NAME: JARIKAT OSHIAHEOVO FADEYI
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DEPARTMENT: MEDICAL LABORATORY SCIENCE

1) Function $y = \frac{1}{x-7}$

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

Domain = Real numbers except $x = 2$

Co - domain = Real numbers except $y = 0$

~~2)~~

2) If $k = \ln v$, differentiate k

Soln

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

3) Express y as an explicit function of x. if

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

$2x - 2 = 3y$

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

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

$x^2 - 4 = y^2$

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

FARIKAF OFFIENEOVO FADEH
MEDICAL LABORATORY SCI
100 LVL

1) If $P = \sin^{-1} t$, find the derivative of P

$P = t \mid \sin$

$t = \sin p \quad \ldots\ldots (1)$

Recall that $\sin^2 P + \cos^2 y = 1 \quad \ldots\ldots (2)$

dt/dp of $(1) = \cos P$

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

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

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

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

$dt/dp = \cos P = \sqrt{(t+t)^2}$

$\therefore\ dP/dt = \dfrac{1}{\sqrt{1-t^2}}$

5) $f(x) = 2x^2 - 5$, $g(x) = 4x - 2$ find $fog(x)$ and $gof(x)$

soln

a) $(fog)x = f[g(x)]$

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

$g(x) = 4x - 2$

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

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

$= (8x-4)^2 - 5$

$= 64x^2 - 32x - 32x + 16 - 5$

$= 64x^2 - 64 + 11$

b) $(gof)x$

$g[f(x)] = g(2x^2 - 5)$

$= 4x - 2[2x^2 - 5)$

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

$= [8x^2 - 20] - 2$

$= 8x^2 - 20 - 2$

$= 8x^2 - 22$

b) $f(x) = 3x^2 - 2x + 1 = 0$, Show that $f_e(x) + f_o(x) = f(x)$

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

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

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

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

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

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

$$\therefore f_e(x) = 3x^2 + 1$$

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

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

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

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

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

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

7) $y = \cos x$ from 1st principle

$y = \cos x$

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

Subtract y from both sides

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

but $y = \cos x$

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

Consider from trigonometry

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

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

$\cos(A+B) - \cos[A-B] = 2\sin A \sin B \ldots 2$

Compare [A] and [2]

Let $A+B = x + \delta x$ ------ (i)

$A - B = x$ ------ (ii)

adding (i) and (ii)

$2A = 2x + \delta x$

$A = \frac{2x+\delta x}{2} \Rightarrow A = x + \frac{\delta x}{2}$ ------ (3)

Substitute eqn (3) in eqn (2)

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

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

Compare eqn (1) and (2)

$\cos[x+\delta x] - \cos x = -2\sin[x + \delta x/2] \sin[\delta x$

$\therefore \delta y = -2\sin[x + \delta x/2] \sin[\delta x/2]$

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

Compare eqn (1) and (2)

$$\cos[x + \delta x] - \cos x = -2\sin[x + \delta x/2]\sin[\delta x/2]$$

$$\therefore \delta y = -2\sin[x + \delta x/2]\sin[\delta x/2]$$

$$\frac{\delta y}{\delta x} = \frac{-2\sin[x + \delta x/2]\sin[\delta x/2]}{\delta x}$$

$$\frac{\delta y}{\delta x} = -\sin[x + \delta x/2]\sin[\delta x/2]$$

$$\delta y/\delta x = -\sin[x + \delta x/2]\frac{\sin[\delta x/2]}{\delta x/2}$$

A standard limit

$$\lim = \frac{\sin[\delta x/2]}{\delta x/2} = 1$$

Find the limit of A as $\delta x \to 0$

$$\lim_{\delta x \to 0}\frac{\delta y}{\delta x} = \lim -\sin(x + \delta x/2)\frac{\sin[\delta x/2]}{\delta x/2}$$

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

$$= -\sin x$$

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

8) $y = 3t^2 \quad x = 1 - t^2$

Soln

$$\frac{dx}{dt} = -2t \quad dy/dt = 6t$$

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

$$= \frac{6t}{-2t}$$

$$= -3t$$

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

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

Using the product rule

$dy/dx = V \, du/dx + U \, dv/dx$

Let $U = x^2$ and $V = \cos 2xe^{4x}$

$du/dx = 2x$

$V = \cos (2xe^{4x})$

Using the chain rule $dy/dx = du/dx \times dy/dx$

$U = 2x^4$ and $y = \cos Y$

$du/dx = 2 \times 4 \times e^{4x}$ and $y = -\sin U$

$= 8e^{4x}$ and $y = -\sin \phi$

$dv/dx = 8e^{4x} \times -\sin (2xe^{4x})$

$= -8e^{4x} \sin (2xe^{4x})$

$dy/dx = \cos (2xe^{4x}) \times 2x + x^2 \times -8e^{4x} \sin (2xe^{2y})$

$= 2x \cos (2xe^{4x}) + -8x^2 e^{4y} \sin (2xe^{4x})$

JARIKRE OGHENEOVO JADEN

100 LVL

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

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

$y = \sin x$ $\qquad dy/du = \cos u$

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

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

$= 9x^2 \cos u$

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