

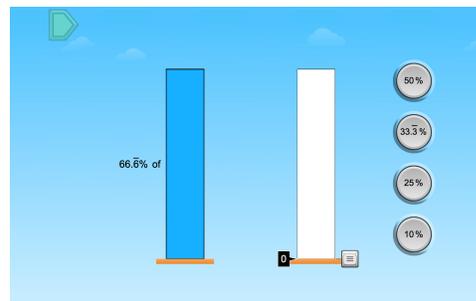


This is a guide to provide support for facilitating student thinking as teachers engage students in academic discourse around math concepts and strategies using ST Math puzzles. This talk can be done over multiple days. **Pre-work can be given to encourage students to think about the concept prior to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

Grade Level: Seventh

Objective: Percents with Increases and Decreases

Game: Percent Coin



Teacher Prep

Description

- **Purpose:** Focus on how to represent “percent of” along with increases and decreases of percents. 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 fraction pieces, whiteboards, and markers.
- **Puzzle Location:** Grade 7 > Percents with Increases and Decreases > Percent Coin > Level 2
- **Game in a Minute:** [View video](#)
- **Duration:** Multiple days
- **Time:** May vary 10 - 20 minutes for each session

Look Fors

How does the student:

- recognize that percents less than 100% will cause the block to shrink, percents equal to 100% will create an equivalent block, and percents greater than 100% will cause the block to grow?
- determine the percent needed to build the new block? Does the student think about factors and whether more than one option will work?
- use equivalent forms, such as fractions and decimals, to solve the puzzle?

Puzzle Progression

Puzzles include six levels. In each level, students must convert visually between percent increase/decrease and percent of. In level 1, fractions of a dollar and coins are used. In level 2, students find a percent of a whole using equivalent percentages. Level 3 introduces “more than” and “less than”. In levels 4-6, students must divide a whole into fractional parts in order to find a percentage of one. In these levels, the percentages may be more than 100% and students are asked to use “more than” or “less than” to find the solution.



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 2.
- Ask students, "What do you notice?"
- Allow a few students to share their thinking with the whole class. Listen for ideas that might include:
 - "There is a blue bar that says 60% of."
 - "There is a white bar with a slider button."
 - "There are buttons (or "coins") with different percent values, such as 50% and 25%."
- Ask, "What do you wonder about this puzzle?" Allow students to share out. Listen for ideas that might include:
 - "What could we click on this puzzle?"
 - "What bars can we make with the slider?"
 - "What do the different percents 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 the fraction pieces and/or their whiteboard to represent the puzzle. Ask students to consider whether the bar they create will be taller than, equal to, or shorter than the original blue bar that is given in the puzzle.
- List these ideas for the class to consider.

Test and Observe

- Select one of the students' strategies.
- Solve the puzzle and have students describe what happened.
 - Draw students' attention to the connection between the number and the number of empty squares in the ground.

Analyze and Learn

- Ask students how what happened compared to what they thought would happen.
- Replay the puzzle and pause the animation. Engage students in a discussion by asking questions like:
 - "Is the block stretching, shrinking, or equal to the original block?"
 - For example, students might notice that 60% is less than one whole so the block will be less than the original.
 - "Out of the percentages available to us, which ones allow us to build 60%?"



- For example, 60% can be built from 10% pieces but not from 25% pieces.
- 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 work.
- Continue with puzzles from Levels 2 and 3. Remind students to think about whether the block will increase, decrease, or remain the same. In Level 3, the percent values are stacked so that only the first piece is labeled and students need to think multiplicatively.
- Discuss ways to represent the percent change in the block.
 - “Of the percents we have available, what percent can be used to build 120%? Is there more than one that could work?”
 - For example, students identify that 120% can be built from 10% pieces but not from the other available percentages because those numbers are not factors of 120.
 - “How can we represent the change using a fraction or a decimal?”
 - For example, make the connection that 120% can be written as the fraction $120/100$ (or $12/10$) and the decimal 1.20. Notice that these values are all greater than one whole so the size of the block will increase.
- 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.

Levels 4-5

- Continue with puzzles from Levels 4 and 5. Levels 4 and 5 use fraction pieces to identify the change in the bar.
 - “How are these puzzles different from the puzzles we’ve solved before?”
 - “Is there more than one way to solve this puzzle?”
 - For example, 60% of the original blue bar could be built from pieces that are $1/5$ each as well as from pieces that are $1/10$ each. As a way to reinforce equivalence, go back and use different denominators to solve the puzzle.
 - “If we could use another percent as a building block, what should we include? What would make that percent useful?”
 - For example, students might include 5% or 15%. This is another opportunity to reinforce factors and equivalence.

Connect and Extend