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19/MHS11/030
PHARMACY, 100LEVEL

MATHS 104 (Assignment)

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

$-3y = 2 - 2x$

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

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

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

$y^2 = 4 - x^2$

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

4) Find dp/dt, $P = \sin^{-1} + P = \frac{t}{\sin}$;

$t = \sin p$

~~$\frac{dt}{dp} = \cos^2 y + \sin^2 y =$~~

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

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 $dp/dt = 1/(1+t^2)$

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

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

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

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

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

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

$= 8x^2 - 20 - 2$

$= 8x^2 - 22$

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

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

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

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

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

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

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

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

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

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

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

7) Differentiate $y = \cos x$

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

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

Recall:

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

Comparing (1) and (2)

$A + B = x + \delta x$ — (3)

$A - B = x$ — (4)

Adding (3) and (4) and subtracting (3) and (4)

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

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

$\boxed{A = x + \delta x/2}$

Comparing (1) and (2)

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

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

Dividing through by δx

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

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

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

Taking limit $\delta x \to 0$

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

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

$\lim_{\delta x \to 0}$ $dy/dx = -\sin x$

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

$dy/dx = dy/dt \times dt/dx$

$= dy/dx \div dx/dt$

$dy/dt = 6t$; $dx/dt = -2/t^3$

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

$= 6t \times \frac{-2}{t^3} = \frac{6 \times (-2)}{t^2}$

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

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CONTD....

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 sides with x

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

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

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 $u = 3x^3 + 5$

$dy/dx = \cos u$

$du/dx = 9x^2$

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

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

$\overline{9x^2 \cos u}$

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