Name: Richard

QUIZ 9

MATH 200

September 19, 2024

1. In this problem $y = xe^x + x^2$.

(a) $\frac{dy}{dx} = 1 \cdot e^x + xe^x + 2x = \boxed{e^x + xe^x + 2x}$

(b) $\frac{d^2y}{dx^2} = e^x + 1 \cdot e^x + xe^x + 2 = \boxed{2e^x + xe^x + 2}$

2. Find the derivative of $y = \cot\left(3x^2 + x\right)$.

$y' = \boxed{-\csc^2(3x^2+x)(6x+1)}$ (chain rule)

3. Find the derivative of $y = x^2 \cos(\pi x)$.

$y' = 2x\cos(\pi x) + x^2(-\sin(\pi x)\pi)$

$= \boxed{2x\cos(\pi x) - \pi x^2 \sin(\pi x)}$

4. Information about functions $f(x)$, $f'(x)$, $g(x)$ and $g'(x)$ is tabulated below. Let $h(x) = f\left(g(x)\right)$.

x	0	1	2	3	4	5
$f(x)$	−4	−2	0	1	1	3
$f'(x)$	2	1	1	3	5	−1
$g(x)$	8	9	5	4	0	−4
$g'(x)$	0	−1	−1	−3	−4	−4

(a) $h(2) = f(g(2)) = f(5) = \boxed{3}$

(b) $h'(2) = f'(g(2))g'(2) = f'(5)g'(2)$

$= (-1)(-1) = \boxed{1}$

(c) Find the **equation** of the tangent line to $y = h(x)$ at $(2, h(2))$. $= (2, 3)$

Point on line: $(2,3)$. Slope of line: $h'(2) = 1$.

Point-slope formula for line $y - y_0 = m(x - x_0)$

$y - 3 = 1(x-2)$

Answer $\longrightarrow$ $\boxed{y = x+1}$

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1. In this problem $y = 3x^2 + \cos(5x)$.

   (a) $\frac{dy}{dx} = 6x - \sin(5x)\cdot 5 = \boxed{6x - 5\sin(5x)}$

   (b) $\frac{d^2y}{dx^2} = 6 - 5\cos(5x)\cdot 5 = \boxed{6 - 25\cos(5x)}$

2. Find the derivative of $y = \frac{\tan(\pi x)}{x}$.

$$y' = \frac{\sec^2(\pi x)\pi \cdot x - \tan(\pi x)\cdot 1}{x^2}$$

$$= \boxed{\frac{\pi x \sec^2(\pi x) - \tan(\pi x)}{x^2}}$$

3. Find the derivative of $y = \sin\left(3x^2 + x\right)$.

$$\boxed{y' = \cos(3x^2 + x)(6x+1)}$$

4. Information about functions $f(x)$, $f'(x)$, $g(x)$ and $g'(x)$ is tabulated below. Let $h(x) = f\left(g(x)\right)$.

x	0	1	2	3	4	5
$f(x)$	−4	−2	0	1	1	3
$f'(x)$	2	1	1	3	5	−1
$g(x)$	8	9	5	4	0	−4
$g'(x)$	0	−1	−1	−3	−4	−4

   (a) $h(3) = f(g(3)) = f(4) = \boxed{1}$

   (b) $h'(3) = f'(g(3))g'(3) = f'(4)g'(3)$

   $= 5\cdot(-3) = \boxed{-15}$

   (c) Find the **equation** of the tangent line to $y = h(x)$ at $(3, h(3)) = (3, 1)$

Point on line: $(x_0, y_0) = (3, 1)$
Slope of line: $m = h'(3) = -15$
Point-slope formula for line: $y - y_0 = m(x - x_0)$

$y - 1 = -15(x - 3)$

Answer $\longrightarrow$ $\boxed{y = -15x + 46}$