Applied Mathematics

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Derivatives of Logarithmic Functions

Derivatives

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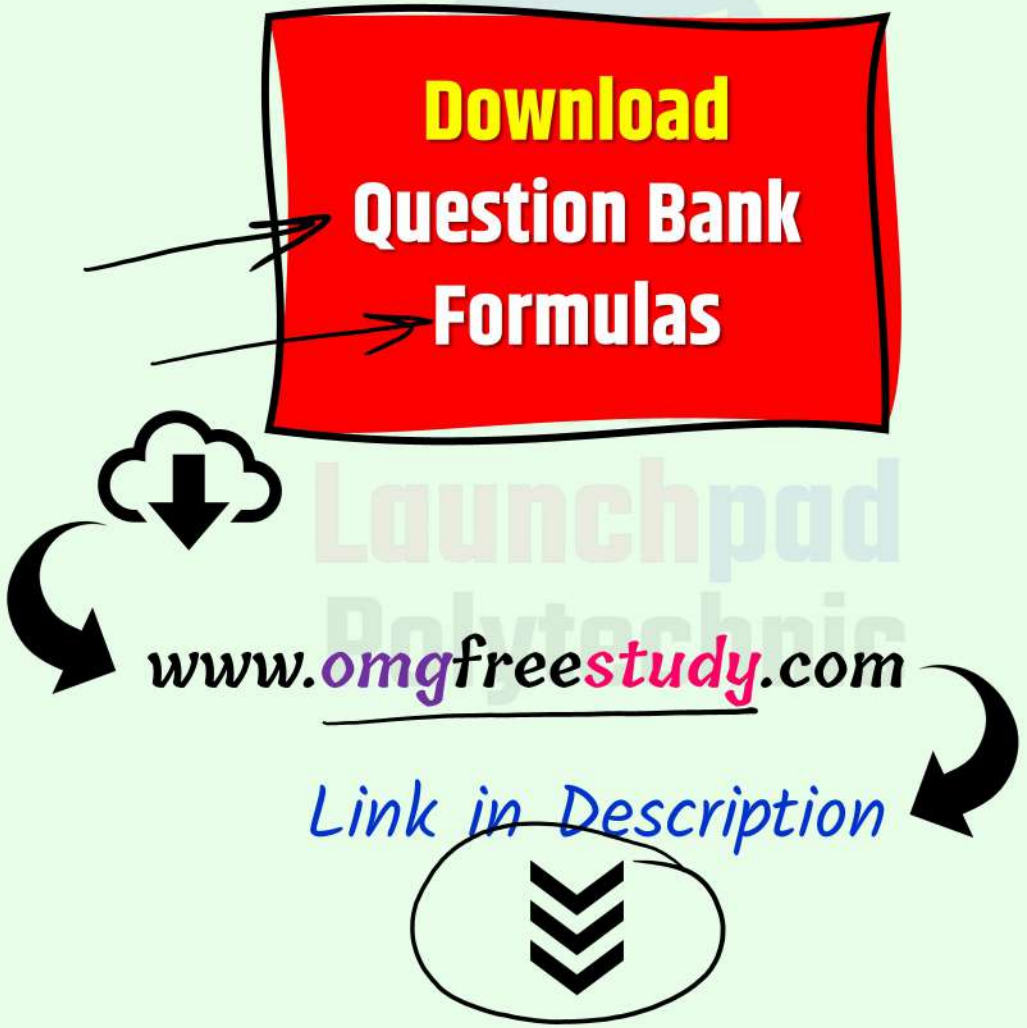


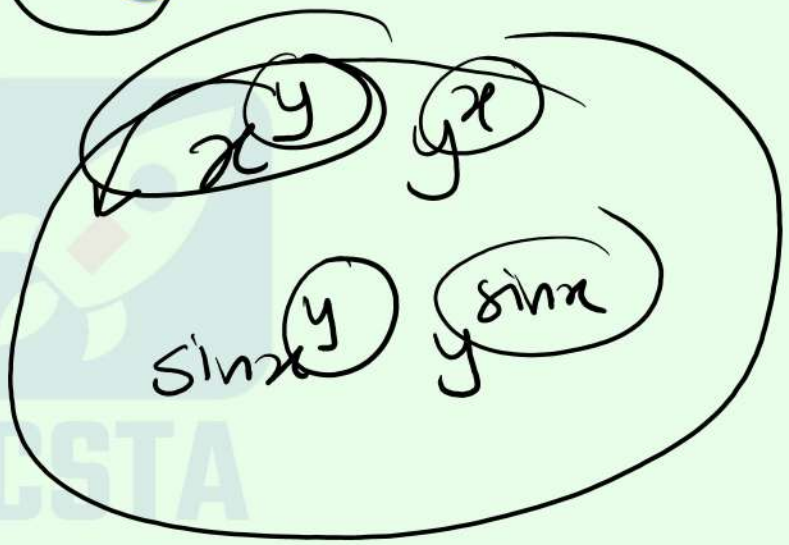
Derivatives of Logarithmic Functions

$\log m^n =$

$= n \cdot \log m$

$= \log m^n$

$\log\left(x^{\sin x}\right)$



2M

If $x^y = e^{x-y}$ show that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$

$y =$

⟶ given eq

$x^y = e^{(x-y)}$ — (1)

taking Log o.b.s.

$\log x^y = \log e^{(x-y)}$

$\log m^n = n \log m$

$y \log x = (x-y) \cdot \log e$

$\log e = 1$

$y \log x = (x-y) \cdot 1$

$\rightarrow y \log x = x - y$

If $x^y = e^{x-y}$ show that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$

$y \log x = x - y$

$y \log x + y = x$

$y(\log x + 1) = x$

$y = \frac{x}{(\log x + 1)}$ — (2)

diff w.r.t x

$\frac{dy}{dx} = \frac{d}{dx}\left[\frac{x}{\log x + 1}\right]$ $\frac{u}{v}$

$\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{v\frac{d}{dx}u - u\frac{d}{dx}v}{v^2}$

If $x^y = e^{x-y}$ show that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$?

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

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

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

$$= \frac{(\log x + 1)\cdot 1 - x\left[\frac{d}{dx}\log x + \frac{d}{dx}1\right]}{(\log x + 1)^2}$$

$$= \frac{(\log x + 1) - x\left[\frac{1}{x} + 0\right]}{(\log x + 1)^2}$$

If $x^y = e^{x-y}$ show that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$

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

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

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

L.H.S = R.H.S

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