Document Id: 11_04_03_1
Date Received: 2003-11-04 **Date Revised**: 2003-11-24 **Date Accepted**: 2003-11-26
Curriculum Topic Benchmarks: M5.2.2, M5.2.4, M5.3.7, M5.4.1, M5.4.6, M5.4.7, M5.4.12
Grade Level: Middle School [6-8]
Subject Keywords: Geometry, Plane figures, Congruent angles, Parallel Lines
Rating: Moderate

Geometry to the Rescue: A Story in Pictures

By: Lin Chambers, NASA Langley Research Center, MS 420, Hampton, VA 23681-2199 e-mail: L.H.Chambers@larc.nasa.gov

From: The PUMAS Collection http://pumas.jpl.nasa.gov

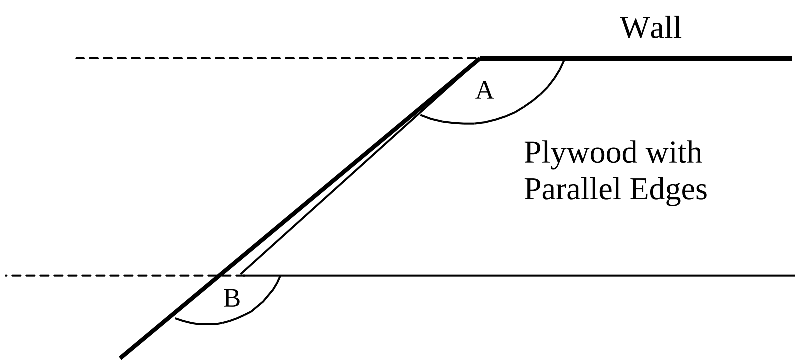
Our kitchen floor was in need of something (repair, replacement, rejuvenation?). This being the do-it-yourself age, we took ourselves to the nearest big box home store, and picked out a lovely laminate flooring in a pattern that looks like tile. The ads and the instructions all make it sound like a pretty simple project. We brought it home and set to work. Immediately, we ran into a problem (Fig. 1). Our breakfast nook is in an octagonal shape. This means no matter which wall we started on, we immediately had to tackle an angle cut. Problem: How do you measure an included angle with a protector, when that angle is between two solid walls?

Figure 1: How do you measure an included angle with a protractor when you have two solid walls?

We thought about it for a while, attempted some approximate measurements, and concluded that this angle "ought" to be about 45˚. [Since an octagon has eight angles, the average external angle should be 360˚/8 or 45˚. The internal angle, {A) in the diagram after Figure 2, would be 180˚-45˚=135˚.] So, we got out a practice piece of plywood (at least we had that much foresight!) and did the first cut. Result: not satisfactory (see Fig. 2).

Figure 2: The first practice cut, based on an estimate of the corner angle – not good enough.

This practice piece gave us new measurement options, however. We now had the following situation:



We want to measure the angle between the two walls, A. Using the fact that the two edges of the plywood are parallel, we can use congruent angles to measure the angle B where the plywood meets the straight wall and we will know the angle we need!

So, here is the measurement (Fig. 3). We find the actual angle to be 46˚– only a degree off from our original estimate, but it sure makes a difference!


Figure 3. Measuring the congruent angle at a spot where the wall is straight.

With our newly measured angle, and new confidence, we tried another practice cut. Indeed, the results are much better (Fig. 4).


Figure 4. The second practice cut with the measured congruent angle. Looks much better!

The next problem we encountered was figuring out how to cut the second row of laminate, since we picked one that has a pattern. On the second piece, we needed to figure out where to start the cut, to get the pieces to line up. Our solution (Fig. 5) was to use two uncut pieces. We can then measure the distance, Δx, to figure out where the second row of laminate needs to start. In this case it's about the length of one "tile" (but not exactly; note that the corner is cut off in Fig. 6).

Figure 5. Measuring the starting point for the second row of laminate.

Finally, thanks to geometry, the corner was conquered!

Figure 6. The finished corner!

Extension:
Brainstorm other ways to use geometry to solve this problem. Can you design a tool that would be helpful in this situation?

Real World Learning
Such a tool already exists. It's called a butterfly bevel, and a friend brought one over to use after we finished the first day of work – once we had nearly completed our octagonal kitchen nook.