Maths Formula Sheet

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

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CHAPTER 18

Application of Derivatives

Tangent and normal

TANGENT

$$y - y_1 = m(x - x_1), \qquad m = \left(\frac{dy}{dx}\right)_{(x_1, y_1)}$$

NORMAL

$$y - y_1 = -\frac{1}{m}(x - x_1)$$

ANGLE BETWEEN CURVES

$$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|; \qquad \text{orthogonal if } m_1 m_2 = -1$$

Rate of change and approximation

$$\frac{dV}{dt} = \frac{dV}{dr} \cdot \frac{dr}{dt}, \qquad \Delta y \approx f'(x)\,\Delta x$$

Monotonicity

$$f'(x) > 0 \text{ on } I \Rightarrow f \text{ increasing}; \qquad f'(x) < 0 \Rightarrow \text{decreasing}$$

Maxima and minima

FIRST DERIVATIVE TEST

$$f' \text{ changes } + \to - : \text{local max}; \qquad - \to + : \text{local min}$$

SECOND DERIVATIVE TEST

$$f'(c) = 0,\ f''(c) < 0 : \max; \qquad f''(c) > 0 : \min$$

CLOSED INTERVAL

$$\text{absolute extrema on } [a,b] : \text{compare } f \text{ at critical points and at } a, b$$

Mean value theorems

ROLLE'S THEOREM

$$f \text{ continuous on } [a,b], \text{differentiable on } (a,b),\ f(a) = f(b) \Rightarrow f'(c) = 0$$

LAGRANGE'S MVT

$$f'(c) = \frac{f(b) - f(a)}{b - a}, \qquad c \in (a,b)$$

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