# Chinese Restaurant

**A-E Strand(s): Geometry. Sample Courses: Integrated 1 and Geometry.**

**Topic/Expectation**

G.B.8 Geometric constructions

a. Carry out and explain simple straight-edge and compass constructions.

b. Use geometric computer or calculator packages to create and test conjectures about geometric properties or relationships.

## Rationale

This task allows students to see how geometric constructions can be used to inform decisions about where to locate a business. It provides opportunities to use pencil-and-paper construction or geometric software (or both) to solve the problem and software to explore or verify conjectures.

## Instructional Task

Yuan Min has been working to open a Chinese Restaurant in her town. There are currently three Chinese Restaurants in the area. Hoping to decrease competition for her new restaurant, Yuan decides to locate it equidistantly from each of the other restaurants. The locations of the three existing Chinese Restaurants are shown on the map below. You are hired by Yuan to determine exactly where her restaurant should be located and to prepare a justification for why this is the proper location.

Using the three given Chinese restaurant locations:

1. Identify the point where Yuan should locate her new restaurant.

2. Form a hypothesis about the perpendicular bisectors of the segments formed by three points. Explain how you would test your conjecture.


# Discussion/Extension/Notes

Which construction(s) could you use to locate a point that is equidistant from two restaurants? How could you use this information to find a point equidistant from more than two restaurants?

Is it necessary to construct all three perpendicular bisectors to find the location of the site? Explain your reasoning. (This may lead to a discussion, or even a formal proof, depending on the level of the class.)

Using at least three different constructions, have students create a logo for the restaurant.

It may be interesting to explore setting up this task with an actual city map and current restaurants.

# Sample Solutions

Using the three given Chinese restaurant locations:

1. Identify the point where Yuan should locate her new restaurant.

   *To find the best location for Yuan's new restaurant, construct the perpendicular bisector of segment AB, segment BC, and segment AC. Label the intersection of these three lines point D. Since point D is on the perpendicular bisector of segment AB, it is equidistant from A and B. Likewise, since D is on the perpendicular bisector of segment BC, it is equidistant from B and C, and since D is on the perpendicular bisector of segment AC, it is equidistant from A and C. Therefore, D is equidistant from A, B, and C. The intersection point of the three perpendicular bisectors is the point that is equidistant from all three restaurants; this point is called the circumcenter of the three points. (See the extension question about constructing two perpendicular bisectors instead of three.)*

2. Form a hypothesis about the perpendicular bisectors of the segments formed by three points. Explain how you would test your conjecture.

   *The intersection of the three perpendicular bisectors of a triangle is equidistant from all three points of the triangle. Students may describe various methods of testing their conjectures, from formal proof to use of dynamic geometry software.*