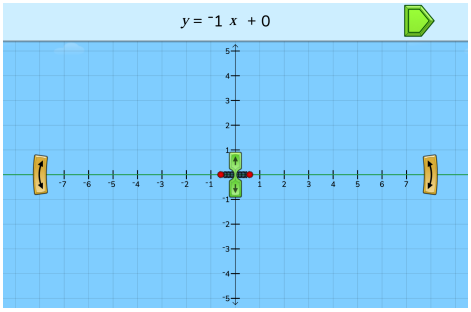
Puzzle Talk Facilitation Guide

This is a guide to provide support for facilitating student thinking as teachers engage students in academic discourse around math concepts and strategies using ST Math puzzles. This talk can be done over multiple days. ***Pre-work can be given to encourage students to think about the concept prior to the Puzzle Talk.*** *Read the Puzzle Talks Overview to learn more.*

Grade Level: Eighth
Objective: Graphing Linear Functions
Game: Linear Balloons Match Equation



Teacher Prep

Description

- **Purpose:** Focus on how to shift and rotate a line to match a linear equation. Use guiding questions for each step in the Problem Solving Process to support student thinking and the development of problem solving skills.
- **Materials Needed:** Provide students with whiteboards (or graph paper in sheet protectors) and markers
- **Puzzle Location:** Grade 8 > Graphing Linear Functions > Linear Balloons Match Equation > Level 1
- **Game in a Minute:** View video
- **Duration:** Multiple days
- **Time:** May vary 10 - 20 minutes each session

Look Fors

How does the student:

- shift and rotate the line to represent the given equation?
- identify the slope?
- identify the y-intercept?
- determine how the slope and y-intercept are represented in both the equation and the graph?

Puzzle Progression

Students encounter puzzles that give an equation in the slope-intercept form $y = mx + b$ with examples of positive, negative, or zero values for either the slope or the y-intercept. As they progress through the puzzles, the equations become more challenging and will require students to represent both the slope and y-intercept. In higher levels, students will encounter slopes given in the decimal form.

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Facilitation Suggestions (This is what a student-led discussion might look like.)

This would occur over multiple days

Notice and Wonder

- Display the first puzzle from Level 1. Ask: "What do you notice about this puzzle?"
- Allow a few students to share out. Listen for ideas that might include:
  - "There is an equation at the top."
  - "There are arrows on a green tab."
  - "There is a coordinate plane with a green line."
- Ask: "What do you wonder about this puzzle?" Allow students to share out. Listen for ideas that might include the following:
  - "What could we click on this puzzle?"
  - "How does the equation represent what we need to do?"

Predict and Justify

- Ask students to think individually about how they could solve the puzzle, then turn and share with a partner before sharing as a class.
- Students should provide mathematical reasoning for the idea they want to try. They can use their whiteboard to represent the puzzle. Ask students to consider what they think needs to happen for JiJi to move across the screen.
- List these ideas for the class to consider.

Test and Observe

- Choose one of the ideas from the class to try. Typically, a teacher might choose an incorrect answer the first time in order to allow for enhanced discussion and exploration of why JiJi was unable to cross the screen.
- Play the puzzle and ask students to observe what happens in the puzzle. *Remember to use the animation control features to replay or stop during points in the feedback to highlight important ideas.*
- Based on what they have learned from the feedback, ask students to choose another idea to try.
- Play the puzzle and ask students to observe what happens in the puzzle, using the animation control features and stopping when appropriate.
- Consider:
  - "What happened when we changed the slope or y-intercept?"
    - For example, the solution to the linear equation dropped into the puzzle and a green line was drawn.

- "Using the direction arrows we are given, how can we get JiJi across the screen?"
  - For example, change the slope or y-intercept to match the equation solution.
- You can use the puzzle controls to pause the puzzle while students check if their answer matches the puzzle on the screen. Discuss how this might provide evidence for why the solution will work or not.

Analyze and Learn

- Continue with puzzles from Levels 1 and 2.
- Discuss ways to help JiJi across the screen.
  - "What is happening in this puzzle?"
    - For example, does moving the line in a positive direction mean the same as in a negative direction?
  - "How is a slope of 0 represented? How is a y-intercept of 0 represented?"
    - Compare what is shown in the equation with how it is represented on the graph.
  - "Using the given equation, can we determine some of the points that will fall on the line?"
    - These predicted points can be used to determine how to move the line on the graph.
  - "How could we find the slope and y-intercept?"
    - For example, students might use their whiteboards to attempt to solve the equation.
- You can use the animation controls to replay and examine what happens in the puzzle.
  - If the puzzle was correct, discuss why the strategy used was successful.
  - If the puzzle was incorrect, analyze what happened and consider how to adjust the strategy to try again.

Connect and Extend

- Continue with puzzles from Level 3.
- As you discuss the puzzles, ask questions such as these:
  - "How are these puzzles different from those we've solved before?"
  - "What is happening to the line as we change the slope and y-intercept?"
  - "Based on the given equation, can you predict where the line will cross

the y-axis?"

- For a given equation, make a list of points that will fall on the resulting line. Challenge students to name 3 points that will NOT fall on the line. Ask students to provide justification for the points they have selected.
- Using graph paper, draw a line and ask a partner to determine the equation that would match the line.
- Explicitly tie in your classroom teaching of slope. Have the students make connections between the puzzle and the phrasing *rise over run* if you use this as part of your teaching of slope.