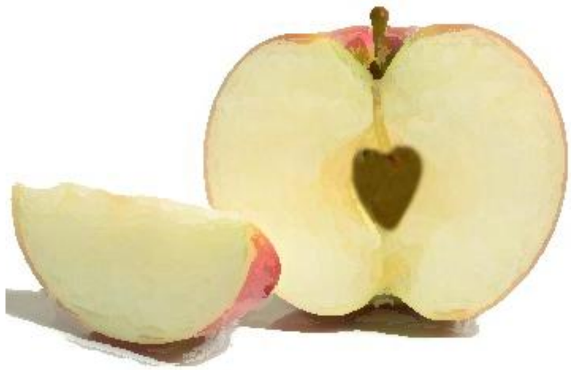

Getting to the Core

Algebra II

A9 – Functions – Unit of Study

Updated on May 3, 2013

Student Name ___________________________________ **Period** ______

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Unit A9 – Functions

Table of Contents

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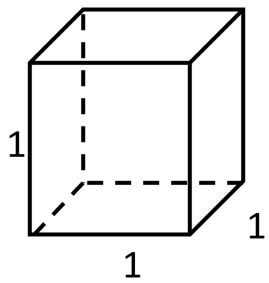
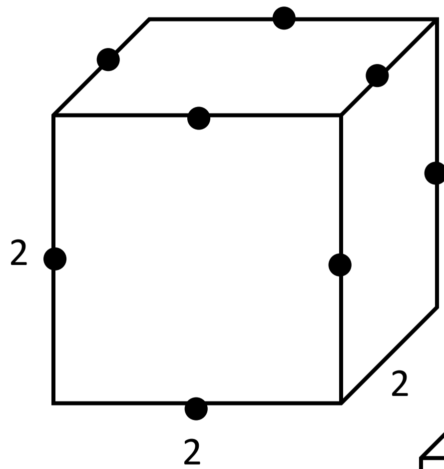
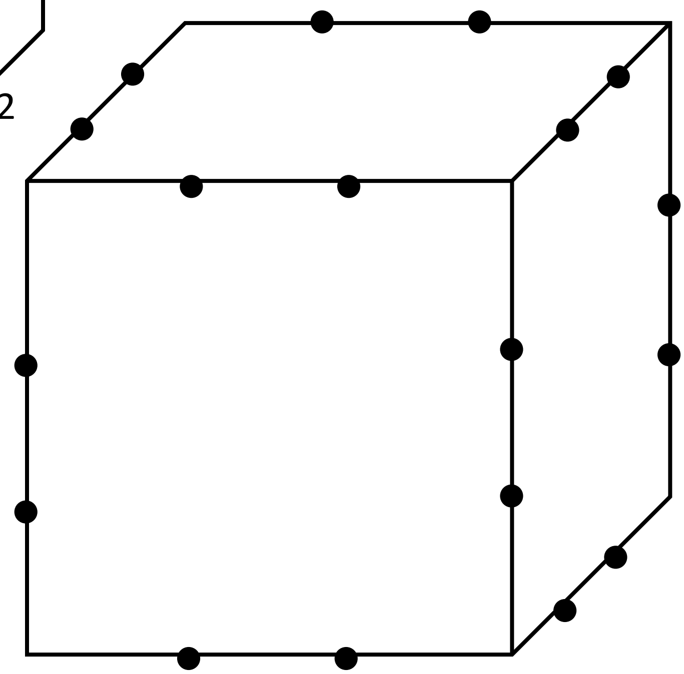
Cube Growth **Name** ___________________________________**Period**__

Jason is creating cubes with different side lengths out of straws and construction paper. He needs your help to figure out how many straws (each straw is 1 ft) and sheets of paper (1ft by 1ft) he needs. Help Jason calculate how many materials he should purchase by completing the following table.





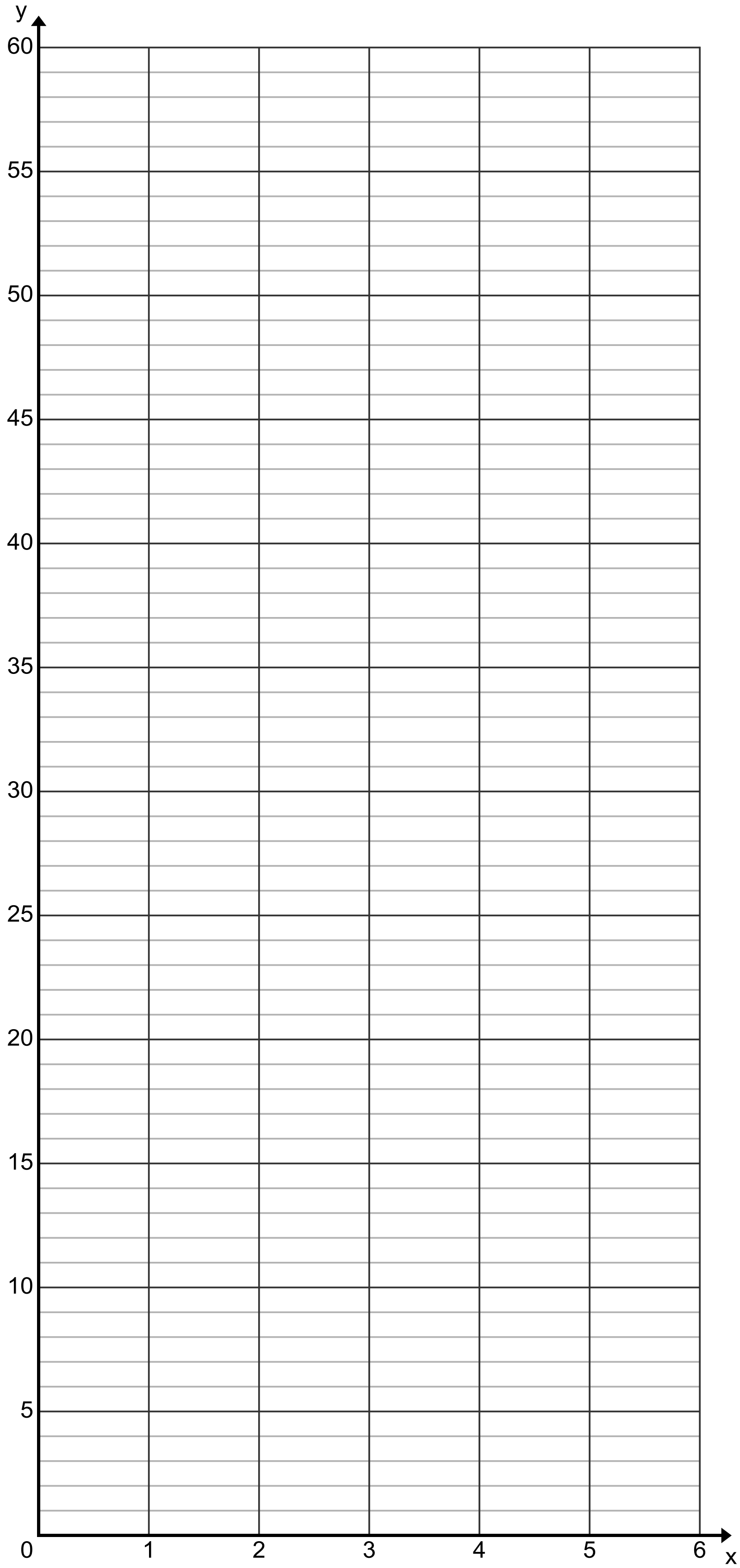


Start by counting the straws and papers for a cube with edges of 1 foot, then count for the 2nd and 3rd cube.

Next, use the patterns or your own drawings to fill in the rows for 0, 4 and 5.

x (in feet)	How many straws Jason would need?	How many sheets of construction paper Jason would need to cover the sides?	What is the volume of the cube that Jason makes?
0			
1			
2			
3			
4			
5			

Note: the volume of a cube is the number of 1 ft cubes that will fit inside it.



Use the data from your table and three different colors to make three graphs in this coordinate plane.

One graph will be for the number of straws.

A second will be for the number of 1ft by 1ft squares of paper.

The third will be for the volume.

1. How many straws do you think Jason will need if $x = 6$?
    a. How do you know? Explain the pattern.
    b. Is there an equation you can create to represent the number of straws Jason will need given any x value? Write the equation.
    c. What does this graph look like? What type of function is this?
    d. How many straws will Jason need if $x = 10$? Show your work.
2. How many sheets of construction paper do you think Jason will need if $x = 6$?
    a. How do you know? Explain the pattern.
    b. Is there an equation you can create to represent the sheets of paper Jason will need given any x value? Write the equation.
    c. What does this graph look like? What type of function is this?
    d. How many sheets of paper will Jason need if $x = 10$? Show your work.
3. What would be the volume if Jason builds a cube with $x = 6$?
    a. How do you know? Explain the pattern.
    b. Is there an equation you can create to represent the volume for any x value? Write the equation.
    c. What does this graph look like? What type of function is this?
    d. What will be the volume if $x = 10$? Show your work.

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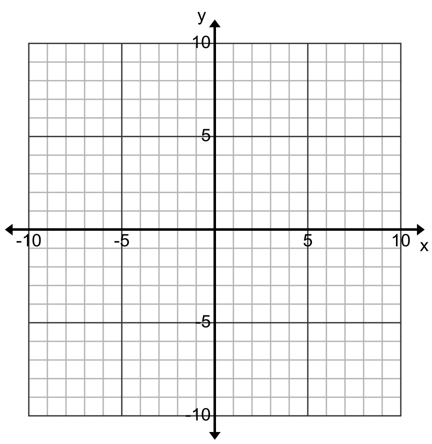
Functions Unit Pre-Assessment **Name** ____

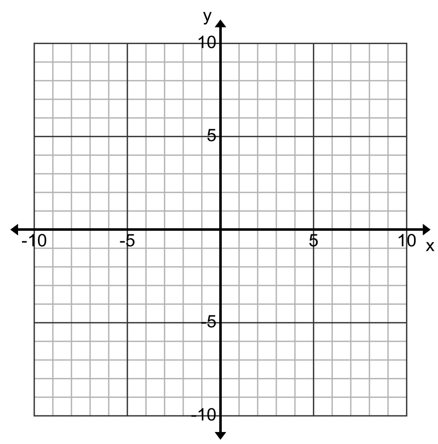
Part 1: For each of the functions given below, find the indicated values.

$f(x) = 3x$	$g(x) = x^2$	$h(x) = x^3$
$f(5) =$	$g(4) =$	$h(3) =$
$f(-2) =$	$g(-3) =$	$h(-5) =$
$f(x) = \sqrt{x}$	$g(x) = 3^x$	$h(x) = x^3 - 3x^2$
$f(16) =$	$g(4) =$	$h(4) =$
$f(100) =$	$g(-3) =$	$h(-4) =$

Part 2: Draw the graphs of the following functions.

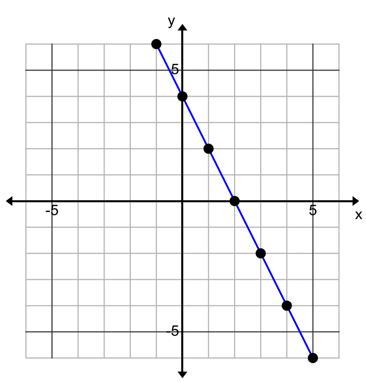


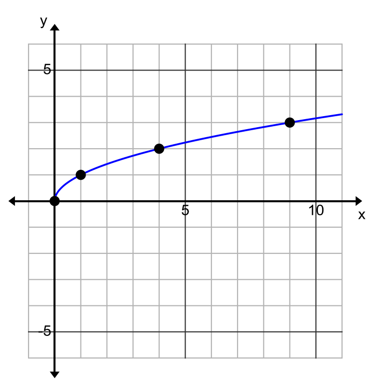
$f(x) = 3x - 4$

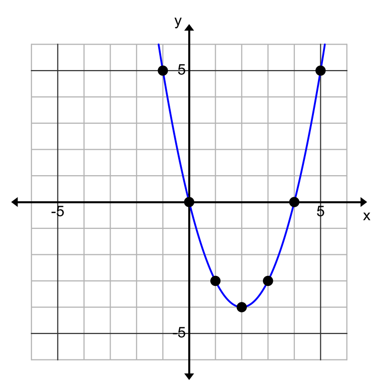


$g(x) = x^2 - 6$

Part 3: Identify the function in each graph.







$f(x) =$	$g(x) =$	$h(x) =$

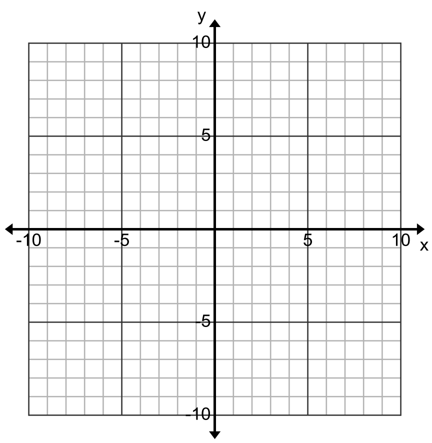
Functions Unit Skill Review Name ____

Note: $f(x) = 5x$ is read “f of x equals five x” and $f(4)$ is read “f of 4” and is the y-value or function value at x=4.

For each of the functions given below, find the indicated values.

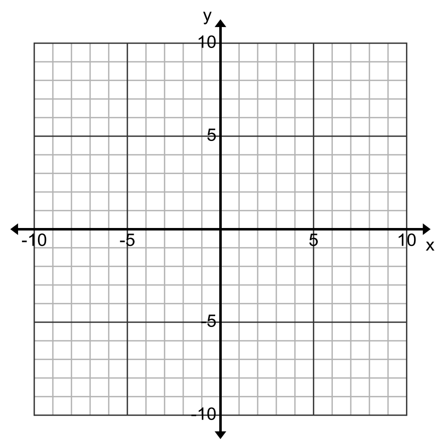
$f(x) = -x + 2$ $f(5) =$ $f(-2) =$	$g(x) = 3x^2$ $g(4) =$ $g(-3) =$	$h(x) = x^3 - 4$ $h(3) =$ $h(-5) =$
$f(x) = \sqrt{x}$ $f(9) =$ $f(81) =$	$g(x) = 4^x$ $g(2) =$ $g(-3) =$	$h(x) = x^2 + 4x + 3$ $h(2) =$ $h(-3) =$

Draw the graphs of the following functions by calculating function values for each input.



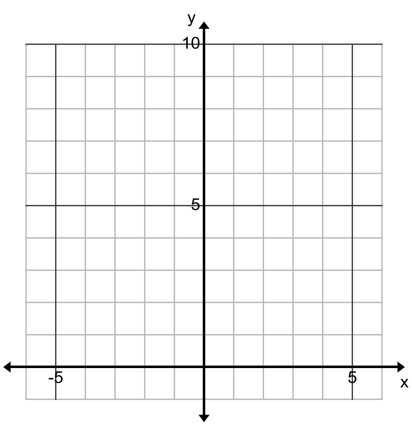
$f(x) = \frac{1}{2}x - 2$

x	y
-2	
0	
2	
4	
6	



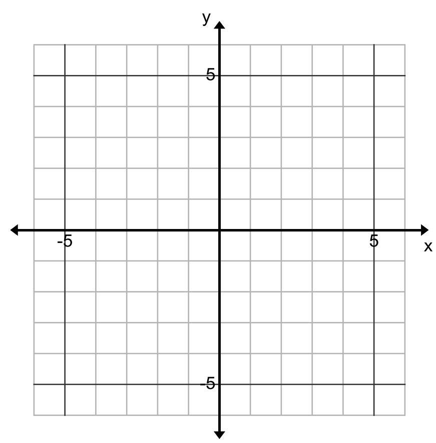
$g(x) = x^2 - 4$

x	y
-2	
-1	
0	
1	
2	



$k(x) = 3^x$

x	y
-2	
-1	
0	
1	
2	



$h(x) = \sqrt{x + 5}$

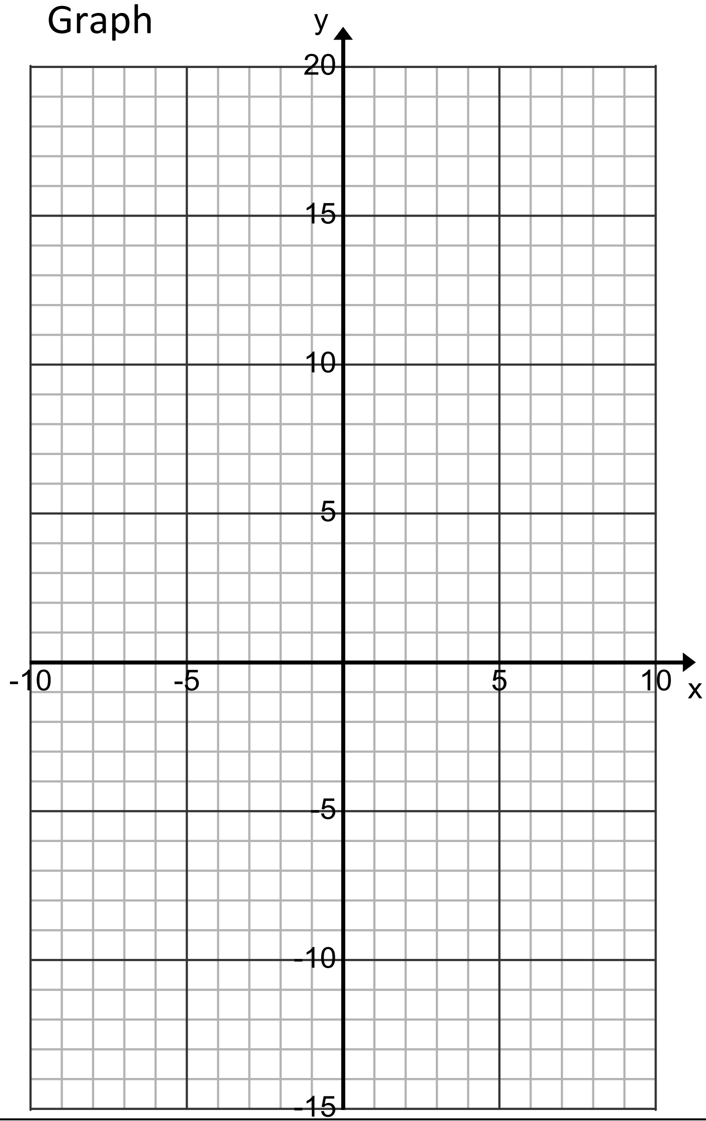
x	y
-5	
-4	
-1	
4	
11	

________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

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

Situation

Drawing

Record your observations and questions here:

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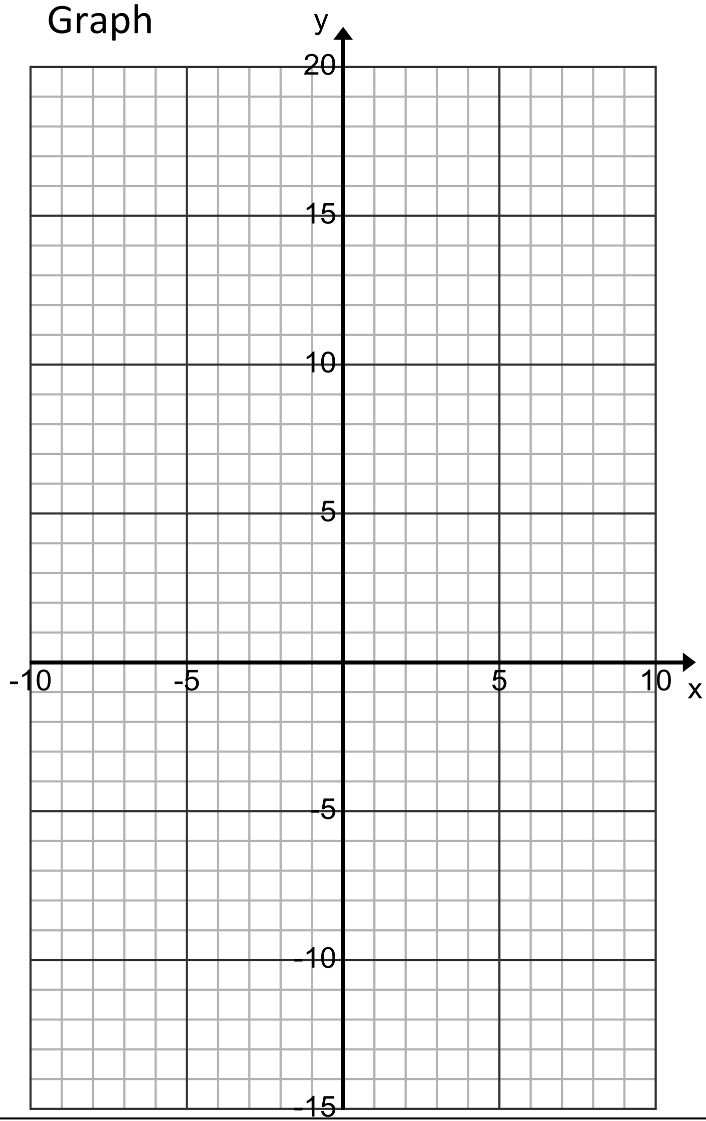
________________ Growth Function Page   Name ______________________________

Data Table

x	f(x)
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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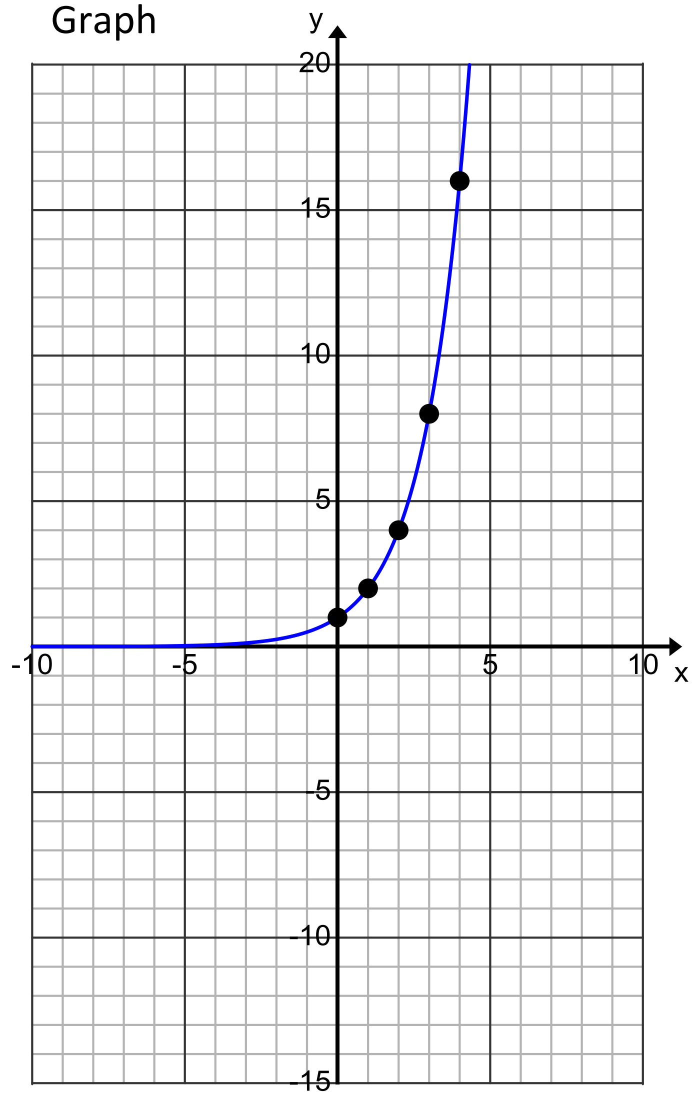
______________ Growth Function Page Name ___________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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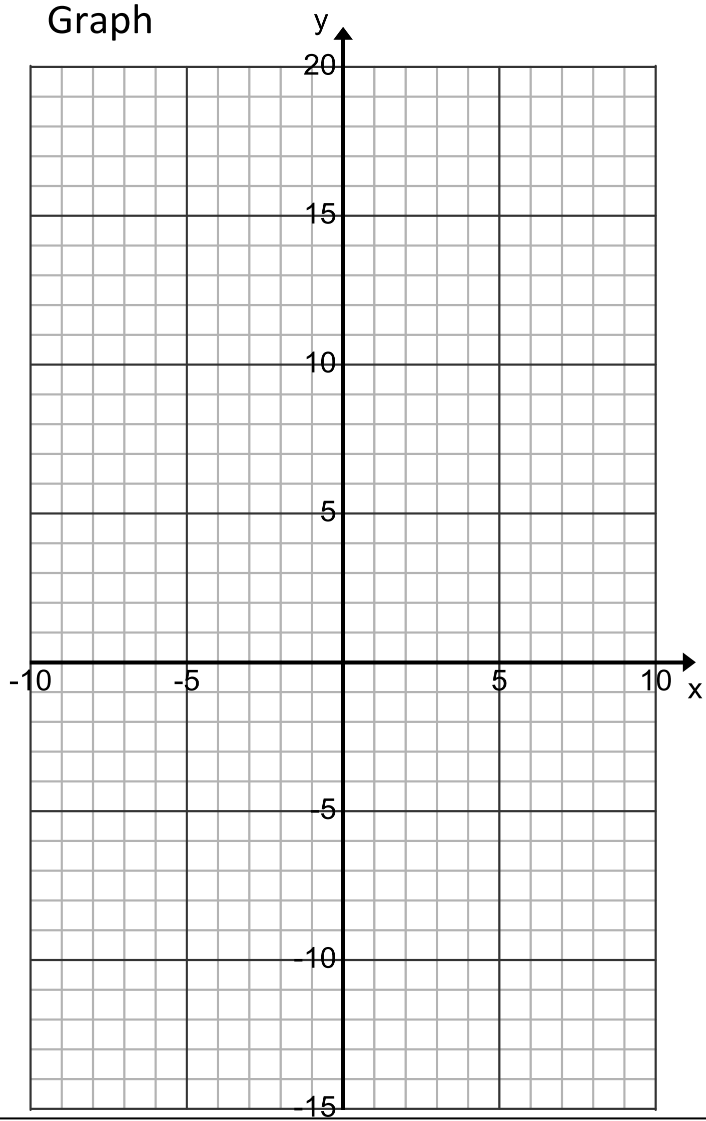
_________________ Growth Function Page Name _______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Ezra starts with just one block, but doubles his amount on the first day. He continues to double his amount every day.

Drawing

Record your observations and questions here:

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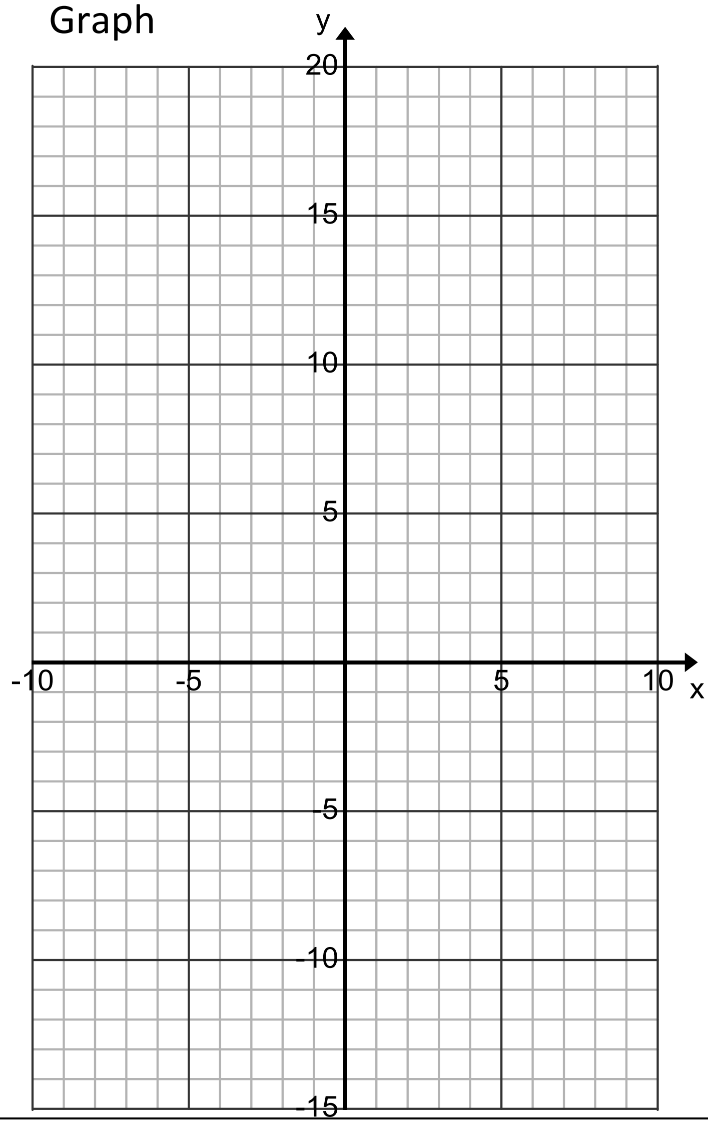
________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph

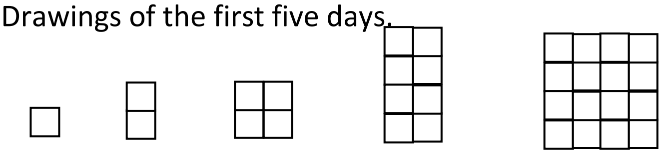


Model Equation

$f(x) =$

Situation

Drawings of the first five days.



Record your observations and questions here:

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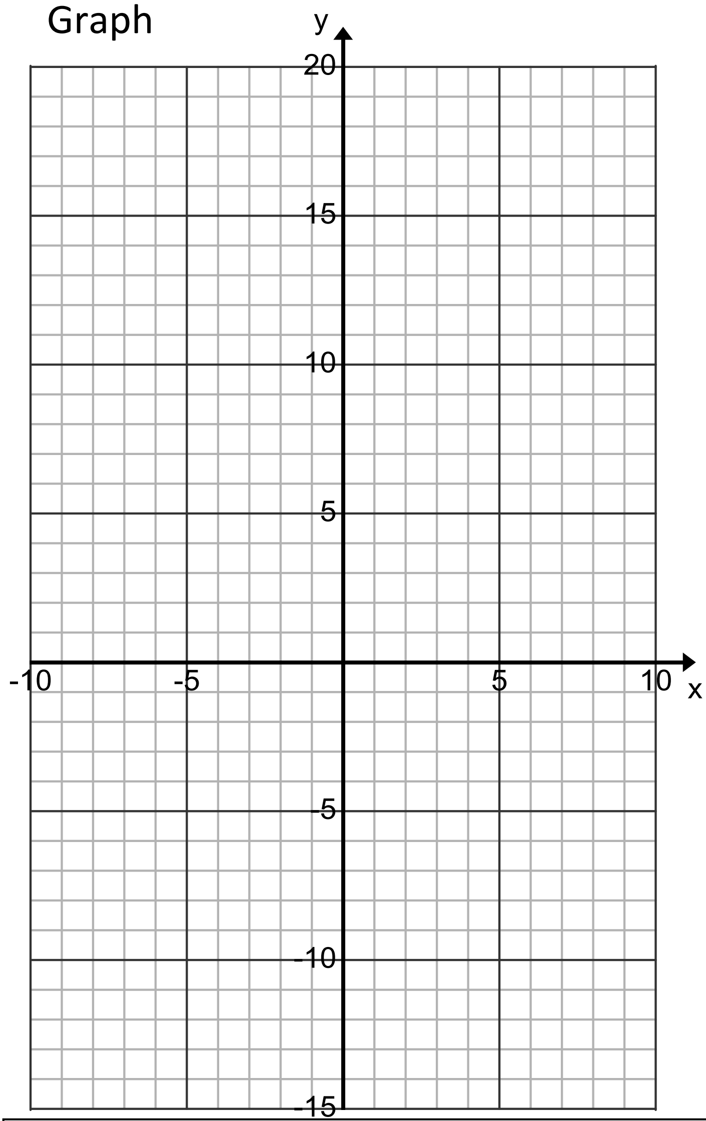
_______________ Growth Function Page   Name ____________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$$f(x) = \sqrt{x}$$

Situation

Drawing

Record your observations and questions here:

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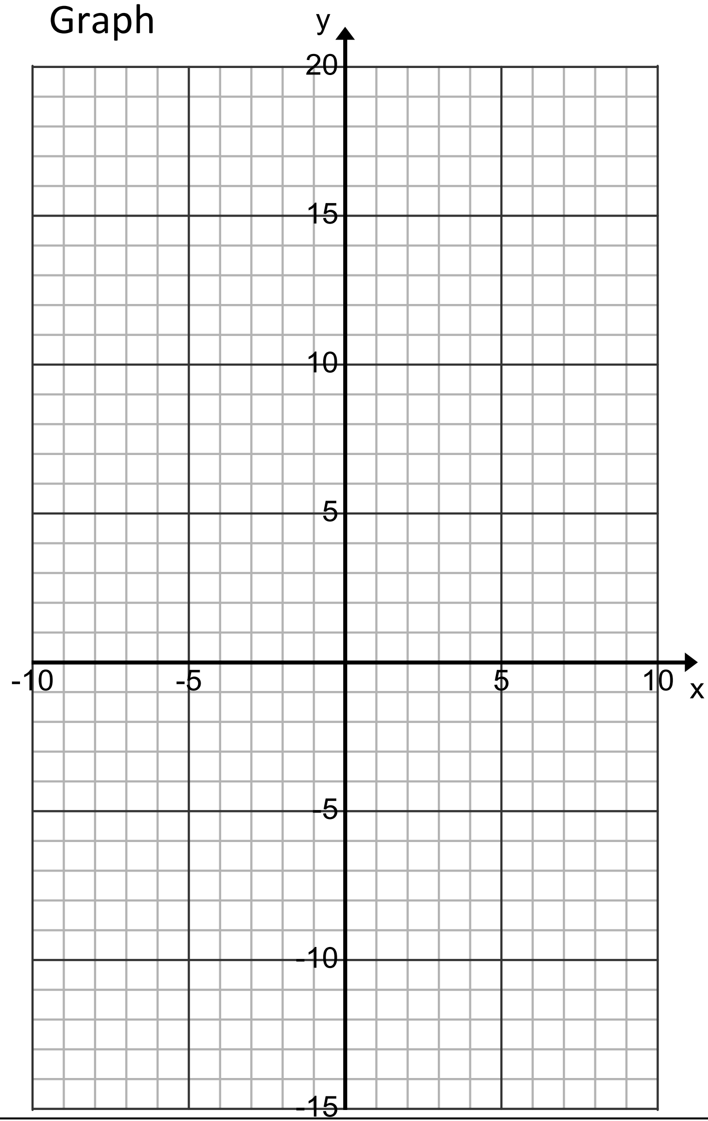
________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	0
1	1
2	1.41
3	1.73
4	2
5	2.24
6	2.45
7	2.65
8	2.83
9	3

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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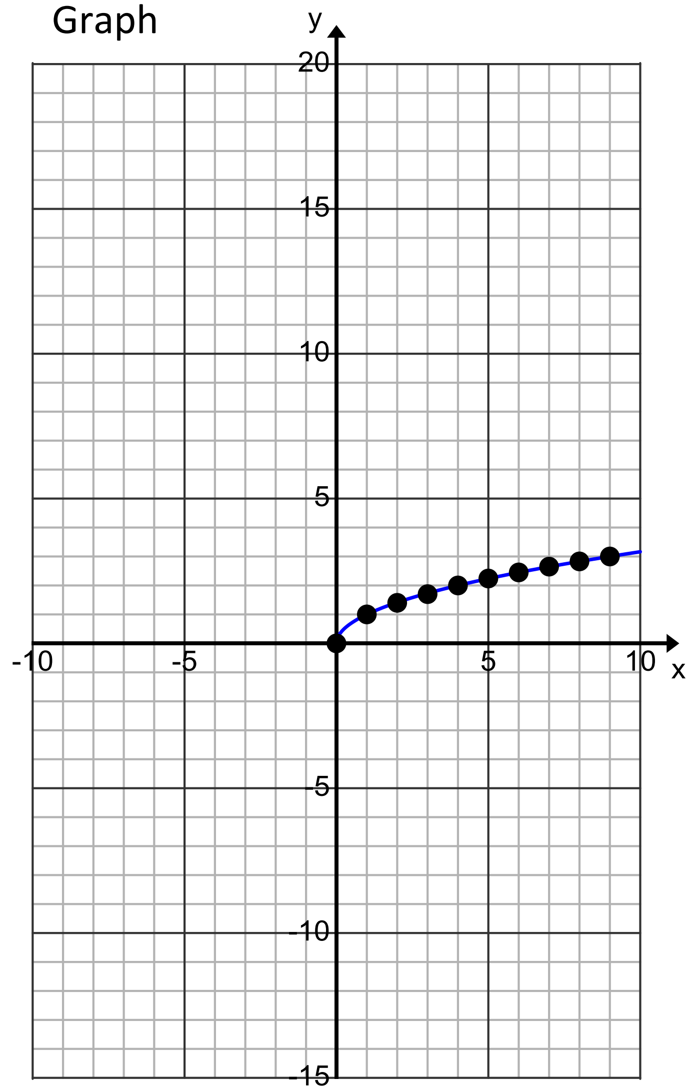
_______________ Growth Function Page   Name _____________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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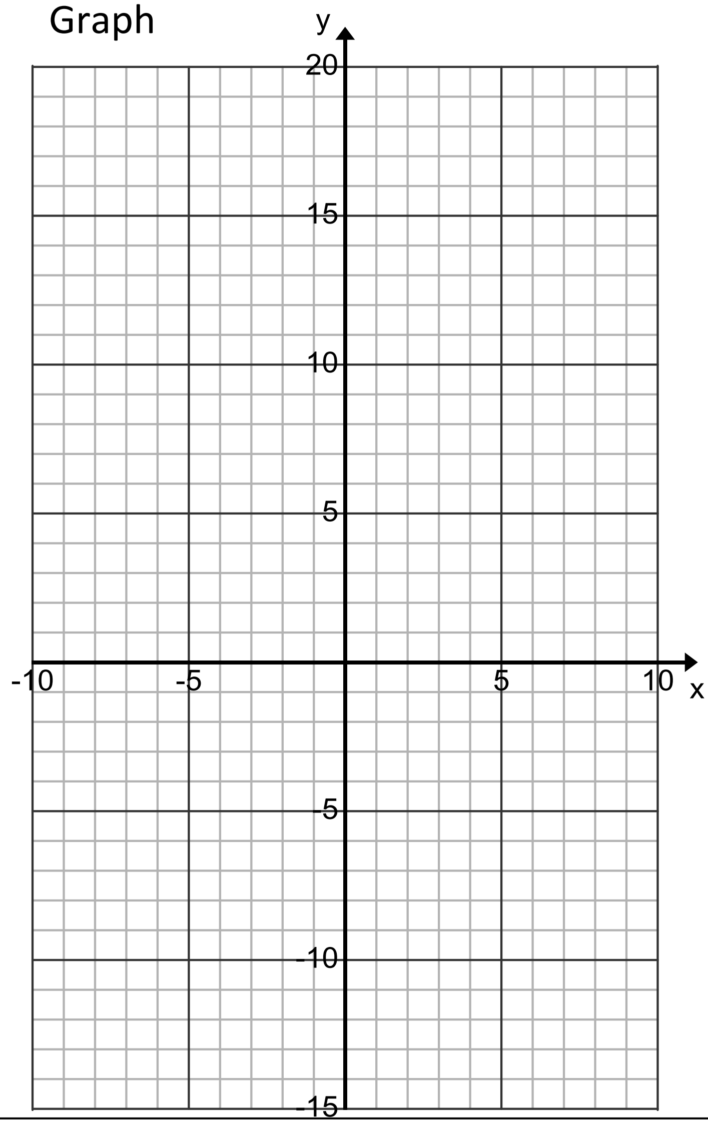
Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Simon loves squares. He doesn't have one on the first day, but every day after he makes a square with an area that is one larger than the day before. Then he measures the side of the square.

Drawing

Record your observations and questions here:

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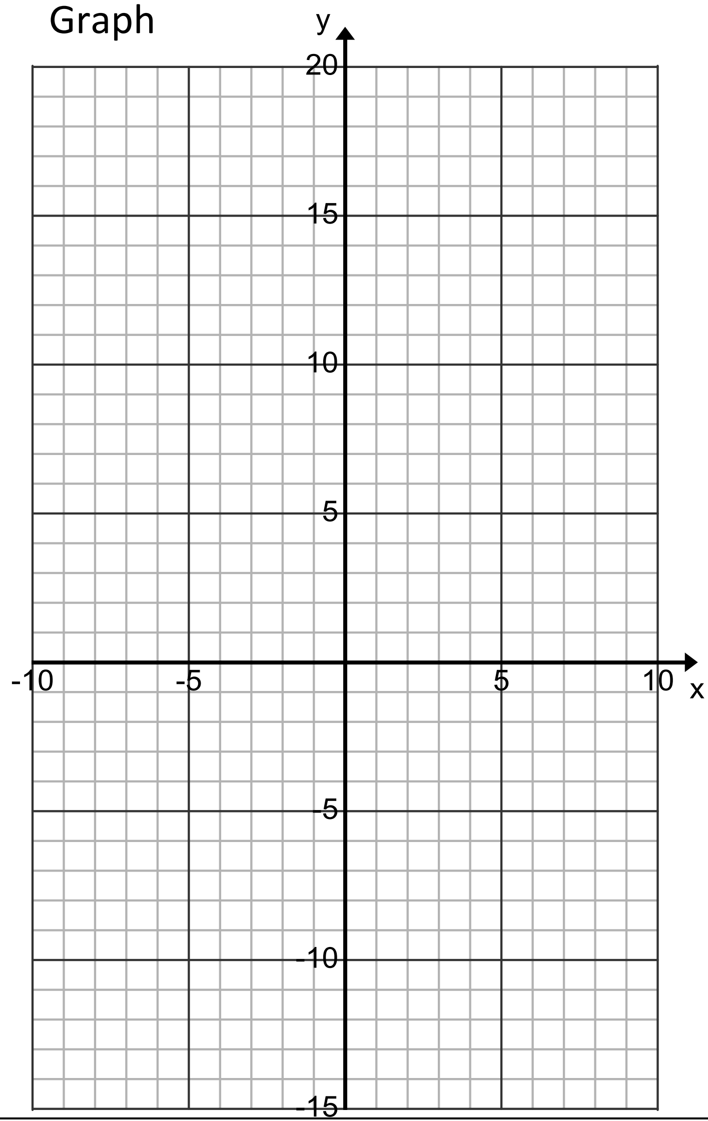
________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph

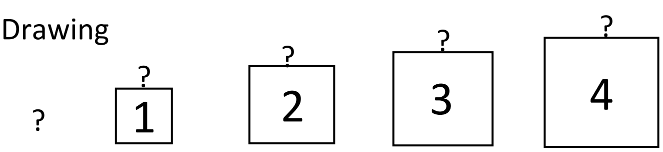


Model Equation

$f(x) =$

Situation

Drawing



Record your observations and questions here:

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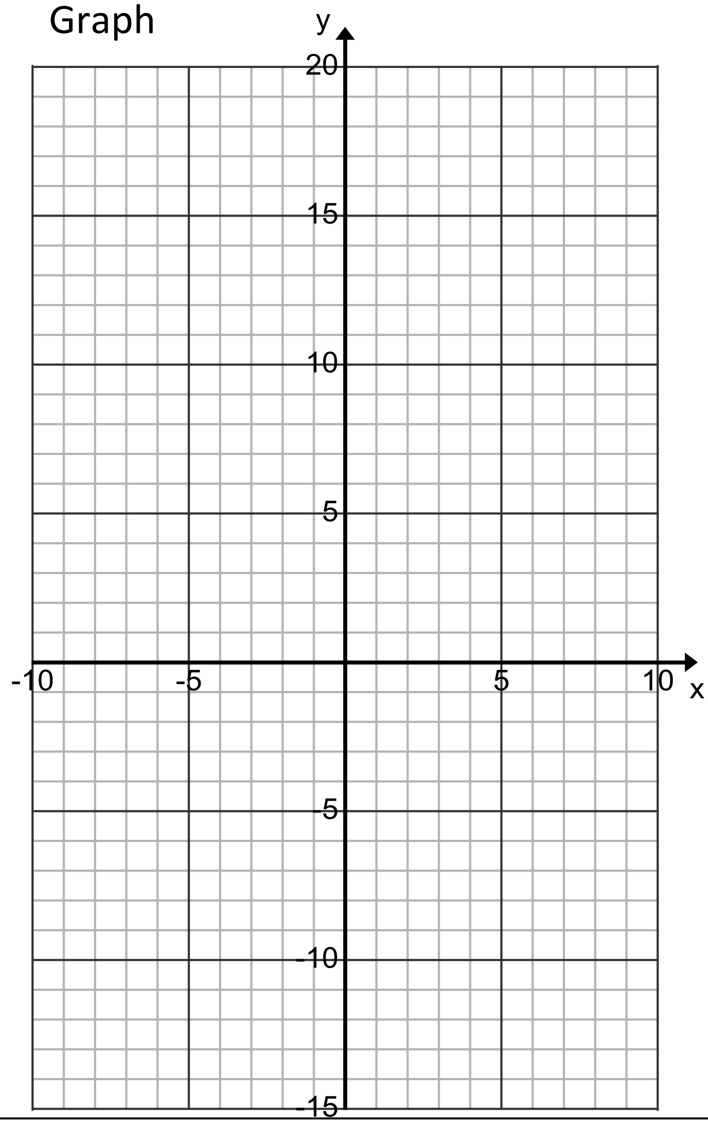
________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	0
1	3
2	8
3	15
4	24
5	35
6	48
7	63
8	80
9	99

Graph



Model Equation

$$f(x) =$$

Situation

Drawing

Record your observations and questions here:

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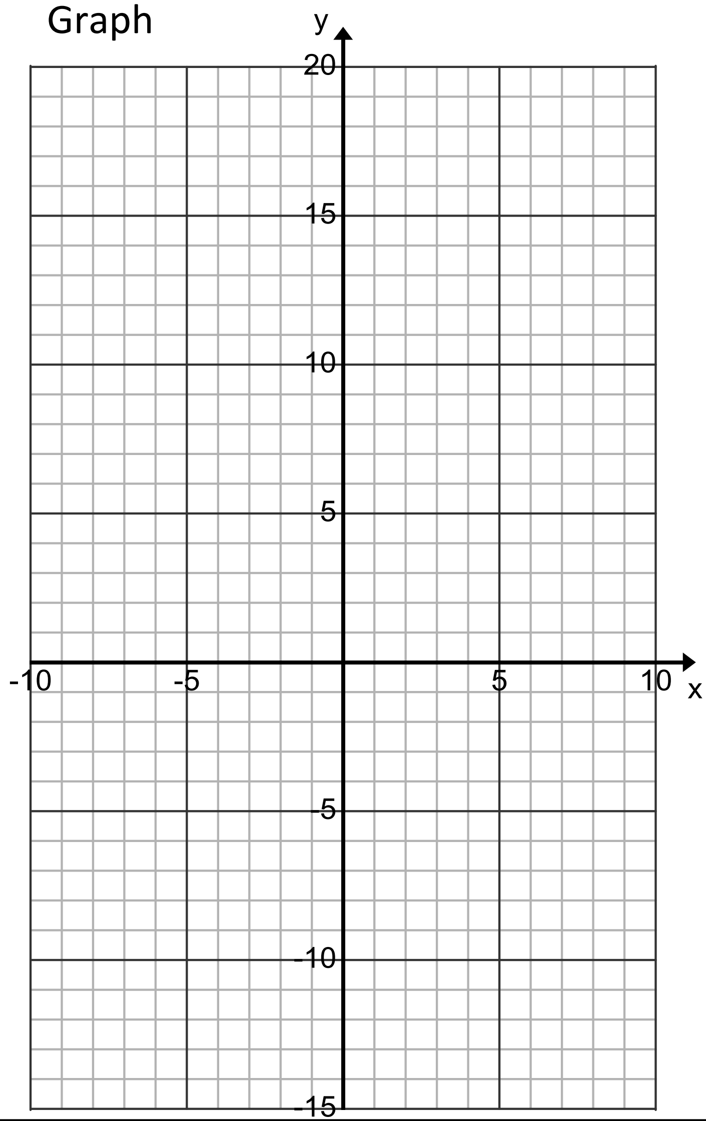
_______________ Growth Function Page   Name ____________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

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

Situation

Drawing

Record your observations and questions here:

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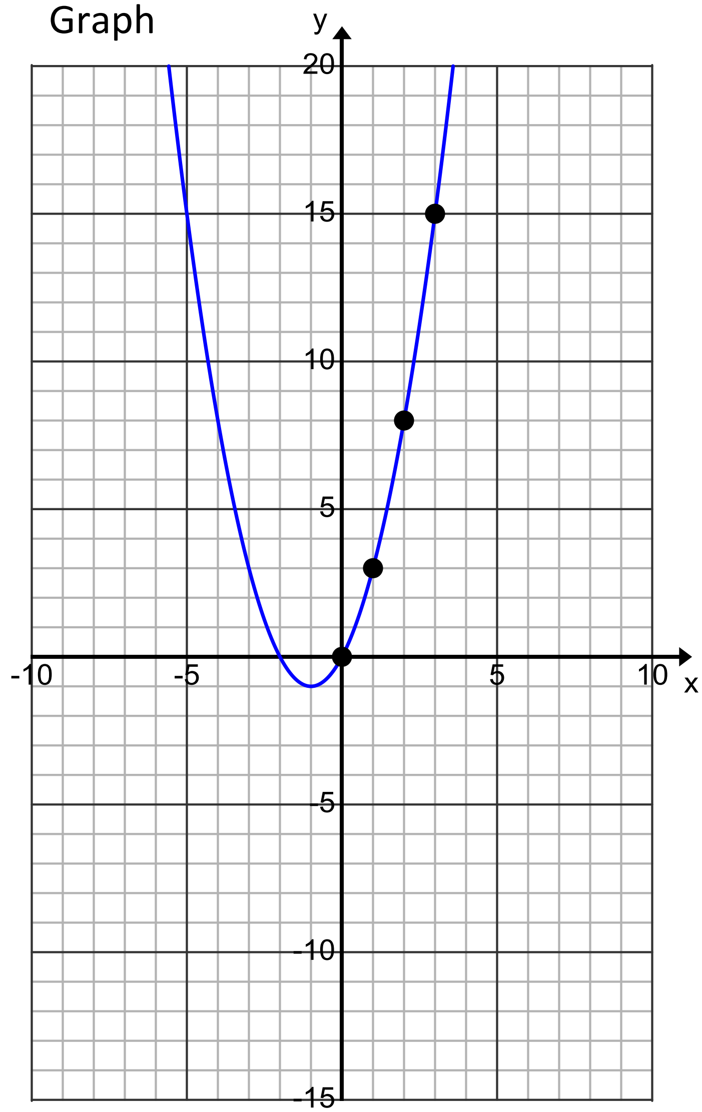
________________ Growth Function Page   Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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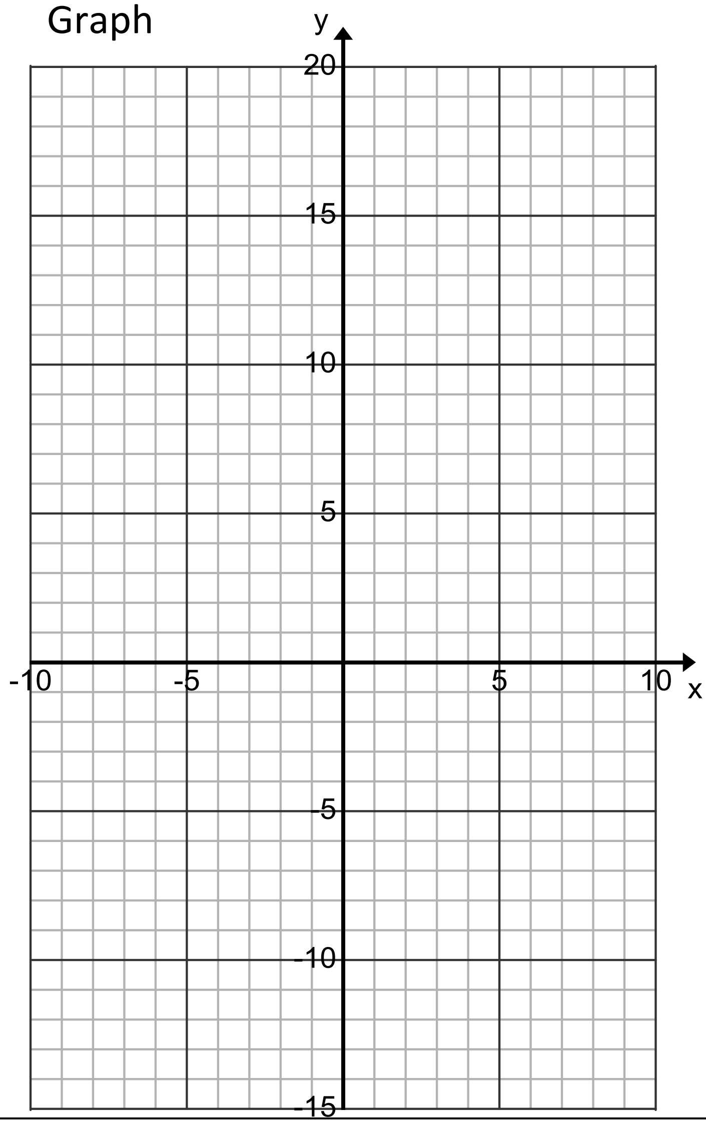
______________ Growth Function Page Name ____________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Drawing

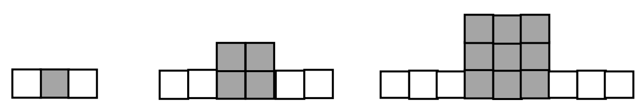


Figure 1 Figure 2 Figure 3

Record your observations and questions here:

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______________ Growth Function Page Name ______________________________

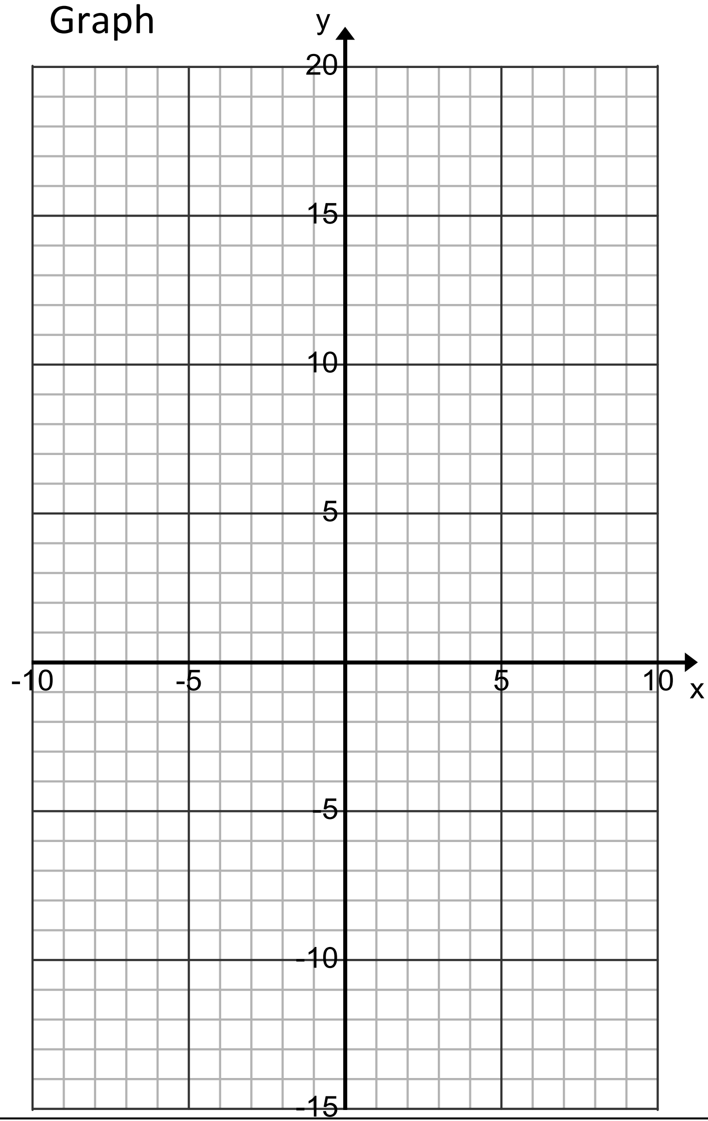
Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Model Equation

$f(x) =$

Graph



Situation

Bella is building a pattern with square tiles that she calls “Squares with Wings.” Each square has two straight wings that are as long as the side of the square.

Drawing

Record your observations and questions here:

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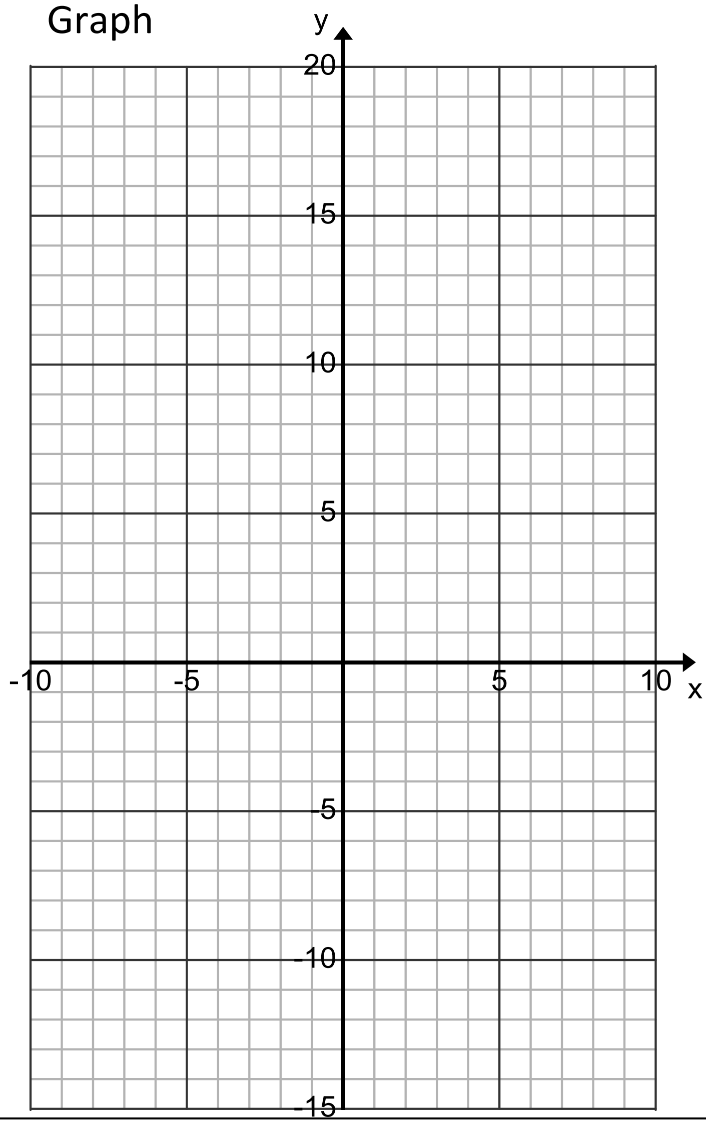
_______________ Growth Function Page Name ____________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$$f(x) = x^3$$

Situation

Drawing

Record your observations and questions here:

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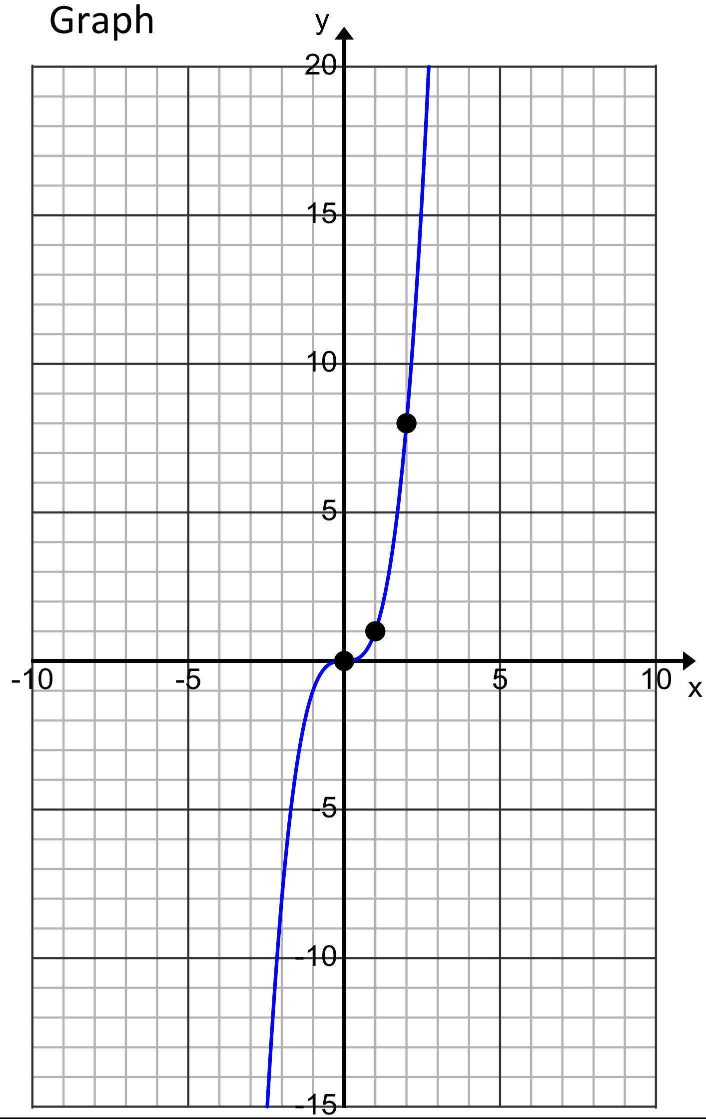
________________ Growth Function Page

Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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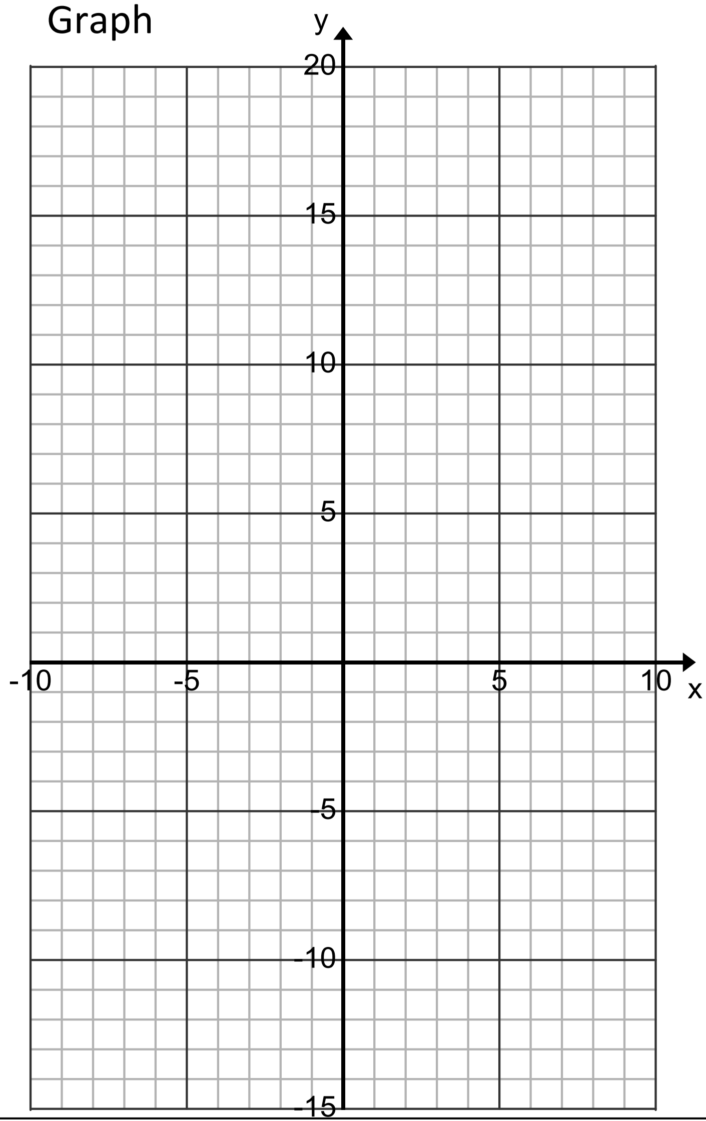
________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	0
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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____

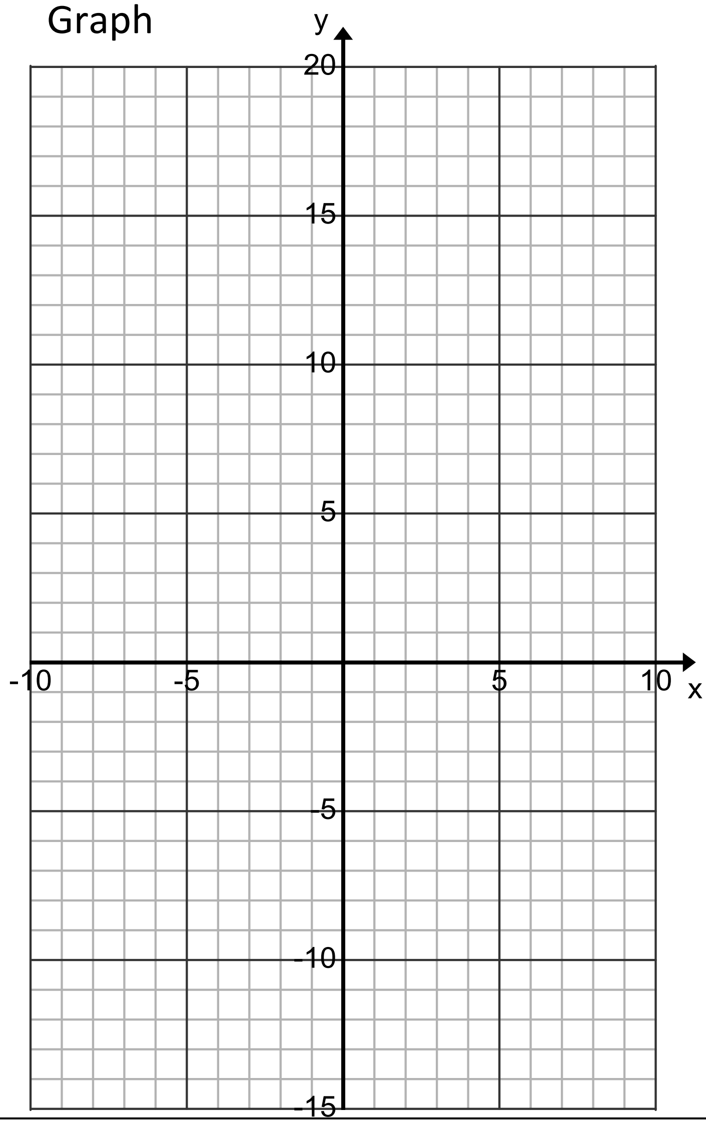
____

________________ Growth Function Page   Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$$f(x) =$$

Situation

How many unit cubes does it take to build a larger cube that is “x” long on each edge?

Drawing

Record your observations and questions here:

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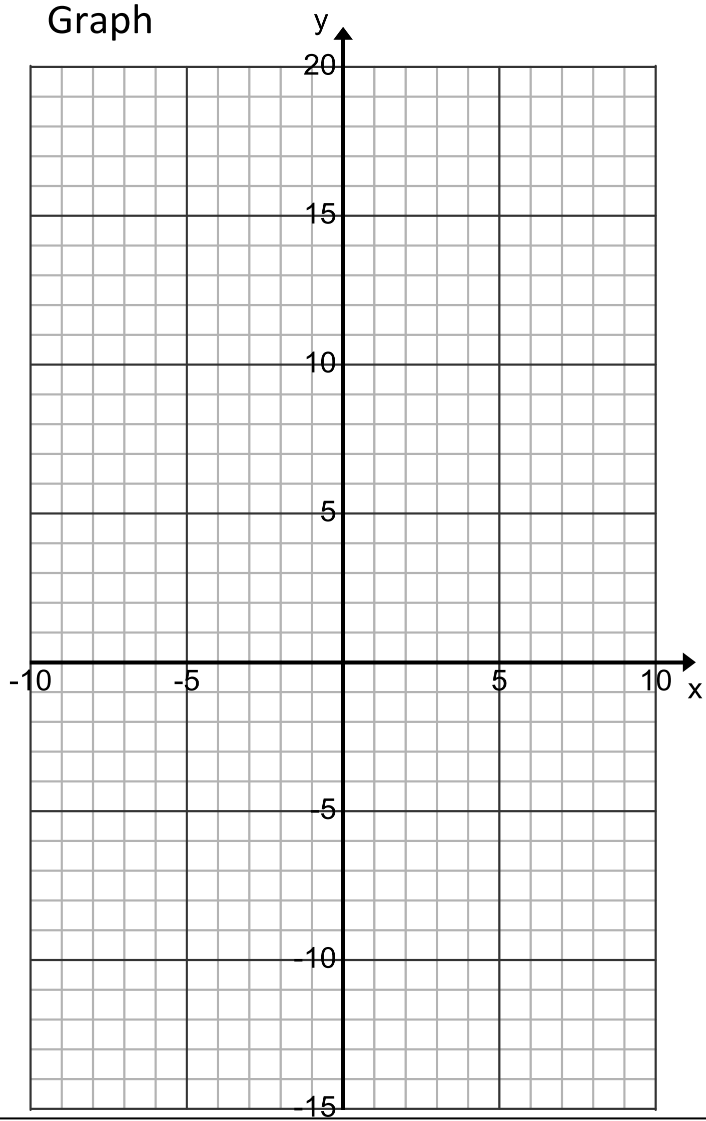
_______________ Growth Function Page Name ____________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph

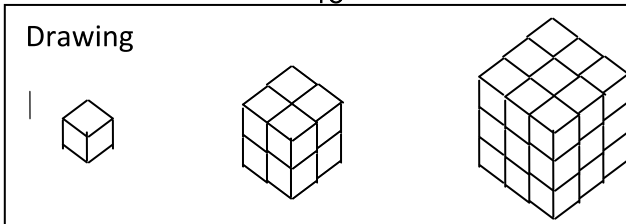


Model Equation

$$f(x) =$$

Situation

Drawing



Record your observations and questions here:

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________________ Growth Function Page Name ______________________________

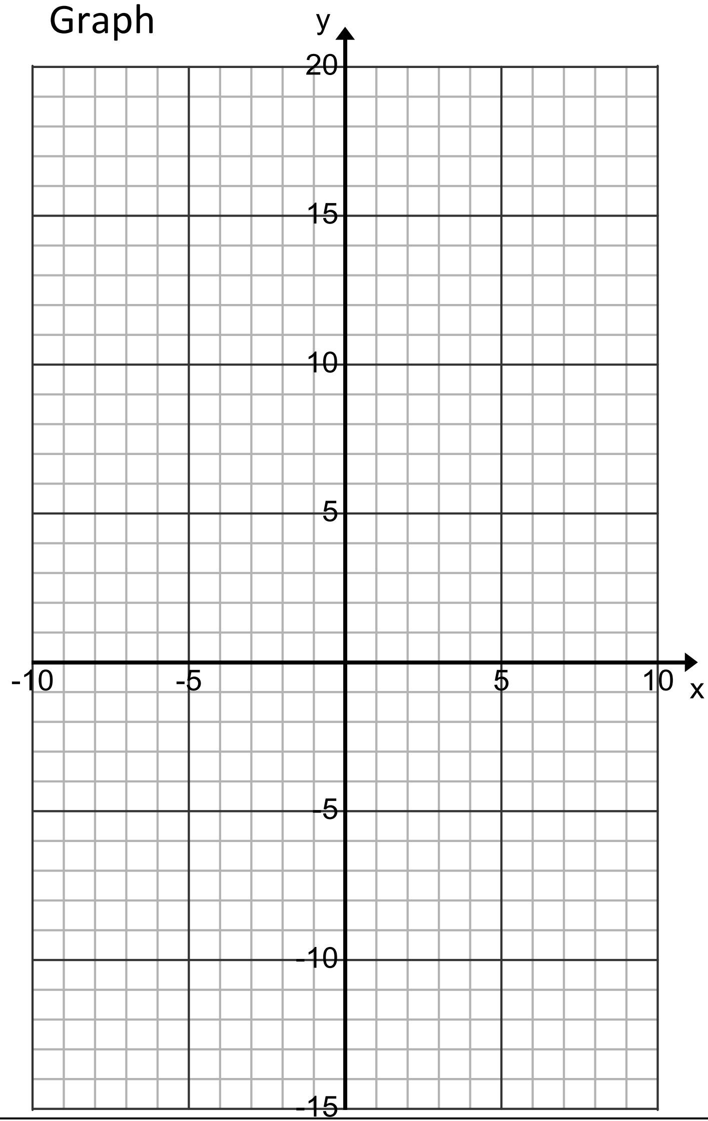
Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Model Equation

$$f(x) = 3x + 1$$

Graph



Situation

Drawing

Record your observations and questions here:

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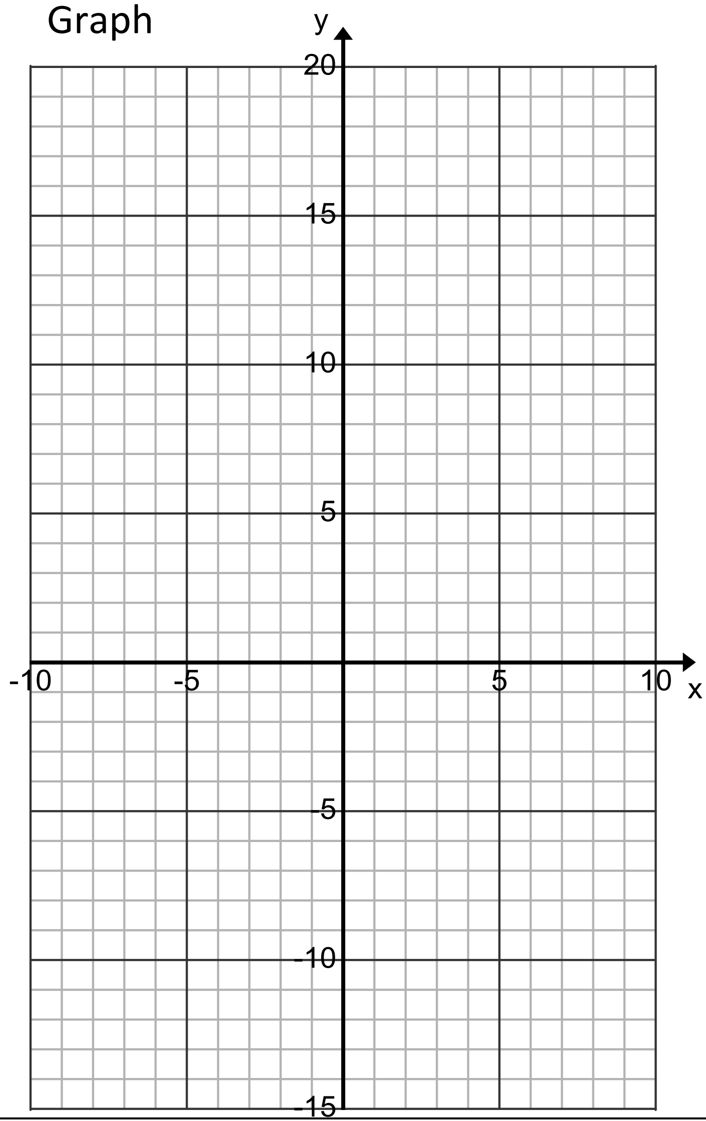
____

________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	1
1	4
2	7
3	10
4	13
5	16
6	19
7	22
8	25
9	28

Graph



Model Equation

$f(x) =$

Situation

Drawing

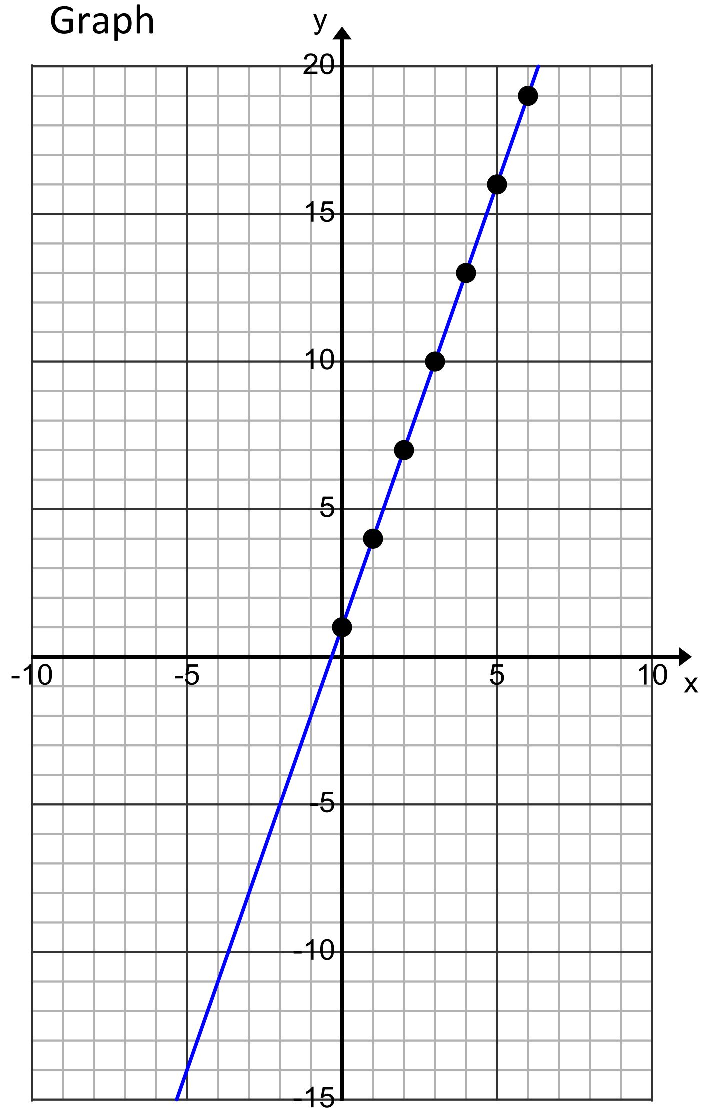
Record your observations and questions here:

________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Drawing

Record your observations and questions here:

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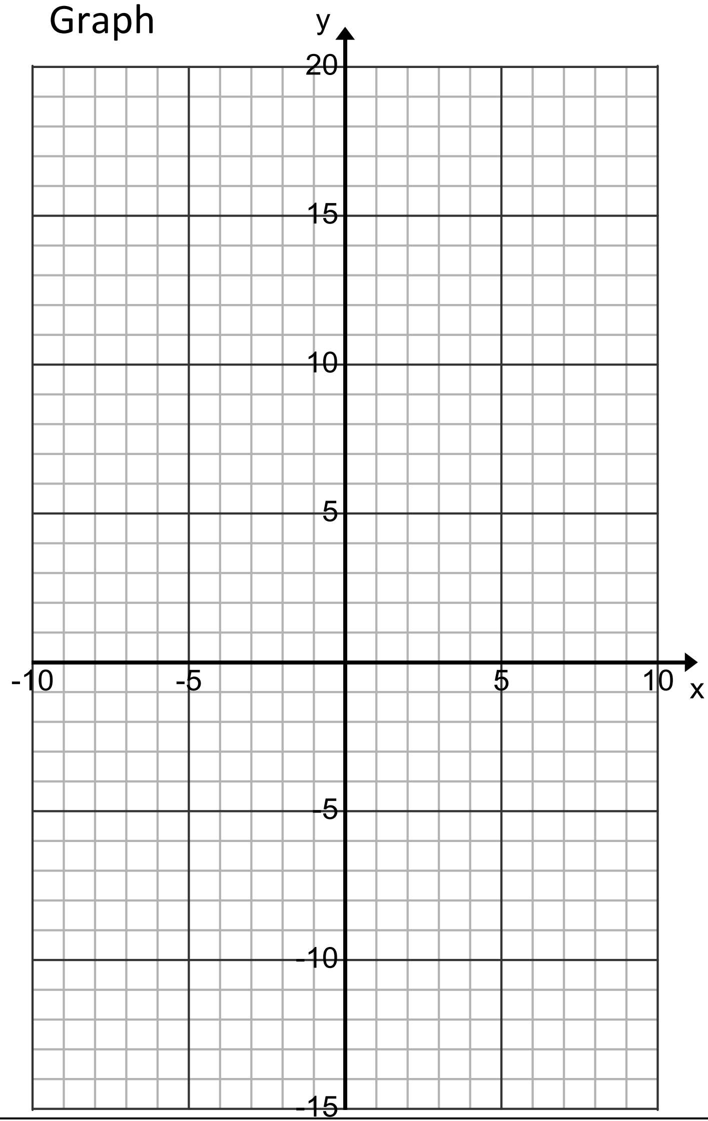
________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

$f(x) =$

Situation

Angel is saving money for a new skateboard. He has \$1 and knows if he stops buying cookies at lunch he can save \$3 each week. How much will he have in x weeks?

Drawing

Record your observations and questions here:

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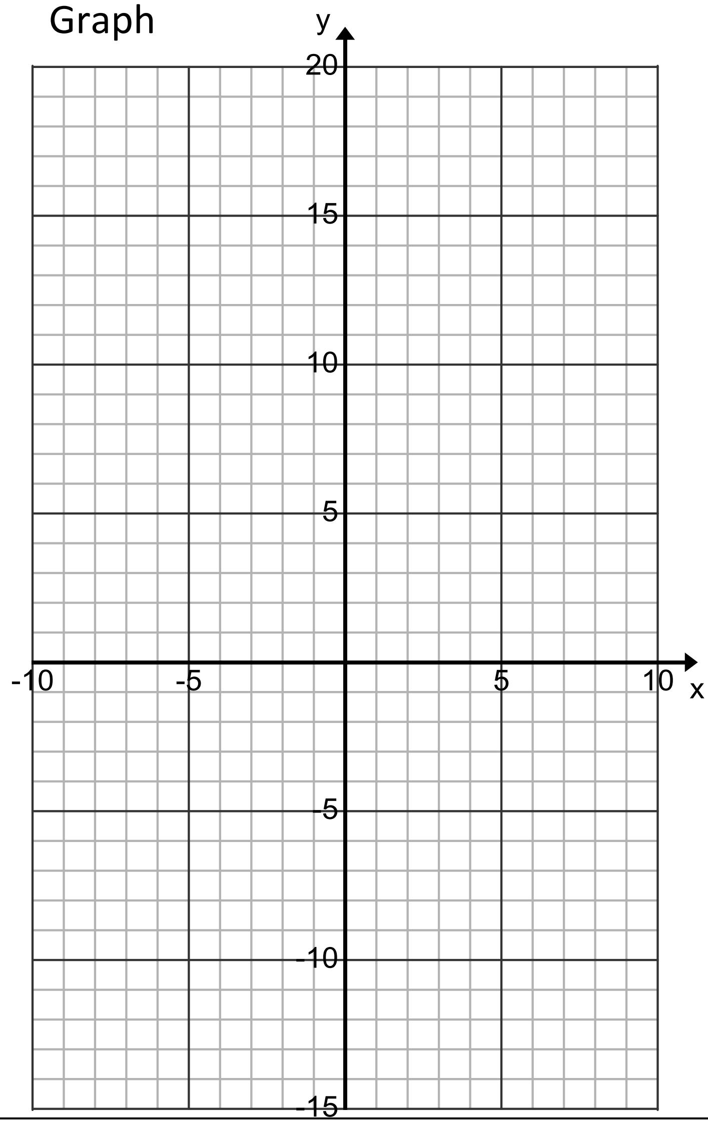
________________ Growth Function Page Name ______________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph

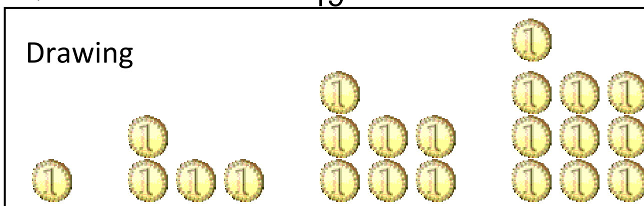


Model Equation

$f(x) =$

Situation

Drawing



Record your observations and questions here:

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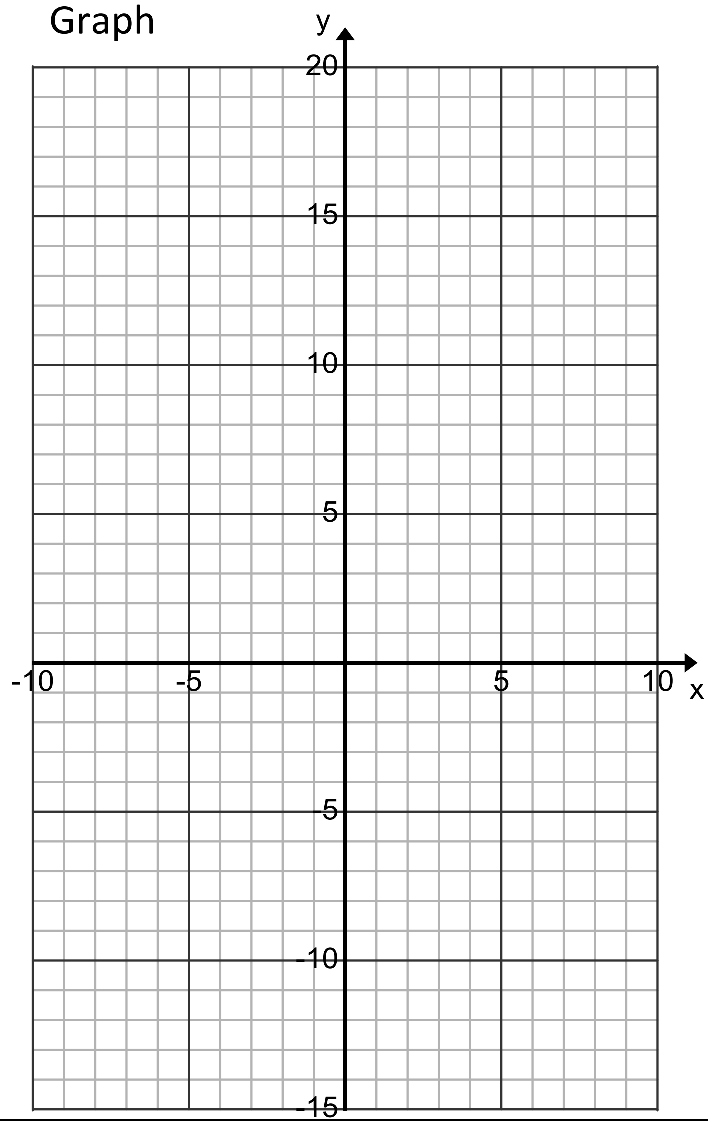
_______________ Growth Function Page Name ____________________________

Data Table

x	f(x)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Graph



Model Equation

Situation

Drawing

Record your observations and questions here:

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Summary of Key Features from Each of the Five Representations

Directions: In each of the boxes below, write several sentences explaining how all of your pages match. Each box is about a different key feature of the function. In your writing, include specific facts from your different representations of the function. Be sure to include observations from all five representations: table, graph, equation, drawing and story.

Y-intercept: How does the y-intercept appear in each representation? What does it mean?

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Other Points: Explain how pairs of inputs and outputs are the same in each representation. Explain what a few of them mean.

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Rate of Change: How is the function growing? How do you see this growth in each representation? Explain how the rate of change matches across all of the representations.

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Domain of a function

From Wikipedia, the free encyclopedia

In mathematics, the **domain of definition** or simply the **domain** of a function is the set of "input" or argument values for which the function is defined. That is, the function provides an "output" or value for each member of the domain.[1] The set of values the function may take is termed the range of the function.

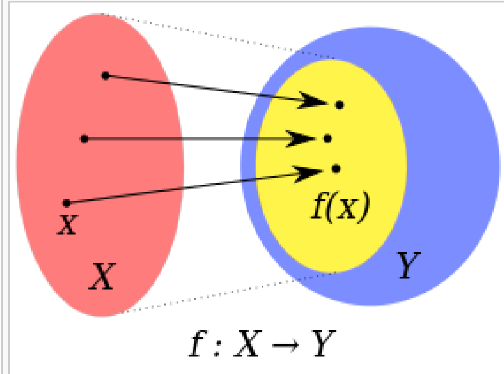


Illustration showing *f*, a function from domain *X* to codomain *Y*. The smaller oval inside *Y* is the image of *f*, sometimes called the range of *f*.

For instance, the domain of cosine is the set of all real numbers, while the domain of the square root consists only of numbers greater than or equal to 0 (ignoring complex numbers in both cases). For a function whose domain is a subset of the real numbers, when the function is represented in an *xy* Cartesian coordinate system, the domain is represented on the *x*-axis.

Contents [hide]

Formal definition [edit]

Given a function $f:X\to Y$, the set X is the **domain** of f; the set Y is the codomain of f. In the expression $f(x)$, x is the **argument** and $f(x)$ is the **value**. One can think of an argument as an input to the function, and the value as the output.

The image (sometimes called the range) of f is the set of all values assumed by f for all possible x; this is the set $\{f(x) \mid x \in X\}$. The image of f can be the same set as the codomain or it can be a proper subset of it. It is in general smaller than the codomain; it is the whole codomain if and only if f is a surjective function.

A well-defined function must carry every element of its domain to an element of its codomain. For example, the function f defined by

$$f(x) = 1/x$$

has no value for $f(0)$. Thus, the set of all real numbers, **R**, cannot be its domain. In cases like this, the function is either defined on $\mathbf{R}-\{0\}$ or the "gap is plugged" by explicitly defining $f(0)$. If we extend the definition of f to

$$f(x) = \begin{cases} 1/x & x \neq 0 \\ 0 & x = 0 \end{cases}$$

then f is defined for all real numbers, and its domain is $\mathbb{R}$.

Any function can be restricted to a subset of its domain. The restriction of $g : A \to B$ to S, where $S \subseteq A$, is written $g|_S : S \to B$.

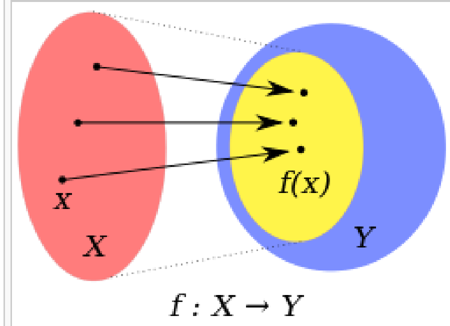
This page was copied from Wikipedia on 4/16/2013. http://en.wikipedia.org/wiki/Domain_of_a_function

Range (mathematics)

From Wikipedia, the free encyclopedia

This article is about range of a function. For the difference between the largest and smallest numbers in a set, see range (statistics).

In mathematics, the **range** of a function refers to either the codomain or the image of the function, depending upon usage. The codomain is a set containing the function's output, whereas the image is only the part of the codomain where the elements are outputs of the function. For example, the function $f(x) = x^2$ is often described as a function from the real numbers to the real numbers, meaning that the codomain is **R**, but its image is the set of non-negative real numbers. Some books say that range of this function is its codomain, the set of all real numbers, reflecting that the function is real-valued. These books call the actual output of the function the image. This is the current usage for range in computer science. Other books say that the range is the function's image, the set of non-negative real numbers, reflecting that a number can be the output of this function if and only if it is a non-negative real number. In this case, the larger set containing the range is called the codomain.[1] This usage is more common in modern mathematics.



f is a function from domain X to codomain Y. The smaller oval inside Y is the image of f. Sometimes "range" refers to the codomain and sometimes to the image.

Contents [hide]

Examples [edit]

Let *f* be a function on the real numbers $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 2x$. This function takes as input any real number and outputs a real number two times the input. In this case, the codomain and the image are the same (*i.e.*, the function is a surjection), so the range is unambiguous; it is the set of all real numbers.

In contrast, consider the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \sin(x)$. If the word "range" is used in the first sense given above, we would say the range of *f* is the codomain, all real numbers; but since the output of the sine function is always between -1 and 1, "range" in the second sense would say the range is the image, the closed interval from -1 to 1.

Formal definition [edit]

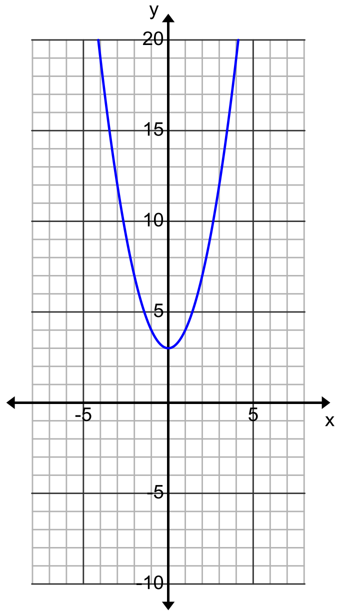
Standard mathematical notation allows a formal definition of range.

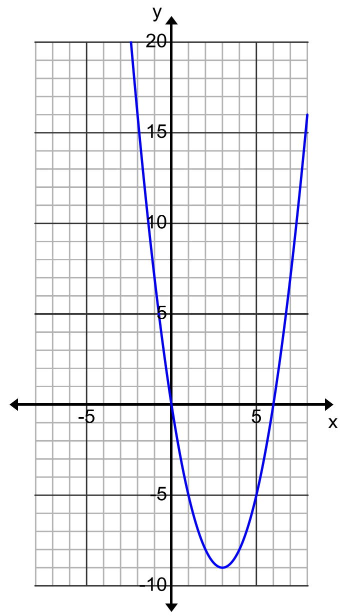
In the first sense, the range of a function must be specified; it is often assumed to be the set of all real numbers, and {*y* | there exists an *x* in the domain of *f* such that *y* = *f*(*x*)} is called the image of *f*.

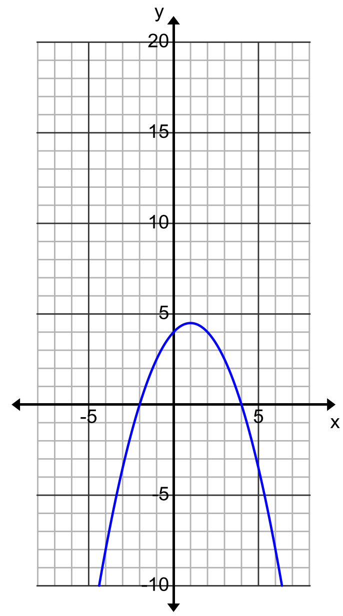
In the second sense, the range of a function *f* is {*y* | there exists an *x* in the domain of *f* such that *y* = *f*(*x*)}. In this case, the codomain of *f* must be specified, but is often assumed to be the set of all real numbers.

In both cases, image *f* ⊆ range *f* ⊆ codomain *f*, with at least one of the containments being equality.

Three Quadratic Functions







$f(x) = x^2 + 3$

$g(x) = x^2 - 6x$

$h(x) = -\frac{1}{2}x^2 + x + 4$

Notes/Observations about the domain and range of f(x):

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Notes/Observations about the domain and range of g(x):

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Notes/Observations about the domain and range of h(x):

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Observations/Conjectures/Conclusions about the domains and ranges of quadratic functions: (Please be sure to explain and justify your statements.)

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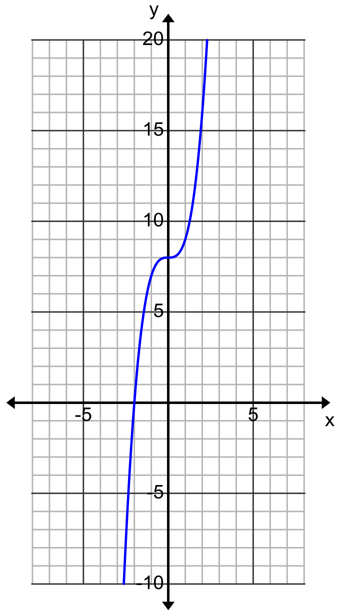
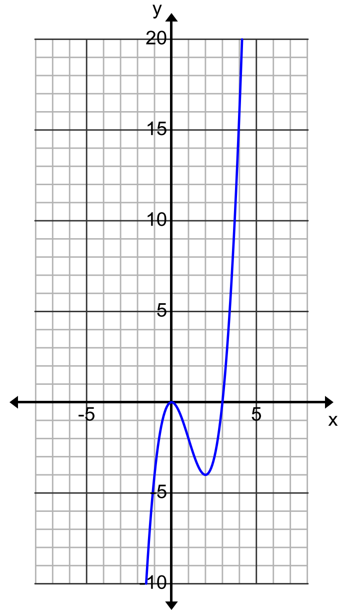
Three Cubic Functions



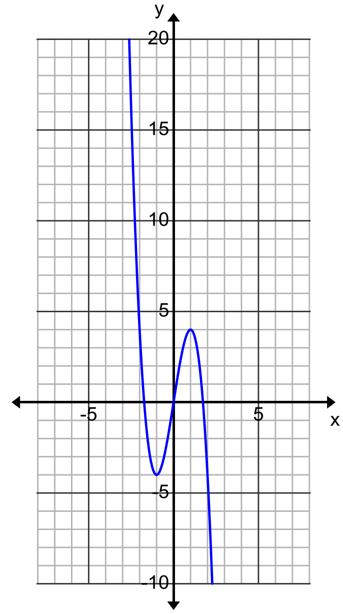
$f(x) = x^3 + 8$

Notes/Observations about the domain and range of f(x):



$g(x) = x^3 - 3x^2$

Notes/Observations about the domain and range of g(x):

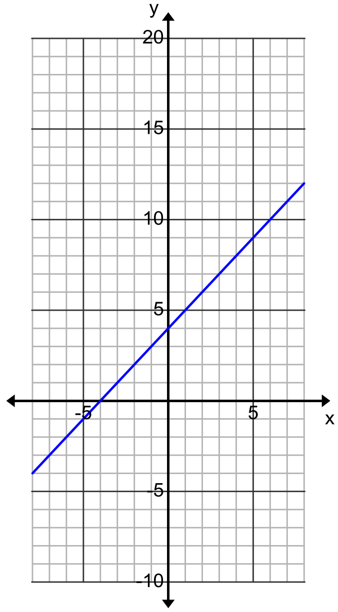


$h(x) = -2x^3 + 6x$

Notes/Observations about the domain and range of h(x):

Observations/Conjectures/Conclusions about the domains and ranges of cubic functions: (Please be sure to explain and justify your statements.)

Three Linear Functions



$f(x) = x + 4$

Notes/Observations about the domain and range of f(x):

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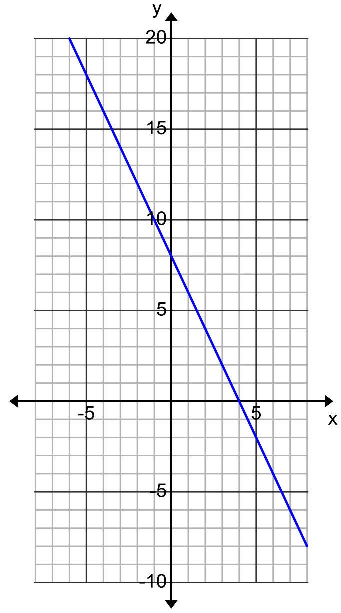

$g(x) = -2x + 8$

Notes/Observations about the domain and range of g(x):

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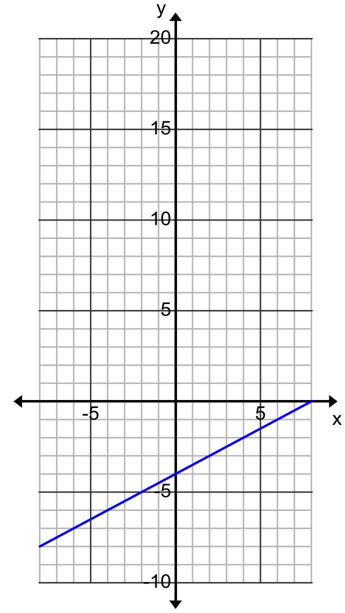

$h(x) = \frac{1}{2}x - 4$

Notes/Observations about the domain and range of h(x):

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Observations/Conjectures/Conclusions about the domains and ranges of linear functions: (Please be sure to explain and justify your statements.)

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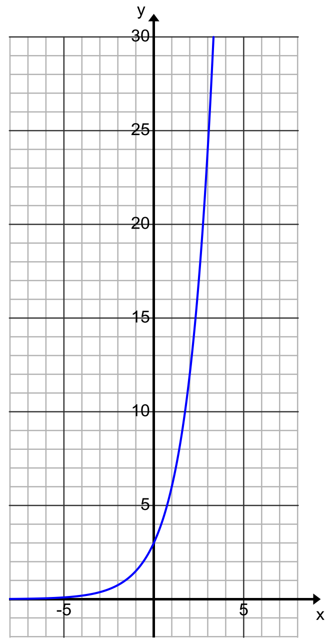
Three Exponential Functions



$f(x) = 3 \cdot 2^x$

Notes/Observations about the domain and range of f(x):

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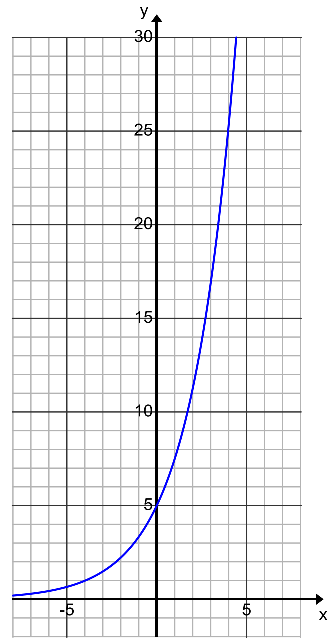

$g(x) = 5 \cdot (1.5)^x$

Notes/Observations about the domain and range of g(x):

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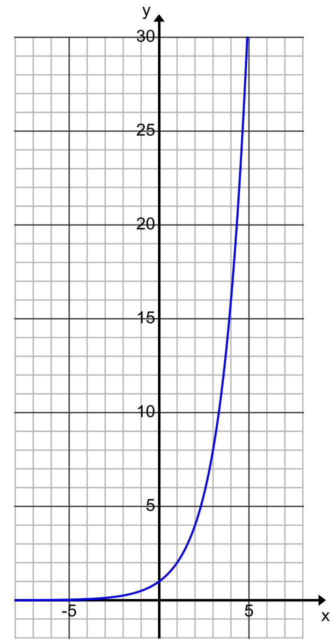

$h(x) = 2^x$

Notes/Observations about the domain and range of h(x):

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Observations/Conjectures/Conclusions about the domains and ranges of exponential functions:
(Please be sure to explain and justify your statements.)

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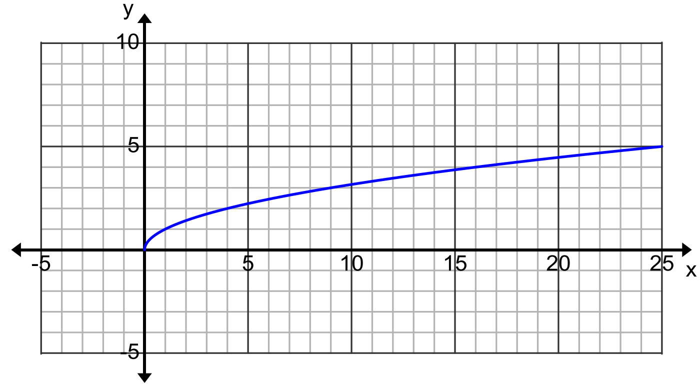
Three Radical (Square Root) Functions



$$f(x) = \sqrt{x}$$

Notes/Observations about the domain and range of f(x):

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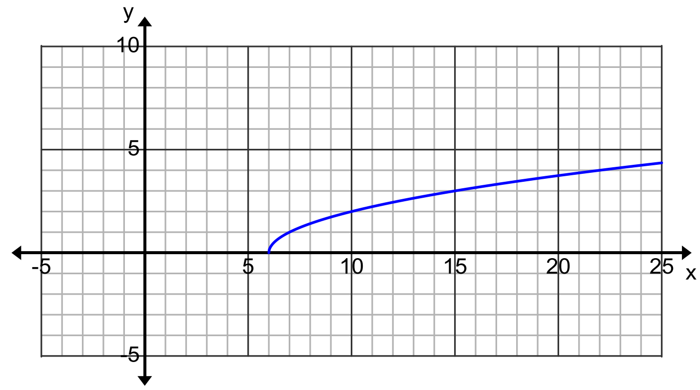

$$g(x) = \sqrt{x - 6}$$

Notes/Observations about the domain and range of g(x):

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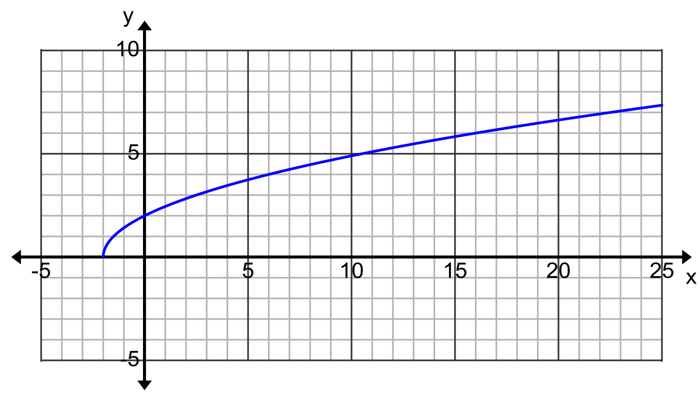

$$h(x) = \sqrt{2x + 4}$$

Notes/Observations about the domain and range of h(x):

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Observations/Conjectures/Conclusions about the domains and ranges of radical (square root) functions: (Please be sure to explain and justify your statements.)

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Growth Rates

Sisters Courtney and Nina have started an Internet business. Their business started out slow, but business is picking up. They want the business to double how much it earns in the next four months. Courtney and Nina know the company can grow at different rates. They investigate two growth rates, linear and exponential rates. Nina creates the following the following chart for the steady rate.

Linear Rate				
$2,000,	_________ ,	_________ ,	_________ ,	$4,000
January	February	March	April	May

1. Complete the sequence of earnings that grows at a linear rate.
   Explain how you know it is linear.

Next the sisters consider the exponential rate. They create a similar chart.

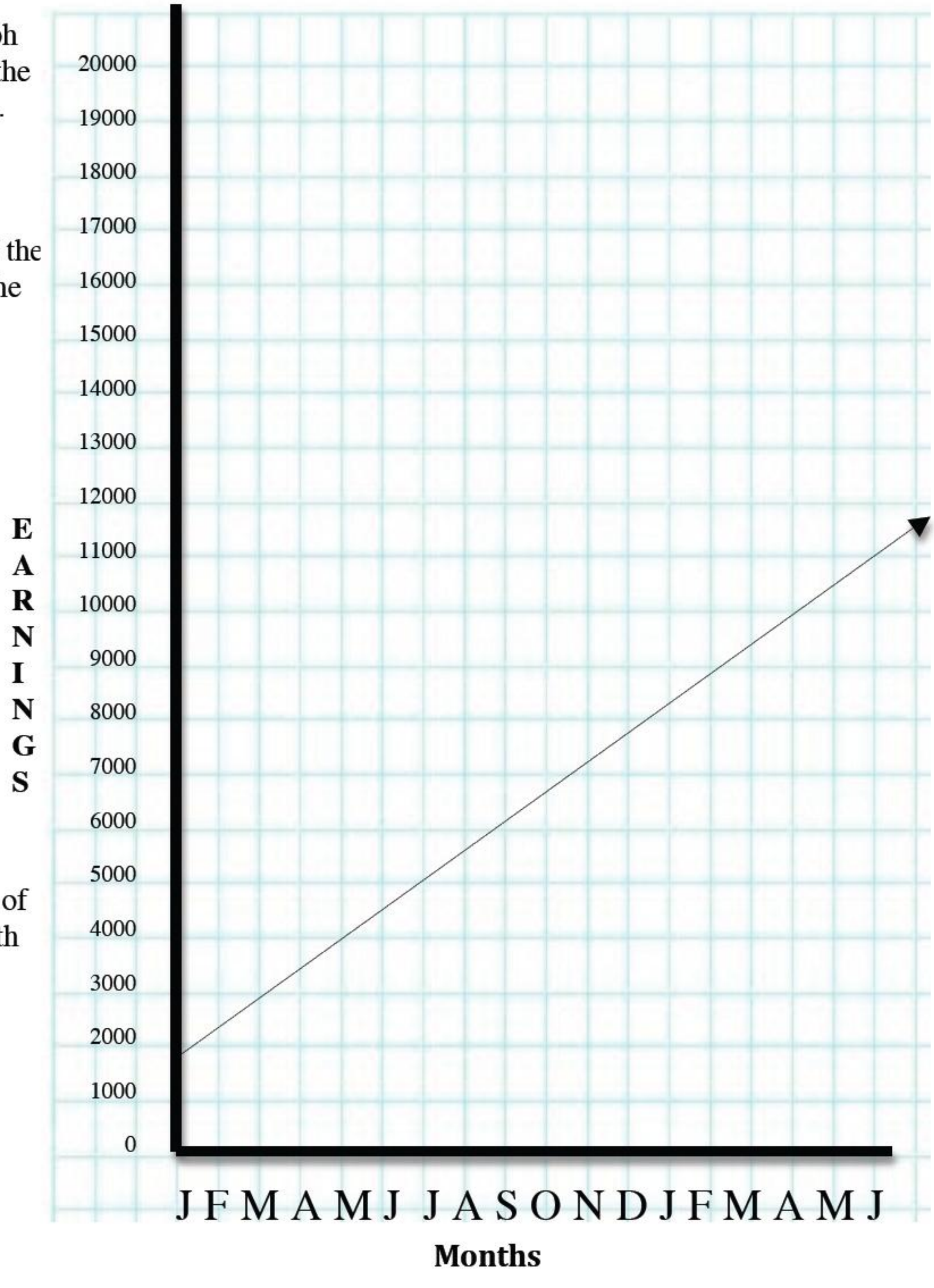
Exponential Rate				
$2,000,	_________ ,	_________ ,	_________ ,	$4,000
January	February	March	April	May

2. Complete the sequence of earnings that grow at an exponential rate.
   Show how you determined the earnings for each month.

Courtney drew a graph of the earnings from the linear data calculated.

3. Draw the graph of the exponential data on the same axis.

4. Write an equation of the exponential growth rate.



5. They want to earn a million dollars. If the business grows at that exponential rate, in how money months would that occur? Show how you figured it out.

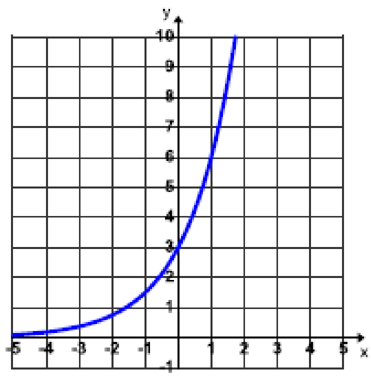
Functions Assessment

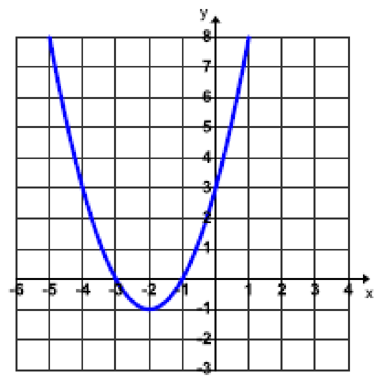
Name ________________ Period___

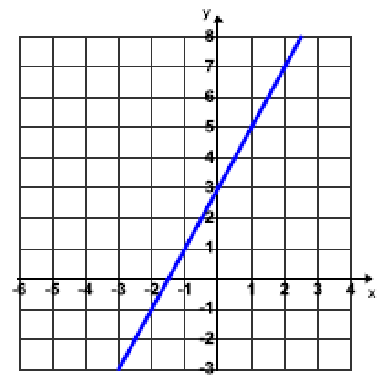
1. Match the equation to the graph.

$f(x) = 2x + 3$ $\qquad f(x) = 3 \cdot 2^x$ $\qquad f(x) = \sqrt{x} + 3$ $\qquad f(x) = 3x + 2$

$f(x) = x^2 + 4x + 3$ $\qquad f(x) = 2 \cdot 3^x$ $\qquad f(x) = x^3 + 3$







Equation:________________ Equation:________________ Equation:________________

2. Write the equation for the following function.

x	f(x)
0	4
1	9
2	14
3	19
4	24

Equation:_______________

How did you know what kind of equation to use?

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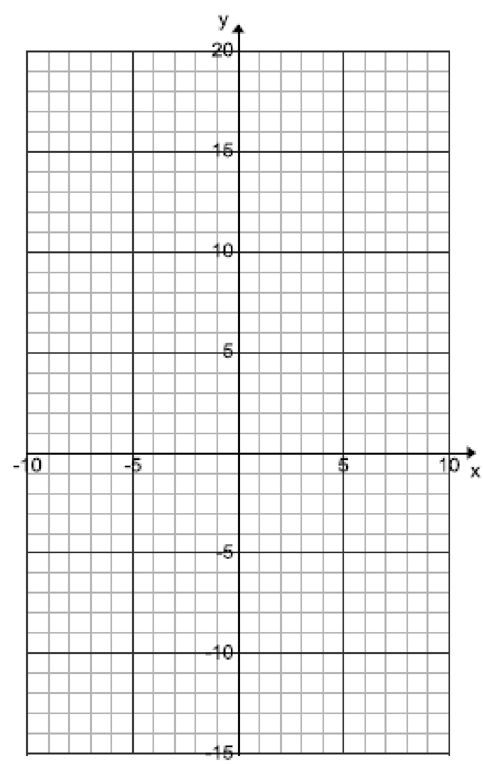
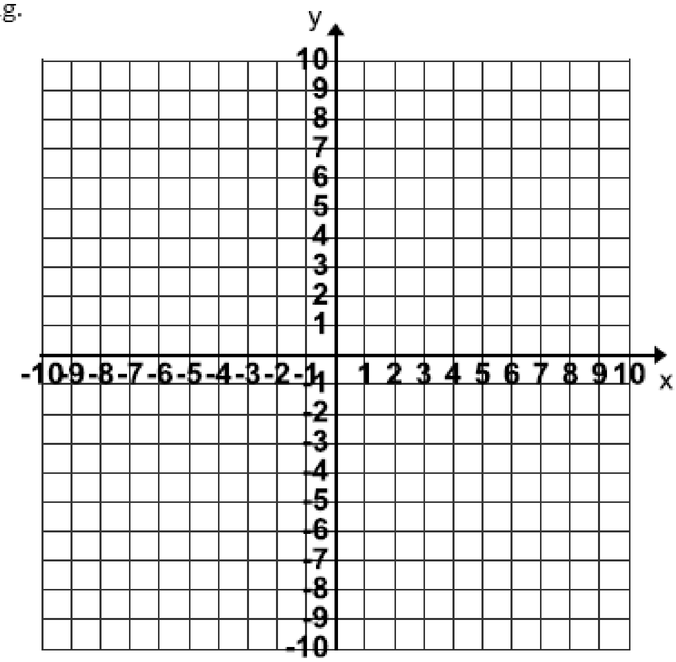
3. Graph the following function: $f(x) = x^3 + 1$



4. Given the function $f(x) = \sqrt{x}$, complete the following.

x	f(x)
0	
1	
4	
9	
16	



What is the domain of this function? Explain what this means.

What is the range of this function? Explain what this means.

5. Write the equation for the following situation: Louis starts with $1 but doubles his money on the first day and continues to double his amount every day.

Equation:____________________

How much money will Louis have on Day 5?

When will Louis have more than $1000?

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