MAT 104

8/4/20

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Pharmacy
(a) M/15/4/029

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

- The function is defined for all real numbers except $x = 2$
- The domain is the set of real numbers expect $x = 2$
- The codomain of the set of real numbers expect $y = 0$

2) $h = \ln v$

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

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

$-3y = 2 - 2x$

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

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

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

$y^2 = 4 - x^2$

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

4) Find dp/dt, $p = \sin^{-1} t$

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

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

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

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

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

Hence, $dp/dt = 1/\sqrt{1-t^2}$

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

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

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

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

$3x^2 + 2x + 1$

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

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

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

$= -4x/2 = -2x$

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

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

7) Differentiate $y = \cos x$

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

$\delta y = \cos(x + \delta x) - \cos x \quad - (1)$

Recall

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

Comparing (1) & (2)

$A + B = x + \delta x \quad -(3)$

$A - B = x \quad - 4$

Adding (3) + (4) & Subtracting (3) & (4)

$2A = 2x + \delta x \qquad \& \quad \boxed{B = \delta x/2}$

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

Comparing (1) & (2)

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

$2\sin(x + \delta x/2)\ \sin(\delta x/2)$

Dividing through by δx

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

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

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

Taking limit $\delta x \to 0$

$$\lim_{\delta x \to} \frac{\sin \delta x/2}{\delta x/2} = 1$$

$$\delta y/\delta x = \sin\left(x + 0/2\right) \times 1$$

$$\delta y/\delta x = -\sin\left(x + 0/2\right) \times 1$$

$$\delta y/\delta x = -\sin x$$

8 $y = 3t^2, \quad x = 1/t^2$

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

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

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

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

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

$\frac{-12}{t^2}$

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

sin

Taking $\log_e$ of both sides

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

multiplying both sides by y

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

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

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

let $u = 3x^3 + 5$

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

$\frac{du}{dx} = 9x^2$

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

$\cos u \times 9x^2$

$9x^2 \cos u$

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