Edema Oluwasayo Ayomikun
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Computer Engineering

① $dy/dx \; (x^2+3)/\ln(2x)$

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

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

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

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

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

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

at $x=2.5$ $\quad \frac{4(2.5)}{\ln(2(2.5))} - \frac{2(2.5)^3+3}{(2.5)\ln^2(2(2.5))}$

$= 3.8198$

3.82 (SSF)

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

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

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

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

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

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

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

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

$$= -\frac{18}{1} \quad \text{gradient} = -18$$

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

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

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

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

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

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

let $u = 2x^2+1$

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

$du = 4x\,dx$

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

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

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

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

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

$$= \frac{1}{6}[27-1]$$

$$\frac{1}{6}[26]$$

$$= 4.333$$