Making Stencils for Recurring Patterns

Sometimes when we “get our crafty on”, we want to make a stencil of a pattern or image rather than a line drawing. The following is a technique I developed over the years. There are dozens of other ways to do this; some are easier and/or more expensive, but this works reliably for me. The purpose of this tutorial is to provide you with a starting point and a perspective. Hopefully, this enables you take off from the starting point and modify the process to suit your needs and software.

Full disclosure: I am a retired grunt and curmudgeon that looks good in polyester, and I believe that sarcasm is merely an unpleasant way of telling the truth. I try break things down “Barney Style” because the simple things trip us up more frequently than the complicated stuff.

Let’s start with the resources needed:

A computer (duh);

Vector-based design software (double-duh), such as CAD programs like EazyDraw, Adobe Illustrator, Affinity Design, Inkscape, etc. Heck, you can use PowerPoint too. It’s important that the program can create layers, or move objects backwards and forwards. Another desired feature is the ability to export a design as a JPEG or PNG image.

A Glowforge (no sh*t, Sherlock);

Basic knowledge of stencil designs. A handy web site to review is on wikipedia:

> https://en.wikipedia.org/wiki/Stencil
>
> The first two paragraphs are all you need to review and understand the concepts of ‘islands’ and ‘bridges’.

A pattern or image you want to reproduce.

OK, on to the process. Reminder: I’m providing a starting point and perspective so you can freely modify and develop techniques to suit YOU. The INTENT of the process is more important than the PROCEDURE.

1. Find a pattern.

   > For the Japanese Ariake-Andon lanterns I make, I like to use traditional Kumiko patterns. A great source for those patterns is the Tanihata company in Japan. Their web page for the designs they use is:

https://www.tanihata.co.jp/english/design/

For this tutorial, I'm going to use the 'Kakuasa' pattern as an example. You can find the pattern at this URL:

https://www.tanihata.co.jp/english/products/tn-113/

BTW, Tanihata makes beautiful wall hangings and can ship almost anywhere. They're not cheap, but the craftsmanship is exquisite. I view their products as heirlooms.

If you want to make your own Kumiko design, try this website:

https://kumiko-generator.netlify.app/

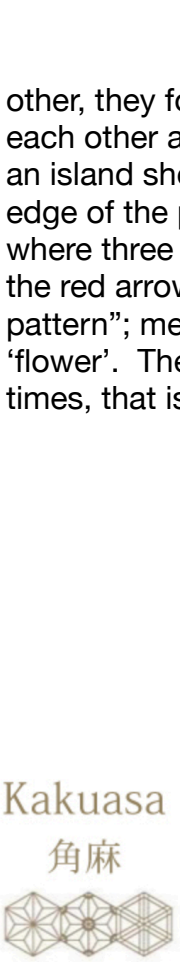
2. Inspect the pattern.

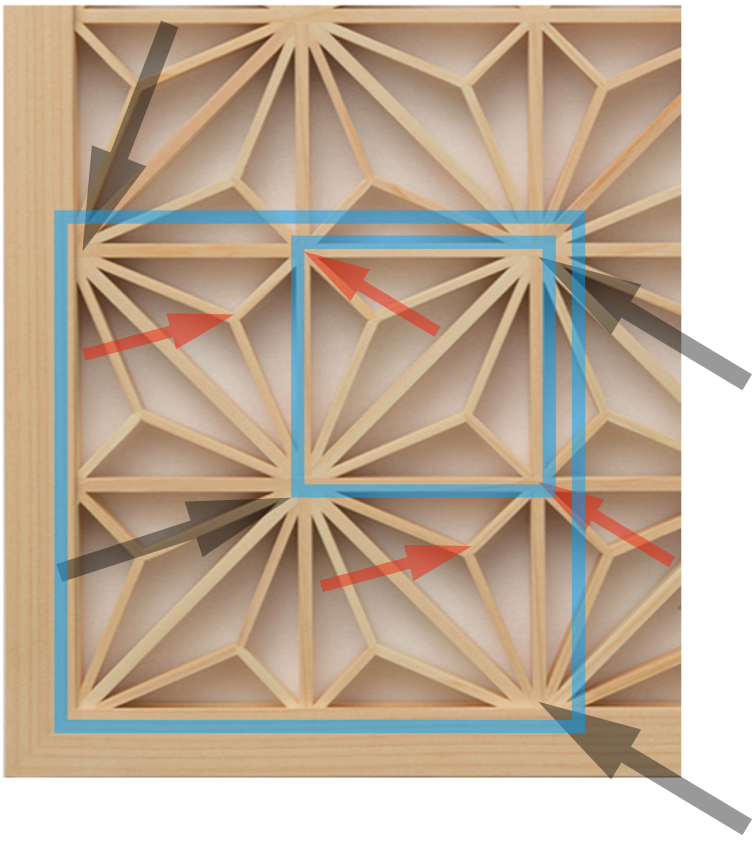
   Identify the bridges (lines in this case) and islands. Imagine that the gaps between the bridges/islands are the areas you want cut out. The goal is to ensure the pattern is structurally sound and the pattern is still recognizable. The Kakuasa pattern has no islands per se; but where 16 bridges intersect with each

other, they form a circular island because the thickness of the bridges overlap each other at the meeting point (see the gray arrows below). As a rule of thumb, an island should have at least one bridge connecting it to another island or the edge of the pattern area. Ideally, two or more bridges are preferred. Note that where three to eight bridges intersect each other also form smaller islands (see the red arrows below). Note that the Kakuasa pattern has a “pattern within a pattern”; meaning that there is a large square encompassing an eight-petaled ‘flower’. The flower is actually made up of a smaller single design repeated four times, that is flipped horizontally or vertically (see the blue squares).

Kakuasa

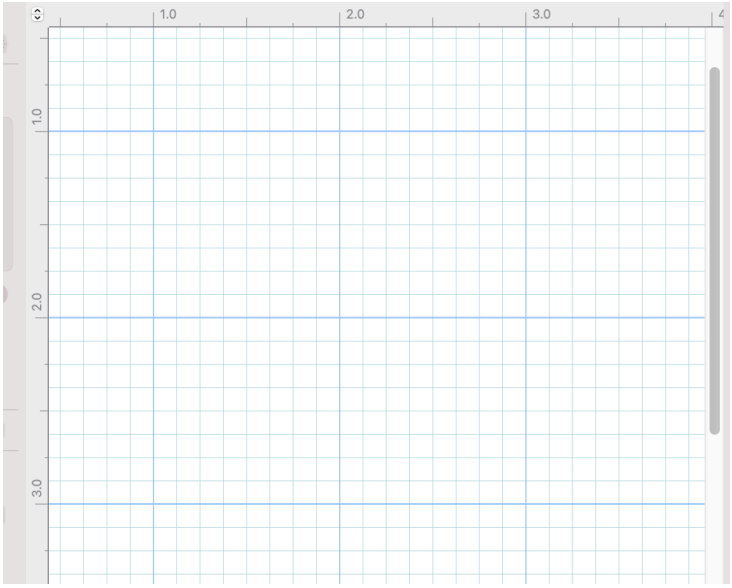
角麻





3. Open your design program.

   Create a new project, and display the rulers and grid pattern. Set the major grid lines to 1 inch (~25mm) intervals and the minor grids to 1/8 inch (~3mm). Create two layers; bottom layer and a top layer.



4. Determine the design dimensions.

   Following the “pattern within the pattern” design, we’ll create the smaller design first, then copy, paste, and flip it a few times to make the bigger design.

   When we transfer this design to the Glowforge, we want the smaller design to be 2 inches by 2 inches square (50mm x 50mm). The larger design will be a repeat of the smaller design and be a 4 inch wide by 6 inch tall rectangle (100mm by 150mm). Our bridges need to be wider than 1/8 inch (~3mm wide); preferably 3/16 inch (~5mm).

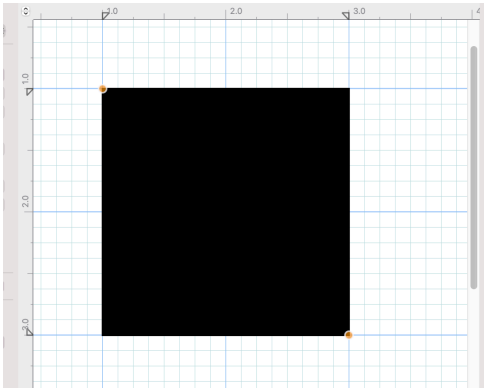
   The reason for the bridge’s minimum width is the structural support needed to keep the design intact and somewhat sturdy. If this design is going into an object sitting on the table, it’s going to get knocked around. So some strength is needed. However, if it’s going to be a wall hanging, or there will be some reinforcing backing, then we can make the bridges narrower.

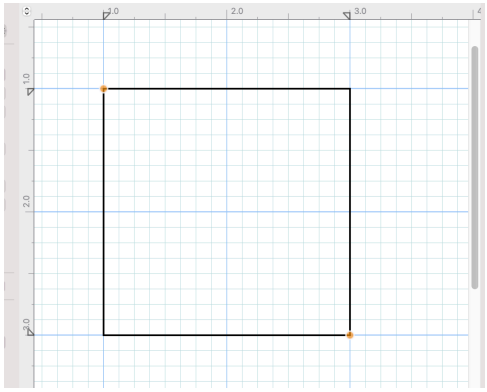
   Remember too, that the Glowforge laser has a kerf that removes material. So the bridge that’s 3/16 inch wide (~5mm wide) will be right at about 1/8 inch wide after the laser cuts down both sides.

5. Draw the smaller design.

In your vector program make a line drawing of the smaller design that's 2 inches by 2 inches (50mm x 50mm). If program has the feature, enable 'snapping' to the grid.

First, draw a square in the bottom layer with a black line and a black fill. Turn off the fill ("no fill"), leaving just the black line. If you want, you can make the black line a couple of points wide. 'Lock' the black square so it can't be edited or moved.

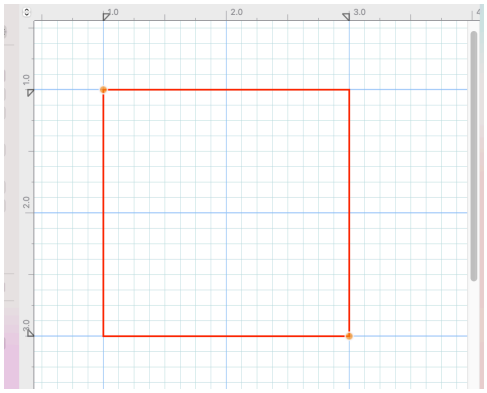




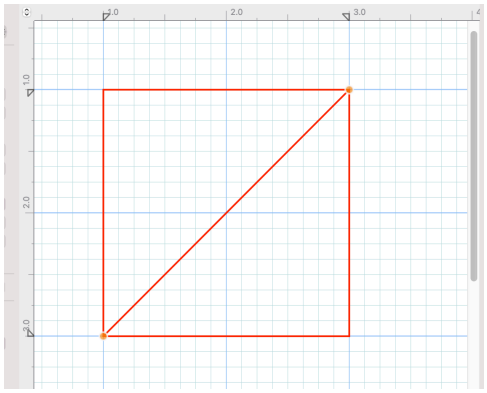
Save the work.

Second, switch to the top layer and begin making a line drawing of the Kakuasa pattern; using red lines.

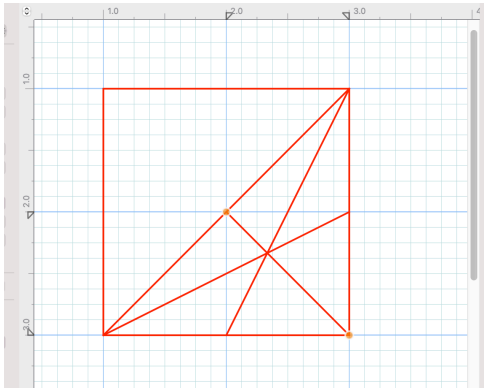
In the top layer, draw a square with red lines that overlays the black square in the bottom layer.



In the top layer, draw a long diagonal red line from one corner of the square to the opposite corner. This 'splits' the square into a pair of right triangles.



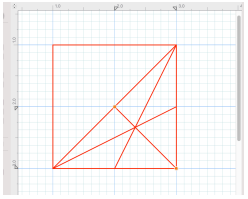
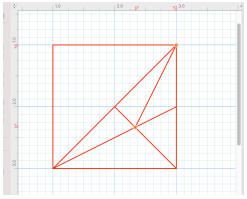
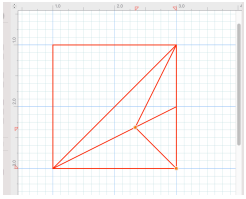
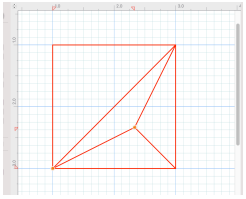
In the top layer, draw the three short red diagonal lines in each triangle. Each diagonal should start at a vertex and connect to the midpoint of the side opposite of the vertex. If your program has the feature, switch the ‘snap’ feature from ‘grid’ to “vertices/endpoints/segment midpoints”.



Save your work.

It’s obvious that the small diagonal lines in the triangle are too long for the Kakuasa pattern. Where the three red diagonals intersect each other in the middle of the triangle is limit on the length of each diagonal line.

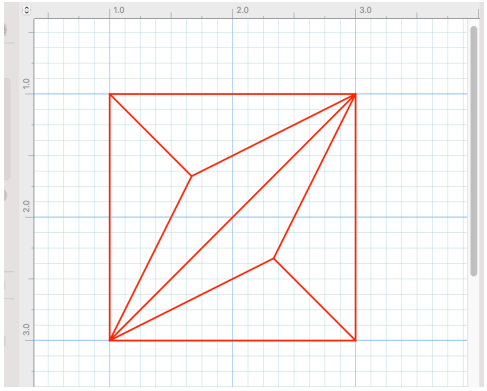
One at a time, select each small red diagonal line, then grab the end that’s on a triangle’s side midpoint. Move that end to the intersection in the middle of the triangle. You should not have to grab the line end at any

of the vertices of the triangle:

Save your work.

In the top layer, repeat the process by drawing three small red diagonal lines in the other right triangle. With both triangles filled in with small red diagonal lines, the small design should look like this:

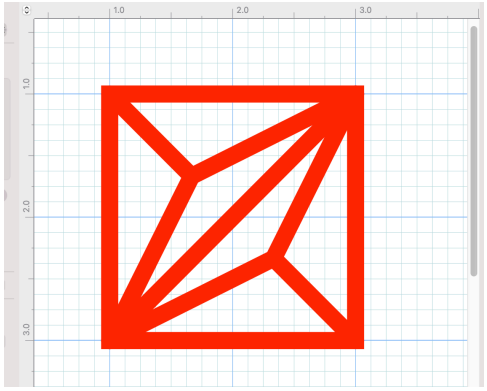


Save your work.

Make a copy of the small red design as a line drawing (like the above illustration) before continuing. You'll revisit this line drawing later.

———>>This is the "Start Over" point I mention later in the instructions.

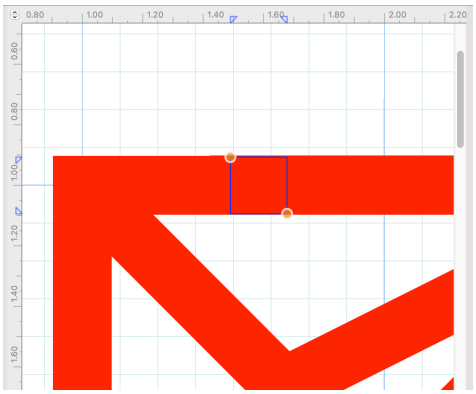
In the top layer, select all of the red line segments, and red square, and group them together. Next, select the group and open the properties window for the group. Find the control for line width and input a number to make the line wider. With most programs, 1/8 inch (~3mm) is about 10 points.



In the top layer, make a very small square that is 3/16 inch (0.1875 inch or 4.7mm) on each side. Make the small square's lines 1 point thick and color the

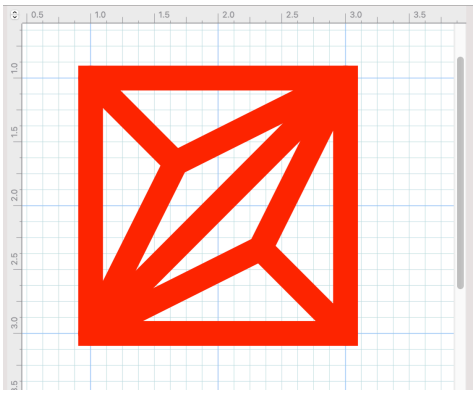
lines blue, with no fill. Click on the small square and bring it to the 'front' of the drawing. The purpose of this small square is to use it as a measurement device to check width of the lines (bridges).

Zoom in and click & drag the small blue square over the one of the horizontal or vertical lines in the the small red design. Click on the small red design and go to the line properties box and adjust the width of the lines. Increase or decrease the line width until the red line width is the same as the small blue square. In my case, I had to adjust the red line widths to 14 points. Your width setting may be different in your program.



In the top layer, once you adjusted the lines to the correct width, delete the small blue square. If you want to make more adjustments later on, simply recreate the square to the desired height and width.

In the top layer, zoom out far enough to see the entire small red design. The lines look much thicker than in the picture. Keep in mind two things: the artisans who built the Kakuasa design in the picture used solid hardwoods, whereas we are using Glowforge (GF) Proofgrade Plywood. The plywoods have hardwood veneer with an MDF core. The strength of the plywood is less than the solid hardwoods; therefore we make the lines wider to improve the strength and durability. Second, the laser kerf will also remove some material, thus making the lines narrower.



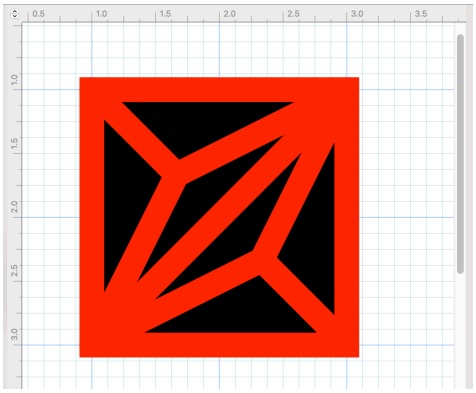
This highlights the need to experiment with the design before committing to a final version. Once we finish with the small design, make some experimental cuts on scrap stock and see what it looks like and how sturdy it is. Most likely you'll make the lines narrower for aesthetic reasons; but you'll have a baseline to work from when making the adjustments.

Later on, think about varying the line widths for each type of diagonal and the surrounding square in the small design. Get a little crazy…

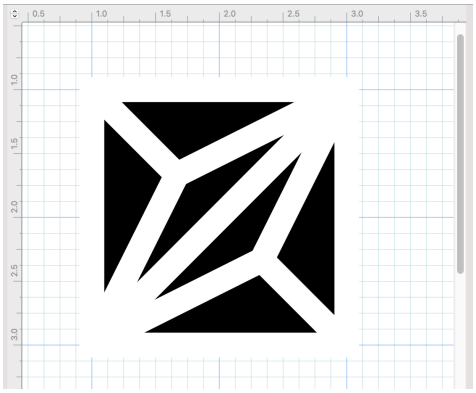
In the top layer, 'lock' the small red design so it can't be edited or moved.

Save your work.

In the BOTTOM layer, ensure the 2 inch by 2 inch square (50mm x 50mm) is directly under the small red design. Bring up the properties box and make the line black, 1 point wide, and make the fill black. In your drawing program, the small red design in the top layer should be exactly superimposed over the black square in the bottom layer:



In the TOP layer, bring up the properties box for the small red design and change the color of all the lines to white:



What you see in the black & white design above are six triangles inside the small design. Those are the areas we need to cut out for the stencil.

Save your work.

In your drawing program, export your project as a JPEG file, at 96 dpi (dots per inch). The exported JPEG should look something like this:

In your web browser, go to this URL:

https://convertio.co/

Convertio is an online file converter that's "sort of" free. For us occasional hobbyists, it's free; but if you're doing this stuff as a business, consider signing up and pay the annual fees. Please don't tell me about other 'free' online converters or another method to convert the file. Remember, I'm a curmudgeon and stuck in my old fashioned ways…. :-)

Seriously though, if you don't know how/where to convert files, this is a good starting point. Do your research, see what you can find, and works for you.

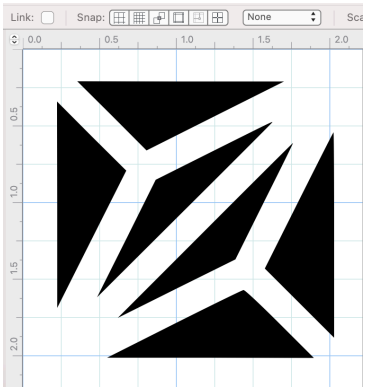
On the Convertio web page, look down at the red (of course…) box and click on the icon for "Choose Files" (outline of a folder with a magnifying glass). Browse to the JPEG file you exported and select it; then click 'Open'. You can upload multiple files to convert all at once; but there's a catch: As a free online user, Convertio allows you to convert about 10 files per day. If you subscribe, you can convert an unlimited number of files per day.

When converting a file on the Convertio web site, it prefers black and white imagery. I've tried other colors with mixed results; mostly bad.

After uploading your JPEG file, you should see another web page with a list of your files you wanted converted. Look at the JPEG name, and to the right is a box that has "to…" and a pull-down menu. Click on the menu and select 'Image —> SVG'. I use SVG files a LOT, but your vector design program may use something different. The INTENT is to convert the JPEG file into a vector file format that your program uses (SVG, AI, EPS, DXF, etc.). Do some research on your program's capabilities and select the export format you need.

Go to the lower right area of the web page and click on the red 'Convert' button. Once the conversion is finished, a new web page appears that says "Conversion Completed!". Your exported file has the same file name, but with a different extension name (SVG in my case). Click the 'Download' button, and store the file on your computer; preferably in the same folder as your project. BTW, Convertio stores your files for 48 hours, then they're deleted.

Open the converted file with your vector program and examine it:



The first thing you'll notice is that the overall design is not 2 inches by 2 inches (50mm x 50mm). It appears to be 1.8 inches on each side overall. Actually, the JPEG design was almost 2.25 inches on a side; because half of the small design square's line width went past the edge on each side. The other half of the width went inward.

Second, each of the triangles are 'bezier' curves, not straight sides. Each can be bent and curved after you click on it. Don't do that (for now). Select all the triangles and group them together; then 'lock' them.

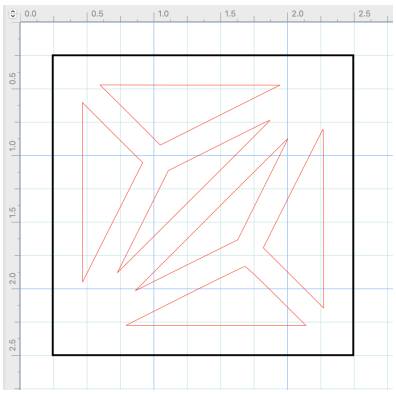
Save your work.

You now have a baseline small design stencil to experiment with.

Open a new project and import the small design stencil. Create a square that is 2.25 inches (~57mm) on each side. Center the stencil over the square (horizontally and vertically).

Save your work.

Color-code the stencil and square as you usually would for export to the Glowforge. I'll use red lines for the triangles with no fill, and black lines for the square with no fill:



Export the stencil and square project to Glowforge. Place a piece of scrap proof grade material in the cutting area. Set the cutting sequence to do the triangles first (interior), then cut the square last.

Hit the 'Print' button on the Glowforge and wait for the laser to finish. Afterwards, take a look at the product and check for sturdiness and aesthetics (does it look pretty, or too chunky?). If you decide to make the lines (or 'bridges' in stencil-speak) thinner, go back to the "Start Over" point, and make a copy of the small design line drawing.

Open the copy of the small design line drawing and follow the directions to adjust the line widths back to this point. Make note of the final line width(s) you selected, because you'll need it for the large design we'll make next.

Save your work.

6. Make the Large Design.

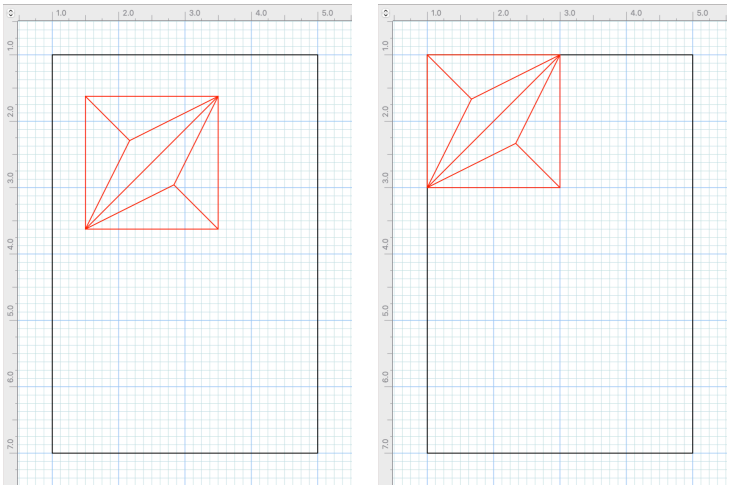
Create a new project, and display the rulers and grid pattern. Set the major grid lines to 1 inch (~25mm) intervals and the minor grids to 1/8 inch (~3mm). Create two layers; bottom layer and a top layer. Set the snapping feature to 'grid'.

Save your work. Mind numbing to see that phrase over-and-over-and-over isn't it?

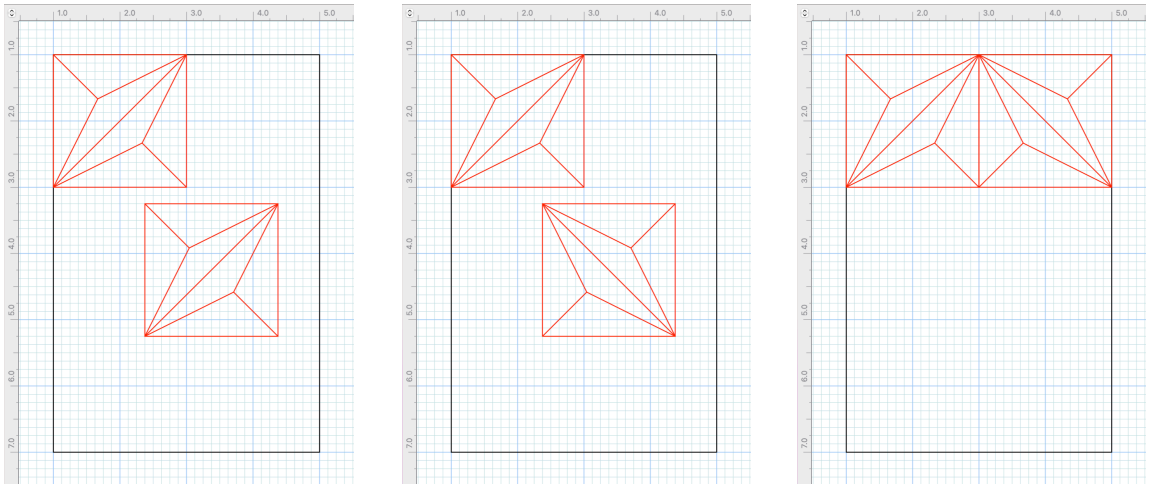
In the BOTTOM layer, create a rectangle 4 inches (~100mm) wide by 6 inches (~100mm) tall. Make the line black, 2 points wide, and set the fill to "no fill". Lock the rectangle.

Switch to the TOP layer.

Locate your small design line drawing, copy it, and then paste it into the top layer of your new project for the large design. Move the small design to the upper left corner of the black rectangle (that's in the bottom layer):



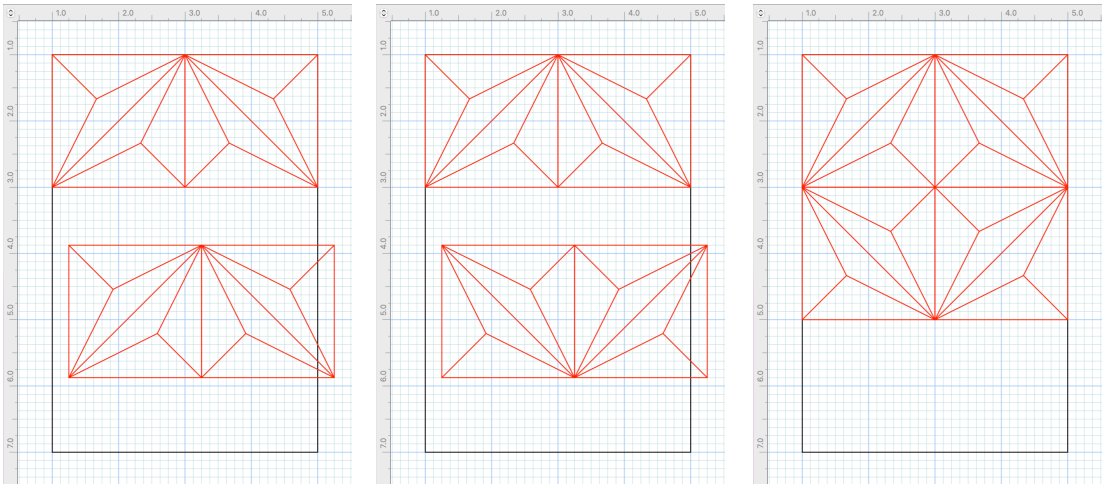
In the top layer, click on the small design, copy, and paste it into the top layer. Click on the copy, and 'flip' it horizontally. Move the 'flipped' copy of the small design to the upper right corner of the black rectangle (that's in the bottom layer):



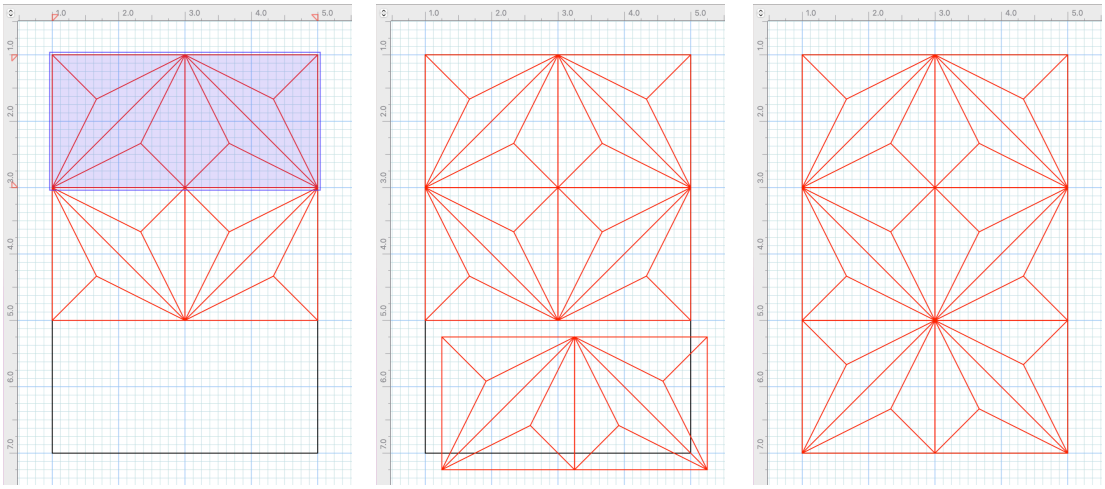
Save your work.

In the top layer, click on the two upper small designs, and ‘group’ them together.

In the top layer, click on the grouped design, copy, and paste it into the top layer. Click on the copy, and ‘flip’ it vertically. Move the ‘flipped’ copy of the small designs to just below the two upper small designs. The copy should be in the vertical middle of the black rectangle (that’s in the bottom layer):

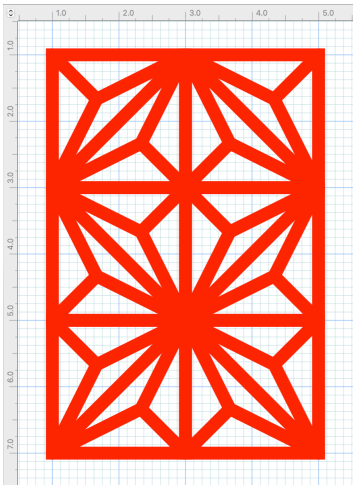


In the top layer, click on the upper grouped design, copy, and paste it into the top layer. Move the copy to the bottom of the rectangle and just under the two groups above it.



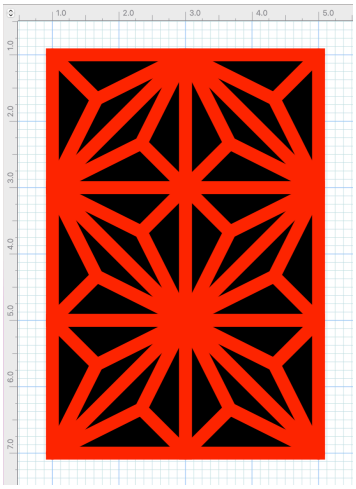
Save your work.

In the top layer, select all the small design groups and bring up the line properties. Set the line widths to 14 points and examine the design:

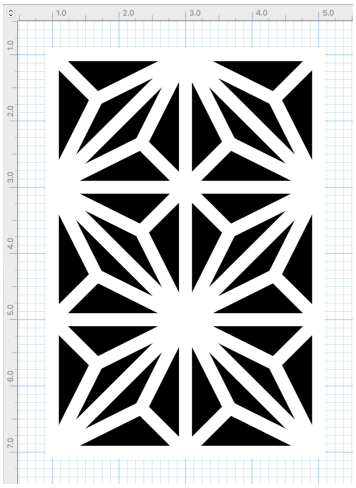


In the top layer, make adjustments to all the line widths until you're satisfied with the look. For this tutorial, I'm keeping the 14 point width for all lines.

In the BOTTOM layer, ensure the 4 inch by 6 inch rectangle (~100mm x ~150mm) is directly under the small red design groups. Bring up the rectangle's properties box and make the line black, 1 point wide, and make the fill black. In your drawing program, the small design groups in the top layer should be exactly superimposed over the black rectangle in the bottom layer:

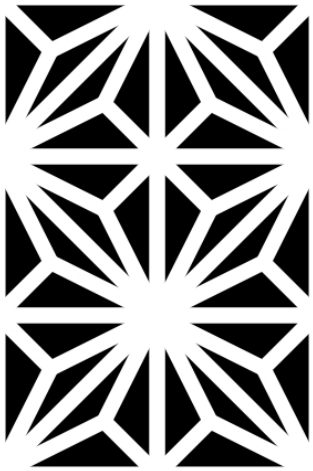


In the TOP layer, bring up the properties box for the small red design groups and change the color of all the lines to white:



Save your work.

In your drawing program, export your project as a JPEG file, at 96 dpi (dots per inch). The exported JPEG should look something like this:

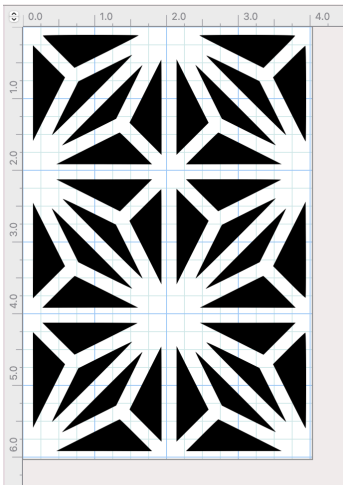


In your web browser, go to the Convertio website URL:

https://convertio.co/

Upload your JPEG file of the large design, convert it to an SVG file, then download the SVG file to your project directory.

Open the converted file with your vector program and examine it:

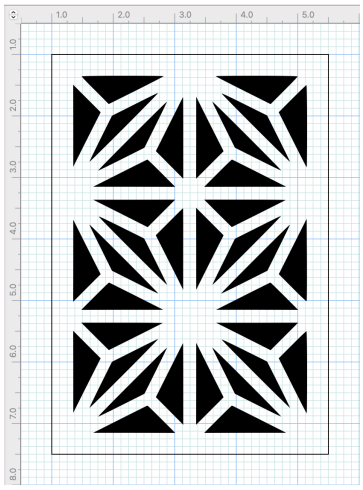


As with the small design, you'll notice is that the overall large design is not 4 inches by 6 inches (~100mm x ~150mm). Second, each of the triangles are 'bezier' curves, not straight sides. Each can be bent and curved after you click on it. Don't do that (for now). Select all the triangles and group them together; then 'lock' them.

Save your work.

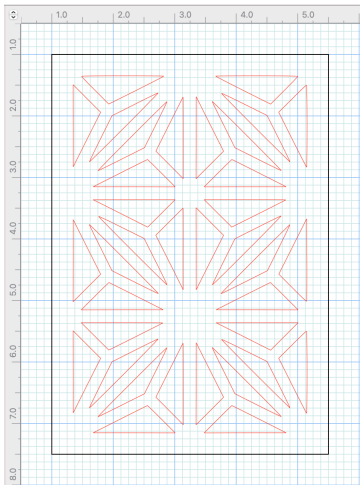
You now have a baseline large design stencil to experiment with.

Open a new project and import the large design stencil. Create a rectangle that is 4.5 inches (~114mm) wide by 6.5 inches (~165mm) high. Center the stencil over the square (horizontally and vertically).



Save your work.

Color-code the stencil and square as you usually would for export to the Glowforge. I'll use red lines for the triangles with no fill, and black lines for the rectangle with no fill:



Save your work.

Export the stencil and rectangle project to Glowforge. Place a piece of scrap proof grade material in the cutting area. Set the cutting sequence to do the triangles first (interior), then cut the square last.

Hit the 'Print' button on the Glowforge and wait for the laser to finish. Afterwards, take a look at the product and check for sturdiness and aesthetics (does it look pretty, or too chunky?).

7. Conclusion.

If you made it this far, thank you for your time and patience. I deliberately went into excruciating detail so as to highlight all the small things involved in making a stencil.

Remember, this is just one way to make a 'negative' image (a stencil) from a 'positive' image (the original object). I'm quite certain others on our web forum will pipe up with their methods as well; so you have some options to consider for your way of doing things.

Good luck, and have fun experimenting!

Now, you young whipper snappers get off my grass! This curmudgeon wants his nap time back…. :-)