Math 2554 Quiz 10: $\oint$ 4.4 **Name:** _____

due: Tues 31 Mar 2015

This quiz is due at the end of drill today. You may use your brain, notes, book, other humans and any pet of your choice. Your solutions must be legible, in order, stapled, de-fringed, and with your name on the top right corner of each page. If you fail to meet any of these requirements you will receive a zero.

Remember, **answer the question** and include correct units. Your answer should include showing it is a maximum or minimum.

1. **(1 point)** Suppose an airline policy states that all baggage must be box-shaped with a sum of length, width, and height not exceeding 108 in. What are the dimensions and volume of a square-based box with the greatest volume under these conditions?

2. **(1 pt each)** A simple model for travel costs involves the cost of gasoline and the cost of a driver. Specifically, assume that gasoline costs p dollars per gallon, the vehicle gets g miles per gallon, and the driver charges w dollars per hour. Let v equal the speed of the vehicle.

   (a) A plausible function to describe how gas mileage varies with speed is
   $$g(v) = \frac{v(85 - v)}{60} \quad \text{miles per gallon.}$$
   Evaluate $g(0)$, $g(40)$, and $g(60)$ and explain why these values are reasonable.

   (b) At what speed does te gas mileage function have its maximum?

   (c) Explain why the cost of a trip of length L miles is
   $$C(v) = \frac{Lp}{g(v)} + \frac{Lw}{v} \quad \text{dollars}$$
   (where $g(v)$ is from part (a)).

   (d) Suppose $L = 400$ miles, $p = 4$ dollars per gallon, and $w = 20$ dollars per hour. At what (constant) speed should the vehicle be driven to minimize the cost of the trip?

   (e) Should the optimal speed (your answer from (d)) be increased or decreased if L is increased from 400 to 500 miles? Explain.

   (f) Should the optimal speed (your answer from (d)) be increased or decreased if p is increased from 4 dollars per gallon to 4.20 dollars per gallon?

   (g) Should the optimal speed (your answer from (d)) be increased or decreased if w is decreased from 20 dollars per hour to 15 dollar per hour?

3. **(1 point)** Find the radius and height of a cylindrical soda can with a volume of 354 cm^3 that minimizes the surface area.

4. **(1 point)** A rectangle is constructed with one side on the positive x-asix, one side on the positive y-axis, and one vertex on the line $y = 10 - 2x$. What dimensions maximize the area of the rectangle? What is the maximum area?