**2.4 Complex Numbers**

**Objective:** To add, subtract, multiply and divide complex numbers as well as find complex solutions (non-real zeros) *\*\*\*Not on Test\*\*\**

*Point of Emphasis: Complex answers come in pairs, don’t touch x-axis on graph, and you can use synthetic division with real solutions until you reach a quadratic in which you can use the Quadratic Formula to find complex roots when needed*

**Imaginary Unit:** i, defined as **,** or**, i2 = -1**

Simplify using imaginary, i

Example 1: Example 2: Example 3:

**Imaginary Number**: a + bi; when b ≠ 0

**Complex Number:** Imaginary and real numbers together

**Standard Form**: **a + bi**

**Imaginary Number**: a + bi; when b ≠ 0

**Pure Imaginary Number**: a + bi; when a = 0 and b ≠ 0, or, **bi**

**Complex Number Plane:** the point (a, b) represents the complex number a+bi

x-axis is the real axis

y-axis is the imaginary axix

Graph a+bi then find the Absolute Value.

Find the absolute value of a complex number: (distance formula)

**Sum of Complex Numbers**:

(a + bi) + (c + di) = (a + c) + (b + d)i

**Difference of Complex Numbers**:

(a + bi) – (c + di) = (a – c) + (b – d)i

* Add or Subtract Real Numbers
* Add or Subtract Imaginary Numbers

*Examples:*

(4 – i) + (3 + 2i) (7 – 5i) – (1 – 5i)

(4+3)+(-1+2)i (7-1)+(-5+5)i

**7+i** 6+0i=**6**

(4 + 3i) – (-2 + 4i) (1 + 5i) + (6 – 2i)

(4+2)+(3-4)i (1+6)+(5-2)i

**6-i** **7+3i**

6 – (-2 + 9i) + (-8 + 4i)

(6+2-8)+(9+4)i

0+13i=**13i**

**Multiplying Complex Numbers;**

1) Use distributive or FOIL methods

2) Simplify (combine like terms and use i2 = -1)

3) Put into Standard Form (a + bi)

*Examples:*

5i(-2 + i) (7 – 4i)(-1 + 2i)

(6 + 3i)(6 – 3i) (10 – 8i)2

**Complex Conjugates**: a + bi, and, a – bi

* Product is always a real number
* *Used to eliminate complex numbers from denominators*

**The Square Root of a Negative Number**;

* If r is a positive real number, then
* 

**Dividing Complex Numbers;**

1) Multiple numerator and denominator by complex conjugate of denominator (use FOIL)

2) Simplify (combine like terms and use i2 = -1)

3) Put into Standard Form (a + bi)

*Example:*

 

 

**Solving Quadratics Equations with Complex Solutions**

1) Isolate the squared term on one side of the equation

2) Square root both sides

3) Substitute i = √-1 into equation and simplify radical

4) Write solution in Standard Form (a + bi)

Examples:

x2 = -9 2x2 + 3 = -13

3x2 + 10 = -26 (x – 1)2 = -7

**Homework** (in class… more discussion that actual take home work)

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