

# Polymorphism in OOP

In this lesson, we will be implementing polymorphism using the OOP concepts.

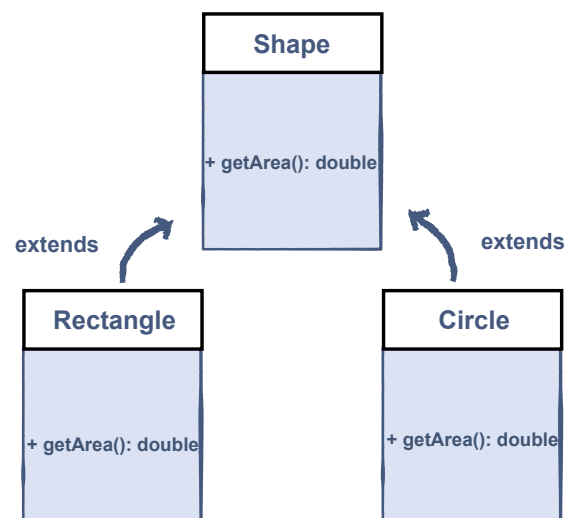
## WE'LL COVER THE FOLLOWING ^

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So far, we have learned that we can add new data and methods to a class through inheritance. But what if we want our derived class to inherit a method from the base class and have a different implementation for it? That is when polymorphism, a fundamental concept in the OOP paradigm, comes into play.

## Example #

Here we consider the example of a **Shape** class, which is the base class while many shapes like *Rectangle* and *Circle* extending from the base class are derived classes. These classes contain the **getArea()** method which calculates the area for the respective shape.



# Implementation #

We will be implementing the **Base** class and the **Derived** classes respectively.

## Shape Class #

The **Shape** class has only one public method called `getArea()`.

Let's look at the implementation of the **Shape** class:

```
// A simple Shape which provides a method to get the Shape's area
class Shape {

    public double getArea(){}

}
```



## Rectangle Class #

Now, consider the **Rectangle** class which is extended from the *Shape* class. It has two data members, i.e., `width` and `height` and it returns the *Area* of the rectangle by using the `getArea()` method.

Let's look at the implementation of the **Rectangle** class:

```
// A Rectangle is a Shape with a specific width and height
class Rectangle extends Shape { // derived form Shape class

    // Private data members
    private double width;
    private double height;

    // Constructor
    public Rectangle(double width, double height) {
        this.width = width;
        this.height = height;
    }

    // Public method to calculate Area
    public double getArea() {
        return width * height;
    }

}
```



## Circle Class #

Now, consider the **Circle** class which is extended from the *Shape* class. It has only one data member, i.e., *radius* and it returns the *Area* of the circle by using the **getArea()** method.

Let's look at the implementation of the **Circle** class:

```
// A Circle is a Shape with a specific radius
class Circle extends Shape {

    // Private data member
    private double radius;

    // Constructor
    public Circle(double radius) {
        radius = radius;
    }

    // Public method to calculate Area
    public double getArea() {
        return 3.14 * radius * radius;
    }

}
```

## Complete Program #

Now, by merging all the classes and calling the **getArea()** method, see what happens:

```
// A sample class Shape which provides a method to get the Shape's area

class Shape {

    public double getArea() {
        return 0;
    }

}

// A Rectangle is a Shape with a specific width and height
class Rectangle extends Shape {    // extended form the Shape class

    private double width;
    private double height;

    public Rectangle(double width, double heigh) {
        this.width = width;
        this.height = heigh;
    }

    public double getArea() {
        return width * height;
    }

}
```

```
}

// A Circle is a Shape with a specific radius

class Circle extends Shape {
    private double radius;

    public Circle(double radius) {
        this.radius = radius;
    }
    public double getArea() {
        return 3.14 * radius * radius;
    }
}

class driver {

    public static void main(String args[]) {
        Shape[] shape = new Shape[2]; // Creating shape array of size 2

        shape[0] = new Circle(2); // creating circle object at index 0
        shape[1] = new Rectangle(2, 2); // creating rectangle object at index 1

        System.out.println("Area of the Circle: " + shape[0].getArea());
        System.out.println("Area of the Rectangle: " + shape[1].getArea());
    }
}
```



## Program Execution #

In the main function, we have declared a **Shape** class array of size **2** and declared the **Rectangle** and the **Circle** class objects at index **0** and **1** respectively. Now the `getArea()` method returns the area of the respective shape. This is **Polymorphism**.

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In the next lesson, we'll be learning about the process of **method overriding**.