## Calculus Worksheet #1 Unit 7

Use calculus to solve each of the following problems. Show all of your work, including an appropriate diagram, and your answer neatly organized.

1. A ten-foot ladder stands upright against a vertical wall. If the lower end of the ladder is pulled away from the wall (on level ground) at the rate of 2 feet per second (fps), then how fast is the top of the ladder coming down the wall at the instant it is 8 feet above the ground?

2. At 1:00 PM an ocean liner leaves Boston harbor and steams due east at 15 mph. At 2:00 PM on the same day a freighter leaves Boston harbor and heads due south at 10 mph. How far apart are the ships at 3:00 PM, and how fast is that distance increasing?

3. A boat is being pulled in to a wharf using a rope that passes over the edge of the wharf and is attached to the boat at a point that is 10 feet lower than the level of the wharf. If the rope is being pulled in at 0.5 feet per second, then how fast is the boat moving when there are 26 feet of rope between the wharf and the boat?

4. A light one mile off a straight shore rotates once every two minutes. How fast is the beam of light moving along the shore the instant it makes an angle of 30 degrees with the shore? (Express your final answer in feet per second.)

5. An airplane traveling at 100 meters per second at an altitude of 2000 meters flies directly overhead. How fast is the angle of elevation to the plane changing 1 minute later? (Express your final answer in degrees per second.)

6. A conical reservoir with its axis vertical is 12 feet deep and also 12 feet across the top. If water is being added at the rate of 3 cubic feet per second ( $ft^3/s$ ), then how fast is the water rising the instant it is 4 feet deep? (Express your final answer in inches per second.)

7. A light is on the ground, 50 feet from a wall. A boy who is five feet tall walks from the light toward the wall at 5 fps. How fast is the height of his shadow decreasing when he is 10 feet from the light?

8. Air is being blown into a spherical balloon at the rate of 10 cubic inches per second. How fast are the radius and the surface area increasing at the instant the radius is 4 inches?