

LESSON 6

Objective

Write and solve an equation with a variable.

Common Core State Standards

- **6.EE.5** Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
- **6.EE.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
- **6.EE.7** Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.

Expressions and Equations

Equations with a Variable

Students further develop their mathematical flexibility by using variable expressions to write equations. They use concrete models and mental math to solve for the unknown value in an equation. In the activity, the implicit use of inverse operations involving only basic facts lays the foundation for using symbolic representations to solve more complex equations.

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

Talk About It

Discuss the Try It! activity.

- **Ask:** How does mental math help you to solve the equations?
- **Ask:** How do you solve $5 \times b = 20$ using a related fact?
- **Say:** Tell a story that could be solved using the equation $36 \div p = 4$. Explain how to solve the equation.

Solve It

Reread the problem with students. Have them write a paragraph to explain how they use the models and mental math to solve the equations.

More Ideas

For other ways to teach about equations with a variable—

- Have students use Two-Color Counters to model the problem. They can start with 20 counters, all with the red side showing, to represent the apples that Bryce had after he went to the store. Students then turn over 6 of the counters to represent the apples that he bought at the store. Guide students to use the remaining red counters to solve the variable equation.
- Have groups of students make up simple word problems, use Centimeter Cubes to model the data, and write equations that can be used to solve the problem. Encourage students to use mental math to solve each problem.

Formative Assessment

Have students try the following problem.

There are 24 coins on Miguel's desk. Of these, 6 coins are quarters and the rest are dimes. Which equation could be used to find the number of dimes on Miguel's desk?

- A. $6 \times d = 24$ B. $d - 24 = 6$ C. $d + 6 = 24$ D. $d \div 6 = 24$

Try It! 20 minutes | Groups of 4

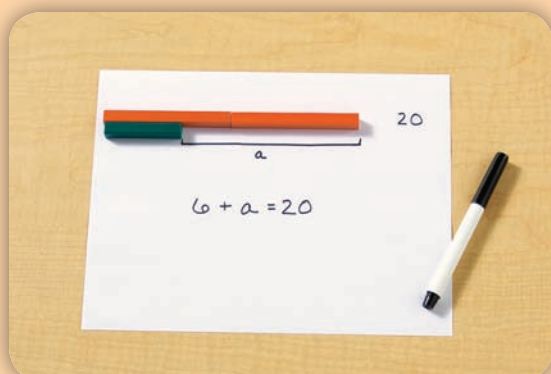
Here is a problem about equations with a variable.

Bryce has some apples. He buys 6 more at the store. Now he has 20 apples. Write an equation to determine how many apples Bryce had before he went to the store. He has a recipe that uses 5 apples to make one batch of applesauce. Write an equation to determine how many batches of applesauce he can make with 20 apples.

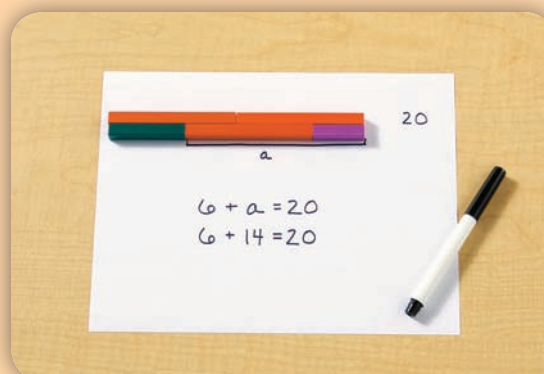
Introduce the problem. Then have students do the activity to solve the problem. Distribute the Cuisenaire Rods, paper, and pencils to students. Explain that an equation is a statement that two quantities are equal.

Materials

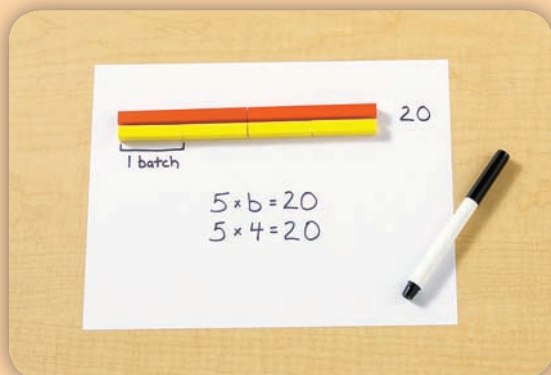
- Cuisenaire® Rods (1 set per group)
- paper (2 sheets per group)
- pencils (1 per group)



1. Have students state what is unknown. Using rods, have students model the facts of the first question. **Ask:** *What operation does buying more apples suggest?* Guide students to write an addition equation using a variable to represent the unknown number of apples. Write $6 + a = 20$ on the board.



2. Have students complete the model by making the two rows equal. **Say:** *Think "Six plus what number equals 20?"* Encourage students to use mental math or related facts when they solve the equation.



3. Say: *Bryce uses 5 apples to make one batch of applesauce. What equation would you use to determine how many batches of applesauce he can make with 20 apples?* Have students model the problem and write the multiplication equation.

Look Out!

Students who cannot write equations may need to list the known facts and the information needed to solve the problem. Review key words that may help students recognize the operation needed to solve the problem. Reviewing and modeling fact families to see the relationships between operations may benefit the students.



Use Cuisenaire Rods to model each equation containing the variable b and the operation stated. Solve the equation.

1. addition

(Check students' work.)



$$5 + b = 18; b = 13$$

2. multiplication



$$b \times 4 = 16; b = 4$$

Using Cuisenaire Rods, model the given equation. Sketch the model. Solve the equation.

3. $a + 8 = 21$

4. $3 \times d = 15$

$$a = 13$$

$$d = 5$$

Solve each equation.

5. $4 + f = 19$

$$f = 15$$

6. $3 \times g = 15$

$$g = 5$$

7. $22 = s + 9$

$$s = 13$$

8. $13 + j = 27$

$$j = 14$$

9. $7 \times k = 28$

$$k = 4$$

10. $9 \times p = 45$

$$p = 5$$

Answer Key

Challenge! How can you use related facts to help you solve the equations in this lesson? Give an example.

Challenge: (Sample) I used the two numbers that were in the equation and the operation that is the opposite of the operation in the equation. For the equation $3 \times g = 15$, I used $15 \div 3 = g$. Division is the opposite operation of multiplication.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

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2. multiplication



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Name _____

Challenge! How can you use related facts to help you solve the equations in this lesson? Give an example.

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