

The Number System

(8.NS.1)

Cluster:	Know that there are numbers that are not rational, and approximate them by rational numbers.
Standard:	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
Standards for Mathematical Practice (SMP) to be emphasized	MP.2 Reason abstractly and quantitatively. MP.6 Attend to precision. MP.7 Look for and make use of structure.
Connections:	This cluster goes beyond the Grade 8 Critical Area of Focus to address Working with irrational numbers, integer exponents, and scientific notation. This cluster builds on previous understandings from Grades 6-7, The Number System.
Title:	Our Real Number System
Time:	One (40 minute) class period
Resources:	Real Numbers worksheet (appendix), Changing Repeating Decimals to Fractions worksheet (appendix)
Vocabulary:	rational numbers, irrational numbers, repeating, terminating
Task Description:	<p>In this lesson, students will get the "big picture" of our number system as it includes irrational numbers.</p> <ol style="list-style-type: none">As a warm-up activity, work with students on changing fractions to decimals and terminating decimals to fractions. <i>For example, change the following fractions to decimals: $-\frac{1}{2}$, $\frac{1}{4}$, $4/5$, $9/10$ and change the following decimals to fractions in simplest form: -0.12, 0.3, 0.125, 0.8.</i>Review the Rational Number System that students are familiar with including natural numbers, whole numbers, integers, and rational numbers. Complete the left side of the Venn diagram on the Real Numbers worksheet. Be sure to define each subset of the rational numbers. Be sure that students understand that numbers can be described in multiple ways (<i>for example, -5 is an integer and a rational number, 18 is a natural number, a whole number, an integer and a rational number, 0.85 can only be described as a rational number.</i>)

3. Define *rational number* as a number written as $\frac{a}{b}$, where a and b are integers and b is not zero. All rational numbers can be expressed as terminating or repeating decimals.
4. Students already know how to change a terminating decimal to a fraction by using the Base Ten system and then simplifying when possible. Review this if students are struggling.
5. Complete the *Changing Repeating Decimals to Fractions* worksheet. Work through the examples, work problems #1 and #2 as a group, then have the students work the remainder of the problems independently. As students work through the examples, be sure to have a discussion on why we are multiplying by 10 and 100. This is a great place to have a discussion about Base Ten. Also, ask students, "What would happen if we used 1000? Would that change our answer?" Remember, it is important that students develop an understanding of the concept, not just memorize the steps of the procedure.

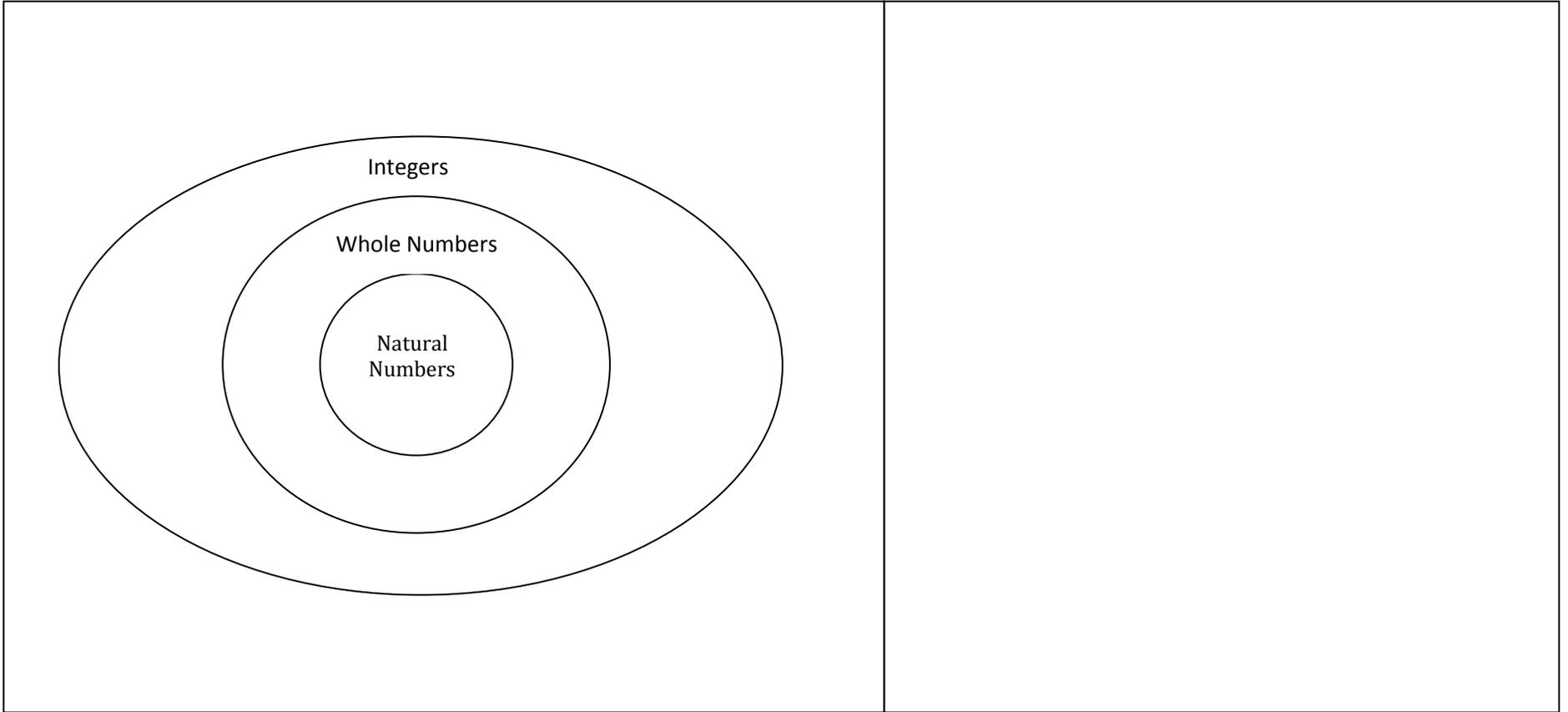
Suggested
Formative:

As an Exit Ticket, ask students to define a rational number and give three examples of rational numbers.

REAL NUMBERS

Rational Numbers

Irrational Numbers



Changing Repeating Decimals to Fractions

Example #1:

$$n = 0.\overline{4}$$
$$10n = 4.\overline{4}$$

$$10n = 4.\overline{4}$$
$$\underline{n = 0.\overline{4}}$$
$$9n = 4$$
$$n = \frac{4}{9}$$

Example #2:

$$n = 0.\overline{45}$$
$$100n = 45.\overline{45}$$

$$100n = 45.\overline{45}$$
$$\underline{- n = 0.\overline{45}}$$
$$99n = 45$$
$$n = \frac{45}{99}$$

Change the following repeating decimals to fractions.

1. $n = 0.\overline{7}$

2. $n = 0.\overline{31}$

3. $n = 0.\overline{2}$

4. $n = 0.\overline{37}$

5. $n = 0.\overline{6}$

6. $n = 0.\overline{27}$