Maxima & Minima

SUBJECT : MATHEMATICS
CHAPTER NUMBER: 6
CHAPTER NAME : Application of Derivatives

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Determination of Maxima by using 2nd derivative test

As proved in the first derivative test, f(x) has maximum value at x = a if $\frac{dy}{dx}$ changes sign from +ve to –ve at x = a.

But $\frac{dy}{dx}$ is itself a function of x. Since it changes sign from +ve to –ve . Therefore, it decreases at x =a and hence its

derivative $\frac{d\left(\frac{dy}{dx}\right)}{dx} = \frac{d^2y}{dx^2}$ is –ve at x = a.

Hence the function y = f(x) has maximum value at x = a if

(i) $\frac{dy}{dx} = 0$, x =a

(ii) $\frac{d^2y}{dx^2}$ is – ve at x = a

Determination of Minima by using 2nd derivative test

As proved in the first derivative test, f(x) has minimum value at x = a if $\frac{dy}{dx}$ changes sign from -ve to +ve at x = a.

But $\frac{dy}{dx}$ is itself a function of x. Since it changes sign from -ve to +ve . Therefore, it increases at x =a and hence its

derivative $\frac{d\left(\frac{dy}{dx}\right)}{dx} = \frac{d^2y}{dx^2}$ is +ve at x = a.

Hence the function y = f(x) has minimum value at x = a if

(i) $\frac{dy}{dx} = 0$, x =a

(ii) $\frac{d^2y}{dx^2}$ is + ve at x = a

NOTE:

If $\frac{d^2y}{dx^2} = 0$ at x = a ,then the function may have point of inflexion, If $\frac{d^3y}{dx^3} \neq 0$ at x = a, then function has point of inflexion.

Problem-1

Determine the maximum and minimum value of the function $y = x^5 - 5x^4 + 5x^3 - 1$

Problem-2

Determine the local maxima and minima value of the function $y = Sinx + Cosx,\ 0 < x < \frac{\pi}{2}$

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Problem-3

Find all the points of local maxima and local minima of the function f given by $f(x) = 2x^3 - 6x^2 + 6x + 5$

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HOME ASSIGNMENT

Q1. Show that the function given by $f(x) = \frac{logx}{x}$ has maximum value at $x = e$

Q2. Find the local maximum and local minimum value of the function

$$f(x) = \frac{3}{10}x^4 - \frac{4}{5}x^3 - 3x^2 + \frac{36}{5}x + 11$$

Q3. Find the local maximum and local minimum value of the function

$$f(x) = Sinx + \frac{1}{2}Cos2x, \quad \text{where } 0 < x < \frac{\pi}{2}$$

THANKING YOU

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