Eneka-Onwuneme Sochukwudum Michael
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MAT 104
Mechanical Engr. S/N: 37

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

$\ln 4y = \frac{du}{dx} = 4x \quad \frac{dv}{dx} = \frac{1}{x}$

From quotient's rule

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

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

$$= \left(\frac{4x\ln 2x}{1} - \frac{2x^2+3}{x}\right) \div \ln(2x)^2$$

$$= \frac{4x^2\ln 2x - (2x^2+3)}{x} \times \frac{1}{\ln(2x)^2}$$

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

Substitute x as 2.5

$$= \frac{4(2.5)^2\ln(2\times 2.5) - 2(2.5)^2 - 3}{2.5\ln(2\times 2.5)^2}$$

$$= \frac{40.26 - 12.5 - 3}{6.48}$$

$$= \frac{24.76}{6.48} = 3.82$$

2) $y = \frac{2x}{(x^2-5)} = \frac{u}{v}$

$u = 2x$; $du/dx = 2$

$v = x^2 - 5$; $dv/dx = 2x$

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

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

$$= \frac{-10 - 2x^2}{(x^2-5)^2} = \frac{-10 - 2(2)^2}{(2)^2 - 5)^2} = -18$$

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

$u = 2x^3$

dy

$\frac{dz}{dy} = \frac{d(2x^3 \ln y)}{dy}$

$$= 2x^3 \cdot \frac{d(\ln y)}{dy} + \ln y \frac{d(2x^2)}{dy}$$

$$(2x^3)(1/y) + (\ln y)(0)$$

$$= \frac{2x^3}{y} + 0$$

$$= \frac{2x^3}{y}$$

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

let $u = 2x^2+1$

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

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

$\therefore \int_0^2 x(u)^{1/2}\,dx = \int_0^2 x\sqrt{u}\,du$

$\int_0^2 x\sqrt{2x^2+1}\cdot\frac{du}{4x}$ $\int_0^2 x\sqrt{u}\,\frac{du}{4x}$

$= \frac{1}{4}\int_0^2 \sqrt{u}\,du$

$= \frac{1}{4}\left[\frac{u^{3/2}}{3/2}+c\right]_0^2$

$= \frac{1}{4}\left[\frac{2(2x^2+1)^{3/2}}{3}\right]_0^2$

$= \frac{1}{4}\left[\frac{2(2(2)^2+1)^{3/2}}{3} - \frac{2(2(0)^2+1)^{3/2}}{3}\right]$

$= \frac{1}{4}\left[\frac{52}{3}\right] = \frac{13}{3}$ //