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Dept: Pharmacy

1) The function is defined for all real numbers except $x=2$
Domain - Real numbers except $x=2$
Codomain - Real numbers except $y=0$

2) If $K=\ln v$ differentiate K

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

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

$=2x-2=3y$

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

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

$x^2+4=y^2$

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

4) If $P=\sin^{-1}t$ find the derivattive of p

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

$t=\sin p$ —— (1)

Recall that $\sin^2 p+\cos^2 y=1$ —— (2)

$\frac{dt}{dp}$ of (1) $=\cos p$

From (2) $\sin^2 p+\cos^2 p=1$

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

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

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

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

$$\therefore dp/dt = \frac{1}{\sqrt{1-t^2}}$$

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

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

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

$$= \cancel{2(16x^2+16x+4) = 5}$$

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

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

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

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

$$= 3x^2 - 20 - 2$$

$$= 8x^2 - 22$$

$$= 2(4x^2 - 11)$$

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

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

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

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

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

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

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

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

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

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

$= 3x^2+1$

$\rightarrow F_o(x) = \frac{F(x) - F(-x)}{2}$

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

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

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

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

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

Recall: $F(x) = F_e(x) + F_o(x)$

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

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

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

7) Differentiate $y = \cos x$

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

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

Recall

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

Comparing ① & ②

$A + B = x + \delta x$ — ③

$A - B = x$ — ④

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Adding ③ & ④ & subtracting ③ & ④

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

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

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

Comparing ① & ②

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

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

Dividing through by δx

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

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

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

Taking limit $\delta x \to 0$

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

$\delta y/\delta x = -\sin(x + 0/2)\times 1$

$\lim_{\delta x \to 0}$

$\delta y/\delta x = -\sin x$

⑧ $y = 3t^2 \cdot x = 1/t^2$

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

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

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

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

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

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

⑨ $y = x^2\cos 2x\, e^{4x}$

soln

Taking $\log_e$ of both sides

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

Differentiating both in x

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

multiplying both sides by 'y'

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

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

⑩ $y = \sin(3x^3+5)$

let $u = 3x^3+5$

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

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

$= 9x^2\cos u$

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