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COMPUTER ENGINEERING
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MAT 104 SERIAL NO: 35

1 Evaluate dy/dx at $x = 2.5$, correct to 3 significant figures given
$$y = \frac{(2x^2+3)}{\ln 2x}$$

Sol

$$y = \frac{(2x^2+3)}{\ln 2x} \quad \frac{u}{v}$$

$$\frac{dy}{dx} = \frac{v\,du/dx - u\,dv/dx}{v^2}$$

$$v = \ln 2x \; ; \; \frac{dv}{dx} = \frac{1}{x}$$

$$u = 2x^2+3 \; ; \; \frac{du}{dx} = 4x$$

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

$$\frac{dy}{dx} = \frac{4x\ln 2x - 2x - 3/x}{\ln(2x)^2}$$

$$\frac{dy}{dx} = \frac{4x\ln 2x - 2x - 3/x}{\ln^2(2x)}$$

If $x = 2.5$ $\therefore \frac{dy}{dx} = \frac{[4(2.5)\ln 2(2.5) - 2(2.5) - (3/2.5)]}{\ln^2(2(2.5))}$

$$\therefore \frac{dy}{dx} = 3.81979532$$

3 significant fig $\triangleq$ 3.819

2 Find the gradient of the curve $y = \frac{2x}{(x^2-5)}$ at point $(2, -4)$

Sol

sol

$y = \frac{2x}{(x^2-5)}$ gradient $= \frac{dy}{dx}$

$\frac{dy}{dx} = \frac{V^{du}/dx - U^{dv}/dx}{V^2}$

$V = x^2 - 5$; $\frac{dv}{dx} = 2x$

$U = 2x$; $\frac{du}{dx} = 2$

$\therefore \frac{dy}{dx} = \frac{2(x^2-5) - (2x)^2}{(x^2-5)^2}$

$\frac{dy}{dx} = \frac{2x^2 - 10 - 4x^2}{(x^2-5)^2}$

at point 2, -4 $x = 2$

$\frac{dy}{dx} = \frac{2(2)^2 - 10 - 4(2)^2}{((2)^2-5)^2}$

$\frac{dy}{dx} = \frac{8 - 10 - 16}{1} = -18$

Gradient of the curve $= -18$

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

sol

$\frac{dz}{dy} = V\frac{dy}{dy} + U\frac{dv}{dy}$

where $U = 2x^3$; $\frac{du}{dy} = 0$

$V = \ln y$; $\frac{dv}{dy} = \frac{1}{y}$

$\frac{dz}{dy} = \ln y(0) + 2x^3\left[\frac{1}{y}\right]$

$\therefore \frac{dz}{dy} = \frac{2x^3}{y}$

4 Integrate $x(2x^2+1)^{1/2}$ with respect to x from (o to 2)

Sol

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

$$dy = x(2x^2+1)^{1/2} \cdot dx$$

$$\int dy = x(2x^2+1)^{1/2} \cdot dx$$

$$y = \int x(2x^2+1)^{1/2}\, dx$$

let $u = 2x^2 + 1$; $\frac{du}{dx} = 4x$

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

$$y = \int x\sqrt{u} \cdot du/4x$$

$$y = 1/4 \int \frac{\cancel{x}\sqrt{u}}{\cancel{x}} \cdot du$$

$$y = 1/4 \int u^{1/2}\, du$$

$$y = \frac{1}{4} \cdot \left[\frac{u^{3/2}}{3/2}\right]$$

$$y = \frac{1}{\cancel{4}_2} \cdot \frac{\cancel{2}u^{3/2}}{3}$$

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

Recall that $u = 2x^2 + 1$

$$\therefore y = \frac{(2x^2+1)^{3/2}}{6} + C$$

From 0 to 2 $y = \int_0^2 f(x)\, dx$

$$\therefore y = \left[\frac{(2(2)^2+1)^{3/2}}{6}\right] - \left[\frac{(2(0)^2+1)^{3/2}}{6}\right]$$

$$y = \left[\frac{(9)^{3/2}}{6}\right] - \left[\frac{(1)^{3/2}}{6}\right]$$

$$y = 9/2 - 1/6$$

$$y = 13/3 \text{ or } 4.33$$