

# Complex numbers

Symbol `i` is initialized to  $\sqrt{-1}$ .

Complex quantities can be entered in either rectangular or polar form.

```
a + i b
```

$$a + ib$$

```
exp(1/3 i pi)
```

$$\exp\left(\frac{1}{3}i\pi\right)$$

Converting a complex number to rectangular or polar coordinates causes simplification of mixed forms.

```
A = 1 + i
```

```
B = sqrt(2) exp(1/4 i pi)
```

```
A - B
```

$$1 + i - 2^{1/2} \exp\left(\frac{1}{4}i\pi\right)$$

```
rect(last)
```

$$0$$

Rectangular complex quantities, when raised to a power, are multiplied out.

```
(a + i b)^2
```

$$a^2 - b^2 + 2iab$$

When  $a$  and  $b$  are numerical and the power is negative, the evaluation is done as follows.

$$(a + ib)^{-n} = \left( \frac{a - ib}{(a + ib)(a - ib)} \right)^n = \left( \frac{a - ib}{a^2 + b^2} \right)^n$$

Here are a few examples.

```
1/(2 - i)
```

$$\frac{2}{5} + \frac{1}{5}i$$

```
(-1 + 3 i)/(2 - i)
```

$$-1 + i$$

The absolute value of a complex number returns its magnitude.

```
abs(3 + 4 i)
```

$$5$$

The imaginary unit can be changed from  $i$  to  $j$  by defining  $j = \sqrt{-1}$ .

```
j = sqrt(-1)
```

```
sqrt(-4)
```

$$2j$$