Methods

What is a method?

In mathematics, you might have studied about functions. For example, $f(x) = x^2$ is a function that returns squared value of *x*.

If x = 2, then f(2) = 4
If x = 3, f(3) = 9
and so on.

Similarly, in programming, a function is a block of code that performs a specific task.

In object-oriented programming, method is a jargon used for function. Methods are bound to a class and they define the behavior of a class.

Types of Java methods

Depending on whether a method is defined by the user, or available in standard library, there are two types of methods:

- Standard Library Methods
- User-defined Methods

Standard Library Methods

The standard library methods are built-in methods in Java that are readily available for use. These standard libraries come along with the Java Class Library (JCL) in a Java archive (*.jar) file with JVM and JRE.

For example,

- print() is a method of java.io.PrintSteam. The print("...") prints the string inside quotation marks.
- sqrt() is a method of Math class. It returns square root of a number.

Here's an working example:

```
public class Numbers {

   public static void main(String[] args) {
      System.out.print("Square root of 4 is: " + Math.sqrt(4));

   }
```

When you run the program, the output will be:

```
Square root of 4 is: 2.0
```

User-defined Method

You can also define methods inside a class as per your wish. Such methods are called user-defined methods.

How to create a user-defined method?

Before you can use (call a method), you need to define it.

Here is how you define methods in Java.

```
public static void myMethod() {
        System.out.println("My Function called");
}
```

Here, a method named myMethod() is defined.

The complete syntax for defining a Java method is:

```
modifier static returnType nameOfMethod (Parameter List) {
        // method body
}
```

Here,

- modifier - defines access type whether the method is public, private and so on.
- static - If you use `static` keyword in a method then it becomes a static method. Static methods can be called without creating an instance of a class.

  For example, the `sqrt()` method of standard Math class is static. Hence, we can directly call `Math.sqrt()` without creating an instance of Math class.
- returnType - A method can return a value.

  It can return native data types (int, float, double etc.), native objects (String, Map, List etc.), or any other built-in and user defined objects.

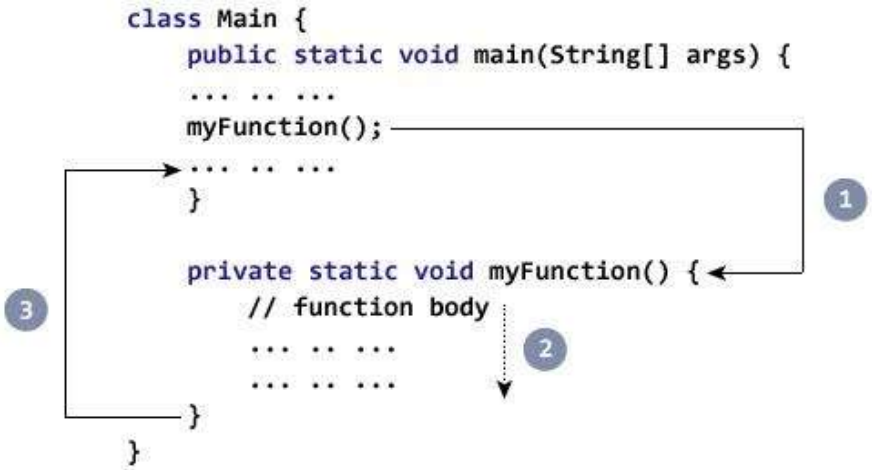
  If the method does not return a value, its return type is void.
- nameOfMethod - The name of the method is an identifier.

  You can give any name to a method. However, it is more conventional to name it after the tasks it performs. For example, *calculateInterest*, *calculateArea*, and so on.
- Parameters (arguments) - Parameters are the values passed to a method. You can pass any number of arguments to a method.
- Method body - It defines what the method actually does, how the parameters are manipulated with programming statements and what values are returned. The codes inside curly braces { } is the body of the method.

How to call a Java Method?
Now you defined a method, you need to use it. For that, you have to call the method. Here's how:

```
myMethod();
```

This statement calls the `myMethod()` method that was declared earlier.



1. While Java is executing the program code, it encounters `myMethod();` in the code.
2. The execution then branches to the `myFunction()` method, and executes code inside the body of the method.
3. After the codes execution inside the method body is completed, the program returns to the original state and executes the next statement.

Example: Complete Program of Java Method
Let's see a Java method in action by defining a Java class.

```
class Main {


  public static void main(String[] args) {
    System.out.println("About to encounter a
    method.");


    System.out.println("Method was executed successfully!");
  }


  // method definition
  private static void myMethod(){
```

When you run the program, the output will be:

```
About to encounter a method.
Printing from inside myMethod().
Method was executed successfully!
```

The method myMethod() in the above program doesn't accept any arguments. Also, the method doesn't return any value (return type is void).
Note that, we called the method without creating object of the class. It was possible because myMethod() is static.
Here's another example. In this example, our method is non-static and is inside another class.

```
class Main {


  public static void main(String[] args) {

    Output obj = new Output();

    System.out.println("About to encounter a method.");


    // calling myMethod() of Output class
    obj.myMethod();


    System.out.println("Method was executed successfully!");

  }

}
```

When you run the program, the output will be:

```
About to encounter a method.
Printing from inside myMethod().
Method was executed successfully!
```

Note that, we first created instance of *Output* class, then the method was called using *obj*object. This is because myMethod() is a non-static method.

Java Methods with Arguments and Return Value
A Java method can have zero or more parameters. And, they may return a value.

Example: Return Value from Method
Let's take an example of method returning a value.

```
class SquareMain {

   public static void main(String[] args) {
      int result;

      result = square();

      System.out.println("Squared value of 10 is: " + result);

   }

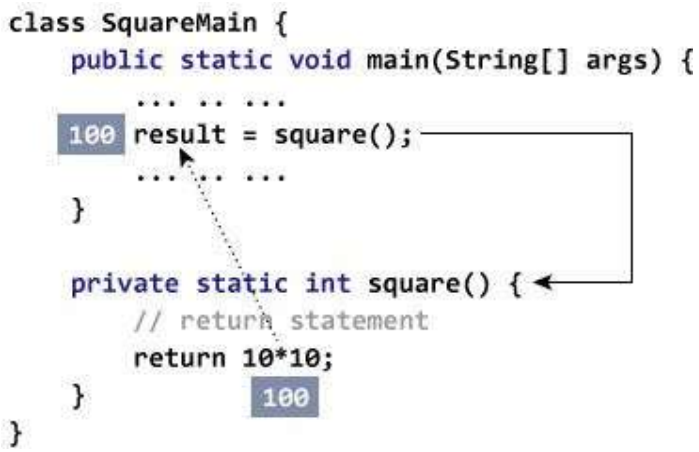


       public static int square() {
```

When you run the program, the output will be:

```
Squared value of 10 is: 100
```

In the above code snippet, the method square() does not accept any arguments and always returns the value of 10 squared.
Notice, the return type of square() method is int. Meaning, the method returns an integer value.



As you can see, the scope of this method is limited as it always returns the same value.
Now, let's modify the above code snippet so that instead of always returning the squared value of 10, it returns the squared value of any integer passed to the method.

Example: Method Accepting Arguments and Returning Value

```
public class SquareMain {


   public static void main(String[] args) {int
      result, n;
```

```
*

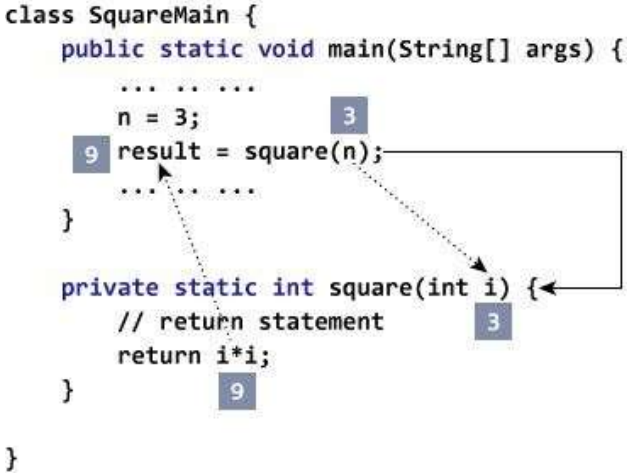
      n = 4

      result = square(n);

      System.out.println("Square of 4 is: " + result);

   }
```

When you run the program, the output will be:
Now, the square() method returns the squared value of whatever integer value passed to it.



Java is a strongly-typed language. If you pass any other data type except int (in the above example), compiler will throw an error.
The argument passed *n* to the getSquare() method during the method call is called actual argument.

```
result = getSquare(n);
```

The parameter *i* accepts the passed arguments in the method definition getSquare(int i). This is called formal argument (parameter). The type of the formal argument must be explicitly typed.
You can pass more than one argument to the Java method by using commas. For example,

```
public class ArithematicMain {


   public static int getIntegerSum (int i, int j) {
      return i + j;

   }
```

```
Squared value of 3 is: 9
Squared value of 4 is: 16
```

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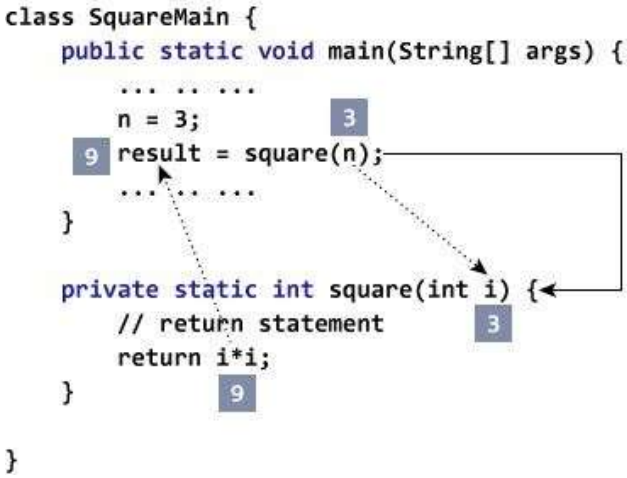

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public class ArithematicMain {


   public static int getIntegerSum (int i, int j) {
      return i + j;

   }
```

```
public static void main(String[] args) { System.out.println("10
    + 20 = " + getIntegerSum(10, 20)); System.out.println("20
    x 40 = " + multiplyInteger(20, 40));

}
```

When you run the program, the output will be:

```
10 + 20 = 30
20 x 40 = 800
```

The data type of actual and formal arguments should match, i.e., the data type of first actual argument should match the type of first formal argument. Similarly, the type of second actual argument must match the type of second formal argument and so on.

Example: Get Squared Value of Numbers from 1 to 5

```
public class JMethods {



   // method defined

   private static int getSquare(int x){
      return x * x;

   }



   public static void main(String[] args) {for
      (int i = 1; i <= 5; i++) {
```

When you run the program, the output will be:

```
Square of 1 is : 1
Square of 2 is : 4
Square of 3 is : 9
Square of 4 is : 16
Square of 5 is : 25
```

In above code snippet, the method getSquare() takes int as a parameter. Based on the argument passed, the method returns the squared value of it.

Here, argument *i* of type int is passed to the getSquare() method during method call.

```
result = getSquare(i);
```

The parameter *x* accepts the passed argument [in the function definition getSquare(int x)]. return i * i; is the return statement. The code returns a value to the calling method and terminates the function.

Did you notice, we reused the getSquare method 5 times?

What are the advantages of using methods?

1. The main advantage is code reusability. You can write a method once, and use it multiple times. You do not have to rewrite the entire code each time. Think of it as, "write once, reuse multiple times."
- Methods make code more readable and easier to debug. For example, getSalaryInformation() method is so readable, that we can know what this method will be doing than actually reading the lines of code that make this method.