Mathematical Thinking Routines for Algebra I

Mathematical thinking routines can help teachers incorporate the Standards for Mathematical Practice and Mathematical Habits of Mind into their classroom cultures. *The math practices live not in the final answer a student gets for a math problem, but in the thinking and reasoning a student uses to arrive at a solution, so students need mathematics tasks that encourage them to think and reason.* (Kelemanik, Lucenta & Creighton, 2016, p. 13)
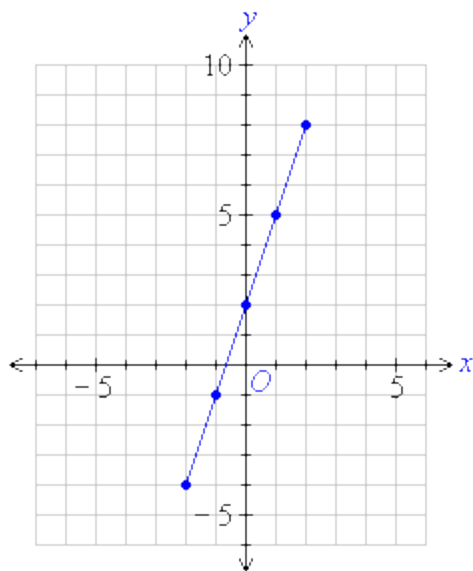
> *Mathematics routines develop the behaviors that allow students to do mathematics.*
> ~ Anne Burgunder

Kelemanik, G., Lucenta, A., & Creighton, S.J. (2016) *Routines for Reasoning: Fostering the Mathematical Practices in All Students*. Portsmouth, NH: Heinemann.

As you enact thinking routines, it is important to provide individual think time, partner work time, and full-group discussion. Use the student-generated ideas to launch into the mathematical ideas you want to focus on for the lesson. Routines, like the ones below, not only help launch a lesson, but also help students to develop and practice crucial mathematical thinking habits. These routines could also be used as formative assessments to see what students already know or to help identify possible misconceptions they have.

1) Tell All You Know – List all the things you know about the image below:
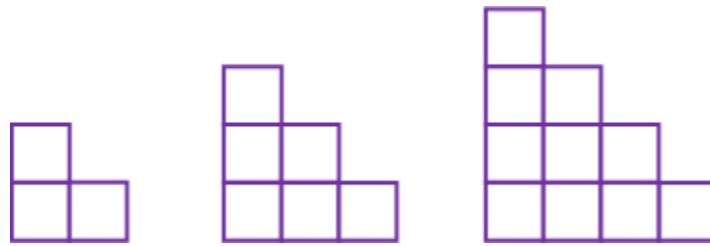
   a)

   Some possible answers:
   - Linear graph
   - Goes through Quadrants I, II and III
   - y-intercept is +2
   - x-intercept is a fraction less than 0
   - Five points are marked: (-2,-4), (-1,-1), (0,2), (1,5) and (2,8)
   - Positive slope
   - Slope = 3
   - Equation of line is y = 3x + 2
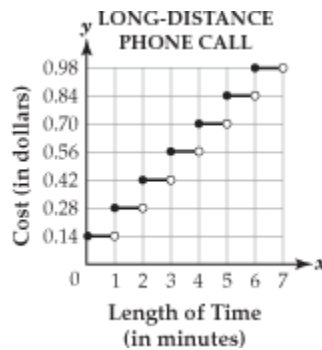   - Domain = -2 ≤ x ≤ 2
   - Range = -4 ≤ y ≤ 8

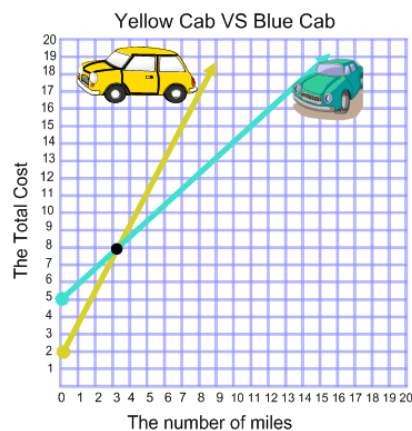Any visual or graph could be used for the "Tell All You Know" routine.

b)

c)

LONG-DISTANCE PHONE CALL

2) What Could the Question Be? – List possible questions that might have been posed for the answer below:
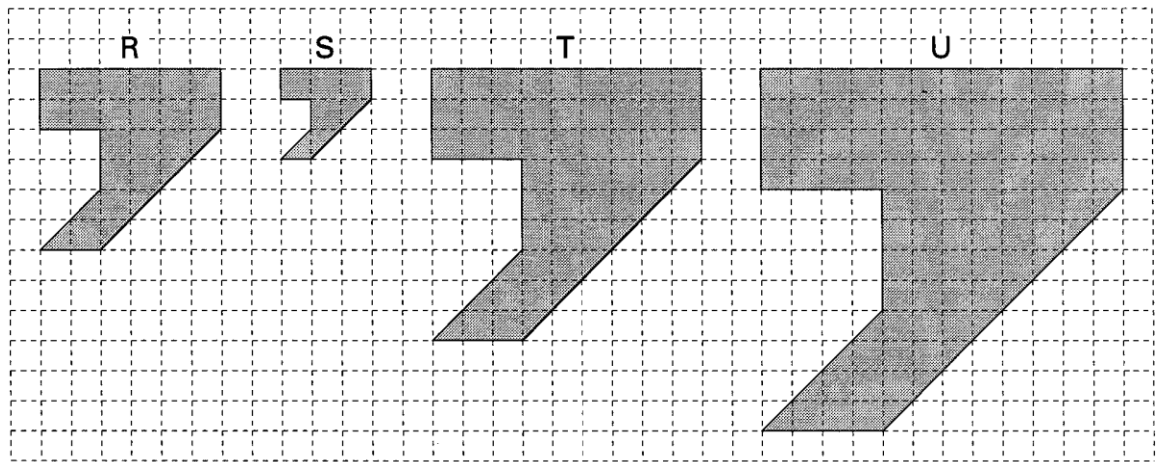
a)

Yellow Cab VS Blue Cab

Some possible answers:
- When is the rate for the yellow and blue cabs equal?
- Which cab should you take?
- Is one cab rate cheaper for long trips?
- What is the equation for the yellow line? The blue line?
- What does it cost to just call each cab, before you ever go anywhere?

b) What Could the Question Be?

Source: https://www.mathlearningcenter.org/sites/default/files/pdfs/VM2-SA-Web.pdf

3) Next 5, Previous 5 – This routine is focused on helping students see structure.

What are the next five equations that fit the pattern below? What are the previous 5 equations?

a)
$$x + 1 = 6$$
$$x + 2 = 7$$
$$x + 3 = 8$$

This routine helps students see structure, patterns and logic in the number system. The list below shows the next 5 and previous 5 equations:

- $x + -4 = 1$
- $x + -3 = 2$
- $x + -2 = 3$
- $x + -1 = 4$
- $x + 0 = 5$
- $x + 1 = 6$
- $x + 2 = 7$
- $x + 3 = 8$
- $x + 4 = 9$
- $x + 5 = 10$
- $x + 6 = 11$
- $x + 7 = 12$
- $x + 8 = 13$

b) What are the next 5 problems that fit the pattern? What are the previous 5 problems that fit the pattern? (multiplication with integers)

$$5 \cdot 5 = 25$$
$$5 \cdot 4 = 20$$
$$5 \cdot 3 = 15$$

c) What are the next 5 problems that fit the pattern? What are the previous 5 problems that fit the pattern? (subtracting an integer)

$$7 - 3 = 4$$
$$6 - 2 = 4$$