LECTURE 02

CLASS XI - PHYSICS

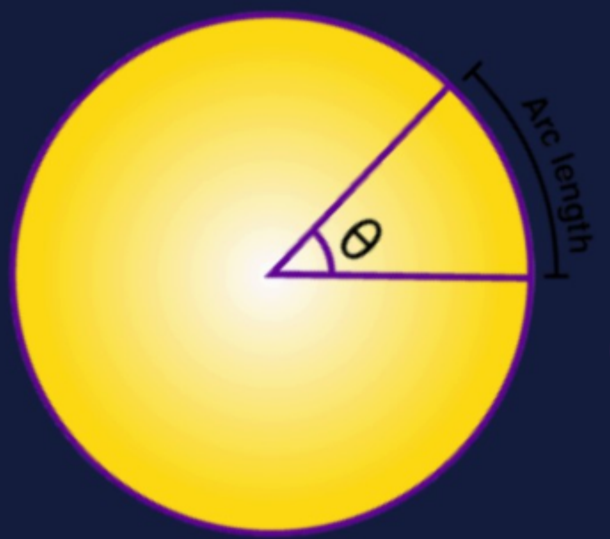
BASIC MATHS AND CALCULUS

RECAP

- Trigonometric Functions
  - Relationship Between Radian and Degree

    rad $\rightleftharpoons$ degree

    $\theta = \frac{Arc}{R}$
  - Trigonometric Ratios
  - Angle Transformation(New)



$\theta = \frac{Arc}{R}$

rad

$\sin\theta = \frac{1}{\csc\theta}$	,	$\csc\theta = \frac{1}{\sin\theta}$
$\cos\theta = \frac{1}{\sec\theta}$	,	$\sec\theta = \frac{1}{\cos\theta}$
$\tan\theta = \frac{1}{\cot\theta}$	,	$\cot\theta = \frac{1}{\tan\theta}$

$$\sin^2\boxed{\theta} + \cos^2\boxed{\theta} = 1$$

$$1 + \tan^2\theta = \sec^2\theta$$

$$1 + \cot^2\theta = \csc^2\theta$$

☆☆☆ Small Angle Approximation

$\sin\theta \approx \theta$

$\tan\theta \approx \theta$

$\cos\theta \approx 1$

Topics to be Covered

- Algebra
- Binomial Approximation
- Logarithms
- Exponential

प्रारंभ BATCH

How’s the JOSH?

Angle Transformation

Ⓢ :- Samajadari

$\Rightarrow 0, 90, 180, 270^\circ, 360^\circ$

$\Rightarrow \pm\ 30^\circ, 45^\circ, 60^\circ$

Ⓢ : sign

$\Rightarrow$ Q : I , II , III , IV

All S T C

cos & sec

Ⓣ : Transform

$90, 270^\circ \Rightarrow s \rightleftharpoons c\ \&\ t \rightleftharpoons \cot$

$180, 360^\circ \Rightarrow$ No change

$\sin 315^\circ$

$\sin(\underbrace{270 + 45}_{\cos})$

$= -\cos 45^\circ$

$= -\dfrac{1}{\sqrt{2}}$

$\sin(360 - 45^\circ)$

$= -\sin 45^\circ$

$= -\dfrac{1}{\sqrt{2}}$

Trigonometric Addition & Subtraction Formulas:

Sine Formulas

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

Cosine Formulas

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

Sin ⇒ Sidhe-Sada

cos ⇒ chalak

⇒ A & B

$\boxed{30^\circ, 45^\circ, 60^\circ, 90^\circ}$

Ques. find value of $\sin 15^\circ \Rightarrow 45-30^\circ$

$\Downarrow$

$60-45^\circ$

$30^\circ, 45^\circ, 60^\circ, 90^\circ$

SOLUTION

A & B

$$\underset{A}{\sin}(60-45^\circ) = \sin A \cos B - \cos A \sin B$$

$$= \sin 60^\circ \cos 45^\circ - \cos 60 \sin 45^\circ$$

$$= \left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{2}}\right) - \left(\frac{1}{2}\right)\left(\frac{1}{\sqrt{2}}\right)$$

$$\boxed{\sin 15^\circ = \frac{1}{2\sqrt{2}}\left(\sqrt{3}-1\right)}$$

Ques. find value of cos 75°

SOLUTION

$\Rightarrow 30^\circ, 45^\circ, 60^\circ, 90^\circ$

ऐसा क्यु ?
Lect. 1

$\sin(90-\theta) = \cos\theta$

$\sin 15^\circ$

$= \sin(90-75)$

$= \cos 75^\circ$

$\cos(45+30^\circ)$ (A) (B)

$= \cos A \cos B - \sin A \sin B$

$= \cos 45^\circ \cos 30^\circ - \sin 45^\circ \sin 30^\circ$

$= \left(\frac{1}{\sqrt{2}}\right)\left(\frac{\sqrt{3}}{2}\right) - \left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{2}\right)$

$\cos 75^\circ = \frac{1}{2\sqrt{2}}(\sqrt{3}-1) = \sin 15^\circ$

NOTE :-

$\sin 2\theta = 2\sin\theta \cdot \cos\theta$

$\cos 2\theta = \cos^2\theta - \sin^2\theta$

HELLO EVERYONE

HOW IS THE JOSH ?🔥

priyanka

Algebra

Linear Function $\Rightarrow$ straight line

eg.

$y = 5x + 2$

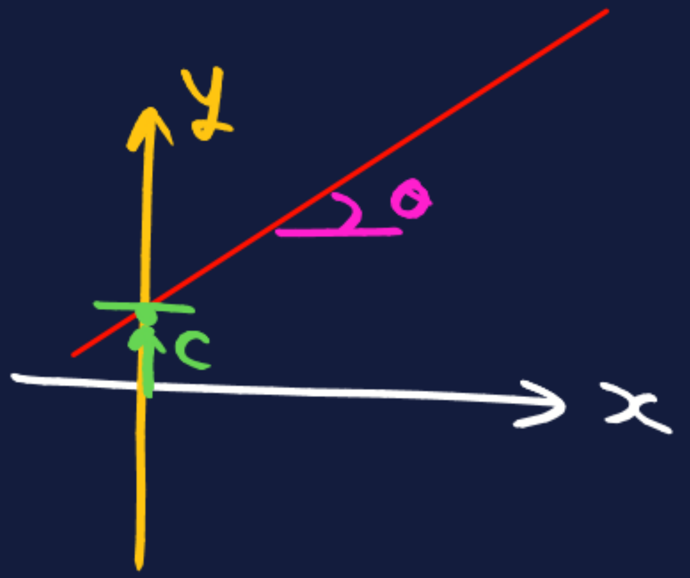
$y = 5x + 3$

$y = 10x - 10$

Variable की max power = 1

$\Rightarrow$ linear

$\Rightarrow y = mx + c$



y-intercept $= c$

Slope $= m = \tan\theta$

$= \dfrac{y_2 - y_1}{x_2 - x_1}$

Quadratic Equations

eg.

$y = 5x^2 + 2x + 3$

Variable की Max power = 2

$\Rightarrow y = ax^2 + bx + c$

$y = ax^2 + bx + c$

$x \to \alpha, \beta \Rightarrow y = 0$

α & β Equation's Roots

$\Rightarrow \alpha = \dfrac{-b + \sqrt{b^2 - 4ac}}{2a}$

$\Rightarrow \beta = \dfrac{-b - \sqrt{b^2 - 4ac}}{2a}$

$\boxed{\alpha + \beta = \dfrac{-b}{a}}$

$\boxed{\alpha\beta = \dfrac{c}{a}}$

Quadratic Formula (for finding roots):

If $ax^2 + bx + c = 0$, then the roots are given by:

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}, \quad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

Ques. given , $6x^2 - 13x + 6 = 0$ find the root equation

HW

Standard Algebraic Identities:

- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $a^2 - b^2 = (a + b)(a - b)$
- $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Remember

1 Sum of first n natural numbers:

- $1 + 2 + 3 + 4 + 5 + \ldots\ldots + n = \frac{n(n+1)}{2}$

2 Sum of Squares of first n natural numbers:

$$1^2 + 2^2 + 3^2 + 4^2 + 5^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

3 Sum of cubes of first n natural numbers:

$$1^3 + 2^3 + 3^3 + 4^3 + 5^3 + \ldots\ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$$

Power of a Power Rule:

If a number with an exponent is raised to another exponent:

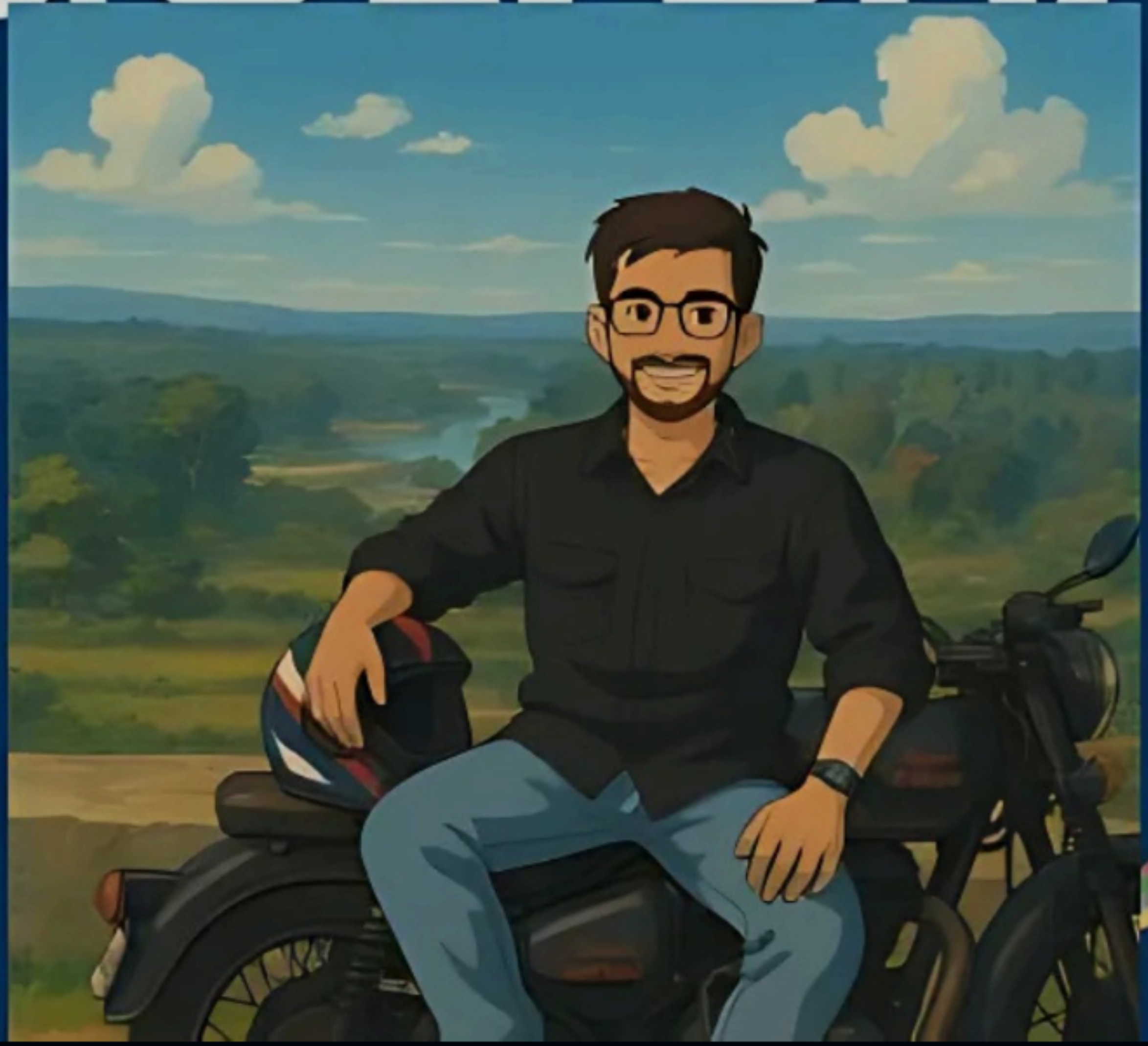
$$(x^m)^n = x^{m\times n}$$

Example: $(4^2)^2 = (16)^2 = 256$

$4^{2\times2} = 4^4 = 4 \times 4 \times 4 \times 4 = 256$

Both expressions are equal, which confirms the identity.

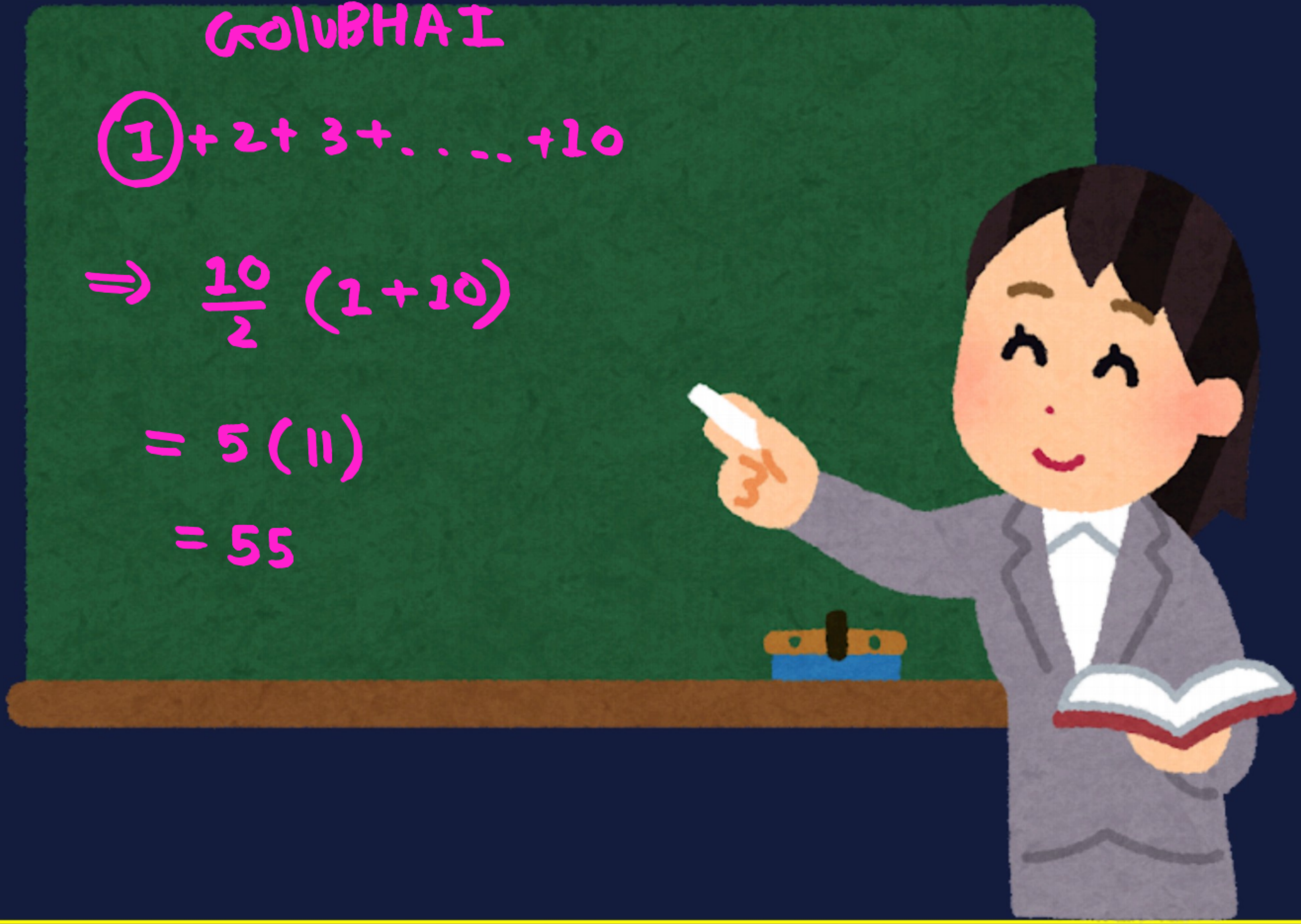
HOW THE JOSH GOLI BHAI



BY SAMYAK RAJPUT

$(9^2)^{3/4} = ?$

A.P. & G.P.


GOLUBHAI
1+2+3+.....+10
⇒ 10/2 (1+10)
= 5(11)
= 55

AP

1, 3, 5, 7, 9....

- $d = 3-1 = 5-3 = 7-5 = 9-7$

$\boxed{d = 2}$

- $\underbrace{a}_{1^{st}} + \underbrace{(a+d)}_{2^{nd}} + \underbrace{(a+2d)}_{3^{rd}\text{ term}} + \ldots + \underbrace{a+(n-1)d}_{n^{th}\text{ term}}$

- $S_n = \frac{n}{2}\left(\text{1st term} + \text{last term}\right)$

GP.

1, 2, 4, 8, 16, ...

- $r = \frac{2}{1} = \frac{4}{2}, \frac{8}{4} = 2$

- $a = 1$

- $a + ar + ar^2 + ar^3 + \ldots + ar^{n-1}$

- $S_n = \frac{a}{1-r}(1-r^n)$

If $|r| << 1$ & $n \to \infty$

$\boxed{S_\infty = \frac{1}{1-r}}$

Phy.

A.P. (Arithmetic Progression)

A sequence where the difference between consecutive terms is constant.

Example: 1, 3, 5, 7, 9, ...

$$S_n = \frac{n}{2}\left(1^{st}\,\text{term} + n^{th}\,\text{term}\right)$$

$$n^{th}\,\text{term} = a + (n-1)d$$

Key Terms:

- First term (a)
- Common difference (d) : 2nd term - 1st term

Ques. 3, 6, 9, 12 ....

$\frac{6}{3} \neq \frac{9}{6} \Rightarrow r \Rightarrow G.P \times$

$6-3 = 9-6 = 3 = d \Rightarrow A.P \checkmark$

1. find the 30th term
2. sum of first 30 terms

SOLUTION

(i) $30^{th}\ \text{term} = a + (n-1)d$

$= 3 + (30-1)(3)$

$= 3 + (29)(3)$

$= 90$

(ii) $S_{30} = \frac{n}{2}\left(1^{st}\ \text{term} + 30^{th}\ \text{term}\right)$

$= \left(\frac{30}{2}\right)(3 + 90)$

$= (15)(93) = 1395$

$n^{th}\ \text{term} = a + (n-1)d$

$S_n = \frac{n}{2}\left(1^{st}\ \text{term} + n^{th}\ \text{term}\right)$

G.P. (Geometric Progression)

A sequence where the ratio between consecutive terms is constant.

Example: 1, 2, 4, 8, 16, 32,....

$|r| < 1$ & ... $n \Rightarrow \infty$

$$\boxed{S_\infty = \frac{a}{1-r}}$$

Key Terms:

- First term (a)
- Common ratio (r): $\frac{2^{nd}\text{ term}}{1^{st}\text{ term}} = \frac{3^{rd}\text{ term}}{2^{nd}\text{ term}}$ ✓

Q.

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots\dots + \infty$$

$$= 1 + (1)\left(\frac{1}{2}\right) + (1)\left(\frac{1}{2}\right)^2 + (1)\left(\frac{1}{2}\right)^3 + (1)\left(\frac{1}{2}\right)^4 + \dots \infty$$

$$= a + ar + ar^2 + ar^3 + ar^4 + \dots + \infty$$

$S_\infty = \frac{a}{1-r}$

$r << 1$ & $n \to \infty$

yes

$$S_\infty = \frac{a}{1-r} = \frac{1}{1-(1/2)} = \frac{1}{1/2} = 2$$

प्रारंभ BATCH

Binomial Theorem

$\Rightarrow$ Physics

$$(1+\square)^n \simeq 1 + n\square$$

$$(1-\square)^n \simeq 1 - n\square$$

Condition :- $\square \ll 1$

$$(1+\square)^n = 1 + n\square$$

C: $\square \ll 1$

Q. $(1.001)^4$ YES

$$= (1 + 0.001)^4$$

$$= (1) + (4)(0.001)$$

$$= 1 + 0.004 = 1.004 \checkmark$$

Q. $(0.995)^3$ YES

$$= (1 - 0.005)^3$$

$$= 1 - (3)(0.005)$$

$$= \_\_\_$$

The acceleration due to gravity at a height h above the surface of the earth (radius = R) is given by $g' = g R^2 / (R + h)^2$

[Gravitation]
Derivation

If $h <<<< R$, then show that : $\boxed{g' = g (1 - 2h/ R)}$

SOLUTION

$$g' = \frac{g \, R^2}{(R+h)^2}$$

$(1+\square)^n = 1 + n\square$

$\square << 1$

$$g' = \frac{gR^2}{(R+h)^2}$$

$$= \frac{g}{\frac{(R+h)^2}{R^2}}$$

$$= \frac{g}{\left(\frac{R+h}{R}\right)^2}$$

$$= \frac{g}{\left(\frac{R}{R}+\frac{h}{R}\right)^2}$$

$$= \frac{g}{\left(1+\frac{h}{R}\right)^2}$$

$$= g\left(1+\frac{h}{R}\right)^{-2}$$

$$= g\left(1-\frac{2h}{R}\right)$$

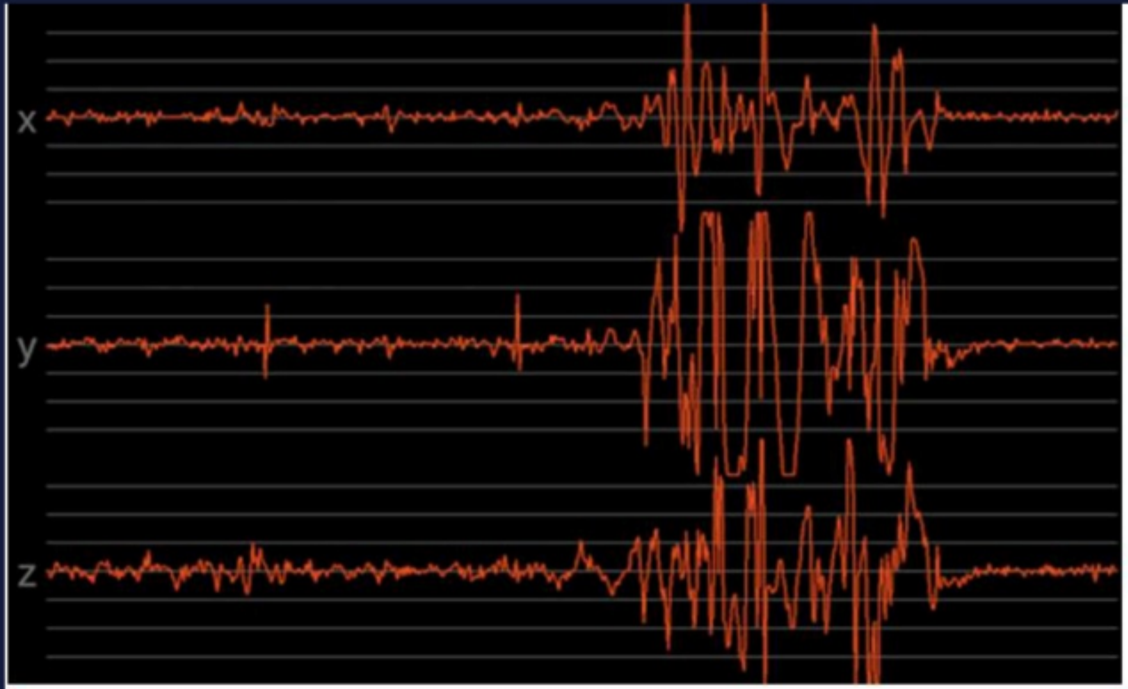
$$\left(1+\frac{h}{R}\right)^{-2}$$

$h << R$

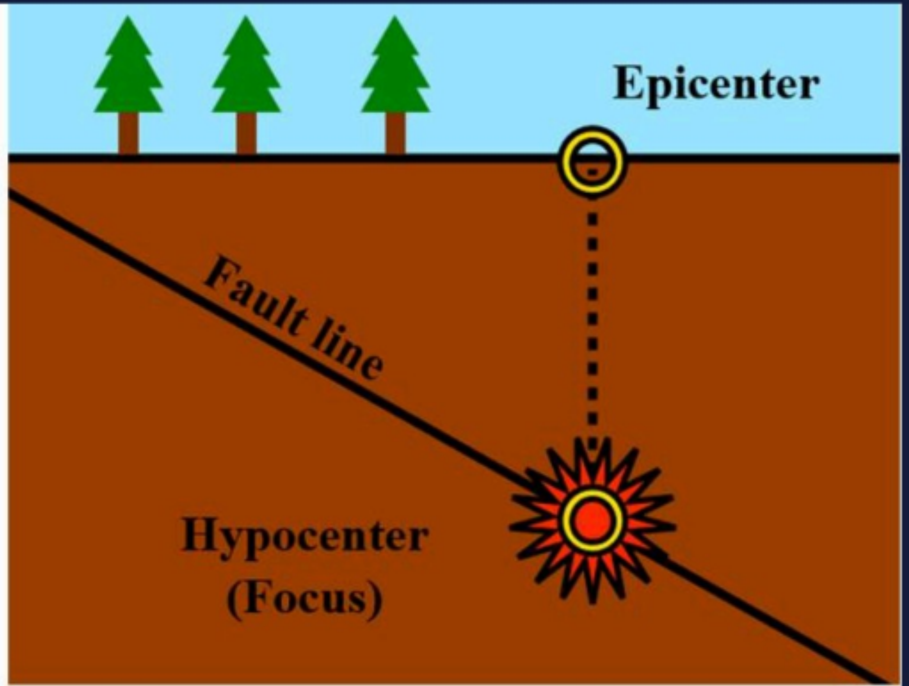
$\Rightarrow \frac{h}{R} << 1$

$$= \left(1+(-2)\frac{h}{R}\right)$$

$$= \left(1-\frac{2h}{R}\right)$$



Seismogram



Earthquake Epicenter

Earthquake

sin(x)

cos( )

$\boxed{\log(\ )}$

$$\log_b x = y$$

LOGARITHMS

$b^n = a$

Exponential

$\therefore n = \log_b(a)$

Logarithm

$b^n = a$ ⇄ $\log_b a = n$

base value

base value

b = base, a = value, n = exponent

(power)

① $b^y = x$

$y = \log_b(x)$

The logarithmic form is:

② $\log_b x = y$

$x = b^y$

$\log_b x$ represents "logarithm of x with base b"

b is the base
x is the result
y is the power
(or exponent)

class के बाद
use se Revise

Ques. $\log_2 x = -4$, find the value of x

A. 16

B. 1 / 16

C. -16

D. - 1/ 16

$x = 2^{-4}$

$x = \frac{1}{2^4} = \frac{1}{16}$

SOLUTION


दुनिया में कितने प्रकार के
लोग होते है ?

$\log_{b} \bigcirc$

chem.

Natural Logarithm (ln)

$b = e = 2.73$

$\log_e \boxed{} = \ln \boxed{}$

phy

Common Logarithm (log)

$b = 10$

$\log_{10} \boxed{} = \log_{10} \boxed{}$

Standard Values to remember

Base e	Base 10
$\ln(2) = 0.693$	$\log_{10}(2) = 0.301$
$\ln(3) = 1.09$	$\log_{10}(3) = 0.477$
$\ln 5 = 1.6$	$\log_{10}(5) = 0.699$

Relationship Between Natural and Common Logarithms

$$\log_e \boxed{} = \ln \boxed{}$$

$$= 2.303 \times \log_{10} \boxed{}$$

eg.

$$\ln \boxed{x} = 2.303 \log_{10} \boxed{x}$$

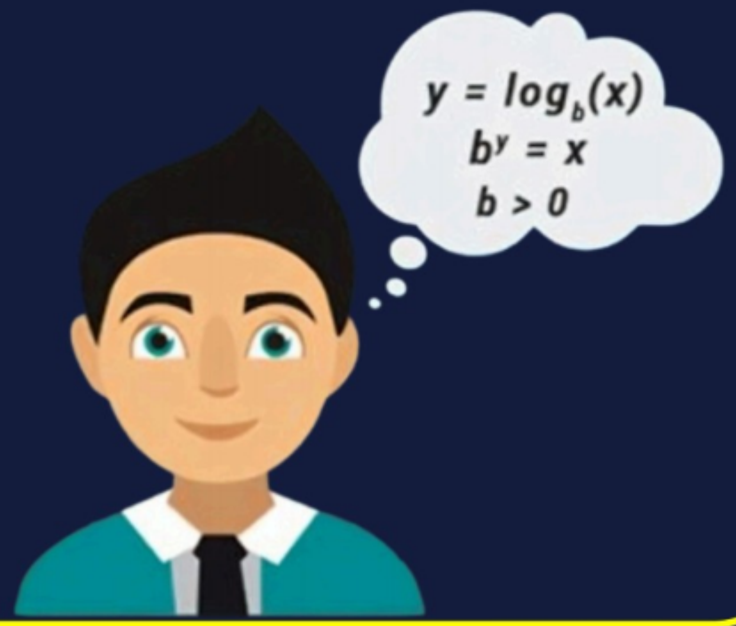
Properties of Logarithms

1. Product Rule: $\log(m \cdot n) = \log(m) + \log(n)$

2. Quotient Rule: $\log\left(\frac{m}{n}\right) = \log(m) - \log(n)$

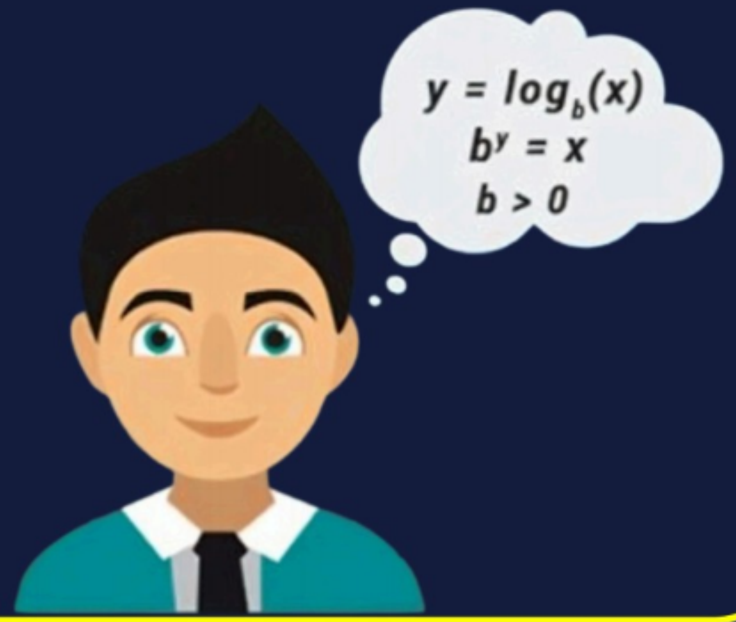
3. Exponential (Power) Rule:

$$\log(m)^n = n\log(m)$$



4. Change of Base Rule:

$$\log_b a = \frac{\log_k a}{\log_k b}$$



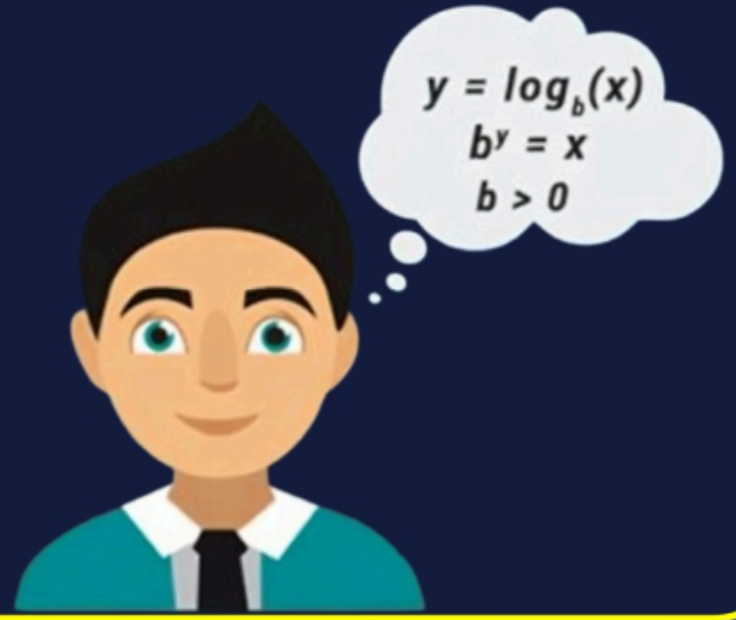
5. Base Switch:

$$\log_b x = \frac{1}{\log_x b}$$

Example:

$$\log_4 16 = \frac{1}{\log_{16} 4}$$

$$\log_9 3 = \frac{1}{\log_3 9}$$

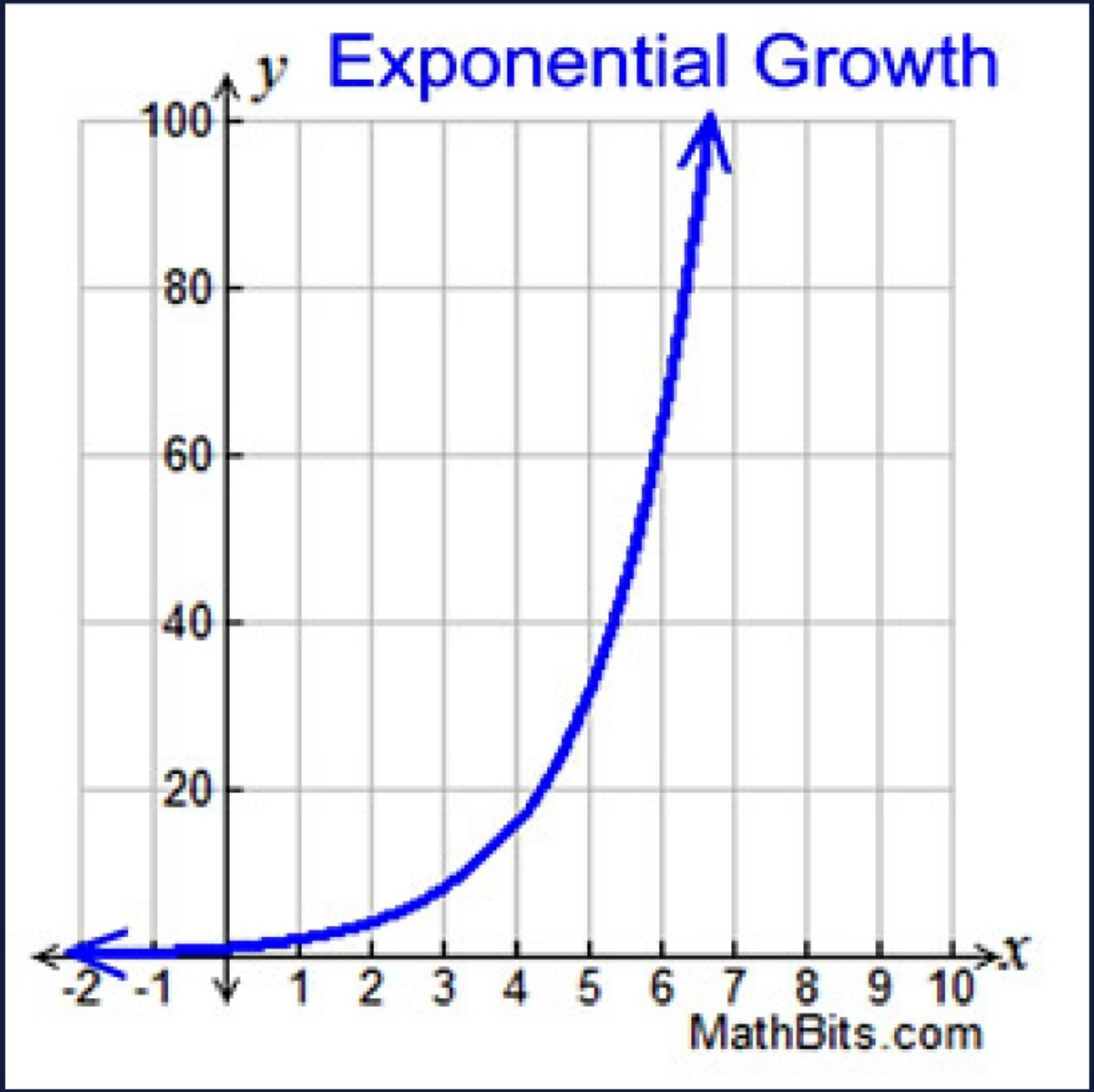


Exponential Function

The mathematical constant e = 2.714.

An exponential function has the form $(e)^x$ or $(2.714)^x$.

e is the base, and x is the exponent.


Exponential Growth
y
100
80
60
40
20
-2
-1
1
2
3
4
5
6
7
8
9
10
x
MathBits.com

#HOME WORK

- Notes
- PCP
- Revise

Next Lecture's Goal

- Differentiation

milta hn next class ma mera pyara baccho🤗🤗

agar sab kuch samjh aya tho chat ma likho swaha 🥰🥰

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