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SERIALNO: 151 MATRICNO: 19/ENG04/003
COURSE CODE : MAT 104

1) Find $\frac{dy}{dx}$ at $x = 2.5$ when $y = \frac{(2x^2+3)}{\ln 2x}$

Using Quotient Rule
let $u = 2x^2+3$, $v = \ln 2x$

$\frac{du}{dx} = 4x$ $\qquad \frac{dv}{dx} = \frac{1}{x}$

$$\frac{v\,du/dx - u\,dv/dx}{v^2} = \frac{(\ln 2x)(4x) - (2x^2+3)(1/x)}{(\ln 2x)^2}$$

at $x = 2.5$

$$\frac{\ln 2(2.5)(4\times2.5) - (2(2.5)^2+3)(1/2.5)}{[(\ln 2(2.5))]^2}$$

$$\frac{[1.609\times10]-[15.5\times0.4]}{2.590} = \frac{9.89}{2.590} = 3.8185 \simeq 3.82\ (3s.f)$$

Ans $= 3.82\ (3s.f)$

2.) $y = \frac{2x}{x^2-5}$ Using Quotient Rule $\left[\frac{df}{dx}, \frac{df}{dy}\right]$

let $U = 2x$; $V = x^2 - 5$

$du/dx = 2$ $\quad dv/dx = 2x$.

$= \frac{V\,du/dx - U\,dv/dx}{V^2} = \frac{(x^2-5)(2)-(2x)(2x)}{(x^2-5)^2}$

$y' = \frac{-2x^2-10}{(x^2-5)^2}$ $\therefore$ at $(2,-4)$

$\cancel{y'} = \frac{-2(2)^2-10}{(2^2-5)^2} = \frac{df}{dx} = -18$ //

$\frac{df}{dy} = 0$

$\therefore$ The gradient of the curve = $[-18, 0]$ //

3.) If $z = 2x^3 \ln y$ Find dz/dy

Solution

$$\ln z = \ln(2x^3) + \ln(\ln y)$$

$$\frac{1}{z} \cdot \frac{dz}{dy} = \frac{1}{2x^3} \times 6x^2 + \frac{1}{\ln y} \cdot \frac{1}{y}$$

$$\frac{1}{z} \cdot \frac{dz}{dy} = \left[\frac{3}{x} + \frac{1}{y \ln y}\right]$$

$$\frac{dz}{dy} = z \left[\frac{3}{x} + \frac{1}{y \ln y}\right]$$

$$\frac{dz}{dy} = 2x^3 \ln y \left[\frac{3}{x} + \frac{1}{y \ln y}\right]$$

dx $\quad$ du

4.) $\int_0^2 x(2x^2+1)^{1/2}$

let $u = 2x^2+1$

$\frac{du}{dx} = 4x$; $dx = \frac{du}{4x}$

$\therefore \frac{1}{4}\int \sqrt{u}\, du$

$\int u^{1/2} = \frac{2u^{3/2}}{3}$ $\therefore \left[\frac{1}{4}\int \sqrt{u}\, du\right]$

$= \frac{u^{3/2}}{6}$

$u = 2x^2+1 \therefore \frac{[2x^2+1]^{3/2}}{6}$

$\int_0^2 x\sqrt{2x^2+1} = \int_0^2 \frac{(2x^2+1)^{3/2}}{6}$

$\frac{[2(2)^2+1]^{3/2}}{6} - \frac{[2(0)^2+1]^{3/2}}{6}$

$= \frac{[9]^{3/2}}{6} - \frac{[1]^{3/2}}{6} = 4.33$