

7.2 Exponential Growth and Decay

ALGEBRA 2

Write your questions here!

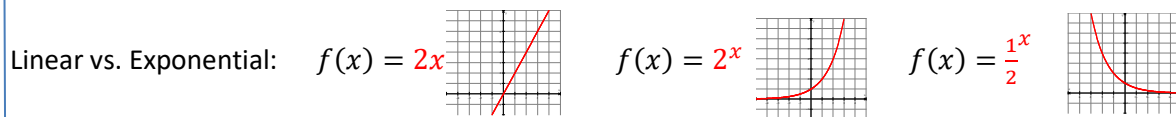
If the variable is not in the **exponent**, then it is **not** an exponential function.

$$F(x) = a(b)^x$$

Condition 1: $a \neq 0$

Condition 2: The base (b) is a positive number not equal to 1.

Exponential _____ if $b > 1$
 Exponential _____ if $0 < b < 1$



Identify if the following functions are exponential. If they are, state the initial value and the growth/decay factor. If they're not, explain why not.

$f(x) = 2^x$	Is it exponential?	$a =$	$b =$	growth/decay
$f(x) = 4x^{-2}$	Is it exponential?	$a =$	$b =$	growth/decay
$f(x) = 4(0.1)^{-x}$	Is it exponential?	$a =$	$b =$	growth/decay
$f(x) = 2(0.5)^x$	Is it exponential?	$a =$	$b =$	growth/decay
$f(x) = x(2.6)^5$	Is it exponential?	$a =$	$b =$	growth/decay
$f(x) = 10(6)^{-x}$	Is it exponential?	$a =$	$b =$	growth/decay
$f(x) = 2(-0.5)^x$	Is it exponential?	$a =$	$b =$	growth/decay

For each problem, create an equation to model the scenario. Then, answer the question.		
A local college has increased its number of graduates by a factor of 1.045 over the previous year for every year since 1997. In 1997, 924 students graduated.	Sully's dance school currently has 520 members. Every day, one-fourth of them quit.	A population of fruit flies is currently at 150 flies. In 4 days, the population increases to 400 flies.
How many students will graduate in 2005?	How many students will there be at the end of 1 week?	How many fruit flies will there be at the end of 1 week?

Doubling and Half-Life Formulas

An initial amount a that doubles/halves every x .

$$f(t) =$$

$$f(t) =$$

Create a function that models each scenario, then answer the question.

There is 500 grams g of radioactive material. Its half-life is 5,700 years. How many grams will there be in 20,000 years?

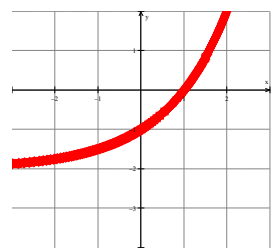
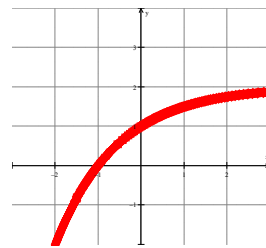
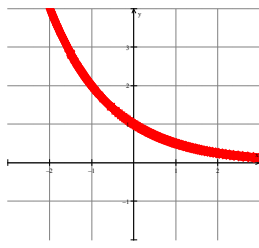
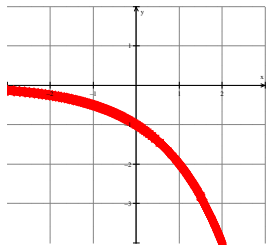
The rodent population p at Mr. Bean's house doubles every 6 months. If there are currently 400 rodents, how many will there be in 5 years?

EXPONENTIAL GROWTH FUNCTIONS:

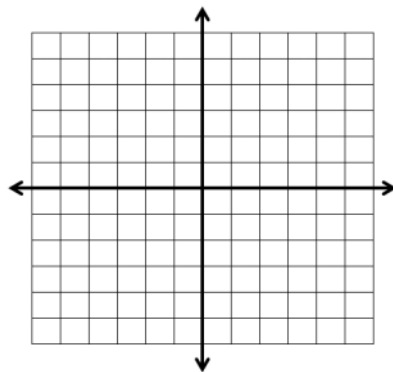
If $b > 1$, then the graph will "grow" _____ the asymptote as you move left to right.
 If $b < 1$, then the graph will "grow" _____ the asymptote as you move left to right.

ASYMPTOTE: an imaginary line that _____.

Are the following graphs exponential **growth or decay** functions?



Graph $F(x) = 3(2)^x$



x	$F(x)$

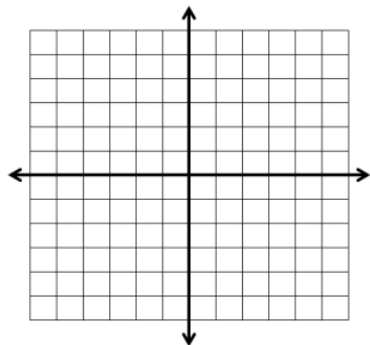
Domain:

Range:

Growth or Decay?



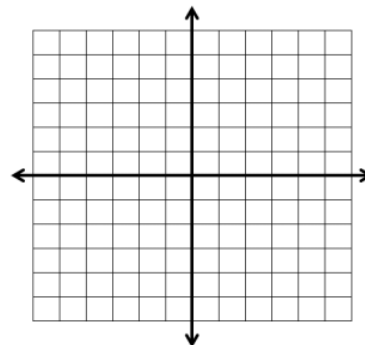
2. Graph $F(x) = -6 \cdot \left(\frac{1}{3}\right)^x$



Growth or Decay?

Domain: Range:

3. Graph $F(x) = -2 \left(\frac{3}{2}\right)^{x+4} + 3$



Growth or Decay?

Domain: Range:

Graphing Exponential Functions:

1. Build a T-Table for (_____). Start at the value of x that creates an exponent _____
2. Fill in the table with values _____ from Step 1.
3. Label the _____!

SUMMARY:

Now,
summarize
your notes
here!

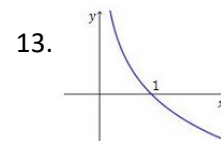
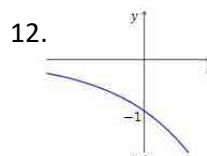
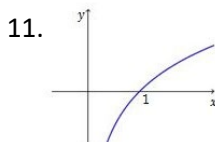
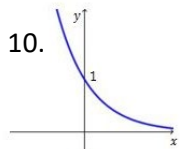
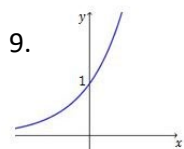
7.2 Exponential Growth and Decay

PRACTICE

Tell whether the equation represents an exponential **growth** or an exponential **decay** function. Also, state the growth/decay factor, if possible.

1. $F(x) = -2(3.2)^x$ 2. $F(x) = 5\left(\frac{1}{3}\right)^x$ 3. $F(x) = 6\left(\frac{5}{3}\right)^x$ 4. $F(x) = -3\left(\frac{1}{9}\right)^{-x}$

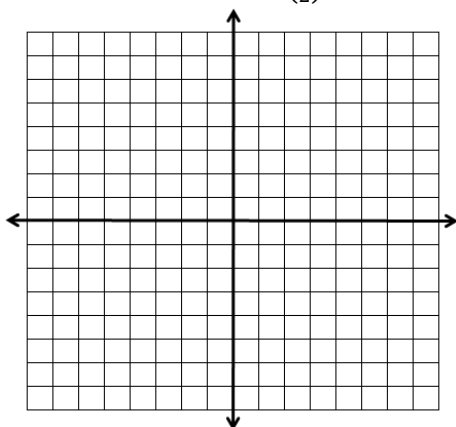
5. $F(x) = 8(x)^4$ 6. $F(x) = 3(0.2)^x$ 7. $F(x) = -\frac{1}{2}(6.3)^x$ 8. $F(x) = 12(0.8)^{-x}$



<p>14. The number of mosquitos at a lake where the time is measured in days is modeled by the equation:</p> $m(d) = 1000(4.25)^d$ <p>a. How many mosquitos are at the lake when the initial count was taken?</p> <p>b. If this rate continues, how many mosquitos will there be 10 days from now.</p>	<p>15. Mr. Sullivan bought a new trailer for a lot at his favorite trailer park. It cost him \$35,000. Unfortunately, each year the value is nine-tenths the value of the previous year.</p> <p>a. Write a model for the value of the trailer home.</p> <p>b. How much will the trailer home be worth in 13 years?</p>
<p>16. The number of downloads per week of Sully's new pop-song doubles every 3 weeks. The first week, there were 2 downloads.</p> <p>a. Use the doubling formula to create a function that models the situation.</p> <p>b. If this rate continues, how many downloads will there be in 1 year?</p>	<p>17. Mr. Brust loves jacuzzis! In fact, as soon as he moved to Sigonella, he bought a brand new \$1500 model with disco lights. After 5 years, it was worth \$800. Find the decay factor for the value of the jacuzzi by substituting into the equation: $V(x) = ab^x$. Then, write the decay function that models the value of the jacuzzi.</p>

Sketch the graph of each exponential function by doing the following: Sketch the asymptote, label at least **two distinct coordinate points** on each graph, and write the domain and range of each function.

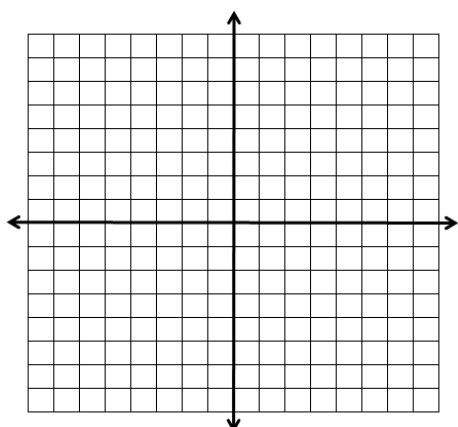
18. $F(x) = 3\left(\frac{1}{2}\right)^x$



Growth or Decay?

Domain: Range:

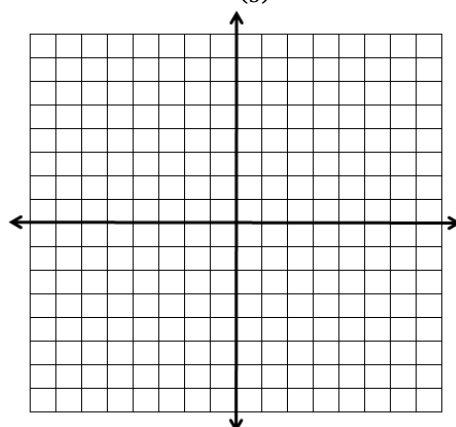
19. $F(x) = -2(3)^x + 2$



Growth or Decay?

Domain: Range:

20. $F(x) = 4\left(\frac{1}{3}\right)^x - 5$



Growth or Decay?

Domain: Range:

7.2 Exponential Growth and Decay

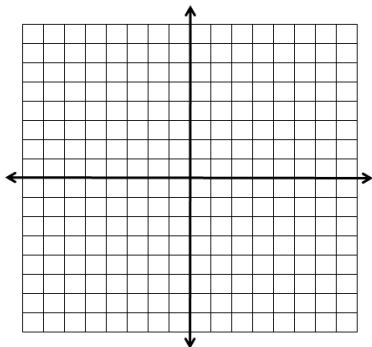
7.2 WRAP UP

1. $F(x) = 3\left(\frac{1}{3}\right)^{x-3} - 4$

Growth or Decay?

Domain:

Range:



2. The number of pigs at Mr. Bean's house measured in days is modeled by the equation:

$$m(d) = 20(1.6)^d$$

- How many pigs are at his house when the initial count was taken?
- If this rate continues, how many pigs will there be 100 days from now?
- Why do you think Sully calls this the Aporkalypse?

3. After *www.flippedmath.com* was created, the number of hits was tracked. The table shows the number y of hits in each of the first 10 months where x is the month number.

x	1	2	3	4	5	6	7	8	9	10
y	22	39	70	126	227	408	735	1322	2380	4285

a. Enter the values into two separate lists on a graphing calculator.

STEP 1: Hit **STAT** and then option 1.

STEP 2: Enter x -values into List 1.

STEP 3: Enter y -values into List 2.

b. Calculate an exponential model and write the equation below. (Round to 3 decimals.)

STEP 1: Hit **STAT**, then right for the "CALC" menu.

STEP 2: Scroll down until you can choose "ExpReg"

STEP 3: Hit Enter and calculate the " a " and " b ".

$$y = \underline{\hspace{10em}}$$

c. According to your model from part b, how many hits do you expect in the 12th month?

d. According to your model in part b, how many hits would there be in the 41st month? What is wrong with this number?

EXIT TICKET

The student body at K-Town high school is raising money for the newly formed Bosnian-Cosplay club, or *Bosplay*. "**Zdravo!**" The *Algebras* contribute \$50 to get things started. After that, the students increase the balance by a growth factor of **1.45** per week.

a. Write a **model** that represents this situation.

Using your model from part a, how much money will the students raise after a semester (18 weeks)?

