Course Number
Instructor
Date

Section 1.5 Complex Numbers

Objective: In this lesson you learned how to perform operations with complex numbers.

Important Vocabulary Define each term or concept.

Complex number If a and b are real numbers, the number $a + bi$, where the number a is called the real part and the number bi is called the imaginary part, is a complex number written in standard form.

Imaginary number If $b \neq 0$, the number $a + bi$ is called an imaginary number.

Complex conjugates A pair of complex numbers of the form $a + bi$ and $a - bi$.

I. The Imaginary Unit *i* (Page 126)

What you should learn
How to use the imaginary unit i to write complex numbers

Mathematicians created an expanded system of numbers using the **imaginary unit *i*,** defined as $i =$ $\sqrt{-1}$, because . . . there is no real number x that can be squared to produce -1.

By definition, $i^2 =$ -1.

If a and b are real numbers, then the complex number $a + bi$ is said to be written in standard form. If $b = 0$, the number $a + bi = a$ is a(n) real number. If $b \neq 0$, the number $a + bi$ is a(n) imaginary number. If $a = 0$, the number $a + bi = bi$, where $b \neq 0$, is a(n) pure imaginary number.

The set of complex numbers consists of the set of real numbers and the set of imaginary numbers.

Two complex numbers $a + bi$ and $c + di$, written in standard form, are equal to each other if . . . and only if $a = c$ and $b = d$.

II. Operations with Complex Numbers (Pages 127–128)

What you should learn
How to add, subtract, and multiply complex numbers

To add two complex numbers, . . . add the real parts and the imaginary parts of the numbers separately.

To subtract two complex numbers, . . . subtract the real parts and the imaginary parts of the numbers separately.

The **additive identity** in the complex number system is ___0___.

The **additive inverse** of the complex number $a + bi$ is ___$-(a + bi) = -a - bi$___.

Example 1: Perform the operations:
$(5 - 6i) - (3 - 2i) + 4i$
2

To multiply two complex numbers $a + bi$ and $c + di$, . . . use the multiplication rule $(ac - bd) + (ad + bc)i$ or use the Distributive Property to multiply the two complex numbers, similar to using the FOIL method for multiplying two binomials.

Example 2: Multiply: $(5 - 6i)(3 - 2i)$
$3 - 28i$

III. Complex Conjugates (Page 129)

> ***What you should learn***
> How to use complex conjugates to write the quotient of two complex numbers in standard form

The product of a pair of complex conjugates is a(n) ______real______ number.

To write the quotient of the complex numbers $a + bi$ and $c + di$ in standard form, where c and d are not both zero, . . . multiply the numerator and denominator by the complex conjugate of the denominator.

Example 3: Divide $(1 + i)$ by $(2 - i)$. Write the result in standard form.
$1/5 + 3/5i$

IV. Complex Solutions of Quadratic Equations (Page 130)

> ***What you should learn***
> How to find complex solutions of quadratic equations

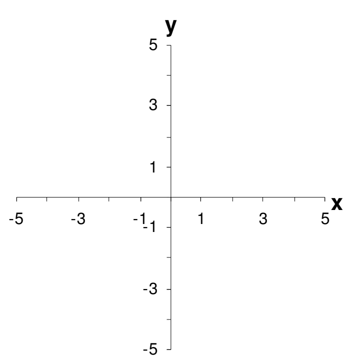
If a is a positive number, the **principal square root** of the negative number $-a$ is defined as ___$\sqrt{-a} = \sqrt{a}\, i$___.

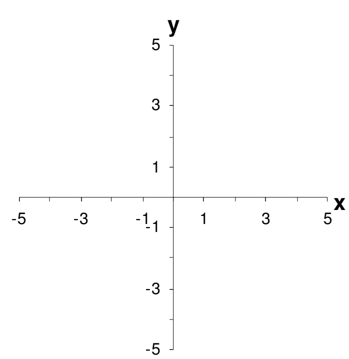
To avoid problems with square roots of negative numbers, be sure to convert complex numbers to ______standard form______ before multiplying.

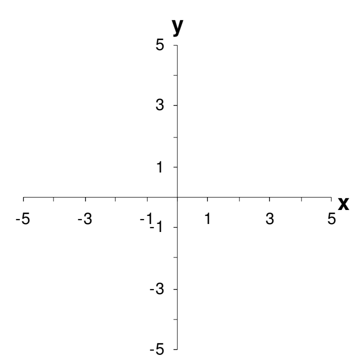
Example 4: Perform the operation and write the result in standard form: $(5-\sqrt{-4})^2$

$21 - 20i$

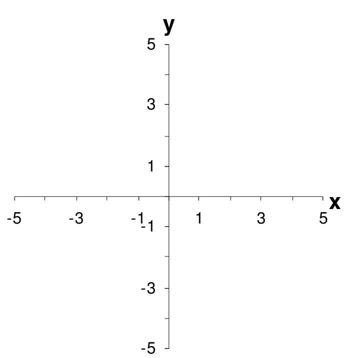
Additional notes

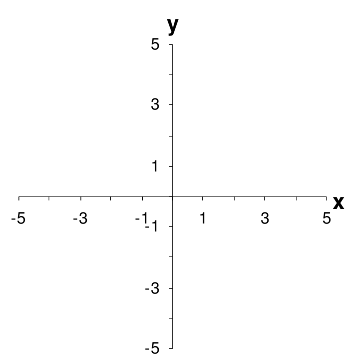


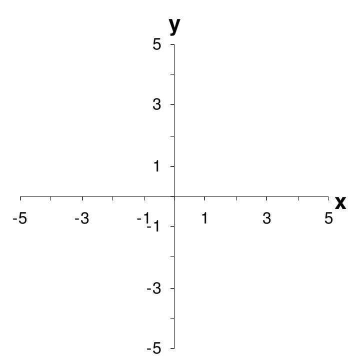




Additional notes







Homework Assignment
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