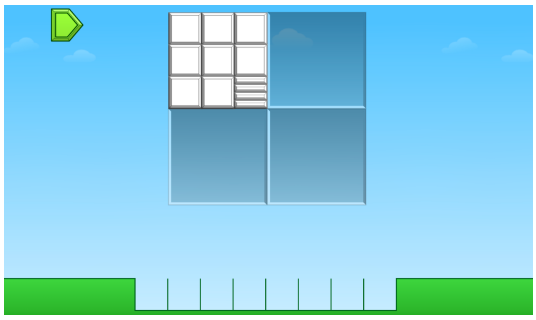
Puzzle Talk Facilitation Guide

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: Solving Linear Equations
Game: Frac Wall



Teacher Prep

Description

- **Purpose:** Focus on how to solve visual representations of the form px = r, where p and x are positive rational numbers (of the form a/b). 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 and markers
- **Puzzle Location:** Grade 8 > Solving Linear Equations > Frac Wall > 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:

- recognize how multiplication or division influences the outcome?
- identify the rate/constant of proportionality?
- write an equation in the form of y = px to represent the puzzle?
- solve for an unknown value when given a value for either x or y?

Puzzle Progression

Students will encounter puzzles where x pieces are multiplied by the number of shaded squares (p) to match the number of pieces needed to fill in the hole in the ground (r). As puzzles continue, the pieces (x) are cut by blades, requiring division based on the number of cuts. In the final puzzles, students explore puzzles that require both multiplication and division to solve the puzzle.

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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 students: "What do you notice?"
- Allow a few students to share out. Listen for ideas that might include the following:
  - "There are 6 empty spaces in the ground."
  - "There are blocks in the sky. Some of the blocks are smaller than others."
  - "There is an empty square next to the square that contains the blocks."
- 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 many blocks would we choose to fill the space in the ground?"

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.
- 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 chose the blocks?"
    - For example, when there is an empty square next to the blocks, the number of blocks doubles.
  - "If we want to use symbols to represent this puzzle, what could we write?"
    - For example, 2(3) = 6 would represent the doubling of a group of 3 blocks to equal 6 blocks. This is an opportunity to review that an equation uses

an equal sign to show that two expressions are equivalent.
    - Another opportunity for writing with symbols is to use a variable with a coefficient in the equation. Within the context of the puzzle, what do each of these mean?
- 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. The puzzles in Level 2 involve cutting the pieces to fill the space in the ground.
- Discuss ways to determine how many blocks will be needed to fill the space in the ground.
    - "What is happening in this puzzle? Which operation is represented?"
        - For example, the pieces are being multiplied in Level 1 puzzles and cut by a saw in Level 2 puzzles. Discuss whether multiplication or division would be most appropriate to describe the puzzle.
    - "How could we use a variable in an equation to describe this puzzle? What about the equation would remain constant?"
        - For example, make the connection that if there is one saw dividing each block in half, you could use the equation $\frac{1}{2}x = 4$ to represent a puzzle that has 4 blocks in the ground. Because there is a single saw, the variable will always be multiplied by $\frac{1}{2}$.
    - "What if there were ____ spaces in the ground? How many blocks would we choose?"
    - "What if we choose ____ blocks? How many spaces will be needed in the ground?"
- 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. Level 3 integrates multiplication and division within the puzzles.
- As you discuss the puzzles, ask questions such as these:
    - "How are these puzzles different from the puzzles we've solved before?"

- "What equation(s) could be used to represent this puzzle?"
- "Is there more than one way to solve this puzzle?"

- Give students equations, such as $3x = 12$ or $\frac{1}{2}x = 5$, and challenge them to draw a *Frac Wall* puzzle to represent the equation. Students can pair with a partner to explain how their puzzle represents the given equation.
- Brainstorm how a selected puzzle might change if it used different values. For example, if a puzzle represents $2x = 8$, how does the puzzle change if it becomes $2x = 10$? What other parts of the equation could be changed, and how will the changes influence the puzzle?