7) Differentiate $y = \cos x$

$y + dy = \cos(x + dx)$

$dy = \cos(x + dx) - \cos x \; (y = \cos x)$

Recall

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

Comparing (1) & (2)

$A + B = x + dx$ — (3)

$A - B = x$ — (4)

Adding (3) and (4) & Substracting (3)&(4)

$2A = 2x + dx$

$A = \frac{\cancel{2x} + dx}{2}$ $\boxed{B = \frac{dx}{2}}$

$\boxed{A = x + \frac{dx}{2}}$

Comparing (1) & (2)

$dy = \cos(x + dx) - \cos x$

$= 2\sin(x + dx/2)\sin(dx/2)$

Dividing through by dx

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

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

$$= -\sin(x + dx/2) * \frac{\sin(dx/2)}{dx/2}$$

Taking Limit $dx \to 0$

$$\lim_{\delta x \to 0} \frac{\sin dx/2}{dx/2} = 1$$

$$\lim_{\delta x \to 0} \frac{dy}{dx} = -\sin\left(x + \frac{0}{2}\right) \times 1$$

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

8) $y = 3t^2$; $x = \frac{1}{t^2}$

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

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

$= 6t \times \frac{-2}{t^3} = \frac{-6x - 2}{t^2} = \frac{12}{t^2}$

$\frac{dy}{dx} = \frac{-12}{t^2}$

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

Sol

Taking Loge of both sides

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

Differentiating both wit x

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

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

Multiplying both sides by 'y'

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

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

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

Let $u = 3x^3 + 5$

$dy/du = \cos u$

$du/dx = 9x^2$

$dy/dx = dy/du \times du/dx$

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

$= 9x^2 \cos u$

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

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

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

2) $K = \ln V$

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

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

$-3y = 2 - 2x$

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

$y = \frac{2x+2}{3}, \frac{2(x+1)}{3}$

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

$y^2 = 4 - x^2$

$y = \pm\sqrt{4-x^2}$

4) find dp/dt, $p = \sin^{-1} t$ $p = \frac{t}{\sin}$,

$t = \sin p$

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

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

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

$t = \sin p$

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

Hence $\frac{dp}{dt} = \frac{1}{(1-t^2)}$

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

$Fog(x) = 2(4x-2)^2 - 5$

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

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

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

~~$gof(x) = 4($~~

$gof(x) = 4(2x^2 - 5) - 2$

$= 8x^2 - 20 - 2$

$= 8x^2 - 22$

6) Show that $F(x) = F_e(x) + F_o(x)$

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

$F_e(x) = \frac{F(x) + F(-x)}{2}$

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

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

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

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

$= -4x/2 = -2x$

$F_e(x) + F_o(x) = 3x^2 + 1 - 2x$

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