**Lesson Plan Title:** Variables on Both Sides Equations & Intro to No Solution

**Teacher’s Name:** Anna Eng  **Subject/Course:** Mathematics

**Unit:** Equations  **Grade Level:** 8th Grade

**Overview of and Motivation for Lesson:**

To review and refresh students’ understanding of how to solve two-step equations. To help students practice solving two-step equations with different combinations of multiplication/division and addition/subtraction, distributive property, and combining like terms. To review students’ understanding of algebraic vocabulary related to equations. To introduce the possibility of a no solution equation where the variable terms are eliminated.

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| **Stage 1-Desired Results** |
| **Standard(s):*** 8.EE.C - Analyze and solve linear equations and pairs of simultaneous linear equations.
	+ 7. - Solve linear equations in one variable.
		- 7a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of the possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).
		- 7b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
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| **Aim/Essential Question:*** How can you solve an equation that has variables on both sides?
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| **Understanding(s):***Students will understand that . . .** they must do the same to both sides of the equation.
* when an expression is evaluated, they use the order of operations.
* when an equation is solved, they use the reverse order of operations, and the goal is to isolate the variable term and solve for the variable.
* they can check their solution by inserting their answer into the original equation and then evaluating.
* cross-multiplication can be used to solve a division one-step equation.
* algebraic vocabulary can be used to orally describe steps in solving one-step and two-step equations.
* the distributive property can be used to expand an expression.
* like terms can be combined to simplify an expression.
* terms can be moved to opposite sides of the equal sign by performing the inverse operation.
* addition is commutative.
* multi-step equations can be solved by performing one step at a time.
* if the variable terms are eliminated, the equation will have no solution. (Results in a=b, where a and b are different numbers).
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| **Content Objectives:** *Students will be able to . . .* * solve two-step equations by using the inverse operations to isolate the variable.
* check solutions to two-step equations by using the solution to evaluate the original equation.
* solve two-step equations with variable terms on both sides.
* solve two-step equations where the variable term is eliminated, resulting in no solution.
 | **Language Objectives:**ELD Level 2. *Students will be able to . . . in English** write in fill-in-the-blanks that declares there is “no solution” to a given equation and provides a reason as to why.

ELD Level 5. *Students will be able to . . . in English** write a statement that declares there is “no solution” to a given equation and provides a reason as to why.
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| **Key Vocabulary*** Equation
* Variable
* Coefficient
* Constant
* Term
* Solve/Solution
* Check [solution]
* Statement
* Like terms
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| **Stage 2-Assessment Evidence** |
| **Performance Task or Key Evidence*** Students will be trying examples of equations similar to the ones shown in the videos. Using Pear Deck, they will draw or type on their screens to answer the examples for the teacher to view. If students need extra practice, additional examples will be provided.
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| **Key Criteria to measure Performance Task or Key Evidence*** Students’ steps in solving the two-step equations.
	+ Do they show all the steps in solving a multi-step equation?
	+ Do they use the Reverse Order of Operations?
	+ Do they check their solution or write a statement?
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| **Stage 3- Learning Plan** |
| **Learning Activities:**Do Now/Bell Ringer/Opener:* Check-in & Attendance
	+ Using a presentation (with Pear Deck).
	+ Warm-up
		- Two-step equation with variables on both sides and one constant.
		- Multiple choice vocabulary practice.
* (About 7 minutes total)

Learning Activity 1:* Using a [presentation](https://docs.google.com/presentation/d/1IpF2m_QqHql6pDH9S5vVXBFguHHd16Mzv6stmQugazU/edit?usp=sharing) (with Pear Deck).
	+ Solving equations with variables on both sides and 1 constant (~23 minutes)
		- 1-2 videos, 1 example
	+ Solving equations with no solution. (at least 30 minutes for remainder of class)
		- 1 video, 2 examples
	+ Mixed practice of one solution/no solution equations
		- 1-2 examples
	+ Student practice (show steps and check/statement) [Backup example problems are included for extra practice as needed]
* (About 53 minutes total)

Learning Activity 2:* Using a presentation (with Pear Deck).
	+ Vocabulary - Practice (multiple-choice scattered in slides for break)
	+ (About 2 minutes total)

Application Students will be able to apply their approaches in solving two-step equations to algebraically solve other multi-step equations using the reverse order of operations (SADMEP), distributive property, and combining like terms. These steps can be used to solve more complex two-step equations, including variables on both sides and the distributive property, as well as in solving word problems involving multi-step equations. Students will be able to differentiate between equations with one solution and equations with no solution.Summary/Closing* Check for any final questions.
* Describe homework/asynchronous aspects..
* (About 4 minutes total)

**Multiple Intelligences Addressed:**

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| ☐ Linguistic | ☐ Logical-Mathematical | ☐ Musical  | ☐Bodily-kinesthetic |
| ☐ Spatial  | ☐ Interpersonal | ☐Intrapersonal | ☐Naturalistic  |

**Student Grouping****☐** Whole Class ☐ Small Group ☐ Pairs ☐ Individual**Instructional Delivery Methods**☐Teacher Modeling/Demonstration ☐ Lecture ☐ Discussion☐ Cooperative Learning ☐ Centers ☐ Problem Solving☐ Independent Projects |
| **Accommodations*** Provide captions for the videos for students to follow along.
* Provide videos with visual and audio included.
 | **Modifications**Click here to enter text. |
| **Homework/Extension Activities:*** 10 questions with a mix of two-step equations/vocabulary.
	+ 8 equations (4 one solution, 4 no solution)
	+ 2 vocabulary practice
* YouTube video for reference of two-step equations with no solution.
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| **Materials and Equipment Needed:*** Pear Deck
* Screencastify Videos
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**Adapted from Grant Wiggins and Jay McTighe-*Understanding by Design***