Math 135: Intermediate Algebra Worksheet 4 October 18, 2007

- 1. Interpolation and extrapolation are common techniques in many areas of science. The idea is that we measure some quantity at a few points. Then we find a line that connects those points and use it to predict the results of other measurements.
 - (a) A chemist is measuring how a metal expands when it is heated. At a temperature of 15° C, she measures the density of the metal to be 8 grams/cm³. As a temperature of 75° C, the density is 6 grams/cm³. On a graph of density versus temperature, plot these points and draw a line connecting them.
 - (b) Find the slope of the line between two points.
 - (c) Find the equation of the line connecting the points.
 - (d) The chemist wants to know what the density will be at 50° C. Find the density assuming that the line you have just found gives the density as a function of temperature. (Since 50° C is between the two data points you have, this is called interpolation.)
 - (e) Find the density at a temperature of 150° C. (Since 150° C is not between the two data points you have, this is called extrapolation.)
- 2. A man is whirling a rock on the end of a rope. The rock moves in a cirlce, and at every instant of time the rock is moving tangent to the circle. Its direction of motion is always perpendicular to the rope, as shown below.



- (a) Suppose the man is located at the origin, (0,0), and that at a certain instant the rock is at (1,4). (The units are in feet.) Find the equation of the line describing the rope.
- (b) What is the slope of the line describing the rock's direction of motion?
- (c) The man releases the rock, which flies off in a straight line. What is the equation of the line describing the rock's subsequent motion?
- (d) Two seconds later the rock has reached x = -3 meters. What is its y coordinate?
- (e) How far has the rock travelled in those two seconds? What is its speed?
- 3. A small company has a choice of two long distance plans. One plan has a monthly fee of \$30 and calls cost \$0.12 per minute; the other has a monthly fee of \$55 and calls cost \$0.08 per minute.
 - (a) Write a function $C_1(m)$ giving the cost of the first plan in terms of the number of minutes m of calls.
 - (b) Write a similar function $C_2(m)$ for the second plan.
 - (c) How many minutes of calls per month does the company have to make for the second plan to be cheaper?

- (d) Suppose the company is offered a third plan, with a monthly fee of \$85 and \$0.05 per minute. Write a function $C_3(m)$ for the third plan.
- (e) If the second plan is still the cheapest, how many minutes of calls per month is the company making?
- (f) Graph C_1 , C_2 , and C_3 on the same graph. Explain the significance of the points where the lines cross.