Mathematical Library Tools in C

In C, the <math.h> library provides a collection of mathematical functions to perform standard mathematical operations. Below is a categorized list of commonly used tools from <math.h>:

1. Basic Arithmetic Functions

- double ceil(double x): Returns the smallest integer greater than or equal to x.
- double floor(double x): Returns the largest integer less than or equal to x.
- double fabs(double x): Returns the absolute value of x.
- double fmod(double x, double y): Returns the remainder of x / y.

2. Power and Exponential Functions

- double pow(double x, double y): Returns x^y (x raised to the power y).
- double sqrt(double x): Returns the square root of x.
- double exp(double x): Returns e^x (exponential function).
- double log(double x): Returns the natural logarithm (ln(x)).
- double log10(double x): Returns the base-10 logarithm of x.

3. Trigonometric Functions

- double sin(double x): Returns the sine of x (angle in radians).
- double cos(double x): Returns the cosine of x (angle in radians).
- double tan(double x): Returns the tangent of x (angle in radians).
- double asin(double x): Returns the arcsine (inverse sine) of x in radians.
- double acos(double x): Returns the arccosine (inverse cosine) of x in radians.
- double atan(double x): Returns the arctangent (inverse tangent) of x in radians.
- double atan2(double y, double x): Returns the angle in radians between the positive x-axis and

the point (x, y).

4. Hyperbolic Functions

- double sinh(double x): Returns the hyperbolic sine of x.
- double cosh(double x): Returns the hyperbolic cosine of x.
- double tanh(double x): Returns the hyperbolic tangent of x.

5. Rounding and Modulus Functions

- double round(double x): Rounds x to the nearest integer.
- double trunc(double x): Returns the integer part of x by truncating the fractional part.

6. Special Functions

- double hypot(double x, double y): Returns sqrt(x^2 + y^2) (Euclidean distance).
- double cbrt(double x): Returns the cube root of x.
- double exp2(double x): Returns 2^x.
- double log2(double x): Returns the base-2 logarithm of x.

Usage Example:

```
#include <stdio.h>
#include <math.h>

int main() {
    double angle = 30.0;
    double radians = angle * M_PI / 180.0; // Convert degrees to radians

    printf("sin(30 degrees) = %f\n", sin(radians));
    printf("cos(30 degrees) = %f\n", cos(radians));
```

```
    printf("sqrt(16) = %f\n", sqrt(16.0));
    printf("pow(2, 3) = %f\n", pow(2.0, 3.0));

    return 0;
}
```

Important Notes:

1. Header File: Always include <math.h> to use these functions.

2. Linking Math Library: When compiling, link the math library using the -lm flag (e.g., gcc program.c -lm).

3. Return Type: Most functions return double. For single-precision or long double versions, use functions like sinf, cosf, sqrtf, sinl, cosl, etc.