**Lesson Title:** Using substitution and elimination methods

**Unit Title:** Solving Systems of Linear Equations

**Teacher Candidate:** Bertha Valencia

**Subject, Grade Level, and Date:** Algebra, 9th and 10th grade, February 11, 2015

**Placement of Lesson in Sequence**

This lesson is the second lesson out of three in the solving systems of linear equations unit. In the first lesson students learned how to solve systems of linear equations by graphing. Students were able to distinguish what graphs described a system that only had one solution, no solution, and infinite number of solutions. In this lesson students will learn two other methods that can be used when solving systems of linear equations, they are the substitution and elimination methods.

**Central Focus and Essential Questions**

The central focus of this lesson is for students to be able to apply the substitution and elimination methods when solving systems of linear equations. The questions to be answered are, “How can I manipulate an equation to perform the substitution method or elimination method?” and “Does my answer make the initial equations true?” Students will be given two practice problems after being introduced the new methods to practice. Manipulating the equations will be necessary to use the specific method for the problem.

**Content Standards**

CCSS.Math.Content.HSA.REI.C.5:

Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

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| **Learning Outcomes** | **Assessment** |
| Students will be able to apply the substitution and elimination methods to solve systems of linear equations.  | For this lesson, the teacher will use the students’ work on the four practice problems to assess how much was achieved in this lesson. Students worked independently on these problems so the teacher can have a good idea of the areas students are struggling with. This information will allow the teacher accurately assess areas of concern that may need to be addressed in the next lesson. |

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| **Learning Targets** | **Student Voice** |
| I will be able to use the substitution method and elimination method to solve systems of linear equations.  | Students will be able to ask clarifying questions when the teacher is explaining the methods of substitution and elimination to solve systems of linear equations. The teacher will also elicit student voice by asking questions to check for understanding when presenting the two methods to the students.  |

**Prior Content Knowledge and Pre-Assessment**

This is the second lesson in the unit so students have a visual understanding of what solutions of systems of linear equations are after solving by graphing. Students also have prior knowledge when working with equations and how to solve for “y.” This will be helpful when manipulating equations will be necessary to successfully use the substitution and elimination methods. In the previous pre-assessment students were assessed of their conceptual understanding of how systems of linear equations have different solutions. Students understanding that there could be systems of linear equations that are inconsistent, dependent, and some that only have one solution is very important when transitioning to symbolic and numerical representations of the systems.

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| **Academic Language Demands** |
| **Vocabulary & Symbols** | **Language Functions** | **Precision, Syntax & Discourse** |
| * Inconsistent system
* Dependent system
* Elimination method
* Substitution method
 | Students will need to know and apply correct vocabulary when asked to use a specific method to solve systems of linear equations. Also when describing a solution correct vocabulary needs to be used. | **Mathematical Precision:** When solving systems of linear equations using the substitution and elimination methods students must manipulate and combine equations correctly in order to obtain the correct solution to the systems. **Syntax:** Students will be given several equations they might have to manipulate in order to substitute one equation into the other or get one equation to eliminate one of the variables when practicing the two new methods. **Discourse:** In this particular lesson students will have an open discourse as a class when the teacher is presenting the new methods to the class. The teacher will ask questions to check for understanding throughout the lesson so students have an opportunity to share their thoughts and ideas on the new methods.  |

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| **Language Target** | **Language Support**  | **Assessment of Language Target** |
| I will be able to explain the process of solving systems of linear equations by using the substitution and elimination methods. I will also be able to explain what a solution means when solving systems of linear equations. | As a class, students will be introduced to new vocabulary words during this lesson in exploring two new methods to solve systems of linear equations. The teacher will be sure to emphasis those new vocabulary words and their differences. At this point students are able to ask clarifying questions and also when they are working individually on the practice problems.  | Students will be formally assessed when completing the four practice problems and describing the solutions he or she found as their answer.  |

**Lesson Rationale (Connection to previous instruction and Objective Standards)**

 This lesson connects to the previous lesson because it introduces new methods to solving systems of linear equations. After learning how to solve by graphing, which is visual, students need to explore the idea of solving systems of linear equations numerically. The first lesson dealt with more of a conceptual understanding of systems of linear equations and how the graphs describe the solutions of the systems. This second lesson focused more on the procedural fluency of finding the solutions using methods that do not require visuals. This lesson expands on what students learned in the previous lesson about possible solutions of systems of linear equations and makes the students analyze the systems differently using just the equations to solve the systems of linear equations.

**Differentiation, Cultural Responsiveness and/or Accommodation for Individual Differences**

In order to accommodate to all students, the learning target will be written on the board so that all students are aware of what they should strive to achieve by the end of the class period. The teacher will give direct instruction when presenting the two new methods to solve systems of linear equations. The teacher will also use this time to ask clarifying questions to make sure students are understanding the material. This is very beneficial to students that have a difficult time staying focused because the teacher is keeping those students engaged and accountable when taking notes on the new material. Although students will be working individually on the practice problems, the teacher will be available to help students that may need clarification of the problem and/or if they are struggling with the procedure of the methods.

**Materials – Instructional and Technological Needs (attach worksheets used)**

Projector to display practice problems that will be assigned for each method

Textbook that every student has to see practice problems.

White board in which the teacher will demonstrate examples of the two methods being used.

Students will need to take notes on the new methods for later reference.

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| **Teaching & Instructional Activities** |
| **Time** | **Teacher Activity** | **Student Activity** | **Purpose** |
| 5 min | Review what types of solutions were found when solving systems of linear equations by graphing. | Students will be participating in a whole class review about what they found in the previous lesson when graphing to solve systems of linear equations.  | The connection of the two lessons is important. Students should understand that they types of solutions found will be the same but the solving methods will be different.  |
| 15 min | Introduce the substitution method to solve systems of linear equations. Demonstrate the process of manipulating an equation and plugging it in to the other to solve for “x” and “y.” Show that the solution will be an ordered pair and use specific vocabulary to describe the solution. The teacher will also ask clarifying questions to make sure students are understanding the process.  | Students will take notes on how to apply the substitution method. Students can also ask questions to make sure the method is clear. When asked by the teacher, students will also share what he or she understands regarding the substitution method.  | The purpose of this activity is for students to learn about a new method, which they can use to solve systems of linear equations without graphing them.  |
| 7-8 min | The teacher will give students specific practice problems out of their textbook that they have to solve by using the substitution method. At this time the teacher will be available to help students that may need help or struggle with using the new method.  | Students will work on these practice problems on a separate sheet of paper that they will turn in at the end of class. If students have any questions they can ask the teacher for help.  | The purpose of this activity is for students to practice individually the new method. This is a great way for students to assess their own learning and evaluate how well they can apply the solving method of substitution.  |
| 15 min | Introduce the elimination method to solve systems of linear equations. Demonstrate the process of manipulating an equation to eliminate one of the variables when adding it to the other equation and solving for “x” and “y.” Show that the solution will be an ordered pair and use specific vocabulary to describe the solution. The teacher will also ask clarifying questions to make sure students are understanding the elimination process. | Students will take notes on how to apply the elimination method. Students can also ask questions to make sure the method is clear. When asked by the teacher, students will also share what he or she understands regarding the substitution method.  | The purpose of this activity is for students to learn about a new method, which they can use to solve systems of linear equations without graphing them. Students now have three different methods to solve systems of linear equations.  |
| 7-8 min | The teacher will give students specific practice problems out of their textbook that they have to solve by using the elimination method. At this time the teacher will be available to help students that may need help or struggle with using the new method. Before the class time is over, the teacher will ask several students to share their answers so that the entire class has an idea of how they did.  | Students will work on these practice problems on the same sheet of paper and turn it in before leaving class. If students have any questions they can ask the teacher for help. Students will share answers and compare their solutions with those of their classmates.  | The purpose of this activity is for students to practice individually the new method. At this time students can assess their own learning and evaluate how well they can apply the elimination method.  |