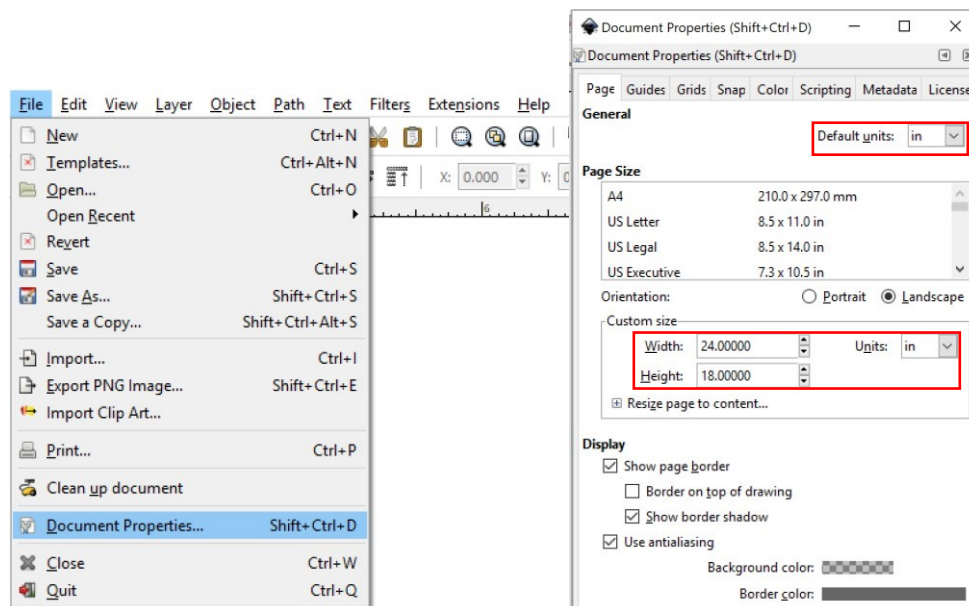


Advanced Laser-Cutting Workshop

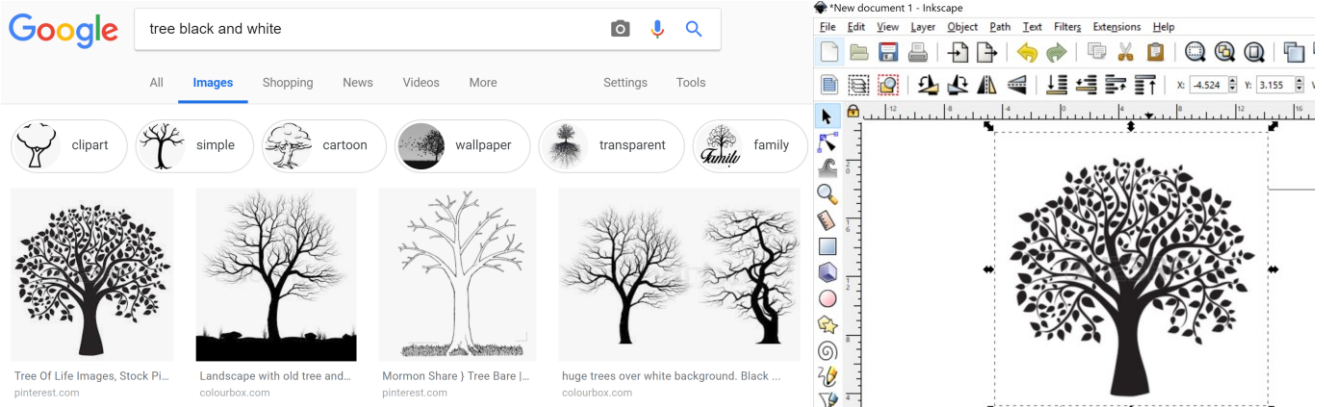
This tutorial shows you how to do advanced techniques in Inkscape including color mapping, dynamic offsets, custom fills, placing text on paths, and path operations. We'll be making this 3D tree using nothing but laser.



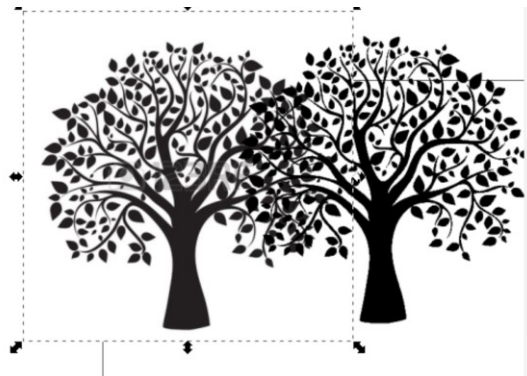
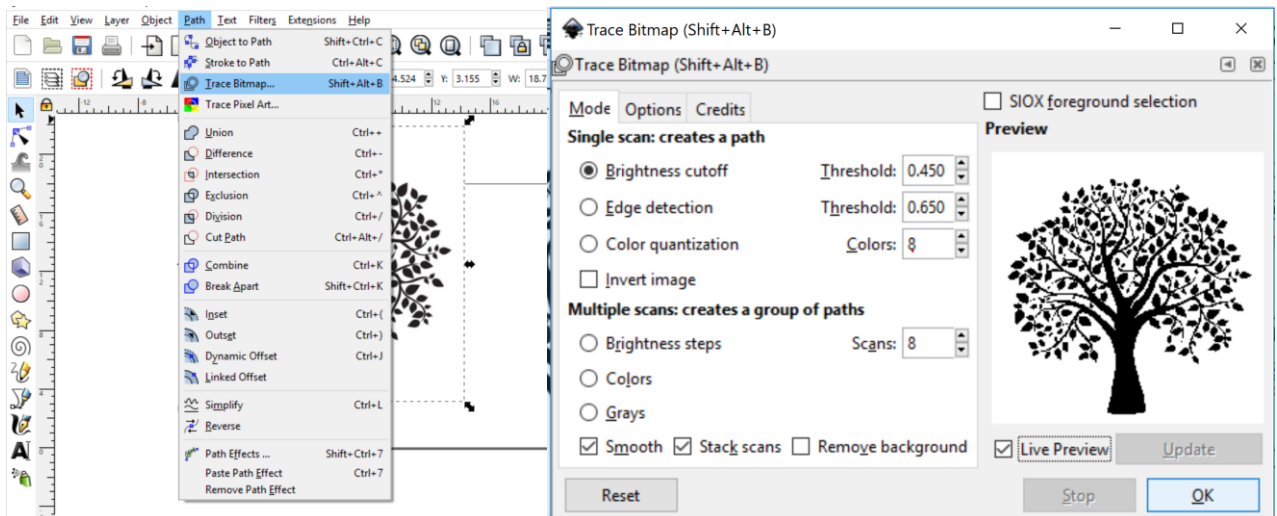
1. First thing we want to do is to change the document size to fit the size of the laser-cutter bed by going to document properties as shown below. We do this so that it's easier for us to orient our design on the bed of the laser cutter.



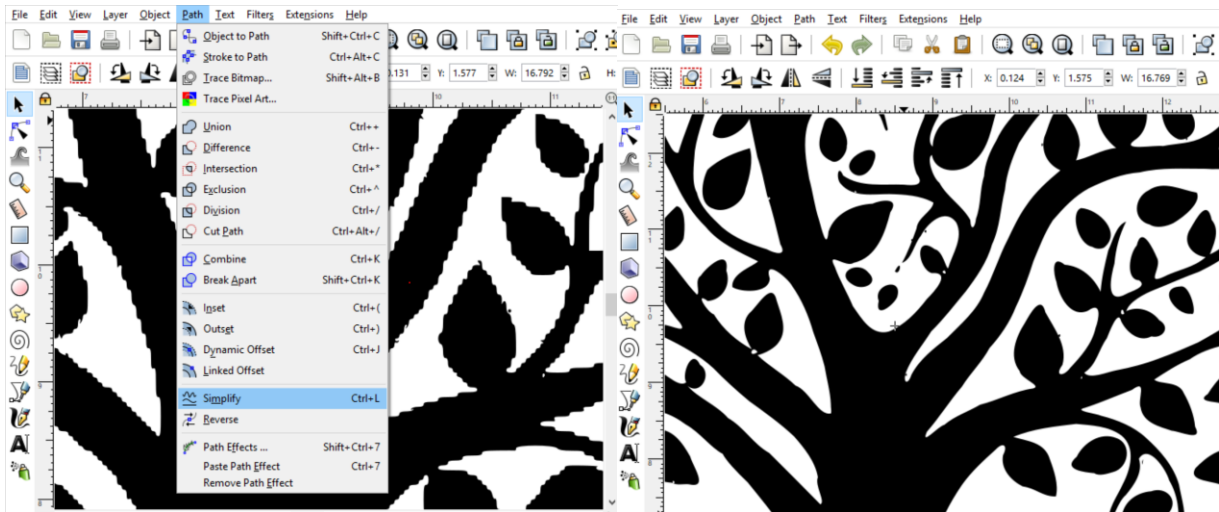
2. Look up a black and white image of a tree and copy and paste it into Inkscape.



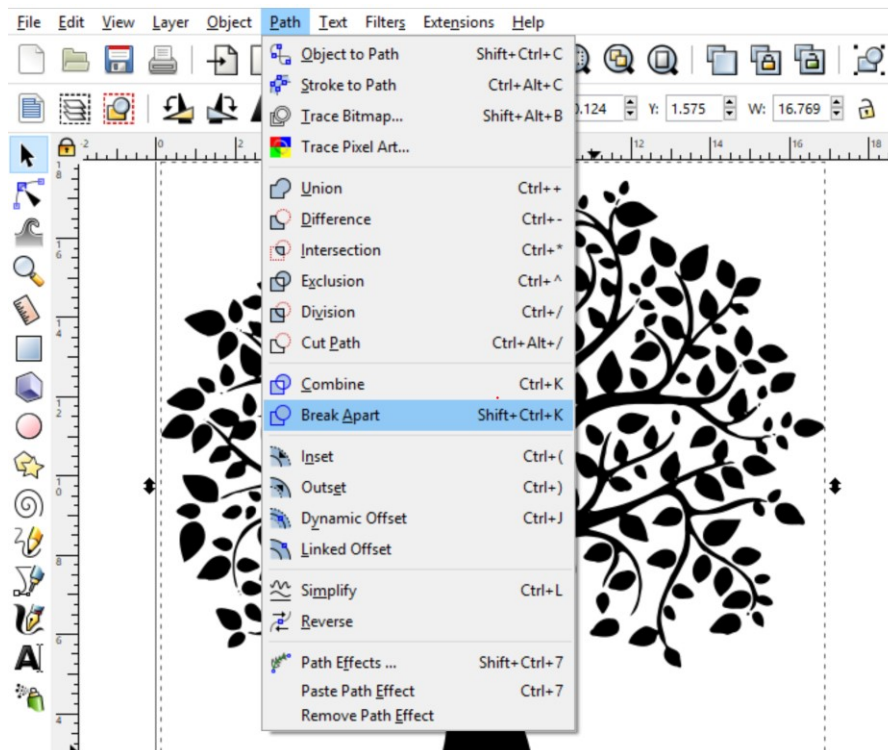
3. We want to turn the bitmap into a vector so that the laser knows how to trace out the fleur de lis. Thus, we are going to vectorize the image via “Trace Bitmap”. Since the image we’re using has high contrast, it is very easy for our function to detect the edges, so the default settings work for this case. You would need to play with the settings a bit in those cases where the picture doesn’t have as much contrast. Press “ok” and close the “Trace Bitmap” window. You can delete the original image once you have the vector.



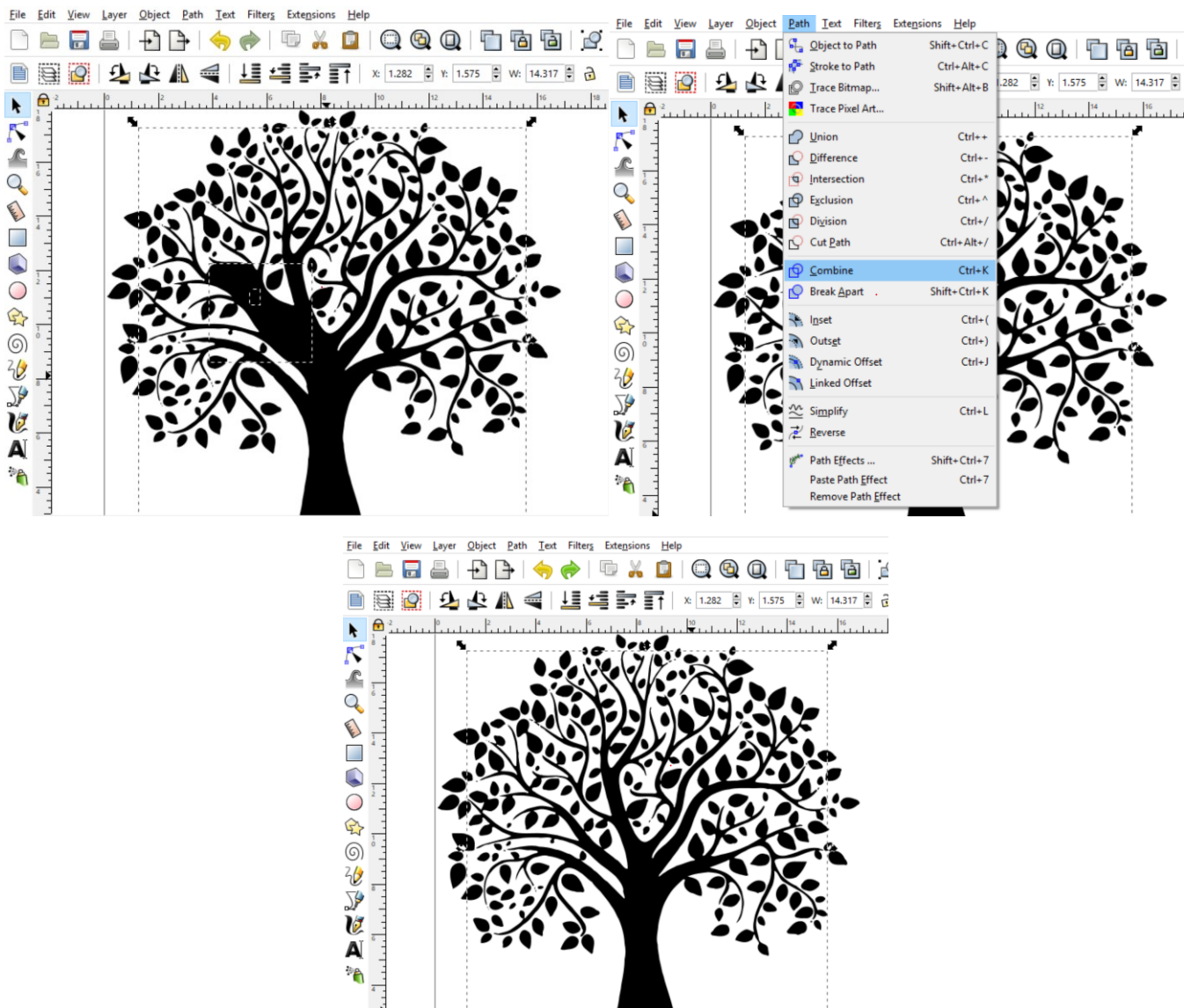
4. If the vector is jagged, you can go to simplify under the Path tab to smooth out your path. The number of times you need to do this depends on your simplify settings under “Preferences” under “File”, so repeat this process until it is how you like.



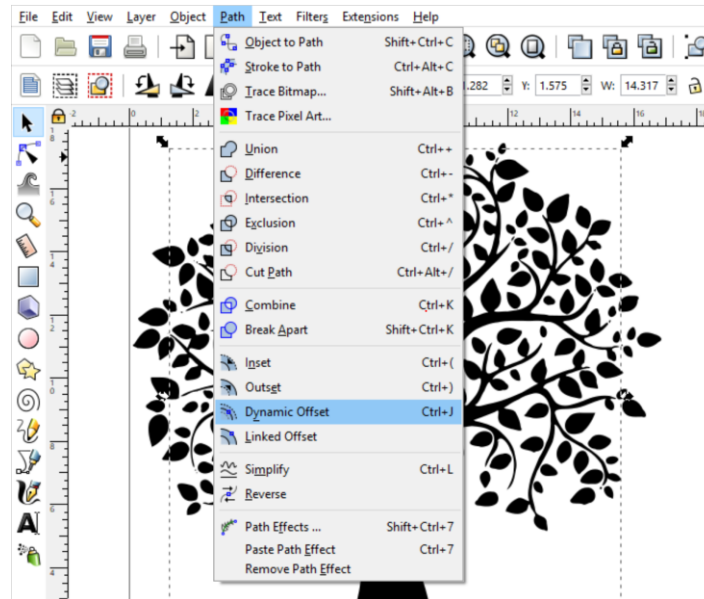
5. If you look at the tree we have, you’ll notice that most of the leaves are detached from the tree. As a result, we have to manually attach the leaves to the tree. In order to do this, we have to be able to move individual leaves. As a result, we are going to use the “Break Apart” option shown below to separate the leaves and tree.



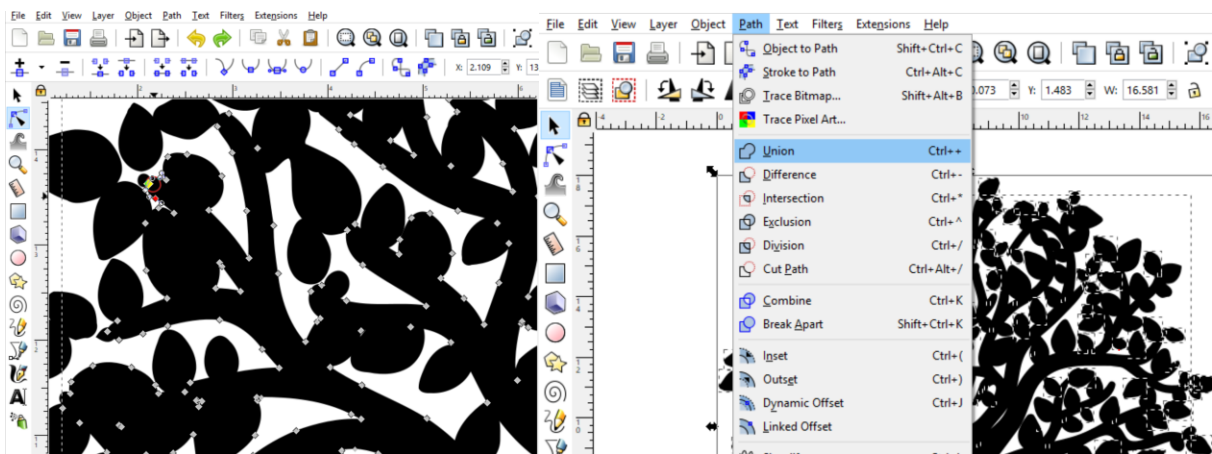
6. You'll notice that the tree is missing a chunk where the open space forms a cycle. We need to recombine this cycle with the branches, so we are going to be using the "Combine" command shown below. Select the branch/trunk and the cycle shown below.



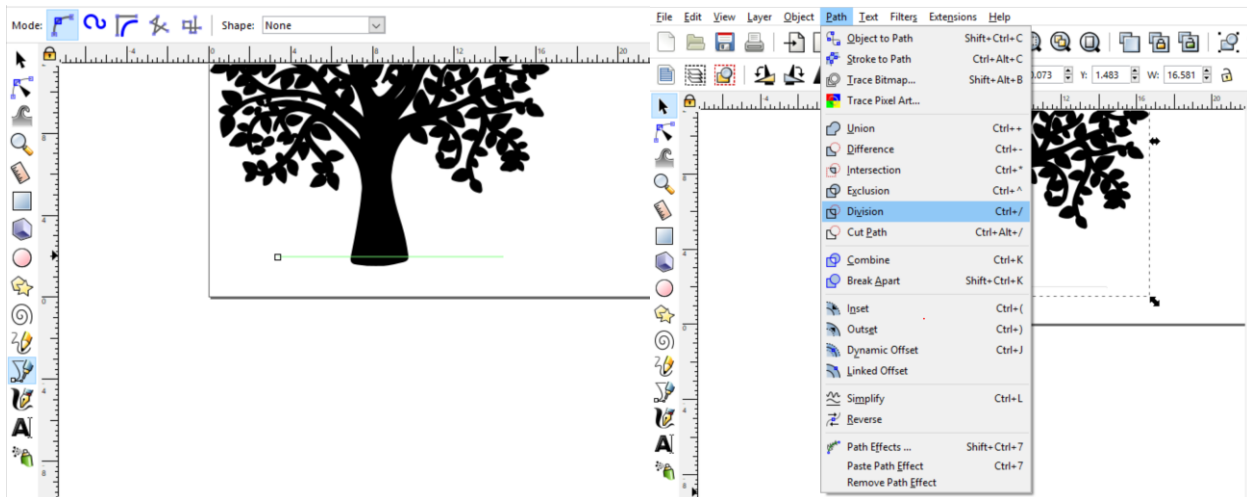
7. Now, we want to thicken each branch and leaf and hope that most of them get attached to the tree. This can be done using the "Dynamic Offset" option. So first press **Ctrl + A** to select everything and then apply the "Outset" option or the "Dynamic Offset" option. Everything should be much thicker at this point.



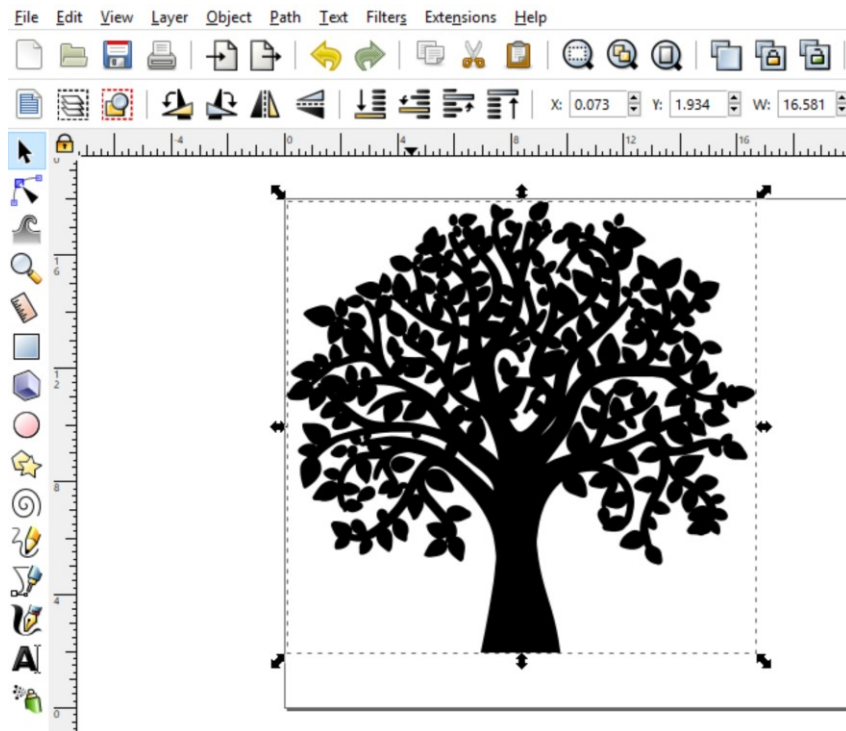
8. Now, we are going to move any disconnected leaves onto the tree. Once you have everything overlapping, select everything (**Ctrl + A**) and use the “Union” option shown below. This combines everything so that the leaves and trees are all in one piece.



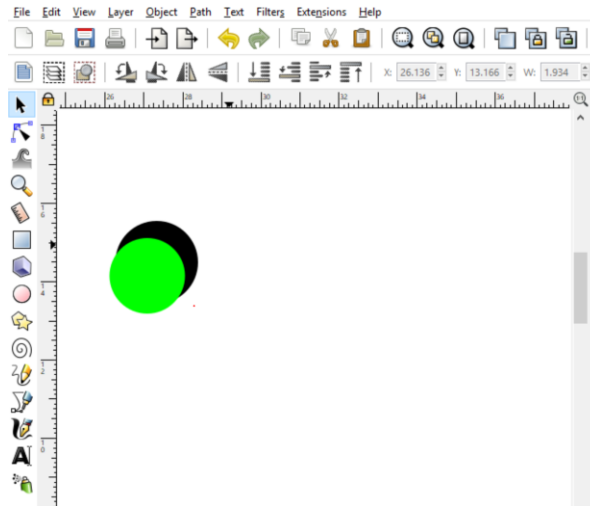
9. To make the tree stand up, we first need to make sure that its base is flat. To do this, we are going to create a straight, horizontal line using the Bezier tool (highlighted on the left). While you draw the line hold **Ctrl** to keep it horizontal. Then select the line and tree and use the “Division” command to cut the base off.



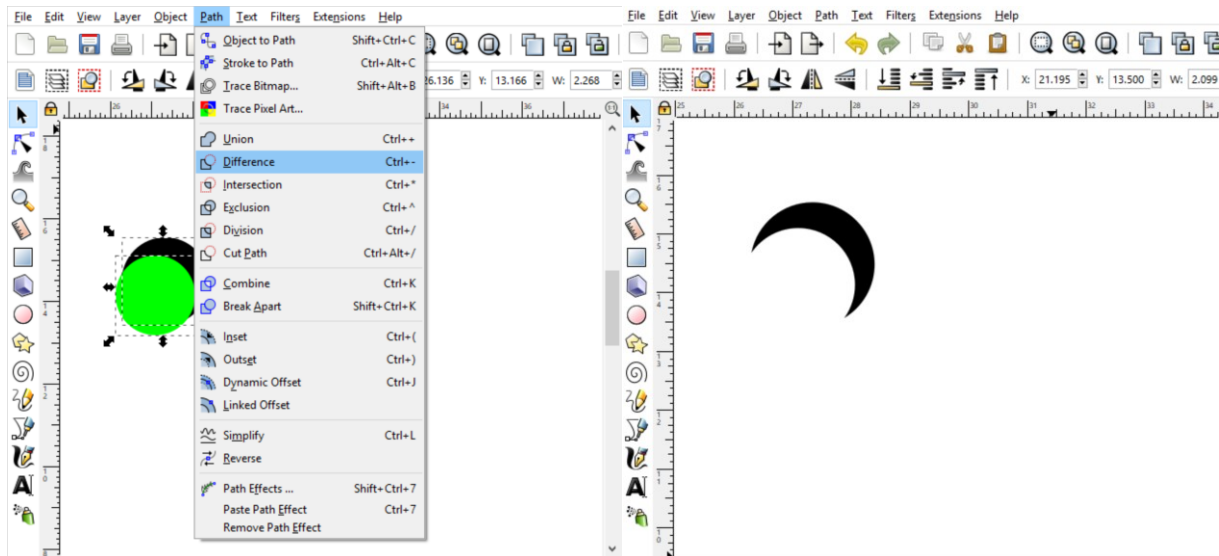
10. Delete the bottom piece, then select everything (Ctrl + A) and recombine them like we did before.



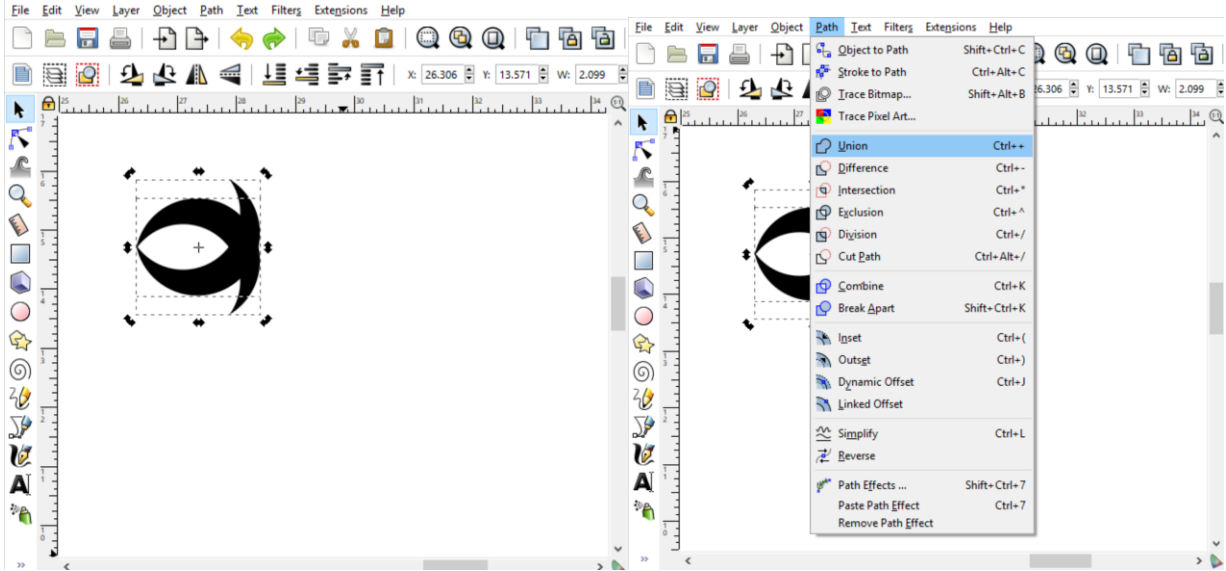
11. Before we move on, we are going to create the base using a shape and creating tiled clones. We are going to start with two circles as shown below:



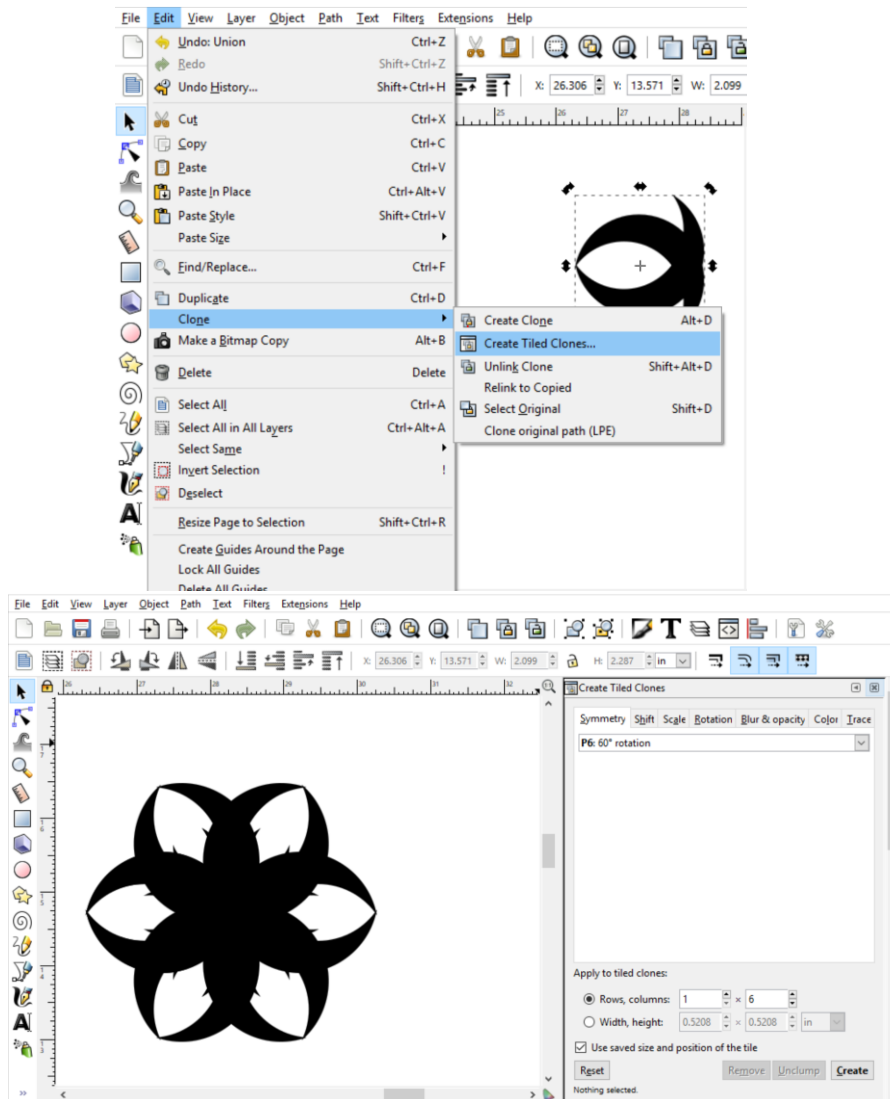
12. Select both circles and perform the “Difference” operation



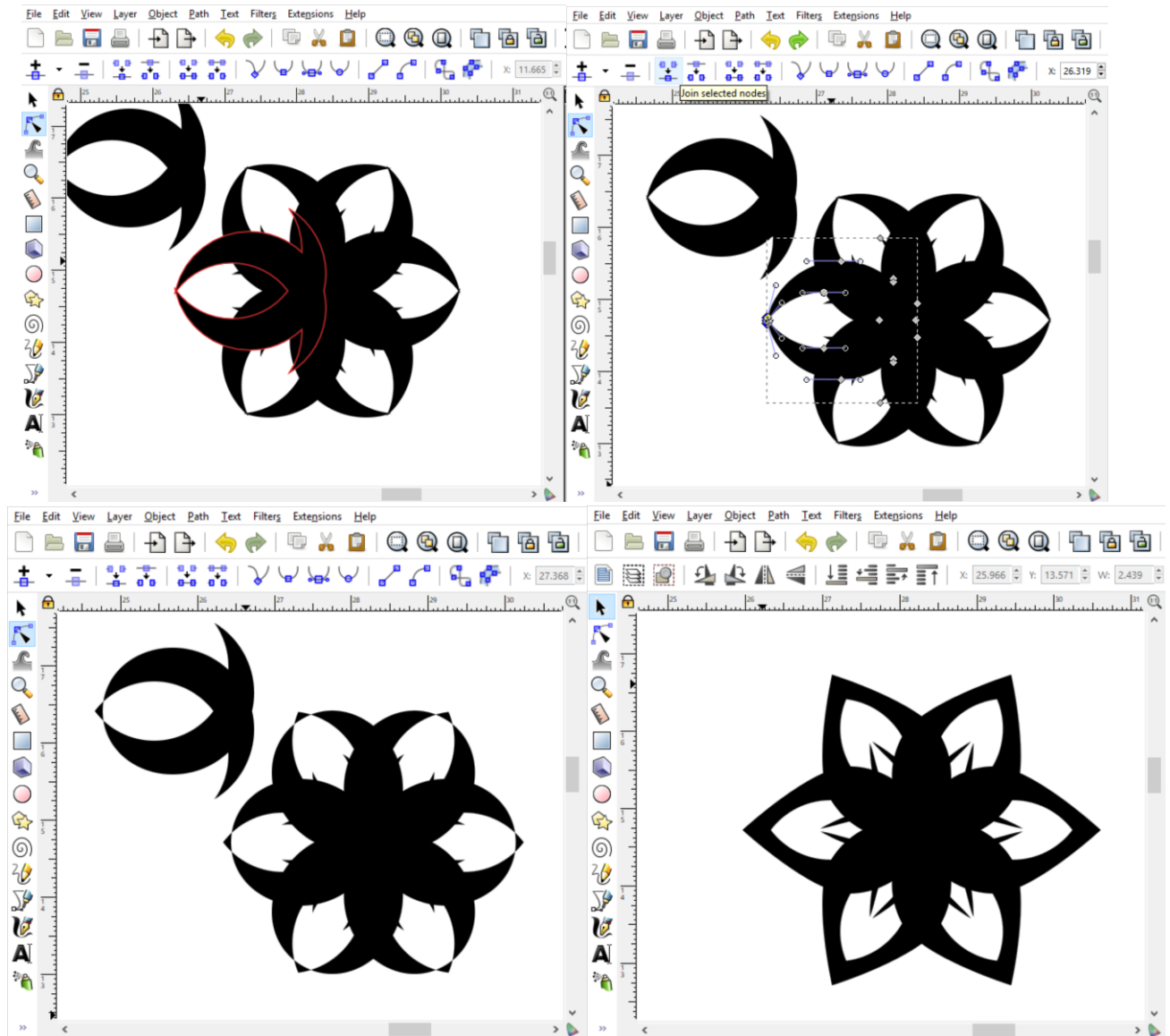
13. Then, make a copy and flip and overlay the two as shown. Use the “Union” tool to combine them.



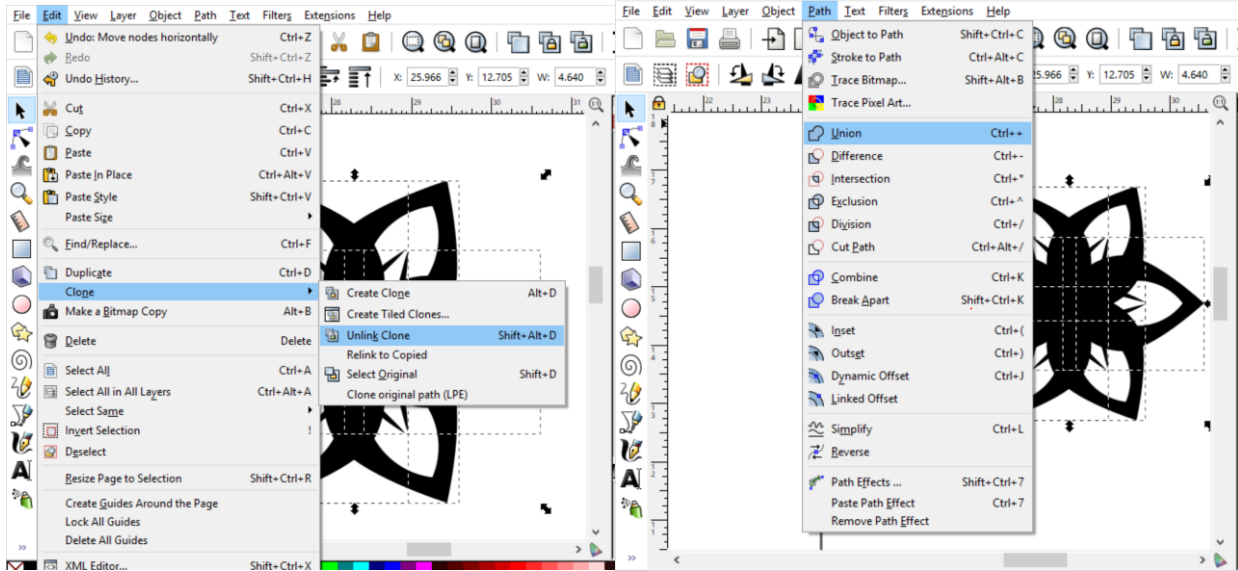
14. Create a tiled clone. Use the options shown. This allows you to create a cool base for your tree.



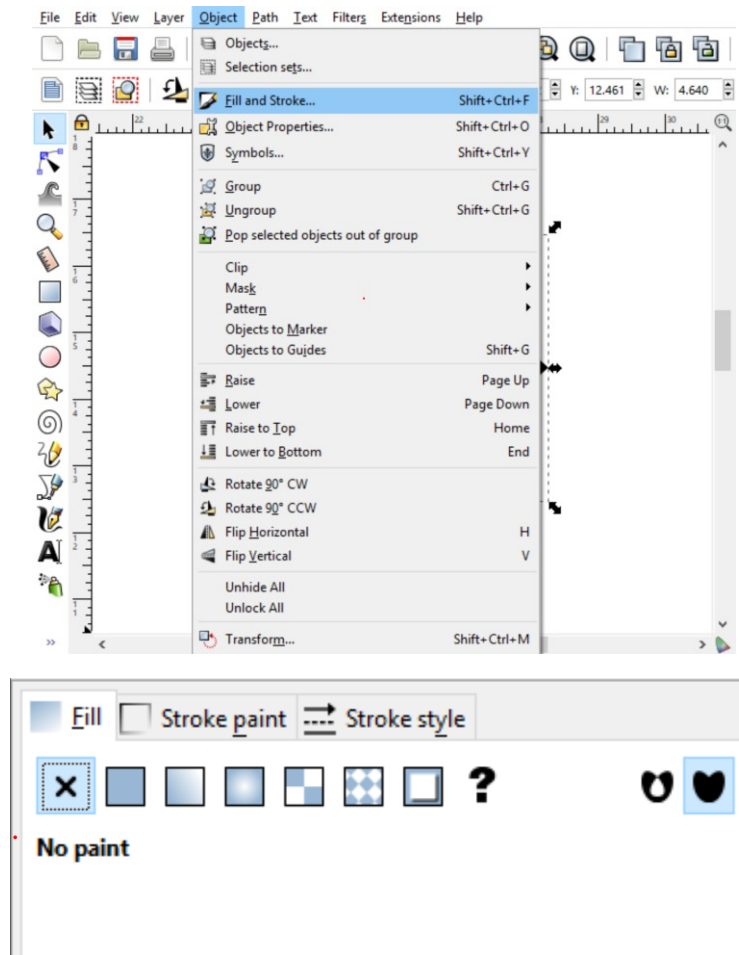
15. The tiled clone option allows us to modify the original copy and propagate the change to all the clones. So find your original by using the node tool (2nd tool). You should see a red outline around the original. Modify it until you are happy.

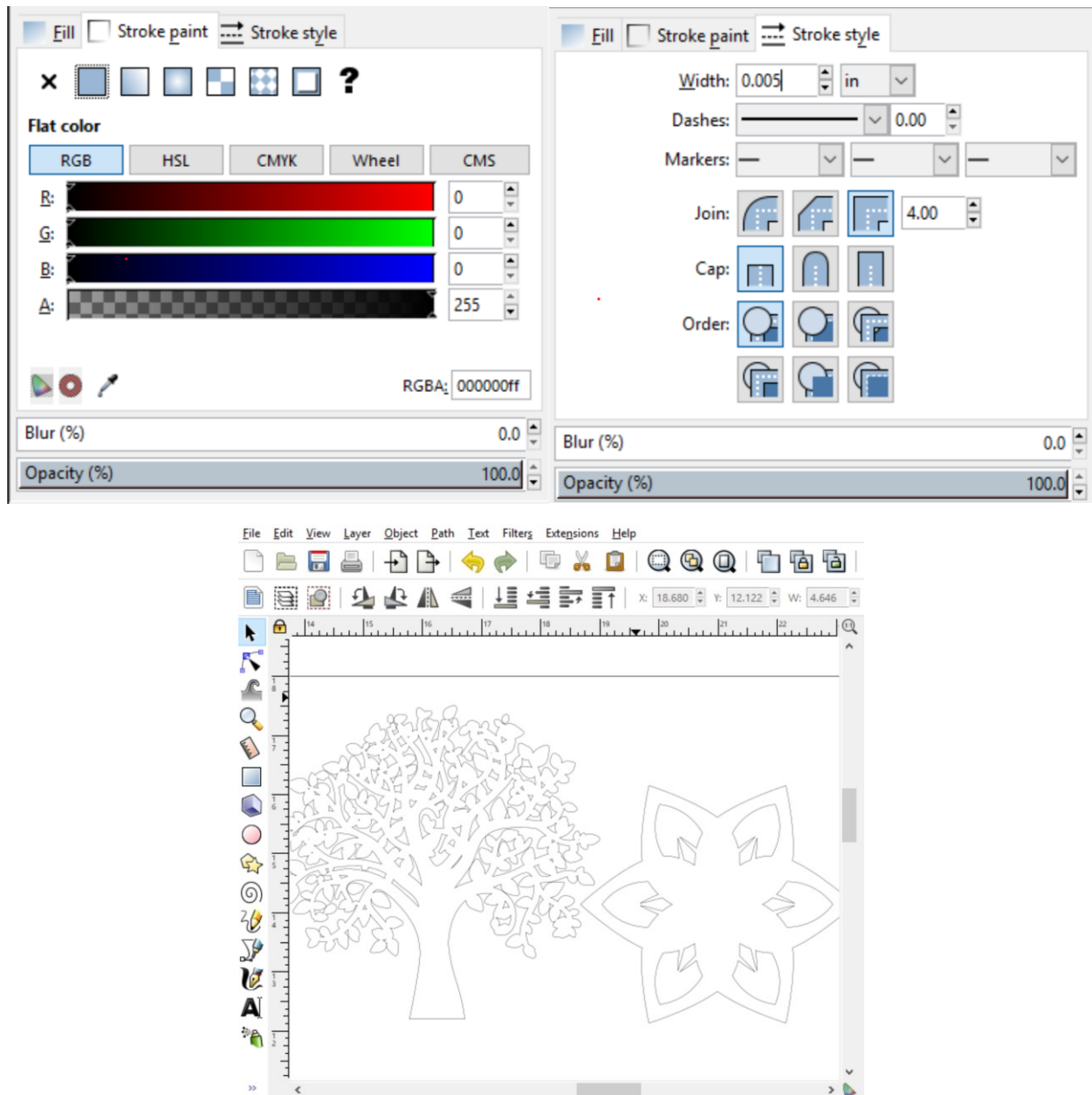


16. Now we want to join all the clones together. But to do that, we have to unlink them. Select all the clones and do the operation below. Join the pieces together using “Union”.

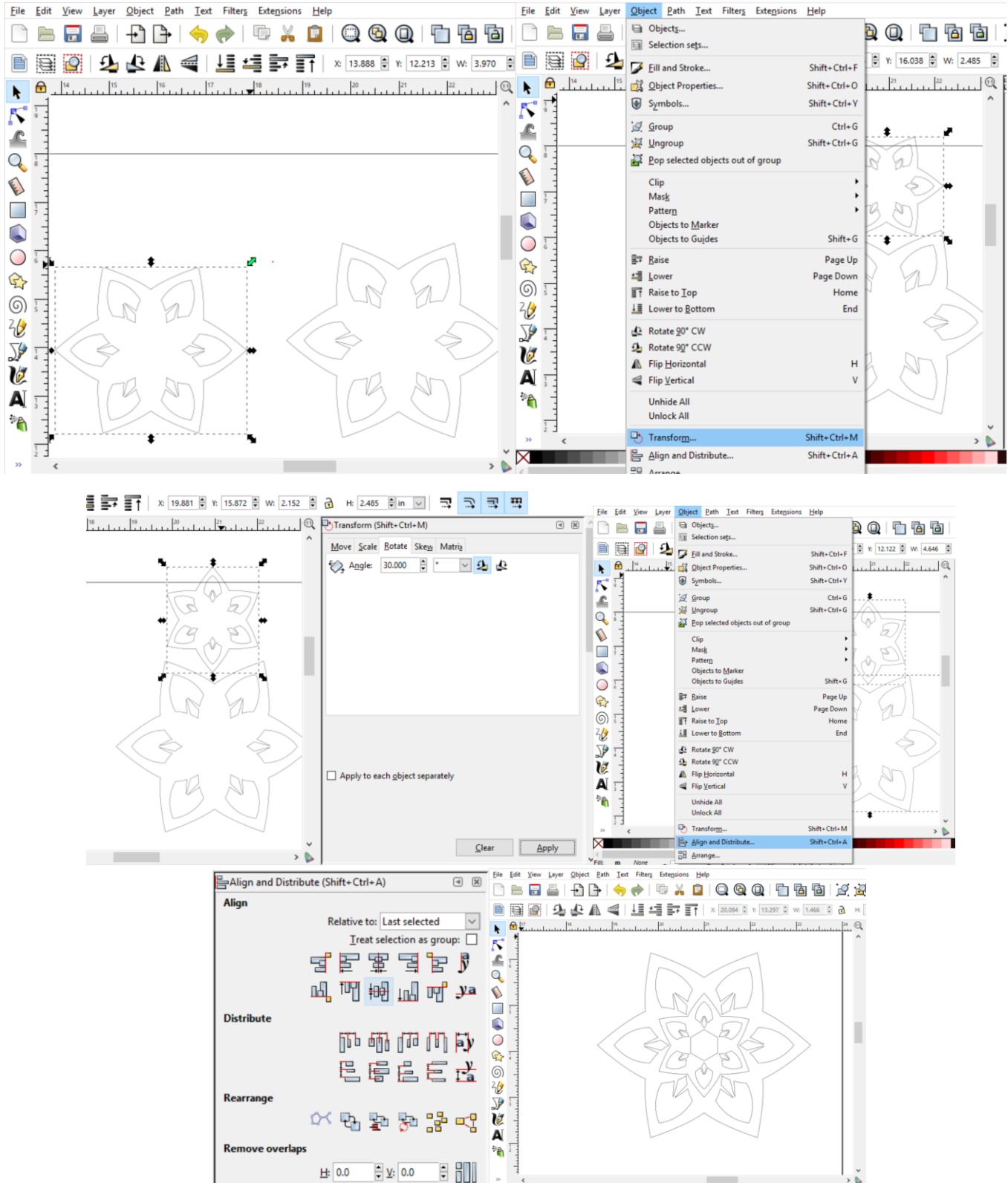


17. Now turn off the fill and turn on the stroke by doing the operations below:

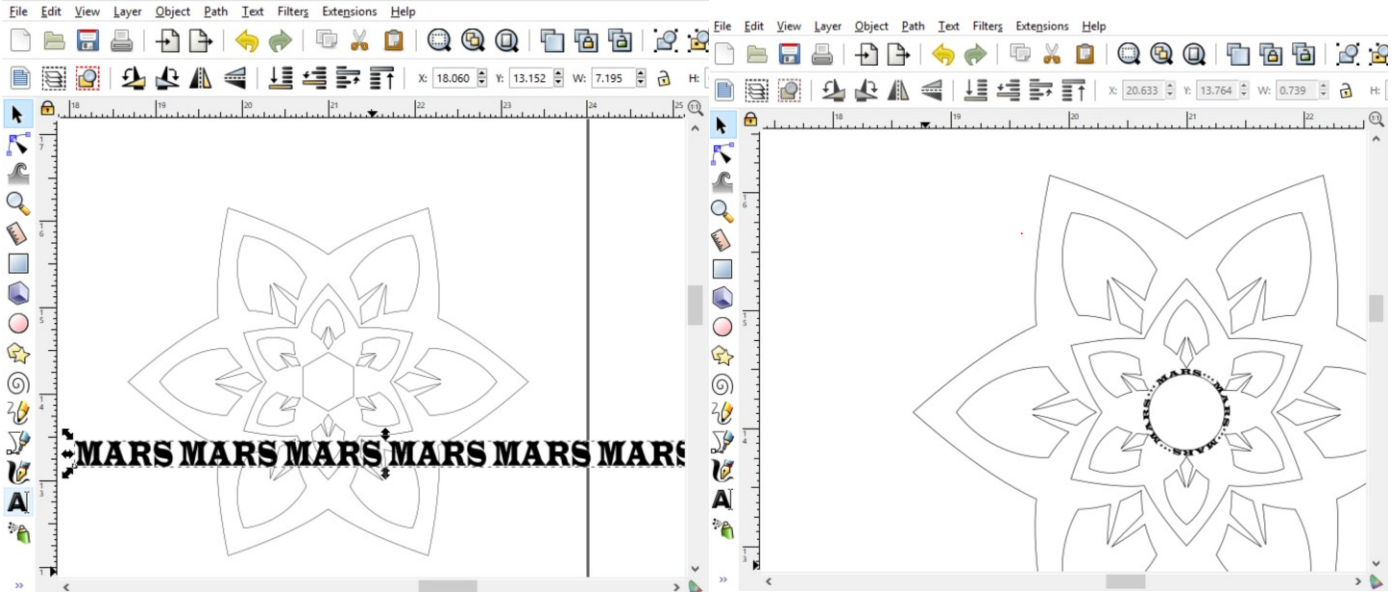




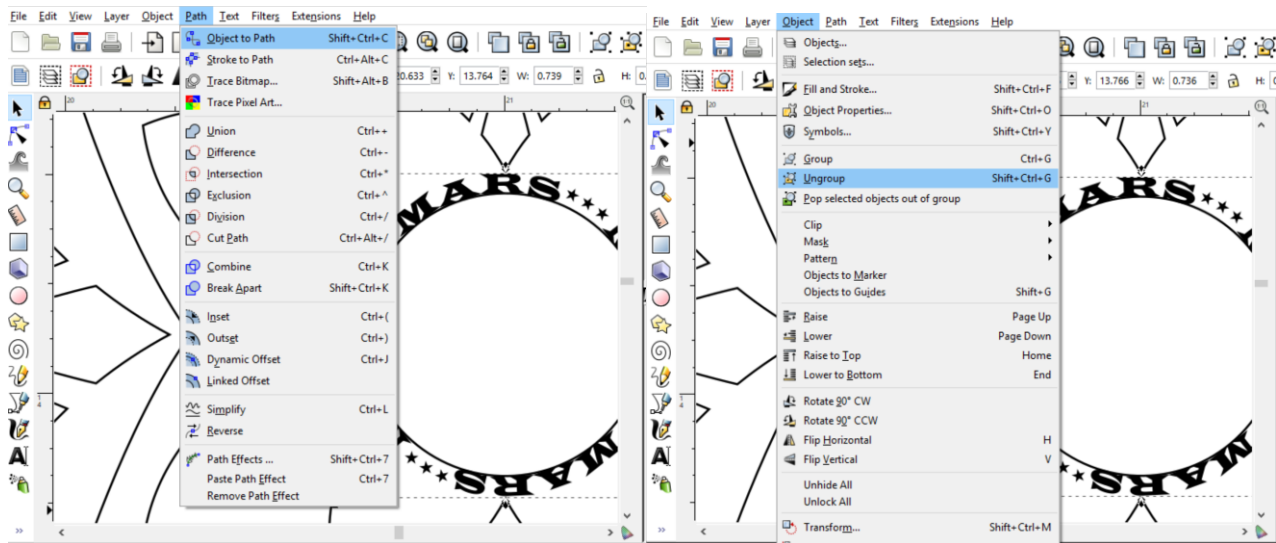
18. Now make another copy of the base. We're going to resize it and rotate it to make a more intricate base and center it on the bigger base. Follow the instructions below:

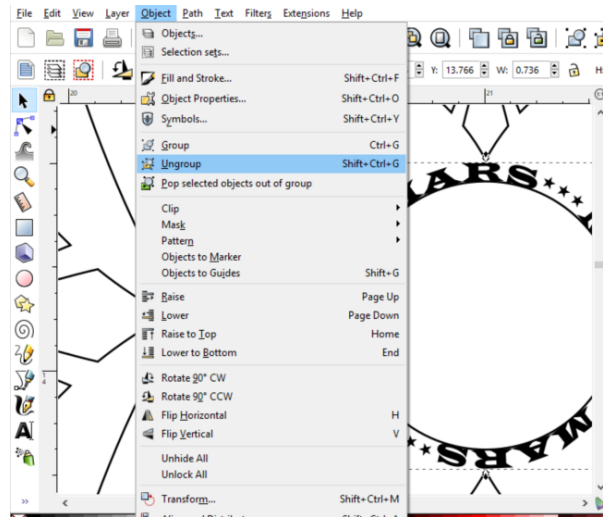


19. We are going to put text on the base using the text on path tool. Type whatever message you want and create a circle or some other shape you want to put the text on. Select the text and the shape you want to put it on, navigate to “Text”, then to “Put text on path”, and then you should see something similar to what is shown below:

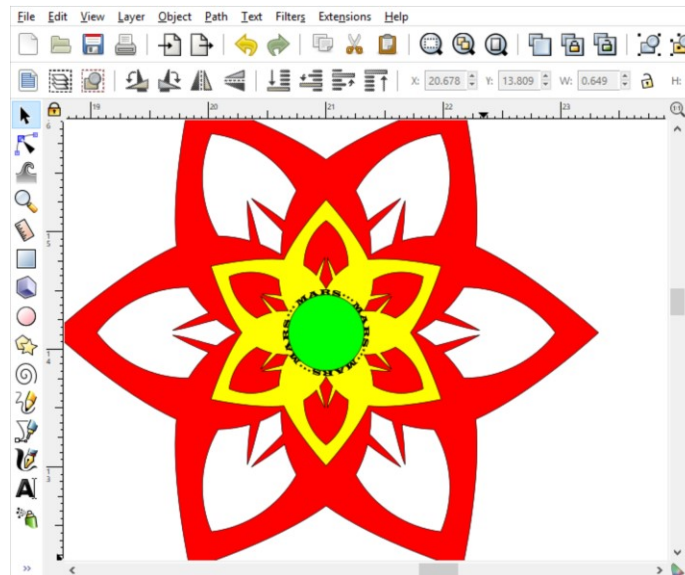


20. Now we are going to combine everything in the base into one path. Before we do this, we have to turn the text into a path using the commands shown below. Be sure to ungroup it after this operation.

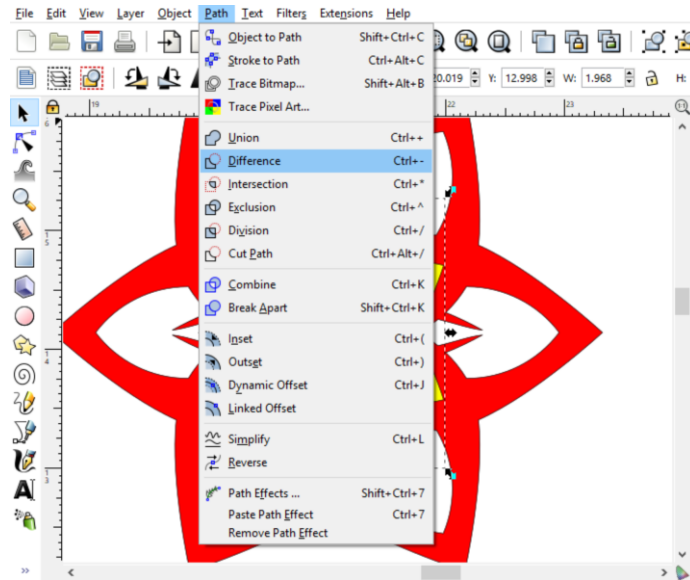




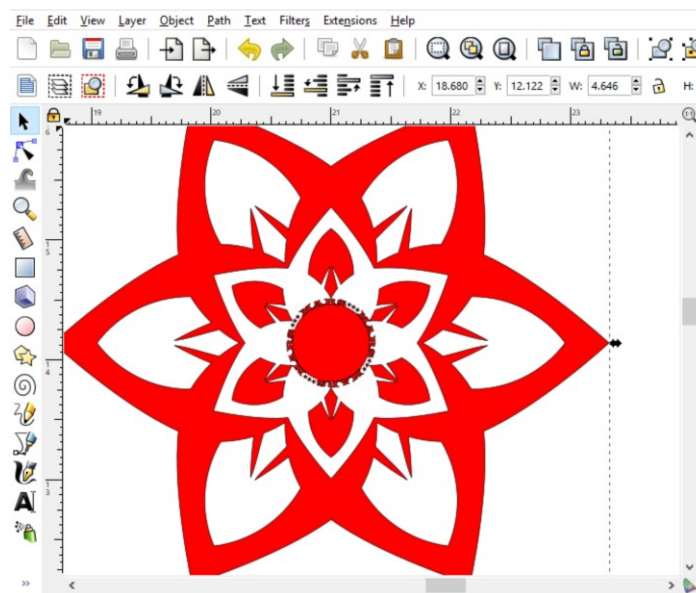
21. Color the parts of the base as shown below:



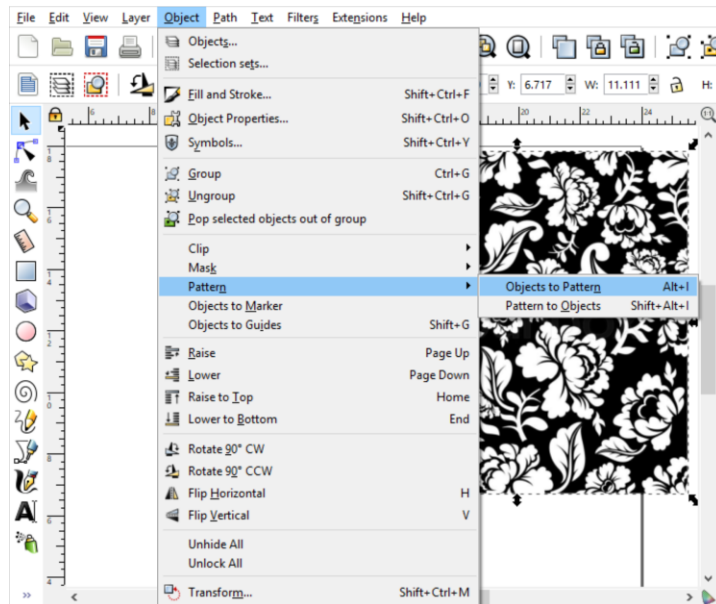
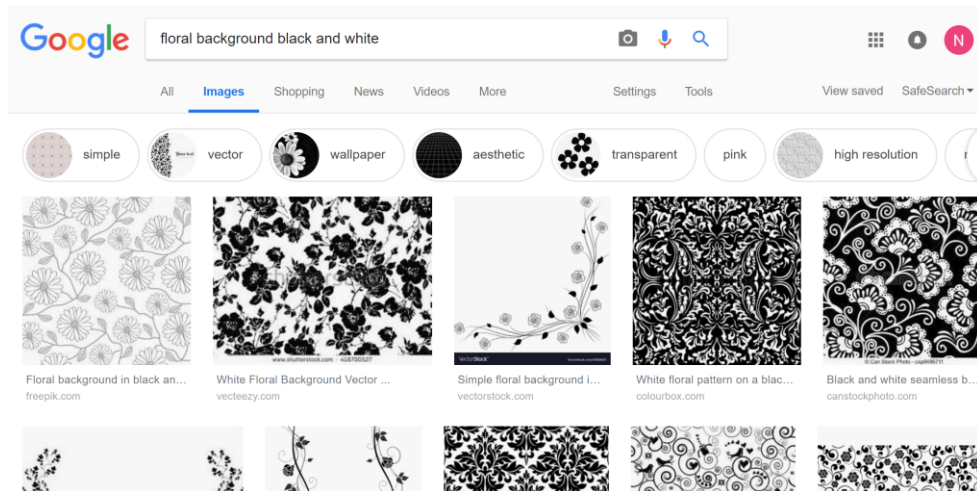
22. Now do the Boolean path difference in the following order. First, take the difference between the green circle and the yellow base. Then, take the difference between the black text and the yellow base. Finally, take the difference between the yellow base and the red base.



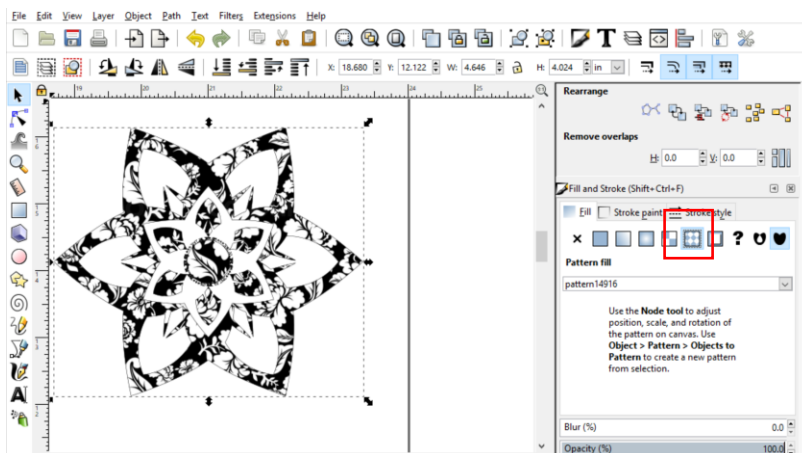
23. You should end up with what is shown below:



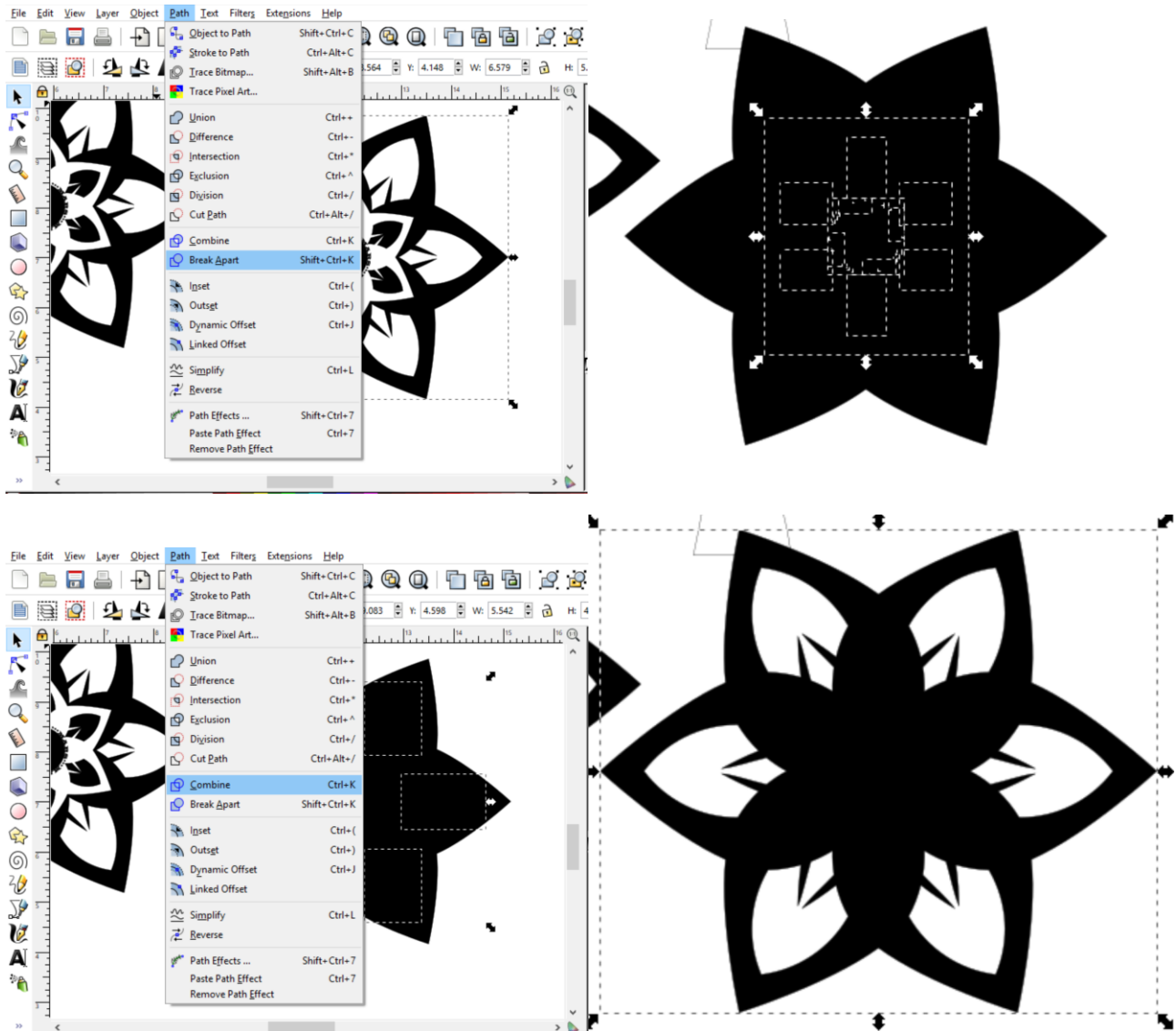
24. Now we are going to create a custom fill. Find your desired fill online and copy and paste it into Inkscape. Use the “Object to pattern” command to create the custom fill.



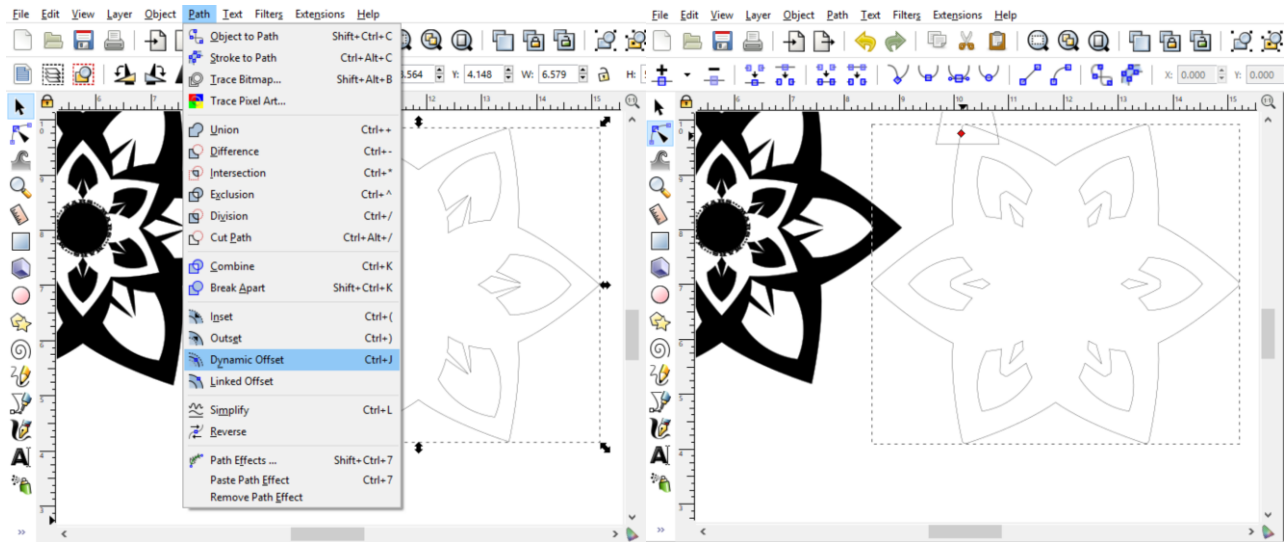
25. Change the fill to the pattern fill.



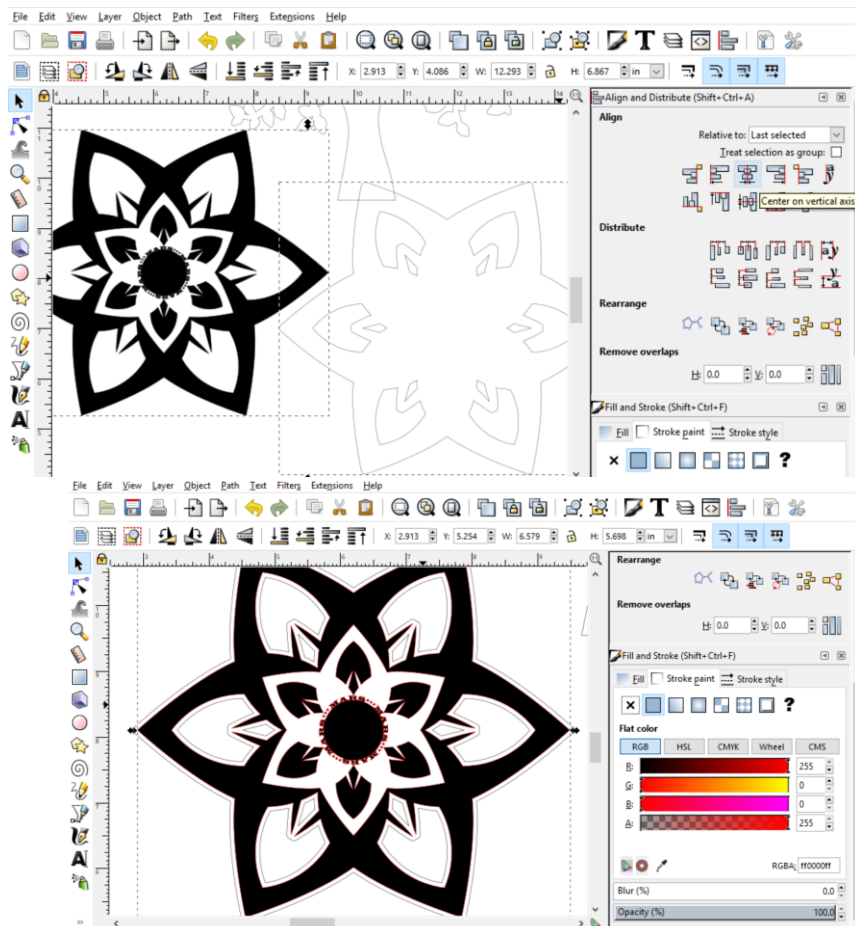
26. We want to create the parts of the base that we want to cut out. To do that, we make a copy of the base and break the copy apart. Delete any part of the path that you don't want to cut out (as shown) and recombine the remaining pieces. You should see whatever is left.

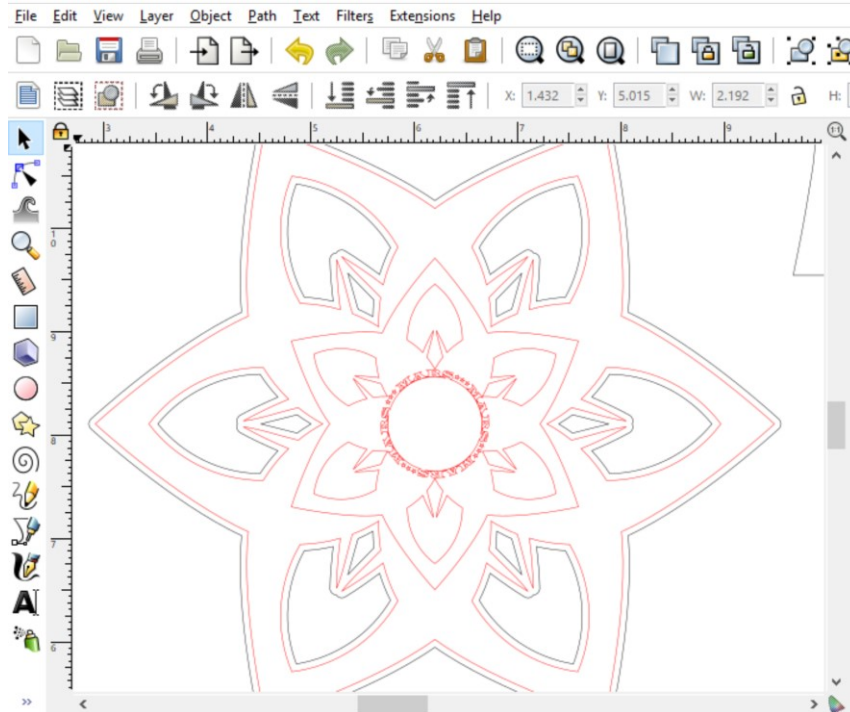


27. Perform a dynamic offset so we have a little margin between our design for the base and the part we are cutting out.

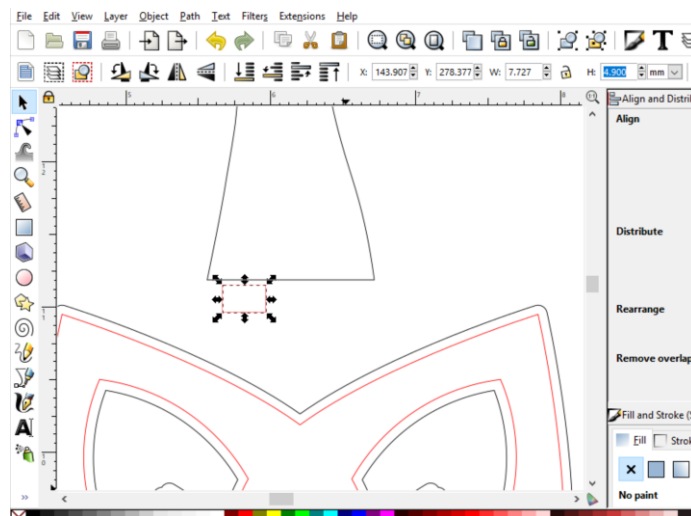


28. Center the cutting path with the base design as shown. Change the outline of the design to red. We are color mapping this so that we can tell the laser not to cut this part all the way through. It's easiest to see this when there is no fill.

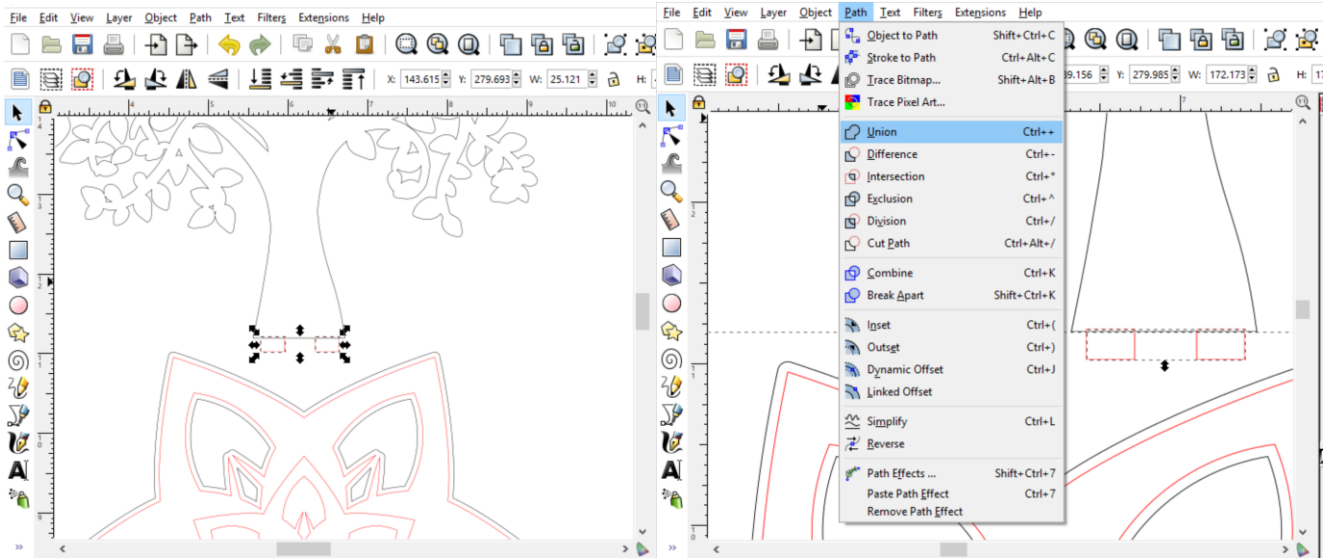




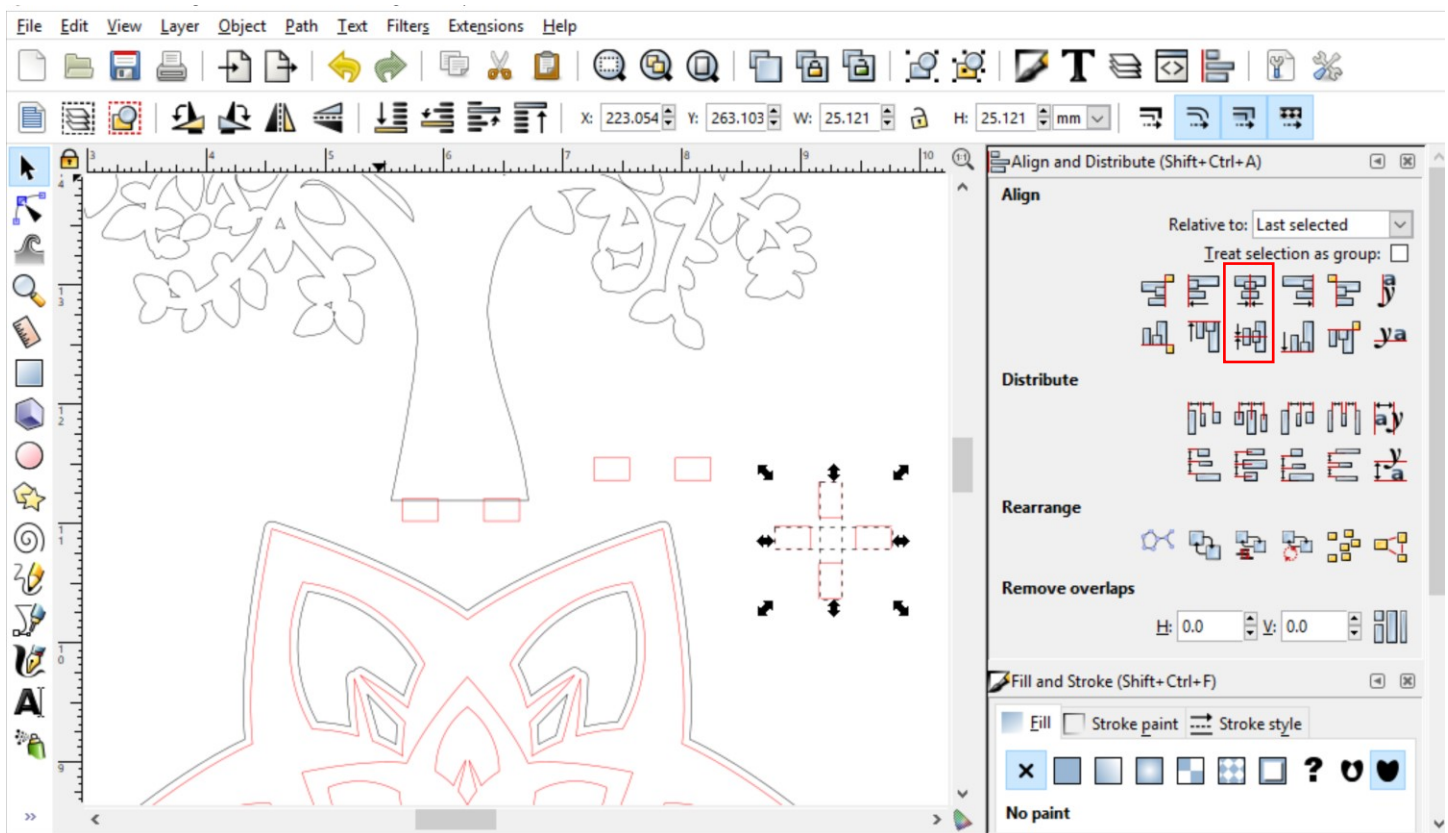
29. Now we need to make tabs to make the tree stand up in the base. To do this, we are making a rectangle corresponding to the thickness of the material we're making the tree out of, which in this case is about 4.9 mm.



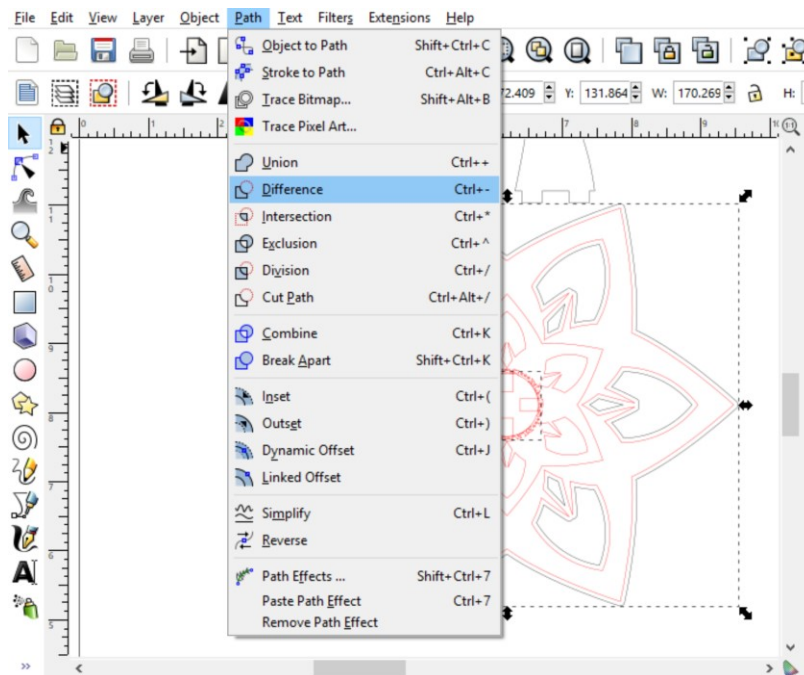
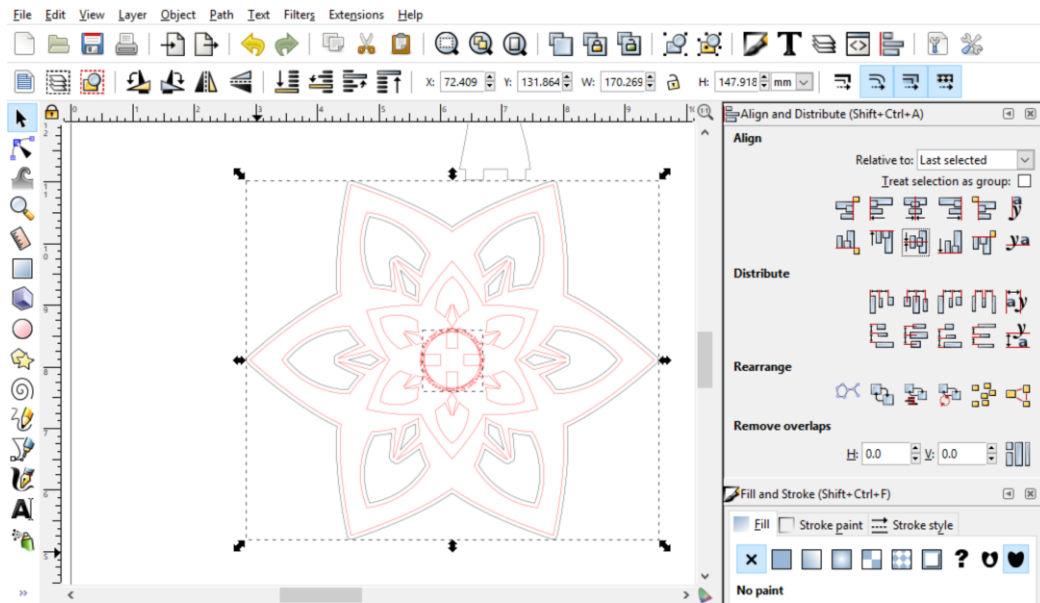
30. Make a copy of the rectangle, arrange them so that they are centered horizontally, and union them together. Make a few copies to be used for creating the inserts in the tree pieces and the base. Join the pair to the base of the tree using the "Union" command. Make sure there is a little overlap between the tree and the rectangles.



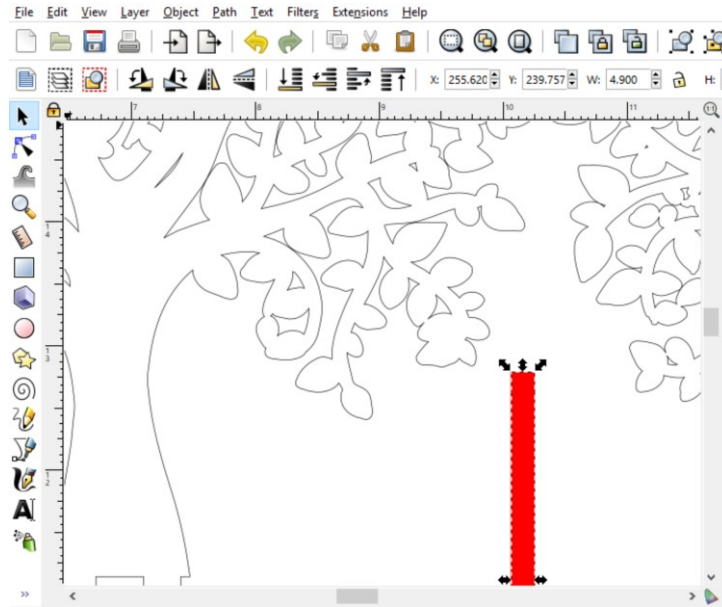
31. Take one of the rectangle pairs you copied and pasted earlier and rotate it by 90 degrees. Then center that group with another group. Join them together with the “Union” command. This will form a cross for the holes in the base.



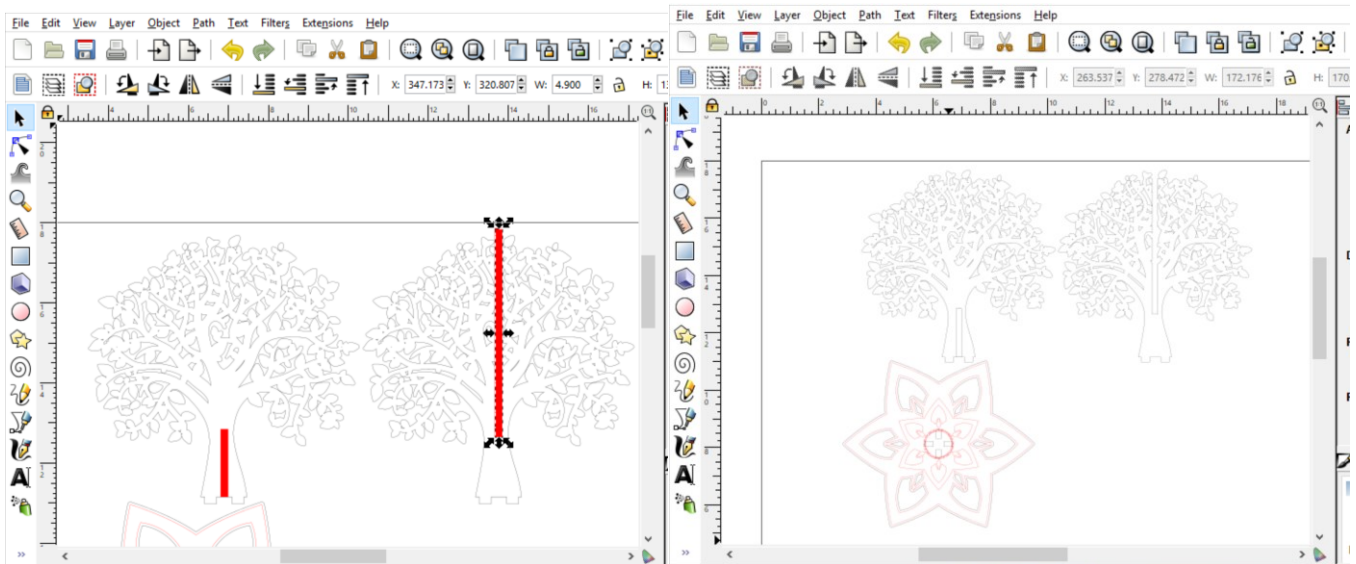
32. Center the cross shaped hole and the outside path (the black one) of the base. Use the “Difference” command to cut the holes into the base. You should end up with something like what is shown below.



33. Now we want to make a slot to slide the halves of the tree together. First, make a copy of your tree. Then, create a rectangle with width of 4.9mm and a height a little more than half the height of the trunk. We will be using this to cut slots into each copy of the tree.



34. Place the rectangles so that they are centered between the tabs of the tree as shown below. Make one rectangle start from the bottom half of the tree and the other start from the top of the other tree. Make sure that there will be enough material on either side of the slit as well as above/below the slit so that the tree will not break apart upon being removed. Use the “Difference” command to cut those slits into the tree.



35. Finally, rearrange your pieces to fit within the board. Press “Ctrl+A” to select all your pieces and go to “Stroke Style” under “Fill and Stroke”. Change “Width” to 0.001 in, and your file is ready to be exported as a pdf for laser-cutting. Congratulations on making a 3D tree out of 2D slices of wood!

