

$= \frac{25500}{6}\text{km}$

$= 4250\ \text{km}$

Distance covered in $4\frac{1}{6}$ hours $= 4250\ \text{km}$

11. Question

The cost of $3\frac{1}{2}$ meters of cloth is Rs. $166\frac{1}{4}$. What is the cost of one metre of cloth?

Answer

Cost of $3\frac{1}{2}\text{m}$ of cloth = Rs $166\frac{1}{4}$

Cost of 1m of cloth = Cost of $3\frac{1}{2}\text{m}$ of cloth $\div\ 3\frac{1}{2}$

$= \text{Rs}\ 166\frac{1}{4} \div\ 3\frac{1}{2}$

$= \text{Rs}\ \frac{665}{4} \div\ \frac{7}{2}$

$= \text{Rs}\ \frac{665}{4} \times \frac{2}{7}$

$= \text{Rs}\ \frac{1330}{28}$

$= \text{Rs}\ 47\frac{1}{2}$

Cost of 1m of cloth= Rs $47\frac{1}{2}$

12. Question

A cord of length $71\frac{1}{2}$ m has been cut into 26 pieces of equal length. What is the length of each piece?

Answer

Length of cord = $71\frac{1}{2}\text{m}$

No of pieces = 26

Length of each piece = Length of cord ÷ No of pieces

$= 71\frac{1}{2}\text{m} \div 26$

$= \frac{143}{2}\text{m} \div 26$

$= \frac{143}{2}\text{m} \times \frac{1}{26}$

$= \frac{143}{2}\text{m} \times \frac{1}{26}$

$= \frac{143}{2 \times 26}\text{m}$

$= \frac{143}{52}\text{m}$

$= \frac{11}{4}\text{m}$

$= 2\frac{3}{4}\text{m}$

Length of each piece= $2\frac{3}{4}\text{m}$

13. Question

The area of a room is $65\frac{1}{4}m^2$. If its breadth is $5\frac{7}{16}$ meters, what is its length?

Answer

Area of room = $65\frac{1}{4}\text{m}^2$

Breadth of room = $5\frac{7}{16}\text{m}$

Length of room = Area of room ÷ Breadth of room

$= 65\frac{1}{4}\text{m}^2 \div 5\frac{7}{16}\text{m}$

$= \frac{261}{4}\text{m}^2 \div \frac{87}{16}\text{m}$

$= \frac{261}{4}\text{m}^2 \times \frac{16}{87}\text{m}$

$= \frac{4176}{348}\text{m}$

$= 12\text{ m}$

Length of room= 12 m

14. Question

The product of two fractions is $9\frac{3}{5}$. If one of the fractions is $9\frac{3}{7}$, find the other.

Answer

Product of two fractions = $9\frac{3}{5}$

First fraction = $9\frac{3}{7}$

Second fraction = Product of two fractions ÷ First fraction

$= 9\frac{3}{5} \div 9\frac{3}{7}$

$= \frac{48}{5} \div \frac{66}{7}$

$= \frac{48}{5} \times \frac{7}{66}$

$= \frac{336}{330}$

$= \frac{56}{55}$

$= 1\frac{1}{55}$

Second fraction $= 1\frac{1}{55}$

15. Question

In a school, $\frac{5}{8}$ of the students are boys. If there are 240 girls, find the number of boys in the school.

Answer

Fraction of boys = $\frac{5}{8}$

Fraction of girls =1- $\frac{5}{8} = \frac{3}{8}$

Number of girls= 240

Number of girls = Total students × $\frac{3}{8}$

⇒ 240 = Total students × $\frac{3}{8}$

⇒ Total students = 240 ÷ $\frac{3}{8}$

$= 240 \times \frac{8}{3}$

$= \frac{240 \times 8}{3}$

$= \frac{1920}{3} = 640$

Total students =640

Number of boys = Total students - Number of girls

=640 – 240 = 400

Number of boys= 400

16. Question

After reading $\frac{7}{9}$ of a book, 40 pages are left. How many pages are there in the book?

Answer

Fraction read = $\frac{7}{9}$

Fraction left = $1-\frac{7}{9}=\frac{2}{9}$

Pages left = 40

Pages left = $\frac{2}{9}\times$Total pages

40= $\frac{2}{9}\times$Total pages

⇒ Total pages = $40\div\frac{2}{9}$

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

$=180$

Total pages = 180

17. Question

Rita had Rs. 300. She spent $\frac{1}{3}$ of her money on notebooks and $\frac{1}{4}$ of the remainder on stationary items. How much money is left with her?

Answer

Total money = Rs 300

Fraction spent on notebooks = $\frac{1}{3}$

Amount spent on notebooks = $\frac{1}{3}\times 300$ = Rs 100

Amount left = Rs 300 – Rs 100 =Rs 200

Fraction spent on stationary = $\frac{1}{4}$

Amount spent on stationary = $\frac{1}{4}\times 200$ = Rs 50

Money left = Rs 300 – Rs 150 = Rs 150

18. Question

Amit earns Rs. 32000 per month. He spends $\frac{1}{4}$ of his income on food; $\frac{3}{10}$ of the remainder on house rent and $\frac{5}{21}$ of the remainder on the education of children. How much money is still left with him?

Answer

Total earnings = Rs 32000

Amount spend on food = $\frac{1}{4} \times \text{Rs } 32000 = \text{Rs } 8000$

Amount left = Rs 32000 - Rs 8000 = Rs 24000

Amount spend on house rent = $\frac{3}{10} \times \text{Rs } 24000 = \text{Rs } 7200$

Amount left = Rs 24000- Rs 7200 = Rs 16800

Amount spend on education = $\frac{5}{21} \times \text{Rs } 16800 = \text{Rs } 4000$

Amount left = Rs 16800 - Rs 4000 = Rs 12800

Money left = Rs 12800

19. Question

If $\frac{3}{5}$ of a number exceeds its $\frac{2}{7}$ by 44, find the number.

Answer

Let the number be x

$\frac{3}{5}$ of $x = \frac{3}{5}x$

$\frac{2}{7}$ of $x = \frac{2}{7}x$

According to the question,

$$\frac{3}{5}x - \frac{2}{7}x = 44$$

$$\Rightarrow \frac{3x \times 7 - 2x \times 5}{35} = 44$$

$$\Rightarrow \frac{21x - 10x}{35} = 44$$

$$\Rightarrow \frac{11}{35} \times x = 44$$

$$\Rightarrow x = 44 \div \frac{11}{35}$$

$$\Rightarrow x = 44 \times \frac{35}{11}$$

$$\Rightarrow x = \frac{1540}{11}$$

$$\Rightarrow x = 140$$

The number is 140

20. Question

At a cricket test match $\frac{2}{7}$ of the spectators were in a covered place while 15000 were in open. Find the total number of spectators.

Answer

Fraction of spectators covered $= \frac{2}{7}$

Fraction left $= 1 - \frac{2}{7} = \frac{7-2}{7} = \frac{5}{7}$

Number of spectators in open = 15000

According to the question,

Number of spectators in open = Total number of spectators $\times \frac{5}{7}$

$\Rightarrow 15000 = \frac{5}{7} \times \text{Total number of spectators}$

$\Rightarrow \text{Total number of spectators } = 15000 \div \frac{5}{7}$

$\Rightarrow \text{Total number of spectators } = 15000 \times \frac{7}{5}$

$\Rightarrow \text{Total number of spectators } = 21000$

Exercise 1H

1. Question

$\left(\frac{-5}{16} + \frac{7}{12}\right) = ?$

Options A. $-\frac{7}{48}$

B. $\frac{1}{24}$

C. $\frac{13}{48}$

D. $\frac{1}{3}$

Answer

$\frac{-5}{16} + \frac{7}{12}$

LCM of 12 and 16 = 48

$= \frac{-5 \times 3 + 7 \times 4}{48}$

$= \frac{-15 + 28}{48}$

$= \frac{13}{48}$

2. Question

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

Options A. $\frac{28}{15}$

B. $\frac{-28}{15}$

C. $\frac{-4}{5}$

D. $\frac{-4}{15}$

Answer

$\frac{8}{-15}=\frac{8\times-1}{-15\times-1}=\frac{-8}{15}$

And,

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

$\Rightarrow\frac{8}{-15}+\frac{4}{-3}=\frac{-8}{15}+\frac{-4}{3}$

$=\frac{-8\times3+(-4)\times15}{45}$

$=\frac{-24-60}{45}$

$=\frac{-84}{45}=\frac{-84\div3}{45\div3}=\frac{-28}{15}$

3. Question

$\left(\frac{7}{-26}+\frac{16}{39}\right)=?$

Options A. $\frac{11}{78}$

B. $\frac{-11}{78}$

C. $\frac{11}{39}$

D. $\frac{-11}{39}$

Answer

$$\frac{7}{-26}=\frac{7\times-1}{-26\times-1}=\frac{-7}{26}$$

$$\Rightarrow\frac{7}{-26}+\frac{16}{39}=\frac{-7}{26}+\frac{16}{39}$$

$$=\frac{-7\times3+16\times2}{78}$$

$$=\frac{-21+32}{78}$$

$$=\frac{11}{78}$$

4. Question

$$\left(3+\frac{5}{-7}\right)=?$$

Options A. $\frac{-16}{7}$

B. $\frac{16}{7}$

C. $\frac{-26}{7}$

D. $\frac{-8}{7}$

Answer

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

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

$$\Rightarrow3+\frac{5}{-7}=\frac{3}{1}+\frac{-5}{7}$$

$$=\frac{3\times7+(-5)\times1}{7}$$

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

$$=\frac{16}{7}$$

5. Question

$$\left(\frac{31}{-4}+\frac{-5}{8}\right)=?$$

Options A. $\frac{67}{8}$

B. $\frac{57}{8}$

C. $\frac{-57}{8}$

D. $\frac{-67}{8}$

Answer

$\frac{31}{-4} = \frac{31 \times -1}{-4 \times -1} = \frac{-31}{4}$

$\Rightarrow \frac{31}{-4} + \frac{-5}{8} = \frac{-31}{4} + \frac{-5}{8}$

$= \frac{-31 \times 2 + (-5) \times 1}{8}$

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

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

6. Question

What should be added to $\frac{7}{12}$ to get $\frac{-4}{15}$?

Options A. $\frac{17}{20}$

B. $\frac{-17}{20}$

C. $\frac{7}{20}$

D. $\frac{-7}{20}$

Answer

Let the number added be x.

Then,

$\frac{7}{12} + x = \frac{-4}{15}$

$\Rightarrow x = \frac{-4}{15} - \frac{7}{12}$

$= \frac{-4 \times 4 - 7 \times 5}{60}$

$= \frac{-16-35}{8}$

$= \frac{-51}{60} = \frac{-51 \div 3}{60 \div 3} = \frac{-17}{20}$

7. Question

$\left(\frac{2}{3}+\frac{-4}{5}+\frac{7}{15}+\frac{-11}{20}\right) = ?$

Options A. $\frac{-1}{5}$

B. $\frac{-4}{15}$

C. $\frac{-13}{60}$

D. $\frac{-7}{30}$

Answer

$\frac{2}{3}+\frac{-4}{5}+\frac{7}{15}+\frac{-11}{20}$

LCM of 3, 5, 15, 20

$= \frac{2 \times 20 + (-4) \times 12 + 7 \times 4 + (-11) \times 3}{60}$

$= \frac{40 - 48 + 28 - 33}{60}$

$= \frac{68 - 81}{60}$

$= \frac{-31}{60}$

8. Question

The sum of two numbers is $\frac{-4}{7}$ to get $\frac{5}{6}$?

Options A. $\frac{5}{2}$

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

C. $\frac{5}{4}$

D. $\frac{-5}{2}$

Answer

Let the number added be x.

Then,

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

$\Rightarrow x=\frac{-4}{7}-\frac{5}{6}$

$=\frac{-4\times 6-5\times 7}{42}$

$=\frac{-24-35}{42}$

$=\frac{-59}{42}$

9. Question

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

Options A. $\frac{-29}{21}$

B. $\frac{29}{21}$

C. $\frac{1}{21}$

D. $\frac{-1}{21}$

Answer

Let the number added be x.

Then,

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

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

$=\frac{-2\times 7-(-5)\times 3}{21}$

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

$=\frac{1}{21}$

10. Question

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

Options A. $\frac{5}{2}$

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

C. $\frac{5}{4}$

D. $\frac{-5}{2}$

Answer

Let the number subtracted be x.

Then,

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

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

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

$= \frac{-10 - 5}{6}$

$= \frac{-15}{6} = \frac{-15 \div 3}{6 \div 3} = \frac{-5}{2}$

11. Question

$\left(\frac{-3}{7}\right)^{-1} = ?$

Options A. $\frac{7}{3}$

B. $\frac{-7}{3}$

C. $\frac{3}{7}$

D. none of these

Answer

We know,For any real number a≠0, $a^{-1} = \frac{1}{a}$ So, $\left(\frac{-3}{7}\right)^{-1} = \frac{7}{-3} = \frac{7 \times -1}{-3 \times -1} = \frac{-7}{3}$

12. Question

The product of two rational numbers is $\frac{-28}{81}$. If one of the numbers is $\frac{14}{27}$ then the other one is

Options A. $\frac{-2}{3}$

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

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

D. $\frac{-3}{2}$

Answer

Let the other number be x.

Then,

$\frac{14}{27} \times x = \frac{-28}{81}$

$\Rightarrow x = \frac{-28}{81} \div \frac{14}{27}$

$\Rightarrow x = \frac{-28}{81} \times \frac{27}{14}$

$\Rightarrow x = \frac{-756}{1134} = \frac{-756 \div 378}{1134 \div 378} = \frac{-2}{3}$

13. Question

The product of two numbers is $\frac{-16}{35}$. If one of the numbers is $\frac{-15}{14}$, the other is

Options A. $\frac{-2}{5}$

B. $\frac{8}{15}$

C. $\frac{32}{75}$

D. $\frac{-8}{3}$

Answer

Let the other number be x.

Then,

$\frac{-15}{14} \times x = \frac{-16}{35}$

$\Rightarrow x = \frac{-16}{35} \div \frac{-15}{14}$

$\Rightarrow x = \frac{-16}{35} \times \frac{14}{-15}$

$\Rightarrow x = \frac{-224}{-525} = \frac{-224 \times -1}{-525 \times -1} = \frac{224}{525}$

$\Rightarrow x = \frac{224}{525} = \frac{224 \div 7}{525 \div 7} = \frac{32}{75}$

14. Question

What should be subtracted from $\frac{-3}{5}$ to get -2?

Options A. $\frac{-7}{5}$

B. $\frac{-13}{5}$

C. $\frac{13}{5}$

D. $\frac{7}{5}$

Answer

Let the number subtracted be x.

Then,

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

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

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

$\Rightarrow x = \frac{-3 + 10}{5}$

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

15. Question

The sum of two rational numbers is -3. If one of them is $\frac{-10}{3}$ then the other one is

Options A. $\frac{-13}{3}$

B. $\frac{-19}{3}$

C. $\frac{1}{3}$

D. $\frac{13}{3}$

Answer

Let the other number be x.

Then,

$\frac{-10}{3} + x = \frac{-3}{1}$

$\Rightarrow x = \frac{-3}{1} - \frac{-10}{3}$

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

$\Rightarrow x = \frac{-9 + 10}{3}$

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

16. Question

Which of the following numbers is in standard form?

Options A. $\frac{-12}{26}$

B. $\frac{-49}{71}$

C. $\frac{-9}{16}$

D. $\frac{28}{-105}$

Answer

$\frac{-12}{26}$ is not in standard form since 12 and 26 have a common divisor 2.

$\frac{28}{-105}$ is not in standard form since its denominator is negative.

Therefore, only $\frac{-49}{71}$and $\frac{-9}{16}$ are in standard forms as their numerator and denominator have no common divisor and their denominators are positive.

17. Question

$\left(\frac{-9}{16}\times\frac{8}{15}\right)=?$

Options A. $\frac{-3}{10}$

B. $\frac{-4}{15}$

C. $\frac{-9}{25}$

D. $\frac{-2}{5}$

Answer

$\frac{-9}{16}\times\frac{8}{15}$

$=\frac{-9\times 8}{16\times 15}$

$=\frac{-72}{240}=\frac{-72\div 24}{240\div 24}=\frac{-3}{10}$

18. Question

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

Options A. $\frac{-5}{2}$

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

C. $\frac{-10}{27}$

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

Answer

$\frac{-5}{9}\div\frac{2}{3}$

$=\frac{-5}{9}\times\frac{3}{2}$

$=\frac{-5\times 3}{9\times 2}$

$=\frac{-15}{18}=\frac{-15\div 3}{18\div 3}=\frac{-5}{6}$

19. Question

$\frac{4}{9} \div ? = \frac{-18}{15}$

Options A. $\frac{-32}{45}$

B. $\frac{-8}{5}$

C. $\frac{-9}{10}$

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

Answer

$\frac{4}{9} \div x = \frac{-8}{15}$

$\Rightarrow x = \frac{4}{9} \div \frac{-8}{15}$

$\Rightarrow x = \frac{4}{9} \times \frac{15}{-8}$

$\Rightarrow x = \frac{4 \times 15}{9 \times -8}$

$\Rightarrow x = \frac{60}{-72} = \frac{60 \times -1}{-72 \times -1} = \frac{-60}{72}$

$\Rightarrow x = \frac{-60}{72} = \frac{-60 \div 6}{72 \div 6} = \frac{-5}{6}$

20. Question

Additive inverse of $\frac{-5}{9}$ is

Options A. $\frac{-9}{5}$

B. 0

C. $\frac{5}{9}$

D. $\frac{9}{5}$

Answer

Additive inverse of a number $\frac{a}{b}$ is the number $-\frac{a}{b}$ such that, $\frac{a}{b} + \left(\frac{-a}{b}\right) = 0$

Therefore,

Additive inverse of $\frac{-5}{9}$ is $\frac{5}{9}$

21. Question

Reciprocal of $\frac{-3}{4}$ is

Options A. $\frac{4}{3}$

B. $\frac{3}{4}$

C. $\frac{-4}{3}$

D. 0

Answer

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

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

22. Question

A rational number between $\frac{-2}{3}$ and $\frac{1}{4}$ is

Options A. $\frac{5}{2}$

B. $\frac{-5}{12}$

C. $\frac{5}{24}$

D. $\frac{-5}{24}$

Answer

Rational number between $\frac{-2}{3}$ and $\frac{1}{4}$

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

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

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

$= \frac{1}{2} \times \frac{-5}{12}$

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

23. Question

The reciprocal of a negative rational number

Options A. is a positive rational number

B. is a negative rational number

C. can be either a positive or a negative rational number

D. does not exist

Answer

Let $\frac{-a}{b}$ be a negative rational number

Then, its reciprocal will be $\frac{-b}{a}$ which is also a negative rational number.

Hence, the reciprocal of a negative rational number is a negative rational number

CCE Test Paper-1

1. Question

Find the additive inverse of(i) $\frac{7}{-10}$ (ii) $\frac{8}{5}$.

Answer

Additive inverse of a number $\frac{a}{b}$ is the number $-\frac{a}{b}$ such that, $\frac{a}{b} + \left(\frac{-a}{b}\right) = 0$

Therefore,

(i) $\frac{7}{-10} = \frac{7 \times -1}{-10 \times -1} = \frac{-7}{10}$

Additive inverse of $\frac{-7}{10}$ is $\frac{7}{10}$

(ii) Additive inverse of $\frac{8}{5}$ is $\frac{-8}{5}$

2. Question

The sum of two rational numbers is -4. If one of them is $\frac{-11}{5}$, find the other.

Answer

Sum of two rational numbers = -4

First number = $\frac{-11}{5}$

Second number = Sum of two rational numbers - First number

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

$= \frac{-20 - (-11)}{5}$

$= \frac{-20+11}{5}$

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

Second number= $\frac{-9}{5}$

3. Question

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

Answer

Let the number added be x

Then,

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

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

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

$\Rightarrow x = \frac{10+9}{15}$

$\Rightarrow x = \frac{19}{15}$

4. Question

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

Answer

Let the number subtracted be x

Then,

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

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

$\Rightarrow x = \frac{-3 \times 1 - (-1) \times 2}{4}$

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

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

5. Question

Find the multiplicative inverse of (i) $\frac{-3}{4}$ (ii) $\frac{11}{4}$.

Answer

Multiplicative inverse of a rational number $\frac{a}{b} = \frac{b}{a}$

Therefore,

(i) Negative inverse of $\frac{-3}{4} = \frac{4}{-3}$

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

(ii) Negative inverse of $\frac{11}{4} = \frac{4}{11}$

6. Question

The product of two numbers is -8. If one of them is -12, find the other.

Answer

Let the other number be x

Then,

$$-12 \times x = -8$$

$$\Rightarrow x = -8 \div -12$$

$$\Rightarrow x = \frac{-8}{-12} = \frac{-8 \times -1}{-12 \times -1} = \frac{8}{12}$$

$$\Rightarrow x = \frac{8}{12} = \frac{8 \div 4}{12 \div 4} = \frac{2}{3}$$

7. Question

Evaluate:

(i) $\frac{-3}{5} \times \frac{10}{7}$ (ii) $\left(\frac{-5}{8}\right)^{-1}$ (iii) $(-6)^{-1}$

Answer

(i)

$$\frac{-3}{5} \times \frac{10}{7}$$

$$= \frac{-3 \times 10}{5 \times 7}$$

$$= \frac{-30}{35} = \frac{-30 \div 5}{35 \div 5} = \frac{-6}{7}$$

(ii)

$$\left(\frac{-5}{8}\right)^{-1}$$

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

(iii)

$$(-6)^{-1}$$

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

8. Question

Name the property of multiplication shown by each of the following statements:

(i) $\frac{-12}{5} \times \frac{3}{4} = \frac{3}{4} \times \frac{-12}{5}$ (ii) $\frac{-8}{15} \times 1 = \frac{-8}{15}$

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

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

(v) $\frac{2}{5} \times \left(\frac{-4}{5} + \frac{-3}{10}\right) = \left(\frac{2}{5} \times \frac{-4}{5}\right) \times \left(\frac{2}{5} \times \frac{-3}{10}\right)$

Answer

(i) Commutative law of multiplication i.e., a b = b a

(ii) 1 as multiplicative identity i.e., a × 1 = b × 1

(iii) Associative law of multiplication i.e., a(bc) = (ab)c

(iv) Multiplicative property of 0 i.e., a× 0=0

(v) Distributive law of multiplication over addition i.e., a(b + c) = ab + ac

9. Question

Find two rational numbers lying between $\frac{-1}{3}$ and $\frac{1}{2}$.

Answer

Rational number between $\frac{-1}{3}$ and $\frac{1}{2}$

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

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

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

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

$= \frac{1}{12}$

Now,

Rational number between $\frac{1}{12}$ and $\frac{1}{2}$

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

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

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

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

$= \frac{7}{24}$

10. Question

What should be added to $\frac{-3}{5}$ to get $\frac{-1}{3}$?

Options A. $\frac{4}{5}$

B. $\frac{8}{15}$

C. $\frac{4}{15}$

D. $\frac{2}{5}$

Answer

Let the number added be x

Then,

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

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

$\Rightarrow x = \frac{-1 \times 5 - (-3) \times 3}{15}$

$\Rightarrow x = \frac{-5 + 9}{15}$

$\Rightarrow x = \frac{4}{15}$

11. Question

What should be added to $\frac{-2}{3}$ to get $\frac{3}{4}$?

Options A. $\frac{-11}{12}$

B. $\frac{-13}{12}$

C. $\frac{-5}{4}$

D. $\frac{17}{12}$

Answer

Let the number added be x

Then,

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

$\Rightarrow x=\frac{3}{4}-\frac{-2}{3}$

$\Rightarrow x=\frac{3\times 3-(-2)\times 4}{12}$

$\Rightarrow x=\frac{9+8}{12}$

$\Rightarrow x=\frac{17}{12}$

12. Question

$\left(\frac{-5}{4}\right)^{-1}=?$

Options A. $\frac{4}{5}$

B. $\frac{-4}{5}$

C. $\frac{5}{4}$

D. $\frac{3}{5}$

Answer

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

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

13. Question

The product of two numbers is $\frac{-1}{4}$. If one of them is $\frac{-3}{10}$, then the other is

Options A. $\frac{5}{6}$

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

C. $\frac{4}{3}$

D. $\frac{-8}{5}$

Answer

Let the other number be x

Then,

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

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

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

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

$\Rightarrow x = \frac{-10}{-12} = \frac{-10 \times -1}{-12 \times -1} = \frac{10}{12}$

$\Rightarrow x = \frac{10}{12} = \frac{10 \div 2}{12 \div 2} = \frac{5}{6}$

14. Question

$\left(\frac{-5}{6} \div \frac{-2}{3}\right) = ?$

Options A. $\frac{-5}{4}$

B. $\frac{5}{4}$

C. $\frac{-4}{5}$

D. $\frac{4}{5}$

Answer

$\frac{-5}{6} \div \frac{-2}{3}$

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

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

$= \frac{-15}{-12} = \frac{-15 \times -1}{-12 \times -1} = \frac{15}{12}$

$= \frac{15}{12} = \frac{15 \div 3}{12 \div 3} = \frac{5}{4}$

15. Question

$\frac{4}{3} \div ? = \frac{-5}{2}$

Options A. $\frac{-8}{5}$

B. $\frac{8}{5}$

C. $\frac{-8}{15}$

D. $\frac{8}{15}$

Answer

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

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

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

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

$\Rightarrow x = \frac{8}{-15} = \frac{8 \times -1}{-15 \times -1} = \frac{-8}{15}$

16. Question

Reciprocal of $\frac{-7}{9}$ is

Options A. $\frac{9}{7}$

B. $\frac{-9}{7}$

C. $\frac{7}{9}$

D. none of these

Answer

Reciprocal of $\frac{-7}{9} = \frac{9}{-7}$

$\frac{9}{-7} = \frac{9 \times -1}{-7 \times -1} = \frac{-9}{7}$

17. Question

A rational number between $\frac{-2}{3}$ and $\frac{1}{2}$ is

Options A. $\frac{-1}{6}$

B. $\frac{-1}{12}$

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

D. $\frac{5}{6}$

Answer

Rational number between $\frac{-1}{3}$ and $\frac{1}{2}$

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

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

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

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

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

18. Question

Fill in the blanks.

(i) $\frac{25}{8} \div (.....) = -10.$

(ii) $\frac{-8}{9} \times (.....) = \frac{-2}{3}.$

(iii) $(-1)+(.....)=\frac{-2}{9}$.

(iv) $\frac{2}{3}-(.....)=\frac{1}{15}$.

Answer

(i)

$\frac{25}{8}\div x=-10$

$\Rightarrow x=\frac{25}{8}\div -10$

$\Rightarrow x=\frac{25}{8}\times\frac{1}{-10}$

$\Rightarrow x=\frac{25\times 1}{8\times -10}$

$\Rightarrow x=\frac{25}{-80}=\frac{25\times -1}{-80\times -1}=\frac{-25}{80}$

$\Rightarrow x=\frac{-25}{80}=\frac{-25\div 5}{80\div 5}=\frac{-5}{16}$

(ii)

$\frac{-8}{9}\times x=\frac{-2}{3}$

$\Rightarrow x=\frac{-2}{3}\div\frac{-8}{9}$

$\Rightarrow x=\frac{-2}{3}\times\frac{9}{-8}$

$\Rightarrow x=\frac{-2\times 9}{3\times -8}$

$\Rightarrow x=\frac{-18}{-24}=\frac{-18\times -1}{-24\times -1}=\frac{18}{24}$

$\Rightarrow x=\frac{18}{24}=\frac{18\div 6}{24\div 6}=\frac{3}{4}$

(iii)

$-1+x=\frac{-2}{9}$

$\Rightarrow x=\frac{-2}{9}-(-1)$

$\Rightarrow x=\frac{-2\times 1-(-1)\times 9}{9}$

$\Rightarrow x=\frac{-2+9}{9}$

$\Rightarrow x=\frac{7}{9}$

(iv)

$$\frac{2}{3}-x=\frac{1}{15}$$

$$\Rightarrow x=\frac{2}{3}-\frac{1}{15}$$

$$\Rightarrow x=\frac{2\times 5-1\times 1}{15}$$

$$\Rightarrow x=\frac{10-1}{15}$$

$$\Rightarrow x=\frac{9}{15}=\frac{9\div 3}{15\div 3}=\frac{3}{5}$$

19. Question

Write 'T' for true and 'F' for false for each of the following:

(i) Rational numbers are always closed under subtraction.

(ii) Rational numbers are always closed under division.

(iii) $1\div 0=0.$

(iv) Subtraction is commutative on rational numbers.

(v) $-\left(\frac{-7}{8}\right)=\frac{7}{8}.$

Answer

(i) true

Let there be two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$

Then,

$$\frac{a}{b}-\frac{c}{d}=\frac{ad-bc}{bd}$$

which is also a rational number

Hence, Rational numbers are always closed under subtraction.

(ii) false

$\frac{a}{0}=\infty$

Hence, Rational numbers are not always closed under division.

(iii) false

$$\frac{1}{0}=\infty$$

Hence, $\frac{1}{0}\neq 0$

(iv) false

Let there be two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$

Then,

$$\frac{a}{b}-\frac{c}{d}=\frac{ad-bc}{bd}$$

And

$$\frac{c}{d}-\frac{a}{b}=\frac{bc-ad}{bd}$$

Therefore,

$$\frac{a}{b}-\frac{c}{d}\neq\frac{c}{d}-\frac{a}{b}$$

Hence, Subtraction is not commutative on rational numbers.

(v) true

$$-\left(\frac{-7}{8}\right)=-1\times\frac{-7}{8}=\frac{7}{8}$$