High School: Algebra I
Solving Systems of Equations

This learning progression was designed primarily for students who are in a traditional classroom setting and have similar mathematical abilities. This class consists of 28 students, mainly freshmen, who are studying algebra I as part of their graduation requirement. The algebra I class has been designed to cover topics at a pace that meets the state requirements of content topics in high school algebra. Since the class is set up on a semester system, the majority of the students in this class have been a part of this class since the start of the school year and have had the same exposure and background knowledge about algebra. Many students enjoy talking and taking part in discussions during class, that is why I am going to teach this learning progression in a student-lead conversation.

Standards:
The Common Core State Standards that will be satisfied are from the High School Algebra: Reasoning with Equations and Inequalities cluster. We will cover CCSS.MATH.CONTENT.HSA.REI.C.6 solving systems of linear equations exactly and approximately. We will also 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 with standard CCSS.MATH.CONTENT.HSA.REI.C.5. In this course, students focus on mastering basic algebra knowledge that is required by the state, while integrating in common core standards and mathematical practices. In this learning progression the students will use four mathematical practices including: MP4, MP5, and MP7.
The curriculum these students are learning is based off the *McDougal Littell: Algebra I.* This textbook is a resource used to design lectures, find worksheets, and create practice problems through.

Accommodations:
Throughout the learning progression accommodations are made for students with IEPs and ELL students. For the students who need a longer amount of time to write down their notes, they are able to get the notes from me a day early so that they do not fall behind during lecture and are able to participate in the discussion during class. Another accommodation made is that I let my 2 ELL students sit next to each other because they feel most comfortable working in partners this way. In addition to these accommodations, the learning progression designed has activities that are accessible to all learners. They do not require internet or any other tools beside from the classroom projector, pen, and paper.

Central Focus:
The central focus of this learning progression is for students to understand how to solve systems of linear equations by graphing, substitution, and combination. Students will also have an understanding of how to identify which process is most effective to use given a system of linear equations.

Lesson 1: Substitution

The central focus and purpose for this learning segment is to understand when and how to use substitution to solve systems of linear equations, fluently solve systems of linear equations by substitution, and be able to explain their answer using vocabulary including: distribute, cancellation, ordered pair, and intersection.

We will start with an introduction to systems of linear equations and a brief reminder of how to solve systems of linear equations by graphing. Since many of the students have already had an introduction to this topic, it will be much easier to engage in a class in student lead discussion when I ask them, "How can you solve a system of linear equations by graphing?" and "What format do we look for when writing our solution?" This discussion of solving systems of linear equations by graphing will begin to build their mathematical thinking and conceptual understanding that they will use again during their partner tasks.

Entry Task: Find the intersection point of the following system of equations: y=x-2 and y=5.

Answer: (7,5)

During the entry task students will demonstrate MP 7 looking for a way to identify structure. After reviewing the entry task I will have the students take notes on solving systems of linear equations by substitution. After this I will put two problems on the board and students will complete the problems in groups, of 2-4 people and discussing their problem solving approach. Students will then write the answers on their paper and once finished we will discuss solutions. Then we will discuss any final questions the students might have.Students will exhibit their conceptual understanding and procedural fluency through group and whole class discussions. I will identify whether or not the learning targets have been met by answering these questions:

-Do the students show proof of understanding solving systems of equations by substitution?

-Can my students correctly solve for a system of linear equations by substitution? Student will self-assess and peer-assess in their groups. When students discuss their ideas as a group to the class I will know whether they understand how to solve systems of linear equations by substitution. I will make sure that the students have a chance to ask questions in a group setting or individual as they complete their individual assessment task at the end of the lesson. I will use these types of assessment as immediate feedback in order to self-reflect on my teaching of the system of linear equations unit.

Attached below is my rubric for assessment of this lesson:

	On Target	Developing	Missing
1. Created the correct graph during the entry task	On Target 3	Developing 1	Missing 0
2. Solved system of linear equations using substitution	On Target 3	Developing 1	Missing 0
3. Student justifies how to set up and solve system of linear equations using substitution	On Target 3	Developing 1	Missing 0

Lesson 2: Combination

The central focus and purpose for this learning segment is to understand when and how to use combination to solve systems of linear equations, fluently solve systems of linear equations by

combination, and be able to explain their answer using vocabulary including: distribute, cancellation, ordered pair, and intersection. In this activity students will be able to solve systems of linear equations as well as be able to explain their answers. We will not have a warm up activity today, but instead start with learning the new process, combination, of solving systems of equations We will be expanding our knowledge of systems of linear equations by building off of the prior lesson where students learned about solving by substitution. I will work through two example problems of solving by combination and hold a discussion. After this, we will break up into groups and I will give each group one system of equation to solve using combination. Then I will split the groups again so that every member in a group has a different problem solution. They will then explain their process to their group. This lesson aligns with the following standard CCSS.MATH.CONTENT.HSG.CO.C.6 solving systems of linear equations. Finally once groups have explained their work, I will ask questions to assess their understanding such as "Where their any similarities in the procedures you used to solve you problem?" and "Where you able to follow each others explanations of solving equations by combination?"These questions are important to ask students to make sure that they are using tools (such as combination procedures) appropriately MP5. These group discussions will be a formative and summative assessment to make sure that students can properly use the new information we just learned as well as explain their answers using old vocabulary.

Attached below is my rubric for this lesson:

	On Target	Developing	Missing
1. Created the correct set up for solving systems of equations using combination	On Target 3	Developing 1	Missing 0
2. Solved system of linear equations using combination	On Target 3	Developing 1	Missing 0
3. Student justifies how to set up and solve system of linear equations using combination	On Target 3	Developing 1	Missing 0

Lesson 3: Choose your own adventure
The central focus and purpose for this learning segment is to understand when and how to use graphing, combination, and substitution to solve systems of linear equations. Also, students should be able to fluently solve systems of linear equations by any method learned and be able to explain their answer using vocabulary including: distribute, cancellation, ordered pair, and intersection. In this activity students will be able to solve systems of linear equations as well as be able to explain their answers. This will help students make sense of all three methods for solving linear equations. One of the key components of this lesson is being able to set up a system of linear equations from an applied word problem. Students will start with a brief overview of how the class will be set up today. Then I will split the class into 3 groups: graphing, substitution, and combination. Then I will give the students one applied word problem to solve. Once they have worked on it independently for 10 minutes then they have another 10 minutes to collaborate with their groups and determine who will be presenting their information to the class. Then each group will have one student come to the front board and explain their work. By the end of the presentations the students will have identified 3 ways to solve one problem all resulting in the same answer. During this activity students will achieve their learning target of CCSS.MATH.CONTENT.HSA.REI.C.5 and MP 4: "Model with Mathematics" because students will use their applied word problems to model a relationship between a system of linear equations. Then students will be given an exit task to complete to which will include solving another applied word problem any

way that they would like. In addition to this word problem students will answer 3 questions: What solving strategy did you use? Why did you choose this strategy? How confident are you in all three solving techniques (1 to 5 rating)?

Attached below is my rubric for this lesson:

	On Target 3	Developing 1	Missing 0
1. Set up an applied word problem correctly	On Target 3	Developing 1	Missing 0
2. Solved system of linear equations using any of the three methods	On Target 3	Developing 1	Missing 0
3. Student justifies how to set up and solve system of linear equations	On Target 3	Developing 1	Missing 0