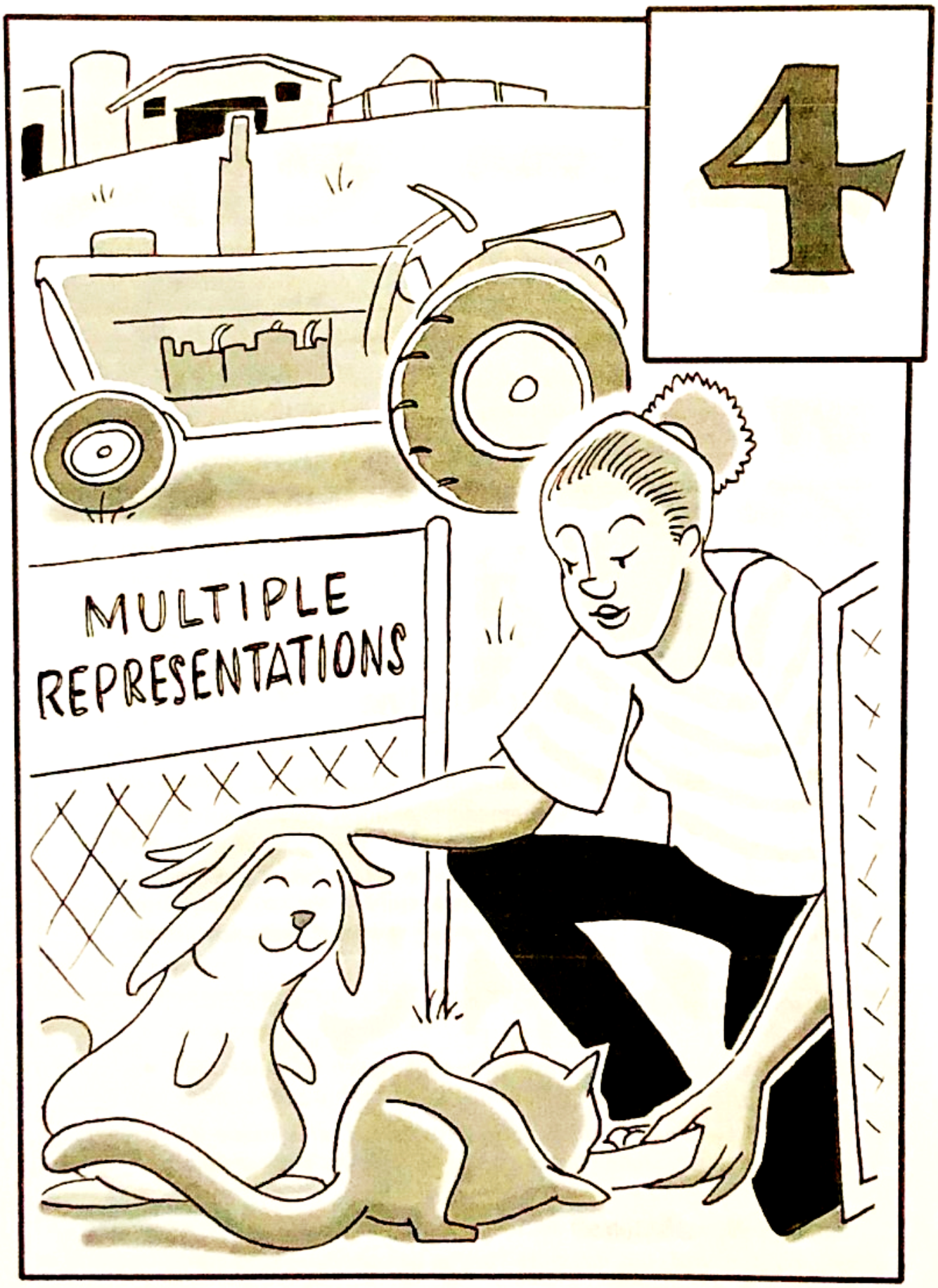

4
MULTIPLE
REPRESENTATIONS

CHAPTER 4 Multiple Representations

This chapter builds on the work you did in the previous two chapters. Chapter 4 contains only one section, as it focuses solely on the connections between the four representations of data: patterns, tables, graphs, and equations (also referred to as "rules").

In this chapter, you will learn:

- How to change any representation of data (such as a pattern, table, graph or rule) to any of the other representations.
- How to use the connections between patterns, tables, graphs, and rules to solve problems.

Guiding Questions

What is the connection?

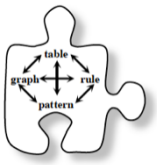
Is there a pattern?

How does the pattern grow?

In how many different ways can it be represented?

How does the pattern show up in the table, graph, and rule?

Section 4.1



You will shift between different representations of linear patterns, using the web diagram shown at left. By finding connections between each representation, you and your team will find ways to change from one representation to each of the other three representations.

Lesson 4.1.1 Finding Connections Between Representations

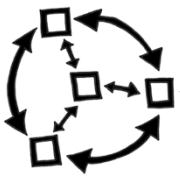
What is the Connection?

In Chapter 3, you studied different ways to represent patterns. You organized information into tables, graphed information about patterns, and learned how to find the rules that govern specific patterns.

Starting today and continuing throughout this chapter, you will find connections between different representations of the same pattern. You will also explore each representation in further depth. This work will develop efficient ways to go from one representation to another. By the end of this chapter, you will have a deeper understanding of many of the most powerful tools of algebra.

Lesson 1 **Problem 4-1**

TILE PATTERN CHALLENGE



Your task is to show every way you can represent your pattern and highlighting all of the connections between the representations that you can find. *Finding and showing the connections are the most important parts of this activity*.

Pattern Analysis:

- Extend the pattern by drawing Figures 0 and 4. Then describe Figure 100. Give as much information as you can about Figure 100. What will it look like? How will the tiles be arranged? How many tiles will it have?
- Find the number of tiles in each figure. Record your data in a table and on a graph.
- Generalize the pattern by writing a rule that will give the number of tiles in any figure in the pattern. Show how you got your answer.
- Demonstrate how the pattern grows. Use color, arrows, labels, and other math tools to help you show and explain. Show growth in each representation.
- What connections do you see between the different representations (figures, x→y table, and graph)? How can you show these connections?

Some people describe mathematics as "the study of patterns." For each tile pattern below, draw Figure 0 and Figure 4 on the provided grid. What does Figure 100 look like? Explain how you know.

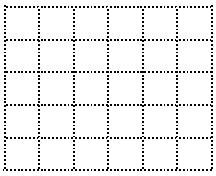


Figure 0

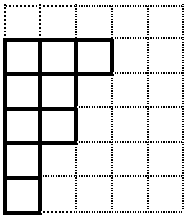


Figure 1

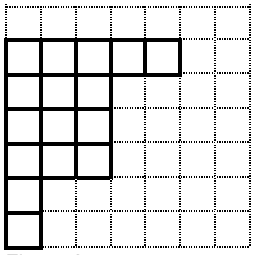


Figure 2

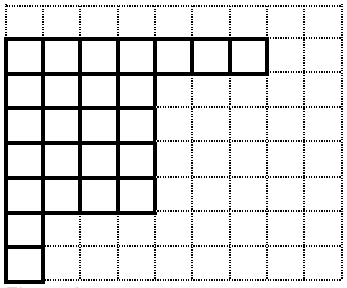


Figure 3

Figure x

Figure 100

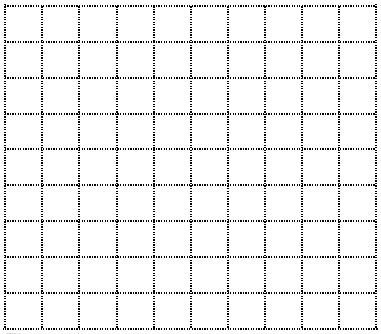
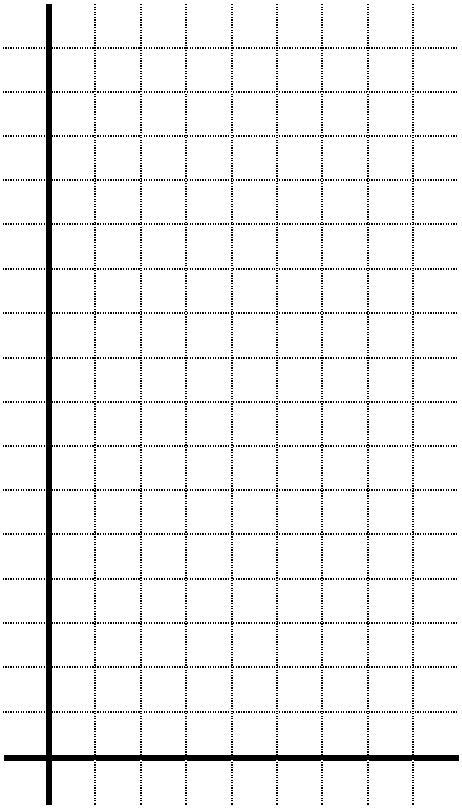


Figure 4

Create a table for the pattern:

x	0	1	2	3	4	5	6	7	100	Rule
y										*y*=



What connections do you see between the different representations (figures, x→y table, and graph)? How can you show these connections?

Review & Preview **Problem 4-3**

Draw Figure 0 and Figure 4 for the pattern at below.

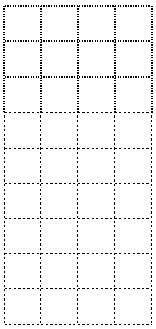


Figure 0

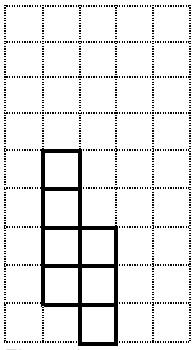


Figure 1

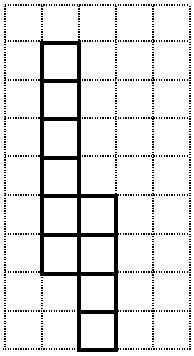


Figure 2

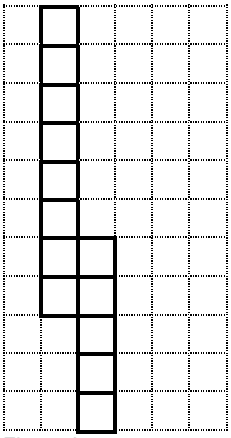


Figure 3

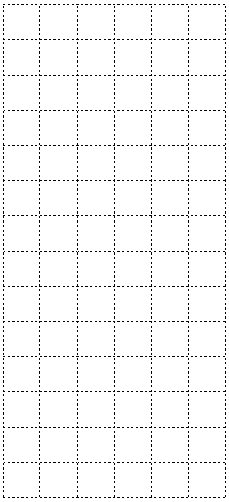
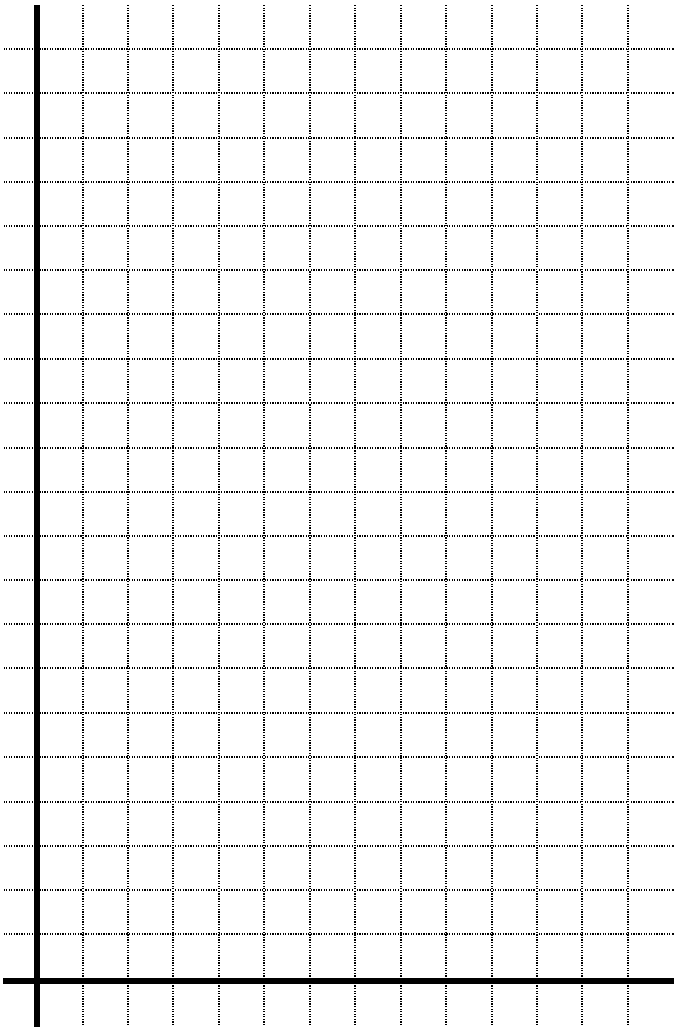


Figure 4

a. Represent the number of tiles in each figure in an x→y table. Let x be the figure number and y be the total number of tiles.

x	0	1	2	3	4	5	6	7	100	Rule
y										*y*=



b. Use the table to graph the pattern.

c. Without drawing Figure 5, predict where its point would lie on the graph. Justify your prediction.

Problem 4-4

Evaluate the expressions below for the given values.

a. $3(2x + 1)\ for\ x = -8$

b. $x - 64 - 1\ for\ x = -14$

c. $-2m^2 + 10\ for\ m = -6$

d. $k \cdot k \div k \cdot k \div k\ for\ k = 9$

Problem 4-5

Simplify the following expressions by combining like terms.

a. $x + 3x - 3 + 2x^2 + 8 - 5x$

b. $2x + 4y^2 - 6y^2 - 9 + 1 - x + 3x$

c. $2x^2 + 30y - 3y^2 + 4xy - 14 - x$

d. $20 + 3xy - 3xy + y^2 + 10 - y^2$

Problem 4-6

Use the Distributive Property to rewrite each expression.

a. $3(2x - 7)$

b. $-2(x - 7) + 5x$

c. $5x + 10$

d. $8x + 12y$

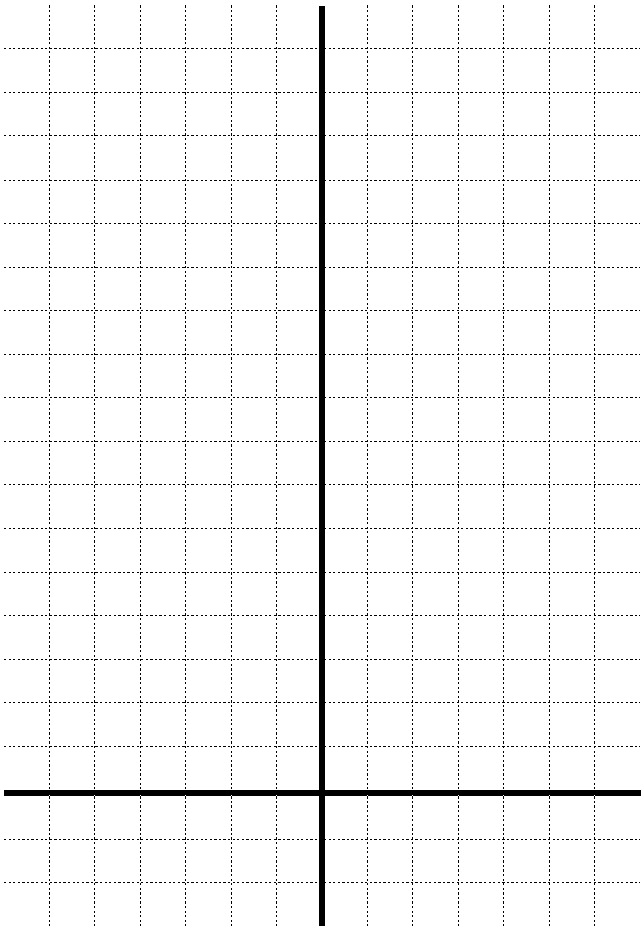
Problem 4-7

Make an x→y table for the rule $y = x^2 - 2x$.

a. Plot and connect the points on a complete graph.

b. Does your graph look like a full parabola? If not, add more points to your table and graph to complete the picture.

x								
$y = x^2 - 2x$								

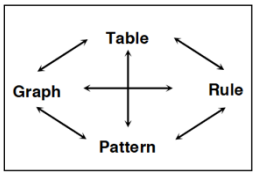


Lesson 4.1.2
Seeing Growth in Different Representations

How does it grow?

In Lesson 4.1.1, you looked at four different ways of representing patterns and began to find connections between them.

Throughout this chapter, you will explore connections between and find efficient ways to move from one type of representation to another. Today, you will look for specific connections between geometric patterns and equations.



As you work, keep these questions in mind:

How can you see growth in the rule? *How do you know your rule is correct?*

What does the representation tell you? *What are the connections between the representations?*

Problem 4-12 & 13

Examine the tile patterns shown below. For each pattern, answer the questions a-d.

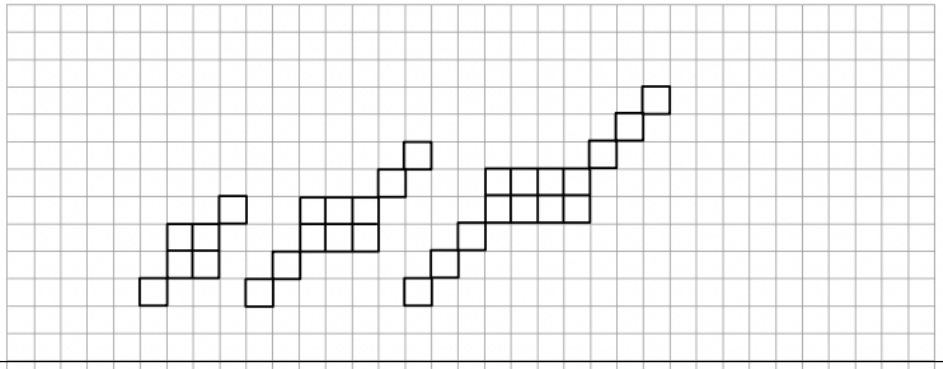
a. What do you notice? After everyone has had a moment to examine the figures independently, discuss what you see with your team.
b. Sketch the next figure in the sequence (Figure 4) on your resource page. Sketch Figure 0, which is the figure that comes before Figure 1.
c. How is the tile pattern growing? Where are the tiles being added with each new figure? On your resource page, use a marker or colored pencil to color in the new tiles in each figure.
d. What would Figure 100 look like? Describe it in words. How many tiles would be in the 100th figure? Find as many ways as you can to justify your conclusion. Be prepared to report back to the class with your team's findings and methods.

Pattern Analysis

Figure 0 Figure 1 Figure 2 Figure 3 Figure 4

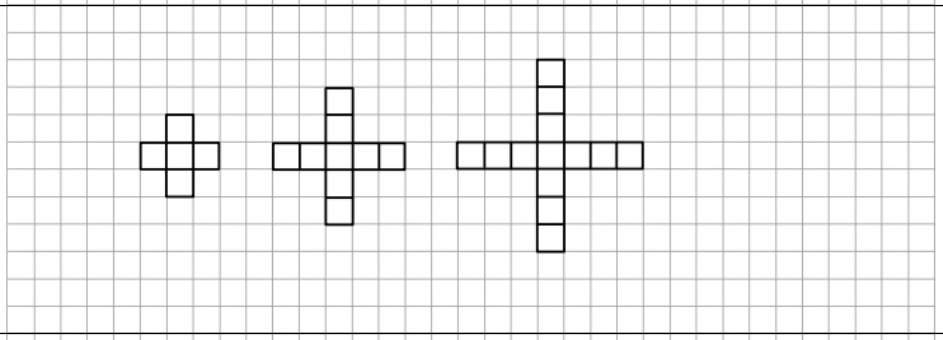
Sketch Figure 100

Tile Pattern #1



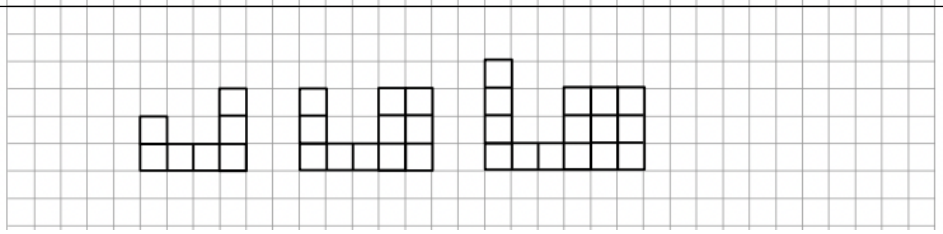
Rule
***y*=**

Tile Pattern #2



Rule
***y*=**

Tile Pattern #3



Rule
***y*=**

Problem 4-14

PUTTING IT TOGETHER

Look back at the three different tile patterns in problems 4-12 and 4-13 to answer the following questions.

a. When you compare these three patterns, what is the same and what is different? Explain in a few sentences.

SAME:

DIFFERENT:

b. Find an equation (rule) for the number of tiles in each pattern. Label each tile pattern on your resource page with its rule.

c. What connections do you see between your equations and the tile pattern? Explain these connections.

d. Imagine that the team next to you created a new tile pattern that grows in the same way as the ones you have just worked with, but they refused to show it to you. What other information would you need to be able to predict the number of tiles in Figure 100?

Problem 4-15

Consider **Tile Pattern #4**, shown below.

a. Draw Figures 0 and 4.

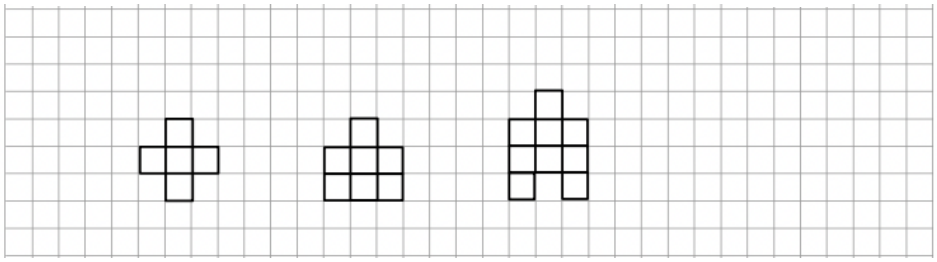
b. Find an equation (rule) for the number of tiles in this pattern. Label Tile Pattern #4 with its rule. Then use a new color to show where the numbers in your rule appear in the tile pattern.

c. What is the same about this pattern and Tile Pattern #3? What is different? What do those similarities and differences look like in the tile pattern? In the equation?

d. How is the number of tiles by which the pattern increases each time you move from one figure to the next figure in the sequence represented in each equation?

Fig. 0 Fig. 1 Fig. 2 Fig. 3 Fig. 4

Sketch Figure 100



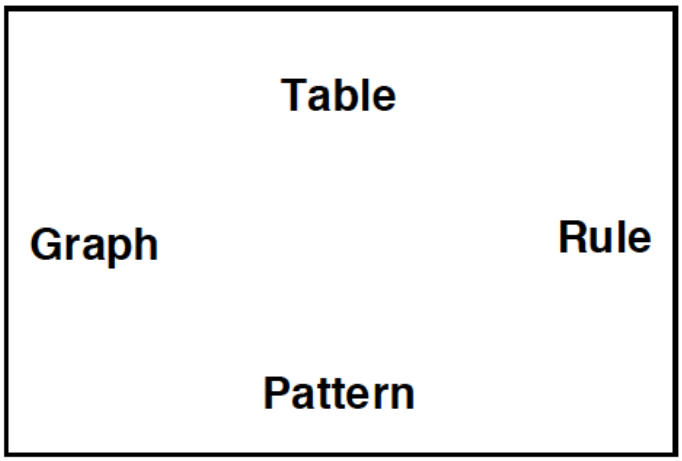
Tile Pattern #4

Rule

***y*=**

Problem 4-16

Draw lines and/or arrows to show which representations you have studied so far in this course. Explain the connections you learned today. Be sure to include anything you figured out about how the numbers in equations (rules) relate to tile patterns. Title this entry "Representations of Patterns Web" and label it with today's date.



Review & Preview — Problem 4-17

Simplify each of the following equations and solve for x. Show all work and check your solution.

a. $7 - 3x = -x + 1$

b. $-2 + 3x = -(x + 6)$

Problem 4-18

Leala can write a 500-word essay in an hour. If she writes an essay in 10 minutes, approximately how many words do you think the essay contains?

Problem 4-19

Complete the table below.

IN (x)	2	10	6	7	-3		-10	1000	*x*
OUT (y)	9	25	17			15			y=

a. Explain in words what is done to the input value (x) to produce the output value (y).

b. Write the rule you described in part (a) with algebraic symbols.

Problem 4-20

When Susan's brother went to college, she and her two sisters evenly divided his belongings. Among his possessions were 3 posters, 216 books, and 24 CDs. How were these items divided?

Problem 4-21

Kelso's mom wants to put a floating blanket over the family's circular wading pool to keep the heat in and the leaves out. The pool has a diameter of 10 feet.

a. How many square feet of blanket will Kelso's mother need?

b. If the pool supply store charges $0.10 per square foot for the blanket, how much will the material for the blanket cost?

Lesson 4.1.3
Connecting Linear Rules and Graphs

How does it Grow?

You have been looking at geometric patterns and ways in which those patterns can be represented with x→y tables, graphs, and equations. In Lesson 4.1.2, you worked with four different tile patterns and looked for connections between the geometric shapes and the numbers in the equations. Today you will go back to those four equations and look for connections to other representations.

By the end of this lesson, you should be able to answer the following target questions:

How is growth shown in a graph? How is growth shown in a rule?

How can you determine the number of tiles in Figure 0 from a graph?

How can you determine which tile pattern grows faster from a graph?

Problem 4-22

Examine the tile patterns from lesson 4.1.2, a-d

Make sure you have a rule for each tile pattern.

a. On the next page, complete the table for each rule.
b. Create a graph for each pattern. Put all patterns on the same set of axes. Use different colors for each pattern.
c. Explain how the growth appears in the pattern, in the table, in the graph, and in the rule.
d. What connections do you see between these representations? Describe any connections you see.

Pattern Analysis

Tile Pattern #1

Figure #	0	1	2	3	4
# of Tiles					

Tile Pattern #2

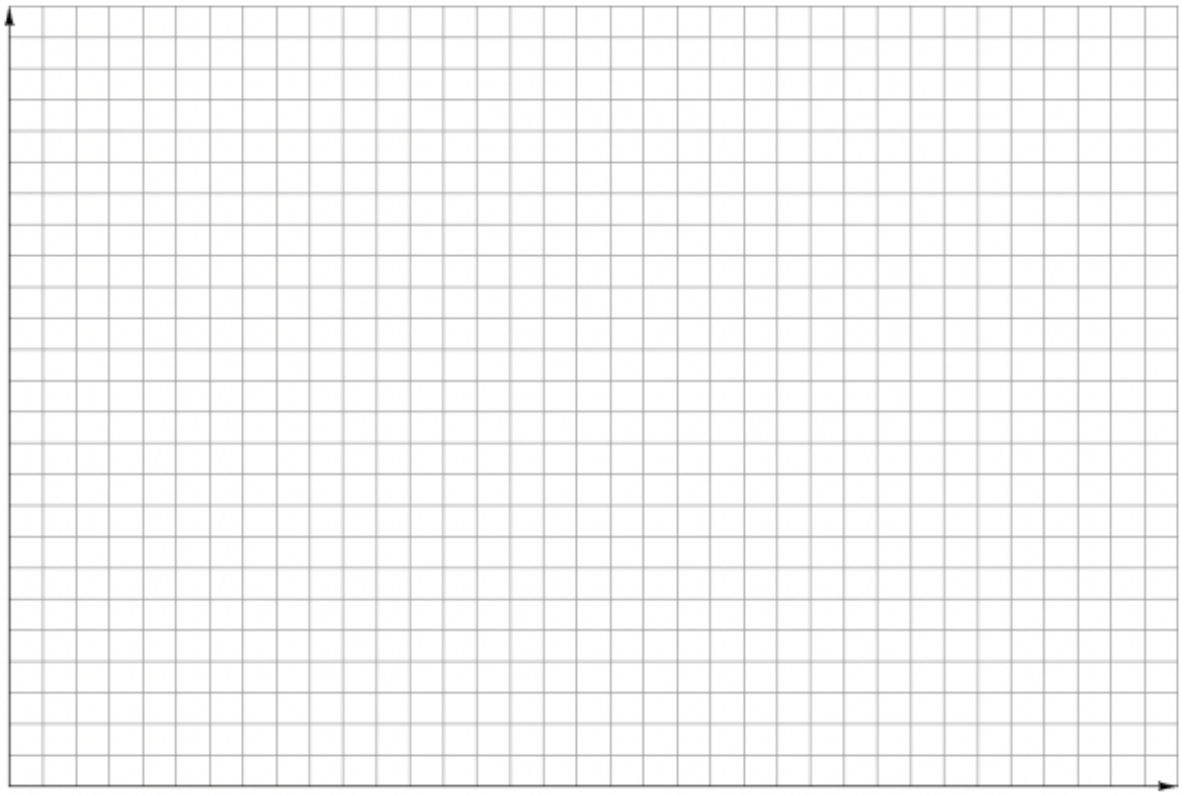
Figure #	0	1	2	3	4
# of Tiles					

Tile Pattern #3

Figure #	0	1	2	3	4
# of Tiles					

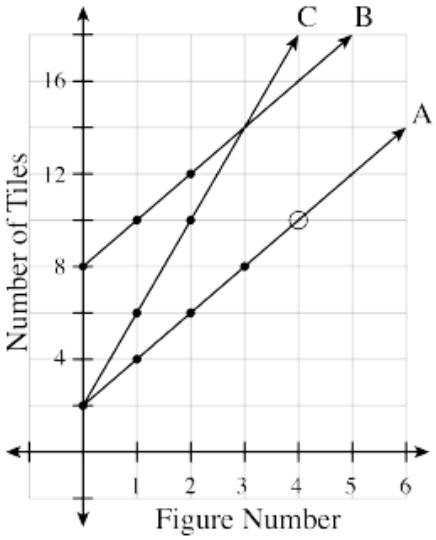
Tile Pattern #4

Figure #	0	1	2	3	4
# of Tiles					



Problem 4-23

The graph at right gives information about three new tile patterns. Remember that in this course, tile patterns will be considered to be elements of continuous relationships and thus will be graphed with a continuous line or curve.



Answer the following questions as a team.

a. What information does the circled point (O) on the graph tell you about tile pattern A?

b. Find the growth of each tile pattern. For example, how much does tile pattern A increase from one figure to the next? Explain how you know.

c. **<u>Look at the lines for tile patterns A and B</u>**.
What is the same about the two lines?

What conclusion can you make about these tile patterns?

What is different about the lines?

What does this tell you about the tile patterns?

Use what you see on the graph to justify your answers.

d. **<u>Look at lines A and C on the graph.</u>**
What do these two lines have in common?

In what ways are the lines different?

What does this tell you about the tile patterns?

Explain completely.

Problem 4-24

LEARNING LOG
In your Learning Log, answer the target questions for this lesson, reprinted below.

How is growth shown in a graph? *How is growth shown in a rule*?

How can you determine the number of tiles in Figure 0 from a graph?

How can you determine which tile pattern grows faster from a graph?

Review & Preview — Problem 4-25

Two of the connections in your Representations of Patterns Web are pattern → table and pattern → rule. Practice these connections as you answer the questions below.

a. Draw Figure 0 and Figure 4 for the pattern below
b. Represent the number of tiles in each figure with a table.
c. Represent the number of tiles in each figure with an algebraic rule.


Figure 0

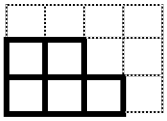


Figure 1

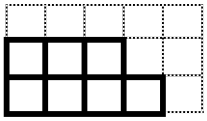


Figure 2


Figure 3

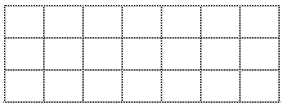


Figure 4

Figure Number	0	1	2	3	4	5	***x***
Number of Tiles							***y=***

Problem 4-26

Use the formula for the area of a circle to solve for the radius of the circle if the area is $78.5\ cm^2$. $(A = \pi r^2)$

Problem 4-27

For each of the equations below, solve for x. Show all work and check your solution.

a. $-2 + 2x = -x + 2 + x$

b. $2 - 3x = x + 2$

Problem 4-29

Joe drove 100 miles from San Francisco to Gilroy and used 4 gallons of gas. How much gas should he expect to use for a 3000-mile trip to New York City? What is the unit rate (miles per gallon)? Be sure to justify your reasoning.

Lesson 4.1.4

$y = mx + b$ *What is the Rule? How can I use it?*

In Lessons 4.1.2 and 4.1.3, you investigated connections between tile patterns, x→y tables, graphs, and rules (equations). Today you will use your observations about growth and Figure 0 to write rules for linear patterns and to create new tile patterns for given rules.

Problem 4-30

With your team, list some of the equations you have been working with in the past two lessons. What do all these rules have in common?

Problem 4-31

UNDERSTANDING $y = mx + b$

Rules for linear patterns can all be written in the form $y = mx + b$

In $y = mx + b$, ***x*** and ***y*** represent variables, while ***m*** and ***b*** represent parameters. Parameters are numbers that stay the same in the equation after they are chosen. Discuss these questions with your team:

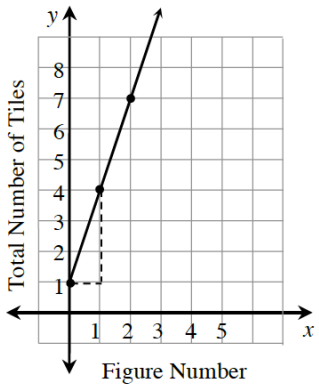
a. What does ***m*** tell you about the pattern?

b. What does ***b*** tell you about the pattern?

Problem 4-32

GRAPH → RULE

Allysha claims she can find the equation of a line by its graph without using a table. How is that possible? Discuss this idea with your team and then try to find the equation of the line at right without first making a table. Be ready to share with the class how you found the rule.



Problem 4-33

TABLE → RULE

Allysha wonders if she can use the idea of m and b to find the equation of a line from its table.

a. For example, if she knows the information about a linear pattern given in the table below, how can she find the equation of the line? Work with your team to complete the table and find the rule.

IN (x)	0	1	2	3	4	5	6
OUT (y)	−2						

+5 +5 +5. +5 +5 +5

$y =$

b. Use this same idea to find the rule of the linear tile patterns represented by the tables below.

IN (x)	–1	0	1	2	3	4	5
OUT (y)	3	5	7	9	11	13	15

$y =$

IN (x)	0	1	2	3	4	5	6
OUT (y)	7	4	1	–2	–5	–8	–11

$y =$

c. Write a summary statement explaining how you used your knowledge about m and b to quickly write a rule.

Problem 4-34

RULE → PATTERN

In each problem below, invent your own pattern that meets the stated conditions.

a. Draw Figures 0, 1, 2, and 3 for a tile pattern that has $y = 4x + 3$ as a rule.

b. A tile pattern decreases by 2 tiles. Figure 2 of the pattern has 8 tiles. Draw Figures 0, 1, 2, and 3 and write the rule (equation) for the pattern.

Problem 4-35

Invent two different tile patterns that grow by adding 4 every time but have different x→y tables. Draw Figures 0, 1, 2, and 3 and find rules for each of your patterns. What is different about your rules? What is the same?

Problem 4-36

LEARNING LOG

The linear equations you have been working with can be written in this general form: $y = mx + b$

In your Learning Log, summarize what you know about m and b so far. What does the m tell you about a pattern? What does the b tell you about a pattern? Where can you see m and b in each representation? Sketch examples if it helps. Title this entry "$y = mx + b$" and label it with today's date.

Review & Preview

Problem 4-37

Examine the x→y table below.

Figure number	0	1	2	3
Number of Tiles	5	9	13	17

a. Invent a tile pattern that fits this data.
b. How is the pattern growing? Show where the pattern of growth appears in the x→y table and the tile pattern.
c. Write a rule for this pattern.

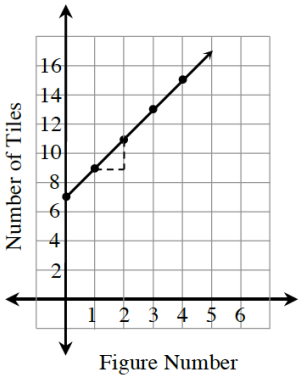
Problem 4-38

Look at the graph at right.
What statements can you make about the tile pattern the graph represents?

How many tiles are in Figure 0? Figure 1?

What is the pattern of growth?

What is the rule for the pattern?



Problem 4-39

For each equation below, solve for x. Check your solution, if possible, and show all work.

a. $3x - 6 + 1 = -2x - 5 + 5x$

b. $-2x - 5 = 2 - 4x - (x - 1)$

Problem 4-40

I am thinking of a number. When I double my number and then subtract the result from five, I get negative one. What is my number? Write and solve an equation.

Problem 4-41

Use your pattern skills to complete table below and a. and b.

In (x)	2	10				-3			x
Out (y)	4	28	13	-17	10		2.5	148	$y = 3x - 2$

a. Explain in words what is done to the input value, x, to produce the output value, y.

b. Explain the process you used to find the missing input values.

Lesson 4.1.5
Checking Connections

What are the Connections?

In the last several lessons, you have been finding connections and relationships between different representations of patterns. You have worked backward and forward. You have also used information about Figure 0 (or the starting point) and the pattern of growth to write rules. In today's activity, you will use pieces of information from various parts of the web to generate a complete pattern.

Problem 4-42 DAY 1

CHECKING THE CONNECTIONS: TEAM CHALLENGE

Today you are going to apply what you know about the starting point (Figure 0), the pattern of growth, and the connections between representations to answer some challenging questions. The information in each question, parts (a) through (d), describes a different pattern. The graph of each pattern is a line. From this information, generate the **rule, x→y table, graph**, and **tile pattern** (Figures 0 through 3) that follow the pattern. You may answer these questions in any order, but make sure you answer each one completely before starting another problem.

Work together as a team. The more you listen to how other people see the connections and the more you share your own ideas, the more you will know at the end of the lesson. Stick together and be sure to talk through every idea.

On graph paper, show four complete representations **(rule, x→y table, graph**, and **tile pattern)** for each pattern.
Remember to…
Generate the **rule, x→y table, graph**, and **tile pattern** (Figures 0 through 3) that follow the pattern.
You should be neat and readable. Use a ruler for all straight lines and makes sure to include all necessary parts to each representation; rule, table, graph, pattern.

a.

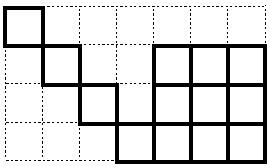
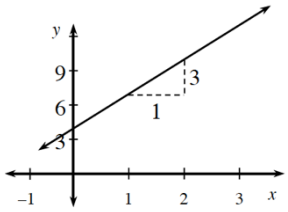
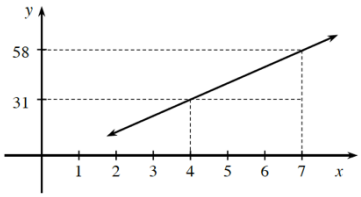


Figure 3



b.

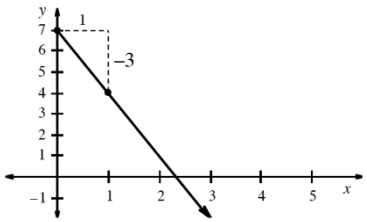


c.

Figure number	Number of Tiles
0	
1	
2	
3	12

Figure 8

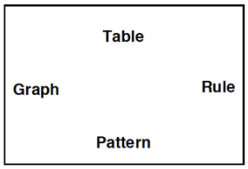
d.



Problem 4-43

REPRESENTATIONS OF PATTERNS WEB

Update your Representations of Pattern Web from problem 4-16 with any new connections that you can make between representations following today's work. Pay attention to the direction of any arrows that you draw.

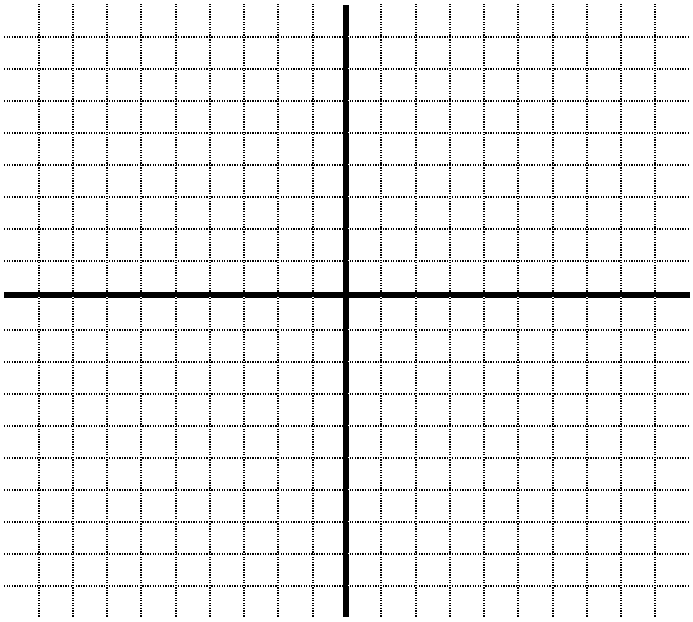


Review & Preview Day 1 Problem 4-44

Complete a table for the rule $y = 3x - 2$

a. Draw a complete graph for this rule.

a. Is $(-50,-152)$ a point on the graph? Explain how you know.



x	$y = 3x - 2$

Problem 4-45

Write down everything you know about the tile pattern represented by the x→y table at right. Be as specific as possible.

x	y
3	25
5	39
6	46
1	11

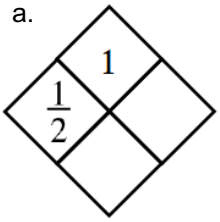
Problem 4-46

Find the area and circumference of a circle that has a diameter of 17 mm. Write your answers in terms of π and as a decimal approximation.

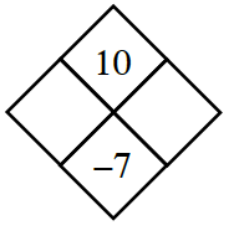
Problem 4-47

Copy and complete each of the Diamond Problems below. The pattern used in the Diamond Problems is shown at right.

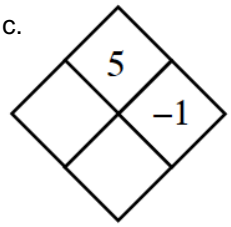
a.



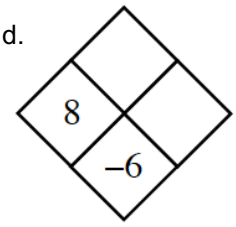
b.



c.



d.



Problem 4-48

Simplify each of the expressions below. You may use an Equation Mat and tiles.

a. $-(5x+1)$	b. $6x-(-5x+1)$
c. $-(1-5x)$	d. $-5x+(x-1)$

Lesson 4.1.5. Making Connections

Problem 4-42 DAY 2

CHECKING THE CONNECTIONS:
Continue working on problem 42 on graph paper. Be prepared to share your work with the class.

Remember to…
Generate the **rule, x→y table, graph**, and **tile pattern** (Figures 0 through 3) that follow the pattern.
You should be neat and readable. Use a ruler for all straight lines and makes sure to include all necessary parts to each representation; rule, table, graph, pattern.

Review & Preview Day 2 Problem 4-49

Invent a tile pattern that grows by 4 each time. Draw Figures 0, 1, 2, and 3. Use color or shading to show the growth.

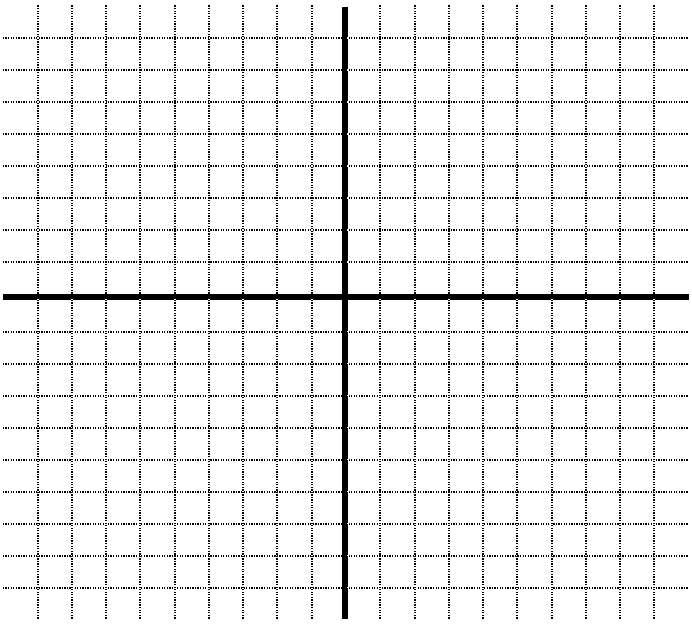
Problem 4-50

Complete a table for the rule $y = 3 - x$

a. Draw a complete graph for this rule.

b. Is (32,−29) a point on this graph? Explain why or why not.

x	$y = 3 - x$



Problem 4-51

For each equation below, solve for the variable. Check your solutions, if possible, and show all work.

a. $3p - 7 + 9 - 2p = p + 2$, solve for p

b. $-2x + 5 + (-x) - 5 = 0$, solve for x

Problem 4-51 continued

c. $12 = r + 6 - 2r$, solve for r

d. $-(y^2 - 2) = y^2 - 5 - 2y^2$, solve for y

Problem 4-52

a. $\frac{x}{8} = \frac{3}{4}$

b. $\frac{2}{5} = \frac{x}{40}$

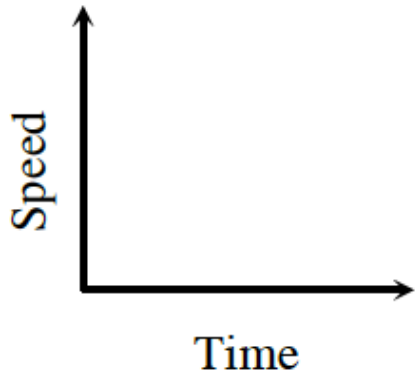
c. $\frac{1}{8} = \frac{x}{12}$

d. $\frac{x}{10} = \frac{12}{15}$

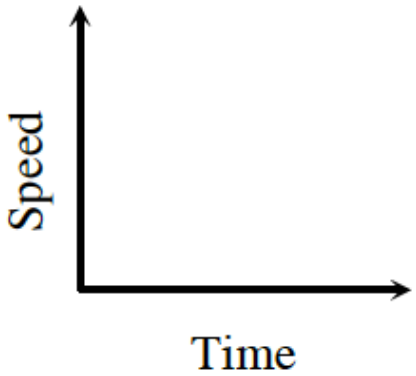
Problem 4-53

Use the graphs below to represent each story below using the axes labeled.

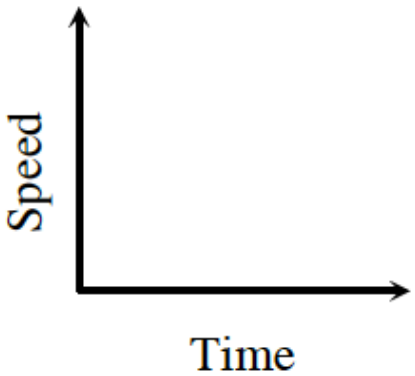
a. Luis rides his skateboard at the same speed all the way home. It takes him ten minutes to get there.



b. Corinna jogs along at the same speed until she reaches a hill, and then she slows down until she finally stops to rest.



c. Sergei is talking with his friends at the donut shop when he realizes that it is almost time for math class. He runs toward school, but he slows to a walk when he hears the bell ring and realizes that he is already late. He sits down in class four minutes after he left the donut shop



Lesson 4.1.6
Graphing a line without an x-y Table

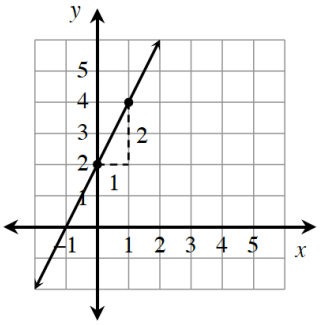
How can I use growth?

In the last several lessons, you have been finding connections and relationships between different representations of patterns. You have worked backward and forward. You have also used information about Figure 0 (or the starting point) and the pattern of growth to write rules. In today's activity, you will use pieces of information from various parts of the web to generate a complete pattern.

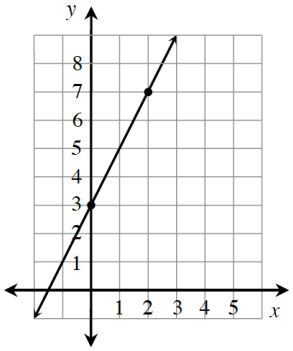
Problem 4-54

For each of the graphs below:
-Write a rule.
-Describe how the pattern changes and how many tiles are in Figure 0.

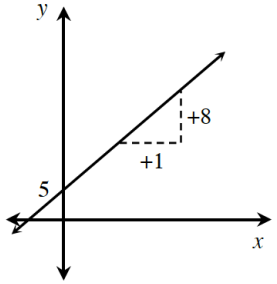
a.



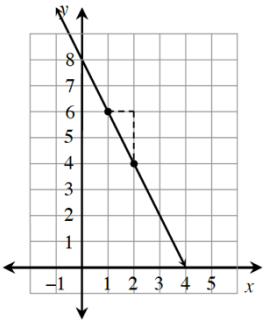
b.



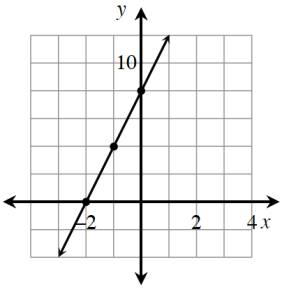
c.



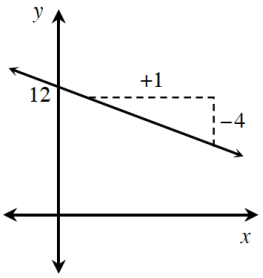
d.



e.



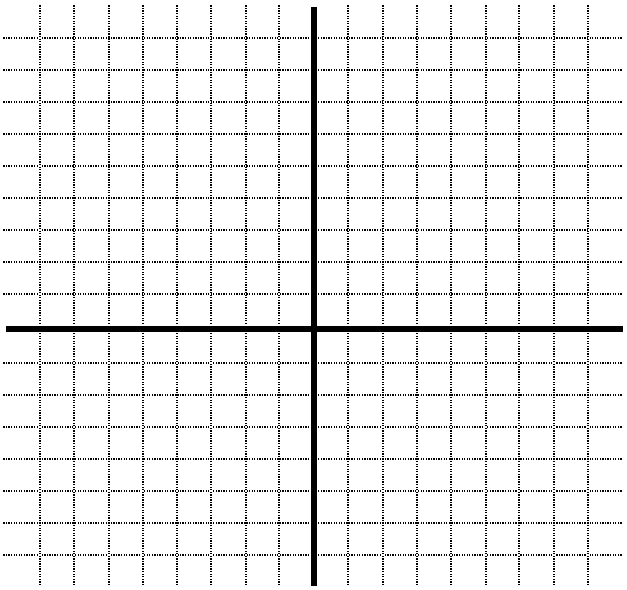
f.



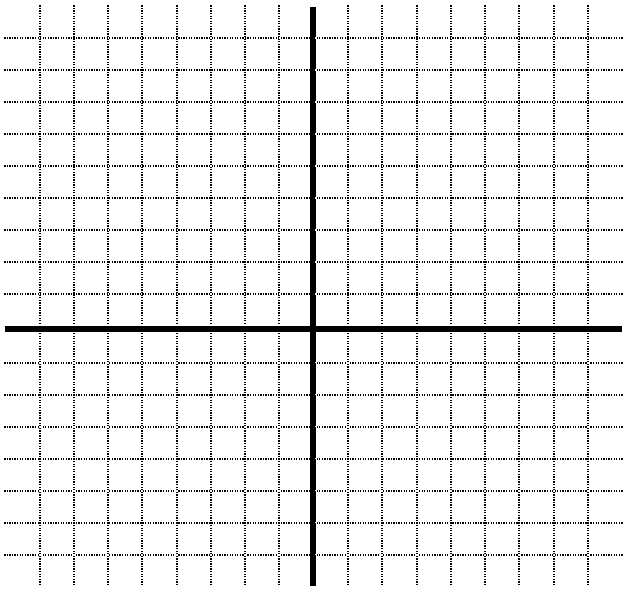
Problem 4-55

Now reverse the process. Graph the following rules without first making a table. Parts (a) and (b) can go on the same set of axes, as can parts (c) and (d). Label each line with its equation, y-intercept, and a growth triangle.

a. $y = 4x + 3$ b. $y = -2x$



c. $y = -3x + 8$ d. $y = x - 1$



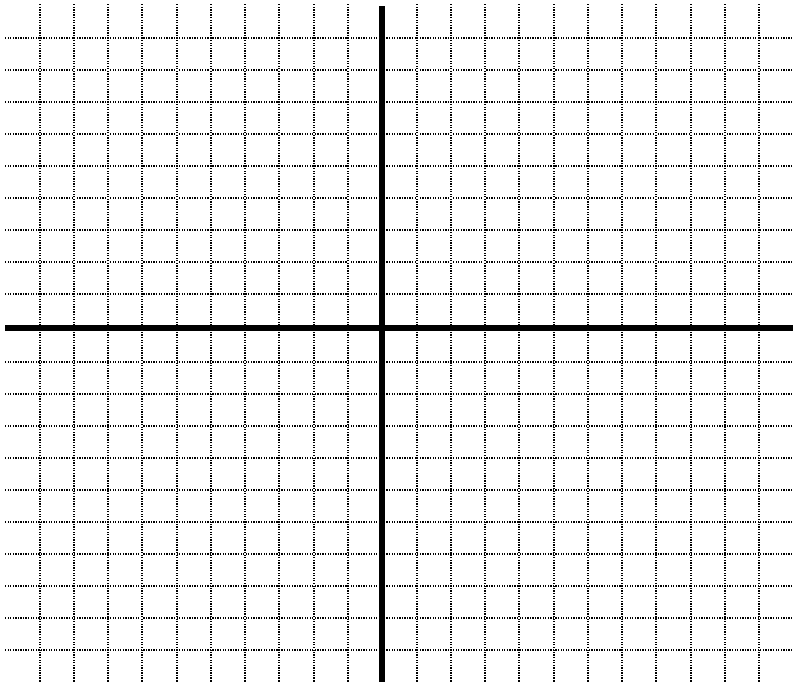
Problem 4-56

Draw a graph that fits each description below and then label each line with its equation. You can put all of the graphs on one set of axes if you label the lines clearly. Use what you know about the growth pattern and Figure 0 to help you.

a. A pattern that has three tiles in Figure 0 and adds four tiles in each new figure.

b. A pattern that shrinks by three tiles between figures and starts with five tiles in Figure 0.

c. A pattern that has two tiles in all figures.



Problem 4-57

Now reverse your process to describe the pattern represented by the rule $y = -2x + 13$. Be as detailed as you can.

Problem 4-58

a. CONSOLIDATING YOUR LEARNING
Find the Representations of Patterns Web that you updated at the end of Lesson 4.1.5. On it, add arrows for any new connections between representations that you can now make.

a. LEARNING LOG
In your Learning Log, write a step-by-step process for graphing directly from a rule. It may help you to think about these questions as you write:

What information do you get from your rule?
How does that information show up on the graph?
Where does your graph start?
How do you figure out the next point?
What should you label to make it a complete graph?

- Title this entry "Graphing Without an x→y Table," and label it with today's date.

Review & Preview

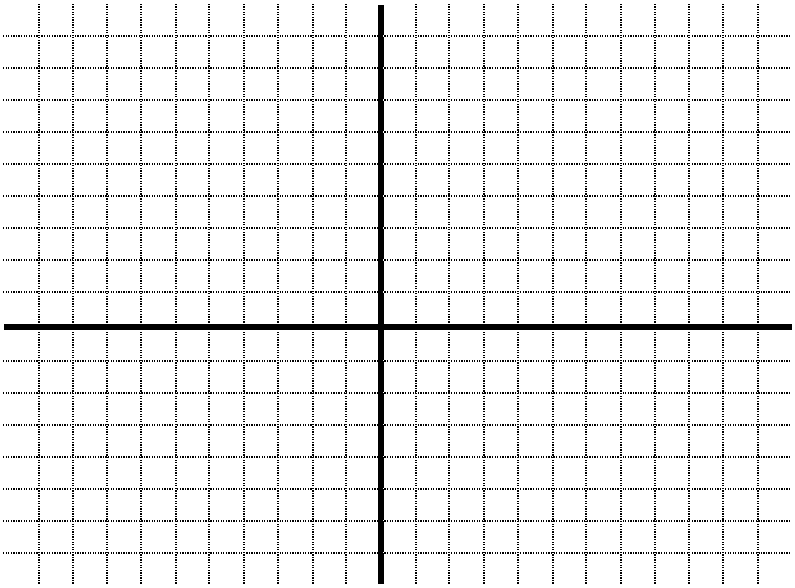
Problem 4-59

Use what you know about *m* and *b* to graph each rule below without making a table. Draw a growth triangle for each line. Label each line with its equation and use a different color

a. $y = 2x - 3$

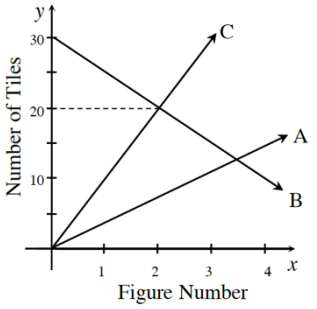
b. $y = -2x + 5$

c. $y = \frac{1}{2}x + 1$



Problem 4-60

Examine the graph at right, which displays three tile patterns.



a. What do you know about Figure 0 for each of the three patterns?

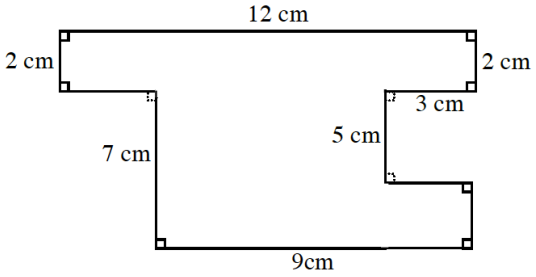
b. Which pattern changes most quickly? How quickly does it change?

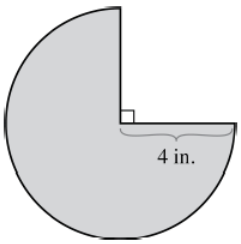
c. Which figure number has the same number of tiles in patterns B and C? Explain how you know.

d. Write a rule for pattern B.

Problem 4-62

Find the **area** and **perimeter** of each shape. Show your work and label your answers.





Problem 4-63

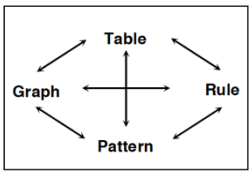
Ms. B is making snickerdoodle cookies. Her recipe uses one and a half teaspoons of cinnamon to make two dozen cookies. If she needs to make thirteen dozen cookies to give one cookie to each of her students, how much cinnamon will she need?

There are three teaspoons in one tablespoon. How many tablespoons and teaspoons will Ms. B need?

Lesson 4.1.7
Completing the Web

What are the connections?

After all of the work you have done with equations in $y = mx + b$ form, you know a lot about starting with one representation of a pattern and moving to different representations. Today you will work with your team to make sure you are confident moving around the Representations of Patterns Web.



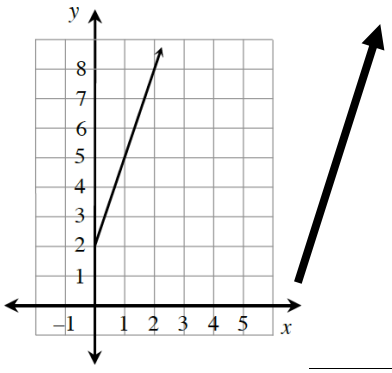
Answer problems 4-64 and 4-65 on graph paper. Discuss each problem with your team to get as much as you can out of these problems.

Problem 4-64

GRAPH → PATTERN and TABLE → PATTERN

On graph paper, draw tile patterns (Figures 0, 1, and 2) that could represent the data shown below. Be creative, but make sure that the growth of each pattern makes sense to your teammates.

a.



b.

x	*y*
0	14
1	11
2	8
3	5
4	2

Problem 4-65

REVISITING "GROWING, GROWING, GROWING"

Problem 1-10 from Chapter 1 asked you to determine which figure in the pattern shown below would have 79 tiles. Now that you know more about tile **patterns**, **x→y tables**, **graphs**, and **rules**, you can show the answer to this question in multiple ways.

Your Task: Solve this problem by completing the following tasks. Be sure to record your work and justify your thinking.

- On the grid below, extend the pattern to include Figures 1 and 5.
- Create a table, a graph, and a rule, for this pattern.
- Which figure will have 79 tiles? Use as many representations as you can to justify your answer.

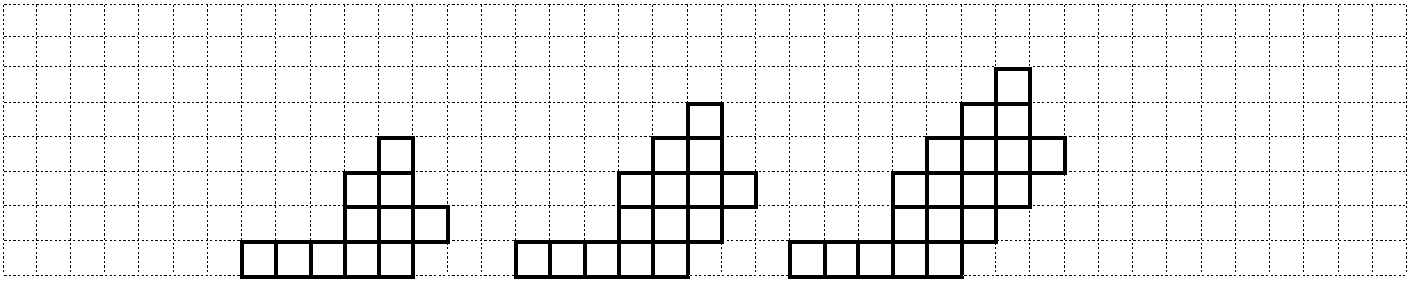
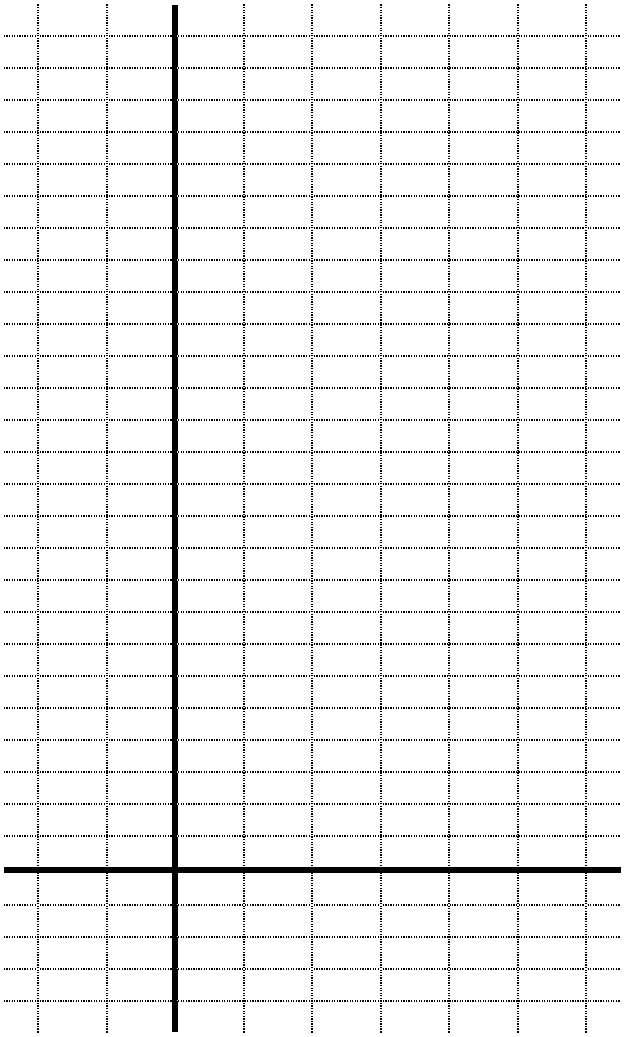


Figure 1 Figure 2 Figure 3 Figure 4 Figure 5

Table

x	*y*
0	
1	
2	
3	
4	
5	

Rule:



"Representations of Patterns"

Tool Kit page 31

Review & Preview — Problem 4-67

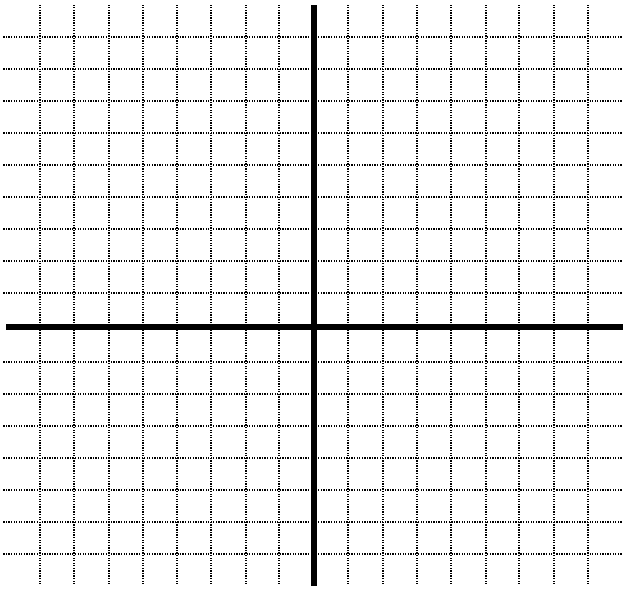
Use what you know about ***m*** and ***b*** to graph each equation below without making a table. Show a growth triangle on each graph and label the x- and y-intercepts.

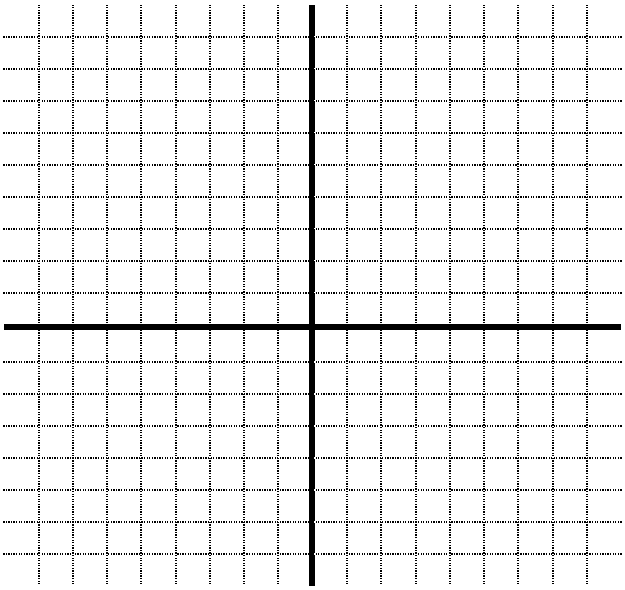
a. $y = 3 - 2x$

b. $y = 2x$

c. $y = 3$

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





Problem 4-68

Complete each x→y table below. Using what you know about ***m*** and ***b***, write an equation that represents the data in the table.

a.

x	*y*
0	5
1	7
2	9
3	11
4	13
30	
200	
	505
x	***y=***

b.

x	*y*
0	4
1	2
2	0
3	-2
4	-4
30	
150	
300	
x	***y=***

c.

x	*y*
-2	7
-1	4
0	1
1	-2
2	-5
3	
100	
	70
x	***y=***

Problem 4-69

For a tile pattern with the rule $y = 6x + 4$ (where x represents the figure number and y represents the number of tiles), which figure number has 40 tiles in it? How do you know?

Problem 4-70

Josie and Jules are building a model car. They find that the real car is 54 inches tall and 180 inches long. They decide to make their model 3 inches tall, but now they are having a disagreement. Josie thinks that their model should be 10 inches long and Jules thinks it should be 129 inches long. Help them settle their argument by deciding if either of them is correct. Explain how you know exactly how long their model should be.

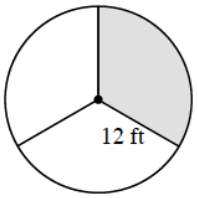
Problem 4-71

This problem is a checkpoint for area and perimeter of circles and composite figures. It will be referred to as Checkpoint 4. **Find the area and perimeter or circumference of each figure.**

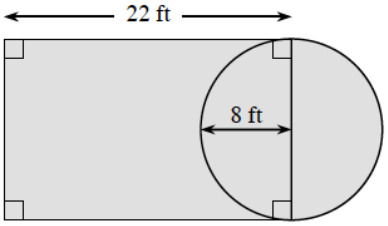
a. Circle with radius 3 cm.

b. Circle with diameter 10 feet.

c. Only the shaded region (each sector has equal area).



d.



Chp. 4 Closure
Reflection and Synthesis *What have I learned?*

CL 4-72

Examine the pattern below, and then complete parts (a) through (f) that follow.

a. Draw Figure 0 and Figure 4.
b. Make a table showing Figure 0 through Figure 4.
c. Write a rule to represent the pattern.
d. Graph of the number of tiles in each figure.
e. What is the growth for the pattern?
f. Predict how many tiles Figure 100 will have.

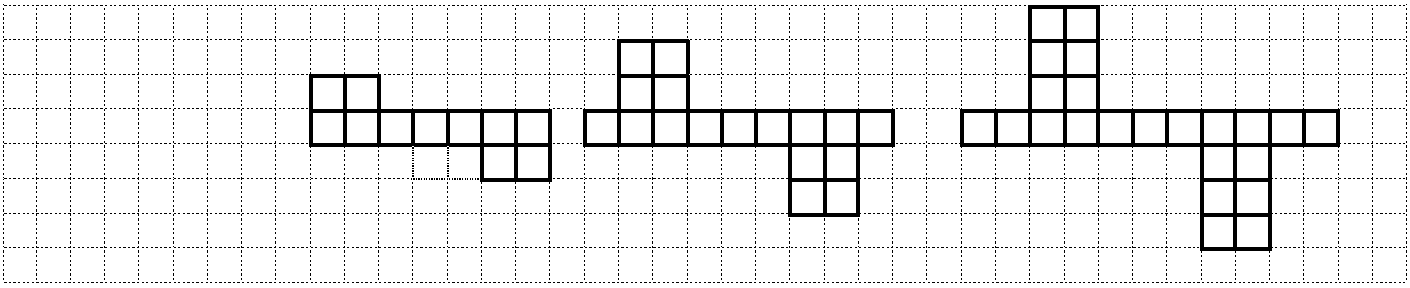
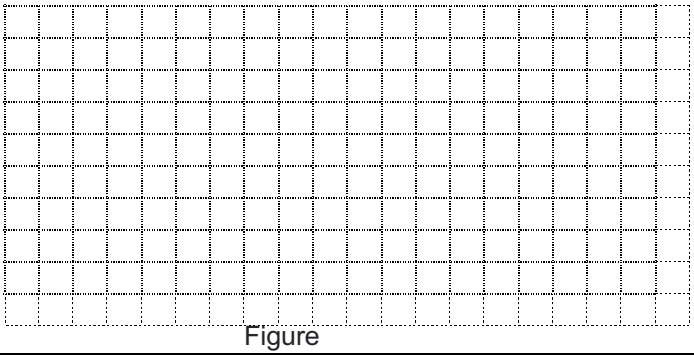


Figure 0 Figure 1 Figure 2 Figure 3

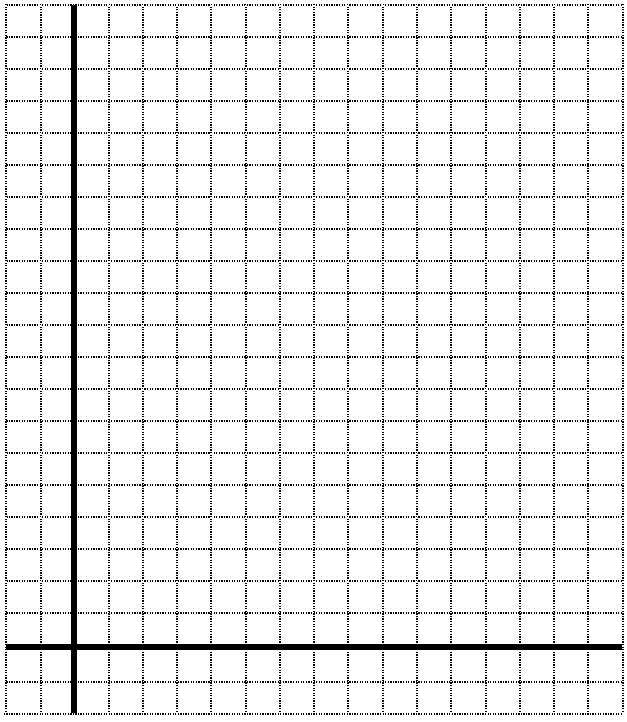


Figure

Table

					Rule

Graph



Sketch and label Figure 100

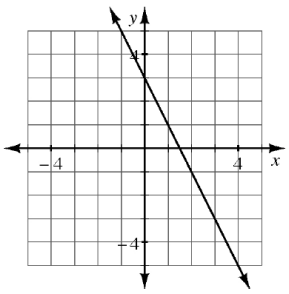
CL 4-73

Are the two expressions below equal? Show how you know.

$$4x^2 + 2x - 5 - 3x \text{ and } 6x^2 - x + 3 - 2x^2 - 8$$

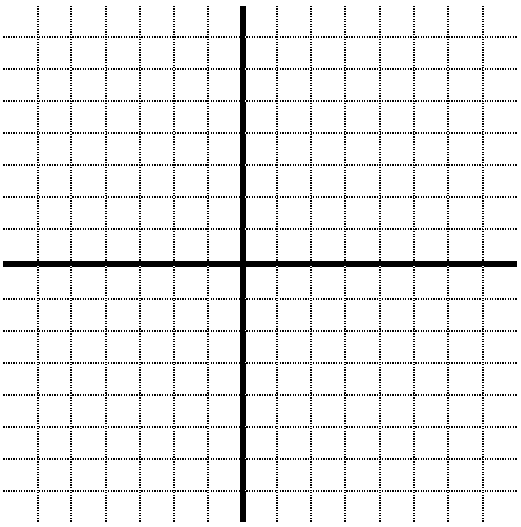
CL 4-74

Examine the graph at right.



a. Give two ways you can tell that the rule $y = 2x - 3$ does not match the graph.

b. Make a graph that matches the rule $y = 2x - 3$.



c. Find a rule that represents the graph at right.

CL 4-75

Consider the rule $y = 5x + 7$

a. How many tiles are in Figure 0?

b. Which figure has 37 tiles?

c. In the equation $y = mx + b$, what do the letters m and b represent?

CL 4-76

Molly read 75 pages of the latest thriller mystery novel in 45 minutes. What was her unit rate? If she continues to read at this rate, how long will it take her to read the entire 425-page novel?

CL 4-77

Solve this equation to find x: $2 - (3x - 4) = 2x - 9$

CL 4-78

Simplify the following expressions, if possible.

a. $x + 4x - 3 + 3x^2 - 2x$

b. $2x + 4y^2 - 6y^2 - 9 - x + 3x$

c. $3x^2 + 10y - 2y^2 + 4x - 14$

d. $20 + 3xy - 4xy + y^2 + 10 - y^2$

e. Evaluate the expressions in parts (a-d) above when $x = 5$ *and* $y = -2$.

a.

b.

c.

d.

CL 4-79

Complete the table for the linear pattern below.

IN (x)	-4	-3	-2	-1	0	1	2	3	4
OUT (y)					-2	3	8		

a. What is the y-intercept? What is the pattern of growth?

b. Find the rule for this line.

c. If the output number (y) is −52, what was the input number (x)?

CL 4-80

For the problem below, define a variable, write an equation, and solve it.

For the school play, the advance tickets cost $3, while tickets at the door cost $5. Thirty more tickets were sold at door than in advance, and $2630 was collected. How many of each kind of ticket were sold? Write your answer in a sentence.