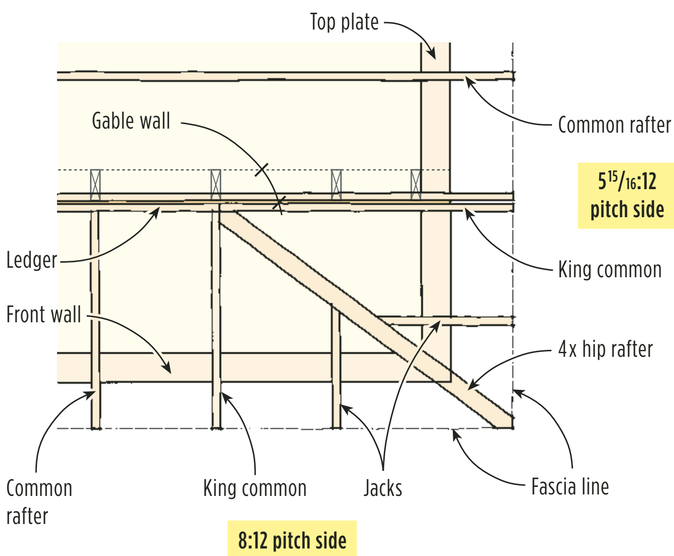
Framing a Dutch Gable

This method uses calculations and layout shortcuts to speed production

by Tim Uhler

Like most framers, I learned my trade from one of the older carpenters on the crew. He was a good framer, but he was intimidated by the math required to lay out complicated roofs. Instead of calculating, we often resorted to eyeballing cuts, estimating angles, and just cutting until the pieces fit.

After several years of framing, I decided it was time to stop guessing and learn how to do the calculations. In this article, I'll show my approach to laying out an irregular Dutch gable. Though the math may look a little intimidating at first glance, it's not so bad if you break it down into individual steps.



Framing the Gable

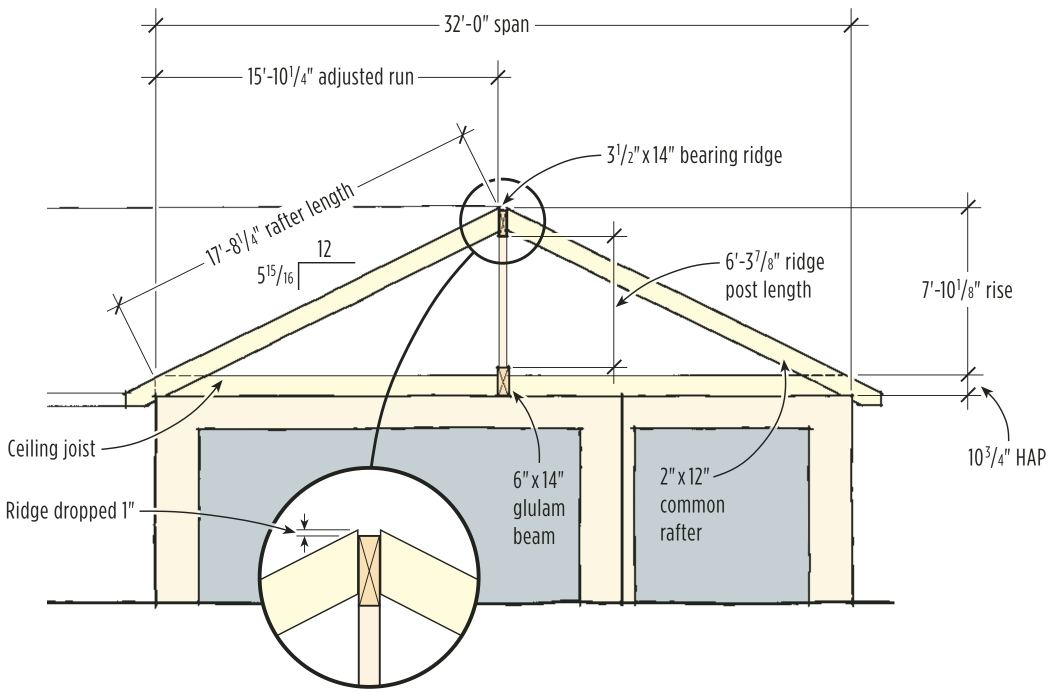


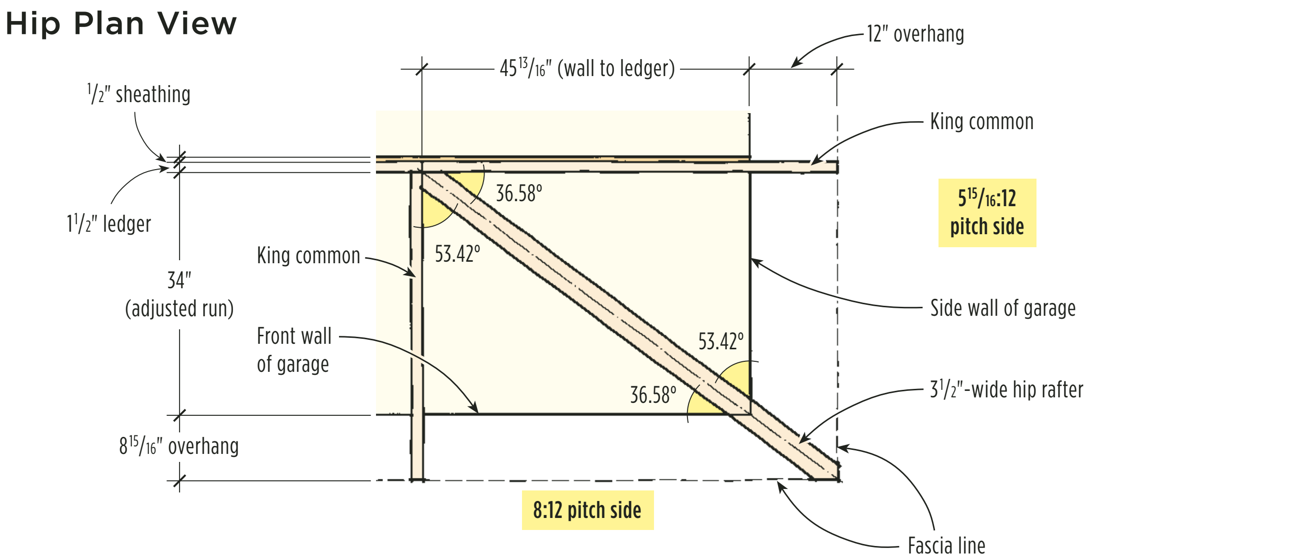
Figure 1. Framing a Dutch hip starts with the gable, which in this case sits 3 feet back from the end wall. The author uses 10 3⁄4 inches as the heel stand, or height-above-plate (HAP), because it provides adequate bearing at the rafter seat cuts of all three pitches that will form the corner. Given the HAP, the span, and the pitch, a Construction Master calculator makes it easy to find the rafter dimensions and the height of the center post. Note that the ridge beam is dropped 1 inch to allow for ventilation.

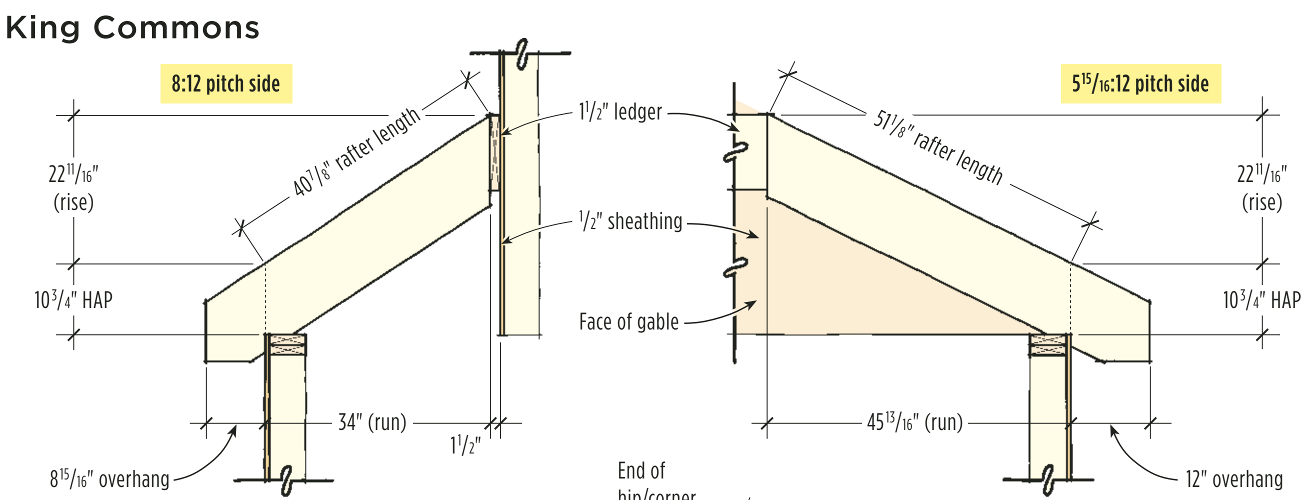
Calculating the Gable

A Dutch gable (also called a Dutch hip) is a combination hip and gable roof. The pitches can be equal, but they were different on the roof shown here, so part of this story is about how to frame an irregular pitch hip. I'll focus specifically on the front right corner of the garage roof (**see illustration, previous page**). Note that on this job, we did not make the front and side soffits equal width, which is a more complicated framing process.

The gable sits back about 3 feet from the front wall (**see Figure 1**). The 32-foot garage ceiling span is broken by a glulam beam that carries both joists and the posts supporting the structural ridge. The gable has a 5 15⁄16-inch pitch — arrived at in order to maximize the building height within the zoning restrictions.

Laying Out King Commons and Irregular Hip





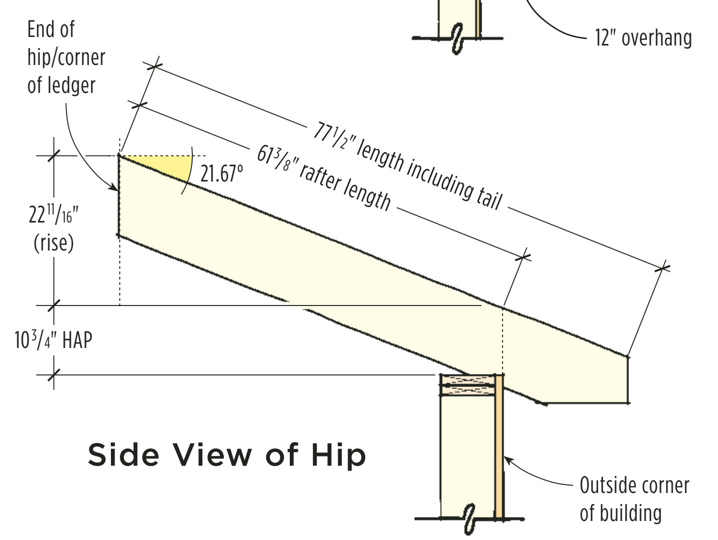


Figure 2. Subtracting the thickness of the ledger from the 8/12 common run yields the "adjusted" run of 34 inches — the basis for the layout of the hip corner in plan. Adding the 10 3/4-inch HAP to the rise of the hip and commons gives the top height of the ledger.

I use a Construction Master Pro (Trig Plus III) for roof calculations. First I calculate the adjusted run of the gable common rafters:

(span – ridge thickness) ÷ 2 = adjusted run of the common rafter

(32 feet – $3\frac{1}{2}$ inches) ÷ 2 = 15 feet $10\frac{1}{4}$ inches

With that number still on the screen, I punch the Run button, then enter the pitch by keying in $5\frac{15}{16}$ inches and hitting the Pitch key. At this point the calculator contains all the information needed to calculate the rafter length and rise. To get the length of the common rafter, I hit the Diag key, which returns the value 17 feet $8\frac{1}{4}$ inches. This gives me the rafter length to the wall plate, for the birdsmouth plumb cut. To cut the rafter to proper length, I have to add the 12-inch overhang to the run and redo the calculations.

With the rafter length still on the screen, I calculate the length of the ridge posts by hitting Rise. The calculator displays 7 feet $10\frac{1}{8}$ inches, the height of the ridge above the plates for a theoretical rafter with a 0-inch heel stand, or height-above-plate (HAP). This roof happens to be framed with 2x12s, so I made the HAP $10\frac{3}{4}$ inches, which provides plenty of bearing for the seat cuts on both roof pitches. I determine the length of the ridge posts by performing the following calculation:

Rise + HAP – ridge depth – depth beam in garage = adjusted ridge post length

7 feet $10\frac{1}{8}$ inches + $10\frac{3}{4}$ inches – 14 inches – 14 inches = 6 feet $4\frac{7}{8}$ inches

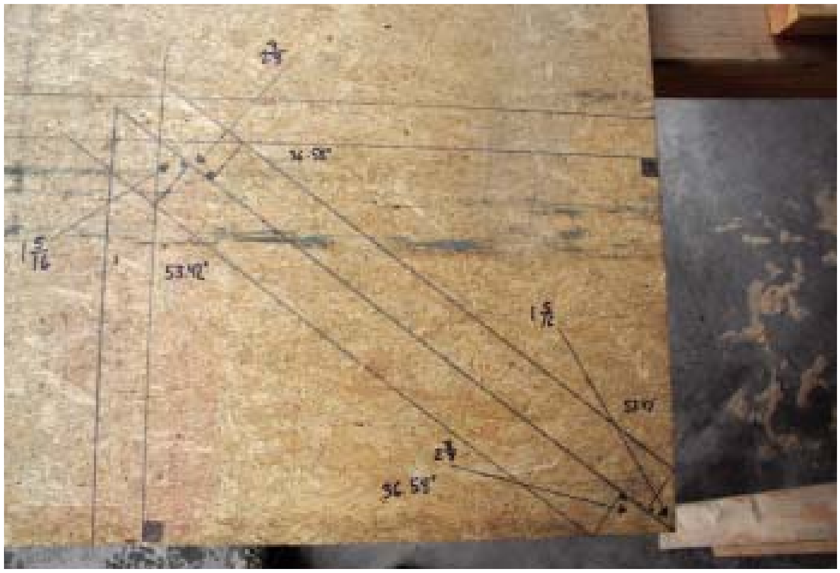


Figure 3. A full-scale drawing of the irregular hip corner helps keep the angles straight. The drawing also gives a quick visual reference for the setback cut lines, which are needed to make the top bevel and birdsmouth cuts meet in the center of the hip.

Dropping the ridge. To make sure air can reach the ridge vent, I drop the ridge by subtracting another inch from the ridge post, making it 6 feet $3\frac{7}{8}$ inches high. At this point, we can frame the gable portion of the roof and sheathe the gable wall. We leave off the fly rafters for now; they would only be in the way when we frame the hip.

Figuring the Hip

I start the calculations for the hip by calculating the short 8-pitch rafters that end at the gable wall. The sheathed face of the gable wall is $35\frac{1}{2}$ inches back from the front of the building (**Figure 2, previous page**). Because we're nailing the 8/12 commons to a 2-by ledger, I subtract another $1\frac{1}{2}$ inches to get an adjusted run of 34 inches.

I begin by entering the run and pitch. To do this I enter 34 inches and Run, then 8 inches and Pitch. Hitting the Diag key gives the result $40\frac{7}{8}$ inches, the length — not including overhang — of the 8/12 king common. To get the height of the ledger, I hit Rise ($22\frac{11}{16}$ inches), then add the HAP ($10\frac{3}{4}$ inches) to get $33\frac{7}{16}$ inches.

Irregular hip adjustment. The calculator already "knows" that one side of the roof has an 8-inch pitch, so I have to enter the other side as well. I enter the other pitch, $5\frac{15}{16}$ inches, and without hitting the Pitch key, make the following keystrokes: Conv, Hip/V, Hip/V.

The result is $61\frac{3}{8}$ inches — the length of the irregular hip to the plate line. Hitting Hip/V a third time gives me 21.67 degrees, the angle on the Speed Square that I use to mark the plumb cut.

To get the other angles, I continue punching the Hip/V button. This gives me a level cut (seat cut) of 68.33 degrees and complementary angles of 53.42 and 36.58 degrees for the diamond point on the hip, and the cheek cuts on the jacks. To keep track of the angles, I make a full-scale working drawing on a piece of plywood (**Figure 3**). This is particularly

Laying Out the Hip Bevel Cuts

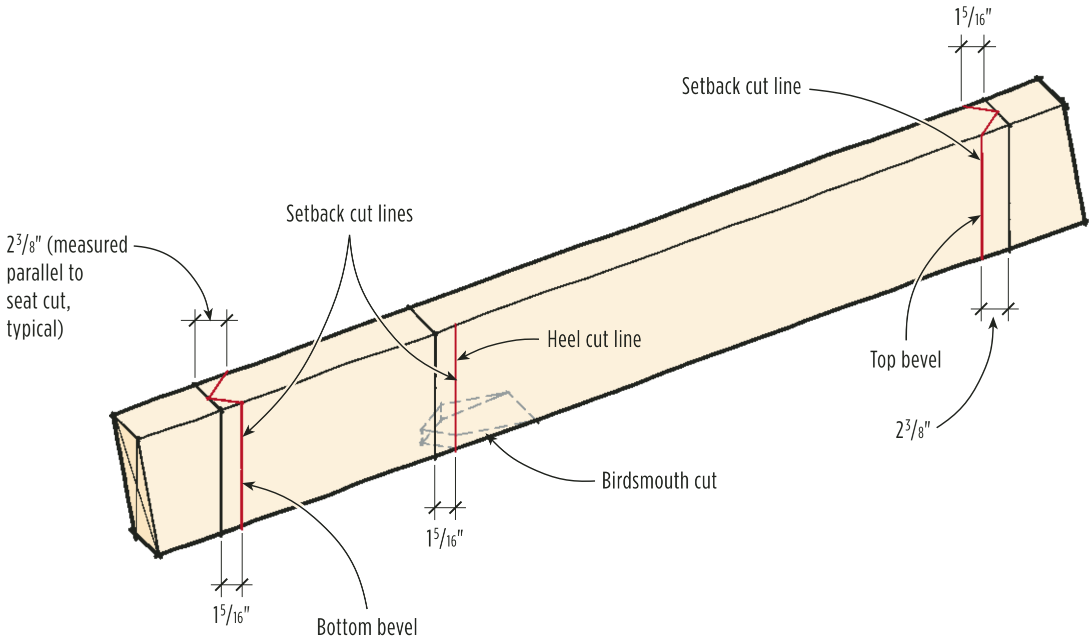


Figure 4. Before cutting the irregular hip rafter to length, the top and bottom plumb marks and the birdsmouth heel cut line must all be shortened, or set back, so that the bevel cuts meet at the hip centerline (below).

helpful with an irregular hip, because it skews toward the steeper slope, and the bevel angles at the top of the hip are opposite those at the bottom. The drawing provides a ready, useful reminder of which angle goes where. It's worth noting that when you cut a bevel, you tilt the saw to the complementary angle — to 37 degrees to cut the 53-degree angle, and vice versa.

I've now calculated the 8/12 commons, the hip, and the cut angles. Another quick calculation gives me the length of the king common on the 5¹⁵⁄16-inch side: I enter 34 inches, but this time as the rise, then enter 36.58 as the pitch. Punching the Run button gives 45¹³⁄16 inches, the run of the king common that's fastened to the gable on the 5¹⁵⁄16-inch side. To get its actual length, I enter 45¹³⁄16 inches, Run; 5¹⁵⁄16 inches, Pitch; then hit Diag to get 51¹⁄8 inches.

Rafter tails. I still have to add in the soffit run to get the actual rafter lengths. This is easy on the 5¹⁵⁄16-inch side,

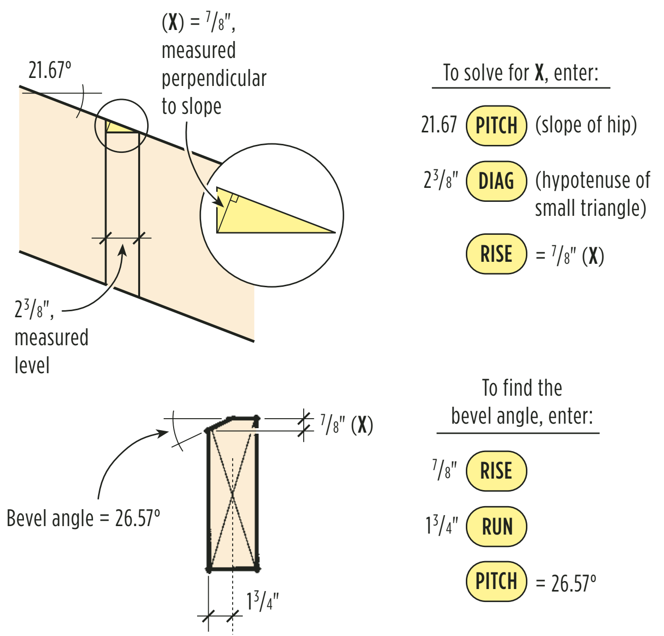


Figure 5. To speed construction, the author typically backs only one side of the hip. Starting from the top edge of the shallow-pitch side, he first measures down the birdsmouth heel cut line the HAP distance (far left). He then makes the seat cut through to the other side, flips the hip stock over, hooks his tape in the kerf, and measures back up the opposite heel cut line the same distance (left). This marks the line along which the steep side of the hip planes into the roof surface. A two-step process with a Construction Master calculator gives the backing angle (illustration). Note that the backing bevel does not reach the center of the hip; the other edge of the hip — still square — is set flush with the shallow-side rafters (below).

Figure 6. Because the heel cut lines have been set back the correct distance on each side, the birdsmouth sits at the exact corner of the wall.

which has the same 12-inch overhang as the main gable. But as I mentioned before, the overhang in front is not the same: The 8/12 rafters, being steeper, have a shorter soffit.

The 12-inch overhang, because it's on the $5\frac{15}{16}$-inch side of the roof, has by definition a rise of $5\frac{15}{16}$ inches. Because the soffit is level, the overhang on the 8/12 side must also have the same rise. So to calculate the 8/12 overhang, I enter $5\frac{15}{16}$ inches, Rise; 8 inches, Pitch; then Run. The calculator displays $8\frac{15}{16}$ inches, which is the distance you add to the 34-inch run on the 8/12 side (refer to Figure 2).

Laying Out the Hip

Using my 12-inch Speed Square, the first thing I do is square a line across the top edge at the upper end of the hip stock. Where this line hits the edges I draw the 21.67-degree plumb cuts on both faces (**Figure 4, page 5**).

Cut lines. Before cutting, I have to locate the cut lines so that the two bevel angles will meet at the center of the stock. The scale drawing shows where the lines for the plumb cuts should be, relative to the 21.67-degree lines I just drew. If the bevels are to meet in the center of the 4-by stock, the cut lines have to shift — $1\frac{5}{16}$ inches for the 53.42-degree bevels and $2\frac{3}{8}$ inches for the 36.58-degree bevels.

You can also use the calculator to find the setback distances: Enter half the thickness of the hip — $1\frac{3}{4}$ inches — as the rise, and the bevel on that side — 53.42 degrees — as the pitch, then hit Run. The result will be $1\frac{5}{16}$ inches, same as on the drawing.

Marking the length. After cutting the top of the hip, I hook my tape on the diamond point and measure down to make marks at $61\frac{3}{8}$ inches (the corner of the wall) and $77\frac{1}{2}$ inches (the end of the tail). Again I square a line across the top and plumb lines down the sides. The upper line represents the outside corner of the building and the lower one the tail of the hip. These lines will also have to be adjusted before cutting, as shown in Figure 4.

Backing the Hip

On a regular hip roof, the hip rafter is usually dropped (lowered) so the jacks will flush out with the edges. But with an irregular hip, you have to lower each edge a different distance. Some framers handle this by cutting a backing bevel from each side, but I just bevel one side — the steep side — and set the top corner of the shallow side in plane with the shallow pitched roof. The plywood sheathing will have a small gap under it in the middle of the hip, but that doesn't matter.

To find the backing cut line, I lay out the lower-pitched side first so that the jacks will be flush with its existing edge. I first locate the seat cut, simply measuring $10\frac{3}{4}$ inches down from the top edge of the hip along the offset cut line shown in Figure 4.

Next, I make the seat cut from this side — the $5\frac{15}{16}$-inch side — all the way through the stock. I then flip the stock and hook my tape on the seat-cut kerf on the opposite side — the 8/12 side — and measure $10\frac{3}{4}$ inches up the plumb cut line to locate the backing cut line (**Figure 5, previous page**).

Bevel angle. We make the cut with the saw bevel set to an angle equal to the slope of a triangle with a run of $1\frac{3}{4}$ inches (half the thickness of the hip) and a rise of "X," as shown in Figure 5. Because the other side of the hip has already been dropped, the backing cut doesn't reach the center of the stock.

We use the same $1\frac{5}{16}$-inch and $2\frac{3}{8}$-inch setbacks to lay out the diamond cut

Finding the Jack Length

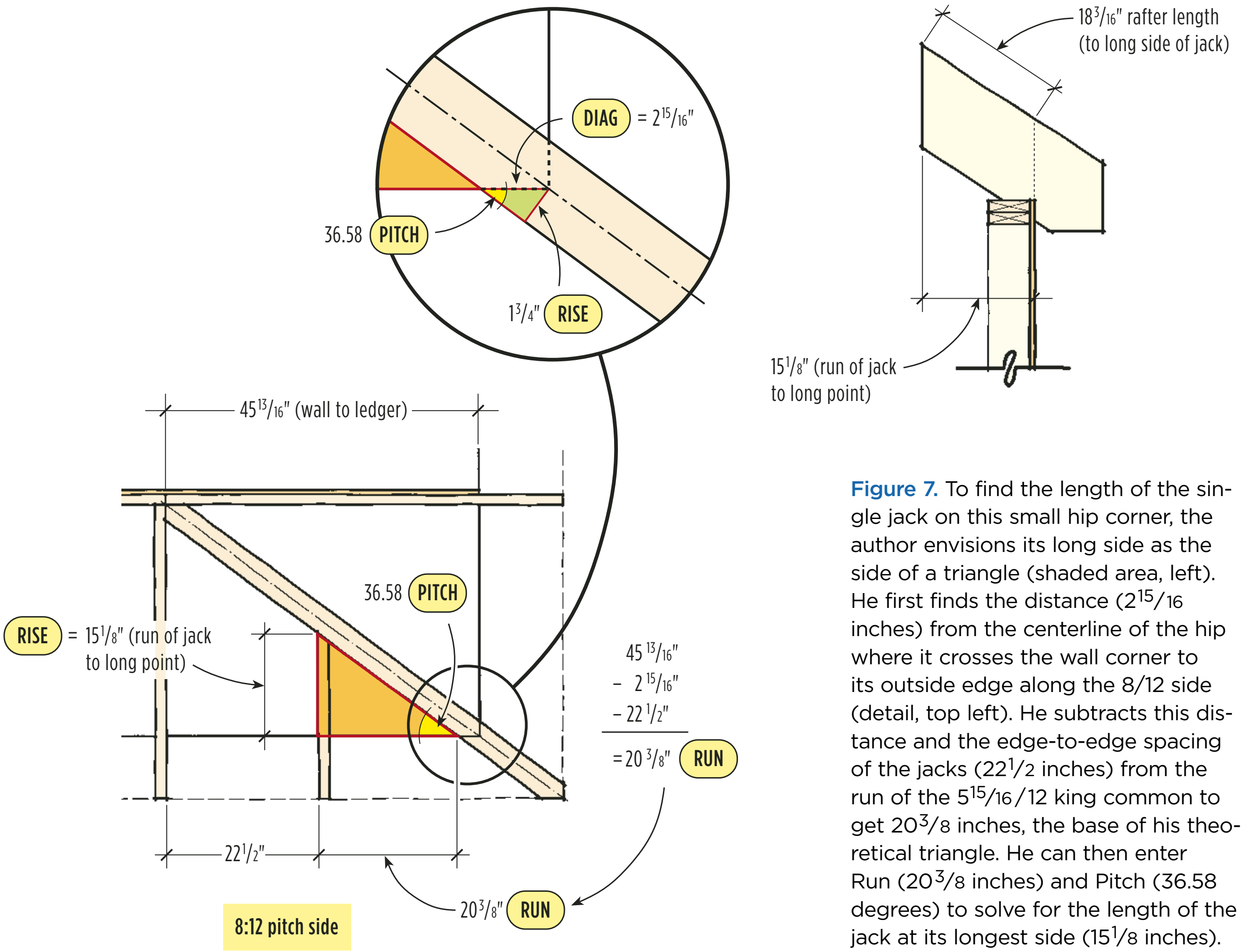


Figure 7. To find the length of the single jack on this small hip corner, the author envisions its long side as the side of a triangle (shaded area, left). He first finds the distance (2 15/16 inches) from the centerline of the hip where it crosses the wall corner to its outside edge along the 8/12 side (detail, top left). He subtracts this distance and the edge-to-edge spacing of the jacks (22 1/2 inches) from the run of the 5 15/16/12 king common to get 20 3/8 inches, the base of his theoretical triangle. He can then enter Run (20 3/8 inches) and Pitch (36.58 degrees) to solve for the length of the jack at its longest side (15 1/8 inches).

on the lower end of the hip. The final layout step is to draw a level line for the soffit cut. Once the layout is complete, I finish cutting the birdsmouth (**Figure 6, previous page**) and make the diamond cuts and level cut at the tail.

Jack Layout

I lay out jacks from the long point of the bevel. In this case, because the hip is so short, there's only one jack. I make its long side one of the sides of an imaginary triangle, then solve for its run (**Figure 7**).

Difference between jacks. If there were more jacks, I'd calculate their lengths by taking the length of one and then adding (or subtracting) the difference in length to find the succeeding ones. So for rafters 24 inches on-center, I'd start by finding the run of a jack 24 inches away from where the hip and wall meet. To do this, I'd enter a run of 24 inches, a pitch of 36.58 degrees, and hit Rise. The result is 17 13/16 inches, the run of that jack. We then enter a run of 17 13/16 inches, a pitch of 8 inches, and hit Diag. The result is 21 7/16 inches, the difference in length of successive jacks on the 8/12 side.

We use a similar process to figure the jacks on the 5 15/16-inch side. The difference is we'd start with the adjusted run of the 8/12 king common and use an angle of 52.42 degrees.

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