

DEPARTMENT: COMPUTER ENGINEERING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$= 2(2x^2 + 1) \ln y$$

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

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

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

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

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

$$= -18$$

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

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

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

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

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

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

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

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

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

$$du = dx \cdot 4x$$

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

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

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

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

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

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

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

$$= 4.333 \approx 4.33$$