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DEPARTMENT: INDUSTRIAL CHEMISTRY
COURSE: MAT 104
COLLEGE: SCIENCES
Matric Num: 19/sci09/004

Number 11.

$$\lim_{x \to 0} \frac{(1 - \cos x)}{x}$$

$$\lim \left(\frac{1 - \cos x}{x}\right) \frac{(1 + \cos x)}{(1 + \cos x)}$$

$$\lim_{x \to 0} \frac{(1 - \cos^2 x)}{x(1 + \cos x)}$$

Recall the identity, $\sin^2 x + \cos^2 x = 1$
therefore $1 - \cos^2 x = \sin^2 x$

$$\lim_{x \to 0} \frac{(1 - \cos^2 x)}{x(1 + \cos x)}$$

$$\lim_{x \to 0} \frac{\sin^2 x}{x(1 + \cos x)} = \frac{(\sin x)(\sin x)}{x(1 + \cos x)}$$

$$\lim_{x \to 0} \frac{\sin^2 x}{x(1 + \cos x)} = \frac{(\sin x)(\sin x)}{x(1 + \cos x)}$$

$$\lim_{x \to 0} = \frac{\sin x}{x} \frac{\sin x}{(1 + \cos x)}$$

$$\lim_{x \to 0} \frac{\sin x}{x} \lim_{x \to 0} \frac{\sin x}{1 + \cos x}$$

Recall

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

$$\lim_{x \to 0} \frac{\sin x}{1 + \cos x}$$

$$1 = \frac{\sin 0}{1 + \cos(0)}$$

$$1 \frac{0}{1+1} \Rightarrow 1 \cdot \frac{0}{2} \Rightarrow \frac{0}{2}$$

Number 2:

$y = -3 \quad u = -4\tan 7x \quad w = e^{3x}$

$\frac{du}{dx} = 0 \quad \frac{dv}{dx} = 7\sec^2 7x \quad w = 3e^{3x}$

$\frac{dy}{dx} = y^{xc}\left[\frac{1}{3}(0) + \frac{1}{\tan 7x}(7\sec^2 7x) + \frac{1}{e^{3x}}(3e^{3}\right.$

$y\left[0 + \frac{7\sec^2 7x}{\tan 7x} + 3\right.$

$\frac{dy}{dx} = \left[\frac{7\sec^2 7x}{\tan 7x} + 3\right]\left[-3\tan 7x e^{3x}\right]$

Number 3:

$y = \cos 3x$

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

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

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

Comparing equation $B = 3x$

$\frac{A+B}{2} = \frac{3x - \Delta x + 3x}{2} = \frac{6x + \Delta x}{2}$

and

$\frac{A-B}{2} = \frac{3x + \Delta x - 3x}{2} = \frac{\Delta x}{2}$

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

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

∴ This value determines the numbe is divided by

$+1 + B$

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

$\frac{\Delta y}{\Delta x} = -2\sin\left(\frac{6x + \Delta x}{2}\right)\left(\sin\frac{\Delta x}{2}\right) \times \frac{1}{2}$

$\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = -2\sin(6x + 0)\ {}^{3x \times 1/2}\lim_{\Delta x \to 0} \frac{\sin\left(\frac{\Delta x}{2}\right)}{\Delta x/2}$

since $= \lim_{\Delta x \to 0} \frac{\sin\left(\frac{\Delta x}{2}\right)}{3x/2} = 1$

Hence $\frac{dy}{dx} = -2 \sin 6x$.

Number 4:

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

$(f-g)(5) = 7(5) - g(5)$

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

$(f-g)(5) = 2[125) - 35] - [-15]$

$(f-g)(5) = 250 - 35 + 15$

$(f-g)(5) = 230$ //

Number 5:

$f(x) = 4x^2 + 2 \quad g(x) \; 2x + 3$

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

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

$= 4(4x^2 + 6x + 6x + 9) + 2$

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

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

$= 16x^2 + 48x + 38$ //

Number 6:

$x^2 + 2xy + y^2 = 1020$

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

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

$\frac{dy}{dx}(2x + 2y) = -2x - 2y$

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

Number 7

$$y = x^2 \cos x$$

$$u = x^2 \quad y = \cos x$$

$$\frac{du}{dx} = 2x$$

$$V = \cos x$$

$$\frac{dv}{dx} = -\sin x$$

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

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

$$-x^2 \sin x + 2x \cos x$$

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

$$x(2\cos x - x \sin x] \text{ Or } (2x \cos x - x^2 \sin x)$$