9.4 Complex Solutions of Quadratic Equations

A. Writing Complex Numbers using i notation

**Complex Numbers** - is a number that can be written in the form: ____________

   where ______ is called a real part and ______ is called imaginary part.

The Imaginary Unit is defined as

**Example 1.** Write each radical as the product of a real number and i.

1. \( \sqrt{-81} \)

2. \( \sqrt{-13} \)

3. \( \sqrt{-80} \)

B. Adding and Subtracting Complex Numbers

**Rules:**
1. \((a + bi) + (c + di) = (a + c) + (b + d)i\)
2. \((a + bi) - (c + di) = (a - c) + (b - d)i\)

**Example 2.** Add or subtract.

1. \((-1 + i) + (4 - 3i)\)

2. \((7 + 6i) - (2 + 8i)\)

C. Multiply Complex Numbers

**Rules:**
1. \(c(a + bi) = ac + cbi\)
2. \((a + bi)(c + di) = ac + (ad + cb)i - bd\)

**Example 3.** Multiply and write the product in standard form.

1. \(2i(1 - 7i)\)
2. \((2+5i)(6-i)\)

3. \((9+7i)(9-7i)\)

\[D. \text{ Dividing Complex Numbers}\]

Rules:
1. \((a + bi)(a - bi) = a^2 + b^2\)
2. \((a + bi)\) and \((a - bi)\) are called complex conjugates of each other.

\[\text{Example 4.}\] Write each complex number in the standard form.

1. \(\frac{-3+i}{2+3i}\)

2. \(\frac{4-3i}{7-i}\)
E. Solving Quadratic Equations with Complex Solutions

Example 5. Solve.

1. \((x - 1)^2 = -9\)

2. \(x^2 = 2x - 3\)

3. \(x^2 + x = -2\)