

## AP COMPUTER SCIENCE A – HOMEWORK #7

Consider the class `Triangle.java`, listed here:

```
public class Triangle {
    /**/
    private double [] sides, angles;
    private double area;
    /**/
    public Triangle () {}
    /**/
    public void setSides( double [] s ) {
        /**/
        sides=s;
        return;
    }
    /**/
    public void setAngles( double [] a ) {
        /**/
        angles=a;
        return;
    }
    /**/
    public void calcArea () {
        /**/
        double rad=(Math.PI/180.0)*angles[1];
        area=0.5*sides[0]*sides[2]*Math.sin(rad);
        /**/
        return;
    }
    /**/
    public double [] getSides () {
        return sides;
    }
    /**/
    public double [] getAngles () {
        return angles;
    }
    /**/
    public double getArea () {
        return area;
    }
}
```

Note that this class is merely a container for the quantities of a triangle, *viz.*, its side lengths (`sides`), its angles in degrees (`angles`), and its area (`area`). The file `Triangle.java` can be downloaded from [canvas.instructure.com](http://canvas.instructure.com).

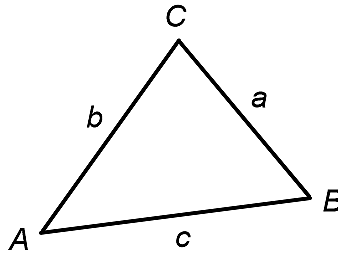
We wish to solve the triangles in the input file `triangles.txt`, the first few lines of which are listed here:

```
SAS:  16.57  78.61  52.61
SAS:  30.69   9.09  79.88
ASA:  11.29  76.05 132.52
SAS:   1.66  73.92   9.32
ASA:  11.79  72.14  86.78
SAS:  53.31  53.52  74.25
SAS:  51.85  65.58  75.80
ASA:  46.64  57.84  70.16
SSS:  60.31  69.71  83.84
SSS:  26.42  34.67  60.50
.
.
.
```

The file `triangles.txt` may be downloaded from [canvas.instructure.com](http://canvas.instructure.com).

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If the side lengths of the triangle are  $a$ ,  $b$  and  $c$ , and the angles are  $A$ ,  $B$  and  $C$ , as depicted in the figure below,



then, if the start of an input line is:

- (i) SSS:, then the three numerical entries in the line are  $a$ ,  $b$  and  $c$ .
- (ii) SAS:, then the three numerical entries in the line are  $a$ ,  $B$  and  $c$ .
- (iii) ASA:, then the three numerical entries in the line are  $A$ ,  $c$  and  $B$ .

These three cases of triangles can be solved with the Laws of Cosines and Sines:

### Law of Cosines

$$a^2 = b^2 + c^2 - 2bc \cos A \quad b^2 = a^2 + c^2 - 2ac \cos B \quad c^2 = a^2 + b^2 - 2ab \cos C$$

### Law of Sines

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

- 1) Your program should use class `SSSTriangle` extends `Triangle`. Start with the file `SSSTriangleStub.java` from [canvas.instructure.com](https://canvas.instructure.com), and follow the directions in the comments to solve the triangle.
- 2) Your program should use class `SASTriangle` extends `Triangle`. Start with the file `SASTriangleStub.java` from [canvas.instructure.com](https://canvas.instructure.com), and follow the directions in the comments to solve the triangle.
- 3) Your program should use class `ASATriangle` extends `Triangle`. Start with the file `ASATriangleStub.java` from [canvas.instructure.com](https://canvas.instructure.com), and follow the directions in the comments to solve the triangle.

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4) Finally, write a program `AnalyzeTriangles.java` containing a main method which:

- a) Reads the file `triangles.txt` into an `ArrayList<Triangle>`.
- b) Prints the solved triangles to an output file. The first few lines of the output file should look something like:

no	a	b	c	A	B	C	area
-----							
0	16.57	51.94	52.61	18.22	78.61	83.17	427.29
1	30.69	49.81	79.88	5.59	9.09	165.32	193.65
2	25.22	94.93	76.05	11.29	132.52	36.19	706.68
3	1.66	9.00	9.32	10.21	73.92	95.87	7.43
4	14.91	72.84	72.14	11.79	86.78	81.43	536.83
5	53.31	60.40	74.25	45.21	53.52	81.27	1591.35
6	51.85	72.00	75.80	40.97	65.58	73.45	1789.31
7	47.11	60.95	57.84	46.64	70.16	63.20	1281.65
8	60.31	69.71	83.84	45.10	54.95	79.95	2069.84
9	26.42	34.67	60.50	6.95	9.14	163.91	126.91
				.			
				.			
				.			

Once you are convinced that your program is working correctly, bundle your source files `*.java` into `hw7.jar`, and submit `hw7.jar` to `canvas.instructure.com`.