

Lesson 8-1

Exploring Exponential Models

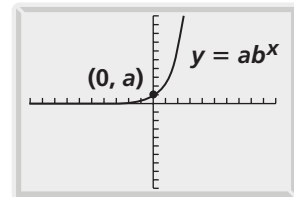
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|---|---|
| Lesson Objectives 1 Modeling exponential growth 2 Modeling exponential decay | NAEP 2005 Strand: Algebra Topic: Algebraic Representation Local Standards: _____ |
|---|---|

Vocabulary

An exponential function is _____

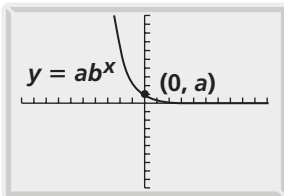
The growth factor is _____

Exponential Growth



Growth factor $b > 1$

Exponential Decay



Decay factor $0 < b < 1$

The decay factor is _____

An asymptote is _____

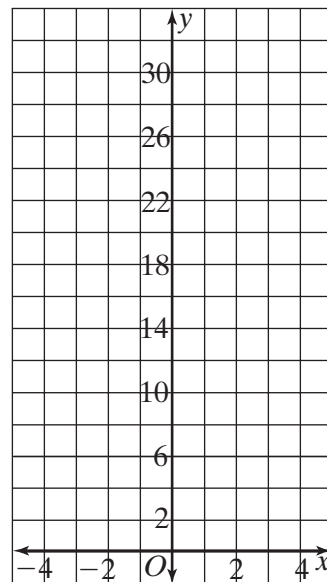
Examples

1 **Graphing Exponential Growth** Graph $y = 3^x$.

Step 1 Make a table of values.

Step 2 Graph the coordinates.
Connect the points with a smooth curve.

| x | 3^x | y |
|-----|----------|--------------------------|
| -3 | 3^{-3} | $\frac{1}{27} = \square$ |
| -2 | 3^{-2} | $\frac{1}{9} = \square$ |
| -1 | 3^{-1} | $\frac{1}{3} = \square$ |
| 0 | 3^0 | \square |
| 1 | 3^1 | \square |
| 2 | 3^2 | \square |
| 3 | 3^3 | \square |



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2 Writing an Exponential Function Write an exponential function $y = ab^x$ for a graph that includes (1, 6) and (0, 2).

$y = ab^x$ Use the general term.

$\square = ab^{\square}$ Substitute for x and y using (1, 6).

$\frac{\square}{b} = a$ Solve for a .

$\square = \frac{\square}{b} b^{\square}$ Substitute for x and y using (0, 2) and for a using $\frac{\square}{b}$.

$\square = \frac{\square}{b} \cdot \square$ Any nonzero number to the zero power equals \square .

$b = \square$ Solve for b .

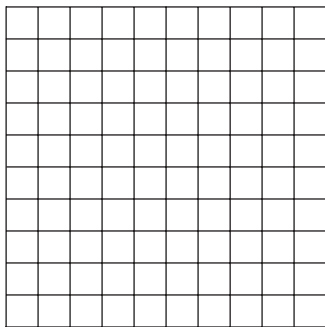
$a = \frac{6}{b} = \frac{6}{\square} = \square$ Use your equation for a , substitute 3 for b , and simplify.

$y = \square \cdot \square^x$ Substitute \square for a and \square for b in $y = ab^x$.

The exponential function for a graph that includes (1, 6) and (0, 2) is $y = \square$.

Quick Check

1. Graph the function $y = 4(2)^x$.



2. Write an exponential function $y = ab^x$ for a graph that includes (2, 4) and (3, 16).

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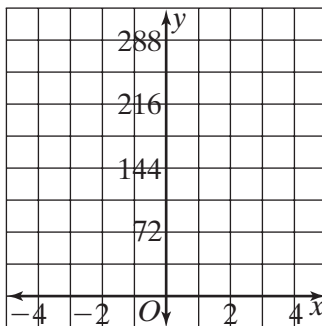
Example

3 Graphing Exponential Decay Graph $y = 36(0.5)^x$. Identify the horizontal asymptote.

Step 1 Make a table of values.

| x | y |
|----|----------------------|
| -3 | <input type="text"/> |
| -2 | <input type="text"/> |
| -1 | <input type="text"/> |
| 0 | <input type="text"/> |
| 1 | <input type="text"/> |
| 2 | <input type="text"/> |
| 3 | <input type="text"/> |

Step 2 Graph the coordinates. Connect the points with a smooth curve.



As x increases, y approaches .

The horizontal asymptote is the -axis, $y =$.

Quick Check

3. Without graphing, determine whether each function represents exponential growth or exponential decay.

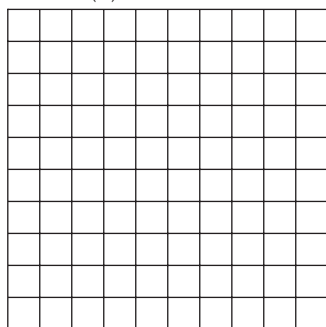
a. $y = 100(0.12)^x$

b. $y = 0.2(5)^x$

c. $y = 16\left(\frac{1}{2}\right)^x$

Graph each decay function. Identify the horizontal asymptote.

d. $y = 24\left(\frac{1}{3}\right)^x$



e. $y = 100(0.1)^x$

