NAME_____

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 bounded by $y = x^3 - 7x^2 + 10x$ and the x-axis. Be sure to sketch a graph first!

2.   Find all four second-order partial derivatives of $f(x, y) = \ln(x^2 + y + 1)$. Do NOT simplify.

3. Find and classify the critical points of $f(x,y) = -x^3 + 4xy - 2y^2 + 1$.

4. Suppose two products have demand equations $D_1 = 2000 + \dfrac{100}{p_1 + 2} + 25p_2$ and

$D_2 = 1500 - \dfrac{p_2}{p_1 + 7}$, 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.   A company manufactures a single product at two different locations. The cost of producing x_1 units at location 1 is $C_1 = 0.02x_1^2 + 4x_1 + 500$, and the cost of producing x_2 units at location 2 is $C_2 = 0.05x_2^2 + 4x_2 + 275$. The product sells for $15 per unit. Find the quantity that should be produced at each location in order to maximize the total profit.

6.   Calculate $\displaystyle\int_4^\infty \frac{x}{\sqrt{(x^2+9)^3}}\,dx$.

7.   The sales revenue of a company is found to be related to its advertising budget according to the formula $S = 20x + y^2 + 4xy$, where x is the amount spent on radio advertising and y is the amount spent on television advertising. If the company plans to spend \$30,000 on these two means of advertising, how should that budget be allocated between the two media in order to maximize sales revenue?