Grade Level	Content Area	Course Title *(9-12 Samples Only)*	Unit Title
8	**Math**	**N/A**	**Rational and Irrational Numbers and Decimal Expansions**

Length of Unit	Time of Year Taught	Expected Prior Knowledge
3 days	**14th week**	Converting decimals to fractions and fractions to decimals; understanding integers and the concept of the number line

Unit Description

Students will learn through direct instruction the difference between rational and irrational numbers and be able to identify and distinguish between the two. Students will be able to convert decimals to fractions to prove that a number is rational, and they will learn how to use decimal expansions for purposes of distinguishing between rational and irrational numbers.

Standards: See instructions on page 15.	**Domain: The Number System** **Cluster: Know that there are numbers that are not rational, and approximate them by rational numbers.** **Standard: 1** 1. 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.
Summative Assessment *In addition to the description, include a copy of the summative assessment in the application package.*	Students will take a quiz in class on rational and irrational numbers.
Scoring for Summative Assessment *In addition to the description, include a copy of the answer key and scoring rubric (if applicable) for the summative assessment in the application package.*	There will be 17 questions for a total of 20 points as shown on p. 7. The total points earned will be divided by 25 to determine a percentage and thereby an A-F grade. C- or lower is considered not meeting the standard; C through B- is approaching; B or better is meeting the standard.
Materials/Resources Needed *Include all items for the entire unit.*	Textbooks (student and teacher editions), white board, white board markers, pencils, paper, handouts, worksheets

	Lesson 1	Lesson 2	Lesson 3
Instruction and Timeline	Teacher will review the definition of an integer and then explain that a rational number is any number that can be written as a ratio of 2 integers; in other words, if a number can be written as a fraction where the numerator and denominator are both integers it is rational. Teacher will tell students how "rational" comes from "ratio" because rational numbers can be written in the ratio form p/q where p and q are integers and q is not zero. The teacher will write examples on the board and explain how decimals that repeat or terminate are rational. The teacher will explain what irrational numbers are and how they can be written as decimals but not as fractions. Irrational numbers have decimal expansions that neither terminate nor repeat. Examples will be given of irrational numbers such as pi, the square root of 3, and the	The teacher will use the Pythagorean Theorem to demonstrate a point about irrational numbers. He/she will ask students to draw a line segment one unit long. Then they are to draw another line segment one unit long that is perpendicular to the first one. Then they draw the diagonal that connects the two ends. The teacher will explain how the triangle's diagonal cannot be measured by any rational number and that its length is the square root of 2, the number which when multiplied by itself yields 2. The square root of 2, as a decimal, does not repeat or terminate and therefore cannot be written as a fraction. The proof of this was shocking and groundbreaking when it was first demonstrated by Pythagoras' followers. (15 minutes).	Teacher reviews how to convert fractions to decimals and vice versa. The teacher gives a lesson on converting repeating decimals into fractions and demonstrates: Given a repeating decimal, it is possible to calculate the fraction that produced it. For example: x = 0.33333… 10x = 3.3333… (multiplying each side of the first line by 10) 9x = 3 (subtracting the 1st line from the 2nd line) x = 3/9 = 1/3 (reducing to lowest terms) (20 minutes)

	square root of 5. The teacher will demonstrate why those numbers are not rational. The teacher will distribute a handout with the definitions of rational and irrational numbers and examples. (25 minutes)		

	Lesson 1	**Lesson 2**	**Lesson 3**
Student Activities and Timeline	Students will do the guided practice in the textbook with the help of the teacher and then will independently solve math problems having to do with the subject of rational number and irrational numbers. (20 minutes)	Students complete problems on the subject of rational vs. irrational numbers in the textbook. (20 minutes). With a partner, students read about Pythagoras and complete a worksheet on irrational numbers. (10 minutes).	Students solve problems in the textbook requiring them to convert fractions to decimals and decimals (including repeating decimals) to fractions and to distinguish rational from irrational numbers based on decimal expansions. (25 minutes)

Note that math class in eighth grade will be approximately 105 minutes, but this unit will be taught simultaneously with another unit, and the lessons for this unit will be 45 minutes each.

Quiz on Rational & Irrational Numbers

Fill in the blank:

1. A _____ number is any number that can be written as a _____ of

two integers p/q, where q is not equal to _____.

2. Irrational numbers are numbers that can be written _____ as but

not as _____.

3. Pi is an example of a(n) _____ number.

4. Pythagoras was a Greek philosopher and mathematician who proved that the Pythagorean Theorem was true. In a right triangle, if both legs equal 1, the hypotenuse is _____.

Write in simplest fraction form:

5. 0.7

6. 0.803

7. -1.902

8. 0.333…

9. -0.666…

Next to each number, state whether it is rational or irrational:

10. ½

11. 10.261

12. square root of 7

13. 10.666…

14. 75.797979…

15. 0

16. square root of 60

17. 3.141592…

20 points total *3 points for #1; 2 points for #2; 1 point each for #3-17*

1. rational; ratio; zero

2. decimals; fractions

3. irrational

4. The square root of 2

5. 7/10

6. 803/1,000

7. -951/500

8. 1/3

9. -2/3

10. rational

11. rational

12. irrational

13. rational

14. rational

15. rational

16. irrational

17. irrational