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DEPT: Medical Laboratory Science
MATRIC: 19/MHS06/024

1) funct. $y = \frac{1}{x-2}$

Soln
The function is defined for all real numbers except $x = 2$
Domain = Real numbers except $x = 2$
Co-Domain - Real number except $y = 0$

2) if $k = \ln v$ differentiate K

$\frac{d}{dk}[\ln v] = \frac{1}{v}$

3(a)

$2x - 3y - 2 = 0$
$2x - 2 = 3y$
$y = \frac{2x + 3}{3}$

3(b)

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

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

$P = t/\sin$
$t = \sin P$ -- (1)
Recall that: $\sin^2 P + \cos^2 y = 1$ -- (2)
dt/dp of (1) $= \cos P$

find (2) $\sin^2 P + \cos^2 P = 1$
$\cos^2 t = 1 - \sin^2 P$
$\cos P = \sqrt{1 - \sin P}$
$\cos P = \sqrt{1 - t^2}$
$\frac{dt}{dp} = \cos P = \sqrt{1 - t^2}$
$dP/dt = \frac{1}{\sqrt{1-t^2}}$

5) $(fog)x = f(g(x))$
$f(x) = 2x^2 - 5$
$g(x) = 4x - 2$
$f(gx) = f(4x - 2)$
$= 2(4x - 2)^2 - 5$
$= (8x - 4)^2 - 5$
$= 64x^2 - 32x - 32x + 16 - 5$

(b) $g(fx) = g(2x^2 - 5)$
$= 4x - 2[2x^2 - 5)$
$= 4[2x^2 - 5] - 2$
$= [8x^2 - 20] - 2$
$= 8x^2 - 20 - 2$
$= 8x^2 - 22$

6. $f(x) = 3x^2 - 2x + 1 = 0$, show that $f_e(x) + f_o(x)$

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

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

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

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

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

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

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

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

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

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

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

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

$$= \underline{\underline{3x^2 - 2x + 1}}$$

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

Question 7

$y = \cos x$

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

Substract 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 Trig

$\cos[A + B] = \cos A \cos B \sin A \sin B$

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

$\cos[A + B] - \cos[A - B] = -2\sin A \sin B$ --- **

compare * and **

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 equ (3) and (2)

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

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

Compare eqn (*) and 2(x)

$\cos\{x + \delta x) - \cos x = -2\sin\left[x + \delta x/2\right] \sin\left[\delta x/2\right]$

$\therefore \delta y = -2\sin\left[x + \delta x/2\right] \sin(\delta x/2)$

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

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

$$\frac{\delta y}{\delta x} = -\sin\left[x + \delta x/2\right] \frac{\sin(\delta x/2)}{\delta x/2} \quad \text{---- (4)}$$

A Standard limit

$$\lim_{\delta x \to 0} = \frac{\sin\left[\delta x/2\right]}{\delta x/2} = 1$$

find limit of 4 as $\delta x \to 0$

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

$= 2\sin\{x + 0\} - 1$

$= -\sin x$

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

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

$y = x^2 \cos(2xe)$

using the Product rule

$\frac{dy}{dx} = v\frac{du}{dx} + u\frac{dv}{dx}$

let $u = x^2$ and $v = \cos 2xe^{4x}$

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

using the chain rule

$u = 2xe$ and $y = \cos u$

$du/dx = 2x4xe^{4x}$ and $y = \sin u$

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

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

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

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

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

10 $y = \sin[3x^2 + 5]$

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

$u = 3x^2 + 5 \quad y = \sin y$

$= 6x \quad y = \cos y$

$dy/dx = 6x \cos y$

$= 6x \cos y$

Since $y = 8x^2 + 5$

$dy/dx = 6x \cos(3x + 5$