2.1 Classifying Numbers

$5^2 = 25$ $(-4)^2 = 16$ $\sqrt{64} = 8$ $\sqrt{-100} =$

It is impossible to take the square root of a negative number; it doesn't exist. That is why these numbers are called imaginary numbers.

$$i = \sqrt{-1}$$

In order to find the square root of negative numbers, find the square root of the positive & put an i on it.

1) Find each root.

a) $\sqrt{-25} = 5i$ b) $\sqrt{-81} = 9i$ c) $\sqrt{-121} = 11i$

d) $\sqrt{-16} = 4i$ e) $\sqrt{-100} = 10i$ f) $\sqrt{-169} = 13i$

The reason we will care so much about imaginary numbers in this class is that it will assure that every problem has a solution. The most common application outside of this class is for calculations with electricity.

Imaginary numbers are a smaller group of the **complex** numbers. Complex numbers are defined as having a real part/coefficient and an imaginary part/coefficient.

Complex number: $a + bi$ * order matters

real part

imaginary coefficient

2) Identify the real and imaginary coefficient of the following complex numbers:

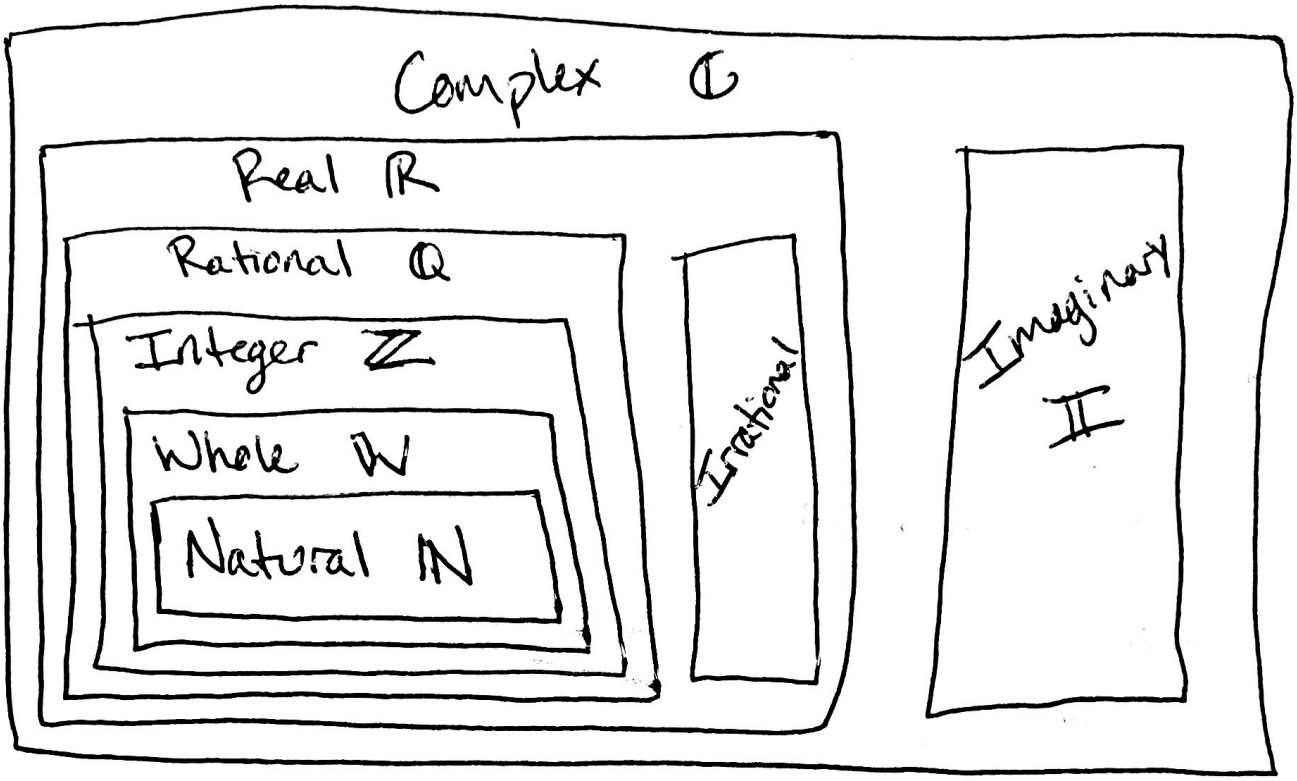
a) $6 + 5i$ b) $8 - 3i$ c) $-4 - 7i$

Real: 6
Imaginary: 5

R: 8
I: -3

R: -4
I: -7

Every number can be classified based on its characteristics. Below we are going to draw a nesting model for number classification.



Set	Symbol	Description
Complex	ℂ	Real part & imaginary part ex: 7-2i, 0+5i, 2+0i *every number is complex
Real	ℝ	Any number without i
Imaginary	𝕀	Square roots of negative numbers, $i=\sqrt{-1}$
Rational	ℚ	Any number that can be written as a fraction of integers ex: $\frac{2}{1}$, $\frac{3}{4}=0.75$, $\frac{1}{3}=0.\overline{33}$ *decimals that end or have a pattern
Irrational	No symbol	Decimals that never end and have no pattern ex: π, $\sqrt{2}$ ← imperfect roots
Integer	ℤ	Positive & negative whole numbers (no decimals) ex: ...-3, -2, -1, 0, 1, 2, 3...
Whole	W	Integers 0 & above 0, 1, 2, 3...
Natural	ℕ	Integers 1 & above 1, 2, 3...

When classifying numbers, you want to make sure to simplify the number first.

3) Name the set or sets that each number belongs to. Circle the most specific set:

a) $\sqrt{81} = 9$

$\mathbb{C}$ $\mathbb{R}$ $\mathbb{Q}$
$\mathbb{Z}$ $\mathbb{W}$ (N)

the most specific is the last one (if you go in order)

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

$\mathbb{C}$ $\mathbb{R}$ $\mathbb{Q}$
$\mathbb{Z}$ (W)

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

$\mathbb{C}$ $\mathbb{R}$ (Irr.)

d) $\sqrt{225} = 15$

$\mathbb{C}$ $\mathbb{R}$ $\mathbb{Q}$
$\mathbb{Z}$ $\mathbb{W}$ (N)

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

$\mathbb{C}$ $\mathbb{R}$ (Q)

This is a decimal that ends, so it's rational

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

$\mathbb{C}$ $\mathbb{R}$ (Q)

g) $-9+2 = -7$

$\mathbb{C}$ $\mathbb{R}$ $\mathbb{Q}$
(Z)

h) $\pi+3 = 6.14159...$

$\mathbb{C}$ $\mathbb{R}$ (Irr.)

i) $2i$ $\mathbb{C}$ (I)

j) $7-2i$ (C)

This has real & imaginary, so it stops at complex

Test your understanding

4) Determine if each statement is always, sometimes, or never true:

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

Never

b. An integer is a whole number.

Sometimes ex: 7 is a whole number & integer, -3 is an integer but not a whole number

c. A natural number is a real number.

Always

d. A whole number is a natural number.

Sometimes ex: 0 is a whole number but not a natural number

1 is a whole number & natural number