

CHAPTER 8 - LET'S MAKE A FEW MORE HOUSES AND BARNES

Objective:

Create more complicated three-dimensional houses and barns.

Vocabulary:

Compound angle

Dimensions

Bisect

Dormer

Elevation

Floor plan

Gable

Gambrel

Hip roof

Overhang

Projection

Scale

Slope

Materials:

Standard white paper

Several large sheets of 22 x 29-inch white poster-board (gridlines are helpful)

A ruler

Sharp No. 2 pencils

A quality compass

A pair of scissors

Cellophane tape

An eraser

1/2-inch x 3 1/2-inch white label strips (recommended)

In **Chapter 4** we made a simple house, gradually developing the plan based on a cube. In that exercise, we expanded the cube to a rectangular box, added a simple gable to each end, and capped it with a folded roof. Easy enough!

This time, we are going to make a somewhat more complicated model, requiring that we create a floor plan and elevation. We will also give this house an intersecting gabled roof, in two parts. This intersection creates a compound angle, which is very difficult to represent properly on a “flat” plan. So, whenever compound angles occur, we must make use of two or more views of the house plan to determine how the roofs will intersect. A floor plan is nothing more than a layout of a house showing the placement of rooms, halls, etc. The elevation is an accurate drawing of the house as seen from the front, or from the side. In making our model, measurements are essential, so keep your ruler handy.

The House

Steps:

1. On graph paper, let's lay out a simple floor plan. This will give you an understanding of the process that will allow you to develop your own designs. **Figure 8.1** is a 3-D rendition of the house we are going to build, followed by a simple floor plan as seen in **Figure 8.2**.

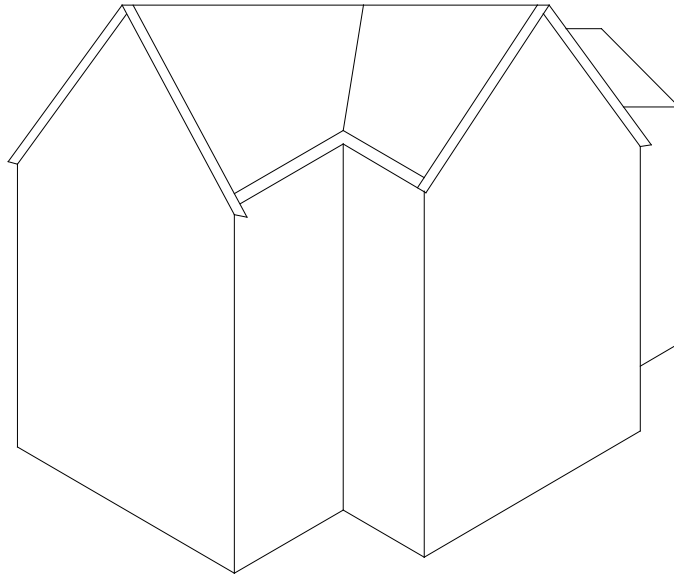


Figure 8.1

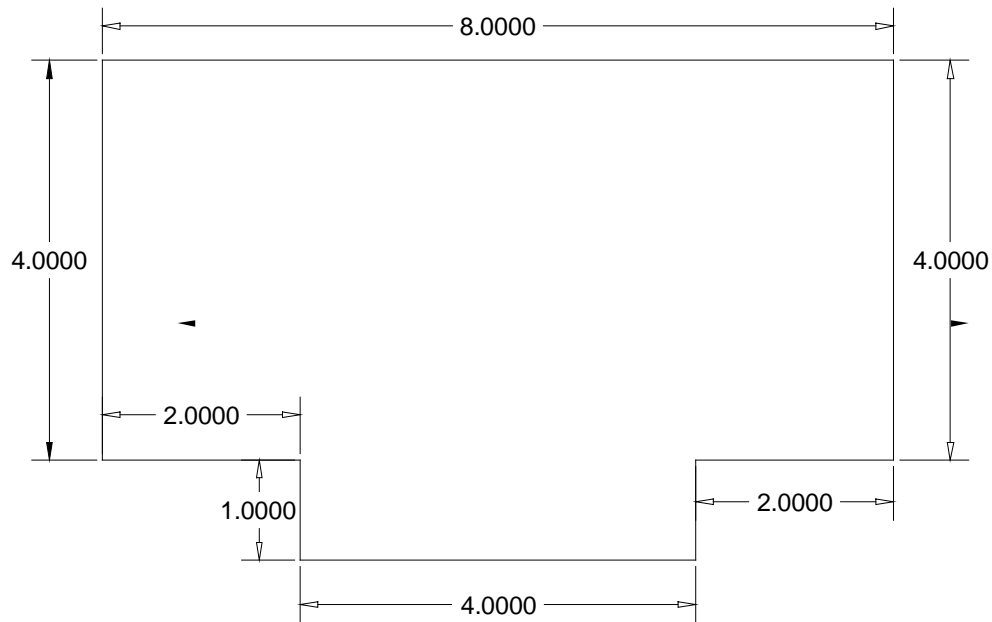


Figure 8.2

2. The dimensions of our model are as follows: back wall, 8"; two side walls, 4" each; front projection – 4" wide "bump out", stepped out 1" on either side; with 2" panels on either side of the bump out. As you can see from the sketch, the 4" side walls will support the main gabled roof, and the front projection will support a smaller intersecting gabled roof over the bump out. The height of the walls of our house will be 5", and the heights of the gabled roofs have yet to be determined. Front and side elevations of the house are indicated in **Figures 8.3 and 8.4**.

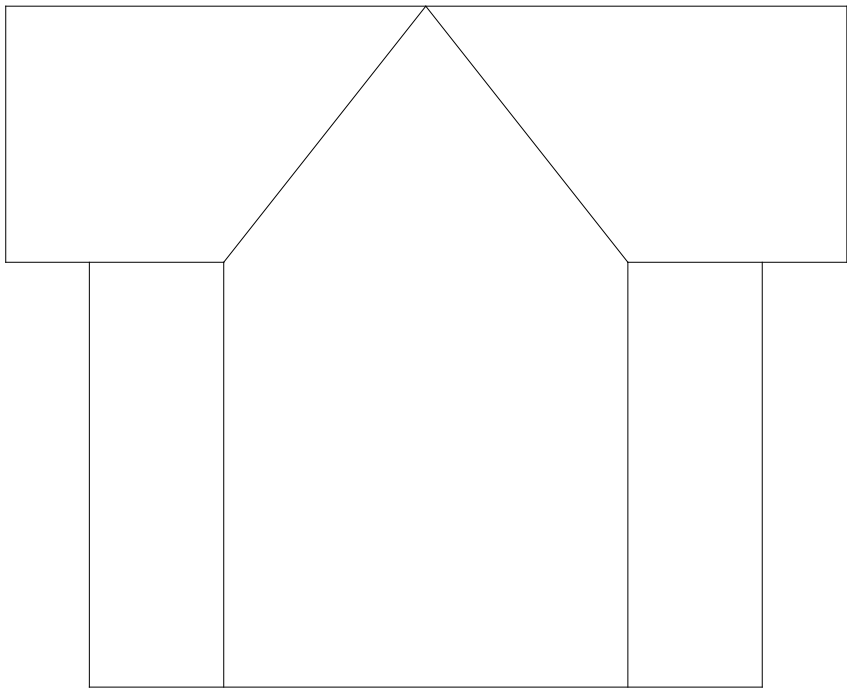


Figure 8.3

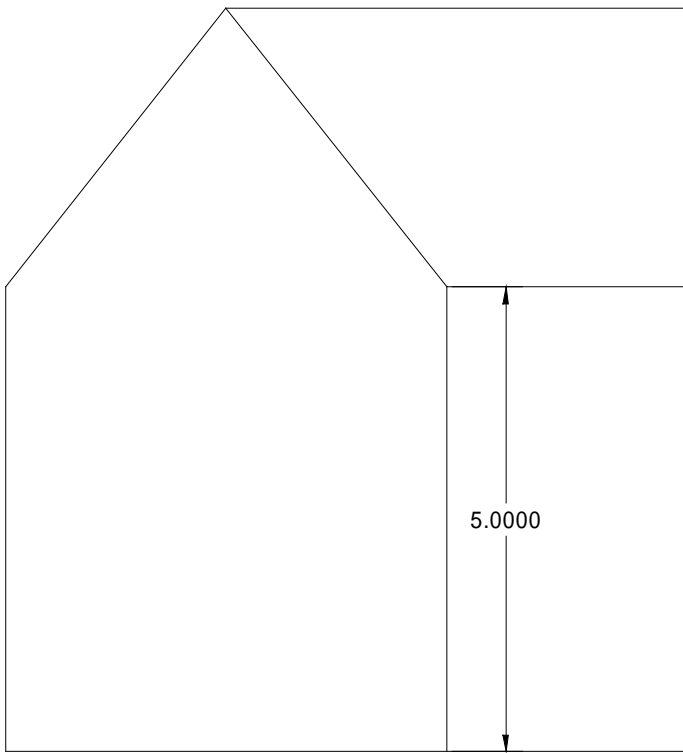
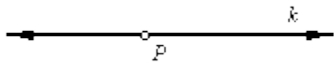
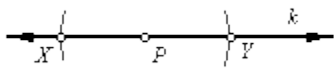
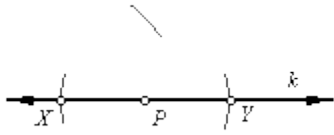
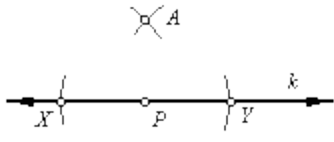
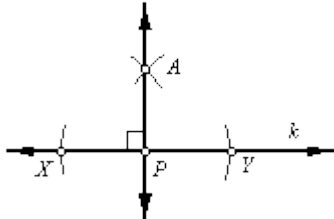


Figure 8.4

3. We must add up all the wall lengths (eight in all), to determine the total length of our net. They are $8+4+2+1+4+1+2+4$, for a total of 26 inches. Using a full 29-inch sheet of poster board, draw a line with your ruler at least 26 inches long (not including the $\frac{1}{2}$ " glue tabs on either side for easy assemble), parallel to one edge at a distance of at least $5\frac{1}{2}$ " inches from the lower edge of the poster board. This $5\frac{1}{2}$ " will enable us to enclose the bottom of the house.

4. Using your ruler, mark off the 26" line at 8 inches, 4 inches, 2 inches, 1 inch, etc., and construct perpendiculars to this line at the first and last of these points using the steps outlined in **Figure 8.5**. These perpendiculars should stand at five inches high (the height of the house, not including the gables), and then use these points to draw a 26-inch line parallel to your original line.

Given point P on line k, construct a line through P, perpendicular to k.

1. Begin with line k, containing point P.	
2. Place the compass on point P. Using an arbitrary radius, draw arcs intersecting line k at two points. Label the intersection points X and Y.	
3. Place the compass at point X. Adjust the compass radius so that it is more than $(1/2)XY$. Draw an arc as shown here.	
4. Without changing the compass radius, place the compass on point Y. Draw an arc intersecting the previously drawn arc. Label the intersection point A.	
5. Use the straightedge to draw line AP. Line AP is perpendicular to line k.	

From: <http://whistleralley.com/construction/c2.htm>

Figure 8.5

5. Carefully, mark off the newly drawn line using the same measurements in order, 8", 4", 2", 1", etc... Connect these notches to create the corners of the model house. Extend the 8" "back panel" downward 4" to form the bottom panel. Measure 2" in from either side of this panel and create the 1" "bump out" that you see on the front elevation of the house. When you reach this point, your design should look like **Figure 8.6**. When folded properly, the base panel will be folded under and correspond to all the wall panels.

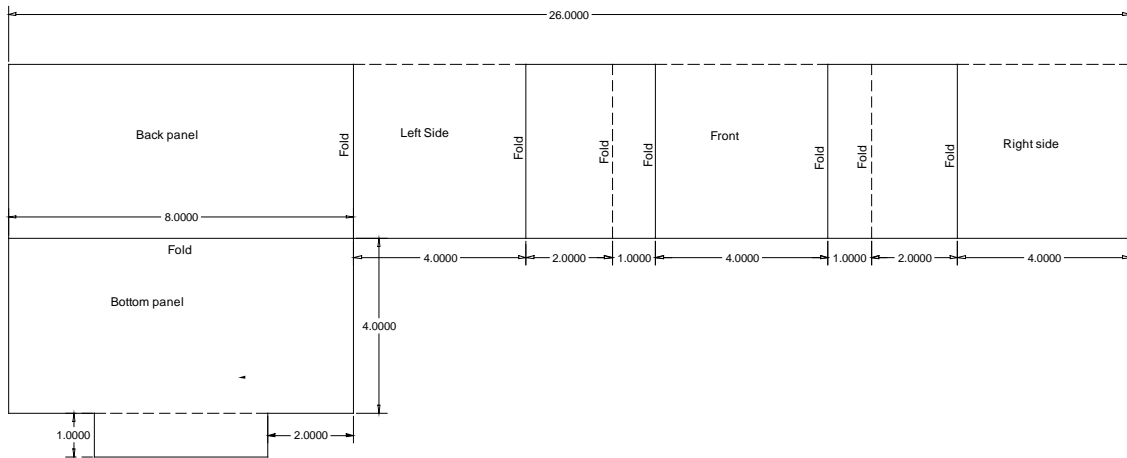


Figure 8.6

6. Every 4" section will support a gabled roof, but what will be the slope or angle of the roof? For the purpose of simplification, we want a slope that will be easy to work with, so we must decide if we want a tall, steep roof, or one with a more gradual incline. Your compass can help you with this decision. Let's look at a close-up of one side of the house. See **Figure 8.7**.

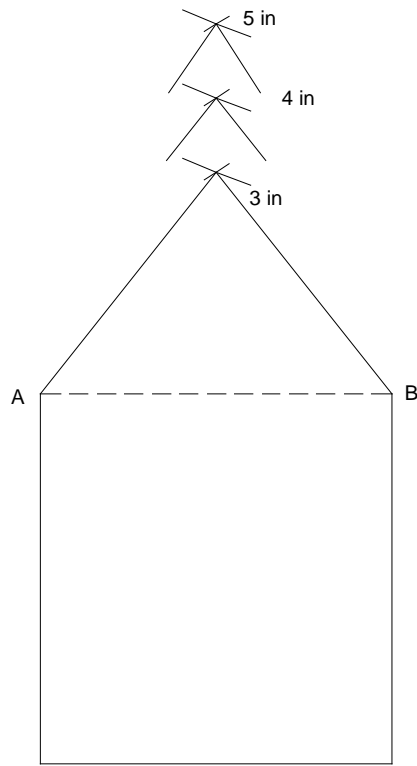


Figure 8.7

7. If you set your compass at 5 inches, you will see that an arc swept from points A and B of our drawing will produce a very high gable! A 4" arc makes the gable an equilateral triangle. 3" arcs drawn from points A and B produce a lower more manageable roof slope. This is the dimension we will use. On your poster board layout, draw in the 3 gables using a 3" compass width over the left, front, and right side panels. **Figure 8.8** illustrates the gabled walls with glue tabs included for easy assembly.

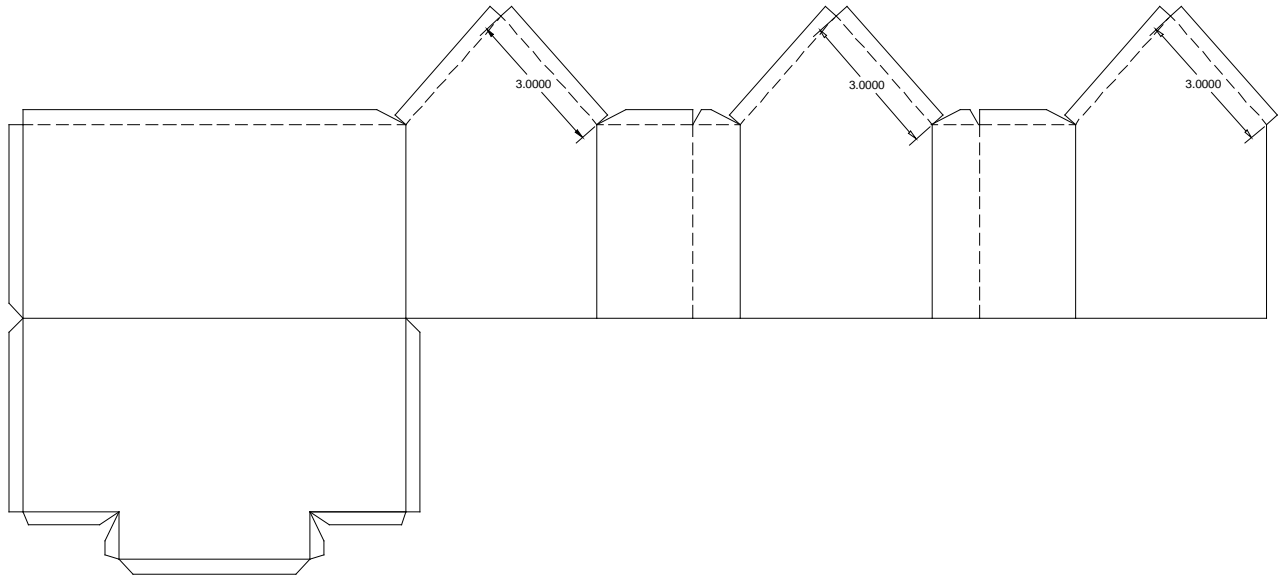


Figure 8.8

8. Score the net appropriately with your compass. The net is now ready to be cut out, folded, and glued or taped together.

9. Now we must design and cut out our two intersecting roof sections. This will take a bit of work. We have a certain amount of information to help us determine the necessary measurements, such as the floor plan and elevations of the house, its dimensions, the slope of the gables, etc. But the one elusive measurement is the actual length of the valleys where the two gables meet (the compound angle). No matter which view we look, this compound angle appears “foreshortened,” and cannot be properly measured from any of the drawings. Most of the other necessary dimensions can be determined rather quickly by taking another look at the plan, with the smaller front roof superimposed. An aerial view of the roof is shown in **Figures 8.9a and 8.9b**. *** Keep in mind that you can not use this diagram to construct the roof because the aerial view distorts the measurements.**

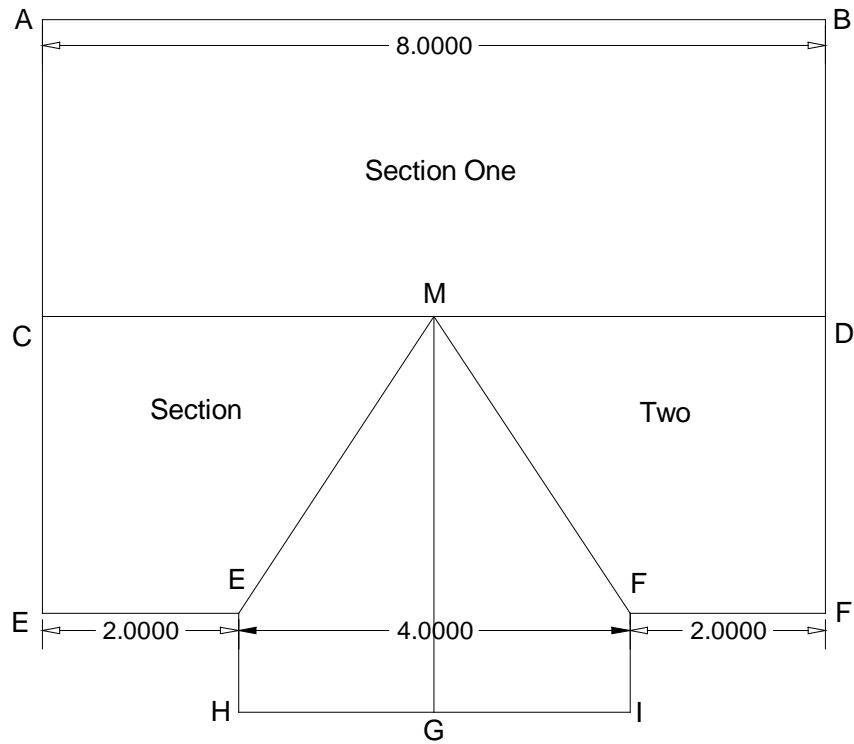


Figure 8.9a



Figure 8.9b

10. It is clear from the diagram and photo that section one of the roof runs the length of the house and is 8 inches long (line segment AB). The ridge of the roof also extends the full length, from the tip of the gable on one side to the other (line segment CD). Section two is interrupted by a 4-inch centered gable (line segment E^1F^1), leaving a 2-inch section at line segment EE^1 , and another at line segment FF^1 .

11. All of the dimensions given thus far are accurate. **Figure 8.10** provides us with a net for the roof as well as all the dimensions.

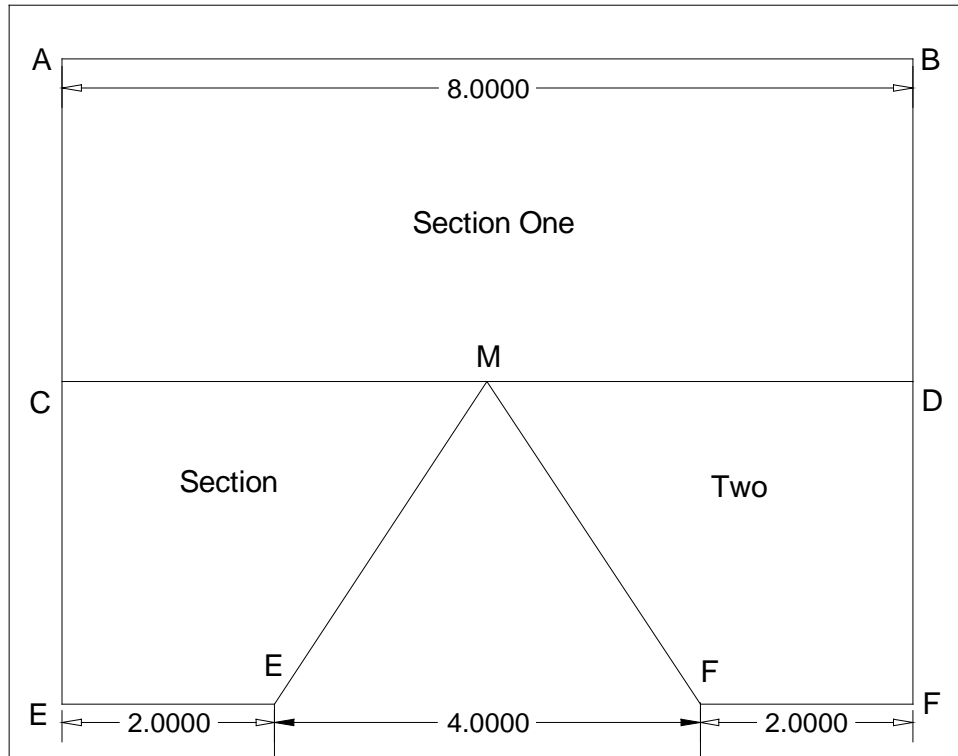


Figure 8.10

12. Line segments AB, CD, and EF are all 8 inches long and parallel to each other. We now know line segments AC and CE each to be 3 inches long, parallel and equal to the opposite side, line segments BD and DF. From the roof plan on **Figure 8.10**, we see that the front “bump out” takes up four inches of the roof on the front of the house. This leaves a panel on each side of 2 inches--and we know that the front gable interrupts the roof ridge at mid-point M.

13. Let’s now construct the front gable. The side elevation shown in **Figure 8.4** helps us determine that the distance from the mid-point M of the main roof ridge to the roof peak of the front gabled roof is 3 inches. We also know that the slope of the roof is 3 inches, as are all the roof slopes. By drawing these two dimensions and taking into consideration the 1 inch bump out, we can measure the distance between points E¹ and M to complete the front gabled roof. **Figure 8.11** shows the net for the front gabled roof with ½” glue tabs included.

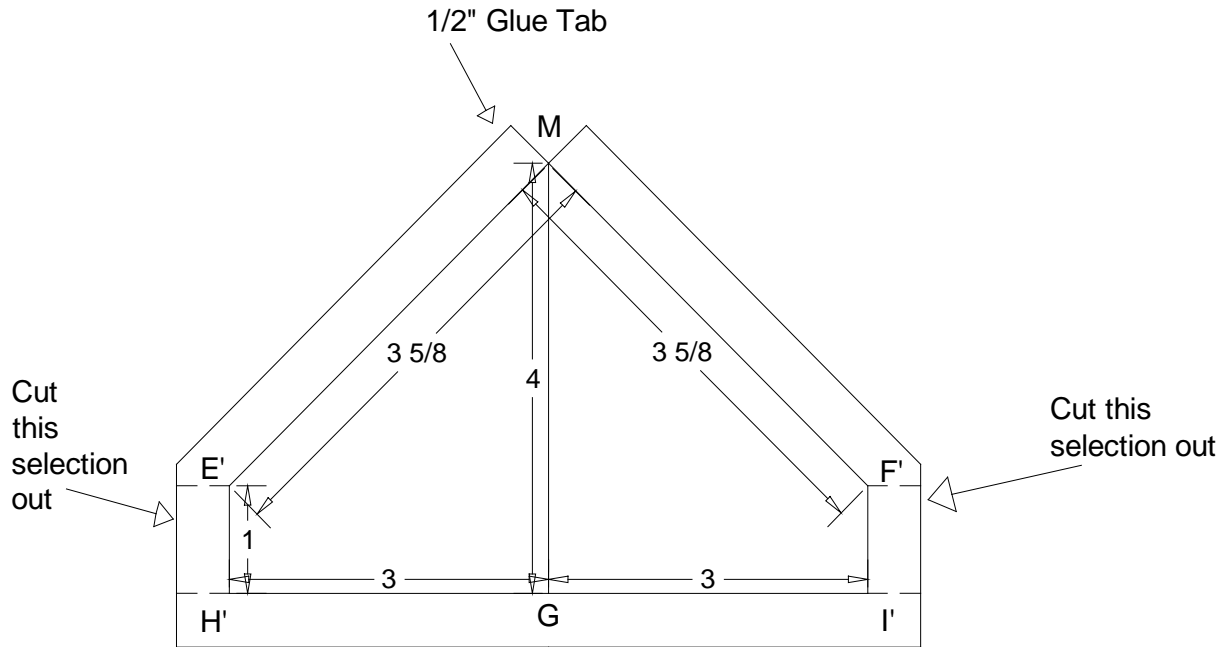


Figure 8.11

15. Cut out both roof nets and align roof section one with the gables on each end of the model and glue or tape in place. The width of the glue tabs should be identical with the roof overhang all around. Next, glue the roof in place along the 2" front sections, and finally, glue the back panel. Clamps or paper clips will hold these edges together until they dry.

16. Glue the front roof panel first along the gable, matching up both points M, then along the compound angles on roof section two, with the tabs folded under. For tight places, a dab of glue on a cotton swab or on a small scrap of poster-board will get between the cracks. Here is your finished house! (**Figures 8.12a and 8.12b**)



Figure 8.12a

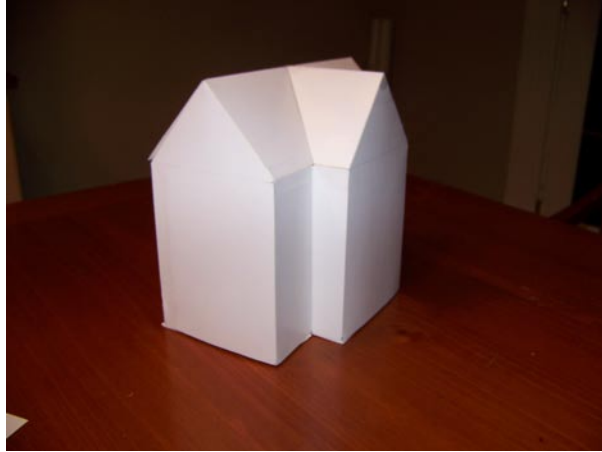


Figure 8.12b

The Barn

After this complex project, a barn with a gambrel-style roof should be quite simple. Determine the length and width of your barn design, and lay out the plan as if it is to be a flat-topped structure. Don't forget to include a base panel and glue tabs for sturdiness.

Steps:

1. **Figure 8.13** shows a net for the base of the barn with the indicated dimensions - Length 6", width 4", and height 4".

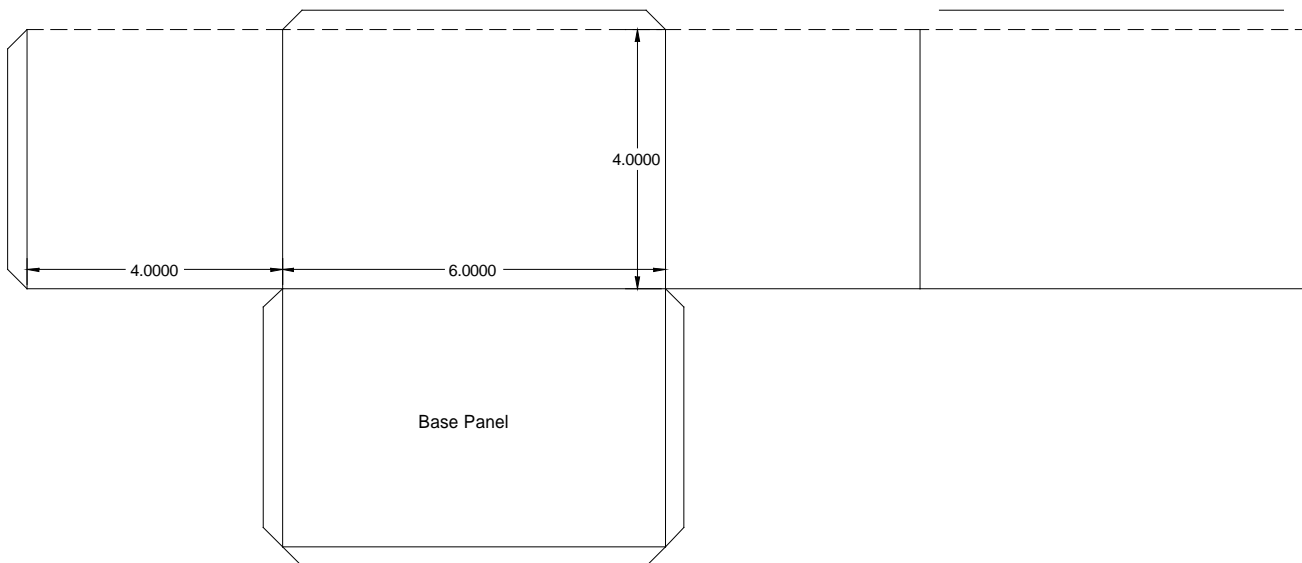


Figure 8.13

2. The short sides will, of course, be gabled, but with the gambrel roof so common to barns. How do we achieve this? On one of the short sides (**Figure 8.14**), construct the perpendicular bisector of line segment AB using A and B as reference points. Follow the directions on how to construct a perpendicular through the midpoint of a line segment by viewing **Figure 8.15**.

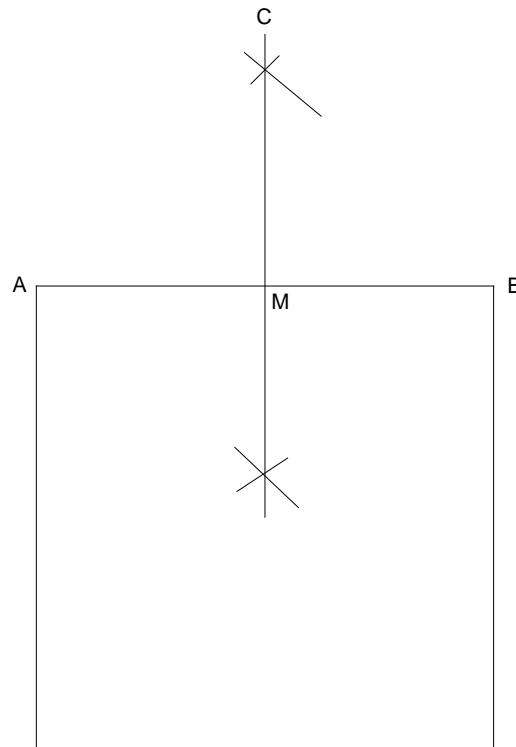
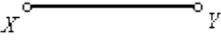
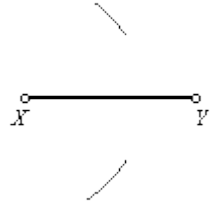
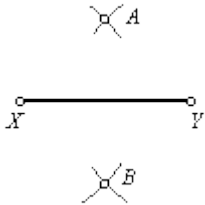
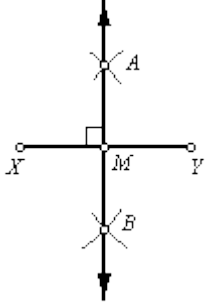


Figure 8.14

Construct the perpendicular bisector of a line segment.

<p>1. Begin with line segment XY.</p>	
<p>2. Place the compass at point X. Adjust the compass radius so that it is more than $(1/2)XY$. Draw two arcs as shown here.</p>	

<p>3. Without changing the compass radius, place the compass on point Y. Draw two arcs intersecting the previously drawn arcs. Label the intersection points A and B.</p>	
<p>4. Using the straightedge, draw line AB. Label the intersection point M. Point M is the midpoint of line segment XY, and line AB is perpendicular to line segment XY.</p>	

From: <http://whistleralley.com/construction/c1.htm>

Figure 8.15

3. Place the point of your compass on point M and sweep a half-circle with a 2" radius over the entire side from A (across the perpendicular) to B . The perpendicular will divide the half-circle into two 90-degree angles at C . Review **Figure 8.14**.
4. Bisect both of these right angles using A and C , and B and C as reference points. Open your compass to about 3" and place the point of the compass on point A . Sweep a small arc above point A . Without changing the compass width, sweep another small arc from point C . Connect the intersection of these two arcs and point M to bisect the angle and locate point D on the semi-circle.
5. Repeat this process to locate point E . The semi-circle is now divided into four chords AD , DC , CE , and EB . Draw lines to indicate the four chords.

6. These chords will give you the gambrel shape desired, which complete both ends of the barn roof (**Figure 8.16** includes glue tabs).

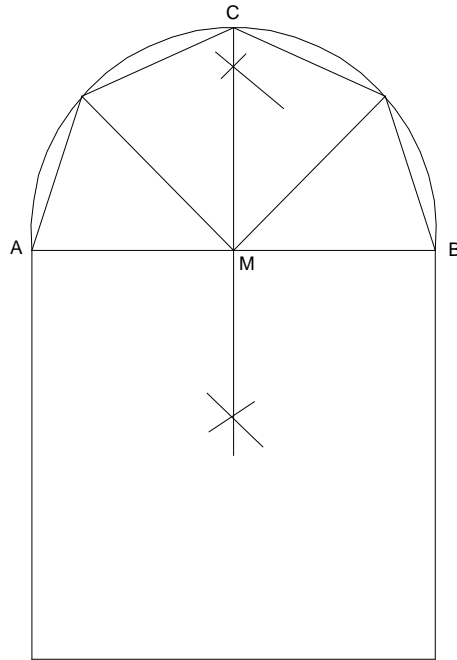


Figure 8.16

7. Measure each chord (all four should be equal) to give you your roof dimensions at each end. Remember, the length of the barn is 6". Lay out your roof design on poster-board, allowing a 1/2" overhang all around. See **Figure 8.17**.

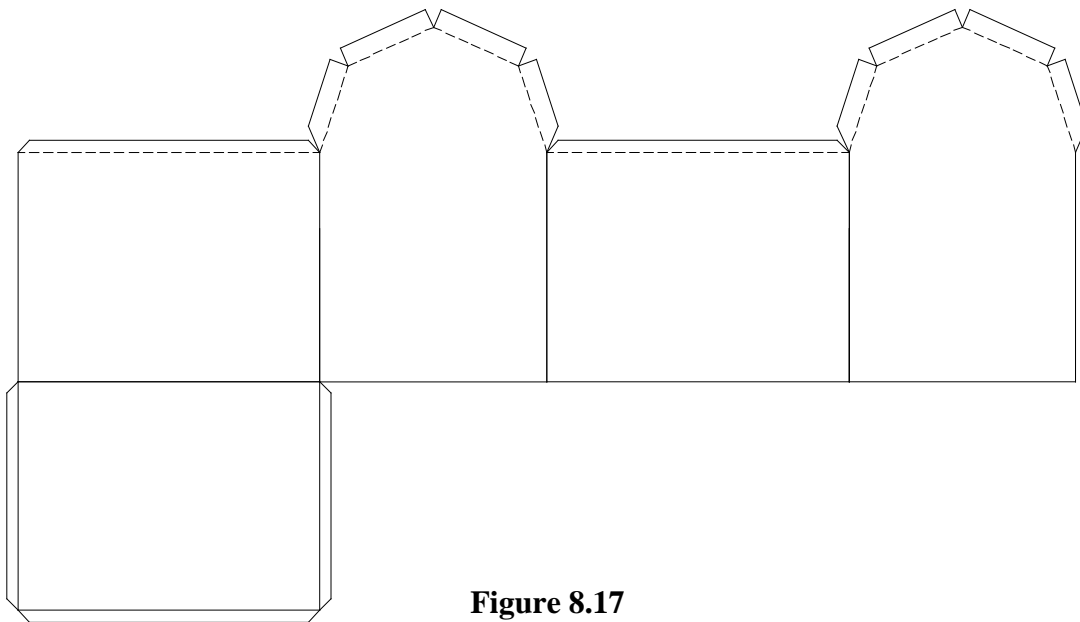


Figure 8.17

8. Cut out your nets and score fold lines for easy assembly. Tape or glue the main part of the barn. Then, affix the gambrel roof. **Figure 8.18** shows the final product.



Figure 8.18

More Complex Roof Configurations

Experiment with varied roof designs on both the barn and the house. Add overhangs to the house roofs, a gable to the back of the house or an additional gambrel roof to the middle of the front of the barn. Remember that changing the roof design will also necessitate altering the floor plan. The possibilities are endless!