1. **(7 points)** Let us consider the graph of the function $f(x) = 2 + 3x^2 - x^3$. Answer the following questions preparatory to sketching the curve.

   (a) **(2 points)** On what intervals of x-values is the function increasing? On which intervals is it decreasing? Label which is which.

   (b) **(2 points)** At what x-values are the local extrema, and which type of local extremum is each?

   (c) **(3 points)** On what intervals of x-values is the function concave up? On which is it concave down? Label which is which. Also identify the points of inflection.

2. **(7 points)** We want to enclose a rectangular animal pasture with a fence all around the outside as well as one fence down the middle, parallel to a pair of sides of the pasture, so as to divide the enclosure into two rectangular sections. We have 900 feet of fencing to use. What dimensions for our pasture maximize its area?

3. **(6 points)** Determine the value of the following limits.

   (a) $\lim_{x \to +\infty} \frac{(\ln x)^2}{x}$

   (b) $\lim_{\theta \to 0} \frac{\cos \theta - 1}{\theta^2}$

   (c) $\lim_{t \to 0} \frac{e^t}{t \sin t + \cos t}$

4. **(2 point bonus)** An open-topped box is made from 5 rectangular pieces of cardboard. The length of the bottom of the box should be twice its width, and the box should be 36 cubic inches. What dimensions minimize the necessary quantity of cardboard?