Name: UTOR CHUKWUEBUKA EMMANUEL
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Course MAT 104

2 $y = -3\tan 7x\, e^{3x}$

$\frac{dy}{dx} = 5$

3 $y = \cos 3x$

$y + \Delta y = \cos 3[x + \Delta x] - \cos 3x \quad \ldots (1)$

Recall $\cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2} \quad \ldots (2)$

Hence

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

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

$\frac{\Delta y}{\Delta x} = \frac{-2\sin(3x + 3\Delta x)\sin(3\Delta x/2) \times 1/2}{\Delta x \times 1/2}$

$\Delta y/\Delta x = \frac{-\sin(3x + 3\Delta x)\sin(3\Delta x/2)x}{\Delta x/2}$

Taking lim as $\Delta x \to 0$

$\lim \Delta y = -\sin(3x + 3\Delta x)$

$= -\sin(3x) = -\sin 3x$

$\lim \Delta y = \sin(3\Delta x/2)$

$= \sin(0) = 1$

$dy/dx = -3\sin 3x$

$F(x) = 2x^3 - 7x \qquad g(x) = -3x$

$F'(x) = 6x^2 - 7 \qquad g'(x) = -3$

$5 - (f - g) = 2x^3 - 7x - (-3x)$

$[(6x^2 - 7) - (-3)] = 2x^3 + 10x$

$(6x^2 - 4)5 \quad (f - g)5 = 5(2x^3 + 10x)$

$30x^2 - 20 = 10x^2 - 5x$

5 $Fog(x)$ if $f(x) = 4x^2 + 2$ and $g(x) = 2x + 3$

$= f(g(x)) = f(2x + 3)$

$= 4(2x + 3)^2 + 2$

$= 4(4x^2 + 12x + 9) + 2$

$= 16x^2 + 48x + 36 + 2$

$Fog(x) = 16x^2 + 48x + 38$

7 $V = x^2 \qquad V = \cos x$

$du/dx = 2x \qquad dv/dx = -5\sin x$

$$\frac{dy}{dx} = \frac{u\,dv}{dx} + \frac{v\,du}{dx}$$

$= x^2(-\sin x) + \cos x(2x$

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