Algebra 2 7.1

Graph exponential growth functions* $y = 5^{(x)}$

Graph exponential decay functions*

* Algebra 1 Ch. 7

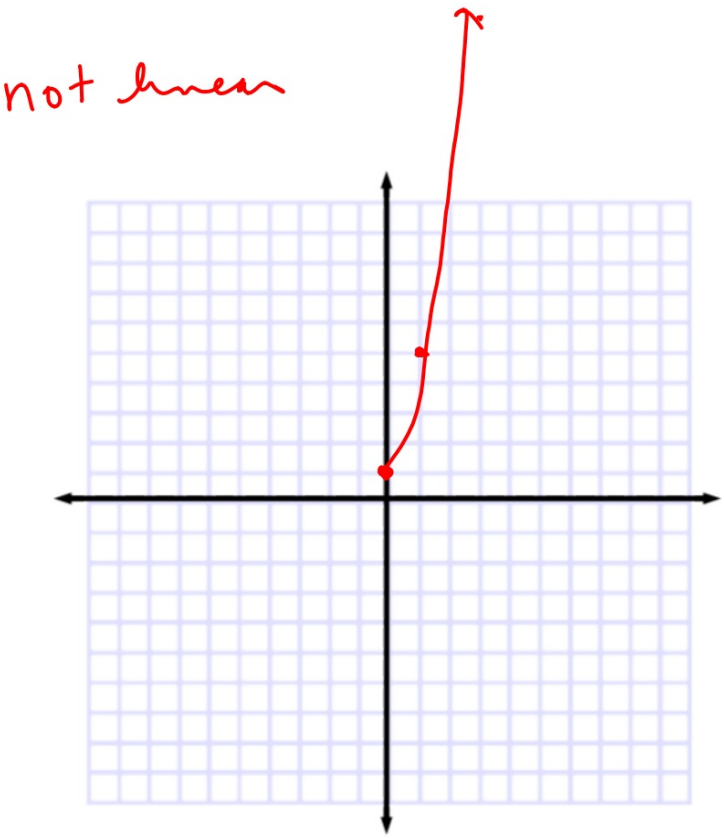
decrease

	0	1
base	1	5 (×5)
exponent	2	25 (×5)
→ asymptote	3	125 (×5)
domain x		
range y		
growth factor ↑	→	
decay factor ↓		
whiteboards		

- 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,

n^{15} 5^n n^{20} 9.5×10^{13}

How many forwards?



p. 451

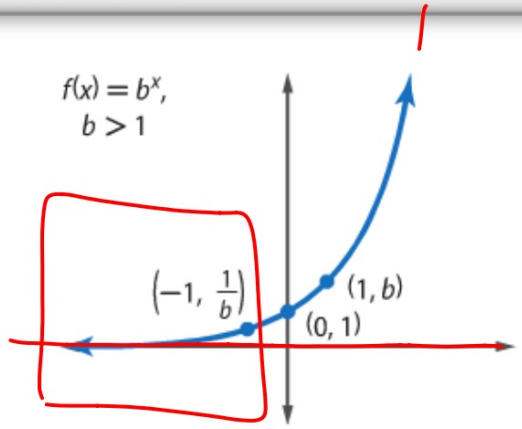
KeyConcept Parent Function of Exponential Growth Functions

Parent Functions:	$f(x) = b^x$, $b > 1$
Type of graph:	continuous, one-to-one, and increasing
Domain: ARN	all real numbers
Range: $y > 0$	all positive real numbers
Asymptote:	x-axis
Intercept:	(0, 1)

b^0

b^1

b^{-1}



$y = 2^x + 3$

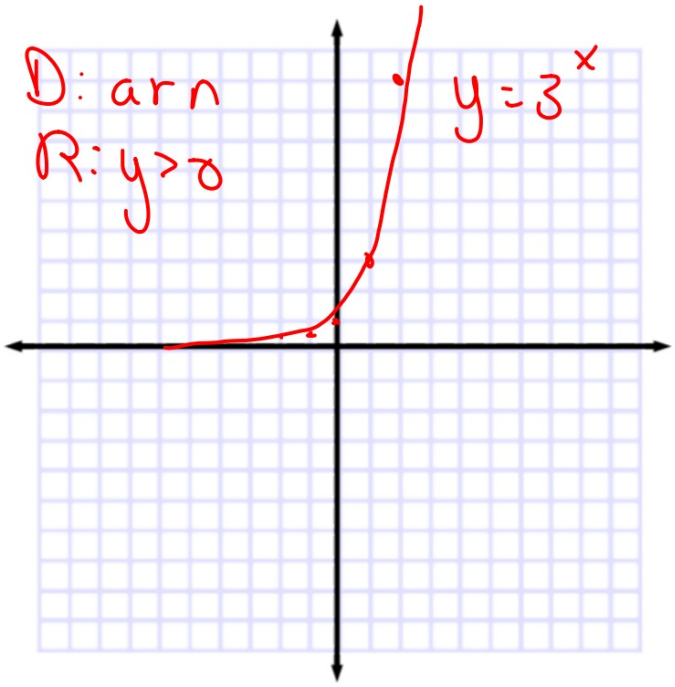
Example 1 Graph Exponential Growth Functions

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

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

-2	3^{-2}	$\frac{1}{9}$
-1	3^{-1}	$\frac{1}{3}$
0	3^0	1
1	3^1	3
2	3^2	9

giant graphs



graph

Label: equation

y int

domain

range

−2
−1
0
1
2

$-3(2)^x$ x^2 $(x-3)^2$ p. 453

KeyConcept Transformations of Exponential Functions

$\frac{1}{2}(3)^x$

$$f(x) = ab^{x-h} + k$$

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. $y = 2^x + 1$

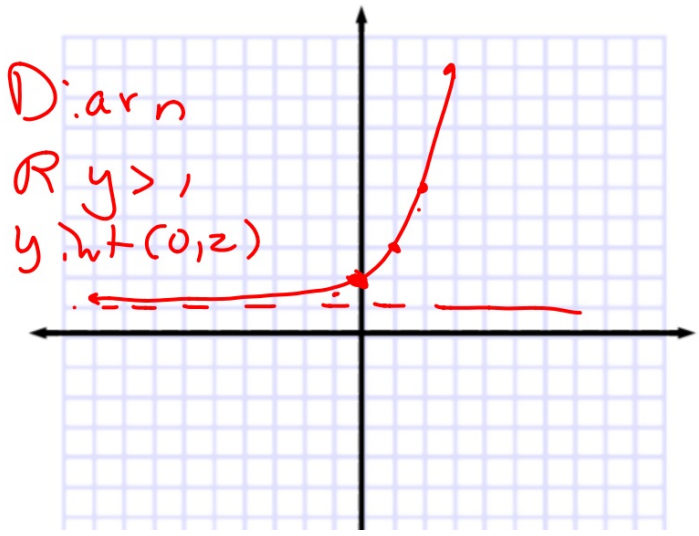
1. parent graph
2. vertical stretch?
3. translation?

(follow order of operations)

$2^x + 1$

-2	2^{-2}	$1\frac{1}{4}$
-1	2^{-1}	1.5
0	2^0	2
1	2^1	3
2	2^2	5

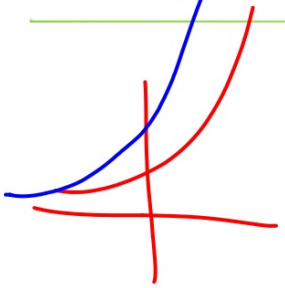
giant graphs



GuidedPractice

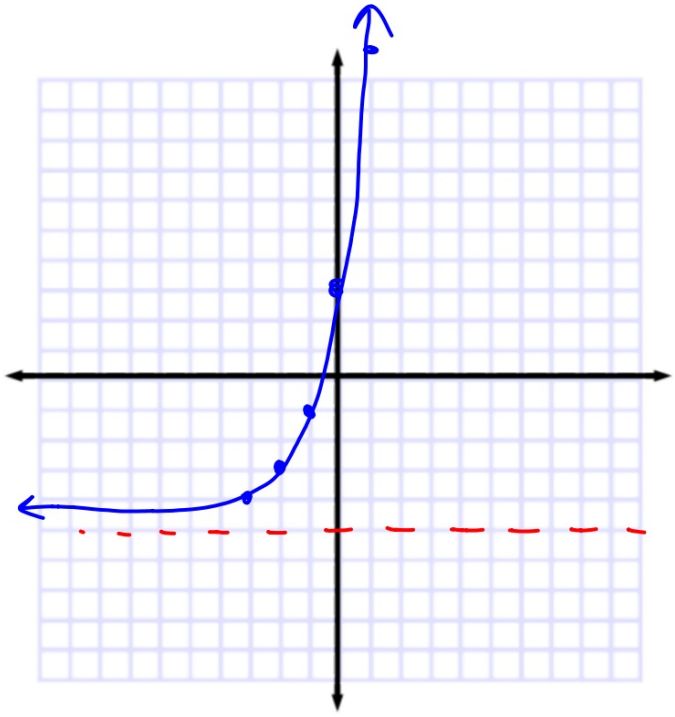
2A. $y = 2^{x+3} - 5$

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



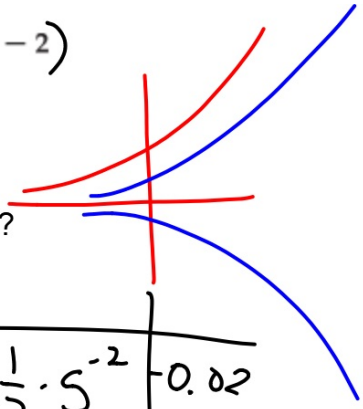
giant graphs

0	$2^3 - 5$	3
1	2^4	11
2	2^5	
−1	2^2	−1
−2	2^1	−3
−3		−4

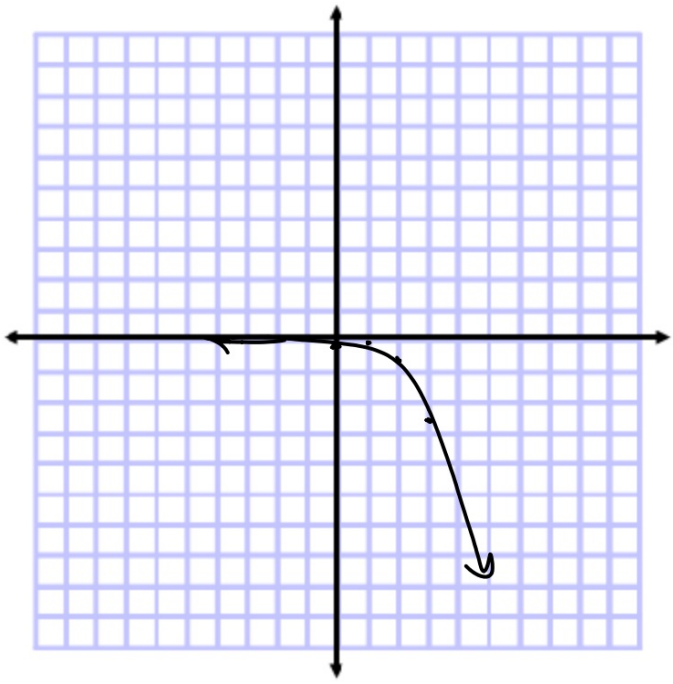


b. $y = -\frac{1}{2} \cdot 5^{(x-2)}$

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



0	$-\frac{1}{2} \cdot 5^{-2}$ = -0.02
1	$-\frac{1}{2} \cdot 5^{-1}$ = -1
2	$-\frac{1}{2} \cdot 5^{0}$ = $-\frac{1}{2}$
3	$-\frac{1}{2} \cdot 5$ = -2.5



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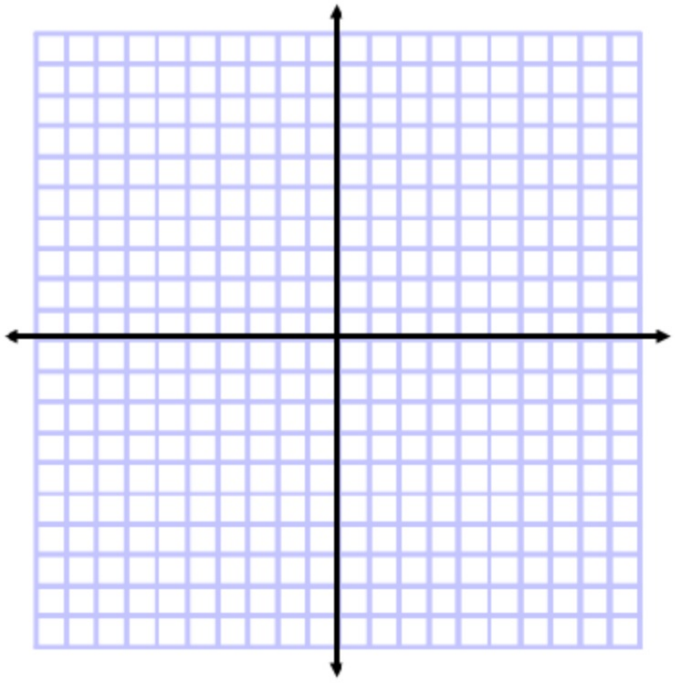
2B. $y = 0.1(6)^x - 3$

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



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

1+r growth factor
percent>>decimal

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.

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.

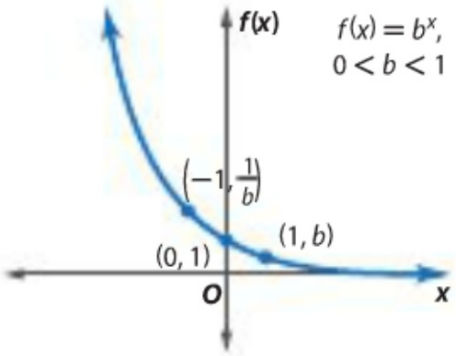
graphing calc

0< 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

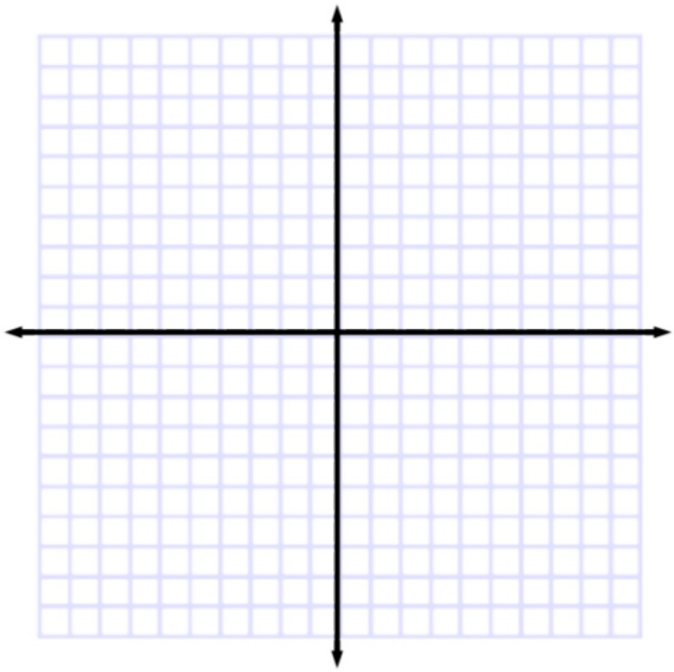


Example 4 Graph Exponential Decay Functions

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

Real-World Example 5 Graph Exponential Decay Functions

TEA A cup of green tea contains 35 milligrams of caffeine. The average teen can eliminate approximately 12.5% of the caffeine from their system per hour.

a. Draw a graph to represent the amount of caffeine remaining after drinking a cup of green tea.

b. Estimate the amount of caffeine in a teenager's body 3 hours after drinking a cup of green tea.

GuidedPractice

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.