

Name: _____

Linear and Exponential Functions | 4.1H

Ready, Set, Go!

Ready

Topic: Recognizing arithmetic and geometric sequences



Predict the next 2 terms in the sequence. State whether the sequence is arithmetic, geometric, or neither. Justify your answer.

1. $4, -20, 100, -500, \dots$

2,500, -12,500
Geometric, multiply by -5

2. $3, 5, 8, 12, \dots$

17, 23
Neither

3. $64, 48, 36, 27, \dots$

Geometric, multiply by $\frac{3}{4}$

4. $1.5, 0.75, 0, -0.75, \dots$

$-1.5, -2.25$
Arithmetic, subtract 0.75

Topic: Rates of change in linear models

Say which situation has the greatest rate of change

5. The amount of stretch in a short bungee cord stretches 6 inches when stretched by a 3 pound weight. A slinky stretches 3 feet when stretched by a 1 pound weight.

Slinky

6. Pumping 25 gallons of gas into a truck in 3 minutes or filling a bathtub with 40 gallons of water in 5 minutes.

Pumping gas

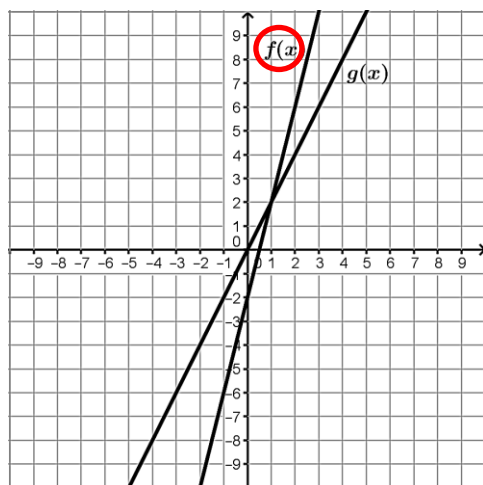
7. Riding a bike 10 miles in 1 hour or jogging 3 miles in 24 minutes.

Riding a bike

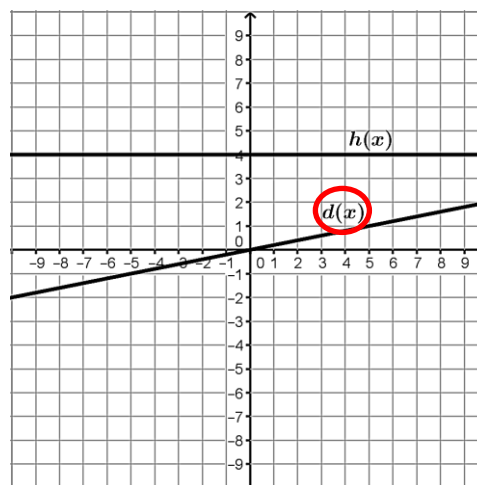
Topic: Recognizing the greater rate of change when comparing 2 linear functions or 2 exponential functions.

Decide which function is growing faster.

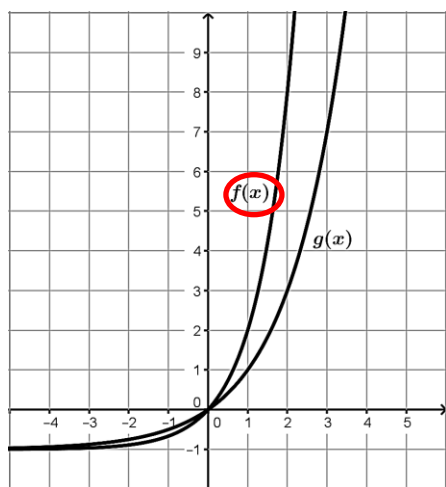
8.



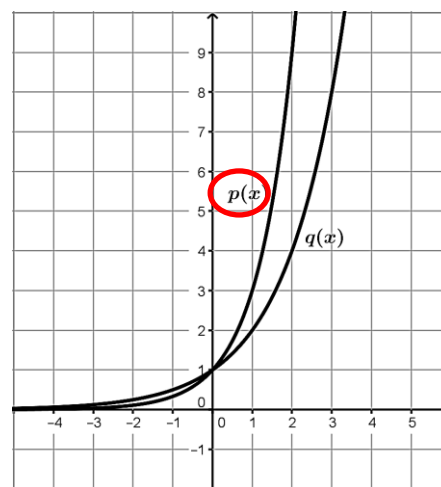
9.



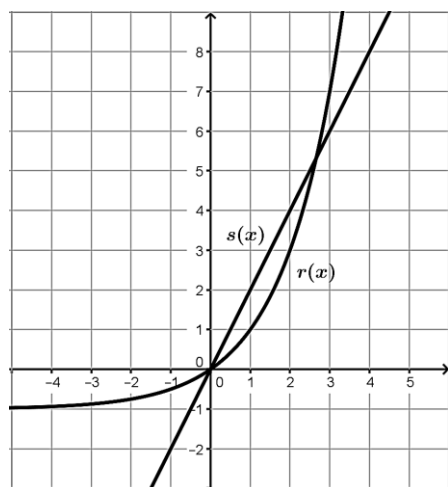
10.



11.



12.



- a. Examine the graph at the left from 0 to 1. Which graph do you think is growing faster?

$s(x)$

- b. Now look at the graph from 2 to 3. Which graph is growing faster in this interval?

$r(x)$

Set

Topic: Discrete and continuous relationships

Identify whether the following statements represent a *discrete* or a *continuous* relationship.13. The hair on your head grows $\frac{1}{2}$ inch per month. **Continuous**14. For every ton of paper that is recycled, 17 trees are saved. **Discrete**15. The average person laughs 15 times per day. **Discrete**16. The city of Buenos Aires adds 6,000 tons of trash to its landfills every day. **Continuous**

Topic: Linear rates of change

Determine the rate of change in each table below.

17.

x	y
-1	-1
0	$\frac{1}{2}$
1	2
2	$\frac{7}{2}$

 $\frac{3}{2}$

18.

x	y
-4	-4
0	4
2	8
6	16

2

19.

x	y
-10	-14
5	-8
25	0
50	10

 $\frac{2}{5}$

20. Complete the tables below to create the indicated type of function.

a. Linear Function

x	$f(x)$
-5	
-4	
-3	
-2	
-1	
0	

b. Exponential Function

x	$f(x)$
-5	
-4	
-3	
-2	
-1	
0	

Answers will vary. For the "Linear Function," check for equal differences over equal intervals. For the "Exponential Function," check for equal factors/ratios over equal intervals.

Go

Topic: Recursive and explicit equations of geometric sequences.

Write the recursive and explicit equations for each geometric sequence.

21. Marissa has saved \$1000 in a jar. She plans to withdraw half of what's remaining in the jar at the end of each month.

Recursive equation:

$$f(0) = 1000, f(n) = f(n-1) \cdot \frac{1}{2}$$

Explicit Equation:

$$f(n) = 1000 \cdot \left(\frac{1}{2}\right)^n$$

22.

Time (Days)	Number of Bacteria
1	10
2	100
3	1000
4	10000

Recursive Equation:

$$f(1) = 10, f(n) = f(n-1) \cdot 10$$

Explicit Equation:

$$f(n) = 10^n \text{ or } f(n) = 10 \cdot 10^{n-1}$$

23.

Folds in paper	Number of rectangles
0	1
1	2
2	4
3	8

Recursive Equation:

$$f(0) = 1, f(n) = f(n-1) \cdot 2$$

Explicit Equation:

$$f(n) = 2^n$$

24. 1024, 256, 64, 16, ...

Recursive Equation:

$$f(1) = 1024, f(n) = f(n-1) \cdot \frac{1}{4}$$

Explicit Equation:

$$f(n) = 1024 \cdot \left(\frac{1}{4}\right)^{n-1}$$

25. 3, 9, 27, 81, ...

Recursive Equation:

$$f(1) = 3, f(n) = f(n-1) \cdot 3$$

Explicit Equation:

$$f(n) = 3^n$$

Name:

Linear and Exponential Functions 4.2H

Ready, Set, Go!

Ready

Topic: Comparing rates of change in both linear and exponential situations.

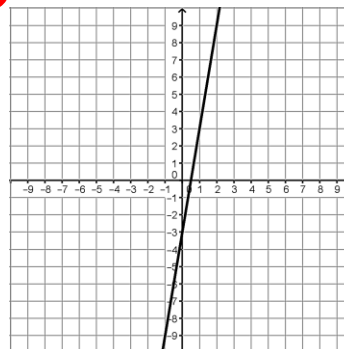


Identify whether situation "a" or situation "b" has the greater rate of change.

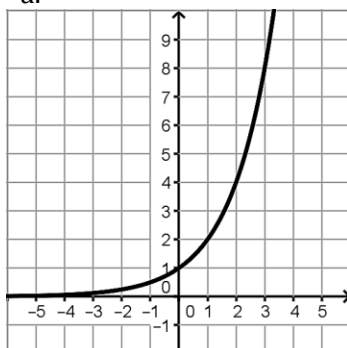
1. a.

x	y
-10	-48
-9	-43
-8	-38
-7	-33

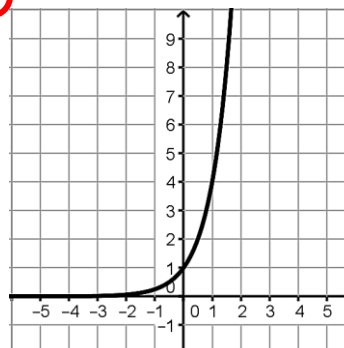
b.



2. a.



b.



3. a. Lee has \$25 withheld each week from his salary to pay for his subway pass.

b. Jose owes his brother \$50. He has promised to pay half of what he owes each week until the debt is paid.

Depends (probably a)

4. a.

x	6	10	14	18
y	13	15	17	19

b. The number of rhombi in each shape.

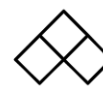


Figure 1

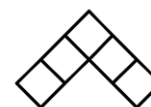


Figure 2

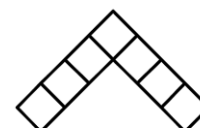


Figure 3

5. a. $y = 2(5)^x$ b. In the children's book, *The Magic Pot*, every time you put one object into the pot, two of the same objects come out. Imagine that you have 5 magic pots.

Set

Topic: Recognizing linear and exponential functions.

For each representation of a function, decide if the function is linear, exponential, or neither.

6. The population of a town is decreasing at a rate of 1.5% per year. 7. Joan earns a salary of \$30,000 per year plus a 4.25% commission on sales

Exponential

Linear

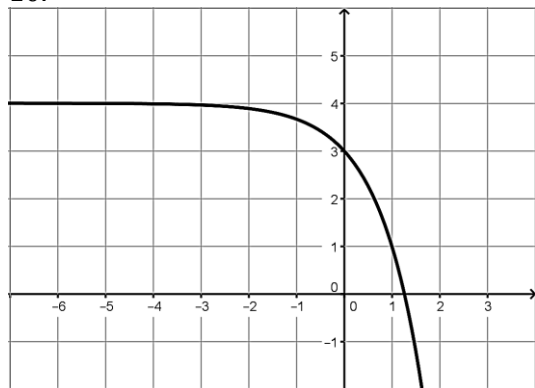
8. $3x + 4y = -3$

Linear

9. The number of gifts received each day of “The 12 Days of Vacation” as a function of the day. (“On the 4th day of vacation my true love gave to me, 4 calling birds, 3 French hens, 2 turtle doves, and a partridge in a pear tree.”)

Neither

10.



Exponential (Students most likely won't see this, but the equation is $f(x) = -(3)^x + 4$)

11.

Side of a square	Area of a square
1 inch	1 in ²
2 inches	4 in ²
3 inches	9 in ²
4 inches	16 in ²

Neither

12. *Calcu-rama* had a net income of 5 million dollars in 2010, while a small competing company, *Computafest*, had a net income of 2 million dollars. The management of *Calcu-rama* develops a business plan for future growth that projects an increase in net income of 0.5 million per year, while the management of *Computafest* develops a plan aimed at increasing its net income by 15% each year.

- a. Express the projected net incomes in these two business plans as recursive formulas.

Let n represent the number of years since 2010, and $f(n)$ is in terms of millions:

***Calcu-rama:* $f(0) = 5, f(n) = f(n - 1) + 0.5$**

***Computafes:* $f(0) = 2, f(n) = f(n - 1) \cdot 1.15$**

- b. Write an explicit equation for the net income as a function of time for each company's business plan.

Let n represent the number of years since 2010, and $f(n)$ is in terms of millions:

***Calcu-rama:* $f(n) = 0.5n + 5$**

***Computafes:* $f(n) = 2 \cdot (1.15)^n$**

- c. Compare your answers in *a* and *b*. How are the two representations similar? How do they differ? What relationships are highlighted in each representation?

Answers will vary

- d. Explain why if both companies are able to meet their net income growth goals, the net income of *Computafest* will eventually be larger than that of *Calcu-rama*. In what year will the net income of *Computafest* be larger than that of *Calcu-rama*?

As time increases, *Computafest* will grow at a faster rate. In the year 2022, the *Computafest* will have a larger net income.

Go

Topic: Geometric means

For each geometric sequence below, find the missing terms in the sequence.

12.

<i>x</i>	1	2	3	4	5
<i>y</i>	2	± 6	18	± 54	162

13.

<i>x</i>	1	2	3	4	5
<i>y</i>	$\frac{1}{9}$	$-\frac{1}{3}$	1	-3	9

14.

<i>x</i>	1	2	3	4	5
<i>y</i>	10	± 5	2.5	± 1.25	0.625

15.

<i>x</i>	1	2	3	4	5
<i>y</i>	<i>g</i>	gz	gz^2	gz^3	gz^4

16.

<i>x</i>	1	2	3	4	5
<i>y</i>	-3	± 9	-27	± 81	-243

Name: _____

Linear and Exponential Functions 4.3H

Ready, Set, Go!

Ready

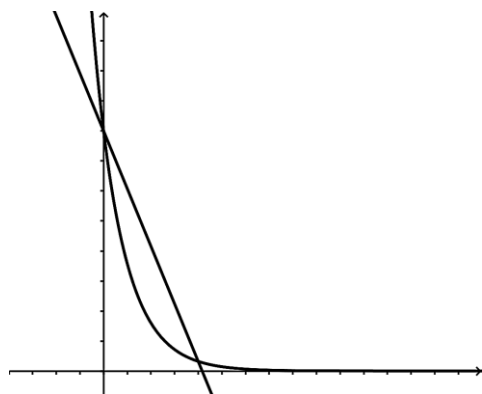
Topic: Finding an appropriate viewing window.

When viewing the secant line of an exponential function on a calculator, you want a window that shows the two points on the curve that are being connected. Since exponential functions get very large or small in just a few steps, you may want to change the scale as well as the dimensions of the window. Don't be afraid to experiment until you are satisfied with what you see.



The graphs below depict an exponential function and a secant line. The equations are given. Identify the dimensions of the viewing window. Include the scale for both the x and y values. Check your answer by matching your calculator screen to the one displayed here.

1. $Y_1 = 4(0.2)^x$ and $Y_2 = -1.92x + 4$



a. X min: -2

b. X max: 8

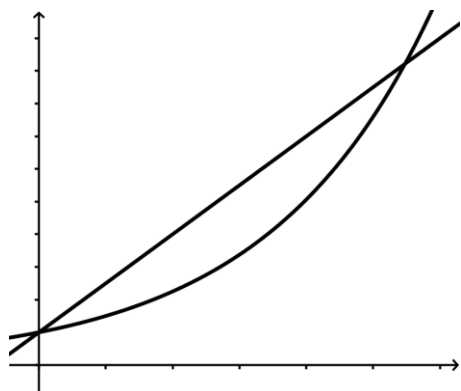
c. X scl: 0.5

d. Y min: 0

e. Y max: 6

f. Y scl: 0.5

2. $Y_1 = 1.5^x$ and $Y_2 = 1.5x + 1$



a. X min: 0

b. X max: 6

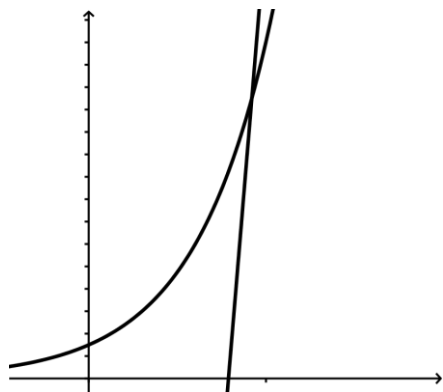
c. X scl: 1

d. Y min: 0

e. Y max: 10

f. Y scl: 1

3. $Y_1 = 150(10)^x$ and $Y_2 = 9500x - 7500$



- a. X min: 0
- b. X max: 2
- c. X scl: 1
- d. Y min: 150
- e. Y max: 1650
- f. Y scl: 100

Set

Topic: Using slope to compare change in linear and exponential models.

The tables below show the values for a linear model and an exponential model. Use the slope formula between *each set of 2 points* to calculate the rate of change.

Example: Find the slope between the points (1, 30) and (2, 630) then between (2, 630) and (3, 1230). Do the same between each pair of points in the table for the exponential model.

4 a. Linear Model

x	y
1	30
2	630
3	1230
4	1830
5	2430

slopes = 600, 600, 600, 600

b. Exponential Model

x	y
1	30
2	90
3	270
4	810
5	2430

slopes = 60, 180, 540, 1620

5. Compare the change between each pair of points in the linear model to the change between each pair of points in the exponential model. Describe your observations and conclusions.

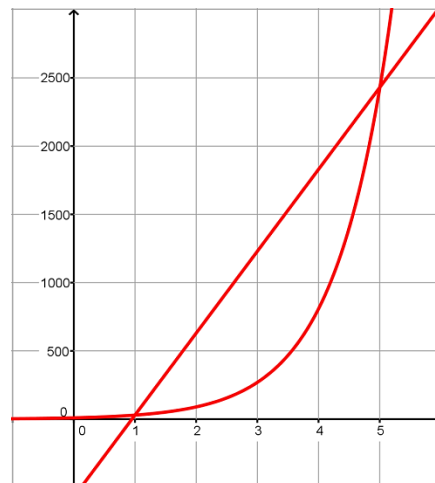
Answers may vary

6. Find the average of the 4 rates of change of the exponential model. How does the average of the rates of change of the exponential model compare to the rates of change of the linear model?

The average rates of change of the exponential model equal the rates of change of the linear model.

7. Without using a graphing calculator, make a rough sketch on the same set of axes of what you think the linear model and the exponential model would look like.

8. How did your observations in #5 influence your sketch?



9. Explain how a table of 5 consecutive values can begin and end with the same y -values and be so different in the middle 3 values. How does this idea connect to the meaning of a secant line?

10. A plane left Chicago at 8:00 A.M. At 1: P.M., the plane landed in Los Angeles, which is 1500 miles away. What was the average speed of the plane for the trip?

300 miles per hour

11. After 30 baseball games, A-Rod had 25 hits. If after 100 games he had 80 hits, what is his average hits per baseball game.

$\frac{11}{14} \approx 0.786$ hits per game

Go

Topic: Writing explicit equations for linear and exponential models.

Write the explicit equation for the tables and graphs below.

12 .

x	$f(x)$
-1	$\frac{2}{5}$
0	2
1	10
2	50

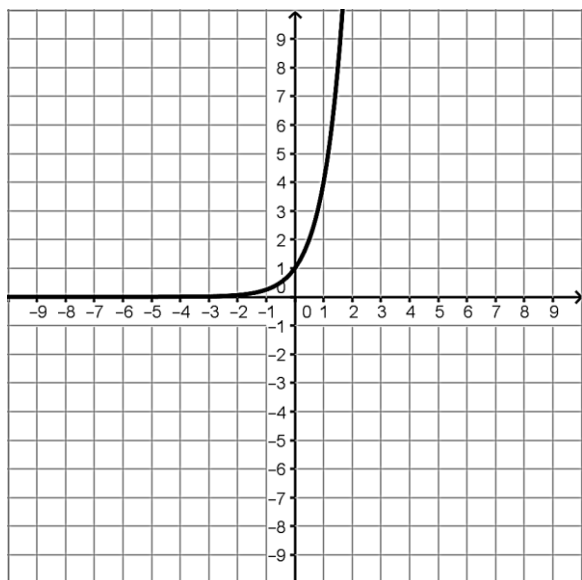
$f(x) = 2 \cdot 5^x$

13.

x	$f(x)$
-4	81
-3	27
-2	9
-1	3

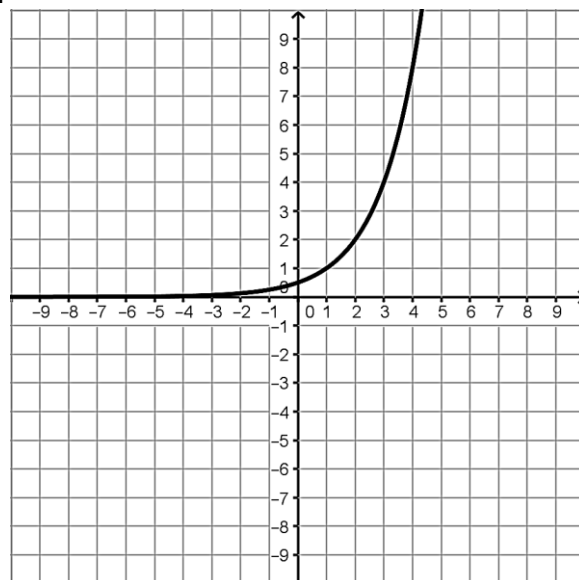
$f(x) = \left(\frac{1}{3}\right)^x$

14.



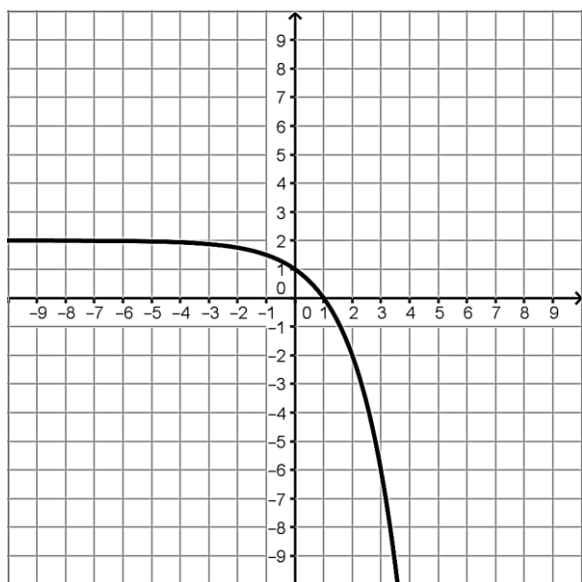
$$f(x) = 4^x$$

15.



$$f(x) = \frac{1}{2} \cdot 2^x$$

16.

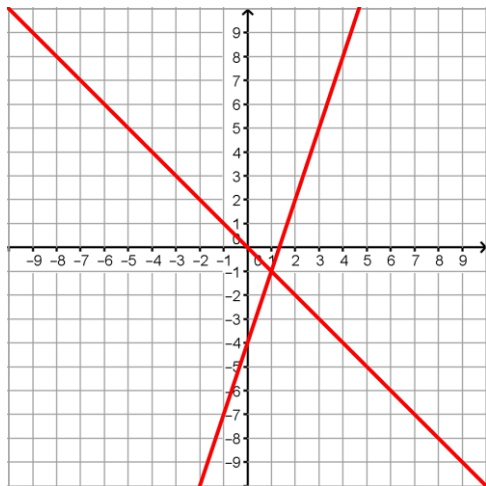


$$f(x) = -2^x + 2$$

Topic: Solving systems through graphing.

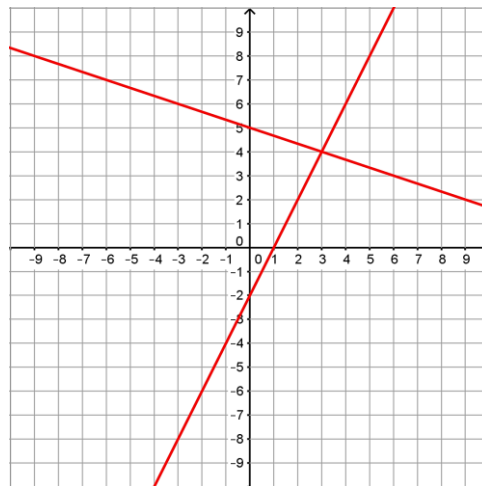
Find the solution to the systems of equations by graphing.

$$17. \begin{cases} x + y = 0 \\ 3x - y = 4 \end{cases}$$



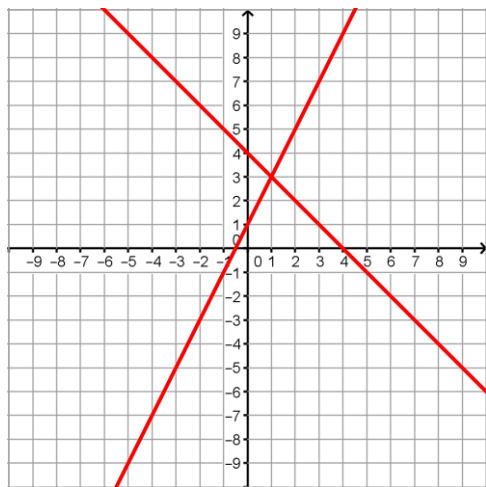
(1, -1)

$$18. \begin{cases} y = 2x - 2 \\ x + 3y = 15 \end{cases}$$



(3, 4)

$$19. \begin{cases} y = -(x - 4) \\ y - 2x - 1 = 0 \end{cases}$$



(1, 3)

Name: _____ Linear and Exponential Functions 4.4H

Ready, Set, Go!



Ready

1. Give a contextual example that can be modeled by a discrete function.

Answers will vary

2. Give a contextual example that can be modeled by a continuous function.

Answers will vary

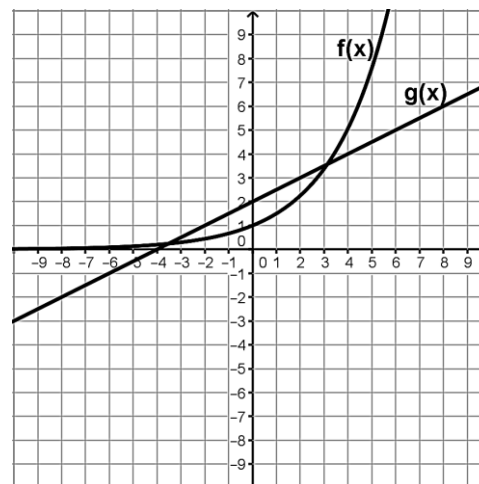
3. The first and 5th terms of a sequence are given. Fill in the missing numbers for an arithmetic sequence. Then fill in the numbers for a geometric sequence.

Arithmetic	-6250	-4690	-3130	-1570	-10
Geometric	-6250	±1250	-250	±50	-10

4. Compare the rate of change in the pair of functions in the graph by identifying the interval where it appears that $f(x)$ is changing faster and the interval where it appears that $g(x)$ is changing faster. Verify your conclusions by making a table of values for each function and exploring the rates of change in your tables.

$$f(x): \approx (-\infty, 0.5)$$

$$g(x): \approx (0.5, \infty)$$



5. Identify the following sequences as linear, exponential, or neither.

a. $-23, -6, 11, 28, \dots$

Linear

b. $49, 36, 25, 16, \dots$

Neither

c. $5125, 1025, 205, 41, \dots$

Exponential

d. $2, 6, 24, 120, \dots$

Neither

e. $0.12, 0.36, 1.08, 3.24, \dots$

Exponential

f. $21, 24.5, 28, 31.5, \dots$

Linear

Topic: Writing equations of lines.

Using the given information, write the equation of a line in slope-intercept form: $y = mx + b$, and standard form: $Ax + By = C$.

6. $m = -7$, $b = 4$

$$y = -7x + 4$$

$$7x + y = 4$$

7. $m = \frac{3}{8}$, $b = -3$

$$y = \frac{3}{8}x - 3$$

$$3x - 8y = 24$$

Write the equation of the line in point-slope form: $y = m(x - x_1) + y_1$, using the given information.

8. $m = \frac{2}{3}$, $(-6, 1)$

$$y = \frac{2}{3}(x + 6) + 1$$

9. $m = -5$, $(4, 11)$

$$y = -5(x - 4) + 11$$

10. $(2, -5)$ $(-3, 10)$

$$y = -3(x - 2) - 5$$

or

$$y = -3(x + 3) + 10$$

11. $(-4, 8)$ $(3, 1)$

$$y = -1(x + 4) + 8$$

or

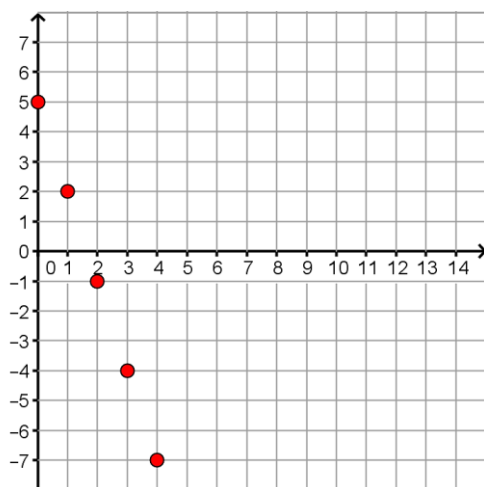
$$y = -1(x - 3) + 1$$

Topic: Graphing linear and exponential functions

Make a graph of the function based on the following information. Add your axes. Choose an appropriate scale and label your graph. Then write the equation of the function.

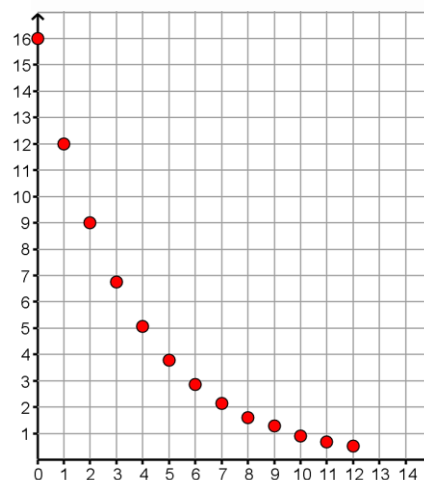
12. The beginning value of the function is 5 and its value is 3 units smaller at each stage.

Equation: $y = -3x + 5$



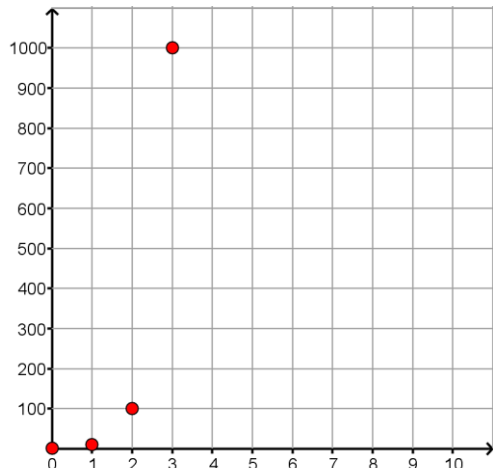
13. The beginning value is 16 and its value is $\frac{1}{4}$ smaller at each stage.

Equation: $y = 16 \cdot \left(\frac{3}{4}\right)^x$



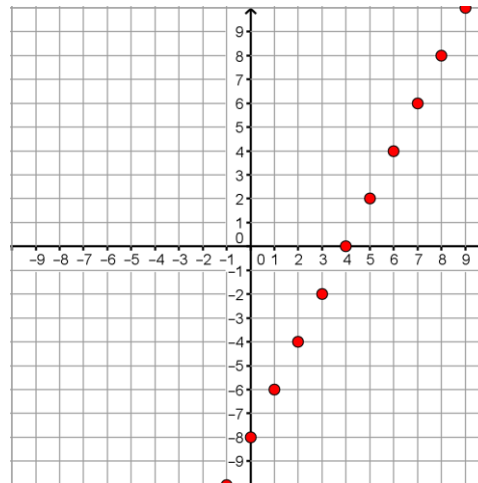
14. The beginning value is 1 and its value is 10 times as big at each stage.

Equation: $y = 10^x$



15. The beginning value is -8 and its value is 2 units larger at each stage.

Equation: $y = 2x - 8$



Topic: Four forms of linear equations

16. Below are the 4 forms of the same linear equation. Complete the table:

Slope-Intercept	Point-Slope	Standard	Recursive Formula	Rate of Change	x-intercept	y-intercept
$y = 3x - 2$	$y - 13 = 3(x - 5)$	$3x - y = 2$	$f(0) = -2$ $f(n) = f(n - 1) + 3$	3	$x = \frac{2}{3}$	$y = -2$
$y = \frac{1}{4}x + 7$	$y - 5 = \frac{1}{4}(x + 8)$	$x - 4y = -28$	$f(0) = 7$ $f(n) = f(n - 1) + \frac{1}{4}$	$\frac{1}{4}$	$x = -\frac{7}{4}$	$y = 7$
$y = -\frac{2}{3}x + 3$	$y + 1 = -\frac{2}{3}(x - 6)$	$2x + 3y = 9$	$f(0) = 3$ $f(n) = f(n - 1) - \frac{2}{3}$	$-\frac{2}{3}$	$x = \frac{9}{2}$	$y = 3$

Go

Topic: Slope-intercept form

Rewrite the equations in slope-intercept form.

16. $(y - 13) = \frac{1}{2}(8x - 14)$

$y = 4x + 6$

19. $3(2x - y) = 9x + 12$

$y = -x - 4$

22. $y + 1 = \frac{3}{4}(x + 3)$

$y = \frac{3}{4}x + \frac{5}{4}$

Name: _____ Linear and Exponential Functions 4.5H

Ready, Set, Go!

Ready

Topic: Simple interest



When a person borrows money, the lender usually charges “rent” on the money. This “rent” is called interest. Simple interest is a percent “ r ” of the original amount borrowed “ P ” multiplied by the time “ t ”, usually in years. The formula for calculating the interest is $i = Prt$.

Calculate the simple interest owed on the following loans.

1. $P = \$1000$ $r = 11\%$ $t = 2 \text{ years}$ $i = \underline{\$220}$

2. $P = \$20,000$ $r = 8.5\%$ $t = 6 \text{ years}$ $i = \underline{10,200}$

Juanita borrowed \$1,000 and agreed to pay 15% **simple interest** for 5 years. Juanita did not have to make any payments until the end of the 5 years, but then she had to pay back the amount borrowed “ P ” plus all of the interest “ i ” for the 5 years “ t .” Below is a chart that shows how much money Juanita owed the lender at the end of each year of the loan.

End of Year	Interest owed for the year	Total amount of money owed to the lender to pay back the loan.
1	$\$1000 \times 0.15 = \150	$A = \text{Principal} + \text{interest} = \1150
2	$\$1000 \times 0.15 = \150	$A = P + i + i = \$1300$
3	$\$1000 \times 0.15 = \150	$A = P + i + i + i = \$1450$
4	$\$1000 \times 0.15 = \150	$A = P + i + i + i + i = \1600
5	$\$1000 \times 0.15 = \150	$A = P + i + i + i + i + i = \1750

3. a. Look for the pattern you see in the chart above for the amount (A) owed to the lender. Write a function that best describes A with respect to time (in years).

$$A = P + t \cdot i$$

- b. What type of function does the function from part a represents?

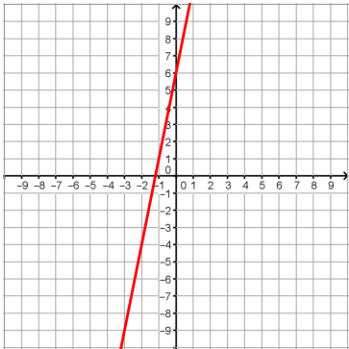
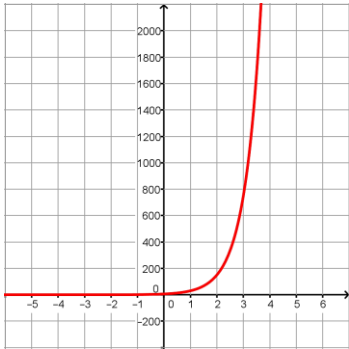
Linear

4. Consider if the lender charged **15% of the amount owed** instead of 15% of the amount of the original loan. Calculate the **interest owed** each year if the lender required **15% of the amount owed at the end of each year**. Note that the interest owed at the end of the first year would still be \$150. Complete the table below.

End of Year	Starting Amount for the Year	Interest	Total Amount at the End of the Year
1	\$1000	$\$1000 \times 0.15 = \150	\$1150
2	\$1150	$\$1150 \times 0.15 = \underline{\$172.50}$	$\$1150 + \underline{\$172.50} = \underline{\$1322.50}$
3	\$1322.50	$\\$1322.50 \times 0.15 = \\198.38	$\\$1322.50 + \\$198.38 = \\$1520.88$
4	\$1520.88	$\\$1520.88 \times 0.15 = \\228.13	$\\$1520.88 + \\$228.13 = \\$1749.01$
5	\$1749.01	$\\$1749.01 \times 0.15 = \\262.35	$\\$1749.01 + \\$262.35 = \\$2011.36$

Set

Describe the defining characteristics of each type of function by filling in the cells of each table as completely as possible.

	$y = 6 + 5x$	$y = 6(5)^x$																								
5. Type of growth	Linear	Exponential																								
6. What kind of sequence corresponds to each model?	Arithmetic	Geometric																								
7. Make a table of values	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>6</td> </tr> <tr> <td>1</td> <td>11</td> </tr> <tr> <td>2</td> <td>16</td> </tr> <tr> <td>3</td> <td>21</td> </tr> <tr> <td>4</td> <td>26</td> </tr> </tbody> </table>	x	y	0	6	1	11	2	16	3	21	4	26	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>6</td> </tr> <tr> <td>1</td> <td>30</td> </tr> <tr> <td>2</td> <td>150</td> </tr> <tr> <td>3</td> <td>750</td> </tr> <tr> <td>4</td> <td>3750</td> </tr> </tbody> </table>	x	y	0	6	1	30	2	150	3	750	4	3750
x	y																									
0	6																									
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x	y																									
0	6																									
1	30																									
2	150																									
3	750																									
4	3750																									
8. Find the rate of change	5	Not Constant																								
9. Graph each equation. Compare the graphs. What is the same? What is different?																										
10. Find the y-intercept for each function.	(0, 6)	(0, 6)																								
11. Write the recursive form of each equation.	$f(0) = 6$ $f(x) = f(x-1) + 5$	$f(0) = 6$ $f(x) = f(x-1) \times 5$																								

Go

Topic: Solving multi-step equations

Solve the following equations

12. $12 + 6x - 4 = 5 + 2(3x - 1)$ No Solution	13. $5(2x + 4) = 3(x + 5) - 19$ $x = -\frac{24}{7}$
14. $7 - 3(4x + 2) = 6(2x + 3) - 17$ $x = 0$	15. $2(x + 1) = 6(x - 3)$ $x = 5$

16. What does it mean when you have solved an equation?

Solving an equation means you have found the value(s) of x that make the equation true.

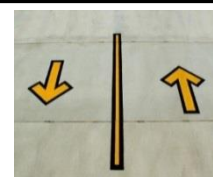
17. Explain how a linear equation can have more than one solution.

There are an infinite number of pairs of x and y values that make any linear equation true.

Name: _____

Linear and Exponential Functions | 4.6H

Ready, Set, Go!



Ready

Topic: Solving linear and exponential equations using graphs and equations.

- 1.
- Table Puzzles:**
- Use the tables to find the missing values of
- x
- :

a.

x	$y = 0.7x - 3$
-2	-4.4
-10	-10
-8	-8.6
4	-0.2
6	1.2

b.

x	$y = -\frac{2}{3}x + 4$
10	$-10\frac{2}{3}$
-3	6
5	$\frac{2}{3}$
6	0
-9	10

- c. What equations could be written, in terms of
- x
- only, for each of the rows that are missing the
- x
- in the two tables above?

Neither. They both can be written in terms of x and y .

d.

x	$y = 3^x$
5	243
4	81
-3	$\frac{1}{27}$
-1	$\frac{1}{3}$
2	9

e.

x	$y = \left(\frac{1}{2}\right)^x$
-5	32
-3	8
0	1
2	$\frac{1}{4}$
4	$\frac{1}{16}$

- f. What equations could be written, in terms of
- x
- only, for each of the rows that are missing the
- x
- in the two tables above?

Equations d. and e

2. What strategy did you use to find the solutions to equations (question 1c) generated by the tables that contained linear functions?

Possible Answers: Solve the equation for x in terms of y .

3. What strategy did you use to find the solutions to equations (question 1f) generated by the tables that contained exponential functions?

Possible Answers: Guess and check. Think about the equation graphically.

Graph Puzzles

4. The graph of $y = -\frac{1}{2}x + 3$ is given below. Use the graph to solve the equations for x and label the solutions.

a. $5 = -\frac{1}{2}x + 3$

$x = \underline{-4}$

Label the solution with an A on the graph

b. $-\frac{1}{2}x + 3 = 1$

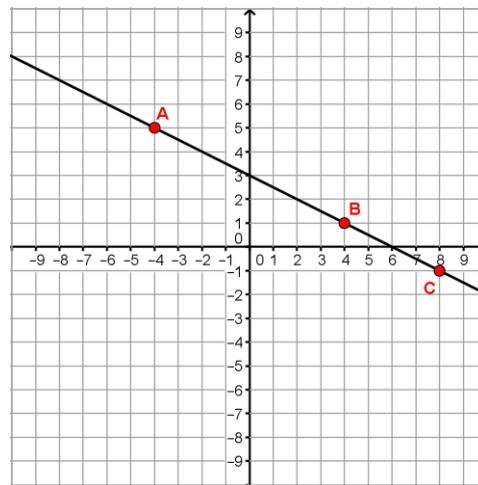
$x = \underline{4}$

Label the solution with a B on the graph

c. $-0.5x + 3 = -1$

$x = \underline{8}$

Label the solution with a C on the graph



Set

Topic: Evaluate using the formulas for simple interest or compound interest.

Given the formula for simple interest: $i = Prt$, calculate the simple interest paid.

(Remember, i = interest, P = the principal, r = the interest rate per year as a decimal, t = time in years)

5. Find the simple interest you will pay on a 5 year loan of \$7,000 at 11% per year.

\$3850

6. How much interest will you pay in 2 years on a loan of \$1500 at 4.5% per year?

\$135

Use $i = Prt$ to complete the table. All interest rates are annual.

	i	=	P	×	r	×	t
7.	\$4059		\$11,275		12%		3 years
8.	\$1,428		\$5,100		4%		7 years
9.	\$93.75		\$1,250		15%		6 months
10.	\$54		\$900		8%		9 months

Given the formula for compound interest: $A = P(1 + r)^t$, write a compound interest function to model each situation. Then calculate the balance after the given number of years. (Remember: $A =$ the balance after t years, $P =$ the principal, $t =$ the time in years, $r =$ the annual interest rate expressed as a decimal)

11. \$22,000 invested at a rate of 3.5% compounded annually for 6 years.

\$27,043.62

12. \$4300 invested at a rate of 2.8% compounded annually for 15 years.

\$6,506.77

13. Suppose that when you are 15 years old, a magic genie gives you the choice of investing \$10,000 at a rate of 7% or \$5,000 at a rate of 12%. Either choice will be compounded annually. The money will be yours when you are 65 years old. Which investment would be the best? Justify your answer.

\$10,000 at 7% \approx \$294,570

\$5,000 at 12% \approx \$1,445,010

Using the formulas for simple interest or compound interest, calculate the following.

14. The simple interest on a loan of \$12,000 at an interest rate of 17% for 6 years.

\$12,240

15. The simple interest on a loan of \$20,000 at an interest rate of 11% for 5 years.

\$11,000

16. The amount owed on a loan of \$20,000, at 11%, compounded annually for 5 years.

\$33,701.16

17. Compare the interest paid in #15 to the interest paid in #16. Which kind of interest do you want if you have to take out a loan?

There is a \$22,701.16 difference between the simple and compound interests described above. You would want the simple interest.

18. The amount in your savings account at the end of 30 years, if you began with \$2500 and earned an interest rate of 7% compounded annually.

\$19,030.64

Go

There were 2 girls in my grandmother's family, my mother and my aunt. They each had 3 daughters. My two sisters, 3 cousins, and I each had 3 daughters. Each one of our 3 daughters have had 3 daughters.

19. If the pattern of each girl having 3 daughters continues for 2 more generations (my mom and aunt being the 1st generation, I want to know about the 5th generation), how many daughters will be born then?

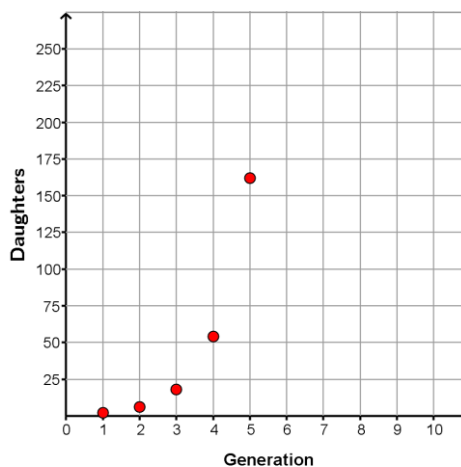
162

20. Write the explicit equation for this pattern.

$$y = \frac{2}{3} \cdot 3^x$$

21. Create a table and a graph describing this pattern. Is this situation **discrete** or continuous?

Generation	Daughters
1	2
2	6
3	18
4	54
5	162
6	486



Topic: Using order of operations when evaluating equations

Evaluate the equations for the given values of the variables.

22. $(b - 1)^2 + ba^2$; when $a = 5$, and $b = 3$

79

23. $an^4 + a(n - 7)^2 + 2n$; when $a = -2$, and $n = 4$

-522

Topic: Solving equations

Solve the following equations.

24. $5x + 3 = 2(x - 6)$

$x = -5$

25. $6x - 12x + 10 = 2(-3x - 6)$

No Solution

26. $13x - 12x + \frac{1}{2} = x + \frac{3}{6}$

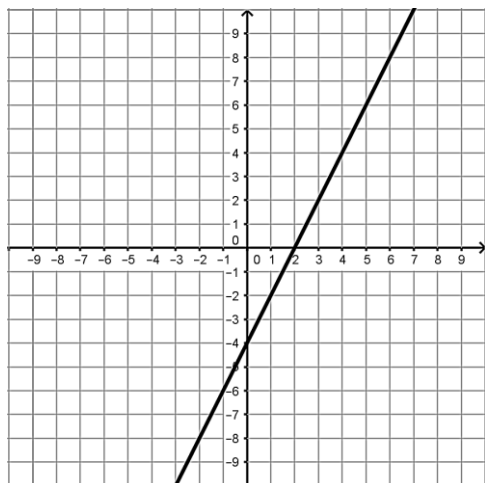
Infinitely Many Solutions

Module 4 Review Homework

Characteristics of Functions:

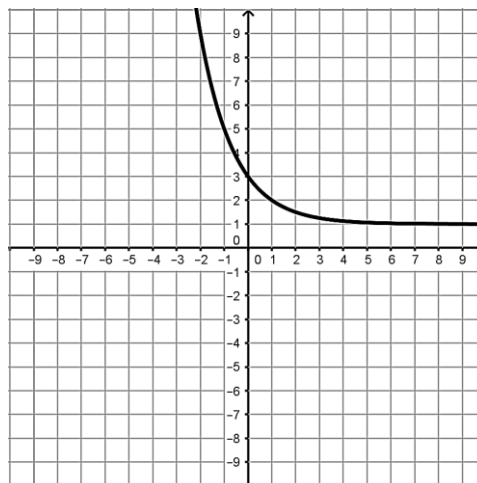
For each of the functions find the following information.

1.



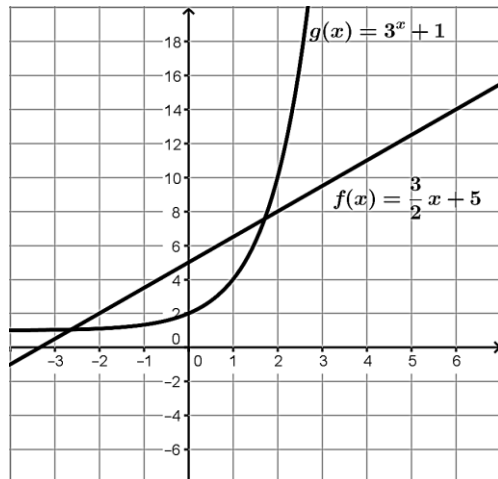
x-intercept: (2, 0)
 y-intercept: (0, -4)
 Rate of change between $x = -1$ and $x = 2$: 2

2.



x-intercept: No x-intercept
 y-intercept: (0, 3)
 Rate of change between $x = -1$ and $x = 2$: $-\frac{7}{6}$

3. Discuss and compare the functions by analyzing the rates of change, intercepts, and where one function is greater or less than the other.



$f(x)$: rate of change: $\frac{3}{2}$
 x-intercept: $(\frac{10}{3}, 0)$
 y-intercept: $(0, 5)$

$g(x)$: rate of change: **not constant**
 x-intercept: **none**
 y-intercept: $(0, 2)$

$f(x)$ is greater than $g(x)$ from about $x = -2.75$ to 1.75 .

Linear and Exponential Models:

4. Write an explicit formula to model the number of dots per day.

○ ○

○ ○
○ ○
○ ○○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○
○ ○ ○ ○ ○ ○

Day 1

Day 2

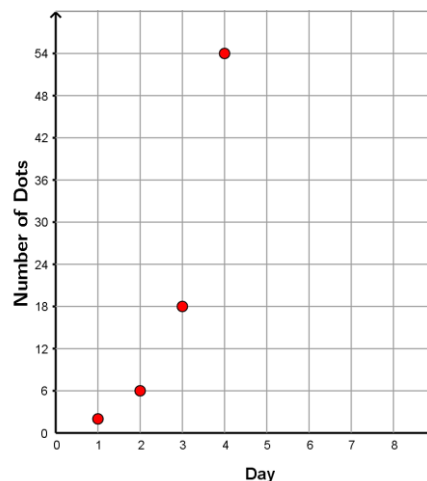
Day 3

$$f(x) = \frac{2}{3} \cdot 3^x \text{ or } 2 \cdot 3^{x-1}$$

Model the function using the table provided:

Day	Number of Dots
1	2
2	6
3	18
4	54

Use your table to create a graph of the function:



5. Sherry has a huge doll collection of 80 dolls. Her mom tells her that she needs to get rid of 5 per year to get it down to a decent number before leaving for college. Write an explicit formula to model the number of dolls per year. If she is 12, how many will she have left when she is 18?

$$f(x) = 80 - 5x$$

When she is 18, $x = 6$ so $f(6) = 50$. Sherry will have 50 dolls when she is 18 years old.

6. You bought a Toyota Corolla in 2004 for \$12,500. The car's value depreciates by 7% a year. How much is the car worth now? How much is it worth in 2020?

$$f(x) = 12500 \cdot (1 - 0.07)^x$$

In 2020, $x = 16$ so $f(16) \approx \$3914.15$. The car will be worth approximately \$3,914.15 in 2020.

7. The population of a large city increases by a rate of 3% a year. When the 2000 census was taken, the population was 1.2 million.

a. Write a model for this population growth.

$$f(x) = 1.2 \cdot (1 + 0.03)^x$$

b. What should the population be now? What is the projected population for 2020?

In 2014, $x = 14$ so $f(14) = 1.815$ million people.

In 2020, $x = 20$ so $f(20) = 2.167$ million people.

8. Bank Plans:

Suppose you worked mowing lawns all summer and earned \$50. Two savings institutions, Linear Luck and Exponential Experiment want you to let them “hold onto your money” for a while.

Linear Luck: This savings plan will add \$100 to your balance for every month that you leave your money in the account.

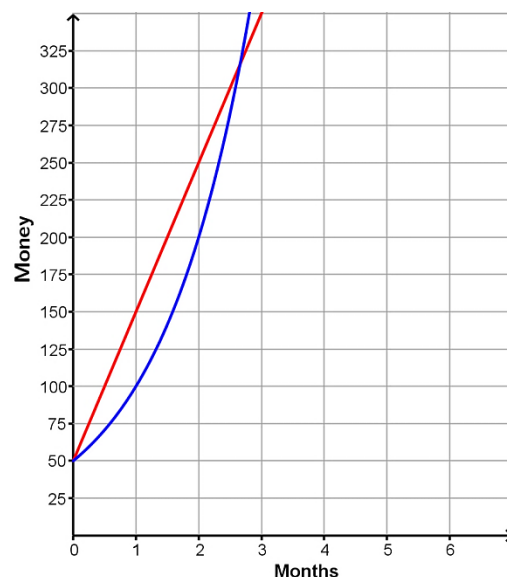
Exponential Experiment: This savings plan will multiply your balance by 2 every month that you leave your money in their account.

Analyze the plans: Write the explicit function for each account, and decide which account is best at what times.

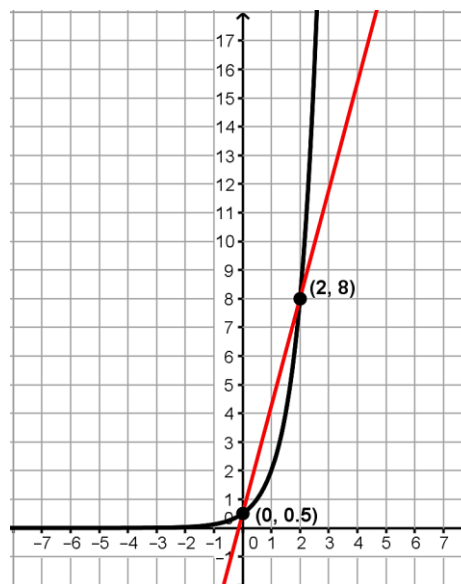
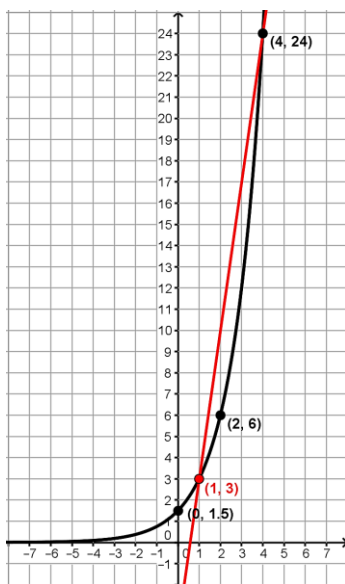
Linear Luck: $f(x) = 100x + 50$

Exponential Experiment: $f(x) = 50 \cdot 2^x$

Linear Luck is better for only the first 2 months. After about 2 and a half months, both accounts will be about \$315. After that, Exponential Experiment is much better.



- 9.
- Write the equation of the function shown in the graph below.
 $f(x) = 1.5(2)^x$
 - Then find the average rate of change of the function when x is between 1 and 4.
7
 - Draw in the secant line (the line that you are finding the slope of when x is between 1 and 4).
- 10.
- Write the equation of the function shown in the graph below.
 $f(x) = 0.5(4)^x$
 - Then find the average rate of change of the function when x is between 0 and 2.
3.75
 - Draw the secant line (the line that you are finding the slope of when x is between 0 and 2).



Solve the following equations for y .

11. $2y + 10 = 6x + 12$

$y = 3x + 1$

12. $5x + y = 7x + 4$

$y = 2x + 4$

13. $(y + 11) = -7(x - 2)$

$y = -7x + 3$

14. $y - 2 = \frac{1}{5}(10x - 25)$

$y = 2x - 3$

15. $y + 13 = -1(x + 3)$

$y = -x - 16$

16. $(y - 5) = 3(x + 2)$

$y = 3x + 11$

Module 4 Challenge Problems

The following problems are intended for students to work on after Module 4H Test. The problems are meant to be done on their own and reviewed during the following class. The following page is blank for the teacher to copy and give to each student after the test. Below are the solutions.

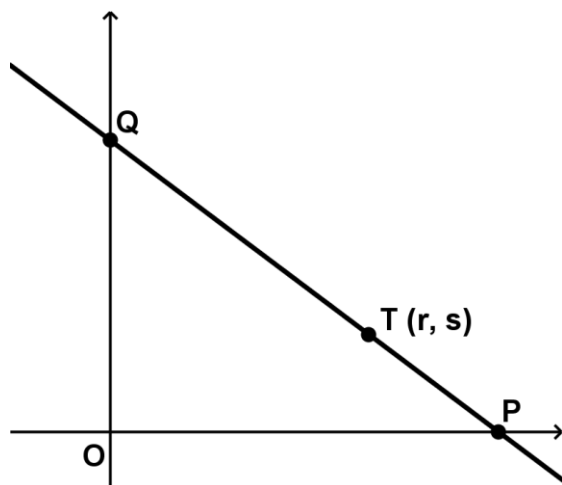
- Some tokens are placed in a bag. Each of the tokens has a positive integer stamped on one of its sides. The other side is blank. It is possible that more than one token in the bag has the same number stamped on it. The average of all the tokens in the bag is 56. If a token with the number 68 on it is removed from the bag, the average number on the remaining tokens is 55. Determine the largest possible integer that could appear on one of the tokens in the bag

649

- Including takeoff and landing, a plane has average speed 500 km/h while in flight. The plane travels from Toronto to Thunder Bay in 1 hour 40 minutes, has a brief layover, then returns to Toronto. The return flight is by the same route and in the same amount of time. If the wait in Thunder Bay reduces the average speed to 425 km/h for the entire two-way trip, how long was the layover?

$\frac{10}{17}$ hours or approximately 35 minutes.

- The line $y = -\frac{3}{4}x + 9$ crosses the x -axis at P and the y -axis at Q. Point T(r, s) lies on \overline{PQ} . The area of $\triangle POQ$ is three times the area of $\triangle TOP$. Determine the values of r and s , the coordinates of T.



(8, 3)