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

Function is defined at $x - 2 = 0$

Hence $x = 2$

Domain: all real numbers of x except 2

Co-domain: all real numbers of y

2. $$K = \ln V$$

Differentation of K

$$\frac{d}{dK}(\ln V) = \frac{1}{V}$$

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

$$2x - 3y = 2$$

differentatie all factors

$$\frac{d}{dx}(2x) - \frac{d}{dx}(3y) = \frac{d}{dx}(2)$$

$$2 - 3\frac{dy}{dx} = 0$$

$$2 = \frac{3dy}{dx}$$

3b. Differentiate all factors

$$\frac{d}{dx}(x^2) + \frac{d}{dx}(y^2) = \frac{d}{dx}(4)$$

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

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

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

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

4. $p = \sin^{-1}$

Find dy/dx

$$p = \frac{t}{\sin} \quad : \quad t = \sin p$$

$$\frac{dt}{dp} = \cos p \ : \ \frac{dp}{dt} = \frac{1}{\cos p}$$

Recall $\cos^2 p + \sin^2 p = 1$

$$\cos p = 1 - \sin^2 p$$

$$\cos p = \sqrt{1 - \sin^2 p}$$

since $t = \sin P$

$\cos P = \sqrt{1-t^2}$ $\quad dP/dt = \frac{1}{\sqrt{1-t^2}}$

$f(x) = 2x^2 - 5$

$g(x) = 4x - 2$

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

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

$= 32x^2 - 32x + 8 - 5$

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

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

$= 8x^2 - 20 - 2$

$= 8x^2 - 22$

$f(x) = 3x^2 - 2x + 1 = 0$

show $f(x) = f_o(x) + f_e(x)$

$f_o = \frac{f(x) + f(-x)}{2} \longrightarrow x \in R$

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

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

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

$= \frac{\cancel{6}^{3}x^2 + \cancel{2}^{1}}{\cancel{2}}$

$= 3x^2 + 1$

$3x^2 1$

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

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

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

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

$$= \underline{\underline{-2x}}$$

hence

$$f(x) = f_e(x) + f_o(x)$$

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

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

7. Differentiate $y = \cos x$

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

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

Recall

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

comparing 1 & 2

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

$$A + B = x \quad - (4)$$

Add 3 & 4 Subtract 3 & 4

$2A = 2x + \delta x$

$A = 2x + \delta x$ & $B = \delta x/2$

$A = x + \delta x/2$

comparing 1 & 2

$\delta y = ~~\cos~~ \; 2 \sin(x + \delta x/2) \sin(\delta x/2)$

dividing through by δx

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

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

Taking limit $\delta x \to 0$

$\lim \delta x \to 0 \quad \frac{\sin \delta x/2}{\delta x/2} = 1$

$dy/dx = -\sin(x + 0/2) \times 1$

$dy/dx = -\sin x$

$y = 3t^2 \; ; \; x = 1/t^2$

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

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

$$\frac{dy}{dx} = 6t \div \frac{-2}{t^3} \qquad dy/dx = \frac{6x - 2}{t^2}$$

$$= \frac{12}{t^2}$$

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

Soln

Taking $\log_e$ of both sides

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

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

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

multiplying both notes by y

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

$= x^2 \cos 2x\, e^{4x} \times \frac{2}{x} - \frac{2\sin x}{\cos x})$

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

Let $u = 3x^3 + 5$

$\frac{dy}{du} = \frac{dy}{du} * \frac{du}{dx}$

$\cos u * 9x^2$

$= 9x^2 \cos u$

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