

NAME

complex - basics of complex mathematics

SYNOPSIS

```
#include <complex.h>
```

DESCRIPTION

Complex numbers are numbers of the form $z = a + b*i$, where a and b are real numbers and $i = \sqrt{-1}$, so that $i*i = -1$.

There are other ways to represent that number. The pair (a,b) of real numbers may be viewed as a point in the plane, given by X- and Y-coordinates. This same point may also be described by giving the pair of real numbers (r,ϕ) , where r is the distance to the origin O , and ϕ the angle between the X-axis and the line Oz . Now $z = r*\exp(i*\phi) = r*(\cos(\phi) + i*\sin(\phi))$.

The basic operations are defined on $z = a + b*i$ and $w = c + d*i$ as:

addition: $z + w = (a + c) + (b + d)*i$

multiplication: $z * w = (a*c - b*d) + (a*d + b*c)*i$

division: $z / w = ((a*c + b*d)/(c*c + d*d)) + ((b*c - a*d)/(c*c + d*d))*i$

Nearly all math function have a complex counterpart but there are some complex-only functions.

EXAMPLE

Your C-compiler can work with complex numbers if it supports the C99 standard. Link with *-lm*. The imaginary unit is represented by *I*.

```
/* check that exp(i * pi) == -1 */
#include <math.h> /* for atan */
#include <stdio.h>
#include <complex.h>

int
main(void)
{
    double pi = 4 * atan(1.0);
    double complex z = cexp(I * pi);
    printf("%f + %f * i\n", creal(z), cimag(z));
}
```

SEE ALSO

[cabs\(3\)](#), [cacos\(3\)](#), [cacosh\(3\)](#), [carg\(3\)](#), [casin\(3\)](#), [casinh\(3\)](#), [catan\(3\)](#), [catanh\(3\)](#), [ccos\(3\)](#), [ccosh\(3\)](#), [cerf\(3\)](#), [cexp\(3\)](#), [cexp2\(3\)](#), [cimag\(3\)](#), [clog\(3\)](#), [clog10\(3\)](#), [clog2\(3\)](#), [conj\(3\)](#), [cpow\(3\)](#), [cproj\(3\)](#), [creal\(3\)](#), [csin\(3\)](#), [csinh\(3\)](#), [csqrt\(3\)](#), [ctan\(3\)](#), [ctanh\(3\)](#)

COLOPHON

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