Module 1- Rational and Irrational Script

Slide 1: this is Module 1 use of manipulatives and strategies with a focus on rational and irrational numbers. This is part 3 of a 3-part professional learning session for module 1. We encourage you to follow along and construct the visual representations discussed within this session. Feel free to pause the presentation at any point.

Slide 2: subitizing is ability to quickly identify the number of items in a small set without counting. Research shows babies at the age of six months are able to exhibit a form of subitizing. The subitizing activity helps to reinforce addition of integers. Showing this image to students you would ask, "what do you see and how do you see it?" The result of using subitizing cards such as this one is students will begin to look for zero pairs to determine the quantity.

Slide 4: a number line is a flexible tool. Here a number line is used to determine -3 + 5. Beginning at zero, we travel along the number to -3. With a problem such as this, you would want students to understand a zero pair is applied, as we travel across zero when adding 5 positive steps.

Slide 5: it works both ways. Here we travel from neutral or zero to +4 before subtracting 7 or adding -7. With a problem such as this, discuss with the students if there are any zero pairs and if so how many.

Slide 6: take a moment to consider these three expressions. Explain the sum of each using two color counters or another set of countable objects as well as a number line to support your explanation.

Slide 7: take a look at this number line. What do you notice? You may see three being subtracted 3 times, you may notice skip counting by -3, you may even notice 3 jumps of -3.

Slide 8: what about this empty number line? What similarities can you identify? Allowing students to show their mathematical thinking on an empty number line allows them to be flexible in their thinking and make connections among mathematical ideas. With this strategy, students are not bound by memorization allow for the application of a reasoning strategy.

Slide 9: in this visual representation of 3 X -3, we begin with neutral. The three circles represent the 3 groups of -3 we will compose.

Slide 10: we are using the conventional red to represent our negative quantity. From this representation, students would conclude 3 groups of -3 is the same as negative 9.

Slide 11: think for a moment how we might illustrate -3 X -3. If 3 X -3 can be interpreted as 3 groups of -3 and added -3 to our neutral space, how could we interpret -3 X -3.

Slide 12: Van de Walle describes it this way, removing 3 groups of -3. In order for us to physically remove 3 groups of negative 3, zero pairs are created. What is the total value of this representation? It is important for students to understand this visual here is equivalent to the previous slide of blank circles. Creating opportunities for students to determine the total value of various amounts of zero pairs will help reinforce this idea.

Slide 13: we can physically remove 3 groups of -3 leaving only positives within our groups. Memorizing the integer rules will not help with the students' ability to reason with positive and negative numbers. Experiences with concrete or visual representations will allow students to make sense of the mathematical ideas.

Slide 15: with division, we working backward from our thinking with multiplication. Instead of being given a certain set of a particular quantity, we must determine how many sets of a given quantity will be equivalent to the total. Notice how we begin with neutral or zero. With this problem of -10 divided by 5 we removing sets of 5 to create -10. Five is removed 2 times. Connecting this idea to multiplication, if we remove 2 groups of 5 we would be left with 2 groups of -5 which is equivalent to -10.

Slide 16: take a look at this explanation. How could you connect this to your multiplication understanding? Encouraging students to look for and make use of structure helps students make explicit connections and have to commit less rules to memory.

Slide 18: rational numbers are numbers which can be represented as a fraction and includes decimals and percentages.

Slide 19: in this task, students categorize rational numbers stating if they repeat or terminate. This is an important idea and will assist students as they begin working with irrational numbers. Allow students to explore the characteristics of unit fractions and non-unit fractions.

Slide 20: understating the relative size of fractions is critical to understanding and computing fractions. Fraction strips such as these can be printed on red and yellow construction paper to make the visual connection between operations with integers and operations with fractions. In module 1, part 1 we discussed strategies for operations with fractions.

Slide 21: games are a great way to get students to practice a strategy in a meaningful way. With this game, students move along the solid line from fraction to fraction in order to create 3 or -3.

Slide 22: square numbers will be discussed in depth in the module 2 professional learning session. An important idea for students to understand when it comes to square numbers is perfect squares visually form a square. What perfect squares can you see within this image?

Slide 24: when students understand this big idea, they will not need to memorize every perfect square and through imaging, determine if a number of a perfect square or not.

Slide 25: if rational numbers are described as those numbers that can be represented as a fraction, how could you describe an irrational number? Students understanding of rational numbers will support them with irrational numbers.

Slide 26: students need to understand radicals can be rational or irrational. The square root of 6 is not as easily determine as a number such as the square root of 4. However, when students understand a perfect square visually has equal rows and equal columns they can conclude this area of 6 is not that of a perfect square.

Slide 27: however, it falls between two perfect squares. Which two perfect squares does it fall between? 4 and

Slide 28: 9. Using different colors to distinguish between the quantities highlights 2 key connections. The square root of 6 is greater than 4 and less than 9. The square root of 6 contains 2 of the 5 pieces needed to make 9.

Slide 29: using a number line to demonstrate our thinking, how far apart is the square root of 4 and the square root of 9? The distance is 5. How far is the square of 6 from the square root of 4? Two is part of the distance from one perfect square to the next. 5 is the whole distance. We could estimate the square root of 6 to be 2 and 2/5 just as we did with the color tiles.

Slide 30: with an activity such as this one, students can apply either strategy, concrete materials or number line. You could encourage students to use both strategies and decide which is most efficient for the numbers given.

Slide 31: to obtain a closer approximation, students could work with 10 X 10 squares. This will give a decimal representation of the root. For this example, we are determining the approximate root of 2. What would you identify as the root or length of a square with an area of 2? 1.4 and a little more.

Slide 32: this task from open middle.com is a great application of understanding of irrational numbers. Using only numbers 1-6 once per inequality, fill in the boxes to create a true statement with the smallest possible interval. What numbers would you use for the first inequality?

Slide 33: we want students to construct conjectures based on their experiences with the mathematical content. With tasks like this one, students are able to justify their conjectures with the multiple examples from provided.

Slide 34: what do you do when students struggle?

Slide 35: allow students to work at their own pace of understanding. It's perfectly fine for students to hover between the representational stage and abstract stage.

Slide 36: tiered tasks are a great way to allow students to work at their own pace of understanding while continuing to move through the curriculum. You may have a single task tiered at three different levels. Below expectation, at expectation and above expectation.

Slide 37: this task from module 1 could be tiered in this manner tier 1: find the estimate of the square root of each number. Show an illustration in two different ways. Tier 2: find the estimate of the square root of at least 3 numbers. Show an illustration using a number line or tiles. Tier 3: find the estimate of the square root of at least two numbers using a number line or tiles. This will highlight of students are less comfortable with larger numbers which will help with targeted instruction.

Slide 38: meeting with small groups of students is certainly beneficial. We have pulled suggestions for implementing small groups. The link listed will provide insight on how other teachers are implementing small groups at the secondary level.

Slide 39: this suggestion comes from the Social Emotional Learning in Mathematics session from Global Math Department. It lists a class size of 30 students to demonstrate you do not have to have a small class size to implement small group instruction. The GADOE is not suggesting the FOA class sizes should be increased to 30 students.

Slide 40: this suggestion comes from the Social Emotional Learning in Mathematics session from Global Math Department. It lists a class size of 30 students to demonstrate you do not have to have a small class size to implement small group instruction. The GADOE is not suggesting the FOA class sizes should be increased to 30 students.

Slide 41: The GaDOE has created a wiki space for high school teachers to engage in discussions about math teaching using the GSE. Here you'll find a forum to keep the conversation going, resources and who knows, you might make a few friends. It's a call to action and you are invited to make a difference. Access this online community here: https://ccgpsmathematics9-10.wikispaces.com/