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 Course: Math 104  
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 Department: Civil Engineering

$$① y = \frac{(2x^2 + 3)}{\ln 2x}$$

$$\ln y = \ln(2x^2 + 3) - \ln(\ln 2x)$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{1}{2x^2 + 3} \cdot 4x - \frac{1}{\ln 2x} \cdot \frac{2}{2x}$$

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

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

$$\text{when } x = 2.5, \frac{dy}{dx} = \frac{2(2.5^2) + 3}{\ln 2(2.5)} \left( \frac{4(2.5)}{2(2.5^2) + 3} - \frac{1}{2.5 \ln(2 \cdot 2.5)} \right)$$

$$= 3.82 + 3.54$$

$$② y = \frac{2x}{x^2 - 5}$$

$$\ln y = \ln 2x - \ln x^2 - 5$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{1}{2x} \cdot 2 - \frac{1}{x^2 - 5} \cdot 2x$$

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

$$= \frac{2x}{x^2 - 5} \left( \frac{1}{x} - \frac{2x}{x^2 - 5} \right)$$

$$\text{at } x = 2.4, \frac{dy}{dx} = -37.26$$

right w

$$\textcircled{3} z = 2x^3 \ln y$$

$$\frac{dz}{dy} = \frac{1}{y}$$

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

$$\text{let } u = 2x^2 + 1$$

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

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

$$\begin{aligned} \therefore \int_0^2 x \sqrt{2x^2+1} dx &= \int_0^2 x \sqrt{u} \frac{du}{4x} = \frac{1}{4} \int_0^2 \sqrt{u} du \\ &= \frac{1}{4} \left[ \frac{u^{3/2}}{3/2} + C \right] \\ &= \frac{1}{4} \left[ \frac{2(2x^2+1)^{3/2}}{3} \right] \\ &= \frac{1}{4} \left[ \frac{(2(2(2)^2+1))^{3/2}}{3} - \frac{2(2(0)^2+1)^{3/2}}{3} \right] \\ &= \frac{1}{4} \left[ \frac{52}{3} \right] \\ &= \frac{13}{3} \end{aligned}$$