Java Math Library

The `Math` class in Java belongs to the `java.lang` package and provides many static methods for performing **mathematical operations** like square root, trigonometry, logarithms, rounding, etc.

You don't need to import this class separately as it's part of the default `java.lang` package.
All methods are **static**, so you can use them **directly with the class name**: `Math.methodName()`.

Commonly Used Methods in `Math` Class

Method	Description	Example
`Math.abs(x)`	Returns absolute value of x	`Math.abs(-5) → 5`
`Math.max(a, b)`	Returns larger value	`Math.max(4, 7) → 7`
`Math.min(a, b)`	Returns smaller value	`Math.min(4, 7) → 4`
`Math.sqrt(x)`	Returns square root of x	`Math.sqrt(25) → 5.0`
`Math.pow(a, b)`	Returns a raised to the power of b	`Math.pow(2, 3) → 8.0`
`Math.cbrt(x)`	Returns cube root of x	`Math.cbrt(27) → 3.0`
`Math.round(x)`	Rounds to nearest integer	`Math.round(4.6) → 5`
`Math.ceil(x)`	Rounds **upward**	`Math.ceil(4.3) → 5.0`
`Math.floor(x)`	Rounds **downward**	`Math.floor(4.9) → 4.0`
`Math.random()`	Returns a random double between 0.0 and 1.0	`Math.random()`
`Math.log(x)`	Returns natural logarithm (base e)	`Math.log(1) → 0.0`
`Math.log10(x)`	Returns logarithm base 10	`Math.log10(100) → 2.0`
`Math.sin(x)`	Returns sine of angle in radians	`Math.sin(Math.PI/2) → 1.0`
`Math.cos(x)`	Returns cosine of angle	`Math.cos(0) → 1.0`
`Math.tan(x)`	Returns tangent of angle	`Math.tan(Math.PI/4) → 1.0`

Constants in Math Class

Constant	Value
`Math.PI`	3.141592653589793
`Math.E`	2.718281828459045

Example Java Program

```
public class MathDemo {
    public static void main(String[] args) {
        System.out.println("Absolute: " + Math.abs(-10));
        System.out.println("Max: " + Math.max(5, 9));
        System.out.println("Power: " + Math.pow(2, 3));
        System.out.println("Random number: " + Math.random());
        System.out.println("Sine of 90 degrees: " +
Math.sin(Math.toRadians(90)));
    }
}
```

Important Points

- All methods are **static**.
- Angles used in trigonometric functions must be in **radians**.
- `Math.random()` gives a value between **0.0 (inclusive)** and **1.0 (exclusive)**.

Loops in Java

Types of Loops:

1. `for` loop
2. `while` loop
3. `do-while` loop

1. `for` Loop

Used when: Number of iterations is known in advance.

Syntax:

```
for (initialization; condition; update) {
    // code block
}
```

Example:

```
for (int i = 1; i <= 5; i++) {
    System.out.println(i);
}
```

2. `while` Loop

Used when: Number of iterations is **not known** in advance.

Syntax:

```
while (condition) {
    // code block
}
```

Example:

```
int i = 1;
while (i <= 5) {
    System.out.println(i);
    i++;
}
```

3. `do-while` Loop

Used when: Loop should run **at least once**.

Syntax:

```
do {
    // code block
} while (condition);
```

Example:

```
int i = 1;
do {
    System.out.println(i);
    i++;
} while (i<= 5);
```

Loop Control Statements

Keyword	Description
`break`	Terminates the loop immediately
`continue`	Skips current iteration and continues the loop

Example – `break`:

```
for (int i = 1; i <= 5; i++) {
    if (i == 3) break;
    System.out.println(i);
}
```

Example – `continue`:

```
for (int i = 1; i <= 5; i++) {
    if (i == 3) continue;
    System.out.println(i);
}
```