SHOW ALL YOUR WORK
This includes any graphs that you obtain from your calculator. If you use a calculator to generate a graph be sure to sketch a copy on your exam paper and LABEL IT so I know what it is a graph of.

1. (10 pts.) Find the global maximum and minimum values of

\[ f(x) = e^{-x} \sqrt{x} \]

on the domain \( 0 \leq x \leq 3 \)
2. (10 pts.) If \( f(2) = -1 \) and \( f'(x) \geq -2 \) on [2, 5], estimate the value of \( f(5) \).

3. (10 pts.) Compute \( \lim_{x \to 0^+} x^2 \ln x^2 \)
4. (25 pts.) The graph of the first derivative of $f(x)$ is given at right. Use it to answer the following questions.

(a) On what intervals is $f$ increasing?

(b) On what intervals is $f$ decreasing?

(c) Where does $f$ have critical numbers?

(d) Where does $f$ have local maxima?

(e) Where does $f$ have local minima?

(f) On what intervals is $f$ concave up?

(g) On what intervals is $f$ concave down?

(h) Where does $f$ have inflection points?
5. On the axes provided below, sketch a graph of \( f \) that accurately displays all the information from Problem 4. Assume that \( f(0) = 0 \).
6. (15 pts.) The cost to make a cylindrical can (as shown at right) is $0.03/in^2 for the curved side wall, and $0.05/in^2 for the top and bottom. For a fixed volume, $V$, find the radius of the cheapest can.
7. (5 pts.) Find the ratio of height to radius in your answer to Problem 6. For full credit you must simplify your answer as far as possible.

8. (10 pts.) Use Newton’s method with initial approximation $x_0 = 0$ to find $x_2$, the second approximation of the root of $e^x - x^2 = 0$. 
9. (10 pts.) Find $f$ for which $f''(x) = \cos x + x^2$, $f'(0) = 1$, and $f(0) = 2$. 