4A: Graphing Exponential Functions

In this lesson, we will generalize exponential functions and explore their graphs.

Definition

An **exponential function** is of the form

$$f(x) = a(b^x)$$

Where a is nonzero, b is positive, and $b \neq 1$. The constant a is the *initial value* and b is the *base*.

Try These:

Which of the following are exponential functions?

a) $f(x) = 2.5^x$ b) $g(x) = 2(-3)^x$ c) $h(x) = .5(2^{-x})$ d) $j(x) = 2(x^3)$

Graph it

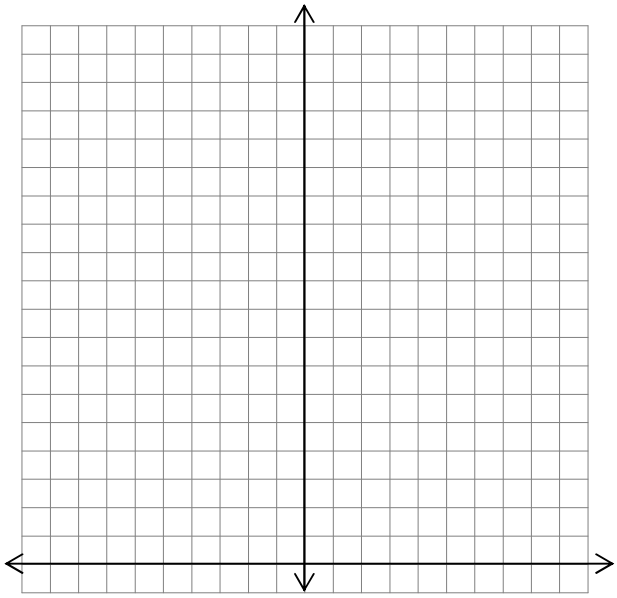
Graph the following functions by hand on the same axes:

$y = 2^x$

$y = 3^x$

$y = \left(\frac{1}{2}\right)^x$

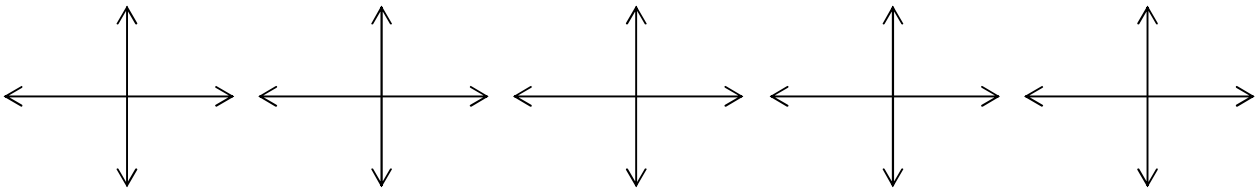
$y = \left(\frac{1}{3}\right)^x$

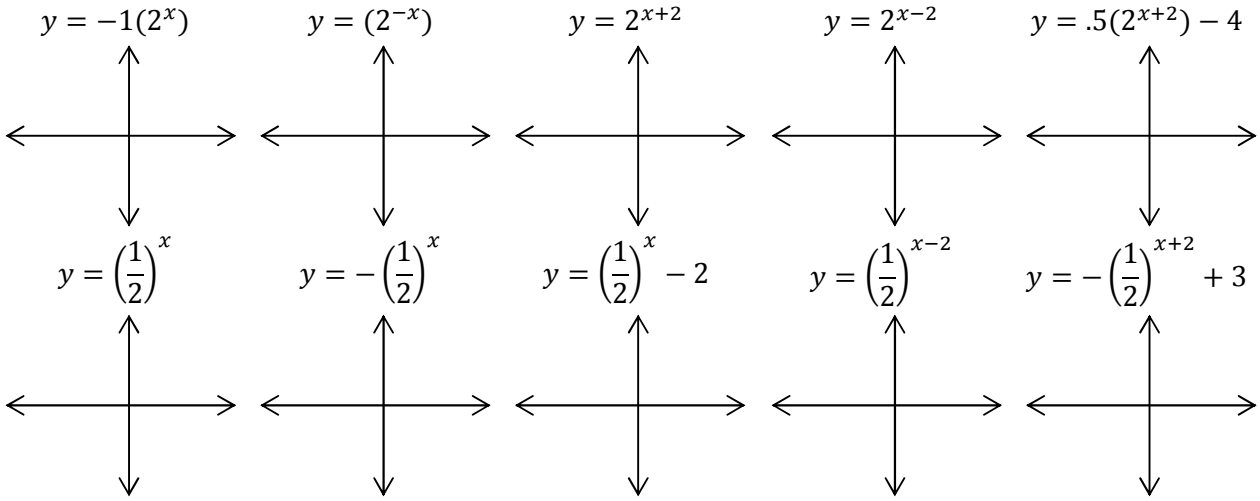


Explore.

Now let's explore some translations. Predict the shape of the graph, sketch it, then check it on your calculator (change your drawing if needed)

$y = 2^x$ $y = 2^x + 1$ $y = 2^x - 3$ $y = .5(2^x)$ $y = .1(2^x)$





Transformations of Exponential Functions:

Describe how the values of a, b, c and d affect the graph of $y = a(b^{x+c}) + d$

a:

b:

c:

d:

Below are several graphs of functions in the form $f(x) = ab^x$. With a partner, consider the following.

1. Which functions have positive a values, and which have negative a values?

2. Order the functions from largest a value to smallest a value. How did you decide this order?

3. Which functions have a b value that is greater than 1, and which functions have a b value that is less than 1?

4. Order the functions from largest b value to smallest a value. How did you decide this order?