CLASSES BY SACHIN SHARMA

DIFFERENTIATION - Exercise 5.7

CLASS 12TH - Ch-5
Exercise 5.7
–First Part (Q1-10)

Here we need to do the differentiation of a function twice.

Q1: x^2+x+2

Let $y = x^2+x+2$

$$\frac{dy}{dx} = 2x+1$$

$$\frac{d^2y}{dx^2} = 2$$

Q2: x^{20}

Let $y = x^{20}$

$$\frac{dy}{dx} = 20x^{19}$$

$$\frac{d^2y}{dx^2} = 380\,x^{18}$$

Q4: Log x

Let y = Log x

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

$$\frac{d^2y}{dx^2} = -\frac{1}{x^2} \text{ (How?)}$$

$\frac{d^2y}{dx^2}$ = Solved through quotient rule:

$$\frac{x\left(\frac{d}{dx}1\right) - 1\left(\frac{d}{dx}x\right)}{x^2} = \frac{x\ (0) - 1(1)}{x^2}$$

Or $x^{-1} = (-1)\, x^{-1-1} = (-1)x^{-2}$

Q7: $e^{6x}\cos 3x$

I II

Let $y = e^{6x}\cos 3x$

(here 2 functions e^{6x} & cos3x are in product so we will apply product rule)

$$\frac{dy}{dx} = e^{6x}\,(-\sin 3x) \times 3 \quad + \quad \cos 3x(e^{6x} \times 6)$$

$$= e^{6x}\,(-3\sin 3x + 6\cos 3x)$$

I II

(here again 2 functions e^{6x} and $-3\sin 3x + 6\cos 3x$ are in product so we will again apply Product Rule)

$$\frac{d^2y}{dx^2} = e^{6x}\,(-3\cos 3x*3 + 6(-\sin 3x*3)) \quad + \quad (-3\sin 3x + 6\cos 3x)\,e^{6x}*6$$

$$\frac{d^2y}{dx^2} = e^{6x}\,(-9\cos 3x - 18\sin 3x - 18\sin 3x + 36\cos 3x)$$

$$\frac{d^2y}{dx^2} = 9e^{6x}\,(3\cos 3x - 4\sin 3x)$$

Q8: $Tan^{-1} x$

Let $y = Tan^{-1} x$

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

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

Like the derivative of $\frac{1}{x}$ **is** $-\frac{1}{x^2}$

In the same way derivative of $\frac{1}{1+x^2}$ **is** $-\frac{1}{(1+x)^2}$

and then derivative of x^2 which is 2x

Q9: Log (Log x)

Let y = Log (Log x)

$$\frac{dy}{dx} = \frac{1}{\text{Log } x} \times \frac{1}{x}$$

$$\frac{d^2y}{dx^2} = \frac{X\log x\ (0) - 1\ \left(\frac{x}{x} + \log x\right)}{(X \log x)^2}$$ (By Applying Quotient Rule)

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

Q10: Sin(Log x)

Let y = Sin(Log x)

$$\frac{dy}{dx} = \frac{Cos(Log\ x)}{x}$$

$$\frac{d^2y}{dx^2} = \frac{x(-sin(log x) \times \frac{1}{x}) - 1\ (Cos(Log\ x))}{X^2}$$ **(Applying Quotient Rule)**

$$\frac{d^2y}{dx^2} = \frac{-(Cos(Log\ x) + Sin\ (logx))}{X^2}$$