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Units *&* Lessons
MATHEMATICS

Grade 8

Grant funded by:



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Grade 8 • Edition 1

Lesson 6: Introduction to Substitution

Focus Standard(s): 8.EE.8b

Additional Standard(s): 8.EE.7a, 8.EE.7b

Standards for Mathematical Practice: SMP.1, SMP.2, SMP.3, SMP.4, SMP.5, SMP.6, SMP.7, SMP.8

Estimated Time: 55 minutes

Resources and Materials:

- Algebra Tiles
- Graph paper
- Rulers
- Handout 6.1: Equation Mat
- Interactive Algebra Tiles: http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html

Lesson Target(s):

- Students will demonstrate the concept of substitution using Algebra Tiles.
- Students will utilize the substitution method to solve a system of equations.

Guiding Question(s):

- How can a system of equations be solved when the point of intersection is not a lattice point?

Vocabulary


Academic Vocabulary:

- Substitution

Instructional Strategies for Academic Vocabulary:

- Introduce words with student-friendly definitions and pictures
- Model how to use the words in discussion
- Discuss the meaning of word in a mathematical context

Write/discuss using the words

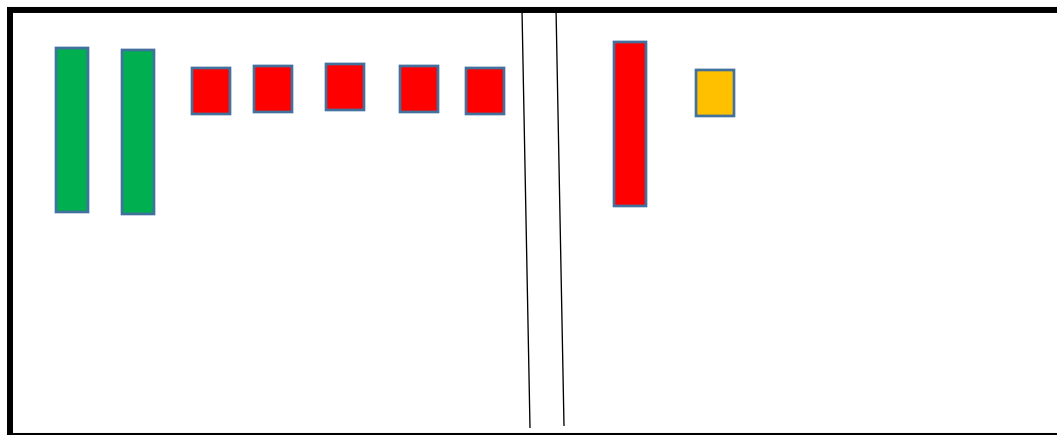
Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)
Instructional Plan	
<p>Understanding Lesson Purpose and Student Outcomes: Students will recognize that graphing systems is not always the most efficient method of solving. Students will use Algebra Tiles to develop a conceptual understanding of solving a system of equations using the substitution method.</p> <p>Anticipatory Set/Introduction to the Lesson: Do Now Distribute graph paper. Instruct students to graph to solve the system $y = 3x - 2$ and $y = 5x + 1$. Tell students to Turn and Talk to share the solution to the system (SMP.3).</p> <p>Note: The solution to the system is not easily seen from a graph. Allow students time to productively struggle in finding an accurate solution (SMP.1)</p> <p>Explain that sometimes graphing isn't the best method for solving systems because if the point of intersection is not on a lattice point, the solution may not be accurate. Introduce substitution as a alternative method that may be used to find the exact solution to systems of equations (SMP.6)</p> <p>Activity 1: Substitution using Algebra Tiles Note: If Algebra Tiles are unavailable, teacher may print tiles on cardstock and allow students time to cut out their own set of Algebra Tiles or Interactive Algebra Tiles can be found online.</p> <p>Distribute Algebra Tiles and Handout 6.1: Equation Mat. Model solving equations using the equation mat with algebra tiles (SMP.5). Write the following systems on the board: $y = 2x - 5$ and $y = -x + 1$.</p>	

Ask students what the two equations have in common. Guide students to discuss that they are both in slope-intercept form, therefore both equations are indicating what y equals (SMP.2). Have student highlight what y equals in each of the equations.

$$y = 2x - 5 \quad \text{and} \quad y = -x + 1$$

Facilitate a conversation detailing how y can be substituted with an expression it is equivalent to. Tell students that since y is equivalent to $2x - 5$ and $-x + 1$, that those two expressions are equivalent to one another (SMP.8).

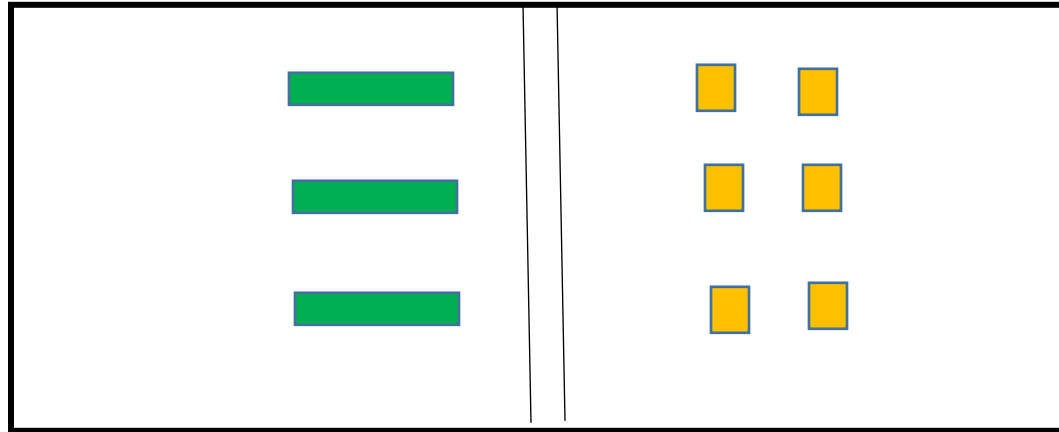
Model the equation with Algebra Tiles and algebraically, having students follow along (SMP.4).



$$2x - 5 = -x + 1$$

Solve for x by putting all x tiles on one side of the double lines and all square tiles on the other. Remind students they made add an equal number of tiles to each side to create zero pairs or “flip” over the double line (SMP.7).

Continue solving for x using Algebra Tiles. Students will distribute the square tiles evenly to each x tile.



$$\begin{aligned} 3x &= 6 \\ x &= 2 \end{aligned}$$

Ask students what a solution of a system of equation is and to Turn and Talk about whether they believe the process of solving using substitution is complete and why (SMP.3).

Reemphasize that a solution to a system is an ordered pair and has an x and y value. Have students share ideas for how we can find the y -value for the system using substitution now that we have an x -value. Allow students time to substitute the x -value to solve for the y -value. Provide students several examples to practice substituting using Algebra Tiles. Ensure students are representing their work algebraically as well.

For students who are EL, have disabilities, or perform well below grade level:

- Provide students with a list of rules for solving equations with Algebra Tiles.

Extensions for students with high interest or working above grade level:

- Encourage students to first solve algebraically and then verify solution with Algebra Tiles.
- Ask students to make predictions about what systems with no solution or infinite solutions would look like with Algebra Tiles.

Note: Teacher may want to use the “Checkpoint System” in which students complete one step and waits until teacher checks for comprehension and accuracy. For example,

- Students use tiles to represent the next system.
- Teacher assesses student progress.
- Students use tiles to substitute.
- Teacher assesses student progress.
- Students use tiles to solve.
- Teacher assesses student progress.

✓ Display three more systems for students to work on independently. Monitor student progress for comprehension.

Reflection and Closing:

✓ **Exit Ticket:** Students write down pros and cons of using graphing and substitution methods.

Homework

Students will draw a representation of the following systems using algebra tiles (SMP.4).

1. $y = 4x + 3$; $y = 2x - 4$
2. $2x + y = 6$; $y = 5 - 2x$
3. $7 - 2y = x$; $x + 2y = 3$

Handout 6.1: Equation Mat

Name: _____

Date: _____



For training or questions regarding this unit,
please contact:

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