Name _____ Date _____

Mr. Tallman Math 7

Lesson #11 – Sets of Numbers

Try to remember way back when you were first learning numbers. What types of numbers did you learn first? When did you learn the number zero? When did you learn about fractions? What about the difference between positive and negative numbers?

Consider the following: In the space below, describe the number five (5). Write down any words that you can think of that describe what type of number 5 is.

Whole number Positive Real number

Integer Counting number Rational number

Sets of Numbers: Every number that we encounter on a daily basis are called **Real Numbers** and can be classified into certain **sets** (or groups). Each set of numbers has its own definition. These sets of numbers are:

- Natural (Counting) Numbers
- Whole Numbers
- Integers
- Rational Numbers
- Irrational Numbers

****Note: Numbers do not have to only belong to one set of numbers. Numbers can belong to multiple sets of numbers****

Number Set	Definition	Examples
Natural (Counting) Numbers	**Positive** whole numbers **not including zero.**	1, 2, 3, 4, ...
Whole Numbers	**Positive** whole numbers **including zero.**	0, 1, 2, 3, 4...
Integers	**Positive and negative** whole numbers.	...-3, -2, -1, 0, 1, 2, 3...
Rational Numbers	Any number (positive or negative) that can be written as a fraction and has a **terminating or repeating decimal.**	$\frac{1}{2}$, 0.25, 1.6, $1\frac{3}{4}$
Irrational Numbers	Any number that cannot be written as a fraction and **does not have a terminating or repeating decimal.**	π, $\sqrt{2}$, 3.68715...

Directions: Classify the following real numbers as real, natural, whole, integer, rational, or irrational. Be sure to write down all that apply.

1) 0 Real, Whole, Integer, rational	2) -458 Integer, rational, Real	3) $\frac{1}{2}$ rational, real
4) π Irrational, Real	5) 6.8 Rational, real	6) $\frac{12}{5}$ Rational, Real

Now, You Try!

Matching Column: Write the letter of the definition that matches each set of numbers.

1) Rational Numbers B

2) Integers C

3) Whole Numbers D

4) Irrational Numbers A

A. Non-terminating, non-repeating decimals

B. Terminating and/or repeating decimals.

C. Positive and negative whole numbers.

D. Natural numbers, including zero.

5) Which of the following sets does the number -38 belong to? Circle all that apply.

A) Irrational Numbers B) Rational Numbers C) Whole Numbers

D) Natural Numbers E) Integers F) Real Numbers

6) Which of the following does the number π belong to? Circle all that apply.

A) Irrational Numbers B) Rational Numbers C) Whole Numbers

D) Natural Numbers E) Integers F) Real Numbers

True or False: For each statement, write true or false.

7) 0 is only in the set of integers. False

8) All whole numbers are natural numbers. False

9) Irrational numbers are numbers that can be written as fractions. False

10) **Challenge – True or False:** The number $\pi + 2$ is an irrational number. True

Rational Numbers vs. Irrational Numbers

Recall the definition of **Rational Numbers:** #'s that Can be written as fractions, terminating, or repeating decimals.

Example 1) In the space below, give 3 examples of rational numbers.

$\frac{1}{2}$, -0.5, $0.\overline{3}$

Recall the definition of **Irrational Numbers:** #'s that Cannot be written as fractions & have non-terminating AND non-repeating decimals.

Example 2) In the space below, give 3 examples of irrational numbers.

π, $\sqrt{2}$, $\sqrt{7}$

How can we tell if a number is rational or irrational?

If a number is Rational, the number...	If a number is Irrational, the number...
• is expressed as a perfect square. Examples: $\sqrt{4}=2$ $\sqrt{9}=3$ $\sqrt{25}=5$	• is not expressed as a perfect square. Examples: $\sqrt{2}$, $\sqrt{7}$, $\sqrt{12}$
• is expressed as a terminating or repeating decimal. Examples: 0.3 $0.\overline{6}$ 1.2	• is not expressed as a terminating or repeating decimal. Examples: $8.6315\ldots$ $-7.21879\,28\ldots$
• can be written as a fraction or mixed number. Examples: $\frac{1}{2}$ $8\frac{3}{4}$ **Note: **All** fractions are **always** rational**	• cannot be written as a fraction or mixed number. Examples: π
• can be written as an integer. Examples: -2, 0, 15	• cannot be written as an integer. Examples: π, $\sqrt{8}$

Tell whether the following numbers are rational or irrational. Explain.

Ex 3) $\sqrt{2}$ Irrational. $\sqrt{2}$ is a non-perfect Square.	Ex 4) $\frac{25}{31}$ Rational. $\frac{25}{31}$ is a fraction.
Ex 5) 13.174957390136 .... Irrational. The decimal is non-terminating & non repeating.	Ex 6) $\sqrt{36}=6$ Rational. $\sqrt{36}$ is a perfect Square.

Now, you try!

Tell whether the following numbers are rational or irrational. Explain.

7) 0.15 Rational. 0.15 is a terminating decimal.	8) $\sqrt{25} = 5$ Rational. $\sqrt{25}$ is a perfect Square.
9) 13.174957390136 .... Irrational. Non-terminating + non-repeating decimal.	10) $2.3333\overline{3}$ ..... Rational. Repeating decimal.

11) Which of the following is an **irrational** number?

A) 3.14

B) 5.025

C) 4π pi is always irrational.

D) $\frac{22}{7}$

12) A rational number can **always** be written in which form?

A) Repeating Decimal

B) Fraction

C) Square Root

D) Terminating Decimal