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Math 104 Assignment.

1. The Function is defined for all Real numbers except $x = 2$.

The set of all real numbers except $x = 2$ (Domain). The Codomain is the Set of all real number except $y = 0$.

2. If $K = \ln V$ differentiate K.

$K = \ln V$

Let $K = y$ & $V = x$.

$y = \ln x$.

Recall in Log form

$y = \ln x$

$y = \log_e x$.

$e^y = x$.

$\frac{d}{dx}(e^y) = e^y \frac{dy}{dx} = x$.

Where x is differentiated gives 1

$e^y \frac{dy}{dx} = 1$

Recall $e^y = x$.

$x \frac{dy}{dx} = 1$

$\frac{dy}{dx} = 1/x$.

3. Express y as an explicit function of x in the following

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

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

$-3y = 2 - 2x$

$-3y = 2(1-x)$

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

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

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

$y^2 = 4 - x^2$

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

$y = 2 - x$

4. If $p = \sin^{-1} A$, Find the derivative of p

$p = \sin^{-1} A$

Let $p = y$ & $A = x$

$y = \sin^{-1} x = \arcsin(x)$

$y = \sin^{-1} x$

$y = \frac{x}{\sin}$

$x = \sin y$

$\frac{dx}{dy} = \cos y$ $\quad \frac{dy}{dx} = \frac{1}{\cos y}$

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

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

$\sin^2 y = x^2$

$\cos y = \sqrt{1 - x^2}$

Hence; $\frac{dy}{dx} = \frac{1}{\cos y} = \frac{1}{\sqrt{1 - x^2}}$

but $y = p$ and $A = x$.

$\frac{dy}{dx} = \frac{1}{\cos p} = \frac{1}{\sqrt{1 - A}}$

5

Fr

b.

6

f

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

$g(x) = 4x - 2$.

Find $fog(x)$ and $gof(x)$.

$fog(x) = f(gx)$

$2(4x-2)^2 - 5$.

$2[(4x-2)(4x-2)] - 5$.

$2[(16x^2 - 8x \mp 8x + 4)] - 5$.

~~$2[(16x^2 + 4)] - 5$~~.

$2[(16x^2 - 16x + 4)] - 5$.

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

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

b. $gof(x) = g(fx)$.

$4(2x^2 - 5) - 2$.

$8x^2 - 20 - 2$.

$8x^2 - 22$.

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

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

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

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

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

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

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

$$f_o(x) = \frac{-4x}{2} = -2x.$$

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

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

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

7. Differentiate from first principle.

$y = \cos x$

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

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

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

$\cos(A+B)\ \cos A \cos B - \sin A \sin B$.

$\cos(A-B) = \cos A \cos B + \sin A \sin B$.

Let $A+B = \Delta + \Delta x$.

$A - B = x$.

$2A = 2x + \Delta x$.

$$A = \frac{2x+\Delta x}{2}.$$

$$A = x + \frac{\Delta x}{2}.$$

$$B = \frac{\Delta x}{2}.$$

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

$\Delta y = 2\sin(x+\Delta x/2)\sin(\Delta x/2)$

$\Delta y = 2\sin(x+\Delta y/\cancel{2})\sin(\Delta x/2)$.

$$\frac{dy}{dx} = \sin(x+\Delta x/2)\frac{\sin(\Delta x/2)}{\Delta x/2}.$$

Standard Limit

Limit $\Delta x = 0$.

$$\frac{dy}{dx} = -\sin(x+0)$$

$$= -\sin x.$$

8 $y = 3t^2$ ~~$y = 1/3x$~~

$t^2 = 1/x$

$$y = \frac{3}{x}.$$

$$y = 3 \times \frac{1}{x}$$

$$\text{Let } u = \frac{1}{x}$$

$$\frac{du}{dx} = -\frac{1}{x^2}.$$

$$y = 3u.$$

$$\frac{dy}{du} = 3.$$

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

$$3 \times -\frac{1}{x^2}$$

$$\frac{dy}{dx} = -\frac{3}{x^2}.$$

9. find $\frac{dy}{dx}$ If $y = x^2 \cos 2x e^{4x}$.

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

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

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

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

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

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

$$\frac{dy}{dx} = \frac{x}{2} + \cot 2x + 1$$

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

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

10. Given that $y = \sin(3x^3+5)$ Find the derivative of y

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

Let $u = 3x^3+5$ $\quad du/dx = 9x^2$

$y = \sin u$ $\quad dy/du = \cos u$

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

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

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

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