AP Calculus Name _____

3.7 Related Rates – Worksheet

Read each problem carefully. Show your work in an organized manner…as shown during class. Make sure that you are putting units on your answers.

1) A point is moving along the graph of the function $y = x^2 + 1$ such that $\frac{dx}{dt}$ is 2 centimeters per second. Find $\frac{dy}{dt}$ when $x = -1$.

2) The radius r of a circle is increasing at a rate of 3 centimeters per minute. Find the rate of change of the area when the radius is 6 centimeters.

3) The radius r of a sphere is increasing at a rate of 2 inches per minute. Find the rate of change of the volume when the radius is 24 inches.

4) A spherical balloon is inflated with gas at the rate of 800 cubic centimeters per minute. How fast is the radius of the balloon increasing at the instant the radius is 30 centimeters.

5) All edges of a cube are expanding at a rate of 3 centimeters per second. When the edge is 10 centimeters, find the rate of change of the following:

a) The volume of the cube

b) The surface area of the cube

6) A rock is thrown into a still pond and causes a circular ripple. If the radius of the ripple is increasing at a rate of 4 ft/sec, at what speed is the area of the ripple increasing when its radius is 2 feet?

7) A ladder 25 feet long is leaning against the wall of a house. The base of the ladder is pulled away from the wall at a rate of 2 feet per second.

a) How fast is the top of the ladder moving down the wall when its base is 7 feet from the wall?

b) Consider the triangle formed by the side of the house, the ladder, and the ground. Find the rate at which the area of the triangle is changing when the base of the ladder is 7 feet from the wall.

8) A 5 foot ladder is leaning against a wall. If the foot of the ladder is sliding away from the wall at a rate of 8 ft/sec, at what speed is the top of the ladder falling when the foot of the ladder is 4 feet away from the base of the wall?

9) Two cyclist leave simultaneously from WHS. One travels north at 12 mph, the other travels east at 16 mph. Determine the rate at which the distance between them is changing after 2 hours of riding.

10) The formula for the volume of a cone is $V = \frac{1}{3}\pi r^2 h$. Find the rate of change of volume when the radius is 6 inches given that $\frac{dr}{dt}$ is 2 inches per minute and h = 3r.

11) At a sand and gravel plant, sand is falling off a conveyor and onto a conical pile at a rate of 10 cubic feet per minute. The diameter of the base of the cone is approximately three times the altitude. At what rate is the height of the pile changing when the pile is 15 feet high?

12) A conical tank (with vertex down) is 10 feet across the top and 12 feet deep. If water is flowing into the tank at a rate of 10 cubic feet per minute, find the rate of change of the depth of the water when the water is 8 feet deep.

13) The length L of a rectangle is decreasing at a rate of 2 meters per second, while the width W is increasing at a rate of 2 meters per second. When L = 10 meters and W = 2 meters, find the rate of change of the following:

a) The area of the rectangle

b) The perimeter of the rectangle