



## COMPLEX NUMBERS

### Why

We want to find roots of negative numbers

### Definition

A *complex number* is an ordered pair of real numbers. The *real part* of a complex number is its first coordinate. The *imaginary part* of a complex number is its second coordinate.

The *complex conjugate* (or just *conjugate*) of a complex number  $z$  is the complex number whose real part matches  $z$  and whose imaginary part is the additive inverse of  $z$ . The complex conjugate of a real number (imaginary part is zero) is the real number. In other words, the complex conjugate of a complex number with no imaginary part is the same complex number.

### Notation

Let  $z$  be a complex number. We denote the real part of  $z$  by  $\mathbf{Re}(z)$ , read “real of  $z$ ,” and the imaginary part by  $\mathbf{Im}(z)$ , read “imaginary of  $z$ .” If  $z = (a, b)$ , then  $\mathbf{Re}(z) = a$  and  $\mathbf{Im}(z) = b$ .

We denote the complex conjugate of the complex number  $z \in \mathbf{C}$  by  $z^* \in \mathbf{C}$ . Another common notation, not used in these sheets is  $\bar{z}$  or  $\bar{z}$ . If there exists  $a, b \in \mathbf{R}$  so that  $z = (a, b)$ , then  $z^* = (a, -b)$ .



