

3.3 Complex Numbers

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1 2
4 5

Imaginary Numbers

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PROPERTIES OF THE IMAGINARY UNIT i

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

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

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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

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Combine like terms!

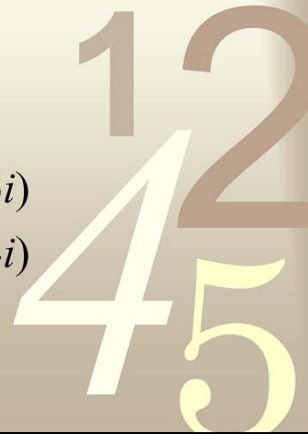
Examples:

1. $(3 + 2i) - (8 + 7i)$

2. $(4 - 3i) + (2 + 5i)$

3. $(-1 + 4i) - (-3 + 6i)$

4. $(-3 + 2i) + (-8 - 4i)$



Multiplication of Complex Numbers

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FOIL and combine like terms!

(remember $i^2 = -1$)

Examples:

1. $(3 + 2i)(8 + 7i)$

2. $(-1 + 4i)(-3 + 6i)$



Division of Complex Numbers

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

Examples:

1. $\frac{3 + 5i}{7 - 2i}$

2. $\frac{4 - 7i}{-12i}$



Example

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Solve the equation

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

