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Complete MATH

IIT-JEE · CBSE eBOOKS

CLASS 11&12th

CLASS 12th

Application of Derivatives

01. Derivative as a Rate Measurer

$\frac{dy}{dx}$ represents the role of change of y w.r.t. x for a definite value of x.

REMARK

(1) The value of $\frac{dy}{dx}$ at $x = x_0$ i.e. $\left(\frac{dy}{dx}\right)_{x=x_0}$ represent the rate of change of y with respect to x at $x = x_0$.

(2) If $x = \phi(t)$ and $y = \Psi(t)$, then $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$, provided that $\frac{dx}{dt} \neq 0$.

02. Mean Value Theorems

ROLLE'S THEOREM

Let f be a real valued function defined on the closed interval $[a, b]$ such that

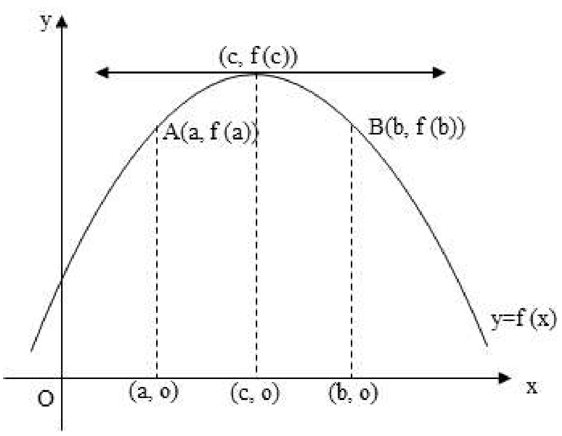
(i) it is continuous on the closed interval $[a, b]$,

(ii) it is differentiable on the open interval (a, b),

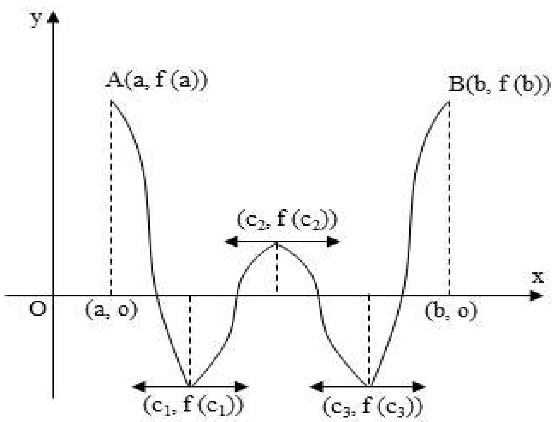
and, (iii) $f(a) = f(b)$.

Then, there exists a real number $c \in (a, b)$ such that $f'(c) = 0$.

GEOMETRICAL INTERPRETATION OF ROLLE'S THEOREM



$\exists\, c \in (a,b)$; tangent to the curve $y = f(x)$ at $(c, f(c))$ is parallel to



$\exists\, c_1, c_2, c_3 \in (a,b)$; tangent to the curve $y = f(x)$ at

ALGEBRAIC INTERPRETATION OF ROLLE'S THEOREM

Between any two roots of a polynomial $f(x)$, there is always a root of its derivative $f'(x)$.

03. Lagrange's Mean Value Theorem

Let $f(x)$ be a function defined on $[a,b]$ such that

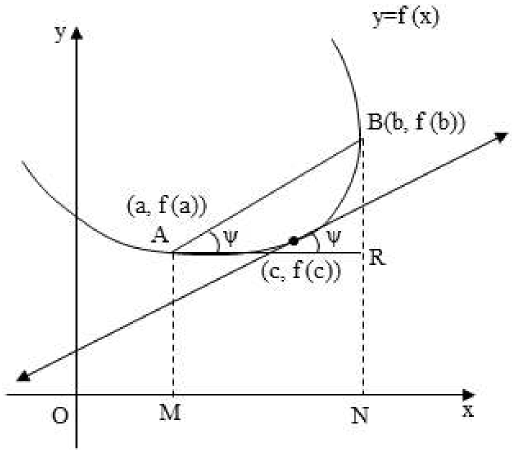
(i) it is continuous on $[a,b]$,

(ii) it is differentiable on (a,b).

Then, there exists a real number $c \in (a,b)$ such that

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

GEOMETRICAL INTERPRETATION



There exists a point $(c_1 f(c))$ on the curve such that the tangent there at is parallel to the chord joining the end points of the curve.

04. Slopes of the Tangent and the Normal

Slope of the tangent : Let $y = f(x)$ be a continuous curve, and let $P(x_1, y_1)$ be a point on it. $\left(\frac{dy}{dx}\right)_P = \tan\Psi =$ Slope of the tangent at P, where Ψ is the angle which the tangent at $P(x_1, y_1)$ makes with the positive direction of $x-axis$.