LESSON 9

Objective

Solve systems of two linear equations in two variables.

Common Core State Standards

- **8.EE.8b** Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*
- **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.*

Expressions and Equations

Solving Systems of Equations

This lesson introduces students to solving systems of equations in an informal manner so that they will have a basic understanding of what is usually thought to be a rather complex skill. In this activity, students solve the problem using a model and then transfer the information to paper in order to solve the problem algebraically.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- Students have expressed the number of girls in terms of boys (i.e., $2(7 - B) + 3B = 18$). **Ask:** *Can you solve the problem by expressing the number of boys in terms of girls?*
- **Ask:** *Why is it important to reread the problem after you've found the values of your unknown variables?*

Solve It

Reread the problem with students. Discuss with them how to create a system of equations. Encourage them to be methodical as they analyze the information found in the story problem. Have students use substitution to solve the equation. Then have them substitute their results into the original problem in order to answer the question it poses.

More Ideas

For another way to teach about solving systems of equations—

- Have students use the XY Coordinate Pegboard to solve this and similar problems. Students should create a table for both equations and then graph the results. The point of intersection of the two lines (3, 4) will be the solution to the problem.

$G + B = 7$

G	B
0	7
1	6
2	5
3	4
4	3
5	2
6	1
7	0

$2G + 3B = 18$

G	B
0	6
3	4
6	2
9	0

Formative Assessment

Have students try the following problem.

Steve has twice as many video games as David. Together, they have 15 video games. Which of the following systems of equations best represents this information?

A. $S = 2D$
$S + D = 15$

B. $2S = D$
$S + D = 15$

C. $2S = D$
$S - D = 15$

D. $S = 2D$
$D = 15$

Try It! 20 minutes | Pairs

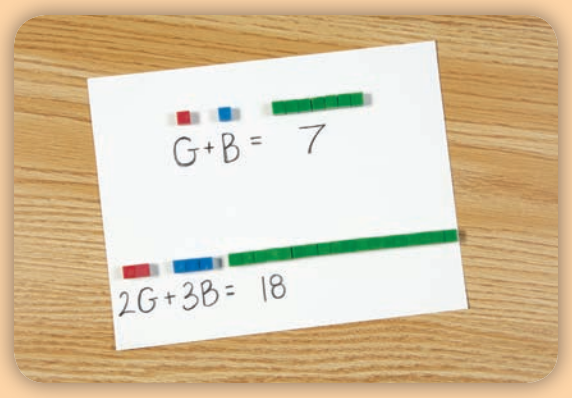
Here is a problem about solving a system of equations.

There are 18 students in the Math Club. There are twice as many girls and three times as many boys as there are in the Jazz Club. The Jazz Club has 7 students in it. How many boys and girls are in the Math Club?

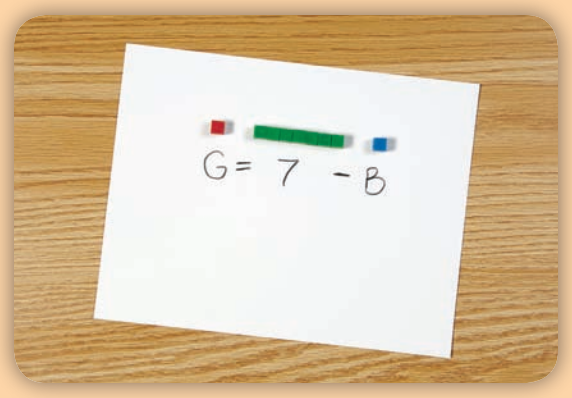
Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

Materials

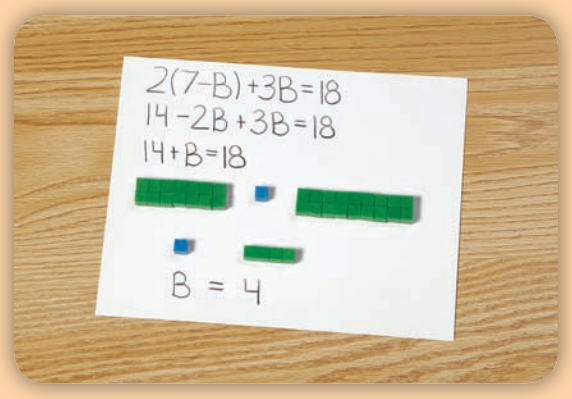
- Centimeter Cubes (5 red; 5 blue; 25 of any other color)
- paper (4 sheets per pair)
- pencils (1 per pair)



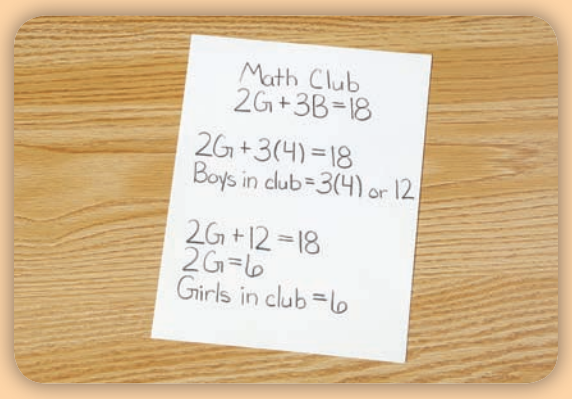
1. Have students use the red cubes to represent "girls," blue cubes to represent "boys," and cubes of another color to represent the number of students. Have students write their two equations and model them on a piece of paper.



2. Have students express the first equation as the number of girls in terms of boys. Have them write the new equation on their paper and model it with Centimeter Cubes.



3. Have students substitute the new equation into the second equation and use the Distributive Property to solve for boys.



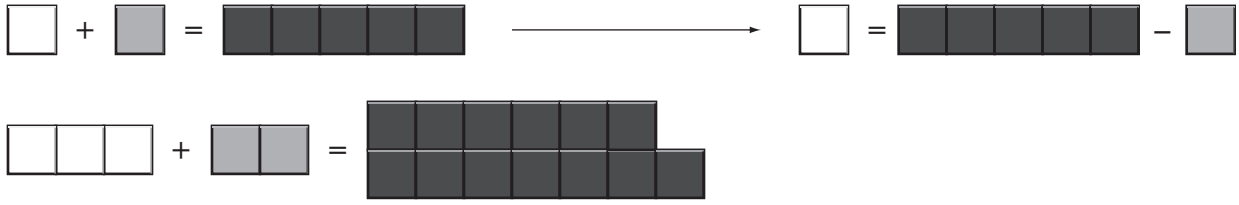
4. Use the value of *B* to solve for the number of boys and girls in the Math Club.

Answer Key

Use Centimeter Cubes to model the system of equations shown. Write the system. Then use substitution to solve the system. Write all the steps to finding the solution.

(Check students' work.)

1.



Equations in the system: $x + y = 5$

$3x + 2y = 13$

Solution: $x = 3, y = 2$

Using Centimeter Cubes, model the system of equations and use substitution to find the solution. Sketch the models.

2. $x + y = 5$ and $2x + y = 6$ (Check students' models.)

Solution: $x = 1, y = 4$

Use substitution to solve each system of equations.

3. $x + y = 10$

$x - 2y = 1$

$x = 7, y = 3$

4. $x + y = 7$

$x + 2y = 12$

$x = 2, y = 5$

5. $x + y = 4$

$4x - y = 1$

$x = 1, y = 3$

6. $x + y = 2$

$x + 5y = 2$

$x = 2, y = 0$

Answer Key

Challenge! How many times do you use substitution to solve a system of linear equations? Explain when you use it.

Challenge: (Sample) Twice; In the beginning, you solve one of the equations for a variable, such as *x*. That expression is substituted into the other equation and the equation is solved. After you have that solution, you substitute that value into either equation to solve for the other variable.

Name _____

Use Centimeter Cubes to model the system of equations shown. Write the system. Then use substitution to solve the system. Write all the steps to finding the solution.

1.

Equations in the system: _____

_____

Solution: _____

Using Centimeter Cubes, model the system of equations and use substitution to find the solution. Sketch the models.

2. $x + y = 5$ and $2x + y = 6$

Solution: _____

Use substitution to solve each system of equations.

3. $x + y = 10$

$x - 2y = 1$

_____

4. $x + y = 7$

$x + 2y = 12$

_____

5. $x + y = 4$

$4x - y = 1$

_____

6. $x + y = 2$

$x + 5y = 2$

_____

Name _____

Challenge! How many times do you use substitution to solve a system of linear equations? Explain when you use it.