

NAME & ZID:

SCORE:

1. (6 points) Prove the Product Rule, i.e., $\frac{d}{dx}(f(x)g(x)) = f'(x)g(x) + f(x)g'(x)$.

2. (6 points each) Find derivatives. Do NOT simplify your answers.

$$\frac{d}{dy} \left(\sqrt[7]{y^4} + \frac{7}{\sqrt[7]{y^4}} - 5y^6 + \frac{5}{y^6} - \sqrt[7]{2} \right) =$$

$$\frac{d}{dx} [(6 - \tan x)^5] =$$

$$\frac{d}{dx} (x^9 \cos x) =$$

$$\frac{d}{dx} \frac{\sin x}{5 + x^4} =$$

$$\frac{d}{dx} \cot(9x - x^9) =$$

$$\frac{d}{dx} \sec(x^4) =$$

$$\frac{d}{dx} [\sin^8(3x) \cos^7(4x)] =$$

3. (12 points) Find $\frac{dy}{dx}$ if $x^9 + x^5 y^6 = \sin y$.

4. (10 points) A rock thrown vertically upward from the ground at an initial velocity of 64 miles per second reaches a height of $64t - 3.2t^2$ miles in t seconds. How long does it take the rock to reach its highest point? How high does the rock go?

5. (10 points) A 6-foot man walks away from a light 18 feet high above a horizontal road. If the man has a speed of 5 feet per second, how fast does the man's shadow on the road increase?

6. (10 points) Let $f(x) = \sqrt[3]{(x-1)^2}$. Then $f'(x) = \frac{2}{3\sqrt[3]{x-1}}$. Find the maximum and minimum of $f(x)$ on the interval $[-7, 28]$.

7. (10 points) Let $f(x) = \frac{x^2 + x + 9}{x + 1}$. Then $f'(x) = \frac{(x+4)(x-2)}{(x+1)^2}$. Find the local extrema of $f(x)$, if any, and list the largest intervals on which $f(x)$ is increasing.