Chapter 4

Complex Numbers

This calculator is capable of performing the following operations using complex numbers.

- Arithmetic operations (addition, subtraction, multiplication, division)
- Calculation of the reciprocal, square root, and square of a complex number
- Calculation of the absolute value and argument of a complex number
- Calculation of conjugate complex numbers
- Extraction of the real number part
- Extraction of the imaginary number part

4-1 Before Beginning a Complex Number Calculation

Before beginning a complex number calculation, press OPTN F3 (CPLX) to display the complex number calculation menu.

OPTN F3 (CPLX)

F1 (*i*) ..... Input of imaginary unit *i*
F2 (Abs) ..... Calculation of absolute value
F3 (Arg) ..... Calculation of argument
F4 (Conj) ..... Calculation of conjugate
F5 (ReP) ..... Extraction of real number part
F6 (ImP) ..... Extraction of imaginary number part

4-2 Performing Complex Number Calculations

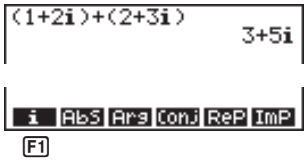
The following examples show how to perform each of the complex number calculations available with this calculator.

■ Arithmetic Operations

Arithmetic operations are the same as those you use for manual calculations. You can even use parentheses and memory.

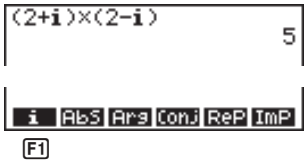
Example 1 **(1 + 2*i*) + (2 + 3*i*)**

AC OPTN F3 (CPLX)
(1 + 2 F1 (*i*)) +
(2 + 3 F1 (*i*)) EXE



Example 2 **(2 + *i*) × (2 – *i*)**

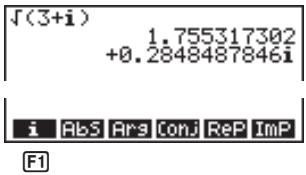
AC OPTN F3 (CPLX)
(2 + F1 (*i*)) ×
(2 − F1 (*i*)) EXE



■ Reciprocals, Square Roots, and Squares

Example $\sqrt{(3 + i)}$

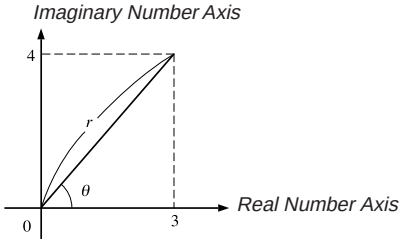
AC OPTN F3 (CPLX)
SHIFT √ (3 + F1 (*i*)) EXE



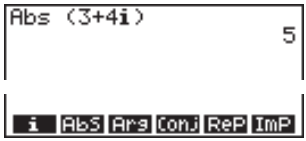
■ Absolute Value and Argument

The unit regards a complex number in the format Z = $a + bi$ as a coordinate on a Gaussian plane, and calculates absolute value $|Z|$ and argument (arg).

Example **To calculate absolute value (r) and argument (θ) for the complex number 3 + 4i, with the angle unit set for degrees**

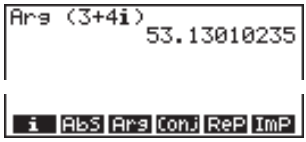


AC OPTN F3 (CPLX) F2 (Abs)
(3 + 4 F1 (i)) EXE
(Calculation of absolute value)



F1 F2

AC OPTN F3 (CPLX) F3 (Arg)
(3 + 4 F1 (i)) EXE
(Calculation of argument)



F1 F3

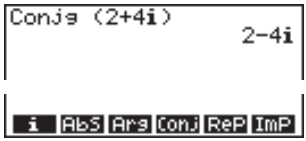
- The result of the argument calculation differs in accordance with the current angle unit setting (degrees, radians, grads).

■ Conjugate Complex Numbers

A complex number of the format $a + bi$ becomes a conjugate complex number of the format $a - bi$.

Example **To calculate the conjugate complex number for the complex number 2 + 4i**

AC OPTN F3 (CPLX) F4 (Conj)
(2 + 4 F1 (i)) EXE



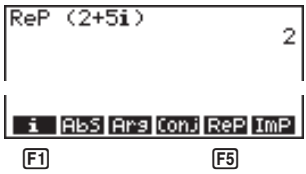
F1 F4

■ Extraction of Real and Imaginary Number Parts

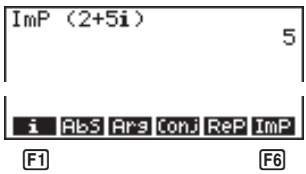
Use the following procedure to extract real part a and imaginary part b from a complex number with the format $a + bi$.

Example **To extract the real and imaginary parts of the complex number 2 + 5*i***

AC OPTN F3 (CPLX) F5 (ReP)
(2 + 5 F1 (*i*)) EXE
(Real part extraction)



AC OPTN F3 (CPLX) F6 (ImP)
(2 + 5 F1 (*i*)) EXE
(Imaginary part extraction)



4-3 Complex Number Calculation Precautions

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- The input/output range of complex numbers is normally 10 digits for the mantissa and two digits for the exponent.
- When a complex number has more than 21 digits, the real number part and imaginary number part are displayed on separate lines.
- When either the real number part or imaginary number part equals zero, that part is not displayed.
- 20 bytes of memory are used whenever you assign a complex number to a variable.
- The following functions can be used with complex numbers.

  $\sqrt{\ }$, x^2, x^{-1}

  Int, Frac, Rnd, Intg, Fix, Sci, ENG, $\overleftarrow{\text{ENG}}$, ° ' ", $\overleftarrow{\text{° ' "}}$, $a\ {}^{b}/_{c}$, d/c, F⇔D