| | [**Overview**](http://docs.google.com/overview-summary.html) | [**Package**](http://docs.google.com/package-summary.html) | **Class** | [**Use**](http://docs.google.com/class-use/StrictMath.html) | [**Tree**](http://docs.google.com/package-tree.html) | [**Deprecated**](http://docs.google.com/deprecated-list.html) | [**Index**](http://docs.google.com/index-files/index-1.html) | [**Help**](http://docs.google.com/help-doc.html) | | --- | --- | --- | --- | --- | --- | --- | --- | | | ***Java™ Platform***  ***Standard Ed. 6*** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [**PREV CLASS**](http://docs.google.com/java/lang/StackTraceElement.html)   [**NEXT CLASS**](http://docs.google.com/java/lang/String.html) | [**FRAMES**](http://docs.google.com/index.html?java/lang/StrictMath.html)    [**NO FRAMES**](http://docs.google.com/StrictMath.html)     [**All Classes**](http://docs.google.com/allclasses-noframe.html) |
| SUMMARY: NESTED | [FIELD](#3znysh7) | CONSTR | [METHOD](#2et92p0) | DETAIL: [FIELD](#3dy6vkm) | CONSTR | [METHOD](#2s8eyo1) |

## **java.lang**

Class StrictMath

[java.lang.Object](http://docs.google.com/java/lang/Object.html)  
 **java.lang.StrictMath**

public final class **StrictMath**extends [Object](http://docs.google.com/java/lang/Object.html)

The class StrictMath contains methods for performing basic numeric operations such as the elementary exponential, logarithm, square root, and trigonometric functions.

To help ensure portability of Java programs, the definitions of some of the numeric functions in this package require that they produce the same results as certain published algorithms. These algorithms are available from the well-known network library netlib as the package "Freely Distributable Math Library," [fdlibm](ftp://ftp.netlib.org/fdlibm.tar). These algorithms, which are written in the C programming language, are then to be understood as executed with all floating-point operations following the rules of Java floating-point arithmetic.

The Java math library is defined with respect to fdlibm version 5.3. Where fdlibm provides more than one definition for a function (such as acos), use the "IEEE 754 core function" version (residing in a file whose name begins with the letter e). The methods which require fdlibm semantics are sin, cos, tan, asin, acos, atan, exp, log, log10, cbrt, atan2, pow, sinh, cosh, tanh, hypot, expm1, and log1p.

**Since:** 1.3

| **Field Summary** | |
| --- | --- |
| static double | [**E**](http://docs.google.com/java/lang/StrictMath.html#E)            The double value that is closer than any other to *e*, the base of the natural logarithms. |
| static double | [**PI**](http://docs.google.com/java/lang/StrictMath.html#PI)            The double value that is closer than any other to *pi*, the ratio of the circumference of a circle to its diameter. |

| **Method Summary** | |
| --- | --- |
| static double | [**abs**](http://docs.google.com/java/lang/StrictMath.html#abs(double))(double a)            Returns the absolute value of a double value. |
| static float | [**abs**](http://docs.google.com/java/lang/StrictMath.html#abs(float))(float a)            Returns the absolute value of a float value. |
| static int | [**abs**](http://docs.google.com/java/lang/StrictMath.html#abs(int))(int a)            Returns the absolute value of an int value.. |
| static long | [**abs**](http://docs.google.com/java/lang/StrictMath.html#abs(long))(long a)            Returns the absolute value of a long value. |
| static double | [**acos**](http://docs.google.com/java/lang/StrictMath.html#acos(double))(double a)            Returns the arc cosine of a value; the returned angle is in the range 0.0 through *pi*. |
| static double | [**asin**](http://docs.google.com/java/lang/StrictMath.html#asin(double))(double a)            Returns the arc sine of a value; the returned angle is in the range -*pi*/2 through *pi*/2. |
| static double | [**atan**](http://docs.google.com/java/lang/StrictMath.html#atan(double))(double a)            Returns the arc tangent of a value; the returned angle is in the range -*pi*/2 through *pi*/2. |
| static double | [**atan2**](http://docs.google.com/java/lang/StrictMath.html#atan2(double,%20double))(double y, double x)            Returns the angle *theta* from the conversion of rectangular coordinates (x, y) to polar coordinates (r, *theta*). |
| static double | [**cbrt**](http://docs.google.com/java/lang/StrictMath.html#cbrt(double))(double a)            Returns the cube root of a double value. |
| static double | [**ceil**](http://docs.google.com/java/lang/StrictMath.html#ceil(double))(double a)            Returns the smallest (closest to negative infinity) double value that is greater than or equal to the argument and is equal to a mathematical integer. |
| static double | [**copySign**](http://docs.google.com/java/lang/StrictMath.html#copySign(double,%20double))(double magnitude, double sign)            Returns the first floating-point argument with the sign of the second floating-point argument. |
| static float | [**copySign**](http://docs.google.com/java/lang/StrictMath.html#copySign(float,%20float))(float magnitude, float sign)            Returns the first floating-point argument with the sign of the second floating-point argument. |
| static double | [**cos**](http://docs.google.com/java/lang/StrictMath.html#cos(double))(double a)            Returns the trigonometric cosine of an angle. |
| static double | [**cosh**](http://docs.google.com/java/lang/StrictMath.html#cosh(double))(double x)            Returns the hyperbolic cosine of a double value. |
| static double | [**exp**](http://docs.google.com/java/lang/StrictMath.html#exp(double))(double a)            Returns Euler's number *e* raised to the power of a double value. |
| static double | [**expm1**](http://docs.google.com/java/lang/StrictMath.html#expm1(double))(double x)            Returns *e*x -1. |
| static double | [**floor**](http://docs.google.com/java/lang/StrictMath.html#floor(double))(double a)            Returns the largest (closest to positive infinity) double value that is less than or equal to the argument and is equal to a mathematical integer. |
| static int | [**getExponent**](http://docs.google.com/java/lang/StrictMath.html#getExponent(double))(double d)            Returns the unbiased exponent used in the representation of a double. |
| static int | [**getExponent**](http://docs.google.com/java/lang/StrictMath.html#getExponent(float))(float f)            Returns the unbiased exponent used in the representation of a float. |
| static double | [**hypot**](http://docs.google.com/java/lang/StrictMath.html#hypot(double,%20double))(double x, double y)            Returns sqrt(*x*2 +*y*2) without intermediate overflow or underflow. |
| static double | [**IEEEremainder**](http://docs.google.com/java/lang/StrictMath.html#IEEEremainder(double,%20double))(double f1, double f2)            Computes the remainder operation on two arguments as prescribed by the IEEE 754 standard. |
| static double | [**log**](http://docs.google.com/java/lang/StrictMath.html#log(double))(double a)            Returns the natural logarithm (base *e*) of a double value. |
| static double | [**log10**](http://docs.google.com/java/lang/StrictMath.html#log10(double))(double a)            Returns the base 10 logarithm of a double value. |
| static double | [**log1p**](http://docs.google.com/java/lang/StrictMath.html#log1p(double))(double x)            Returns the natural logarithm of the sum of the argument and 1. |
| static double | [**max**](http://docs.google.com/java/lang/StrictMath.html#max(double,%20double))(double a, double b)            Returns the greater of two double values. |
| static float | [**max**](http://docs.google.com/java/lang/StrictMath.html#max(float,%20float))(float a, float b)            Returns the greater of two float values. |
| static int | [**max**](http://docs.google.com/java/lang/StrictMath.html#max(int,%20int))(int a, int b)            Returns the greater of two int values. |
| static long | [**max**](http://docs.google.com/java/lang/StrictMath.html#max(long,%20long))(long a, long b)            Returns the greater of two long values. |
| static double | [**min**](http://docs.google.com/java/lang/StrictMath.html#min(double,%20double))(double a, double b)            Returns the smaller of two double values. |
| static float | [**min**](http://docs.google.com/java/lang/StrictMath.html#min(float,%20float))(float a, float b)            Returns the smaller of two float values. |
| static int | [**min**](http://docs.google.com/java/lang/StrictMath.html#min(int,%20int))(int a, int b)            Returns the smaller of two int values. |
| static long | [**min**](http://docs.google.com/java/lang/StrictMath.html#min(long,%20long))(long a, long b)            Returns the smaller of two long values. |
| static double | [**nextAfter**](http://docs.google.com/java/lang/StrictMath.html#nextAfter(double,%20double))(double start, double direction)            Returns the floating-point number adjacent to the first argument in the direction of the second argument. |
| static float | [**nextAfter**](http://docs.google.com/java/lang/StrictMath.html#nextAfter(float,%20double))(float start, double direction)            Returns the floating-point number adjacent to the first argument in the direction of the second argument. |
| static double | [**nextUp**](http://docs.google.com/java/lang/StrictMath.html#nextUp(double))(double d)            Returns the floating-point value adjacent to d in the direction of positive infinity. |
| static float | [**nextUp**](http://docs.google.com/java/lang/StrictMath.html#nextUp(float))(float f)            Returns the floating-point value adjacent to f in the direction of positive infinity. |
| static double | [**pow**](http://docs.google.com/java/lang/StrictMath.html#pow(double,%20double))(double a, double b)            Returns the value of the first argument raised to the power of the second argument. |
| static double | [**random**](http://docs.google.com/java/lang/StrictMath.html#random())()            Returns a double value with a positive sign, greater than or equal to 0.0 and less than 1.0. |
| static double | [**rint**](http://docs.google.com/java/lang/StrictMath.html#rint(double))(double a)            Returns the double value that is closest in value to the argument and is equal to a mathematical integer. |
| static long | [**round**](http://docs.google.com/java/lang/StrictMath.html#round(double))(double a)            Returns the closest long to the argument. |
| static int | [**round**](http://docs.google.com/java/lang/StrictMath.html#round(float))(float a)            Returns the closest int to the argument. |
| static double | [**scalb**](http://docs.google.com/java/lang/StrictMath.html#scalb(double,%20int))(double d, int scaleFactor)            Return d × 2scaleFactor rounded as if performed by a single correctly rounded floating-point multiply to a member of the double value set. |
| static float | [**scalb**](http://docs.google.com/java/lang/StrictMath.html#scalb(float,%20int))(float f, int scaleFactor)            Return f × 2scaleFactor rounded as if performed by a single correctly rounded floating-point multiply to a member of the float value set. |
| static double | [**signum**](http://docs.google.com/java/lang/StrictMath.html#signum(double))(double d)            Returns the signum function of the argument; zero if the argument is zero, 1.0 if the argument is greater than zero, -1.0 if the argument is less than zero. |
| static float | [**signum**](http://docs.google.com/java/lang/StrictMath.html#signum(float))(float f)            Returns the signum function of the argument; zero if the argument is zero, 1.0f if the argument is greater than zero, -1.0f if the argument is less than zero. |
| static double | [**sin**](http://docs.google.com/java/lang/StrictMath.html#sin(double))(double a)            Returns the trigonometric sine of an angle. |
| static double | [**sinh**](http://docs.google.com/java/lang/StrictMath.html#sinh(double))(double x)            Returns the hyperbolic sine of a double value. |
| static double | [**sqrt**](http://docs.google.com/java/lang/StrictMath.html#sqrt(double))(double a)            Returns the correctly rounded positive square root of a double value. |
| static double | [**tan**](http://docs.google.com/java/lang/StrictMath.html#tan(double))(double a)            Returns the trigonometric tangent of an angle. |
| static double | [**tanh**](http://docs.google.com/java/lang/StrictMath.html#tanh(double))(double x)            Returns the hyperbolic tangent of a double value. |
| static double | [**toDegrees**](http://docs.google.com/java/lang/StrictMath.html#toDegrees(double))(double angrad)            Converts an angle measured in radians to an approximately equivalent angle measured in degrees. |
| static double | [**toRadians**](http://docs.google.com/java/lang/StrictMath.html#toRadians(double))(double angdeg)            Converts an angle measured in degrees to an approximately equivalent angle measured in radians. |
| static double | [**ulp**](http://docs.google.com/java/lang/StrictMath.html#ulp(double))(double d)            Returns the size of an ulp of the argument. |
| static float | [**ulp**](http://docs.google.com/java/lang/StrictMath.html#ulp(float))(float f)            Returns the size of an ulp of the argument. |

| **Methods inherited from class java.lang.**[**Object**](http://docs.google.com/java/lang/Object.html) |
| --- |
| [clone](http://docs.google.com/java/lang/Object.html#clone()), [equals](http://docs.google.com/java/lang/Object.html#equals(java.lang.Object)), [finalize](http://docs.google.com/java/lang/Object.html#finalize()), [getClass](http://docs.google.com/java/lang/Object.html#getClass()), [hashCode](http://docs.google.com/java/lang/Object.html#hashCode()), [notify](http://docs.google.com/java/lang/Object.html#notify()), [notifyAll](http://docs.google.com/java/lang/Object.html#notifyAll()), [toString](http://docs.google.com/java/lang/Object.html#toString()), [wait](http://docs.google.com/java/lang/Object.html#wait()), [wait](http://docs.google.com/java/lang/Object.html#wait(long)), [wait](http://docs.google.com/java/lang/Object.html#wait(long,%20int)) |

| **Field Detail** |
| --- |

### E

public static final double **E**

The double value that is closer than any other to *e*, the base of the natural logarithms.

**See Also:**[Constant Field Values](http://docs.google.com/constant-values.html#java.lang.StrictMath.E)

### PI

public static final double **PI**

The double value that is closer than any other to *pi*, the ratio of the circumference of a circle to its diameter.

**See Also:**[Constant Field Values](http://docs.google.com/constant-values.html#java.lang.StrictMath.PI)

| **Method Detail** |
| --- |

### sin

public static double **sin**(double a)

Returns the trigonometric sine of an angle. Special cases:

* If the argument is NaN or an infinity, then the result is NaN.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**a - an angle, in radians. **Returns:**the sine of the argument.

### cos

public static double **cos**(double a)

Returns the trigonometric cosine of an angle. Special cases:

* If the argument is NaN or an infinity, then the result is NaN.

**Parameters:**a - an angle, in radians. **Returns:**the cosine of the argument.

### tan

public static double **tan**(double a)

Returns the trigonometric tangent of an angle. Special cases:

* If the argument is NaN or an infinity, then the result is NaN.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**a - an angle, in radians. **Returns:**the tangent of the argument.

### asin

public static double **asin**(double a)

Returns the arc sine of a value; the returned angle is in the range -*pi*/2 through *pi*/2. Special cases:

* If the argument is NaN or its absolute value is greater than 1, then the result is NaN.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**a - the value whose arc sine is to be returned. **Returns:**the arc sine of the argument.

### acos

public static double **acos**(double a)

Returns the arc cosine of a value; the returned angle is in the range 0.0 through *pi*. Special case:

* If the argument is NaN or its absolute value is greater than 1, then the result is NaN.

**Parameters:**a - the value whose arc cosine is to be returned. **Returns:**the arc cosine of the argument.

### atan

public static double **atan**(double a)

Returns the arc tangent of a value; the returned angle is in the range -*pi*/2 through *pi*/2. Special cases:

* If the argument is NaN, then the result is NaN.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**a - the value whose arc tangent is to be returned. **Returns:**the arc tangent of the argument.

### toRadians

public static double **toRadians**(double angdeg)

Converts an angle measured in degrees to an approximately equivalent angle measured in radians. The conversion from degrees to radians is generally inexact.

**Parameters:**angdeg - an angle, in degrees **Returns:**the measurement of the angle angdeg in radians.

### toDegrees

public static double **toDegrees**(double angrad)

Converts an angle measured in radians to an approximately equivalent angle measured in degrees. The conversion from radians to degrees is generally inexact; users should *not* expect cos(toRadians(90.0)) to exactly equal 0.0.

**Parameters:**angrad - an angle, in radians **Returns:**the measurement of the angle angrad in degrees.

### exp

public static double **exp**(double a)

Returns Euler's number *e* raised to the power of a double value. Special cases:

* If the argument is NaN, the result is NaN.
* If the argument is positive infinity, then the result is positive infinity.
* If the argument is negative infinity, then the result is positive zero.

**Parameters:**a - the exponent to raise *e* to. **Returns:**the value *e*a, where *e* is the base of the natural logarithms.

### log

public static double **log**(double a)

Returns the natural logarithm (base *e*) of a double value. Special cases:

* If the argument is NaN or less than zero, then the result is NaN.
* If the argument is positive infinity, then the result is positive infinity.
* If the argument is positive zero or negative zero, then the result is negative infinity.

**Parameters:**a - a value **Returns:**the value ln a, the natural logarithm of a.

### log10

public static double **log10**(double a)

Returns the base 10 logarithm of a double value. Special cases:

* If the argument is NaN or less than zero, then the result is NaN.
* If the argument is positive infinity, then the result is positive infinity.
* If the argument is positive zero or negative zero, then the result is negative infinity.
* If the argument is equal to 10*n* for integer *n*, then the result is *n*.

**Parameters:**a - a value **Returns:**the base 10 logarithm of a.**Since:** 1.5

### sqrt

public static double **sqrt**(double a)

Returns the correctly rounded positive square root of a double value. Special cases:

* If the argument is NaN or less than zero, then the result is NaN.
* If the argument is positive infinity, then the result is positive infinity.
* If the argument is positive zero or negative zero, then the result is the same as the argument.

Otherwise, the result is the double value closest to the true mathematical square root of the argument value.

**Parameters:**a - a value. **Returns:**the positive square root of a.

### cbrt

public static double **cbrt**(double a)

Returns the cube root of a double value. For positive finite x, cbrt(-x) == -cbrt(x); that is, the cube root of a negative value is the negative of the cube root of that value's magnitude. Special cases:

* If the argument is NaN, then the result is NaN.
* If the argument is infinite, then the result is an infinity with the same sign as the argument.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**a - a value. **Returns:**the cube root of a.**Since:** 1.5

### IEEEremainder

public static double **IEEEremainder**(double f1,  
 double f2)

Computes the remainder operation on two arguments as prescribed by the IEEE 754 standard. The remainder value is mathematically equal to f1 - f2 × *n*, where *n* is the mathematical integer closest to the exact mathematical value of the quotient f1/f2, and if two mathematical integers are equally close to f1/f2, then *n* is the integer that is even. If the remainder is zero, its sign is the same as the sign of the first argument. Special cases:

* If either argument is NaN, or the first argument is infinite, or the second argument is positive zero or negative zero, then the result is NaN.
* If the first argument is finite and the second argument is infinite, then the result is the same as the first argument.

**Parameters:**f1 - the dividend.f2 - the divisor. **Returns:**the remainder when f1 is divided by f2.

### ceil

public static double **ceil**(double a)

Returns the smallest (closest to negative infinity) double value that is greater than or equal to the argument and is equal to a mathematical integer. Special cases:

* If the argument value is already equal to a mathematical integer, then the result is the same as the argument.
* If the argument is NaN or an infinity or positive zero or negative zero, then the result is the same as the argument.
* If the argument value is less than zero but greater than -1.0, then the result is negative zero.

Note that the value of StrictMath.ceil(x) is exactly the value of -StrictMath.floor(-x).

**Parameters:**a - a value. **Returns:**the smallest (closest to negative infinity) floating-point value that is greater than or equal to the argument and is equal to a mathematical integer.

### floor

public static double **floor**(double a)

Returns the largest (closest to positive infinity) double value that is less than or equal to the argument and is equal to a mathematical integer. Special cases:

* If the argument value is already equal to a mathematical integer, then the result is the same as the argument.
* If the argument is NaN or an infinity or positive zero or negative zero, then the result is the same as the argument.

**Parameters:**a - a value. **Returns:**the largest (closest to positive infinity) floating-point value that less than or equal to the argument and is equal to a mathematical integer.

### rint

public static double **rint**(double a)

Returns the double value that is closest in value to the argument and is equal to a mathematical integer. If two double values that are mathematical integers are equally close to the value of the argument, the result is the integer value that is even. Special cases:

* If the argument value is already equal to a mathematical integer, then the result is the same as the argument.
* If the argument is NaN or an infinity or positive zero or negative zero, then the result is the same as the argument.

**Parameters:**a - a value. **Returns:**the closest floating-point value to a that is equal to a mathematical integer.

### atan2

public static double **atan2**(double y,  
 double x)

Returns the angle *theta* from the conversion of rectangular coordinates (x, y) to polar coordinates (r, *theta*). This method computes the phase *theta* by computing an arc tangent of y/x in the range of -*pi* to *pi*. Special cases:

* If either argument is NaN, then the result is NaN.
* If the first argument is positive zero and the second argument is positive, or the first argument is positive and finite and the second argument is positive infinity, then the result is positive zero.
* If the first argument is negative zero and the second argument is positive, or the first argument is negative and finite and the second argument is positive infinity, then the result is negative zero.
* If the first argument is positive zero and the second argument is negative, or the first argument is positive and finite and the second argument is negative infinity, then the result is the double value closest to *pi*.
* If the first argument is negative zero and the second argument is negative, or the first argument is negative and finite and the second argument is negative infinity, then the result is the double value closest to -*pi*.
* If the first argument is positive and the second argument is positive zero or negative zero, or the first argument is positive infinity and the second argument is finite, then the result is the double value closest to *pi*/2.
* If the first argument is negative and the second argument is positive zero or negative zero, or the first argument is negative infinity and the second argument is finite, then the result is the double value closest to -*pi*/2.
* If both arguments are positive infinity, then the result is the double value closest to *pi*/4.
* If the first argument is positive infinity and the second argument is negative infinity, then the result is the double value closest to 3\**pi*/4.
* If the first argument is negative infinity and the second argument is positive infinity, then the result is the double value closest to -*pi*/4.
* If both arguments are negative infinity, then the result is the double value closest to -3\**pi*/4.

**Parameters:**y - the ordinate coordinatex - the abscissa coordinate **Returns:**the *theta* component of the point (*r*, *theta*) in polar coordinates that corresponds to the point (*x*, *y*) in Cartesian coordinates.

### pow

public static double **pow**(double a,  
 double b)

Returns the value of the first argument raised to the power of the second argument. Special cases:

* If the second argument is positive or negative zero, then the result is 1.0.
* If the second argument is 1.0, then the result is the same as the first argument.
* If the second argument is NaN, then the result is NaN.
* If the first argument is NaN and the second argument is nonzero, then the result is NaN.
* If
  + the absolute value of the first argument is greater than 1 and the second argument is positive infinity, or
  + the absolute value of the first argument is less than 1 and the second argument is negative infinity,

then the result is positive infinity.

* If
  + the absolute value of the first argument is greater than 1 and the second argument is negative infinity, or
  + the absolute value of the first argument is less than 1 and the second argument is positive infinity,

then the result is positive zero.

* If the absolute value of the first argument equals 1 and the second argument is infinite, then the result is NaN.
* If
  + the first argument is positive zero and the second argument is greater than zero, or
  + the first argument is positive infinity and the second argument is less than zero,

then the result is positive zero.

* If
  + the first argument is positive zero and the second argument is less than zero, or
  + the first argument is positive infinity and the second argument is greater than zero,

then the result is positive infinity.

* If
  + the first argument is negative zero and the second argument is greater than zero but not a finite odd integer, or
  + the first argument is negative infinity and the second argument is less than zero but not a finite odd integer,

then the result is positive zero.

* If
  + the first argument is negative zero and the second argument is a positive finite odd integer, or
  + the first argument is negative infinity and the second argument is a negative finite odd integer,

then the result is negative zero.

* If
  + the first argument is negative zero and the second argument is less than zero but not a finite odd integer, or
  + the first argument is negative infinity and the second argument is greater than zero but not a finite odd integer,

then the result is positive infinity.

* If
  + the first argument is negative zero and the second argument is a negative finite odd integer, or
  + the first argument is negative infinity and the second argument is a positive finite odd integer,

then the result is negative infinity.

* If the first argument is finite and less than zero
  + if the second argument is a finite even integer, the result is equal to the result of raising the absolute value of the first argument to the power of the second argument
  + if the second argument is a finite odd integer, the result is equal to the negative of the result of raising the absolute value of the first argument to the power of the second argument
  + if the second argument is finite and not an integer, then the result is NaN.
* If both arguments are integers, then the result is exactly equal to the mathematical result of raising the first argument to the power of the second argument if that result can in fact be represented exactly as a double value.

(In the foregoing descriptions, a floating-point value is considered to be an integer if and only if it is finite and a fixed point of the method [ceil](http://docs.google.com/java/lang/StrictMath.html#ceil(double)) or, equivalently, a fixed point of the method [floor](http://docs.google.com/java/lang/StrictMath.html#floor(double)). A value is a fixed point of a one-argument method if and only if the result of applying the method to the value is equal to the value.)

**Parameters:**a - base.b - the exponent. **Returns:**the value ab.

### round

public static int **round**(float a)

Returns the closest int to the argument. The result is rounded to an integer by adding 1/2, taking the floor of the result, and casting the result to type int. In other words, the result is equal to the value of the expression:

(int)Math.floor(a + 0.5f)

Special cases:

* If the argument is NaN, the result is 0.
* If the argument is negative infinity or any value less than or equal to the value of Integer.MIN\_VALUE, the result is equal to the value of Integer.MIN\_VALUE.
* If the argument is positive infinity or any value greater than or equal to the value of Integer.MAX\_VALUE, the result is equal to the value of Integer.MAX\_VALUE.

**Parameters:**a - a floating-point value to be rounded to an integer. **Returns:**the value of the argument rounded to the nearest int value.**See Also:**[Integer.MAX\_VALUE](http://docs.google.com/java/lang/Integer.html#MAX_VALUE), [Integer.MIN\_VALUE](http://docs.google.com/java/lang/Integer.html#MIN_VALUE)

### round

public static long **round**(double a)

Returns the closest long to the argument. The result is rounded to an integer by adding 1/2, taking the floor of the result, and casting the result to type long. In other words, the result is equal to the value of the expression:

(long)Math.floor(a + 0.5d)

Special cases:

* If the argument is NaN, the result is 0.
* If the argument is negative infinity or any value less than or equal to the value of Long.MIN\_VALUE, the result is equal to the value of Long.MIN\_VALUE.
* If the argument is positive infinity or any value greater than or equal to the value of Long.MAX\_VALUE, the result is equal to the value of Long.MAX\_VALUE.

**Parameters:**a - a floating-point value to be rounded to a long. **Returns:**the value of the argument rounded to the nearest long value.**See Also:**[Long.MAX\_VALUE](http://docs.google.com/java/lang/Long.html#MAX_VALUE), [Long.MIN\_VALUE](http://docs.google.com/java/lang/Long.html#MIN_VALUE)

### random

public static double **random**()

Returns a double value with a positive sign, greater than or equal to 0.0 and less than 1.0. Returned values are chosen pseudorandomly with (approximately) uniform distribution from that range.

When this method is first called, it creates a single new pseudorandom-number generator, exactly as if by the expression

new java.util.Random

This new pseudorandom-number generator is used thereafter for all calls to this method and is used nowhere else.

This method is properly synchronized to allow correct use by more than one thread. However, if many threads need to generate pseudorandom numbers at a great rate, it may reduce contention for each thread to have its own pseudorandom number generator.

**Returns:**a pseudorandom double greater than or equal to 0.0 and less than 1.0.**See Also:**[Random.nextDouble()](http://docs.google.com/java/util/Random.html#nextDouble())

### abs

public static int **abs**(int a)

Returns the absolute value of an int value.. If the argument is not negative, the argument is returned. If the argument is negative, the negation of the argument is returned.

Note that if the argument is equal to the value of Integer.MIN\_VALUE, the most negative representable int value, the result is that same value, which is negative.

**Parameters:**a - the argument whose absolute value is to be determined. **Returns:**the absolute value of the argument.**See Also:**[Integer.MIN\_VALUE](http://docs.google.com/java/lang/Integer.html#MIN_VALUE)

### abs

public static long **abs**(long a)

Returns the absolute value of a long value. If the argument is not negative, the argument is returned. If the argument is negative, the negation of the argument is returned.

Note that if the argument is equal to the value of Long.MIN\_VALUE, the most negative representable long value, the result is that same value, which is negative.

**Parameters:**a - the argument whose absolute value is to be determined. **Returns:**the absolute value of the argument.**See Also:**[Long.MIN\_VALUE](http://docs.google.com/java/lang/Long.html#MIN_VALUE)

### abs

public static float **abs**(float a)

Returns the absolute value of a float value. If the argument is not negative, the argument is returned. If the argument is negative, the negation of the argument is returned. Special cases:

* If the argument is positive zero or negative zero, the result is positive zero.
* If the argument is infinite, the result is positive infinity.
* If the argument is NaN, the result is NaN.

In other words, the result is the same as the value of the expression:

Float.intBitsToFloat(0x7fffffff & Float.floatToIntBits(a))

**Parameters:**a - the argument whose absolute value is to be determined **Returns:**the absolute value of the argument.

### abs

public static double **abs**(double a)

Returns the absolute value of a double value. If the argument is not negative, the argument is returned. If the argument is negative, the negation of the argument is returned. Special cases:

* If the argument is positive zero or negative zero, the result is positive zero.
* If the argument is infinite, the result is positive infinity.
* If the argument is NaN, the result is NaN.

In other words, the result is the same as the value of the expression:

Double.longBitsToDouble((Double.doubleToLongBits(a)<<1)>>>1)

**Parameters:**a - the argument whose absolute value is to be determined **Returns:**the absolute value of the argument.

### max

public static int **max**(int a,  
 int b)

Returns the greater of two int values. That is, the result is the argument closer to the value of Integer.MAX\_VALUE. If the arguments have the same value, the result is that same value.

**Parameters:**a - an argument.b - another argument. **Returns:**the larger of a and b.**See Also:**[Long.MAX\_VALUE](http://docs.google.com/java/lang/Long.html#MAX_VALUE)

### max

public static long **max**(long a,  
 long b)

Returns the greater of two long values. That is, the result is the argument closer to the value of Long.MAX\_VALUE. If the arguments have the same value, the result is that same value.

**Parameters:**a - an argument.b - another argument. **Returns:**the larger of a and b.**See Also:**[Long.MAX\_VALUE](http://docs.google.com/java/lang/Long.html#MAX_VALUE)

### max

public static float **max**(float a,  
 float b)

Returns the greater of two float values. That is, the result is the argument closer to positive infinity. If the arguments have the same value, the result is that same value. If either value is NaN, then the result is NaN. Unlike the numerical comparison operators, this method considers negative zero to be strictly smaller than positive zero. If one argument is positive zero and the other negative zero, the result is positive zero.

**Parameters:**a - an argument.b - another argument. **Returns:**the larger of a and b.

### max

public static double **max**(double a,  
 double b)

Returns the greater of two double values. That is, the result is the argument closer to positive infinity. If the arguments have the same value, the result is that same value. If either value is NaN, then the result is NaN. Unlike the numerical comparison operators, this method considers negative zero to be strictly smaller than positive zero. If one argument is positive zero and the other negative zero, the result is positive zero.

**Parameters:**a - an argument.b - another argument. **Returns:**the larger of a and b.

### min

public static int **min**(int a,  
 int b)

Returns the smaller of two int values. That is, the result the argument closer to the value of Integer.MIN\_VALUE. If the arguments have the same value, the result is that same value.

**Parameters:**a - an argument.b - another argument. **Returns:**the smaller of a and b.**See Also:**[Long.MIN\_VALUE](http://docs.google.com/java/lang/Long.html#MIN_VALUE)

### min

public static long **min**(long a,  
 long b)

Returns the smaller of two long values. That is, the result is the argument closer to the value of Long.MIN\_VALUE. If the arguments have the same value, the result is that same value.

**Parameters:**a - an argument.b - another argument. **Returns:**the smaller of a and b.**See Also:**[Long.MIN\_VALUE](http://docs.google.com/java/lang/Long.html#MIN_VALUE)

### min

public static float **min**(float a,  
 float b)

Returns the smaller of two float values. That is, the result is the value closer to negative infinity. If the arguments have the same value, the result is that same value. If either value is NaN, then the result is NaN. Unlike the numerical comparison operators, this method considers negative zero to be strictly smaller than positive zero. If one argument is positive zero and the other is negative zero, the result is negative zero.

**Parameters:**a - an argument.b - another argument. **Returns:**the smaller of a and b.

### min

public static double **min**(double a,  
 double b)

Returns the smaller of two double values. That is, the result is the value closer to negative infinity. If the arguments have the same value, the result is that same value. If either value is NaN, then the result is NaN. Unlike the numerical comparison operators, this method considers negative zero to be strictly smaller than positive zero. If one argument is positive zero and the other is negative zero, the result is negative zero.

**Parameters:**a - an argument.b - another argument. **Returns:**the smaller of a and b.

### ulp

public static double **ulp**(double d)

Returns the size of an ulp of the argument. An ulp of a double value is the positive distance between this floating-point value and the double value next larger in magnitude. Note that for non-NaN *x*, ulp(-*x*) == ulp(*x*).

Special Cases:

* If the argument is NaN, then the result is NaN.
* If the argument is positive or negative infinity, then the result is positive infinity.
* If the argument is positive or negative zero, then the result is Double.MIN\_VALUE.
* If the argument is ±Double.MAX\_VALUE, then the result is equal to 2971.

**Parameters:**d - the floating-point value whose ulp is to be returned **Returns:**the size of an ulp of the argument**Since:** 1.5

### ulp

public static float **ulp**(float f)

Returns the size of an ulp of the argument. An ulp of a float value is the positive distance between this floating-point value and the float value next larger in magnitude. Note that for non-NaN *x*, ulp(-*x*) == ulp(*x*).

Special Cases:

* If the argument is NaN, then the result is NaN.
* If the argument is positive or negative infinity, then the result is positive infinity.
* If the argument is positive or negative zero, then the result is Float.MIN\_VALUE.
* If the argument is ±Float.MAX\_VALUE, then the result is equal to 2104.

**Parameters:**f - the floating-point value whose ulp is to be returned **Returns:**the size of an ulp of the argument**Since:** 1.5

### signum

public static double **signum**(double d)

Returns the signum function of the argument; zero if the argument is zero, 1.0 if the argument is greater than zero, -1.0 if the argument is less than zero.

Special Cases:

* If the argument is NaN, then the result is NaN.
* If the argument is positive zero or negative zero, then the result is the same as the argument.

**Parameters:**d - the floating-point value whose signum is to be returned **Returns:**the signum function of the argument**Since:** 1.5

### signum

public static float **signum**(float f)

Returns the signum function of the argument; zero if the argument is zero, 1.0f if the argument is greater than zero, -1.0f if the argument is less than zero.

Special Cases:

* If the argument is NaN, then the result is NaN.
* If the argument is positive zero or negative zero, then the result is the same as the argument.

**Parameters:**f - the floating-point value whose signum is to be returned **Returns:**the signum function of the argument**Since:** 1.5

### sinh

public static double **sinh**(double x)

Returns the hyperbolic sine of a double value. The hyperbolic sine of *x* is defined to be (*ex - e-x*)/2 where *e* is [Euler's number](http://docs.google.com/java/lang/Math.html#E).

Special cases:

* If the argument is NaN, then the result is NaN.
* If the argument is infinite, then the result is an infinity with the same sign as the argument.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**x - The number whose hyperbolic sine is to be returned. **Returns:**The hyperbolic sine of x.**Since:** 1.5

### cosh

public static double **cosh**(double x)

Returns the hyperbolic cosine of a double value. The hyperbolic cosine of *x* is defined to be (*ex + e-x*)/2 where *e* is [Euler's number](http://docs.google.com/java/lang/Math.html#E).

Special cases:

* If the argument is NaN, then the result is NaN.
* If the argument is infinite, then the result is positive infinity.
* If the argument is zero, then the result is 1.0.

**Parameters:**x - The number whose hyperbolic cosine is to be returned. **Returns:**The hyperbolic cosine of x.**Since:** 1.5

### tanh

public static double **tanh**(double x)

Returns the hyperbolic tangent of a double value. The hyperbolic tangent of *x* is defined to be (*ex - e-x*)/(*ex + e-x*), in other words, [sinh(*x*)](http://docs.google.com/java/lang/Math.html#sinh(double))/[cosh(*x*)](http://docs.google.com/java/lang/Math.html#cosh(double)). Note that the absolute value of the exact tanh is always less than 1.

Special cases:

* If the argument is NaN, then the result is NaN.
* If the argument is zero, then the result is a zero with the same sign as the argument.
* If the argument is positive infinity, then the result is +1.0.
* If the argument is negative infinity, then the result is -1.0.

**Parameters:**x - The number whose hyperbolic tangent is to be returned. **Returns:**The hyperbolic tangent of x.**Since:** 1.5

### hypot

public static double **hypot**(double x,  
 double y)

Returns sqrt(*x*2 +*y*2) without intermediate overflow or underflow.

Special cases:

* If either argument is infinite, then the result is positive infinity.
* If either argument is NaN and neither argument is infinite, then the result is NaN.

**Parameters:**x - a valuey - a value **Returns:**sqrt(*x*2 +*y*2) without intermediate overflow or underflow**Since:** 1.5

### expm1

public static double **expm1**(double x)

Returns *e*x -1. Note that for values of *x* near 0, the exact sum of expm1(x) + 1 is much closer to the true result of *e*x than exp(x).

Special cases:

* If the argument is NaN, the result is NaN.
* If the argument is positive infinity, then the result is positive infinity.
* If the argument is negative infinity, then the result is -1.0.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**x - the exponent to raise *e* to in the computation of *e*x -1. **Returns:**the value *e*x - 1.**Since:** 1.5

### log1p

public static double **log1p**(double x)

Returns the natural logarithm of the sum of the argument and 1. Note that for small values x, the result of log1p(x) is much closer to the true result of ln(1 + x) than the floating-point evaluation of log(1.0+x).

Special cases:

* If the argument is NaN or less than -1, then the result is NaN.
* If the argument is positive infinity, then the result is positive infinity.
* If the argument is negative one, then the result is negative infinity.
* If the argument is zero, then the result is a zero with the same sign as the argument.

**Parameters:**x - a value **Returns:**the value ln(x + 1), the natural log of x + 1**Since:** 1.5

### copySign

public static double **copySign**(double magnitude,  
 double sign)

Returns the first floating-point argument with the sign of the second floating-point argument. For this method, a NaN sign argument is always treated as if it were positive.

**Parameters:**magnitude - the parameter providing the magnitude of the resultsign - the parameter providing the sign of the result **Returns:**a value with the magnitude of magnitude and the sign of sign.**Since:** 1.6

### copySign

public static float **copySign**(float magnitude,  
 float sign)

Returns the first floating-point argument with the sign of the second floating-point argument. For this method, a NaN sign argument is always treated as if it were positive.

**Parameters:**magnitude - the parameter providing the magnitude of the resultsign - the parameter providing the sign of the result **Returns:**a value with the magnitude of magnitude and the sign of sign.**Since:** 1.6

### getExponent

public static int **getExponent**(float f)

Returns the unbiased exponent used in the representation of a float. Special cases:

* If the argument is NaN or infinite, then the result is [Float.MAX\_EXPONENT](http://docs.google.com/java/lang/Float.html#MAX_EXPONENT) + 1.
* If the argument is zero or subnormal, then the result is [Float.MIN\_EXPONENT](http://docs.google.com/java/lang/Float.html#MIN_EXPONENT) -1.

**Parameters:**f - a float value**Since:** 1.6

### getExponent

public static int **getExponent**(double d)

Returns the unbiased exponent used in the representation of a double. Special cases:

* If the argument is NaN or infinite, then the result is [Double.MAX\_EXPONENT](http://docs.google.com/java/lang/Double.html#MAX_EXPONENT) + 1.
* If the argument is zero or subnormal, then the result is [Double.MIN\_EXPONENT](http://docs.google.com/java/lang/Double.html#MIN_EXPONENT) -1.

**Parameters:**d - a double value**Since:** 1.6

### nextAfter

public static double **nextAfter**(double start,  
 double direction)

Returns the floating-point number adjacent to the first argument in the direction of the second argument. If both arguments compare as equal the second argument is returned.

Special cases:

* If either argument is a NaN, then NaN is returned.
* If both arguments are signed zeros, direction is returned unchanged (as implied by the requirement of returning the second argument if the arguments compare as equal).
* If start is ±[Double.MIN\_VALUE](http://docs.google.com/java/lang/Double.html#MIN_VALUE) and direction has a value such that the result should have a smaller magnitude, then a zero with the same sign as start is returned.
* If start is infinite and direction has a value such that the result should have a smaller magnitude, [Double.MAX\_VALUE](http://docs.google.com/java/lang/Double.html#MAX_VALUE) with the same sign as start is returned.
* If start is equal to ± [Double.MAX\_VALUE](http://docs.google.com/java/lang/Double.html#MAX_VALUE) and direction has a value such that the result should have a larger magnitude, an infinity with same sign as start is returned.

**Parameters:**start - starting floating-point valuedirection - value indicating which of start's neighbors or start should be returned **Returns:**The floating-point number adjacent to start in the direction of direction.**Since:** 1.6

### nextAfter

public static float **nextAfter**(float start,  
 double direction)

Returns the floating-point number adjacent to the first argument in the direction of the second argument. If both arguments compare as equal a value equivalent to the second argument is returned.

Special cases:

* If either argument is a NaN, then NaN is returned.
* If both arguments are signed zeros, a value equivalent to direction is returned.
* If start is ±[Float.MIN\_VALUE](http://docs.google.com/java/lang/Float.html#MIN_VALUE) and direction has a value such that the result should have a smaller magnitude, then a zero with the same sign as start is returned.
* If start is infinite and direction has a value such that the result should have a smaller magnitude, [Float.MAX\_VALUE](http://docs.google.com/java/lang/Float.html#MAX_VALUE) with the same sign as start is returned.
* If start is equal to ± [Float.MAX\_VALUE](http://docs.google.com/java/lang/Float.html#MAX_VALUE) and direction has a value such that the result should have a larger magnitude, an infinity with same sign as start is returned.

**Parameters:**start - starting floating-point valuedirection - value indicating which of start's neighbors or start should be returned **Returns:**The floating-point number adjacent to start in the direction of direction.**Since:** 1.6

### nextUp

public static double **nextUp**(double d)

Returns the floating-point value adjacent to d in the direction of positive infinity. This method is semantically equivalent to nextAfter(d, Double.POSITIVE\_INFINITY); however, a nextUp implementation may run faster than its equivalent nextAfter call.

Special Cases:

* If the argument is NaN, the result is NaN.
* If the argument is positive infinity, the result is positive infinity.
* If the argument is zero, the result is [Double.MIN\_VALUE](http://docs.google.com/java/lang/Double.html#MIN_VALUE)

**Parameters:**d - starting floating-point value **Returns:**The adjacent floating-point value closer to positive infinity.**Since:** 1.6

### nextUp

public static float **nextUp**(float f)

Returns the floating-point value adjacent to f in the direction of positive infinity. This method is semantically equivalent to nextAfter(f, Float.POSITIVE\_INFINITY); however, a nextUp implementation may run faster than its equivalent nextAfter call.

Special Cases:

* If the argument is NaN, the result is NaN.
* If the argument is positive infinity, the result is positive infinity.
* If the argument is zero, the result is [Float.MIN\_VALUE](http://docs.google.com/java/lang/Float.html#MIN_VALUE)

**Parameters:**f - starting floating-point value **Returns:**The adjacent floating-point value closer to positive infinity.**Since:** 1.6

### scalb

public static double **scalb**(double d,  
 int scaleFactor)

Return d × 2scaleFactor rounded as if performed by a single correctly rounded floating-point multiply to a member of the double value set. See the Java Language Specification for a discussion of floating-point value sets. If the exponent of the result is between [Double.MIN\_EXPONENT](http://docs.google.com/java/lang/Double.html#MIN_EXPONENT) and [Double.MAX\_EXPONENT](http://docs.google.com/java/lang/Double.html#MAX_EXPONENT), the answer is calculated exactly. If the exponent of the result would be larger than Double.MAX\_EXPONENT, an infinity is returned. Note that if the result is subnormal, precision may be lost; that is, when scalb(x, n) is subnormal, scalb(scalb(x, n), -n) may not equal *x*. When the result is non-NaN, the result has the same sign as d.

Special cases:

* If the first argument is NaN, NaN is returned.
* If the first argument is infinite, then an infinity of the same sign is returned.
* If the first argument is zero, then a zero of the same sign is returned.

**Parameters:**d - number to be scaled by a power of two.scaleFactor - power of 2 used to scale d **Returns:**d × 2scaleFactor**Since:** 1.6

### scalb

public static float **scalb**(float f,  
 int scaleFactor)

Return f × 2scaleFactor rounded as if performed by a single correctly rounded floating-point multiply to a member of the float value set. See the Java Language Specification for a discussion of floating-point value sets. If the exponent of the result is between [Float.MIN\_EXPONENT](http://docs.google.com/java/lang/Float.html#MIN_EXPONENT) and [Float.MAX\_EXPONENT](http://docs.google.com/java/lang/Float.html#MAX_EXPONENT), the answer is calculated exactly. If the exponent of the result would be larger than Float.MAX\_EXPONENT, an infinity is returned. Note that if the result is subnormal, precision may be lost; that is, when scalb(x, n) is subnormal, scalb(scalb(x, n), -n) may not equal *x*. When the result is non-NaN, the result has the same sign as f.

Special cases:

* If the first argument is NaN, NaN is returned.
* If the first argument is infinite, then an infinity of the same sign is returned.
* If the first argument is zero, then a zero of the same sign is returned.

**Parameters:**f - number to be scaled by a power of two.scaleFactor - power of 2 used to scale f **Returns:**f × 2scaleFactor**Since:** 1.6

| | [**Overview**](http://docs.google.com/overview-summary.html) | [**Package**](http://docs.google.com/package-summary.html) | **Class** | [**Use**](http://docs.google.com/class-use/StrictMath.html) | [**Tree**](http://docs.google.com/package-tree.html) | [**Deprecated**](http://docs.google.com/deprecated-list.html) | [**Index**](http://docs.google.com/index-files/index-1.html) | [**Help**](http://docs.google.com/help-doc.html) | | --- | --- | --- | --- | --- | --- | --- | --- | | | ***Java™ Platform***  ***Standard Ed. 6*** |
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For further API reference and developer documentation, see [Java SE Developer Documentation](http://docs.google.com/webnotes/devdocs-vs-specs.html). That documentation contains more detailed, developer-targeted descriptions, with conceptual overviews, definitions of terms, workarounds, and working code examples.

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