

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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