

Complex Numbers

Most of the quadratic equations you will need to solve will have solutions in the real number system. But there are quadratic equations that do not have solutions in the real number system.

Example:

$$x^2 + 1 = 0$$

$$x^2 = -1$$

$$x = \sqrt{-1}$$

$\sqrt{-1}$ has no meaning in the real number system.

To solve problems of this type, we introduce a new number system, the complex number system.

Complex Number System

Define $\sqrt{-1} = i$, so that we get $x^2 = -1$

We then define a number $a + bi$ where a, b are real numbers and i is defined as above.

We can now define the square root of negative numbers in the complex number system.

$$\sqrt{-9} = \sqrt{9}\sqrt{-1} = 3i$$

$$\sqrt{-121} = \sqrt{121}\sqrt{-1} = 11i$$

Examples of complex numbers

$5 + 3i, 2 - 7i, 8, 4i$ are all complex numbers