**Lesson 0**

Introduction to Complex Numbers

The set of all complex numbers is essentially a two-dimensional extension of the field of real numbers. By a complex number we mean a number comprising a real and an imaginary part.

It can be written in the form ;

where and are real numbers, and i is postulated to be the imaginary unit with the property

Complex numbers help in two areas:

- application in real-world applications

- simplifying mathematics

**Cartesian Form**

or

Where and are both real numbers and is known as the imaginary unit and satisfies .

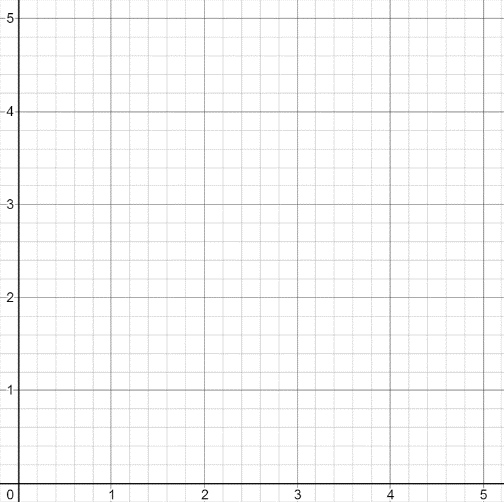
The number is called “the real part of ”

The number is called “the imaginary part of ”

**Lesson 1**

Operations on complex numbers

**Addition/Subtraction**



*Just add/subtract the corresponding components*

If and

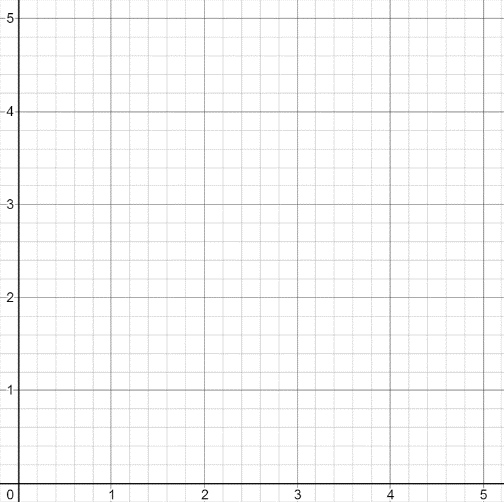
Addition of two complex numbers can be represented as a parallelogram.



**Scalar Multiplication**

If

Scalar multiplication of complex numbers is represented through the stretching principle.



**Multiplication of two complex numbers**

If and

Multiplication of two complex numbers is done through rotation and stretching. The length of is the product of and . The angle of is the sum of and

*Lengths calculated using Pythagoras theorem.*

*Angles calculated using trig.*

Division by a complex number

Quadratic formula

**Lesson 2**

Graphical Representation

<https://jutanium.github.io/ComplexNumberGrapher/>

Complex numbers are represented on the complex plane (Argand diagram) with:

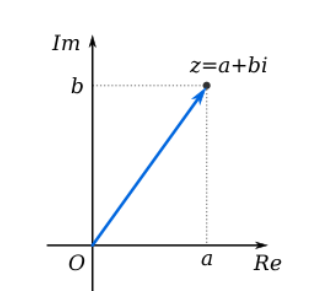
- a “real” (horizontal) axis

- an “imaginary” (vertical) axis

These are written in the form

The number represents a rotation from the real number line

Therefore, a complex number can represent a point, with the real part representing the position on the horizontal, real number line and the imaginary part representing the position on the imaginary or vertical axis.



Operations with complex numbers use the properties of to transform these points.

Example: Square the complex number