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Experiment 11: Program on abstract class and abstract methods

Code:

```java
import java.util.Scanner;
import static java.lang.Math.*;
abstract class Shape
{
  public abstract double area();
  public String toString()
  {
    Double result = Double.valueOf(area());
    String res = result.toString();
    return res;
  }
}
class Rectangle extends Shape
{
  double length, breadth;
  public Rectangle(double length, double breadth)
  {
    this.length = length;
    this.breadth = breadth;
  }
  public double area()
  {
    return length * breadth;
  }
  public String toString()
  {
    String str = "The area of a Rectangle with length " + length + " and
     ↪  width " + breadth + ": " + area();
    return str;
  }
}
class Triangle extends Shape
{
  double side1, side2, side3;
  public Triangle(double side1, double side2, double side3)
  {
    this.side1 = side1;
    this.side2 = side2;
    this.side3 = side3;
  }
  public double area()
  {
    double s = (side1 + side2 + side3) / 2;
    return sqrt(s * (s - side1) * (s - side2) * (s - side3));
  }
```

```
45    public String toString()
46    {
47      String str = "The area of a Triangle with sides " + side1 + " " +
          ↪  side2 + " " + side3 + ": " + area();
48      return str;
49    }
50  }
51  class Circle extends Shape
52  {
53    double radius;
54    public Circle(double radius)
55    {
56      this.radius = radius;
57    }
58    public double area()
59    {
60      return PI * radius * radius;
61    }
62    public String toString()
63    {
64      String str = "The area of a Circle with radius " + radius + ": " +
          ↪  area();
65      return str;
66    }
67  }
68  class AbstracMethods
69  {
70    public static void main(String args[])
71    {
72      Shape[] shapes = new Shape[3];
73      shapes[0] = new Triangle(10, 15, 20);
74      shapes[1] = new Rectangle(10, 20);
75      shapes[2] = new Circle(10);
76      for(int i = 0; i < 3; i++)
77      {
78        System.out.println(shapes[i]);
79      }
80    }
81  }
```

Output:

```
The area of a Triangle with sides 10.0 15.0 20.0: 72.61843774138907
The area of a Rectangle with length 10.0 and width 20.0: 200.0
The area of a Circle with radius 10.0: 314.1592653589793
```

If we make Rectangle class final and make a class Square that inherits from it the Java compiler will show an error

```java
final class Rectangle extends Shape
{
  double length, breadth;
  public Rectangle()
  {
    length  = 0.0;
    breadth = 0.0;
  }
  public Rectangle(double length, double breadth)
  {
    this.length  = length;
    this.breadth = breadth;
  }
  public double area()
  {
    return length * breadth;
  }
  public String toString()
  {
    String str = "The area of a Rectangle with length " + length + " and
     ↪  width " + breadth + ": " + area();
    return str;
  }
}
class Square extends Rectangle
{
}
```

```
AbstractMethods.java:36: error: cannot inherit from final Rectangle
class Square extends Rectangle
                     ^
1 error
```