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Matric Number ÷ 19/ENG04/003
Department ÷ Elect - Elect
Course Code ÷ MAT 104.

1) Differentiate $y = \sin(6/x^2)$ from the first principle
Solution ÷ Using chain rule:

$$\frac{d}{dx}(f(g)) = \frac{d}{dg}(f(g)) \times \frac{d}{dx}(g)$$

where $g = \frac{6}{x^2}$

$$\therefore \frac{d}{dx}\sin\left[\frac{6}{x^2}\right] = \frac{d}{dg}(\sin(g)) \times \frac{d}{dx}\left[\frac{6}{x^2}\right]$$

Solve $\frac{d}{dx}\left[\frac{6}{x^2}\right]$ Using quotient Rule.

$$= \frac{-6 \times 2x}{(x^2)^2} = \frac{-12x}{x^4}$$

And $\frac{d}{dg}(\sin(g)) = \cos(g)$

∴ put g back in cos (g)

$$\cos\left[\frac{6}{x^2}\right] \times \left[\frac{-12x}{x^4}\right]$$

$$\cos\left[\frac{6}{x^2}\right] \times \left[-12 \times \frac{x}{x^4}\right]$$

$$\cos\left[\frac{6}{x^2}\right] \times \left[-12 \times \frac{1}{x^3}\right]$$

$$= \frac{-12\cos(6/x^2)}{x^3}$$

2.)- $A = 4t^3 j + 5k$ $\therefore$ $A = (0)i + 4t^3 j + 5k$

$B = 2t^2 i + 4t j$ $\quad$ $B = 2t^2 i + 4t j + (0)k$

$G = A \times B$

$$A \times B = \begin{vmatrix} i & j & k \\ 0 & 4t^3 & 5 \\ 2t^2 & 4t & 0 \end{vmatrix}$$

i) $(4t^3 \times 0) - (5 \times 4t) - j(0 \times 0) - (5 \times 2t^2) + k(0 \times 4t) - (4t^3 \times 2t^2)$

$\therefore i(0 - 20t) - j(0 - 10t^2) + k(0 - 8t^5)$

$-20t i + 10t^2 j + k(-8t^5)$

$G = \int_0^1 -20t i + 10t^2 j - 8t^5 k$

$$\frac{-20t^2}{2} + \frac{10t^3}{3} - \frac{8t^6}{6}$$

$$= \left[-10t^2 + \frac{10t^3}{3} - \frac{8t^6}{6}\right]_0^1$$

$$\int_0^1 G(t)\,dt = \left[-10(1)^2 + \frac{10}{3}(1)^3 - \frac{4}{3}(1)^6\right] - \left[-10(0)^2 + \frac{10}{3}(0)^3 - \frac{4}{3}(0)^6\right]$$

$$= -10 + \frac{10}{3} - \frac{4}{3}$$

$= -8$ squareunits.

3.) If $x = 4t^3 - t^2$ and $y = t^4 + 2t^2$ find $\frac{dy}{dx}$

$\frac{dx}{dt} = 12t^2 - 2t$, $\frac{dy}{dt} = 4t^3 + 4t$

$\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt} = \frac{dy}{dt} \times \frac{dt}{dx} = \frac{4t^3 + 4t}{12t^2 - 2t}$ //