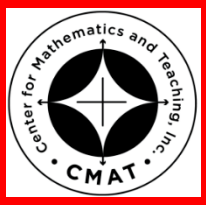
Name _____ Period _____ Date _____



MathLinks

8-3
STUDENT PACKET

MATHLINKS GRADE 8
STUDENT PACKET 3
PATTERNS AND LINEAR FUNCTIONS 1

WORD BANK

Word or Phrase	Definition or Explanation	Example or Picture
function		
explicit rule (input-output rule)		
inductive reasoning		
linear function		
ordered pair		
recursive rule		
y-intercept		

GEOMETRIC PATTERNS

Summary (Ready)

We will extend geometric "toothpick" patterns. We will use numbers, pictures, symbols, and words ("the fourfold way") to describe these patterns.

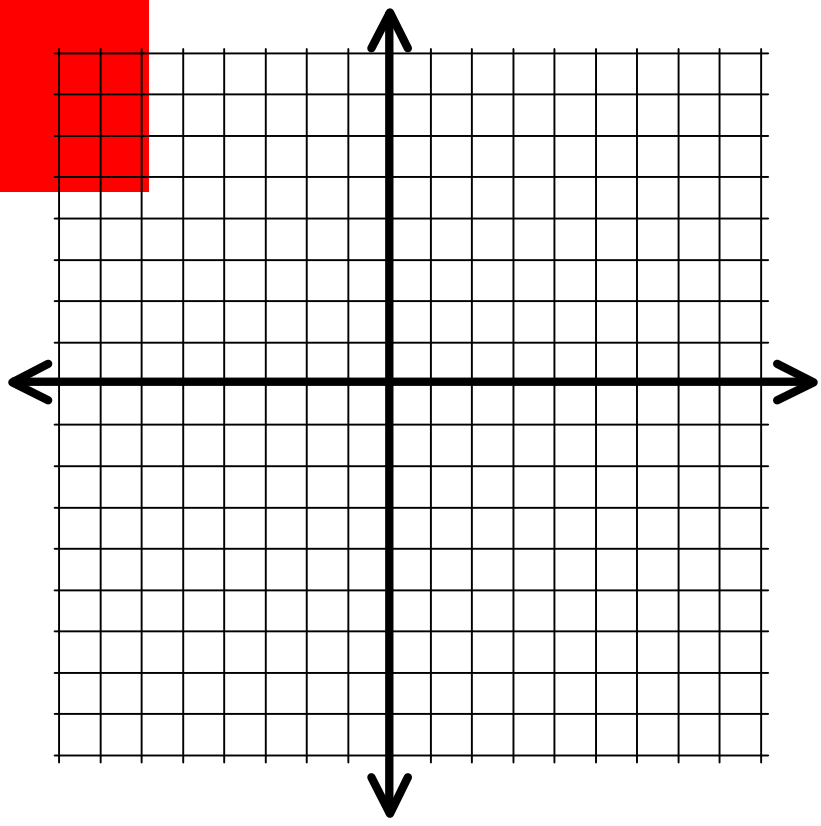
Goals (Set)

- Describe sequences generated by geometric patterns using tables, graphs, and verbal descriptions.
- Plot ordered pairs that satisfy a given condition.
- Develop recursive and explicit rules that describe sequences.

Warmup (Go)

1. Label the horizontal axis and the vertical axis
2. Label the quadrants I, II, III, IV.
3. Plot the points for each ordered pair. Connect the points with line segments to form a polygon.

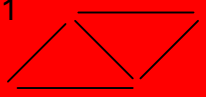
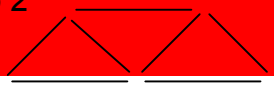
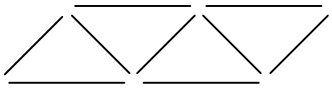
   (2, 3), (2, -5), (-6, -5), (-6, 3)
4. Name the shape.
5. Find its perimeter.
6. Find its area.



TRIANGLES

The fourfold way refers to a collection of four ways to approach and represent a math problem, using numbers, pictures, words, and symbols.

1. Fill in the entire table below before completing the next page.

A Geometric Pattern	**Table**		
Build and draw the first several figures suggested by this pattern.	Step # (Input)	Number of toothpicks (Output)	Break apart numbers to look for a pattern
Step 1 	1	5	
Step 2 	2		
Step 3 	3		
Step 4	4		
Step 5	5		
(do not build or draw step 30)	. . . 30		

TRIANGLES (Continued)

2. Transfer the data from the previous page into the table.

Step # (Input, *x*)	Number of toothpicks (Output, *y*)

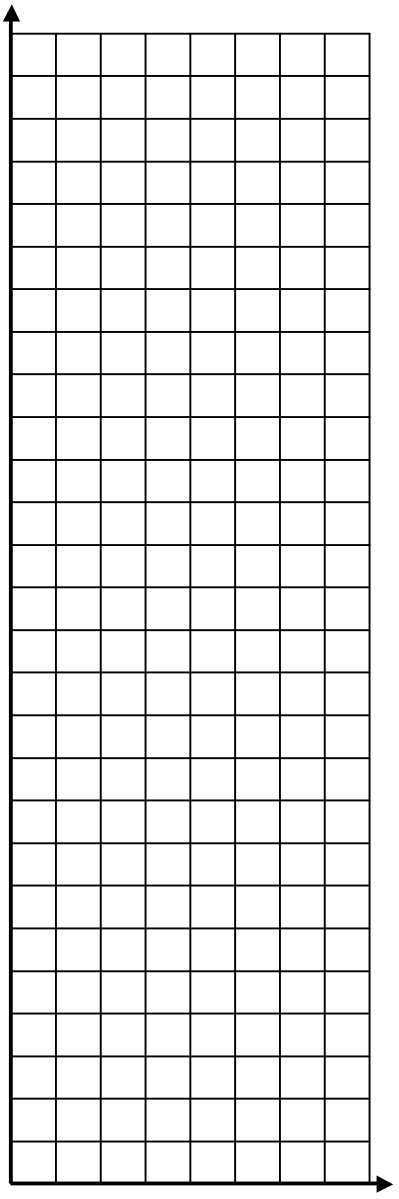
3. Title the graph and label the horizontal and vertical axes.

4. Graph the data points.

5. Describe a rule to find the number of toothpicks (output) for the triangle pattern in two ways.

   Start with ____, and then add ____ each step.
   (This is called a recursive rule.)

   Multiply the step number by ____, and then add ____.
   (This is called an explicit rule.)



6. How many toothpicks are in step #50? _____

7. Which step number has exactly 59 toothpicks? _____

8. What is the output for step #0? _____

   Write it as an ordered pair. (____, ____)

   Since this coordinate is graphed on the *y*-axis, we call this value the *y*-intercept.

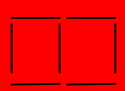
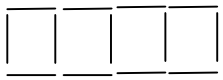
9. Look at any two consecutively graphed points from left to right. When counting from any one point to the next, we can count _____ units up and then 1 unit to the right.

10. Circle the elements of the fourfold way that were used in this problem.

    numbers pictures words symbols

RECTANGLES 1

1. Fill in the entire table below before completing the next page.

A Geometric Pattern	**Table**		
Build and draw the first several figures suggested by this pattern.	Step # (Input)	Number of toothpicks (Output)	Break apart numbers to look for a pattern
Step 1 	1	7	
Step 2 	2		
Step 3 	3		
Step 4	4		
Step 5	5		
(do not build or draw step 30)	. . . 30		

RECTANGLES 1 (Continued)

2. Transfer the data from the previous page into the table.

Step # (Input, *x*)	Number of toothpicks (Output, *y*)

3. Title your graph, label the horizontal and vertical axes, And graph the data points.

4. Describe a recursive rule for the output in the rectangle pattern with words.

   Start with ____, and then add ____ each step.

5. Describe an explicit rule for the output in the rectangle pattern with words.

   Multiply the step number by ____, and then add ____.

6. How many toothpicks are in step #50? _____

7. Which step number has exactly 58 toothpicks? _____

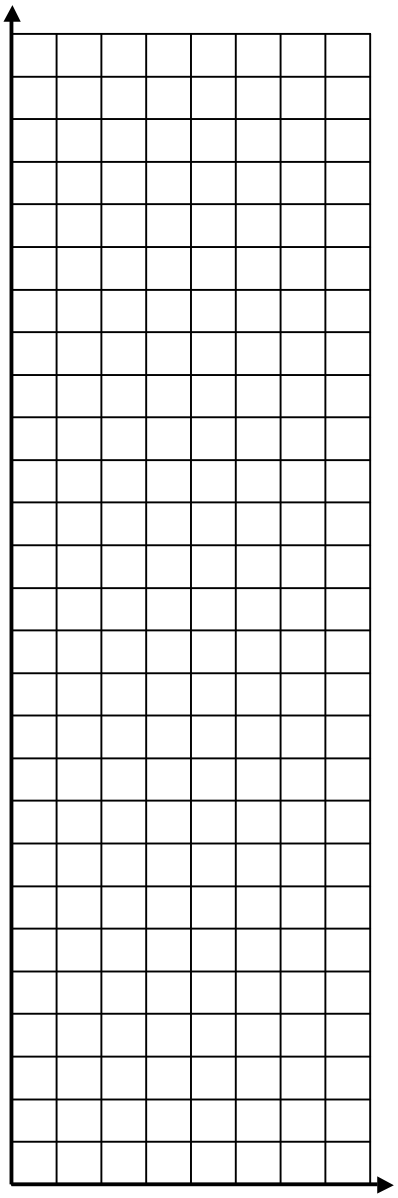
8. Find the *y*-intercept (step #0) for this graph. _____

   Write it as an ordered pair. (____, ____)

9. Look at any two consecutively graphed points from left to right. When counting from any one point to the next, we can count _____ units up and then 1 unit to the _____.

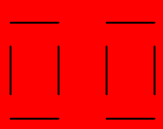
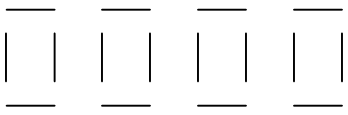
10. Circle the elements of the fourfold way that were used in this problem?

    numbers pictures words symbols



RECTANGLES 2

1. Fill in the entire table below before completing the next page.

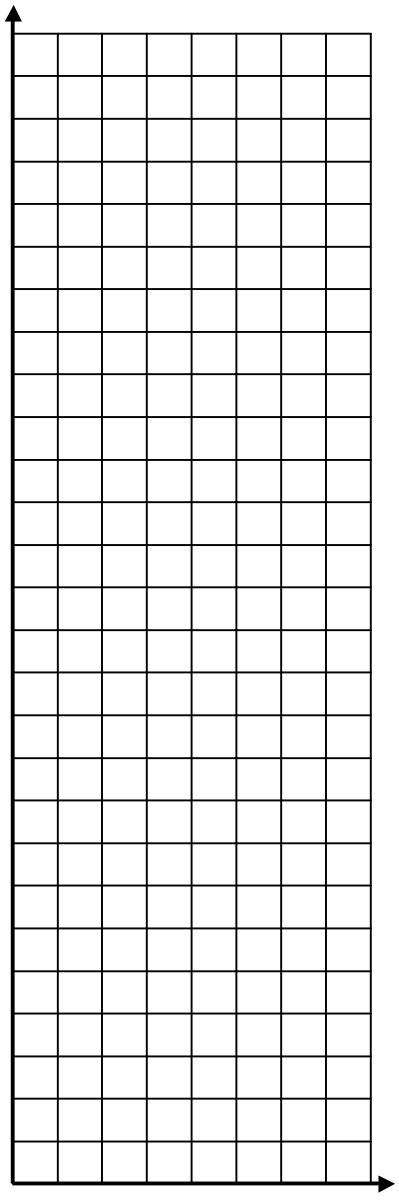
A Geometric Pattern	**Table**		
Build and draw the first several figures suggested by this pattern.	Step # (Input)	Number of toothpicks (Output)	Break apart numbers to look for a pattern
Step 1 	1		
Step 2 	2		
Step 3 	3		
Step 4	4		
Step 5	5		
(do not build or draw step 30)	. . . 30		

RECTANGLES 2 (Continued)

2. Transfer the data from the previous page into the table.

Step # (Input, *x*)	Number of toothpicks (Output, *y*)

3. Title your graph, label the horizontal and vertical axes, And graph the data points.



4. Write a recursive rule for the output.

5. Write an explicit rule for the output.

6. How many toothpicks are in step #50? _____

7. Which step number has exactly 96 toothpicks? _____

8. What is the output for step #0? _____

   Write it as an ordered pair. (____, ____)

   This point is called the _____.

   Look at any two consecutively graphed points from left to right. When counting from any one point to the next, we can count _____ units up and then 1 unit to the right.

9. Consider the triangle and two rectangle problems you have now done. Which pattern depicts the greatest rate of change from one step to another? How do you know?

NUMBER PATTERNS

Summary (Ready)

We will observe and extend number sequences and find recursive and explicit rules for number patterns.

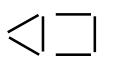
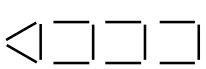
Goals (Set)

- Use verbal descriptions, tables of numbers, and symbols to describe numerical sequences.
- Use inductive reasoning to develop recursive and explicit rules that describe sequences.
- Use rules to find inputs and outputs of functions.

Warmup (Go)

Inductive reasoning is a form of reasoning in which the conclusion is supported by the evidence, but it is not proved.

1. Use inductive reasoning to continue each toothpick pattern.

Step # ⟶	Step 1	Step 2	Step 3	Step 4 (build, then sketch below)
				
Number of toothpicks ⟶	_____	_____	_____	_____

2. Use words to describe a recursive rule for the number of toothpicks.

3. Use words to describe an explicit rule for finding the number of toothpicks based upon the step number.

RECURSIVE RULES

A recursive rule for a sequence of values is a rule that specifies each value based on previous values in the sequence. In order to determine a sequence by a recursive rule, an appropriate number of starting values for the sequence must be identified.

Use inductive reasoning to continue each number pattern. Then describe each pattern with a recursive rule in words.

1. Number Pattern A 1, 5, 9, 13, _____, _____, _____	Recursive Rule: Start with _____ and then add _____ each step.
2. Number Pattern B 3, 7, 11, 15, _____, _____, _____	Recursive Rule:
3. Number Pattern C 6, 10, 14, 18, _____, _____, _____	Recursive Rule:

4. For patterns A-C, why is it NOT sufficient to describe each with a recursive rule of “add 4”?

5. You can now see 7 terms for each sequence. Why might it be difficult to find the 100^{th} term in these sequences with a recursive rule?

6. Make up another number pattern and write a recursive rule.

Number Pattern D	Recursive Rule:

EXPLICIT RULES

An explicit rule (or input-output rule) is a rule that establishes explicitly an output for each input value.

Study the arithmetic used from step to step. Then complete each step using inductive reasoning, and explain each number pattern in words.

1. Number Pattern E

Step 1	Step 2	Step 3	Step 4	Step 5
1 + 4 = 5	2 + 4 = _____	3 + 4 = _____	___ + 4 = _____	
Explicit Rule: The output is equal to the step number plus _____				

2. Number Pattern F

Step 1	Step 2	Step 3	Step 4	Step 5
1 • 4 + 6 = _____	2 • 4 + 6 = _____	3 • 4 + 6 = _____	_____ + 6 = _____	
Explicit Rule:				

3. Number Pattern G

Step 1	Step 2	Step 3	Step 4	Step 5
1 • 3 – 3 = _____	2 • 3 – 3 = _____	3 • 3 – 3 = _____		
Explicit Rule:				

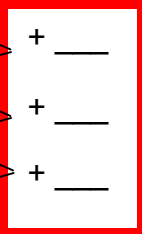
RECURSIVE AND EXPLICIT RULES

In each table:

- Assume the pattern continues with no surprises.
- Find the output value for an input value of 4 for each table.
- Write the recursive rule and explicit rule for each.
- Find the output value when the input value is 100 for each table.

1.

Input Value	Output Value
1	10
2	14
3	18
4	
100	



Recursive rule (operates on output values):

Explicit rule (operates on input values):

2.

Input Value	Output Value
1	3
2	6
3	9
4	
100	

Recursive rule:

Explicit rule:

3.

Input Value	Output Value
1	4
2	7
3	10
4	
100	

Recursive rule:

Explicit rule:

4.

Input Value	Output Value
1	2
2	5
3	8
4	
100	

Recursive rule:

Explicit rule:

PRACTICE WITH EXPLICIT RULES

Fill in the blanks and find an explicit rule for each input-output table. Remember that the rule has to work for every entry in the table. Careful! The input values are different for each table.

1.

Input Value	Output Value
1	-4
2	-3
3	-2
4	-1
10	
	-7

Explicit Rule (words)

2.

Input Value	Output Value
0	1
1	3
2	5
3	7
-5	
	23

Explicit Rule (words)

3.

Input Value	Output Value
0	0
2	10
4	20
6	30
-6	
	-10

Explicit Rule (words)

4.

Input Value	Output Value
1	-2
3	-6
5	-10
7	-14
-11	
	8

Explicit Rule (words)

USING SYMBOLS TO WRITE EXPLICIT RULES

Explicit rules are useful for finding the output for *any* step. Using symbols is usually much more efficient than using words.

A function is a rule that assigns to each input value exactly one output value.

- For each table, write an explicit rule in words and symbols.
- Find each missing input or output value.

1.	Input Value (x)	Output Value (y)
	1	4
	2	7
	3	10
	4	13
	100	
		31

Explicit rule in words: To get the output value, multiply the input value by _____ and then add _____.

Explicit rule in symbols: y = _____

If (the input value) $x = 0$, then (output value) y = _____.

Use the table. The output increases by _____ each time the input increases by 1.

2.	Input Value (x)	Output Value (y)
	1	6
	2	12
	3	18
	4	24
	50	
		-30

Explicit rule in words:

Explicit rule in symbols: y = _____

If $x = 0$, then y = _____.

The output increases by _____ each time the input increases by 1.

3. Which elements of the fourfold way were used in problems 1 and 2 above?

USING SYMBOLS TO WRITE EXPLICIT RULES (Continued)

- For each table, write an explicit rule in words and symbols.
- Find each missing input/output value.

4.

Input Value (x)	Output Value (y)
1	8
2	14
3	20
4	26
200	
	50

Explicit rule in words:

Explicit rule in symbols: $y =$ _____

If $x = 0$, then $y =$ _____.

The output increases by _____ each time the input increases by 1.

5. For the explicit rule (in symbols) in problem 4, what number is the multiplier of x? _____

   What number is added to the product? _____

6. Careful! Input values are not consecutive integers:

Input Value (x)	Output Value (y)
1	7
3	19
5	31
7	43
50	
	601

Explicit rule in words:

Explicit rule in symbols: _____

y-intercept: _____

For this table, notice that the output increases by _____ each time the input increases by 2. What is the change in output each time the input increases by 1? _____

SAVING FOR A PURCHASE

Summary (Ready)

We will use input-output equations, tables, and graphs to find out how much time is needed to save for purchases.

Goals (Set)

- Use numbers, graphs, equations, and words (the "fourfold way") to solve problems.
- Recognize that some real-world situations can be modeled using linear functions.
- Informally connect the *y*-intercept to a context.

Warmup (Go)

1. Use the rule given below to determine the output numbers.

   Rule: Multiply each input number by 3 and then add 5 to get each output number.

Input Number (x)	Output Number (y)
10	(10)(3) + 5 = 35
1	
0	
9	
11	
20	

2. What is an equation for this rule? Use x for input and y for output.

   y = _____

3. Recall that a function is a rule that assigns to each input value a unique output value. Could this rule represent a function? Explain.

CAMERA: INSTRUCTIONS

A digital camera costs $240.

(a) Julie wants to save for the camera. She has $100 in the bank as a starting amount (initial value), and she is going to save $10 each month.

(b) Christina also wants to save for the camera. She has $40 in the bank as a starting amount (initial value), and she is going to save $25 each month.

How many months will it take Julie and Christina to each save up for the digital camera?

1. What is the cost of the digital camera? _____

2. What is the amount that Julie still needs to save? _____

3. What is the amount that Christina still needs to save? _____

We will explore how to write equations (explicit rules) that can be used to determine the amount that each girl saved at the end of any month.

4. Let ***m*** represent the amount of money that Julie and Christina are going to deposit in their bank accounts each ***month***.

   For Julie, m = _____. For Christina, m = _____.

5. Let ***b*** represent the amount that Julie and Christina each already have in the ***bank*** to start.

   For Julie, b = _____. For Christina, b = _____.

6. How much will Julie have saved after 1 month? _____ after 2 months? _____

7. How much will Christina have saved after 1 month? _____ after 2 months? _____

CAMERA: TABLES

1. Use the information on the previous page to complete the tables and find equations.

JULIE

m = $___ per month
b = $___ in the bank to start

X (# of months)	*y* (total amount saved)
0	10(0) + 100 = 100
1	10(___) + 100 = _____

CHRISTINA

m = $___ per month
b = $___ in the bank to start

x (# of months)	*y* (total amount saved)

2. Write an equation for the amount that Julie saved *(y)* at the end of any month (*x*).

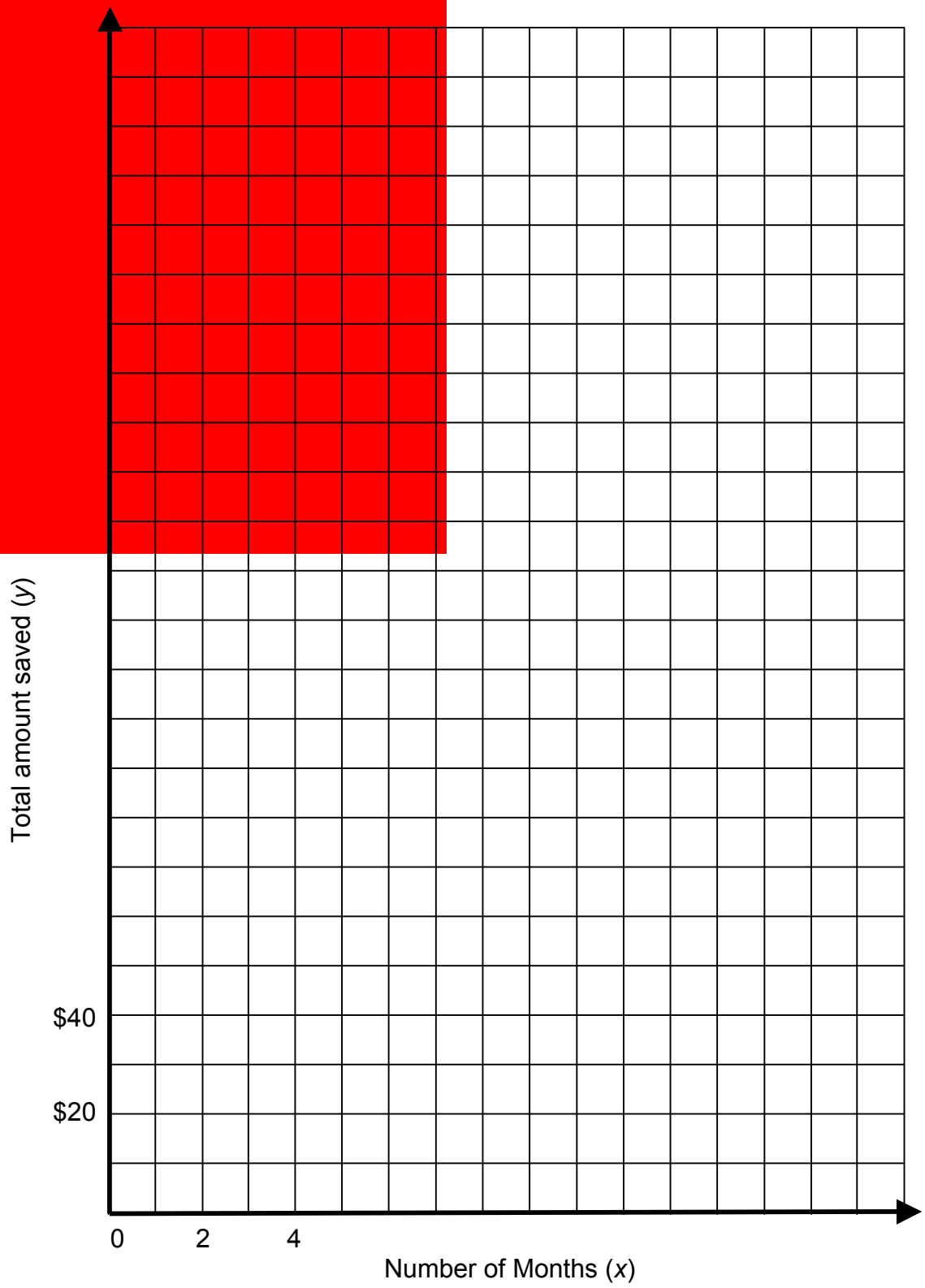
y = _____

3. Write an equation for the amount that Christina saved *(y)* at the end of any month (*x*).

y = _____

CAMERA: GRAPHS

1. Use the data from the tables on the previous page to make graphs representing the total amount of money that Julie and Christina will save each month. Use one color for Julie's graph and another color for Christina's graph.



CAMERA: QUESTIONS

Use any combination of tables, graphs, or equations to answer the questions.

1. Who starts out with more money in the bank? _____ How do you know?

   At what ordered pair is this represented on the graph? (_____, _____)

   Because it is on the *y*-axis, we call it a *y*-intercept.

2. Who is saving at a faster rate? _____ How do you know?

3. When will both girls have saved the same amount of money? _____ How do you know?

   The location on a graph where lines meet is called a point of intersection of the lines.

4. How long will it take Julie to save for the camera? _____

5. How long will it take Christina to save for the camera? _____

6. Who will be the first to save enough money for the camera? _____

7. Write an equation that describes the amount of money *y* that Julie has saved after *x* months.

   $y =$ _____

8. Write an equation that describes the amount of money *y* that Christina has saved after *x* months.

   $y =$ _____

The equations you wrote for Julie and Christina are linear functions in the form $y = mx + b$.

9. For Julie's equation:

   $m =$ _____ $b =$ _____

10. For Christina's equation:

    $m =$ _____ $b =$ _____

PRINTER: INSTRUCTIONS AND TABLES

A printer costs $150.

(a) Theresa wants to save for a printer. She has $10 in the bank to start, and she is going to save $20 each month.

(b) Cary also wants to save for the printer. She has $25 in the bank to start, and she is going to save $15 each month.

How many months will it take Theresa and Cary to each save up for the printer?

To find the total amount saved, use the equation form $y = mx + b$.

Theresa
m = $20 per month
b = $10 in the bank to start

y = _____

x (# of months)	y (total amount saved)

Cary
m = $_____ per month
b = $_____ in the bank to start

y = _____

x (# of months)	y (total amount saved)

PRINTER: GRAPHS AND QUESTIONS

Use the data from the tables on the previous page to make graphs representing the total amount of money that Theresa and Cary will save each month. Use one color for Theresa's graph and another color for Cary's graph. Label your axes and title your graph. Then answer the questions using the tables, graphs, or equations.

1. Who starts out with more money in the bank? In other words, which amount of money represents the greater initial value? How do you know?

2. Who is saving at a faster rate? How do you know?

3. When will both girls have saved the same amount of money?

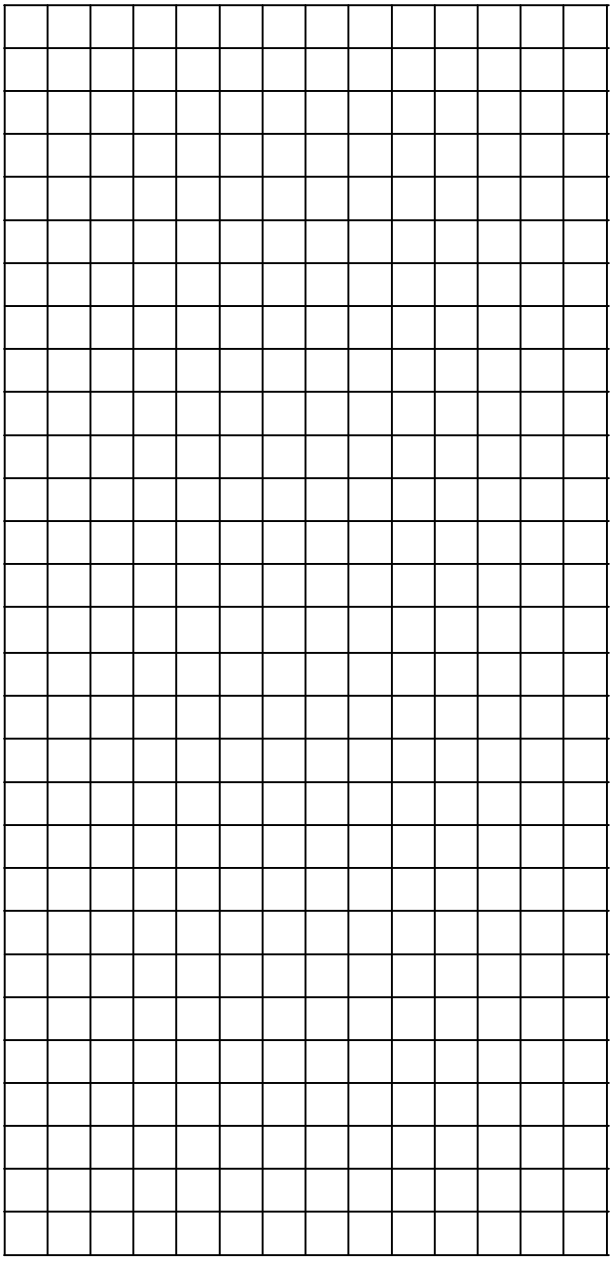
   On the graph, this is called a point of _____ of lines.

4. How long will it take Theresa to save for the printer?

5. How long will it take Cary to save for the printer?

6. Who will be the first to save enough money for the printer?

7. Write an equation that describes the amount of money y that Theresa has saved after x months.



8. Write an equation that describes the amount of money y that Cary has saved after x months.

BRIAN'S PROBLEM: INSTRUCTIONS AND TABLE

Brian wants to save for a camera and then a printer. A digital camera costs $240 and a printer costs $150. He has $100 saved in the bank and is going to save $20 each month.

1. Cost of camera: _____

2. Cost of printer: _____

3. Total amount Brian still needs to save to purchase both: _____

To find the total amount saved, use the equation:

$y = mx + b$

m = the amount of money Brian is going to deposit in his bank account each month

b = the amount of money Brian already has in the bank

x = the number of months he has been saving

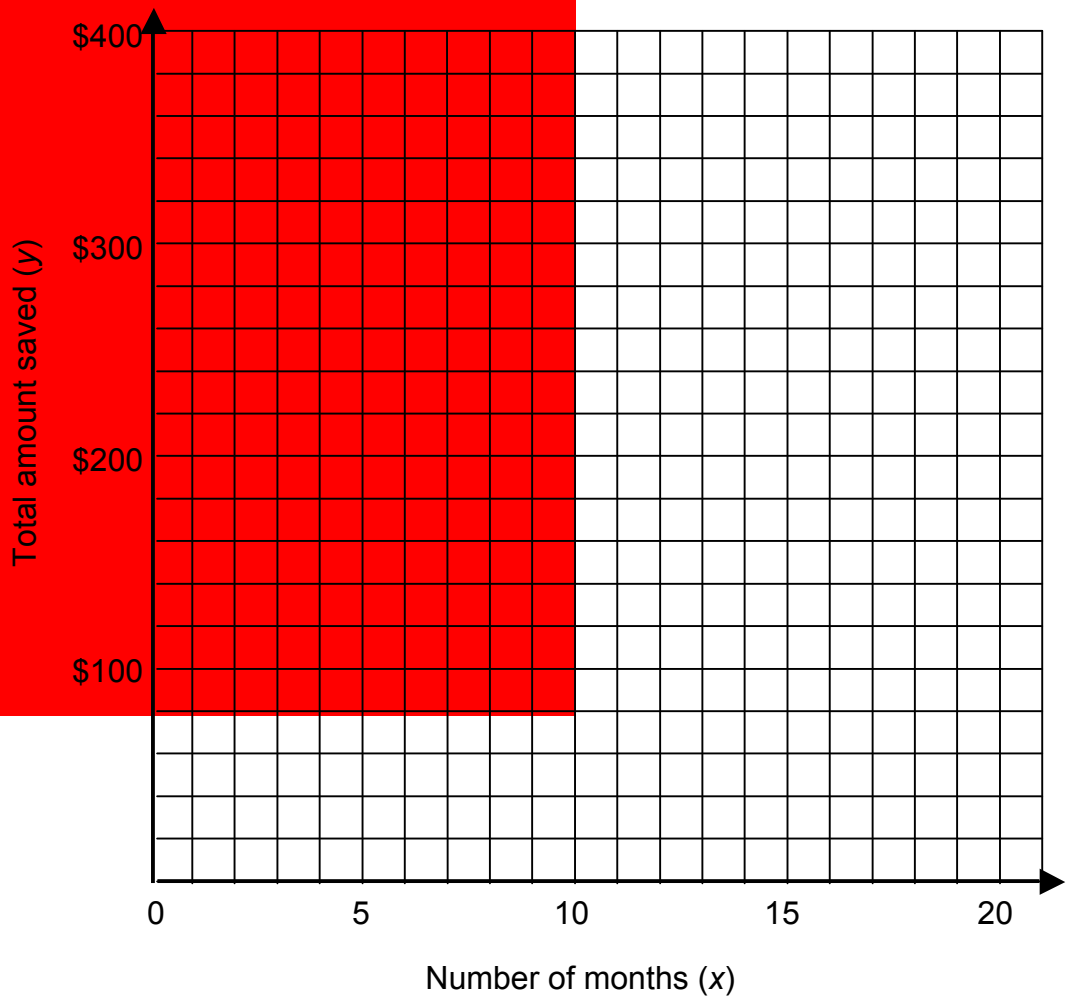
y = total amount saved

4. Write an equation in $y = mx + b$ form to show the total amount of money Brian has saved at the end of each month.

x (# of months)	y (amount saved)

BRIAN'S PROBLEM: GRAPH AND QUESTIONS

1. Make a graph to show the total amount of money Brian has saved each month.



2. Brian wants to buy the camera first. How long will it take Brian to save for the camera? How do you know?

3. Then Brian will buy the printer. How long will it take him to save for the printer, after he purchases the camera? How do you know?

4. Suppose Brian decided to buy the printer first. How long would it take Brian to save for the printer? Why is this number of months different than your answer to #3 above?

SKILL BUILDERS, VOCABULARY, AND REVIEW

SKILL BUILDER 1

Compute.

1. 2.35 + 3.047	2. 18.2 – 6.8	3. 13.7 + 25.5
4. 4.5448 – 1.2	5. $\frac{1}{4} + \frac{2}{3}$	6. $\frac{4}{5} - \frac{2}{15}$
7. $1\frac{3}{5} + \frac{2}{3}$	8. $1\frac{3}{5} - \frac{2}{3}$	9. $0.6 + \frac{4}{5} - \frac{1}{2}$

10. Find the area A and perimeter P of a rectangle with side lengths of $1\frac{5}{16}$ and $2\frac{3}{4}$ inches.

P = _____ A = _____

Name the property illustrated by each equation.

11. 0 + (-24) = -24 _____

12. -16 + 16 = 0 _____

13. (-59)(37) = (37)(-59) _____

SKILL BUILDER 2

Compute.

1. $7 + (-2)$	2. $-2 + 11$	3. $-12 - 9$
4. $4 - 13$	5. $-7 + (-9)$	6. $-8 - (-7)$
7. $5 - 11$	8. $75 - (-25)$	9. $-60 - (20)$

Circle the expression that has a value that is different than the value of the other expressions.

10. $2 - 8$	$-2 + 8$	$2 + (-8)$	$-\lvert 8 - 2 \rvert$
11. $7 + (-4)$	$7 - 4$	$\lvert 4 - 7 \rvert$	$-7 - 4$
12. $\lvert 3 - 9 \rvert$	$-9 - 3$	$9 + (-3)$	$9 - 3$

13. Which statement is *not* true?

a. $-12 - 12 = -24$ b. $-12 - (-12) = 0$

c. $-12 + (-12) = 24$ d. $12 - (-12) = 24$

Evaluate each expression for $x = \frac{3}{4}$ and $y = \frac{1}{8}$.

14. $x + 2y$	15. $\frac{1}{x + y}$	16. $x^2 + y^2$

SKILL BUILDER 3

Continue each pattern below.

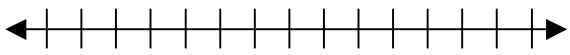
1. -6, -11, -16, -21, _____, _____, _____

2. $\frac{2}{3}$, $1\frac{1}{3}$, 2, $2\frac{2}{3}$, _____, _____, _____

Solve each equation using a mental strategy.

3. $10 - b = -3$	4. $\frac{k-2}{-6} = -3$
5. $-8 = 8 + n$	6. $30 = -5(m + 2)$
7. $2x + 3 = x + 5$	8. $3(x - 4) = -12$

9. Translate the verbal inequality into symbols, solve it mentally, and graph the solution(s).

a. Words: A number times 2 is less than 18.	b. Symbols (let n = the number):
c. Solution(s):	d. Graph: 

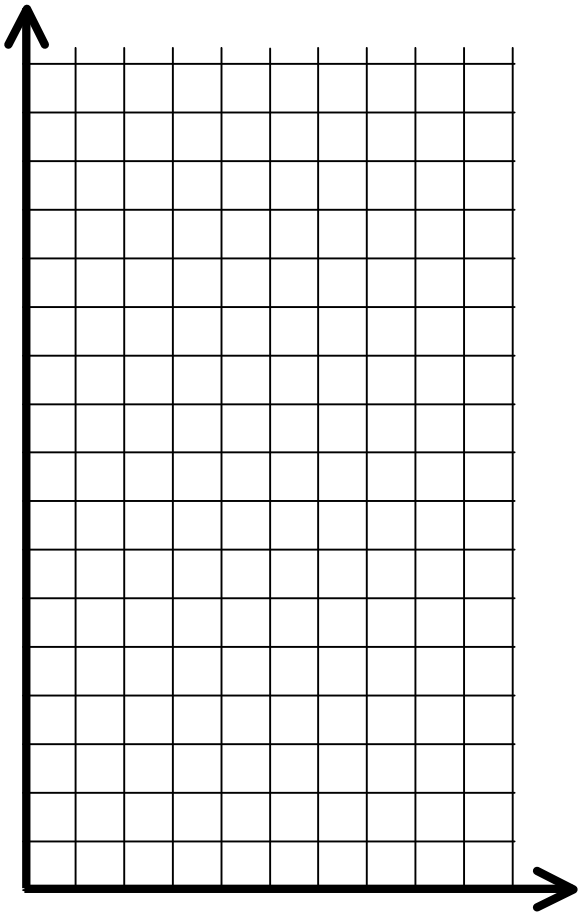
SKILL BUILDER 4

1. Draw the next step suggested by this pattern. Then complete the table and find a rule for the number of toothpicks at step *n*.

step1 step 2 step 3 step 4

Step #	0	1	2	3	4	5	50	*n*
Number of toothpicks		9						
Break apart numbers to look for a pattern								

2. Label the horizontal and vertical axes and graph the data points.



3. Recursive Rule:

   Start with _____ toothpicks, and then

   _____ each step.

4. Explicit Rule: Explain what operations to perform on the input value to arrive at the corresponding output.

5. In which step number are there exactly 87 toothpicks?

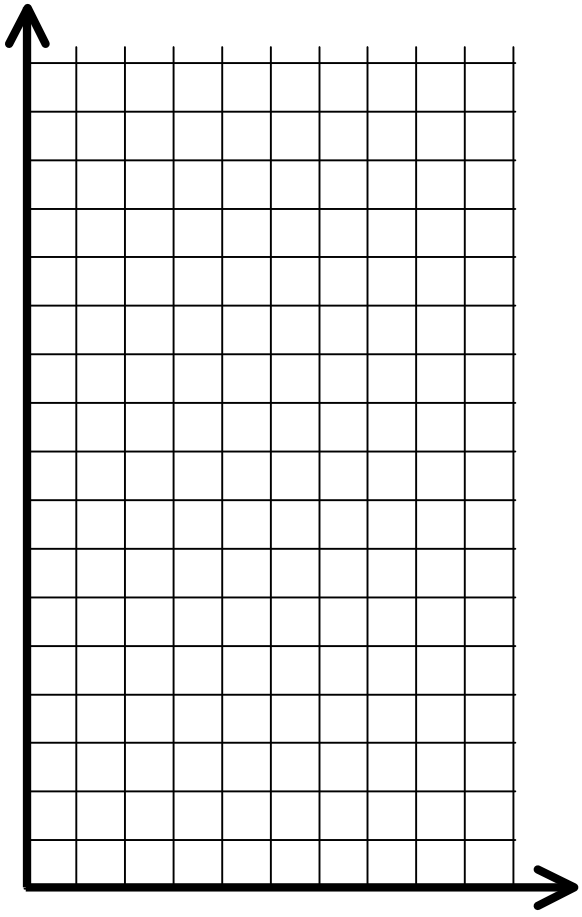
SKILL BUILDER 5

1. Draw the next step suggested by this pattern. Then complete the table and find a rule for the number of toothpicks at step *n*.

step1 step 2 step 3 step 4

Step #	0	1	2	3	4	5	50	*n*
Number of toothpicks		8						
Break apart numbers to look for a pattern								

2. Label the horizontal and vertical axes and graph the data points.



3. Recursive Rule:

   Start with _____ toothpicks, and then

   _____ each step.

4. Explicit Rule: Explain what operations to perform on the input value to arrive at the corresponding output.

5. In which step number are there exactly 92 toothpicks?

SKILL BUILDER 6

Continue each number pattern. Then write a recursive rule consistent with the pattern, using a full sentence for each.

1. 2, 5, 8, 11, _____, _____, _____

2. 7, 10, 13, 16, _____, _____, _____

3. -4, -1, 2, 5, _____, _____, _____

Write an explicit rule for each input-output table in words. Use a full sentence for each rule.

4.

Input Value	Output Value
0	1
1	5
2	9
-1	
	21
Rule:	

5.

Input Value	Output Value
1	-5
2	-10
-3	15
-4	
	23
Rule:	

6.

Input Value	Output Value
-9	-3
-6	-2
-3	-1
0	
	20
Rule:	

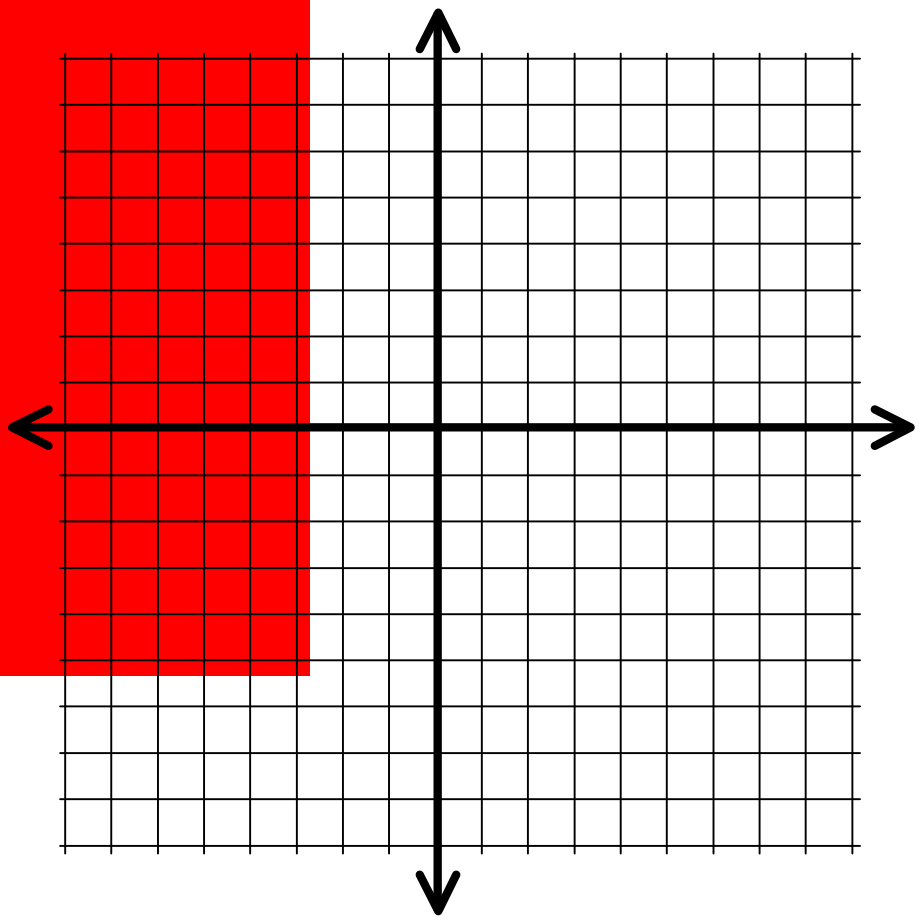
SKILL BUILDER 7

For each equation, find the output values (y) for the given input values (x). Graph the ordered pairs for each equation using a different color pencil. Connect the points for each equation.

1. $y = x$	
x	y
0	
5	
-5	

2. $y = 2x$	
x	y
0	
3	
-3	

3. $y = \frac{1}{2}x$	
x	y
0	
4	
-4	



4. How are the graphs of the equations the same?

5. How are the graphs of the equations different?

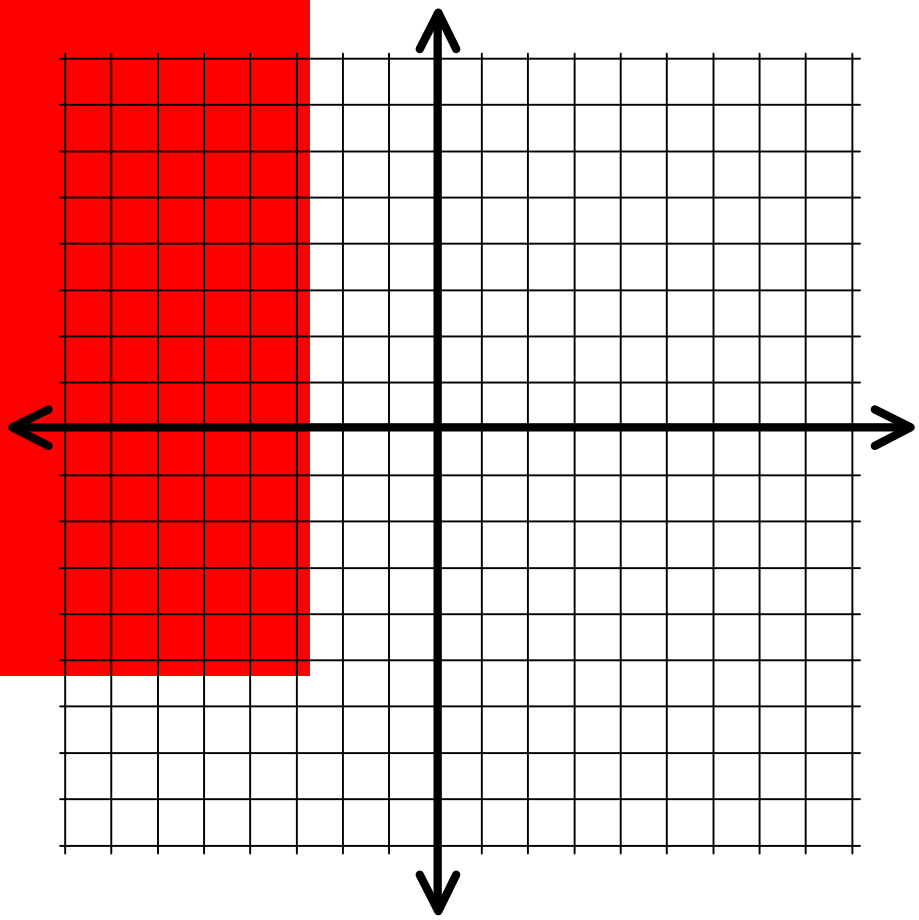
SKILL BUILDER 8

For each equation, find the output values (y) for the given input values (x). Graph the ordered pairs for each equation using a different color pencil. Connect the points for each equation.

1. $y = 2x + 3$	
x	y
0	
1	
-2	

2. $y = 2x$	
x	y
0	
4	
-3	

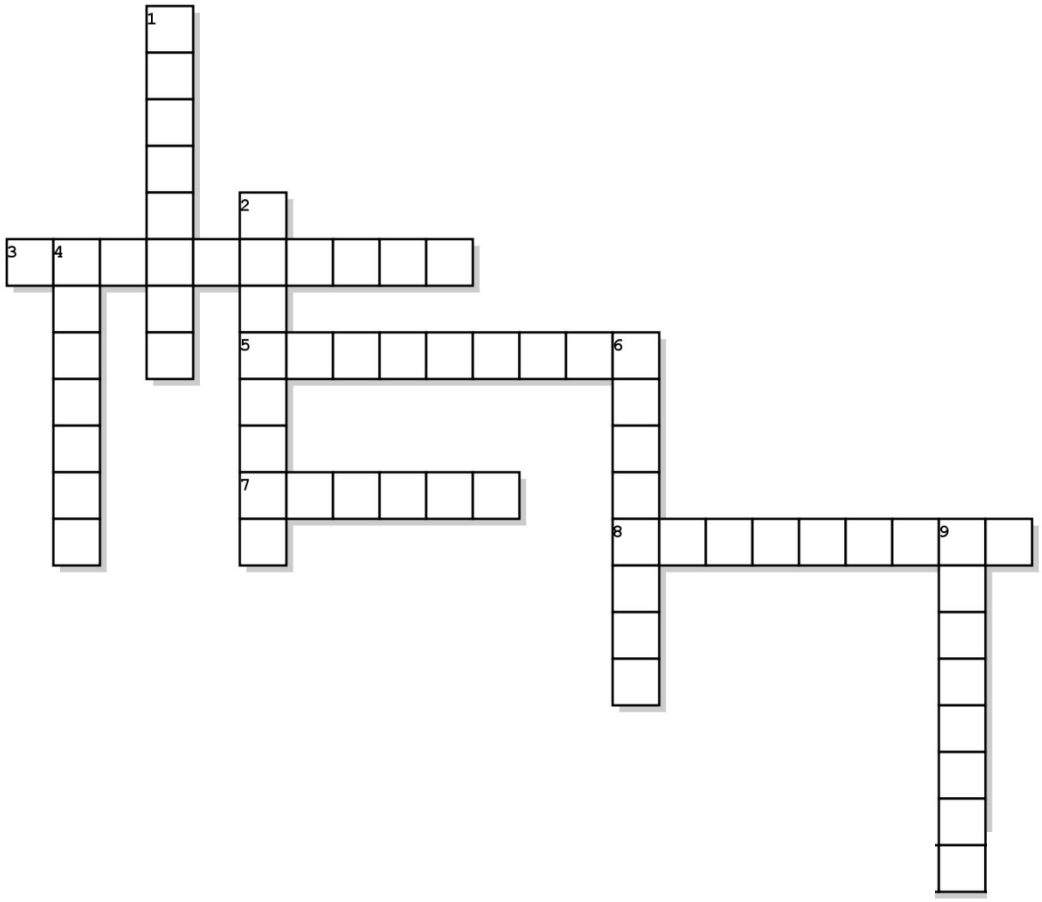
3. $y = 2x - 4$	
x	y
0	
4	
-1	



4. How are the graphs of the equations the same?

5. How are the graphs of the equations different?

FOCUS ON VOCABULARY



Across

3 In the coordinate plane, the orientation of the *x*-axis is ____.

5 A rule that specifies each value based on previous values.

7 $y = mx + b$ is a ____ function

8 A form of reasoning in which the conclusion is supported by the evidence, but is not proved.

Down

1 A rule that assigns to each input value a unique output value.

2 "The ____ way." (pictures, numbers, symbols, and words)

4 Another name for coordinates: ____ pair

6 An input-output rule.

9 In the coordinate plane, the orientation of the *y*-axis is ____.

SELECTED RESPONSE

Show your work on a separate sheet of paper and choose the best answer(s).

1. What is the best recursive rule for the following input-output table?

input value	1	2	3	4
output value	-4	-2	0	2

A. Increase by 2 for each step.
B. Start at 1 and increase by 1 at each step.
C. Start at 1 and increase by 2 each step.
D. Start at -4 and increase by 2 for each step.

2. What is an explicit rule for the following input-output table?

input value (x)	1	2	3	4
output value (y)	4	7	10	13

A. $y = x + 3$
B. $y = x + 1$
C. $y = 3x + 1$
D. $y = 3x$

3. Sierra is saving for a printer that costs $150. She has an initial amount of $75 already saved in the bank and is going to save $35 each month. If x represents the number of months and y represents the total amount saved, which equation shows the total amount of money Sierra will have at the end of each month?

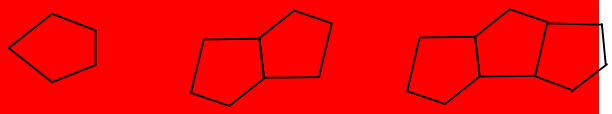
A. $y = 35x + 75$ B. $y = 35x + 150$ C. $y = 75x + 35$ D. $y = 75x + 150$

KNOWLEDGE CHECK

Show your work on a separate sheet of paper and write your answers on this page.

3.1 Geometric Patterns

1. Use inductive reasoning to sketch step 4. Then complete the table, and write a recursive rule in words and an explicit rule in words and symbols for the number of toothpicks at every step.



step 1 step 2 step 3 step 4

Step # (x)	1	2	3	4	5	... 20
# of toothpicks (y)						

3.2 Number Patterns

Write recursive and explicit rules in words for each input-output table.

2.

input	1	2	3	4	5
output	5	7	9	11	13

3.

input	5	3	10	0	-4
output	26	16	51	1	-19

3.3 Saving for a Purchase

4. Write the following explicit rule using symbols:

To find each output number,
multiply each input number by 4,
and then add 2.

Then use the rule to complete the table.

Input (x)	Output (y)
0	
3	
-10	
40	
-100	

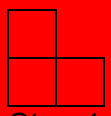
HOME-SCHOOL CONNECTION

Here are some questions to review with your young mathematician.

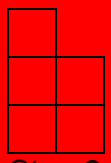
1. Write an equation for this explicit rule (input-output rule): To get each output number (y), multiply each input (x) by 25, and then add 15.

   What is the output value for an input value $x = 100$?

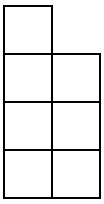
2. Use inductive reasoning to sketch the next stage of the pattern. Then complete the table, and write an explicit rule in words and symbols.



Step 1



Step 2



Step 3

Step 4

Step # (x)	1	2	3	4	5
Number of squares (y)					

Rule (words):

Rule (symbols):

This page is intentionally left blank.

This page is intentionally left blank.

COMMON CORE STATE STANDARDS – MATHEMATICS

STANDARDS FOR MATHEMATICAL CONTENT	
8.EE.8a	Analyze and solve pairs of simultaneous linear equations. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
8.EE.8c	Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*
8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
8.F.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; ~~give examples of functions that are not linear. *For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*~~
8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

STANDARDS FOR MATHEMATICAL PRACTICE	
MP1	Make sense of problems and persevere in solving them.
MP2	Reason abstractly and quantitatively.
MP4	Model with mathematics.
MP8	Look for and express regularity in repeated reasoning.

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