$$\frac{\delta y}{\delta x} = \frac{-2\sin\left(x+\frac{\delta x}{2}\right)\sin\left(\frac{\delta x}{2}\right)}{\delta x}$$

$$\frac{\delta y}{\delta x} = \frac{-\sin\left(x+\frac{\delta x}{2}\right)\sin\left(\frac{\delta x}{2}\right)}{\frac{\delta x}{2}}$$

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

Taking limit $\delta x \to 0$

$$\lim \frac{\sin\left(\frac{\delta x}{2}\right)}{\frac{\delta x}{2}} = 1$$

$$\frac{\delta y}{\delta x} = -\sin\left(x+\frac{0}{2}\right)\times 1$$

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

8) $y = 3t^2$; $x = 1/t^2$

$$dy/dx = dy/dx \times \frac{dt}{dx}$$

$$\frac{dy}{dt} = 6t \quad ; \quad \frac{dx}{dt} = -2t^{-3}$$

$$\frac{dy}{dx} = \frac{6t}{-2t^{-3}} = -3t^4$$

9) $y = x^2 \cos 2x\, e^{4x}$

Solu.

Taking Loge of both Sides

$$\ln y = \ln x^2 + \ln \cos 2x + \ln e^{4x}$$

Diff. both Sides with $\ln x$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{x^2}(2x) + \frac{1}{\cos 2x}(-2\sin 2x) + 4$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{2}{x} - \frac{2\cos 2x}{\cos 2x} + 4$$

Multiplying both Sides by 'y'

$$\frac{dy}{dx} = y\left(2/x - \frac{2\cos 2x}{\cos 2x} + 4\right)$$

$$= x^2 \cos 2x\, e^{4x}\left(\frac{2+2x}{x}\right)$$

10) $y = \sin(3x^3+5)$

let $u = 3x^3+5$

$$\frac{dy}{dx} = \cos x$$

$$\frac{dy}{dx} = 9x^2$$

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

$$= \cos x \times 9x^2$$

$$= 9x^2 \cos x$$

$$= 9x^2 \cos 3x^3 + 5$$

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1. $y = \frac{1}{x-2}$

→ the function is defined for all real nos except $x = 2$
→ The domain is the set of real nos except $x = 2$
→ The codomain is the set of real nos except $y = 0$

2. $K = \ln V$

$\frac{dK}{dV} = \frac{1}{V}$

$\frac{dK}{dV} \ln V = \frac{1}{V}$

3. $2x - 3y - 2 = 0$

$-3y = 2 - 2x$

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

b. $x^2 + y^2 = 4$

$y^2 = 4 - x^2$

$y = \pm 2 - x$

4. Find $\frac{dp}{dt}$, $P = \sin^{-1} t = \frac{t}{\sin}$ ∴ $t = \sin P$

$\frac{dt}{dp} = \cos P$, $\frac{dp}{dt} = \frac{1}{\cos P}$

Recall, $\cos^2 y + \sin^2 y = 1$

$\cos y = \pm\sqrt{1 + \sin^2 y}$

$\cos p = \sqrt{1+t^2}$ ∴ $\frac{dp}{dt} = \frac{1}{\sqrt{1+t^2}}$

5. $F(x) = 2x^2 - 5$, $g(x) = 4x - 2$

i. $F \circ g(x) = 2(4x-2)^2 - 5$

$= 2(16x^2 - 16x + 4) - 5$

$= 32x^2 - 32x + 3$

ii. $g \circ f(x) = 4(2x^2 - 5) - 2$

$= 8x^2 - 20 - 2$

$= 8x^2 - 22$

6. Show that $f(x) = f_e(x) + f_o(x)$

$f(x) = 3x^2 - 2x + 1$

$f_e(x) = \frac{f(x) + f(-x)}{2}$

$f(-x) = 3(-x)^2 - 2(-x) + 1$

$= 3x^2 + 2x + 1$

$f_e(x) = \frac{3x^2 - 2x + 1 + 3x^2 + 2x + 1}{2}$

$= 3x^2 + 1$

To find $f_o(x) = \frac{3x^2 - 2x + 1 - (3x^2 + 2x + 1)}{2}$

$= \frac{-4x}{2} = -2x$

$f_e(x) + f_o(x) = 3x^2 + 1 - 2x$

$= 3x^2 - 2x + 1$

7. Diff $y = \cos x$ using 1st principle

$y + \delta y = \cos(x + \delta x)$

$\delta y = \cos(x + \delta x) - \cos x$ --- (1)

Recall,

$\cos(A+B) - \cos(A-B) = -2\sin \sin B$ --- (2)

Comparing (1) and (2)

$A + B = x + \delta n$ --- (3)

$A - B = x$ --- (4)

Adding and subtracting eqn 3 & 4

$A = \frac{2x + \delta x}{2}$ and $B = \frac{\delta x}{2}$

Comparing eqn (1) and (2)

$= \cos(x + \delta x) - \cos x$

$= 2\sin(x + \delta x/2) \sin(\frac{\delta x}{2}$

Divide through by δx