

Exponential Transformations

The transformational 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 $(x+h)$ LEFT ← $-h$	When "h" is negative $(x-h)$ RIGHT → $+h$
a (sign)	When "a" is positive UP ↗ ↘	When "a" is negative DOWN/Reflection ↙ ↘
a (number)	When "a" is greater than 1 stretch - grows faster	When "a" is between 0 and 1 shrink - grows slower

***When your graph is shifted vertically only (k term), the y-intercept becomes $a + k$.**

***When the graph is shifted vertically, the asymptote becomes $y = k$.**

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) - general form

Equation B $y = (2)^{x+4}$

Equation C $y = -(2)^{x-1} - 2$

$k = 4$
 $k = -2$

	(A)		(B)		(C)
x	2^x	x	$(2)^{x+4}$	x	$-(2)^{x-1} - 2$
-2	.25	-2	4.25	-2	-2.125
-1	.5	-1	4.5	-1	-2.25
0	1	0	5	0	-2.5
1	2	1	6	1	-3
2	4	2	8	2	-4

Graph A
y-intercept:

$(0, 1)$

asymptote: $y = 0$

Graph B
y-intercept: $a+k$

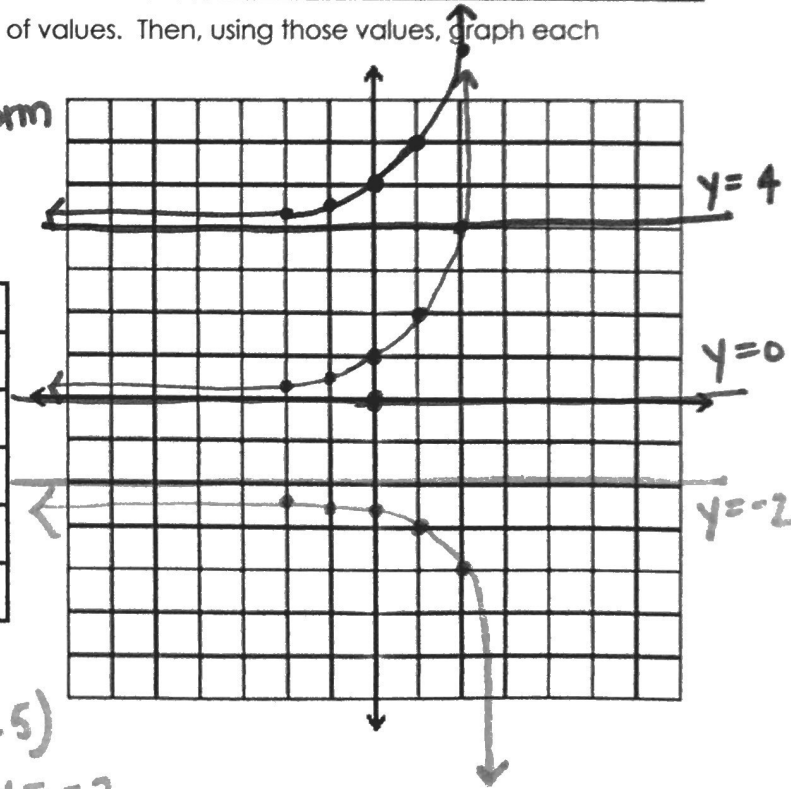
$1+4 (0, 5)$

asymptote: $y = 4$

Graph C
y-intercept:

$(0, -2.5)$

asymptote: $y = -2$



Graph Differences:

a. Describe the transformations that occurred from Graph A to Graph B.

up 4 units

b. Describe the transformations that occurred from Graph A to Graph C.

reflected, right 1, down 2

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

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

2. $y = \frac{1}{4}(8)^x \rightarrow y = \frac{1}{4}(8)^x + 6$ $a = \frac{1}{2}$ $h=0$ $K=6$

Transformations: $h=2$ $K=0$

Transformations:

right 2

up 6, shrink by $\frac{1}{2}$

• Y-intercept: $(0, .25)$

• Y-intercept:

Asymptote: $y=0$

Asymptote: $y=6$

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

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

Transformations: $a=4$ $h=0$ $K=-3$

Transformations: $a=1$ $h=-3$ $K=-8$

down 3, stretch by 4

left 3, down 8

• Y-intercept:

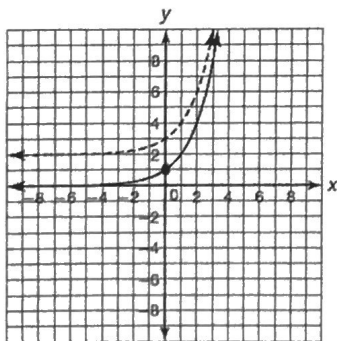
• Y-intercept:

Asymptote: $y=-3$

Asymptote: $y=-8$

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.

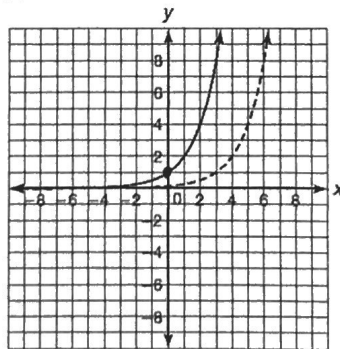
5.



up 2

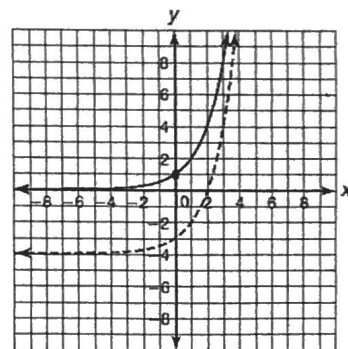
Write the equation for the transformation below.

6.



down 6, right 3

7.



down 4

8. stretch by 2, up 4 units and left 3 units

9. Shrink by $\frac{1}{2}$, down 1 unit and right 7

$a=2$ $K=+4$ $h=-3$

$a = \frac{1}{2}$ $K = -1$ $h = +7$

$y = 2(1)^{(x+3)} + 4$

$y = \frac{1}{2}(1)^{(x-7)} - 1$

more work