ODM EDUCATIONAL GROUP
Changing your Tomorrow

PERIOD-5

MATHEMATICS

CHAPTER NUMBER :~ 1
CHAPTER NAME :~ NUMBER SYSTEMS
SUB TOPIC :~ RATIONALIZATION

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PREVIOUS KNOWLEDGE TEST

1. Visualise 4.262626… on the number line, up to 4 decimal places.

2. Visualise 3.765 on the number line, using successive magnification.

LEARNING OUTCOME:~

Students will learn

a) More on Rationalization

b) Laws of Exponents for Real Numbers

Question 1.

Classify the following numbers as rational or irrational.

Solution:

(i) Since, it is a difference of a rational and an irrational number.
∴ $2 - \sqrt{5}$ is an irrational number.

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

Question 2.

Simplify each of the following expressions

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

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?

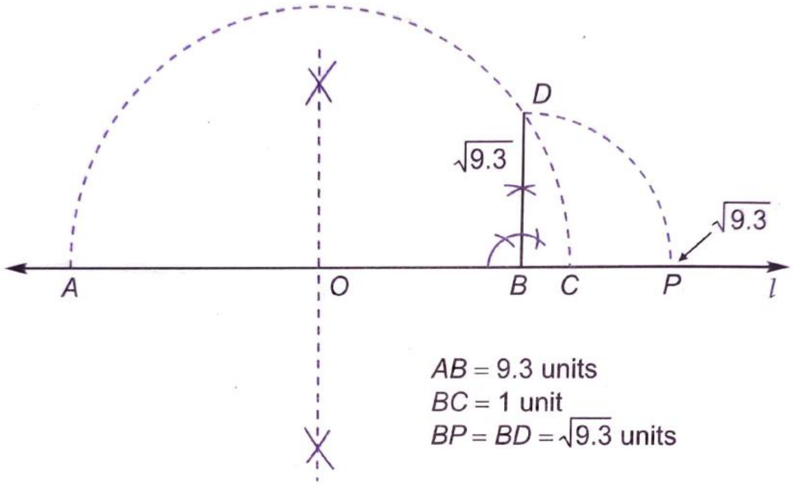
Solution:

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.

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.



https://www.youtube.com/watch?v=JMnm6xeHC58

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

RATIONALIZATION:-

The word rationalize literally means making something more efficient. Rationalization is the process of eliminating a radical or imaginary number from the denominator or numerator of an algebraic fraction.

Laws of Exponents for Real Numbers

If $a > 0$ and $b > 0$ be real numbers and p and q be rational numbers, then

(i) $a^p . a^q = a^{p+q}$ (ii) $(a^p)^q = a^{pq}$ (iii) $\frac{a^p}{a^q} = a^{p-q}$ (iv) $a^p b^p = (ab)^p$

(v) $\frac{a^p}{b^p} = \left(\frac{a}{b}\right)^p$ (vi) $a^{\frac{m}{n}} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}$

REMARKS An exponent is a number or symbol that indicates the power to which another number or expression is raised. For example, $(x + y)^n$ indicates that the expression $(x + y)$ is raised to the nth power ; n is the exponent.

Commit To Memory (C.T.M.)

1. $a^m . a^n = a^{m+n}$	When numbers with equal bases are multiplied, their powers get added.
2. $\frac{a^m}{a^n} = a^{m-n}, \quad a \neq 0$	When numbers with equal bases are divided, their powers get subtracted.
3. $(a^m)^n = a^{mn}$	When number with some power is raised to another power, powers get multiplied.
4. $a^0 = 1, \quad a \neq 0$	Any non-zero number raised to power zero is equal to 1.
5. $a^m = a^n \Rightarrow m = n$	When bases are equal, powers are equal.
6. $a^m . b^m = (ab)^m$	When numbers with different bases but equal powers are multiplied, their bases get multiplied retaining the same power.
7. $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m, b \neq 0.$	When numbers with different bases but equal powers are divided, their bases get divided retaining the same power.
8. $a^{-m} = \frac{1}{a^m}, \quad a \neq 0$	A number with negative power is equal to the reciprocal of that number raised to equal positive power.

Evaluation:

Question: Rationalize the denominator

a. $1/5+\sqrt{2}$

b. $2/3\sqrt{3}$

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Homework : Exercise 1.6

AHA:~

1. If x= 3+$\sqrt{8}$, find $x^2 + \frac{1}{x^2}$.
2. If x= 2+$\sqrt{3}$, find $x^1 + \frac{1}{x^1}$.
3. If $a^x = b, b^y = c, c^z = a$ then prove that: xyz=1.

THANKING YOU

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