NCERT Solution

Class 8 Maths

Chapter 1- Rational Numbers

Exercise 1.1

Question 1

Using appropriate properties, find:

(i) $-\frac{2}{3} \times \frac{3}{5} + \frac{5}{2} - \frac{3}{5} \times \frac{1}{6}$ (ii) $\frac{2}{5} \times \left(-\frac{3}{7}\right) - \frac{1}{6} \times \frac{3}{2} + \frac{1}{14} \times \frac{2}{5}$

Answer:

(i) 2 (ii) $\frac{-11}{28}$

Solution:

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

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

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

[Using a (b − c) = ab - ac]

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

$= \frac{3}{5} \times \frac{-5}{6} + \frac{5}{2}$

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

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

$= \frac{4}{2}$

$= 2$

(ii) $\frac{2}{5} \times \left(-\frac{3}{7}\right) - \frac{1}{6} \times \frac{3}{2} + \frac{1}{14} \times \frac{2}{5}$

$= \left\{\frac{2}{5} \times \left(\frac{-3}{7}\right) + \frac{1}{14} \times \frac{2}{5}\right\} - \frac{1}{6} \times \frac{3}{2}$

$= \frac{2}{5}\left\{\frac{-3}{7} + \frac{1}{14}\right\} - \frac{1}{6} \times \frac{3}{2}$ [Using a (b + c) = ab + ac]

$= \frac{2}{5}\left\{\frac{-6+1}{14}\right\} - \frac{1}{6} \times \frac{3}{2}$

$= \frac{2}{5} \times \frac{-5}{14} - \frac{1}{6} \times \frac{3}{2}$

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

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

$= \frac{-11}{28}$

Question 2

Write the additive inverse of each of the following:

(i) $\frac{2}{8}$ (ii) $\frac{-5}{9}$ (iii) $\frac{-6}{-5}$ (iv) $\frac{2}{-9}$ (v) $\frac{19}{-6}$

Answer:

(i) $\frac{-2}{8}$ (ii) $\frac{5}{9}$ (iii) $\frac{-6}{5}$ (iv) $\frac{2}{9}$ (v) $\frac{19}{6}$

Solution:

(i) The additive inverse of $\frac{2}{8}$ is $\frac{-2}{8}$

as $\frac{-2}{8} + \frac{2}{8}$

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

$= \frac{0}{8}$

$= 0$

(ii) The additive inverse of $\frac{-5}{9}$ is $\frac{5}{9}$

as $\frac{5}{9} + \left(\frac{-5}{9}\right)$

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

$= \frac{0}{9}$

$= 0$

(iii) The additive inverse of $\frac{-6}{-5}$ is $\frac{-6}{5}$

as $\frac{-6}{5} + \left(\frac{-6}{-5}\right)$

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

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

$= \frac{0}{5}$

$= 0$

(iv) The additive inverse of $\frac{2}{-9}$ is $\frac{2}{9}$

as $\frac{2}{9} + \left(\frac{2}{-9}\right)$

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

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

$= \frac{0}{9}$

$= 0$

(v) The additive inverse of $\frac{19}{-6}$ is $\frac{19}{6}$

as $\frac{19}{6} + \left(\frac{19}{-6}\right)$

$= \frac{19}{6} + \left(\frac{-19}{6}\right)$

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

$= \frac{0}{6}$

$= 0$

Question 3

Verify that $-(-x) = x$ for : (i) $x = \frac{11}{15}$ (ii) $x = -\frac{13}{17}$

Answer:

i.e, $-(-x) = x$. is verified

Solution:

(i) We have,

$x = \frac{11}{15}$ The additive inverse of $x = \frac{11}{15}$ is $-x = \frac{-11}{15}$

as $\frac{11}{15} + \left(\frac{-11}{15}\right) = 0$

The same equality $\frac{11}{15} + \left(\frac{-11}{15}\right) = 0$ shows that the additive inverse of $\frac{-11}{15}$ is $\frac{11}{15}$.

This $\Rightarrow -\left(\frac{-11}{15}\right) = \frac{11}{15}$, i.e, $-(-x) = x$. is verified.

(ii) We have,

$x = -\frac{13}{17}$

The additive inverse of $x = \frac{-13}{17}$ is $-x = \frac{13}{17}$

as $\frac{-13}{17} + \frac{13}{17} = 0$.

$\Rightarrow \frac{13}{17} = -\left(\frac{-13}{17}\right)$

The same equality $\frac{-13}{17} + \frac{13}{17} = 0$ shows that the additive inverse of $\frac{13}{17}$

is $-\frac{13}{17}$. This $\Rightarrow -(-(\frac{-13}{17})) = \frac{-13}{17}$

i.e, $-(-x) = x$. is verified.

Question 4

Find the multiplicative inverse of the following

(i) -13 (ii) $\frac{-13}{19}$ (iii) $\frac{1}{5}$ (iv) $\frac{-5}{8} \times \frac{-3}{7}$

(v) $-1 \times \frac{-2}{5}$ (vi) -1

Answer:

(i) $-\frac{1}{13}$ (ii) $\frac{-19}{13}$ (iii) 5 (iv) $\frac{56}{15}$ (v) $\frac{5}{2}$

(vi) – 1

Solution:

(i) The multiplicative inverse of – 13 is $-\frac{1}{13}$ as $-13 \times \frac{-1}{13} = 1$

(ii) The multiplicative inverse of $\frac{-13}{19}$ is $\frac{-19}{13}$ as $-\frac{13}{19} \times \frac{-19}{13} = 1$

(iii) The multiplicative inverse of $\frac{1}{5}$ is 5 as $\frac{1}{5} \times 5 = 1.$

(iv) The multiplicative inverse of

$$\frac{-5}{8} \times \frac{-3}{7} \text{ is } \frac{8}{-5} \times \frac{7}{-3} = \frac{56}{15} \text{ as } \left(\frac{-5}{8} \times \frac{-3}{7}\right) \times \left(\frac{8}{-5} \times \frac{7}{-3}\right) = 1$$

(v) The multiplicative inverse of $-1 \times \frac{-2}{5}$ is $-1 \times \frac{5}{-2} = \frac{5}{2}$ as

(vi) The multiplicative inverse of – 1 is – 1 as $-1 \times (-1) = 1.$

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

Question 5

Name the property under multiplication used in each of the following:

(i) $\frac{-4}{5} \times 1 = 1 \times \frac{-4}{5} = -\frac{4}{5}$ (ii) $-\frac{13}{17} \times \frac{-2}{7} = \frac{-2}{7} \times \frac{-13}{17}$

(iii) $\frac{-19}{29} \times \frac{29}{-19} = 1$

Answer:

(i) Existence of Multiplicative Identity (1 is the multiplicative identity)

(ii) Commutatively

(iii) Existence of Multiplicative Inverse

Solution:

(i) $\frac{-4}{5} \times 1 = 1 \times \frac{-4}{5} = -\frac{4}{5}$ as 1is the multiplicative identity.

(ii) $-\frac{13}{17} \times \frac{-2}{7} = \frac{-2}{7} \times \frac{-13}{17}$ as multiplication is commutative.

(iii) $\frac{-19}{29} \times \frac{29}{-19} = 1$ as $\frac{29}{-19}$ is the multiplicative inverse of $\frac{-19}{29}$.

Question 6

Multiply $\frac{6}{13}$ by the reciprocal of $\frac{-7}{16}$.

Answer:

$\frac{-96}{91}$

Solution:

Reciprocal of $\frac{-7}{16}$ is $\frac{16}{-7}$.

Now, $\frac{6}{13} \times \left(\frac{16}{-7}\right) = \frac{-96}{91}$

Question 7

What property allows you to compute?

$\frac{1}{3} \times \left(6 \times \frac{4}{3}\right)$ as $\left(\frac{1}{3} \times 6\right) \times \frac{4}{3}$

Answer:

Associativity of Multiplication

Solution:

For any three rational numbers a, b and c, $a \times (b \times c) = (a \times b) \times c$.

The multiplication is associative for rational numbers.

The associativity property allows us to compute $\frac{1}{3} \times \left(6 \times \frac{4}{3}\right)$ as $\left(\frac{1}{3} \times 6\right) \times \frac{4}{3}$,

$\frac{1}{3} \times \left(6 \times \frac{4}{3}\right) = \frac{1}{3} \times \frac{24}{3} = \frac{8}{3}$ and $\left(\frac{1}{3} \times 6\right) \times \frac{4}{3} = \frac{6}{3} \times \frac{4}{3} = \frac{8}{3}$

Here, $\frac{1}{3} \times \left(6 \times \frac{4}{3}\right) = \left(\frac{1}{3} \times 6\right) \times \frac{4}{3}$

Question 8

Is $\frac{8}{9}$ the multiplicative inverse of $-1\frac{1}{8}$? Why or why not?

Answer:

No, because the product is not 1

Solution:

No, because the product of $\frac{8}{9}$ and $-1\frac{1}{8}$ is not 1

Question 9

Is 0.3 the multiplicative inverse of $3\frac{1}{3}$? Why or Why not?

Answer:

Yes, because $0.3 \times \frac{10}{3} = \frac{3}{10} \times \frac{10}{3} = 1$

Solution:

Yes, because $3\frac{1}{3} = \frac{10}{3}$ and $0.3 \times \frac{10}{3} = \frac{3}{10} \times \frac{10}{3} = 1$

Question 10

Write:

(i) The rational number that does not have a reciprocal.

(ii) The rational numbers that are equal to their reciprocals.

(iii) The rational number that is equal to its negative.

Answer:

(i) 0 (ii) 1 and -1 (iii) 0

Solution:

(i) Zero has no reciprocal.

(ii) 1 is equal to its reciprocal as $1 \times 1 = 1$.

– 1 is also equal to its reciprocal as – 1 × (– 1) = 1

(iii) Zero is equal to its negative as $0 + 0 = 0$.

Question 11

Fill in the blanks:

(i) Zero has _____ reciprocals.

(ii) The numbers _____ and _____ are their own reciprocals.

(iii) The reciprocal of – 5 is _____

(iv) Reciprocal of $\frac{1}{x}$, where $x \neq 0$ is _____

(v) The product of two rational numbers is always a _____

(vi) The reciprocal of a positive rational number is _____

Answer:

(i) No (ii) 1, – 1 (iii) $\frac{-1}{5}$ (iv) x

(v) Rational number

(vi) Positive

Solution:

(i) No (ii) 1, – 1 (iii) $\frac{-1}{5}$ (iv) x (v) rational number

(vi) a positive rational number.

Exercise 1.2

Question 1

Represent these numbers on the number line (i) $\frac{7}{4}$ (ii) $\frac{-5}{6}$

Answer:

(i)

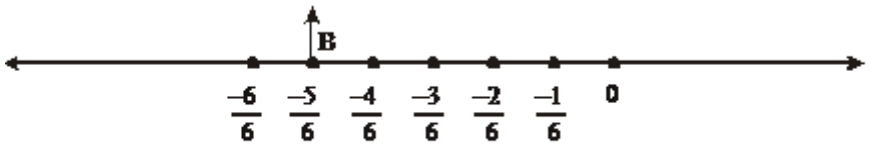
(ii)

Solution:

(i) To represent $\frac{7}{4}$, we make 7 markings of distance $\frac{1}{4}$ each on the right of 0.

Thus, the point A represents $\frac{7}{4}$.

(ii) To represent $\frac{-5}{6}$, we make 6 markings of distance $\frac{1}{6}$ each on the left of zero.

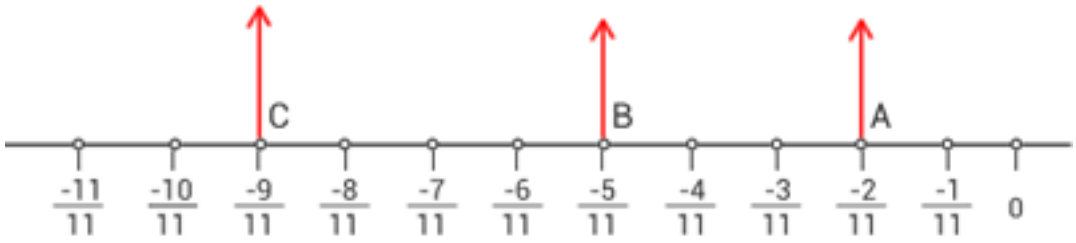


Thus, the point B represents $\frac{-5}{6}$.

Question 2

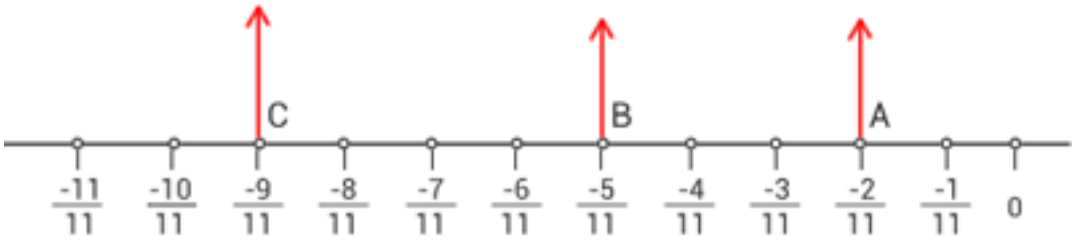
Represent $\frac{-2}{11}$, $\frac{-5}{11}$, $\frac{-9}{11}$ on the number line.

Answer:



Solution:

We draw a line *l*. We take a point O on it. From O, we mark 11 markings of distance $\frac{1}{11}$ each on the left of O (i.e., 0)



Thus, the points A, B and C represent $\frac{-2}{11}$, $\frac{-5}{11}$ and $\frac{-9}{11}$ respectively.

Question 3

Write five rational numbers which are smaller than 2.

Answer:

Some of these are $1, \frac{1}{2}, 0, -1, \frac{-1}{2}$

(There can be many more such rational numbers)

Solution:

Let's take the two numbers 0 and 2. 0 is smaller than 2.

Now, 2 can be written as $\frac{20}{10}$ and 0 as $\frac{0}{10}$.

Thus, we have $\frac{19}{10}, \frac{18}{10}, \frac{17}{10}, \frac{16}{10}, \frac{15}{10}, \frac{14}{10}.....\frac{1}{10}$ between 2 and 0.

We can take any five of these values.

Question 4

Find ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$.

Answer:

$\frac{-7}{20}, \frac{-6}{20}, \frac{-5}{20}, ...\frac{-8}{20}, \frac{-9}{20}$

(There can be many more such rational numbers)

Solution:

First, we make the same denominator of the given rational numbers.

$$\frac{-2}{5} = \frac{-2 \times 2}{5 \times 2} = \frac{-4}{10} = \frac{-4 \times 2}{10 \times 2} = \frac{-8}{20}$$

and

$$\frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10} = \frac{5 \times 2}{10 \times 2} = \frac{10}{20}$$

Note: We make denominator 20 because when the denominator is 10, then we can conveniently find out only 8 rational numbers.

Thus, we have $\frac{-7}{20}, \frac{-6}{20}, \frac{-5}{20}, \ldots\ldots \frac{8}{20}, \frac{9}{20}$

We can take any ten of these values.

Question 5

Find five rational numbers between

(i) $\frac{2}{3}$ and $\frac{4}{5}$ (ii) $\frac{-3}{2}$ and $\frac{5}{3}$ (iii) $\frac{1}{4}$ and $\frac{1}{2}$

Answer:

(i) $\frac{41}{60}, \frac{7}{10}, \frac{11}{15}, \frac{23}{30}$ (ii) $\frac{-8}{6}, \frac{-7}{6}, \frac{-6}{6}, \frac{-5}{6}, \frac{-4}{6} \ldots\ldots \frac{8}{6}, \frac{9}{6}$

(iii) $\frac{11}{24}, \frac{10}{24}, \frac{9}{24}, \frac{8}{24}, \frac{7}{24}$

(There can be many more such rational numbers)

Solution:

(i) $\frac{2}{3}$ and $\frac{4}{5}$

First Method:

We first convert $\frac{2}{3}$ and $\frac{4}{5}$ to rational numbers with the same denominator i.e.

$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15} = \frac{10 \times 3}{15 \times 3} = \frac{30}{45}$ and $\frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15} = \frac{12 \times 3}{15 \times 3} = \frac{36}{45}$

Thus, we have, $\frac{35}{45}, \frac{34}{45}, \frac{33}{45}, \frac{32}{45}$ and $\frac{31}{45}$ as five ration numbers between $\frac{2}{3}$ and $\frac{4}{5}$

Another Method:

We know that, if a and b are two rational numbers, then $\frac{a + b}{2}$ is a rational

number between a and b such that $a < \frac{a + b}{2} < b$.

We find the mean of the given rational numbers,

$\left(\frac{2}{3} + \frac{4}{5}\right) \div 2 = \left(\frac{10 + 12}{15}\right) \times \frac{1}{2} = \frac{22}{15} \times \frac{1}{2} = \frac{11}{15}$

So, $\frac{2}{3} < \frac{11}{15} < \frac{4}{5}$

We now find another rational number between $\frac{2}{3}$ and $\frac{11}{15}$.

For this, we again find the mean of $\frac{2}{3}$ and $\frac{11}{15}$, i.e.,

$\left(\frac{2}{3} + \frac{11}{15}\right) \div 2 = \left(\frac{30 + 33}{45}\right) \times \frac{1}{2} = \frac{63}{45} \times \frac{1}{2} = \frac{7}{5} \times \frac{1}{2} = \frac{7}{10}$

So, $\frac{2}{3} < \frac{7}{10} < \frac{11}{15}$ or $\frac{2}{3} < \frac{7}{10} < \frac{11}{15} < \frac{4}{5}$

Further, we find another rational number between $\frac{11}{15}$ and $\frac{4}{5}$

For this, we again find the mean of $\frac{11}{15}$ and $\frac{4}{5}$ i.e,

$\left(\frac{11}{15} + \frac{4}{5}\right) \div 2 = \left(\frac{11 + 12}{15}\right) \times \frac{1}{2} = \frac{23}{15} \times \frac{1}{2} = \frac{23}{30}$.

So, $\frac{11}{15} < \frac{23}{30} < \frac{4}{5}$ or $\frac{2}{3} < \frac{7}{10} < \frac{11}{15} < \frac{23}{30} < \frac{4}{5}$

Now, we find another rational number between $\frac{2}{3}$ and $\frac{7}{10}$

For this, we again find the mean of $\frac{2}{3}$ and $\frac{7}{10}$,

i.e, $\left(\frac{2}{3} + \frac{7}{10}\right) \div 2 = \left(\frac{20 + 21}{30}\right) \times \frac{1}{2} = \frac{41}{30} \times \frac{1}{2} = \frac{41}{60}$

So, $\frac{2}{3} < \frac{41}{60} < \frac{7}{10}$ or $\frac{2}{3} < \frac{41}{60} < \frac{7}{10} < \frac{11}{15} < \frac{23}{30} < \frac{4}{5}$

Also, we find another rational number between $\frac{23}{30}$ and $\frac{4}{5}$

For this, we again find the mean of $\frac{23}{30}$ and $\frac{4}{5}$, i.e. $\left(\frac{23}{30} + \frac{4}{5}\right) \div \frac{1}{2}$

$\left(\frac{23 + 24}{30}\right) \times \frac{1}{2} = \frac{47}{30} \times \frac{1}{2} = \frac{47}{60}$

So, $\frac{23}{30} < \frac{47}{60} < \frac{4}{5}$ or $\frac{2}{3} < \frac{41}{60} < \frac{7}{10} < \frac{11}{15} < \frac{23}{30} < \frac{47}{60} < \frac{4}{5}$

Thus, the five rational numbers between $\frac{2}{3}$ and $\frac{4}{5}$ are $\frac{41}{60}$, $\frac{7}{10}$, $\frac{11}{15}$, $\frac{23}{30}$ and $\frac{47}{60}$

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

We first convert $\frac{-3}{2}$ and $\frac{5}{3}$ to rational numbers with the same denominator

i.e., $\frac{-3}{2} = \frac{-3 \times 3}{2 \times 3} = \frac{-9}{6}$ and $\frac{5}{3} = \frac{5 \times 2}{2 \times 3} = \frac{10}{6}$

Thus, we have $\frac{-8}{6}, \frac{-7}{6}, \frac{-6}{6}, \frac{-5}{6}, \frac{-4}{6}.....\frac{8}{6}, \frac{9}{6}$

We can take any five of these values as rational numbers between $\frac{-3}{2}$ and $\frac{5}{3}$.

(iii) $\frac{1}{4}$ and $\frac{1}{2}$

We first convert $\frac{1}{4}$ and $\frac{1}{2}$ to rational numbers with the same denominator

i.e., $\frac{1}{4} = \frac{1 \times 6}{4 \times 6} = \frac{6}{24}$ and $\frac{1}{2} = \frac{1 \times 12}{2 \times 12} = \frac{12}{24}$.

Thus, we have, $\frac{11}{24}, \frac{10}{24}, \frac{9}{24}, \frac{8}{24}$ and $\frac{7}{24}$ as rational numbers between $\frac{1}{4}$ and $\frac{1}{2}$.

Question 6

Write five rational numbers greater than – 2.

Answer:

-1. 0. 1, 2, 3 (There can be many more such rational numbers)

Solution:

Since, every integer is a rational number, therefore, we can pick up any five integers greater than -2.

Thus five rational numbers greater than -2 are -1, 0, 1, 2, 3.

Question 7

Find ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$.

Answer:

$\frac{59}{80}, \frac{58}{80}, \frac{57}{80}, \frac{56}{80}, \frac{55}{80}, \frac{54}{80}, \frac{53}{80}, \frac{52}{80}, \frac{51}{80}, \frac{50}{80}, \frac{49}{80}$

(There can be many more such rational numbers)

Solution:

First we make the denominator of the given rational numbers equal

$$\frac{3}{5} = \frac{3 \times 4}{5 \times 4} = \frac{12}{20} = \frac{24}{40} = \frac{48}{80}$$

and

$$\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20} = \frac{30}{40} = \frac{60}{80}$$

Thus, we have, $\frac{59}{80}, \frac{58}{80}, \frac{57}{80}, \frac{56}{80}, \frac{55}{80}, \frac{54}{80}, \frac{53}{80}, \frac{52}{80}, \frac{51}{80}, \frac{50}{80}, \frac{49}{80}$

as rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$.

We can take any ten of these values.