Name _____ Date _____

LESSON 7.4

# Study Guide

*For use with the lesson "Write and Graph Exponential Growth Functions"*

**GOAL** **Write and graph exponential growth models.**

## Vocabulary

An **exponential function** is a function of the form $y = ab^x$ where $a \neq 0$, $b > 0$, and $b \neq 1$.

When $a > 0$ and $b > 1$, the function $y = ab^x$ represents **exponential growth.**

**Compound interest** is interest earned on both an initial investment and on previously earned interest.

## EXAMPLE 1 Write a function rule

**Write a rule for the function.**

**Solution**

**STEP 1** **Tell** whether the function is exponential. Here, the $y$-values are multiplied by 5 for each increase of 1 in $x$, so the table represents an exponential function of the form $y = a \cdot b^x$ where $b = 5$.

| | | | | | |
|---|---|---|---|---|---|
| | +1 | +1 | +1 | +1 | |
| $x$ | −2 | −1 | 0 | 1 | 2 |
| $y$ | $\frac{2}{5}$ | 2 | 10 | 50 | 250 |
| | ×5 | ×5 | ×5 | ×5 | |

**STEP 2** **Find** the value of $a$ by finding the value of $y$ when $x = 0$. When $x = 0$, $y = ab^0 = a \cdot 1 = a$. The value of $y$ when $x = 0$ is 10, so $a = 10$.

**STEP 3** **Write** the function rule. A rule for the function is $y = 10 \cdot 5^x$.

## EXAMPLE 2 Graph an exponential function

**Graph the function $y = 5 \cdot 3^x$. Identify its domain and range.**

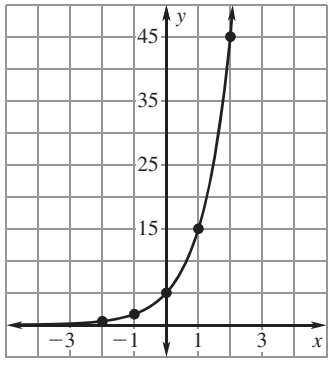
**Solution**

**STEP 1** **Make** a table by choosing a few values for $x$ and finding the values of $y$. The domain is all real numbers.

| $x$ | −2 | −1 | 0 | 1 | 2 |
|---|---|---|---|---|---|
| $y$ | $\frac{5}{9}$ | $\frac{5}{3}$ | 5 | 15 | 45 |

**STEP 2** **Plot** the points.

**STEP 3** **Draw** a smooth curve through the points. From either the table or the graph, you can see that the range is all positive real numbers.



LESSON 7.4

# Study Guide *continued*

*For use with the lesson "Write and Graph Exponential Growth Functions"*

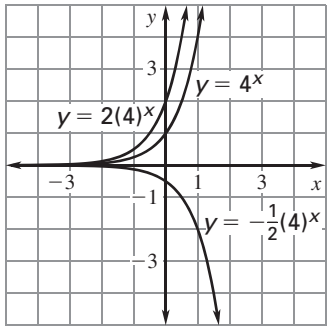
## EXAMPLE 3 Compare graphs of exponential functions

**Graph $y = -\frac{1}{2} \cdot 4^x$ and $y = 2 \cdot 4^x$. Compare each graph with the graph of $y = 4^x$.**

### Solution

To graph each function, make a table of values, plot the points, and draw a smooth curve through the points.

| $x$ | $y = 4^x$ | $y = -\frac{1}{2} \cdot 4^x$ | $y = 2 \cdot 4^x$ |
|---|---|---|---|
| $-2$ | $\frac{1}{16}$ | $-\frac{1}{32}$ | $\frac{1}{8}$ |
| $-1$ | $\frac{1}{4}$ | $-\frac{1}{8}$ | $\frac{1}{2}$ |
| 0 | 1 | $-\frac{1}{2}$ | 2 |
| 1 | 4 | $-2$ | 8 |
| 2 | 16 | $-8$ | 32 |




Because the $y$-values for $y = -\frac{1}{2} \cdot 4^x$ are $-\frac{1}{2}$ times the corresponding $y$-values for $y = 4^x$, the graph of $y = -\frac{1}{2} \cdot 4^x$ is a vertical shrink and a reflection in the $x$-axis of the graph of $y = 4^x$.

Because the $y$-values for $y = 2 \cdot 4^x$ are 2 times the corresponding $y$-values for $y = 4^x$, the graph of $y = 2 \cdot 4^x$ is a vertical stretch of the graph of $y = 4^x$.

## Exercises for Examples 1, 2, and 3

**1.** Write a rule for the function.

| $x$ | $-2$ | $-1$ | 0 | 1 | 2 |
|---|---|---|---|---|---|
| $y$ | 1 | 3 | 9 | 27 | 81 |

**2.** Graph $y = 4 \cdot 3^x$ and identify its domain and range.

**3.** Graph $y = -5 \cdot 6^x$. Compare the graph with the graph of $y = 6^x$.