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MATRIC NO: 19/ENG04/015 SERIAL NUMBER: 19
MAT104 ASSIGNMENT

(1.) $y = \sin(6/x^2)$

$y + \Delta y = \sin\left[\frac{6}{(x+\Delta x)^2}\right]$

$\Delta y = \sin\left[\frac{6}{(x+\Delta x)^2}\right] - y$

$\Delta y = \sin\left[\frac{6}{(x+\Delta x)^2}\right] - \sin\left[\frac{6}{x^2}\right]$

Recall: $\sin A - \sin B = 2\cos\left[\frac{A+B}{2}\right]\sin\left[\frac{A-B}{2}\right]$

$\therefore \Delta y = 2\cos\left[\frac{12x^2 + 12x\Delta x + 6\Delta x^2}{2x^2(x+\Delta x)^2}\right]\sin\left[\frac{-12x\Delta x - 6\Delta x^2}{2x^2(x+\Delta x)^2}\right]$

$\frac{\Delta y}{\Delta x} = \frac{2\cos\left[\frac{12x^2 + 12x\Delta x + 6\Delta x^2}{2x^2(x+\Delta x)^2}\right]\sin\left[\frac{-12x\Delta x - 6\Delta x^2}{2x^2(x+\Delta x)^2}\right]}{-\frac{6\Delta x}{x^3}} \times \frac{-6}{x^3}$

$\lim_{\Delta x \to 0}\frac{\Delta y}{\Delta x} = \lim_{\Delta x \to 0}\frac{-12\cos}{x^3}\left[\frac{12x^2 + 12x\Delta x + 6\Delta x^2}{2x^2(x+\Delta x)^2}\right] \cdot \lim_{\Delta x \to 0}\frac{\sin\left[\frac{-12x\Delta x - 6\Delta x^2}{2x^2(x+\Delta x)^2}\right]}{6\Delta x}$

$\frac{dy}{dx} = -12\cos\left[\frac{12x^2}{2x^2[x]^2}\right] \cdot 1$

$\frac{dy}{dx} = \frac{-12\cos}{x^3}\left[\frac{12x^2}{2x^4}\right] = -\frac{12\cos}{x^3}\left[\frac{6}{x^2}\right]$

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

(2.) $x = 4t^3 - t^2 \qquad y = t^4 + 2t^2$

$A =$ area

$A = \int_a^b y\,dx$

Given $y = t^4 + 2t^2$ then $A = \int_a^b t^4 + 2t^2\,dx$

Given $x = 4t^3 - t^2$

$dx/dt = 12t^2 - 2t$

$dx = (12t^2 - 2t)\,dt$

$\therefore A = \int_1^3 (t^4 + 2t^2)(12t^2 - 2t)\,dt$

A_4

$$A = \int_1^3 (12t^6 - 2t^5 + 24t^4 - 4t^3)\,dt$$

$$A = \left[\frac{12t^7}{7} - \frac{2t^6}{6} + \frac{24t^5}{5} - \frac{4t^4}{4}\right]_1^3$$

$$A = \left[\frac{12(3)^7}{7} - \frac{2(3)^6}{6} + \frac{24(3)^5}{5} - \frac{4(3)^4}{4}\right] - \left[\frac{12(1)^7}{7} - \frac{2(1)^6}{6} + \frac{24(1)^5}{5} - \frac{4(1)^4}{4}\right]$$

$$A = \frac{160704}{35} - \frac{544}{105}$$

$$= 4586.36 \text{ Square units}$$

(3.) $x = 4t^3 - t^2$ $\quad y = t^4 + 2t^2$

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

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

$$= \frac{4t(t^2+1)}{2t(6t-1)} = \frac{2(t^2+1)}{6t-1}$$