Mock Midterm 2B

Note: The problems on this mock midterm have not necessarily been selected to allow them to be easy to work without a calculator. The problems on the real midterm will not require the use of a calculator.

(1) Given \( g(t) = \frac{5t^2}{t^2 - 3t - 4} \).
   (a) What are the asymptotes for \( g(t) \)?
   (b) Find and classify all critical points of \( g(t) \).
   (c) Find the inflection points and intervals of concavity for \( g(t) \).
   (d) Sketch a graph of \( g(t) \). Be sure to include all important features of the graph.

(2) An environmental study for a certain community indicates that there will be \( Q(p) = p^2 + 4p + 900 \) units of a harmful pollutant in the air when the population is \( p \) thousand people. If the population is currently 50,000 and is increasing at the rate of 1500 per year, at what rate is the level of pollution increasing?

(3) When a particular commodity is priced at \( p \) dollars per unit, consumers demand \( q = \sqrt{400 - 0.01p^2} \).
   (a) Find the elasticity of demand for this commodity.
   (b) For a unit price of $120, is the demand elastic, inelastic, or of unit elasticity?

(4) Carla is a carpenter who has been hired to make a closed box with a square base and volume of 250 cubic meters. The material for the top and bottom of the box costs $2 per square meter, and the material for the sides costs $1 per square meter. Can Carla construct the box for less than $300? What is the price of the least expensive box?

(5) Suppose the total cost in dollars of manufacturing \( q \) units is \( C(q) = 3q^2 + q + 500 \).
   (a) Use marginal analysis to estimate the cost of manufacturing the 41st unit.
   (b) Compute the actual cost of manufacturing the 41st unit.