TI - 85

Entering and Using Complex Numbers

Complex numbers begin and end with parentheses, and have two elements separated by either a comma (rectangular format) or an angle symbol (polar format).

Complex Numbers

A complex number has two components. On the TI-85, the complex number $a + bi$ is entered as (a, b). In this guidebook, this is expressed as $(real, imag)$ in rectangular format or $(magnitude \angle angle)$ in polar format.

Lists, matrices, and vectors can have complex elements.

Entering Complex Numbers

Complex numbers are stored in rectangular format, but you can enter a complex number in rectangular or polar format, regardless of the format specified by the MODE setting. The separators, which are entered from the keyboard, determine the format. The components can be real numbers or expressions that evaluate to real numbers; the expression is evaluated when the command is executed.

Complex Number Variables

On the TI-85, complex numbers can be stored to and represented by variables.

Complex Results

Complex numbers in results, including list, matrix, and vector elements, are displayed in the format (rectangular or polar) specified by the MODE setting or by a display conversion instruction (page 11–4):

$(real, imag)$ or $(magnitude \angle angle)$

For example, in **PolarC** and **Degree** MODE, (2,1) → (1 ∠ 45) returns (1.32565429614 ∠ 12.7643896828).

Using a Complex Number in an Expression

To use a complex number in an expression, you may:

- Type the complex number directly.

- Type the name of the complex-number variable (case-sensitive).

- Select the name from the VARS CPLX screen.

The CPLX (Complex Number) Menu

The CPLX menu accesses additional functions and instructions to use with complex numbers. Press [MORE] to move around the menu. When you select from the CPLX menu, the name of the function or instruction is copied to the cursor location. These examples assume Radian MODE.

The CPLX Menu

When you press [2nd] [CPLX], the menu keys are labeled with the first five items of the complex menu.

conj	real	imag	abs	angle
▶Rec	▶Pol			

Lists are valid arguments for all of these functions and instructions, returning a list of results calculated on an element-by-element basis.

The conj Function

conj (conjugate) returns the complex conjugate of a complex number or list.

conj $(real, imag)$ returns $(real, -imag)$ in **RectC** MODE.

conj $(magnitude \angle angle)$ returns $(magnitude \angle -angle)$ in **PolarC** MODE.

For example, conj (3,4) returns (3,-4) or (5 ∠ -.927295218002).

The real Function

real returns the real portion(s) of a complex number or list as a real number.

real $(real, imag)$ returns $real$.

real $(magnitude \angle angle)$ returns $magnitude*cos angle$.

For example, real (3,4) returns 3 and real (3 ∠ 4) returns -1.96093086259.

The imag Function

imag (imaginary) returns the imaginary (nonreal) portion(s) of a complex number or list as a real number.

imag $(real, imag)$ returns $imag$.

imag $(magnitude \angle angle)$ returns $magnitude*sin angle$.

For example, imag (3,4) returns 4 and imag (3 ∠ 4) returns -2.27040748592.

The CPLX (Complex Number) Menu (Continued)

The abs Function

abs (absolute value) returns the magnitude (modulus), $\sqrt{(real^2 + imag^2)}$, of a complex number or list.

abs (*real,imag*) returns $\sqrt{(real^2 + imag^2)}$.

abs (*magnitude* ∠ *angle*) returns *magnitude*.

For example, **abs (3,4)** returns **5** and **abs (3 ∠ 4)** returns **3**.

The angle Function

angle returns the polar angle of a complex number or list, calculated as tan⁻¹(*imag/real*) (adjusted by +π in the second quadrant or −π in the third quadrant).

angle (*real,imag*) returns tan⁻¹(*imag/real*).

angle (*magnitude* ∠ *angle*) returns *angle*, −π<*angle*≤π.

For example, **angle (3,4)** returns **.927295218002** and **angle (3 ∠ 4)** returns **-2.2831853O718**.

The ▶Rec Instruction

▶Rec (display as rectangular) displays a complex result in rectangular format. It is valid only at the end of a command. It is not valid if the result is real.

*complexresult***▶Rec** displays (*real,imag*).

For example, √−2**▶Rec** displays **(0,1.41421356237)**, even if the MODE is **PolarC**.

The ▶Pol Instruction

▶Pol (display as polar) displays a complex result in polar format. It is valid only at the end of a command. It is not valid if the result is real.

*complexresult***▶Pol** displays (*magnitude* ∠ *angle*).

For example, even if the MODE is **RectC**, √−2**▶Pol** displays **(1.41421356237 ∠ 1.57O79632679)** in **Radian** MODE.