MAT 104 SHINKU WILLIAMS
19/ENG05/059

1. $y = x - \cos x / x$

$dy/dx = 1 + \frac{\sin x}{x}$

at $x \to 0$

$\frac{1 + \sin x}{1}$

$= \frac{1 + \sin 0}{1}$

$= 1/1 + 0/1$

$\Rightarrow 1 + 0 = 1$ //

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

$y = u\ v\ w$

$u = -3$

$v = \tan 7x$

$w = e^{3x}$

From $dy/dx = uvw \cdot (1/u\ du/dx + 1/v\ dv/dx + 1/w\ dw/dx)$

$du/dx = 0$

$dv/dx = 7 \sec^2 7x$

$dw/dx = 3e^{3x}$

Substituting u, v, w

$[0/3 \times 0 + 1/\tan 7x \times (7 \sec^2 7x) + 1/e^{3x} \times (3e^{3x})] \cdot 3 \tan 7x e$

$= 3 \tan 7x e^{3x} [0 + 7 \sec^2 7x / \tan x + 3e^{3x}/e^{3x}]$

$= 3 \tan 7x e^{3x} (7 \sec^2 7x / \tan x + 3)$ //

4. $f(x) = 2x^3 - 7x$

$g(x) = -3x$

$f(-g)5 \Rightarrow$ Similarly $(f-g)x$

$= [2x^3 - 7x + 3x]$

$= 2x^3 - 4x$

Since $x = 5$

$= 2(5)^3 - 4(5)$

$= 150 - 20$

$= 130_{//}$

5. $f(x) = 4x^2 + 2$

$g(x) = 2x + 3$

$fog(x) = 4[2x+3]^2 + 2$

$4[(2x+3)(2+3)] + 2$

$4[4x^2 + 12x + 9] + 2$

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

$16x^2 + 48x + 38_{//}$

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

$2x + 2y + 2x\, dy/dx + 2y\, dy/dx = 1020$

$2x + 2y - 1020 = (-2x - 2y)\, \Delta y/\Delta x$

$\Delta y/\Delta x = \frac{2(x+y-0)}{-2(x+y)}$

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

$= -1_{//}$

3. $\cos 3x = y$

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

From 1st principle $\Rightarrow$

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

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

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

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

$A = 3x + 3\Delta x$, $B = 3x$

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

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

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

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

Recall $\frac{-\sin \Delta x/2}{\Delta x/2}$

At $\lim \Delta x \to 0 = 1$

$\therefore \Delta y/\Delta x = 3(-\sin x - \sin 0/2)(1)$

$= 3(-\sin x)(1)$

$= -3\sin x 3$

rearranging $= -3\sin 3x$ //

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

using product rule $= V\,dy/dx + y\,dv/dx$

$u = x^2$

$V = \cos x$

$du/dx = 2x$

$dv/dx = -\sin x$

$= \cos x\,[2x] + [-\sin x]\,x^2$

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