Alien Invasion

In the next ten thousand years, the star which earthlings have named WOH G64 will explode as a supernova. (Use the internet to research WOH G64.) This planet was inhabited by creatures who were very similar to those in the book Flatland; however, on this planet, the creatures were all rectangles of various dimensions. To locate a planet capable of sustaining life for their people, a spaceship from a planet orbiting WOH G64 traveled 160,000 light years to reach our solar system. One alien was left behind on each of our solar system's eight planets, and two of our dwarf planets, Ceres and Pluto.

The alien who was left behind on Earth noticed rectangular shaped objects mounted on poles along the roads. One stated "Free concert in the park Saturday." Another stated "Garage Sale." In order to be inconspicuous, she took on the shape of a similar rectangle 18 units wide by 24 units long. At first, this planet seemed perfect, but exposure to Earth's atmosphere caused something very strange to happen. After exactly one hour, the alien split in half. Now there were two aliens, each one half as big as the original alien. After another hour, each of those two aliens split in half. Now there were four smaller aliens. After each hour, each alien split in half again.

You are to model what happened to the number of aliens and the size of each alien by repeatedly cutting each of your aliens in half. Complete the table as you make each set of cuts. Use this table for the two graphs on the following pages. The first graph will show the number of aliens with respect to time. The second graph will show the size of the aliens with respect to time.

Time since alien landing (in hours)	Number of aliens	Number of aliens in exponential form	Area of each alien (square units)
0	1	2^0	432
1	2	2^1	216
2	4	2^2	108
3	8	2^3	54
4	16	2^4	27
5	32	2^5	13.5
6	64	2^6	6.75
n		2^n	

Number of aliens as a function of time   Name: _____

Complete the table on the previous page and use it to answer the following questions:

1. After how many hours will the alien population be 512? Explain how you determined your answer.

   9 hours

2. How large will the alien population be after 12 hours? After 24 hours? Explain how you determined your answers.
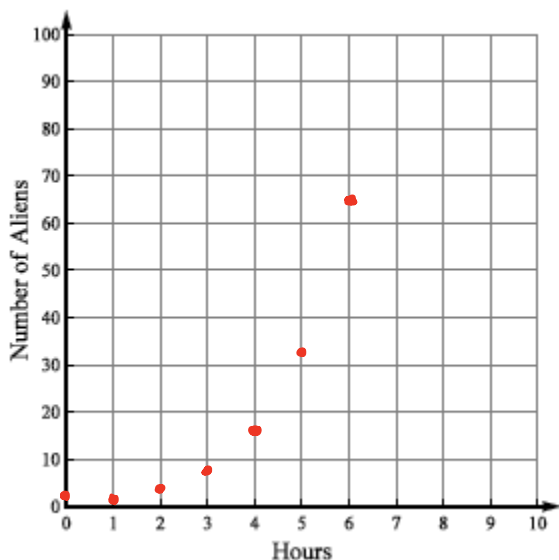
   $2^{12} \rightarrow$ **4096 aliens** $2^{24} \rightarrow$ **16,777,216**

3. Is the alien population growing at a constant rate? Explain your answer.

   No, but it is mult by same # each hour

4. On the grid, plot the number of aliens with respect to time.

5. Should the points on the graph be connected with a smooth curve? If not, why should they remain unconnected? Provide at least one reason to explain your answer.

   No - Aliens are only splitting on the hour

6. If the equation representing the number of aliens is f(n) = ____2^n____(see your table),
   find the following values.

   a. f(-2) = **.25**   b. f(14) = **16384**   c. Find x if y = 262144.   D. Find

   use calc - plug 2^x into y, & use table

   x if y = $\frac{1}{16}$ = **.0625**

   X= -4   **X=18**

Area of each alien as a function of time.
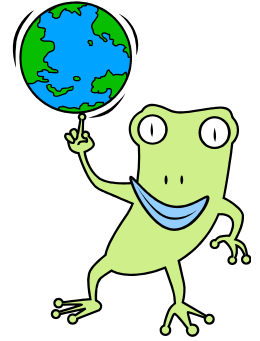
7. On the grid, plot the size (area) of each alien, in square units, with respect to time.
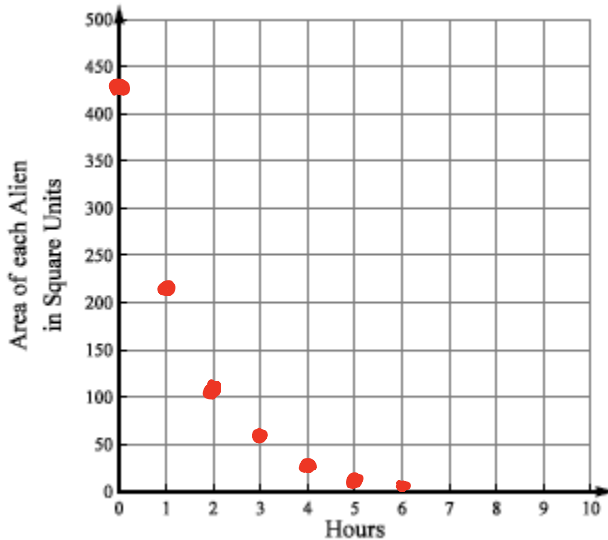
Size

8. Describe what is happening to the size of an individual alien.

   multiplying by $\frac{1}{2}$
   or
   = dividing by 2

9. The graph of the alien's size with respect to time is an example of "exponential decay". Based on the table and the second graph, create a definition for exponential decay.

   Decreasing by a certain factor

10. Will the aliens eventually disappear? Justify your answer.

    No - your always taking
        half of something

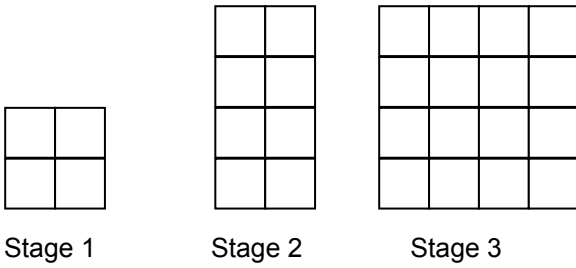11. What is the sum of the areas of all the aliens at any point in time?

    432 sq units

12. Will the aliens be able to take over planet earth? Write a paragraph explaining what will happen to the alien invasion force.
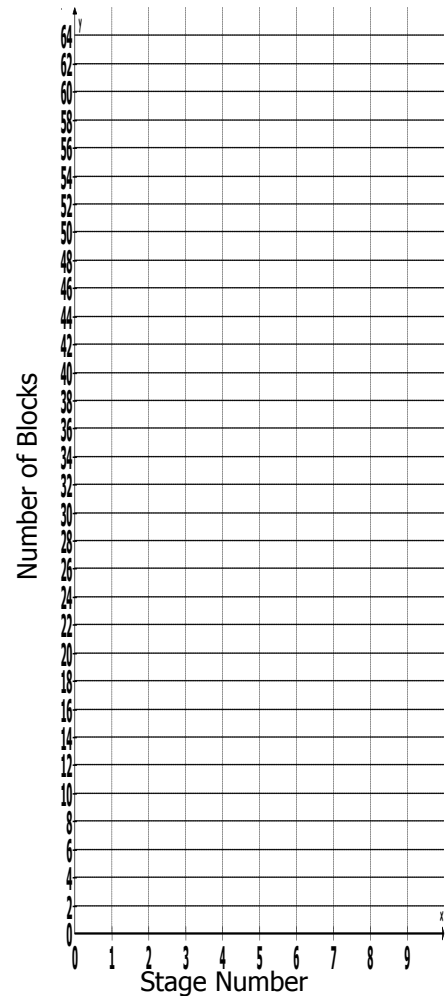
Practice – Introduction to Exponential Functions   **pp 772-778**

Name _____ Date _____ Period _____

1. Complete the table below based on the pattern.

Stage 1   Stage 2   Stage 3

x	y
0	
1	
2	
3	
4	

Number of Blocks (vertical axis, 0–64)

Stage Number (horizontal axis, 0–9)

2. Shade in the graph based on your table.

3. Plot the ordered pairs from the table, connect with a smooth curve.

4. How many blocks would be needed for the 5th stage?

   Draw this on the graph.

5. If the equation $y = 2 \cdot 2^x$ represents this function and 131,072 blocks were used, what would be the stage number?

6. Given the equation $y = 5^x$, if $x = $ -2, what would be the value of y?

7. Given the equation $y = 3 \cdot 4^x$, if $y = $ 49,152, what would be the value of x?

8. Given the equation $y = -3^x$, if $y = $ -59,049, what would be the value of x?

9. Given the equation $y = 4 \cdot 3^x$, if $x = $ 6, what would be the value of y?