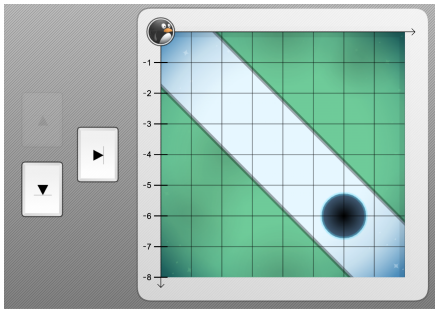
Puzzle Talk Facilitation Guide

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: Scale and Slope Graphs
Game: Graph Path

Teacher Prep

Description

- **Purpose:** Focus on how to move a point along a straight line in a coordinate plane. 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 > Scale and Slope Graphs > Graph Path > 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:

- record coordinate pairs?
- determine the direction of movement for the graph?
- use mathematical vocabulary to describe the puzzle?

Puzzle Progression

Students will encounter puzzles that move JiJi along a straight line in a coordinate plane. As puzzles continue, students only have control along one axis and the other axis has an automatic movement. Students begin to see and understand the slope of a line by connecting the steepness of the line to how quickly JiJi moves as the animation plays out.

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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 the following:
  - "JiJi is in the lower left corner of the graph." (Students also might refer to this point as (0,0) or the *origin*.)
  - "There is an arrow that points up and an arrow that points to the right."
  - "There is a black dot on the graph."
- 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 could we move JiJi to the dot?"

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 how JiJi will move on the graph.
- 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.
- Possible considerations, depending on the puzzle:
  - "What happens when we move two spaces to the right?"
    - For example, JiJi stops, can't move any further, and turns red.
  - "Using the direction arrows we are given, how can we keep JiJi on the path?"
    - For example, move up one, then over one. Repeat this pattern.

- You can use the animation 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 work.

Analyze and Learn

- Continue with puzzles from Levels 1 and 2. *Consider choosing a variety of slopes that represent positive, negative, and zero slope.*
- Discuss ways to help JiJi complete the path.
  - "What is happening in this puzzle? Are there other patterns that could work?"
    - For example, does moving up one and over one on the graph give the same result as moving up two and over two?
  - "How could we record the steps that we are using to move JiJi along the path?"
    - For example, students might keep track of the coordinate pairs that JiJi uses to get to the final destination and use them to predict the next point in the puzzle.
  - "What happens when a third control is introduced?"
    - For example, students might notice the different direction of the graph when using the down arrow compared to the up arrow. They could compare the coordinate pairs that result.
- You can use the puzzle 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 the puzzles we've solved before?"
  - "How are they the same?"
  - "If we can only control what happens on the y-axis, how can we help JiJi get to the correct spot?"
  - "What happens if you move JiJi too fast or too slow?"
  - "What determines how fast or slow you have to move JiJi?"
  - "Before we begin this puzzle, can you predict which coordinate points JiJi will cross on the way to the spot?"
- Plot the linear path you think JiJi will take on your coordinate plane before we click on the animation."
- Create your own Graph Path for JiJi and swap it with a partner to solve each

other's paths.

- 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.
- Have students show and explain to you how positive, negative, and zero slopes affect JiJi movement. Can they describe real world examples, such as how slope might impact speed while skiing?
- With a partner, write out a path of ordered pairs for Jiji to take and get to a set point starting at the origin. Put the ordered pairs on a coordinate plane and connect them. What do you notice?