Exam 2

Name: _______________________

Each problem is worth 30 points. Complete at least five problems; you may complete the sixth for extra credit. Show all your work.

1. State the constant multiple rule, and prove the rule using the definition of the derivative.

2. Find \( \frac{d}{dx} \frac{\sqrt{x}}{x} \) using the definition of the derivative. Check your work using differentiation rules.
3. Approximate the slope of the graph of \( f(x) = \sin (\pi \sin (x)) \) at \( x = \pi \), and use your approximation to find a formula for the tangent line to the graph of \( f(x) \) at \( x = \pi \).

4. Find

\[
\frac{d}{dx} \sqrt{xe^x}
\]
5. Suppose the number of UT students infected with a mutant strain of the H5N1 virus $t$ weeks after delivery of an contaminated shipment of poultry is given by

$$I(t) = \frac{25,000t^2}{50 + t^2}$$

Determine when the infection is speeding up and slowing down.
6. For the function \( f(x) \) pictured below, sketch \( f'(x) \) and a possible antiderivative \( F(x) \). Justify each of your graphs by writing a sentence relating the sign, slope, and concavity of the graph of \( f(x) \) with the relevant features of your graphs.