Problem Set 2 Exercise #27: Triangle Incenter

Reference: Lecture 6 notes

Learning objective: Functions with Pointers

Estimated completion time: 40 minutes

Problem statement:

In geometry, the incircle (or inscribed circle) of a triangle is the largest circle contained in the triangle; it touches (is tangent to) the three sides. The center of the incircle is called the triangle's incenter.

Write a program **incenter.c** to read in the coordinates (of type **double**) of 3 vertices of a triangle and compute the coordinates of its incenter.

Your program should contain a function **incenter()** that passes back the coordinates of the incenter via two address parameters. What are the correct parameters to take?
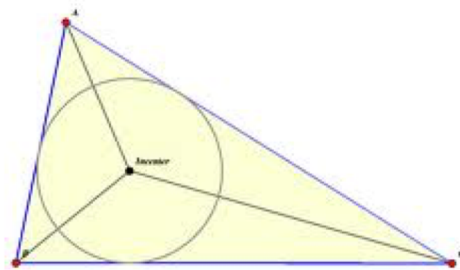
Note that there should be no **printf()** statement in your **incenter()** function as this function is solely for computation purpose. The **main()** function is responsible for data input / output.

Useful tips:

The Cartesian coordinates of the incenter are a weighted average of the coordinates of the three vertices using the side lengths of the triangle as weights. If the three vertices are located at (x_a, y_a), (x_b, y_b), and (x_c, y_c), and the sides opposites these vertices have corresponding lengths **a**, **b** and **c**, then the incenter is at

$$\left(\frac{ax_a + bx_b + cx_c}{p}, \quad \frac{ay_a + by_b + cy_c}{p} \right)$$

where **p = a + b + c**.

An incenter calculator is available on this website:

http://www.had2know.com/academics/centroid-circumcenter-orthocenter-incenter-triangle.html

Sample run #1:

```
Coordinates of 1st vertex: -1 0
Coordinates of 2nd vertex: 3 0
Coordinates of 3rd vertex: 1 5
Coordinates of incenter = (1.00, 1.35)
```

Sample run #2:

```
Coordinates of 1st vertex: 63.2 21.8
Coordinates of 2nd vertex: -15 -6
Coordinates of 3rd vertex: -19.2 5.7
Coordinates of incenter = (-11.52, 1.34)
```