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The Imaginary Unit i

The **imaginary unit** i is defined as $i = \sqrt{-1}$, where $i^2 = -1$

Complex Numbers and Imaginary Numbers

The set of all numbers in the form a + bi,

with real numbers a and b, and i, the imaginary unit, is called the set of **complex numbers**. The real number a is called the **real part** and the real number b is called the **imaginary part** of the complex number a + bi, If b ≠ 0, then the complex number is called an **imaginary number**. An imaginary number in the form bi is called a **pure imaginary number**.

Add or Subtract Complex Numbers

- To add two complex numbers, add their real parts and add their imaginary parts.
- To subtract one complex number from another, subtract their real parts and subtract their imaginary parts.

Multiplying Complex Numbers

To multiply two complex numbers use the distributive property.

Division with Complex Numbers

The two complex numbers a + bi and a – bi are called **complex conjugates** or simply **conjugates**.

To write a fraction with complex numbers in standard form

1. Multiply both the numerator and denominator by the complex conjugate of the denominator.
2. Simplify the resulting products in both the numerator and denominator.
Write the simplified result in standard form.

Principal Square Root of a Negative Number

For any positive real number b, the principal square root of the negative number –b is defined by
$$\sqrt{-b} = i\sqrt{b}$$

Example 1: