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Chemical Engineering
MAT 104 Assignment

1 $y = \frac{2x^2+3}{\ln 2x}$

Let $u = 2x^2+3$ $\quad \frac{du}{dx} = 4x$

$v = \ln 2x$ $\quad \frac{dv}{dx} = 1/x$

Using Quotient Rule

$$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

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

@ $x = 2.5$

$$\frac{dy}{dx} = \frac{(\ln(2\times2.5))(4\times2.5) - (2(2.5)^2+3)(\frac{1}{2.5})}{(\ln(2\times2.5))^2}$$

$$= \frac{(\ln(5))(10) - (15.5)(\frac{1}{2.5})}{(\ln(5))^2}$$

$$= 3.8198 \simeq 3.82$$

$$\Rightarrow \frac{dy}{dx} = 3.82$$

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

Let $u = 2x$ $\quad \frac{du}{dx} = 2$

$v = x^2-5$ $\quad \frac{dv}{dx} = 2x$

Applying Quotient Rule

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

$$\frac{dy}{dx} = \frac{3(x^2-5) - 4x^2}{(x^2-5)^2}$$

@ point $(2, -4)$

$$\text{Gradient} = \frac{dy}{dx} = \frac{2((2)^2-5) - 4(2)^2}{((2)^2-5)^2}$$

$$= \frac{2(-1) - 4(4)}{(-1)^2} = \frac{-2-16}{1} = -18$$

3 If $z = 2x^3 \ln y$, find $\frac{dz}{dy}$

$u = 2x^3 \quad \frac{du}{dy} = 0$

$v = \ln y \quad \frac{dv}{dy} = \frac{1}{y}$

$$\frac{dz}{dy} = u\frac{dv}{dy} + v\frac{du}{dy}$$

$$\frac{dz}{dy} = (2x^3)\left(\frac{1}{y}\right) + (\ln y)(0)$$

$$= 2x^3 \cdot \frac{1}{y}$$

$$\frac{dz}{dy} = \frac{2x^3}{y}$$

4 $\int_0^2 x(2x^2+1)^{0.5}\,dx$

Let $u = 2x^2+1 \quad \frac{du}{dx} = 4x \Rightarrow du = 4x\,dx \Rightarrow dx = \frac{du}{4x}$

$$\int_0^2 x(u)^{0.5}\frac{du}{4x} \Rightarrow \int_0^2 \frac{x(u)^{0.5}}{4x}\,du$$

$$= \int_0^2 \frac{1}{4}(u)^{0.5}\,du \Rightarrow \frac{1}{4}\int_0^2 (u)^{0.5}\,du$$

$$= \frac{1}{4}\left[\frac{u^{1.5}}{1.5}\right]_0^2$$

$$\frac{1}{4}\left[\frac{(2)^{1.5}}{1.5}\right] - 0$$

$$= 0.471 //$$