## Supplemental Exercises for the Related Rates Lab

### Exercise 8.1

A weather balloon is rising vertically at the rate of 10 ft/s. An observer is standing on the ground 300 ft horizontally from the point where the balloon was released. At what rate is the distance between the observer and the balloon changing when the balloon is 400 ft height?

### Exercise 8.2

Imagine a railroad-crossing gate. For purposes of this problem we are going to treat the arm of the gate as a line that pivots on the vertical pole via a round gear whose center is exactly 4 feet off the ground. The distance between the tip of the arm and the center of the gear is exactly 28 ft. When the arm is being lowered the angle of elevation of the arm decreases at a constant rate of $6^O$/sec. Find the rate at which the tip of the arm approaches the ground (vertically) at the instant the angle of elevation of the arm is $30^O$.

### Exercise 8.3

Jimbo is drinking soda from a conical cup; the radius of the cup at its top is 5 cm and the height of the cup is 10 cm. Jimbo is drinking through a straw at a constant rate of 0.25 $cm^3$/s. Assuming that the cup remains vertical whilst Jimbo drinks, find the rate of change in the height of the liquid when there are exactly 100 $cm^3$ of soda left in the cup

### Exercise 8.4

A certain snowball maintains a perfectly spherical shape as it melts; the snowball melts at a constant rate of 25 $cm^3$/min. Determine the rate at which the surface area of the snowball changes at the instant the radius of the snowball has a radius of 6 cm.

**Hint:** What quantity is measured using cubic centimeters? That quantity and the surface area are the variables for the problem.