Lab Exercise 8

A triangle is a polygon with three edges and three vertices. It is one of the basic shapes in geometry. A triangle with vertices P, Q, and R is denoted ΔPQR as depicted in Figure 2, where p , q and r are the sides of length and their corresponding angles are α, β and γ.

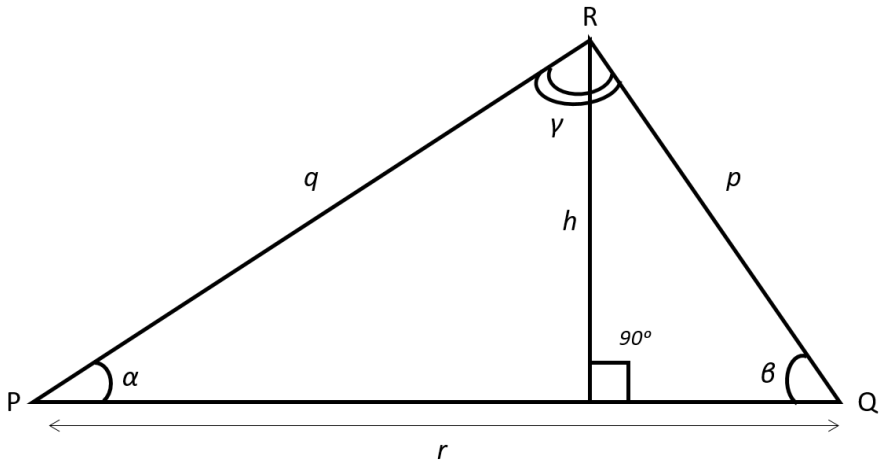


Figure 2: ΔPQR with its sides of length and their corresponding angles

According to the law of cosine, given two known lengths of a triangle p and q , and the angle between the two known sides γ (or the angle opposite to the unknown side r), to calculate the third side c, the following formula can be used:

$$r = \sqrt{p^2 + q^2 - 2\,pq\cos(\gamma)}$$

Similarly, p and q can be calculated by using the following formulas:

$$q = \sqrt{p^2 + r^2 - 2\,pr\cos(\beta)}$$

$$p = \sqrt{q^2 + r^2 - 2\,qr\cos(\alpha)}$$

The area of the triangle can be calculated by using the following formula:

$$\Delta PQR = \frac{1}{2}\,hr$$

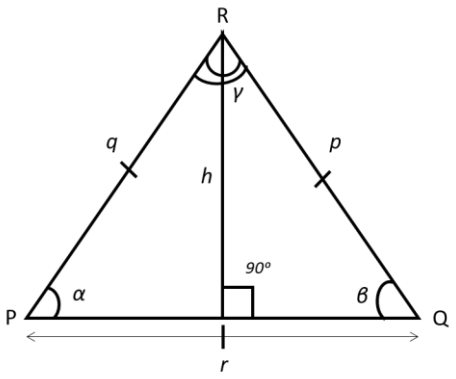
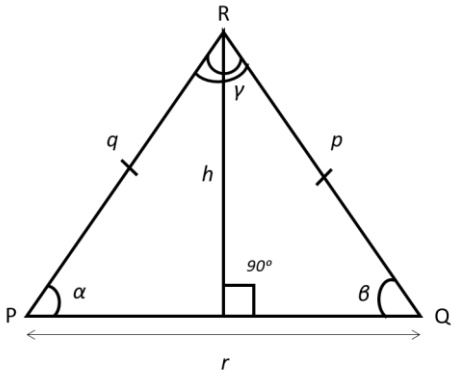
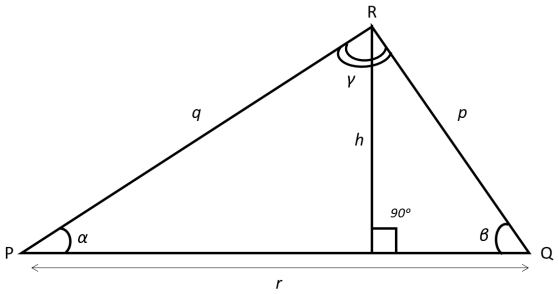
Where, height denoted as h can be easily calculated by using law of sine:

$$h = p\sin(\beta)$$

There are three prominent subclass of Triangle such as:

Table 1: Type, Criteria and formula for the Equilateral Triangle, Isosceles Triangle and Right Triangle.

Type	**Criteria**	**Example**

Equilateral Triangle	It has the same length for all sides with all angles measuring 60^o Assuming that $p = q = r$ and $\alpha = \beta = \gamma$.	 $h = \sqrt{p^2 + \left(\frac{p}{2}\right)^2 - 2\,p\left(\frac{p}{2}\right)\cos 60^\circ}$
Isosceles Triangle	It has two sides of equal length with two similar angles Assuming that $p = q$ and $\alpha = \beta$	 $r = \sqrt{p^2 + q^2 - 2\,pq\sin(180 - 2\alpha)}$ $h = \sqrt{p^2 + \left(\frac{r}{2}\right)^2 - 2p\left(\frac{r}{2}\right)\cos\alpha}$
Right Triangle	It has one of its interior angles measuring 90° (a right angle) and also called right-angle triangle. Assuming that $\alpha = 90^\circ$ and p is the hypotenuse of the triangle. $area = 0.5\ x\ p\ x\ r$	 $r = \sqrt{p^2 - q^2}$

Consider the Class diagram in Figure 2 and formula given in Table 1.

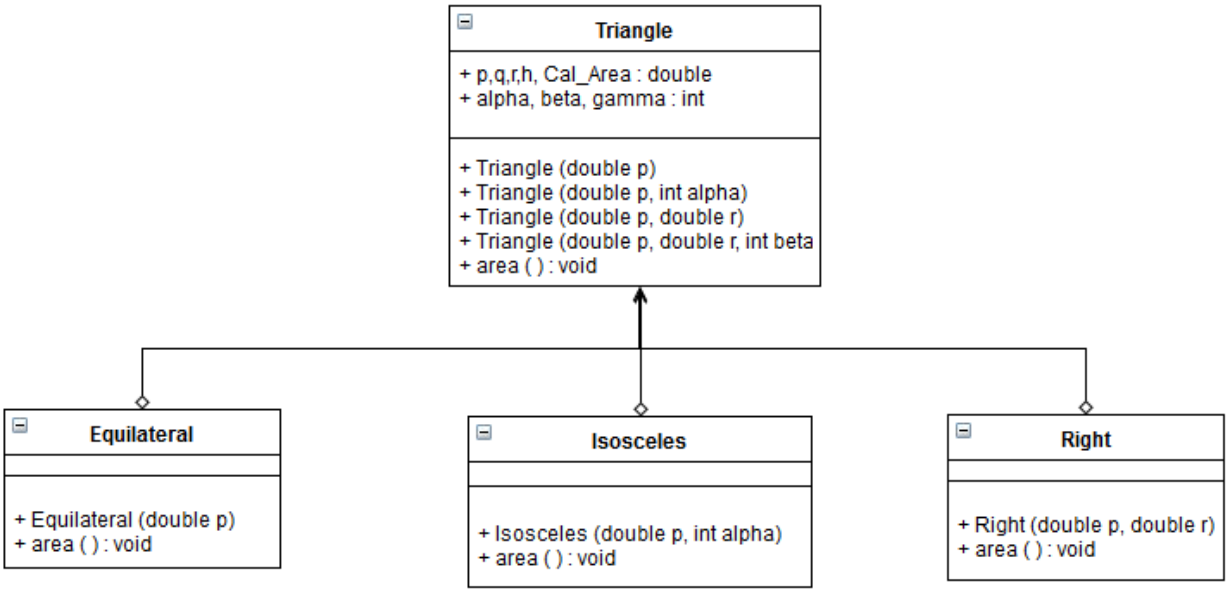


Figure 3: UML Class Diagram

Based on the problem statement given, you need to construct a Java application using all classes to compute the area of *Normal Triangle*, *Equilateral Triangle*, *Isosceles Triangle* and *Right Triangle.*