If an exponential equation models a real situation:

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

Initial amount

Growth or Decay Factor

Represents the percent remaining after a given percent increase or decrease.

# of time periods

Don't round x

1. The value of a house has been decreasing 3.7% each year. In 2005, the value was $310,000. Find the value of the house in 2018 to the penny.

$100 - 3.7 = 96.3$

0.963

$$y = 310{,}000(0.963)^{13}$$

$$= \$189{,}890.58$$

2. There is a US Census taken every 10 years. The population of a city in 2010 was 1,325,000. The population has been increasing 2.4% each census. Find the population in each of the following years to the nearest whole number.

$b = 1.024$

$a = 1,325,000$

a) 2018

$x = 8$ $\quad y = 1,325,000(1.024)^{8}$

$= 1,601,826$

b) 1997

$y = 1,325,000(1.024)^{-13}$

$973,456$

3. The number of cells of a certain organism doubles every 40 minutes. At 8:30 am on a given day there were 80,000 cells. Find the number of cells at the given time rounded to the nearest whole number.

a) 3:20pm the same day

$\frac{410}{40} = 10.25$

$y = 80,000(2)^{10.25}$

$= 97,119,847$

b) 10:15pm the previous night

$y = 80,000(2)^{-15.375}$

$= 2$

4. The half-life of a radioactive material is 3 days. If there is 1,500,000 grams of this material on June 19, find the number of grams of this material remaining on July 8. Round to the nearest hundredth.

$$y = 1{,}500{,}000(.5)^{\frac{19}{3}}$$

$$= 18{,}602.35$$

State the percent change each exponential equation represents.

1. $y = 450(0.704)^x$

$100 - 70.4 = 29.6\%$ dec

2. $y = 0.97(1.0502)^x$

5.02% inc.

2. $y = 95(2)^x$

100% inc.

double

Does each represent growth or decay?

1. $y = 0.003(1.04)^x$ G

2. $y = 44{,}000\left(\frac{223}{232}\right)^{-x}$ $\frac{232}{223}$ G

You can now finish Hwk #2

Practice Sheet: Exponential Equations

Graphs of Exponential Functions

General Form of an Exponential Equation:

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

Coefficient

$a \neq 0$

Base

$b > 0, b \neq 1$

Exponent

any real #

Using the graphing calculator do the following:

Graph $Y_1 = 1 \cdot 2^x$

Use the following window: $X_{min} = -5$ $X_{max} = 5$ $Y_{min} = -5$ $Y_{max} = 10$

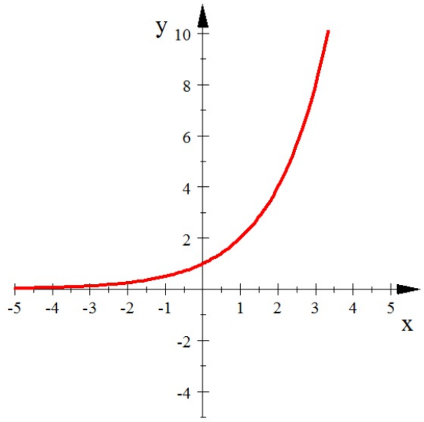
$1(2)^x$

Describe this graph

The graph increases from left to right.

The rate of increase speeds up as you move to the right.

What is the y-intercept? (0,1)



Leaving $Y_1 = 1 \cdot 2^x$ graph $y = 1 \cdot b^x$ for two other values of b bigger than 2 in Y_2 and Y_3 .

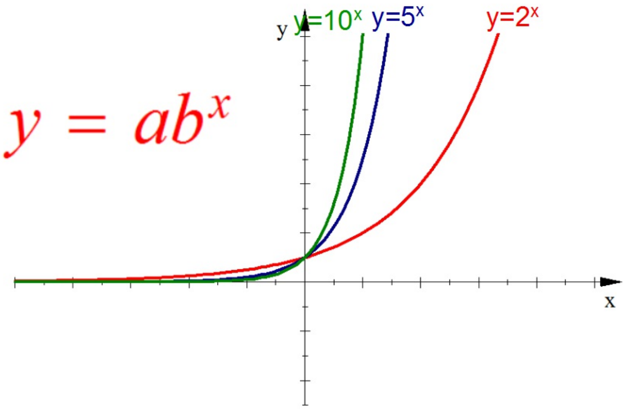
1. Make a sketch of all three graphs labelling each graph with it's equation.

2. Describe what changing the value of b does to the graph.

When b >1 the graph represents Exponential Growth.

in this case b is called the Growth Factor

$$y = ab^x$$



$y=2^x$

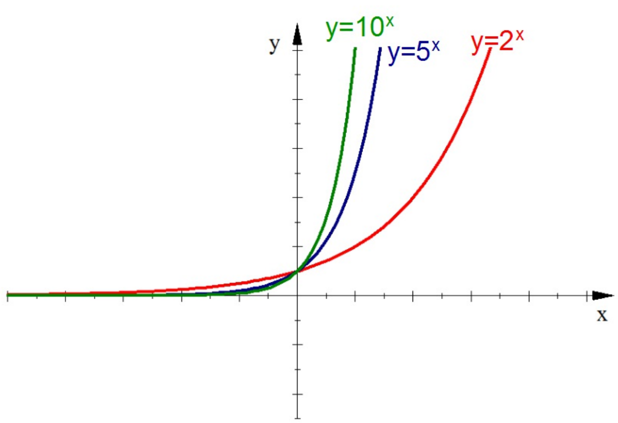
$y=5^x$

$y=10^x$

What point do all 3 graphs have in common?

y-int = 1

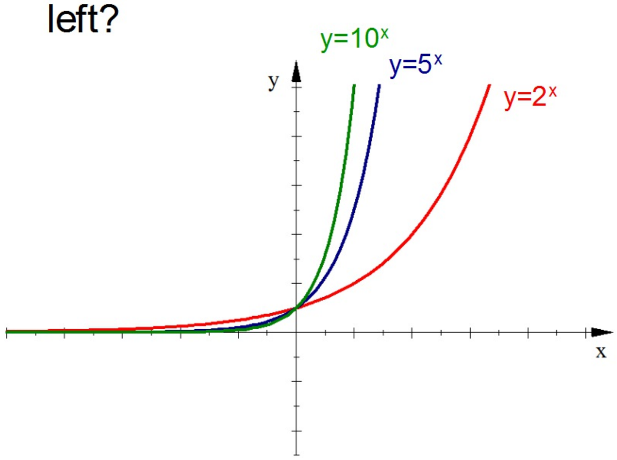
$$y = ab^x$$



As b gets larger the graph increases/grows faster ("steeper")

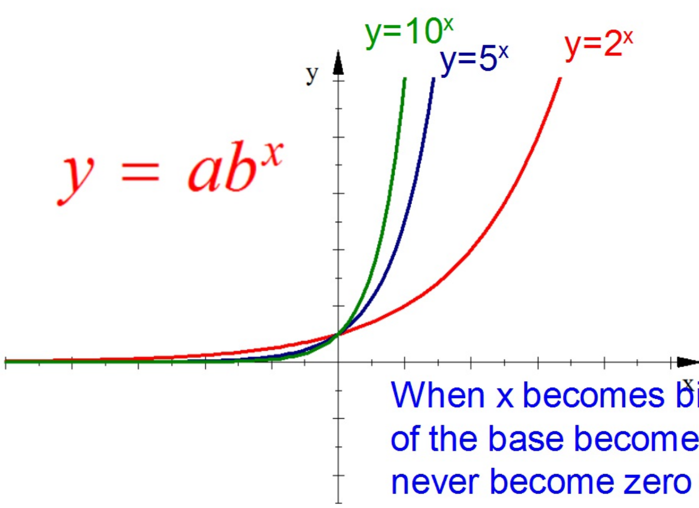
$$y = ab^x$$

What happens to each graph as you move farther to the left?



The graph flattens out and approaches the x-axis, but never actually reaches or crosses it.

The x-axis is called a Horizontal Asymptote.



$$y = ab^x$$

Why will these graphs never reach or cross the x-axis as you move farther and farther to the left?

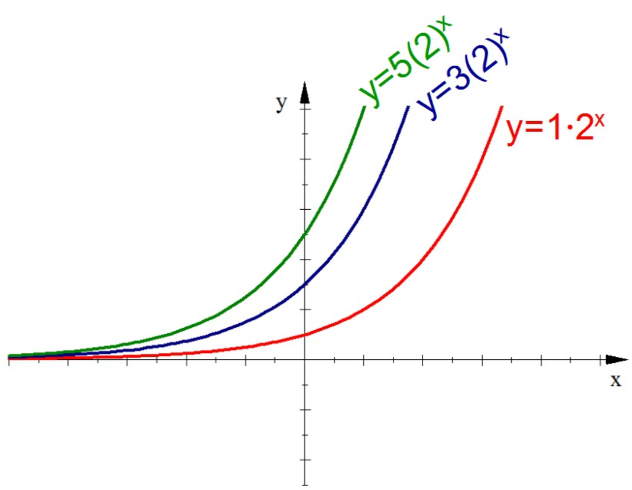
When x becomes bigger negative the reciprocal of the base becomes a smaller number but will never become zero or negative.

Leaving $Y_1=1 \cdot 2^x$ change a from 1 to two other positive values. Graph these equations in Y_2 and Y_3.

1. Make a sketch of all three graphs labelling each graph with it's equation.

2. Describe what changing the value ofa does to the graph.

$$y = ab^x$$



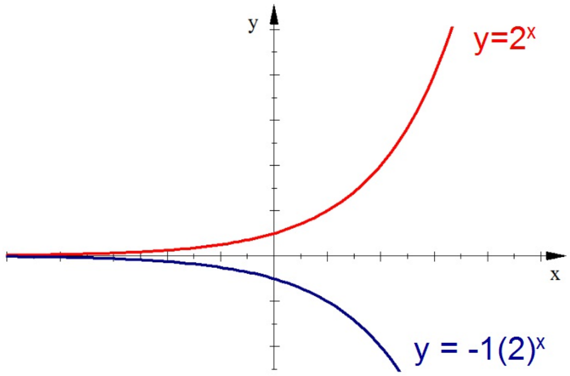
What does changing the value of a in the equation do to the graph?

changing the value of a in the equation changes the y-intercept

a = the y-intercept

$y = ab^x$

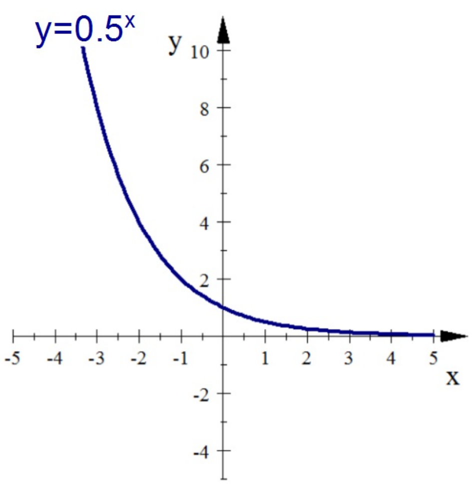
What does a negative value of a do to the graph?



x-axis reflection

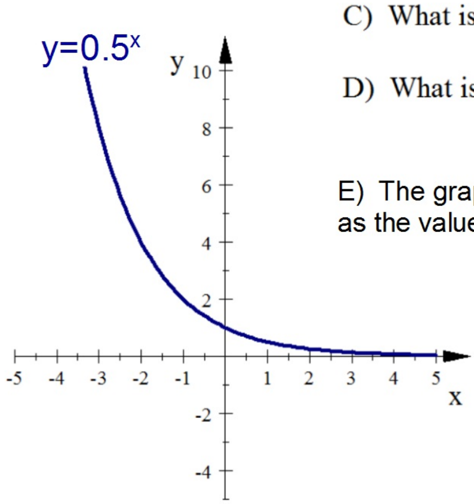
Upside Down

Now, in Y_1 graph the following: $Y_1 = 0.5^x$



When 0<b<1 the graph represents Exponential Decay.

b is called the Decay Factor



C) What is the y-intercept? y-int = 1

D) What is the horizontal asymptote?

y = 0 (x-axis)

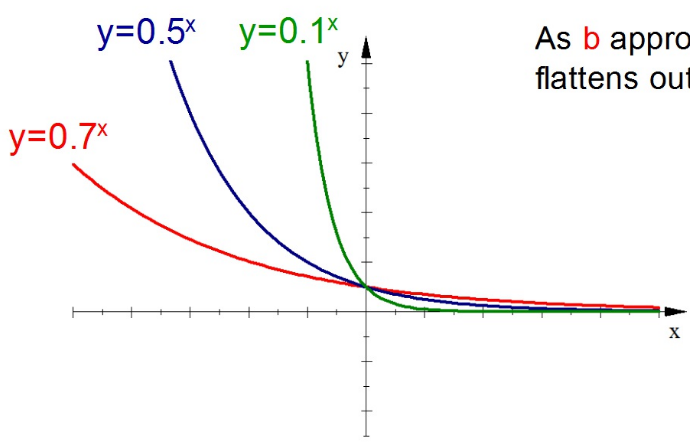
E) The graph approaches this horizontal asymptote as the values of x Increase

Leaving $Y_1=0.5^x$ graph $y=b^x$ for two other values of b between 0 and 1 in Y_2 and Y_3 .

1. Make a sketch of all three graphs labelling each graph with it's equation.

2. Describe what different values of b, when $0<b<1$, does to the graph.

As b gets smaller, but still positive, the graph decreases faster ("steeper")



As b approaches 1, the graph flattens out.

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

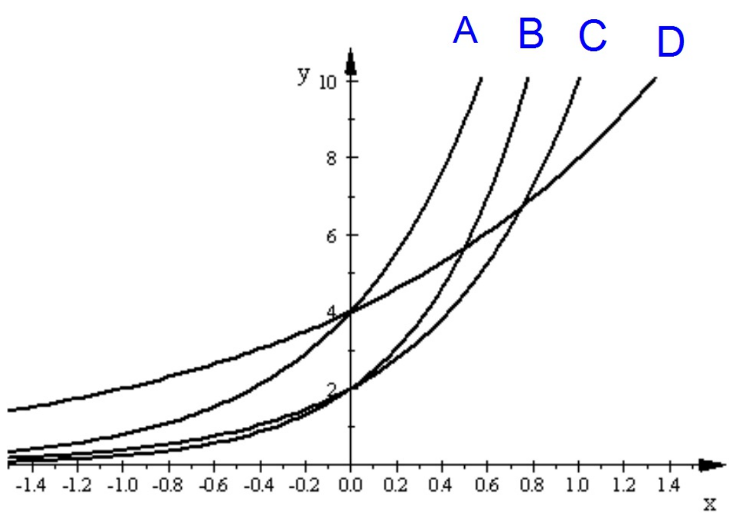
a: the y-intercept. If a is negative graph is upside down (x-axis reflection)

b: Growth or Decay Factor

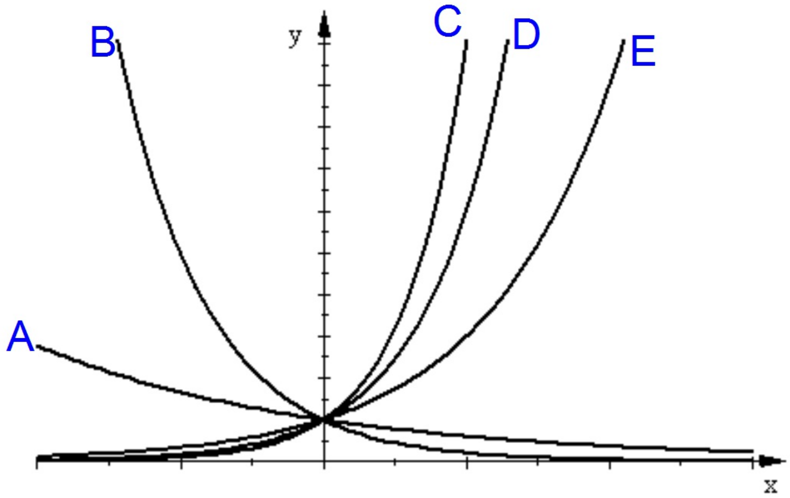
Growth Factor: The larger the value of b the faster the graph increases.
$b>1$

Decay Factor: The smaller the value of b the faster the graph decreases
$0<b<1$

1 D $y = 4(2)^x$ 2 C $y = 2(5)^x$ 3 B $y = 2(8)^x$ 4 A $y = 4(5)^x$



1 D $y = 6^x$ 2 B $y = 0.5^x$ 3 A $y = 0.8^x$ 4 C $y = 10^x$



5 E $y = 2^x$