

LESSON 7

Objective

Solve multi-step equations.

Common Core State Standards

- **8.EE.7b** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Expressions and Equations

Solving Multi-Step Equations

Once students have the foundations of solving equations in place, they will be able to begin to solve multi-step equations. They will combine the skills they have applied to solving one-step equations and their understanding of the order of operations to solve more complicated equations. Throughout algebra, students will solve multi-step equations when finding zeroes of functions.

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

Talk About It

Discuss the Try It! activity.

- **Ask:** *What is known? What is unknown? How is the perimeter of a triangle calculated?*
- **Ask:** *What equation did you write/model? How do you combine like terms using the Algebra Tiles™?*
- **Ask:** *Once you find the value of x , how do you find the lengths of the other sides? How can we be sure these sides make up the sides of a triangle? (Triangle Inequality)*

Solve It

Read the problem with the students. Have students solve the multi-step equation. Ask students to show their work by creating a model with Algebra Tiles. Then have students sketch the model and record their work.

More Ideas

For another way to teach about solving multi-step equations—

- Have students use Algeblocks® and the Algeblocks Sentences Mat to model each equation. Students can combine like terms and then reverse the order of operations to isolate the variable and find the answer.

Formative Assessment

Have students try the following problem.

A computer company charges a \$75 diagnostic fee plus \$32 per hour to fix any problem. If Marta pays \$203 to have her computer repaired, how many hours did the company work on it?

- A. 2.7
- B. 3
- C. 3.1
- D. 4

Try It!

20 minutes | Groups of 3

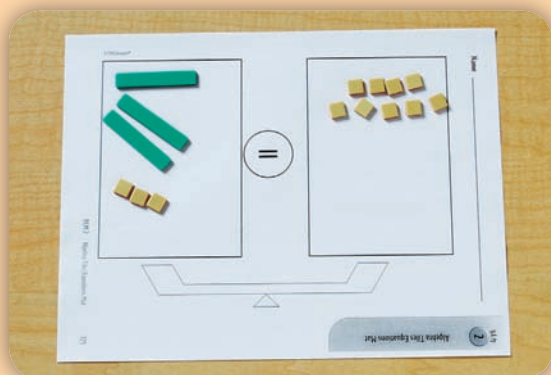
Here is a problem about solving multi-step equations.

The second side of a triangle is 2 times the length of the first. The third side is 3 units long. The perimeter of the triangle is 9. What is the length of the first side of the triangle?

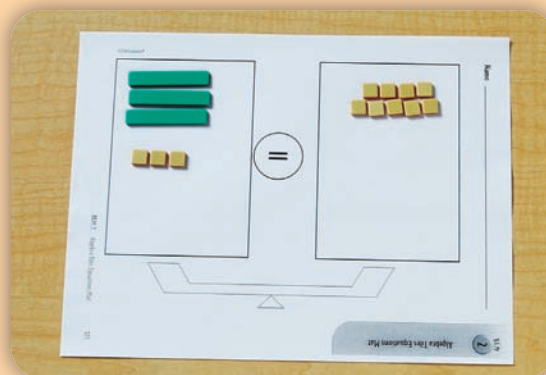
Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

Materials

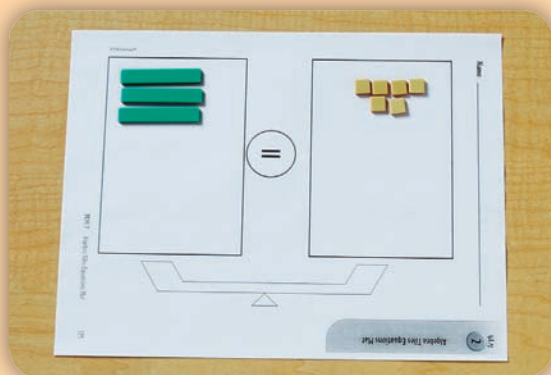
- Algebra Tiles™
- Algebra Tiles Equations Mat (BLM 2; 1 per group)
- Algebra Tiles Mini Equations Mats (BLM 3; 1 per student)



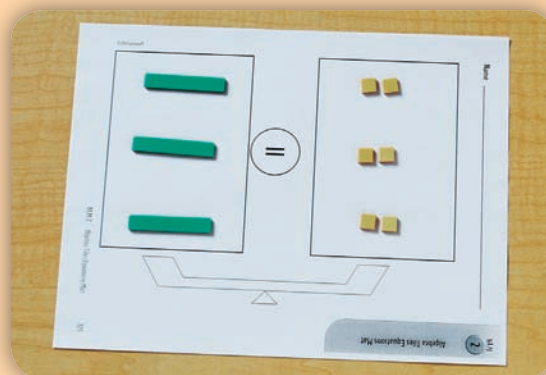
1. Ask: What will the x Algebra Tile represent? What represents the length of the second side? The third side? Have students use Algebra Tiles to model the triangle's perimeter and draw it on their Algebra Tiles Mini Equations Mats BLM 3. Students should write the equation. $[x + 2x + 3 = 9]$



2. Ask: Can any of the groups be combined? Have students combine like terms by joining the x Algebra Tiles into one group. Students should draw this arrangement on their mini mats and write the new equation, showing like terms combined. $[3x + 3 = 9]$



3. Ask: How can we isolate the variable? Have students remove 3 from each side. Then have students draw the Algebra Tiles on their mini mats. Students will write the changes to the equation, showing the steps and the results. $[3x = 6]$

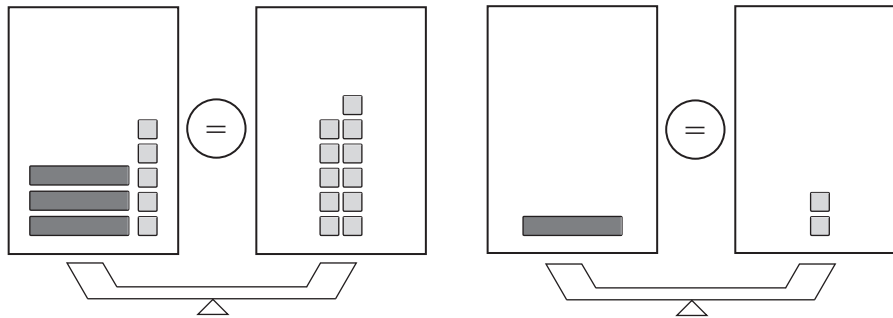


4. Say: We need to find the value of one x . Have students create 3 equal groups on each side, and draw the groups on their mini mats. **Say:** Circle your groups. They will show that each side was divided by the same number and the resulting equation. **Ask:** What is the length of the first side? $[x = 2]$

Use Algebra Tiles and the Algebra Tiles Equations Mat to model the equation shown and then solve it. Write the equation and the solution.

(Check students' work.)

1.



$$3x + 5 = 11, x = 2$$

$$x = 2$$

Using Algebra Tiles and the Algebra Tiles Equations Mat, model the equation. Sketch the model. Solve the equation and write the solution.

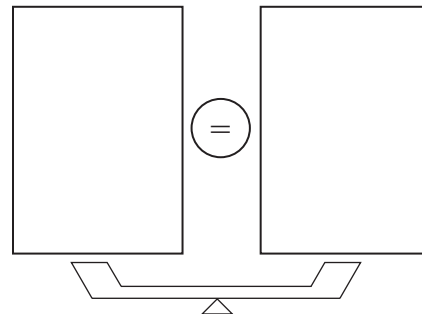
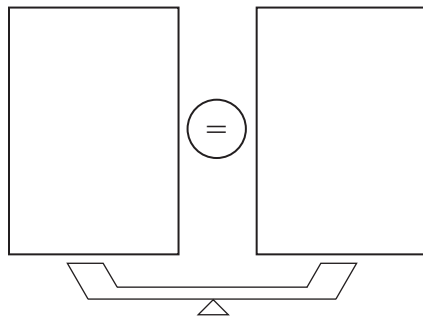
2. $8 = 2x + 2$

$$x = 3$$

3. $5x + 4 = 9$

$$x = 1$$

(Check students' models.)



Find each solution.

4. $6x + 12 = 18$

$$x = 1$$

5. $8x + 4 = 20$

$$x = 2$$

6. $16 = 10x + 6$

$$x = 1$$

7. $21 = 2x - 7$

$$x = 14$$

8. $3x + 9 = 51$

$$x = 14$$

9. $45 = 5x - 5$

$$x = 10$$

Answer Key

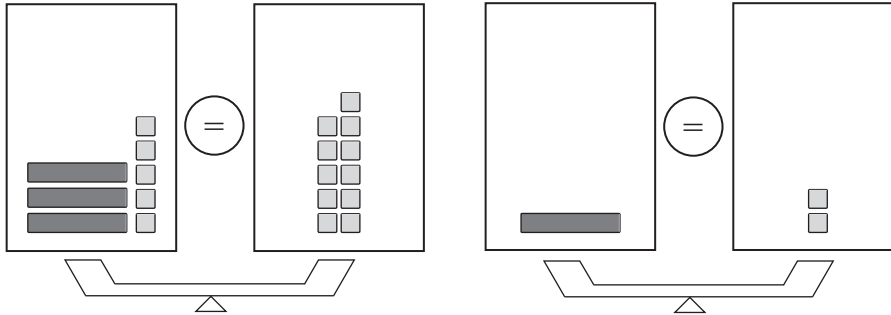
Challenge! Explain the difference between solving equations like $2x = 14$ and $x + 6 = 14$ and solving $2x + 6 = 14$.

Challenge: (Sample) In the first 2 equations you're simply undoing one operation. In $2x + 6 = 14$, you have to undo two operations. So it's as if you're following the order of operations in reverse.

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Use Algebra Tiles and the Algebra Tiles Equations Mat to model the equation shown and then solve it. Write the equation and the solution.

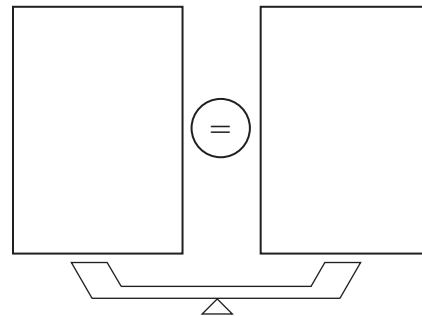
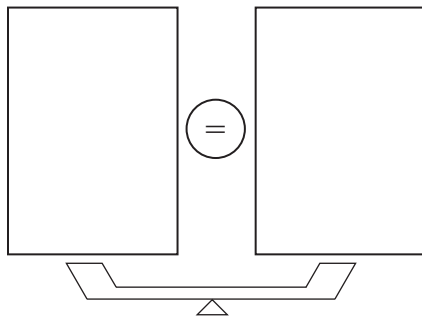
1.



Using Algebra Tiles and the Algebra Tiles Equations Mat, model the equation. Sketch the model. Solve the equation and write the solution.

2. $8 = 2x + 2$

3. $5x + 4 = 9$



Find each solution.

4. $6x + 12 = 18$

5. $8x + 4 = 20$

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7. $21 = 2x - 7$

8. $3x + 9 = 51$

9. $45 = 5x - 5$

Name _____

Challenge! Explain the difference between solving equations like $2x = 14$ and $x + 6 = 14$ and solving $2x + 6 = 14$.

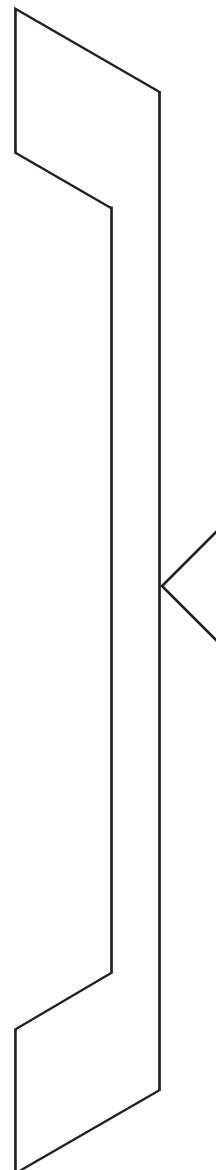
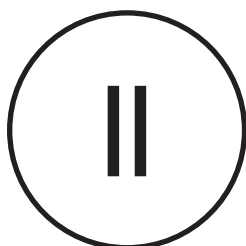
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Name _____

BLM

2

Algebra Tiles Equations Mat



Name _____

