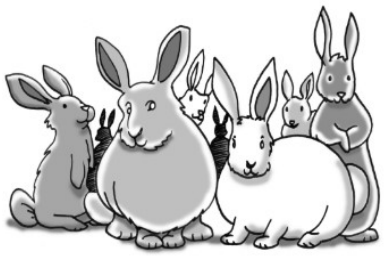
Algebra 2

Representing Exponential Growth. How does the pattern grow?



So far in this course, you have been investigating the family of linear, quadratic, and polynomial functions using multiple representations (especially graphs, and equations). In this last unit, you will learn about a new family of functions and the type of growth it models.

A-1. MULTIPLYING LIKE BUNNIES

Now that it is spring, the grass is growing, and my yard is full of rabbits. I have so many rabbits in my yard, I'm thinking of raising rabbits myself.

Suppose I started with two rabbits and that in each month following those rabbits have two babies. Also suppose that every month thereafter, each pair of rabbits has two babies.

Your Task: With your team, determine how many rabbits I would have after one year (12 months). Represent this situation with a written description of the pattern of growth, a diagram, and a table. What patterns can you find and how do they compare to other patterns that you have investigated previously?

What strategies could help us keep track of the total number of rabbits?

What patterns can we see in the growth of the rabbit population?

How can we predict the total number of rabbits after many months have passed?

A-2. How can you determine the number of rabbits that will exist at the end of one year? Consider this as you answer the questions below.

a.) Draw a diagram to represent how the total number of rabbits is growing each month. How many rabbits will I have after three months?

b.) As the number of rabbits becomes larger, a diagram becomes too cumbersome to be useful. A table might work better. Organize your information in a table showing the total number of rabbits for the first several months (at least 6 months). What patterns can you find in your table? Describe the pattern of growth in words.

c.) If you have not done so already, use your pattern to determine the number of rabbits that I would have after one year (12 months) have passed.

d.) How does the growth in the table that you created compare to the growth patterns that you have investigated previously? How is it similar and how is it different?

A-3. I want to raise as many rabbits as possible, so they have a few options to consider. I could start with a larger number of rabbits, or they could raise a breed of rabbits that reproduces faster. How do you think that each of these options would change the pattern of growth you observed in the previous problem? Which situation might yield the largest rabbit population after one year?

A.) To help answer these questions, model each case below with a table for the first five months.

Case 2: Start with 10 rabbits; each pair has 2 babies per month.

Case 3: Start with 2 rabbits; each pair has 4 babies per month.

Case 4: Start with 2 rabbits; each pair has 6 babies per month.

b.) Which case would appear to give Lennie and George the most rabbits after one year? How many rabbits would they have in that case?

Algebra 2

A-4. A NEW FAMILY?

Look back at the tables you created in problems A-1 and A-3.

a.) What pattern do they all have in common? Functions that have this pattern are called exponential functions.

b.) Obtain the Lesson A.1.1 Resource Page from your teacher. Graph the data for Case 2. Give a complete description of the graph.

A-5. REFLECTION

To represent the growth in number of rabbits in problems A-1 and A-3, you discovered a new function family that is not linear. Functions in this new family are called exponential functions. Throughout this chapter and later in Appendix B, you will learn more about this special family of functions.

Write a couple of sentences to record what you have learned so far about exponential functions. For example, what do their graphs look like? What patterns do you observe in their tables?

A-6. What if the data for Lennie and George (from problem A-1) matched the data in each table below? Assuming that the growth of the rabbits multiplies as it did in problem A-1, complete each of the following tables. Show your thinking or give a brief explanation of how you know what the missing entries are.

Months	Rabbits
0	4
1	12
2	36
3	
4	

Month	Rabbits
0	6
1	
2	24
3	
4	96

A-7. Jill is studying a strange bacterium. When she first looks at the bacteria, there are 1000 cells in her sample. The next day, there are 2000 cells. Intrigued, she comes back the next day to find that there are 4000 cells!

a.) Should the graph of this situation be linear or curved?

b.) Create a table and graph for this situation. The inputs are the days that have passed after she first began to study the sample, and the outputs are the numbers of cells of bacteria.