Optimization Problems- HW Problems

1. A cylindrical metal container without a top is to be made with a volume of $100 ft^3$. Find the dimensions that will minimize the cost of the metal to manufacture it.

2. Find two positive numbers so that the second number is the reciprocal of the first number and the sum of the two numbers is a minimum.

3. A rectangular box with a square base is to be made with two materials. The material for the top and four sides costs $4/ft^2$ and the material for the bottom costs $8/ft^2$. Find the dimensions of the box with greatest possible volume if you can spend $1,152.

4. Find the area of the largest rectangle that has its vertices in the first and second quadrant on the parabola $y = 9 - x^2$ and one side along the x-axis.

5. Ten feet of wire is used to form a circle and a square. How much of the wire should be used for each figure to maximize the enclosed area?

6. Find the closest point of the line $y = 2x + 5$ to (0,0).

7.   A window is constructed by adjoining a semicircle top to a rectangular bottom. Find the dimensions of maximum area if the total perimeter is 24 feet.

8.   Two particles are moving in a plane. The first particle starts at the point $(-10,0)$ and moves along the x-axis in the positive direction at 1 unit/sec. The second particle starts at $(0,5)$ and moves at 2 units/sec in the negative direction along the y-axis. Find the minimum distance between the particles for $t \geq 0$.

9.   Find the dimensions of a cylinder with the largest volume that can be inscribed inside a sphere of radius R.