

Exponential Functions, Growth, and Decay

7.1

An **exponential function** has a variable as an exponent. The parent exponential function is $f(x) = b^x$ where the base “b” is a constant and the exponent “x” is the independent variable.



The diagram shows the formula $f(x) = b^x$ with a blue arrow pointing to the base 'b' labeled 'Base' and a red arrow pointing to the exponent 'x' labeled 'Exponent'. Below the formula, the text 'where $b > 0, b \neq 1$ ' is displayed.

A function of the form $f(x) = ab^x$ with $a > 0$ and $b > 1$ is an **exponential growth function**. When $0 < b < 1$ the function is called an **exponential decay function**.

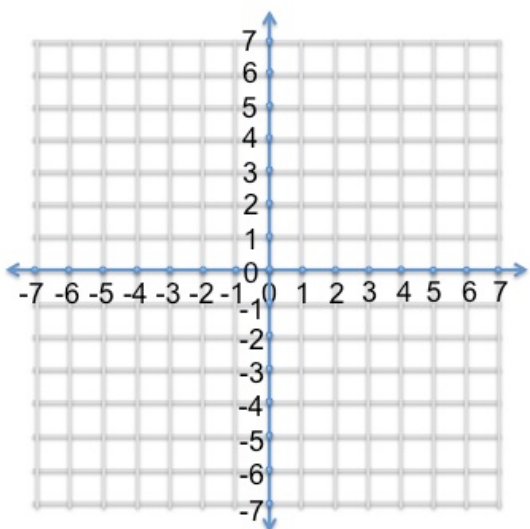
Examples:

I do:

Is this an exponential growth or decay function?

Graph the function.

$$f(x) = 10 \left(\frac{1}{2}\right)^x$$

Function	$f(x) = 10 \left(\frac{1}{2}\right)^x$
Identify b	$b = \frac{1}{2}$
Identify growth or decay	$0 < \frac{1}{2} < 1$ Decay
Plot points and sketch	

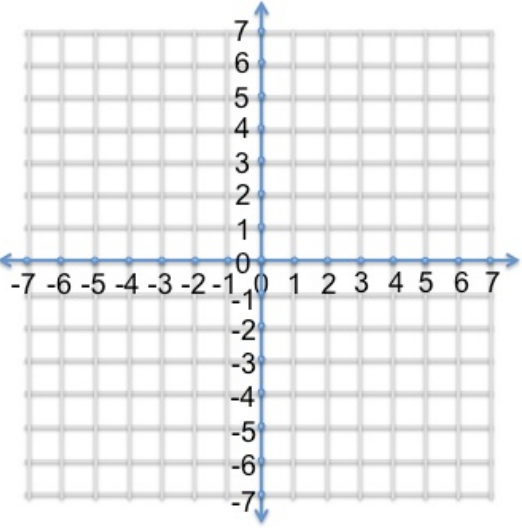
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We Try:

Is this an exponential growth or decay function?

Graph

$$f(x) = 2(1.5)^x$$

Function	$f(x) = 2(1.5)^x$
Identify b	
Identify growth ($b > 1$) or decay $0 < b < 1$	
Plot points and sketch	

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Closure

Discuss with your partner.

Given:

$$f(x) = -1(2)^x$$

What kind of function is this?

What would the graph look like?

Is it growth or decay?