Nnaemeka Okafor
Computer Engineering
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Math 104

1) $\frac{dy}{dx}: \frac{2x^2+3}{\ln 2x}$

$$\frac{\frac{d}{dx}[2x^2+3]\cdot\ln(2x)-(2x^2+3)\cdot\frac{d}{dx}[\ln(2x)]}{\ln^2(2x)}$$

$$\frac{(2\cdot\frac{d}{dx}[x^2]+\frac{d}{dx}[3])\ln(2x)-(2x^2+3)\cdot\frac{1}{2x}\cdot\frac{d}{dx}[2x]}{\ln^2(2x)}$$

$$\frac{(2\,2x+0)\ln(2x)-(2x^2+3)\cdot 2\cdot\frac{d}{dx}[x]}{2x}$$

$$\ln^2(2x$$

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

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

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

at $x=2.5$

$$\frac{4(2.5}{\ln(2(2.5)} - \frac{2(25)^3+3}{2.5\ln^2(2(25)}$$

$$= 3.3198 \simeq 3.32 \text{ to } 3 \text{ s.f}$$

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

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

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

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

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

$2(x^2-2x+0)x-5$

$(x^2-5)^2$

$2(-x^2-5)$

$(x^2-5)^2$

$m = -2(2)^2 - 10$

$[(2)^2 - 6]^2$

$= \frac{-18}{1}$

$m = -18$

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

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

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

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

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

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

Let $u = 2x^2+1$

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

$dx = du/4x$

$\int_0^2 u^{1/2} \cdot du/4$

$\frac{1}{4}\int_{20}^{1} u^{1/2} du$

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

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

$= 1/6\,[27 - 1]$

$= 1/6\,[26]$

$= 4333$