

## Section 7.2: Transformations of Exponential Function

$$y = a(c)^{b(x-h)} + k$$

### Vertical Stretch

Parameter	Transformation	Example
$a$	<ul style="list-style-type: none"> <li>Vertical stretch about the <math>x</math>-axis by a factor of <math> a </math></li> <li>For <math>a &lt; 0</math>, reflection in the <math>x</math>-axis</li> <li><math>(x, y) \rightarrow (x, ay)</math></li> </ul>	

### Horizontal Stretch

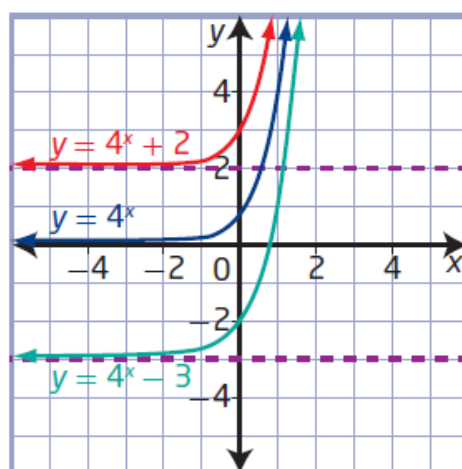
$b$	<ul style="list-style-type: none"> <li>Horizontal stretch about the <math>y</math>-axis by a factor of <math>\frac{1}{ b }</math></li> <li>For <math>b &lt; 0</math>, reflection in the <math>y</math>-axis</li> <li><math>(x, y) \rightarrow \left(\frac{x}{b}, y\right)</math></li> </ul>	
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## Vertical Translation

$k$

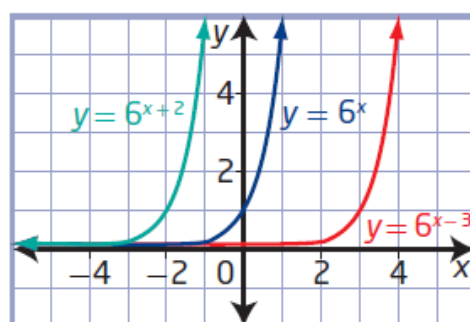
- Vertical translation up or down
- $(x, y) \rightarrow (x, y + k)$



## Horizontal Translation

$h$

- Horizontal translation left or right
- $(x, y) \rightarrow (x + h, y)$



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## Lesson 7.2 Transformations of Exponential Functions

### Example 1

#### Apply Transformations to Sketch a Graph

Transform the graph of  $y = 3^x$  to sketch the graph of  $y = \frac{1}{2}(3)^{x+4}$ .

Describe the domain, range, equation of the horizontal asymptote and intercepts.

**Solution** 
$$y = a(c)^{b(x-h)} + k$$

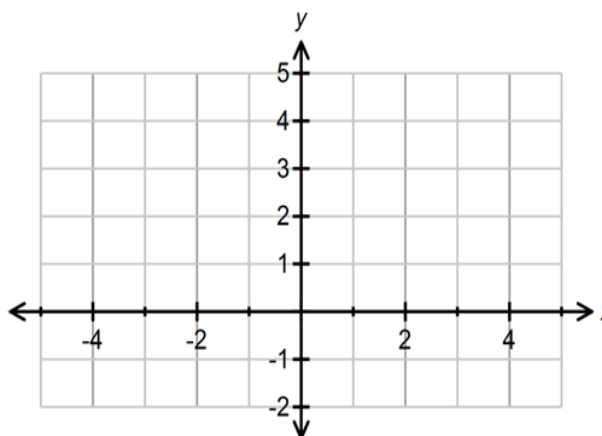
Step 1: Identify the four parameters and write the mapping rule

$a =$                        $k =$                        $b =$                        $h =$

Step 2: Create a new table of values for the given function:

$y = 3^x$		$y = \frac{1}{2}(3)^{x+4}$																								
<table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <thead> <tr><th style="padding: 5px;">x</th><th style="padding: 5px;">y</th></tr> </thead> <tbody> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> </tbody> </table>	x	y											<div style="border: 2px solid black; padding: 5px; display: inline-block;"> <math>(x,y) \longrightarrow</math> </div>	<table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <thead> <tr><th style="padding: 5px;">x</th><th style="padding: 5px;">y</th></tr> </thead> <tbody> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> <tr><td style="height: 20px;"> </td><td> </td></tr> </tbody> </table>	x	y										
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Step 3: Graph



**Examining the characteristics:**

Domain: \_\_\_\_\_

Range: \_\_\_\_\_

Horiz. Asymptote \_\_\_\_\_

x-intercept: \_\_\_\_\_

y-intercept: \_\_\_\_\_

## Lesson 7.2 Transformations of Exponential Functions

### Your Turn

Transform the graph of  $y = 2^x$  to sketch the graph of  $y = -4(2)^{3(x-1)} + 5$ .

Describe the domain, range, equation of the horizontal asymptote and intercepts.

### Solution

$$y = -4(2)^{3(x-1)} + 5$$

$a =$

$k =$

$b =$

$h =$

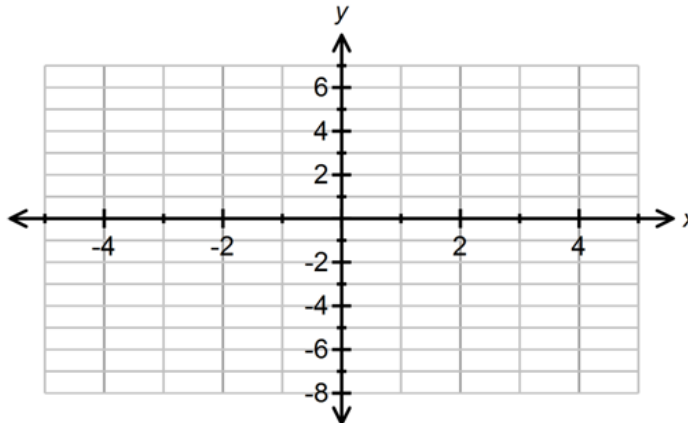
$y = 2^x$

x	y

$(x,y) \longrightarrow$

$y = -4(2)^{3(x-1)} + 5$

x	y



### Examining the characteristics:

Domain: \_\_\_\_\_

Range: \_\_\_\_\_

Horiz. Asymptote \_\_\_\_\_

x-intercept: \_\_\_\_\_

y-intercept: \_\_\_\_\_

Practice Questions P.354-357 #1-4, 6cd, 7cd

## Lesson 7.2 Transformations of Exponential Functions