

Algebra 2 7.1

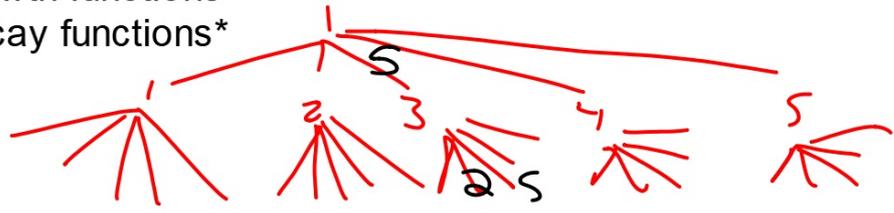
Graph exponential growth functions*

Graph exponential decay functions*

* Algebra 1 Ch. 7

base
exponent

$y = 5^x$



→ asymptote

X domain \mathbb{R}

Y range depends

growth factor ↑

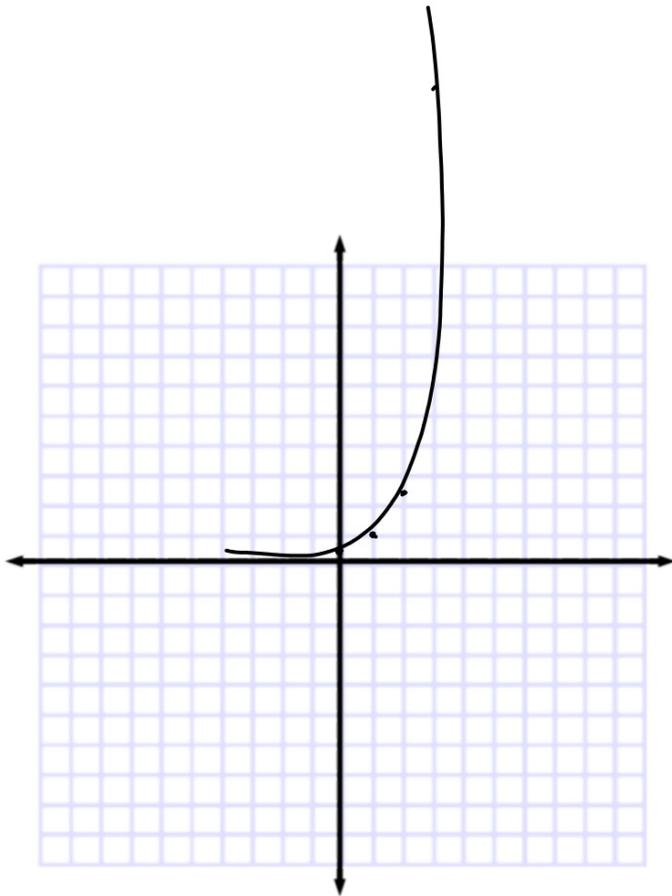
decay factor ↓

whiteboards

0	1	5^0
1	5	5^1
2	25	5^2
3	125	5^3
4	625	5^4

125
625

● Have you ever received an e-mail that tells you to forward it to 5 friends? If each of those 5 friends then forwards it to 5 of their friends,



How many forwards?

KeyConcept Parent Function of Exponential Growth Functions

Parent Functions: $f(x) = b^x$ $b > 1$

Type of graph: continuous, one-to-one, and increasing

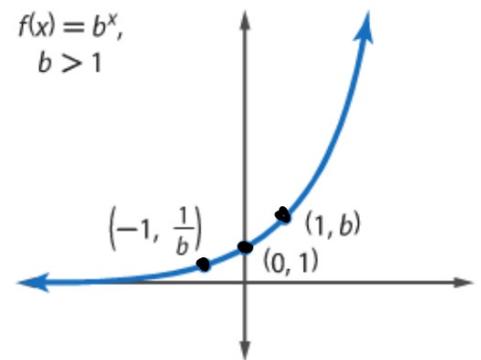
Domain: $D: \text{all real numbers}$

Range: all positive real numbers

Asymptote: x-axis $y > 0$

Intercept: (0, 1)

$$\begin{array}{r|l} & 1 \\ 0 & \\ \hline 1 & b \\ -1 & \frac{1}{b} \end{array}$$



$$\left(\frac{1}{3}\right)^{-1}$$



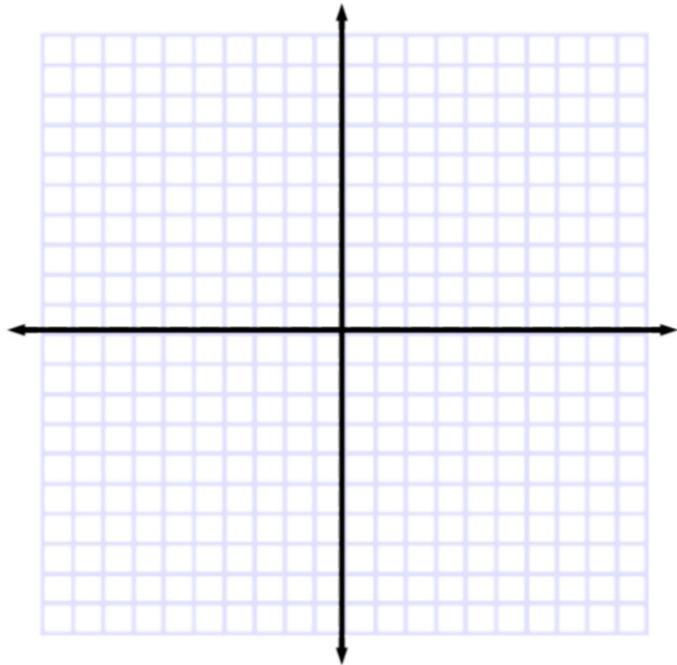
Example 1 Graph Exponential Growth Functions

Graph $y = 3^x$. State the domain and range.

Make a table of values. Then plot the points and sketch the graph.

0	
1	
2	
-1	

giant graphs



$$y = x^2 + 3$$

 **KeyConcept** Transformations of Exponential Functions

$$3(x-2)^2$$

$$f(x) = a(x-h) + k$$

h – Horizontal Translation

h units right if h is positive
 $|h|$ units left if h is negative

k – Vertical Translation

k units up if k is positive
 $|k|$ units down if k is negative

a – Orientation and Shape

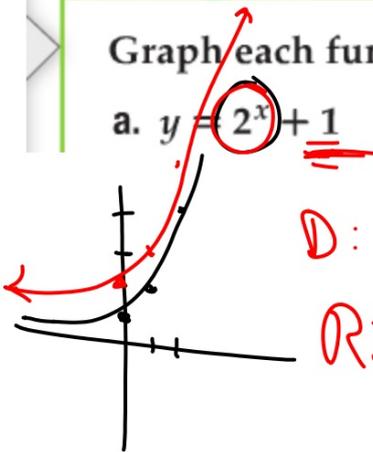
If $a < 0$, the graph is reflected in the x -axis.

If $|a| > 1$, the graph is stretched vertically.
If $0 < |a| < 1$, the graph is compressed vertically.

Example 2 Graph Transformations

Graph each function. State the domain and range.

a. $y = 2^x + 1$

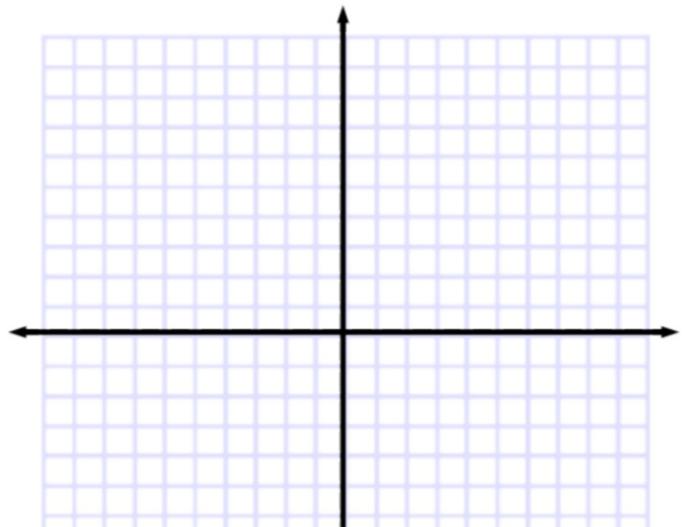


D: all x

R: $y > 1$

1. parent graph
2. vertical stretch?
3. translation?
(follow order of operations)

giant graphs

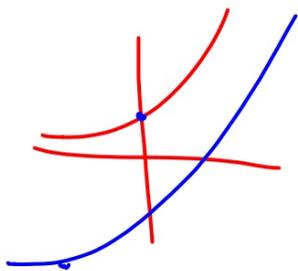


Guided Practice

2A. $y = 2^{x+3} - 5$

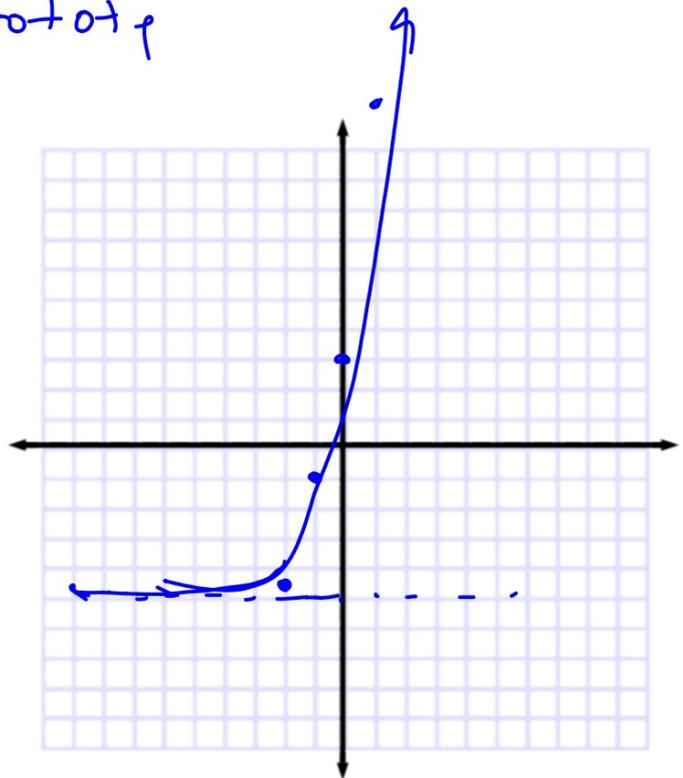
asymptote of f

1. parent graph
2. vertical stretch?
3. translation?

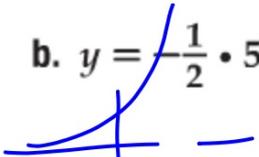


giant graphs

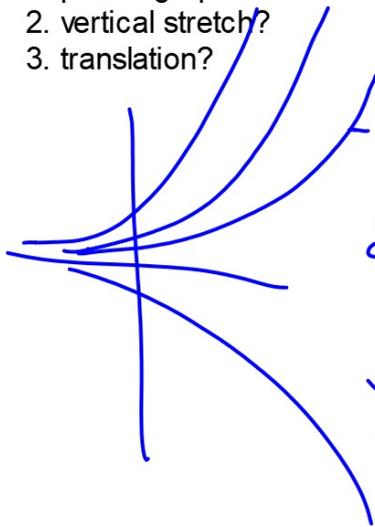
1	$2^4 - 5$	11
0	$2^3 - 5$	3
-1	$2^2 - 5$	-1
-2	$2^1 - 5$	$-4\frac{1}{2}$



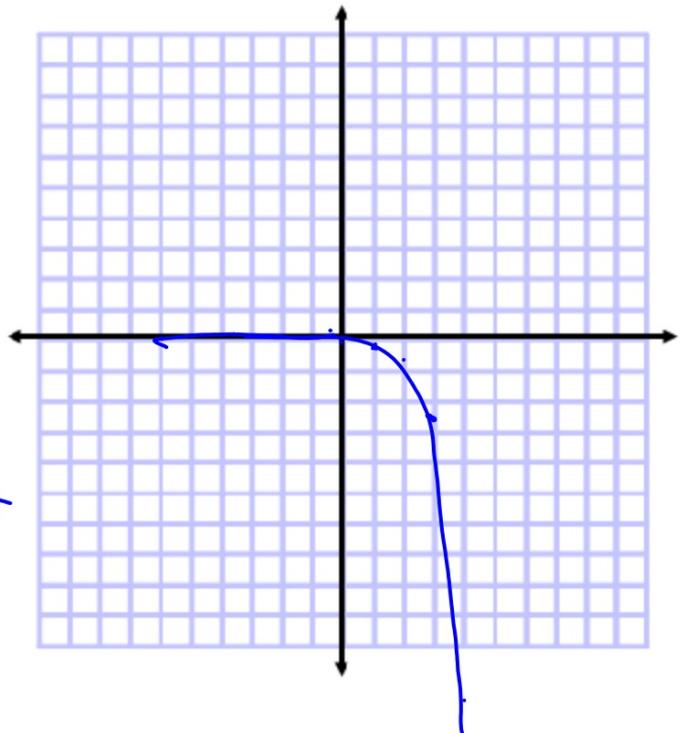
b. $y = -\frac{1}{2} \cdot 5^{2-2}$



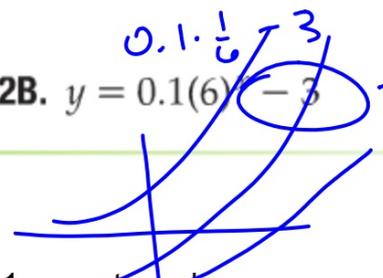
1. parent graph
2. vertical stretch?
3. translation?



1	$-\frac{1}{2} \cdot \frac{1}{5}$	$-\frac{1}{10}$
0	$-\frac{1}{2} \cdot \frac{1}{25}$	$-\frac{1}{50}$
-1	$-\frac{1}{2} \cdot \frac{1}{125}$	0
2	$-\frac{1}{2} \cdot 1$	$-\frac{1}{2}$
3	$-\frac{1}{2} \cdot 5$	-2.5
4	$-\frac{1}{2} \cdot 25$	-12.5



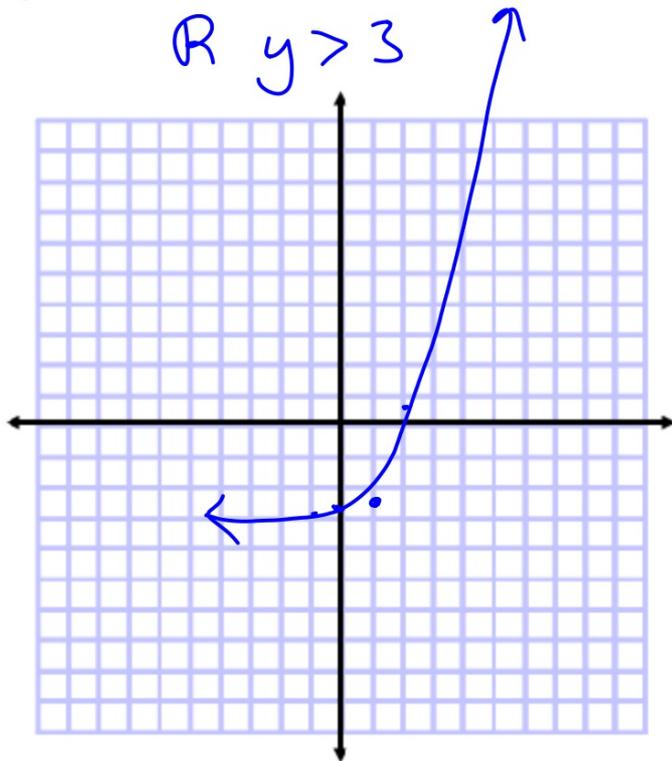
2B. $y = 0.1(6)^{x-3} - 3$



1. parent graph
2. vertical stretch?
3. translation?

1	· 1.6 - 3	= 2.4
0	· 1.1 - 3	= 2.9
-1		
2		

$\mathbb{R} \ y > 3$



$$A(t) = a(1 + r)^t \text{ time}$$

↑ final
↑ initial
↓ %

1+r growth factor
percent >> decimal

$$y = 3,929,214(1 + 0.0203)^t$$

20,831,487

graphing calc



Real-World Example 3 Graph Exponential Growth Functions

CENSUS The first U.S. census was conducted in 1790. At that time, the population was 3,929,214. Since then, the U.S. population has grown by approximately 2.03% annually. Draw a graph showing the population growth of the U.S. since 1790.

0.02

A blue handwritten arrow pointing from the number '0.02' to the '2.03%' in the text above.

3. **FINANCIAL LITERACY** Teen spending is expected to grow 3.5% annually from \$79.7 billion in 2006. Draw a graph to show the spending growth.
-

graphing calc

$0 < \text{base} < 1$

KeyConcept Parent Function of Exponential Decay Functions



Parent Functions: $f(x) = b^x, 0 < b < 1$

Type of graph: continuous, one-to-one, and decreasing

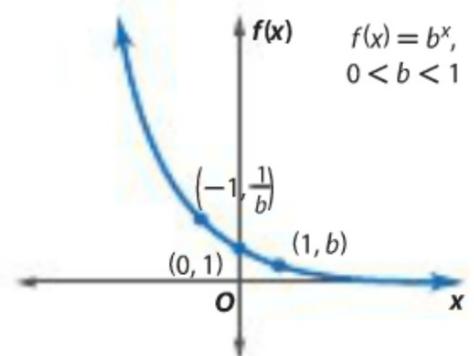
Domain: all real numbers

Range: positive real numbers

Asymptote: x -axis

Intercept: $(0, 1)$

Model

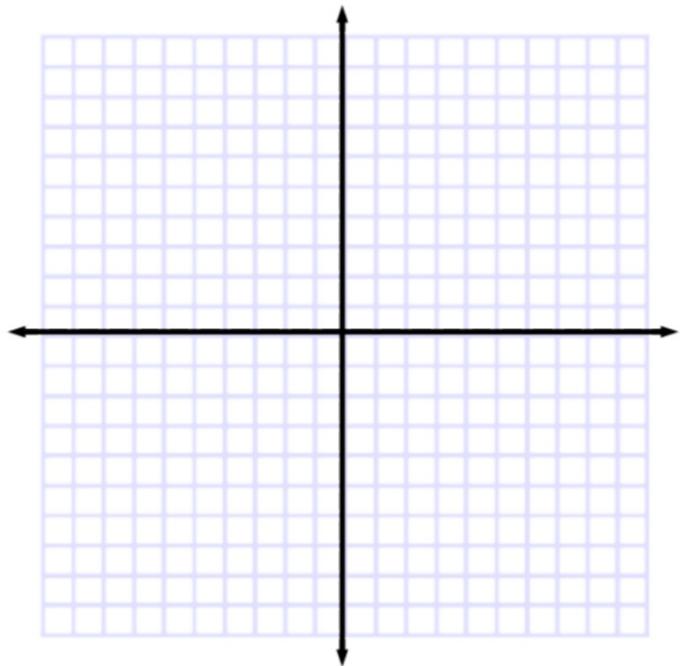


Example 4 Graph Exponential Decay Functions

Graph each function. State the domain and range.

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

giant graphs



$$A(t) = a(1 - r)^t$$

1-r decay factor
percent >> decimal

Guided Practice

5. A cup of black tea contains about 68 milligrams of caffeine. Draw a graph to represent the amount of caffeine remaining in the body of an average teen after drinking a cup of black tea. Estimate the amount of caffeine in the body 2 hours after drinking a cup of black tea.