March 15, 2016

Lesson 7.2 Warm Up

1. You invested $3000 into an account that grows at 4.5%. How much money will be in the account after 4 years?

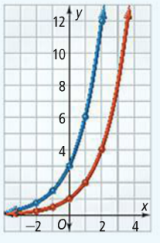
2. Describe what the numerical values mean in the equation $y = 2(1.3)^x$.

Lesson 7.2 Properties of Exponential Functions

Essential Understanding: The factor a in $y = ab^x$ can stretch or compress, and possibly reflect the graph of the parent function $y = b^x$.

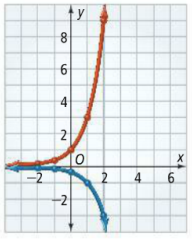
The graphs of $y = 2^x$ (in red) and $y = 3 \cdot 2^x$ (in blue) are shown. Each y-value of $y = 3 \cdot 2^x$ is 3 times the corresponding y-value of the parent function $y = 2^x$.

x	$y = 2^x$	$y = 3 \cdot 2^x$
-2	$\frac{1}{4}$	$\frac{3}{4}$
-1	$\frac{1}{2}$	$\frac{3}{2}$
0	1	3
1	2	6
2	4	12



$y = 3 \cdot 2^x$ stretches the graph of the parent function $y = 2^x$ by the factor 3.

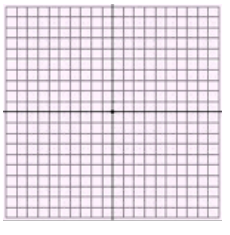
Ex. How does the graph of $y = -1/3(3)^x$ compare to the graph of the parent function $y = (3)^x$?



*Notice that the domain remains the same. The x-axis on both graphs is known as an asymptote. An asymptote is an imaginary line that a graph approaches but never touches or crosses.

Take your past knowledge of transformations and apply them to the exponential function below. Check by graphing.

$y = 3^{x-5} + 2$



Ex. Describe the transformations of $y = -1/2(4)^{x+2} + 1$.

Concept Summary Families of Exponential Functions

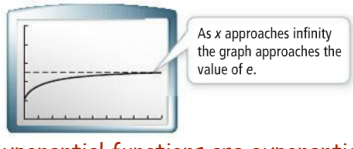
Parent function	$y = b^x$
Stretch ($\lvert a \rvert > 1$) Compression (Shrink) ($0 < \lvert a \rvert < 1$) Reflection ($a < 0$) in x-axis	$y = ab^x$
Translations (horizontal by h; vertical by k)	$y = b^{(x-h)} + k$
All transformations combined	$y = ab^{(x-h)} + k$

Ex. The best temperature to brew coffee is between 195°F and 205°F. Coffee is cool enough to drink at 185°F. The table shows temperature readings from a sample cup of coffee. How long does it take for a cup of coffee to be cool enough to drink? Use an exponential model. (hint: room temperature is about 68°F).

Temp-68

Time (min)	Temp (°F)
0	203
5	177
10	153
15	137
20	121
25	111
30	104

Up to this point you have worked with rational bases. However, exponential functions can have irrational bases as well. One important irrational base is the number e. The graph of $y = (1 + 1/x)^x$ has an asymptote at $y = e$ or $y \approx 2.71828$.

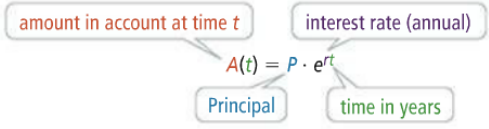


Natural base exponential functions are exponential functions with base e. These functions are useful for describing continuous growth or decay. Exponential functions with base e have the same properties as other exponential functions.

Your calculators have an 'e' button. To evaluate e^5, you simply hit e ^ 5.

Ex. Evaluate e^8.

Key Concept Continuously Compounded Interest



Ex. Suppose you won a contest at the start of 5th grade that deposited $3000 in an account that pays 5% annual interest compounded continuously. How much will you have in the account when you enter high school 4 years later? Express the answer to the nearest dollar.

Ex. Is investing $2000 in an account that pays 5% annual interest compounded continuously the same as investing $1000 at 4% and $1000 at 6% each compounded continuously? Explain.