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DEPARTMENT: COMPUTER ENGINEERING

COURSE: MAT 104

MATRIC NO: 19/Eng02/011

ASSIGNMENT

1. ~~$y=5\sin\left(\frac{6}{x^2}\right)$~~ $x=4t^3-t^2$, and $y=t^4+2t^2$, at $t=1$ and $t=3$

~~$r=xi+yj+zk$~~

$r=(4t^3-t^2)i+(t^4-2t^2)j$

$\frac{dr}{dt}=\frac{id}{dt}(4t^3-t^2)+\frac{jd}{dt}=$

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

Let A represent the area, then

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

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

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

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

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

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

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

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

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

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

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

$$= \frac{482112 - 544}{105} = \frac{481568}{105} \text{ Square units}$$

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

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

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

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

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

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

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

$y = \sin(6x^{-2})$

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

$y + \Delta y = \sin(6x^{-2} + 6\Delta x^{-1})$

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

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

Recall that $\frac{2\cos(A+B)}{2} * \frac{\sin(A-B)}{2}$

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

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

Divide through by $\Delta x$

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

$$\frac{2\cos\left(\frac{12x^{-2}+6\Delta x^{-2}}{2}\right)\cdot \sin\left(\frac{6\Delta x^{-2}}{2}\right)\times\frac{1}{2}}{\frac{\Delta x}{2}}$$

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

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

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

$$\frac{dy}{dx} = \cos 6x^{-2}$$