Applications of First and Second Derivatives:

1. For each of the following determine

   a) Critical values of x
   b) open intervals where the graph is increasing and decreasing
   c) location of all relative extrema (maximum and minimum points)

   1) $f(x) = -2x^2 + 4x + 3$
   2) $f(x) = \dfrac{x^5 - 5x}{5}$
   3) $f(x) = (x-1)^2(x+2)$
   4) $f(x) = x^{\frac{2}{3}}(x-5)$

2. The concentration "C" of a certain chemical in the blood stream "t" hours after injection into muscle tissue is given by: $C = \dfrac{3t}{27 + t^3}$. When is the concentration greatest?

3. The profit "P" (in dollars) made by a fast food restaurant selling "x" hamburgers is $P = 2.44x - \dfrac{x^2}{20{,}000} - 5000, \quad 0 \le x \le 35{,}000$. Find the open intervals on which "P" is increasing or decreasing.

4. After birth, an infant normally will lose weight for a few days and then start gaining. A model for the average weight "W" (in pounds) of infants over the first two weeks following birth is: $W = 0.033t^2 - 0.3974t + 7.3032, \quad 0 \le t \le 14$ where "t" is measured in days. Find the open intervals on which "W" is increasing or decreasing.

5. Find the points of inflection of each of the following functions:
   a) $f(x) = 2x^3 - 6x^2 + 12x - 8$
   b) $f(x) = x(x-4)^3$
   c) $f(x) = x\sqrt{x+3}$

6. The deflection "D" of a particular bean of length "L" is $D = 2x^4 - 5Lx^3 + 3L^2x^2$ where "x" is the distance from one end of the beam. Find the value of "x' that yields the maximum deflection.

7. A manufacturer has determined that the total cost "C" of operating a factory is $C = 0.5x^2 + 15x + 5000$ where "x" is the number of units produced. At what level of production will the average cost per unit be minimum.