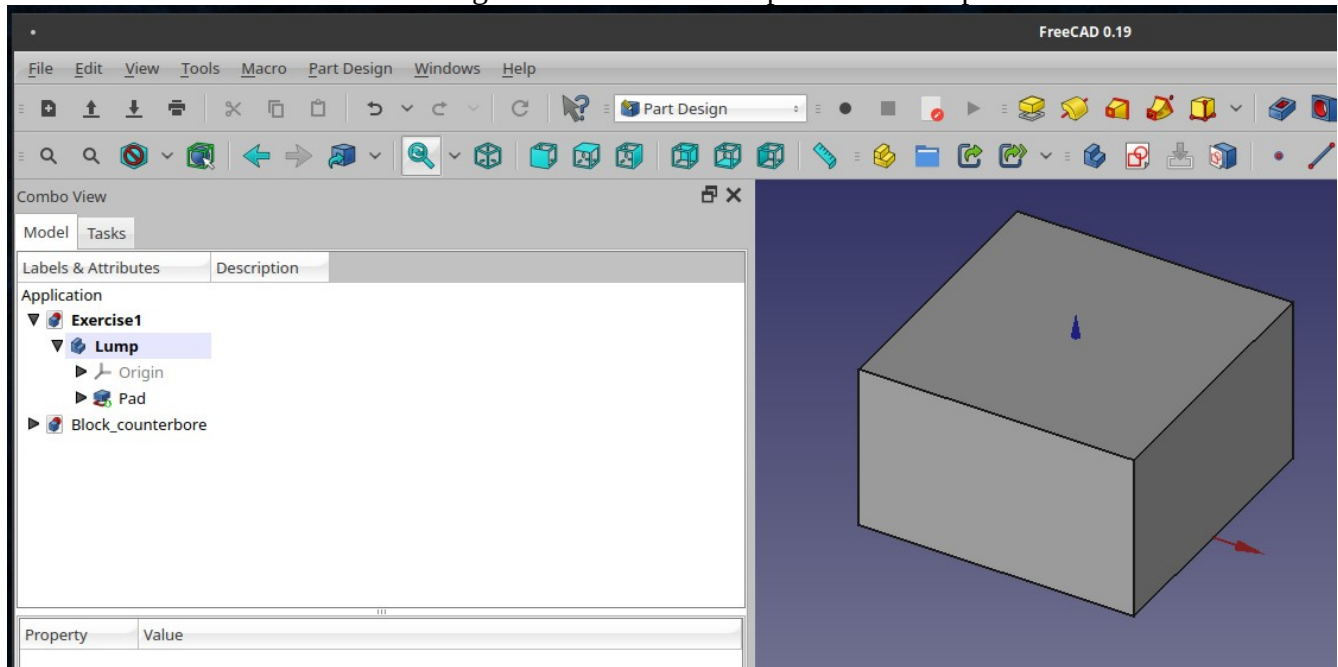



This document is meant to detail an additional way to accomplish the counterbored hole as shown in StartingToDesignWithFreeCAD. We will use the Hole tool in FreeCAD to create the counterbored hole.

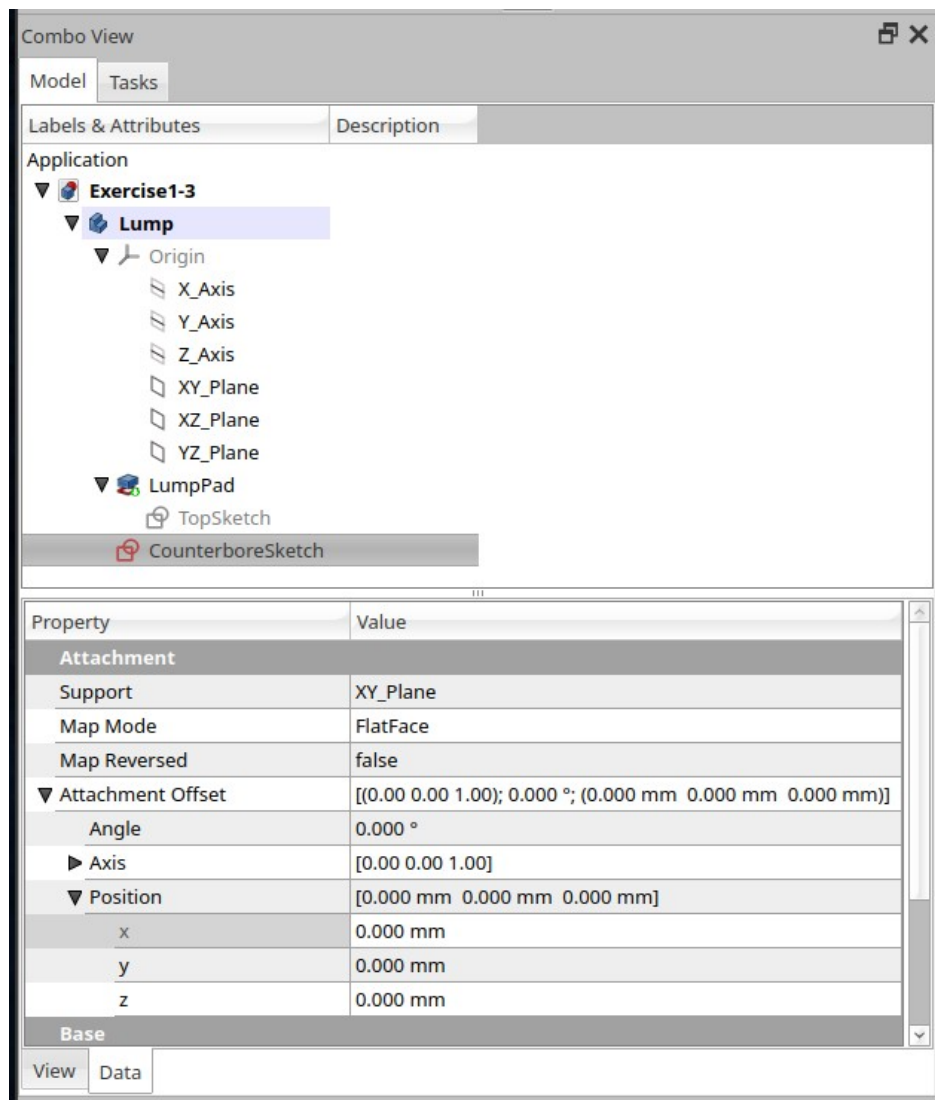
See the discussion in that treatise to get to the initial development of a lump of material.




1. To begin, make sure the Lump body is the active body. If it has a gray background, as show above, then it is active. If not, right click on the Lump body in the tree. Select *Toggle active body*. Click on anything else to see the gray background. (You can double click the body to do this toggle as well.)
2. Now create a ne sketch, click the new sketch icon . Select the XY_Plane and OK.
3. Rename the sketch to CounterboreSketch.

Since the counter bore will be going into the top surface of the we could have selected the top face and then created the sketch. This would mean the sketch would be attached to the face. Because of the topological issues discussed in StartingToDesignWithFreeCAD this could be a problem in the future. At the moment the sketch is attached to the XY_Plane at $Z = 0$. Since we want the hole entering the top of our lump, we need to correct that. We will do that by chaging the attachment offset.

4. If the sketch is still open, click close.
5. Select the CounterboreSketch in the tree. Take a look at the Property window. Make sure the Data tab is selected.

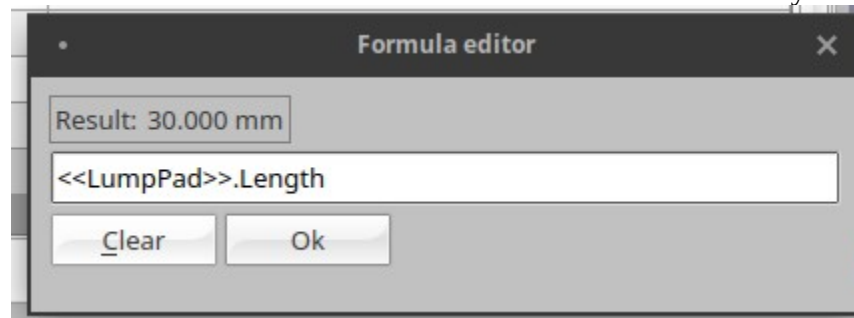


- Expand the Attachment Offset. Note currently the Z Position is set to 0.000 mm. Since we know the top of the lump is 30 mm (because we padded the lump 30 mm) we could simply enter 30 mm in the Z Placement field. But, instead we will use the parametric nature of FreeCAD to make the counterbore follow the top surface if we were to change the pad value.
- Click in the Z Position field. Notice the function $f(x)$ icon appears in the right hand side of the field:

▶ AXIS	[0.00 0.00 1.00]
▼ Position	[0.000 mm 0.000 mm 0.000 mm]
x	0.000 mm
y	0.000 mm
z	0.000 mm 

- Click the $f(x)$ icon. The formula editor dialog pops up. Start typing “LumpPad”. After the first couple letters you will be offered list of property names that begin with those letters. LumpPad should be in the list and you can simply click it in the list. Then begin typing the word

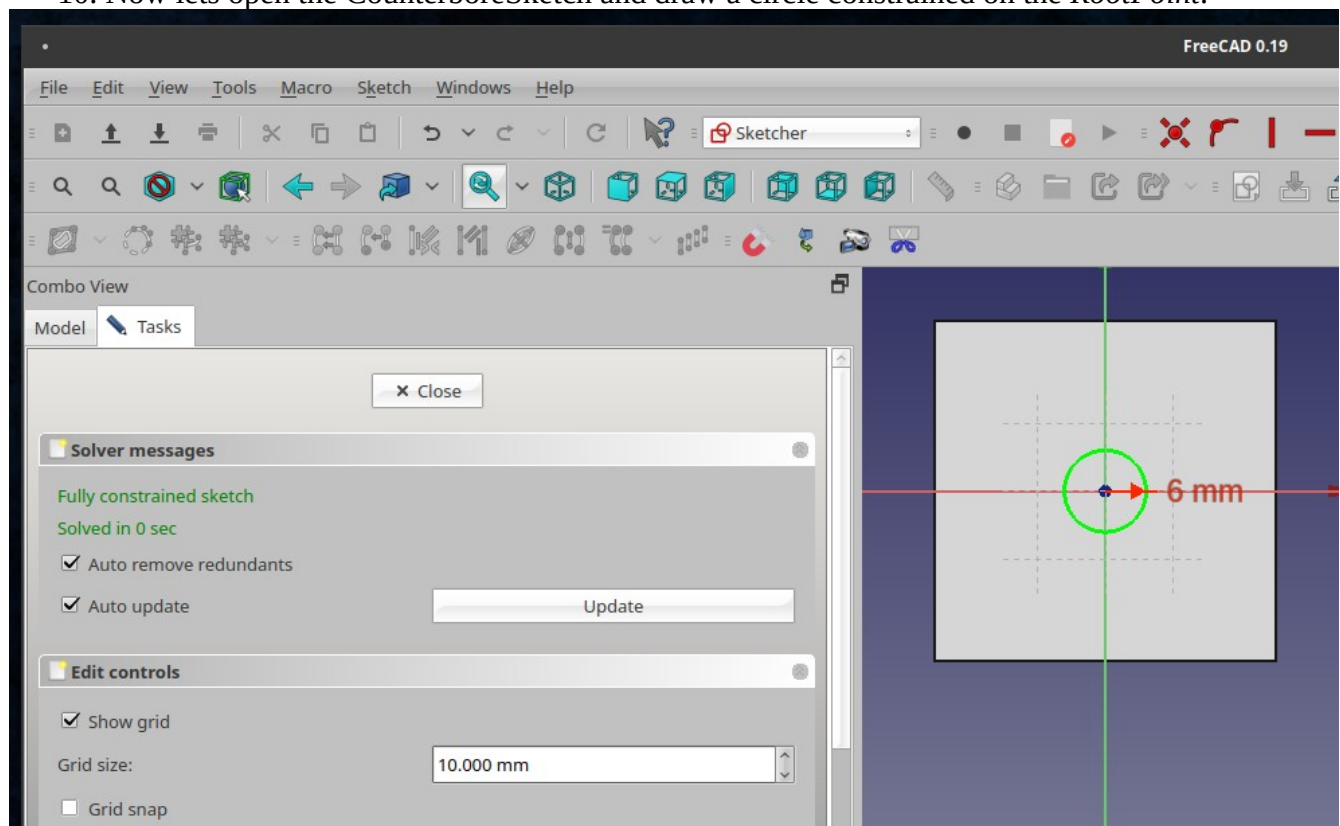
“Length”. Since the Pad feature has a property “Length”, our pad named LumpPad inherited the property and we can chose it from the list. It should look like this when you are done.



Note: the pad name is surrounded by chevrons to indicate this is a user name. In fact, we could have just typed Pad since the internal name is still Pad. (If we did another Pad the internal name would be Pad001).


9. Click OK.

10. Now lets open the CounterboreSketch and draw a circle constrained on the *RootPoint*.

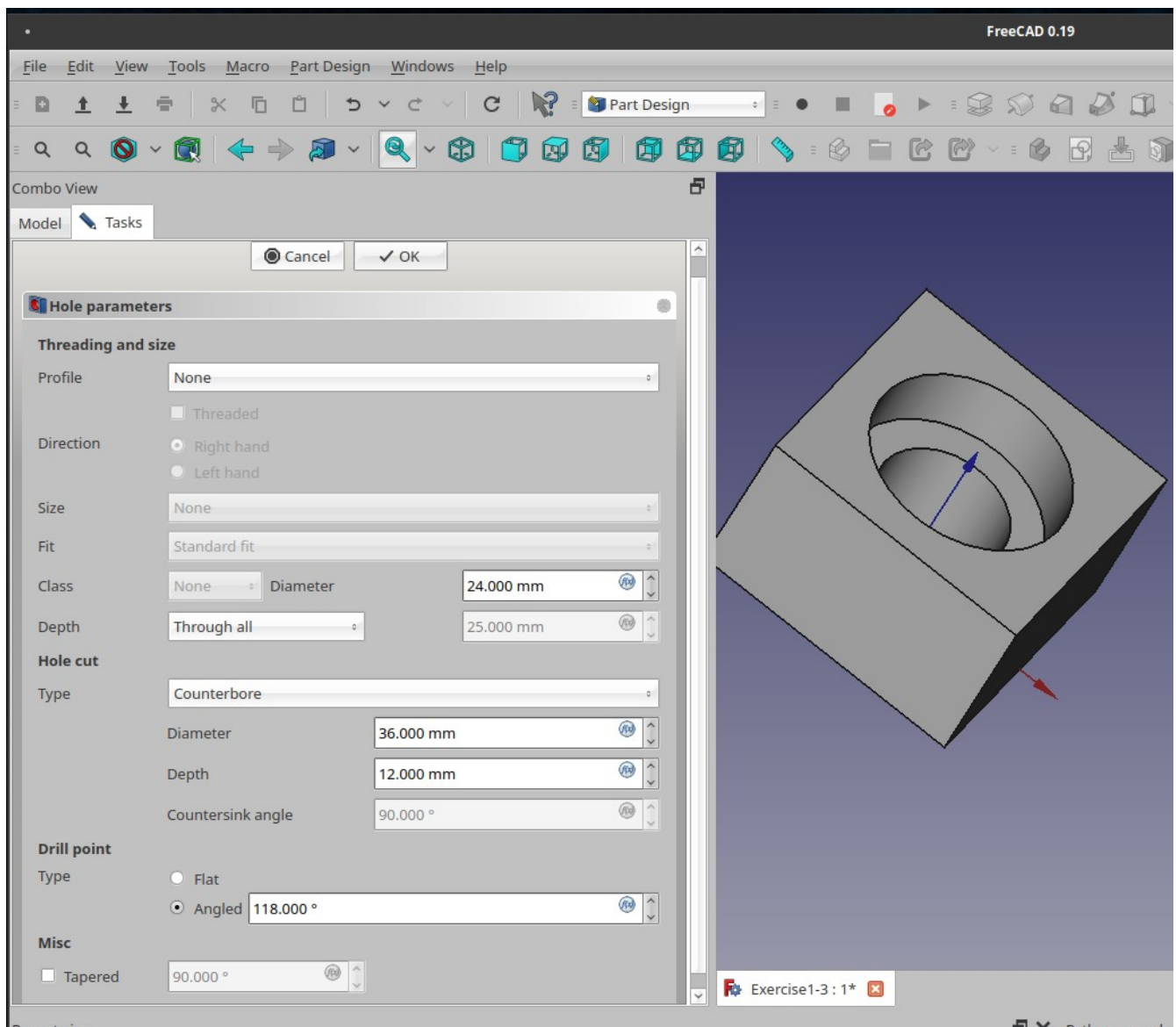


Note I’ve constrained the radius of the circle as well. This is for completeness. The Hole tool only needs to know the center point of the hole feature. The Hole tool sets the hole diameter as we’ll see shortly.

11. Click Close. Note the circle we just created is on the top of the lump. This is because of the attachment offset we added previously.

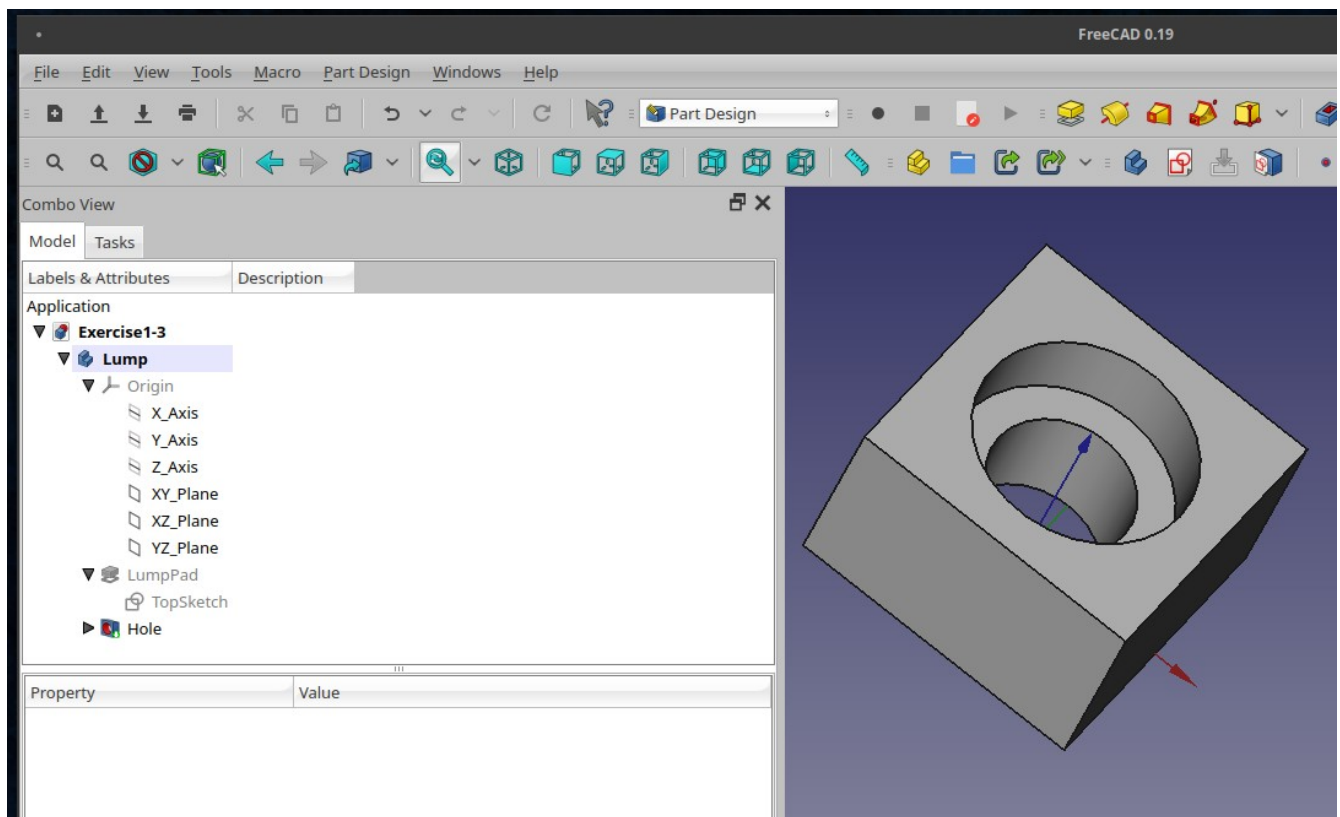
12. With CounterBoreSketch selected, click the Hole icon .

13. You will see the Hole Parameter dialog in the Tasks tab of the Combo View. Below you can see I’ve filled in the hole diameter, changed the depth to Through all, changed the Hole Cut Type to Counterbore, set the counterbore diameter and depth.



14. Click OK.

You can see we've now created the same part as before.



The Hole feature can be very useful. It has a lot of options and can make threaded holes and countersinks as well. By simply changing the Counterbore property to Countersink:

Hole	
Property	Value
Thread Fit	Standard
Diameter	24.000 mm
Thread Direction	Right
Hole Cut Type	Countersink
Hole Cut Diameter	36.000 mm
Hole Cut Depth	12.000 mm
Hole Cut Countersink Angle	90.000 °
Depth Type	ThroughAll
Depth	25.000 mm

We get:

