

The set of **complex numbers** is the set of all number of the form $a + bi$, where a and b are real numbers (a is called the **real part** and b is called the **imaginary part**), $i = \sqrt{-1}$, and $i^2 = -1$. If $b \neq 0$, $a + bi$ is called an **imaginary number**; if $b = 0$, $a + 0i$ is the real number a .

Addition, Subtraction, and Multiplication of Complex Numbers:

Treat the complex numbers as if they were algebraic expressions with i being a variable; whenever i^2 appears, we replace it by -1 .

The complex numbers $a + bi$ and $a - bi$ are called **complex conjugates** of one another. Their product is the real number $a^2 + b^2$.

Division of Complex Numbers:

Multiply both the numerator and the denominator of the quotient by the complex conjugate of the denominator.

Square Root of a Negative Number: For any $b > 0$,

$$\sqrt{-b} = i\sqrt{b}.$$

In the complex number system,

$$x^2 = k \quad \text{is equivalent to} \quad x = \pm\sqrt{k}.$$