

8.5 Write and Graph Exponential Growth Functions

TEKS A.1.C, A.3.B, A.4.A, A.11.C



Before You wrote and graphed linear models.
Now You will write and graph exponential growth models.
Why? So you can find the value of a collector car, as in Example 4.

Key Vocabulary

- exponential function
- exponential growth
- compound interest

An **exponential function** is a function of the form $y = ab^x$ where $a \neq 0$, $b > 0$, and $b \neq 1$. Exponential functions are *nonlinear* functions. Observe how an exponential function compares with a linear function.

| | Linear function: $y = 3x + 2$ | | | | | Exponential function: $y = 2 \cdot 3^x$ | | | | |
|---|-------------------------------|----|----|----|----|---|---------------|------------|------------|------------|
| | | +1 | +1 | +1 | +1 | | +1 | +1 | +1 | +1 |
| x | -2 | -1 | 0 | 1 | 2 | -2 | -1 | 0 | 1 | 2 |
| y | -4 | -1 | 2 | 5 | 8 | $\frac{2}{9}$ | $\frac{2}{3}$ | 2 | 6 | 18 |
| | | +3 | +3 | +3 | +3 | | $\times 3$ | $\times 3$ | $\times 3$ | $\times 3$ |

EXAMPLE 1 Write a function rule

Write a rule for the function.

| | | | | | |
|---|----|----|---|----|----|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 2 | 4 | 8 | 16 | 32 |

Solution

STEP 1 Tell whether the function is exponential.

| | +1 +1 +1 +1 | | | | |
|---|-------------|------------|------------|------------|------------|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 2 | 4 | 8 | 16 | 32 |
| | | $\times 2$ | $\times 2$ | $\times 2$ | $\times 2$ |

Here, the y -values are multiplied by 2 for each increase of 1 in x , so the table represents an exponential function of the form $y = ab^x$ where $b = 2$.

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 8, so $a = 8$.

STEP 3 Write the function rule. A rule for the function is $y = 8 \cdot 2^x$.

GUIDED PRACTICE for Example 1

1. Write a rule for the function.

| | | | | | |
|---|----|----|----|----|-----|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 3 | 9 | 27 | 81 | 243 |