

1. Problem statement: Create an abstract class Figure with following properties and functions:

Properties: double dim1;

Methods: abstract void findArea();

abstract void findPerimeter();

Create three subclasses Circle, Rectangle and Triangle that extends Figure class and define both the methods.

Write a program that will find the area and perimeter of 3 Figures and print the details for all.

2. code with comments:

```
public class Circle extends Shape {
    private final double radius;
    final double pi = Math.PI;

    public Circle() {
        this(1);
    }
    public Circle(double radius) {
        this.radius = radius;
    }

    @Override
    public double area() {
        // A = p r^2
        return pi * Math.pow(radius, 2);
    }

    public double perimeter() {
        // P = 2pr
        return 2 * pi * radius;
    }
}

public class Rectangle extends Shape {
    private final double width, length; //sides

    public Rectangle() {
        this(1,1);
    }
    public Rectangle(double width, double length) {
        this.width = width;
        this.length = length;
    }

    @Override
    public double area() {
        // A = w * l
        return width * length;
    }

    @Override
```

```

        public double perimeter() {
            //  $P = 2(w + l)$ 
            return 2 * (width + length);
        }
    }

    public abstract class Shape {
        public abstract double area();
        public abstract double perimeter();
    }

    public class TestShape {
        public static void main(String[] args) {

            // Rectangle test
            double width = 5, length = 7;
            Shape rectangle = new Rectangle(width, length);
            System.out.println("Rectangle width: " + width + " and length: " +
length
                + "\nResulting area: " + rectangle.area()
                + "\nResulting perimeter: " + rectangle.perimeter() + "\n");

            // Circle test
            double radius = 5;
            Shape circle = new Circle(radius);
            System.out.println("Circle radius: " + radius
                + "\nResulting Area: " + circle.area()
                + "\nResulting Perimeter: " + circle.perimeter() + "\n");

            // Triangle test
            double a = 5, b = 3, c = 4;
            Shape triangle = new Triangle(a,b,c);
            System.out.println("Triangle sides lengths: " + a + ", " + b + ", " +
c
                + "\nResulting Area: " + triangle.area()
                + "\nResulting Perimeter: " + triangle.perimeter() + "\n");
        }
    }

    public class Triangle extends Shape {
        private final double a, b, c; // sides

        public Triangle() {
            this(1,1,1);
        }
        public Triangle(double a, double b, double c) {
            this.a = a;
            this.b = b;
            this.c = c;
        }

        @Override
        public double area() {
            // Heron's formula:
            //  $A = \text{SquareRoot}(s * (s - a) * (s - b) * (s - c))$ 
            // where  $s = (a + b + c) / 2$ , or 1/2 of the perimeter of the triangle
            double s = (a + b + c) / 2;
            return Math.sqrt(s * (s - a) * (s - b) * (s - c));
        }
    }

```

```

    @Override
    public double perimeter() {
        // P = a + b + c
        return a + b + c;
    }
}

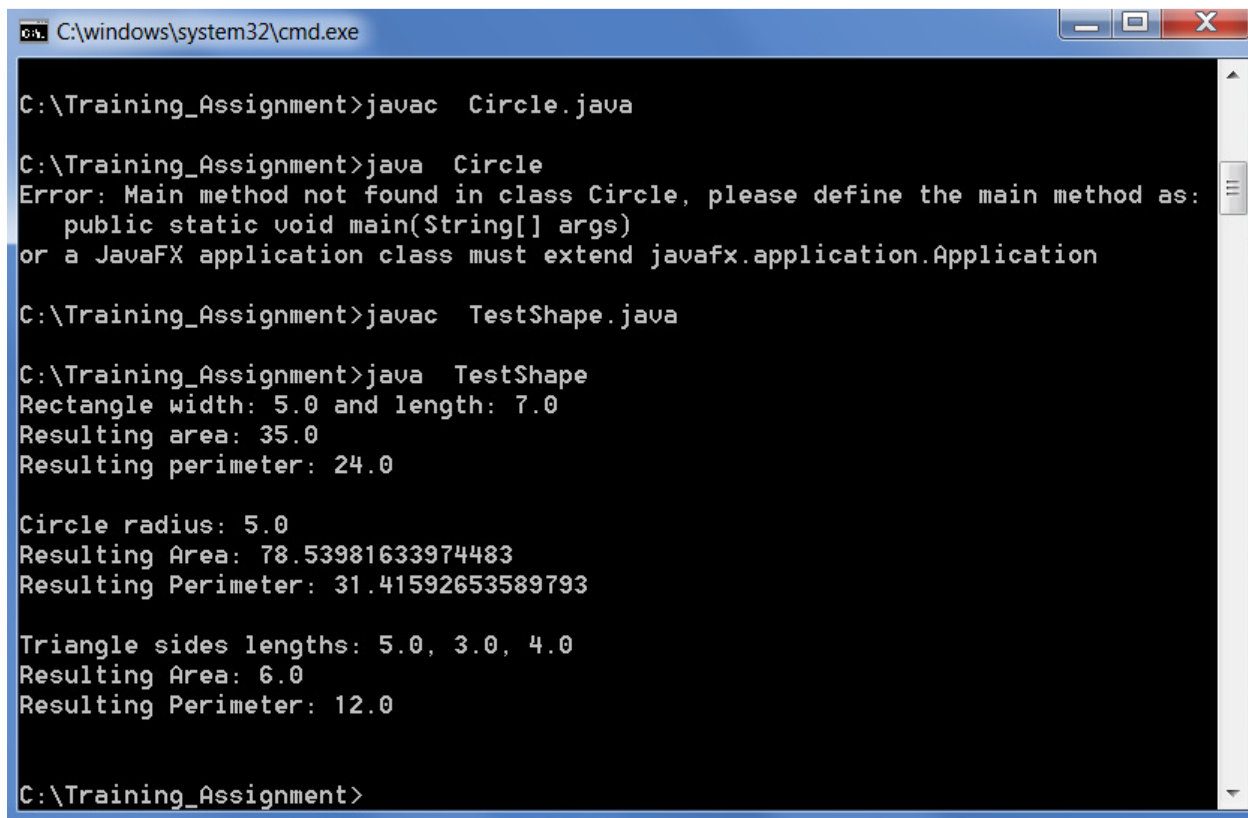
```

### 3. Explanation of the code:

Created an abstract class shape and extended the same in the classes - circle rectangle and triangle to print the areas and perimeter

4. Result flow in detail: Created an abstract class shape and extended the same in the classes - circle rectangle and triangle to print the areas and perimeter

### 5. Output screenshot:



```

C:\windows\system32\cmd.exe

C:\Training_Assignment>javac Circle.java

C:\Training_Assignment>java Circle
Error: Main method not found in class Circle, please define the main method as:
    public static void main(String[] args)
or a JavaFX application class must extend javafx.application.Application

C:\Training_Assignment>javac TestShape.java

C:\Training_Assignment>java TestShape
Rectangle width: 5.0 and length: 7.0
Resulting area: 35.0
Resulting perimeter: 24.0

Circle radius: 5.0
Resulting Area: 78.53981633974483
Resulting Perimeter: 31.41592653589793

Triangle sides lengths: 5.0, 3.0, 4.0
Resulting Area: 6.0
Resulting Perimeter: 12.0

C:\Training_Assignment>

```