Math 105, Fall 2013

Worksheet 8, Tuesday, November 5, 2013

Reminder: This worksheet is a chance for you not to just *do* the problems, but rather *understand* the problems. Please discuss ideas with your partners. Your solutions should be focused moreso on presentation than on numerical values. For your Related Rates problems, you should double-check if your answer *makes sense*. If your quantity is decreasing or shrinking, then you should get a negative rate of change. (Why?) If your quantity is increasing or growing, then you should get a positive rate of change. (Why?)

Position-Velocity Problems

1. A stone is dropped from a bridge that is 576 feet above a river. The stone's position above the water is given in feet at time t by $s(t) = -16t^2 + 576$.
   - How long does it take for the stone to impact the water (fixed at position 0 here)?
   - What is the stone's velocity when it impacts the water?

2. Suppose a falling ball's position is given by $s(t) = 256 - 16t^2$ feet at t seconds.
   - What is the ball's initial position above the ground?
   - Find the average velocity of the ball during the initial two seconds of its drop.
   - Find the velocity at 2 seconds and 3 seconds respectively.
   - How much time passed before the ball hit the ground?
   - What was the ball's velocity when it hit the ground?
   - Finally, find the ball's acceleration at 3 seconds.

Related Rates: For the following problems I expect you to follow the guidelines set in class. You must show your work outlined as follows, with full labelling:

- Diagram
- Variables
- Given Information
- Equation relating variables
- Differentiate
- Substitute (given information)
- Solve (for desired quantity or rate)
- Answer the original questions (in words)

3. Suppose a snowball remains spherical while it melts with the radius shrinking at one inch per hour. How fast is the volume of the snowball decreasing when the radius is 2 inches?

4. An oil spill occurs at sea. The oil gushes out from an offshore derrick and forms a circle whose area increases at a rate of 100 ft^2/min. how fast is the radius of the spill icreasing when the spill is 20 feet across the entire diameter?

5. The sides of a rectangle change with respect to time. The width is increasing at a rate of 2 in/sec. while the length is descreasing at a rate of 3 in/sec. How fast is the area of the rectangle changing when the width is 6 inches and the length is 8 inches?

6. A box has a square base, and its height is always 10 inches. If the edge of the base is increasing at a rate of 2 in/min, how fast is the volume of the box increasing when the edge is 8 inches?

7. A conical tank, 14 feet across the entire top and 12 feet deep, is leaking water. The radius of the water level is decreasing at the rate of 2 feet per minute. How fast is the water leaking out of the tank when the radius of the water level is 2 feet?

   *** Recall the volume of the cone is given by $V = \frac{1}{3}\pi r^2 h$.

8. The top of a ten foot ladder is sliding down a vertical wall at the rate of one foot every second. How fast is distance between the bottom of the ladder and the wall changing when the top of the ladder is three feet above the ground?

9. A kite starts flying 300 feet directly above the ground. The kite is being blown horizontally at 10 feet per second. When the kite has blown horizontally for 40 seconds, how fast is the string running out?

Turn in your own solutions.