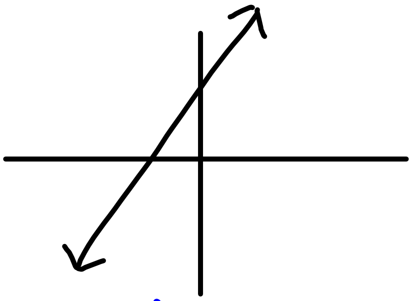
Warm-Up 3/19/18

1. What are the differences between a Linear Function and a Quadratic Function?

(Hint: think about their characteristics)

Linear



Domain: All real # $(-\infty, \infty)$ $\mathbb{R}$

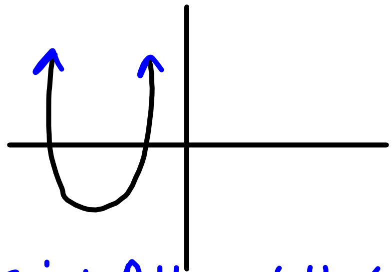
Range: $\mathbb{R}$

No Extrema

No axis of Symmetry.

Both ends go opposite direction

Quadratic



Domain: All real #s $(-\infty, \infty)$ $\mathbb{R}$

Range: $\cap$ $(-\infty, \text{y-value}]$

$\cup$ $[\text{y-value}, \infty)$

Extrema

Axis of Symmetry

Both ends go same direction

DAY 1: GRAPHING EXPONENTIAL FUNCTIONS

Unit 4: Exponential Functions

Essential Questions: 3/19/18

- How can I evaluate an Exponential Function?
- How can I graph an Exponential Function?

Standard:

MGSE9-12.A.CED.2 Create exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + r/n)^{nt}$ has multiple variables.)

Opening: Exploring

Exploring with Graphs: Graph the following equations:

a. $y = x$

x	-3	-2	-1	0	1	2	3
y	-3	-2	-1	0	1	2	3

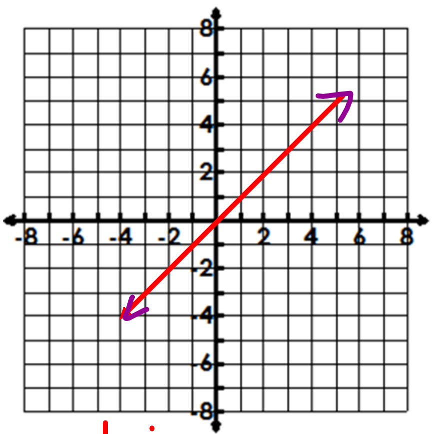
b. $y = x^2$

x	-3	-2	-1	0	1	2	3
y	9	4	1	0	1	4	9

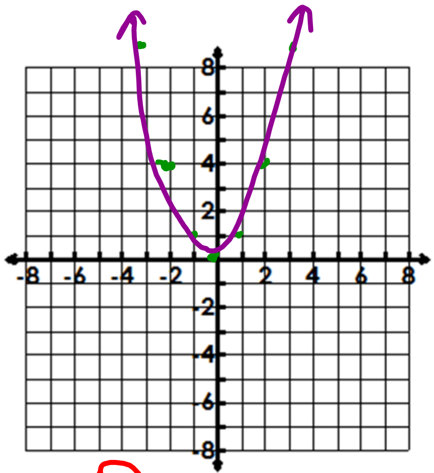
c. $y = 2^x$

x	-3	-2	-1	0	1	2	3
y	.125	.25	.5	1	2	4	8

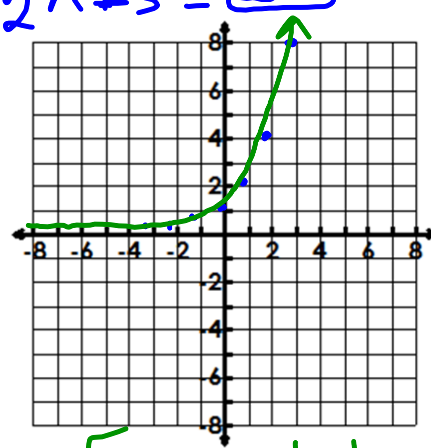
2 ^ -3 = $\boxed{<\ >}$



Type: Linear



Type: Quadratic



Type: Exponential

How is Equation C different from Equations A and B (you have already learned about equations A & B).

Exploring

Exploring with a Scenario:
Which of the options below will make you the most money after 15 days?

a. Earning $1~~00~~ a day?

x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

b. Earning a penny at the end of the first day, earning two pennies at the end of the second day, earning 4 pennies at the end of the third day, earning 8 pennies at the end of the fourth day, and so on?

x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
y	1	2	4	8	16	32	64	128	256	512	1024	2048	4096	8192	16384

1 x 2 enter x 2 enter .

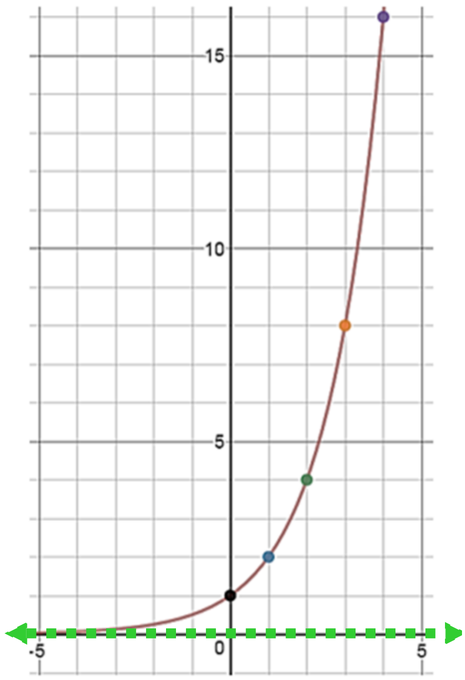
$163.84

Exponential Functions

Exponential Functions

$$y = ab^x$$

1. Variable is in the power (exponent) versus the base
2. Start small and increase quickly or vice versa
3. Asymptotes (heads towards a horizontal line but never touches it)
4. Constant Ratios (multiply by same number every time)

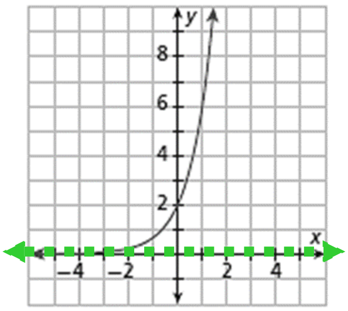


Asymptotes

An **asymptote** is a line that an exponential graph gets closer and closer to but never touches or crosses. **The equation for the line of an asymptote for a function in the form of $f(x) = ab^x$ is always y = ______.**

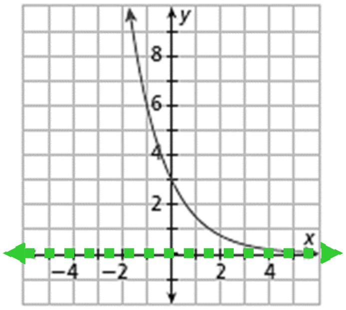
Identify the asymptote of each graph.

a.



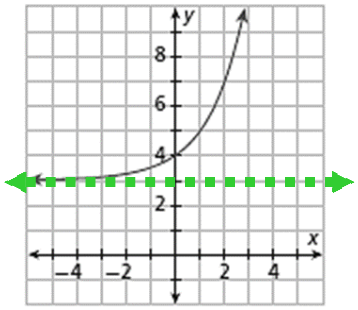
$y=0$

b.



$y=0$

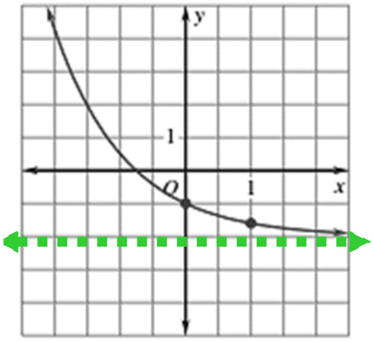
c.



$y=3$

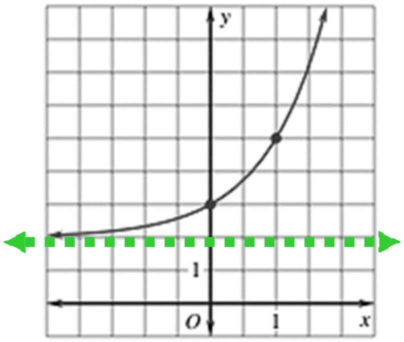
Asymptotes

d.



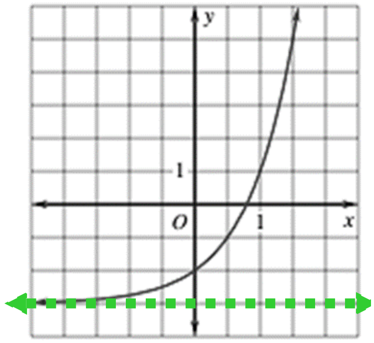
$y = -2$

e.



$y = 2$

f.



$y = -3$

Evaluating Functions

- When graphing exponential functions, it is important that you understand how to evaluate an exponential function.
- Since the variable is in the exponent, you will evaluate the function differently that you did with a linear function. You will still substitute the value of x into the function, but will be taking that value as a power.

General Form

The general form of an exponential function is:

$$\underbrace{y = a}_{\text{y-int.}}\underbrace{b}_{\text{growth or decay factor!}}{}^{x}$$

Where **a** represents your starting or initial value/population and y-intercept
b represents your growth/decay factor

Graphing Exponential Functions

Graphing Exponential Functions Steps

1. Create an x-y chart with 5 values for x (Safest values for x: -2, -1, 0, 1, 2).
2. Substitute those values into the function and record the y or f(x) values.
3. Graph each ordered pair on a graph.

EXAMPLE 1

Graph the following:

a. $y = 3(4)^x$

a b

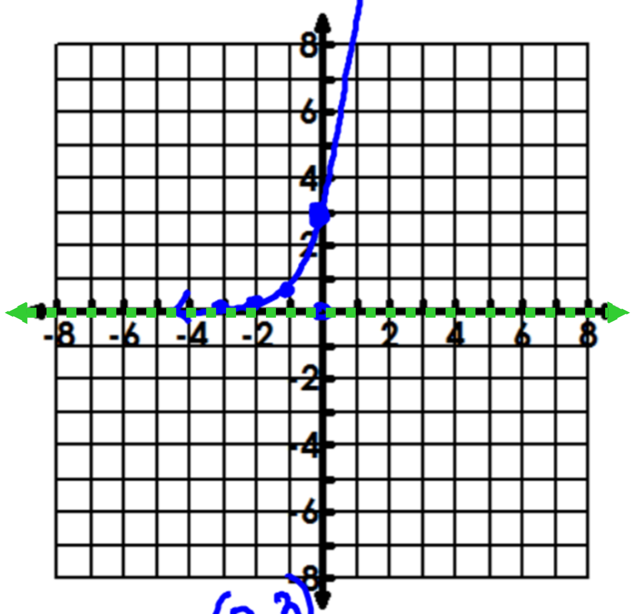
x	y
-3	.05
-2	.1875
-1	.75
0	3
1	12
2	48

y-int

×4

×4

×4



Y-intercept: (0,3)

Asymptote y=0

EXAMPLE 2

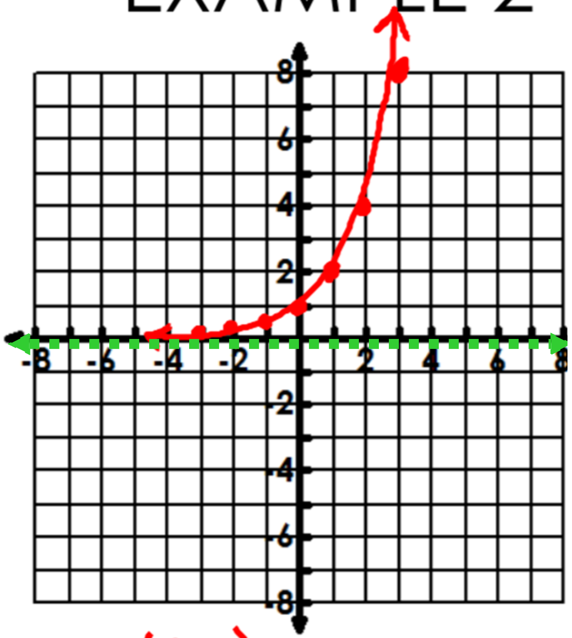
$y = ab^x$

Graph the following:

b. $f(x) = 2^x$

$f(x) = \underset{a}{1}(\underset{b}{2})^x$

	x	y	
	-3	.125	
	-2	.25	
	-1	.5	×2
y-int	$\boxed{0}$	$\boxed{1}$	×2
	1	2	×2
	2	4	×2
	3	8	



Y-intercept: (0,1)

Asymptote: y=0

Graph the following:

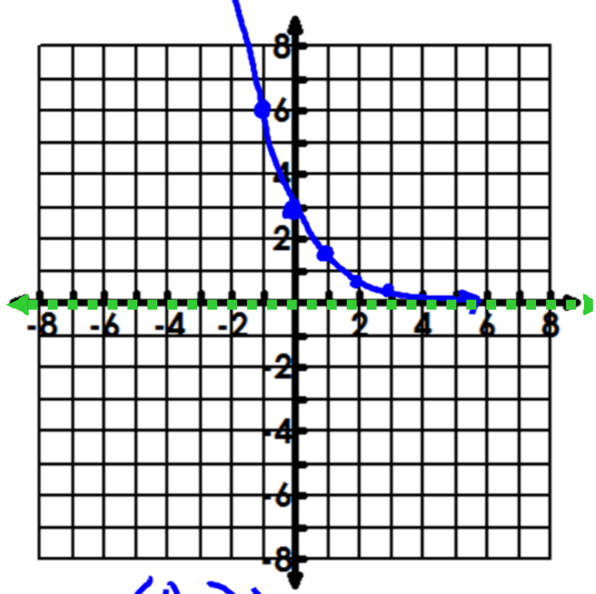
c. $y = 3\left(\frac{1}{2}\right)^x$

a = 3, b = $\frac{1}{2}$ ✓

decay

x	y	
-2	12	$\times \frac{1}{2}$
-1	6	$\times \frac{1}{2}$
y-int $\boxed{0}$	$\boxed{3}$	$\times \frac{1}{2}$
1	1.5	
2	.75	
3	.375	

EXAMPLE 3



Y-intercept: (0, 3)

Asymptote: y = 0

Example 4

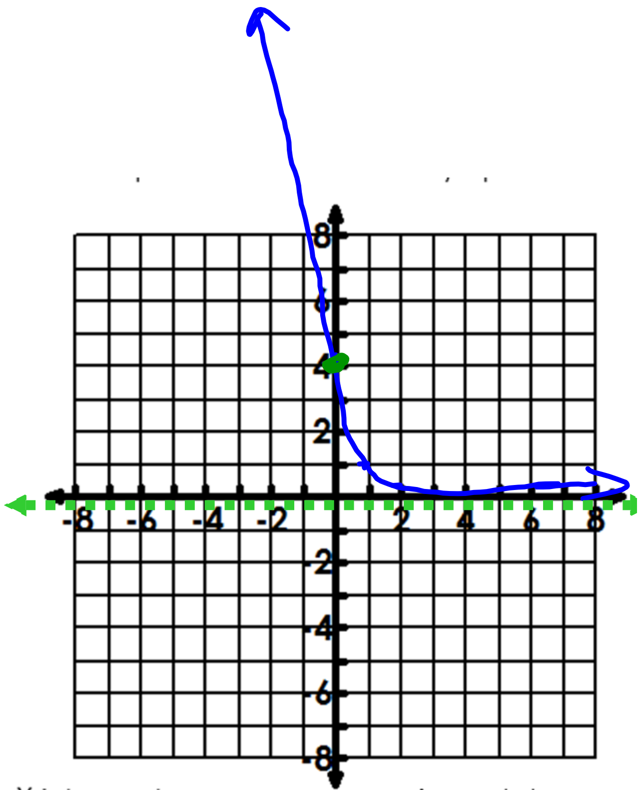
Graph the following:

d. $f(x) = 4(.25)^x$ decay

a b

x	y
−2	64
−1	16
0	4
1	1
2	0.25

y-int



Y-intercept: (0,4)

Asymptote: y=0

The Y-intercept

Think about it...

What did you notice about the y-intercept and the equation?

The y-intercept and the a-value are the same

You have two ways you can find the y-intercept when given an equation: $y = 3(4)^x$

a. Identify the a-value

b. Create a table of values and read what y is when $x=0$.

Summary

Equation	'a' values	'b' values	General Shape of Graph
$y = 3(4)^x$ $f(x) = 2^x$	3 1	4 2	growth $b > 1$
$y = 3\left(\frac{1}{2}\right)^x$ $f(x) = 4(.25)^x$	3 4	1/2 .25	decay $b < 1$

Identifying Growth and Decay

a. $y = 4(3/4)^x$ decay; $b < 1$

b. $y = -2(3)^x$ growth; $b > 1$

c. $y = \frac{1}{2}(1.4)^x$ growth; $b > 1$

d. $y = (0.9)^x$ decay; $b < 1$

e. $y = 3\left(\frac{5}{2}\right)^x$ growth; $b > 1$

Home Work - 3/19/18

1. Day 1: Evaluating Exponential Functions

2. Day 1: Graphing Exponential Functions

Due tomorrow - Tuesday 3/20/18

Day 1: Evaluating Exponential Functions **Name:** ____________________________

Practice Assignment

Evaluate each exponential function for the stated value.

1. $f(x) = \frac{1}{3}(6)^x$; x = 2

$f(2) = \frac{1}{3}(6)^2$

$f(2) = 12$

2. $f(n) = 10(2)^n$; f(-2)

$F(-2) = 10(2)^{-2}$

$\frac{5}{2}$

2.5

3. $y = 4 \cdot 2^x$; x = 4

$4 \cdot 2^4$

$4 \cdot 8$

64

Answer the following word problems:

4. If a basketball is bounced from a height of 20 feet, the function $f(x) = 20(0.9)^x$ gives the height of the ball in feet of each bounce, where x is the bounce number. What will be the height of the 6th bounce? Round your answer to the nearest tenth of a foot.

$f(6) = 20(0.9)^6 = 10.6$ ft.

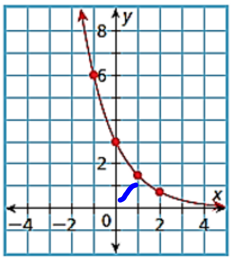
5. Suppose the depth of a lake can be described by the function $y = 334(0.976)^x$, where x represents the number of weeks from today. Today, the depth of the lake is 334 ft. What will be the depth in 6 weeks? Round your answer to the nearest whole number.

$F(6) = 334(0.976)^6 =$

289 Ft

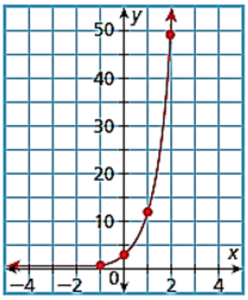
Name the asymptote for each graph:

6.



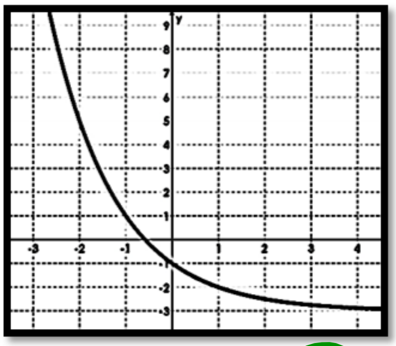
$y = 0$

7.



$y = 0$

8.



$y = -3$

Directions: Decide whether each of the following is an example of exponential growth (increase) or decay (decrease) and explain why. Then state the y-intercept.

9. $y = 5^x$

Growth

$b>1$

10. $y = \left(\frac{1}{2}\right)^x$

Decay

$b<1$

11. $y = -3^x$

growth

$b>1$

12. $y = 2\left(\frac{4}{3}\right)^x$

growth

$b>1$

Directions: Determine if the following tables or graphs represent linear, quadratic, or exponential functions.

13.

x	y
−2	7
−1	4
0	1
1	−2
2	−5

−3
−3
−3
−3

Linear

14.

x	y
−1	1.5
0	3
1	6
2	12

•2
•2
•2

Exponential

15.

9 − (−9)

x	y
−1	−9
1	9
3	27
5	45

18
18
18

Linear

16.

x	y
−2	6
−1	3
0	2
1	3
2	6

vertex

Quadratic

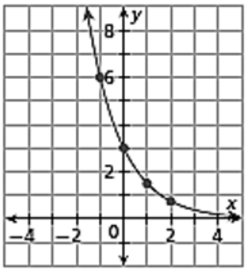
17.

Volleyball Tournament	
Round	Teams Left
1	16
2	8
3	4
4	2

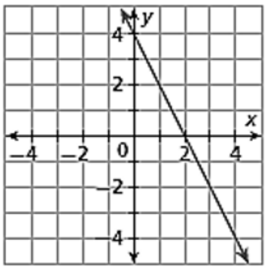
18.

x	y
10	1
11	6
12	36
13	216

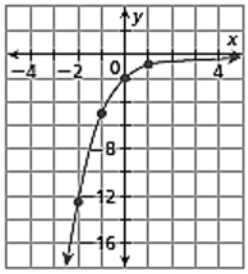
19.



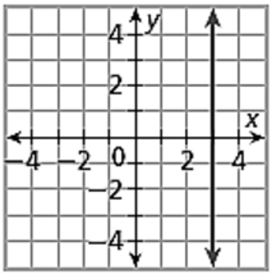
20.



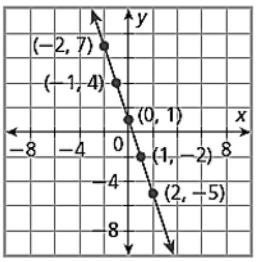
21.



22.



23.



24.