Also note that the type of `_Complex_I` (and hence the type of `I`) is `float _Complex`, not `double _Complex`. When it's used in expressions, `I` will automatically be widened to `double _Complex` or `long double _Complex` if necessary.

The `CX_LIMITED_RANGE` Pragma

#pragma directive ➤ 14.5

The `<complex.h>` header provides a pragma named `CX_LIMITED_RANGE` that allows the compiler to use the following standard formulas for multiplication, division, and absolute value:

$$(a + bi) \times (c + di) = (ac - bd) + (bc + ad)i$$

$$(a + bi)/(c + di) = [(ac + bd) + (bc - ad)i]/(c^2 + d^2)$$

$$|a + bi| = \sqrt{a^2 + b^2}$$

Using these formulas may cause anomalous results in some cases because of overflow or underflow; moreover, the formulas don't handle infinities properly. Because of these potential problems, C99 doesn't use the formulas without the programmer's permission.

The `CX_LIMITED_RANGE` pragma has the following appearance:

```
#pragma STDC CX_LIMITED_RANGE on-off-switch
```

where *on-off-switch* is either `ON`, `OFF`, or `DEFAULT`. If the pragma is used with the value `ON`, it allows the compiler to use the formulas listed above. The value `OFF` causes the compiler to perform the calculations in a way that's safer but possibly slower. The default setting, indicated by the `DEFAULT` choice, is equivalent to `OFF`.

The duration of the `CX_LIMITED_RANGE` pragma depends on where it's used in a program. When it appears at the top level of a source file, outside any external declarations, it remains in effect until the next `CX_LIMITED_RANGE` pragma or the end of the file. The only other place that a `CX_LIMITED_RANGE` pragma might appear is at the beginning of a compound statement (possibly the body of a function); in that case, the pragma remains in effect until the next `CX_LIMITED_RANGE` pragma (even one inside a nested compound statement) or the end of the compound statement. At the end of a compound statement, the state of the switch returns to its value before the compound statement was entered.

`<complex.h>` Functions

The `<complex.h>` header provides functions similar to those in the C99 version of `<math.h>`. The `<complex.h>` functions are divided into groups, just as they were in `<math.h>`: trigonometric, hyperbolic, exponential and logarithmic, and power and absolute-value. The only functions that are unique to complex numbers are the manipulation functions, the last group discussed in this section.