

Name:

IN THIS LESSON, YOU WILL:

- Recognize and define the parts of an exponential function
- Write exponential functions to model a given situation
- Evaluate and solve exponential functions
- Analyze return on an investment given starting investment, rate of return and time periods



INTRO

DISCUSSION PROMPTS: Repeated Doubling

Answer each question using any appropriate math notation.

1. If you were asked to start with the number 5 and double it three times, how would you write this problem using math notation?
2. If you were asked to start with the number 5 and double it nine times, how would you write this problem using math notation?
3. If you were asked to start with the number 5 and double it one hundred times, how would you write this problem using math notation?



LEARN IT

An exponential function is a function in the form $y = ab^x$ where

- **a** is the starting value of the function
- **b** is the number that is repeatedly multiplied, commonly referred to as the growth or decay factor.

Assuming positive numbers, then the following is true:

- If **b** > 1, then the function will grow. This is also referred to as exponential growth
- If **b** is between 0 and 1 (fractions and decimals) then the function will shrink. This is also referred to as exponential decay
- If **b** = 1, then the function will not grow or decay because multiplying by 1 does not change the starting value.

- x is the number of times that you will be multiplying by b

1. Given the exponential function $y = 3(5)^x$

- a. State the starting value:
- b. State the growth/decay factor:
- c. Is the function growing or decaying?
- d. Describe in words what this function is doing. Refer to the language in the intro activity.
- e. What is the result if $x = 3$?

2. Given the exponential function $y = 32(0.25)^x$

- a. State the starting value:
- b. State the growth/decay factor:
- c. Is the function growing or decaying?
- d. Describe in words what this function is doing. Refer to the language in the intro activity.
- e. What is the result if $x = 5$?



PRACTICE IT

Use what you have learned about the parts of exponential functions to write an equation for each of the following situations and answer the questions.

- 1. Everytime Pinocchio lies, his nose doubles in size. His nose is 1.5 inches long before he has told any lies.**
 - a. Write an equation that represents this situation where x is the number of lies and y is the size of Pinocchio's nose after x lies.
 - b. Use your equation to calculate how long Pinocchio's nose will be after 6 lies.
- 2. You make a \$10,000 investment that has historically doubled every 7 years.**
 - a. Write an equation that represents this situation where x is the number of years and y is the investment value after x years.

- b. Use your equation to calculate the value of your investments after 15 years.



LEARN IT

As with other types of equations, you can solve exponential functions for any variable. In this section, we will solve for the exact initial value but only estimate the exponent since solving for exponents is beyond what we have learned so far.

1. **Sari makes an investment with the goal of having \$20,000 after 30 years. If the growth factor is 1.12, how much money will she need to invest to reach her goal?**
2. **Charlotte has \$12,000 to invest and would like this investment to grow to \$18,000. If the growth factor is 1.09, how many years will it take to reach her goal? Use guess and check to find an approximate answer.**



APPLY IT

Follow your teacher's directions to complete the Application Problems.

Teachers, you can find the Application problems linked in the Lesson Guide.