

## Meet Me at the Corner

### Common Core Standard

G.CO.C.9 Prove theorems about lines and angles. Theorems include: **vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent;** points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G.MG.A.1 Use geometric shapes, their measures, and their properties to describe objects.

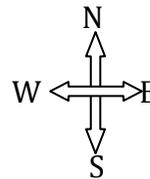
Note: This activity focuses on vertical angles and angles created by parallel lines with transversals. Students will need to use of the parallel line theorems (and postulates) and the vertical angle theorem. It then focuses on a proof of the vertical angle theorem.

### The Task

Recently, the Baltimore County Safety commissioner has received information that there are safety concerns at the Catonsville Road intersections shown on the map below. The traffic engineers want to install guard rails that will fit into several of the street corners.

They plan to use this map to find the proper angle at which to have the guard rails constructed. The engineers have already verified that Osborne Avenue and N. Beaumont Avenue run parallel to one another.

An on sight crew reports the angle of the northwest corner of Osborne and Edmondson has a measure of  $70^\circ$ , and the northeast corner N. Beaumont and Edmonson has a measure of  $110^\circ$ , but they neglected to report the rest.



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Using the given measurement of that angle, find the measurements of these angles so the engineers may report them and order the proper rails:

(Note: The image may not be to scale, so your strategy to find these angles should be devised without measuring them on the map.)

1. All 4 corners at the intersection of Osborne and Edmondson.
2. The northeast corner and the southwest corner of N. Beaumont and Edmondson.

Label the measures of these angles on the map

There is some doubt among the engineers that the angles you have are correct. You must verify that, given that the original measurement reported is accurate, all of your angles are correct as well. In particular they are concerned that you have the two angles requested at N. Beaumont and Edmondson incorrect. Construct a convincing argument that your angles at that corner are both are correct. In particular, convince the engineers why they are equal.

Write your argument below so that the engineers could read it and understand it.

### Facilitator Notes

1. Place students in groups of three. Have graph paper and patty paper available.
2. Present the task. Have students work through all part of the task. Provide adequate time for students to complete the task.
3. Jigsaw students into different groups. Each member must show the convincing argument for the correctness of the measures of the requested angles. Have the other members of the new group rate the argument (scale 1-5) for its ability to convince them of the correctness.
4. Have students return to their original group. Ask groups to tally their scores. Recognize the high scoring group. Allow groups with various scores to explain their method. Ask for alternate approaches. Allow students to defend their group's argument.

### Follow-Up Questions

1. What, in your opinion, makes an argument convincing?
2. How many of our arguments were different? Did we have different styles of writing our arguments?

## Solutions

Using vertical angles and parallel line theorems:

Corner of Osborne and Edmondson:  
NW and SE =  $70^\circ$  NE and SW =  $110^\circ$

Corner of N. Beaumont and Edmondson  
NE and SW =  $110^\circ$

The point is to use the various theorems (vertical angles and parallel lines) to find the angles, but to prove that the vertical angles are congruent, essentially proving the vertical angle theorem. Styles of proof may vary. The use of patty paper and folding or graph paper to show congruence will highlight transformations as a way of demonstrating congruence. Also a proof using diagram, two column proof, flowchart, paragraph, may be used. The essential proof involves the fact that both vertical angles are supplementary to the same angle, either the angle at the NW corner or the SE corner, and therefore must be equal to each other.

## Extension Activities

1. There is a claim that Glenmore and Melvin are also parallel to Osborne and N. Beaumont. You are sending a crew on sight to help you determine this. What angles do you want them to find? This crew is expensive to use. Try to keep the number of angles they must find to a minimum.
2. The crew also finds the angle at the SE corner of Wyndcrest and Edmondson to be  $75^\circ$ . What conclusions can you draw about the relationship of Wyndcrest to the other streets that cross Edmondson?