NAME: AIBANGBEE EFEOSA ANTHONIA
DEPARTMENT: PHARMACY
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Assignment

1. For what values of x is the function $y = \frac{1}{x-2}$ defined State the domain and Codomain?

Ans

The function is defined for all real numbers except $x = 2$

The domain is all real numbers except $x = 2$

The Codomain is all real numbers except $y = 0$

2 If $K = \ln V$ differentiate K

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

3 Express y as an explicit function of x

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

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

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

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

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

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

4 If $P = \sin^{-1} t$ find derivative of P

$$P \frac{t}{\sin}$$

$t = \sin p$ ----

differentiate both sid

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

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

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

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

$$\frac{dp}{dt} = \frac{1}{\sqrt{1 - \sin^2 p}}$$

$t = \sin p$

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

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

$$fog(x) = 2(4x-2)^2 - 5$$
$$= 2(16x^2 - 16x + 4) - 5$$
$$= 32x^2 - 32x + 8 - 5$$
$$= 32x^2 - 32x + 3 //$$

$$gof(x) = 4(2x^2 - 5) - 2$$
$$= 8x^2 - 20 - 2$$
$$= 8x^2 - 22 //$$

6 $f(x) = 3x^2 - 2x + 1 = 0$

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

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

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

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

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

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

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

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

$$f_c(x) + f_i(x) = 3x^2 + 1 + (-2x)$$

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

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

7 $y = \cos x$ from first principle

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

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

$$\delta y = \cos(x + \delta x) - \cos x \quad \text{— eqn 1}$$

$$\cos(A + B) - \cos(A - B) = -2\sin A \sin B \quad \text{— eqn 2}$$

Compare equation 1 and 2

let $(A + B) = x + \delta x$

let $(A - B) = x$

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

$$B = \delta x/2$$

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

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

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

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

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

$$\lim_{dx \to 0} = -\sin(x + \delta x/2) - 1$$

$$= -\sin(x + 0) - 1$$

$$= -\sin x$$

8. dy/dx if $y = 3t^2$ and $x = 1/t^2$

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

$$\frac{dy}{dx} = \frac{6t}{-2t^{-3}} = 6t \div -\frac{1}{2t^3}$$

$$= 6t \times -2t^3$$

$$= -12t^4 \;//$$

9. dy/dx if $y = x^2 \cos 2x\, e^{4x}$

ln of both sides

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

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

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

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

multiply both sides by y

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

$$\frac{dy}{dx} = x^2 \cos 2x\, e^{4x}\left(2x^{-1} - \frac{2\sin 2x}{\cos 2x} + 4\right) //$$

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

$y = \sin u$ $\qquad u = 3x^3 + 5$

$dy/du = \cos u$ $\qquad du/dx = 9x^2$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx} = 9x^2 \times \cos u$$

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

$$= 9x^2 \cos(3x^3 + 5) //$$