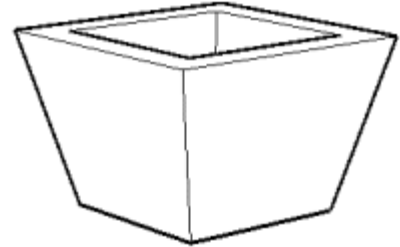


<http://www.pdxtex.com/canoe/compound.htm>

Compound Angle Calculators

I recently had a woodworking project with compound angles. A quick search of the web for an online calculator quickly showed that, even though there are plenty of great miter calculators out there, I wasn't able to find to for calculate a butted joint at a compound angle. After a bit of research, I discovered the possible reason why – calculating a butted joint is much more complicated than calculating a mitered joint.

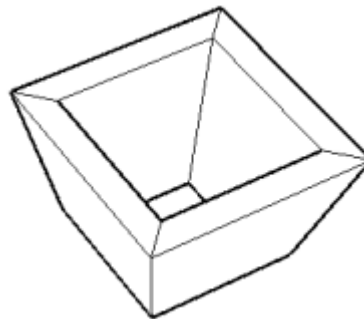


Thanks to this website: <http://www.sbebuilders.com>, and also to Joe Bartok whose [archived](#) treasure trove of timber framing math was a huge help.

Compound Miter

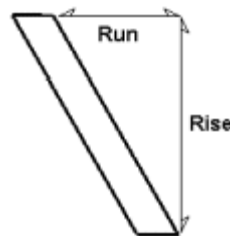
(enter values in degrees)

Slope
Included Angle degrees -or- sides
End Angle
Bevel angle



Calculate Slope

Horizontal run (inches) Vertical rise (inches) Slope (degrees)



Compound Angle -- Butted joint

Slope A
Slope B

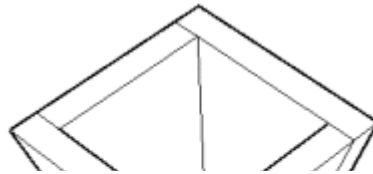
Included Angle degrees -or- sides

Results:

Side A end
angle

Side B end
angle

Bevel angle



These two calculators were designed with a tablesaw in mind, although you could use it with any tool. Just adjust angular orientation accordingly.

Notes on angles:

Input:

Slope angle is measured from the horizontal plane. 0° is horizontal and 90° is vertical.

Included angle refers to the angle the two pieces meet in plan view. The angle is measured between the two pieces – 90° is a 4-sided box, 120° is 6-sides, etc.

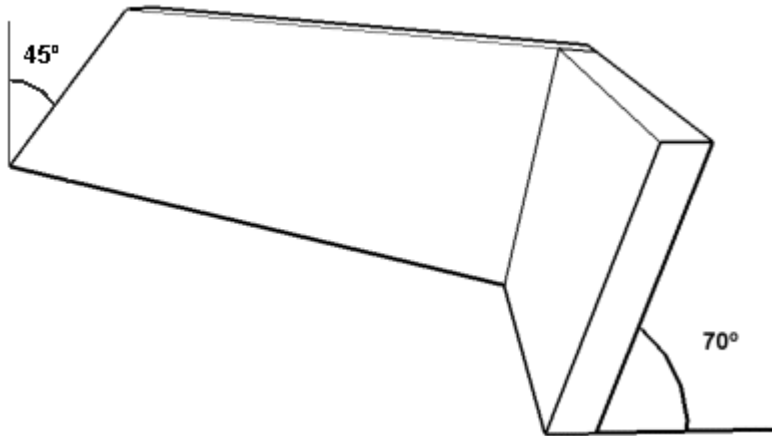
Results:

End angles are given in relation to a square end. 0° is a square ended piece, 45° is a piece cut with a 1:1 angle. End angle refers to the angle on the end of the piece when it is laying in the horizontal plane (like on the top of a tablesaw). End angle is the angle you'd set your crosscut fence to.

Bevel is given in degrees from vertical, when the piece is laying flat on a horizontal plane (like on the top of a saw table). 0° a square edge (no bevel), 45° is a piece cut with a 1:1 bevel. Bevel is the angle you'd set your blade to.

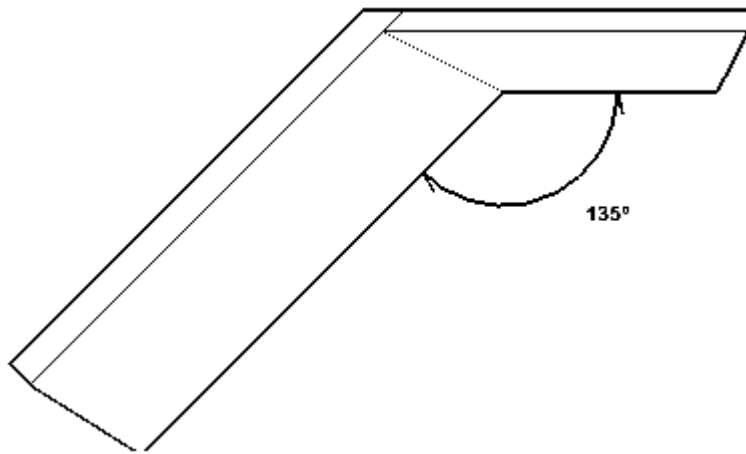
Butted compound angles.

Butted compound angles are more complex than a simple mitered joint. Unlike a mitered joint where the two pieces to be joined are tipped at the same angle, in a butted joint, the two pieces to be joined can have different angles.



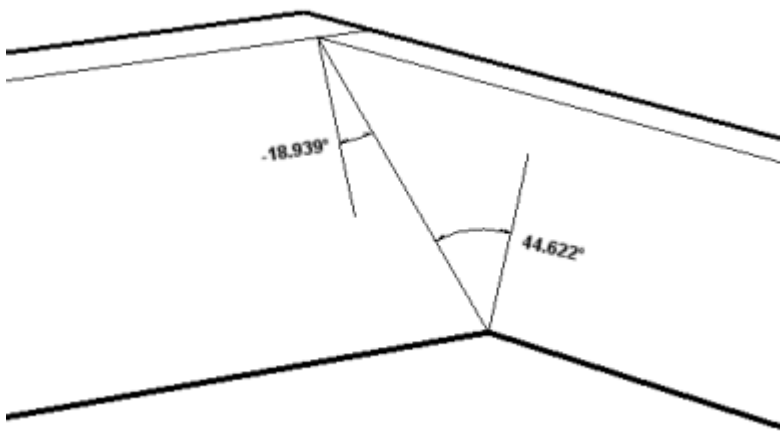
In this example, the butting piece is tipped at an angle of 70° , or 20° from vertical and the capping piece has an angle of 45° . (fig 1)

fig 1



The two pieces are joined at an angle of 135° in the horizontal plane (or plan view). (fig 2)

fig 2



Notice that the long point of the angle on the butting piece is toward the top, and the long point of the capping piece is at the bottom (this is represented by the negative angle). This happens when a shallower angled piece intersects a steeper angled piece. This can be tricky to visualize when cutting -- mark your material carefully!

The results for this calculation is as follows:

Butting piece – the end is cut at a 44.622° angle

Capping piece – the end is cut at a -18.939° angle

Both pieces are beveled at a 45.373°

angle.

fig 3

It doesn't actually matter which piece butts and which caps, so in the calculator, they are simply referred to as A and B.

If you're interested in playing or checking my work (please!), here are the formulas I used:

For the miter:

End angle: $\text{atan}(\cos(\text{slope_angle}) * \tan(\text{corner_angle} / 2))$

Bevel angle: $\text{asin}(\sin(\text{slope_angle}) * \sin(\text{corner_angle} / 2))$

For the butted joint:

End angle A: $90 - \text{atan}((\tan(\text{slopeB}) * \sin(\text{corner_angle})) / (\sin(\text{slopeA}) + \tan(\text{slopeB}) * \cos(\text{slopeA}) * \cos(\text{corner_angle})))$

End angle B: $90 - \text{atan}((\tan(\text{slopeA}) * \sin(\text{corner_angle})) / (\sin(\text{slopeB}) + \tan(\text{slopeA}) * \cos(\text{slopeB}) * \cos(\text{corner_angle})))$

If either of these values exceed 90°, I subtract from 180 to provide a negative angle that indicates the angle goes the other way.

Bevel angle: $\text{asin}(\cos(\text{slopeA}) * \cos(\text{slopeB}) - \sin(\text{slopeA}) * \cos(\text{slopeB}) * \cos(\text{corner_angle}))$

A [spreadsheet version](#) is available as well.

This page is offered "as-is" -- use it at your own risk. If you find a mistake, I'd love to hear about it. If it doesn't do what you want, go ahead and make your own, like this excellent page: [Bjorn Jansson's Compound Miter Saw Calculator](#) (his does butted joint too)