Practice 2: Solving One-Step Equations with an Equation Balance Mat

STRAND: Patterns, Functions and Algebra

STRAND CONCEPT: Equality/Solving Equations

SOL: 6.13, 7.12

Remediation Plan Summary

Students solve one-step and two-step linear equations in one variable. Note that this lesson may need to be taught over 2 or 3 days depending on your students.

Common Errors and Misconceptions

Students see 2x as 2 + x.

Students may misapply integer operation rules when solving equations.

Students may misunderstand the process using inverse operations because they are using mental math to solve for the variable.

Materials

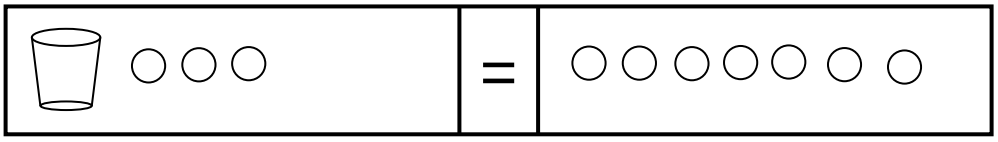
- Cups
- Two-color Counters
- "Warm – Up"
- "Equation Balance Mat Practice 2" handout

Introductory Activity

Assign the warm-up activity sheet. Students should be familiar with using cups and counters to solve one-step equations from the previous lesson.

Plan for Instruction

- Display the equation 3x – 2x + 3 = 7. Talk about how you set this up with cups and counters (used in previous lesson). Say: We first put down 3 cups. (Do this) The next step tells us to do something. It says to "take away 2 cups" so we are going to do this as part of the set up. Now we add the +3 counters and 7 on the right side of the equal sign so that the set up looks like this.



- In setting up we have already done one step in solving this equation.

  $3x - 2x + 3 = 7$

  $1x + 3 = 7$

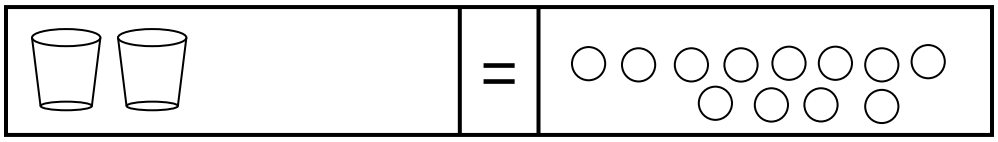
- We call this step "combining like terms" because to set up we already put together terms that are the same (cups are same terms just like 2x and 3x are same terms)

- Ask the students what to do next as they already have practice solving one-step equations.

- Repeat the process as many times as needed for your students using the cups and counters for two-step equations that combine like terms.

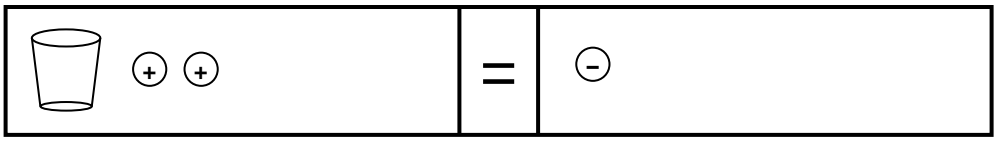
- Direct students to complete questions 1- 6 of the "Equation Balance Mat Practice 2" worksheet. Provide assistance where needed

- Explain to the students that up to this point, they have been solving equations with only addition and subtraction. The equation $2x = 12$ involves multiplication. Ask the class what the term "$2x$" means. ("Two *x*'s" or, in our model, two cups.) Then, set up the model of the equation by adding 2 cups on the left side of the mat and putting 12 counters on the right side to form a balanced equation.

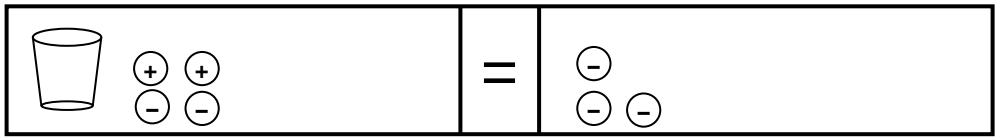


- Ask the students to tell you the next step in solving this equation, using the model. (Divide 12 counters on the right side into two equal groups to match the two cups on the left side). Because 2 cups are equal to 12 counters, 1 cup must equal 6 counters.
- Provide as much additional practice as a group as needed using equations such as $3x = 15$, model it with the procedure outlined in the previous step.
- When the students are ready for individual practice, assign equations 7 -9 on the worksheet.
- Explain to the students that so far, they have been solving equations with only positive numbers, but now they will see how to solve equations that include negative numbers. Display 3 positive counters (3 ones) to the students and ask them the value of the 3 counters. Then, place 3 negative counters (minus ones) next to the 3 positive counters and ask the students the value of the 6 counters all together. They should respond by saying "zero." If they do not, be sure to place each positive counter directly next to a negative counter so they can see why the value is zero. Refer to the combination of a positive and a negative together as a "zero pair." Ask the students to make zero in any form with their counters. Some will simply use 1 positive and 1 negative counter, while others may use 5 (or any equal number) of each. Allow students to share their zero pairs with each other.

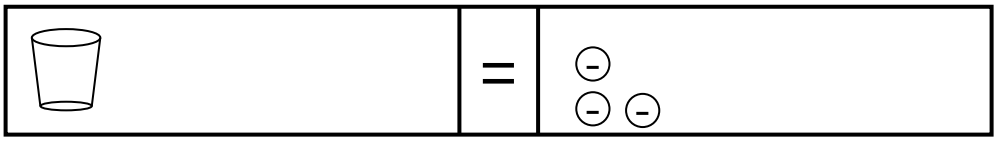
- Tell the students they will now use zero pairs to help them solve equations like this one: $x + 2 = -1$. Model this equation by placing 1 cup and 2 positive counters (ones) on the left side of the equation balance mat. Place 1 negative counter (minus one) on the right side of the mat. Remind the students that the goal is to get the cup by itself on one side of the equation balance mat.



- Ask the students whether it is possible to remove 2 positive counters from each side of the mat. (No, since there are no positive counters on the right.) Ask them what they could do to "cancel out" or reduce to zero the 2 positive counters on the left. (Add 2 negative counters to the left side to create 2 zero pairs on that side.) Ask, "If you add 2 negative counters to the left side, must you do anything to the right side to keep the equation balanced?" (Yes, add the same thing—2 negative counters—on the right side.)



- Point out that you now have 2 zero pairs on the left side and that they can simply be removed because they are equal to zero. Ask, "Does removing these 2 zero pairs change the value of the left side of the mat?" (No, because you are removing only zero.) "Must you do anything to the right side to keep the equation balanced?" (No) Point out that you have now solved the equation: the cup is now by itself on one side of the mat, and there are 3 negative counters (minus ones) on the other side. Therefore, the cup is equal to 3 minus ones, or $x = (-3)$



- Direct students to solve equations 10-11.
- Before assigning #12, point out (and model if needed) that sometimes you need to do two of the steps you learned today.

Pulling It All Together (Reflection)

Have students model, sketch and solve the following equation: $3x + 4 - 2x = -2$.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Name:

Equation Balance Mat Practice 2

Solve the following equations, using cups and counters on the equation balance mat shown below:

1. $x + 1 = 6$
2. $x + 2 = 5$
3. $5x = 10$
4. $4x - 3x + 1 = 17$
5. $3x + 4 + 2x = 24$
6. $5x + 2 + x + 3 = 23$
7. $3x = 9$
8. $2x = 22$
9. $12 = 4x$
10. $x + 3 = (-4)$
11. $x + 5 = (-8)$
12. $2x + 3 = (-11)$

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Name:

Warm-up

Solve the following equations, using cups and counters on the equation balance mat shown below:

1. $x + 5 = 10$
2. $x + 7 = 10$
3. $y + 2 = 5$
4. $t + 8 = 9$
5. $a + 4 = 6$
6. $x + 6 = 11$