B.B.S.S. Sec School

CLASS-X (MATHS) (1)

Irrational numbers:- A number which can not be written in the form of $\frac{p}{q}$ $(q \neq 0)$ where p and q are integers.

for example, $\sqrt{2}$, $\sqrt{3}$, $\sqrt{15}$, π etc are irrational numbers.

Theorem:-

Let p be a prime number, If p divides a^2 then p divides a, where a is a posative integer.

If p is a prime number then $\sqrt{p}$ is an irrational number.

To prove a number be irrational:-

Working Rules:-

Step I:- Assume the number, to the contrary as rational.

Step II Based on this assumption, write a series of statements which are logically correct.

Step-III Finally, conclude the statement which contradicts the assumption that given number be rational therefore assumption must be wrong. Hence give number is irrational.

Ex.1.3:- **Q.1** Let $\sqrt{5}$ be rational,

$\therefore \sqrt{5} = \frac{a}{b}$ $(b \neq 0)$ where a and b are coprimes.

$\Rightarrow a = \sqrt{5}b$

on squaring both sides we get

$a^2 = 5b^2$ — ①

$\Rightarrow a^2$ is divisible by 5

$\Rightarrow a$ is divisible by 5

$\therefore$ 5 is a factor of a

Let $a = 5c$

on squaring both sides

$a^2 = 25c^2$ —(II)

Now from ① and (II)

$5b^2 = 25c^2$

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$b^2 = \frac{\cancel{25}}{\cancel{5}} c^2 = 5c^2$

$\Rightarrow b^2 = 5c^2$

$\Rightarrow b^2$ is divisible by 5

$\Rightarrow b$ is divisible by 5

$\therefore$ 5 is a factor of b.

This shows that a and b have a common factor of 5

but we have assume that a and b are co-primes

so, our assumption is wrong

$\therefore$ $\sqrt{5}$ is irrational. HP

Q.2. Let $3+2\sqrt{5}$ is rational, therefore

$3+2\sqrt{5} = \frac{a}{b}$ $(b \neq 0)$ where a and b are co-primes.

$2\sqrt{5} = \frac{a}{b} - 3$

$2\sqrt{5} = \frac{a-3b}{b}$

$\sqrt{5} = \frac{a-3b}{2b}$

$\because$ $\frac{a-3b}{2b}$ is rational because a and b are integers.

$\therefore$ $\sqrt{5}$ is rational.

But we know that $\sqrt{5}$ is irrational. Therefore our assumption is wrong and hence $3+2\sqrt{5}$ is Irrational HP

Home work Ex 1.3 Q. 3 (i) (ii) (iii)

Assignment :-

① Prove that $\sqrt{3}$ is irrational.

② Prove that $5+3\sqrt{7}$ is irrational.

(3) Prove that $\frac{1}{\sqrt{3}}$ is irrational.

(4) Prove that $3-5\sqrt{2}$ is irrational.

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CLASS-X

MATHS

Theorem:- (I) If x is a rational number whose decimal expansion terminates, then x can be expressed in the form of $\frac{p}{q}$, where p and q are co-primes (no factor other than 1) and the prime factorisation of q is of the form $2^m 5^n$ where m and n are non negative integers.

(II) Let $x = \frac{p}{q}$ be a rational number. Such that the prime factorisation of q is not of the form $2^m 5^n$ where n and m are non negative integers. Then x has a decimal expansion which is non-terminating and repeating.

Ex 1.4 Q1 (I) $\frac{13}{3125}$ Here $q = 3125$

$q = 3125 = 5 \times 5 \times 5 \times 5 \times 5$

$= 5^5$

$\Rightarrow 3125 = 2^0 5^5$

5	3125
5	625
5	125
5	25
5	5
	1

Here q is in the form of $2^m 5^n$ where $m = 0$, $n = 5$

$\therefore$ Decimal expansion is terminates.

(III) $\frac{64}{455}$, $q = 455$

$q = 5 \times 7 \times 13$

5	455
7	91
13	13
	1

q is not in the form of $2^m 5^n$

$\therefore$ Decimal expansion is non terminates

Q.2 (i) $\frac{13}{3125} = \frac{13}{5 \times 5 \times 5 \times 5 \times 5} = \frac{13}{5^5} = \frac{13 \times 2^5}{5^5 \times 2^5} = \frac{13 \times 32}{10^5} = \frac{416}{100000}$

$= 0.00416$ Ans

(IV) $\frac{15}{1600} = \frac{3 \times \cancel{5}}{2^6 \times 5 \times \cancel{5}} = \frac{3}{2^6 \times 5} = \frac{3 \times 5^5}{2^6 \times 5 \times 5^5} = \frac{9375}{2^6 \times 5^6}$

$= \frac{9375}{10^6} = 0.009375$ Ans

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Q.3 (i) ∵ 43.123456789 is terminating
∴ It represent a rational number.
43.123456789 can be expressed in the form of $\frac{p}{q}$
where $q = 10^9$.

(ii) 0.120120012000..... is non-terminating and non repeating
∴ It is an irrational number.

Home work: Ex.1.4 Q1. (ii) (iv) to (x)
Q.2. (ii) (iii) (v) to (x)
Q3 (iii)

Assignment:

Q1 Without actual division state whether the following rational number will have a terminating or a non-terminating repeating decimal expansion.

(i) $\frac{17}{8}$ (ii) $\frac{53}{343}$ (iii) $\frac{17}{625}$ (iv) $\frac{77}{210}$ (v) $\frac{17}{320}$ (v) $\frac{23}{2^3\ 5^2}$

Q2 After how many decimal expansion will the following expansion terminate.

(i) $\frac{35}{16000}$ (ii) $\frac{13}{125}$ (iii) $\frac{43}{2^4 \times 5^3}$ (iv) $\frac{107}{1250}$

Q.3 Find HCF and LCM of.
(i) 615, 750 (ii) 81, 54 (iii) 1250, 31575

Q.4 Given the HCF (81, 54) = 27 Find LCM (81, 54)

Q.5 Prove that $\sqrt{17}$ is an irrational number.

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