Secondary Math 2

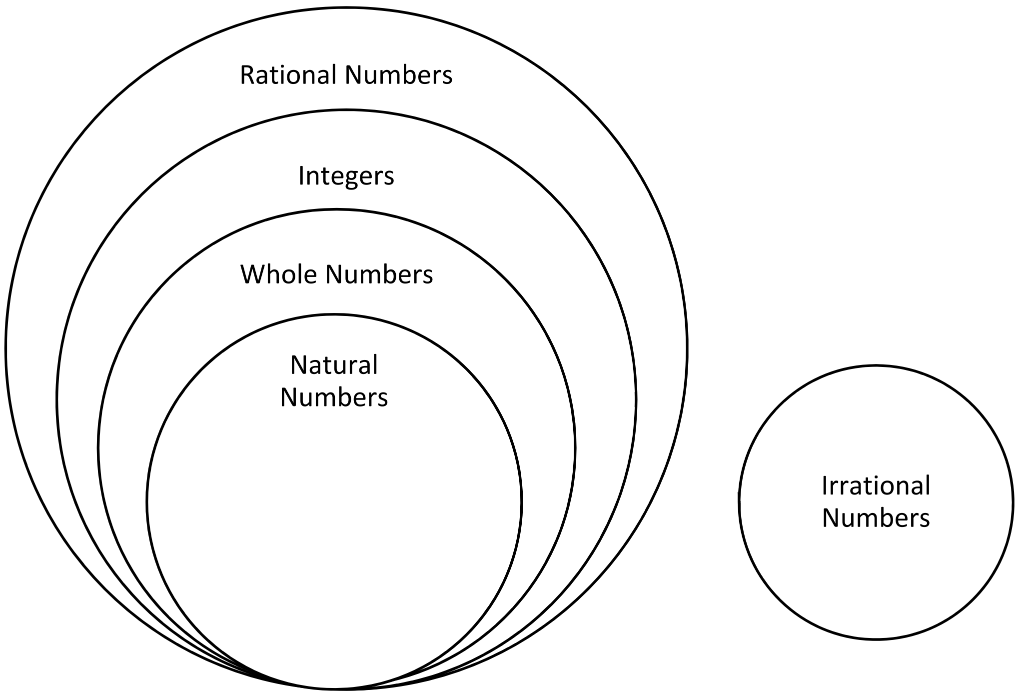
Unit 2: The Real and Complex Number Systems

Monday	Tuesday	Wednesday	Thursday	Friday
11 (A Day) 2.1: Classifying Numbers in the Number System	12	13 (A Day) 2.2: Simplifying Radicals	14	15 (A Day) 2.3: Operations in the Number Systems
18	19 (A Day) Unit 2 Review	20	21 (A Day) Unit 2 TEST	22
25 (A Day)	26	27 (A Day)	28	29 (A Day)

i can …		Got It	Kind of	Almost	Nope
2.1	Describe the difference between a natural, whole, integer and rational number				
	Identify an irrational number				
	Identify the real and imaginary part in a complex number				
	Use $i = \sqrt{-1}$ to simplify a radical expression				
2.2	Simplify a radical in the real number system				
	Determine when a simplified radical needs absolute values and when it does not.				
	Simplify a radical in the complex number system				
2.3	Describe generally what happens when different types of numbers are added/multiplied together (rat vs irra etc.)				
	Add and Subtract Complex Numbers				
	Multiply Complex numbers (with $i^2 = 1$)				

2.1: Classifying Numbers In the Number System

1. **THE REAL NUMBER SYSTEM** – Classifying Real Numbers.



Example 1: Name the set or sets that each number belongs to. Circle the most specific set:

a) $\sqrt{81}$

b) $\frac{0}{-2}$

c) $\sqrt{\frac{279}{3}}$

d) $\sqrt{225}$

e) $\frac{176}{64}$

f) $\frac{68}{40}$

g) -9+2

h) π+3

Example 2: Determine if each statement is always, sometimes, or never true:

a. If a number is rational, it can be irrational too.

b. An integer is a whole number.

c. A natural number is a real number.

d. A whole number is a natural number.

Example 3:

a. What is the most specific set that $\sqrt{81}$ belongs to?

b. What is the most specific set that $(-5-2)$ belongs to?

c. What is the most specific set that $\sqrt{70}$ belongs to?

d. What is the most specific set that 6^0 belongs to?

e. What is the most specific set that $(2 \cdot 9 - 3 \cdot 6)$ belongs to?

THE COMPLEX NUMBER SYSTEM

Let's start by trying to square a few numbers. What do you notice about every example?

$5^2 =$	$2^2 =$	$.1^2 =$	$(-10)^2 =$

*When squaring a number the result is always ______________________! It seems like we cannot multiply a number by itself to get a negative answer.

BUT … IMAGINE that there could be such a number (call it imaginary) that could do this.

Mathematicians had a need to be able to solve a problem with a negative inside of a $\sqrt{}$. The only way to solve this sort of a problem initially was to create an alternative number system in which such a number *could* exist! This number system is called the **COMPLEX** number system.

Imaginary Numbers were once thought to be *impossible*, and so they were called "Imaginary" (to make fun of them). But then people researched them more and discovered they were actually **useful** and **important** because they filled a gap in mathematics ... but the "imaginary" name has stuck.

A complex number is a number with a _____ part and an ________________ part. EX: $1-2i$

Example 3: Identify the real and imaginary part of the following complex numbers:

a) $6+5i$ b) $8-3i$ c) $-4-7i$

If $i \cdot i = -1$, what could we do with it? It would enable us to take the square root of a negative number … for start.

Imaginary Numbers: i	
$i^2 =$	$i =$

Example 1: Use $i = \sqrt{-1}$ to simplify each radical expression:

a) $\sqrt{-25}$

b) $\sqrt{-81}$

c) $\sqrt{-121}$

d) $\sqrt{-16}$

e) $\sqrt{-100}$

f) $\sqrt{-169}$

2.2: Simplifying Radicals

A **RADICAL** is an expression that involves a square root, cube root, etc. Today we will simplify radicals in the real number system and in the complex number system (resulting in imaginary numbers).

THE REAL NUMBER SYSTEM

How do we simplify a radical:

1. Make a factor tree
2. Find groups of the same number.
3. Any groups come out. Non-groups stay in the radical.
4. Multiply everything outside the radical.
5. Multiply everything inside the radical.

a) $\sqrt{392}$

b) $\sqrt[3]{132}$

c) $\sqrt{63}$

d) $2\sqrt{112}$

e) $6\sqrt{225}$

Variables change things a bit because a variable can be positive or negative. It is sometimes necessary to restrict your answer to ONLY positive numbers. To do this, you use absolute values in your solution.

You need absolute values in your solution when:

f) $\sqrt{128x^4}$

g) $\sqrt[3]{72x^4}$

h) $2\sqrt{12x^3}$

i) $3\sqrt{175x^3y^2}$

j) $6\sqrt{24x^4y^2}$

k) $\sqrt[3]{64x^6}$

THE COMPLEX NUMBER SYSTEM

The complex number system assumes that there WILL be negatives inside of the radical. Because of this – <u>absolute value signs are NOT necessary when solving the problem!</u>

a) $\sqrt{-20}$

b) $\sqrt{-80}$

c) $\sqrt{-120}$

d) $\sqrt{-16}$

e) $\sqrt{-1000}$

f) $\sqrt{-50}$

g) $\sqrt{-25x^2y^4}$

h) $\sqrt{-60xy^3}$

i) $\sqrt{-27x^{10}y^7}$

2.3: Operations in the Number Systems

1. Sum and Product Properties:

- What happens when we add two rational numbers together?
- What happens when we add a rational number with an irrational number?
- What happens when we add two irrational numbers together?
- What happens when we multiply two rational numbers together?
- What happens when we multiply a rational number with an irrational number?
- What happens when we multiply two irrational numbers?

Let’s explore …

Rational Vs. Rational		Rational Vs. Irrational	
Add	Multiply	Add	Multiply

Irrational Vs. Irrational		Complex Vs. Real	
Add	Multiply	Add	Multiply

We can add and subtract complex numbers just like we do polynomials (Day 1)

Example 4: Add or Subtract each set of complex numbers:

a) $(-3-9i)+(11-71)$ b) $(-1-3i)-(3-6i)$ c) $(6-11i)-(11-6i)$

We can also multiply complex numbers like we do polynomials. There is one major difference however. We know that $i^2 =$ ___ and can make that substitution to simplify our expression.

Example 5: Multiply:

a) $(-7+2i)(-7-4i)$

b) $(6+8i)(-6-2i)$

c) $(4-2i)^2$

d) $(5+2i)(5-2i)$

e) $(-4+5i)(4+5i)$

f) $(-1+6i)(-5+4i)$

g) $5(2-3i)+4(2i)$

h) $(3+9i)-5(2-i)$