YAKEEN NEET 2.0

2026

Basic Maths and Calculus (Mathematical Tools)

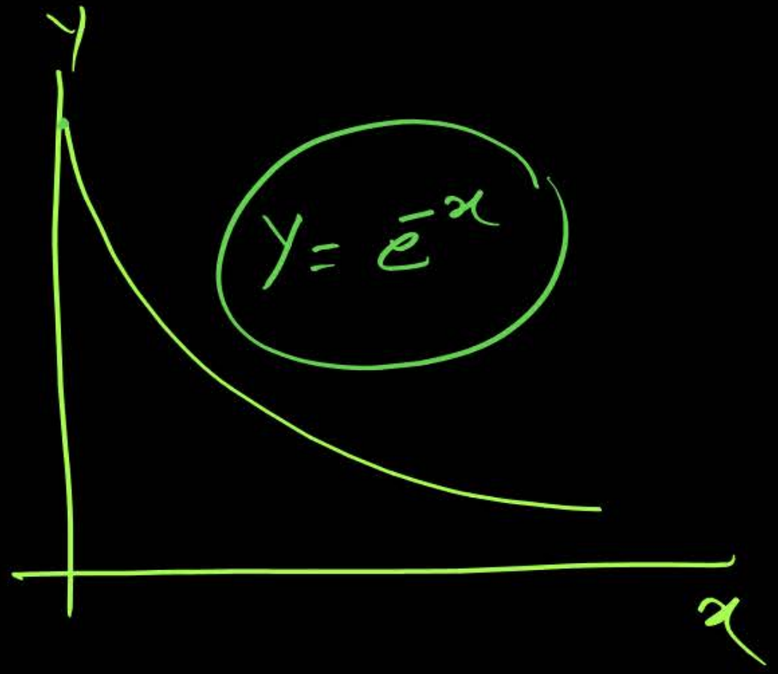
Physics | Lecture - 11

By- Manish Raj (MR Sir)

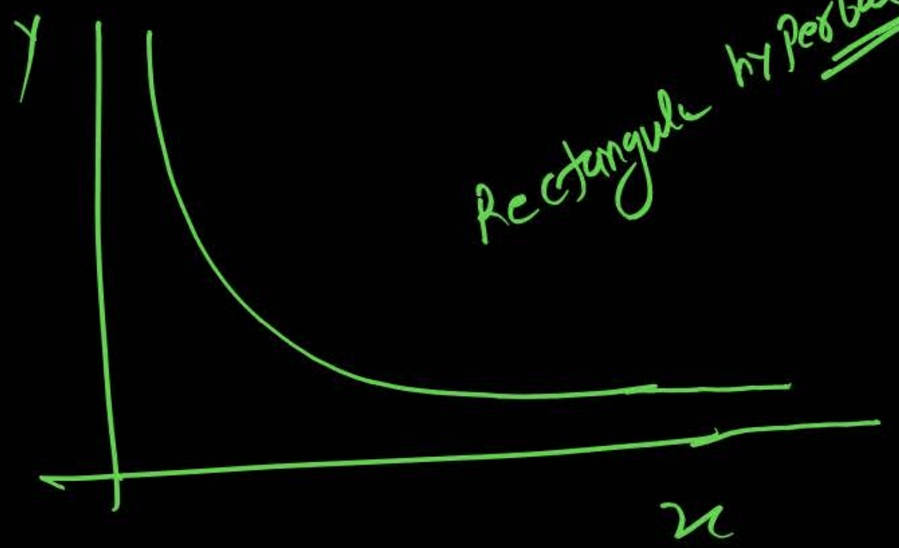
Topics to be covered

1. H/W → video solution. ✓
2. # Koin banega dr. Dadh on Graph. ✓✓
3. Class Question Ka P.d.f. →
4. # Rule of differentiation

(1)



$y = \frac{1}{x}$



Rectangular hyperbola

22%
X (a) $y = \frac{1}{x}$

(b) $y = x^2$

X (c) $y = e^{2x}$

60% - (d) $y = e^{-x}$

(2)

circle

ellipse

Rec. hyps $y = \frac{k}{x^2}$

Parab... Straight

Sinusoidal

	Equation	Nature of Graph
→	(*i*) $x^2 + y^2 = 25$	(A) Parabola
→	(*ii*) $\frac{x^2}{4} + \frac{y^2}{3} = 16$	(B) Rectangular hyperbola
→	(*iii*) x^2y = constant	(C) Ellipse
→	(*iv*) $5 = y^2 x^{-1} = \frac{y^2}{x}$	(D) Circle
→	(*v*) $4x + 3y = 25$	(E) Straight line
→	(*vi*) $y = 4 \sin \theta$	(F) Sinusoidal

(i) D

(ii) C

(iii) B

(iv) A

(v) E

(vi) F

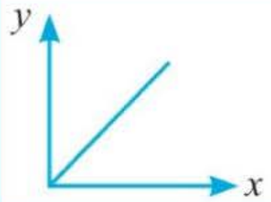
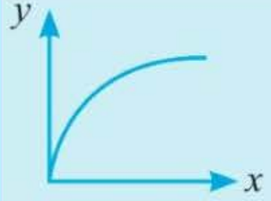
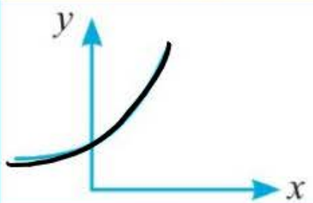
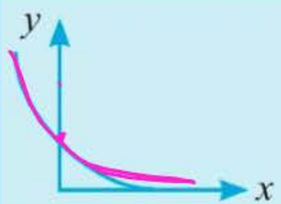
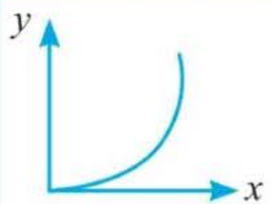
$5 = y^2 x^{-1}$

$5 = \frac{y^2}{x^1}$

$5x^1 = y^2$ Parabola

#

165. Match the following :

	Column-I		Column-II
(*i*)	$y^3 = 5x^2$	(A)	
(*ii*)	$3y = 4x$	(B)	
(*iii*)	$y = e^{-x}$	(C)	
(*iv*)	$y^2 = 7x^4$	(D)	
(*v*)	$y = e^x$	(E)	

$y = 5x^{2/3}$

$y = \frac{4}{3}x$

$y = e^{-x}$

root Both side

$y = \sqrt{7}\,x^2$

$y = e^x$

(i) → B

(ii) → A

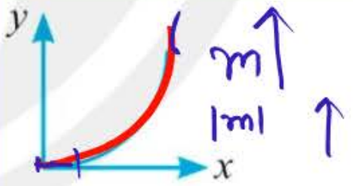
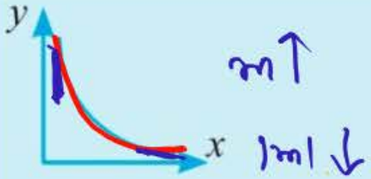
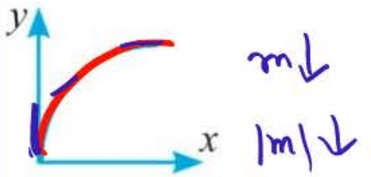
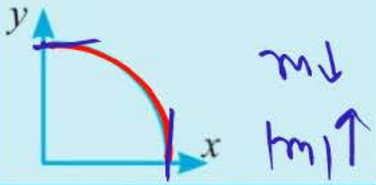
(iii) → D

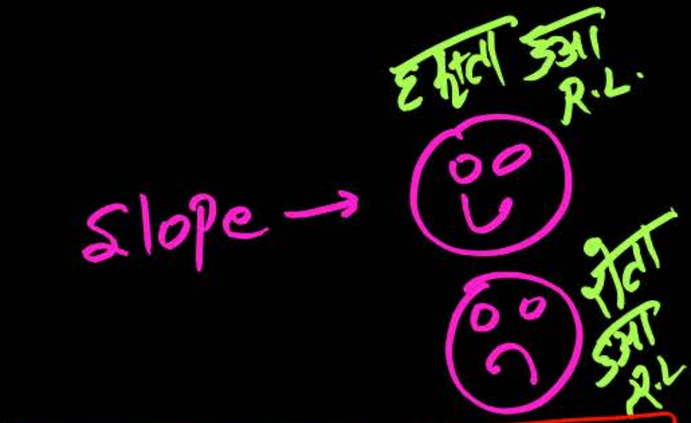
(iv) → E

(v) → C

Ans.

131. Match the following:

	Column-I		Column-II
(1)		(A)	The value of slope is decreasing and also its magnitude is decreasing.
(2)		(B)	The value of slope decreasing but it's magnitude is increasing.
(3)		(C)	Value and magnitude of slope both are increasing.
(4)		(D)	Slope is increasing but it's magnitude decreasing.



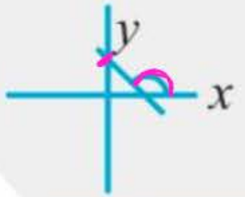
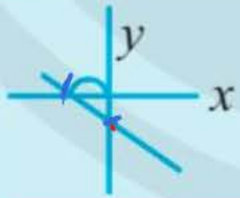
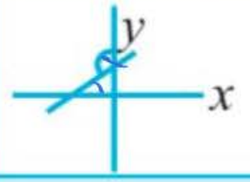
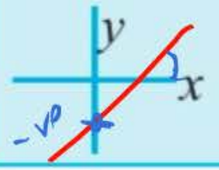
Magnitude of slope → Rekha Ki Condⁿ

1 → C
2 → D
3 → A
(4) → B

all Correct

140. Match the following:

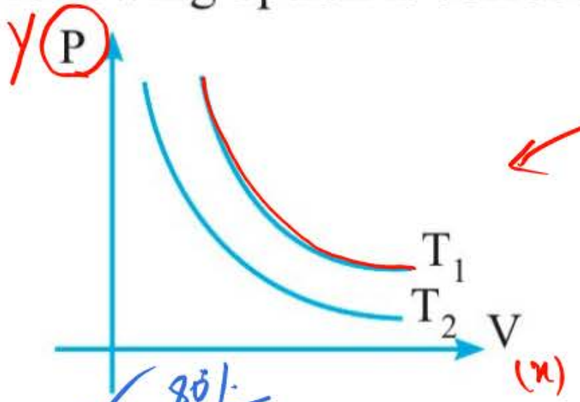
(5)

Column-I		Column-II	
(1)	Positive slope with negative y intercept	(A)	
(2)	Negative slope with negative y intercept	(B)	
(3)	Positive slope with positive y intercept	(C)	
(4)	Negative slope with positive intercept	(D)	

1 - D
2 → B
3 → C
4 → A

$100-0$ $373-273$

171. Which of the following option is correct ??



Rectangular hyp

$PV = nRT$ eqn

$P \propto \frac{1}{V}$

80%

(a) $T_1 = T_2$ (b) $T_1 > T_2$ (c) $T_1 < T_2$ (d) Can't say

$PV = nRT$

Isothermal Temp = Cotn

* $P \propto \frac{1}{V}$

already done in class

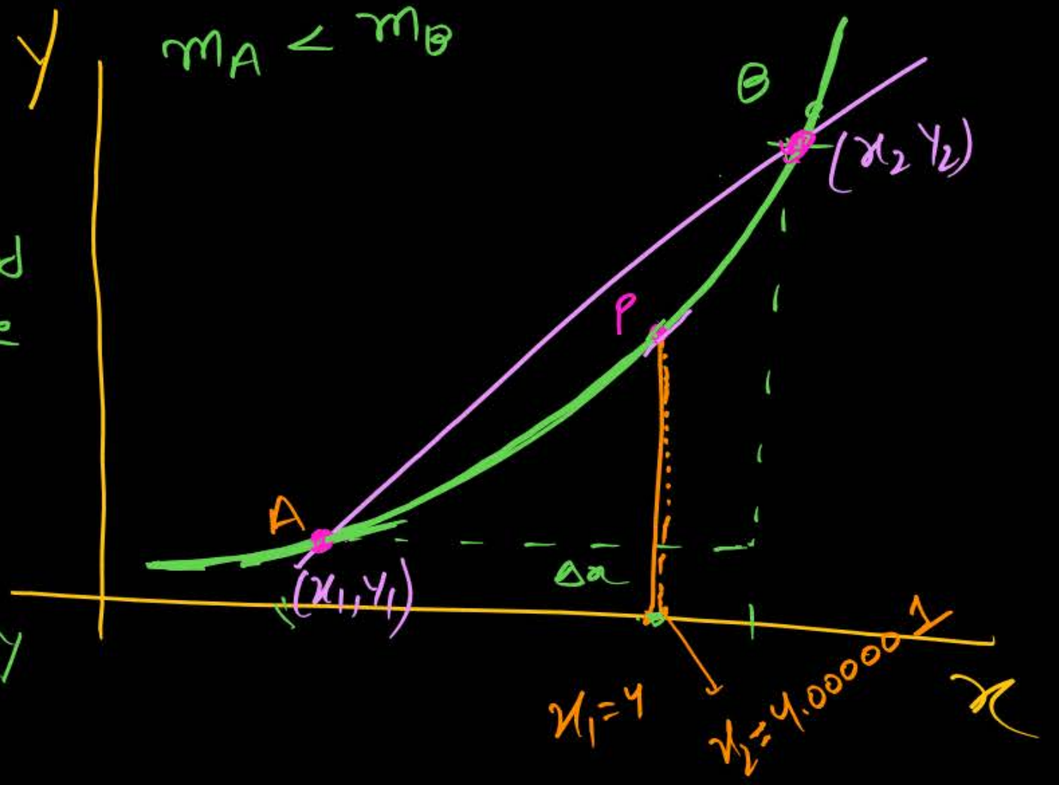
Lecture → 9th

Lets start Diffrentiation.

Differentiation (likhna hai)

Avg slope B/w A & B = Connect A & B with straight line & find slope of that straight line

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$$



Slope at Point

$\Delta x \to 0$ (very-very-very-very small)

$\Delta x \longrightarrow dx$

$\Delta y \longrightarrow dy$

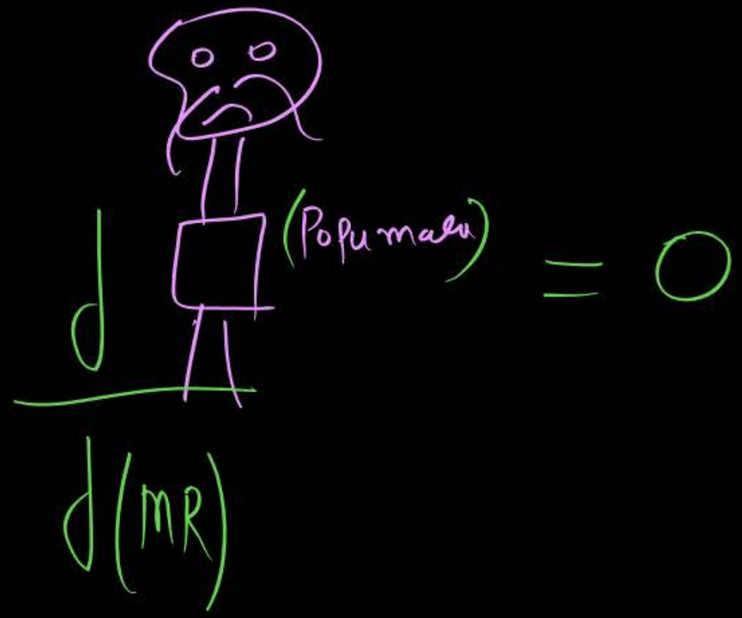
Slope $= \frac{dy}{dx}$ = diff^n of y w.r.t. x

$= \frac{d}{dx}$ of 'y'

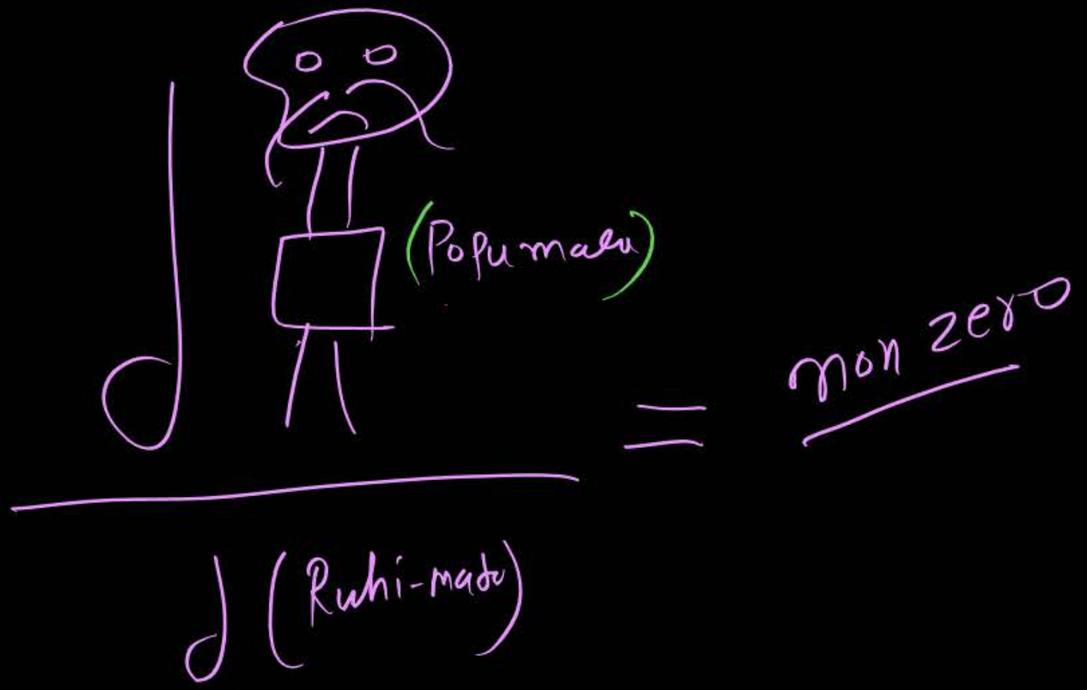
= Rate of change in y w.r.t x

= Slope of tangent at that Point.

$\frac{d}{dx}$ = Differential operation



$= 0$



$=$ non zero

Rule-1 : Diffrention of any Constant value is zero.

$$\# \quad \frac{d(\pi)}{dt} = 0$$

$$\# \quad \frac{d(\tan\theta \cdot \cot\theta)}{d\theta} = \frac{d1}{d\theta} = 0$$

$$\tan\theta \cdot \cot\theta = 1$$

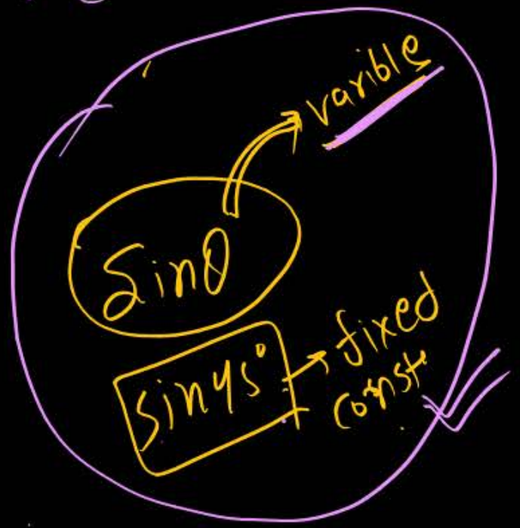
$$\frac{P}{B} \times \frac{B}{P} = 1$$

$$\# \quad \frac{d(\sin^2\theta + \cos^2\theta)}{d\theta} = \frac{d1}{d\theta} = 0$$

$$\frac{d\,2^{\circ}}{dx} = 0$$

$$\frac{dx^{\circ}}{dx} = \frac{d1}{dx} = 0$$

$$\frac{d\,\sin(45^{\circ})}{d\theta} = \frac{d\left(\frac{1}{\sqrt{2}}\right)}{d\theta} = 0$$



Rule-2

diff^n of algebric function.

$$y = x^n$$

$$\# \quad \boxed{\frac{dx^n}{dx} = nx^{n-1}}$$

$\# \quad y = x^{1/3}$

$$\frac{dy}{dx} = \frac{dx^{1/3}}{dx} = \frac{1}{3}x^{\frac{1}{3}-1}$$

$$= \frac{1}{3}x^{\frac{1-3}{3}}$$

$$= \frac{1}{3}x^{-2/3}$$

$\# \quad y = \frac{1}{\sqrt{x}} = \frac{1}{x^{1/2}} = x^{-1/2}$

$$\frac{dy}{dx} = \frac{dx^{-1/2}}{dx} = -\frac{1}{2}x^{-\frac{1}{2}-1}$$

$$= -\frac{1}{2}x^{-3/2}$$

$\# \quad y = \frac{1}{x^4} = x^{-4}$

$$\frac{dy}{dx} = \frac{dx^{-4}}{dx} = -4x^{-4-1}$$

$$= -4x^{-5}$$

Note

Rule-3 Differentiation Triyonometric function, exponential & log.

Kam ka hai

$\frac{d \sin\theta}{d\theta} = \cos\theta$

$\frac{d \cos\theta}{d\theta} = -\sin\theta$

$\frac{d \tan\theta}{d\theta} = \sec^2\theta$

$$\frac{d \sec\theta}{d\theta} = \sec\theta \cdot \tan\theta$$

$\frac{d e^x}{dx} = e^x$

$\frac{d \log_e x}{dx} = \frac{1}{x}$

Note

Rule-4

If any constant value multiplied with varible :—
then constant comes out from diffⁿ.

$$y = 4x^3$$

$$\frac{dy}{dx} = \frac{d\,4x^3}{dx} = 4\frac{dx^3}{dx} = 4\left(3x^{3-1}\right) = 12x^2$$

$$y = 4\sin(x)$$

$$\frac{dy}{dx} = 4\frac{d\sin(x)}{dx} = 4\cos x.$$

$$y = Ae^x$$

$$\frac{dy}{dx} = A\frac{de^x}{dx}$$

$$\boxed{\frac{dy}{dx} = Ae^x}$$

Note Rule-5 addition Rule

Ex $y = e^x + x^2$

$$y = u + v$$

$$\frac{dy}{dx} = \frac{d}{dx}(u+v)$$

$$\frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}$$

Rule-6 subtraction Rule

$$y = u - v$$

$$\frac{dy}{dx} = \frac{du}{dx} - \frac{dv}{dx}$$

Rule-7 multiplication

$$y = u \cdot v$$

$$\frac{dy}{dx} = \left(\frac{du}{dx}\right)v + u\frac{dv}{dx}$$

$$\frac{dy}{dx} = u\left(\frac{dv}{dx}\right) + \left(\frac{du}{dx}\right)v$$

Rule-8 Division Rule *

$$y = \frac{u}{v}$$

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

Rule-5 addition Rule

Ex $y = e^x + x^2$

$$\frac{dy}{dx} = \frac{de^x}{dx} + \frac{dx^2}{dx}$$

$$= e^x + 2x$$

Rule-6 subtraction Rule

$$y = e^x - x^2$$

$$\frac{dy}{dx} = e^x - 2x$$

Rule-7 multiplication

$$y = e^x \times x^2$$

$$\frac{dy}{dx} = \frac{de^x}{dx} \times x^2 + e^x \frac{dx^2}{dx}$$

$$= e^x x^2 + e^x (2x)$$

$$= e^x (x^2 + 2x)$$

Rule-8 Division Rule *

$$y = \frac{e^x (u)}{x^2 (v)}$$

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$= \frac{x^2 \frac{de^x}{dx} - e^x \frac{dx^2}{dx}}{x^4}$$

$$= \frac{x^2 e^x - e^x (2x)}{x^4}$$

$$= \frac{e^x}{x^2} - \frac{2e^x}{x^3}$$

Note

$$y = \frac{e^x}{x^2}$$

$$y = e^x x^{-2}$$

$$y = e^x \times x^{-2}$$

$$\frac{dx^{-2}}{dx} = -2x^{-2-1} = -2x^{-3}$$

$$\frac{dy}{dx} = \frac{de^x}{dx} \times x^{-2} + e^x \frac{dx^{-2}}{dx}$$

$$= e^x x^{-2} + e^x (-2x^{-2-1})$$

$$= e^x x^{-2} - 2x^{-3} e^x$$

$$= \frac{e^x}{x^2} - \frac{2e^x}{x^3}$$

Question

$x^n = \frac{1}{x^{-n}}$

$y = \tan x \cdot \log x$

Product Rule

$$\frac{dy}{dx} = \frac{d\tan x}{dx}\log x + \tan x \frac{d\log x}{dx}$$

$$= \sec^2 x \log x + \tan x \left(\frac{1}{x}\right)$$

Note Karnataka

$y = \frac{A}{x^3} - \frac{B}{x^4}$ where A & B Const.

find $\frac{dy}{dx} = ??$

Soln $y = \frac{A}{x^3} - \frac{B}{x^4}$

$y = Ax^{-3} - Bx^{-4}$

$\frac{dy}{dx} = A\frac{dx^{-3}}{dx} - B\frac{dx^{-4}}{dx}$

$= A(-3x^{-3-1}) - B(-4x^{-4-1})$

$\frac{dy}{dx} = -3Ax^{-4} + 4Bx^{-5}$

$= -\frac{3A}{x^4} + \frac{4B}{x^5}$ } Any.

$$y = \frac{x^2-1}{x^2+1}$$

Use Rule of division

$$\frac{dy}{dx} = \frac{(x^2+1)\frac{d(x^2-1)}{dx} - (x^2-1)\frac{d(x^2+1)}{dx}}{(x^2+1)^2}$$

$$= \frac{(x^2+1)(2x-0) - (x^2-1)(2x+0)}{(x^2+1)^2}$$

$$= \frac{(x^2+1)2x - (x^2-1)2x}{(x^2+1)^2} = \frac{2x^3+2x - 2x^3+2x}{(x^2+1)^2} = \frac{4x}{(x^2+1)^2}$$ Ans.

$$\frac{dx^1}{dx} = \frac{dx}{dx} = 1x^{1-1} = 1x^0 = 1$$

five me five ko Do bar add Karo ??

5 + + 5 = ??

5+5+5 ✓

5++5 ✗

Double diffrention = Single diff^n + Single diff^n.

$$y = 3x^4 \longrightarrow y = 3x^4$$

$$\frac{dy}{dx} = 3\frac{dx^4}{dx} = 3(4x^3) = 12x^3$$

$$\frac{dy}{dx} = 12x^3$$

$$\frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d(12x^3)}{dx} = 12\frac{dx^3}{dx} = 12(3x^2)$$

$$= \underline{36x^2}$$

Double

$\frac{d}{dx} \Rightarrow y \Rightarrow \frac{dy}{dx}$ = diff^n of y w.r.t x = Slope.

$\frac{d}{dx} \xrightarrow[\text{apply}]{} \left(\frac{dy}{dx}\right) = \frac{d}{dx}\left(\frac{dy}{dx}\right)$ = diff^n of $\frac{dy}{dx}$ w.r.t x = Double diff^r.

$\Rightarrow$ $\frac{d^2y}{dx^2}$ = Double Diff^n of y w.r.t x

= 2nd order differentiation.

= 2^n order derivative.

$y = 1x^5 + 2x^4 + 3x^3 + 4x^2 + 5x^1 + 6x^0$

$$\frac{dy}{dx} = 1\frac{dx^5}{dx} + 2\frac{dx^4}{dx} + 3\frac{dx^3}{dx} + 4\frac{dx^2}{dx} + 5\frac{dx^1}{dx} + 6\frac{dx^0}{dx}$$

$$\frac{dy}{dx} = 5x^4 + 2\times4x^3 + 3\times3x^2 + 4\times2x + 5\times1 + 0$$

$$\left(\frac{dy}{dx}\right) = 5x^4 + 8x^3 + 9x^2 + 8x + 5$$ ← 1st order differentiation

$$\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right) = 20x^3 + 24x^2 + 18x + 8 + 0$$ ← 2nd order diff

$$\frac{d^3y}{dx^3} = 60x^2 + 48x + 18 + 0 \longrightarrow \frac{d^4y}{dx^3} = 120x + 48$$

$$\frac{d^5y}{dx^5} = 120$$

$$\frac{d^6y}{dx^6} = 0$$

$y = \sin(x)$

$$\frac{dy}{dx} = \cos x$$

$$\boxed{\frac{d^2y}{dx^2} = -\sin x}$$

$$\frac{d^3y}{dx^3} = -\cos x$$

$$\frac{d^4y}{dx^4} = -(-\sin x) = +\sin x$$

$$\frac{d^5y}{dx^5} = \cos x$$

$$\boxed{\frac{d^6y}{dx^6} = -\sin x}$$

Question

① $y = \cos x + \frac{2}{x^3}$

$\rightarrow y = \cos x + 2x^{-3}$

H/W

② $y = 2x(1-x^2)$

$\frac{dy}{dx} = ??$

(3) $y = \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$

H/W

↳ diff^{n}

1st simplify it

$(a+b)^2 = a^2 + b^2 + 2ab$ ✓

Question

(4)

$$y = \frac{x+1}{x-1}$$

H/W

Question

(5)

$y = x^2 - 4x + 3$, then find value of $\frac{dy}{dx}$ at $x = 2$

Question

6 $y = \frac{A}{x^6} - \frac{B}{x^5}$; then find x where $\frac{dy}{dx} = 0$

11/12

⑦ Position of object $x = 4x^3 + 2x^2 - 7x + 9$ then find velocity $\left(V = \frac{dx}{dt}\right)$ at $t = 2$ sec

H/W

⑧ $y = 4x^3 + 2x^2 - 7x + 9$

⑨ $y = \tan x \cdot \cos^2 x$

(10) $y = \cos x$ find $\frac{dy}{dx}$ at $x = \pi/6$

H/W

(11) $y = \frac{4}{(x^2-4)}$

(12) $y = \sqrt{x} + \frac{1}{\sqrt{x}}$

(13) $y = e^x \log x$

(14) $y = \log x \cdot \sin x$

H/W

THANK YOU