# Problem Set #1.3 - Graphs of Exponential Functions

Name: _____ Class: _____

1. Below are three stories about the population of a
   city over a period of time and four population-
   versus-time graphs. <u>Two</u> of the stories each
   correspond to a graph. Match the two graphs and
   the two stories. Write stories for the other two
   graphs, and draw a graph that matches the third
   story.

   Story 1: The population size grows at a constant
   rate for some time, then doesn't change for a while,
   and then grows at a constant rate once again.

   Story 2: The population size grows somewhat fast
   at first, and then the rate of growth slows.

   Story 3: The population size declines to zero.
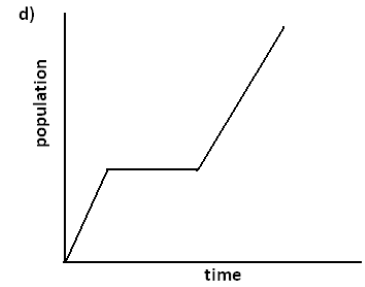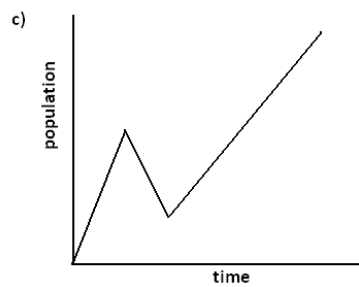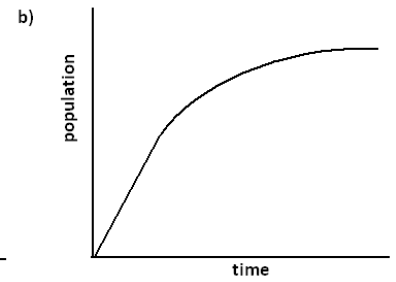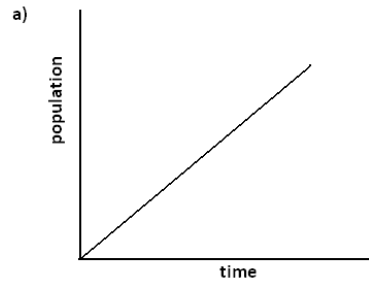
   Graph for the remaining story:

a)

population

time

b)

population

time

c)

population

time

d)

population

time
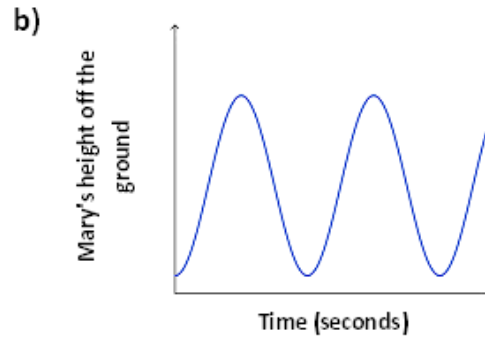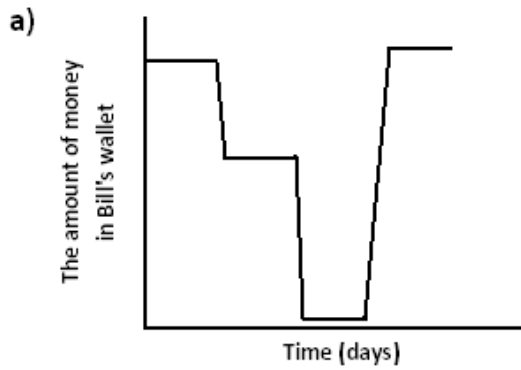
Stories for the remaining two graphs:

2. In the video, the narrator says:
   "Just one bacterium, dividing every 20 minutes, could produce nearly 5,000 billion billion bacteria in one day. That
   is 5,000,000,000,000,000,000,000 bacteria."
   This seems WAY too big. Could this be correct, or did she make a mistake? (Feel free to experiment with numbers
   using a calculator.)

3. *Bacillus cereus* is a soil-dwelling bacterium that sometimes causes food poisoning. Each cell divides to form two new
   cells every 30 minutes. If a culture starts out with exactly 100 bacterial cells, how many bacteria will be present
   after 3 hours?

4. Create a story to match each graph below:

a)

The amount of money in Bill's wallet vs. Time (days)

b)

Mary's height off the ground vs. Time (seconds)

5. Consider the following story about skydiving:

Julie gets into an airplane and waits on the tarmac for 2 minutes before it takes off. The airplane climbs to 10,000 feet over the next 15 minutes. After 2 minutes at that constant elevation, Julie jumps and free falls for 45 seconds until she reaches a height of 5,000 feet. Deploying her chute, she slowly glides back to Earth over the next 7 minutes where she lands gently on the ground.

a. Draw an elevation versus time graph to represent Julie's elevation with respect to time.

b. According to your graph, describe the manner in which the plane climbed to its elevation of 10,000 feet.

c. What assumption(s) did you make about falling after she opened the parachute?

6. Draw a graph of number of bacteria versus time for the following story: Dave is doing an experiment with a type of bacteria that he assumes divides exactly every 30 minutes. He begins at 8:00 a.m. with 10 bacteria in a Petri dish and waits for 3 hours. At 11:00 a.m., he decides this is too large of a sample and adds Chemical A to the dish, which kills half of the bacteria almost immediately. The remaining bacteria continue to grow in the same way. At noon, he adds Chemical B to observe its effects. After observing the bacteria for two more hours, he observes that Chemical B seems to have cut the growth rate in half.

7. Decide how to label the vertical axis so that you can graph the data set on the axes below. Graph the data set and draw a curve through the data points.

x	y
0	-1
1	-2
2	-4
3	-8
4	-16
5	-32
6	-64

(graph axes labeled 0 1 2 3 4 5 6 along horizontal)
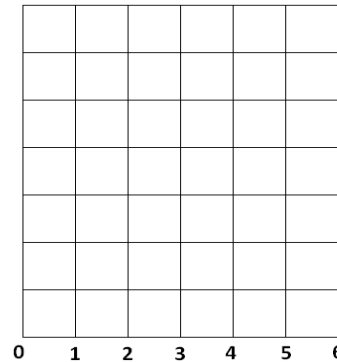
8. Assume that a bacteria population doubles every hour. Which of the following three tables of data, with x representing time in hours and y the count of bacteria, could represent the bacteria population with respect to time? For the chosen table of data, plot the graph of that data. Label the axes appropriately with units.
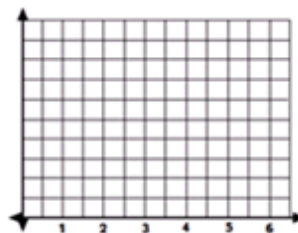
a)

x	0	1	2	3	4	5	6
y	4	7	10	13	16	19	22
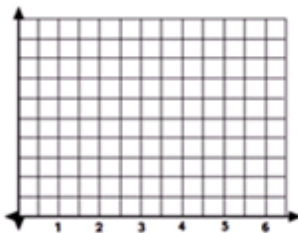
b)

x	0	1	2	3	4	5	6
y	3	6	12	24	48	96	192

c)

x	0	1	2	3	4	5	6
y	1	3	7	13	21	31	43