# Beyond One Right Answer

Monday, March 6

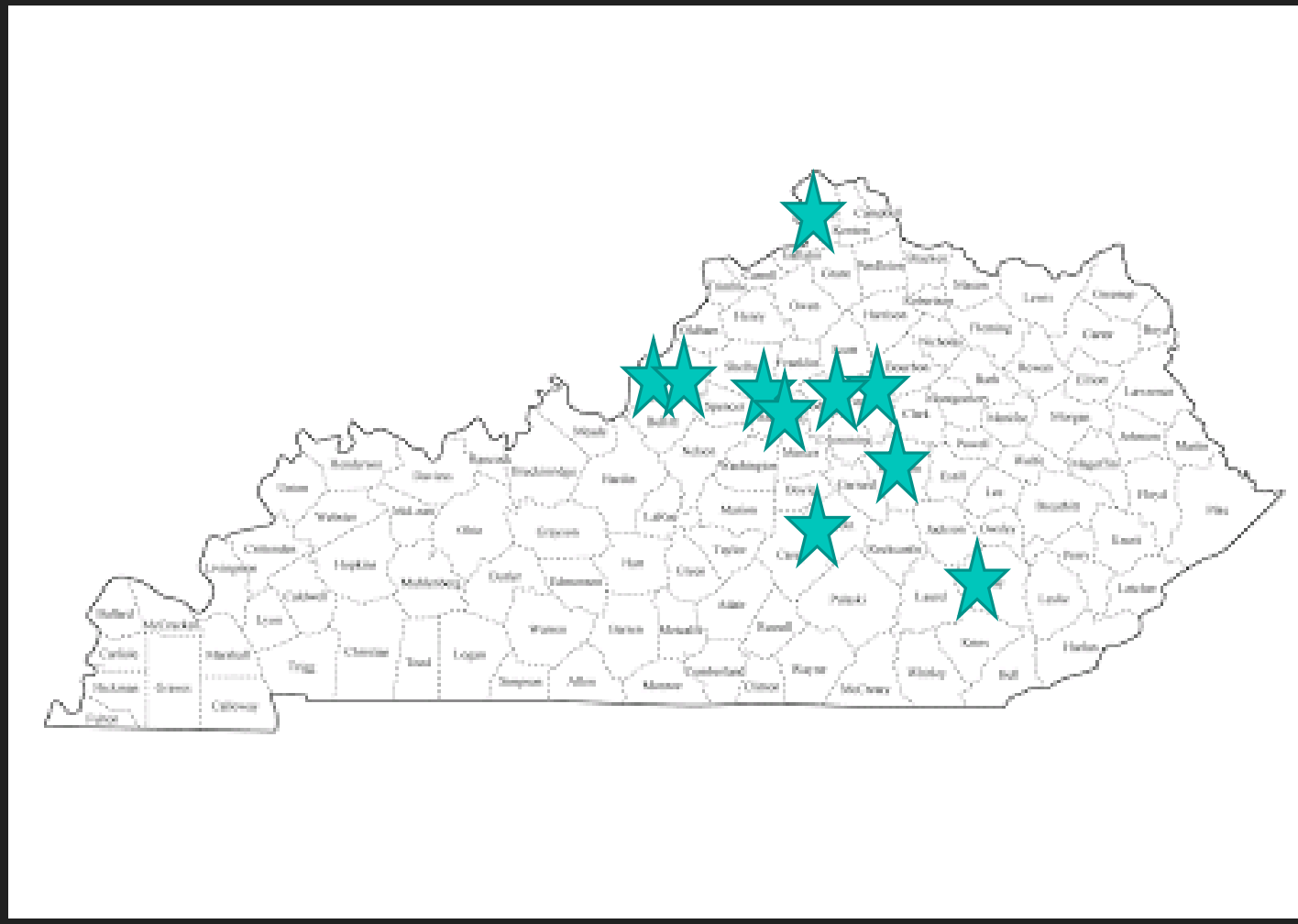
# As you enter……


Use the cardstock on the table to create a name tent.

On the inside of the tent, draw a picture of what learning looks like.

# Master Coaching PLC

- Shannon Blackburn – Fayette County
- Jenny Donnelly – Berea Independent
- Stephanie Fields – Jefferson County
- Angie Johnson – Jefferson County
- Jamie-Marie Miller – Lincoln County
- Debbie Waggoner – Fayette County
- Kristi Woods – Clay County



# Roles for Habits of Mind

Adapted from *Habits of Mind: An Organizing Principle for Mathematics Curriculum"* Al Cuoco, E. Paul Goldenberg, and June Mark, 1996

**Pattern Sniffer**
I look for patterns among a set of numbers or figures or letters.

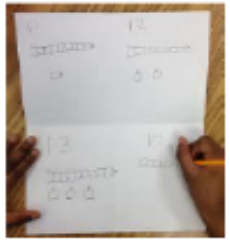
**Experimenter**
I question and then experiment. I record and study results. I perform thought experiments.

**Describer**
I can describe clearly a problem, a process, or a strategy. I use language appropriate for the audience.

**Tinkerers**
I "play around" and investigate. I can take ideas apart and put them back together. I stick with my work and try a different approach if needed.

**Inventor**
I can invent mathematics. I can model a situation. I use math for fun (in games) as well as for finding a solution to a problem.

**Conjecturer**
I make conjectures and predictions about patterns in numbers, for example. I can explain and support my conjectures.



**Visualizer**
I draw pictures or make diagrams to help me understand a problem. I "see" math. I can understand drawings and diagrams.

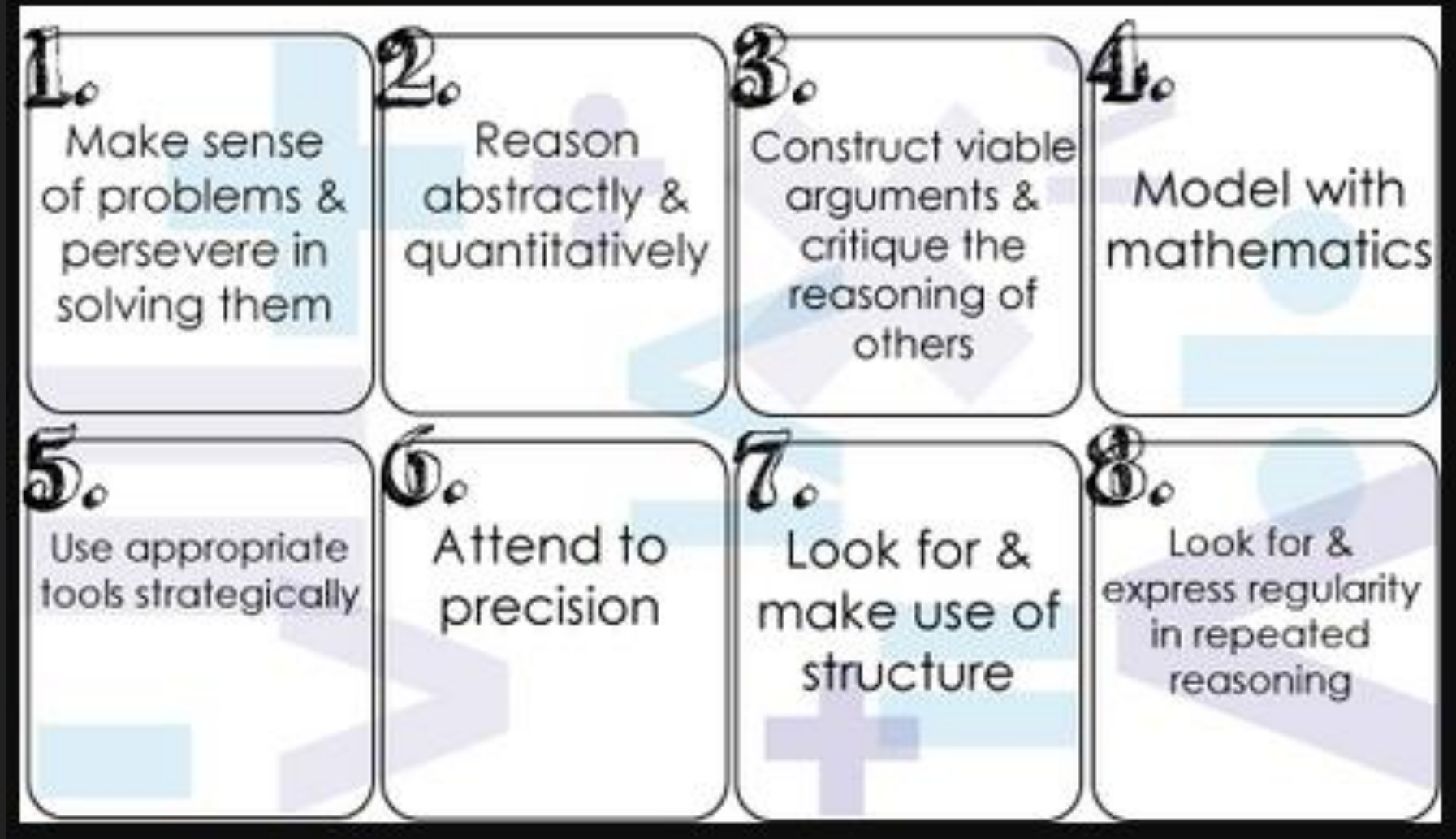
**Guesser**
I make clever guesses based on things I already known as well as new patterns and relationships I have observed.

# Turn and Talk

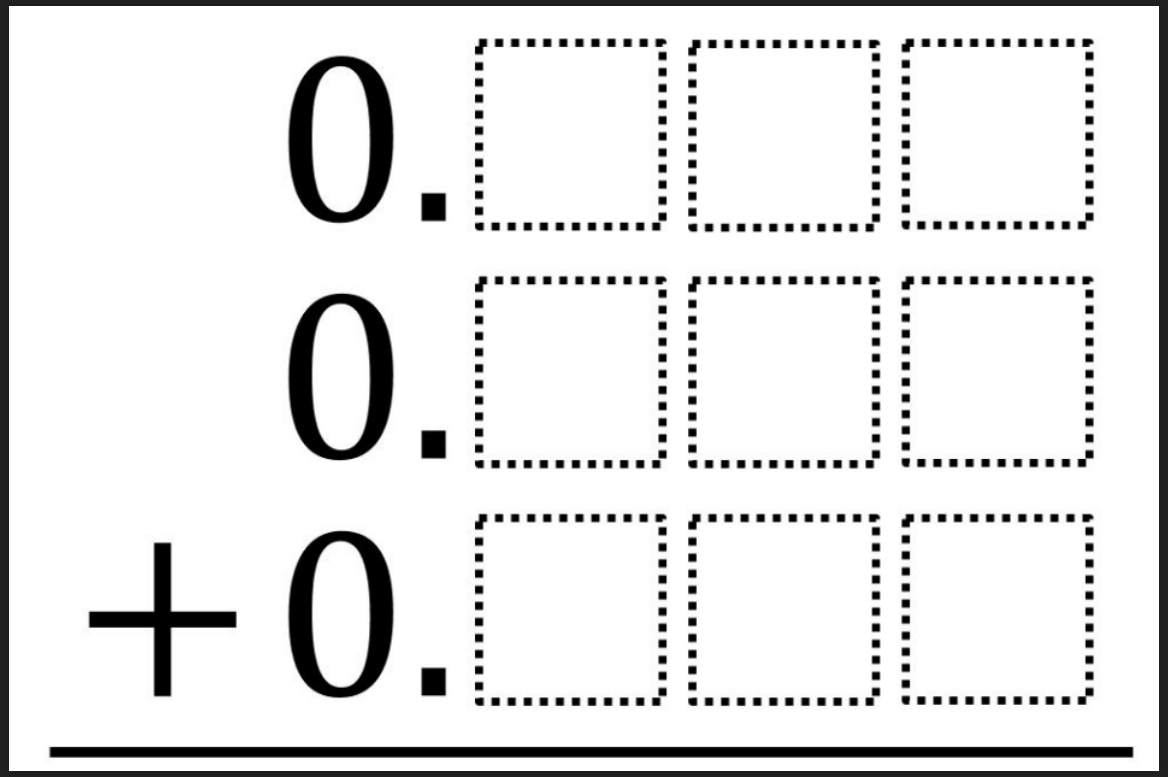

What kinds of activities take place in your classroom that encourage these mathematical habits of mind?

What might we do differently to allow students to think in these ways?

# The Eight Mathematical Practices



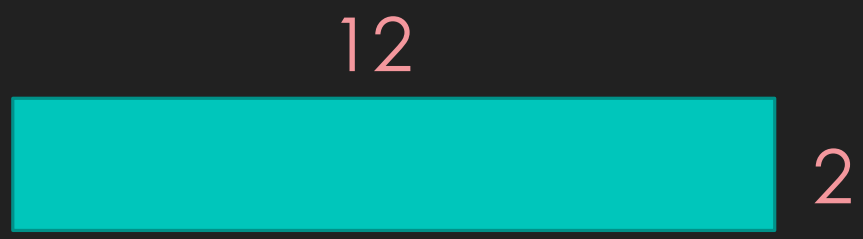
# Use the numbers 1 through 9, exactly one time each, to fill in the boxes and make three decimals whose sum is as close to 1 as possible.




Source: Openmiddle.com

What math habits of mind did you engage in when solving this problem?

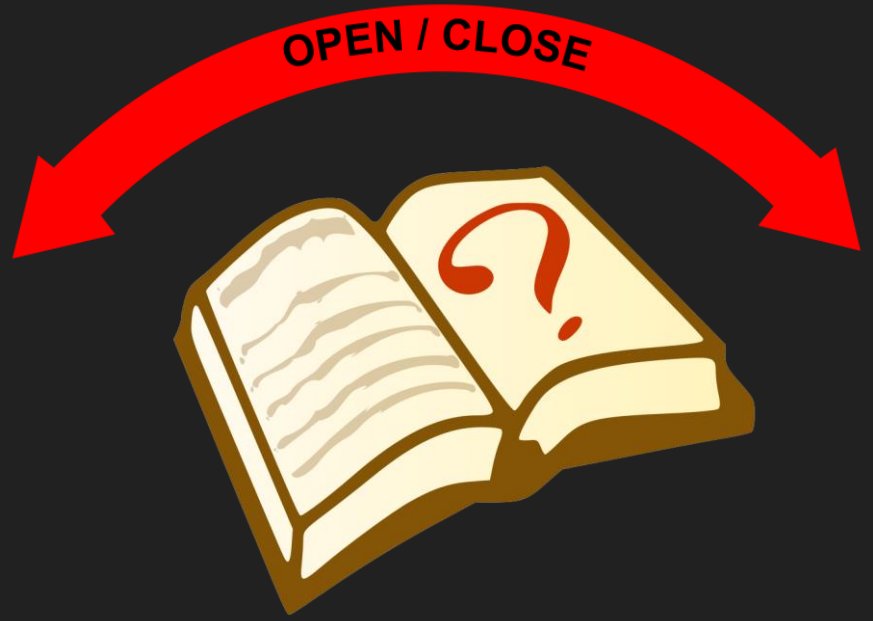
What is the perimeter of this rectangle?



# What if we re-wrote the question

How many rectangles can you find with a perimeter of 24 in?

# Ways to Create Open Questions:




Source: *Beyond One Right Answer* by Marian Small

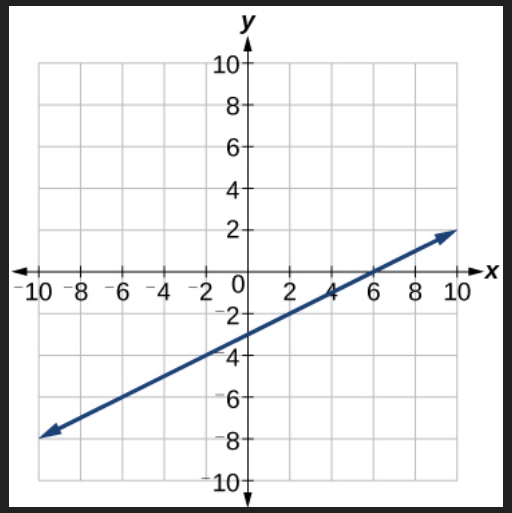
# Start with the answer

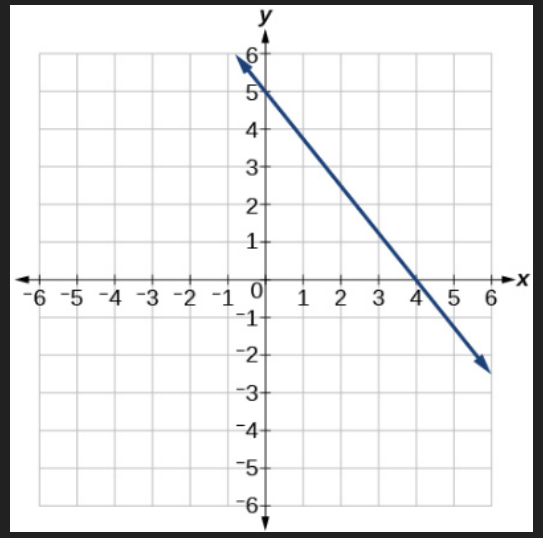

- Example:  The product is 2/3, what might the factors be?
- Example:  = 64

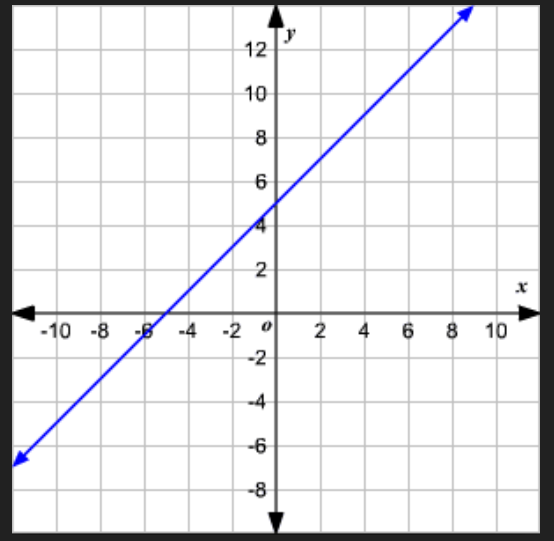
# Ask for similarities and differences

- Example – How are the formulas for the area and circumference of a circle alike?  How are they different?

- How are these graphs alike and how are they different?



# Ask students to create a sentence


- Example – Create a sentence using the words and numbers *product*, *8*, *almost*, and *50*.

- Example – Create a sentence using the words and numbers *surface area*, *volume*, *greater*, and *300*.

# Allow choice in the data provided

- Example – The sum of two integers is a negative integer very far from zero.  What might the two integers be?

- Example – Using the triangle below, choose a number for the box on the left.  What is the length of the hypotenuse of this right triangle?

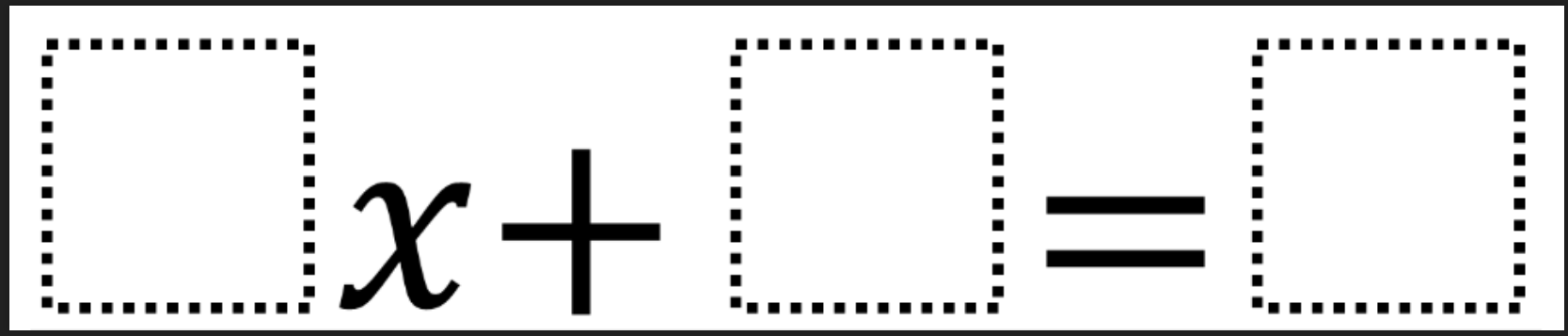
**Choose one question and rewrite using one of the following strategies to create an open question**

1. Start with the answer
2. Ask for similarities and differences
3. Allow choice in the data provided
4. Ask students to create a sentence

- Find the volume of a rectangular prism with a height of 2.1 *m*, depth of 4.5 *m*, and width of 3.3 *m*.
- $5^{-2}$
- Round 9.4587 to the tenths place
- Calculate the mean of 12, 17, 55, 82, 11, and 25.

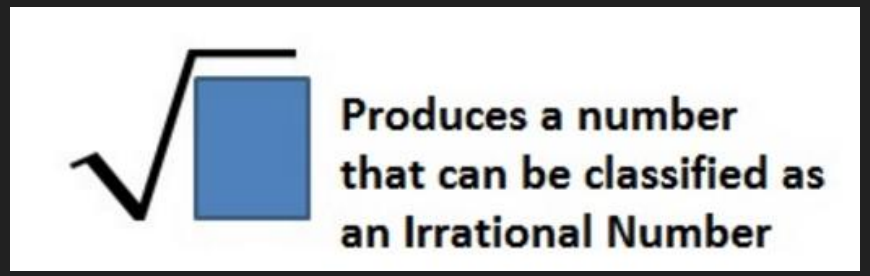
# openmiddle.com

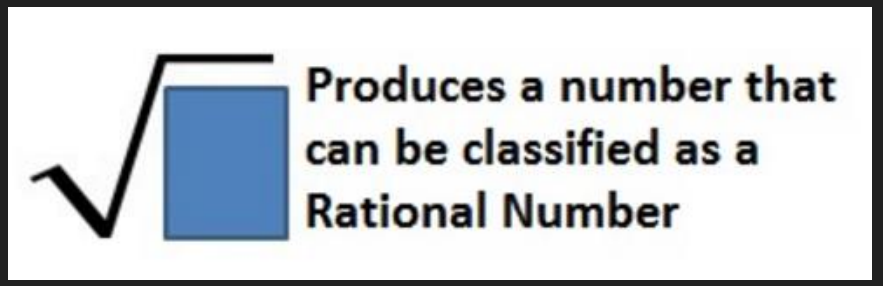
Use the whole numbers 1-9, at most one time each, to find the largest (or smallest) possible values for x.

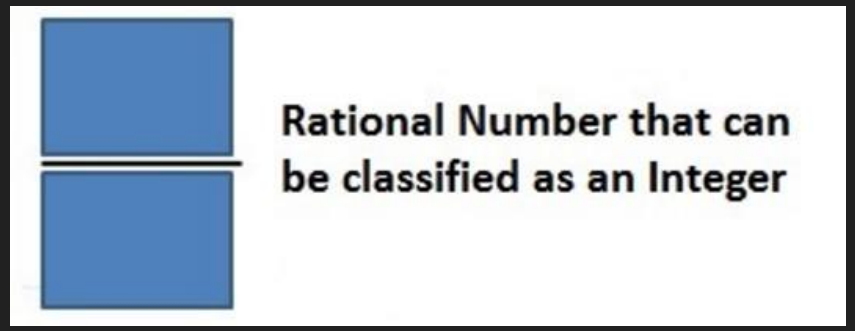


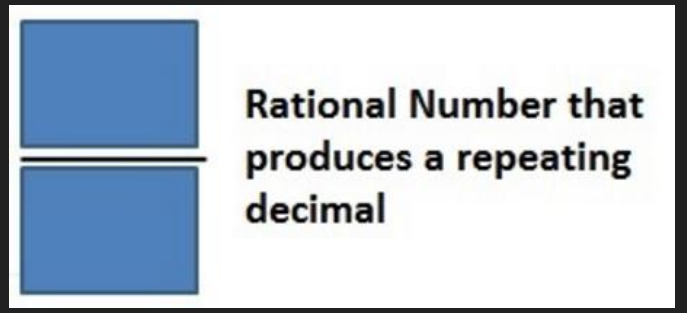

http://www.openmiddle.com/

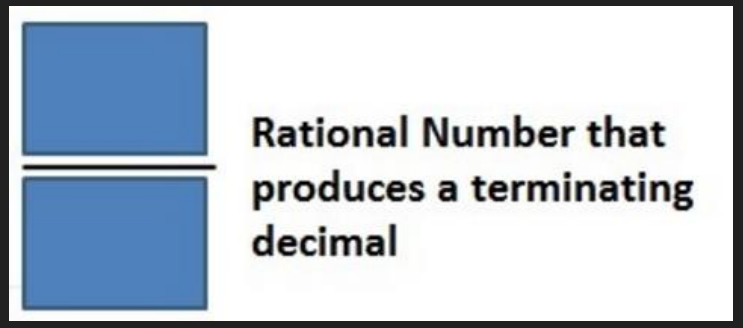
Using only numbers 1-8 (without repeating any number), fill in the boxes to create the following number types:



# Framework for Teaching

| | |
|---|---|
| ***3B - Questioning and Discussion Techniques***<br><br>• Quality of Questions/Prompts<br>• Discussion Techniques<br>• Student Participation | Questioning and discussion are the only instructional strategies specifically referred to in the framework for teaching; this fact reflects their central importance to teachers' practices. But in the framework, it is important that questioning and discussion are used as techniques to deepen student understanding are being used rather than serving as recitation or a verbal quiz. Good teachers use divergent as well as convergent questions, framed in such a way that they invite students to formulate hypotheses, make connections, or challenge previously held views. Students' responses to questions are valued; effective teachers are especially adept at responding to and building upon student responses and making use of their ideas. High- quality questions encourage students to make connections among concepts or events previously believed to be unrelated, and arrive at new understandings of complex material. Effective teachers also pose questions for which they do not know the answers. Even when a question has a limited number of correct responses, the question, being non-formulaic, is likely to promote thinking by students. Class discussions are animated, engaging all students in important issues and in using their own language to deepen and extend their understanding. These discussions may be based on questions formulated by the students themselves.<br>Not all questions must be at high cognitive level in order for a teacher's performance to be rated at a high level; that is, when exploring a topic, a teacher might begin with a series of questions of low cognitive challenge to provide a review, or to ensure that everyone in the class is "on board." Furthermore, if the questions are at a high level, but only a few students participate in the discussion, the teacher's performance on the component cannot be judged to be at a high level. In addition, in lessons involving student in small-group work, the quality of the student's questions and discussion in their small groups may be considered part of this component.<br>In order for students to formulate high-level questions, they must have learned how to do so. Therefore, high-level questions from students, either in the full class, or in small group discussions, provide evidence that these skills have been taught. |

| ***Ineffective*** | ***Developing*** | ***Accomplished*** | ***Exemplary*** |
|---|---|---|---|
| • Teacher's questions are of low cognitive challenge, require single correct responses, and are asked in rapid succession.<br>• Interaction between teacher and students is predominantly recitation style, with the teacher mediating all questions and answers.<br>• A few students dominate the discussion. | • Teacher's questions lead students through a single path of inquiry, with answers seemingly determined in advance.<br>• Alternatively, the teacher attempts to frame some questions designed to promote student thinking and understanding, but only a few students are involved.<br>• Teacher attempts to engage all students in the discussion and to encourage them to respond to one another, but with uneven results. | • **Although the teacher may use some low-level questions, he or she asks the students questions designed to promote thinking and understanding.**<br>• **Teacher creates a genuine discussion among students, providing adequate time for students to respond and stepping aside when appropriate.**<br>• **Teacher successfully engages most students in the discussion, employing a range of strategies to ensure that most students are heard.** | • Teacher uses a variety or series of questions or prompts to challenge students cognitively, advance high-level thinking and discourse, and promote metacognition.<br>• Students formulate many questions, initiate topics, and make unsolicited contributions.<br>• Students themselves ensure that all voices are heard in the discussion. |

# Reflection – What Learning Looks Like


## As you leave today:

Think about what learning looks like in your classroom.

What changes will you make?


What habits are important to you?

Are there any habits that you want your students to engage in?