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19/mhs11/098 pharmacy
MAT104 Assignment

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

- The function is defined for all real numbers except $x=2$
- domain is a set of real numbers except $x=2$.
- Codomain is a set of real numbers except $y=0$.

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

$$\frac{d}{dx}(\ln V) = \frac{1}{V}.$$

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

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

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

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

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

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

8) find $\frac{dy}{dx}$ if $y = 3t^2$; $x = \frac{1}{t^2}$

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

$y = 3t^2$; $\frac{dy}{dt} = 6t$.

$x = \frac{1}{t^2}$, $\frac{dx}{dt} = -2t$.

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

$$\frac{dy}{dx} = -3t$$

4) If $p = \sin^{-1} t$ find the deriviate of p.

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

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

$p = \frac{t}{\sin}$

$t = \sin p$ — — — (1)

differentiating both sides.

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

but we want to dp/dt ∴

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

recall

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

$\cos^2 p = 1 - \sin^2 p.$

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

but $\sin p = t$; $\sin^2 p = t^2.$

∴ $\cos p = \sqrt{1-t^2}.$

hence

$$\frac{dp}{dt} = \frac{1}{\cos p} = \frac{1}{\sqrt{1-t^2}}.$$

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

- $(fog)x = f(g(x))$.

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

$(4x-2)^2 = ((4x-2)(4x-2)) = 16x^2 - 8x$

$16x^2 - 8x + 4.$

- $f(g) = 2g^2 - 5.$

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

$f(g) = 2(16x^2 - \cancel{16x} + 4) - 5$

$f(g) = 32x^2 - 32x + 8 - 5$

$fog(x) = 32x^2 - 32x + 3$

$(4x-2)(4x-2)$

$16x^2 - 8x - 8x +$

$16x^2 - 16x + 4$

- $gof(x) = g(f)$

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

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

$g(f) = 8x^2 - 20 - 2 ; = 8x - 22.$

∴ $g(f) = 8x - 22$

6) if $f(x) = 3x^2 - 2x + 1 = 0$ show $fe(x) + fo(x) = f(x)$.

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

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

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

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

$$fe(x) = \frac{6x^2 + 2}{2}.$$

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

$fe(x) = 3x^2 + 1.$

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

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

$$fo(x) = \cancel{3x^2} \quad \frac{-4x}{2} = -2x.$$

$fo(x) = -2x.$

$\therefore f(x) = fe(x) + fo(x)$

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

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

i) diff $y = \cos x$ from first principle.

$y = \cos x.$

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

substract y from both sides.

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

consider from trig.

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

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

$-2\sin A \sin B$ --- (ii).

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

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

$$A + B = x + \delta x$$
$$+ \quad A - B = x$$
$$2A = 2x + \delta x$$
$$A = \frac{2x + \delta x}{2}$$
$$A = x + \frac{\delta x}{2} \quad --- (iii)$$
$$B = \frac{\delta x}{2}$$

compare (i) & (ii).

$$\cos(x+\delta x) - \cos x = -2\sin\left(x + \frac{\delta x}{2}\right) \sin\left(\frac{\delta x}{2}\right)$$

$$\therefore \delta y = -2\sin\left(x + \frac{\delta x}{2}\right) \sin\left(\frac{\delta x}{2}\right)$$

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

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

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

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

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

$$\frac{dy}{dx} = -\sin x$$

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

taking $\log_e$ of both sides.

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

differentiating both wrt x.

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

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

multiply both sidas by y.

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

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

8) find dy/dx if $y = 3t^2$; $x = 1/t^2$

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

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

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

$$\frac{dy}{dx} = \frac{6t}{-2t} \ ; \ \frac{dy}{dx} = -3t$$

10) $y = \sin(3x^3 + 5)$ find the deriviate of y'

let $u = (3x^3 + 5)$ $du/dx = 9x^2$

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

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

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

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