Module 3:
JAVA Mathematical Functions

Java Math Class

- Java Math class provides several methods to work on math calculations like min(), max(), avg(), sin(), cos(), tan(), round(), ceil(), floor(), abs() etc.

- Unlike some of the StrictMath class numeric methods, all implementations of the equivalent function of Math class can't define to return the bit-for-bit same results. This relaxation permits implementation with better-performance where strict reproducibility is not required.

- The java.lang.Math contains a set of basic math functions for obtaining the absolute value, highest and lowest of two values, rounding of values, random values etc. These basic math functions of the Java Math class will be covered in the following sections. It is invoked by default.

Math Class Basic Functions

- ***Math.abs():*** The Math.abs() function returns the absolute value of the parameter passed to it. The absolute value is the positive value of the parameter. If the parameter value is negative, the negative sign is removed and the positive value corresponding to the negative value without sign is returned. The absolute value of 10 is 10. The absolute value of -20 is 20.

- <u>For Example</u>: int abs1 = Math.abs(10); // abs1 = 10

    int abs2 = Math.abs(-20); // abs2 = 20

- ***Math.min():*** The Math.min() method returns the smallest of two values passed to it as parameter. Here is a Math.min() Java example: **int min = Math.min(10, 20)**. After executing this code the min variable will contain the value 10.

- ***Math.max():*** The Math.max() method returns the largest of two values passed to it as parameter. Here is a Math.max() Java example: **int max = Math.max(10, 20).** After executing this code the max variable will contain the value 20.

- ***Math.round():*** The Math.round() method rounds a float or double to the nearest integer using normal math round rules (either up or down). Here is a Java Math.round() example:
    - double roundedDown = Math.round(23.445);
    - double roundedUp   = Math.round(23.545);

After executing these two Java statements the roundedDown variable will contain the value 23.0 , and the roundedUp variable will contain the value 24.0.

Some More Functions

- *Math.random():*
  - The Math.random() method returns a random floating point number between 0 and 1. Of course the number is not fully random, but the result of some calculation which is supposed to make it as unpredictable as possible. Here is a Java Math.Random() example: **double random = Math.random();**
  - To get a random value between 0 and e.g. 100, multiply the value returned by Math.random() with the maximum number (e.g. 100).
  - Here is an example of how that might look: **double random = Math.random() * 100D;**
- *Math.ceil():*
  - The Math.ceil() function rounds a floating point value up to the nearest integer value. The rounded value is returned as a double.
  - Here is a Math.ceil() Java example: **double ceil = Math.ceil(7.343); // ceil = 8.0**
- *Math.floor():*
  - The Math.floor() function rounds a floating point value down to the nearest integer value. The rounded value is returned as a double.
  - Here is a Math.floor() Java example: **double floor = Math.floor(7.343); // floor = 7.0**
- **Math.rint():** It returns the **double(data type)** value that is closest to the given argument and equal to mathematical integer. **For Example:- Math.rint(1654.9874)=1655.0**

Java.lang.Math Library

- Java.lang.Math Library contains several types of functions:-
  - Basic Math Functions (Ex:- Math.pow(int a,int b) ; Math.sqrt(int a);)
  - Trigonometric Math Functions (Ex:- Math.sin(int a); Math.cos(int b);)
  - Logarithmic Math Methods (Ex:- Math.log();)
  - Hyperbolic Math Methods (Ex:- Math.sinh();)
  - Angular Math Methods (Ex:- Math.to Degrees)

- Note:- There are 100 of functions in java math class, but we will study and work on some, as they are beyond the syllabus of this course.

Some Basic Functions Just to Remember

Method	Description
Math.abs()	It will return the Absolute value of the given value.
Math.max()	It returns the Largest of two values.
Math.min()	It is used to return the Smallest of two values.
Math.round()	It is used to round of the decimal numbers to the nearest value.
Math.sqrt()	It is used to return the square root of a number.
Math.cbrt()	It is used to return the cube root of a number.
Math.pow()	It returns the value of first argument raised to the power to second argument.
Math.signum()	It is used to find the sign of a given value.
Math.ceil()	It is used to find the smallest integer value that is greater than or equal to the argument or mathematical integer.
Math.copySign()	It is used to find the Absolute value of first argument along with sign specified in second argument.

Math.nextAfter()	It is used to return the floating-point number adjacent to the first argument in the direction of the second argument.
Math.nextUp()	It returns the floating-point value adjacent to d in the direction of positive infinity.
Math.nextDown()	It returns the floating-point value adjacent to d in the direction of negative infinity.
Math.floor()	It is used to find the largest integer value which is less than or equal to the argument and is equal to the mathematical integer of a double value.
Math.floorDiv()	It is used to find the largest integer value that is less than or equal to the algebraic quotient.
Math.random()	It returns a double value with a positive sign, greater than or equal to 0.0 and less than 1.0.
Math.rint()	It returns the double value that is closest to the given argument and equal to mathematical integer.

Some Logarithmic And Trigonometric Functions

Method	Description
Math.log()	It returns the natural logarithm of a double value.
Math.log10()	It is used to return the base 10 logarithm of a double value.
Math.log1p()	It returns the natural logarithm of the sum of the argument and 1.
Math.exp()	It returns E raised to the power of a double value, where E is Euler's number and it is approximately equal to 2.71828.
Math.expm1()	It is used to calculate the power of E and subtract one from it.

Method	Description
Math.sin()	It is used to return the trigonometric Sine value of a Given double value.
Math.cos()	It is used to return the trigonometric Cosine value of a Given double value.
Math.tan()	It is used to return the trigonometric Tangent value of a Given double value.
Math.asin()	It is used to return the trigonometric Arc Sine value of a Given double value
Math.acos()	It is used to return the trigonometric Arc Cosine value of a Given double value.
Math.atan()	It is used to return the trigonometric Arc Tangent value of a Given double value.