Algebra Math Plan

Week 4-27 through 5-1   Exponential Functions 2.2 - 2.3

At the end of the week you will know, understand, and/or be able to do the following:
You will be able to recall and be proficient at writing and graphing exponential functions
Why does this learning matter?
Exponential functions are among the most useful mathematical functions it's uses are in virtually all scientific subjects and in finance.
The plan for the week :
• Monday: Review writing exponential functions read 2 pages and do a practice worksheet (Goal: Recall how to write exponential functions) • Tuesday:Read 2 pages and try to understand how to graph exponential functions (Goal: Begin understanding of graphing exponential functions) • Wednesday: Explore how to notice between whether an exponential function is growing or decaying (Goal be able to identify if a function is going to grow or decay) • Thursday: Practice graphing exponential functions (Become proficient at graphing exponetial functions) • Friday: Task or Sudoku (Have fun with either a difficult task a puzzle)
Who To Ask For Help and How To Reach Them
Please feel free to call or e-mail on any of this if you are stuck or just wanting to talk about math. Mr. Humphrey e-mail or phone are great. E-mail: Khumphrey@fernridge.k12.or.us Phone 541.782.8255

Math 4/27 **Monday** Writing Exponential functions Name________________________

Recall on the last day we were in Algebra class we studied how to write exponential functions. We are going to refresh your memory on how to write exponential functions and also do some practice on them today. In general a calculator is helpful during the exponents block because a lot of the numbers can get really big or really small. If you have a computer you can use that and all scientific calculators has a button for it. You can always contact me through out any of it.

Let's look at the algorithm first

WRITING EXPONENTIAL FUNCTIONS FROM RECURSIVE ROUTINES

1. Determine the start value from a situation, sequence or table of values. The start value is always the output that is paired with an input of 0.
2. Determine the constant multiplier by dividing the second output by the first output.
3. Write the exponential function by filling the start value (b) and constant multiplier (m) into the function:

$$f(x) = b \cdot m^x \quad \text{or} \quad y = b \cdot m^x$$

Let's break this down a little more. Given a scenario you will

1. Write the start value as b =

2. Write the rate of change (constant multiplier) as m=

3. Your x in the exponent is your input value. When you are solving for values you'll likely be given the input value to solve for the output

4. the y = or f(x)= as your output value (usually the unknown that you'll be solving for)

Example 1 write and exponential function for this recursive routine.

Start value = 5 Constant multiplier = 2

Label your known values
Then write your function
B =5
M=2

$y=5(2)^x$ you can also write your function like $f(x)=5(2)^x$ They mean the same thing.

Side note

Based on real life applications some times you want to know what happens after a certain amount of time and in those cases you would be solving for the input value. For now we are only going to solve for outputs with tables.

Let's look at 2 examples

Math 4/27 **Monday** Writing Exponential functions Name________________________

The first you're given all of the information up front and then you just solve for the output.
Example 2

Tim's truck is currently worth \$14,000. He was told that each year his truck's value is 0.88 times the value of the previous year.

a. Write an exponential function for this situation where x is the number of years from now and y is the new value of the truck.

b. How much will his truck be worth in 12 years?

a. Find the start value. $b = 14{,}000$

Determine the constant multiplier. $m = 0.88$

Write the exponential function. $y = 14000(0.88)^x$

b. Substitute 12 for x. $y = 14000(0.88)^{12}$

Evaluate. $14000(0.88)^{12} \approx \$3019.40$

Tim's truck will be worth about \$3,019.40 in 12 years.

In order to solve the top example you'll need a calculator.

You'll input .88 then use the button either the carrot button or it has yx or desmos calculator under function looks like a^b and then input 12 and then multiply that by 14000.

Test that out $.88^{12}$ what did you get it should be ≈ .22 what did you get write as much as you can_________________

then multiply what you got by 14000. What did you get?________________________

Example 3 In this example you are first solving for the constant multiplier (Recall big thing we haven't done for a while. You take any output value and divide it by its previous. Use the easiest numbers).

A bug population is growing each day as shown in the table. Write an exponential function that describes the growth. How many of these bugs will there be in 8 days?

Input Days from Now, x	Output Number of Bugs, y
0	5
1	15
2	45
3	135
4	405
5	1215

Find the start value (output paired with the input of 0). $b = 5$

Determine the constant multiplier by dividing the second output by the first output. $m = \frac{15}{5} = 3$

Write the exponential function. $y = 5 \cdot 3^x$

Substitute 8 in for x. $y = 5 \cdot 3^8 = 32805$

If this growth rate continues, there will be 32,805 bugs in 8 days.

Math 4/27 **Monday** Writing Exponential functions Name________________________

Write the exponential function for each recursive routine.

1. Start Value = 3
Constant Multiplier = 4

2. Start Value = 0.7
Constant Multiplier = 6

3. Start Value = −500
Constant Multiplier = $\frac{3}{4}$

Determine the start value and constant multiplier for each table. Write an exponential function that represents each table.

4.

Input x	Output y
0	2
1	10
2	50
3	250
4	1,250
5	6,250

5.

Input x	Output y
0	4,000
1	2,000
2	1,000
3	500
4	250
5	125

6.

Input x	Output y
2	−4
3	−16
4	−64
5	−256
6	−1,024
7	−4,096

7. The population of a small town triples every decade. The town currently has a population of 1,100 people.

   a. Write an exponential function for this situation where x is the number of decades from now and y is the new population of the town.

   b. What will the population of the town be in 50 years (5 decades)?

8. Camille owns a car that is currently worth $12,000. She was told that each year her car's value is 0.92 times the value of the previous year.

   a. Write an exponential function for this situation where x is the number of years from now and y is the new value of the car.

   b. How much will her car be worth in 6 years?

Math 4/28 **Tuesday** Graphing Exponential functions Name________________________

Now that we have practiced writing exponential functions we can graph exponential functions. You must know the start value and the constant multiplier for the function. It is helpful to create an input output table to determine points on the graph. We will look at a few examples and the algorithm. In example one we also walk through the algorithm.

Algorithm: The how to

GRAPHING EXPONENTIAL FUNCTIONS

1. Determine the start value and constant multiplier.
2. Create an input-output table using an appropriate domain.
3. Determine the range needed on the coordinate plane by examining the output values.
4. Graph the ordered pairs from the input-output table on the coordinate plane.
5. When the graph represents a real-world context, determine whether or not to connect the points with a continuous curve.

Example 1.

Keira has raised $1 for her soccer fundraiser. For the next 5 days, she hopes to double the amount of money she raises each day.
a. What is the equation for the exponential function representing this situation?
b. Create a graph showing the amount of money she needs to raise each day.

a. Determine the start value. $b = 1$
Determine the constant multiplier. $m = 2$
Write the equation in the form $y = b \cdot m^x$. $y = 1 \cdot 2^x$

Doubling is the same as multiplying by 2.

Step 1

b. Create in put output table that includes five days

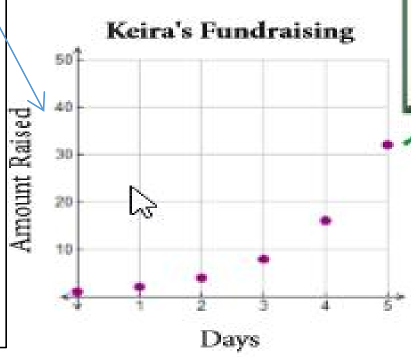
Input *Days from Now, x*	Output *Amount Raised, y*
0	1
1	2
2	4
3	8
4	16
5	32

Step 2

FYI you will need to input the values into the equation to find the outputs

Step 3
Determine based off your output values

Graph the input -output values as a ordered pair



Step 5

In this case, she is not keeping track of partial days so it does not make sense to connect the points.

Step 4
Plot the points

Math 4/28 **Tuesday** Graphing Exponential functions Name________________________

Most real life scenarios are in quadrant one like the first example but some are like example two needing both positive and negative input values.

EXAMPLE 2

Graph the function $f(x) = 10 \cdot (0.5)^x$. Include points on the graph with x-values from −3 to 3.

SOLUTION

Determine the start value. $b = 10$

Determine the constant multiplier. $m = 0.5$

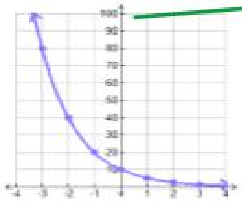
Create an input-output table for the stated domain.

Input x	Output $f(x)$
−3	80
−2	40
−1	20
0	10
1	5
2	2.5
3	1.25

Both $f(x)$ and y can be used to represent the output values.

The start value corresponds to an input of 0.

Graph the input-output values as ordered pairs.



The output values in the table have a range of 1.25 to 80. The graph should include all of these y-values.

Try to do this one when given the table so you will start at step three

x	y
0	10
1	20
2	40
3	80
4	160

1.Use the table to the right

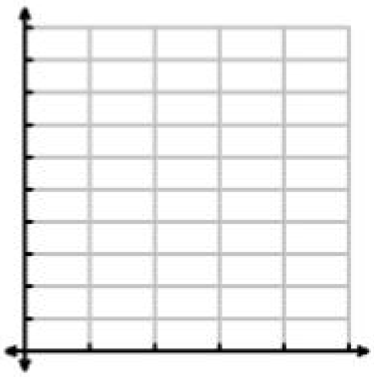
a. What is the highest y-value? _____

b. Round the answer of **part a** up to the nearest hundred. __________

c. There are 10 marks on the y-axis of the graph at the right.

How much should each mark represent? _____

d. Label both axis' and graph points connect to make a smooth curve



Math 4/28 **Tuesday** Graphing Exponential functions Name________________________

Assignment

#1 was on the first page

Write the exponential function for each table. Then graph the function.

2.

x	y
0	1
1	3
2	9
3	27
4	81

3.

x	y
0	1000
1	500
2	250
3	125
4	62.5

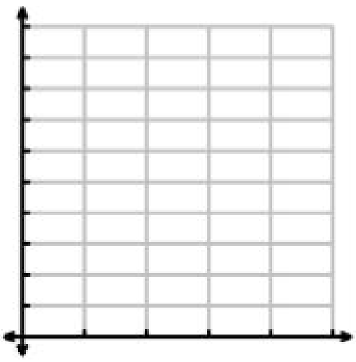
4.

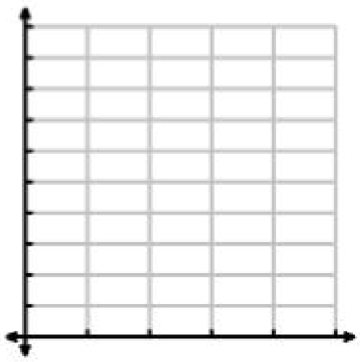
x	$f(x)$
0	15
1	30
2	60
3	120
4	240

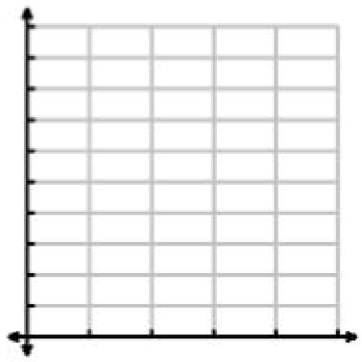
Function: _______________

Function: _______________

Function: _______________



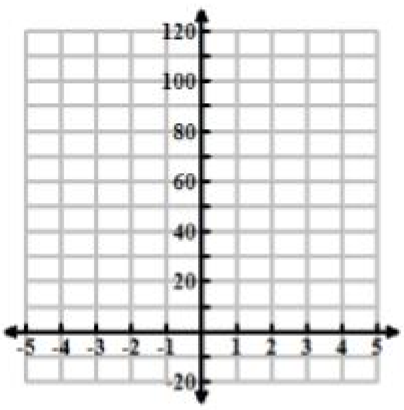




Graph the exponential function. Include points on graph with x-values -2 to 3. FYI This starts at step two in the algorithm.

5. $y = 5 \cdot (2)^x$

x	y
−2	
−1	
0	
1	
2	
3	



Hint check example 2. If still confusing call, e-mail, check the video.

Math 4/29 **Wednesday** Explore increase or decrease Name_______________________

Jill, Byron, Larry and Rayne each have an item that is currently worth $100. Some of their items are increasing in value and others are decreasing. Use the following constant multipliers to complete this **Explore!**.

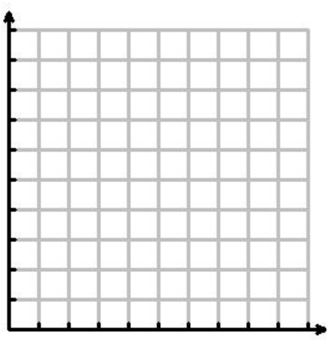
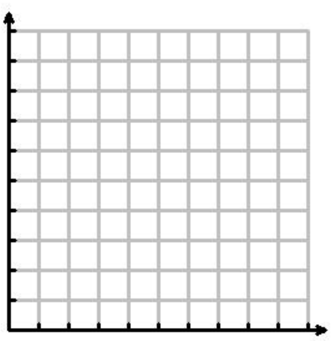
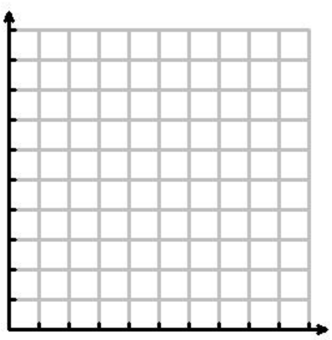
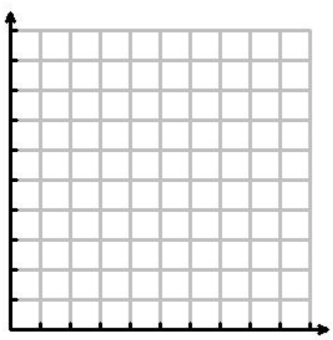
<u>Jill</u>	<u>Byron</u>	<u>Larry</u>	<u>Rayne</u>
1.25	0.9	0.75	1.06

Step 1: Write an exponential function for each person's item.

Step 2: Complete the table below for the value of each person's item for the first 5 years. Round to the nearest whole dollar, when necessary.

Years x	Jill's Item y	Byron's Item y	Larry's Item y	Rayne's Item y
0				
1				
2				
3				
4				
5				

Step 3: On separate first-quadrant coordinate planes, graph the value of each person's item for the next five years.

Step 4: Which people's objects are decreasing in value? Which people's objects are increasing in value?

Math 4/29 **Wednesday** Explore increase or decrease Name________________________

Step 5: Is there a way to tell if there is exponential growth (increase) or decay (decrease) by only looking at the constant multiplier? Explain your answer.

Step 6: Give two more examples of constant multipliers that would show growth and two that would show decay.

Step 7: Does a constant multiplier of 1 create exponential growth, exponential decay or neither? Support your answer with an example.

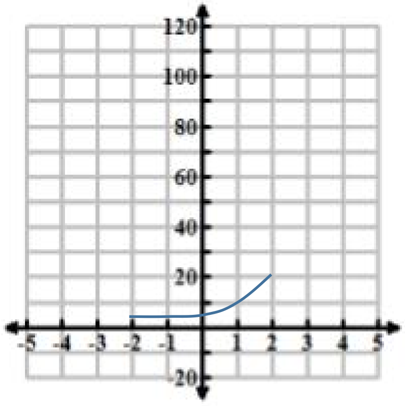
Math 4/30 **Thursday** Graphing exponential function practice Name________________________

Graph the exponential function. Include points on graph with x-values -2 to 3. FYI This starts at step two in the algorithm. Let's double check that you were able to do this one correctly

5. $y = 5 \cdot (2)^x$

x	y
−2	
−1	
0	
1	
2	
3	

$5(2)^{-2}$ = 5(.25)=1.25
$5(2)^{-1}$ = 5(.5)=2.5
$5(2)^{0}$ = 5(1)=5
$5(2)^{1}$ = 5(2)=10
$5(2)^{2}$ = 5(4)=20



Two important things that can sometimes be confusing numbers to the zero power are just 1 and then numbers to the negative powers get smaller and smaller.

Exercises

Graph each exponential function. Include points on the graph with x-values from −2 to 2. Round to the nearest tenth, when necessary.

4. $y = 4 \cdot 2^x$ **5.** $f(x) = 100 \cdot (0.7)^x$ **6.** $y = 6 \cdot (1.5)^x$

7. $y = 2 \cdot 3^x$ **8.** $f(x) = 400 \cdot (0.5)^x$ **9.** $y = 20 \cdot (0.9)^x$

10. Greg grows strawberries in the summer. Each week, he picks three times what he picked the week before. He picked 8 strawberries this week.

a. Write an exponential function for this situation where x is the number of weeks from now.
b. Create a table of values for the next five weeks of picking strawberries. Include the start value as Week 0.
c. Graph the input-output values on a first-quadrant graph.
d. Does it make sense to connect the points on the graph? Why or why not?

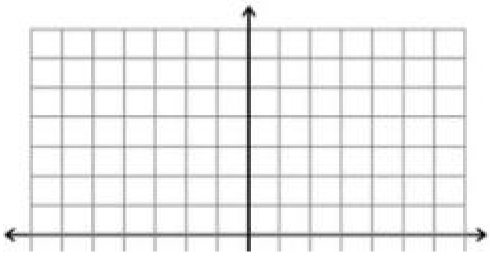
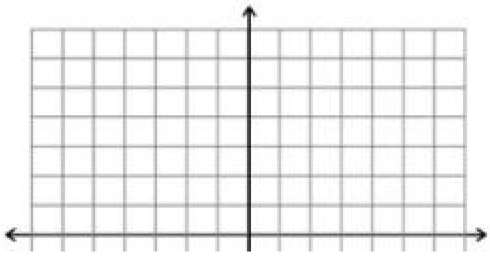
11. Lisa has a car worth $10,000. Each year it is worth 0.88 times the previous year's value.
a. Write an exponential function for this situation where x is the number of years from now.
b. Create a table showing the car's value for the next five years. Include the start value as Year 0. Round to the nearest dollar.
c. Graph the input-output values on a first-quadrant graph.
d. Does it make sense to connect the points on the graph? Why or why not?

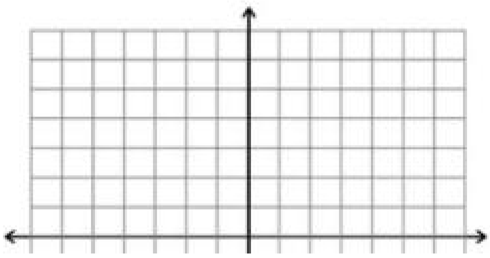
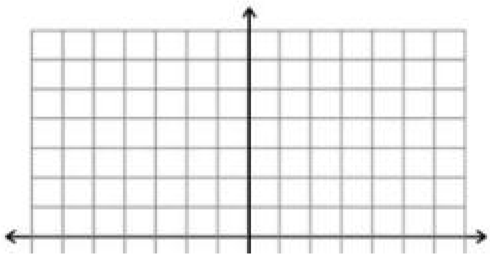
12. Ivan has an antique vase that is currently worth $500. Each year, its value increases by a factor of 1.75. Create a graph showing the value of Ivan's vase over the next four years.

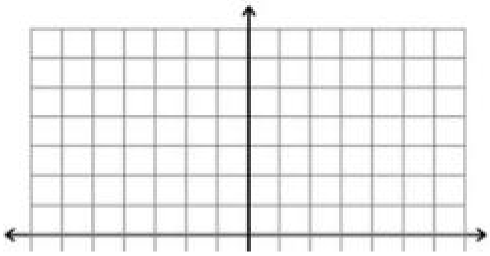
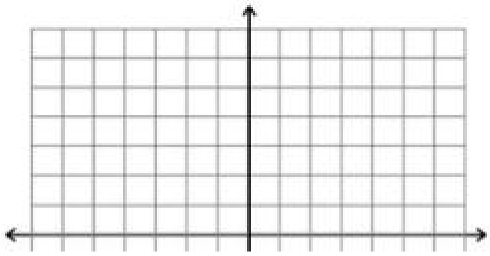
13. Tiara has a plant that grows rapidly. Each day the plant is 1.3 times the height of the previous day. It currently measures 4 inches. Create a graph showing the height of the plant for the next 7 days.

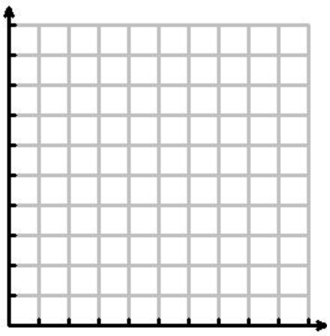
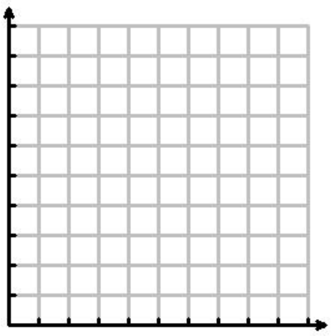
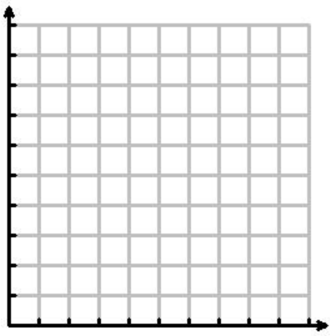
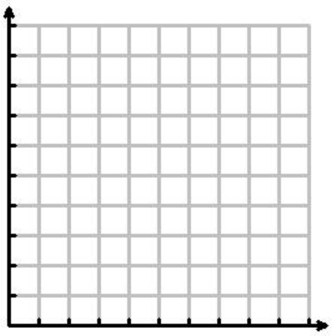
Math 4/ **Thursday** Graphing exponential function practice Name________________________

Graphs to use for Thursday

Math 5/1/20 **Friday** either do this Fishing the task or try a sudoku or two on the next page

Block 2 ~ Exponential Functions

For use after Lesson 2.2

Classifying Functions

Name____ Period______ Date____________

One of the tables below represents a linear function, one represents an exponential function and one does not represent a function.

TABLE A

x	y
0	100
1	80
2	64
3	51.2
4	40.96

TABLE B

x	y
2	1
3	5
4	25
3	125
2	625

TABLE C

x	y
3	5
4	3
6	−1
8	−5
11	−11

1. Determine which type of relationship (linear, exponential, not a function) is shown in each table. Explain your reasoning.

2. Use the table above that represents an exponential function. Write the exponential function that is represented by this table.

3. Suppose the exponential function from the table above represents the value in dollars of a cell phone after x months of use. A store offers to buy the phone from her for $10 when the phone is one year old. The store's motto is "We pay you more than your phone is worth!". Does the store's motto hold true in this situation? Use words and/or numbers to show how you determined your answer.

Math 5/1/20 **Friday** alternative sudoku Name______________________________

The object of Sudoku is to place the numbers 1 through 9 in each Quadrant, Row and Column without any number being repeated. Feel free to try any of these.

Pick at least one puzzle to try.

Easy

3	7		9	6			2	
9		2		3		1		7
5				7	4	6	9	
			8		5	7	1	4
2	8	5		4				9
	4	1	6		3		8	
		7	4		2	9		6
4	9	3		1		2		
	2		3		9		7	1

Medium

					8		6	
3					7			9
			5	6		7	4	
9	3		7	8			5	
		5	4		9	1		
	2			5	6		9	7
	9	7		3	5			
5			8					4
	1		6					

Hard

	8					9		2
							1	
		9	5	6				8
			4		5	3		
	6	5	7		8	4	9	
		4	9		6			
8				4	1	5		
	4							
5		7					6	