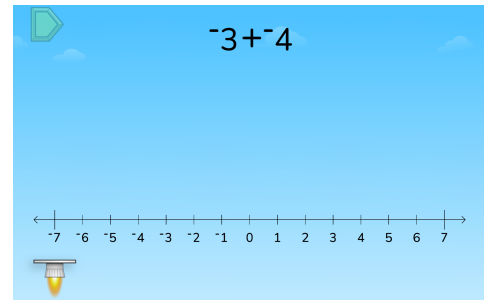


*This is a guide to provide support for facilitating student thinking as teachers engage students in academic discourse around math concepts and strategies using ST Math puzzles. This talk can be done over multiple days. **Pre-work can be given to encourage students to think about the concept prior to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

Grade Level: Seventh

Objective: Addition and Subtraction with Negative Numbers

Game: Integers on the Number Line



Teacher Prep

Description

- **Purpose:** Focus on addition and subtraction of positive and negative integers on a number line. 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 7 > Addition and Subtraction with Negative Numbers > Integers on the Number Line > 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:

- use a number line to represent addition and subtraction?
- connect the given operation to the direction on the number line?
- recognize the inverse relationship between addition and subtraction?

Puzzle Progression

There are six levels in this game. Puzzles include solving addition and subtraction of positive and negative integers with sums or differences between -7 and 7.



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 that results in a negative solution. Ask, "What do you notice about this puzzle?"
- Allow a few students to share out. Listen for ideas that might include:
 - "There is a subtraction expression in the sky."
 - "There is a number line at the bottom of the screen."
 - "The number line has a range from -7 to 7."
 - "0 is in the center of the number line."
- 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?"
 - "How could we represent this subtraction expression using the number line?"

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 sketch a number line and represent the puzzle. Ask students to consider what each piece of the given expression represents mathematically.
- 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.

Analyze and Learn

- Ask students how what happened compared to what they thought would happen.
 - If the answer was incorrect, discuss what was learned and what they think is best to try next. Have students share why that is the best way to solve the puzzle.
 - If the answer was correct, how can they take what they learned and apply it to the next puzzle?
- Show the next puzzle and have students discuss their strategies for solving it and why.
- Engage students in discussions by asking questions like:



- “What is the starting point for the puzzle?”
 - For example, students might notice that the puzzle begins at zero and moves to the point that represents the first number in the given expression.
- “Once we know the first point, how does the puzzle move?”
 - For example, students might observe that the puzzle moves the distance named by the second number in the given expression. In addition expressions, the distance moves to the right; while in subtraction expressions, the distance moves to the left.
- 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 additional puzzles from Levels 2 and 3.
- Discuss ways to represent the expression on the number line. If you would like a quick formative assessment of students’ thinking, students can write their ideas on whiteboards and hold them up to share.
 - “How will this operation cause us to move on the number line?”
 - For example, addition always moves toward the right while subtraction always moves toward the left.
 - “What happens when there is a negative sign in front of one of the numbers?”
 - For example, students might notice that the distance remains the same but moves in the opposite direction.
 - “How might this puzzle change if we used a different operation?”
 - For example, what would happen if the puzzle gave the numerical expression $3 - (-2)$ instead of $3 + (-2)$?
- 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

Levels 4-5

- Continue with puzzles from Levels 4 and 5.
 - “How are these puzzles different from the puzzles we’ve solved before?”
 - “Using these same numbers/distances, could we write an expression with the opposite operation that will give us the same result?”
 - For example, does $4 + (-3)$ result in the same movement as $4 - 3$? Students might notice that using the opposite operation means they need the opposite direction for the distance moved.



- “Is it possible to rewrite subtraction problems as addition? Or addition problems as subtraction? When might this be useful?”