Name:

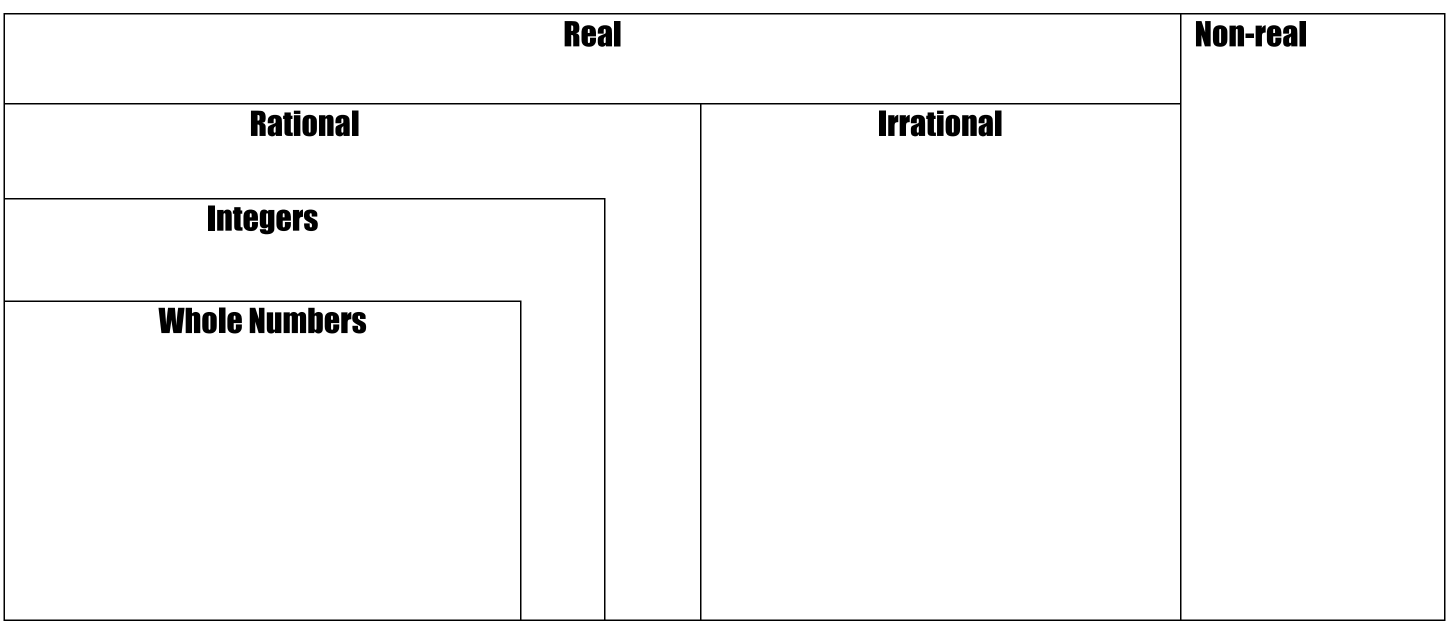
The Number System

Secondary Math II Notes

{ 1.5 }

OBJECTIVE: Classify numbers as real, non-real, rational, irrational, integers, and whole numbers. Understand the implications of combining different types of numbers when using addition and multiplication.

Number Systems	
Whole Numbers	Counting numbers and 0. {0,1,2,3,….}
Integers	Denoted $\mathbb{Z}$ Whole numbers and their negatives. {…, -3,-2,-1,0,1,2,3,….}
Rational Numbers	Denoted $\mathbb{Q}$ Any number that can be written as a ratio $\frac{a}{b}$ in simplest form, where a and b are integers and b≠0. The decimal form or a rational number either terminates or is infinitely repeating.
Irrational Numbers	Any number that isn't rational. The decimal form neither terminates nor repeats.
Real Numbers	Denoted $\mathbb{R}$ Any number that represents a quantity on a number line.
Non-Real Numbers	Numbers that are not real. You'll see…….



Why are repeating decimals rational?

$let\ x = .\overline{9}$

$if\ we\ multiply\ both\ sides\ of\ the\ equation\ by\ 10\ we\ get:$

$10x = 9.9999999999.........$

$now\ subtract\ x\ (which\ is\ .\overline{9})$

$10x = 9.9999999999.........$

$-x \quad -.9999999999.........$

$9x = 9$

$solve\ for\ x...$

$x = 1$

Classifying Numbers

Find the most precise label for each of the real numbers below. *(For example: although 3 is a real number, a rational number, and an integer, it's most precise label is a whole number.)*

π	Irrational	$-\frac{10}{5}$	Integer
$\sqrt{2}$	Irrational	$7.\overline{42}$	Rational
0	Whole	$\sqrt{36}$	Whole
-8	Integer	$-\frac{17}{3}$	Rational
$\sqrt{10}$	Irrational	$-\sqrt{13}$	Irrational
$3.\overline{6}$	Rational	2^3	Whole
4.72	Rational	1.7653	Rational
$\sqrt{16}$	Whole	$-\frac{5}{5}$	Integer
$\frac{1}{2}$	Rational	$-(-1)$	Whole
$\frac{7}{3}$	Rational	$-\sqrt{49}$	Integer

Making Generalizations

Find evidence to disprove the statements below.

The product of two integers is always a whole number.

$-3 \cdot 4 = -12$

If the product of two numbers is an integer, both of the numbers must also be integers.

$\frac{1}{3} \cdot 6 = 2$

CHALLENGE				
Instructions: Read the statements below. If the statement is ALWAYS TRUE, give an example in the corresponding box. If the statement is ALWAYS FALSE, give a non-example in the corresponding box. If the statement is SOMETIMES TRUE and SOMETIMES FALSE, give an example and a non-example in the corresponding boxes.				
	Always TRUE	Always FALSE	Sometimes TRUE	Sometimes FALSE
$rational + irrational = irrational$	$3+\pi=3+\pi$			
$rational \cdot irrational = irrational$			$3\cdot\sqrt{3}=3\sqrt{3}$	$0\cdot\sqrt{3}=0$
$irrational \cdot irrational = rational$			$\sqrt{3}\cdot\sqrt{3}=3$	$\sqrt{3}\cdot\sqrt{7}=\sqrt{21}$
$rational \cdot rational = rational$	$3\cdot 5=15$			
$irrational + irrational = rational$			$-\sqrt{7}+\sqrt{7}=0$	$\sqrt{3}+\sqrt{7}=$ $\sqrt{3}+\sqrt{7}$
$rational + rational = irrational$		$3+7=10$		

Making Generalizations

Consider the following statement:

"The product of a rational number and an irrational number is always irrational."

This statement is sometimes true and sometimes false. Make an adjustment to this statement so that it will always be true.

"The product of a NON-ZERO rational number and an irrational number is always irrational."

Principles of Combining Rational and Irrational Numbers
1. The product of two rational numbers is always rational.
2. The sum of two rational numbers is always always rational.
3. The sum of a rational number and an irrational number is always irrational.
4. The product of a non-zero rational number and an irrational number is irrational.

CHALLENGE
Instructions: Consider the following equation. $z = \sqrt{x^2 + y^2}$ Complete the table below by finding values for x, y, and z, that will make the statement true under each set of circumstances, where R is a rational number and I is an irrational number.

X	Y	Z
R	R	R
I	I	I
I	I	R
I	R	R
I	R	I
R	R	I

X	Y	Z
3	4	5
$\sqrt{13}$	$\sqrt{2}$	$\sqrt{15}$
$\sqrt{7}$	$\sqrt{18}$	5
$\sqrt{7}$	3	4
$\sqrt{3}$	5	$\sqrt{28}$
3	6	$\sqrt{45}$