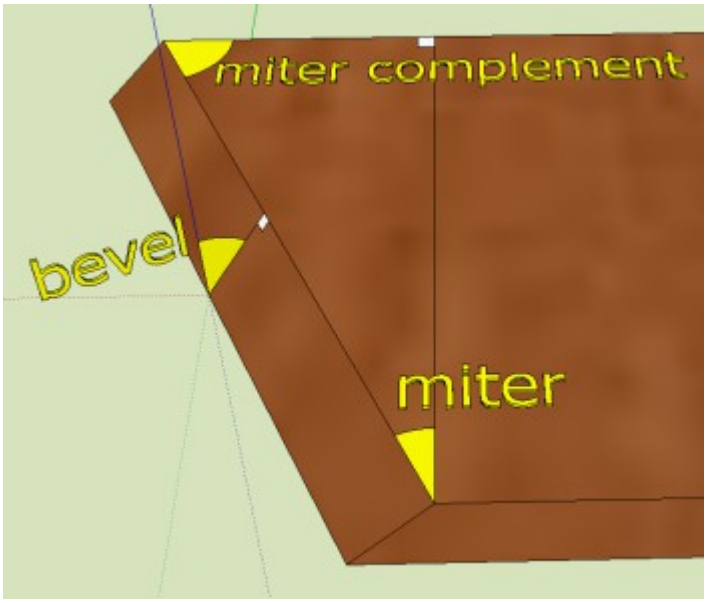
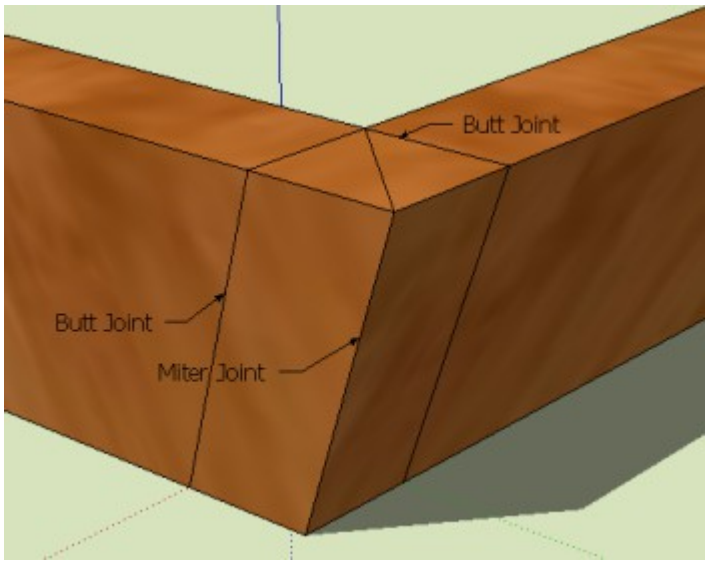
http://jansson.us/jcompound.html

Compound Saw Calculator

A table saw or compound miter saw can cut workpieces with two angle settings; bevel and miter. Such a saw is useful when building for example wooden boxes with angled sides or concrete forms for post caps. It is deceptively difficult to compute compound angle settings. On this page I have collected a few compound angle calculators that will help compute compound angles.

- N-sided Box
- N-sided Pyramid
- Pyramid with Rectangular Base
- General Compound Angles using Coordinates
- General Compound Angles using Angles
- Flip the Board On Edge
- Effective Kerf





Definitions:

I make these definitions for the purpose of clarifying the concepts discussed on these pages. Other definitions may exist elsewhere.

- A *compound* cut consists of two angles, the *bevel* angle and the *miter* angle.
- The *bevel* angle (or blade tilt) is the tilt of the saw blade from vertical on the table saw. This means that a normal square cut has a bevel of 0°. Typically saws have a maximum bevel of 45°.
- The *miter* angle (or cross-cut angle) is the horizontal angle, as seen on the table saw, from a line perpendicular to the long edge of a board. The miter angle is set on the miter gauge of the table saw. A perpendicular cut has a miter of 0°.
- Some saws label the miter angle differently, with a perpendicular cut labeled 90°. This is the *miter complement* angle.
- The *dihedral angle* is the angle between two surface planes. Specifically, we are computing the inside dihedral angle, which is always ≤180°. A block that fits snugly between the two surfaces can be cut with the miter angle set to the dihedral angle minus 90° and with zero blade tilt.
- A *miter joint* joins the cut ends of two boards.
- A *butt joint* joins the cut end of one board (butt) with the uncut side of a second board (cap).

Miter joints and butt joints have identical miter angles; only the bevel angle is different. We can see this in the picture on the right; the cutting lines on the face of the board are parallel.

Angle Precision: Choose the number of decimal digits you would like to round the angle results to.

Number of Decimals in Angles 0 1 2 3

Example: 1.9°

N-sided Box

An n-sided box is built from *n* identical side pieces and a bottom. The box can have sides that are angled outwards. The outward angle is the side angle.

Number of sides:

Side angle (deg): from: vertical horizontal

Blade tilt, mitered joint:

Blade tilt, butted joint:

Miter angle:

Miter complement:

Dihedral angle:

Note that this calculator also works for rectangular boxes.

Derivation

N-sided Pyramid

An n-sided pyramid is built from *n* identical triangular side pieces, not including the base. The *base radius* is the distance from the center of the pyramid's base to one of the base corners. The *height* is the distance from the center of the base to the apex.

Number of sides:

Base radius:

Pyramid height:

Blade tilt, mitered joint:

Blade tilt, butted joint:

Miter angle:

Miter complement:

Base side:

Side Slope:

Dihedral angle:

The side slope is measured from horizontal and can be used to calculate any cuts needed at the bottom of the pyramid's sides.

Pyramids with butted joints are some weird animals. A few more or less realistic examples are shown on the right.

Rectangular Pyramid

A rectangular pyramid is a pyramid with a rectangular base.

A concrete form for casting post caps can be made in the shape of a pyramid. The pyramid can have a square or rectangular base.

Base side A:

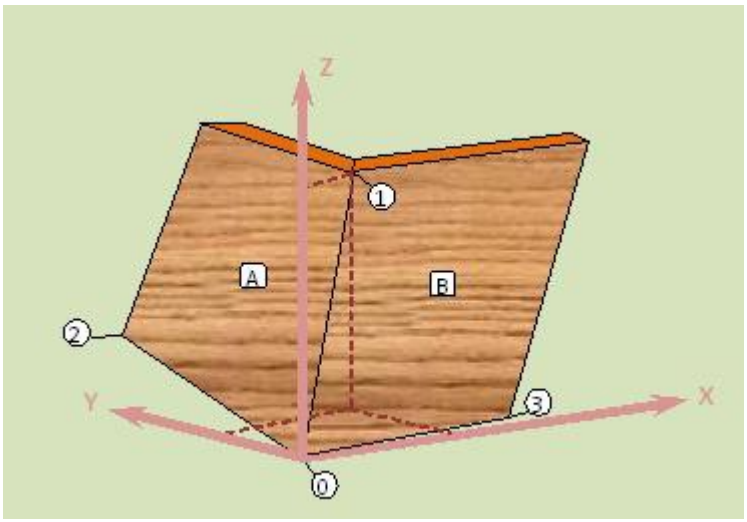
Base side B:

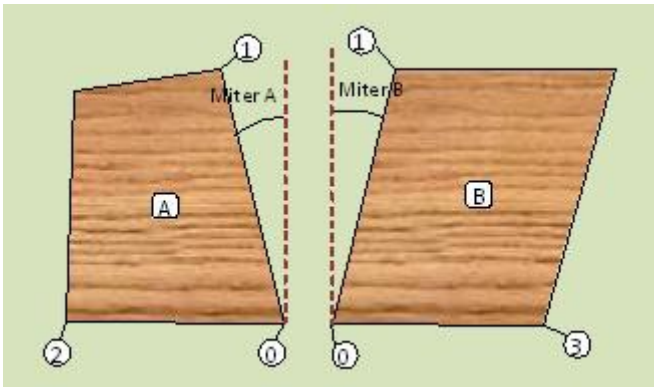
Pyramid height:

Side:	**A**	**B**
Blade tilt, mitered joint:		
Blade tilt, butted joint:	← Same	
Miter angle:		
Miter complement:		
Side slope:		
Dihedral angle:	← Same	

The side slopes are measured from horizontal and can be used to calculate any cuts needed at the bottom of the pyramid's sides.

General Compound Angles





In the general case we have two intersecting surface planes. By defining four points, *0* to *3*, on the surfaces in 3D space we can find the miter and bevel angles of sides A and B.

The figure on the right shows the two pieces assembled. The dashed lines show how the XYZ coordinates for point *1* are determined.

Points *0* and *1* lie on the seam between the two surfaces. Point *1* can be located anywhere along that seam except at the origin (point *0*).

The line between points *0* and *2* is the reference edge for surface A's miter angle. Point *2* can be located anywhere along that edge except at the origin. Line *0-3* likewise for surface B.

	X	**Y**	**Z**
Point 0:	0	0	0
Point 1:			
Point 2:			
Point 3:			

Side:	**A**	**B**
Blade tilt, mitered joint:		← Same

Blade tilt, butted joint: ← Same

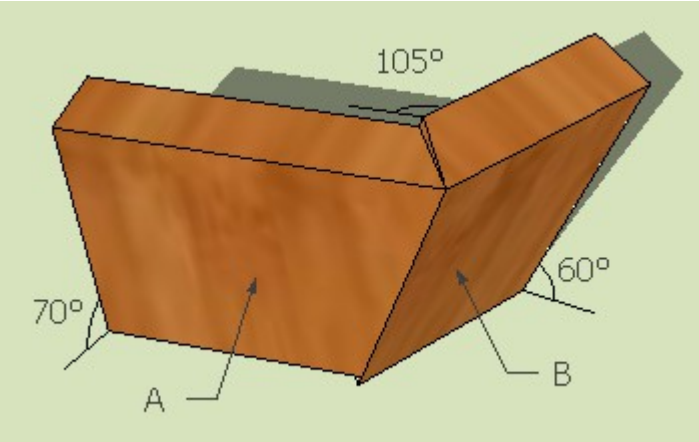
Miter angle:

Miter complement:

Dihedral angle:

For the mitered joint, for simplicity the blade tilts for pieces A and B are the same, but you can change them as long as their sum is the same. This will affect the intersection of A and B at the top and bottom. For the butted joint the blade tilts must be the same.

General Compound Angles 2



Two boards have been joined at arbitrary angles. We orient the joined boards such that their edges are parallel to the horizontal plane. We now specify three angles:

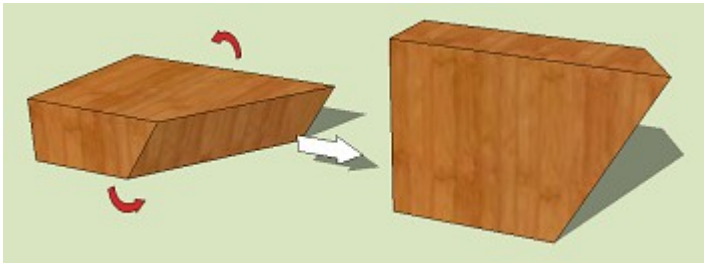
Angle between the boards in the horizontal plane (deg):

Side angle of board A with respect to horizontal (deg):

Side angle of board B with respect to horizontal (deg):

Side:	**A**	**B**
Blade tilt, mitered joint:		← Same
Blade tilt, butted joint:		← Same
Miter angle:		
Miter complement:		
Dihedral angle:		

Flip Board On Edge



A board with +30° blade tilt and +30° miter angle is flipped 90°. The new angles are +25.7° blade tilt and -33.7° miter angle.

The calculators on this page assume that the boards are laying flat on the saw table. Sometimes we would like to have the board lay with its narrow side down instead. Specifically, we flip the board so that the surface that was facing away from us is now facing up. See the example on the right for how the signs of the angles are defined.

To use this calculator, either first use another calculator above and the inputs will be filled in automatically, or enter values in the input boxes manually. For the simplest case, just one blade tilt and a miter angle are needed.

Board Flat

Board:	**A**	**B**
Blade tilt, mitered (deg):		
Blade tilt, butted (deg):		
Miter angle (deg):		

Board On Edge

	Board:	**A**	**B**
	Blade tilt:		
Mitered	Miter angle:		
	Miter complement:		
	Blade tilt:		
Butted	Miter angle:		
	Miter complement:		

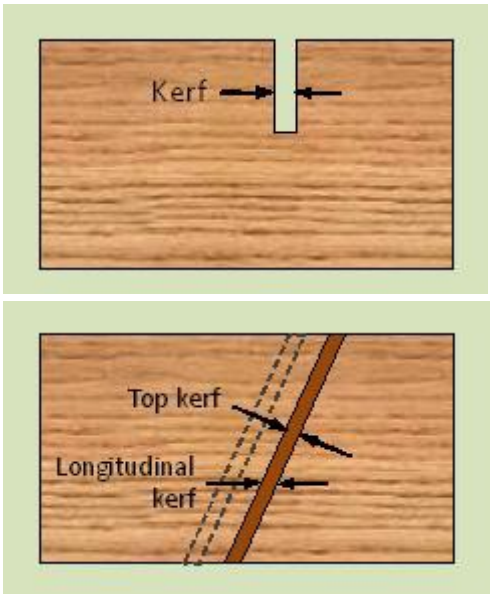
Spreadsheet

The following methods may be useful for orienting the board for the compound angles. (Drawings coming soon)

- Flipping the board 180° (rolling the board on its axis), both blade tilt and miter angle change sign. This is useful for example if the saw can only tilt the blade in one direction.
- Flipping the board end-for-end changes sign of only the miter angle, but it also moves the waste piece to the other side of the blade. This may or may not be practical depending on the situation.

- Rotating the board 180° horizontally (same side up) changes the sign of only the blade tilt, and it moves the waste piece to the other side of the blade.

Effective Kerf



Kerf is the width of the slot cut by the saw blade. When we use miter and bevel cuts the width of the slot increases on the surfaces of the board. Bevel affects the width of the top surface slot, while both bevel and miter affect the width of the slot in the longitudinal direction of the board.

If we want to lay out several pieces to be cut on a board, then we need to know the effective longitudinal kerf which will add up considerably over a few workpieces.

Saw kerf:
Miter (deg):
Bevel (deg):

Effective top kerf:
Effective longitudinal kerf:

Links

Credit goes to Chris Glad for being the first to provide an online calculator for butted joints. It is well worth it to check out his calculator.