ADEYI OREOLUWA OLUWATAYOSE

PHARMACOLOGY

MAT 104 ⟨ASSIGNMENT⟩

19/MHS07/002

1 For what values of x is the function $y = 1/\langle x-2 \rangle$ defined? State the domain and codomain

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

→ The set of all real numbers except $x = 2$ ⟨Domain⟩ - The Co-domain is the set of all real number except $y = 0$.

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

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

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

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

$$-3y = 2 - 2x$$

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

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

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

$$y^2 = 4 - x^2$$

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

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

5 If $f\langle x \rangle = 2x^2 - 5$ and $g\langle x \rangle = 4x - 2$, Find $fog\langle x \rangle$ and $gof\langle x \rangle$

a $fog\langle x \rangle = f\langle g(x) \rangle$

$$f\langle x \rangle = 2x^2 - 5$$

$$g\langle x \rangle = 4x - 2$$

$$f\langle g(x) \rangle = f\langle 4x - 2 \rangle$$

$$= 2\langle 4x - 2 \rangle^2 - 5$$

$$= 2\langle 4x - 2 \rangle\langle 4x - 2 \rangle - 5$$

$$= 2\langle 16x^2 - 8x - 8x + 4 \rangle - 5$$

$$= \cancel{32x^2 - 16x}\ 2\langle 16x^2 - 16x + 4 \rangle - 5$$

$$= 32x^2 - 32x + 4 - 5$$

$$= 32x^2 - 32x - 1$$

b $gof\langle x \rangle = g\langle f\langle x \rangle \rangle$

$$g\langle f(x) \rangle = g\langle 2x^2 - 5 \rangle$$

$$= 4\langle 2x^2 - 5 \rangle - 1$$

$$= 8x^2 - 20 - 1$$

$$= 8x^2 - 21$$

6. If $f\langle x\rangle = 3x^2 - 2x + 1 = 0$, show that $f_e\langle x\rangle + f_o\langle x\rangle = f\langle x\rangle$

$$f_e\langle x\rangle = \frac{f\langle x\rangle + f\langle -x\rangle}{2}$$

$$f\langle -x\rangle = 3\langle -x\rangle^2 - 2\langle -x\rangle + 1$$

$$f\langle -x\rangle = 3x^2 + 2x + 1$$

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

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

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

$$f_e\langle x\rangle = 3x^2 + 1$$

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

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

$$f_o\langle x\rangle = \frac{-4x}{2}$$

$$= -2x$$

$\therefore f\langle x\rangle = f_e\langle x\rangle + f_o\langle x\rangle$

$$f\langle x\rangle = 3x^2 + 1 - 2x$$

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

$\therefore f\langle x\rangle = 3x^2 - 2x + 1$

7. Differentiate $y = \cos x$ from first principle

$y = \cos x$

$y + \delta y = \cos\langle x + \delta x\rangle$

Subtract y from both sides

$\delta y = \cos\langle x + \delta x\rangle - y$

but $y = \cos x$

$\delta y = \cos\langle x + \delta x\rangle - \cos x$ —i)

Consider Trig

$\langle\cos A + B\rangle = \cos A\cos B - \sin A\sin B$ *

$\langle\cos A - B\rangle = \cos A\cos B + \sin A\sin B$ 2*

$\cos\langle A + B\rangle - \cos\langle A - B\rangle = -2\sin A\sin B$

Let,

$A + B = x + \delta x$ ... i

$A - B = x$ ... ii

$2A = 2x + \delta x$

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

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

$B = \frac{\delta x}{2}$

$\cos \langle x + \delta x \rangle - \cos x = -2\sin \langle x + \delta x/2 \rangle \sin \langle \delta x/2 \rangle$

$\delta y = 2 \sin \langle x + \delta x/2 \rangle \sin \langle \delta x/2 \rangle$

$\delta y = \frac{2 \sin \langle x + \delta x/2 \rangle \sin \langle \delta x/2 \rangle}{\delta x}$

$\frac{\delta y}{\delta x} = \frac{\sin \langle x + \delta x/2 \rangle \sin \langle \delta x/2 \rangle}{\delta x/2}$

$\frac{\delta y}{\delta x} = \sin \langle x + \delta x/2 \rangle \frac{\sin \langle \delta x/2 \rangle}{\delta x/2}$

Standard limit

$\lim_{\delta x \to 0} \frac{\delta y}{\delta x} = \lim_{\delta x \to 0} -\sin \langle x + \delta x/2 \rangle \frac{\sin \langle \delta x/2 \rangle}{\delta x/2}$

$= -\sin \langle x + 0 \rangle$

$= -\sin x$

$\therefore dy/dx = -\sin x$

9 Find dy/dx of $y = x^2 \cos 2x e^{4x}$

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

Find loge of both sides

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

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

Differentiate both sides wrt x

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

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

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

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

Multiply both sides by y

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

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

$$\therefore \frac{dy}{dx} = x^2\cos 2x e^{4x}\left\{\frac{x}{2} + \cot 2x + 1\right\}$$

10 Given that $y = \sin\{3x^3 + 5\}$ - Find the derivate of y

$y = \sin\{3x^3+5\}$

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

$\Rightarrow y = \sin u$; $dy/du = \cos u$

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

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

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

but $u = 3x^3 + 5$

$$\frac{dy}{dx} = 9x^2\cos\{3x^3+5\}$$

$\therefore$ the derivate of y is $\frac{dy}{dx} = 9x^2\cos\{3x^3+5\}$

2 If $k = \ln V$, differentiate k.

$k = \ln V$

Let $k = y$ & $V = x$

$y = \ln x$

Recall in logarithmic form

$y = \ln x$; $y = \log_e x$

$x = e^y$

So that;

$y = \ln \{x\}$ can be written as

$e^y = x$

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

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

When x is differiantiated its gives 1

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

Recall $e^y = x$

~~Sub~~

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

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

8 Find dy/dx of $y = 3t^2$ and $x = 1/t^2$

$y = 3t^2$; $dy/dt = 6t$

$x = 1/t^2$; $dx/dt = -2t/t^4$

Hence,

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

$= \cancel{6t}^{3} \times \frac{t^4}{-\cancel{2t}}$

$= -3t^4$

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

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

Let $p = y$ & $t = x$

If $y = \sin^{-1}x = \arcsin\langle x \rangle$

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

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

$x = \sin y$

Differentiating both sides

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

but we want dy/dx, therefore $dy/dx = 1/\cos y$

Recall,

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

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

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

but $\sin y = x \Rightarrow \sin^2 y = x^2$

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

Hence,

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

$\cancel{\frac{dy}{dx} =}$ but $y = p$ and $t = x$

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