

## Section 10.7: Complex Numbers

### Objectives:

1. Define imaginary and complex numbers.
2. Add or subtract complex numbers.
3. Multiply complex numbers.
4. Divide complex numbers.
5. Raise  $i$  to powers.

### Objective 1: Define imaginary and complex numbers

The **imaginary unit**, written as  $i$ , is the number whose square is  $-1$ . That is,

$$i^2 = -1 \text{ and } i = \sqrt{-1}.$$

Examples: Simplify and write using the imaginary unit:

$$\sqrt{-25} \qquad \sqrt{-3} \qquad -\sqrt{-50}$$

Examples: Multiply and Divide:

$$\sqrt{-2} \cdot \sqrt{-7} \qquad -\sqrt{25} \cdot \sqrt{-1} \qquad \sqrt{27} \cdot \sqrt{-3} \qquad \frac{\sqrt{-8}}{\sqrt{2}}$$

### Objective 2: Add or subtract complex numbers

A **complex number** is a number of the form  $a + bi$ , where  $a$  and  $b$  are real numbers and  $i$  is the imaginary unit. The complex number system is an extension of the real number system that allows solutions to equations such as  $x^2 + 1 = 0$ .

Examples: Add or Subtract:

$$(5 + 2i) + (4 - 3i) \qquad 6i - (2 - i) \qquad (-2 - 4i) - (-3)$$

### Objective 3: Multiply complex numbers

Examples: Multiply:

$$-5i \cdot 3i \qquad -2i(6 - 2i) \qquad (3 - 4i)(6 + i)$$

$$(1 - 2i)^2 \qquad (6 + 5i)(6 - 5i)$$

The complex numbers  $(a + bi)$  and  $(a - bi)$  are called **complex conjugates** of each other, and  $(a + bi)(a - bi) = a^2 + b^2$

### Objective 4: Divide complex numbers

Examples: Divide:

$$\frac{3+i}{2-3i} \qquad \frac{6}{5i}$$

### Objective 5: Raise $i$ to powers

Examples: Find powers:

$$i^{11} \qquad i^{40} \qquad i^{50} \qquad i^{-10}$$