5

Systems of Equations

CHAPTER 5 Systems of Equations

In the last chapter, you worked with the connections between different representations of patterns. In this chapter, most of your work will focus on rules (equations). Specifically, you will focus on how to solve them.

In Section 5.1, you will solve equations with multiple variables for one of the variables, creating an equivalent equation. You will also learn an efficient way to solve equations with fractions or decimals.

In Section 5.2, you will explore situations that can be represented by a line and study what it means when two lines intersect (cross each other). By the end of this chapter, you will know how to use graphs, tables, patterns, and rules to solve almost any problem involving lines.

In this chapter, you will learn:

Guiding Questions

How can I solve it?

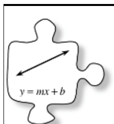
Is there another way?

In how many different ways can it be represented?

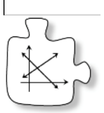
How does the pattern show up in the rule, table, and graph?

How does the pattern grow?

- How to solve multi-variable equations for one of the variables.
- How to solve equations with fractional coefficients.
- How to find the point where two lines intersect.
- How to use the connections between graphs, tables, rules, and patterns to solve problems.



Section 5.1 In Section 5.1, you will continue the solving focus that you began in Chapter 3. You will study how to solve multi-variable equations for one of the variables. You will also learn how to solve equations that contain fractions.



Section 5.2 This section will start by examining word problems in which two amounts are compared. You will use your knowledge of graphs and rules to write equations for word problems. Then, using the Equation Mat, you will solve a pair of linear equations to determine where two lines cross.

Lesson 5.1.1
Working with Multi-Variable Equations

How to change it to $y = mx + b$ form?

So far in this course, you have used your Equation Mat and/or symbols to find solutions for all types of linear equations with one variable. Today you will learn how to apply these skills to solving linear equations with two variables.
As you work today, keep these questions in mind:

What is a solution to an equation? What does it look like?

What is the growth pattern? What is the y-intercept?

Problem 5-1

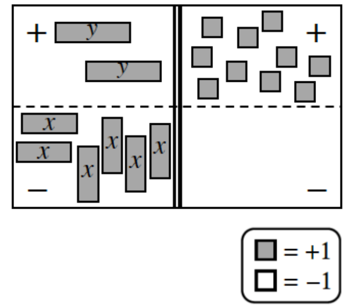
You now have a lot of experience working with equations that compare two quantities. For example, while working with the height of a tree, you found the relationship $\boldsymbol{y = 4x + 5}$, which compared $\boldsymbol{x}$ (the number of years after it was planted) with $\boldsymbol{y}$ (its height in feet). Use the equation for this tree to answer the questions below.

a. What was its starting height? How can you tell from the equation?

b. What was its growth rate? That is, how many feet did the tree grow per year? Justify your answer.

Problem 5-2

CHANGING FORMS



You can find the growth rate and starting value for $\boldsymbol{y = 4x + 5}$ quickly, because the equation is in $\boldsymbol{y = mx + b}$ form. But what if the equation is in a different form? Explore this situation below.

a. The line $\boldsymbol{-6x + 2y = 10}$ is written in **standard form**. Can you tell what the growth of the line is? Its y-intercept? Predict these values.

b. The equation $\boldsymbol{-6x + 2y = 10}$ is shown on the Equation Mat at right. Set up this equation on your Equation Mat using tiles. Using only "legal" moves, rearrange the tiles to get $\boldsymbol{y}$ by itself on the left side of the mat. Record each of your moves algebraically.

c. Now use your result from part (b) to find the growth pattern and y-intercept of the line $\boldsymbol{-6x + 2y = 10}$. Did your result match your prediction in part (a)?

Problem 5-3

Your teacher will assign you one of the linear equations listed below. For your equation:

- Use Algebra tiles with Equation Mat eTool (CPM) to set up the equation on your Equation Mat.
- Using only "legal" moves, rearrange your tiles to create an equation that starts with "$\boldsymbol{y} =$ …" Be sure to record all of your moves algebraically below and be prepared to share your steps with the class.
- What is the pattern of growth for your line? What is the y-intercept? How can you tell?

a. $2x + y = 3x - 7$

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

c. $3y + 2 = 2y - 5x$

d. $2(y - 3) = 2x - 6$

e. $5 - 3(x + 1) = 2y - 3x + 2$

f. $x - (y + 2) = 2(2x + 1)$

Problem 5-4	
Solve each of the following equations for the indicated variable. Use your Equation Mat if it is helpful. Write down each of your steps algebraically.	
a. Solve for y: $2(y-3)=4$	b. Solve for x: $2x+5y=10$
c. Solve for y: $6x+3y=4y+11$	d. Solve for x: $3(2x+4)=2+6x+10$
e. Solve for x: $y=-3x+6$	f. Solve for p: $m=8-2(p-m)$
g. Solve for q: $4(q-8)=7q+5$	h. Solve for y: $x^2+4y=2(3x-6-x)+x^2$

"Linear Equations"

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METHODS AND MEANINGS

MATH NOTES

Linear Equations

A **linear equation** is an equation that forms a line when it is graphed. This type of equation may be written in several different forms. Although these forms look different, they are equivalent; that is, they all graph the same line.

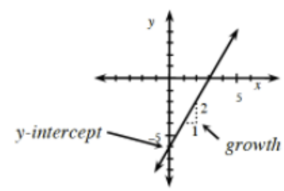
Standard form: An equation in $ax + by = c$ form, such as $6x - 3y = 18$.

$y = mx + b$ **form:** An equation in $y = mx + b$ form, such as $y = 2x - 6$.

You can quickly find the **growth** and **y-intercept** of a line in $y = mx + b$ form. For the equation $y = 2x - 6$, the growth is 2, while the y-intercept is $(0, -6)$.

$$y = 2x - 6$$

growth *y-intercept*



Review & Preview	Problem 5-5
A tile pattern has 5 tiles in Figure 0 and adds 7 tiles in each new figure. Write the equation of the line that represents the growth of this pattern.	

Problem 5-6

a. Solve for x: $2x + 22 = 12$	b. Solve for y: $2x - y = 3$

c. Solve for x: $2x + 15 = 2x - 15$	d. Solve for y: $6x + 2y = 10$

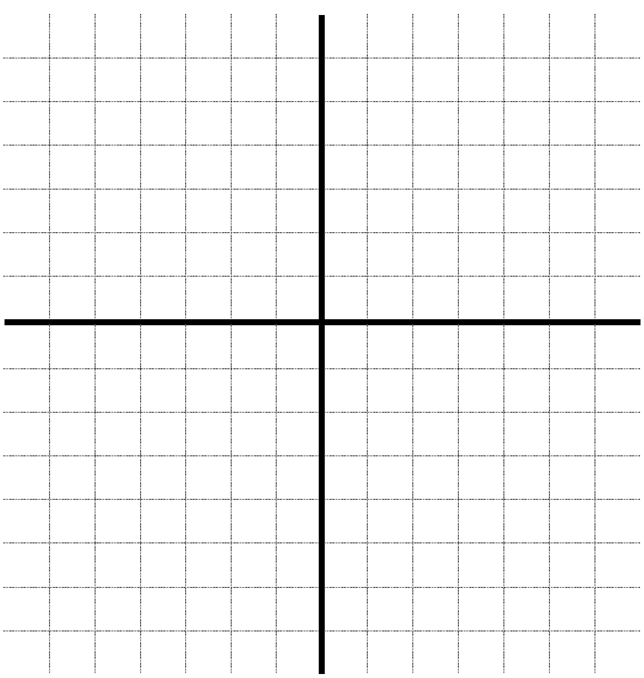
Problem 5-7

Solve each of the following equations for x. Then check each solution

a. $\frac{x}{16} = \frac{7}{10}$	b. $\frac{6}{15} = \frac{3}{x}$	c. $\frac{2x}{5} = \frac{12}{8}$	d. $-8 = \frac{2}{x}$

Problem 5-8

Graph the lines $y = -4x + 3$ and $y = x - 7$ on the same set of axes. Then find their point of intersection.



Problem 5-9

Draw Figures 1, 2, and 3 for a tile pattern that could be described by $\boldsymbol{y = -3x + 10}$

figure 1 figure 2 figure 3

Lesson 5.1.2
Solving Equations with Fractions

How can I eliminate fractions in equations?

Earlier in this course, you worked with proportions such as $\frac{3}{5} = \frac{x}{8}$ One way to begin solving a proportion is to eliminate the fractions and create an equivalent equation. When you eliminate the fractions, it is easier to solve.

Fraction elimination is not just for proportions, however. It also applies to other equations with fractions. In this lesson, you will learn how to eliminate fractions in equations. Then you will be able to use what you learned about solving equations to complete the problems.

Problem 5-10

Hannah wants to solve $0.04x + 1 = 2.2$. *"I think that I need to use my calculator because of the decimals,"* she told Michael. Suddenly Hannah blurted out, "*No, wait! What was the way we learned to rewrite a proportion equation without fractions? Maybe we can use that idea here to get rid of the decimals.*"

a. What is Hannah talking about? Explain what she means. Then rewrite the equation so that it has no decimals.

b. Now solve the new equation (the one with no decimals). Check your solution.

Problem 5-11

Rewriting $\mathbf{0.04x + 1 = 2.2}$ in the previous problem gave you a new, equivalent equation that was easier to solve. If needed, review the Math Notes box in this lesson for more information about equivalent equations.

How can each equation below be rewritten so that it is easier to solve? With your team, find an equivalent equation for each equation below. If the original equation has large numbers, make sure the equivalent equation has smaller numbers. If the original equation has fractions or decimals, eliminate the fractions or decimals in the equivalent equation. Solve each new equation and check your answer.

a. $\mathbf{2.1x + 0.6 = 17.4}$	b. $\mathbf{100x + 250 = -400}$
c. $\mathbf{\frac{2x}{3} = 30}$	d. $\mathbf{\frac{x}{5} + 1 = -6}$

Problem 5-12

Examine the equation $\frac{x}{3}+\frac{x}{5}=16$, and then answer the questions below.

a. Multiply each term by 3. What happened to the fractions? Do any fractions remain?

$$\frac{x}{3}+\frac{x}{5}=16$$

b. If you had multiplied each term in the original equation by 5 instead of 3, would you have eliminated all the fractions?

c. Find a number that you can use to multiply by all the terms that will get rid of all the fractions. How is this number related to the numbers in the equation?

$$\frac{x}{3}+\frac{x}{5}=16$$

d. Solve your new equation from part (c) and check your equation.

Problem 5-13

Use the strategy you developed in problem 5-12 to solve each of the following equations.

a. $\frac{a}{7}+\frac{a}{3}=10$	b. $\frac{3y}{5}+\frac{3}{2}=\frac{7y}{10}$

c. $\frac{(2x-3)}{6} = \frac{2x}{3} + \frac{1}{2}$	d. $\frac{b+3}{3} - \frac{b}{4} = \frac{b-2}{5}$

Problem 5-14

Sam can paint an apartment living room in 3 hours, and Pam can paint the same room in 2 hours. The solution to the equation $\frac{x}{3} + \frac{x}{2} = 1$ describes how long it will take them to paint the living room if they work together. Before solving this problem, make a guess about the answer. Then solve the equation.

How did your guess compare?

Most people are surprised with the correct solution!

METHODS AND MEANINGS
MATH NOTES

"Equivalent Equations"

Tool Kit page 35

Review & Preview — Problem 5-18

Solve each equation below.

a. $\frac{x}{2}+\frac{x}{6}=7$

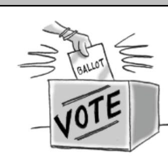
b. $\frac{x}{9}+\frac{2x}{2}=\frac{1}{3}$

Problem 5-19

Fisher thinks that any two lines must have a point of intersection. Is he correct? If so, explain how you know. If not, produce a **counterexample** and explain your reasoning. (In this case, a counterexample would be an example of two lines that do not have a point of intersection.)

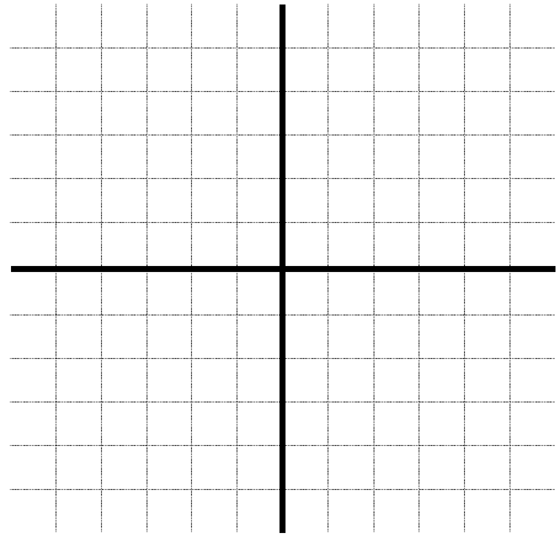
Problem 5-20

In the last election, candidate B received twice as many votes as candidate A. Candidate C received 15,000 fewer votes than candidate A. If a total of 109,000 votes were cast, how many votes did candidate B receive? Write and solve an algebraic equation.



Problem 5-21

Jamila wants to play a game called "Guess My Line." She gives you the following hint: "Two points on my line are (1,1) and (2,4)."



a. What is the growth rate of her line? A graph of the line may help.

b. What is the y-intercept of her line?

c. What is the equation of her line?

Problem 5-22

Solve each of the following equations. Be sure to show your work carefully and check your answers.

a. $2(3x-4)=22$	b. $6(2x-5)=-(x+4)$
c. $2-(y+2)=3y$	d. $3+4(x+1)=159$

Lesson 5.2.1
Introduction to Systems of Equations

When are they the Same?

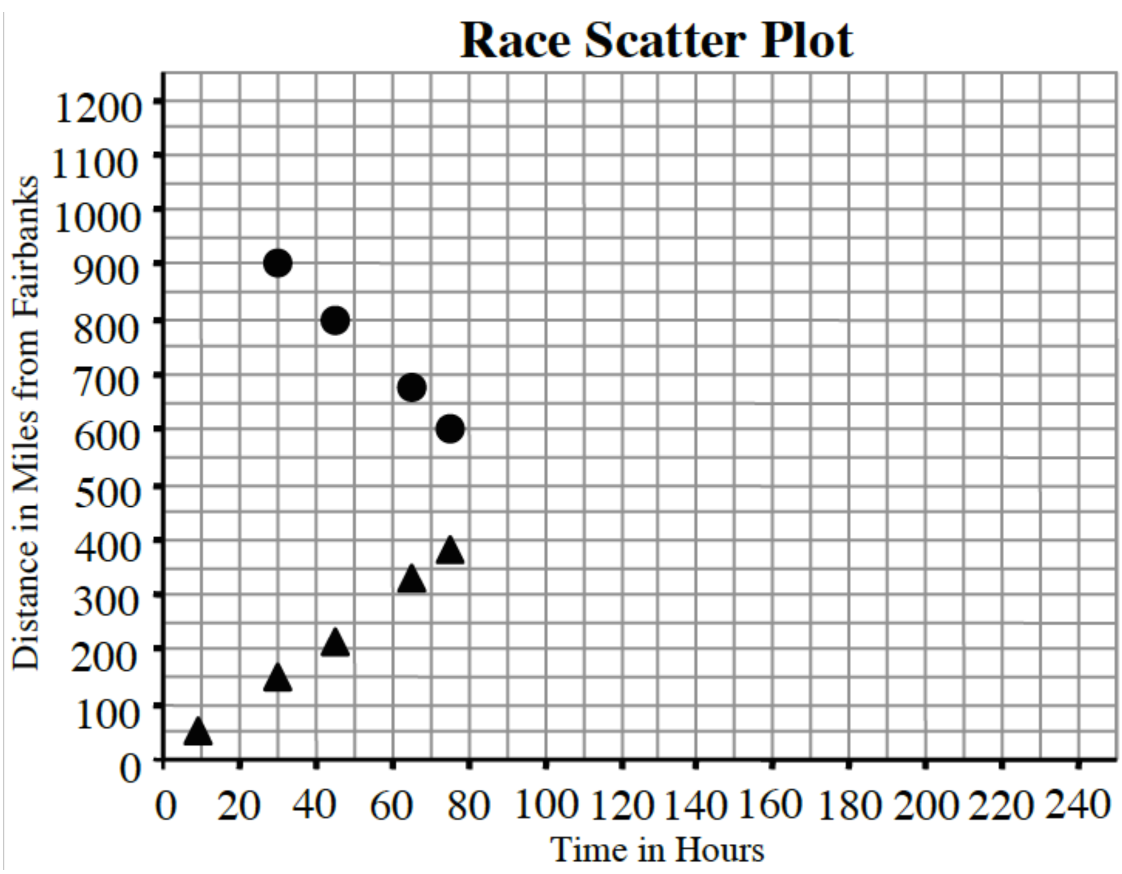
In Section 4.1, you graphed lines and curves that represented tile patterns. But what happens when you graph two lines at the same time? What can you learn? Today you will use data, graphs, and rules to examine what happens when two lines or curves intersect.

Problem 5-23

The Iditarod Trail Sled Dog Race is famous for its incredible length and its use of dogs. In 2015, the sled drivers, known as mushers, started their dog sleds at Fairbanks, Alaska, and rode through the snow for several days until they reached Nome, Alaska. Along the route, there were stations where the competitors checked in, so data was kept on the progress of each team. Joyla and her team of dogs checked in at the first five checkpoints. Her buddy Evie left Nome (the finish line) on the day the race started to meet Joyla and offer encouragement. Evie traveled along the route toward the racers on her snowmobile. The progress of each person is shown on the graph that follows.

Your Task: With your team, analyze the data on the graph. Answer the questions below as you work.

- Which data represents Evie? Which represents Joyla? How can you tell?
- When did Evie meet Joyla?
- How long was the race? How can you tell?
- Who traveled faster? Explain how you know.
- Approximately how long did it take Joyla to finish the race? How did you find your answer?



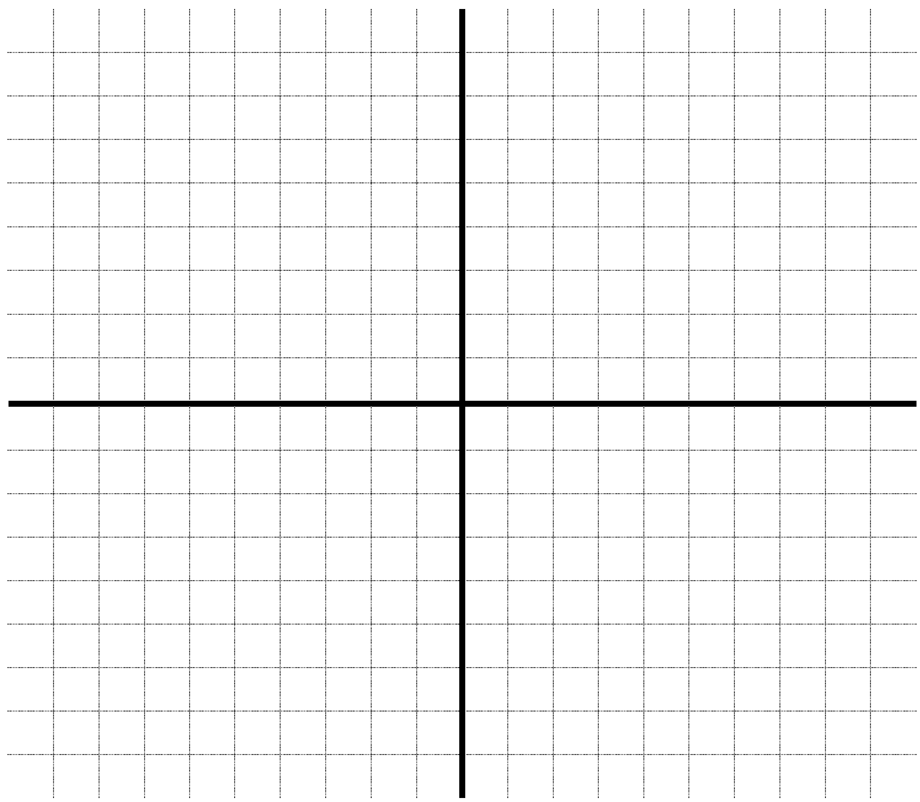
Problem 5-24

The point where two lines (or curves) cross is called a point of intersection. Two or more lines (or curves) are called a system of equations. When you work with data, points of intersection can be meaningful, as you saw in the last problem.

a. On graph paper, graph $y = 3x - 4$ and $y = -2x + 6$ on the same set of axes.

b. Find the point of intersection of these two lines and label the point with its coordinates; that is, write it in the form (x,y).

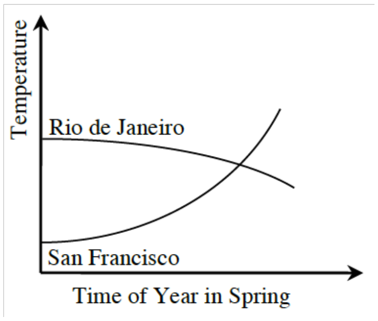
c. What is the significance of this point for the two rules in part (a)?



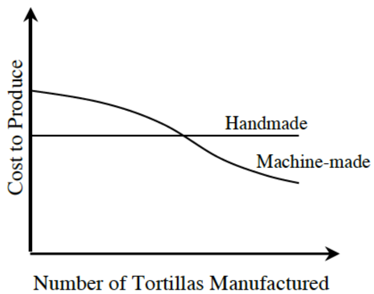
Problem 5-25

The meaning of a point of intersection depends on what the graph is describing. For example, in problem 5-23, the point where Joyla's and Evie's lines cross represents when they met during the race.
Examine each of the graphs below and **write a brief story** that describes the information on the graph. Include a sentence explaining what the point of intersection represents.

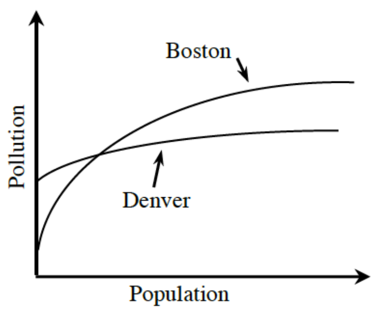
a.



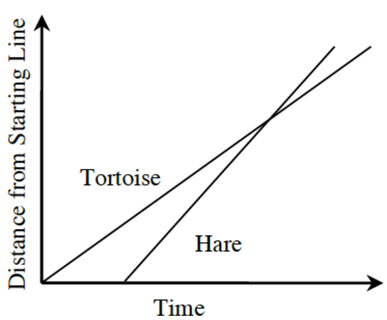
b.



c.



d.



"Solving Equations with Fractions"

FRACTION BUSTERS

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METHODS AND MEANINGS

MATH NOTES

Solving Equations with Fractions (also known as Fraction Busters)

Example: Solve $\frac{x}{3}+\frac{x}{5}=2$ for x.

This equation would be much easier to solve if it had no fractions. Therefore, the first goal is to find an equivalent equation that has no fractions.

$$\frac{x}{3}+\frac{x}{5}=2$$

To eliminate the denominators, multiply both sides of the equation by the common denominator. In this example, the lowest common denominator is 15, so multiplying both sides of the equation by 15 eliminates the fractions. Another approach is to multiply both sides of the equation by one denominator and then by the other.

The lowest common denominator of $\frac{x}{3}$ and $\frac{x}{5}$ is 15.

$$15\cdot\left(\frac{x}{3}+\frac{x}{5}\right)=15\cdot 2$$

$$15\cdot\frac{x}{3}+15\cdot\frac{x}{5}=15\cdot 2$$

Either way, the result is an equivalent equation without fractions:

$$5x+3x=30$$
$$8x=30$$

The number used to eliminate the denominators is called a **Fraction Buster**. Now the equation looks like many you have seen before, and it can be solved in the usual way.

$$x=\frac{30}{8}=\frac{15}{4}=3.75$$
$$\frac{3.75}{3}+\frac{3.75}{5}=2$$

Once you have found the solution, remember to check your answer.

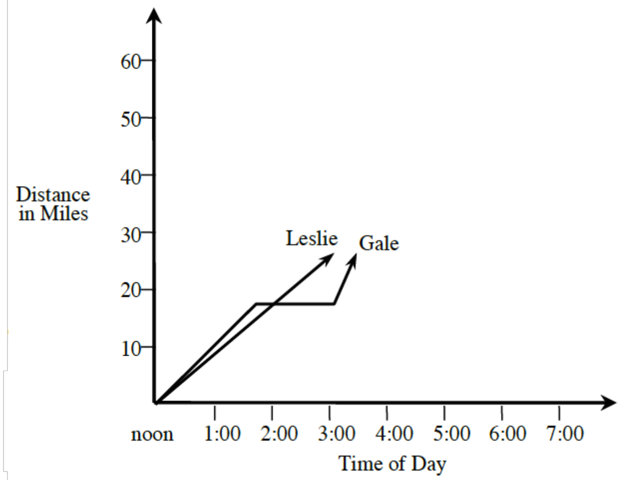
$$1.25+0.75=2$$

Review & Preview **Problem 5-27**

To ride to school, Elaine takes 7 minutes to ride 18 blocks. What is her unit rate (blocks per minute)? Assuming she rides at a constant speed, how long should it take her to go 50 blocks? Show your work.

Problem 5-28

Gale and Leslie are riding in a friendly 60-mile bike race that started at noon. The graph at right represents their progress so far.



a. What does the intersection of the two lines represent?

b. At approximately what time did Leslie pass Gale?

c. About how far had Leslie traveled when she passed Gale?

d. What do you think happened to Gale between 1:30 and 3:00?

e. If Leslie continues at a steady pace, when will she complete the race?

Problem 5-30

Translate each part below from symbols into words **or** from words into symbols.

a. $-y + 8$

b. $2x - 48$

c. $(x + 3)^2$

d. The opposite of six times the square of a number.

e. A number multiplied by itself, then added to five.

Problem 5-31	
Solve each of the following equations for the indicated variable. Show all your steps.	
a. $y = 2x - 5$ for x	b. $p = -3w + 9$ for w
c. $2m - 6 = 4n + 4$ for m	d. $3x - y = -2y$ for y

Lesson 5.2.2
Writing Rules from Word Problems *When are they the Same?*

In Lesson 5.2.1, you discovered that the point of intersection of two lines or curves can have an important meaning. Finding points of intersection is another strategy you can use to solve problems, especially those with two quantities being compared.

Analyze the following situations using the multiple tools you have studied so far.

Problem 5-32, 33

BUYING BICYCLES

Latanya and George are saving up money because they both want to buy new bicycles. Latanya opened a savings account with $50. She just got a job and is determined to save an additional $30 a week. George started a savings account with $75. He is able to save $25 a week.

Your Task: Use a table and graph to find the time (in weeks) when Latanya and George will have the same amount of money in their savings accounts. Be prepared to share your methods with the class.

Consider the questions below to help you decide how to set up the graph.

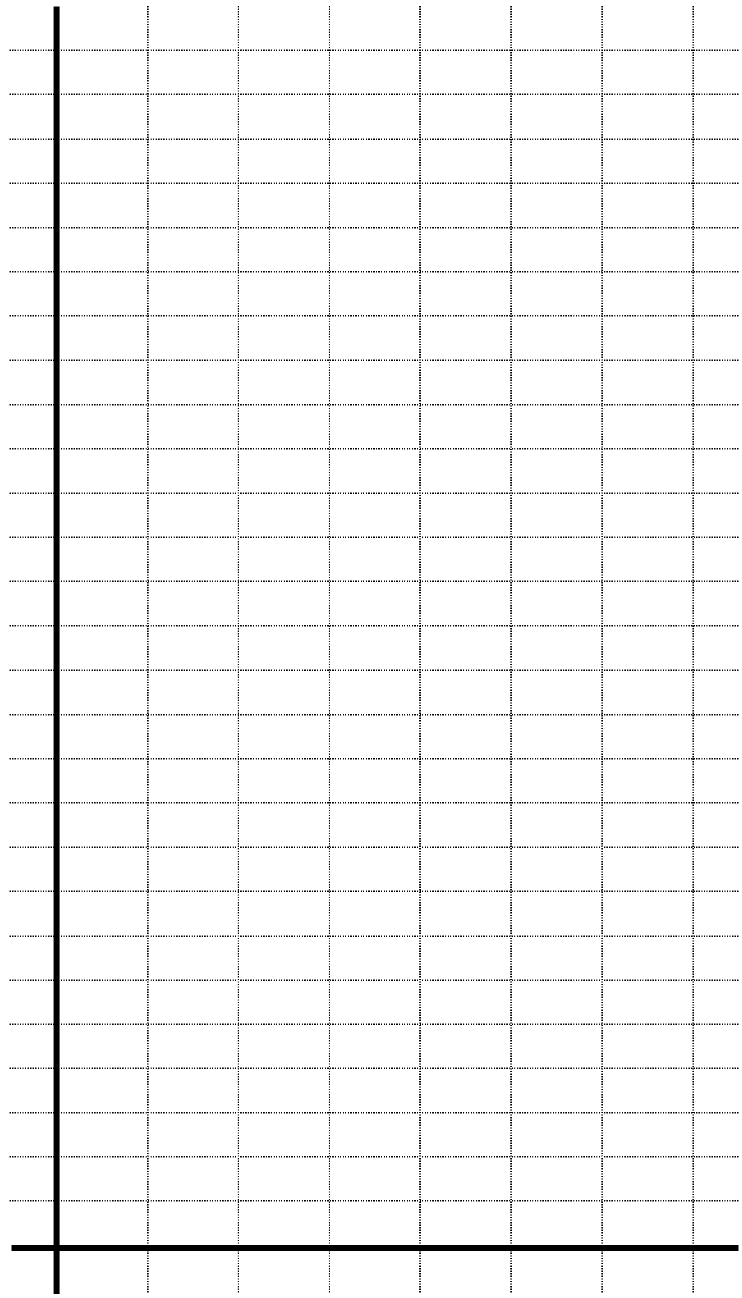
- What should the x-axis represent? What should the y-axis represent?
- How should the axes be scaled?
- Should the amounts in the savings accounts be graphed on the same set of axes or graphed separately? Why?

Latanya

x	0	1	2	3	4	5	6
Y							

George

x	0	1	2	3	4	5	6
y							



Problem 5-34

Use the rules to confirm the point of intersection for Latanya's and George's lines.

a. Write a rule for Latanya's savings account.
b. Write a rule for George's savings account.
c. Solve the system to check the solution to 5-32

Problem 5-35

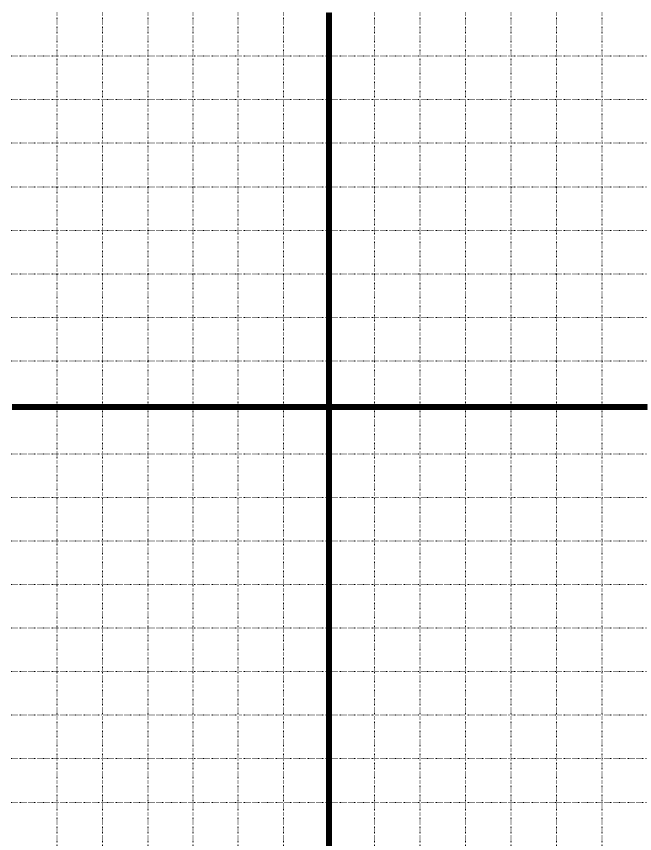
Gerardo decided to use tables to find the point of intersection of the lines y=4x−6 and y=−2x+3. His tables are shown below.

IN (x)	–3	–2	–1	0	1	2	3
OUT $(y = 4x - 6)$	–18	–14	–10	–6	–2	2	6

IN (x)	–3	–2	–1	0	1	2	3
OUT $(y = -2x + 3)$	9	7	5	3	1	–1	–3

a. Examine his tables. Is there a common point that makes both rules true? If not, can you describe where the point of intersection is?

b. Now graph the rules on the same set of axes. Where do the lines intersect?
c. Use the rules to confirm your answer to part (b).
d. Solve the system Algebraically



METHODS AND MEANINGS
MATH NOTES

"Systems of Equations Vocabulary"

Tool Kit page 36

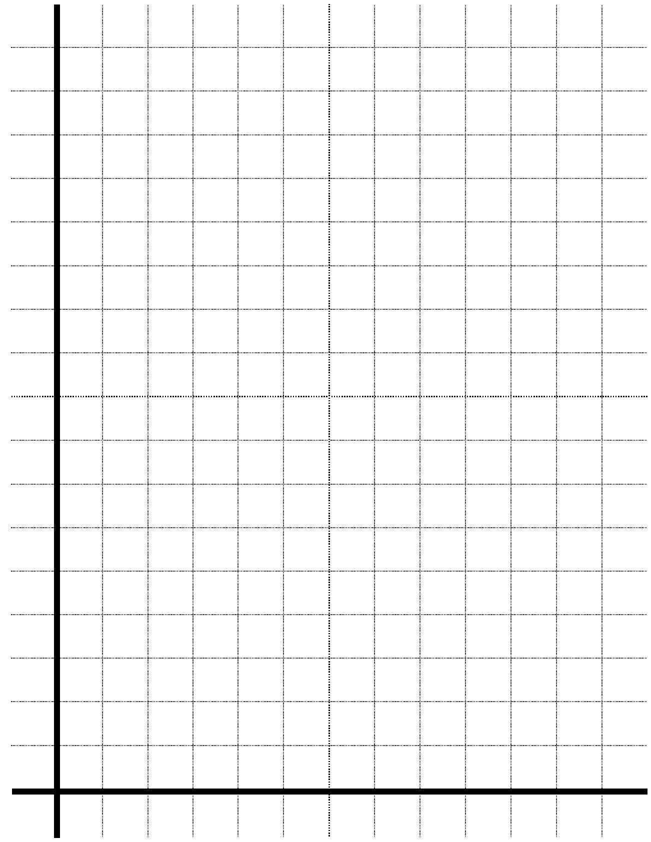
Problem 5-36

It is the end of the semester, and the clubs at school are recording their profits. The Science Club started out with $20 and has increased its balance by an average of $10 per week. The Math Club has saved $5 per week after starting out with $50 at the beginning of the semester.

a. Create an equation for each club. Let ***x*** represent the number of weeks and ***y*** represent the balance of the club's account.

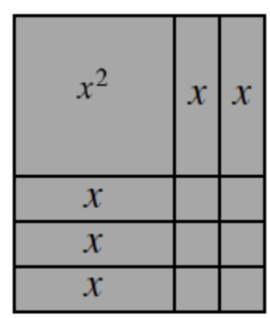
b. Graph both lines on one set of axes. When do the clubs have the same balance?

c. What is the balance at that point?



Problem 5-37

Examine the rectangle formed with algebra tiles at right.

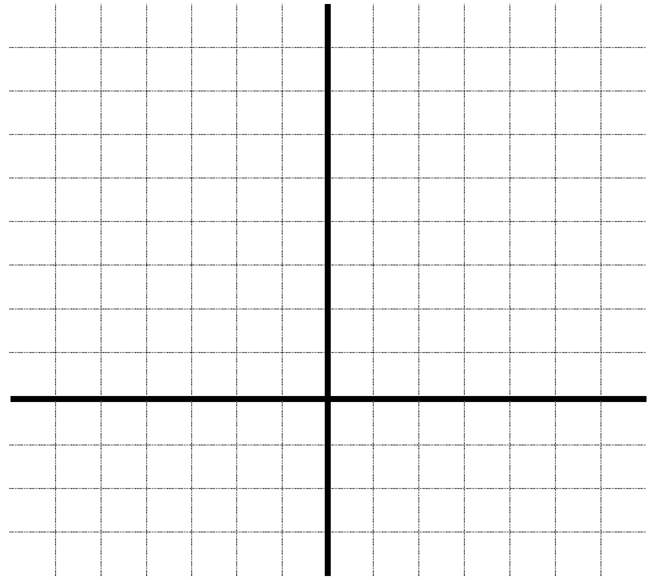


a. Find the area of the entire rectangle. That is, what is the sum of the areas of the algebra tiles?

b. Find the perimeter of the entire rectangle. Show all work.

Problem 5-38

On graph paper, plot the points and (−3,7) and (2,−3) draw a line through them. Then name the coordinates of the x- and y-intercepts of the line.



Problem 5-39

A local restaurant offers a Dim Sum lunch special that includes two dumplings, three egg rolls, a sweet bun, and a drink. Susan and her friends ordered four Dim Sum lunch specials.

How many of each item should they receive?

Problem 5-40

Solve for x.

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

b. $$\frac{x}{3}+\frac{x-1}{4}=2+x$$

Lesson 5.2.3
Solving Systems Algebraically

When are they the Same?

So far in Section 5.2, you have solved systems of equations by graphing two lines and finding where they intersect. However, it is not always convenient (nor accurate) to solve by graphing.

Today you will explore a new way to approach solving a system of equations. Questions to ask your teammates today include:

How can you find a rule? How can you compare two rules? How can you use what you know about solving?

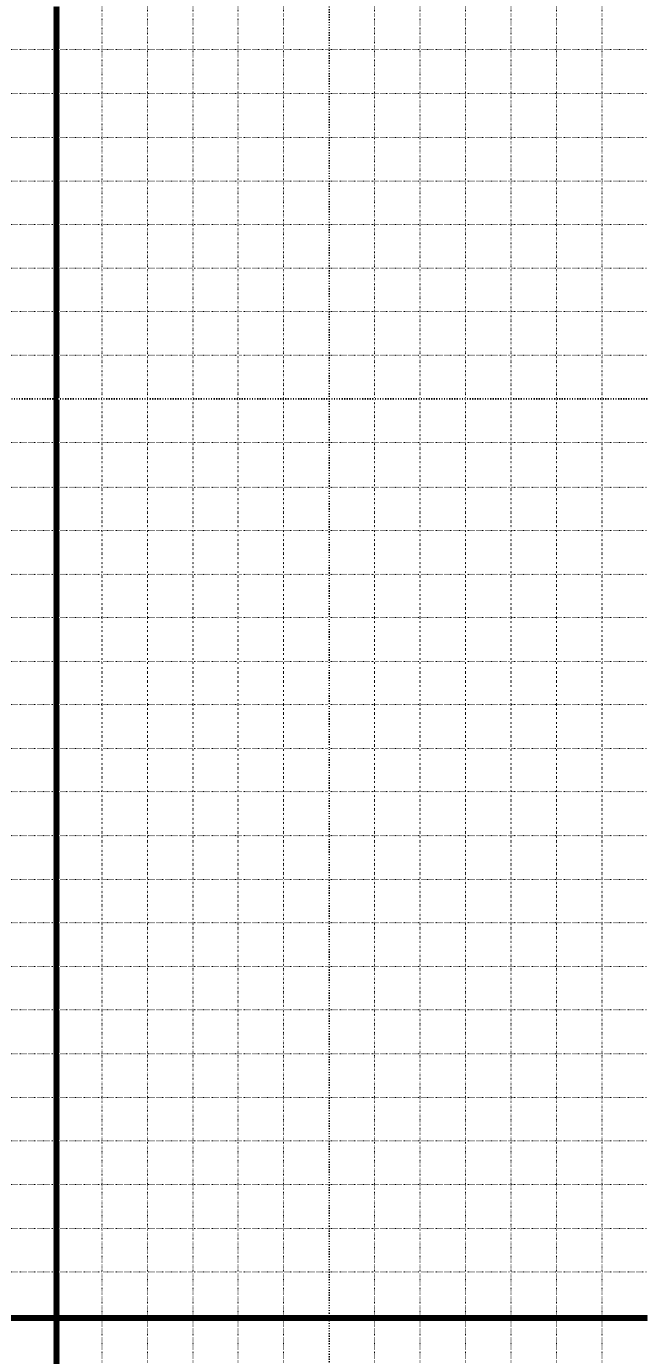
Problem 5-41

CHUBBY BUNNY
Use tables and a graph to find and check the solution for the problem below.

Barbara has a bunny that weighs 5 pounds and gains 3 pounds per year. Her cat weighs 19 pounds and gains 1 pound per year. When will the bunny and the cat weigh the same amount?

years (x)								
pounds (y)								

years (x)								
pounds (y)								



Problem 5-42

SOLVING SYSTEMS OF EQUATIONS ALGEBRAICALLY

In problem 5-41, you could write rules like those shown below to represent the weights of Barbara's cat and bunny. For these rules, x represents the number of years and y represents the weight of the animal.

$$y = \underbrace{5 + 3x}_{\text{weight of bunny}} \quad \text{and} \quad y = \underbrace{19 + x}_{\text{weight of cat}}$$

a. Problem 5-41 asked you to determine when the weight of the cat and the bunny are the same. Therefore, you want to determine when the expressions on the left (for the bunny) and the right (for the cat) are equal. Write an equation that represents this balance.

b. Solve your equation for x, which represents years. According to your solution, how many years will it take for the bunny and the cat to weigh the same number of pounds?

c. Does this answer match your answer from the graph of problem 5-41?

d. How much do the **cat** and **bunny** weigh at this time?

Problem 5-43

CHANGING POPULATIONS

Post Falls High School in Idaho has 1160 students and is growing by 22 students per year. Richmond High School in Indiana has 1900 students and is shrinking by 15 students per year.

a. Without graphing, write a rule that represents the population at Richmond High School and another rule that represents the population at Post Falls High School.

   Let x represent years and y represent population.

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b. Graphing the rules for part (a) is challenging because of the large numbers involved. Using a table could take a long time. Therefore, this problem is a good one to solve algebraically, the way you solved problem 5-42.

Use the rules together to write an equation that represents when these high schools will have the same population. Then solve your equation to find out when the schools' populations will be the same.

c. What will the population be at that time?

Problem 5-44

PUTTING IT ALL TOGETHER

Find the solution to the problem below by solving an equation.

Imagine that your school planted two trees when it was first opened. One tree, a ficus, was 6 feet tall when it was planted and has grown 1.5 feet per year. The other tree, an oak, was grown from an acorn on the ground and has grown 2 feet per year. When will the trees be the same height? How tall will the trees be when they are the same height?

Problem 5-45

Ms. Harlow calls the method you have been using today to solve equations the **Equal Values Method**. Explain why this name makes sense.

METHODS AND MEANINGS
MATH NOTES

"Equal Values Method"

Tool Kit page 37

Problem 5-47

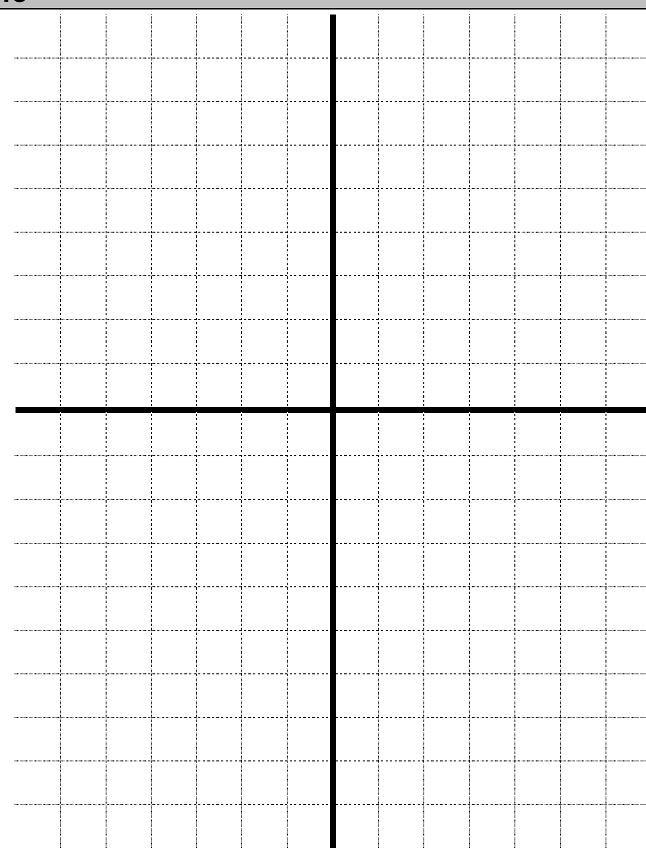
Ariyonne claims that (3,6) is the point of intersection of the lines $y = 4x - 2$ and $y = \frac{1}{2}x + 5$. Is she correct? How do you know?

Problem 5-48

Graph the lines $\boldsymbol{y = 2x - 3\ and\ y = -x + 3}$.

a. Where do they intersect? Label the point on the graph.

b. Find the point of intersection using the Equal Values Method. That is, start by combining both equations into one equation that you can solve for x.



c. Which method is easier, graphing or using algebra to solve?

Problem 5-49

Solve for the variable.

a. $\frac{a+4}{3} - \frac{a}{7} = \frac{a+7}{5}$

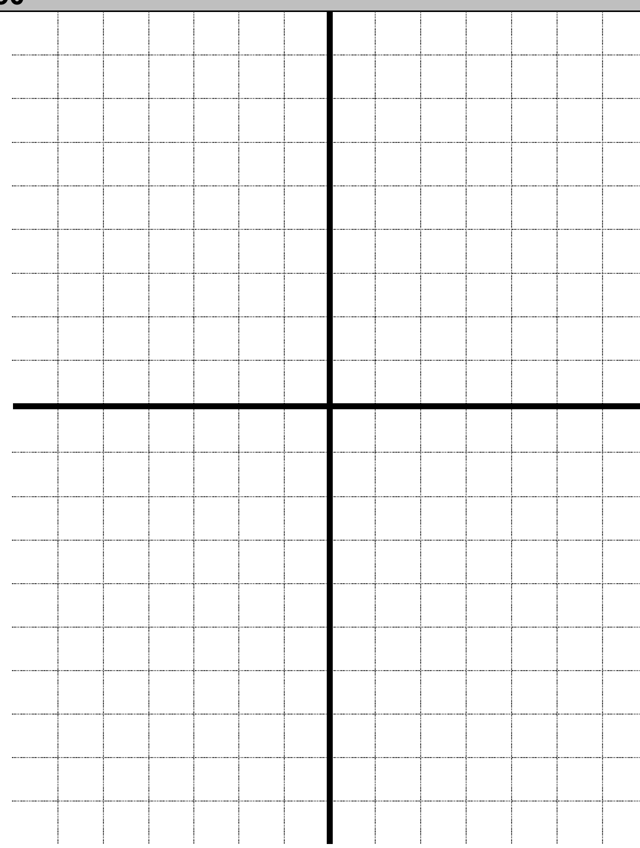
b. $\frac{7y}{8} - \frac{3y}{5} = \frac{11}{2}$

Problem 5-50

Graph the lines $y = 2x - 3$ *and* $y = 2x + 1$

a. Where do they intersect?

b. Solve this system using the Equal Values Method.



c. Explain how your graph and algebraic solution relate to each other.

Problem 5-51

Janelle came to bat 464 times in 131 games. At this rate, how many times should she expect to have at bat in a full season of 162 games?

Lesson 5.2.4
Strategies for Solving Systems

What if systems are not in $y = mx + b$ form?

You have been introduced to systems of linear equations that are used to represent various situations. You have used the Equal Values Method to solve systems algebraically. Just as in linear equations you found that sometimes there were no solutions or an infinite number of solutions, today you will discover how this same situation occurs for systems of equations.

Problem 5-52

Sara has agreed to help with her younger sister's science fair experiment. Her sister planted string beans in two pots. She is using a different fertilizer in each pot to see which one will grow the tallest plant. Currently, **plant A** is **4 inches** tall and grows $\frac{2}{3}$ **inch per day**, while **plant B** is **9 inches** tall and grows $\frac{1}{2}$ **inch per day**.

If the plants continue growing at these rates, in how many days will the two plants be the same height?
Which plant will be tallest in six weeks?
Write a system of equations and solve.

Problem 5-53

Felipe applied for a job. The application process required him to take a test of his math skills. One problem on the test was a system of equations, but one of the equations not in $y = mx + b$ form. The two equations are shown below.

Work with your team to find a way to solve the equations using the Equal Values Method.

$$y = \frac{2}{5}x - 5 \qquad\qquad 3x + 2y = 9$$

Problem 5-54

Using the Equal Values Method can lead to messy fractions. Sometimes this cannot be avoided. But some systems of equations can be solved by simply examining them. This approach is called solving by inspection. Consider the two cases below.

Case I:	$3x + 2y = 2$
	$3x + 2y = 8$

Case II:	$2x - 5y = 3$
	$4x - 10y = 6$

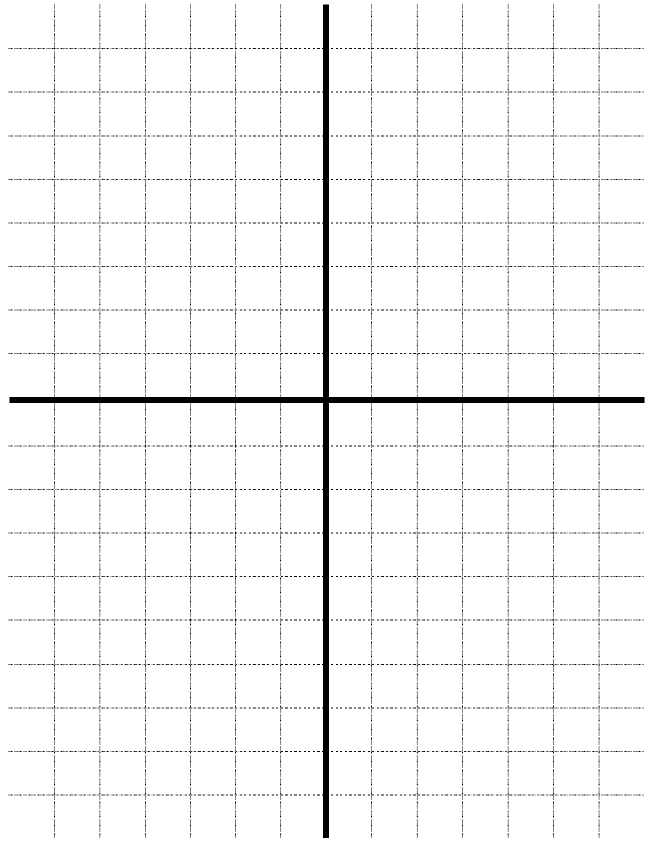
a. Compare the left sides of the two equations in Case I. How are they related?

b. Use the Equal Values Method for solving a system of equations, write a relationship for the two right sides of the equations in Case I, and explain your result.

5-54 continues on next page

c. Graph the two equations in Case I to confirm your result for part (b) and to see how the graphs of the two equations are related.

Case I:	$3x + 2y = 2$
	$3x + 2y = 8$



d. Recall that a **coefficient** is a number multiplied by a variable and that a **constant term** is a number alone.

Compare the coefficients of x, the coefficients of y, and the two constant terms in the equations in Case II. How is each pair of integers related?

Case II:	$2x - 5y = 3$
	$4x - 10y = 6$

e. Half of your team should multiply the coefficients and constant term in the first equation of Case II by 2 and then solve the system using the Equal Values Method. The other half of your team should divide all three values in the second equation of Case II by 2 and then solve using the Equal Values Method. Compare the results from each method. What does your result mean?

Problem 5-56

Felipe's sister thought that he should try some more complicated systems of equations. Use what you learned in problem 5-53 to solve these two systems of equations.

a. $x = 3 + 3y$ $\quad 2x + 9y = 11$	b. $x - \frac{y}{2} = -1$ $\quad x + y = -7$

METHODS AND MEANINGS
MATH NOTES

"Solutions to a Systems of Equations"

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Problem 5-57

Determine the coordinates of each point of intersection without graphing. Homework Help ✎

a. $y = -x + 8$ $\quad y = x - 2$	b. $y = -3x$ $\quad y = -4x + 2$

Problem 5-58	
Change each equation below into $y = mx + b$ form.	
a. $\boldsymbol{y - 4x = -3}$	b. $\boldsymbol{3y - 3x = 9}$
c. $\boldsymbol{3x + 2y = 12}$	d. $\boldsymbol{2(x - 3) + 3y = 0}$

Problem 5-59

Mailboxes Plus sends packages overnight for $5 plus $0.25 per ounce. United Packages charges $2 plus $0.35 per ounce. Mr. Molinari noticed that his package would cost the same to mail using either service. How much does his package weigh?

Problem 5-60

Solve for *x*.

a. $$\frac{2}{3}=\frac{x}{4}$$

b. $$\frac{2}{3}=\frac{x}{4}+\frac{x}{3}$$

c. a. How are these problems the same and how are they different?

Problem 5-61	
This problem is a checkpoint for solving equations. It will be referred to as Checkpoint 5. Solve each equation.	
a. $3x + 7 = -x - 1$	b. $1 - 2x + 5 = 4x - 3$
c. $-2x - 6 = 2 - 4x - (x - 1)$	d. $3x - 4 + 1 = -2x - 5 + 5x$

Lesson 5
CLOSURE

You have been introduced to systems of linear equations that are used to represent various situations. You have used the Equal Values Method to solve systems algebraically. Just as in linear equations you found that sometimes there were no solutions or an infinite number of solutions, today you will discover how this same situation occurs for systems of equations.

Problem 5-62

Solve each equation.

a. $3(2x-1)+7=-44$

b. $6(2x-5)=-(x+4)$

Problem 5-63

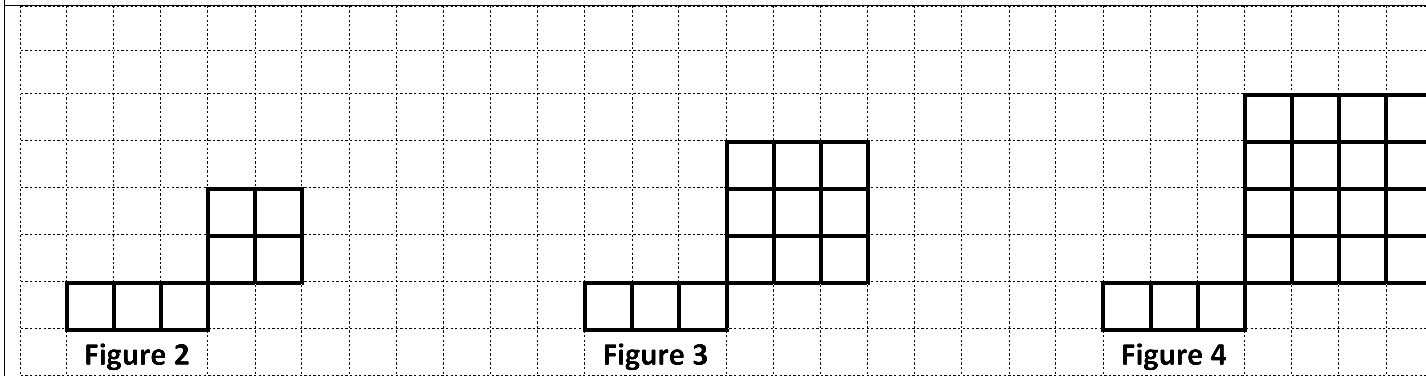
Solve for the indicated variable.

a. $2x+5y=10$ $(solve\ for\ y)$

b. $3(x+2)=y-6$ $(solve\ for\ x)$

Problem 5-64

Examine the tile pattern below. Then complete parts (a) through (c) that follow.



a. Draw Figure 1 and Figure 5.
b. Make an x→y table for the pattern.
c. Make a complete graph. Include points for Figures 0 through 5.

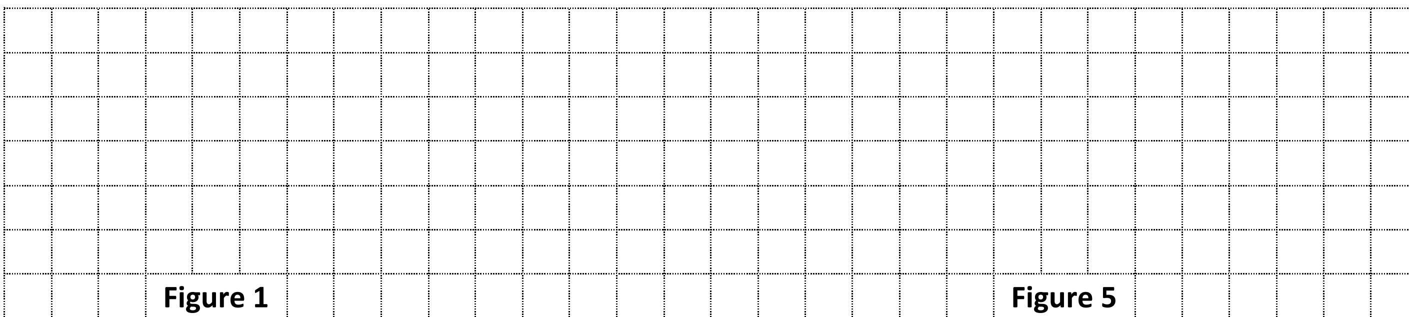
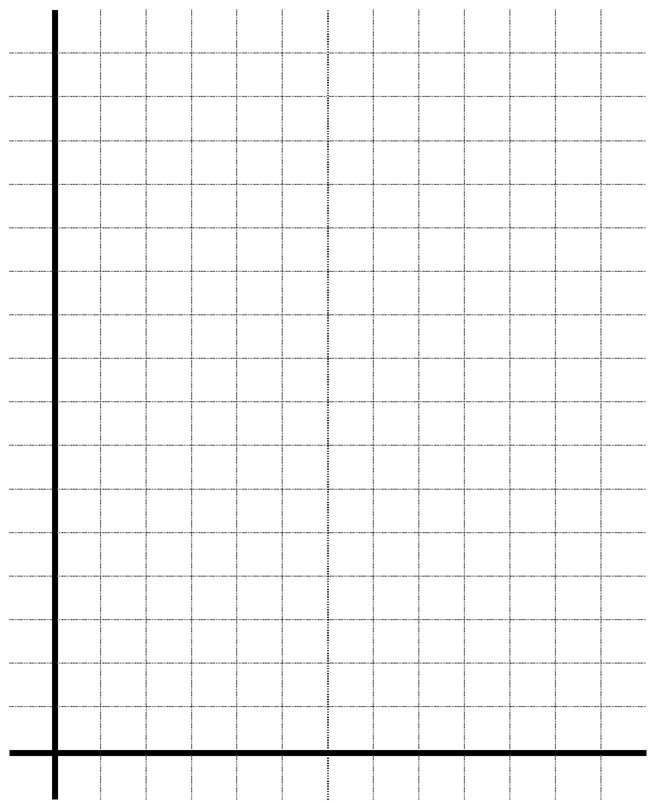


figure (x)								
tiles (y)								



Problem 5-65

Use the table below to complete parts (a) and (b) below.

a. Complete the table.

X	–5	–3	–1	1	3	5	7
y			–3	1		9	

b. Find the rule (y= ?).

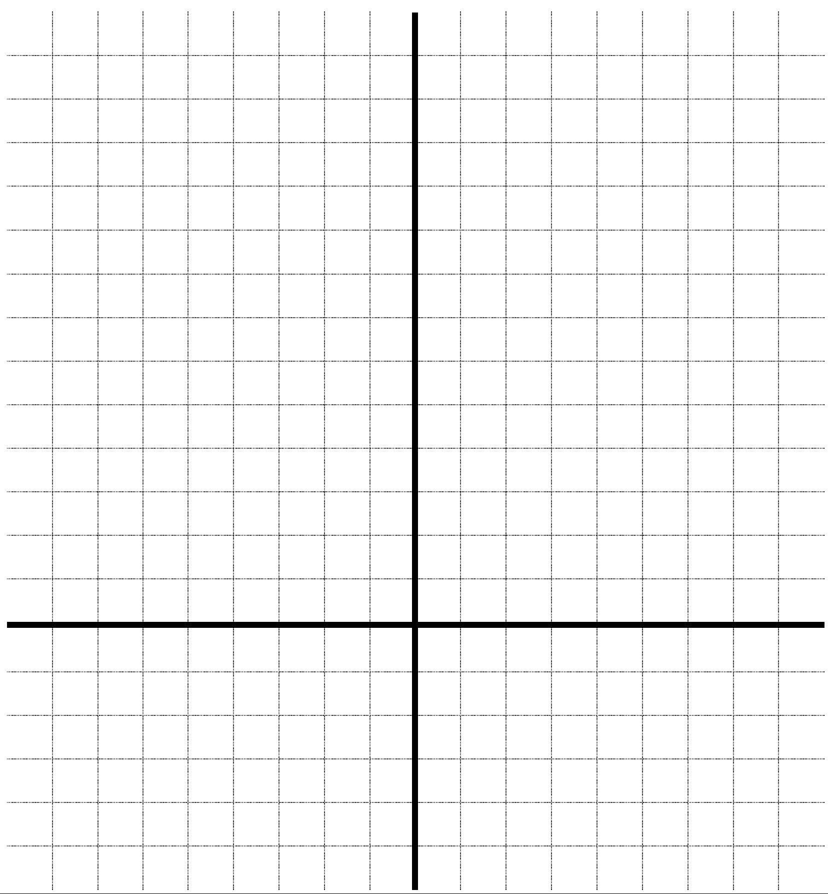
Problem 5-66

For each pair of lines below, solve the system first by graphing and then algebraically using the Equal Values Method. Explain how the graph confirms the algebraic result.

a. $y = 7x - 5 \ \ and \ y = -2x + 13$

b. $y = 3x - 1 \ and \ y = 3x + 2$

c. Solve by graphing



Problem 5-67

To rent a jet ski at Sam's costs $25 plus $3 per hour. At Claire's, it costs $5 plus $8 per hour. At how many hours will the rental cost at both shops be equal?

a. Write an equation that represents each shop's charges. What do your variables represent?
b. Solve the problem. Show your work.

Problem 5-68

Solve each equation.

a.

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

b.

$$\frac{x}{3} + \frac{x}{4} + 1 = \frac{x}{2}$$