

High School: Algebra

Creating Equations

This learning progression is for a 9th grade Algebra 1 classroom. The progression is supported by the textbook, “Algebra 1: Applications, Equations, Graphs,” by Larson, Boswell, Kanold, and Stiff. The progression follows information in the textbook, but not necessarily in the order that the book presents it. This progression has one main Common Core State Standard that it focuses on, which is CCSS.MATH.CONTENT.HSA.CED.A.2: create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. The progression has three main lessons, which have focuses on creating equations from graphs using slope-intercept form, graphing equations in slope-intercept form, and creating equations and graphing them, from real world word problems.

These lessons will be a mix of direct instruction, discussions, I do-we do-you do, individual work, group work, and homework. As the students get more comfortable with the progression and through out the progression, they will reason abstractly and quantitatively (MP2), construct viable arguments and critique the reasoning of others (MP3), and model with mathematics (MP4). Students will mainly practice these things during the assessment activities.

Once the students have a good understanding of the content, each segment can move to activities with a focus on student voice. This gives students a chance to explain their reasoning and discuss the concepts with their peers. The students will be working in groups more often, the farther along they are in the progression. This helps the students who are struggling to be assisted by their peers, and it helps the students who are excelling to be able to go one step further by teaching the information. It is also a way to give the students who learn better from discussion or are too shy to speak out in full-class discussions, the opportunity to maximize their learning.

Creating Equations

Instead of following the textbook’s progression exactly, this learning progression slightly jumps around. Students should know how to solve for a variable in an equation with two or more variables, which will allow them to learn and understand point-slope form. But, they do not yet know how to graph these equations or apply them to the real world.

The first segment will focus on creating equations from graphs using slope-intercept form. On this day, I will have students look at a graph and brainstorm how they might write an equation from the graph, which will lead to a discussion of slope-intercept form. To teach the students how to do this, I will do a problem, do a problem with the student, and then have them do a problem individually. It is important to focus on the components of an equation in point-slope form and how that applies to a graph. Use the benchmark to the right to determine student understanding (BM1).

BM1 – Looking at the graph shown above (graph $y=3x-2$), what is the equation that matches this line?

Once students seem to have a strong understanding of this concept, it is time for the assessment portion. To assess students in this section, I will have them work individually on ten problems similar to the benchmark question. The reason for having students work individually and on a large amount of problems is to give them a chance to repeat the steps thoroughly and focus on the new concept. During this time I will be walking around the room to answer questions and assess student understanding. I will also be searching for a “my favorite no,” problem to do as a closing activity. For this I will chose a problem where a student made a common mistake, show the problem on the board, and have the students discuss how this problem should be done differently and why, in order to correct that thinking.

The middle segment focuses on graphing equations in slope intercept form. Students should now know how to create an equation from a graph, but will now be focusing on creating a graph from an equation.

The segment will start with students individually writing down how they think they can create a graph from an equation. This will allow student to first explore his or her own ideas. I will then do a set of myself doing and explaining a problem of this form, doing a problem with the students guiding me, and then having the students do a problem individually. After students do an individual problem, I will call on a student to present their problem to the class in order to go over the steps once more.

Specifically in this lesson, students will be focusing on what parts of the equation mean and how that can translate to a graph. Students will be looking for the slope and y-intercept of the equation specifically. When they graph they should begin by plotting the y-intercept, then finding a point below and above the intercept using the slope.

To assess this segment I will have students get into groups of four. I will number the students in each group (1-4) to assign them to a problem projected on the board (BM2). Each student must then complete their problem and present it to the rest of their group members. This allows students to have discussion time, be taught by their peers, and teach their peers. In order to teach their group members, they will need to create a representation, consider the problem they are working with, and analyze the equation to create the graph (MP2).

BM2-Graph the equation
 $y=-2x+4$.

MP2-Reason abstractly and
quantitatively

The last portion of instruction in the learning progression is focused on creating equations from word problems and graphing the equations for a visual representation of the problem. This will teach students about representing relationships between quantities as discussed in CCSS.MATH.CONTENT.HSA.CED.A.2 above.

The segment will begin with me asking students if they have ever wanted to know a cheaper price between two things? I will then give an example of two different soccer team prices with different starting prices with different monthly rates and we can discuss which team is cheaper and when. This will hopefully engage students and spark their interest. This will be the portion of the lesson where I do a problem, I will do a problem similar where the students lead me in creating a single equation from a word problem, and then do one on their own (BM3). After some time I will ask for a student volunteer to present their problem to the class.

In these problems, students must focus on specific parts of the scenario. For instance, they should look for a starting amount and then a rate. They should always place the rate next to the x variable. It is important for students to understand these problems because it is how they can relate the math they are learning to their environment.

There are two assessment portions of this segment. The first is having students do a work sheet of five problems with their groups, very similar to the, I do-we do-you do portion above. This will give students the opportunity to discuss what parts of the word problem are important and create strategies for how to read and complete these types of word problems (MP3). I chose to have discussion heavily involved in this assessment to ease the stress that students usually have when completing word problems. The second portion is a take home and to be done as individual work. For this portion students will have three equations that they have to write their own story problem to match. This will allow students to model an equation by using a scenario, give them the student voice and freedom of creating their own story, and emphasizing what parts of the story problem should be most important in matching an equation (MP4) (BM4).

In conclusion, this learning progression builds on students creating equations from graphs, graphing equations, and creating equations from word problems. Students know basic manipulation of equations, but can now apply it to graphs and story problems.

BM3-At Marco's Fitness, a membership consists of an initial fee of \$120, and then a monthly rate of \$32. Write an equation that matches the cost per month of a gym membership at Marco's Fitness and graph the equation.

MP3-Construct a viable argument and critique the reasoning of others

MP4-Model with mathematics

BM4- Given the equation $Y=40x+300$, write a story problem that matches this equation.

