Organizing Numbers

Strand: Number and Number Sense

Topic: Investigating the real number system

Primary SOL: 8.2 The student will describe the relationships between the subsets of the real number system.

Materials

- Real Numbers Cards (attached)
- Scissors
- Real Number System Subset Labels (attached)
- Real Number System Venn Diagram (attached)
- Dry-erase boards and markers

Vocabulary

integers, natural (counting) numbers, product, rational numbers, sum, whole numbers (earlier grades)

irrational numbers, radical number, real numbers, subset (8.2)

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Distribute scissors and copies of the Real Numbers Cards. Discuss various characteristics of the numbers. Then, direct students to cut the cards apart and sort them any way they like. When students are finished sorting, have them discuss with partners how they did their sorts. Lead a class discussion about the different ways they sorted the numbers, asking them to explain the processes they used.
2. Distribute the Real Number System Subset Labels. Have students cut them apart and arrange them in any order. Have students assign each number card to a subset. Point out how some numbers belong in more than one subset, and discuss the characteristics of each subset.
3. Have students work with partners to sort the number cards into rational and irrational numbers. Then, have them sort the rational numbers into integers, whole numbers, and/or natural numbers. When they have finished sorting, discuss the fact that some numbers can appear in more than one subset, e.g., 4 is a rational number, an integer, a whole number, and a natural or counting number. Explain that the attributes of one subset can be part of another subject. Example: All whole numbers are also integers. Explain the process of sorting numbers into the most specific subset.
4. Distribute the Real Number System Venn Diagram. Have students write the names of the subsets in the appropriate areas on the diagram and then write each number from the number cards in the most specific subset. Finally, have students add two more numbers to each subset, explaining why the only number that can be uniquely in the "Whole Numbers" subset area is zero.
5. Students need to be shown that when two rational numbers are added or multiplied, they always equal a rational number. Ask students to try to come up with a counter-

example, and give each student five attempts. Tell them they need to write down what their answer was for each and label what subsets each answer belongs to. For example, if a student were to try to multiply $\frac{1}{3}$ and 7, they would get 2.333, which is a rational number.

6. Students also need to be shown that when an irrational number is added to a rational number, the sum is an irrational number. A similar activity as mentioned in step 5 could be done here. Students also need to be shown that when an irrational number is multiplied by a rational number (except for zero), the product is always irrational. Understandably, this is hard to show students due to the limited nature of calculators, but they need to know this rule exists.

Assessment

- **Questions**
  - To which subset(s) of the real number system does the number −0.75 belong? Why?
  - Is the square root of 15 rational or irrational? How do you know?
- **Journal/Writing Prompts**
  - Identify whether a number can be both whole and irrational, and explain why or why not.
  - Identify which subset of the real number system contains the most rational numbers, and explain why.
  - Explain why rational numbers are “friendly.”
  - Identify whether pi (π) is rational or irrational, and explain why.

Extensions and Connections (for all students)

- Display examples of Venn diagrams used in other areas of study to model the purpose of a Venn diagram.
- Have students use graphic organizer software to create their own organizers to represent the real number system.
- Prepare a large shopping bag labeled “Real Numbers.” Inside the bag, place two smaller, equal-size bags, one labeled “Irrational Numbers” and the other labeled “Rational Numbers.” Inside the “Rational Numbers” bag, place a smaller bag labeled “Integers.” In the “Integers” bag, place a yet smaller bag labeled “Whole Numbers,” and in the “Whole Numbers” bag, place the smallest bag labeled “Natural Numbers.” Display the “Real Numbers” bag, and pull the smaller bags out one at a time to show the differences in sizes and how they relate to each other. Discuss the types of numbers that would be in each bag. Hand students number cards to put into the most specific bags, and then demonstrate putting the set of bags together again.

Strategies for Differentiation

- Use different colors of paper to help students distinguish the different subsets of numbers.

- Use the Venn diagram with only the vocabulary terms, and as a class, create examples of numbers to include. Then, have students create their own Venn diagrams and use the real number cards provided to glue into place.
- Place location signs around the room labeled "Natural Numbers, Whole Numbers, Integers, Rational Numbers, Irrational Numbers, and Real Numbers." Give each student a number card, and have him/her match the number to as many locations as possible by going to the location(s) and writing the number on the sign(s). Confirm in class discussion the place or places each number is placed. Repeat this activity throughout the year.
- Permit students to select one of the journal prompts and orally share their response to a peer instead of writing it.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Real Numbers Cards

Copy on card stock, and cut out.

-6	0.5	$0.\overline{4}$	$0.349\ldots$
$\sqrt{25}$	2	0	$\frac{3}{5}$
π	$\sqrt{13}$	$\frac{2}{3}$	$-\frac{10}{2}$
5	2.25	$-\sqrt{25}$	$\frac{9}{3}$

Real Number System Subset Labels

Copy labels on card stock, and cut out.

Real Numbers
Irrational Numbers
Rational Numbers
Integers
Whole Numbers
Natural Numbers

Real Number System Venn Diagram

Name ___________________________________ **Date** _____________________