Warm-Up 3/20/18

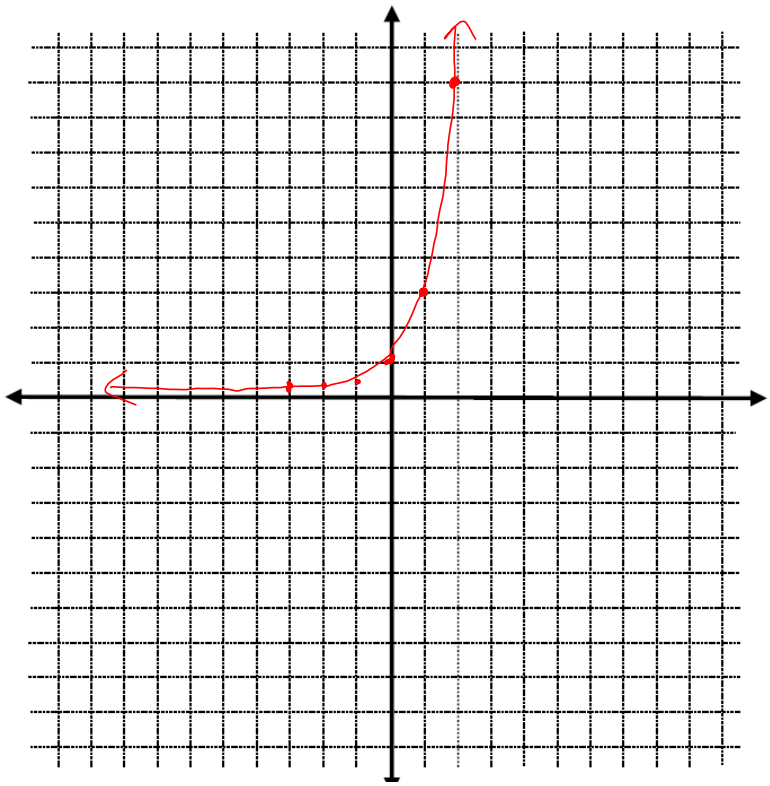
Home Work Review

Day 1 - Graphing Exponential Functions

Graph the functions. Then state the y-intercept and asymptote.

1. $f(x) = 3^x$

x	y
-2	1/9 = 0.11
-1	1/3 = 0.3
0	1
1	3
2	9



y-intercept: (0, 1)

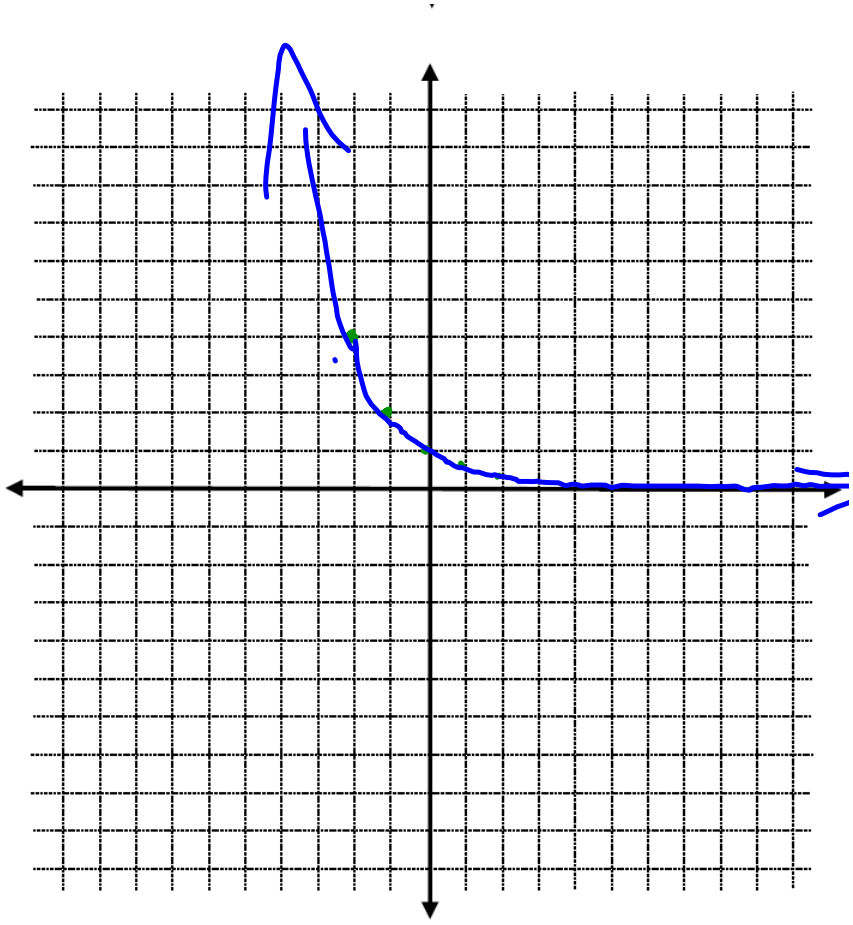
asymptote: $y = 0$

2. $f(x) = 0.5^x$

x	y
-2	4
-1	2
0	1
1	0.5
2	.25

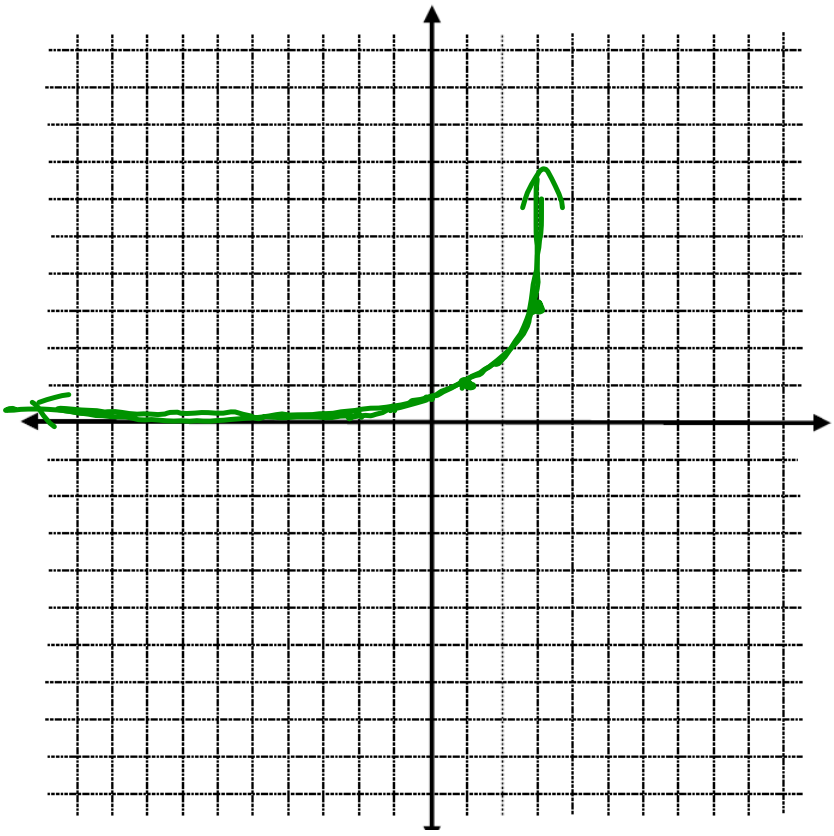
y-intercept: (0, 1)

asymptote: $y = 0$



3. $f(x) = \frac{1}{3}(3)^x$

x	y
-2	1/27
-1	1/9
0	1/3
1	1
2	3



y-intercept: (0, 1/3)

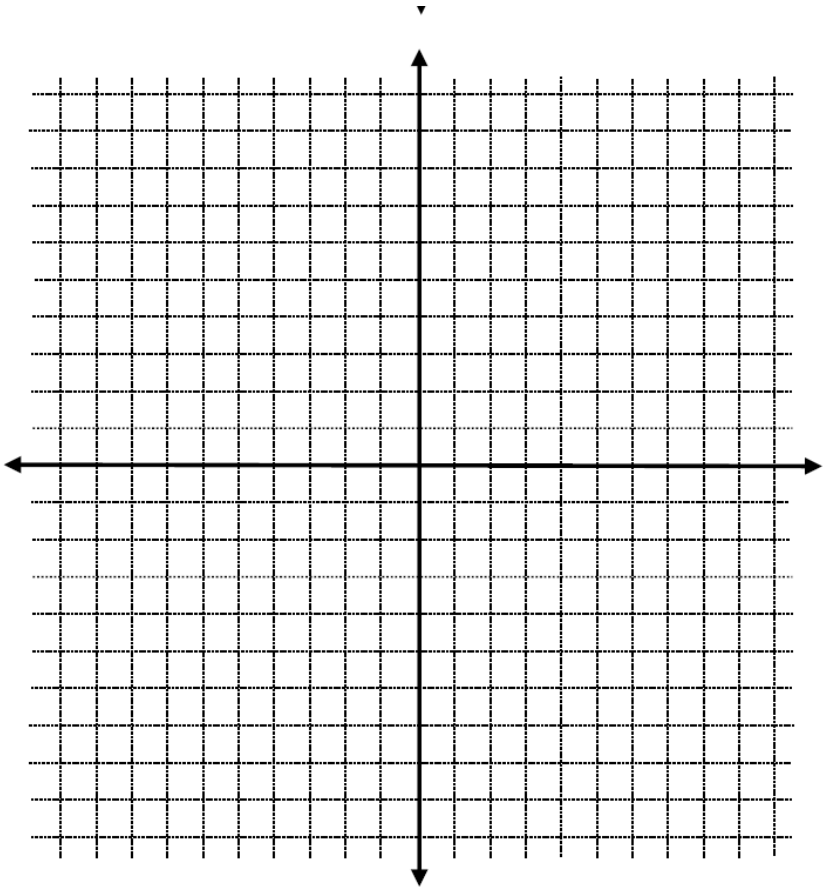
asymptote: y = 0

4. $f(x) = 2(\frac{1}{4})^x$

x	y
-2	32
-1	8
0	2
1	1/2
2	1/8

y-intercept: (0, 2)

asymptote: $y = 0$



3/20/18

DAY 3: TRANSFORMATIONS (A)

Unit 4: Exponential Functions

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Essential Question: 3/20/18

How can I transform the Exponential Parent Function of $f(x) = 2^x$?

Standard:

MGSE9-12.F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

Day 2 – Transformations of Exponential Functions (h and k)

Transformations of exponential functions is very similar to transformations with quadratic functions. Do you remember what a, h, and k do to the quadratic function?

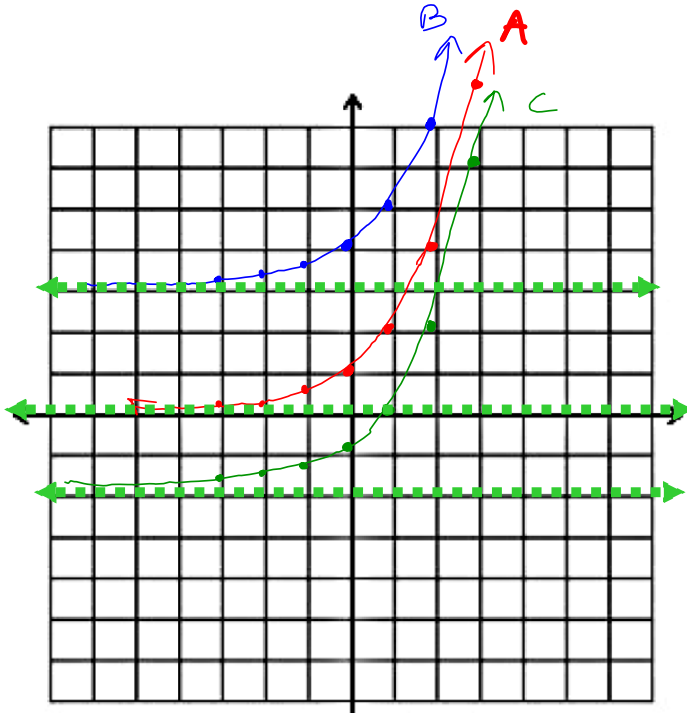
A: If negative, reflects over x-axis, compress, stretch. H: right or left. K: up or down.

The K Value

For each of the following equations, complete the table of values. Then, using those values, graph each equation in a different color.

Equation A $y = 2^x$ (Parent Function)
Equation B $y = 2^x + 3$
Equation C $y = 2^x - 2$

A		B		C	
x	2^x	x	$2^x + 3$	x	$2^x - 2$
-3	.125	-3	3.12	-3	-1.875
-2	.25	-2	3.25	-2	-1.75
-1	.5	-1	3.5	-1	-1.5
0	1	0	4	0	-1
1	2	1	5	1	0
2	4	2	7	2	2
3	8	3	11	3	6



Graph Differences:

a. How is Graph B different than Graph A?

Graph B is higher than graph A

b. How is Graph C different than Graph A?

Graph C is lower than Graph A.

c. Describe what the number at the end seems to do to the parent function $y = 2^x$.

makes the parent function lower or higher.

Graph A

y-intercept: (0,1)

asymptote: $y = 0$

Graph B

y-intercept: (0,4)

asymptote: $y = 3$

Graph C

y-intercept: (0,-1)

asymptote: $y = -2$

d. How does the k value affect the asymptote?

The k-value determines the asymptote.

e. How does the k value affect the y-intercept?

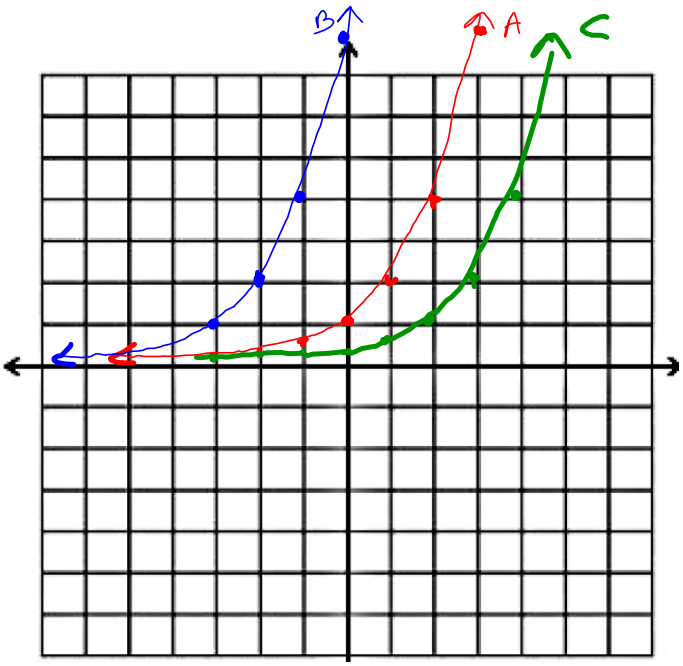
The k-value moves the y-int up or down by the k-value.

The H Value

For each of the following equations, complete the table of values. Then, using those values, graph each equation in a different color.

Equation A $y = 2^x$ (Parent Function)
Equation B $y = 2^{x+3}$
Equation C $y = 2^{x-2}$

A		B		C	
x	2^x	x	2^{x+3}	x	2^{x-2}
-3	.125	-3	1	-3	.03125
-2	.25	-2	2	-2	.0625
-1	.5	-1	4	-1	.125
0	1	0	8	0	.25
1	2	1	16	1	.5
2	4	2	32	2	1
3	8	3	64	3	2



Graph Differences:

a. How is Graph B different than Graph A?

Shifted left by 3 units

b. How is Graph C different than Graph A?

Shifted right by 2 units.

c. Describe the transformation that occurred.

Graph A

y-intercept: (0, 1)

asymptote: $y=0$

Graph B

y-intercept: (0, 8)

asymptote: $y=0$

Graph C

y-intercept: (0, .25)

asymptote: $y=0$

d. How does the h value affect the asymptote?

Does not affect the asymptote.

e. How does the h value affect the y-intercept?

it shifts up or down by the 2^{-h}.

page 9-10 **Practice with h and k Transformations**

Example: Describe the transformations from the parent function to the transformed function:

A. $f(x) = 3^x \rightarrow f(x) = 3^{x+3}$ (h)

left by 3

y-intercept: (0, 27)

asymptote: $y = 0$

B. $y = \frac{1}{2}(5)^x \rightarrow y = \frac{1}{2}(5)^x - 4$ (k)

y-intercept: (0, −3.5)

asymptote: $y = -4$

down by 4 units

Y-Intercepts and Asymptotes

C. $y = 3(0.4)^x \rightarrow y = 3(0.4)^x + 8$ (k)

up by 8

y-intercept: (0, 11) asymptote: $y = 8$

D. $f(x) = 4^x \rightarrow f(x) = 4^{x-6} + 5$ (h, k)

Right by 6, up by 5

y-intercept: (0, 5.00024) asymptote: $y = 5$

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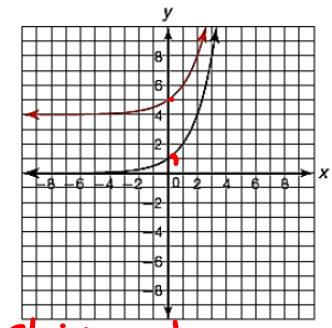
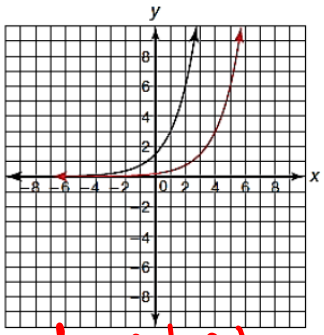
Example: Using the graphs of f(x) and g(x), described the transformations from f(x) to g(x):

A.



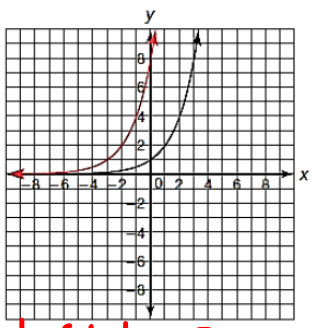
Shift up by 4

B.



down by 1

C.



left by 3

Example: Using the function g(x) = 5^x, create a new function h(x) given the following transformations:

A. up 4 units

$h(x) = 5^x + 4$

B. left 2 units

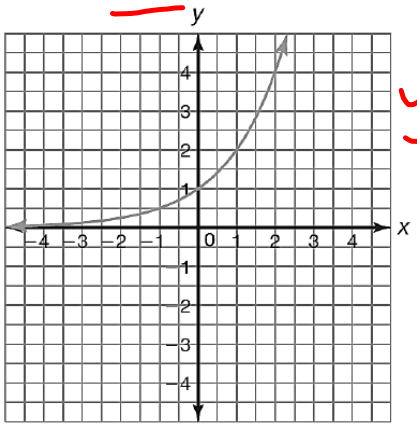
$h(x) = 5^{x+2}$

C. down 7 units and right 3 units

$h(x) = 5^{x-3} - 7$

Example: Using the graph that is given ($y = 2^x$), graph a new function with the stated transformations.

a. shifted up two units

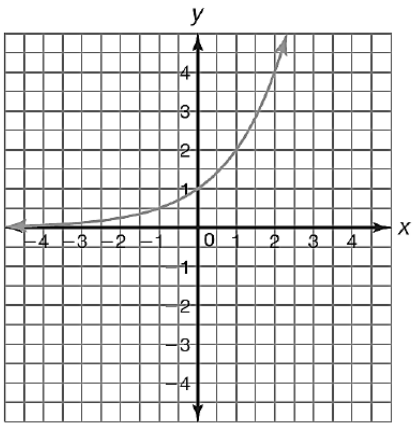


Equation: $y = 2^x + 2$

Y-intercept: (0, 3)

Asymptote: $y = 2$

b. shifted down 4 units and right 3 units



Equation:

Y-intercept:

Asymptote:

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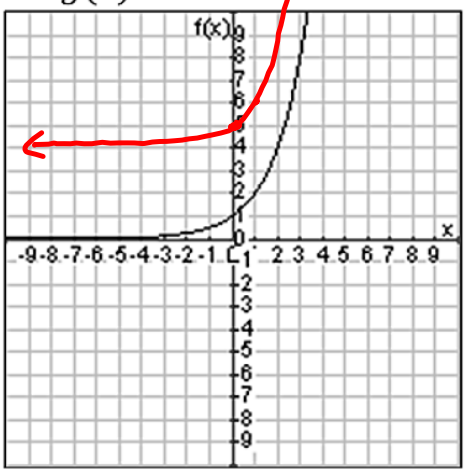
Example: Your parent functions will be either $f(x) = 2^x$ or $f(x) = (\frac{1}{2})^x$. A new function, g(x) is given. Describe the transformations you see in g(x) and then sketch the graph of g(x).

19. $g(x) = 2^x + 4$

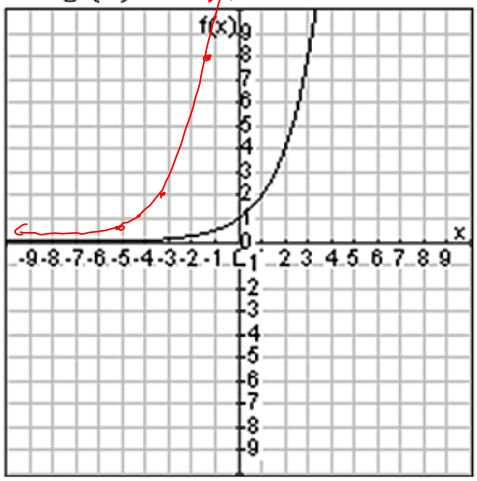
f(x) = 2^x



Y-intercept: (0,5) Asymptote: y=4

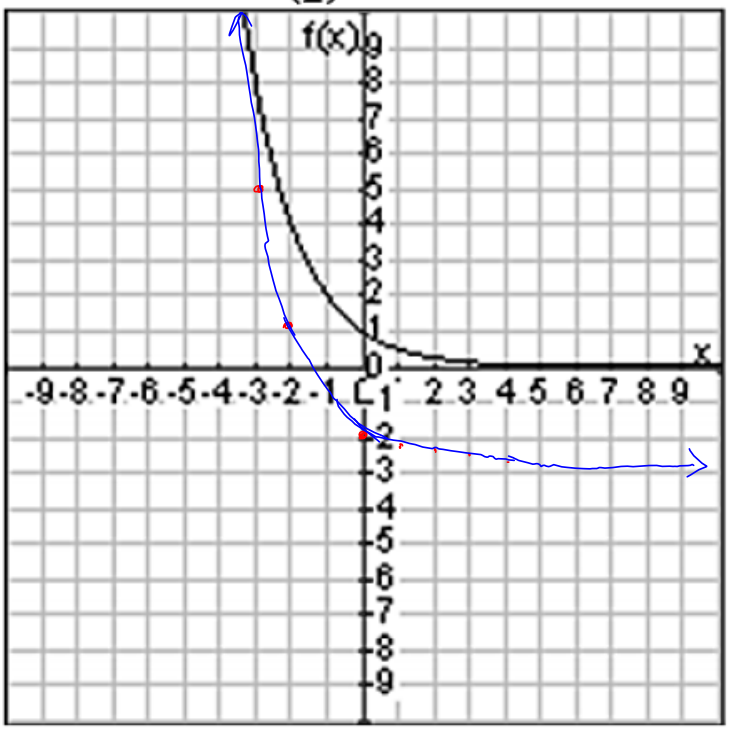
20. $g(x) = 2^{x+4}$

f(x) = 2^x



Y-intercept: (0,16) Asymptote: y=0

30. $g(x) = \left(\frac{1}{2}\right)^x - 3$

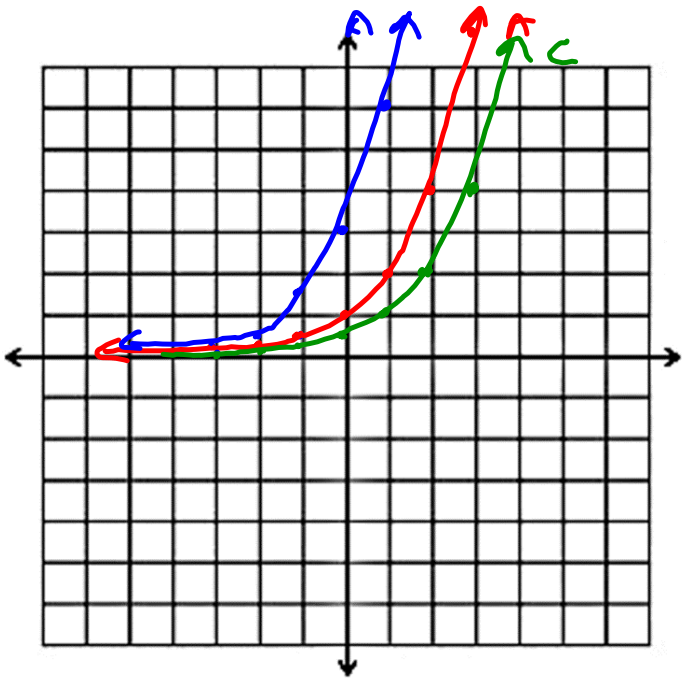


Y-intercept: (0, -2) Asymptote: $y = -3$

Analyzing A - Part 1

Equation A $y = 2^x$ (Parent Function)
Equation B $y = 3(2)^x$
Equation C $y = \frac{1}{2}(2)^x$

A		B		C	
x	2^x	x	$3(2)^x$	x	$\frac{1}{2}(2)^x$
-3	.125	-3	.375	-3	.0625
-2	.25	-2	.75	-2	.125
-1	.5	-1	1.5	-1	.25
0	1	0	3	0	.5
1	2	1	6	1	1
2	4	2	12	2	2
3	8	3	24	3	4



Analyzing A - Part 1

Graph Differences:

a. How is Graph B different than Graph A?

Graph B is taller than graph A

b. How is Graph C different than Graph A?

Graph C is Shorter than Graph A

c. Describe the transformation that occurred.

Vertical stretch by a factor of 3

Vertical shrink by a factor of 1/2

Graph A	Graph B	Graph C
y-intercept: (0, 1)	y-intercept: (0, 3)	y-intercept: (0, 5)
asymptote: y=0	asymptote: y=0	asymptote: y=0

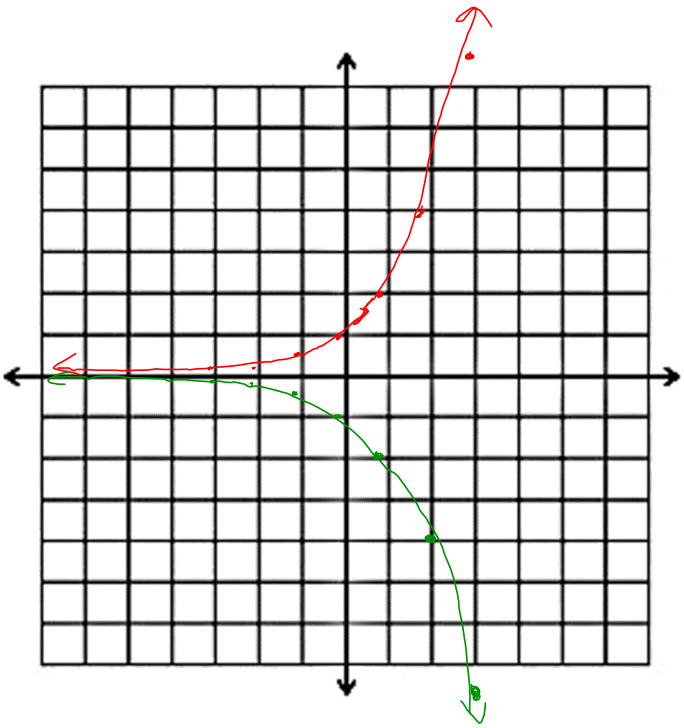
d. What did you notice about the y-intercept and a value?

They are the same

Exploring A - Part 2

Equation A $y = 2^x$ (Parent Function)
Equation B $y = -2^x$

A		B	
x	2^x	x	-2^x
-3	.125	-3	-.125
-2	.25	-2	-.25
-1	.5	-1	-.5
0	1	0	-1
1	2	1	-2
2	4	2	-4
3	8	3	-8



Analyzing A - Part 2

Graph Differences:

a. How is Graph B different than Graph A?

Graph B is upside down

b. How is ~~Graph C~~ different than Graph A?

c. Describe the transformation that occurred.

The graph is reflected over the x-axis.

Graph A

y-intercept: (0, 1)

asymptote: $y=0$

Graph B

y-intercept: (0, −1)

asymptote: $y=0$

Summary of Exponential Transformations

The general form of an exponential function is:

$$f(x) = a(b)^{x-h} + k.$$

Describe the transformations of each variable in the table.

Variable	Effect on the Graph of the Line	
k*	When "k" is positive up	When "k" is negative down
h	When "h" is positive left	When "h" is negative right
a ***(sign)***	When "a" is positive goes up	When "a" is negative reflects over x-axis
a ***(number)***	When "a" is greater than 1 Vertical stretch	When "a" is between 0 and 1 Vertical shrink

***When your graph is shifted vertically, the y-intercept becomes a + k.**
***When the graph is shifted vertically, the asymptote becomes y = k.**

Describing Transformations

Example: Describe the transformations from the parent function to the transformed function:

A. $f(x) = 3^x \rightarrow f(x) = 4(3)^x$

Vertical stretch by factor of 3

B. $y = 5^x \rightarrow y = \frac{1}{2}(5)^x$

Vertical compress by a factor of '12

C. $y = 0.4^x \rightarrow y = 3(0.4)^x$

Vertical stretch by 3

D. $f(x) = 4^x \rightarrow f(x) = -4^x$

reflects over x-axis

E. $y = 3^x \rightarrow y = -\frac{1}{2}(3)^x$

reflects over X-axis' Vertical compress by 1/2

F. $y = 0.8^x \rightarrow y = -3(0.8)^x$

reflects over x-axis, vertical stretch by 3

G. $f(x) = 3^x \rightarrow f(x) = \frac{3}{4}(3)^{x-2}$

Vertical shrink by factor of 3/4; right by 2 units,

H. $y = 5^x \rightarrow y = -\frac{1}{2}(5)^{x+2}$

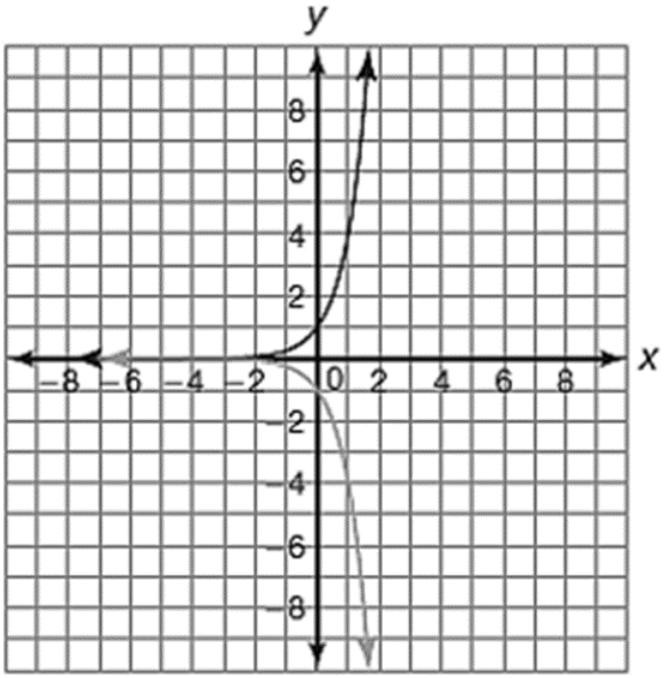
Reflects over x-axis, Vertical shrink by 1/2 Left by 2 units.

I. $y = 0.4^x \rightarrow y = 2(0.4)^x - 6$

Vertical stretch by factor of 2; down by 6.

Closing: 3/20/18

Example: Describe the transformation from $f(x) = 2^x$ to $g(x)$.



The transformation is a reflection over the x-axis

Class Work/Home Work - 3/20/18

1. Day 2: Transformations

Due tomorrow - Wednesday 3/21/18

Day 2: Transforming Exponential Functions Practice (h & k)

Directions: Describe the transformations from the given function to the transformed function. Then name the y-intercept and asymptote.

1. $f(x) = 2^x \rightarrow f(x) = 2^{x-2}$

Transformations:

Y-intercept:

Asymptote:

2. $y = \frac{1}{2}(8)^x \rightarrow y = \frac{1}{2}(8)^x + 6$

Transformations:

Y-intercept:

Asymptote:

3. $y = 4(0.6)^x \rightarrow y = 4(0.6)^x - 3$

Transformations:

Y-intercept:

Asymptote:

4. $f(x) = 4^x \rightarrow f(x) = 4^{x+3} - 8$

Transformations:

Y-intercept:

Asymptote:

Directions: Using the graphs of f(x) and g(x), described the transformations from f(x) to g(x). F(x) is the solid line and g(x) is the dotted line.

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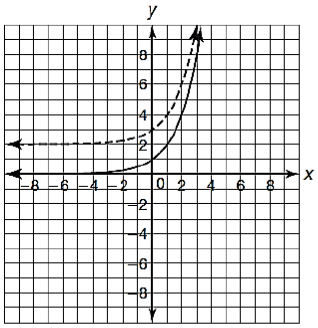

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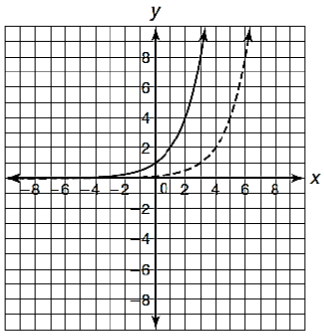

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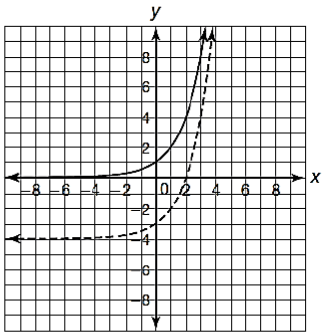

Directions: Using the function $g(x) = 4^x$, create a new function h(x) given the following transformations:

8. down 3 units

9. right 8 units

10. up 4 units and left 2 units

11. left 5 units

12. up 2 units

13. down 1 unit and right 4 units