RATIONAL NUMBERS

NCERT Textbook Questions

EXERCISE 1.1

Q.1. Using appropriate properties find:

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

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

(by distributivity)

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

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

$=\frac{2}{5}\left\{\frac{-3}{7}+\frac{1}{14}\right\}-\frac{1}{4}$ (by distributivity)

$=\frac{2}{5}\left\{\frac{-6+1}{14}\right\}-\frac{1}{4}=\frac{2}{5}\times\frac{-5}{14}-\frac{1}{4}=\frac{-1}{7}-\frac{1}{4}=\frac{-4-7}{28}=\frac{-11}{28}$

Q.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)** $\frac{19}{-6}$

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

$\frac{-2}{8}+\frac{2}{8}=\frac{-2+2}{8}=\frac{0}{8}=0$

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

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

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

$$\frac{-6}{5}+\left(\frac{-6}{-5}\right)=\frac{-6}{5}+\frac{6}{5}=\frac{-6+6}{5}=\frac{0}{5}=0$$

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

$$\frac{2}{9}+\left(\frac{2}{-9}\right)=\frac{2}{9}+\left(\frac{-2}{9}\right)=\frac{2-2}{9}=\frac{0}{9}=0$$

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

$$\frac{19}{6}+\left(\frac{19}{-6}\right)=\frac{19}{6}+\left(\frac{-19}{6}\right)=\frac{19-19}{6}=\frac{0}{6}=0$$

Q.3. Verify that $-(-x)=x$ for:

(i) $x=\frac{11}{15}$ **(ii)** $x=-\frac{13}{17}$

Sol. (i) We have, $x=\frac{11}{15}$

The additive inverse of $x=\frac{11}{15}$ is $-x=\frac{-11}{15}$ since $\frac{11}{15}+\left(\frac{-11}{15}\right)=0$

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

or $-\left(\frac{-11}{15}\right)=\frac{11}{15}$, i.e., $-(-x)=x$.

(ii) We have, $x=\frac{13}{17}$

The additive inverse of $x=\frac{-13}{17}$ is $-x=\frac{13}{17}$ since $\frac{-13}{17}+\frac{13}{17}=0$.

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

or $-\left(\frac{-13}{17}\right)=\frac{13}{17}$ i.e, $-(-x)=x$.

Q.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

Sol. (i) The multiplicative inverse of -13 is $-\frac{1}{13}$, because $-13\times\left(\frac{-1}{13}\right)=1$

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

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

(iv) The multiplicative inverse of $\frac{-5}{8}\times\frac{-3}{7}$ *is* $\frac{8}{-5}\times\frac{7}{-3}$

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

(vi) The multiplication inverse of -1 is -1.

Q.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) $\frac{-19}{29}\times\frac{29}{-19}=1$

Sol. (i) 1 is the multiplicative identity.

(ii) Commutativity

(iii) Multiplicative inverse.

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

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

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

Q.7. Tell what property allows you to compute $\frac{1}{3}\times\left(6\times\frac{4}{3}\right)$ as $\left(\frac{1}{3}\times 6\right)\times\frac{4}{3}$

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

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

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

We know that for any three rational numbers a, b and c,

$$a \times (b \times c) = (a \times b) \times c.$$

This property is called associativity of multiplication for rational numbers.

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

Sol. No, because, $-1\frac{1}{8}=\frac{-9}{8}$ but the rational number, $\frac{8}{9}$ is positive.

Q.9. Is 0.3 the multiplicative inverse of $3\frac{1}{3}$? Why or Why not?

Sol. Yes, because $3\frac{1}{3}=\frac{10}{3}$, i.e., $0.3\times\frac{10}{3}=\frac{3}{10}\times\frac{10}{3}=1$

Q.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.

Sol. (i) Zero has no reciprocal.

(ii) 1 and – 1 are the two numbers that are equal to their respective reciprocals

(iii) Zero is the only rational number that is equal to its negative.

Q.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 numbers is _____.

Sol. (i) no

(ii) 1, –1

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

(iv) x

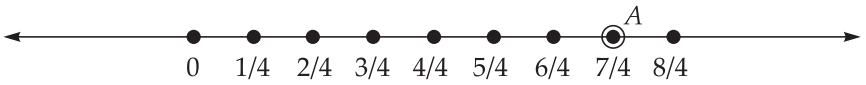
(v) rational number

(vi) positive

EXERCISE 1.2

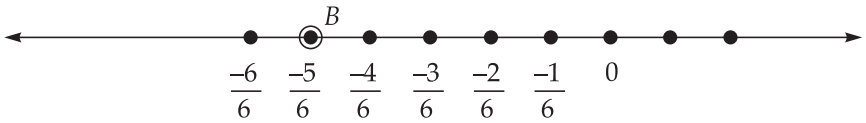
Q.1. Represent these numbers on the number line (i) $\frac{7}{4}$ (ii) $\frac{-5}{6}$

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



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

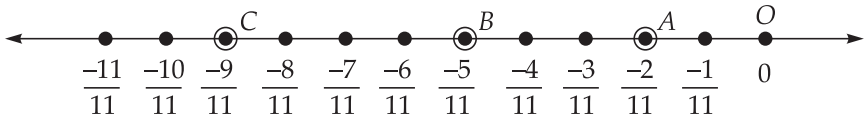
(ii) To represent $\frac{-5}{6}$, we make 6 marking of distance $\frac{1}{6}$ each on the left of zero and starting from 0.



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

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

Sol. Draw a number line. Take a point O on it. From O mark 11 points of distance $\frac{1}{11}$ each on the left of O (i.e., 0)



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

Q.3. Write five rational numbers which are smaller than 2.

Sol. We can take 0 and 2 because 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.

You can take any five of these values.

Q.4. Find ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$.

Sol. First we make 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 find out only 8 rational numbers.

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

You can take any ten of these values.

Q. 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 $\frac{1}{2}$

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

First Method: We first converts $\frac{2}{3}$ and $\frac{4}{5}$ to rational numbers with the same denominators i.e.

$$\frac{2}{3}=\frac{2\times5}{3\times5}=\frac{10}{15}=\frac{10\times3}{15\times3}=\frac{30}{45}$$

and $$\frac{4}{5}=\frac{4\times3}{5\times3}=\frac{12}{15}=\frac{12\times3}{15\times3}=\frac{36}{45}$$

Thus, we have, $\frac{35}{45},\frac{34}{45},\frac{33}{45},\frac{32}{45},\frac{31}{45}$

Another Method: We know that, if a and b are two rational numbers, then $\frac{a+b}{2}$ is a rational numbers between a and b such that a < $\frac{a+b}{2}$ < b.

We find the mean of the given rational numbers,

$$\left(\frac{2}{3}+\frac{4}{5}\right)\div2=\left(\frac{10+12}{15}\right)\times\frac{1}{2}=\frac{22}{15}\times\frac{1}{2}=\frac{11}{15}$$

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.,

$$\left(\frac{2}{3}+\frac{11}{15}\right)\div2=\left(\frac{30+33}{45}\right)\times\frac{1}{2}=\frac{63}{45}\times\frac{1}{2}=\frac{7}{5}\times\frac{1}{2}=\frac{7}{10}$$

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,

$$\left(\frac{11}{15}+\frac{4}{5}\right)\div2=\left(\frac{11+12}{15}\right)\times\frac{1}{2}=\frac{23}{15}\times\frac{1}{2}=\frac{23}{30}\ .$$

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 $\frac{-8}{6}, \frac{-7}{6}, \frac{-6}{6}, \frac{-5}{6}, \frac{-4}{6} \ldots\ldots \frac{8}{6}, \frac{9}{6}$

You can take any five of these values.

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

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

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

Q.6. Write five rational numbers greater than – 2.

Sol. Some of the rational numbers greater than – 2 are:

$-1, 0, \frac{1}{2}, 1, \frac{3}{2}$

Q.7. Find ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$.

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

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

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

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

You can take any ten of these values.