MATH 104 ASSIGNMENT 8/4/20

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① $y = 1/x-2$

* The function is defined for all real number except $x = 2$
* The domain is the set of real numbers except $x = 2$
* The co domain or the set of real numbers except $y=0$

②

$k = \ln v$

$\frac{dk}{dv} = \frac{1}{v}$

③ a

$2x - 3y - 2 = 0$

$-3y = 2 - 2x$

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

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

ⓑ

$x^2 + y^2 = 4$

$y^2 = 4 - x^2$

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

④

Find the dP/dt, $P = \sin^{-1} t$

$P = \frac{t}{\sin}$; $t = \sin p$ *

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

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

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

$t = \sin p$

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

Hence, $dP/dt = 1/(1-t^2)$

$$\boxed{\frac{dp}{dt} = \frac{1}{(1-t^2)}}$$

(5)

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

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

$= 2(16x^2 - 16x + 4) - 5$

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

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

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

$= 8x^2 - 20 - 2$

$= 8x^2 - 22$

(6)

Show that $f(x) + fe(x)$

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

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

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

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

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

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

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

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

$f(x) + fe(x) = 3x^2$

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

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

(7)

Differentiate $y = \cos x$

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

$dy = \cos(x + dx) - \cos x$

$[y = \cos x]$ — *

From;

$\cos(A+B) - \cos(A-B) = -2 \sin A \sin B$ — (i)

comparing (*) and (i)

$A + B = x + dx$ — (ii)

$A - B = x$ — (iii)

Adding (ii) & (iii) & subtracting (ii) & (iii)

$2A = 2x + dx$ &

$\boxed{B = dx/2}$ $\boxed{A = x + dx/2}$

comparing (*) & (i)

$dy = \cos(x + dx) - \cos x$

$= 2 \sin\left(x + \frac{dx}{2}\right) \sin\left(\frac{dx}{2}\right)$

Dividing through by dx

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

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

$$-\sin(x+dx/2)\times\frac{\sin(dx/2)}{dx/2}$$

Taking $\lim dx \to 0$

$$\lim_{dx \to 0} \frac{\sin dx/2}{dx/2} = 1$$

$$\frac{dy}{dx} = -\sin\left(x+\frac{dx}{2}\right)\times 1$$

$dx = 0$

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

(8)

$y = 3t^2 \qquad x = 1/t^2$

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

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

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

$$\frac{dy}{x} = 6t \div \frac{-2}{t^3}$$

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

$$6 \times \frac{-2}{t^2} = \frac{-12}{t^2}$$

(9)

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

Taking $\log_e$ of both side

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

Differentating both side with x

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

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

multiplying both sides by y

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

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

10

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

let $u = 3x^3+5$

$\frac{dy}{du} = \cos u$

$\frac{du}{dx} = dx^2$

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

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

$= 9x^2 \cos u$

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