1. For the following function: \( f(x) = 2x^3 + 3x^2 - 36x + 5 \).
   
   (a) (5 points) Use the first derivative to find the intervals for increasing, decreasing, the local maximum and minimum points and values.

   Increasing in : Decreasing in: Local Max, Max values: Local Min, Min values:

   (b) (3 points) Use the second derivative to find the inflection points, the intervals for concave up, concave down.

   (c) (2 points) Use the information you get from (a) and (b) to graph the function.

2. The total revenue from the sale of \( x \) units of a product is \( R(x) = 24x - 0.5x^2 \). The total cost of producing \( x \) units is \( C(x) = x^2 + 20x + 1050 \). Find the number of units that must be produced and sold in order to yield the maximum profit.

3. Sketch the region bounded by the graph of \( y = x(1 - x) \) and the \( x \)-axis and find the area using the definite integral.

4. Evaluate each of the following integrals:

   \[
   \int (x^2 - e^{-2}) \, dx \quad \int (x - e^{0.3x}) \, dx, \quad \int_1^e (x^{-1} + x) \, dx, \quad \int_{-1}^{1} (8x^7 - 1) \, dx.
   \]

5. Find the derivative. In some cases, it may be to your advantage to simplify first.

   \( f(x) = \sqrt{x} e^{-x} \), \( f(x) = x \ln(x + 1) \), \( f(x) = (x^2 - x)(x + 1) \), \( f(x) = x \cdot 3^x \).

6. Find an antiderivative of \( e^{-3x} \).

7. An apartment complex has 80 units. When the rent is $400 per month, all units are rented. For each $10 increase in rent, one apartment unit becomes vacant. What rent should be charged to produce the maximum revenue?

8. A farmer wants to enclose three rectangular areas next to a river using 300 feet of fencing. What is the largest area that can be enclosed? (Note that the farmer doesn’t have to fence the sides next to the river and the road)