

Calculus Worksheet #3 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 20-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 angle between the ladder and the wall increasing at the instant the top of the ladder is 16 feet above the ground? (Express your answer in degrees per second rounded to 2 significant figures.)
2. A ship leaves port at 10 AM and sails at a constant speed of 8 mph on a heading of 0° (due north). At 12 noon it turns to a new heading of 60° (60° east of north) still moving at a speed of 8 mph. How fast is the distance between the ship and its starting point changing at 1 PM?
3. A boat is being pulled in to a dock using a rope that passes over the edge of the dock and is attached to the boat at a point that is 12 feet lower than the level of the dock. If the rope is being pulled in at 5 feet per second, then how fast is the boat moving when there are 50 feet of rope between the dock and the boat?
4. A conical reservoir with its axis vertical is 40 feet deep and 20 feet across the top. If water is being added at the rate of 20 cubic feet per minute, then how fast is the water rising the instant it is 5 feet deep? (Express your final answer in inches per second rounded to 2 significant digits.)
5. A light is on the ground, 25 feet from a wall. A girl who is five feet tall walks from the light toward the wall at 4 fps. How fast is the height of her shadow decreasing when she is 15 feet from the light?
6. Air is being pumped into a spherical balloon at 8 cubic inches per second. How fast are the radius and the surface area increasing at the instant the radius is 3 inches?
7. One leg of a right triangle is 10 inches long and the other leg is 4 inches long. If the length of the shorter leg is increasing at the rate of 0.6 inches per second, while the length of the longer leg remains the same, then how fast is the length of the hypotenuse increasing after 5 seconds?
8. One leg of a right triangle is 10 cm long and the other leg is 6 cm long. If the length of the longer leg is increasing at the rate of 1.4 cm per second, while the length of the shorter leg is increasing at the rate of 1.2 cm per second, then how fast is the area of the triangle increasing after 10 seconds?