**Homework 16 (Optimization) and 17 (Implicit Differentiation)**

1. Suppose a function y is implicitly defined as a function of x via the equation.

a) Find the derivative of y using implicit differentiation.

b) What is the equation of the tangent line at the point (1, 2).

2. Find the slope of the tangent line to the graph of  at the point (1, -2), assuming that the equation defines *y* as a function of *x* implicitly.

3. Find  if , assuming that *y* is an implicitly defined function of *x*.

4. Suppose x and y are related by the equation $x^{2}+x y+y^{2}=7$

1. Assuming that y is implicitly defined as a function of x, find dy/dx
2. Assuming that x is implicitly defined as a function of y, find dx/dy
3. Assuming that both x and y are implicitly defined as functions of t, find dx/dt and dy/dt

5. Find the absolute extrema (i.e. absolute maximum and absolute minimum) for the function  on the interval [0, 2]

6. Find the absolute maximum and minimum of the function  on the interval
[0, 4]. Do the same for  on [-2, 0].

7. A liquid form of penicillin manufactured by a pharmaceutical firm is sold in bulk at a price of $200 per unit. If the total production cost (in dollars) for x units is C(x) = 500,000 + 80x + 0.003x2 and if the production capacity of the firm is at most 30,000 units in a specified time, how many units of penicillin must be manufactured and sold in that time to maximize the profit ?

8. A farmer wants to fence in a piece of land that borders on one side on a river. She has 200m of fence available and wants to get a rectangular piece of fenced-in land. One side of the property needs no fence because of the river. Find the dimensions of the rectangle that yields maximum area. (Make sure you indicate the appropriate domain for the function you want to maximize). Please state your answer in a complete sentence.

9. Find the dimensions of the rectangle of maximum area that can be inscribed in a semicircle of radius 16, if one vertex lies on the diameter.

10. An open box with a rectangular base is to be constructed from a rectangular piece of cardboard 16 inches wide and 21 inches long by cutting out a square from each corner and then bending up the sides. Find the size of the corner square which will produce a box having the largest possible volume.

