8.7 Exponential Functions

An exponential function is a function in the form

$$y = a \cdot b^x$$

where a is a nonzero constant, b is greater than zero and not equal to one, and x is a real number.

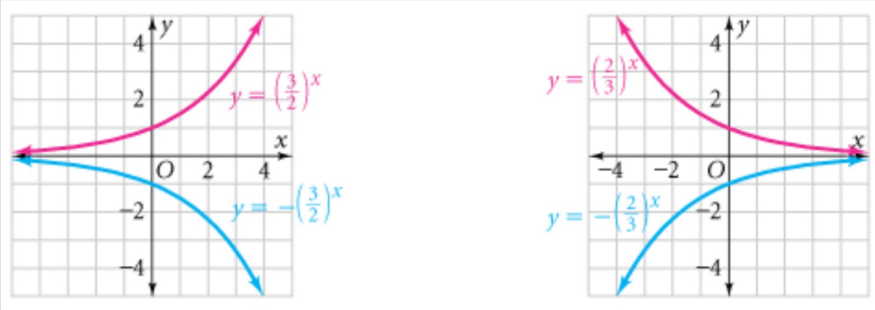
You would evaluate an exponential expression the same way you evaluate any other expression, by plugging in values for x and getting out y-values.

Evaluate each exponential expression for the domain {-2, 0, 3 }

x	$y = 4^x$
-2	$4^{-2} = \frac{1}{16}$
0	$4^0 = 1$
3	$4^3 = 64$

x	$y = 10(5)^x$
-2	$10(5)^{-2} = 10 \cdot \frac{1}{25} = \frac{2}{5}$
0	$10(5)^0 = 10 \cdot 1 = 10$
3	$10(5)^3 = 10 \cdot 125 = 1250$

x	$y = -2(3)^x$
-2	$-2(3)^{-2} = -\frac{2}{1} \cdot \frac{1}{9} = -\frac{2}{9}$
0	$-2(3)^0 = -2 \cdot 1 = -2$
3	$-2(3)^3 = -2 \cdot 27 = -54$



Here are four exponential functions graphed. What do you notice about each graph?

asymptote: a horizontal line that a graph approaches but does not cross.

Exponential graphs follow a few general rules: $y = a(b)^x$

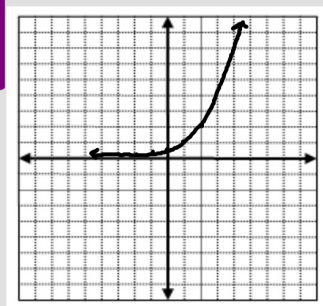
a is the y-intercept

an exponential graph will never cross the x-axis, it will only get very, very close to being horizontal and very, very close to the x-axis.

As with any function, you can always use the fab five to get points to make a graph.

Graph each exponential function.

x	$y = 0.5(2)^x$
-2	$\frac{1}{2}(2)^{-2} = \frac{1}{2} \cdot \frac{1}{4} = \frac{1}{8}$
-1	$\frac{1}{2}(2)^{-1} = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$
0	$\frac{1}{2}(2)^{0} = \frac{1}{2} \cdot 1 = \frac{1}{2}$
1	$\frac{1}{2}(2)^{1} = \frac{1}{2} \cdot 2 = 1$
2	$\frac{1}{2}(2)^{2} = \frac{1}{2} \cdot 4 = 2$



Domain: $-\infty < x < \infty$
Range: $0 < y < \infty$
Asymptote: $y = 0$
Growth or Decay

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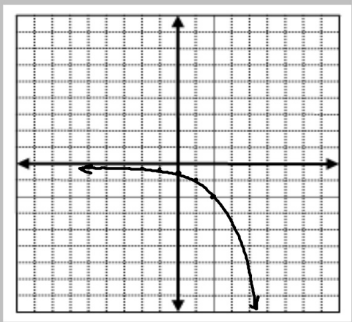
x	$y = -0.5(2)^x$
-2	$-\frac{1}{2}(2)^{-2} = -\frac{1}{2} \cdot \frac{1}{4} = -\frac{1}{8}$
-1	$-\frac{1}{2}(2)^{-1} = -\frac{1}{2} \cdot \frac{1}{2} = -\frac{1}{4}$
0	$-\frac{1}{2}(2)^{0} = -\frac{1}{2} \cdot 1 = -\frac{1}{2}$
1	$-\frac{1}{2}(2)^{1} = -\frac{1}{2} \cdot 2 = -1$
2	$-\frac{1}{2}(2)^{2} = -\frac{1}{2} \cdot 4 = -2$



Domain: $-\infty < x < \infty$
Range: $-\infty < y < 0$
Asymptote: $y = 0$
Growth or Decay

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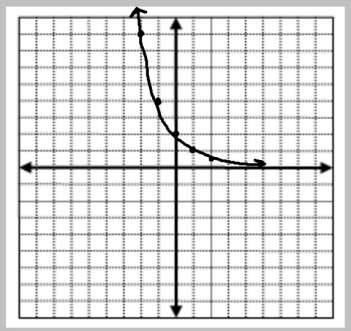
x	$y = 2\left(\frac{1}{2}\right)^x$
-2	$2\left(\frac{1}{2}\right)^{-2} = 2 \cdot 4 = 8$
-1	$2\left(\frac{1}{2}\right)^{-1} = 2 \cdot 2 = 4$
0	$2\left(\frac{1}{2}\right)^{0} = 2 \cdot 1 = 2$
1	$2\left(\frac{1}{2}\right)^{1} = 2 \cdot \frac{1}{2} = 1$
2	$2 \cdot \left(\frac{1}{2}\right)^{2} = 2 \cdot \frac{1}{4} = \frac{1}{2}$



Domain: $-\infty < x < \infty$
Range: $0 < y < \infty$
Asymptote: $y = 0$
Growth or Decay

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