3.3 Complex Numbers

Imaginary Numbers

PROPERTIES OF THE IMAGINARY UNIT i

$$i = \sqrt{-1}, \qquad i^2 = -1$$

THE EXPRESSION $\sqrt{-a}$

If $a > 0$, then $\sqrt{-a} = i\sqrt{a}$.

Examples: Simplify

1. $\sqrt{-81}$
2. $\sqrt{-63}$

From *Precalculus with Modeling and Visualization* 3rd ed. by Rockswold, 2006, p.293

Complex Numbers

A complex number can be written in the form

$$a + bi$$

where a and b are real and i is the imaginary unit

Examples:

$3 + 2i$	3 is the real part and 2 is the imaginary part
$5 - 7i$	5 is the real part and -7 is the imaginary part
$3i$	0 is the real part and 3 is the imaginary part
8	8 is the real part and 0 is the imaginary part

Addition & Subtraction of Complex Numbers

Combine like terms!

Examples:

1. $(3 + 2i) – (8 + 7i)$
2. $(4 – 3i) + (2 + 5i)$
3. $(– 1 + 4i) – (– 3 + 6i)$
4. $(– 3 + 2i) + (– 8 – 4i)$

Multiplication of Complex Numbers

FOIL and combine like terms!

(remember $i^2 = –1$)

Examples:

1. $(3 + 2i)(8 + 7i)$
2. $(– 1 + 4i)(– 3 + 6i)$

Division of Complex Numbers

To divide complex numbers, multiply the top & bottom of the fraction by the complex conjugate of the denominator.

Examples:

1. $\dfrac{3+5i}{7-2i}$
2. $\dfrac{4-7i}{-12i}$

Example

Solve the equation

$$2x^2 + x + 1 = 0$$