

Name: _____

Each problem is worth 25 points. Complete at least five problems; you may complete the seventh for extra credit. Show all your work.

1. Find

$$\frac{d}{dx} [e^{x^2} \sin^2 x]$$

2. Find a tangent to the graph of $\log_3(xy + 26) = 3^{xy}$ when $(x, y) = (-1, -1)$. (Hint: once you have an equation involving y' , substitute $(x, y) = (-1, -1)$ before solving for y' .)

3. Approximate the value of $\sqrt{7}$ using local linear approximation. Perform all arithmetic by hand, and use a graph to illustrate whether your approximation is an underestimate or an overestimate.

4. Find the tangent to the curve given in polar coordinates by $r = e^\theta$ when $(r, \theta) = (e^{\pi/2}, \frac{\pi}{2})$.

5. A mountain climber scales a steep incline with a 400% grade. Find the mountaineer's speed if she gains elevation at a rate of 15 feet per minute. (Hint: you will need to find two equations relating the relevant quantities. Use one equation to eliminate some of the variables in the other.)

6. Find

$$\frac{d}{dx} x^{\tan^{-1} x}$$

7. Find the global maximum and minimum of $f(x) = 3x^4 - 16x^3 + 6x^2 + 72x$ on $[-2, 4]$.