

NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Ex 1.1

Ex 1.1 Class 9 Maths Question 1.

Is zero a rational number? Can you write it in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$?

Solution:

Yes, zero is a rational number it can be written in the form $\frac{p}{q}$.

$0 = \frac{0}{1} = \frac{0}{2} = \frac{0}{3}$ etc. denominator q can also be taken as negative integer.

Ex 1.1 Class 9 Maths Question 2.

Find six rational numbers between 3 and 4.

Solution:

Let q_j be the rational number between 3 and 4, where $j = 1$ to 6.

\therefore Six rational numbers are as follows:

$$q_1 = \frac{3+4}{2} = \frac{7}{2}; 3 < \frac{7}{2} < 4$$

$$q_2 = \frac{3+\frac{7}{2}}{2} = \frac{\frac{13}{2}}{2} = \frac{13}{4}; 3 < \frac{13}{4} < \frac{7}{2} < 4$$

$$q_3 = \frac{4+\frac{7}{2}}{2} = \frac{\frac{15}{2}}{2} = \frac{15}{4}; 3 < \frac{13}{4} < \frac{7}{2} < \frac{15}{4} < 4$$

$$q_4 = \frac{\frac{7}{2} + \frac{13}{4}}{2} = \frac{\frac{14+13}{4}}{2} = \frac{\frac{27}{4}}{2} = \frac{27}{8};$$

$$3 < \frac{13}{4} < \frac{27}{8} < \frac{7}{2} < \frac{15}{4} < 4$$

$$q_5 = \frac{1}{2} \left(\frac{7}{2} + \frac{15}{4} \right) = \frac{1}{2} \left(\frac{14+15}{4} \right) = \frac{29}{8};$$

$$3 < \frac{13}{4} < \frac{27}{8} < \frac{7}{2} < \frac{29}{8} < \frac{15}{4} < 4$$

$$q_6 = \frac{1}{2} \left(\frac{13}{4} + \frac{27}{8} \right) = \frac{1}{2} \left(\frac{26+27}{8} \right) = \frac{53}{16};$$

$$3 < \frac{13}{4} < \frac{53}{16} < \frac{27}{8} < \frac{7}{2} < \frac{29}{8} < \frac{15}{4} < 4$$

Thus, the six rational numbers between 3 and 4 are

Ex 1.1 Class 9 Maths Question 3.

Find five rational numbers between 35 and 45.

Solution:

Since, we need to find five rational numbers, therefore, multiply numerator and denominator by 6.

$$\therefore \frac{3}{5} = \frac{3 \times 6}{5 \times 6} = \frac{18}{30} \text{ and } \frac{4}{5} = \frac{4 \times 6}{5 \times 6} = \frac{24}{30}$$

\therefore Five rational numbers between $\frac{3}{5}$ and $\frac{4}{5}$ are $\frac{19}{30}, \frac{20}{30}, \frac{21}{30}, \frac{22}{30}, \frac{23}{30}$.

Ex 1.1 Class 9 Maths Question 4.

State whether the following statements are true or false. Give reasons for your answers.

- (i) Every natural number is a whole number.
- (ii) Every integer is a whole number.
- (iii) Every rational number is a whole number.

Solution:

(i) True

\because The collection of all natural numbers and 0 is called whole numbers.

(ii) False

\because Negative integers are not whole numbers.

(iii) False

\because Rational numbers are of the form p/q , $q \neq 0$ and q does not divide p completely that are not whole numbers.

NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Ex 1.2

Ex 1.2 Class 9 Maths Question 1.

State whether the following statements are true or false. Justify your answers.

- (i) Every irrational number is a real number.
- (ii) Every point on the number line is of the form \sqrt{m} , where m is a natural number.
- (iii) Every real number is an irrational number.

Solution:

(i) True

Because all rational numbers and all irrational numbers form the group (collection) of real numbers.

(ii) False

Because negative numbers cannot be the square root of any natural number.

(iii) False

Because rational numbers are also a part of real numbers.

Ex 1.2 Class 9 Maths Question 2.

Are the square roots of all positive integers irrational? If not, give an example of the square root of a number that is a rational number.

Solution:

No, if we take a positive integer, say 9, its square root is 3, which is a rational number.

Ex 1.2 Class 9 Maths Question 3.

Show how $\sqrt{5}$ can be represented on the number line.

Solution:

Draw a number line and take point O and A on it such that OA = 1 unit. Draw $BA \perp OA$ as $BA = 1$ unit. Join $OB = \sqrt{2}$ units.

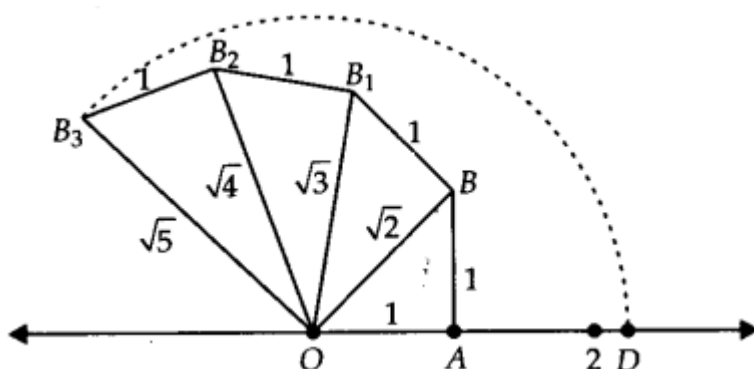
Now draw $BB_1 \perp OB$ such that $BB_1 = 1$ unit. Join $OB_1 = \sqrt{3}$ units.

Next, draw $B_1B_2 \perp OB_1$ such that $B_1B_2 = 1$ unit.

Join $OB_2 = \sqrt{4}$ units.

Again draw $B_2B_3 \perp OB_2$ such that $B_2B_3 = 1$ unit.

Join $OB_3 = \sqrt{5}$ units.



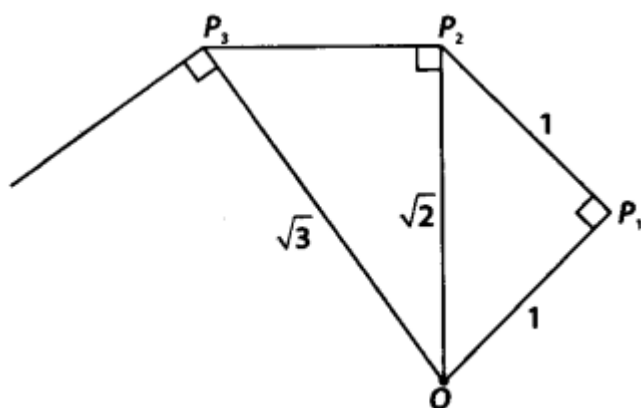
Take O as centre and OB_3 as radius, draw an arc which cuts the number line at D.

Point D

represents $\sqrt{5}$ on the number line.

Ex 1.2 Class 9 Maths Question 4.

Take a large sheet of paper and construct the 'square root spiral' in the following fashion. Start with a point O and draw a line segment OP_1 of unit length. Draw a line segment P_1P_2 perpendicular to OP_1 of unit length (see figure). Now, draw a line segment P_2P_3 perpendicular to OP_2 . Then draw a line segment P_3P_4 perpendicular to OP_3 . Continuing in this manner, you can get the line segment $P_{n-1}P_n$ by drawing a line segment of unit length perpendicular to OP_{n-1} . In this manner, you will have created the points $P_2, P_3, \dots, P_n, \dots$ and joined them to create a beautiful spiral depicting $\sqrt{2}, \sqrt{3}, \sqrt{4}, \dots$



Solution:

Do it yourself.

NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Ex 1.3

Ex 1.3 Class 9 Maths Question 1.

Write the following in decimal form and say what kind of decimal expansion each has

(i) $\frac{36}{100}$ (ii) $\frac{1}{11}$ (iii) $4\frac{1}{8}$ (iv) $\frac{3}{13}$ (v) $\frac{2}{11}$ (vi) $\frac{329}{400}$

Solution:

(i) We have, $36/100 = 0.36$

Thus, the decimal expansion of $36/100$ is terminating.

(ii) Dividing 1 by 11, we have

$$\begin{array}{r}
 11 \overline{) 1.00000} (0.090909 \dots\dots\dots \\
 \underline{-0} \\
 10 \\
 \underline{-00} \\
 100 \\
 \underline{-99} \\
 10 \\
 \underline{-00} \\
 100 \\
 \underline{-99} \\
 10 \\
 \underline{-00} \\
 100 \\
 \underline{-99} \\
 1
 \end{array}$$

$$\therefore \frac{1}{11} = 0.090909\dots = 0.\overline{09}$$

Thus, the decimal expansion of $1/11$ is non-terminating repeating.

(iii) We have, $418 = 338$

Dividing 33 by 8, we get

$$\begin{array}{r}
 8 \overline{) 33.000} (4.125 \\
 \underline{-32} \\
 10 \\
 \underline{-8} \\
 20 \\
 \underline{-16} \\
 40 \\
 \underline{-40} \\
 0
 \end{array}$$

$\therefore 418 = 4.125$. Thus, the decimal expansion of 418 is terminating.

(iv) Dividing 3 by 13, we get

$$\begin{array}{r} 13 \overline{) 3.00000000} \quad (0.23076923... \\ -26 \\ \hline 40 \\ -39 \\ \hline 10 \\ -00 \\ \hline 100 \\ -91 \\ \hline 90 \\ -78 \\ \hline 120 \\ -117 \\ \hline 30 \\ -26 \\ \hline 40 \\ -39 \\ \hline 1 \end{array}$$

Here, the repeating block of digits is 230769

$$\therefore 3/13 = 0.23076923... = 0.230769^-$$

Thus, the decimal expansion of $3/13$ is non-terminating repeating.

(v) Dividing 2 by 11, we get

$$\begin{array}{r} 11 \overline{) 2.0000} \quad (0.1818..... \\ -11 \\ \hline 90 \\ -88 \\ \hline 20 \\ -11 \\ \hline 90 \\ -88 \\ \hline 2 \end{array}$$

Here, the repeating block of digits is 18.

$$\therefore 2/11 = 0.1818... = 0.18^-$$

Thus, the decimal expansion of $2/11$ is non-terminating repeating.

(vi) Dividing 329 by 400, we get

$$\begin{array}{r}
 400 \overline{) 329.0000} \quad (0.8225 \\
 \underline{- 3200} \\
 900 \\
 \underline{- 800} \\
 1000 \\
 \underline{- 800} \\
 2000 \\
 \underline{- 2000} \\
 0
 \end{array}$$

$\therefore 329400 = 0.8225$. Thus, the decimal expansion of 329400 is terminating.

Ex 1.3 Class 9 Maths Question 2.

You know that $17 = 0.142857^-$. Can you predict what the decimal expansions of 27, 137, 47, 57, 67 are, without actually doing the long division? If so, how?

Solution:

We are given that $17 = 0.142857^-$.

$$\therefore 27 = 2 \times 17 = 2 \times (0.142857^-) = 0.285714^-$$

$$37 = 3 \times 17 = 3 \times (0.142857^-) = 0.428571^-$$

$$47 = 4 \times 17 = 4 \times (0.142857^-) = 0.571428^-$$

$$57 = 5 \times 17 = 5 \times (0.142857^-) = 0.714285^-$$

$$67 = 6 \times 17 = 6 \times (0.142857^-) = 0.857142^-$$

Thus, without actually doing the long division we can predict the decimal expansions of the given rational numbers.

Ex 1.3 Class 9 Maths Question 3.

Express the following in the form $\frac{p}{q}$ where p and q are integers and $q \neq 0$.

(i) 0.6^-

(ii) 0.47^-

(iii) 0.001^-

Solution:

(i) Let $x = 0.6^- = 0.6666... \dots$ (1)

As there is only one repeating digit, multiplying (1) by 10 on both sides, we get

$$10x = 6.6666... \dots$$
 (2)

Subtracting (1) from (2), we get

$$10x - x = 6.6666... - 0.6666...$$

$$\Rightarrow 9x = 6 \Rightarrow x = \frac{6}{9} = \frac{2}{3}$$

Thus, $0.\overline{6} = \frac{2}{3}$

$$(ii) \text{ Let } x = 0.\overline{47} = 0.4777\ldots \quad (1)$$

As there is only one repeating digit, multiplying (1) by 10 on both sides, we get

$$10x = 4.\overline{777}$$

Subtracting (1) from (2), we get

$$10x - x = 4.\overline{777} - 0.4777\ldots$$

$$\Rightarrow 9x = 4.3 \Rightarrow x = \frac{43}{90}$$

Thus, $0.\overline{47} = \frac{43}{90}$

$$(iii) \text{ Let } x = 0.\overline{001} = 0.001001\ldots \quad (1)$$

As there are 3 repeating digits, multiplying (1) by 1000 on both sides, we get

$$1000x = 1.\overline{001} \quad (2)$$

Subtracting (1) from (2), we get

$$1000x - x = (1.\overline{001}) - (0.001\ldots)$$

$$\Rightarrow 999x = 1 \Rightarrow x = \frac{1}{999}$$

Thus, $0.\overline{001} = \frac{1}{999}$

Ex 1.3 Class 9 Maths Question 4.

Express $0.99999\ldots$ in the form $\frac{p}{q}$. Are you surprised by your answer? With your teacher and classmates discuss why the answer makes sense.

Solution:

$$\text{Let } x = 0.99999\ldots \quad (i)$$

As there is only one repeating digit, multiplying (i) by 10 on both sides, we get

$$10x = 9.9999\ldots \quad (ii)$$

Subtracting (i) from (ii), we get

$$10x - x = (9.9999\ldots) - (0.9999\ldots)$$

$$\Rightarrow 9x = 9 \Rightarrow x = \frac{9}{9} = 1$$

Thus, $0.9999\ldots = 1$

As $0.9999\ldots$ goes on forever, there is no such a big difference between 1 and $0.9999\ldots$

Hence, both are equal.

Ex 1.3 Class 9 Maths Question 5.

What can the maximum number of digits be in the repeating block of digits in the decimal expansion of $\frac{1}{17}$? Perform the

division to check your answer.

Solution:

In 117, In the divisor is 17.

Since, the number of entries in the repeating block of digits is less than the divisor, then the maximum number of digits in the repeating block is 16.

Dividing 1 by 17, we have

$$\begin{array}{r} 0.0588235294117647... \\ 17 \overline{) 1.0000000000000000} \\ \underline{-85} \\ 150 \\ \underline{-136} \\ 140 \\ \underline{-136} \\ 40 \\ \underline{-34} \\ 60 \\ \underline{-51} \\ 90 \\ \underline{-85} \\ 50 \\ \underline{-34} \\ 160 \\ \underline{-153} \\ 70 \\ \underline{-68} \\ 20 \\ \underline{-17} \\ 30 \\ \underline{-17} \\ 130 \\ \underline{-119} \\ 110 \\ \underline{-102} \\ 80 \\ \underline{-68} \\ 120 \\ \underline{-119} \\ 1 \end{array}$$

The remainder 1 is the same digit from which we started the division.

$\therefore 117 =$

0.0588235294117647-----

Thus, there are 16 digits in the repeating block in the decimal expansion of 117.

Hence, our answer is verified.

Ex 1.3 Class 9 Maths Question 6.

Look at several examples of rational numbers in the form $\frac{p}{q}$ (q

$\neq 0$). Where, p and q are integers with no common factors other than 1 and having terminating decimal representations (expansions). Can you guess what property q must satisfy?

Solution:

Let us look decimal expansion of the following terminating rational numbers:

$$\frac{3}{2} = \frac{3 \times 5}{2 \times 5} = \frac{15}{10} = 1.5 \quad [\text{Denominator} = 2 = 2^1]$$

$$\frac{1}{5} = \frac{1 \times 2}{5 \times 2} = \frac{2}{10} = 0.2 \quad [\text{Denominator} = 5 = 5^1]$$

$$\frac{7}{8} = \frac{7 \times 125}{8 \times 125} = \frac{875}{1000} = 0.875$$

$$[\text{Denominator} = 8 = 2^3]$$

$$\frac{8}{125} = \frac{8 \times 8}{125 \times 8} = \frac{64}{1000} = 0.064$$

$$[\text{Denominator} = 125 = 5^3]$$

$$\frac{13}{20} = \frac{13 \times 5}{20 \times 5} = \frac{65}{100} = 0.65$$

$$[\text{Denominator} = 20 = 2^2 \times 5^1]$$

$$\frac{17}{16} = \frac{17 \times 625}{16 \times 625} = \frac{10625}{10000} = 1.0625$$

$$[\text{Denominator} = 16 = 2^4]$$

We observe that the prime factorisation of q (i.e. denominator) has only powers of 2 or powers of 5 or powers of both.

Ex 1.3 Class 9 Maths Question 7.

Write three numbers whose decimal expansions are non-terminating non-recurring.

Solution:

$$\sqrt{2} = 1.414213562 \dots\dots\dots$$

$$\sqrt{3} = 1.732050808 \dots\dots\dots$$

$$\sqrt{5} = 2.23606797 \dots\dots\dots$$

Ex 1.3 Class 9 Maths Question 8.

Find three different irrational numbers between the rational numbers 57 and 911 .

Solution:

We have,

$$\begin{array}{r}
 0.714285... \\
 7 \overline{) 5.0} \\
 \underline{-49} \\
 10 \\
 \underline{-7} \\
 30 \\
 \underline{-28} \\
 20 \\
 \underline{-14} \\
 60 \\
 \underline{-56} \\
 40 \\
 \underline{-35} \\
 5
 \end{array}
 \quad \text{and} \quad
 \begin{array}{r}
 0.8181... \\
 11 \overline{) 9.0} \\
 \underline{-88} \\
 20 \\
 \underline{-11} \\
 90 \\
 \underline{-88} \\
 20 \\
 \underline{-11} \\
 9
 \end{array}$$

$$\therefore \frac{5}{7} = 0.\overline{714285} \text{ and } \frac{9}{11} = 0.\overline{81}$$

Three irrational numbers between $0.714285\overline{}$ and $0.81\overline{}$ are

- (i) $0.750750075000 \dots$
- (ii) $0.767076700767000 \dots$
- (iii) $0.78080078008000 \dots$

Ex 1.3 Class 9 Maths Question 9.

Classify the following numbers as rational or irrational

- (i) $23\overline{--}\sqrt{}$
- (ii) $225\overline{---}\sqrt{}$
- (iii) 0.3796
- (iv) $7.478478\dots$
- (v) $1.101001000100001\dots$

Solution:

(1) $\because 23$ is not a perfect square.

$\therefore 23\overline{--}\sqrt{}$ is an irrational number.

(ii) $\because 225 = 15 \times 15 = 15^2$

$\therefore 225$ is a perfect square.

Thus, $225\overline{---}\sqrt{}$ is a rational number.

(iii) $\because 0.3796$ is a terminating decimal.

\therefore It is a rational number.

(iv) $7.478478\dots = 7.478\overline{-----}$

Since, $7.478\overline{-----}$ is a non-terminating recurring (repeating) decimal.

\therefore It is a rational number.

(v) Since, $1.101001000100001\dots$ is a non terminating, non-repeating decimal number.

\therefore It is an irrational number.

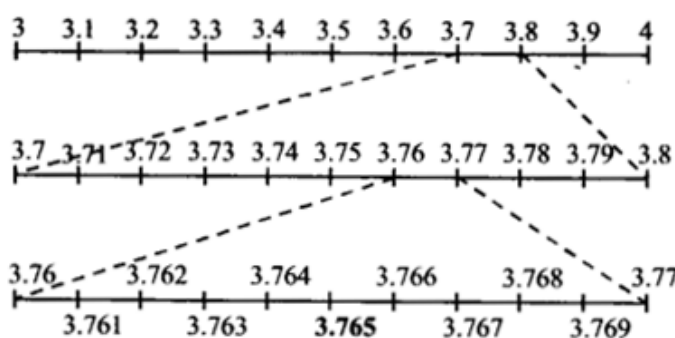
NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Ex 1.4

Ex 1.4 Class 9 Maths Question 1.

Visualise 3.765 on the number line, using successive magnification.

Solution:

3.765 lies between 3 and 4 .



(i) 3.7 lies between 3 and 4

(ii) 3.76 lies between 3.7 and 3.8

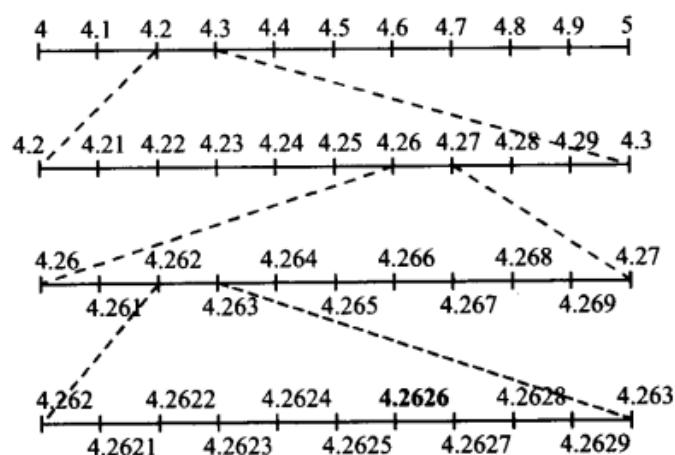
(iii) 3.765 lies between 3.76 and 3.77

Ex 1.4 Class 9 Maths Question 2.

Visualise $4.26\overline{26}$ on the number line, upto 4 decimal places.

Solution:

$4.26\overline{26}$ or 4.2626 lies between 4 and 5 .



(i) 4.2 lies between 4 and 5

(ii) 4.26 lies between 4.2 and 4.3

(iii) 4.262 lies between 4.26 and 4.27

(iv) 4.2626 lies between 4.262 and 4.263

NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Ex 1.5

Ex 1.5 Class 9 Maths Question 1.

Classify the following numbers as rational or irrational.

- (i) $2 - \sqrt{5}$ (ii) $(3 + \sqrt{23}) - \sqrt{23}$ (iii) $\frac{2\sqrt{7}}{7\sqrt{7}}$
 (iv) $\frac{1}{\sqrt{2}}$ (v) 2π

Solution:

(i) Since, it is a difference of a rational and an irrational number.

$\therefore 2 - \sqrt{5}$ is an irrational number.

(ii) $3 + \sqrt{23} - \sqrt{23} = 3 + \sqrt{23} - \sqrt{23} = 3$

which is a rational number.

(iii) Since, $\frac{2\sqrt{7}}{7\sqrt{7}} = \frac{2 \times \sqrt{7} \times \sqrt{7}}{7 \times \sqrt{7} \times \sqrt{7}} = \frac{2 \times 7}{7 \times 7} = \frac{2}{7}$, which is a rational number.

(iv) \therefore The quotient of rational and irrational number is an irrational number.

$\therefore \frac{1}{\sqrt{2}}$ is an irrational number.

(v) $\therefore 2\pi = 2 \times \pi =$ Product of a rational and an irrational number is an irrational number.

$\therefore 2\pi$ is an irrational number.

Ex 1.5 Class 9 Maths Question 2.

Simplify each of the following expressions

- (i) $(3 + \sqrt{3})(2 + \sqrt{2})$ (ii) $(3 + \sqrt{3})(3 - \sqrt{3})$
 (iii) $(\sqrt{5} + \sqrt{2})^2$ (iv) $(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})$

Solution:

(i) $(3 + \sqrt{3})(2 + \sqrt{2})$

$= 2(3 + \sqrt{3}) + \sqrt{2}(3 + \sqrt{3})$

$= 6 + 2\sqrt{3} + 3\sqrt{2} + \sqrt{6}$

Thus, $(3 + \sqrt{3})(2 + \sqrt{2}) = 6 + 2\sqrt{3} + 3\sqrt{2} + \sqrt{6}$

(ii) $(3 + \sqrt{3})(3 - \sqrt{3}) = (3)^2 - (\sqrt{3})^2$

$= 9 - 3 = 6$

Thus, $(3 + \sqrt{3})(3 - \sqrt{3}) = 6$

(iii) $(\sqrt{5} + \sqrt{2})^2 = (\sqrt{5})^2 + (\sqrt{2})^2 + 2(\sqrt{5})(\sqrt{2})$

$= 5 + 2 + 2\sqrt{10} = 7 + 2\sqrt{10}$

Thus, $(\sqrt{5} + \sqrt{2})^2 = 7 + 2\sqrt{10}$

(iv) $(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2}) = (\sqrt{5})^2 - (\sqrt{2})^2 = 5 - 2 = 3$

Thus, $(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2}) = 3$

Ex 1.5 Class 9 Maths Question 3.

Recall, π is defined as the ratio of the circumference (say c) of a circle to its diameter (say d). That is $\pi = \frac{c}{d}$. This seems to contradict the fact that π is irrational. How will you resolve this contradiction?

Solution:

When we measure the length of a line with a scale or with any other device, we only get an approximate rational value, i.e. c and d both are irrational.

$\therefore \frac{c}{d}$ is irrational and hence π is irrational.

Thus, there is no contradiction in saying that π is irrational.

Ex 1.5 Class 9 Maths Question 4.

Represent $9.3 + \sqrt{1}$ on the number line.

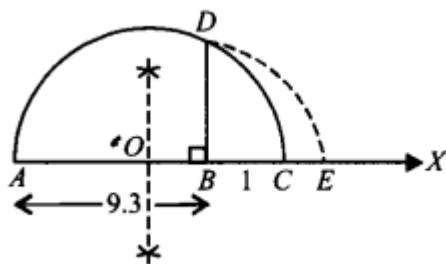
Solution:

Draw a line segment $AB = 9.3$ units and extend it to C such that $BC = 1$ unit.

Find mid point of AC and mark it as O .

Draw a semicircle taking O as centre and AO as radius. Draw $BD \perp AC$.

Draw an arc taking B as centre and BD as radius meeting AC produced at E such that $BE = BD = 9.3 + \sqrt{1}$ units.



Ex 1.5 Class 9 Maths Question 5.

Rationalise the denominator of the following

$$(i) \frac{1}{\sqrt{7}} \quad (ii) \frac{1}{\sqrt{7}-\sqrt{6}} \quad (iii) \frac{1}{\sqrt{5}+\sqrt{2}} \quad (iv) \frac{1}{\sqrt{7}-2}$$

Solution:

$$\begin{aligned} (i) \frac{1}{\sqrt{7}} &= \frac{1 \times \sqrt{7}}{\sqrt{7} \times \sqrt{7}} = \frac{\sqrt{7}}{7} \\ (ii) \frac{1}{\sqrt{7}-\sqrt{6}} &= \frac{1}{\sqrt{7}-\sqrt{6}} \times \frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}+\sqrt{6}} \\ &= \frac{\sqrt{7}+\sqrt{6}}{(\sqrt{7})^2-(\sqrt{6})^2} = \frac{\sqrt{7}+\sqrt{6}}{7-6} = \sqrt{7}+\sqrt{6} \\ (iii) \frac{1}{\sqrt{5}+\sqrt{2}} &= \frac{1}{\sqrt{5}+\sqrt{2}} \times \frac{\sqrt{5}-\sqrt{2}}{\sqrt{5}-\sqrt{2}} \\ &= \frac{\sqrt{5}-\sqrt{2}}{(\sqrt{5})^2-(\sqrt{2})^2} = \frac{\sqrt{5}-\sqrt{2}}{5-2} = \frac{\sqrt{5}-\sqrt{2}}{3} \\ (iv) \frac{1}{\sqrt{7}-2} &= \frac{1}{\sqrt{7}-2} \times \frac{\sqrt{7}+2}{\sqrt{7}+2} \\ &= \frac{\sqrt{7}+2}{(\sqrt{7})^2-(2)^2} = \frac{\sqrt{7}+2}{7-4} = \frac{\sqrt{7}+2}{3} \end{aligned}$$

NCERT Solutions for Class 9 Maths Chapter 1 Number Systems Ex 1.6

Ex 1.6 Class 9 Maths Question 1.

Find:

$$(i) 64^{\frac{1}{2}}$$

$$(ii) 32^{\frac{1}{5}}$$

$$(iii) 125^{\frac{1}{3}}$$

Solution:

$$(i) 64 = 8 \times 8 = 8^2$$

$$\therefore (64)^{1/2} = (8^2)^{1/2} = 8^{2 \times 1/2} = 8 [(a^m)^n = a^{m \times n}]$$

$$(ii) 32 = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$$

$$\therefore (32)^{1/5} = (2^5)^{1/5} = 2^{5 \times 1/5} = 2 [(a^m)^n = a^{m \times n}]$$

$$(iii) 125 = 5 \times 5 \times 5 = 5^3$$

$$\therefore (125)^{1/3} = (5^3)^{1/3} = 5^{3 \times 1/3} = 5 [(a^m)^n = a^{m \times n}]$$

Ex 1.6 Class 9 Maths Question 2.

Find:

(i) $9^{\frac{3}{2}}$

(ii) $32^{\frac{2}{5}}$

(iii) $16^{\frac{3}{4}}$

(iv) $125^{-\frac{1}{3}}$

Solution:

(i) $9 = 3 \times 3 = 3^2$

$\therefore (9)^{3/2} = (3^2)^{3/2} = 3^{2 \times 3/2} = 3^3 = 27$

$[(a^m)^n = a^{mn}]$

(ii) $32 = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$

$\therefore (32)^{2/5} = (2^5)^{2/5} = 2^{5 \times 2/5} = 2^2 = 4$

$[(a^m)^n = a^{mn}]$

(iii) $16 = 2 \times 2 \times 2 \times 2 = 2^4$

$\therefore (16)^{3/4} = (2^4)^{3/4} = 2^{4 \times 3/4} = 2^3 = 8$

$[(a^m)^n = a^{mn}]$

(iv) $125 = 5 \times 5 \times 5 = 5^3$

$\therefore (125)^{-1/3} = (5^3)^{-1/3} = 5^{3 \times (-1/3)} = 5^{-1}$

$= 15 [a^{-n} = \frac{1}{a^n}]$

Ex 1.6 Class 9 Maths Question 3.

Simplify:

(i) $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}}$

(ii) $\left(\frac{1}{3^3}\right)^7$

(iii) $\frac{11^{1/2}}{11^{1/4}}$

(iv) $7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}}$

Solution:

(i) $2^{2/3} \cdot 2^{1/5} = 2^{2/3 + 1/5} = 2^{13/15}$

$[a^m \cdot a^n = a^{m+n}]$

(ii) $\left(\frac{1}{3^3}\right)^7 = (3^{-3})^7 = 3^{-3 \times 7} = 3^{-21} = \frac{1}{3^{21}}$

$\left[\frac{1}{a^n} = a^{-n}\right]$

(iii) $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}} = 11^{1/2} \div 11^{1/4} = 11^{1/2 - 1/4} = 11^{1/4}$

$[a^m \div a^n = a^{m-n}]$

(iv) $7^{1/2} \cdot 8^{1/2} = (7 \times 8)^{1/2} = (56)^{1/2} [a^m \times b^m = (ab)^m]$

STANDARD (ML. AGRAWAL) Some Solutions for Class 9 Maths Chapter 1 Number Systems Ex 1.1

Ex 1.1 Class 9 Maths Question 1

Find a rational number between $\frac{1}{3}$ and $\frac{2}{7}$

Solution:

$$\frac{1}{3} \times \frac{7}{7} \text{ and } \frac{2}{7} \times \frac{3}{3}$$

$$\frac{7}{21} \text{ and } \frac{6}{21}$$

so, $\frac{5}{21}$ is the required rational number

Ex 1.1 Class 9 Maths Question 2

Find three rational number between $\frac{1}{3}$ and $\frac{2}{7}$

Solution:

for convenience we convert it into rational no.

$$0.1 = \frac{1}{10}$$

$$0.11 = \frac{11}{100}$$

now we use the formula $a + \frac{b}{2}$.

$$= \left[\frac{1}{10} + \frac{11}{100} \right] \div 2$$

$$= \frac{6}{100}$$

similarly others two are $\frac{7}{20}$ and $\frac{29}{40}$.

or

given,

$$0.1 \text{ and } 0.11$$

$$\frac{1}{10} = \frac{1}{10} \times \frac{50}{50} = \frac{50}{500}$$

$$\frac{11}{100} = \frac{11}{100} \times \frac{5}{5} = \frac{55}{500}$$

three rational numbers are $= \frac{51}{500}, \frac{52}{500}, \frac{53}{500}$

Ex 1.2 Class 9 Maths Question 1

Locate $\sqrt{10}$ and $\sqrt{17}$ on the number line.

Solution:

Presentation of 5 on number line:

We write 5 as the sum of the square of two natural numbers:

$$5=1+4=2^2+2^2$$

On the number line, take OA=2 units.

Draw BA=1 unit, perpendicular to OA. Join OB.

By Pythagoras theorem, OB=5

Using a compass with centre O and radius OB, draw an arc which intersects the number line at the point C. Then, C corresponds to 5.

Presentation of 10 on the number line:

We write 10 as the sum of the square of two natural numbers:

$$10=1+9=2^2+3^2$$

On the number line, taken OA=3 units.

Draw BA=1 unit, perpendicular to OA, Join OB.

By Pythagoras theorem, OB=10

Using a compass with centre O and radius OB, draw an arc which intersects the number line at the point C. Then, C corresponds to 10.

Presentation of 17 on the number line:

We write 17 as the sum of the square of two natural numbers.

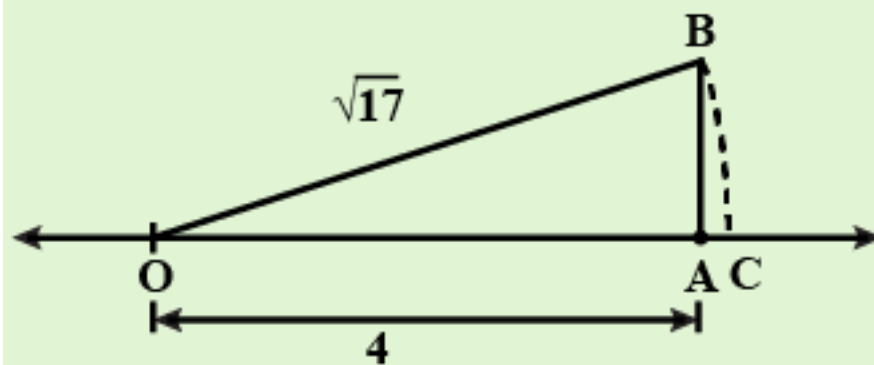
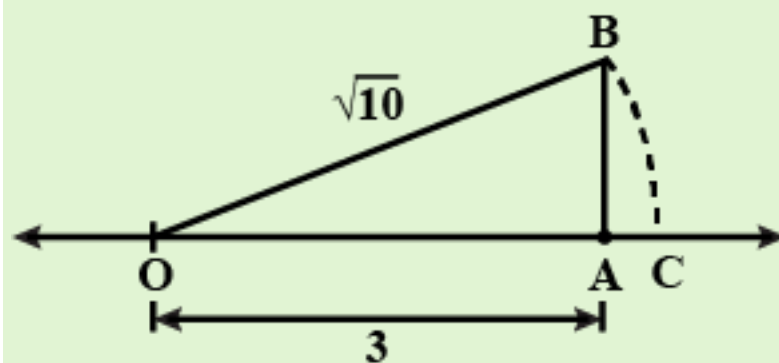
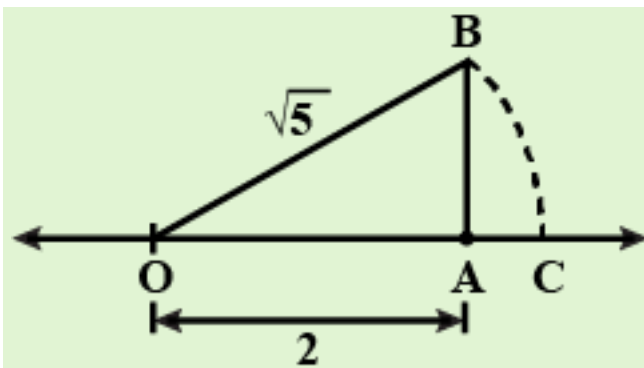
$$17=1+16=2^2+4^2$$

On the number line, take OA=4 units.

Draw BA=1 unit, perpendicular to OA. Join OB.

By Pythagoras theorem, OB=17

Using a compass with centre O and radius OB, draw an arc which intersects the number line at the point C. Then, C corresponds to 17.



Ex 1.2 Class 9 Maths Question 2

Express the $0.\overline{3}$ numbers in the form p/q , where p and q, where p and q are both integers and $q \neq 0$

Solution:

Let, $x = 0.333333\ldots = 0.\overline{3}$ (i)

Multiplying on both sides by '10' we get,

$$10x = 3.333333\ldots = 3.\overline{3} \quad \text{.....(ii)}$$

Subtract (i) from (ii) we get,

$$9x = 3.000000\ldots = 3$$

$$x = \frac{3}{9} = \frac{1}{3}$$

$$\text{I.e., } 0.33333\ldots = 0.\overline{3} = \frac{1}{3}$$

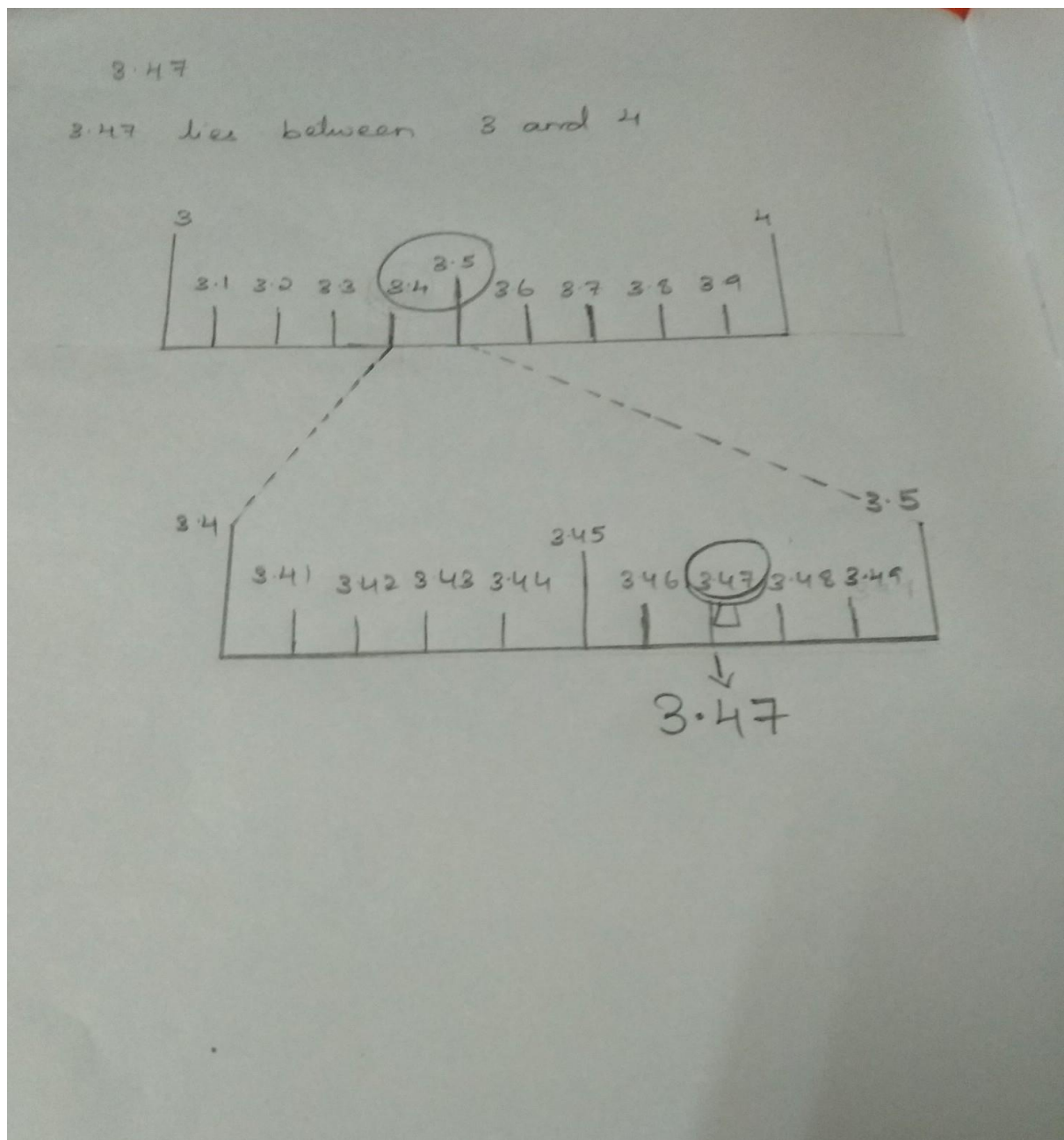
Which is in the form of $\frac{p}{q}$.

Where p and q are integers.

Ex 1.3 Class 9 Maths Question 1

Visualize 3.47 on the line, using successive magnification

Solution:



Ex 1.4 Class 9 Maths Question 1

Simplify $\sqrt{24/8} + \sqrt{54/9}$

Solution:

Let us simplify the expression,

$$\sqrt{24/8} + \sqrt{54/9}$$

$$= \sqrt{(4 \times 6)/8} + \sqrt{(9 \times 6)/9}$$

$$= \sqrt{26/8} + \sqrt{36/9}$$

$$= \sqrt{6/4} + \sqrt{6/3}$$

By taking LCM

$$=(36+46)/12$$

$$=76/12$$

Ex 1.4 Class 9 Maths Question

$$3/\sqrt{8} + 1/\sqrt{2}$$

Solution:

We know that $\sqrt{8} = 2\sqrt{2}$

$$\Rightarrow \frac{3}{2\sqrt{2}} + \frac{1}{\sqrt{2}}$$

$$\Rightarrow \frac{3}{2\sqrt{2}} + \frac{2}{2\sqrt{2}}$$

$$\Rightarrow \frac{3+2}{2\sqrt{2}}$$

$$\Rightarrow \frac{5}{2\sqrt{2}}$$

Now we **rationalize the denominator** to further simplify

$$\Rightarrow \frac{5}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$\Rightarrow \frac{5\sqrt{2}}{2 \times 2}$$

$$\Rightarrow \frac{5\sqrt{2}}{4}$$

Therefore, $\frac{3}{\sqrt{8}} + \frac{1}{\sqrt{2}} = \frac{5\sqrt{2}}{4}$