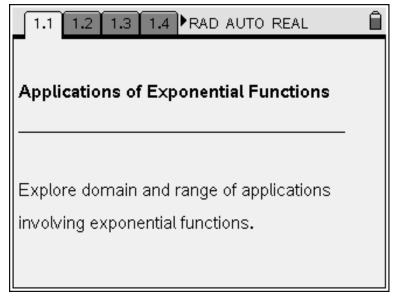
Applications of Exponential Functions
Student Activity

Name ________________
Class ________________

Open the TI-Nspire document *Applications_of_Exponential_Functions*.

In this activity, you will explore applications involving bacteria growth and decay. Exponential functions are used to represent the data. You will also explore the domain and range of the exponential functions in the context of the applications.



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Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

An exponential function can be described with the equation $y = a^x$, where $a > 0$ and $a \neq 1$. Exponential functions are often used to represent real-world applications, such as bacterial growth/decay, population growth/decline, and compound interest.

Suppose you are studying the effects of an antibiotic on a certain bacteria. To begin your research, you first collect information on the growth process of the bacteria. The process of cell reproduction is called mitosis, which is when one cell divides into two identical cells. You begin by placing one bacteria cell in a petri dish to see how quickly it grows. Every 15 minutes, you check the petri dish and count the number of bacteria present. You notice the pattern that at each 15-minute interval, the bacteria have doubled in number. The mitosis of the bacteria is represented in the graph on page 1.5.

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1. If x represents time, what does $x = 6$ mean? Would this be a domain or range value of the function? Explain.

2. What does y represent in the context of the application? Would this be the domain or the range of the function? Explain.

3. Grab and drag the point labeled x on the graph. What domain values make sense in the context of the problem? How would this affect the range values?

4. Find the number of bacteria present in the petri dish at one hour by grabbing and dragging the point labeled *x*.

Now that you have studied the mitosis of the bacteria, you decide to see how it reacts to an antibiotic. Suppose there are 40,000 bacteria present in a petri dish before the antibiotic is added. Through observation, you determine that every 4 hours, the number of bacteria is reduced by half. The graph on page 1.11 represents your findings.

Move to page 1.11.

5. Grab and drag the point labeled *x* until the ordered pair is (0, 4**E** + 4). Interpret the ordered pair in the context of the application.

6. What domain values make sense in the context of the application? Explain.

7. What range values make sense in the context of the application? Explain.

8. According to the exponential function graphed, will the number of bacteria ever be zero? Explain.

9. Approximately how long will it take for the number of bacteria in the petri dish to be fewer than 1,000?

10. Compare and contrast the two graphs. What is similar about the two graphs? What is different?