Solving Equations

Reporting Category   Patterns, Functions, and Algebra

Topic   Solving equations in one variable

Primary SOL   8.15a   The student will solve multistep linear equations in one variable with the variable on one and two sides of the equation.

Materials
- Sets of algebra tiles
- Equation-Solving Balance Mat (attached)
- Equation-Solving Ordering Cards (attached)
- Be the Teacher: Solving Equations activity sheet (attached)
- Student whiteboards and markers

Vocabulary
equation, variable, coefficient, constant (earlier grades)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Give each student a set of algebra tiles and a copy of the Equation-Solving Balance Mat. Lead students through the steps for using the tiles to model the solutions to the following equations. As you are working through the solution of each equation with the students, point out that you are undoing each operation and keeping the equation balanced by doing the same thing to both sides. Explain why you do this. When students are comfortable with modeling equation solutions with algebra tiles, transition to writing out the solution steps algebraically while still using the tiles. Eventually, progress to only writing out the steps algebraically without using the tiles.
   - $x + 3 = 6$
   - $x - 2 = 5$
   - $3x = 9$
   - $2x + 1 = 9$
   - $-x + 4 = 7$
   - $-2x - 1 = 7$
   - $3(x + 1) = 9$
   - $2x = x - 5$
   Continue to allow students to use the tiles whenever they wish as they work to solve equations.

2. Give each student a whiteboard and marker. Provide students with a problem to solve, and as they write each step, have them hold up their whiteboards so you can ensure that they are completing each step correctly and understanding the process. Be sure to discuss the reason for each step and why each step is important.

3. Next, give each student one of the Equation-Solving Ordering Cards. Have them find the other students who have the other steps of their equation and then line up the steps in

order. Emphasize that the process of equation solving involves completing each step, one by one.

4. Distribute copies of the Be the Teacher: Solving Equations activity sheet. Have students check through the solution to each equation to determine whether it is correct. If it incorrect, they should show the correct solution.

Assessment
- **Questions**
  - o   How can you check the solution to an equation?
  - o   Why is writing each step correctly in solving an equation just as important as finding the answer?
- **Journal/Writing Prompts**
  - o   Solve the following equation, showing each step, and explain in writing what you did at each step of the solution: $4(x - 2) = 8x + 16$.
  - o   Explain why showing the steps used to solve an equation is equally important as showing the correct answer.

Extensions and Connections (for all students)
- Have students demonstrate as many different ways as possible to solve an equation in one variable with the variable on both sides.
- Give students a real-world situation that involves a multistep linear equation in one variable with the variable on one or two sides of the equation. Have them set up the equation and solve.

Strategies for Differentiation
- Review how to combine like terms and apply the distributive property.
- Have students practice naming the different types of algebra tiles and expressions that can be made using the tiles before modeling equation solutions with the tiles.
- Use a balance scale to demonstrate how to keep an equation in balance.
- Have students check their work for each equation to ensure their solution is correct.
- Emphasize the importance of the steps used to solve equations, and ensure that students write the steps correctly as they solve.
- Progress from one-step equations to multistep equations with variables on both sides.
- Have students work in pairs or small groups on the "Be the Teacher" activity.

Equation-Solving Balance Mat

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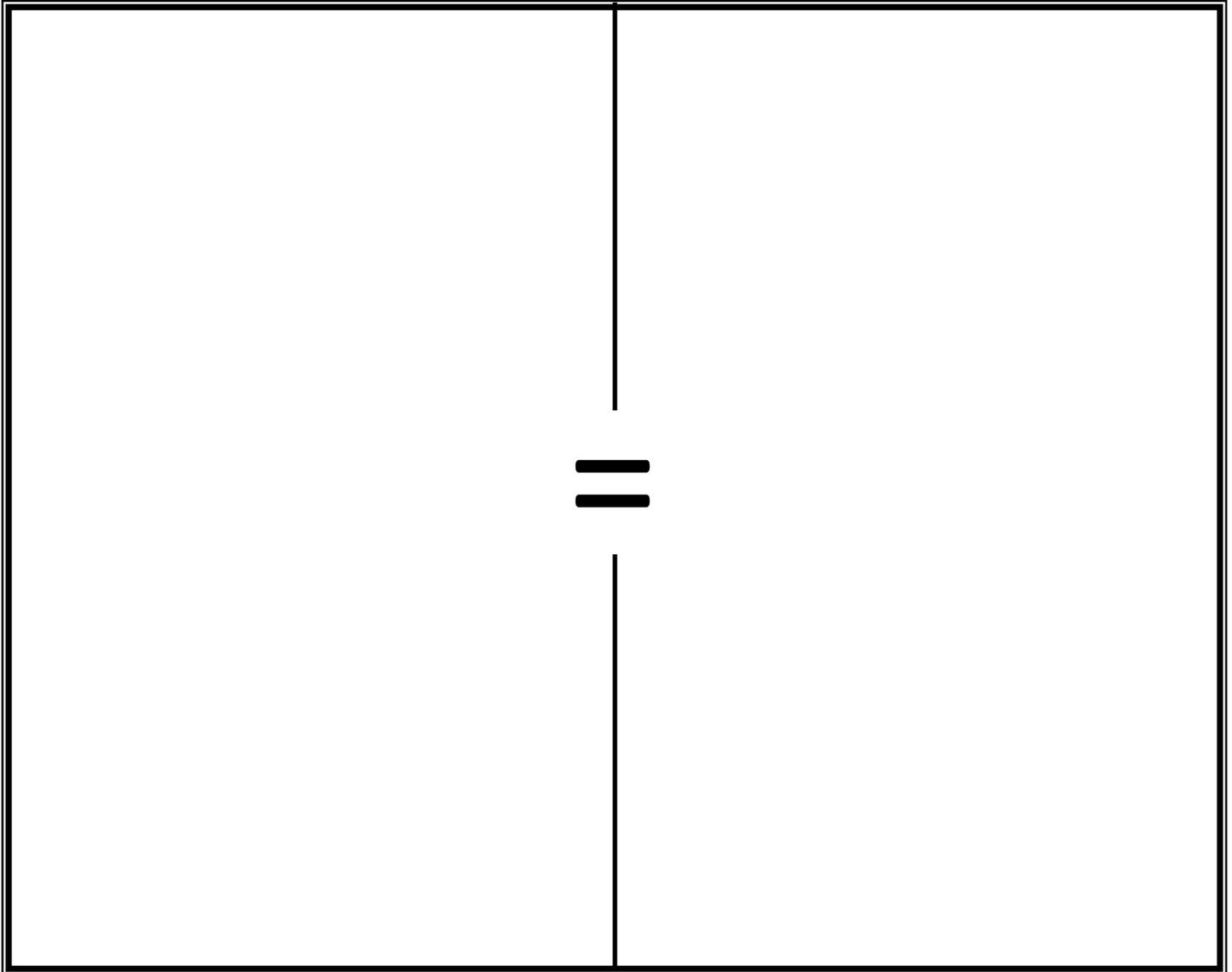
Equation-Solving Ordering Cards

Copy on cardstock and cut out.

$2x + 6 = 18$	**$3(x - 1) = 9$**
Subtract 6 from both sides.	**Distribute the 3 to the x and the -1.**
Divide both sides by 2.	**Add 3 to both sides.**
$x = 6$	**Divide both sides by 3.**
$4x = 7x + 3$	**$x = 4$**
Subtract $7x$ from both sides.	**$6x - 8x + 2 = -12$**
Divide both sides by -3.	**Combine like terms $6x - 8x$**
$x = -1$	**Subtract 2 from both sides.**
$x = 7$	**Divide both sides by -2.**

Be the Teacher: Solving Equations

Name _____ **Date** _____

Check the solution of each equation below. If you find a mistake, redo the problem correctly, and show the correct solution.

1. $6(x - 1) = 12x$
    $6x - 6 = 12x$
    $\underline{-6x \quad -6x}$
    $\dfrac{-6}{6} = \dfrac{6x}{6}$
    $x = 1$

2. $8x - 3x = -15$
    $\dfrac{5x}{5} = \dfrac{-15}{5}$
    $x = -3$

3. $-2(x - 4) = 10$
    $-2x - 8 = 10$
    $\underline{+8 \quad +8}$
    $\dfrac{-2x}{-2} = \dfrac{18}{-2}$
    $x = -9$

4. $3(x - 2) + 7x = -26$
    $3x - 6 + 7x = -26$
    $10x - 6 = -26$
    $\underline{+6 \quad +6}$
    $\dfrac{10x}{10} = \dfrac{-32}{10}$
    $x = -3.2$