High School: Algebra 1
Graphing Linear Equations

This learning progression was designed primarily for a bilingual slower pace 9th -12th-grade Algebra 1 course. This class consists of twenty students of who ten do not speak any English and need assistance in Spanish. Throughout this unit, the lessons were provided in 50% Spanish and 50% English as well as all handouts having written directions in both languages. Aside from this class being slow paced because of the language barrier for some students there is also students who struggle in understanding. Overall, this course consists of about 50% not being able to graduate on time as the class is made up of eleven ninth-graders, four tenth-graders, three eleventh-graders and two twelfth-graders. About 50% of the students in this course are anticipated not to graduate on time as their lack of understanding affects more than this course.

The Common Core State Standards that will be satisfied are from three different domains. The first one comes from the cluster titles, "Define, evaluate, and compare functions" and is 8. S.A.3. The second one is SSE.A.1. A and comes from cluster "Interpret the structure of expressions." The third standard is SSE.B.3 coming from cluster "Write expressions in equivalent forms to solve problems." In this course, students focus on mastering 8th grade standards as they slowly incorporate high school content standards. Throughout this learning progression, students will focus on four mathematical practices which are MP1, MP4, MP5, and MP6.

The curriculum these students are going through comes from the 2004 Holt McDougal Larson Algebra 1 textbook. The textbook is used throughout the unit for instruction and handouts are made using problems directly from the book but made into handouts to allow for written translation of directions to accommodate for ELL's. For this learning progression, students are beginning a brand-new unit on graphing linear functions. Specifically, students will learn how to solve for y, make T-charts to plot points on a coordinate plane, find and use x and y-intercepts to graph and how to use the slope-intercept form as a short cut to graphing.

The central focus of this learning segment is for students to be able to analyze how the equation and the graph of a line are related. Students will represent a linear relationship as points on a coordinate plane and as an equation representing a line. Students will work towards this by learning how to solve a linear equation for y leading to them discovering slope-intercept form. In this form students, will identify the slope and y-intercept of a linear equation as well as on a graph.

COMMON CORE STATE STANDARDS

Define, evaluate, and compare functions.

CCSS.MATH. CONTENT.8. F.A.3:
Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

Interpret the structure of expression.

CCSS.MATH.CONTENT.HSA.SSE. A.1.A:
Interpret parts of an expression, such as terms, factors, and coefficients.

Write expressions in equivalent forms to solve problems.
CCSS.MATH.CONTENT.HSA.SSE. B.3:
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

MATHEMATICAL PRACTICES

CCSS.MATH.PRACTICE.MP.1
Make sense of problems and persevere in solving them.
CCSS.MATH.PRACTICE.MP. 4
Model with mathematics.
CCSS.MATH.PRACTICE.MP.5
Use appropriate tools strategically.
CCSS.MATH.PRACTICE.MP.6
Attend to precision

Once being able to identify the two pieces of information be able to quickly graph lines. As well as deepen their understanding of slope of a line by being able to explain how changes in the slope affect the steepness and direction of a line. The purpose of students being able to master these skills is to deepen their understanding of graphing linear equations by providing a quicker method to graphing. Students will understand that making a T-chart or finding x and y-intercept can be time-consuming while using the slope-intercept form is more efficient. All this building their mathematical reasoning for the second unit which is the second half of the chapter which will focus on students exploring data to determine whether a linear relationship exists. They will be able to determine functions and work with modeling direct variation and find the slope and rate of change. Dividing the chapter into two units will be beneficial to all students in this class as basic skills needed for mastery of the content will be frontloaded into the first unit. The simple knowledge in this learning segment includes the vocabulary relating to the definitions of a term, variable, slope, intercept, x-axis, and y-axis. The procedure of this learning progression is for students to learn to interpret an equation in slope-intercept form and be able to use this form to graph linear equations. Throughout each lesson, I will use the data on prior academic learning and disposition from my observations and the series of entry tasks students turned in to support my students' learning. I sequenced my learning targets to start with familiar learning targets and branched to learning goals that depended on a mastery of the previous ones. Breaking down the learning objectives is beneficial to students with need of support or accommodations, since focusing students' attainment of immediate goals, such as getting today's problem correct increases student self-efficacy according to A. Wade Boykin and Pedro Noguera's book titled "Creating the Opportunity to Learn."

In Task 1, we will revisit a concept learned early in the course, but that is significant that students remember for the success of this unit. In task 1 students will be able to solve a literal equation for a specific variable. Students will begin task 1 with entry task problems in which they will review how to simplify one variable equations. This will begin to build their conceptual understanding as they will later connect their knowledge to simplify equations with two variables. During this activity students, will be using mathematical practice MP6 and MP 1 as they must attend to precision as they apply correct properties to simplify while making sense of the problems. After reviewing the entry task students will work with a partner to complete a handout in which they will be required to deepen their understanding of simplifying one variable equations to having to solve for a specific variable in

LESSON 1

Learning Target

I can use Algebraic reasoning and inverse operations to isolate a variable.

Student Outcomes:

- Transform equations to solve for a variable (in this case preferably for "y").
- Apply basic properties to simply equations.

Task 1:

Entry Task/Primer Tarea

$3x + 6 = 4(x - 2) + 11$

$\frac{2}{3}(x - 6) + 1 = 5$

Partner Task:

1) Solve for x:

$x + a = b$

3) Solve for x:

$bx - 5 = c$

5) Solve for x:

$s = 4x$

7) Solve for y:

$x + sy = t$

9) Solve for x:

$4x - 5c = 3c$

11) Solve for x:

$3x - s = r$

equations with multiple variables. Students will use problem-solving skills to be able to determine the properties need to be able to isolate the required variable using MP5 as they will use appropriate properties to simplify correctly. And not only be able to isolate a variable but be able to work backward and demonstrate they have produced equivalent forms of the equations, this will address their procedural fluency as they will be able to work with equations and undo what they have done. This will address standard SSE.B.3 as students will be producing equivalent forms of an expression working towards later in the unit being able to reveal and explain properties of the quantity represented by the expression that can express the parts of an equation and what they represent on a graph. As students work through the handout, they will explain to their partners their reasoning of why the equations are equivalent when isolating a variable in the equation and how they made the connection between simplifying equations with one variable and simplifying with multiple variables. Students must also be able to explain to their classmates in their preferred language how to solve for a specific variable and how to work backward to undo what they have done. This will be done as a presentation to the class as an assessment of their understanding of solve literal equations. Students will have the opportunity to express their understanding through whole-class discussion in which selected students will explain to the class their findings from the handout. During their presentation students, will use MP4 and MP6 as they will model with mathematics where the equations come from attaining to precision.

In lesson 2, since many of these students are missing much of the background knowledge needed to complete algebra we must spend time reviewing many primary math skills/concepts. In this lesson, we will introduce students to the coordinate plane and practice plotting and locate points in the four quadrants. In the lesson, students will learn key vocabulary words such as coordinate system, coordinate plane, 1st 2nd 3rd and 4th quadrant, axis/axes, origin, ordered pairs, coordinates. Since this is a slower peace class task 2 will be completed as a class with teacher guidance to ensure that students are kept on track and understanding is checked along the way. Students after reviewing vocabulary will apply their knowledge acquired during the direct instruction to be able to plot points in different quadrants. Students will have the opportunity to work through plotting points multiple times. As they will work individually then share with a partner and lastly share as a whole class. Through the sharing part, I will have a student present solution in English and then have a second student present in Spanish; this will occur in each task throughout the unit. Students will receive a list of different coordinate points along with a small whiteboard with a pre-drawn coordinate

LESSON 2

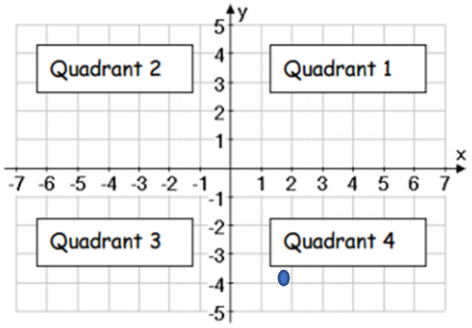
Learning Objectives:

I can make a T-chart that relates to an equation and identify that the values on the chart are coordinate points that can be plotted on a coordinate plane.

Student Outcomes:

- Locate points on the coordinate plane.
- Graph points on a coordinate plane.
- Using a T-chart graph linear equations.

Task 2:



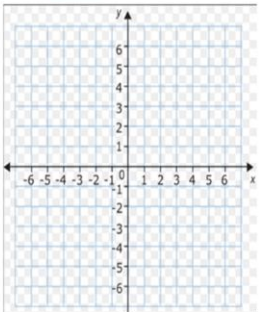
Students must be able to express that the coordinate piont is (1,-4) and that is lives in quadrant 4.

Guiding Questions:

- Why do we need to start at the origin when plotting points on a grid?
- How does a graph show the relationship between 2 variables x and y?

Task 3:

2. Make T-Chart and graph $-8x + 2y = 4$. (Hacer "T-Chart" y despues as un grafico)



plane. In this task students, will use their procedural fluency to plot each point using the correct x and y coordinates. To plot points in this task students will MP4, MP5 and MP6 as students will model each point using the coordinate plane as their tool while they attend to precision to correctly plot each point. Along with these mathematical practices, students will use their mathematical reasoning as well as build on their conceptual understanding as they can express what point in the coordinate represents the x-coordinate and which represents the y-coordinate.

Task 3 will allow students to use MP5 as they will use a T-chart as a tool to be able to graph simple linear equations. During this task as well as in task 2 standards SSE.A.1. A and SSE.B.3 as students will receive a handout with a series of equations in which students will be asked to make a T-chart and graph each equation. Students must be able to interpret the terms in coordinate point they produce in the T-chart as x and y coordinates and be able to plot them to create the graph of the linear equation. As well as build on their conceptual understanding from lesson one as students will be able to isolate a variable in this case "y" to make equations easier to solve by plugging in values for x and solving to get a y value. Students will use problem-solving skills as they recognize that by plugging values for x will produce values for y using MP1 as they will make sense of problems and make the connection of the coordinate points being connected to produce a line that represents the linear equation. Just like in previous tasks this handout will be concluded in a class discussion where students will be in teams of four in which member of the group will have a task. Member 1 will be the spokesperson who will present a solution to the class when called upon depending on the student this will be done in with English or Spanish. Member 2 will be the recorder and will write on the whiteboard the steps to solve each problem. Member 3 will be the handout recorder who will be the one who writes the solution on the handout to turn in for credit at the end of the activity. Finally, member four will be the understanding coordinator who will make sure the calculations are checked, and mathematical reasoning is justified. These jobs will be rotated until all the problems on the handout have been completed with the bilingual class discussion.

Lesson 3, will begin with a brief guided practice for students receive the foundation to be able to solve and find the x and y-intercepts and be able to use them to graph. Since students are just becoming familiarized with graphing, I will present the concept using what they have already learned in the previous lesson using a T-chart. Students will begin to develop their conceptual understanding of x and y-intercepts

LESSON 3

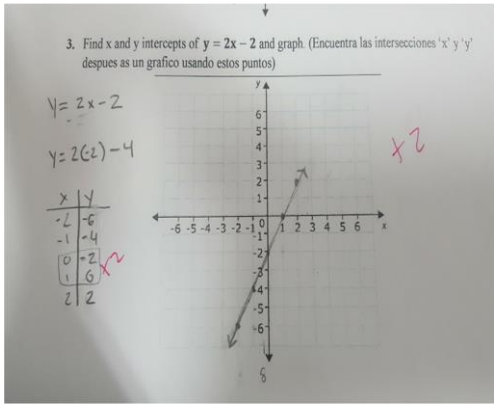
Learning Objectives:
Student will be able to determine the x-intercept and y-intercept of a linear equation to be able to graph.

Student Outcomes:

- Students can determine the x and y-intercepts by inspection of a graph.
- Students can find x and y-intercepts by solving for one of the variables.

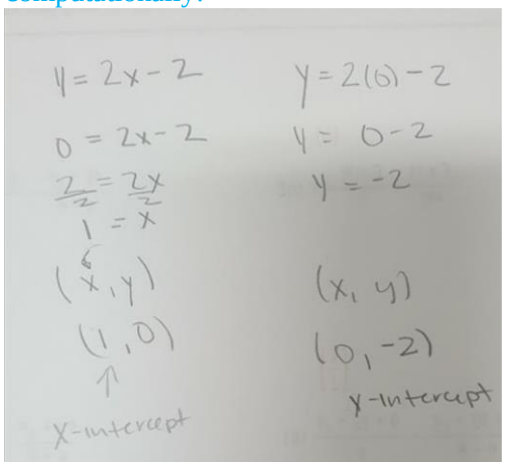
Task 4:

Student Work with T-chart:



Student was able to identify the intercepts both on the t-chart and on the graph.

Student Work finding intercepts computationally:



as they practice graphing lines and inspect the line to determine if the line crosses any of the axes. They will use their mathematical reasoning to connect the values they get on their t-chart and use their procedural fluency to try to determine the computational process to finding the intercepts without having to graph. We will work on discovering that the x-intercept is the point at which the line crosses the x-intercept and that it can be found by substituting a value of 0 for y in the equation of the line and then solving the value of x. Students will use their mathematical reasoning to make the connection to determine that the y-intercept is the point at which the line crosses the y-axis. And that can be found by substituting a value of 0 for x in the equation of the line and solving for the value of y. In this task 4, students will use MP1 as they model each equation with a graph identifying the intercepts as well as model with mathematics when solving for the intercepts. They will also MP6 attend to precision as they will plot coordinate points correctly and take correct algebraic steps when solving. With the end goal being that students see that when graphing and making a t-chart gives us the same values as when we solve for the intercepts. Throughout this activity, students must be able to explain to their classmates in their preferred language their reasoning to connect the graph of the equation to the computations to solving for each intercept. This will address standard SSE. A.1.A as they will interpret the parts of the expression and identify the intercepts as well as standard HSA.SSE. B.3 when students will produce equivalent answers from the t-chart and when solving for the intercepts.

Task 5 will be the conclusion of the unit where students will demonstrate their understanding of the entire unit and be able to demonstrate their mastering of the major concepts. In this task students, will learn to write and graph equations in slope-intercept form. Students will learn slope-intercept form as a short cut to graphing as opposed to using a T-Chart or graphing using intercepts. At the end of the activity, students should be able to rewrite equations into slope-intercept form and quickly graph as well as be able to express what each variable represents in the formula $y = mx + b$. To introduce the lesson, I will not tell the students what it is we will be learning. I will present the class as a review lesson since students in previous days should have been introduced to graphing equations using a T-chart or by finding the x-intercepts. The first thing I will do is make a deal with the students. I will remind them of what they have learned and tell them that we will be reviewing how to graph some linear equations today. We will go through each

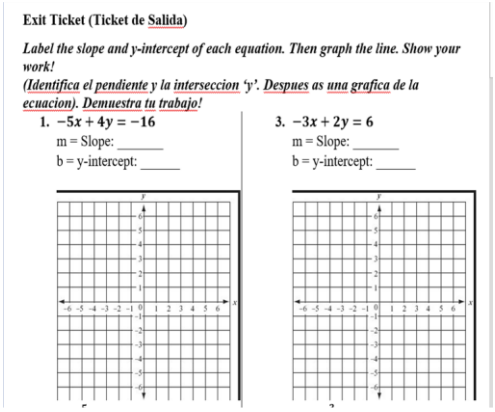
LESSON 4

Learning Objectives:
Students will learn to write and graph equations in slope-intercept form. (Estudiantes aprenderan a escribir y aser un grafico de la ecuasion en form y=mx+b)

Student Outcomes: Students will be able to …

- solve a linear equation for y and identify the slope and y-intercept of the line.
- graph lines using the slope and y-intercept.
- Deepen their understanding of how changes in the slope of a line affect the steepness and direction of the line.

Task 5:

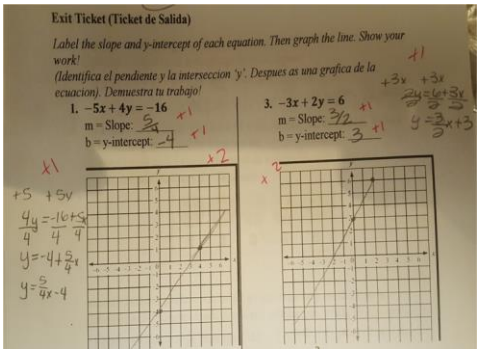

Exit Ticket (Ticket de Salida)

Label the slope and y-intercept of each equation. Then graph the line. Show your work!
(Identifica el pendiente y la interseccion 'y'. Despues as una grafica de la ecuacion). Demuestra tu trabajo!

1. $-5x + 4y = -16$
m = Slope: _____
b = y-intercept: _____

3. $-3x + 2y = 6$
m = Slope: _____
b = y-intercept: _____

Student Work:


Exit Ticket (Ticket de Salida)

Label the slope and y-intercept of each equation. Then graph the line. Show your work!
(Identifica el pendiente y la interseccion 'y'. Despues as una grafica de la ecuacion). Demuestra tu trabajo!

1. $-5x + 4y = -16$
m = Slope: $\frac{5}{4}$
b = y-intercept: -4

3. $-3x + 2y = 6$
m = Slope: $\frac{3}{2}$
b = y-intercept: 3

"Students were able to bring their knowledge from lesson 1 in solving for y and their knowledge from lesson 2 in which they learned to plot coordinate points."

graphing together, but if any of the students can beat me at graphing an equation, I will knock down homework problems from that night's homework list. This will turn the lesson into a competition. Ideally, based on the prior skills students will have at this point I will beat them as I will be able to interpret the slope and y-intercept from the equations. Through this competition after a few problems, the students will begin to wonder how I graph the equations so quickly and without the use of a T-chart or looking for the x-intercepts. Students will use their problem-solving skills to lead themselves through inquiry to discover the representation of the slope and y-intercept in respect to the form $y = mx + b$. Students will be able to pick up what it is I am doing leading to the introduction of slope-intercept form. In task 5 students will use their conceptual understanding as this task addresses standard 8.F.A.3 which will have students be able to interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line. This task will also address standard HSA.SSE. A.1.A as students will use their procedural fluency to change each equation to slope-intercept form to be able to interpret the parts of the expression. Overall, this task will combine all that the students have learned throughout the unit and allow them to demonstrate their understanding. Students will use all four of the mathematical practices as they complete this task as they must make sense of the problems and realize that they must solve for "y" in each equation to be able to interpret the slope and y-intercept. Students will also be modeling with mathematics as they solve the equations for "y" and then graph each equation using the slope and y-intercept. For this students, must use appropriate tools as they must use the correct properties to solve the equations correctly for "y" while attending to precision when graphing. Throughout this students will receive instruction in both English and Spanish as well as have instructions written in both languages on their handout.

For this learning progression, I will use two main instruction methods throughout each lesson. I will begin the lessons using explicit/direct instruction in which students will receive the foundation to be able to complete each task successfully. Then to deepen the students' understanding by completing each task using cooperative learning which will lead to the assessment cycle I will use throughout each lesson to analyze student learning and guide their instruction.

FORMATIVE ASSESSMETN PROCESS AND INSTRUCTION METHODS

Instructional Methods:

- Explicit Instuction/Direct Instruction: involves teaching skill or concept in a highly structured enivironment using clear, direct language.
- Cooperative Learning: Involves students working together in small mixted-ability groups to maximize everyone's learning.

Foramtive Assessment Techniques:

- Listening to students' response: Walk around the classroom and observe students as they work to check for learning. Strategies include: anecdotal records, conferences, and checklist.
- Examining student work: Collect information to help precede in upcoming lesson.

For this, I would be using two main formative assessment techniques which are listening to students' response and examining student work. Types of questions I would ask my students to evaluate their understanding is "If you know the y-intercept what can you tell about the graph?" "Explain your reasoning." Then when examining student written work, I would have to ask myself questions like, "What does the collection of work suggest about next instructional steps?"

Throughout this, I will use three main tasks as a formative assessment technique to support student learning of the CCSS Math. As students will be presenting to the class their solutions and how they worked through each step which will provide me with data on areas that students need more clarification to master the CCSS along with each mathematical practice. Each task allows students to work through problems that connect to CCSS individually and has the students later share in their group answers and process through their work using the mathematical practices mentioned previously. This process will allow the students to work through problems multiple times. Ideally, each time the students work through the problems and explain their reasoning more misconceptions will be clarified and as the teacher, I will be able to pick up on areas that need special attention that will be covered in class.

Ideally, through the process, I have selected to complete the major tasks clarifying and motivating students' learning will occur as a result. Students will have the opportunity to work on problems individually first which will allow students to self-assess and pinpoint areas that they need clarification. Second, the students will break up into their groups and compare/work through problems, and this will motivate students to work together and try to clarify their areas of misunderstanding. Third when the students come up and present their solutions with justification for their answers students will be able to have a third opportunity to review receive clarification on areas that were not touched upon at the beginning of the assessment process. Lastly, I will observe and examine student work and cover any areas that I feel students need more clarification to master the CCSS. Throughout each step as students can review and explain problems multiple times, their motivation will increase as there will always be a problem in which each student will be able to help another classmate understand a concept.

For special populations of students such as my ELL students, in every task, I will provide translations as well as allow students to speak and present their work in their preferred language. This will be a given in any activity we do in class; students will always know that these supports are available for them to use at any given time throughout the school year. I feel that allowing this will make the students feel more confident in their abilities and make students more willing to present their work to the class. I also understand that presenting especially in math is a difficult task for many students, in special cases when I feel it is appropriate I will allow students to present solutions to partners to relieve some of the pressure. This making it so I can collect more accurate data over student understanding of the CCSS.