Math 1111 – Complex Numbers

Objectives:

1. Add and subtract complex numbers

2. Multiply complex numbers

3. Divide complex numbers

4. Perform operations with *i*

When we find the square root of a positive real number, the answer is a real number. To find the square root of a negative number, you get an imaginary number. An imaginary number *i*, is defined as the square root of negative one.

And using the properties of radicals

Imaginary numbers differ from real numbers in that a squared imaginary number produces a negative real number.

To express an imaginary number in the standard form a complex number:

1. Write
2. Write as *i*

3. Write iin simplest form

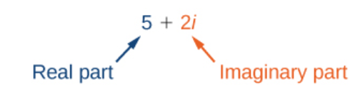
For example, can be rewritten as .

Rewrite as *i.*

The simplest form is 7*i.*

(Use 7i and not -7i because the principal root of 49 is the positive root)

A complex number is the sum of a real number and an imaginary number. A complex number is expressed in standard form when written a + b*i* where *a* is the real part and *b* is the imaginary part.



Imaginary and Complex Numbers:

A complex number is a number of the form *a* + *b*i where

* *a* is the real part of the complex number.
* *b* is the imaginary part of the complex number.

If *b* = 0, then *a* + *bi* is a real number. If *a* = 0 and *b* ≠ 0, the complex number is called a pure imaginary number. An imaginary number is an even root of a negative number.

**Objective 1:** Add and subtract complex numbers.

Given two complex numbers, find the sum or difference.

1. Identify the real and imaginary parts of each number.
2. Add or subtract the real parts.
3. Add or subtract the imaginary parts.
4. Express the answer in standard form.

Example #1: Add or subtract as indicated.

A. (3 – 4*i*) + (2 + 5*i*)

B. (-5 + 7*i*) – (-11 + 2*i*)

C. Subtract 2 + 5*i* from 3 – 4*i*

**Objective 2:** Multiply complex numbers.

Given two complex numbers, multiply to find the product.

1. Use the distributive property or FOIL method.
2. Replace *i*2 with -1.
3. Group together the real terms and imaginary terms.
4. Express the answer in standard form.

Example #2: Multiply or FOIL.

A. 4 (2 + 5)

B.

C. (4 + 3*i*) (2 – 5)

D. (3 – 4*i*) (2 + 3)

When dividing with imaginary numbers, we need to be able to write the fraction with a real number denominator. Therefore, we need to find a term by which we can multiply the numerator and the denominator that will eliminate the imaginary portion of the denominator so that we end up with a real number as the denominator. This term is called the complex conjugate of the denominator, which is found by changing the sign of the imaginary part of the complex number. In other words, the complex conjugate of a + b*i* is a – b*i*.

**Objective 3:** Divide complex numbers

Example #3: Divide the complex numbers and express the answer in standard form.

A.

B.

C.

Since the product rule of radicals only applies to real numbers, you must express the square root of a negative number in terms of *i* before performing any of the operations.

Given the problem, you **cannot** rewrite this as . You could only do this if the numbers were real. Therefore, you need to express each radical in terms of *i*.

= 7*i* \* 2*i* = 14*i* 2 = -14

**Objective 4:** Perform operations with *i*.

Example #4: Perform the indicated operations. Write your final answer in standard form.

A.

B.

C.

D.

E.

F.

OpenStax College Algebra, College Algebra. OpenStax CNX. Aug 2, 2019 http://cnx.org/contents/9b08c294-057f-4201-9f48-5d6ad992740d@11.1.