

Transformations of Exponential Functions

## Lesson 2

Investigate the effects of transformations on the graph of  $y = c^x$

Predict: Using your prior knowledge of transformations, predict the effects of  $a$ ,  $b$ ,  $h$  and  $k$  on exponential functions of the form

$$f(x) = a \cdot c^{b(x-h)} + k$$

$a$ :

$b$ :

$h$ :

$k$ :

Graph each of the following sets on one set of coordinate axes. Sketch the graphs on the grids below. Also graph the basic function  $y = 2^x$

Set a

$$y = 2^x$$

$$y = 3(2)^x$$

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

Set b

$$y = 2^{3x}$$

$$y = 2^{-2x}$$

$$y = 2^{\frac{1}{3}x}$$

Set h

$$y = 2^x$$

$$y = 2^{x-3}$$

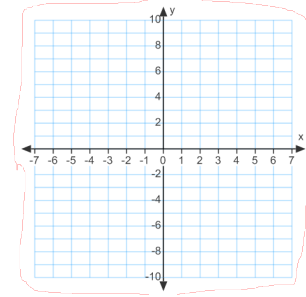
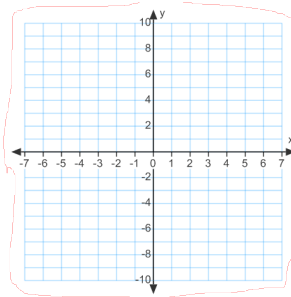
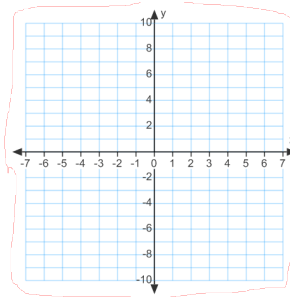
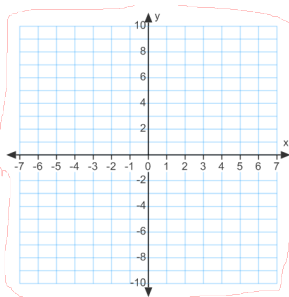
$$y = 2^{x+4}$$

Set k

$$y = 2^x$$

$$y = 2^x + 3$$

$$y = 2^x - 4$$



Were your predictions correct?

Example 1: Apply transformations to sketch a graph.

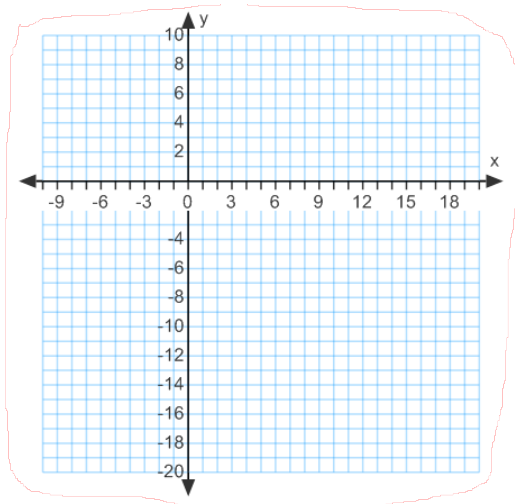
Consider the base function  $y = 3^x$ . For each transformed function.

- state the parameters and describe the corresponding transformations
- map the points from the base function to show what happens to the given points under transformation

$$(x, y) \rightarrow ( \quad , \quad )$$

$y = 3^x$	$y = 2(3)^{x-4}$	$y = -\frac{1}{2}(3)^{\frac{1}{5}x} - 5$
$(-1, \frac{1}{3})$		
$(0, 1)$		
$(1, 3)$		
$(2, 9)$		
$(3, 27)$		

- sketch the graph of the base function and the transformed function
- describe the effects on the domain, range, equation of the horizontal asymptote, and the intercepts.



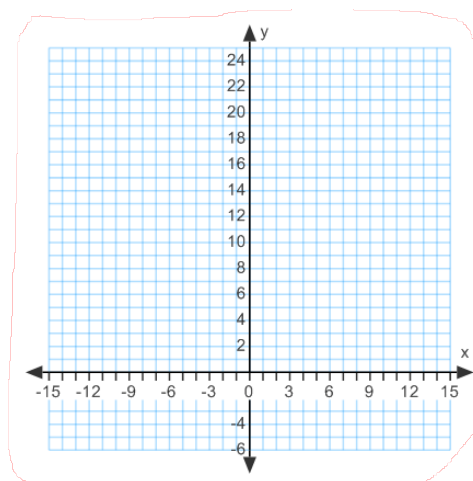
Your Turn:

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

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

Remember! Stretch, Reflect, then Translate

SRT



Example 2: Using Transformations of an Exponential Function to Model a Situation.

The Real Estate Board in Calgary estimates the average home price is \$400 000. It predicts that, at the present growth rate, the average home price will double every 15 years.

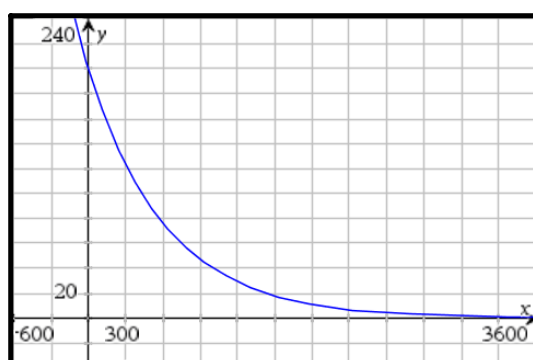
Write a transformed function of the form  $y = a(c)^{b(x-h)} + k$  to model this situation. Justify your answer.

Describe how each of the parameters in the transformed function relates to the information provided.

Graph the function on your calculator and predict the value of the average home after 10 years.

Your Turn:

The radioactive element americium (Am) is used in household smoke detectors. Am-241 has a half-life of approximately 432 years. The average smoke detector contains 200 ug of Am-241.



What is the transformed exponential function that models the graph showing the radioactive decay of 200 ug of Am-241 ?

Identify how each of the parameters of the function relates to the transformed graph.

# Homework

1. Assignment Handout:  
BLM 7-3; Transformations of Exponential Functions
2. Text Pages 354 - 357, Exercises # 1 - 4, 6, 7, 9, 11, 12, C2



## Attachments

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Translations Assignment 1.doc