Tutorial Worksheet, 01/11/2016

Instructions: Please work in groups of 3 or 4 students and solve each of the problems below. Please work with students who will attend the same recitation section. You do not turn these in at the end of class, but I will take attendance so that you get credit for participating.

An Introduction to Mathematical Modeling

1. Suppose that the density of a bacteria population is proportional to B_t, where t is a *time index* indicating 16 minute time intervals (i.e. $t = 0, 1, 2$ corresponds to the initial measurement, a measurement after 16 minutes, a measurement after 32 minutes).

   As explained on p.3 of our textbook, B_t is, more precisely, the *absorbance* of light passing through the bacteria colony and measured by a *spectrophotometer*. The data below is from an experiment conducted by Deb Christensen at Iowa State University.

   Take a few minutes to say hello to each member of your group. Then spend a few minutes discussing how you might measure the population of a bacteria colony. Write one idea below. Use complete sentences.

2. Complete the table below.

Table 1: Measurements of bacterial density at pH 6.25.

Time (min)	Time Index t	Population Density B_t	Population Change / Unit Time $(B_{t+1} - B_t)/1$
0	0	0.022	0.014
16	1	0.036	0.024
32		0.060	
48		0.101	
	4	0.169	
	5	0.266	

3. Plot the following data using a graphing calculator, computer, or by plotting points by hand. In any case, reproduce the graphs in the space below. Choose appropriate ranges of values for your axes. And label each axis.

   (a) Population Density versus Time Index

   (b) Population Change per Unit Time vs. Time Index

(c) Population Change per Unit Time vs. Population Density

4. For each of the graphs above, describe your observations. Answer using complete sentences.