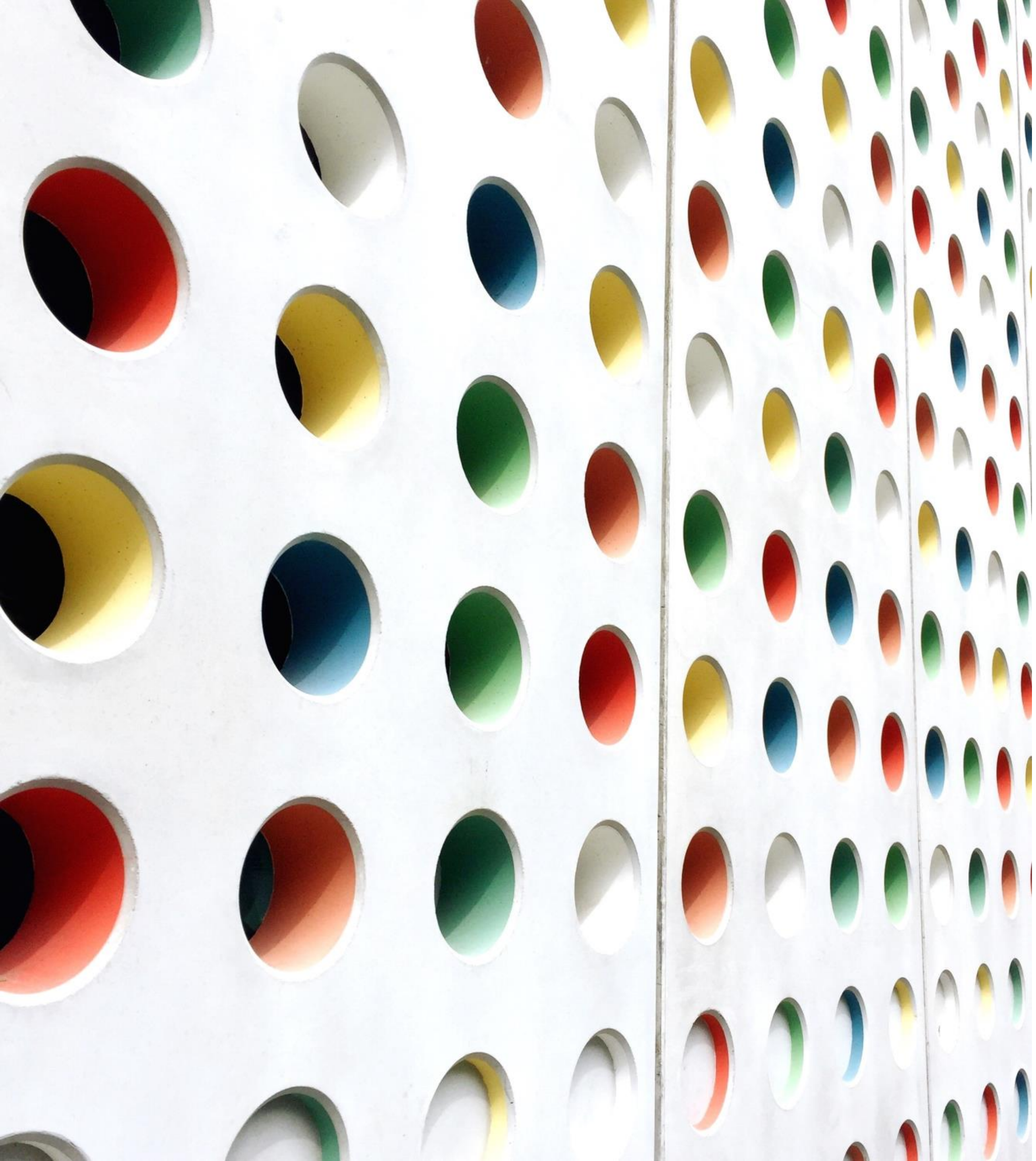

Irrational numbers

1.3

Class: 10th

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What is irrational numbers?

Any real number that cannot be expressed in $\frac{p}{q}$ form is know as irrational number (where $q \neq 0$)

Terminating

↓

0.254

$0.\overline{3}$

$\sqrt{2}, \sqrt{3}, \sqrt{11}$

non-Terminating

Non. Ter Repeating

↓

Rational

Non-Ter non-Repeating

↓

irrational

$0.245\ldots$

Theorem 1.3 : Let ‘p’ be a prime number. If ‘p’ divides ‘a^2’ then ‘p’ divides ‘a’, where ‘a’ is a positive integer.

$p = 2, 3, 5, 7 \ldots$

a = positive Integer

$a = 9$, $a^2 = 81$, $p = 3$

$\frac{a^2}{p} = \frac{\cancel{81}}{\cancel{3}}$ 27, $\frac{a}{p} = \frac{\cancel{9}}{\cancel{3}} = 3$

$a = 4$, $a^2 = 16$, $p = 2$

$\frac{a^2}{p}$, $\frac{a}{p}$

$\frac{\cancel{16}\ 8}{\cancel{2}}$, $\frac{4}{2} = 2$

hence

$\boxed{\frac{81}{5}, \frac{9}{5}}$

Prove that $\sqrt{2}$ is irrational.

Let us assume that $\sqrt{2}$ is a Rational no.

ie $\sqrt{2} = \frac{r}{s}$ $(s \neq 0)$

suppose r and s have a common factor Rath than (1).

if we divide $\frac{r}{s}$ with a common factor

we get $\left(\frac{a}{b}\right)$ a and b Co-prime

ie $\sqrt{2} = \frac{a}{b}$

$a = b\sqrt{2}$ — (I) (square both sides)

$a^2 = b^2(2) \Rightarrow a^2 = 2b^2$ — (II)

$b^2 = \frac{a^2}{2}$ (2 divide a^2) ($\therefore$ 2 also divide (a))

$\therefore \boxed{\frac{a}{2} = c}$

$a = 2c$

Put this value in (II)

$(2c)^2 = 2b^2$

$4c^2 = 2b^2$

$c^2 = \frac{2b^2}{4}$ $\Rightarrow$ $\boxed{c = \frac{b^2}{2}}$

($\therefore$ 2 also divide b)

we have a factor 2 (a, b)

but we can say that a and b have only factor (one)

we contradict that our consider

$\therefore \sqrt{2}$ is irrational no.

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

let us assume that $\sqrt{3}$ is Rational

$\sqrt{3} = \frac{r}{s}$ $(s \neq 0)$

Suppose that r and s have common factor Rather than (1).

Then if we divide $\frac{r}{s}$ with that common factor $\left(\frac{a}{b}\right)$

$\sqrt{3} = \frac{a}{b} \Rightarrow a = \sqrt{3}b$ (a and b is co-prime)

Squaring both side

$a^2 = 3b^2$ (1) $\Rightarrow b^2 = \frac{a^2}{3}$

[3 divide a^2

$\therefore$ 3 also divide a]

ie $\frac{a}{3} = c$

$\boxed{a = 3c}$

use in equation (1)

$a^2 = 3b^2$

$(3c)^2 = 3b^2$

$9c^2 = 3b^2 \Rightarrow c^2 = \frac{3b^2}{9 \, 3}$

$\boxed{c^2 = \frac{b^2}{3}}$ (3 divide b^2)

($\therefore$ 3 also divide b)

$\therefore$ 3 is a common factor of a and b

but a and b have no factor Rather than (1)

we contradict our condition

$\therefore \sqrt{3}$ is irrational no.

Show that $5 - \sqrt{3}$ is irrational

Let assume that $5-\sqrt{3}$ is Rational number

ie $5-\sqrt{3} = \frac{a}{b}$ (a and b is co-prime)

$5 - \frac{a}{b} = \sqrt{3}$ (Here a and b is integers)

$\frac{5b-a}{b} = \sqrt{3}$ (Here after solving $\frac{5b-a}{b}$ = Rational)

$\therefore$ $\frac{5b-a}{b}$ is Rational number and $\sqrt{3}$ Rational numbers

But we contradict our condition that $\sqrt{3}$ irrational

This is due to the wrong assumption.

$\therefore$ $5-\sqrt{3}$ is irrational number

$5 - \frac{1}{2}$

$\frac{10-1}{2} = \frac{9}{2}$

Show that $3\sqrt{2}$ is irrational.

$\frac{1}{3\sqrt{2}} = \frac{1}{6}$

let we assume that $3\sqrt{2}$ is Rational

$3\sqrt{2} = \frac{a}{b}$ $(b \neq 0)$ (a and b is Coprime)

$\sqrt{2} = \frac{a}{3b}$ (here a and b is integers)

after solving $\frac{a}{3b}$ we get a Rational

$\frac{a}{3b}$ = Rational number $\therefore \sqrt{2}$ = Rational.

but we Contradict that $\sqrt{2}$ is irrational number

This due to the wrong assumption of $3\sqrt{2}$ is Ration number

$\therefore 3\sqrt{2}$ is irrational number.

Show that $\frac{1}{\sqrt{2}}$ is irrational.

Let us assume that $\frac{1}{\sqrt{2}}$ is Ration.

$\therefore \frac{1}{\sqrt{2}} = \frac{a}{b}$ $(b \neq 0)$ (a and b is Co-prime)

$\sqrt{2} = \frac{b}{a}$ (Hence a and b is Integers)

$\therefore \frac{b}{a}$ = Rational number, $\sqrt{2}$ = Rational number

we Contradict that $\sqrt{2}$ is irrational number

This due to our wrong supposition about $\frac{1}{\sqrt{2}}$ is Rational

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

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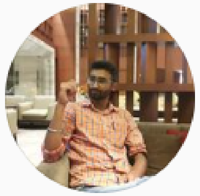

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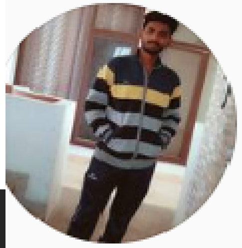

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