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Instructions: Do all of the following questions. Show your work and explain your answers.

Question 1: (40 points) For the following function, determine the critical numbers, where the function is increasing and where decreasing, the relative minimum points, the relative maximum points, the inflection points, where the function is concave up, and where concave down.

$$f(x) = x^3 - 3x^2 - 24x + 5.$$

Question 2: (12 points) Find the absolute minimum *value* and the absolute maximum *value* for the function $f(x) = x^3 - 3x^2 - 24x + 5$.

Question 3: (14 points) Suppose that the demand equation is $x = 800 - 16p$ for $0 \leq p \leq 50$.

(a) Determine the elasticity of demand.

(b) At what price will it be true that for every 1% increase in price there will be 3% decrease in demand?

Question 4: (12 points) How much money should be invested at an annual interest rate of 5% compounded continuously to yield 4000 in 10 years?

Question 5: (10 points) let $f(x) = \frac{x^3}{3} - \frac{3x^2}{2} - 10x + 1$. Use the second derivative test to determine the nature of the relative extrema at $x = 5$ and at $x = -2$.

Question 6: (12 points) Determine two positive numbers whose product is 100 and whose sum is a minimum.

Good Luck