You have 50 minutes to complete this test. You must show all work to receive full credit. Work any 6 of the following 7 problems. Clearly CROSS OUT the problem you do not wish me to grade. Each problem is worth 16 points, and you get 4 points for free, for a total of 100 points. The answers will be posted on the electronic reserves later today.

1. Find the area of the region between \( y = 3x - x^2 \) and the x-axis, from \( x = 0 \) to \( x = 4 \). Be sure to sketch a graph first!

2. Find all four second-order partial derivatives of \( f(x, y) = ye^{x} - x\ln y \). Do NOT simplify.
3. Find and classify the critical points of \( f(x, y) = x^3 - y^3 + 6xy \).

4. Suppose two products have demand equations

\[
D_1 = 500 + \frac{10}{p_1 + 2} - 5p_2 \quad \text{and} \\
D_2 = 400 - 2p_1 + \frac{7}{p_2 + 3},
\]

where \( p_1 \) and \( p_2 \) are the respective prices of the products. Are the products competitive, complementary, or neither? Give an example of two products that might behave this way.
5. Using four rectangles, estimate the area under the curve \( y = \frac{3}{x} \) between \( x = 1 \) and \( x = 7 \). Then find the exact area.

6. Calculate \( \int_{4}^{\infty} e^{-x/2} \, dx \).
7. Suppose a rectangular container with volume 288 cubic feet is to be built. If the bottom of the container costs $5 per square foot and the top and sides each cost $3 per square foot to construct, find the minimum cost of the container.