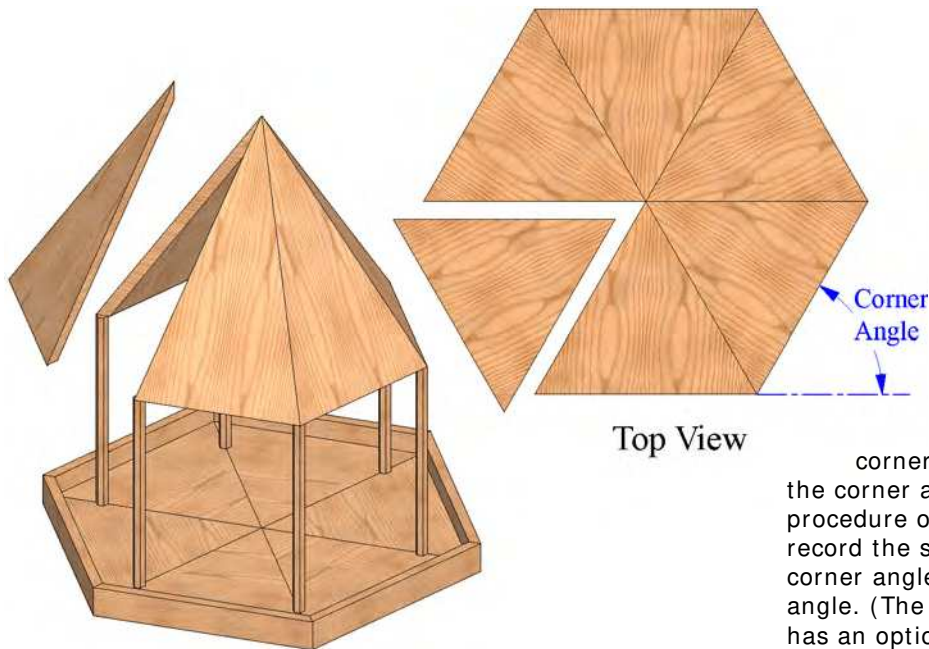


## Compound Miter Cuts

Compound miter cuts are where the saw is both in a miter position and a bevel position at the same time. There are several applications for compound miter cuts, but cutting crown moulding and sloped miters are common examples. The example below shows a very simple birdfeeder roof.



The greatest challenge with compound miters is determining the proper saw settings to achieve the desired miter angle. These saw settings can be found in look-up tables for standard mouldings, but for non-standard angles, determining the proper saw settings requires mathematical calculation.

**i** Note that there are several methods for accurately cutting crown moulding depending on the circumstances. Make sure to review the methods described in the applicable section on page 21.

Calculating compound miter settings requires two parameters from the desired joint: the **corner angle** and the **slope**.

### Corner Angle

The corner angle is the angle between the two pieces, when viewed looking straight down on the joint. The corner angle is relatively easy to determine, but it is also the value that can cause the greatest amount of confusion for many woodworkers. That's because most woodworkers view angles differently than a mathematician will. A woodworker typically considers both inside and outside corners as 90 degrees (with a 45 degree miter) even though a mathematician would make the distinction that one corner is 90 degrees and the other is 270 degrees. To be consistent with miter saw settings, the corner angle is measured from a straight line between the two pieces, as shown above.

### Slope

The Slope angle is the angle that each piece makes with respect to the base of the corner, such as the ceiling or floor in the examples provided here. For a roof-like structure, this would be the pitch of the roof. For crown moulding, this would be the compliment of the "Spring Angle" of the moulding. Common spring angles for mouldings are 38/52 and 45/45.

### Determining the Corner Angle of Polygons

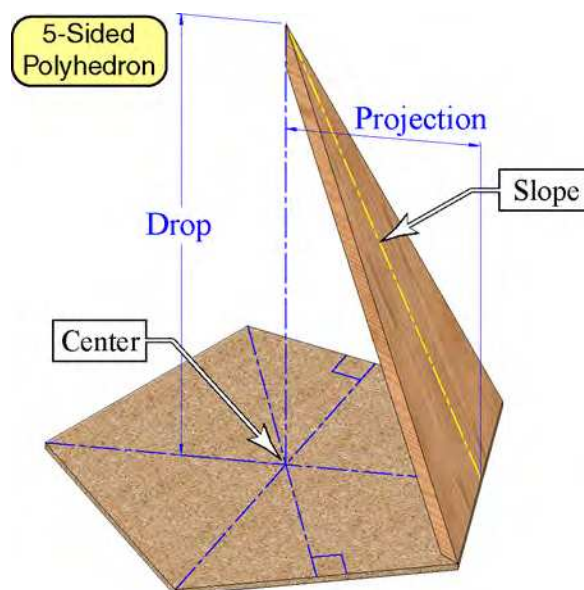
The corner angle for standard polygons is shown in the table on page 18.

### Using the MiterFast Tool to Find a Corner Angle

For non-standard corner angles, such as a room that is slightly out of square, the MiterFast tool can be used to determine the corner angle. To use the MiterFast tool to measure the corner angle, follow the "Using the MiterFast Tool" procedure on page 15, but instead of making the cut, record the saw's miter setting angle. This angle is  $\frac{1}{2}$  the corner angle, so multiplying by 2 will give you the corner angle. (The compound angle calculator on page 21 also has an option for letting you enter this angle directly without needing to double it.)

### Determining the Slope of a Pyramid (Polyhedron)

A polyhedron is a pyramid that can have any number of sides. The easiest method for determining the slope of the polyhedron is by measuring the **Drop** and **Projection** of one face. These are the distances from the center-to-the-edge, and the base-to-the-point of the pyramid. Note that with a polyhedron with an odd number of sides, the center is found by drawing bisecting lines as shown in the image below.

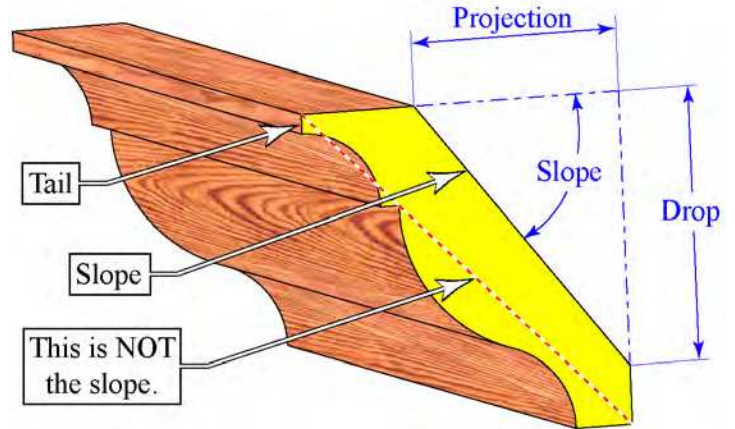


### Determining the Slope of Crown Moulding

As was mentioned previously, the slope of a crown moulding is the compliment of its "Spring Angle" (the spring angle is measured relative to the wall, and the slope is measured relative to the ceiling). The two common spring/slope angles of crown moulding are 38/52 and 45/45. The reason why these angles are represented by dual numbers is because the actual angle depends on which direction the moulding is oriented. For example, turned one way, the slope is 38 degrees, but turned the other way, the slope is 52 degrees. Note that the sum of these two angles is always 90 degrees.

For mouldings that are not the standard 38/52 or 45/45, you will need to measure the moulding to determine its slope. This is very similar to measuring the **Drop** and **Projection** of a pyramid, but more care needs to be taken to ensure the measurements are taken from the correct locations. **Important:** The slope of a moulding does not

necessarily coincide with the "points" or "Tails" of the moulding. The slope is measured from the **back-side** of the moulding, regardless how long the tails of the moulding may extend (see image below).



### Calculating Compound Angles

There are two separate equations for calculating a compound angle. One equation is for calculating the miter setting of the saw, and the other equation is for calculating the bevel setting of the saw.

$$\text{Miter} = \text{ArcTan} \left[ \text{Tan} \left( \frac{\text{CornerAngle}}{2} \right) \times \text{Cos}(\text{Slope}) \right]$$

$$\text{Bevel} = \text{ArcSin} \left[ \text{Sin} \left( \frac{\text{CornerAngle}}{2} \right) \times \text{Sin}(\text{Slope}) \right]$$

If you don't know the **slope** angle, but you know the **Drop** and **Projection**, then use the following to calculate the slope:

$$\text{Slope} = \text{ArcTan} \left[ \frac{\text{Drop}}{\text{Projection}} \right]$$



The most common error in calculating compound angles is using the wrong **Corner Angle**. As a double-check to your calculations, for nearly all cases, the Corner Angle should be less than 100°. The only time the angle should be significantly larger than 90° is either for a 3-sided box, or a wall corner with a sharp edge.

### Compound Angle Calculator

A compound angle calculator has been built into this Adobe® Acrobat® PDF file. If you do not have an original electronic version of this manual, visit the <http://www.festoolusa.com/> website to download a copy.

#### Slope Angle Options

<input type="checkbox"/> Slope Angle		<input type="checkbox"/> Drop	
		<input type="checkbox"/> Projection	

#### Corner Angle Options

<input type="checkbox"/> Corner Angle		<input type="checkbox"/> MiterFast Tool Angle	
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#### Results

Miter Setting		
Bevel Setting		

**Note:** If you are unsure about the corner angle you have entered, check the calculated "MiterFast Tool Angle" value. This number should be no more than 60 degrees for sharp corners, but otherwise, it should always be less than 45 degrees for most corners.

If it is significantly greater than 45 degrees, then you probably have the wrong "Corner Angle."

## Crown Moulding

There are several methods for cutting crown moulding, and each method has its benefits depending on the specific application. The most common method for cutting crown moulding is to use a standard miter cut, where the moulding is tilted against the fence of the saw. For unusual situations, or when the moulding is too large to fit against the fence, compound miters are used. In some applications, inside corners are made using a method called "coping." Each of these methods will be described briefly.

### Standard Miter

A standard miter cut is the easiest and most common method for cutting crown moulding. The Kapex miter saw has an optional auxiliary crown moulding fence (also called the Crown Stop) specifically for making this type of cut. The fence holds the moulding at the correct angle so it can be cut with a normal miter cut.

For this type of cut, you place the moulding on the saw as it would normally rest in the installed position. The edge that normally faces the ceiling is the edge that should be on the base of the saw.



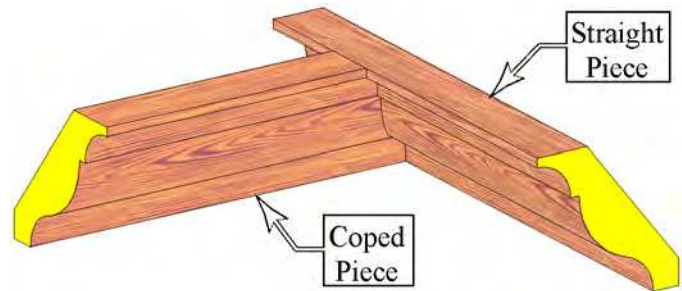
### Compound Miter

A compound miter cut is used when the moulding is too tall to use the standard miter method. This can also be used for a higher level of accuracy when the tails of the moulding are not perfectly perpendicular with each other (a common problem with most mouldings). Place the moulding on the saw with the flat back face on the base.

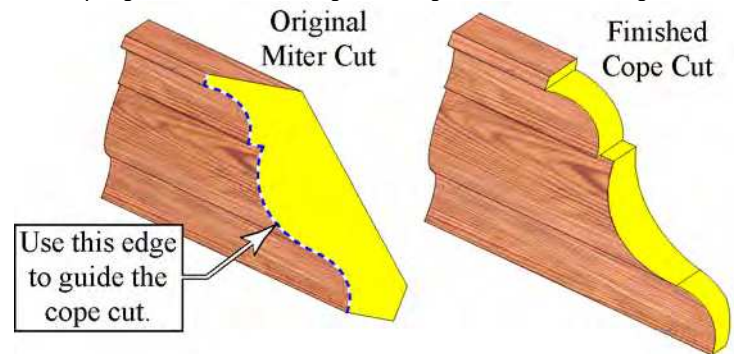
### Coped Cut

A coped cut is sometimes used for making inside corners so there is no visible gap between the two pieces of moulding. A coped cut requires the use of a coping saw (a thin bladed handsaw for cutting

curves), but the initial cut is made with a miter saw. The first piece of moulding does not get a miter, and butts into the adjacent wall. The second piece of moulding gets a coped cut to match the profile of the first piece.



To make a coped cut, cut the second piece of moulding with a miter, just as though it was going to be a mitered joint. Then use a coping saw to cut along the edge of the resulting miter.



### General Notes

- ▶ If you are mitering both ends of a piece of moulding, make the more difficult cut first, because it does not need to be at the exact length. For example, a right-handed operator may want to cut the left-hand miter first. This makes it easier cutting the second miter to exact length.
- ▶ When installing crown moulding around a room with walls that may not be square, use a piece of off-cut scrap moulding to test-fit the miters and lengths.
- ▶ It is mathematically impossible to make a mitered joint that changes two directions at the same time, such as putting crown moulding around a vaulted ceiling. You must either make a double miter joint, or use a corner block.

