

**Lesson Title: Build and Solve Equations****Pre 5.3****Utah State Core Standards and Indicators** Pre-Algebra Standards 2.2 Process Standards 1-4**Summary**

In these lessons, students use Hands On Equation manipulatives to model and solve equations.

**Enduring Understanding**

In algebra, we use the principle of equivalence to help us solve for unknown quantities. Equations and variables are the algebraic conventions used in this problem solving process

**Essential Questions**

How does the principle of equivalence work to help us find missing information?

**Skill Focus**

- Solving basic 1 and 2 step equations.

**Vocabulary Focus****Assessment****Materials**

- Precision School Balance (if possible). Some kind of model for a balance scale to place manipulative on.
- Hands-On® Equations® or teacher created manipulatives.
- One baggie per student that contains 4 number cubes ( 2 cubes numbered from 1-6 and 2 cubes numbered from 7-12) and 8 to 10 triangles to represent the variable (the green triangles from pattern blocks would work well).
- Mats for students that are divided into two equal parts representing 2 sides of the balance scale.

**Launch ideas:**

“We talked about ways to launch the Hands on Equations assignment and the word problems and equations assignment. We had done a lot of fun things! My favorite was handing out candy to half of the class and not to the other half. Then we had a discussion why that wasn’t fair, and that what I did to one side I had to do to the other.”

“Keep asking the question, is it balanced? And saying what you do to one side you have to do to the other.”

“Launches that worked: Teeter tooter, balancing, zero pairs, value, teaching them to read the manipulatives.”

”Use the balance scale to introduce the idea of adding or subtracting the same thing to both sides to maintain a balance. As you relate the scale to an equation, be sure the students understand the sides of the scale are the sides of the equation with the equal sign being the balance. Model equations using the teachers set before the students receive their sets. Have the students take notes so that they have examples of the kind of work each problem should show. Use the above vocabulary and ask questions of the students to verify their understanding. Replace the triangle with the value of  $x$  and check the balance of the scale.”

**Explore ideas:**

“We showed the students the examples with the pawns and dice, and then let them explore doing the rest of the problems.”

“We all felt that it got hard really quickly. S’s sevie’s had a hard time making the jump. I supplemented with more worksheets before giving the distributive page. I used the manipulatives very little because my students were comfortable drawing. D used them more.”

“Students work in pairs with the hands on equations. As they use the manipulative have them write each step of the equation solving process. You could also have students draw each step on one side of a T chart and write the solving process step on the other side for a more visual comparison of how the manipulative relates to the solving process. Ask students why the checking process works. What does it mean if the sides do not balance? Colors help the student distinguish between positive and negative.”

**Summarize**

“We loved this assignment! Some of us were a little hesitant at first, but realized that it was very useful and helpful for helping the kids understand how to manipulate equations. We each had great experiences! And we are going to use the rest of the build and solve equations worksheets. This, for me, was probably my best couple of weeks of teaching! I had students telling me I was a good teacher and that they finally understood things they never had before! My classes have actually ALL worked hard the past few weeks, because they get it, and they can do it! It has been great 😊”

“Using the check as a summary helped cement the idea of what you are solving for and what it all means. We all thought showing work was essential.”

**Apply**

## Directions:

To create number cubes, use unnumbered dice or plain 1 inch wooden cubes. Prepare 4 cubes for each student, 2 cubes with the numbers 0-5 written on and 2 cubes with the numbers 6-12 written on.

\*\*\*\*In all the worksheets below, have students check their answers by substituting in to the original problem or the equation. They can write the numbers above the symbols.

**Introduce the idea of a balance scale.** Show the balance scale using grams weights.


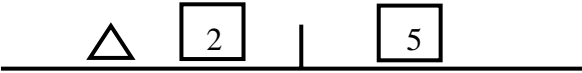




1. Set the scale so that both sides are balanced.
2. Put a 2 gram weight on both sides. The scale is still in balance because the same thing happened to both sides.
3. Put two 5 gram weights on one side and one 10gram weight on the other. The scale is still in balance because even though each side looks different, each side has the same value.
4. Model taking the same thing off both sides and maintaining the balance.
5. Demonstrate the use of manipulatives to represent variables and numbers. Place equivalent blocks on both sides of the balance scale model. Then use a triangle  $\triangle$  to balance a 5, then a 3 etc. The variable varies.
6. Show these others:  $\triangle$  with a 7, a 2, two triangles with an 8, three triangles with a 12. How can we find out what one triangle is equal to? What can you do to both sides so that you are left with  $\triangle = \underline{\quad}$
7. State the rule: Each side of the balance must always equal the other. Your job is to find out the value of one of the triangles
8. Have students complete the worksheet. Teacher moves around the room to listen and assess progress.

# Build and Solve Equations

## Worksheet #1

How can we find out what one triangle  $\triangle$  is equal to in the problems below? The triangle stands for the unknown. Use the letter  $x$  to represent the unknown when writing an equation



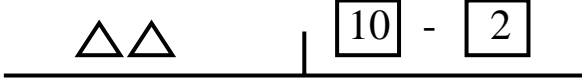



1. Write each equation represented by the balance scale.
2. What can you do to both sides of the balance scale to find what the  $\triangle = \underline{\quad}$
3. Write every step you perform on the balance scale as a step in solving the equation.

Problem	Equation & Solution
1) 	$2x = 8$
2) 	
3) 	
4) 	
5) 	$4x = 2x + 10$
6) 	$2x+5 = 3x+1$

What is the secret to solving equations? Be prepared to explain your groups' ideas.

# Build and Solve Equations


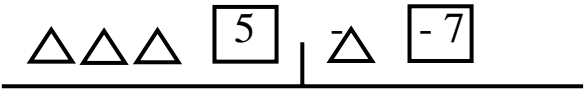
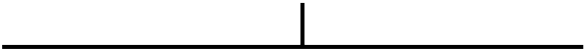


## Worksheet #2

Problem	Equation & Solution
1) 	$x + 5x = 4x + 10$
2) 	$2x + 4 + 3x = x + 12$
3) 	
4) 	
5) 	$2x+3+3x = x+11$
6) 	$x + 3x - x = 30$

What are some rules you could use to help you solve equations? Be prepared to explain.

# Build and Solve Equations







## Worksheet #3







Problem	Equation & Solution
1) 	$x + 3x - 6 = 30 - 2x$
2) 	
3) 	$2(x+5) = 13$
4) 	$2(2x+3) = 3x+9$
5) 	$2(3x+1) = x+22$

What new ideas did you get today about solving equations? Be prepared to explain.

## Introduction to Equation #5

Build and/or solve the equations. Use manipulatives to help you if necessary. Otherwise show steps.

Problem	Equation and Solution
1) 	$2(x+5) = 13$
2) 	$2(x+5) = 11 + x$
3) 	$2(2x+3) = 3x+9$
4) 	$2(x+5) = x+4$
5) 	$3x+x = 2x+2$
6) 	$4x = 2x+4$

<p>7)</p> 	$3x+7 = 4x$
<p>8)</p> 	$x+ 2x- x+7=3x+2$
<p>9)</p> 	$2(3x+1) = x+22$
<p>10)</p> 	$5x-3x+x+8 = 2x+1+ x+x$
<p>11)</p> 	$4x-2x+3 = 2x+2x-x$
<p>12)</p> 	$2(x+4) = x+10$

# Homework

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Order from least to greatest weight.