Maths Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 17

Differentiation

Standard derivatives

$$\frac{d}{dx}x^n = nx^{n-1}, \qquad \frac{d}{dx}e^x = e^x, \qquad \frac{d}{dx}a^x = a^x \ln a, \qquad \frac{d}{dx}\ln x = \frac{1}{x}$$

$$(\sin x)' = \cos x,\ (\cos x)' = -\sin x,\ (\tan x)' = \sec^2 x,\ (\sec x)' = \sec x \tan x,\ (\csc x)' = -\csc x \cot x,\ (\cot x)' = -\csc^2 x$$

$$(\sin^{-1} x)' = \frac{1}{\sqrt{1-x^2}}, \qquad (\cos^{-1} x)' = -\frac{1}{\sqrt{1-x^2}}, \qquad (\tan^{-1} x)' = \frac{1}{1+x^2},$$
$$(\sec^{-1} x)' = \frac{1}{|x|\sqrt{x^2-1}}$$

Rules

$$(uv)' = u'v + uv', \qquad \left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}, \qquad \frac{dy}{dx} = \frac{dy}{du}\cdot\frac{du}{dx}$$

PARAMETRIC

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}, \qquad \frac{d^2y}{dx^2} = \frac{d}{dt}\left(\frac{dy}{dx}\right)\Big/\frac{dx}{dt}$$

LOGARITHMIC

$$y = u^v \ \Rightarrow\ \frac{y'}{y} = v' \ln u + \frac{v\,u'}{u}$$

IMPLICIT

$$F(x,y) = 0 \ \Rightarrow\ \frac{dy}{dx} = -\frac{F_x}{F_y}$$

Higher derivatives

LEIBNIZ

$$(uv)^{(n)} = \sum_{k=0}^{n} {}^{n}C_{k}\, u^{(k)} v^{(n-k)}$$

$$\frac{d^n}{dx^n}\sin(ax+b) = a^n \sin\left(ax+b+\frac{n\pi}{2}\right)$$

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