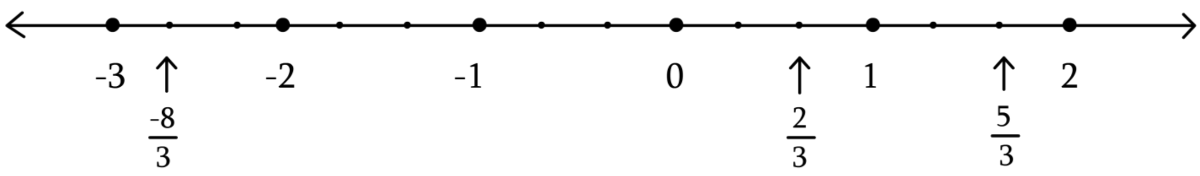
1. Rational and Irrational numbers

1) Show the following numbers on a number line. Draw a separate number line for each example.

(1) $\frac{2}{3}, \frac{5}{3}, \frac{-8}{3}$



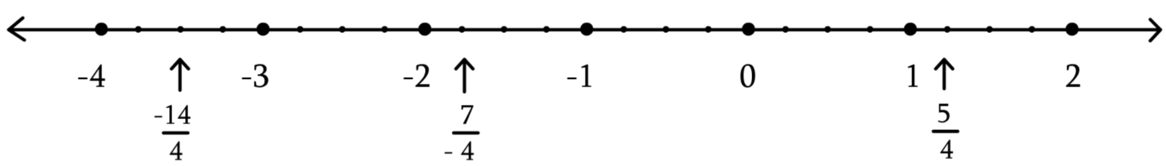
Solution: The denominator of the given rational numbers $\frac{2}{3}, \frac{5}{3}, \frac{-8}{3}$ is 3 Therefore each unit is to be divided in three equal parts.

The second point from zero shows the number $\frac{2}{3}$ on the number line on the right side of zero.

The number $\frac{5}{3}$ shows on the number line on the right side of zero at fifth point from zero.

The number $\frac{-8}{3}$ shows on the number line on the left side of zero at eight point from zero.

(2) $\frac{5}{4}, \frac{-7}{4}, \frac{-14}{4}$



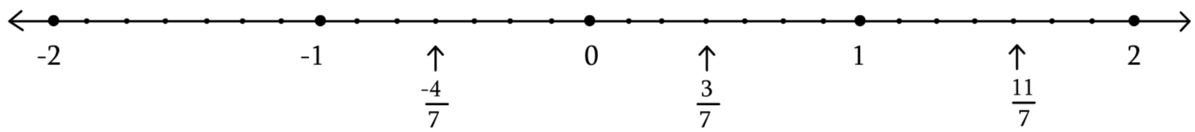
Solution : The denominator of the given rational numbers
$\frac{5}{4}$, $\frac{-7}{4}$, $\frac{-14}{4}$ **.Therefore each unit is to be divided in four equal parts.**

(i) The number $\frac{5}{4}$ shows on the number line on the right side of zero at fifth point from zero.

(ii) The number $\frac{-7}{4}$ shows on the number line on the left side of zero at seventh point from zero.

(iii) The number $\frac{-14}{4}$ shows on the number line on the left side of zero at fourteenth point from zero.

(3) $\frac{-4}{7}$, $\frac{11}{7}$, $\frac{3}{7}$



Solution : The denominator of the given rational numbers $\frac{-4}{7}$, $\frac{11}{7}$, $\frac{3}{7}$ is 7.

Therefore each unit is to be divided in seven equal parts.

(i) The number $\frac{-4}{7}$ shows on the number line on the left side of zero at fourth point from zero.

(ii) The number $\frac{11}{7} = 1\frac{4}{7}$ lies between 1 and 2, therefore $\frac{11}{7}$ is at forth point after 1 on the right side of zero.

(iii)The number $\frac{3}{7}$ shows on the number line on the right side of zero at third point from zero.

(4) $\frac{-3}{2}, +\frac{11}{5}, \frac{+13}{8}$

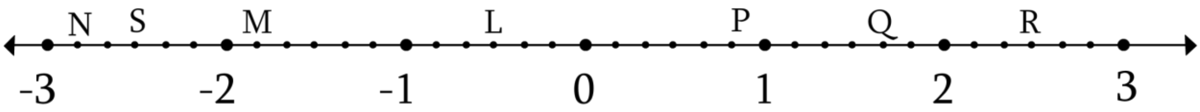
Solution :

(i)The number $\frac{-3}{2} = -1\frac{1}{2}$ lies between -1 and -2. The denominator of the number $\frac{-3}{2}$ is 2. Therefore the distance -1 and -2 is to be divided into two equal parts. The first consecutive point on the left side of -1 shows $\frac{-3}{2}$

(ii) The number $\frac{11}{5} = 2\frac{1}{5}$ lies between 2 and 3. The denominator of the number $\frac{11}{5}$ is 5, therefore the distance and 3 is to be divided in five equal parts. The first consecutive point on the right side of 2 shows $\frac{11}{5}$

(iii) $\frac{+13}{8} = +1\frac{5}{8}$ lies between $+1$ and $+2$ the denominator of the number $\frac{+13}{8}$ is 8 therefore the distance between $+1$ and $+2$ is to be divided in eight equal parts. The fifth consecutive point on the right side of $+1$ shows $\frac{+13}{8}$

2) Observe the number line and answer the questions.



1) Which numbers are indicated by the points 'Q' and 'M'.

2) Which point indicates the number $-2\frac{5}{6}$ on the number line.

3) Write the co - ordinates of the points P and L on the number line.

4) Which point indicates the number $2\frac{3}{6}$

5) Which number is indicated by the opposite point of R.

Solution :

1) $\frac{10}{6}$ is indicated by the point Q and $\frac{-11}{6}$ is indicated by the point M.

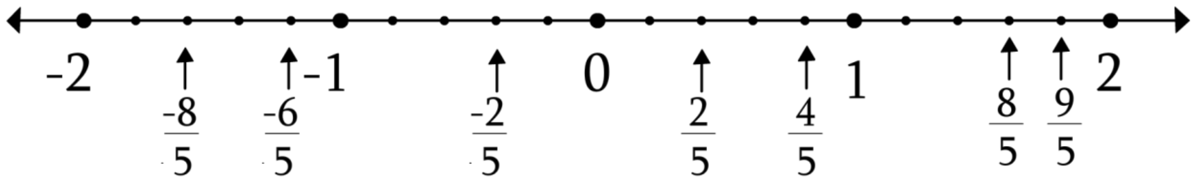
2) The point N indicates the number $-2\frac{5}{6}$ on the number line.

3) The point P denotes the number $\frac{5}{6}$ and the point L denotes the number $\frac{-3}{6}$

4) The point R indicates the number the number $2\frac{3}{6}$

5) The point S is the opposite point of R. $\frac{15}{6}$ means $2\frac{3}{6}$, this number is denoted by the opposite point of R. Therefore $\frac{15}{6}$ or $2\frac{3}{6}$ is the number indicated by the opposite point of R.

3) Observe the number line and answer the questions.



1) Which is the smallest number in $\frac{-8}{5}$ and $\frac{-6}{5}$. Give reason.

2) Which is the greatest number in $\frac{4}{5}$ and O. Give reason.

3) Write the numbers -2, $\frac{-2}{5}$, $\frac{-8}{5}$, $\frac{9}{5}$, 1, 0 in ascending order.

4) Which is the greatest number in 2, $\frac{8}{5}$ and $\frac{2}{5}$. Give reason.

5) Write the numbers $\frac{4}{5}$, $\frac{8}{5}$, 2, $\frac{-2}{5}$, -2 in descending order.

Ans :

1) $\frac{-8}{5}$ is the smallest number than $\frac{-6}{5}$ because the number $\frac{-8}{5}$ lies on the left side of $\frac{-6}{5}$ on the number line.

2) $\frac{4}{5}$ is the greatest number number than O because $\frac{4}{5}$ lies on the right side of O on the number line or any positive number is greater than zero.

3) -2, $\frac{-8}{5}$, $\frac{-2}{5}$, 0, 1, $\frac{9}{5}$ is the ascending order of given numbers

4) 2 is the greater number than $\frac{8}{5}$ and $\frac{2}{5}$ because the number 2 lies on the right side of the numbers $\frac{8}{5}$ and $\frac{2}{5}$ on the number line.

4) Compare the following numbers.

(i) $0, \frac{-3}{7}$

Ans : $0, \frac{-3}{7}$

Zero is always greater than any negative number.

$\therefore 0 > \frac{-3}{7}$

(ii) $\frac{-23}{50}, \frac{-27}{50}$

Ans : $\frac{-23}{50}, \frac{-27}{50}$

The denominators are the same of the given rational numbers.

$\therefore -23 > -27$

(iii) $\frac{13}{11}, 0$

Ans : $\frac{13}{11}, 0$

The positive number is always greater than zero.

$\therefore \frac{13}{11} > 0$

(iv) $\frac{-20}{-36}, \frac{-4}{-9}$

Ans : $\frac{-20}{-36} = \frac{20}{36}$ and $\frac{-4}{-9} = \frac{4}{9}$

Here $a = 20$, $b = 36$, $c = 4$, $d = 9$

$a \times \mathrm{d} = 20 \times 9 = 180\ ;\ \mathrm{b} \times c = 36 \times 4 = 144$

Here $180 > 144$

$\therefore a \times \mathrm{d} > \mathrm{b} \times c$

$\therefore \dfrac{a}{\mathrm{b}} > \dfrac{\mathrm{c}}{\mathrm{d}}$

$\therefore \dfrac{20}{36} > \dfrac{4}{9}$

$\therefore \dfrac{-20}{-36} > \dfrac{-4}{-9}$

v) – 10 , −3

Ans : – 10 , −3

Here , $a = 10$, b = 3

If a and b are positive numbers such that $a > b$, then $-a < -\mathrm{b}$

$\therefore 10 > 3$

$\therefore -10 < -3$

vi) $\dfrac{-1}{7} , \dfrac{5}{7}$

Ans : $\dfrac{-1}{7} , \dfrac{5}{7}$

A negative number is always less than a positive number.

$\therefore -\dfrac{1}{7} < \dfrac{5}{7}$

vii) $\dfrac{48}{35} , \dfrac{173}{35}$

Ans : $\dfrac{48}{35} , \dfrac{173}{35}$

The denominator of the given rational numbers is the same, therefore the smaller the numerator, the smaller the fraction.

$\therefore 48 < 173$

$\therefore \frac{48}{35} < \frac{173}{35}$

viii) $\frac{17}{11}, \frac{9}{19}$

Ans : $\frac{17}{11}, \frac{9}{19}$

Here $a = 17, b = 11, c = 9, d = 19$

$a \times d = 17 \times 19 = 323, b \times c = 11 \times 9 = 99$

Here , $323 > 99$

$\therefore a \times \mathrm{d} > \mathrm{b} \times c$

$\therefore \frac{a}{\mathrm{d}} > \frac{\mathrm{c}}{\mathrm{d}}$

$\therefore \frac{17}{11} > \frac{9}{19}$

ix) $\frac{-30}{12}, \frac{-7}{3}$

Ans : $\frac{-30}{12}, \frac{-7}{3}$

Here , $a = -30, \mathrm{b} = 12, \mathrm{c} = -7, \mathrm{d} = 3$

$a \times d = -30 \times 3 = -90 ; b \times c = 12 \times (-7) = -84$

Here , $-90 < -84$

$\therefore a \times \mathrm{d} < \mathrm{b} \times \mathrm{c}$

$$\therefore \ \frac{a}{b} < \frac{c}{d}$$

$$\therefore \ \frac{-30}{12} < \frac{-7}{3}$$

x) $\frac{-11}{17}, \frac{-3}{5}$

Ans : $\frac{-11}{17}, \frac{-3}{5}$

Here , $a = -11 , b = 17 , c = -3 , d = 5$

$$a \times d = -11 \times 5 = -55 ; \quad b \times c = 17 \times (-3) = -51$$

$$-55 < -51$$

$$\therefore a \times d < b \times c$$

$$\therefore \ \frac{a}{b} < \frac{c}{d}$$

$$\therefore \ \frac{-11}{17} < \frac{-3}{5}$$

5) Write the following rational numbers in decimal form.

i) $\frac{7}{41}$

Solution : $\frac{7}{41}$

```
         0.170731
     ________________
41 ) 7.000000
  −  4 1
     ________________
     290
    −287
     ________________
       0300
   −    287
     ________________
        130
   −    123
     ________________
          070  ⟶  Now there will be repetition.
   −       41
     ________________
           29
```

$\frac{7}{41} = 0.170731..... = 0.\overline{17073}$

$\therefore$ **The decimal form** $\frac{7}{41}$ **is** $0.\overline{17073}$

ii) $\frac{-9}{11}$

Solution : $\frac{-9}{11}$

$$\begin{array}{r|l} & 0.8181 \\ 11 & 9.0000 \\ & -\ 8\ 8 \\ & 20 \\ & -11 \\ & 090 \\ & -\ 88 \\ & 20 \\ & 11 \\ & 09 \end{array}$$

090 → **Now there will be repetition.**

$\frac{9}{11} = 0.8181$

$\therefore \frac{-9}{11} = -\ 0.8181 = -\ 0.\overline{81}$

$\therefore$ **The decimal form of** $\frac{-9}{11}$ **is** $-\ 0.\overline{81}$

iii) $\frac{105}{9}$

Solution : $\frac{105}{9}$

```
       11.66
   ___________
 9 ) 105.00
 -    99
   ___________
      060  ⟶  Now there will be repetition.
    -  54
   ___________
       60
     - 54
   ___________
       06
```

$\frac{105}{9} = 11.66 = 11.\dot{6}$

$\therefore$ The decimal form of $\frac{105}{9}$ is $11.\dot{6}$

iv) $\frac{-33}{-7}$

Solution :

```
       4.714285
   7 ) 33.000000
     − 28
       050
     −  49
         10
       − 7
         030
       − 28
          020
         −14
          060
        −  56
           040
         − 35
             05  ⟶  Now there will be repetition.
```

$\frac{33}{7} = 4.\overline{714285}$

$\therefore$ **The decimal form of** $\frac{-33}{-7}$ **is** $4.\overline{714285}$

v) $\frac{183}{15}$

Solution : $\frac{183}{15}$

$$
\begin{array}{r|l}
 & 12.2 \\
15 & 183.0 \\
 & -15 \\
 & 33 \\
 & -\ 30 \\
 & 30 \\
 & -\ 30 \\
 & 00
\end{array}
$$

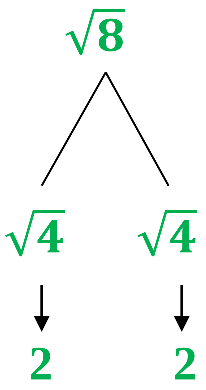
$\therefore \frac{183}{15} = 12.2$

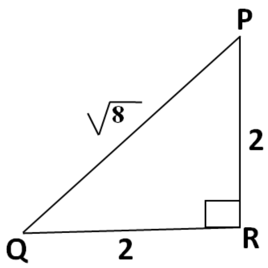
Here the remainder is zero hence the process of division ends.

6) Show the number $\sqrt{8}$ on the number line.

Solution : Here $\sqrt{8} = \sqrt{4+4} = \sqrt{(2)^2 + (2)^2}$

Rough Diagram





If l (PQ) = $\sqrt{4+4} = \sqrt{(2)^2+(2)^2}$

and take l (PR) = 2 units.

In right angled Δ PRQ,

By Pythagoras theorem,

$$(PQ)^2 = (PR)^2 + (QR)^2$$

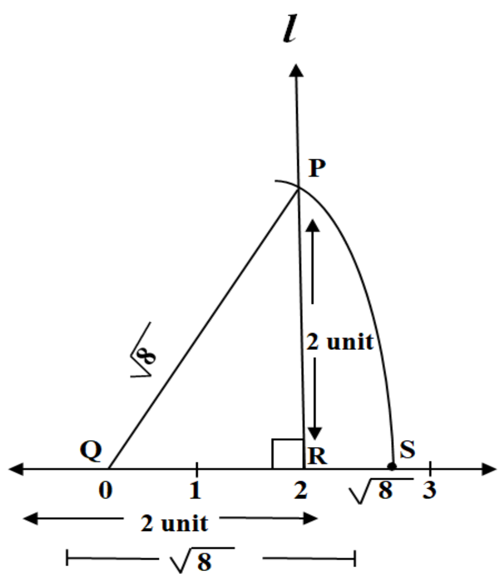
$$(\sqrt{8})^2 = (2)^2 + (2)^2$$

$$= 4 + 4$$

$$= 8$$

Here L.H.S. = R.H.S.

$$\therefore PQ = \sqrt{8}$$



(i) Draw a line ‘t’ and take a centre ‘a’

(ii) Take point R on right side of Q at a distance 2 unit

(iii) Draw line *l* perpendicular to the number line through point R.

(iv) Take point P on line *l* at a distance 2 unit.

(vi) Draw an arc with the distance as a radius QP in compass at the point P name the point as S where the arc intersects the number line.

(vii) The distance QS indicates the number $\sqrt{8}$

7) Compare the numbers $\frac{6}{5}$ and $\frac{7}{4}$ and complete the following activity.

$$\frac{6}{5} = \frac{6 \times \square}{5 \times 4} = \frac{24}{\square}$$

$$\frac{7}{4} = \frac{7 \times 5}{4 \times \square} = \frac{\square}{20}$$

$$\therefore \frac{24}{\square} < \frac{\square}{20}$$

$$\therefore \frac{6}{5} \; \square \; \frac{7}{4}$$

Ans :

$$\frac{6}{5} = \frac{6 \times \boxed{4}}{5 \times 4} = \frac{24}{\boxed{20}}$$

$$\frac{7}{4} = \frac{7 \times 5}{4 \times \boxed{5}} = \frac{\boxed{35}}{20}$$

$$\therefore \frac{24}{\boxed{20}} < \frac{\boxed{35}}{20}$$

$$\therefore \frac{6}{5} \boxed{<} \frac{7}{4}$$

8) Compare the numbers $\frac{-9}{7}$, $\frac{-5}{3}$ and complete the following activity.

$$\frac{9}{7} = \frac{9 \times 3}{7 \times \square} = \frac{27}{\square}$$

$$\frac{5}{3} = \frac{5 \times \square}{3 \times 7} = \frac{\square}{21}$$

$$\therefore \frac{27}{\square} < \frac{\square}{21}$$

$$\therefore \frac{9}{7} \square \frac{5}{3}$$

$$\therefore \frac{-9}{7} \square \frac{-5}{3}$$

Ans : $\frac{9}{7} = \frac{9 \times 3}{7 \times \boxed{3}} = \frac{27}{\boxed{21}}$

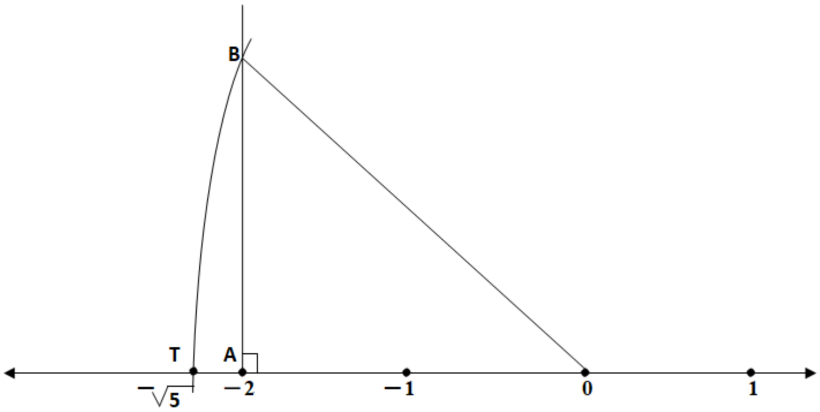
$\frac{5}{3} = \frac{5 \times \boxed{7}}{3 \times 7} = \frac{\boxed{35}}{21}$

$\therefore \frac{27}{21} \boxed{<} \frac{35}{21}$

$\therefore \frac{9}{7} \boxed{<} \frac{5}{3}$

$\therefore \frac{-9}{7} \boxed{>} \frac{-5}{3}$

9) The steps are given to show $-\sqrt{5}$ on the number line, fill in the boxes properly and complete the activity.



Activity :

- **The point A on the number line shows the number ……**

- **A line perpendicular to the number line is drawn through point 1 , Point B is at unit distance from A on the line.**

- **Right angled Δ OAB is obtained by drawing seg OB.**

- **l (OA) = $\square$, l (AB) = 1**

In Δ OAB,

By Pythagoras theorem,

$l\,(OB)^2 = l\,(OA)^2 + (AB)^2$

$= \square^2 + \square^2$

$= \square + \square$

$= \square$

$\therefore l\,(OB) = \square$

Draw an arc with the distance as …….. mark the point of intersection of the line and the arc as T. The point T shows the number ……

Ans :

- **The point A on the number line shows the number − 2**

- **A line perpendicular to the number line is drawn through point 1 , Point B is at unit distance from A on the line.**

- **Right angled Δ OAB is obtained by drawing seg OB.**

- l (OA) = $\boxed{+2}$, l (AB) = 1

  In Δ OAB,

  By Pythagoras theorem,

  $l\,(OB)^2 = l\,(OA)^2 + (AB)^2$

  $= \boxed{2}^2 + \boxed{1}^2$

  $= \boxed{4} + \boxed{1}$

  $= \boxed{5}$

  $\therefore\ l\,(OB) = \boxed{5}$

Draw an arc with the distance as OB mark the point of intersection of the line and the arc as T. The point T shows the number $-\sqrt{5}$

10) Write the following statement true or false.

1) The denominator of a rational number is zero

Ans : False, the denominator of a rational number must not zero.

2) There are infinite rational numbers between any two rational nmbers.

Ans : True

3) While comparing two rational numbers, the number to the left on a number

Ans : True

4) **If the numerator and the denominator of a rational number is multiplied by any non zero number then the value of rational number is changed.**

Ans : False, if the numerator and the denominator of a rational number is multiplied by any non zero number then the value of rational number does not change.

5) **A positive number is less than a negative number.**

Ans : False, a positive number is greater than a negative number.

6) **Every rational number can be written in a non – terminating recurring decimal form.**

Ans : True.

7) **If the denominators are the same, then the rational number with greater numeration is the greater rational number.**

Ans : True

8) **while dividing the numerator of a rational number by its denominator then the rational number is not represented in decimal form.**

Ans : False, while dividing the numerator of a rational number by its denominator then the decimal representation of rational number is formed.

9) A terminating decimal form can be written as a non – terminating recurring decimal form.

Ans : True

10) The decimal form of an irrational number is non – terminating recurring.

Ans : True

11) The rational numbers and an irrational numbers are shown on the number line.

Ans : True

12) Zero is a rational number.

Ans : True

13) 9 is not a rational number.

Ans : False, 9 is a rational number.

14) All integers are the rational numbers

Ans : True, because every integer can be written in $\frac{m}{n}$ form.

15) All fractions are not rational numbers.

Ans : False, all fractions are rational numbers.

16) All rational numbers are negative

Ans : False, the positive numbers and negative numbers are the rational numbers.

11) Match the following pairs.

1.

Group 'A'	Group ' B '
(1) Smallest whole number	(a) Can not say
(2) Greatest natural number	(b) 1
(3) Smallest natural number	(c) -1
(4) Greatest negative integer	(d) 0

Ans :

Group 'A'	Group ' B '
(1) Smallest whole number	(d) 0
(2) Greatest natural number	(a) Can not say
(3) Smallest natural number	(b) 1
(4) Greatest negative integer	(c) -1

2.

Group 'A'	Group 'B'
(1) A rational number	(a) $\sqrt{10}$
(2) A terminating decimal form	(b) $\frac{22}{7}$
(3) A recurring decimal form	(c) 3.14
(4) An irrational number	(d) $\frac{17}{8}$

Ans :

Group 'A'	Group 'B'
(1) A rational number	(c) 3.14
(2) A terminating decimal form	(d) $\frac{17}{8}$
(3) A recurring decimal form	(b) $\frac{22}{7}$
(4) An irrational number	(a) $\sqrt{10}$

3.

Group 'A'	Group 'B'
(1) A rational number	(a) group of rational and an irrational
(2) Integers	(b) non – terminating recurring decimal form
(3) An irrational number	(c) group of positive and Negative numbers
(4) Real number	(d) non termination and non recurring decimal form

Ans :

Group 'A'	Group 'B'
(1) A rational number	(b) non – terminating and recurring decimal form
(2) Integers	(c) group of positive and negative numbers
(3) An irrational number	(d) non termination and non recurring decimal form
(4) Real number	(a) group of rational and an irrational