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Computer Engineering 19/ENG02/051
MAT 104

1) $y = \frac{2x^2 + 3 - U}{\ln(2x) - V}$

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

From Quotients Rule

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

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

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

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

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

Substitute x as 2.5

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

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

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

2) $\frac{d}{dx}\left[\frac{2x}{x^2-5}\right]$

$= 2 \cdot \frac{d}{dx}\left[\frac{x}{x^2-5}\right]$

$= 2 \cdot \frac{\frac{d}{dx}[x] \cdot (x^2-5) - x \cdot \frac{d}{dx}(x^2-5)}{(x^2-5)^2}$

$= \frac{2(1(x^2-5)) - (d/dx(x^2) + d/dx(-5))x}{(x^2-5)^2}$

$= \frac{2(1(x^2-5) - (d/dx(x^2) + d/dx(-5))x}{(x^2-5)^2}$

$= \frac{2(x^2 - (2x+0)x - 5)}{(x^2-5)^2}$

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

$m = \frac{-2(2)^2 - 10}{(2^2-5)^2} = -\frac{18}{1} = -18$

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

$u = 2x^3 \quad v = \ln y$

$\frac{du}{dx} = 6x^2 \quad \frac{dv}{dy} = \frac{1}{y}$

$\frac{du}{dy} = 6x^2 \frac{dx}{dy}$

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

$= \frac{2x^3}{y} + 6x^2 \ln y \frac{dx}{dy}$

(4) $\int_0^2 6x(2x^2+1)^{1/2} dx$

Let $u = 2x^2 + 1$

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

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

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

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

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

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

$$= \underline{13/3}$$