

# Exercise 13 Answers

## Polymorphism

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Here is the `ShapeTest.java` source file after all modifications have been made:

```
abstract class Shape {

    public abstract String getName();
    public abstract double getArea();

}

class Circle extends Shape {

    // Properties of the class...
    public double radius;

    // Constructor of the class...
    public Circle(double aRadius) {
        radius = aRadius;
    }

    // Methods of the class...
    public String getName() {
        return "circle";
    }
    public double getArea() {
        return Math.PI * radius * radius;
    }

}

class Triangle extends Shape {

    // Properties of the class...
    public double base;
    public double height;

    // Constructor of the class...
    public Triangle(double aBase, double aHeight) {
        base = aBase;
        height = aHeight;
    }

    // Methods of the class...
    public String getName() {
```

```

        return "triangle";
    }
    public double getArea() {
        return 0.5 * base * height;
    }
}

class Rectangle extends Shape {

    // Properties of the class...
    public double width;
    public double length;

    // Constructor of the class...
    public Rectangle(double aWidth, double aLength) {
        width = aWidth;
        length = aLength;
    }

    // Methods of the class...
    public String getName() {
        return "rectangle";
    }
    public double getArea() {
        return width * length;
    }
}

class ShapeTest {

    public Shape[] myShapes;

    public void printAreas() {

        for (int i=0; i<myShapes.length; i++) {

            System.out.print("Shape " + i + " has area: ");

            System.out.println(myShapes[i].getArea());

        }
    }

    public void printNames() {

        for (int i=0; i<myShapes.length; i++) {

            System.out.print("Shape " + i + " is a: ");

            System.out.println(myShapes[i].getName());

        }
    }
}

```

```
public void doStuff() {

    // create an empty shapes array...
    myShapes = new Shape[4];

    // fill in the values of the elements...
    myShapes[0] = new Circle(12.0);
    myShapes[1] = new Circle(6.3);
    myShapes[2] = new Triangle(3,8);
    myShapes[3] = new Rectangle(10,10);

    printNames();
    printAreas();
}

// The main method is the point of entry into the program...
public static void main(String[] args) {

    ShapeTest me = new ShapeTest();
    me.doStuff();

}
}
```