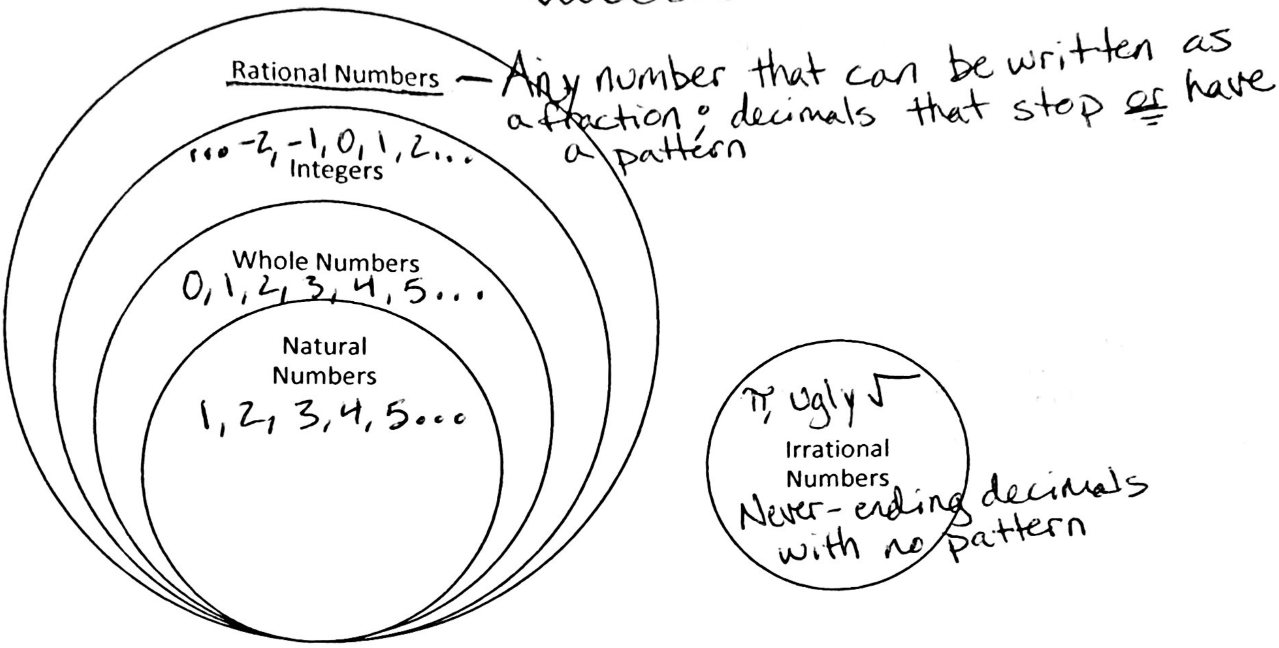
2.1: Classifying Numbers In the Number System

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) $\sqrt{81} = 9$
Real
Rational
Integer
Whole
Natural

b) $\frac{0}{-2} = 0$
Real
Rational
Integer
Whole

c) $\sqrt{\frac{279}{3}} = \sqrt{93}$
Real
Irrational

d) $\sqrt{225} = 15$
Real
Rational
Integer
Whole
Natural

e) $\frac{176}{64} = 2.75$
Real
Rational

f) $\frac{68}{40} = 1.7$
Real
Rational

g) $-9+2 = -7$
Real
Rational
Integer

h) $\pi+3$
Real
Irrational

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

a. If a number is rational, it can be irrational too. Never – can't be both

b. An integer is a whole number. Sometimes – ex: 3 is integer & whole, but -5 isn't

c. A natural number is a real number. Always – all these classifications are real

d. A whole number is a natural number. Sometimes – ex: 5 is whole & natural, but 0 isn't

Example 3:

a. What is the most specific set that $\sqrt{81}$ belongs to? $\sqrt{81} = 9$, Natural

b. What is the most specific set that $(-5-2)$ belongs to? $(-5-2) = -7$, Integer

c. What is the most specific set that $\sqrt{70}$ belongs to? $\sqrt{70}$ is ugly square root, Irrational

d. What is the most specific set that 6^0 belongs to? $6^0 = 1$, Natural

e. What is the most specific set that $(2 \cdot 9 - 3 \cdot 6)$ belongs to?
$(18 - 18) = 0$, Whole

THE COMPLEX NUMBER SYSTEM

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

$5^2 = 25$	$2^2 = 4$	$1^2 = 1$	$(-10)^2 = 100$

*When squaring a number the result is always __positive__! 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 __real__ part and an __imaginary__ part. EX: $1 - 2i$

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

a) $6 + 5i$
Real: 6
Imaginary: 5i

b) $8 - 3i$
Real: 8
Imaginary: -3i

c) $-4 - 7i$
Real: -4
Imaginary: -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	
$i^2 = -1$	$i = \sqrt{-1}$

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

a) $\sqrt{-25} = \pm 5i$

b) $\sqrt{-81} = \pm 9i$

c) $\sqrt{-121} = \pm 11i$

d) $\sqrt{-16} = \pm 4i$

e) $\sqrt{-100} = \pm 10i$

f) $\sqrt{-169} = \pm 13i$

Take normal square root, then slap an i on it

★ Don't forget $\pm$ when taking a square root