Fall 2014 Math 124 Quiz Review 2

1. **Optimization:**

a. A rectangular study plot is bounded on one side by a river, and the other three sides are to be blocked off by a fence. Find the dimensions of the plot that maximizes the area enclosed with 200 meters of fence.

b. Two identical rectangular study plots are created with each region enclosing 10 m^2 of field. The two study plots are side-by-side, sharing a common boundary. Find the dimensions of each plot area that minimizes the amount of fence needed.

c. An open box with its base having a length four times its width is to be constructed with 1200 cm^2 of material. Find the dimensions that maximize the volume of this box.

d. A closed rectangular box must have 5000 cm^3 of space, and its base must have its length be twice its width. Find the dimensions of this box, which is constructed with the least amount of building material possible.

e. A right circular cylindrical container with only a bottom must have a volume of 4500 cm^3. Find the dimensions so that it is constructed with the least amount of material possible.

2. **Trigonometric definitions:** Use the definitions of sine and cosine to give your answer for the other function using only fractions with integers and square roots. The angle measurement uses your scientific calculator.

a. Let $\sin(\theta) = \frac{3}{4}$, then find $\cos(\theta)$ (not in decimal form). Also, determine the value of θ in radians (using your scientific calculator).

b. Let $\cos(\theta) = \frac{2}{7}$, then find $\sin(\theta)$ (not in decimal form). Also, determine the value of θ in radians (using your scientific calculator).

3. A damped spring-mass system has a solution of the form

$$y(t) = 12 + 7\,e^{-0.3t}\sin(5t),$$

where $y(t)$ measures the distance in centimeters from the equilibrium position and t is in seconds.

a. Determine the times when $y(t) = 12$.

b. Find the velocity of the mass by computing the derivative, $v(t) = y\,(t)$.

c. Find the times $t \geq 0$, when the mass is at its absolute maximum and absolute minimum. Also, give the maximum and minimum displacements at those times. Sketch a graph for the position of this mass for $t \in [0, \pi]$.