FOCUS ACADEMY

Kg to 12

English&Gujarati Medium

BRANCH 1- 19-B MUSLIM SOC, B/H FIRDOS MASJID DANILIMDA AHMEDABAD	BRANCH2-2ND 3RD AND 4TH FLOOR,UNIQUE APT. JUHAPURA CROSS ROAD, AHMEDABAD

Ex 1.1 Class 9 Maths Question 1.
Is zero a rational number? Can you write it in the form pq,where p and q are integers and q ≠0?
Solution:
Yes, zero is a rational number it can be written in the form pq.
0 = 01 = 02 = 03 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_i be the rational number between 3 and 4, where j = 1 to 6.
∴ 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

$$\frac{7}{2}, \frac{13}{4}, \frac{15}{4}, \frac{27}{8}, \frac{29}{8} \text{ and } \frac{53}{16}.$$

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** $\frac{4}{5}$

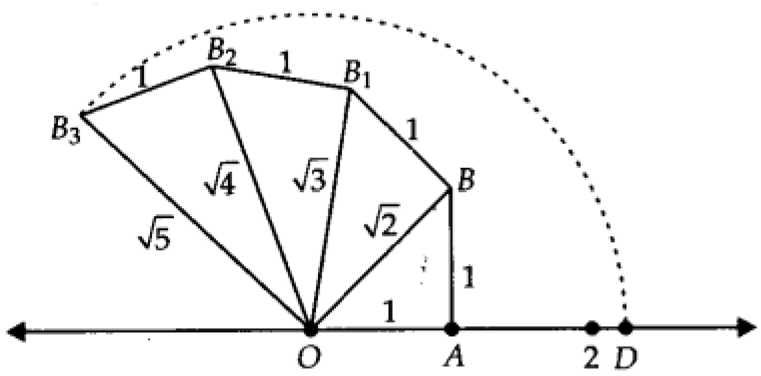
are $\frac{19}{30}, \frac{20}{30}, \frac{21}{30}, \frac{22}{30}, \frac{23}{30}$.

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
∵ The collection of all natural numbers and 0 is called whole numbers.
(ii) False
∵ Negative integers are not whole numbers.
(iii) False
∵ Rational numbers are of the form p/q, q ≠ 0 and q does not divide p completely that are not whole numbers.

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 √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.

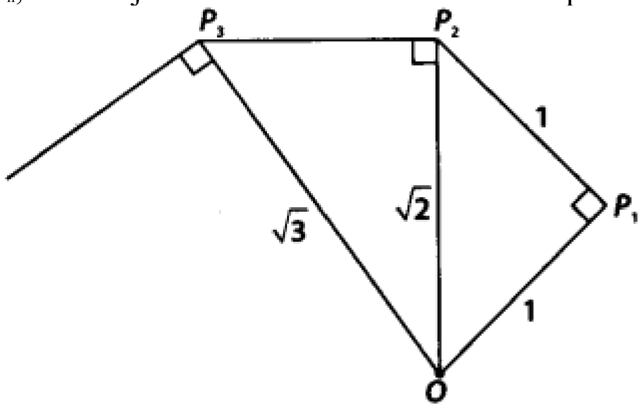
Ex 1.2 Class 9 Maths Question 2.
Are the square roots of all positive integers irrational? If not, give an example of the square root of a number that is a rational number.
Solution:
No, if we take a positive integer, say 9, its square root is 3, which is a rational number.

Ex 1.2 Class 9 Maths Question 3.
Show how √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 ⊥ OA as BA = 1 unit.
Join OB = √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 = 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 √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 lengths Draw a line segment P_1, P_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,…… P_n,….. and joined them to create a beautiful spiral depicting √2,√3,√4,……



Solution:
Do it yourself.

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, 36100 = 0.36
Thus, the decimal expansion of 36100 is terminating.

(ii) Dividing 1 by 11, we have

```
11)1.00000(0.090909.........
  -0
  ---
   10
  -00
  ----
   100
   -99
   ---
     10
    -00
   ----
     100
     -99
    ----
       10
      -00
     ----
       100
       -99
       ---
         1
```

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

Thus, the decimal expansion of 111 is non-terminating repeating.

(iii) We have, 418 = 338

Dividing 33 by 8, we get

```
8) 33.000 (4.125
  -32
   10
   -8
    20
   -16
     40
    -40
      0
```

∴ 418 = 4.125. Thus, the decimal expansion of 418 is terminating.

(iv) Dividing 3 by 13, we get

```
13) 3.00000000 (0.23076923...
   -26
     40
   -39
     10
    -00
     100
     -91
       90
     -78
      120
    -117
        30
      -26
         40
       -39
          1
```

Here, the repeating block of digits is 230769

∴ 313 = 0.23076923… = 0.230769¯

Thus, the decimal expansion of 313 is non-terminating repeating.

(v) Dividing 2 by 11, we get

```
11) 2.0000 (0.1818......
   -1 1
     90
    -88
      20
     -11
       90
      -88
        2
```

Here, the repeating block of digits is 18.

∴ 211 = 0.1818… = $0.\overline{18}$

Thus, the decimal expansion of 211 is non-terminating repeating.

(vi) Dividing 329 by 400, we get

```
400) 329.0000 (0.8225
    -3200
      900
     -800
      1000
      -800
       2000
      -2000
          0
```

∴ 329400 = 0.8225. Thus, the decimal expansion of 329400 is terminating.

Ex 1.3 Class 9 Maths Question 2.

You know that 17 = $0.\overline{142857}$. 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 = $0.\overline{142857}$.

∴ 27 = 2 x 17 = 2 x ($0.\overline{142857}$) =$0.\overline{285714}$

37 = 3 x 17 = 3 x ($0.\overline{142857}$) = $0.\overline{428571}$

47 = 4 x 17 = 4 x ($0.\overline{142857}$) = $0.\overline{571428}$

57 = 5 x 17 = 5 x($0.\overline{142857}$) = $0.\overline{714285}$

67 = 6 x 17 = 6 x ($0.\overline{142857}$) = $0.\overline{857142}$

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 pq where p and q are integers and q ≠ 0.

(i) $0.\overline{6}$

(ii) $0.4\overline{7}$

(iii) $0.\overline{001}$

Solution:

(i) Let x = $0.\overline{6}$ = 0.6666… … (1)

As there is only one repeating digit,

multiplying (1) by 10 on both sides, we get

10x = 6.6666… … (2)

Subtracting (1) from (2), we get

10x – x = 6.6666… -0.6666…

⇒ 9x = 6 ⇒ x = 69 = 23

Thus, $0.\overline{6}$ = 23

(ii) Let x = $0.4\overline{7}$ = 0.4777… … (1)

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

10x = 4.777

Subtracting (1) from (2), we get

10x – x = 4.777…… – 0.4777…….

⇒ 9x = 4.3 ⇒ x = 4390

Thus, 0.47 = 4390

(iii) Let x = 0.001 = 0.001001… … (1)

As there are 3 repeating digits,

multiplying (1) by 1000 on both sides, we get

1000x = 1.001001 … (2)

Subtacting (1) from (2), we get

1000x – x = (1.001…) – (0.001…)

⇒ 999x = 1 ⇒ x = 1999

Thus, 0.001 = 1999

Ex 1.3 Class 9 Maths Question 4.

Express 0.99999… in the form pqAre you surprised by your answer? With your teacher and classmates discuss why the answer makes sense.

Solution:

Let x = 0.99999….. …. (i)

As there is only one repeating digit,

multiplying (i) by 10 on both sides, we get

10x = 9.9999 … (ii)

Subtracting (i) from (ii), we get

10x – x = (99999) — (0.9999)

⇒ 9x = 9 ⇒ x = 99 = 1

Thus, 0.9999 =1

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

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 117? 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

```
      0.0588235294117647...
  17 ) 1.0000000000000000
      -85
       150
      -136
        140
       -136
          40
         -34
           60
          -51
            90
           -85
             50
            -34
             160
            -153
               70
              -68
                20
               -17
                 30
                -17
                 130
                -119
                  110
                 -102
                     80
                    -68
                    120
                   -119
                      1
```

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

∴ 117 = $0.\overline{0588235294117647}$

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 pq ($q \neq 0$). Where, p and q are integers with no common factors other that 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:

$$\frac{3}{2} = \frac{3\times5}{2\times5} = \frac{15}{10} = 1.5 \qquad [\text{Denominator} = 2 = 2^1]$$

$$\frac{1}{5} = \frac{1\times2}{5\times2} = \frac{2}{10} = 0.2 \qquad [\text{Denominator} = 5 = 5^1]$$

$$\frac{7}{8} = \frac{7\times125}{8\times125} = \frac{875}{1000} = 0.875$$

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

$$\frac{8}{125} = \frac{8\times8}{125\times8} = \frac{64}{1000} = 0.064$$

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

$$\frac{13}{20} = \frac{13\times5}{20\times5} = \frac{65}{100} = 0.65$$

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

$$\frac{17}{16} = \frac{17\times625}{16\times625} = \frac{10625}{10000} = 1.0625$$

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

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:

$\sqrt{2} = 1.414213562$ ………..

$\sqrt{3} = 1.732050808$ …….

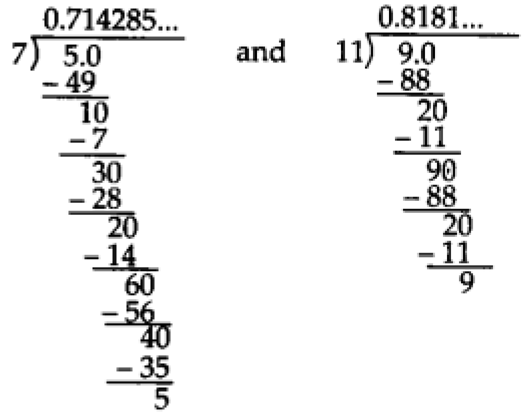
$\sqrt{5} = 2.23606797$ …….

Ex 1.3 Class 9 Maths Question 8.

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

Solution:

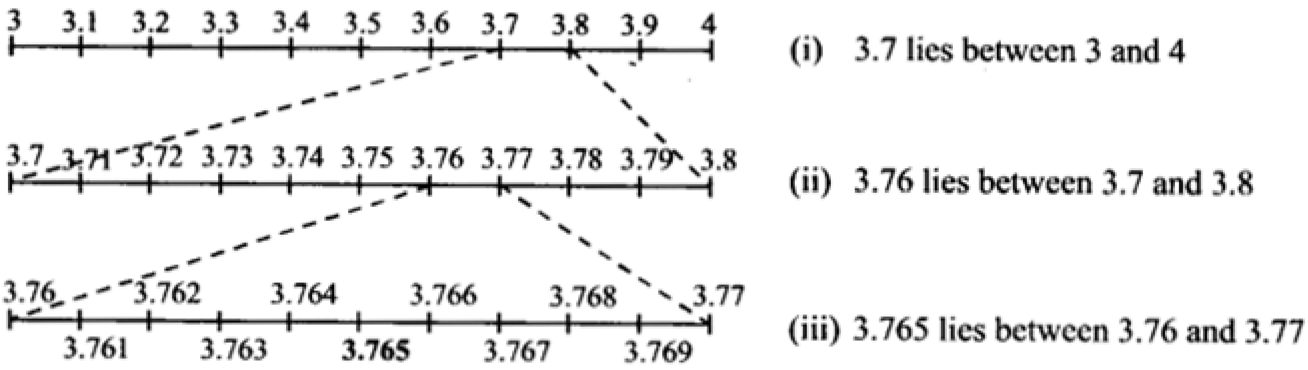
We have,



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

Three irrational numbers between $0.\overline{714285}$ and $0.\overline{81}$ are
(i) 0.750750075000 …..
(ii) 0.767076700767000 ……
(iii) 0.78080078008000 ……
Ex 1.3 Class 9 Maths Question 9.
Classify the following numbers as rational or irrational
(i) $\sqrt{23}$
(ii) $\sqrt{225}$
(iii) 0.3796
(iv) 7.478478…..
(v) 1.101001000100001………
Solution:
(1) ∵ 23 is not a perfect square.
∴ $\sqrt{23}$ is an irrational number.
(ii) ∵ 225 = 15 x 15 = 15^2
∴ 225 is a perfect square.
Thus, $\sqrt{225}$ is a rational number.
(iii) ∵ 0.3796 is a terminating decimal.
∴ It is a rational number.
(iv) 7.478478… = $7.\overline{478}$
Since, $7.\overline{478}$ is a non-terminating recurring (repeating) decimal.
∴ It is a rational number.
(v) Since, 1.101001000100001… is a non terminating, non-repeating decimal number.
∴ It is an irrational number.

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.

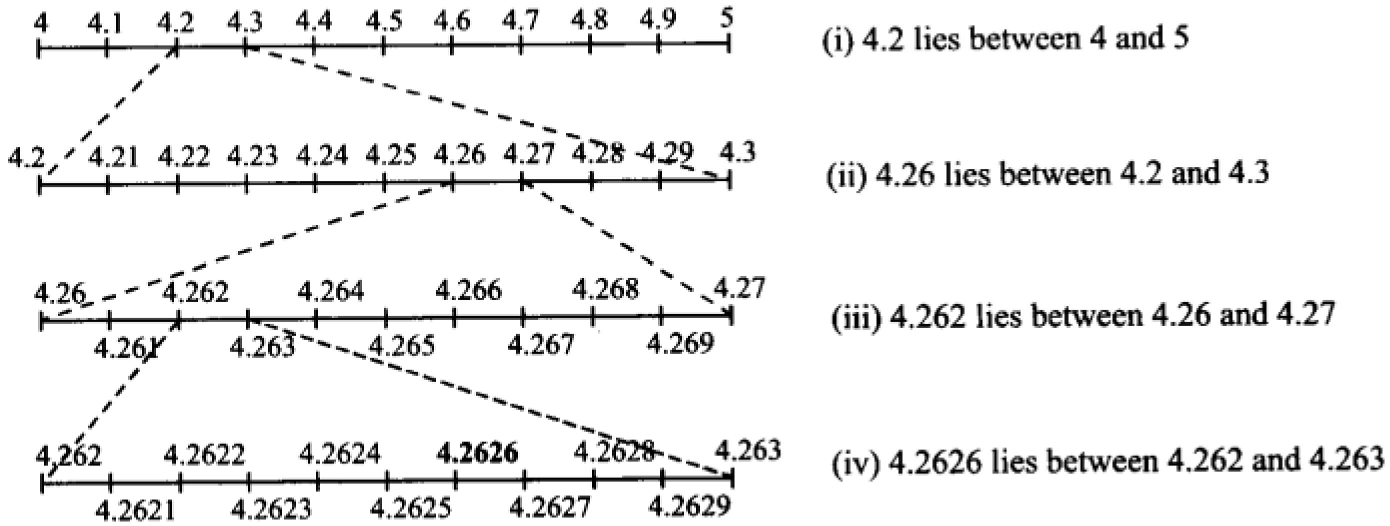


Ex 1.4 Class 9 Maths Question 2.

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

Solution:

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



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.

∴ 2 – √5 is an irrational number.

(ii) 3 + 23−−√ – 23−−√ = 3 + 23−−√ – 23−−√ = 3

which is a rational number.

(iii) Since, 27√77√ = 2×7√7×7√ = 27 , which is a rational number.

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

∴ 12√ is an irrational number.

(v) ∵ 2π = 2 x π = Product of a rational and an irrational number is an irrational number.

∴ 2π 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 + √3)(2 + √2)

= 2(3 + √3) + √2(3 + √3)

= 6 + 2√3 + 3√2 + √6

Thus, (3 + √3)(2 + √2) = 6 + 2√3 + 3√2 + √6

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

= 9 – 3 = 6

Thus, (3 + √3)(3 – √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 π = cd. This seems to contradict the fact that n 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 ational value, i.e. c and d both are irrational.

∴ cd is irrational and hence π is irrational.

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

Ex 1.5 Class 9 Maths Question 4.

Represent 9.3———√ on the number line.

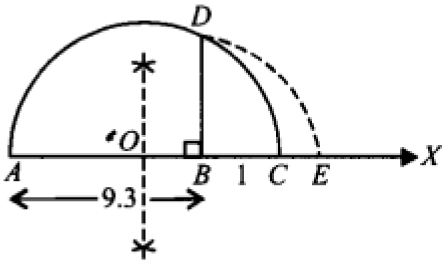
Solution:

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 ⊥ AC.

Draw an arc taking B as centre and BD as radius meeting AC produced at E such that BE = BD = 9.3———√ units.



Ex 1.5 Class 9 Maths Question 5.

Rationalise the denominator of the following

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

Solution:

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

$= \frac{\sqrt{7}+2}{(\sqrt{7})^2-(2)^2} = \frac{\sqrt{7}+2}{7-4} = \frac{\sqrt{7}+2}{3}$

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 x 8 = 8^2
∴ $(64)^{1/2} = (82)^{1/2} = 8^{2 \times 1/2} = 8$ $[(a^m)^n = a^{m \times n}]$
(ii) 32 = 2 x 2x 2 x 2 x 2 = 2^5
∴ $(32)^{1/5} = (2^5)^{1/5} = 2^{5 \times 1/5} = 2$ $[(a^m)^n = a^{m \times n}]$
(iii) 125 = 5 x 5 x 5 = 5^3
∴ $(125)^{1/3} = (5^3)^{1/3} = 5^{3 \times 1/3} = 5$ $[(a^m)^n = a^{m \times n}]$

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 x 3 = 3^2
∴ $(9)^{3/2} = (3^2)^{3/2} = 3^{2 \times 3/2} = 3^3 = 27$
$[(a^m)^n = a^{mn}]$
(ii) 32 = 2 x 2 x 2 x 2 x 2= 2^5
∴ $(32)^{2/5} = (2^5)^{2/5} = 2^{5 \times 2/5} = 2^2 = 4$
$[(a^m)^n = a^{mn}]$
(iii) 16 = 2 x 2 x 2 x 2 = 2^4
∴ $(16)^{3/4} = (2^4)^{3/4} = 2^{4 \times 3/4} = 2^3 = 8$
$[(a^m)^n = a^{mn}]$
(iv) 125 = 5 x 5 x 5 = 53
∴ $(125)^{-1/3} = (5^3)^{-1/3} = 5^{3 \times (-1/3)} = 5^{-1}$
= 15 [a^{-n} 1an]
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) $2^{2/3} . 2^{1/5} = 2^{2/3 + 1/5} = 2^{13/15}$
$[a^m . a^n = a^{m+n}$

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