# Math 135: Intermediate Algebra <br> Worksheet 4 <br> 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 $15^{\circ} \mathrm{C}$, she measures the density of the metal to be $8 \mathrm{grams} / \mathrm{cm}^{3}$. As a temperature of $75^{\circ} \mathrm{C}$, the density is $6 \mathrm{grams} / \mathrm{cm}^{3}$. 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 $50^{\circ} \mathrm{C}$. Find the density assuming that the line you have just found gives the density as a function of temperature. (Since $50^{\circ} \mathrm{C}$ is between the two data points you have, this is called interpolation.)
(e) Find the density at a temperature of $150^{\circ} \mathrm{C}$. (Since $150^{\circ} \mathrm{C}$ 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.
