General Form of an Exponential Equation:

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

Exponent
any real #

Coefficient
$a \neq 0$

Base
$b > 0, b \neq 1$

If an exponential equation models a real situation:

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

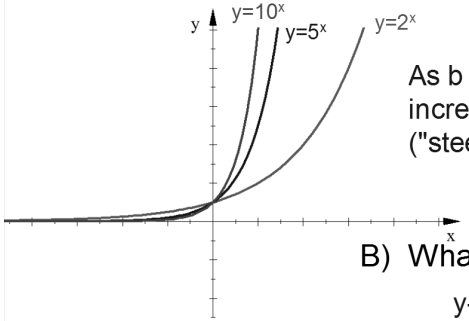
# of time periods

Initial amount

Growth or Decay Factor

When b>1 the graph represents Exponential Growth.

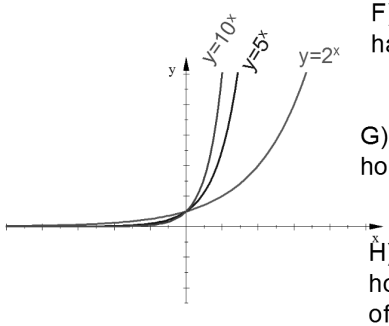
b is called the Growth Factor



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

B) What is the y-intercept?

y-int = 1



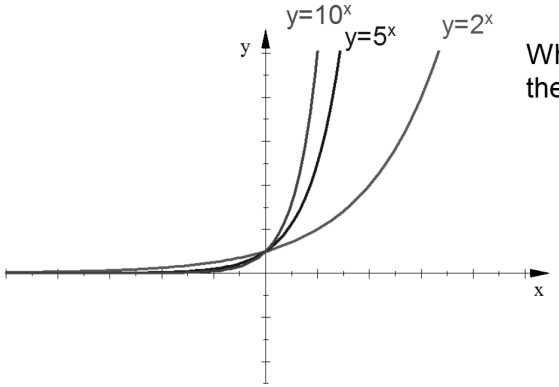
F) What point do all three graphs have in common?

same y-int: y=1

G) All three graphs have the same horizontal asymptote which is

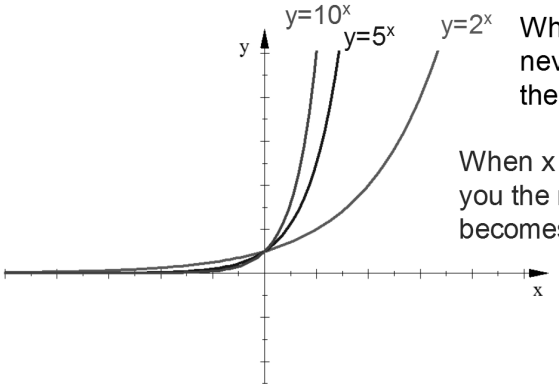
y = 0 (x-axis)

H) The graphs approach this horizontal asymptote as the values of x Decreases



Why do they all have the same y-intercept?

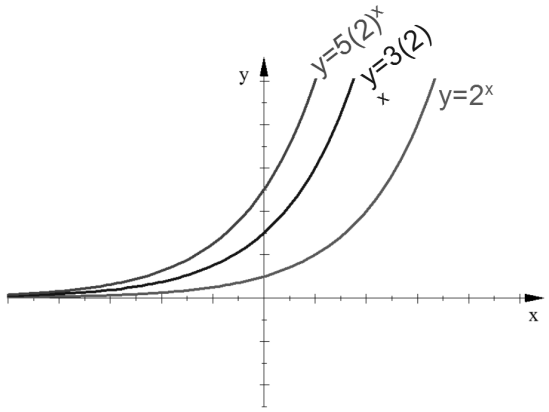
You find a y-int by replacing x with zero and when you do this all three equations equal 1.



Why will these graphs never reach or cross the x-axis?

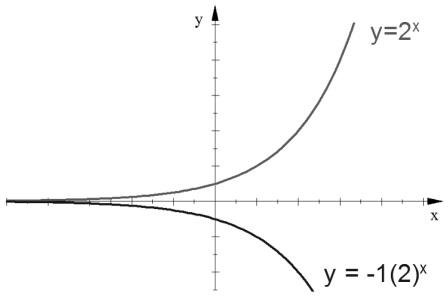
When x becomes bigger negative you the reciprocal of the base becomes a smaller number.

What does a do to the graph?



a is the y-intercept

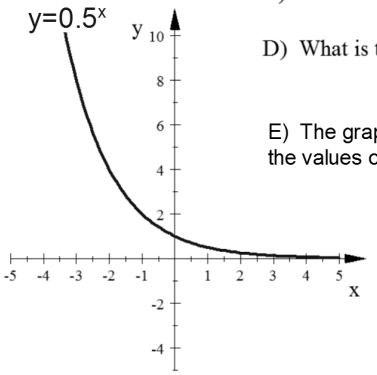
What does a negative value of a do to the graph?



x-axis reflection
Upside Down

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

b is called the Decay Factor



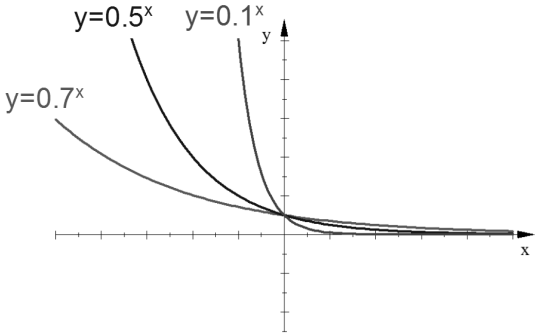
C) What is the y-intercept? y-int = 1

D) What is the horizontal asymptote?

y = 0 (x-axis)

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

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



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

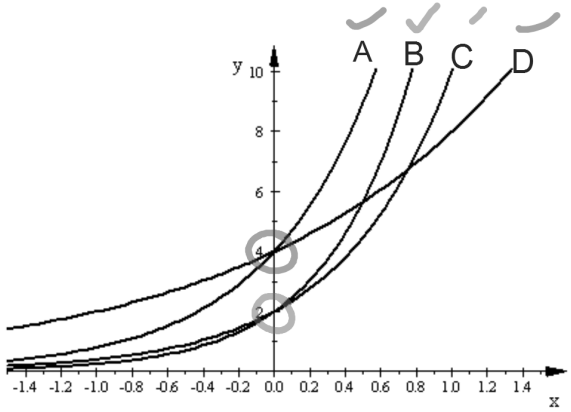
a: the y-intercept. If a is negative graph is upside down (x-axis reflection)

b: Growth or Decay Factor

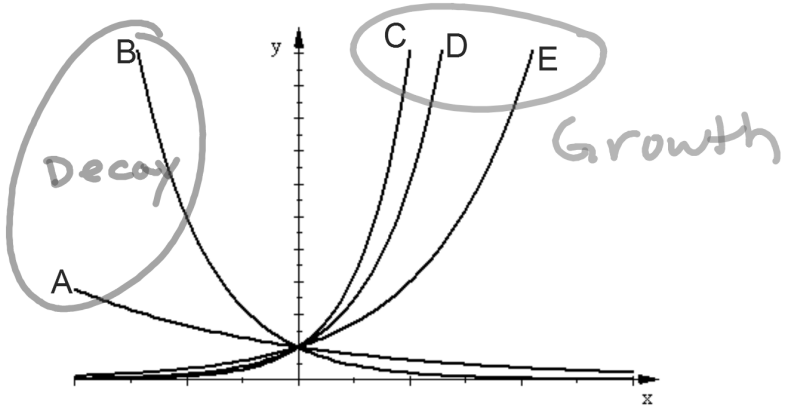
Growth Factor: The larger the value of b the faster the graph increases.
b>1

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

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



D $y = 6^x$ B $y = 0.5^x$ A $y = 0.8^x$ C $y = 10^x$ E $y = 2^x$



Get a small white board, rag, and marker

Does each exponential equation represent growth or decay?

1. $y = 4500(0.9983)^x$ D
   Base is <1
2. $y = 0.045(1.00201)^x$ G
   Base is >1
3. $y = 7\left(\frac{12}{13}\right)^x$ D
   Base is < 1
4. $y = 12.06\left(\frac{42}{39}\right)^x$ G
   Base is >1
5. $y = 145(1.33)^{-x}$ D
   even though it looks like the base is >1 the negative exponent leads to the reciprocal of the base and it becomes <1.

Use the given information to find the base (b) of an exponential equation that could model the situation.

1. Each year there is 20% more. b = 1.2

$100 + 20 = 120\%$ ÷100

2. Each day there is 5% less. b = 0.95

$100\% - 5\% = 95\%$ ÷100

3. Each month there is 31.6% more. b = 1.316

$100 + 31.6 = 131.6$ ÷100

4. Each week there is 17.3% less. b = 0.827

$100 - 17.3 = 82.7$ ÷100

Each situation is exponential: $y = a(b)^x$

What would the exponent, x, represent in each situation?

1. Each year there is 20% more. x is # of years
2. Each day there is 5% less. x is # of days
3. Each month there is 31.6% more. x is # of months

For each function find the percent increase or decrease that the function models.

1. $800(0.816)^x$

×10
81.6
−100
−18.4

18.4% decrease

2. $1.667(1.204)^x$

×100
120.4%
−100
20.4

20.4% inc

The population of a certain city has been increasing 1.4% each year. In 2006 the population was 125,000.

$100 + 1.4 = 101.4\% \Rightarrow b = 1.014$

Find the population of the city in the following years:

a. 2010

$125{,}000(1.014)^4$
$= 132{,}148$

b. 1999

$125{,}000(1.014)^{-7}$
$= 113{,}408$

The number of a certain kind of bird in an area that is being developed has been decreasing 6.1% every five years. The bird population in 2007 was 12,000.

$100 - 6.1 = 93.9\%$ $b = .939$

Find the bird population in the following years:

a. 2017 $12{,}000(.939)^{\frac{10}{5}} = 10{,}581$

b. 2020 $12000(.939)^{\frac{13}{5}} = 10{,}189$

When a couple's first child is born they invest $10,000 in an account that pays 8% interest annually. How much will be in the account when the child turns 18 years old?

$100 + 8 = 108\%$

$b = 1.08$

$y = 10{,}000(1.08)^{18}$

$= \$39{,}960.19$

The number of cases of flu is increasing 22% every 4 days. On February 1 there were 176 cases of flu.

$100 + 22 = 122\%$

$b = 1.22$

a. Find the number of cases 12 days later.

$y = 176(1.22)^{12/4} = 320$

b. Find the nmber of cases of flu 3 weeks later.

$y = 176(1.22)^{21/4} = 500$

You can now finish Hwk #24

Sec 8-1

Page 434

Problems 9, 20-23, 35-38, 45-48