EDUCATIONAL GROUP
Changing your Tomorrow

PERIOD~ 4

MATHEMATICS

CHAPTER NUMBER :~ 1
CHAPTER NAME :~ NUMBER SYSTEMS
SUB TOPIC :~ OPERATIONS ON DECIMAL AND NUMBER LINE

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PREVIOUS KNOWLEDGE TEST

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

2. Represent 4.236on the number line by successive magnification.

LEARNING OUTCOME:~

Students will learn

a) Operations on Real Numbers

b) Representation of square root of decimals on number line c) Rationalization of expressions.

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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

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

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

(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......
−11
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.

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¯.

∴ 27 = 2 x 17 = 2 x (0.142857¯) =0.285714¯

37 = 3 x 17 = 3 x (0.142857¯) = 0.428571¯

47 = 4 x 17 = 4 x (0.142857¯) = 0.571428¯

57 = 5 x 17 = 5 x(0.142857¯) = 0.714285¯

67 = 6 x 17 = 6 x (0.142857¯) = 0.857142¯

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

Question 3.

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

(i) 0.6^{-}

(ii) 0.47^{-}

(iii) 0.001^{-}

Solution:

(i) Let $x = 0.6^{-} = 0.6666\ldots$ … (1)

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

$10x = 6.6666\ldots$ … (2)

Subtracting (1) from (2), we get

$10x - x = 6.6666\ldots - 0.6666\ldots$

$\Rightarrow 9x = 6 \Rightarrow x = 69 = 23$

Thus, $0.6^{-} = 23$

Question 4.

Express 0.99999… in the form pq Are 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.

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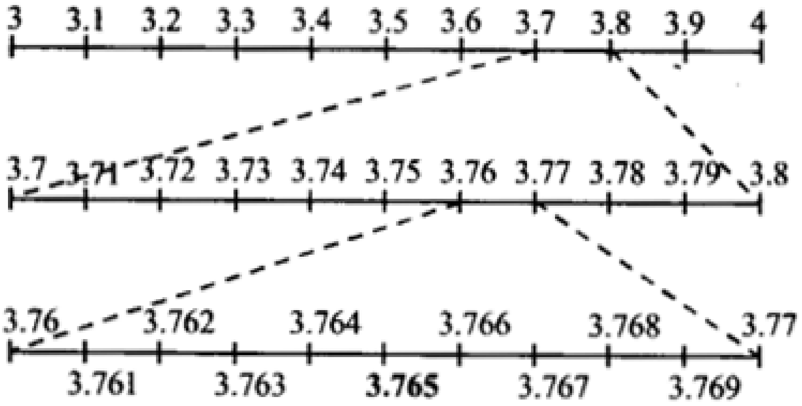
EXERCISE-2.4

Question 1.

Visualise 3.765 on the number line, using successive magnification.

Solution:

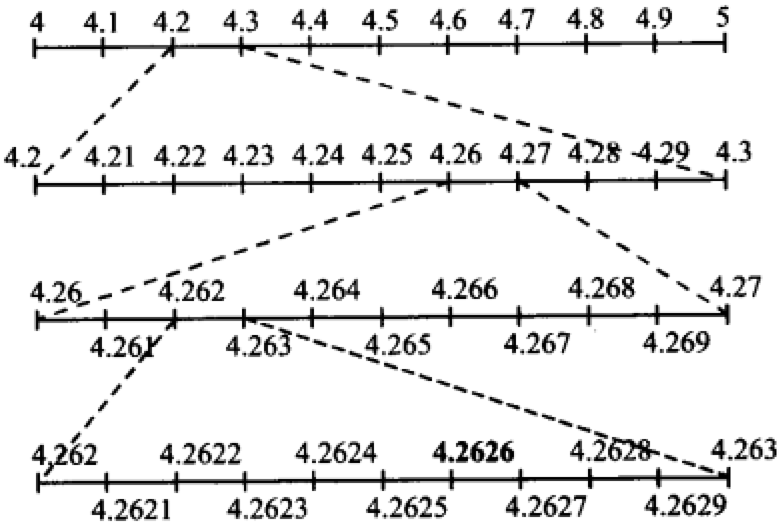


(i) 3.7 lies between 3 and 4

(ii) 3.76 lies between 3.7 and 3.8

(iii) 3.765 lies between 3.76 and 3.77

Question 2.
Visualise $4.\overline{26}$ on the number line, upto 4 decimal places.



(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

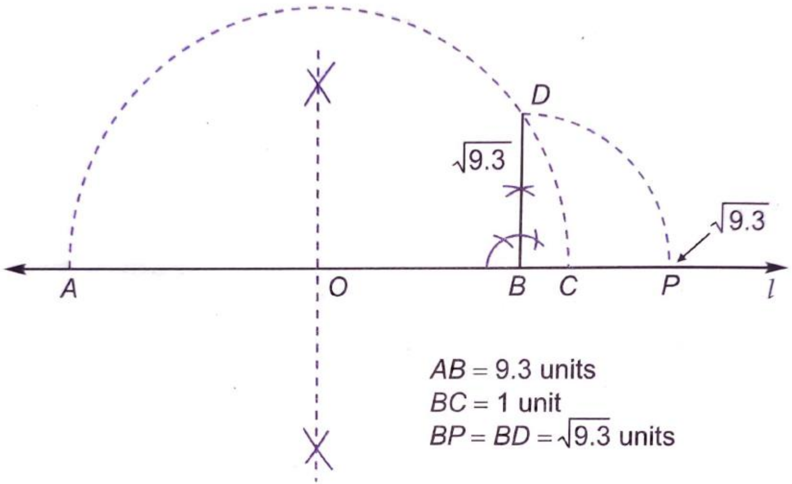
https://www.youtube.com/watch?v=8Br5b_RCwcs

"Numbers Are Intellectual Witness That Belong Only To Mankind…"

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

Solution. Steps of construction :

1. On the number line l, draw $AB = 9.3$ units.
2. Extend AB to point C such that $BC = 1$ unit.
3. Draw the perpendicular bisector of AC and mark the midpoint of AC as O.
4. With O as centre, draw a semicircle of radius $OA = OC$.
5. From B, draw $BD \perp AC$, intersecting the semicircle at D.
6. With B as centre, draw an arc of radius BD intersecting the number line at P.



$AB = 9.3$ units
$BC = 1$ unit
$BP = BD = \sqrt{9.3}$ units

Add $(3\sqrt{2}+4\sqrt{3})$ and $(2\sqrt{2}-\sqrt{3})$.

Solution. $(3\sqrt{2}+4\sqrt{3})+(2\sqrt{2}-\sqrt{3})=(3\sqrt{2}+2\sqrt{2})+(4\sqrt{3}-\sqrt{3})=(3+2)\sqrt{2}+(4-1)\sqrt{3}=5\sqrt{2}+3\sqrt{3}$.

Multiply $4\sqrt{5}$ by $3\sqrt{5}$.

Solution. $4\sqrt{5}\times 3\sqrt{5}=4\times 3\times\sqrt{5}\times\sqrt{5}=12\times 5=60$.

Divide $12\sqrt{15}$ by $4\sqrt{3}$.

Solution. $12\sqrt{15}\div 4\sqrt{3}=\dfrac{12\sqrt{15}}{4\sqrt{3}}=\dfrac{3\times\sqrt{5}\times\sqrt{3}}{\sqrt{3}}=3\sqrt{5}$.

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

(ii) $(3+\sqrt{3})(3-\sqrt{3})=(3)^2-(\sqrt{3})^2=9-3=6.$ $[(a+b)(a-b)=a^2-b^2]$

(iii) $(\sqrt{5}+\sqrt{2})^2=(\sqrt{5})^2+(\sqrt{2})^2+2\,.\sqrt{5}\sqrt{2}$ $[(a+b)^2=a^2+b^2+2ab]$

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

(iv) $(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})=(\sqrt{5})^2-(\sqrt{2})^2=5-2=3.$ $[(a+b)(a-b)=a^2-b^2]$

Evaluation:~

1. Represent $\sqrt{5.2}$ on the number line.

2. $(\sqrt{5}-\sqrt{2})+(\sqrt{5}+\sqrt{2})$.

3. $(\sqrt{3}+2)(\sqrt{3}-2)$.

Homework :

Exercise 1.5

AHA:~

1. Find a and b : $\frac{3+\sqrt{2}}{3-\sqrt{2}} = a+b\sqrt{2}$.
2. $\frac{7+3\sqrt{5}}{3+\sqrt{5}} - \frac{7-3\sqrt{5}}{3-\sqrt{5}}$ evaluate.

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