NAME: IKE-EGBUONU MARVELLOUS CHINELO 02/04/2020
DEPT: INDUSTRIAL CHEMISTRY 100L
MATRIC NO: 19/SCI09/003 DR. OYELAMI

1. Find the Limit of the function $\left\{\frac{x-\cos x}{x}\right\}$ as $x \to 0$

Using L'Hopital's Rule

$\lim_{x\to 0}\left\{\frac{1-(-\sin x)}{1}\right\}$

$\lim_{x\to 0}\left\{\frac{1+\sin x}{1}\right\} = \frac{1+\sin 0}{1} = \frac{1+0}{1} = 1$

2. If $y = -3\tan 7x\, e^{3x}$, find dy/dx

let $u = -3\tan 7x$, $v = e^{3x}$

$du/dx = -21\sec^2 7x$, $dv/dx = 3e^{3x}$

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

$\therefore dy/dx = (-3\tan 7x)(3e^{3x}) + (e^{3x})(-21\sec^2 7x)$

$= -9\tan 7x\, e^{3x} - 21\sec^2 7x\, e^{3x}$

3. If $y = \cos 3x$, Find dy/dx using first principles.

$y = \cos 3x$

$y + \Delta y = \cos(3x + 3\Delta x)$

$\Delta y = \cos(3x + 3\Delta x) - \cos 3x$

Recall that $\cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$

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

$\Delta y = -2\sin\frac{6x+3\Delta x}{2}\sin\frac{3\Delta x}{2}$

$\frac{\Delta y}{\Delta x} = -2\sin\frac{6x+3\Delta x}{2}\sin\frac{3\Delta x}{2}$ multiply by $\frac{1}{2}$

Δx

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$$\frac{\Delta y}{\Delta x} = \frac{-2 \sin \frac{6x+3\Delta x}{2} \sin \frac{3\Delta x}{2} \times \frac{1}{2}}{\frac{\Delta x}{2}}$$

$$\frac{\Delta y}{\Delta x} = -\sin \frac{6x+3\Delta x}{2} \sin \frac{3\Delta x}{2} = -\sin \frac{6x}{2} + \frac{3\Delta x}{2} \sin \frac{3\Delta x}{2}$$

$$\frac{\Delta x}{2} \qquad \frac{\Delta x}{2}$$

$$\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = -\sin(3x + 0), \frac{\sin \frac{3\Delta x}{2}}{\frac{\Delta x}{2}}$$

$$\text{Since } \lim_{\Delta x \to 0} \frac{\sin \frac{3\Delta x}{2}}{\frac{\Delta x}{2}} = 3(1) = 3$$

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

4. Given that $f(x) = 2x^3 - 7x$ and $g(x) = -3x$, find $(f-g)(5)$

$$(f-g)(5) = 2x^3 - 7x - (-3x)$$
$$= 2x^3 - 7x + 3x$$
$$= 2x^3 - 4x$$
$$= 2(5)^3 - 4(5)$$
$$= 250 - 20 = 230$$

5. Find $fog(x)$, if $f(x) = 4x^2 + 2$ and $g(x) = 2x + 3$.

$$fog(x) = 4(2x+3)^2 + 2$$
$$= 4(4x^2 + 6x + 6x + 9) + 2$$
$$= 4(4x^2 + 12x + 9) + 2$$
$$= 16x^2 + 48x + 36 + 2$$
$$= 16x^2 + 48x + 38$$

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6. Find the gradient of $x^2+2xy+y^2=1,020$

$x^2+2xy+y^2=1,020$

$2x\frac{dx}{dx}+2x\,dy/dx+2y\frac{dx}{dx}+2y\,dy/dx=0$

$2x+2x\,dy/dx+2y+2y\,dy/dx=0$

$dy/dx\,(2x+2y)=-2x-2y$

$\therefore dy/dx=\frac{-2x-2y}{2x+2y}$

7. Find the first derivative of the function $y=x^2\cos x$

$y=x^2\cos x$

let $U=x^2$, $V=\cos x$

$du/dx=2x$, $dv/dx=-\sin x$

$dy/dx=U\frac{dv}{dx}+V\frac{du}{dx}$

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

$dy/dx=-x^2\sin x+2x\cos x$