

$$\textcircled{1} \frac{dy}{dx} (2x^2+3) / \ln(2x)$$

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

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

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

$$\ln^2(2x)$$

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

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

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

$$\text{at } x = 2.5$$

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

$$= 3.8198 \approx 3.82 \text{ to 3 s.f.}$$

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

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

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

$$= 2(2x^2 + 2x + 1)$$

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

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

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

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

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

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

$$\text{Gradient} = -18$$

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

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

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

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

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

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

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

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

$$du = dx \cdot 4x$$

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

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

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

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

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

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

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

$$= 4.333 \approx 4.33$$