

Coding Assessment: Shape Calculator

Task: Create a Java class hierarchy representing different shapes (e.g., Circle, Rectangle) and implement methods to calculate their area.

Requirements:

Define a base class Shape with an abstract method calculateArea() that returns the area of the shape (double).

Create subclasses Circle and Rectangle that extend Shape.

Implement the calculateArea() method in each subclass specific to the shape's formula (e.g., $\text{PI} * \text{radius}^2$ for circle, $\text{length} * \text{width}$ for rectangle).

In the main method, create instances of Circle and Rectangle with user-provided dimensions (e.g., radius, length, and width).

Call the calculateArea() method on each shape object and display the results.

Bonus:

Add a Triangle subclass with its calculateArea() implementation.

Implement method overloading in the Shape class for a calculateArea(double... sides) method that can handle shapes with variable sides (e.g., triangle).

Answer:

```
import java.util.Scanner;
```

```
abstract class Shape {
```

```
    // Abstract method to calculate the area of the shape
```

```
    public abstract double calculateArea();
```

```
    // Method overloading for shapes with variable sides
```

```
    public double calculateArea(double... sides) {
```

```
        return 0.0; // Default implementation, to be overridden by subclasses if  
needed
```

```
}  
}
```

```
class Circle extends Shape {  
    private double radius;
```

```
    public Circle(double radius) {  
        this.radius = radius;  
    }
```

```
@Override
```

```
    public double calculateArea() {  
        return Math.PI * Math.pow(radius, 2);  
    }  
}
```

```
class Rectangle extends Shape {
```

```
    private double length;  
    private double width;
```

```
    public Rectangle(double length, double width) {  
        this.length = length;  
        this.width = width;  
    }
```

```
@Override
```

```
    public double calculateArea() {  
        return length * width;
```

```
}  
}
```

```
class Triangle extends Shape {
```

```
    private double base;
```

```
    private double height;
```

```
    public Triangle(double base, double height) {
```

```
        this.base = base;
```

```
        this.height = height;
```

```
    }
```

```
    @Override
```

```
    public double calculateArea() {
```

```
        return 0.5 * base * height;
```

```
    }
```

```
// Overloaded method to calculate the area using Heron's formula
```

```
    @Override
```

```
    public double calculateArea(double... sides) {
```

```
        if (sides.length != 3) {
```

```
            throw new IllegalArgumentException("Triangle must have 3 sides.");
```

```
        }
```

```
        double a = sides[0];
```

```
        double b = sides[1];
```

```
        double c = sides[2];
```

```
        double s = (a + b + c) / 2; // Semi-perimeter
```

```
        return Math.sqrt(s * (s - a) * (s - b) * (s - c));
```

```
}  
}
```

```
public class ShapeCalculator {  
    public static void main(String[] args) {  
        Scanner scanner = new Scanner(System.in);  
  
        // Circle  
        System.out.print("Enter the radius of the circle: ");  
        double radius = scanner.nextDouble();  
        Circle circle = new Circle(radius);  
        System.out.println("Area of the circle: " + circle.calculateArea());  
  
        // Rectangle  
        System.out.print("Enter the length of the rectangle: ");  
        double length = scanner.nextDouble();  
        System.out.print("Enter the width of the rectangle: ");  
        double width = scanner.nextDouble();  
        Rectangle rectangle = new Rectangle(length, width);  
        System.out.println("Area of the rectangle: " + rectangle.calculateArea());  
  
        // Triangle  
        System.out.print("Enter the base of the triangle: ");  
        double base = scanner.nextDouble();  
        System.out.print("Enter the height of the triangle: ");  
        double height = scanner.nextDouble();  
        Triangle triangle = new Triangle(base, height);
```

```
System.out.println("Area of the triangle (base-height method): " +  
triangle.calculateArea());
```

```
// Triangle with sides
```

```
System.out.print("Enter the sides of the triangle: ");
```

```
double side1 = scanner.nextDouble();
```

```
double side2 = scanner.nextDouble();
```

```
double side3 = scanner.nextDouble();
```

```
System.out.println("Area of the triangle (Heron's formula): " +  
triangle.calculateArea(side1, side2, side3));
```

```
scanner.close();
```

```
}
```

```
}
```

Output:

```
nagav@sundeeep MINGW64 ~/OneDrive/Desktop/st33/CoreJava  
$ javac ShapeCalculator.java  
●  
nagav@sundeeep MINGW64 ~/OneDrive/Desktop/st33/CoreJava  
● $ java ShapeCalculator  
Enter the radius of the circle: 5  
Area of the circle: 78.53981633974483  
Enter the length of the rectangle: 34  
Enter the width of the rectangle: 54  
Area of the rectangle: 1836.0  
Enter the base of the triangle: 3  
Enter the height of the triangle: 4  
Area of the triangle (base-height method): 6.0  
Enter the sides of the triangle: 5  
5  
6  
Area of the triangle (Heron's formula): 12.0
```