

Topic: Transformations of exponential graphs

What is it? Shifting, stretching, shrinking, and reflecting of graphs

Types: Vertical or Horizontal shift

Add outside $y = 2^x + 3$
MOVES _____

Subtract outside $y = 2^x - 3$
MOVES _____

Add inside $y = 2^{(x+3)}$
MOVES _____

Subtract inside $y = 2^{(x-3)}$
MOVES _____

Examples

Reflection

Multiply by negative (-)
 $y = -2^x$
Causes the graph to _____

Vertical Stretch or Shrink

Multiply by Fraction (less than 1)
 $y = \frac{1}{4}(2)^x$
Causes the graph to _____

Multiply by integer
 $y = 4(2)^x$
Causes the graph to _____

GSE Algebra I
Common Unit Pre/Post Assessment
Unit 5: Comparing and Contrasting Functions
Student Version

Directions:

Today you will be taking the GSE Algebra I, Unit 5 assessment on Comparing and Contrasting Functions.

You will have 60 minutes to complete the assessment.

Do your best work. Read each question carefully. For each selected-response item, indicate the best answer. For each constructed-response item, provide the most detailed and accurate response possible. Be sure to record your responses, legibly, on the answer document provided. The standard for each assessment item is referenced above the item.

You may use scratch paper to complete your work. The use of a scientific or graphing calculator may be necessary to solve some assessment items.

F.LE.1a

1. Which table best describes a function modeling exponential decay?

a.

x	$f(x)$
1	81
2	27
3	9
4	3

b.

x	$f(x)$
1	80
2	70
3	50
4	20

c.

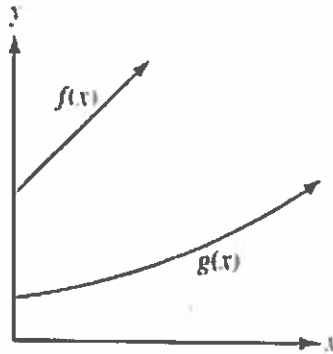
x	$f(x)$
1	80
2	76
3	67
4	51

d.

x	$f(x)$
1	2
2	4
3	8
4	16

F.LE.3

2. This coordinate plane shows two functions of x .
- $f(x)$ is an increasing linear function.
 - $g(x)$ is an increasing exponential function.



Based on the information, which statement is true for all real values of the domain $x \geq 0$?

- a. $f(x) > g(x)$ for all values in the domain
- b. $f(x) < g(x)$ for all values in the domain
- c. $f(x) = g(x)$ for many values in the domain
- d. $f(x) = g(x)$ for only one value in the domain

F.IF.9

3. Two linear functions are defined below.

Function 1: $y = 2x + 3$

Function 2:

$m = 2$

x	$f(x)$
1	-1
2	2
3	5
4	8

$m = 3$

Which of these linear functions has a slope greater than the slope for Function 1 and less than the slope of Function 2?

- a. $f(x) = 3x + 2$ $m = 3$
- b. $f(x) = 2.5x - 6$ $m = 2.5$
- c. $f(x) = 2x + 2.5$ $m = 2$
- d. $f(x) = 1.5x + 1$ $m = 1.5$

F.LE.3

4. As the value of x increases, which function has the greatest rate of growth?

- a. $f(x) = x^2 + 7$
- b. $g(x) = 2 + 7^x$
- c. $h(x) = 7 - x^2$
- d. $k(x) = 2^x + 7$

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F.BF.3

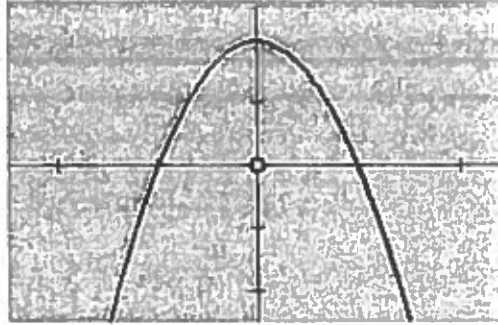
5. Which statement is not true of the function $f(x) = (x + 1)^2 - 9$?

- a. Its y-intercept is $(0, -9)$.
- b. It has two x-intercepts at $(-4, 0)$ and $(2, 0)$.
- c. Its minimum value is -9 .
- d. It has no minimum.

vertex: $(-1, -9)$

F.IF.9

6. The graph below represents function f . A second function, g , is represented by the equation $-5x^2 + 2$. Which of the following is not an accurate comparison of the key features of the functions?



- a. Both functions have the same y-intercept $(0, 2)$.
- b. Both of the functions have two x-intercepts.
- c. Regarding end behavior, the end of the graph of f point down and so do the ends of the graph of g .
- d. On the portions of the graph where both functions are decreasing, f is decreasing at a faster rate.

F.IF.5

7. A flying disk is thrown into the air from a height of 25 feet at time $t = 0$. The function that models this situation is $h(t) = -16t^2 + 75t + 25$, where t is measured in seconds and h is the height in feet. What values of t best describe the times when the disk is flying in the air?

- a. $0 < t < 5$
- b. $0 < t < 25$
- c. All real numbers
- d. All positive integers

$a = -16$
 $b = 75$
 $c = 25$

$$x = \frac{-75 \pm \sqrt{5625 + 1600}}{-32} = \frac{-75 \pm \sqrt{7225}}{-32}$$

$$= \frac{-75 \pm 85}{-32} = \rightarrow \frac{-160}{-32} = +5$$

$$\rightarrow \frac{10}{-32} = -.3125$$

F.IF.6

8. Using the table below, what is the average rate of change of $f(x)$ over the interval $-2 \leq f(x) \leq 0$?

x	$f(x)$
-2	15
-1	9
0	5
1	3
2	3

$$\frac{5 - 15}{0 - (-2)} = \frac{-10}{2} = -5$$

- a. -10
- b. -5
- c. 5
- d. 10

F.IF.5

9. The function $f(t) = -16t^2 + 64t + 5$ models the height of a ball that was hit into the air, where t is measured in seconds and h is the height in feet.

The table represents the height, $g(t)$, of a second ball that was thrown into the air.

Time, t (in seconds)	Height, $g(t)$ (in feet)
0	4
1	36
2	36
3	4

$g(t) - 3$ seconds

$f(t)$

Which statement best compares the length of time each ball is in the air?

- a. The ball represented by $f(t)$ is in the air for about 5 seconds, and the ball represented by $g(t)$ is in the air for about 3 seconds.
- b. The ball represented by $f(t)$ is in the air for about 3 seconds, and the ball represented by $g(t)$ is in the air for about 5 seconds.
- c. The ball represented by $f(t)$ is in the air for about 3 seconds, and the ball represented by $g(t)$ is in the air for about 4 seconds.
- d. The ball represented by $f(t)$ is in the air for about 4 seconds, and the ball represented by $g(t)$ is in the air for about 3 seconds.

F.LE.3

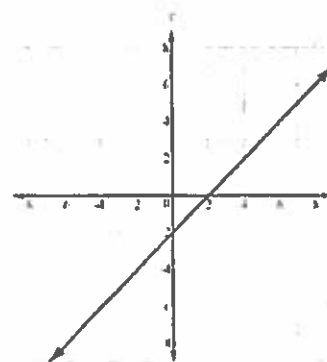
10. Which statement is true about the graphs of exponential functions?

- a. The graphs of exponential functions never exceed the graphs of linear and quadratic functions
- b. The graphs of exponential functions always exceed the graphs of linear and quadratic functions
- c. The graphs of exponential functions eventually exceed the graphs of linear and quadratic functions
- d. The graphs of exponential functions eventually exceed the graphs of linear functions, but not quadratic functions.

F.LE.2

11. Which function corresponds to the graph shown to the right?

- a. $f(x) = x + 1$
- b. $f(x) = 2x + 1$
- c. $f(x) = x - 2$
- d. $f(x) = 3x + 1$



F.IF.2

12. A farmer owns a horse that can continuously run an average of 8 miles an hour for up to 7 hours. Let y be the distance the horse can travel for a given x amount of time in hours. The horse's progress can be modeled by a function.

$$y = 8x$$

$$0 \leq x \leq 7$$

$$0 \leq y \leq 56$$

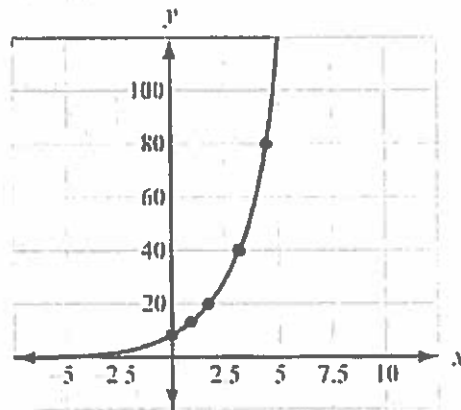
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- a. $0 \leq x \leq 7$
 b. $0 \leq y \leq 7$
 c. $0 \leq x \leq 56$
 d. $0 \leq y \leq 56$

both true

F.IF.4

13. A population of squirrels doubles every year. Initially there were 5 squirrels. A biologist studying the squirrels created a function to model their population growth, $P(t) = 5(2^t)$ where t is time. The graph of the function is shown. What is the valid range of the function if it is to correctly model the population?



- a. Any real number
 b. Any whole number greater than 0
 c. Any whole number greater than 5
 d. Any whole number greater than or equal to 5

F.IF.7

14. The expression $-x^2 + 70x - 600$ represents a company's profit for selling x items. For which number(s) of items sold is the company's profit equation to \$0?

- a. 0 items
 b. 35 items
 c. 10 items and 60 items
 d. 20 items and 30 items

$$a = -1 \quad X = \frac{-70 \pm \sqrt{4900 - 2400}}{-2} = \frac{-70 \pm \sqrt{2500}}{-2}$$

$$b = 70$$

$$c = -600 = \frac{-70 \pm 50}{-2} \begin{cases} \frac{-120}{-2} = 60 \\ \frac{-20}{-2} = 10 \end{cases}$$

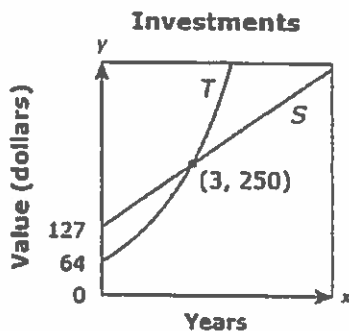
F.IF.1

15. The points $(0,1)$, $(1,4)$, $(2,16)$, and $(3,64)$ are on the graph of a function. Which equation represents that function?

- ~~a.~~ $f(x) = 2^x$
~~b.~~ $f(x) = x^2 + 1$
 c. $f(x) = 4^x$
 d. $f(x) = 2x + 1$

F.LE.1

16. **Constructed Response:** Anthony invested money in two companies at the same time. He invested \$127 in Company S and \$64 in Company T. The growth with Company S was linear, and the growth with Company T was exponential. The graph shows the values of the two investments for the first few years.



Part A

The point of intersection of the two graphs is $(3, 250)$. Interpret this point in terms of Anthony's two investments. Be specific in your answer. *After 3 years, the values of both investments was the same*

Part B

Write an equation of a linear function, S , that expresses the amount of money Anthony has in Company S as a function of the number of years, x , that it has been invested. Show your work.

Part C

What does the slope of the line from Part B tell you about the investment?

Part D

The exponential function $T(x) = 64(1.575)^x$ expresses the amount of money Anthony has in Company T as a function of the number of years, x , that it has been invested. What does the base of the exponent tell you about the investment?

F.LE.1c

17. **Constructed Response:** During the first month of a new business, the expenses were \$180 and the revenue was \$15. During each of the next several months, the expenses and the revenue increased as shown in the table.

Time (months)	Expenses (dollars)	Revenue (dollars)
1	180	15
2	190	30
3	200	60
4	210	120

Write an equation that expresses the expenses, E , as a function of the number of months, m . Then write an equation that expresses the revenue, R , as a function of the number of months, m . Examine the two equations you wrote. Is it possible to determine whether the monthly revenue will ever exceed the monthly expenses? Explain how you know without giving any dollar amounts.

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