Representations of Linear Equations Breakout

Lesson Overview

In this lesson, students will identify different representations of linear equations – graphs, equations, and tables. Students will match ordered pairs, equations, slope-intercept forms of equations, and tables of ordered pairs to determine codes to unlock a breakout box.

Standards Addressed

8.EEI.6 Apply concepts of slope and y-intercept to graphs, equations, and proportional relationships.

a. Explain why the slope, m, is the same between any two distinct points on a nonvertical line using similar triangles.

b. Derive the slope-intercept form ($y = mx + b$) for a nonvertical line.

c. Relate equations for proportional relationships ($y = kx$) with the slope-intercept form ($y = mx + b$) where $b = 0$.

Disciplinary Literacy Strategies

Making Thinking Visible

Two-Minute Papers

Computational Thinking

Tool: Physical Breakout

Cornerstones:

- Decomposition: Based on given clues, link the clues to lock, be able to identify the y-intercept, use slope to graph the second point
- Pattern Recognition: Lines are graphed. The equation of a line gives information such as y-intercept and slope. Most lines are graphed using y-intercept and slope.
- Abstraction: Determine which part of the clues are helpful, which are not. There are two unique lines, vertical and horizontal, that use different patterns.
- Algorithmic Thinking: Use clues to collect information about each line. The equations need to be in the slope-intercept form to be graphed. The y-intercept is required to plot the first point. The slope is necessary to plot the second point.

Lesson Plan

Time required: Two 60-70 minute class periods

Disciplinary Vocabulary: Linear equations, slope, y-intercept, graphical representation, tabular representation, ordered pairs, axes, slope-intercept form

Materials needed:

- Avenger Breakout Graphic Organizer – 1 per group
- 1 set of each of the following posted around the room:
  - Avatars with Ordered Pair Clues
  - Graphical Representations
  - Slope Intercept Representations
  - Linear Equation Representations
  - Tabular Representations

Engage

NOTE: Previously, students have solved equations, concepts of slope and intercepts, calculating/finding slope, determining/finding y-intercept, and analyzing/writing the slope-intercept form of equations.

Part 1: To review with students, ask questions such as the following: *(NOTE: This list can be modified based on students' knowledge and experiences at teacher discretion.)*

- What is slope?
- How do you find/calculate slope?
- What is the y-intercept?
- How might slope and y-intercept be used?
- Is it possible to write a linear equation in slope-intercept form?
- Can you graph lines using ordered pairs?
- Can you find the equation of a line from ordered pairs?
- Can you write an equation that is not in the slope-intercept form as an equation in slope-intercept form?
- Is it possible for an equation to have NO y-intercept?
- Is it possible for an equation to have a y-intercept of 0?

NOTE: Students should be explaining their yes/no responses.

Part 2: Set Up/Scenario for the Breakout: POSE the following scenario to students.

"The Marvel Superheroes are working on getting the infinity stones back from Thanos. They need to find the key to unlock the box containing the stones. The first group to match the Avenger with the corresponding representations of equations, tables, and graphs will obtain the key."

Explore

Breakout Set-Up:

- Students should be in 8 groups.
- The Marvel Superheroes avatars should be on the cards with two ordered pairs listed on each. The half-sheets will instruct students to find the matching slope-intercept form of the line containing those ordered pairs, the graphical representation, the tabular representation, and another linear equation, which corresponds to the other representations.
- Label the Marvel Superheroes by name. Number the slope-intercept forms, the graphs, and the tables, of the lines, 1-8. Display the cards or papers around the room on the wall or board (in groups based on what they are). For example, one section of the room/wall/board will contain all the superheroes, one section all the slope-intercept forms of the equations, etc.
- Give each group of students a Marvel Superhero's "name" to start (1-8).
- Students will complete their Avenger Breakout Graphic Organizer by determining which slope-intercept form of the equation, which graph, which table, and which linear equation correspond to the ordered pair on the Avenger card.
- Once they have found the first assigned avenger match, they will record the corresponding parts by number in their blank Avenger Breakout Graphic Organizer. Next, they will move to another avenger card. Follow the same process until all avengers' matches are found. Once a group has completed the entire Avenger Breakout Graphic Organizer, they will share the teacher results. The first group to complete the Graphic Organizer correctly will obtain the key to open the box containing the infinity stones.

Explain

Discussion Questions for Teams – have students discuss the following questions in their teams and be ready to report out.

1. What mathematical skills did you use?
2. What concepts allowed you to determine the pieces?

3. What methods allowed you to be more efficient in determining the matching pieces?
4. What did you learn?

Whole Group Discussion:
Write the numbers 1-8 on slips of paper, one number per slip. Draw a number and ask the corresponding group to respond to question 1 from above. Draw a second slip and ask the affiliated group to respond to the same question. Draw two more slips, having those two groups respond to question 2. Continue until various groups have addressed all questions.
NOTE: Instruct students to take notes as peers share to help them formulate responses in the lesson's Evaluate section.
Ask for any other thoughts/discussion.

Elaborate

Ask students to discuss how the representations are related? Have groups create a Making Thinking Visible Poster to show how the representations are related.
NOTE: The teacher is looking for descriptions such as the graph showing the y-intercept which corresponds to the "b" in the equation's slope-intercept form. Use the table to calculate slope and match the "m" in the equation's slope-intercept form. The y-intercept could be determined from the graph or algebraically, etc.

Evaluate

Two Minute Paper (NOTE: this is a solo writing task – the two minutes do not have to be a literal two minutes – flexible time for students to work to answer the question should be allowed.)
Have students respond to the following prompt using their experiences and notes from the Explain Section of this lesson.
Prompt: "What is one concept or connection you are making that allows you to find the matches for the different representations more efficiently/quickly?

Teacher Biographical Information

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Lesson adapted from https://platform.breakoutedu.com/game/linear-equation-vs-the-avengers

Avenger Breakout Graphic Organizer

Avenger	Slope-Intercept Form	Table	Graph	Linear Equation
Black Widow				
Antman				
Wolverine				
Hulk				
Captain America				
Spiderman				
Iron Man				
Thor				

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Black Widow				
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Iron Man				
Thor				

Avenger Breakout Graphic Organizer ANSWER KEY

Avenger	Slope-Intercept Form	Table	Graph	Linear Equation
Black Widow	8	5	6	1
Antman	3	8	2	6
Wolverine	2	4	1	8
Hulk	4	2	5	7
Captain America	5	1	4	2
Spiderman	1	7	7	3
Iron Man	6	3	8	4
Thor	7	6	3	5

Help Captain America find his missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (10 , 32) & (20 , 62).

Help the Incredible Hulk find his missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (15 , 19) & (20 , 24).

Help Iron Man find his missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (20 , 5) & (-10 , 5).

Help Wolverine find his missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (40 , 20) & (0 , 0).

Help Spiderman find his missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (10 , 22) & (18 , 38).

Help Thor find his missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (30 , 10) & (-12, -4).

Help Black Widow find her missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (-8 , 25) & (10 , -11).

Help Antman find his missing chart, graph, rhyming hint and equation in slope-intercept form based on the ordered pairs (-10 , 17) & (10 , -3)

1

x	-12	12	24
y	-34	38	74

2

x	-12	12	24
y	-8	16	28

3

x	-12	12	24
y	5	5	5

4

x	-12	12	24
y	-6	6	12

5

x	-12	12	24
y	33	-15	-39

6

x	-12	12	24
y	-4	4	8

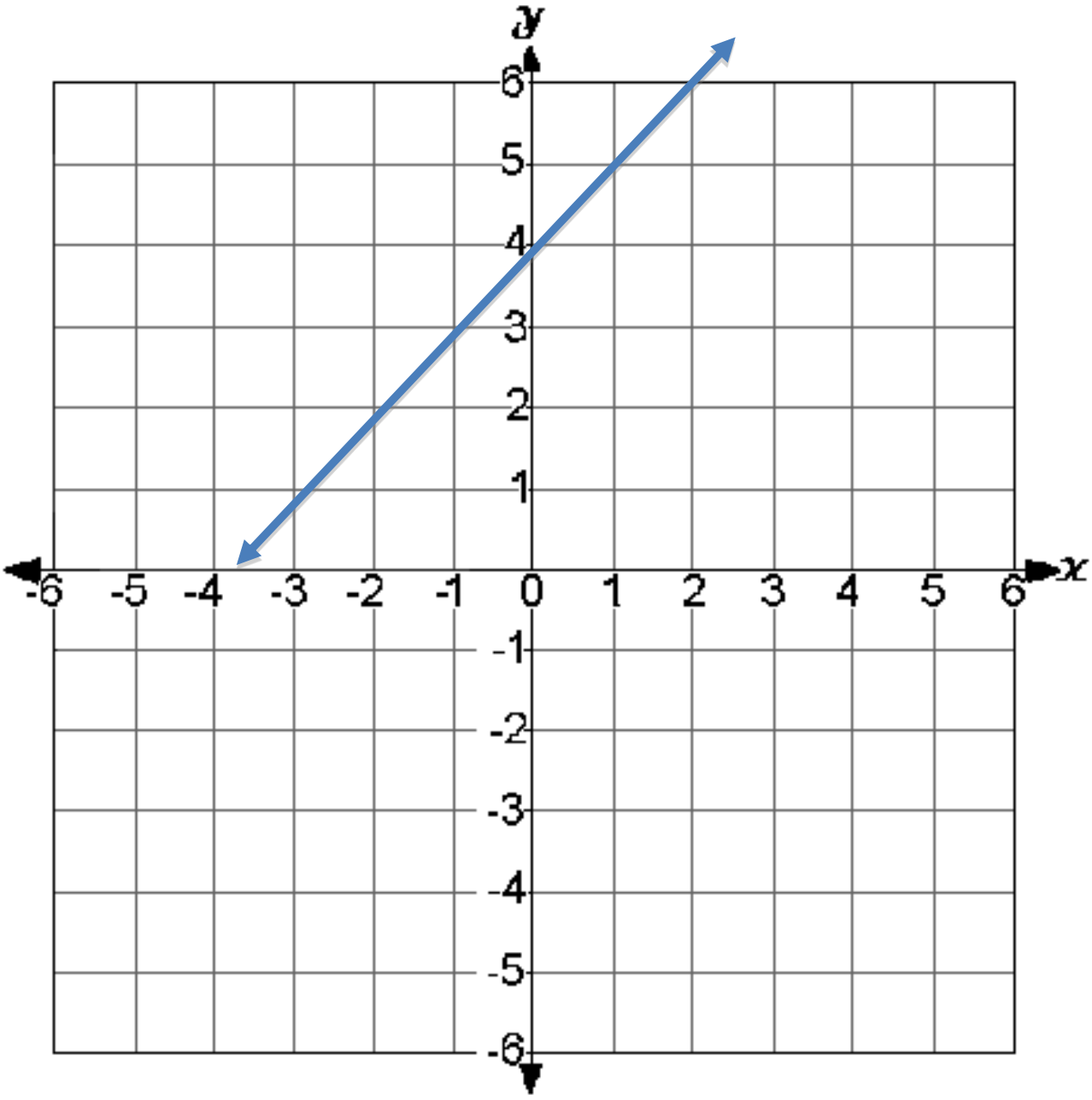
7

x	-12	12	24
y	-22	26	50

8

x	-12	12	24
y	19	-5	-17

5



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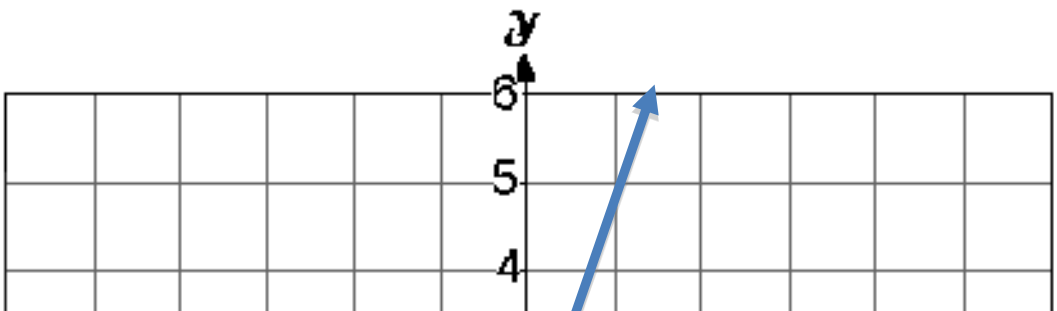

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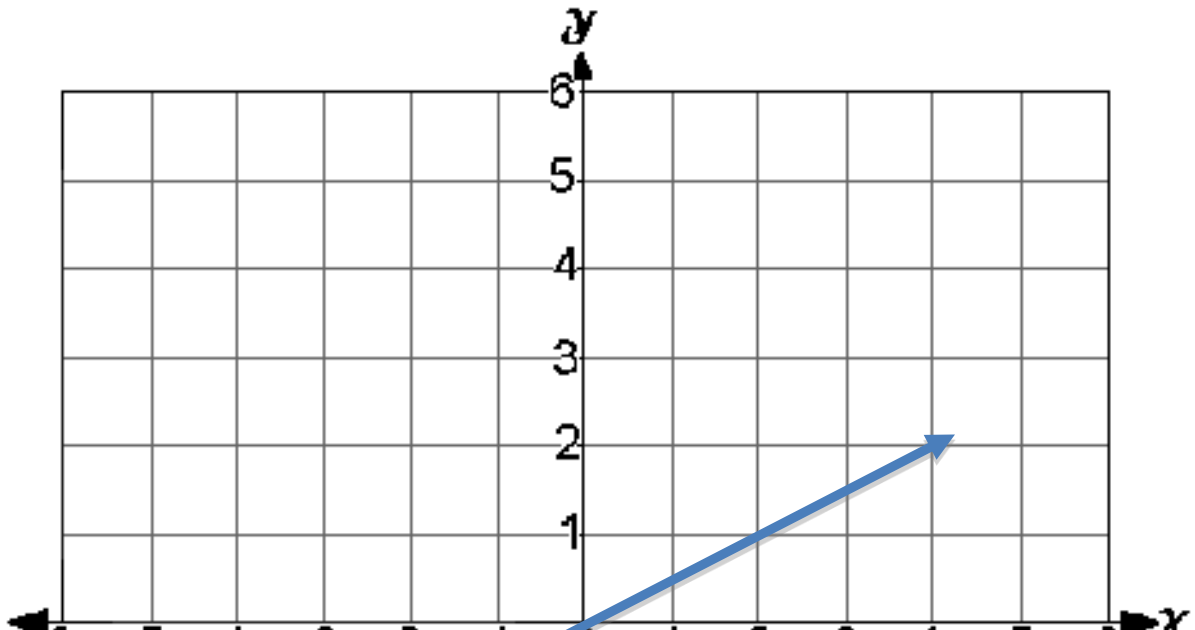

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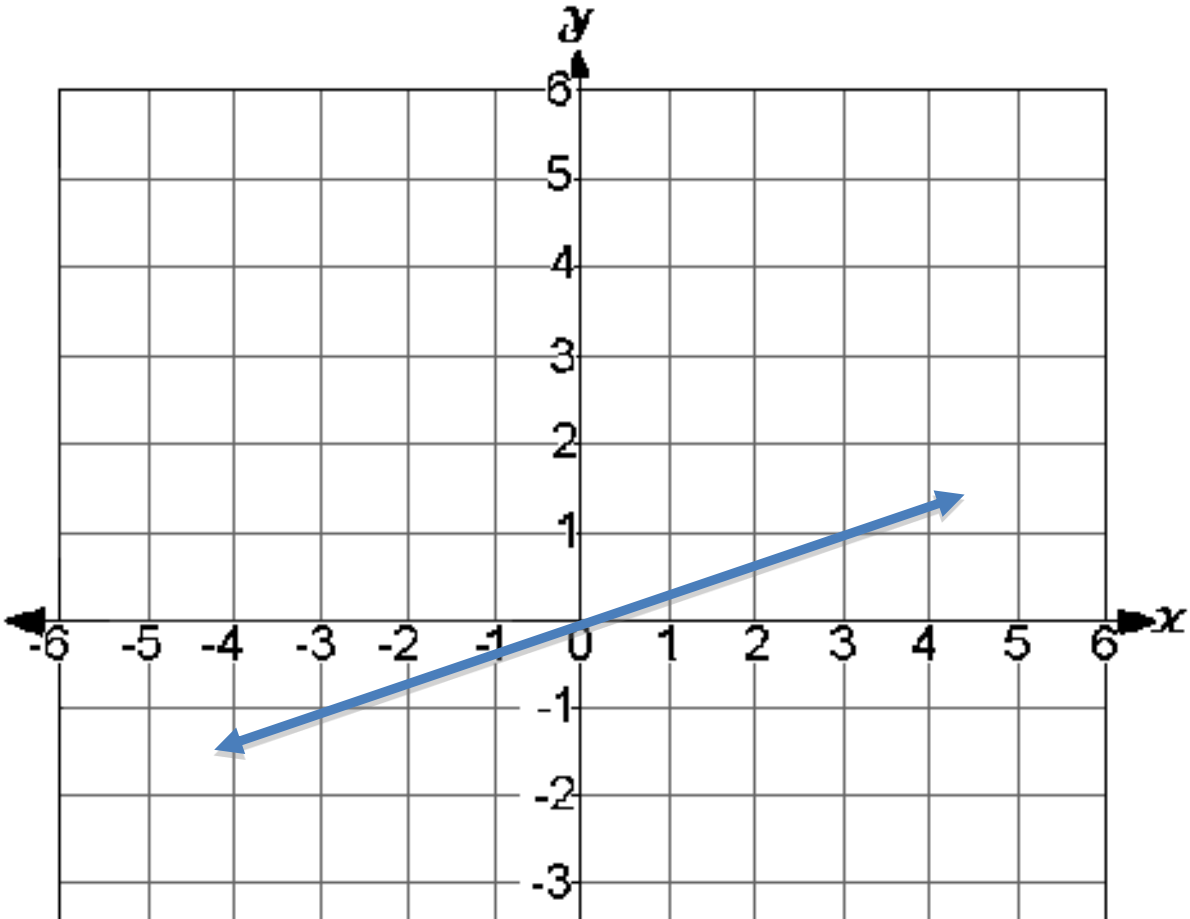

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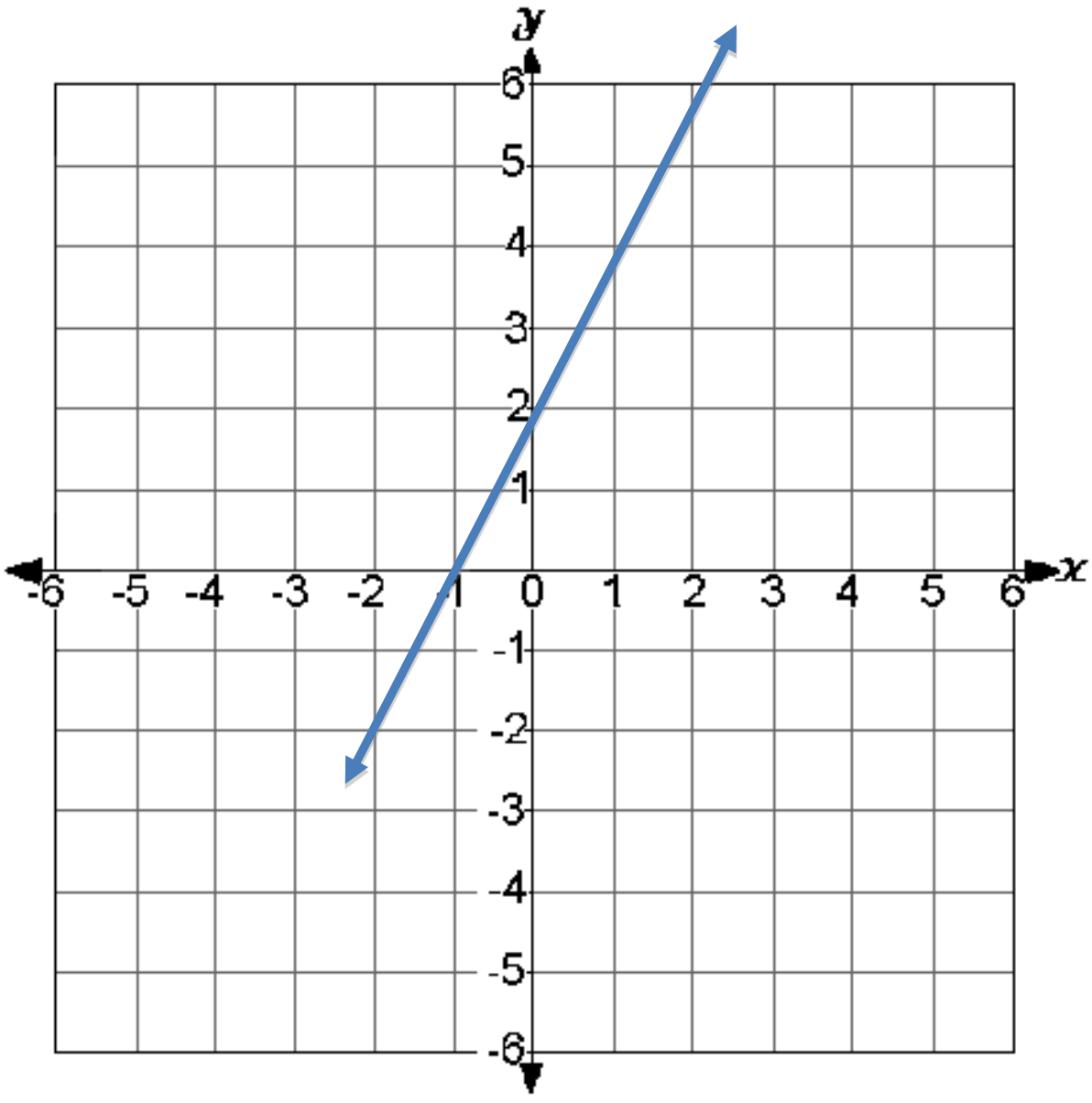

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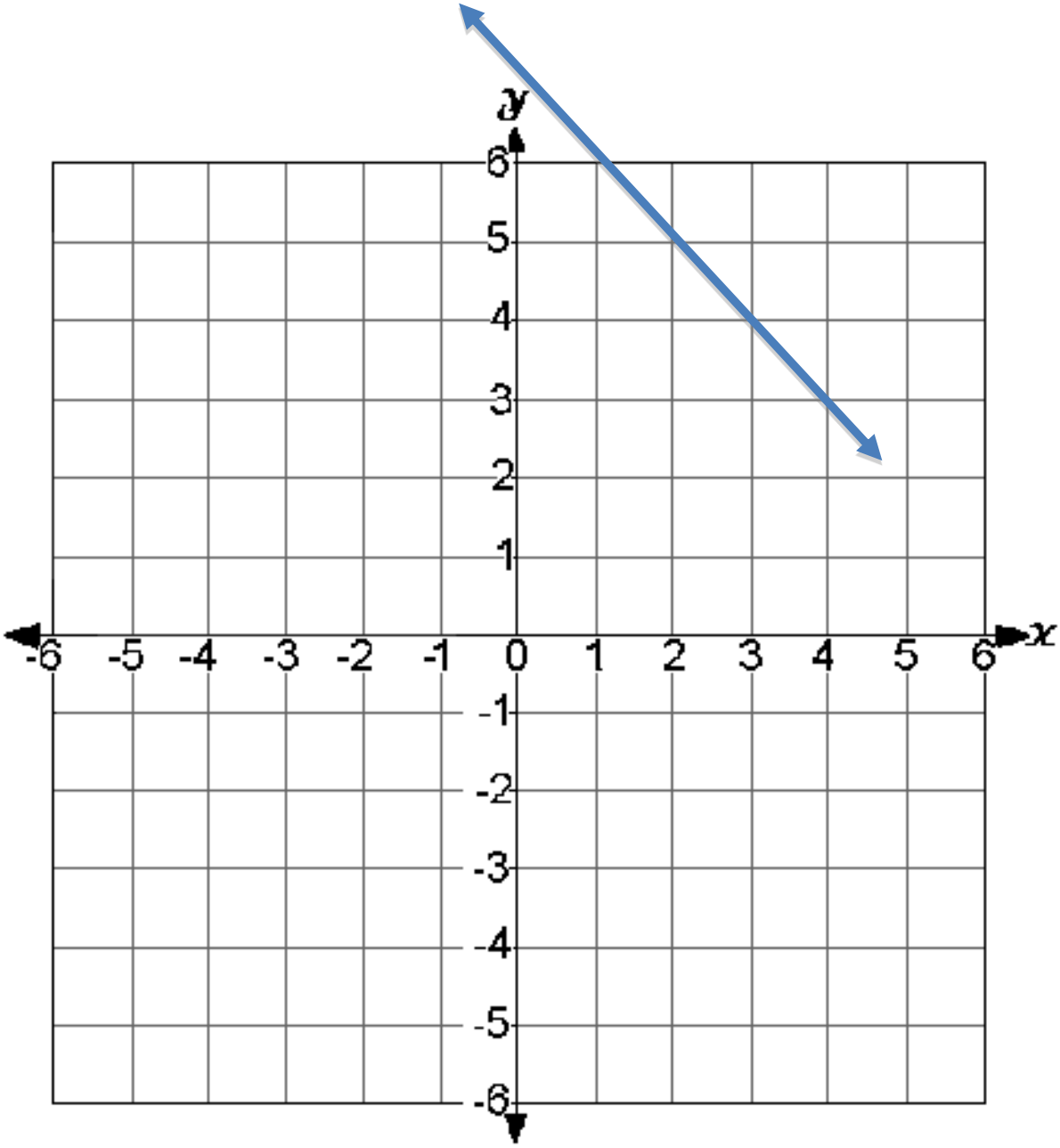

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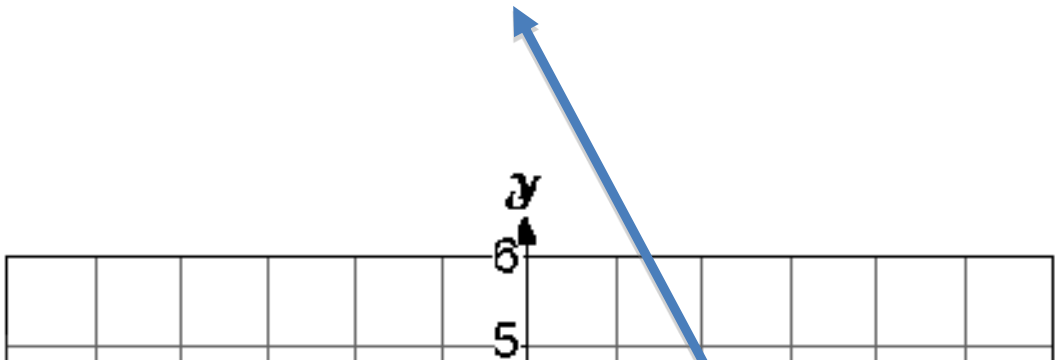

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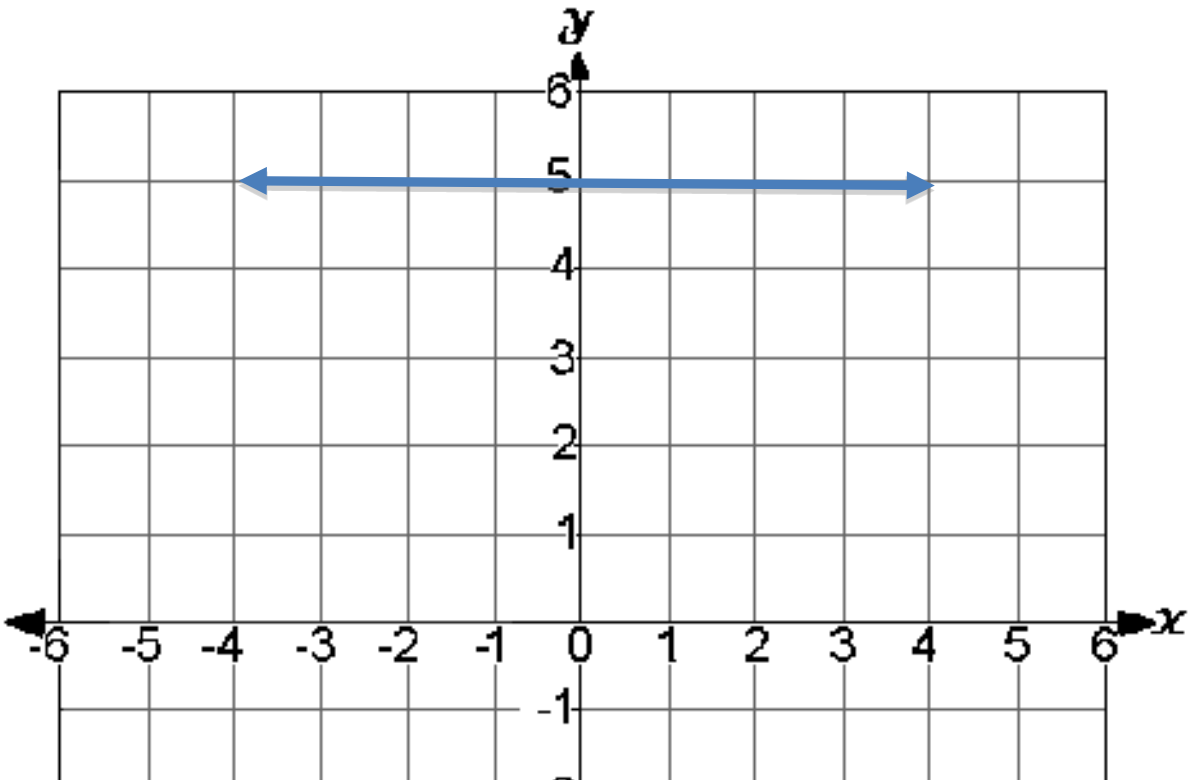

6 *Computational Thinking Lesson Planning Template* $3y+3x=21$	8 *iSTEM CS* $3y-27=3\left(\frac{1}{2}x-9\right)$
1 $3y+8x=27+2x$	4 $2(y+3x)=10+6x$
5 $6(2y+1)=2(2x+3)$	7 $2y-8=2x$
2 $12x-4y=-8$	3 $2y+6=4x+10$

3 $y = -x + 7$	2 $y = \frac{1}{2}x$
8 $y = -2x + 9$	4 $y = x + 4$
5 $y = 3x + 2$	1 $y = 2x + 2$
6 $y = 5$	7 $y = 1/3x$