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PHARMACY
19/MHS11/123 MAT104

1. $y = 1/(2x-2)$
- The function is defined for all real numbers except $x=2$
- The codomain is all real numbers except 0.

2. If $k = \ln V$ Differentiate k
$\frac{dk}{dv} = \frac{1}{V}$

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

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

4. If $p = \sin^{-1} t$, find the derivative
$p = \frac{t}{\sin}$; $t = \sin p$
$dt/dp = \cos p$; $\frac{dp}{dt} = \frac{1}{\cos p}$
Recall, $\cos^2 y + \sin^2 y = 1$
$\cos y = \pm\sqrt{1+\sin^2 y}$
$t = \sin p$
$\cos p = \sqrt{1-t^2}$
Hence $dp/dt = \frac{1}{(1-t^2)}$

5. $f(x) = 2x^2 - 5$ and $g(x) = 4x - 2$. find $fog(x)$ and $gof(x)$
$fog(x) = 2(4x-2)^2 - 5$
$= 2(16x^2 - 16x + 4) - 5$
$= 32x^2 - 32x + 8 - 5$
$= 32x^2 - 32x + 3$

$gof(x) = 4(4x^2 - 5) - 2$
$= 8x^2 - 20 - 2$
$= 8x^2 - 22$

6) If $f(x) = 3x^2 - 2x + 1 = 0$
Show that $f_e(x) + f_o(x) = f(x)$
$f(x) = 3x^2 - 2x + 1$
$f_e(x) \; f(x) + f(-x)/2$
$f(-x) = 3(-x)^2 - 2(-x) + 1$
$= 3x^2 + 2x + 1$
$f_e(x) = \frac{3x^2 - 2x + 1 + (3x^2 + 2x + 1)}{2}$
$= 6x^2 + 2/2 = 3x^2 + 1$
$f_o(x) = 3x^2 - 2x + 1 - (3x^2 + 2x + 1)$
$= \frac{-4x}{2} = 2x$
$f_e(x) + f_o(x) = 3x^2 + 1 - 2 - 2x$
$= 3x^2 - 2x + 1$

7) Differentiate $y = \cos x$
$y + \delta y = \cos(x + \delta x)$ subtract y from both sides
$\delta y = \cos(x + \delta x) - y$
where $y = \cos x$
$\delta y = \cos(x + \delta x) - \cos x$ — (*)
consider from trig
$\cos(A + B) = \cos A \cos B - \sin A \sin B$
$\cos(A \pm B) = \cos A \cos B + \sin A \sin B$
$\cos(A+B) - \cos(A-B) = 2\sin A \sin B$ (**)

Compare (A) and (2*)

Let $A+B = x+\delta x$ — (1)

$A-B = x$ — (2)

adding (1) and (2)

$2A = 2x+\delta x$

$A = 2x+\delta x/2$

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

$B = \frac{\delta x}{2}$ — (3*)

Comparing (*) and (2*)

$\cos(x+\delta x) - \cos x = -2\sin(x+\delta x/2)\sin(\delta x/2)$

divide through by δx

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

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

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

Taking limit $\delta x \to 0$

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

$\frac{\delta y}{dx} = -\sin(x+0)\times 1$

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

8 Find dy/dx if $y=3t^2$ and $x=1/t^2$

$y=3t^2$; $x=1/t^2$

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

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

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

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

$= 6t \times \frac{t^3}{-2} = \frac{-6x-2}{t^2} = \frac{12}{t^2}$

$dy/dx = \frac{-12}{t^2}$

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

Taking Loge both sides

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

Differentiate both with x

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

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

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 $u = 3x^3+5$

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

$dy/dx = 9x^2$

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

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

$= 9x^2\cos u$

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