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, take the square root as normal & slap 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 and an imaginary part.

Complex number: $a + bi$
real part → a; imaginary part → bi

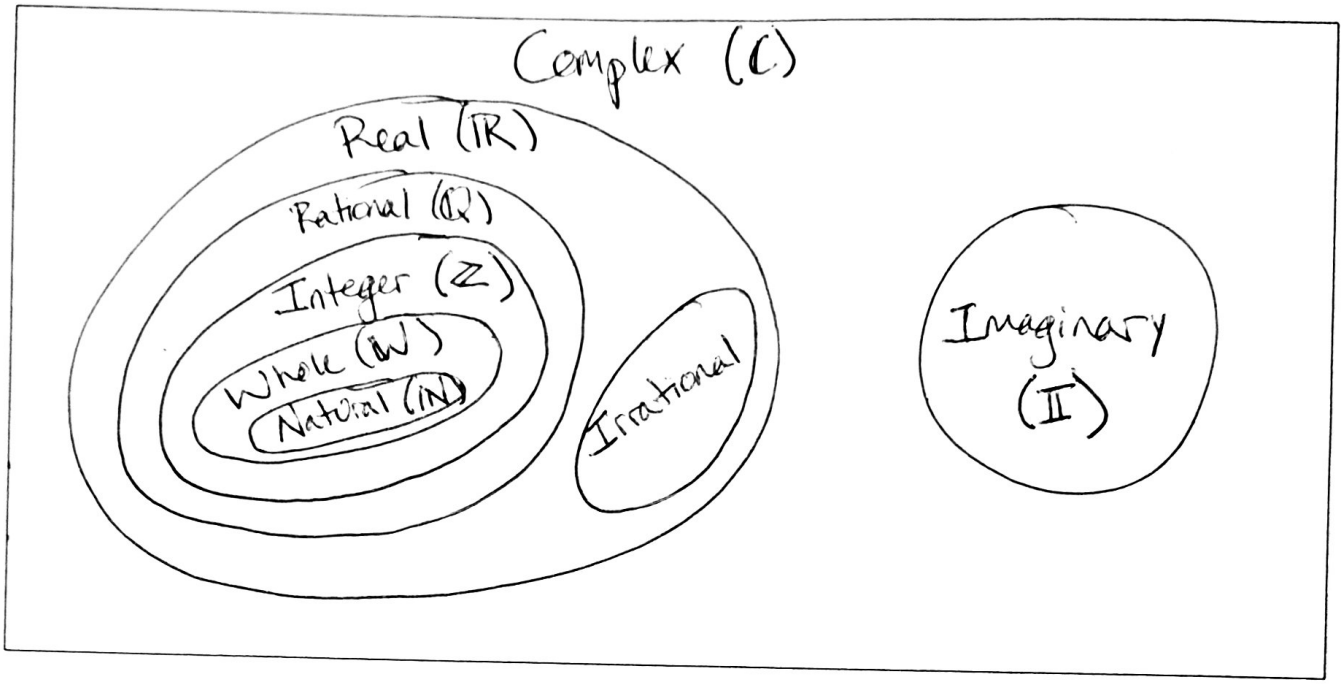
2) Identify the real and imaginary part of the following complex numbers:

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

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

c) $-4 - 7i$
Real: -4
Imaginary: -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
Real	ℝ	Normal numbers, anything without an i
Imaginary	𝕀	$i = \sqrt{-1}$
Rational	ℚ	Any number that can be written as a fraction; decimals that end or have a pattern ex: $2, \frac{3}{5}, 0.18, 5.3\overline{3}$...
Irrational	No symbol	Decimals that go on forever and have no pattern, ex: $\pi, \sqrt{6}, 1.782139812...$ imperfect roots
Integer	ℤ	Positive & negative numbers with no decimal ex: $-5, -91, 7, 2, 0$
Whole	𝕎	Integers 0 and above ex: 0, 1, 2, 3...
Natural	ℕ	Integers 1 and above ex: 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) $\sqrt{81} = 9$

ℂ ℝ ℚ

ℤ 𝕎 (ℕ)

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

ℂ ℝ

ℚ ℤ (𝕎)

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

ℂ ℝ

(Irrational)

d) $\sqrt{225} = 15$

ℂ ℝ ℚ ℤ

𝕎 (ℕ)

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

ℂ ℝ (ℚ)

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

ℂ ℝ (ℚ)

g) $-9+2 = -7$

ℂ ℝ ℚ

(ℤ)

h) $\pi+3$

ℂ ℝ

(Irrational)

Test your understanding

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.