Pensil Holder
Visual Guide
Materials
• Semi-transparent plastic mug
• A4 Paper
• Pencil and Eraser
• Fine tipped marker
• Ruler
• Masking tape
• Paper glue
• Exacto knife / Scalpel

Tools and Software
• Laser cutter
• A phone with a document scanning app
• Adobe Illustrator
• Photocopier / Desk printer
The first step is to translate the shape of the plastic mug onto a peace of A4 paper. To do this you can use masking tejp to tejp the paper to the mug as seen in the picture. Then you simply have to roll-up the paper over the mug, holding the pencil tip at the top and bottom of the mug. Once you unroll it you will have the shape of the mug drawn out on the paper as seen bellow.

Next, you’ll want a bit of a margin. To draw this first use the ruler to mark a few offset points along the top and bottom of the drawn edges, about 15mm should be appropriate. With these helping markers use a light hand to draw the offset lines.
Next is when you will have to be a bit creative. Draw the shapes that you would like to be on the sides of your Pencil holder. These shapes are entirely up to you and you so don’t feel constrained by my example. Do however try to leave at least 7mm of space in-between any two shapes as it will be hard for the printer to work with much less than that. Do not worry too much about being precise and neat when you draw the pattern, just make sure that you keep a light hand that way you can easily erase mistakes. Also make sure that you erasor won’t leave smodges (like mine).

If you would like to get an impression how the final shape will look then you can use a document scanner app on your phone - or a flatbed scanner if you have access to one - to create a copy that you can print. You can then use a pair of scissors to cut the shape out and roll it around your mug to see if you like it or not. You can do this a few times over, altering your pattern as you see fit untill you get a nice seem where the pattern comes together.
Once you are happy with the pattern, clean up as much as you can with the eraser and then use the fine pointed marker to fill in the pencilled lines. You want the lines to be straight and clear so practise drawing the arcing shape of the mug a few times on a separate paper. If you have a printer you can also create a copy in case, you make a mistake.  

With that done it is time to use your phones document scanner app to take a picture of the A4 paper. The app will do its best to straighten your picture, but you get the best results if you try to take the picture from straight above with a good lighting. As previously mentioned you can also use a flatbed scanner for the absolute best result, but most modern phone cameras should do a fine job.  

Using an A4 sized paper and a document scanner means that when we open the image in Adobe Illustrator, we simply have to create an A4 size canvas to know that the lasercut shape will be the same size as our original drawing.  

Once you have opened illustrator you want to create a new document. Change the Size to A4 and make sure that you have click the landscape button before pressing ok.  

To bring your image into Illustrator, simply drag and drop it onto the canvas. At this point the image will likely be larger than the canvas but start by left clicking and dragging the image to the center of the canvas. After that holding down shift+alt / shift+cmd before left clicking and dragging one of the corner squares (as indicated by the red box) inwards towards the corresponding corner of the canvas (as indicated by the red circle).
The next step is to convert our image into something that the lasercutter will understand, what we want is to convert our image to vectors. This could be done by hand but thankfully Illustrator can do it for us. The tool we want is called Image Trace and you can access it by pressing the indicated button below.

After pressing that button a menu similar to the one in the picture below should appear, if it does not then press the icon circled in red. Menu open, press the small arrow next to the Advanced label to reveal some further options. I recommend that you enter the same settings as I have selected to starting out, only altering the **Stroke** value until you get something akin the picture on the next page. Once you are happy press the **Expand** button.

Once you have done that the next step is to tidy-up a bit. First thing is first, press the **A** key to switch to the **Direct Selection Tool**. This will allow you to interact with the individual parts of your newly created vector image (When **Direct Selection Tool** is active your mouse cursor will appear white). What we want to do is remove excess parts such as these lines down in the corner. That is simply done by left clicking and dragging across the parts in question and pressing the **Delete** key.
The other thing we want to address are anomalies and defects in the shapes like the one circled in red to the right. Same as before, left-click and drag over the concerned parts to select them and press the Delete key to remove them. Note that we now have a gap in this particular shape. Assuming that you have not clicked anywhere after pressing the Delete key, then you can simply press `ctrl + J / cmd + J` to close this gap. If you did click away from the selection then simply press `ctrl + Z / cmd + Z` to undo and the correct parts should be selected once again.

Continue cleaning up until all shapes are nice and self-contained similar to the picture below.

Next we want to leverage some computer magic to make the shapes all nice and smooth. Start by pressing `ctrl + A / cmd + A` to select all the shapes on the canvas. After that you want to open the Simplify tool as indicated to the left. I recommend starting off by changing the settings to the same as below. You can tweak these settings until you are happy with the results at which point you can press **ok**.
Now all that remains before we can lasercut the shape is to change the colour and width of the line so that the lasercuter will know what to do. Start by pressing `ctrl + A / cmd + A` to select all the shapes on the canvas. Next click the icon circled in red and change the colour to the first red on the first row. Next change the stroke by typing 0,5 into the indicated box. With that you are done and ready to lasercut your shape.

With your pattern lasercut it is time to put it together. Simply roll it around the plastic mug and use masking tape to join the ends together. Then use your sharp knife to cut away the masking tape as seen in the picture below. Use paper glue in spots where the paper won't follow the shape of the mug. With that, your soon to be Pencilholder is ready to be scanned!