

Exponential Functions

Learning Goal:

By the end of today, I will be able to recognize and sketch an exponential function.

An exponential functions is different from our previous functions because it is the first to have a variable/unknown as an exponent.

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

$$f(x) = 5^x$$

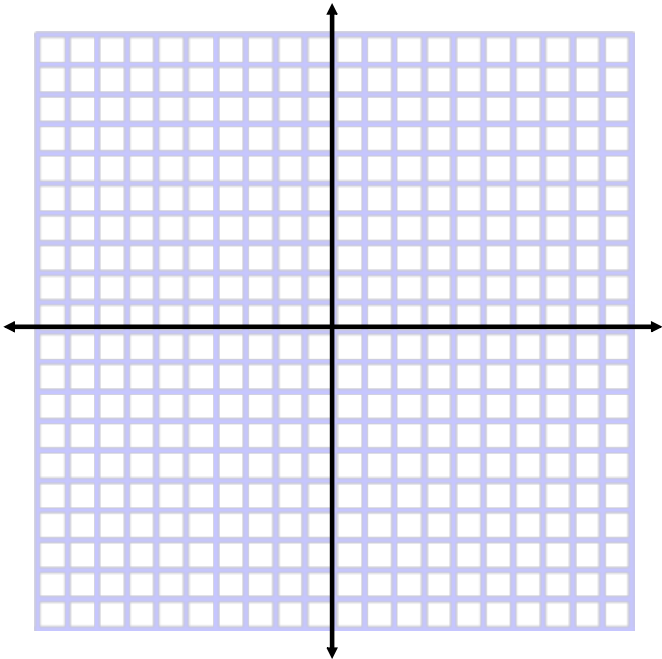
Note the base can be any real number except 0 and 1.

Complete the table for the following function and use the coordinates to graph the function:

$f(x) = 2^x$

X	Y
3	
2	
1	
0	
-1	
-2	
-3	
-4	

FD

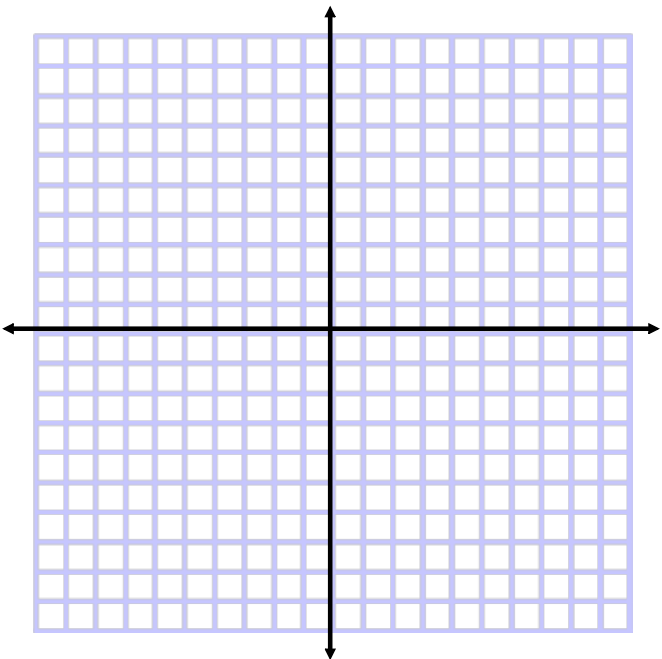


Complete the table for the following function and use the coordinates to graph the function:

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

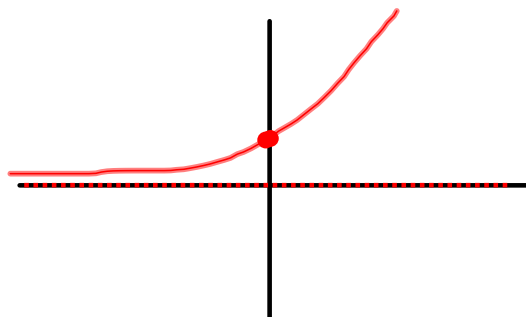
X	Y
3	
2	
1	
0	
-1	
-2	
-3	
-4	

FD



An asymptote is a line a graph cannot cross, although it might get very close to it.

The key elements to drawing an exponential base curve are the original y intercept and horizontal asymptote components.



For bases larger than 1, the function is normally considered to be an example of exponential growth.

For bases between 0 and 1, the function is normally considered to be an example of exponential decay.

The Finite differences of an exponential function repeat the same pattern with each difference.

Key Ideas

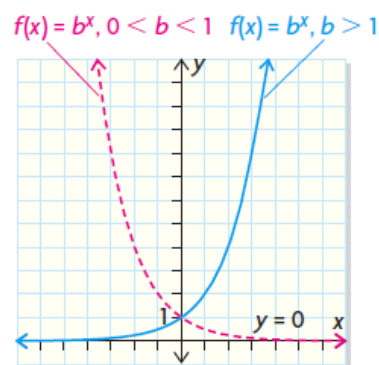
- Linear, quadratic, and exponential functions have unique difference patterns that allow them to be recognized.

Linear	Quadratic	Exponential
Linear functions have constant first differences.	Quadratic functions have first differences that are related by an addition pattern. As a result, their second differences are constant.	Exponential functions have first differences that are related by a multiplication pattern. As a result, their second differences are not constant.

- The exponential function $f(x) = b^x$ is
 - an increasing function representing rapid growth when $b > 1$
 - a decreasing function representing rapid decay when $0 < b < 1$

Need to Know

- The exponential function $f(x) = b^x$ has the following characteristics:
 - The function is exponential only if $b > 0$ and $b \neq 1$; its domain is the set of real numbers, and its range is the set of all positive real numbers.
 - If $b > 1$, the greater the value, the faster the growth.
 - If $0 < b < 1$, the lesser the value, the faster the decay.
 - The function has a horizontal *asymptote*, which is the x -axis.
 - The function has a y -intercept of 1.



Homework Questions:

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Extension: - Transformations and Exponential Functions.

Using Graphing Technology graph the following:

$$f(x) = 2^x \quad \text{base curve}$$

$$y = f(x) + 5$$

$$y = f(x - 6)$$

$$y = 2^x + 5$$

$$y = 2^{x-6}$$

$$y = -f(x) - 3$$

$$y = 5f(x) - 1$$

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

$$y = 5(2^x) - 1$$