Math 130 Day 25

Office Hours (LN 301/301.5): M 3:30-4:30, Tu 11:00-1:00, W 12:15-1:15, F 1:30-2:30. Other times by appointment. **Math Intern:** Sun through Thurs: 3:00–6:00, 7:00–10:00pm. **Website:** Use the links at the course homepage on **Canvas** or go to my course Webpage: `http://math.hws.edu/~mitchell/Math130F16/index.html`.

Practice

Today we will work on Related Rates problems. These are interesting applications of implicit differentiation.

1. a) **Read** Chapter 3.11 and the online notes about related rates.

b) Try problems page 227ff #5, 9, 12(ans $-.5/(3\times 12^2) \approx -0.00116$ ft/s, 13, 15(the question is saying that $dV/dt = k\cdot 4\pi r^2$ for some constant k), 23, 27 (you want dV/dt), 33.

c) **Read ahead in Section 4.1**. There is a lot of technical material in this chapter, lots of terms with which to become familiar, so read carefully.

d) From your reading in Chapter 4.1, can you define absolute max? Local min?

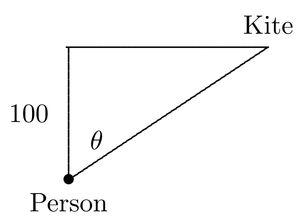
2. Finish any problems below we don't complete in class. These are all done in detail in the online notes.

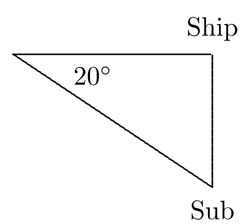
Class Work: Related Rates

1. **Example 1**. Two students finish a conversation and walk away from each other in perpendicular directions. If one person walks at 4ft/sec and the other at 3ft/sec, how fast is the distance between the two changing at time $t = 10$ sec?

2. **Example 2**. In warm weather, the radius of a snowman's abdomen decreases at 2cm/hr. How fast is the volume changing when the radius of the abdomen is 80cm?

3. **Example 3**. A kite 100 feet above the ground moves horizontally at a rate of 8ft/s. At what rate is the angle between the string and the vertical direction changing when 200 ft of string have been let out? Hint: Let x denote the horizontal side opposite θ. Use trig to relate θ and x.





4. **Example 4**. As you walk away from a 20 foot high lamppost, the length of your shadow changes. If you are 6 feet tall and walking at 3ft/sec, at what rate is the length of your shadow changing?

5. **Example 5**. A surface ship is moving in a straight line at 10 km/hr. An enemy sub maintains a position directly below the ship while diving at an angle of 20°. to the surface. How fast is the sub moving?

6. **Example 6**. An ice block (draw and label a diagram) with a square base is melting in the sun at a steady rate of 48 cm^3/hr. If the height is decreasing at a rate of 0.5 cm/hr, how fast is the surface area of the block changing at the same moment?

Over

Math 130. Hand In Monday: Name: ________________________

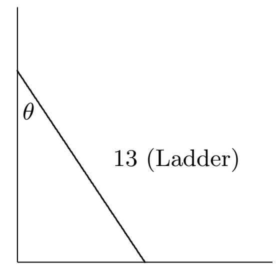
These problems will be assigned again on Friday.

0. Work on WeBWorK set Day 25. Seven Problems. Due Sunday night.

1. a) [WeBWorK #2] In an animated cartoon, a box with a square base is "growing" so that its height is increasing at 2 cm/s and its bottom edges are increasing at 3 cm/s. Determine how the volume of the box is changing when the height is 8 cm and the edge length is 5 cm. **Label each step as we did in class.**

b) How is the surface area of the box changing? **Label each step as we did in class.**

2. a) [WeBWorK #4] The bottom of a ladder is sliding away from a wall at 2 ft/s. The ladder is 13 ft tall. How fast is the top of the ladder moving down the wall when the bottom of the ladder is 5 feet away from the wall. **Label each step as we did in class.**

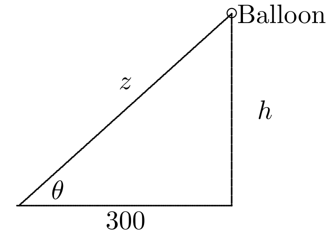


b) If θ is the angle between the ladder and the wall, how is θ changing at the same moment?

3. Page 228 #20. Similar to Classwork Example 5 on page 1 (also done in the online notes—look at them for guidance). Draw the triangle. Just do the first part: Determine how the height (altitude) of the triangle is changing.

4. Page 228 #26. Same ideas as in Classwork Example 1 (also done in online notes). Draw the triangle. You know how the legs are changing, find how the hypotenuse is changing, in general. Then find how it is changing at 1 second (you can determine the lengths of the legs at this time).

5. Page 229 #34. Use the same ideas as the Classwork Example 3 kite problem (also in online notes).



6. a) [WeBWorK #7] Gravel is being dumped from a conveyor belt at a rate of 50 cubic feet per minute. It forms a pile in the shape of a right circular cone whose base diameter (watch out: what about the radius?) and height are always the same. How fast is the height of the pile increasing when the pile is 20 feet high? Recall that the volume of a right circular cone with height h and radius of the base r is given by $V = \frac{\pi}{3}r^2h$. Hint: Write the volume in terms of the height only by using the relation between the height and the radius.