

IYAMU UCHENNA PRECIOS

MECHANICAL ENGINEERING

19/ENG06/031

MAT 104

Name: IYAMU UCHENNA PRECIOS  
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$y = 2x^2 + 3$

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

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

$\frac{dy}{dx} = y \left[ \frac{4x}{2x^2 + 3} \right]$

$\frac{dy}{dx} = \frac{2x^2 + 3}{109} \left[ \frac{4x}{2x^2 + 3} \right]$

$\frac{dy}{dx} = \frac{135}{109} [0.597]$

$\frac{dy}{dx} = 3.8244$

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

$$\frac{dy}{dx} \text{ at } x=2, y=3.82$$

$$\text{Gradient} = \frac{dy}{dx}$$

$$y = 2x$$
$$(x^2 - 5)$$

$$m_1 = m(2x) = m(x^2 - 5)$$

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

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

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

$$\frac{dy}{dx} = \frac{2x}{x^2 - 5} \left[ \frac{1}{x} - \frac{2x}{x^2 - 5} \right]$$

$$\frac{dy}{dx} = m$$

∴ m at point (2, 3.82) =

$$m = \frac{2(2)}{2^2 - 5} \left[ \frac{1}{2} - \frac{2(2)}{2^2 - 5} \right]$$

$$m = \frac{4}{-1} \left[ \frac{1}{2} - \frac{4}{-1} \right]$$

$$m = -4 [0.5 + 4]$$

$$m = -18$$

$$(3) z = 2x^3 y \quad \text{Find } \frac{dz}{dy}$$

$$\frac{dz}{dy} = 2x^3 \times 1$$

$$\frac{dz}{dy} = \frac{2x^3}{1}$$

$$\int x \sqrt{2x^2+1} dx$$

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

$$u^2 = 2x^2+1$$

$$2x^2 = u^2 - 1$$

$$x = \frac{u^2-1}{2} = \frac{u^2-1}{2}$$

$$\text{let } u = \sqrt{2x^2+1} \Rightarrow \frac{du}{dx} = u$$

$$x \frac{du}{dx} = \frac{1}{2} \frac{du}{dx} \Rightarrow \frac{du}{dx} = \frac{2}{u}$$

$$\frac{dx}{du} = \frac{1}{2\sqrt{u^2-1}}$$

$$\frac{dx}{du} = \frac{1 \times \sqrt{2}}{2\sqrt{u^2-1}} = \frac{\sqrt{2}}{2\sqrt{u^2-1}}$$

$$\frac{dx}{du} = \frac{u \sqrt{2}}{2\sqrt{u^2-1}}$$

$$\frac{dx}{du} = \frac{u \sqrt{2}}{2\sqrt{u^2-1}}, \quad dx = \frac{u \sqrt{2} du}{2\sqrt{u^2-1}}$$

$$\int x \sqrt{2x^2+1} dx$$

$$\int \sqrt{u-1} \cdot u \cdot \frac{2-2u}{2} du$$

$$\int \frac{u^2 du}{2} = \left[ \frac{u^3}{6} \right] + C$$

$$u = \sqrt{2x^2+1}$$

$$\left[ \frac{\sqrt{2x^2+1}^3}{6} \right] + C$$

$$\int_0^2 x \sqrt{2x^2+1} dx = \frac{1}{2}$$

$$\left[ \frac{\sqrt{2x^2+1}^3}{6} \right] - \left[ \frac{\sqrt{2x^2+1}^3}{6} \right]$$

$$= \frac{2^3}{6} - \frac{1^3}{6} = \frac{8}{6} - \frac{1}{6} = \frac{7}{6}$$

$$\int_0^2 x \sqrt{2x^2+1} dx = \frac{7}{6} \text{ Square units}$$