Algebra 2A Notes Name: _____

4-8 Complex Numbers Date: _____ Hr: _____

Objective:

- To identify, graph, and perform operations with complex numbers
- To find complex number solutions of quadratic equations

Common Core Content Standard:

N.CN.1 Know there is a complex number i such that $i^2 = -1$ and every complex number has the form a + bi with a and b real.

Also: **N.CN.2. N.CN.7, N.CN.8**

The _____ unit I is the complex number whose square is -1. So, $i^2 = -1$ and $i = \sqrt{-1}$.

Take Note

Key Concept Square Root of a Negative Real Number

Algebra

For any positive number a,

$\sqrt{-a} = \sqrt{-1 \cdot a} = \sqrt{-1} \cdot \sqrt{a} = i\sqrt{a}$.

Example

$\sqrt{-5} = i\sqrt{5}$

Note that $(\sqrt{-5})^2 = (i\sqrt{5})^2 = i^2(\sqrt{5})^2 = -1 \cdot 5 = -5$ (not 5).

Example 1: **Simplifying a Number Using i**

How do you write $\sqrt{-24}$ using the imaginary unit i?

An _____ number is any number of the form a + bi, where a and b are real numbers and b ≠ 0. Imaginary numbers and real numbers together make up the set of complex numbers.

Take Note **Key Concept** Complex Numbers

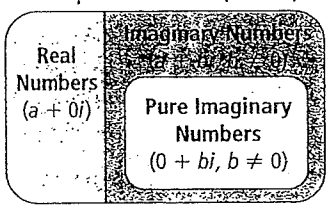
You can write a complex number in the form $a + bi$, where a and b are real numbers.

If $b = 0$, the number $a + bi$ is a real number.

If $a = 0$ and $b \neq 0$, the number $a + bi$ is a pure imaginary number.

$a + bi$

a: Real part; bi: Imaginary part



In the complex number plane, the point (a, b) represents the complex number a + bi. To graph a complex number, locate the real part on the horizontal axis and the imaginary part on the vertical axis.

The _____ of a complex number is its distance from the origin in the complex plane.

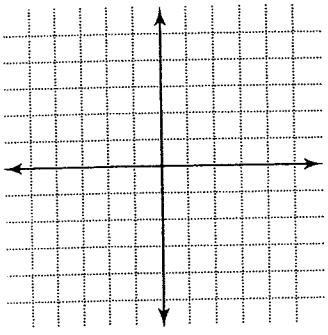
$|a + bi| = \sqrt{a^2 + b^2}$

Example 2: **Graphing in the Complex Number Plane**

What are the graph and absolute value of each complex number?

a.) 1 – 3i

b.) -4 + i



To add or subtract complex numbers, add like terms by combining the real parts and the imaginary parts separately.

Example 3: **Adding and Subtracting Complex Numbers**

What is each sum or difference?

a.) (2 + i) + (-3 + 3i)

b.) (-6 – 2i) – (4 + 2i)

You multiply complex numbers a + bi and c + di as you would multiply binomials.

Example 4: **Multiplying Complex Numbers**

What is each product?

a.) –i(4 – 8i)

b.) (5 – 7i)(-4 - 3i)

Number pairs of the form a + bi and a – bi are complex _____ . You can use complex conjugates to rewrite division of complex numbers.

Example 5: **Dividing Complex Numbers**

What is each quotient?

a.) $\frac{4-i}{6i}$

b.) $\frac{5+2i}{3-2i}$

Example 6: **Factoring Using Complex Conjugates**

What is the factored form of $3x^2 + 12$?

Example 7: **Finding Imaginary Solutions**

What are the solutions of $-x^2 + 4x - 5 = 0$?