Grade Level	Content Area	Course Title *(For 9-12 Samples Only)*	Unit Title
8th grade	Math		Decimal expansion

Length of Unit	Time of Year Taught	Expected Prior Knowledge
5 days- 60 minutes/day	2nd quarter	Expressions and Equations: Expressions and equations with radicals and integer exponents 8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$. 8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational. 8.EE.3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.* 8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Unit Description: The unit focuses on helping students know that there are numbers that are not rational. They will also understand that every number has a decimal expansion. Later in the unit, students will convert a decimal expansion that repeats into a rational number. Students will be assessed later in the unit with a 20 question quiz.

Standards: See instructions on page 15.	The Number System, Know that there are numbers that are not rational and approximate them by rational numbers. 8.NS.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 be assessed with a 20 question quiz at the end of the unit.
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 theth application package.*	Students will take a quiz and each correct answer is worth one point. Students will demonstrate mastery by scoring a 14 out of 20 which is at least a 70%.
Materials/Resources Needed *Include all items for the entire unit.*	Calculator, white board, math journal, overhead projector

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
3Instruction and Timeline	Objective: Students will know that numbers that are not rational are called irrational Anticipatory Set: Students write vocabulary words in their math journals: irrational, real and rational. Instructional Input/Modeling: Show students a number line. Explain that there are numbers that are real but are not rational. These are irrational numbers. Give students examples of decimals, fractions and whole numbers. Guided Practice: Show Students $\sqrt{4}$. Where does this go on the number line? Active Participation; What is the $\sqrt{4}$. Use your calculator to figure out $\sqrt{2}$. Can this be put on the number line? No,	Objective: Student will understand informally that every number has a decimal expansion and review how to turn a decimal into a fraction. Anticipatory Set: In your math journal, Turn this into a faction: .33, .5. Instructional Input/Modeling: Review vocabulary and irrational numbers. All numbers have a decimal expansion. A decimal expansion of 1 is 1.00 a decimal expansion of 35 is 35.000. Guided Practice: Discuss: Terminating decimal numbers can easily be written as a fraction: for example 0.67 is 67/100, 3.40938 = 340938/100000 etc. In your math journals: practice writing decimal numbers as fractions: .2, .4. Review with students that to change larger	Objective: Students will understand for rational numbers show that the decimal expansion repeats eventually. Anticipatory Set: In your math journal, turn 1/3 and ½ into a decimal. Instructional Input/Modeling: We talked how terminating decimal numbers are obviously rational numbers. How about non-terminating decimal numbers? You might have never heard of those. Take for example 1/9 and convert it into a decimal number with long division. What do you get? Guided Practice: How about 2/9? 3/9? 1/11? 2/13? 7/15? Model 2/9 and have students complete the rest on white boards using long division. Check for Understanding: Can you find more fractions that turn into non-terminating decimal numbers?	Objective: Students will convert a decimal expansion which repeats eventually into a rational number Anticipatory Set: Using long division turn 3/13 into a decimal using long division. Instructional Input/Modeling: Review previous lessons. Teacher explains: ince 0.11111... = 1/9, then the decimal number 0.11111... *is* a rational number. In fact, every non-terminating decimal number that REPEATS a certain pattern of digits, *is* a rational number. For example, let's make up a decimal number 0.135135135135135... that never ends. Do you believe we CAN write it as a fraction, in the form a/b? This sounds like it would be pure guesswork, but no, there is a method, a nice and clever one, in my opinion. Let's name our number a = 0.135135135... and multiply it by a power of 10, then subtract the original a and the new number so that the repeating decimal parts cancel each other in the subtraction. $a = 0.135135135...$ $10a = 1.35135135135...$	Objective: Students will demonstrate mastery of showing that rational numbers have a decimal expansion that repeats eventually, and converting a decimal expansion which repeats eventually into a rational number. Anticipatory Set: Review a question from the previous day: .234234. Instructional Input/Modeling: Teacher will describe the assessment after review content from the unit. Independent

	because the decimal goes on randomly. Check for Understanding: Place the $\sqrt{3}$ on a number line. Place 2/3 on the number line. Place 6 on the number line. Place 1.121212 on the number line. Independent Practice: Give students a list of fractions, decimals, and whole numbers. Have them place the numbers on the number line in their math journals. Closure: Review places on the number line.	numbers a decimal into a fraction, add the same number of 0 as places you move the decimal. Independent Practice: Write in the form *a*/*b* a) 0.7 b) 0.803 c) 1.902 d) 10.45 e) 4 f) 1 4/5 g) -100 h) -404.04 i) 405,700.3 j) 5.08497593 Closure: Review a and b from the independent practice.	Independent Practice: Write each rational number and its decimal expansion on an index card. 3/5, 1/6, 1/7, 2/7, 3/8, 5/12, 7/16, 3/20, Sort the index cards into three stacks: • Decimals that terminate, or end (for example,1/2=0.5 which is a terminating decimal) • Decimals that repeat (for example,7/1= 0.6363 which is a repeating decimal) • Decimals that neither terminate nor repeat Students write in journals. Which rational numbers are in each stack? Closure: Students will share which rational numbers are in each stack.	$100a = 13.5135135135...$ $1000a = 135.135135135...$ Then we subtract the original, and the 1000a. $1000a = 135.135135135...$ $-\ a = 0.135135135...$ $999a = 135$ from which a = 135/999. Guided Practice: Teacher reviews another fraction: .231231231. Students follow along in their math journals and teacher guides problem. Independent Practice: Students complete the following in their math journals: .414141, .1818181, .543543 Closure: Review any questions. If a decimal repeats, is it a rational number? What if it doesn't repeat?	Practice: Students will complete assessment. Closure: What is a rational number? What is an irrational number?

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student Activities and Timeline	Students write vocabulary words in their math journals: irrational, real and rational. Students answer: What is the $\sqrt{4}$. Use your calculator to figure out $\sqrt{2}$. Can this be put on the number line? No, because the decimal goes on randomly. Students will place the $\sqrt{3}$ on a number line. Place 2/3 on the number line. Place 6 on the number line. Place 1.121212 on the number line. Give students a list of fractions, decimals, and whole numbers. Have them place the numbers on the number line in their math journals. Students will review places on the number line.	Students will turn this into a faction: .33, .5. Students review that to change larger numbers a decimal into a fraction, add the same number of 0 as places you move the decimal. Students complete: Write in the form *a/b* a) 0.7 b) 0.803 c) 1.902 d) 10.45 e) 4 f) 1 4/5 g) -100 h) -404.04 i) 405,700.3 j) 5.08497593 Students review a and b from the independent practice.	Students will in their math journal, turn 1/3 and ½ into a decimal. Students complete the rest on white boards using long division. 3/9? 1/11? 2/13? 7/15? Student will find more fractions that turn into non-terminating decimal numbers? Students will write each rational number and its decimal expansion on an index card. 3/5, 1/6, 1/7, 2/7, 3/8, 5/12, 7/16, 3/20, Sort the index cards into three stacks: • Decimals that terminate, or end (for example,1/2=0.5 which is a terminating decimal) • Decimals that repeat (for example,7/1= 0.6363 which is a repeating decimal) • Decimals that neither terminate nor repeat Students write in journals. Which rational numbers are in each stack Students will share which rational numbers are in each stack.	Using long division turn 3/13 into a decimal using long division. Students follow along in their math journals and teacher guides problem. Students Practice with teacher guidance. Students complete the following in their math journals: .414141, .1818181, .543543 Students will review any questions. If a decimal repeats, is it a rational number? What if it doesn't repeat?	Students review a question from the previous day: .234234. Students will complete assessment. Students answer: is a rational number? What is an irrational number?

Name: _____date: _____

8th Grade Math Test for **The Number System**

(1) We learned about _____ _____ and ____ _____ numbers.
(2) The opposite of rational is _____.
(3) If a decimal expansion repeats the number is _____.
(4) The decimal expansion for ½ is _____.
(5) The decimal expansion for 783 is _____.
(6) The decimal expansion for 7/12 is _____.

Convert the following decimal expansion(s) into a rational number(s) (fraction (s)).
(7) .2
(8) .135135
(9) .6666
(10) .166666

Identify the following numbers as rational and irrational.

(11)	.45454545	(12)	.67896543
(13)	6/16	(14)	.1256712567
(15)	.23578432	(16)	5/12

Place the following rational and irrational numbers on a number line.

←++→

(17) 1/2
(18) 2/3
(19) .345345
(20) .342523452345

Name: _____ date: _____

8th Grade Math Test for **The Number System**

Answer Key

(1) We learned about _____rational_____ and ____irrational_____ numbers.

(2) The opposite of rational is _____irrational_____.

(3) If a decimal expansion repeats the number is ___rational_____.

(4) The decimal expansion for ½ is ____.5_____.

(5) The decimal expansion for 783 is ____783.000_____.

(6) The decimal expansion for 7/12 is ____.5833_____.

Convert the following decimal expansion(s) into a rational number(s) (fraction (s)).

(7) .2- (1/5)

(8) .135135 (135/999)

(9) .6666 (2/3)

(10) .16666 (1/6)

Identify the following numbers as rational and irrational.

(11)	.45454545- rational	(12)	.67896543- irrational
(13)	6/16- rational	(14)	.1256712567- rational
(15)	.23578432- irrational	(16)	5/12- rational

Place the following rational and irrational numbers on a number line.

←+++++0+++++++.345+++++1/2+++++2/3++++++++++1++++++→

(17) 1/2

(18) 2/3

(19) .345345

(20) .342523452345 (cannot go on number line)

Score: _____/20

Each correct answer is worth 1 point. 14 out of 20 points is the minimum needed for mastery.

Number correct:	Percent:	
0-9	0% -49%	Falls Far Below
10-13	50%-69%	Approaches
14-20	70%-100%	Meets Mastery Level