Math 150 Lecture Notes
Complex Numbers

A **complex number** is an expression of the form $a + bi$ where a and b are real numbers and $i^2 = -1$. The **real part** of this complex number is a and the **imaginary part** is b.

Two complex numbers are **equal** iff their real parts are equal and their imaginary parts are equal.

A complex number whose real part is 0 is a **pure imaginary number**.

Addition of Complex Numbers
$(a + bi) + (c + di) = (a + c) + (b + d)i$

Multiplication of Complex Numbers
$(a + bi) \cdot (c + di) = (ac\text{-}bd) + (ad + bc)i$

To **simplify the quotient** $\frac{a+bi}{c+di}$, multiply the numerator and the denominator by the form of 1 using the complex conjugate of the denominator $(c - di)$.

If $-r$ is negative, then the **principal square root** of $-r$ is $\sqrt{-r} = i\sqrt{r}$.
The two square roots of $-r$ are $i\sqrt{r}$ and $-i\sqrt{r}$.

Example 1: Subtract: $6i - (4 - i)$

Example 2: Multiply: $(-2 + i)(3 - 7i)$

Example 3: Simplify: $\frac{(1+2i)(3-i)}{2+i}$

Example 4: Simplify: $\frac{1-\sqrt{-1}}{1+\sqrt{-1}}$

Example 5: Find all solutions: $4x^2 - 16x + 19 = 0$