Anna Oluwagbolahan Emmanuel

Electrical/Electronics

19/ENG04/002

Mat 104

i) $y = \sin\left(\frac{6}{x^2}\right)$ according to the first principle

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

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

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

Recall that $\sin A - \sin B = 2\cos\left(\frac{A+B}{2}\right) \cdot \sin\left(\frac{A-B}{2}\right)$

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

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

$-6\Delta x$

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

$$\lim_{\Delta x \to 0} \frac{}{6\Delta x}$$

$$\frac{dy}{dx} = -\frac{12}{x^3}\cos\left[\frac{12x^2}{2x^2(x)^2}\right] \cdot 1$$

$$\frac{dy}{dx} = -12x^{-3}\cos\left(\frac{6}{x^2}\right.$$

2. $x = 4t^3 - t^2 \quad y = t^4 + 2t^2$ at $t=3$ and $t=1$

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

$$A = \int_1^3 t^4 + 2t^2\,dx$$

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

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

$$A = \int_1^3 t^4 + 2t^2 \cdot 12t^2 - 2t\,dt$$

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

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

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

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

$$A = \left[\frac{26244}{7} - 243 + \frac{5832}{5} - 81\right] - \left[\frac{12}{7} - \frac{1}{3} + \frac{24}{5} - 1\right]$$

$$A = \frac{160704}{35} - \frac{544}{105} = \frac{482112}{105} - \frac{544}{105} = \frac{481568}{105}$$

$$A = 4586.36$$

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

$$\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt}$$

$$\frac{dy}{dt} = 4t^3 + 4t$$

$$\frac{dx}{dt} = 12t^2 - 2t$$

$$\frac{dy}{dx} = \frac{4t^3 + 4t}{12t^2 - 2t} = \frac{2t(2t^2 + 2)}{2t(6t - 1)}$$

$$\frac{dy}{dx} = \frac{2t^2 + 2}{6t - 1}$$