Exam 3

Name: _____

Each problem is worth 15 points. Show all your work for full credit; numerical or graphical estimates are unacceptable unless specifically requested.

1. Find the derivative:

   (a) $\frac{\mathrm{d}}{\mathrm{d}x} \ln \tan x$

   (b) $\frac{\mathrm{d}}{\mathrm{d}x} \sin \sqrt{x}$

   (c) $\frac{\mathrm{d}}{\mathrm{d}x} e^x \cot x$

   (d) $\frac{\mathrm{d}}{\mathrm{d}x} (\csc x)^x$

2. Find y':

$$\ln(x+y) = \sin(xy)$$

3. Find the slope of the tangent line to the graph given (in polar coordinates) by $r = \theta^2$ at $\theta = \frac{\pi}{2}$.

4. State and prove the differentiation rule for $y = \sec^{-1} x$.

5. Use local linear approximation to estimate $\ln 3$. Use a graph to show whether your approximation is an overestimate or an underestimate.

6. Suppose two boats are sailing near each other. Boat A is 10 miles south and 2 miles west of boat B. Boat A is traveling east at 20 mph, and boat B is traveling north at 5 mph. Determine whether the boats are getting closer together or further apart, and how quickly.

7. Find the global minimum and global maximum of $f(x) = x^3 - 12x$ on $[0, 4]$.