MATH 11010: Complex Numbers
Section 2.2

- **The number i:** The number i is defined such that $i = \sqrt{-1}$ and $i^2 = -1$.

Example 1: Express the number in terms of i.

(a) $\sqrt{-16}$ (b) $\sqrt{-45}$

- **Complex Numbers:** A **complex number** is a number of the form $a + bi$ where a and b are real numbers. The number a is said to be the **real part** of $a + bi$ and the number b is said to be the **imaginary part** of $a + bi$.
  - Note that a real number is a complex number with $b = 0$.

Example 2: Add or subtract and simplify each of the following.

(a) $(-9 + 3i) + (-5 - 7i)$ (b) $(7 - 3i) - (4 + 3i)$

CAUTION: If $\sqrt{a}$ and $\sqrt{b}$ are real numbers, then $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$. However, this is not true when $\sqrt{a}$ and $\sqrt{b}$ are not real numbers.

Example 3: Multiply and simplify each of the following.

(a) $\sqrt{-16} \cdot \sqrt{-4}$ (b) $\sqrt{-3} \cdot \sqrt{-5}$

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

(d) $(3-4i)^2$

- **Conjugate of a complex number:** The **conjugate** of a complex number $a+bi$ is $a-bi$. The numbers $a+bi$ and $a-bi$ are **complex conjugates**. Note that the product of a complex number and its conjugate is a real number.

Example 4: Simplify the following. Write answers in the form $a+bi$, where a and b are real number.

(a) $\dfrac{6}{3-5i}$

(b) $\dfrac{3-2i}{4+3i}$