Aim:

Design a Java program that offers a menu-driven interface for users to perform mathematical operations on geometric shapes. The program should provide options for calculating the area of a triangle and the area of a rectangle using runtime polymorphism

Source Code:

GeometryCalculator.java

```
import java.util.Scanner;

abstract class Shape {
    abstract double calculateArea();
}

//write your code here..
class Rectangle extends Shape{
   double length, width;
   Rectangle(double l, double w){
      length = l;
      width = w;
   }
   double calculateArea(){
      return length*width;
   }
}
class Triangle extends Shape{
   double base, height;
   Triangle(double b, double h){
      base = b;
      height = h;
   }
   double calculateArea(){
      return 0.5 * base * height;
   }
}

public class GeometryCalculator {
   public static void main(String[] args){
      Scanner sc = new Scanner(System.in);
      Shape shape;
      while(true){
         System.out.println("Select an option:");
         System.out.println("1. Area of triangle");
         System.out.println("2. Area of rectangle");
         System.out.println("3. Exit");
         System.out.print("Enter option: ");
         int choice = sc.nextInt();

         switch(choice){
            case 1:
               System.out.print("base: ");
               double b = sc.nextDouble();
```

```
                System.out.print("height: ");
                double h = sc.nextDouble();
                shape = new Triangle(b,h);
                System.out.println("Area: "+shape.calculateArea());

                break;
            case 2:
                System.out.print("length: ");
                double l = sc.nextDouble();
                System.out.print("width: ");
                double w = sc.nextDouble();
                shape = new Rectangle(l,w);
                System.out.println("Area: " + shape.calculateArea());
                break;
            case 3:
                return;
            default:
                System.out.println("Invalid choice");
         }
      }
   }
}
```

Execution Results - All test cases have succeeded!

Test Case - 1
User Output
Select an option: 1
1. Area of triangle 1
2. Area of rectangle 1
3. Exit 1
Enter option: 1
base: 4
height: 6
Area: 12.0 2
Select an option: 2
1. Area of triangle 2
2. Area of rectangle 2
3. Exit 2
Enter option: 2
length: 10
width: 20
Area: 200.0 3
Select an option: 3
1. Area of triangle 3
2. Area of rectangle 3
3. Exit 3
Enter option: 3

Test Case - 2
User Output

Select an option: 1
1. Area of triangle 1
2. Area of rectangle 1
3. Exit 1
Enter option: 1
base: 22.5
height: 30.4
Area: 342.0 3
Select an option: 3
1. Area of triangle 3
2. Area of rectangle 3
3. Exit 3
Enter option: 3

Test Case - 3
User Output
Select an option: 1
1. Area of triangle 1
2. Area of rectangle 1
3. Exit 1
Enter option: 1
base: 20
height: 30
Area: 300.0 5
Select an option: 5
1. Area of triangle 5
2. Area of rectangle 5
3. Exit 5
Enter option: 5
Invalid choice 3
Select an option: 3
1. Area of triangle 3
2. Area of rectangle 3
3. Exit 3
Enter option: 3