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 part
- Extraction of the imaginary 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.

- {***i***} ... {imaginary unit *i* input}
- {**Abs**}/{**Arg**} ... obtains {absolute value}/{argument}
- {**Conj**} ... {obtains conjugate}
- {**ReP**}/{**ImP**} ... {real}/{imaginary} part extraction

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

[OPTN]-[CPLX]-[*i*]

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

```
(1+2i)+(2+3i)
                3+5i
```

Example 2 **(2 + *i*) × (2 − *i*)**

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

```
(2+i)×(2-i)
                  5
```

■ Reciprocals, Square Roots, and Squares

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

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

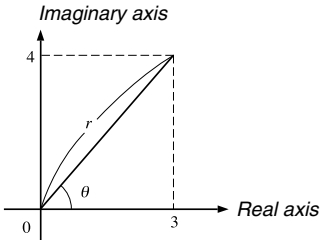
```
√(3+i)
          1.755317302
       +0.2848487846i
```

■ Absolute Value and Argument

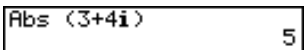
[OPTN]-[CPLX]-[Abs]/[Arg]

The unit regards a complex number in the form $a + bi$ 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 + 4*i*, with the angle unit set for degrees**

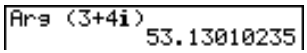


AC OPTN F3 (CPLX) F2 (Abs)
(3 + 4 F1 (*i*)) EXE



(Calculation of absolute value)

AC OPTN F3 (CPLX) F3 (Arg)
(3 + 4 F1 (*i*)) EXE



(Calculation of argument)

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

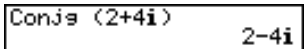
■ Conjugate Complex Numbers

[OPTN]-[CPLX]-[Conj]

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

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

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



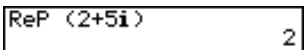
■ Extraction of Real and Imaginary Parts

[OPTN]-[CPLX]-[ReP]/[ImP]

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

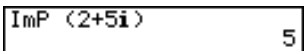
Example **To extract the real and imaginary parts of the complex number 2 + 5*i***

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)

■ Complex Number Calculation Precautions

P.22

- 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 part and imaginary part are displayed on separate lines.
- When either the real part or imaginary 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