Grade Level	Content Area	Course Title *(9-12 Samples Only)*	Unit Title
Eighth	**Mathematics**	**Algebra I**	**Irrational Numbers**

Length of Unit	Time of Year Taught	Expected Prior Knowledge
1 Week	**First Quarter**	- Rational Numbers - Integers - Whole Numbers - Real Numbers - Natural Numbers - Estimation with decimal numbers

Unit Description

Students will classify numbers to distinguish what characteristics are involved for each classification with a focus on Irrational Numbers. Students will apply this knowledge when finding the length of a given area of a square and the side length for the side of a given cube. They will then distinguish if the side length is a rational or irrational number.

Strand(s), Concept(s), and PO(s) *List and define the required Strand(s), Concept(s), and PO(s) for each lesson included in this sample.*	**The Number System (NS)** 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 *Describe a cumulative and comprehensive activity that allows students to demonstrate mastery of stated POs. A copy of the summative assessment must be included in the application package.*	The assessment will be based on classifying numbers and distinguishing between rational and irrational numbers. The students will classify numbers using a graphic organizer, state if a number is rational or irrational, plot irrational numbers on a number line, and answer two area/volume problems. **A copy of the summative assessment/answer key (scoring rubric) is attached.**
Assessment Scoring *Explain how each assessment is scored, to include points per question, total points possible, criteria, and grading scale. Describe rubric, if applicable,*	**The first ten questions are worth 1 point each and the last five questions are worth 2 points each.** **Mastery = 16/20 or higher.** **A copy of the answer key/scoring rubric is attached.** **Remediation students given more time.**

to include components being evaluated and the scoring criteria for each. A copy of the answer key and/or scoring rubric must be included in the application package.	
Materials/Resources Needed *(Include all items for the entire unit.)*	- Journals - Real Number Graphic Organizer - Area and Volume word problems – missing sides - Calculators - Chart Paper - Independent practice worksheet – Rational or Irrational? - Number line

	Lesson 1	**Lesson 2**	**Lesson 3**	**Lesson 4**
Lesson Instruction	The teacher will review the meaning of prior knowledge and write the definitions on the board. <u>Real number –</u> are numbers belonging to rational and irrational sets of numbers <u>Rational number –</u> a number that can be written as a simple fraction <u>Integer –</u> the set that combines whole numbers and their opposite <u>Whole number –</u> the counting numbers including zero <u>Natural number –</u> the counting numbers not	The teacher will direct the students to open their notebooks. On the board, the teacher will write the number: .25 "Is this number a rational or irrational number? Why?" After writing the answer in their notebooks, the students will share their thinking at their tables. The teacher will do a think-aloud on his/her thought process as they determine if a number is rational or irrational.	Bellwork: On a number line, place these numbers: 1.25, 3, $\sqrt{4}$, and 5/2. After students come up to the front and label the large number line the teacher will discuss how this are definitive points. We can accurately label these numbers on a number line. Then the question is posed: "what type of numbers are all of these?" Rational Since irrational numbers	When the students walk in they see two problems on the board: 1. Stan knows his square shaped yard is 1296 square feet. He wants to know how long each side of the yard is? Would this be a rational or irrational number? 2. A website says that a cubed shaped package has a volume of 928 cubic inches. What is the length of

	including zero The teacher will pass out the real number graphic organizer. He/she will write 10 numbers on the board that fall into the categories of rational numbers, integers, whole numbers, and natural numbers. With their partners students will classify these numbers on their graphic organizer. After sufficient work time, the teacher will call on students to numbers to a graphic organizer on a piece of chart paper. This will lead into the introduction of the term irrational number. The teacher will place 3 examples of irrational numbers on the board. The students will be directed to jot down characteristics of the numbers in their journals. The teacher will then lead think-pair-share and asking probing questions while monitoring the room. The ideas from the think-	**Teacher's thought process:** Since this number is a decimal it can't be an integer, whole number or natural number. So this doesn't clue me in on if this is a rational number based on the classifying progression. So I ask myself these two questions: Does this number repeat? NO Does this number end? YES If I answer yes to either one of these questions, then my number is rational." The teacher will then do another problem on the board as a guided practice. The students are encouraged to defend their thinking with their table. This process will continue into an independent practice where the students are determining if a number is rational or irrational.	never end or never repeat, they do not have a specific place. We need to estimate their values by utilizing rounding. The teacher writes the number 1.49276… on the board and has the students first think to themselves an estimation for this irrational number. After then sharing with a partner, the teacher writes down some of the students estimations. The instructor will talk about how accuracy is important and getting as close to the value of the irrational is critical. The teacher then plots the estimation on the number line at 1.5. After multiple examples, the students then begin plotting examples of irrational numbers on their number lines. The teacher monitors the room for misconceptions and refinement to promote student growth and mastery.	each side? Would this measurement be a rational or irrational number? Reminder: Area of a square = s^2 Volume of a cube = s^3 The teacher discusses that since we know the area and volume that we need to work backwards. Based on earlier lessons, we know that the inverse operation of squaring or cubing a number is find the roots. So to find #1, the teacher states that we need to find the square root of 1296 or the length of the side = $\sqrt{1296}$. Using the calculators, the answer is 36 feet in length which is a rational number. #2: The teacher and students take the cube root of 928 to find the length of each side: side length = $\sqrt[3]{928}$. The teacher demonstrates how to input this into their calculators. The answer is 30.4631… which will be estimated to 30.5 inches in length and

	pair-share will be used to develop a class definition of irrational number (a number that never repeats, never ends, and can't be made into a fraction. Closure: Students will add come up with their own examples of irrational numbers and write them on their graphic organizer. Examples: .26589… 129.339103… $\sqrt{2}$ π			this is an irrational numbers. The students then complete the area and volume word problems based on this procedure. They are connecting how we use estimation of irrational numbers and how they compare to rational numbers in a real world setting.

	Lesson 1	Lesson 2	Lesson 3	Lesson 4
Student Activities	The students will write down the definitions for real number, rational number, integer, whole number, and natural number. Using the graphic organizer the students will classify the 10 examples the teacher placed on the board. They will collaborate with their partners to discuss and defend their answers. After completion students will help the teacher complete the master graphic organizer on the chart paper. The students will then take notes in their journals as the teacher models and facilitates the lesson on irrational numbers. The students will help develop the definition of irrational numbers based on observation and discussion along with coming up with examples of irrational numbers to put on their graphic organizer.	The lesson will have the students classifying numbers as either rational or irrational. They will use the driving questions of Does this number repeat? Does this number end? If either answer is a yes then this number is rational. The students will discuss and defend their thought process and complete the <u>Independent Practice worksheet – Rational or Irrational</u>?	Students will first complete the bellwork by plotting On a number line, place these numbers: 1.25, 3, $\sqrt{4}$, and 5/2. Students will be called up to fill out the large classroom number line. The students are then posed the question to plot the number 1.49276… They first estimate the number for accuracy and share their thoughts with a partner. The students then plot the estimation of this number as 1.5. The students are then given multiple examples of irrational numbers that are to be plotted on a number line.	The students get a calculator and write down the problems in their notebooks. 1. Stan knows his square shaped yard is 1296 square feet. He wants to know how long each side of the yard is? Would this be a rational or irrational number? 2. A website says that a cubed shaped package has a volume of 928 cubic inches. What is the length of each side? Would this measurement be a rational or irrational number? Reminder: Area of a square = s^2 Volume of a cube = s^3 Following along with the teacher, they solve these problems. Students will ask questions to clarify

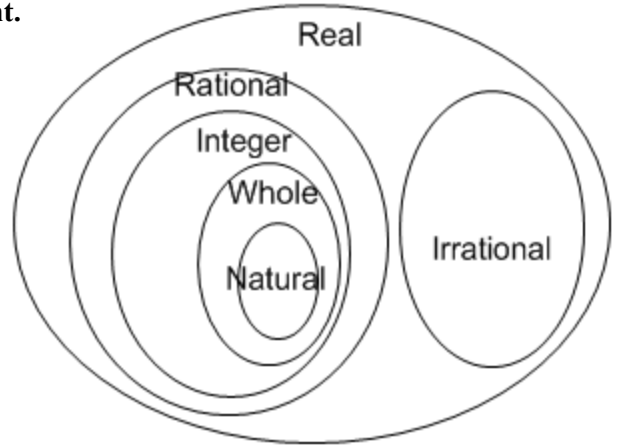
				their thinking before collaborating with a partner to answer area and volume word problems that are aligned with the two problems that they wrote in their notebooks. They ask questions to the instructor to help hone their thought process and clear up misconceptions.

Rational or Irrational Assessment

Name_____ **Date**_____ **Score** _____/20

Classify these numbers on the chart provided. **Each is worth 1 point.**

1. **0**
2. $\sqrt{9}$
3. 1.2
4. $-\frac{6}{2}$
5. **Π**
6. $\sqrt{8}$
7. $\sqrt[3]{8}$



Write if the number is rational or irrational. **Each is worth 1 point.**

8. $.\overline{23}$ _____
9. $\sqrt{225}$ _____
10. 12.4445 … _____

Estimate and plot the irrational numbers on the number line. **1 point for the estimation and 1 for plotting the point**

11. **1.2934….** _____
12. **3.012…** _____
13. **Π** _____

Answer the problem. **Each problem is worth 2 points**

14. **Fill has a small room in his house that is in the shape of a square. The area of the room is 144 square feet. What is the length of each side? Is this measurement rational or irrational?**

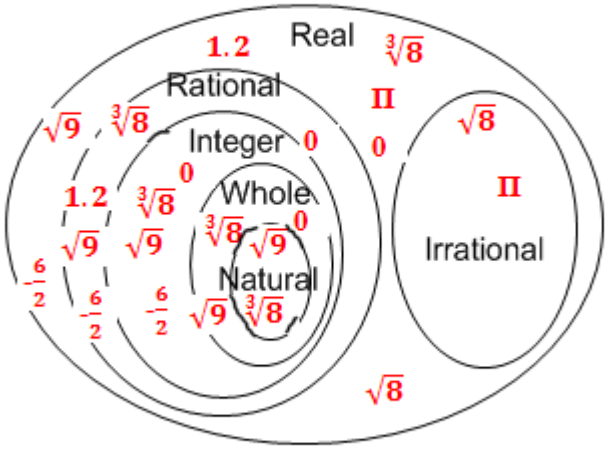
15. **Skip made a small, homemade number cube. He told all of his friends that the 28 cubic inches. Based on his volume, what is the measure of each side? Is this measurement rational or irrational?**

Rational or Irrational Assessment – Answer Key

Name_____ **Date**_____ **Score** _____/20

Classify these numbers on the chart provided. **Each is worth 1 point.**

1. **0**
2. $\sqrt{9}$
3. **1.2**
4. $-\frac{6}{2}$
5. **Π**
6. $\sqrt{8}$
7. $\sqrt[3]{8}$



Write if the number is rational or irrational. **Each is worth 1 point.**

8. $.\overline{23}$ _____**Rational**_____
9. $\sqrt{225}$ _____**Rational**_____
10. **12.4445 …** _____**Irrational**_____

Estimate and plot the irrational numbers on the number line. **1 point for the estimation and 1 for plotting the point**

11. **1.2934….** ____**1.3**_____
12. **3.012…** _____**3**_____
13. **Π** _____**3.14**_____

Answer the problem. **Each problem is worth 2 points**

14. Fill has a small room in his house that is in the shape of a square. The area of the room is 144 square feet. What is the length of each side? Is this measurement rational or irrational?
    Length = 12 feet; Rational

15. Skip made a small, homemade number cube. He told all of his friends that the 28 cubic inches. Based on his volume, what is the measure of each side? Is this measurement rational or irrational?
    Length is about 3 inches; Irrational