Figure C.17a

Stage 1 – Desired Results

Established Goals

G

CA Algebra I Standards

3.0 Students solve equations and inequalities involving absolute values.

4.0 Students simplify expressions before solving linear equations and inequalities in one variable,

5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.

6.0 Students graph a linear equation and compute the x- and y-intercepts

7.0 Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations by using the point-slope formula.

8.0 Students understand the concepts of parallel lines and perpendicular lines and how those slopes are related.

9.0 Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets.

Where are students likely to misunderstand important ideas? Where are they most likely to struggle in applying knowledge and skill?

- Some students get mixed up with negative slopes. Stress that they can place the negative in the numerator ("down and to the right") or the denominator ("up and to the left") and get the same result. Also, they should have understand that negative slope represent a line that falls as we read the graph from left to right.
- Students are often challenged by horizontal and vertical lines. Rather than just memorize rules for recognizing them, try to get them to "read" the equation. ("x=4" tells us that the x-coordinate is "4" regardless of the y-coordinate.

Transfer

Students will be able to independently use their learning to…

T

Recognize and solve real-world problems that are linear in nature.

Meaning

UNDERSTANDINGS

U

Students will understand that…

1. Mathematics can efficiently describe naturally occurring patterns. 2. Linear equations and their graphs are concise methods for representing relationships that involve constant rates of change. 3. We have more than one way to represent and understand linear relationships, including equations (in various forms), graphs, and tables. One representation may be more suitable than another for our needs. Any one of these representations can be used to generate the other two. 4. Graphs of lines show us information that can be summarized in an equation.

ESSENTIAL QUESTIONS

Q

Students will keep considering…

1. What is the best way to represent (a particular relationship)?
2. What are the defining characteristics of a type of relationship? How do we best measure and interpret them?
3. When would I prefer one algebraic representation of a line over another? Is there always only one best option?
4. When should I use an equation? A graph? A table? How do I know?

Acquisition of Knowledge & Skill

Students will know…

K

1. What is the formula for finding slope?
2. What is the y-intercept?
3. What is the slope-intercept form of a linear equation?
4. What is the form of the equation of a vertical line? … a horizontal line?
5. What is the slope of a vertical line? … a horizontal line?
6. How are the slopes of parallel lines related? … of perpendicular lines?

Students will be skilled at…

S

1. Finding distance and midpoint between two points. 2. Finding the slope between two points and interpret slope. 3. Identifying constant rate of change in real-world examples and recognize it as slope. 4. Writing equations and graph lines given slope and y-intercept. 5. Writing equations and graph lines given two points. 6. Changing between the various forms of lines and extract information necessary for graphing. 7. Recognizing parallel and perpendicular lines from their equations. 8. Graphing linear absolute value equations, and compare them to related linear equations without absolute value. 9. Graphing linear inequalities and compare them to related linear equations.

Figure C.17b

Stage 2 – Evidence

Evaluative Criteria *Performance is judged in terms of –*	Assessment Evidence: *Students will need to show their learning by –*
• Accuracy of the equations • Accuracy of graphic representations • Effective mathematical reasoning • Clear explanation and justification	**TRANSFER TASK(S):** TT As the Crow Flies You are the Flight Network Adviser for a new airline, in charge of developing how the flight network will function across the country. You need to choose the best hub for your airline and develop equations to describe the flight paths from that hub to six important destination cities. You must express and graph the relationship between average speed and distance traveled. Develop an equation for the pilots to use to estimate arrival times to the six cities (give a range). Finally, explain how the company could customize your formulas if they add routes to new cities in the future.
• Accuracy of the equations and graphic representations • Appropriate "real world" examples used • Use of proper mathematical terminology • Suitable for target audience.	The Linear Sampler: An Information Guide You have been asked to develop an Information Guide for the School's Study Center. Your task is to identify and illustrate "real world" examples of different types of linear relationships, showing both algebraic and graphic representations for each. Include examples for: positive slope, negative slope, horizontal, vertical, inequalities, absolute value, and pairs of lines that are parallel or perpendicular.
• Correct answers • Valid Reasons	**OTHER EVIDENCE:** OE Quizzes will be given throughout the unit to determine if students know: - the formula for finding slope. ... the y-intercept. - the slope-intercept form of a linear equation. - the form of the equation of a vertical line. ... a horizontal line. - the slope of a vertical line. ... a horizontal line. - how the slopes of parallel lines are related. ... of perpendicular lines. and if students can: - write equations and graph lines given y-intercept and slope, point and slope, and two points. - calculate the distance between two points and find the midpoint. - graph and interpret linear relationships that involve absolute value and linear inequalities.

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

The teaching and learning needed to achieve the unit goals.

1. Name That Spot – Students will investigate paired data from a geometric standpoint using only natural language and observation.1. Place two points on the board that are on the same line horizontally (don't actually draw a line at this point). Label them A and B. Ask students to describe what they see. How could they compare their locations? They should describe them in terms of one being to the left or the other to the right. They could estimate how far apart they are in inches. Draw a line through the points, the real number line, and choose a zero point somewhere between A and B. Mark off dashes that indicate individual units. Now what can they say about the points? They can now give them labels that indicate position, as well as describe the distance between them using the units indicated by the dashes. Ask them to locate the point that is exactly half-way between them. Ask for the arithmetic they used, and show them that they have simply averaged the two numbers. New example: Place two points on the board, A and B, that are not in a horizontal line.

2. The Cartesian-Coordinate Plane, Midpoints, and the Distance Formula (A) Students will receive direct instruction in the graphing of ordered pairs and how to find the distance between two points and their midpoint. Use the previous event's discussion to generate the formula for distance between points. Show them the formula as it is given in textbooks. HOWEVER, see if anyone can relate it back to the Pythagorean Formula.

3. How Much Can That Truck Hold? – Students will explore how one variable has a direct impact on a second in transporting sand. Tell students that you really love the seashore, and are considering redecorating your living room like the beach - paint the walls blue with an ocean mural on one side, set-up some beach chairs and an umbrella...but first you need to buy sand - a lot of sand. How many bags of sand do you need for an average-size living room. Solicit and check reasonable estimates. In the end, settle on something like 100 bags – 6000 pounds. Will you be able to get it all in one trip in a pick-up? ... There is a constant relationship between number of bags and weight - ask students to describe it. Have them create a chart for Home Depot to help customers who want to figure out how heavy a certain number of bags of sand will be and which kind of vehicle is best for which loads. How could we create a picture to represent this relationship?

4. Students will receive direct instruction in simple linear relationships and graphing them by plotting points. Give students practice writing simple linear equations from verbal descriptions.

5. Is it a Line? – In this event, students will explore sets of points that do not create a line and the special cases of horizontal and vertical lines.1. Give students the following four sets of points and have them graph them on separate sets of axes: a. (-3, -4), (1, 0) and (5, 4); b. (-3, -4), (1,0) and (5,5); c. (3, -5), (3, 0) and (3, 6); d. (-4, 3), (0, 3) and (2, 3). First question - for each line is there a line that hits all three points? (Yes, except for (b).) If so, draw the line. For example (b), how many lines are there that hit at least two points? (3 distinct lines.) For all combinations of points (3 per exercise), evaluate slope. Discuss findings. Use (a) to discuss collinear points and the fact that all slopes are equal. Use (b) to discuss that if points look like they might be collinear, checking the slopes between them is a way to test that. Discuss the special lines that are determined by (c) and (d). What are their slopes? Differentiate between slope being 0 for any horizontal line and slope not existing for a vertical line. If slope is 0, what happens to $y = mx + b$?

6. Students will explore the slopes of parallel and perpendicular lines by creating graphic examples and analyzing them.

7. How Many Ways? – Students will apply their understanding of parallel and perpendicular lines in an event involving multiple solutions.Give students 3 non-collinear points. Ask them to try to create a pair of equations of parallel lines so that all three points are hit by one of the lines. Is this possible (yes), and if so, find all possible solutions (3 possible solutions). Give students 3 non-collinear point. Ask them to try to create a pair of equations of perpendicular lines so that all three points are hit by one of the lines. Is this possible (yes), and if so, find all possible solutions (3 possible solutions). 3. Give students 3 collinear points. Ask them to try to create a pair of equations of parallel lines so that all three points are hit by one of the lines. Is this possible (yes), and if so, find all possible solutions (infinite number of possible solutions - since one line hits all three, there are infinite possibilities for the second line).

How Far From Home? Students will consider the difference between location relative to a certain point and distance from that point, motivating absolute value equations. Draw a line on the board, representing a road that stretches from East to West. Draw a house at 0 and a person 10 miles to the left. Justify labeling this position as -10 based on past experience with the number line. Tell students that the person is going to travel East at 2 miles per hour. How long until they will be home? If they keep walking, where will they be after 8 hours?

Have students make a chart relating time to location (at time 0, location is -10; at time 1 location is -8, etc.). Ask them to write an equation and draw a graph that represents the relationship between time and distance from home. Which variable is dependent? Independent? Which should go on the horizontal axis? Some students may need some help with the fact that the variable of location is oriented horizontally in the diagram, but ends up being on the y-axis of our graph. Now add a third column to your chart labeled distance from home - ask students to fill in this column. With a different color, or a dashed line, have them graph the relationship of distance to time and compare it to location. How could we write an algebraic representation of distance versus time?