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 19/Eng02/045
 Math 104

$$1) y = \sin\left(\frac{6}{x^2}\right)$$

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

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

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

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

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

$$\Delta y = 2 \cos\left[\frac{6x^2 + 6x^2 + 12x\Delta x + 6(\Delta x)^2}{2x^4 + 4x^3\Delta x + 2x^2(\Delta x)^2}\right] \sin\left[\frac{6x^2 - 6x^2 - 12x\Delta x - 6(\Delta x)^2}{2x^4 + 4x^3\Delta x + 2x^2(\Delta x)^2}\right]$$

$$\Delta y = 2 \cos\left[\frac{12x^2 + 12x\Delta x + 6(\Delta x)^2}{2x^4 + 4x^3\Delta x + 2x^2(\Delta x)^2}\right] \sin\left[\frac{-12x\Delta x - 6(\Delta x)^2}{2x^4 + 4x^3\Delta x + 2x^2(\Delta x)^2}\right]$$

$$\Delta y = 2 \cos\left[\frac{6x^2 + 6x\Delta x + 3(\Delta x)^2}{x^4 + 2x^3\Delta x + x^2(\Delta x)^2}\right] \sin\left[\frac{-6x\Delta x - 3(\Delta x)^2}{x^4 + 2x^3\Delta x + x^2(\Delta x)^2}\right]$$

$$\frac{\Delta y}{\Delta x} = 2 \cos\left[\frac{6x^2 + 6x\Delta x + 3(\Delta x)^2}{x^4 + 2x^3\Delta x + x^2(\Delta x)^2}\right] \sin\left[\frac{\Delta x(-6x - 3\Delta x)}{x^4 + 2x^3\Delta x + x^2(\Delta x)^2}\right]$$

$$\frac{\Delta y}{\Delta x} = 2 \frac{(-6x - 3(0))}{x^4 + 2x^3(0) + x^2(0)^2} \cos\left(\frac{6x^2 + 6x(0) + 3(0)^2}{x^4 + 2x^3(0) + x^2(0)^2}\right) \cdot 1$$

$$\frac{\Delta y}{\Delta x} = 2 \frac{(-6x)}{x^4} \cos\left(\frac{6x^2}{x^4}\right)$$

$$\frac{\Delta y}{\Delta x} = 2 \frac{(-6)}{x^3} \cos\left(\frac{6}{x^2}\right)$$

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

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

$$y = t^4 + 2t^2$$

$$A = \int_0^3 y dx$$

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

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

$$A = \int_0^3 (12t^2 - 2t)(t^4 + 2t^2) dt$$

$$A = \int_0^3 (12t^6 + 24t^4 - 2t^5 - 4t^3) dt$$

$$A = \left[\frac{12t^7}{7} + \frac{24t^5}{5} - \frac{2t^6}{6} + \frac{4t^4}{4} \right]_0^3$$

$$A = \left[\frac{12t^7}{7} + \frac{24t^5}{5} - \frac{t^6}{3} - t^4 \right]_0^3$$

$$A = \left[\frac{12(3)^7}{7} + \frac{24(3)^5}{5} - \frac{3^6}{3} - 3^4 \right] - \left[\frac{12(0)^7}{7} + \frac{24(0)^5}{5} - \frac{0^6}{3} - 0^4 \right]$$

$$A = \frac{1536}{7} - 0 + \frac{783}{5} - 24 - \left(\frac{-64}{3} \right) + (-8 + 1)$$

$$A = \frac{1524}{7} + \frac{761}{5} - 63 - 7$$

$$A = 217.71 + 152.2 - 21 - 7$$

$$A = 341.91 \text{ unit}^2$$

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

$$y = t^4 + 2t^2$$

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

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

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

$$= \frac{4t^3 + 4t}{12t^2 - 2t}$$

$$= \frac{4t^2 + 4}{12t - 2}$$

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

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