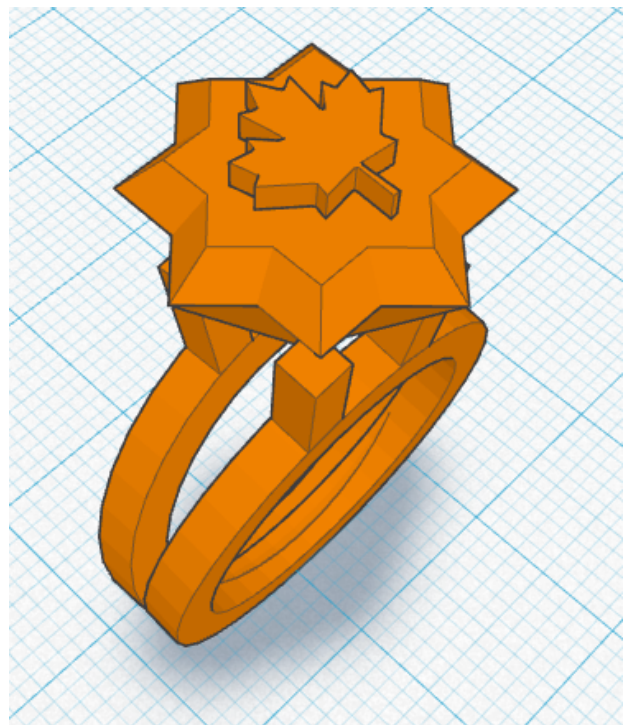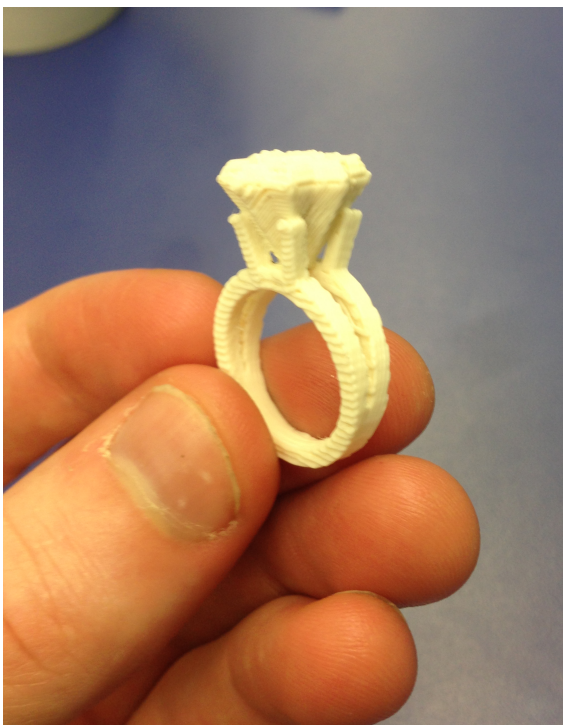# How to Make a 3D-Printable Ring Using TinkerCAD

> **Goal:** We will create a ring on TinkerCAD as a way of familiarizing ourselves with the website and the core features of 3D Modelling.
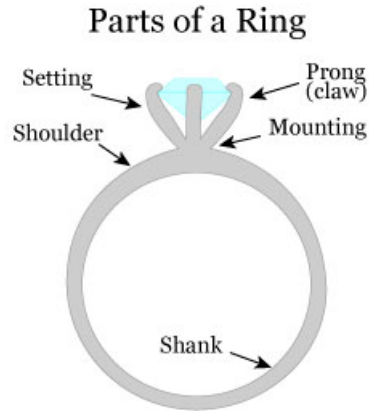
Once you've created your design and had it approved by a teacher, we can print this ring on the 3D Printer!

> ### You should already know:
>
> I will assume you have gone through these short lessons at
> www.tinkercad.com/quests:
>
> - Learning the moves
> - Camera controls
> - Creating holes
> - Scale, Copy & Paste

Parts of a Ring

from: www.asia-gems.com

Part 0 - Getting Ready to Build

1. Using Google Chrome, go to tinkercad.com and sign in with the button at the top-right of the page. If you don't have an account click Sign Up and enter your information.

2. From your Dashboard (home page), click Create New Design.

3. By default, TinkerCAD generates a name for your design. Let's start by renaming ours to something like *Mr King's Ring*. To do this, go to **Design > Properties** from the top menu bar**.** Check that the Visibility is set to **Private**. Click **Save Changes**.

4. We now see our Workplane. This is the 3D space we use to create models.

   As a quick reminder, here are the view (camera) controls
   - **Click and Drag** – rotates the workplane to let us view from different angles
   - **Ctrl+Click and Drag** – Pans (slides) the workplace side to side to move the camera's position *(**note:** Ctrl+Click is the same as Right Click)*
   - **Scroll Up/Down** – Zooms in and out.
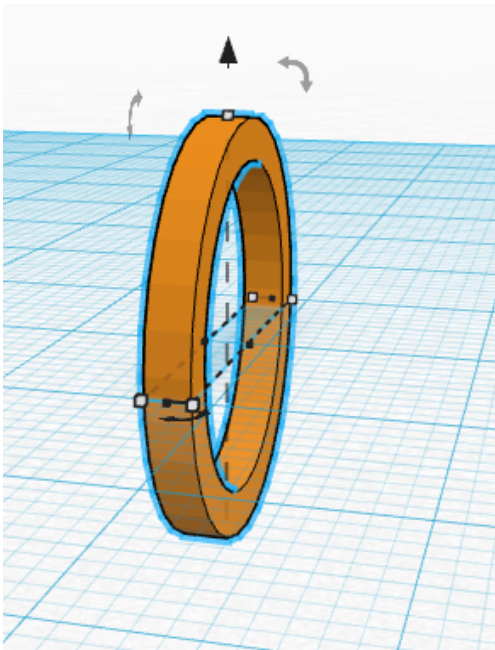
Home   Menu Bar   Shape Shortcuts
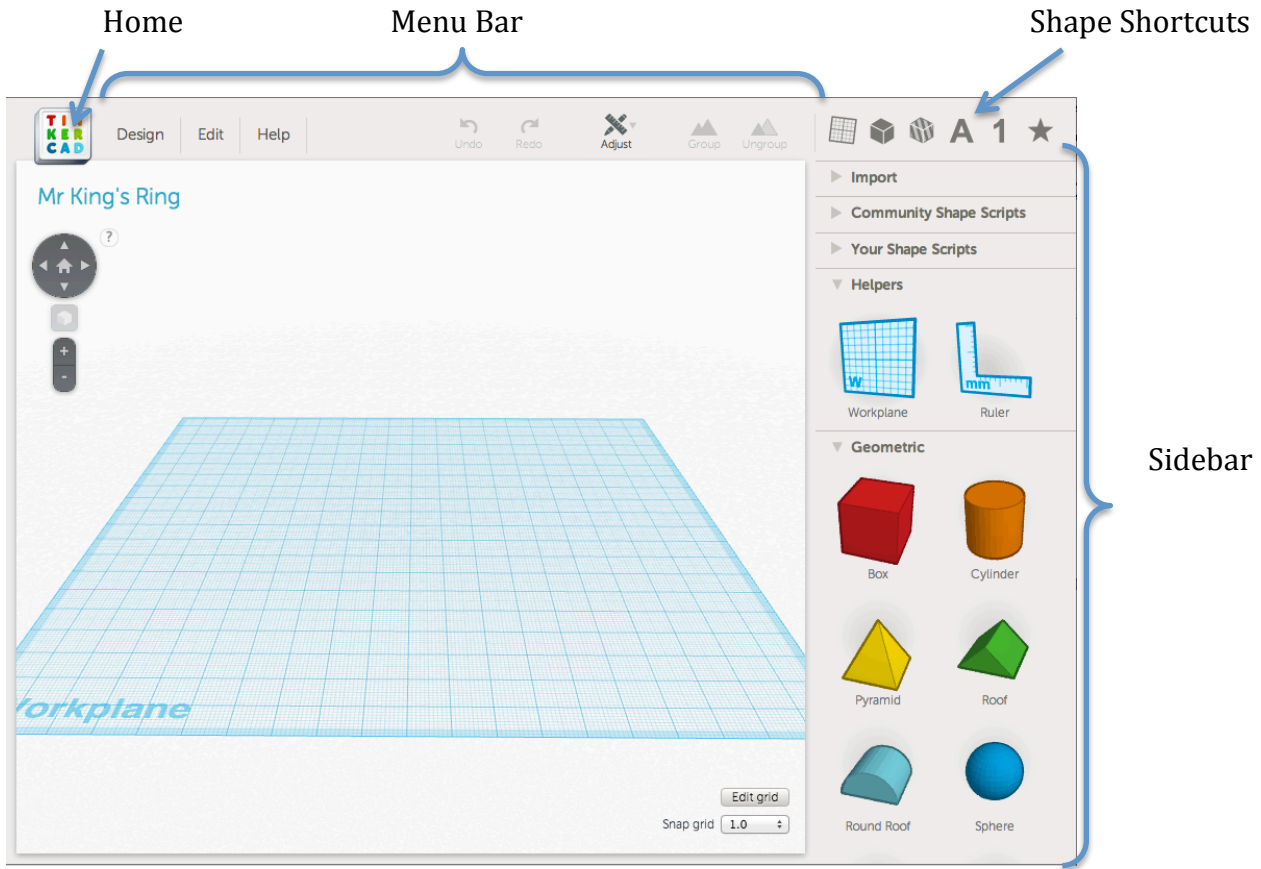
Sidebar

Part 1 – Creating the Ring Shank

1. In the sidebar, scroll down and click on the **Tube thin** shape. Drag it to the middle of your workplane.
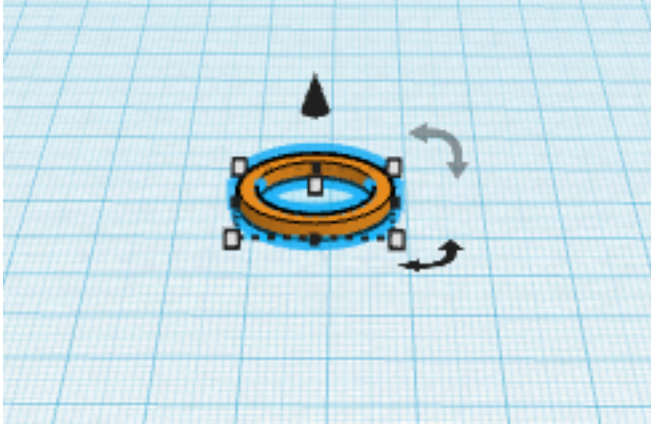
2. **Click and drag** the rotator arrow on the top-right corner of the shape to rotate the tube to a vertical position. To have the tube snap to exactly 90-degrees, **hold shift**.

Tip: Did you make a mistake? You can undo with Ctrl+Z, or by using the Undo button in the Menu Bar.

Tip: Want to see the Dimensions? Drag the Ruler tool from the Sidebar into the workplane.

Remove it later by clicking the "x"

3. Use a ruler to measure the *diameter* of the finger you want to wear your ring on (in units of mm). By default the tube is created with an outer diameter of 20 *mm* and thickness of 2*mm,* which gives it an inner diameter of 16*mm*.

   Rotate the tube so that you can easily grab one of the white sizing handles.

   Hold Shift and drag this handle so that the <u>inner</u> diameter matches the

diameter of your finger. (notice that the dimensions show the <u>outer</u> diameter!!)

Note: technically as we make the ring larger, it also gets a little bit thicker but as long as your finger diameter is less than about 24mm we can ignore this slight change.
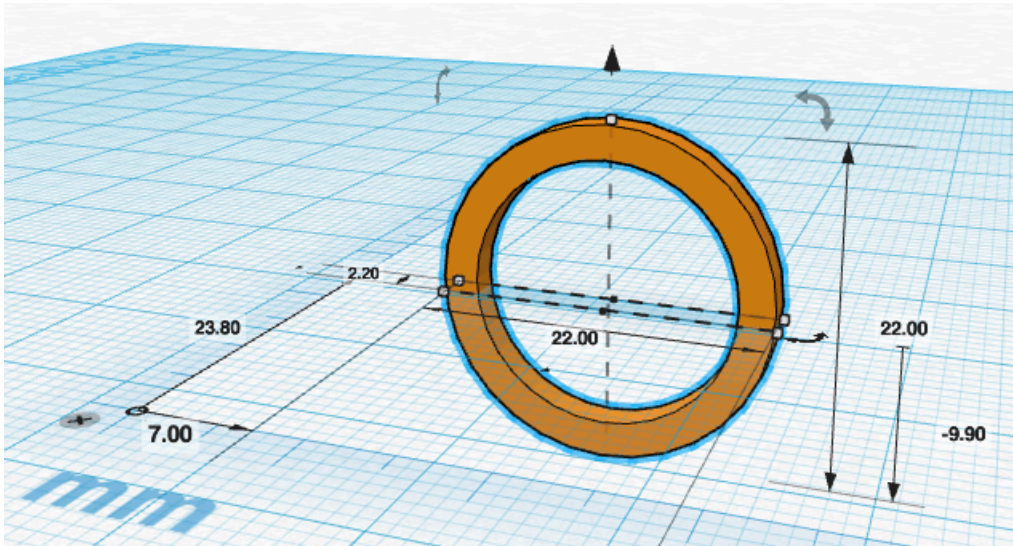
4. Rotate the tube so you are looking at it edge-on. To copy it, we'll **hold Ctrl and Drag** it sideways. After you've started dragging (but before you let go) also hold down **shift**. This will keep the copied tube directly in line with the first one.
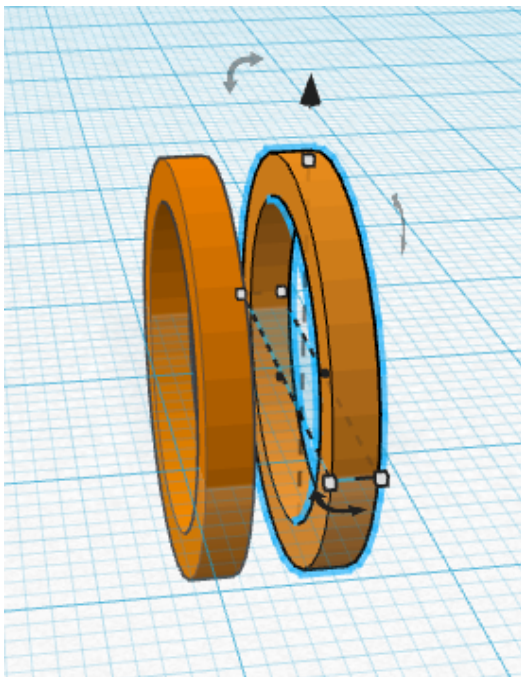
5. You can see that in the final design these tubes aren't parallel with each other. Let's use the rotators to angle them away from each other by a few degrees. I chose to do it by 6 degrees but yours can be more or less if you like!
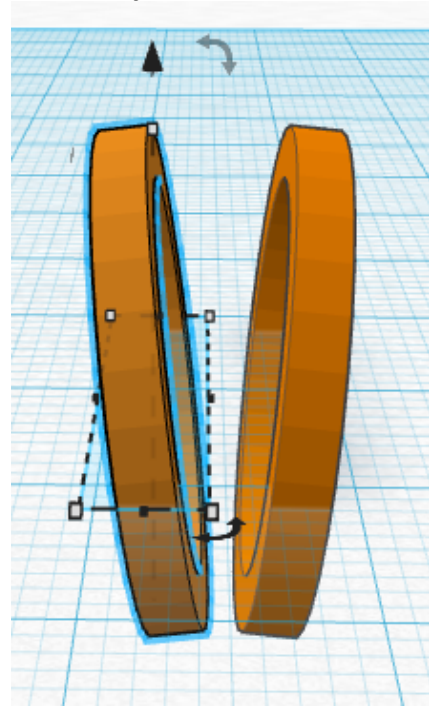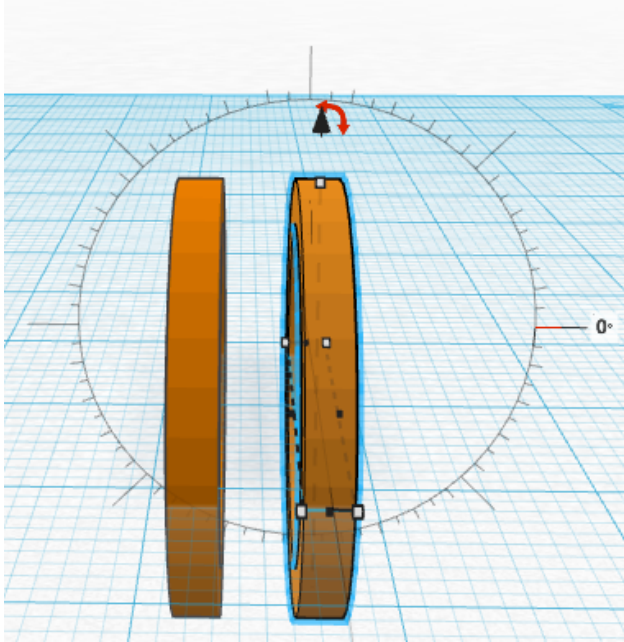
6. These still seem to have a gap between them. Select one of the rings and either **drag** or use the **arrow keys** to move them back together so that their bases are aligned with each other.

7. Then, hold **shift** and click them both so that both are selected. Click the **black arrow** floating above or below the shapes and **drag it upwards** to translate (move) the shapes vertically.

8. Finally, with both shapes still selected, **click Group** in the Menu Bar to join the shapes. They can be Ungrouped later if you decide you want to change something by using the **Ungroup** button.

Your finished shank should look something like the one below:
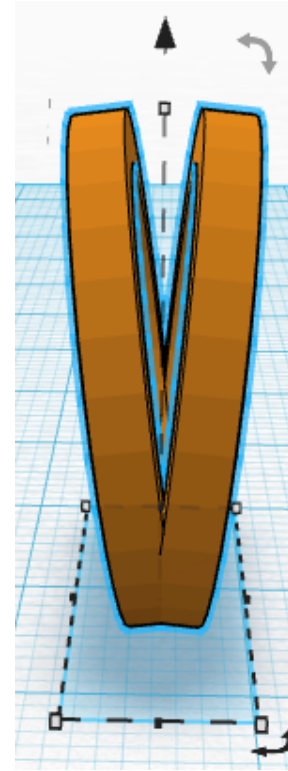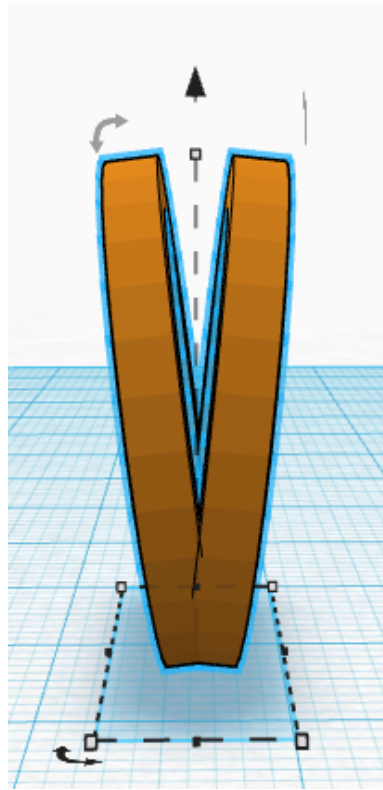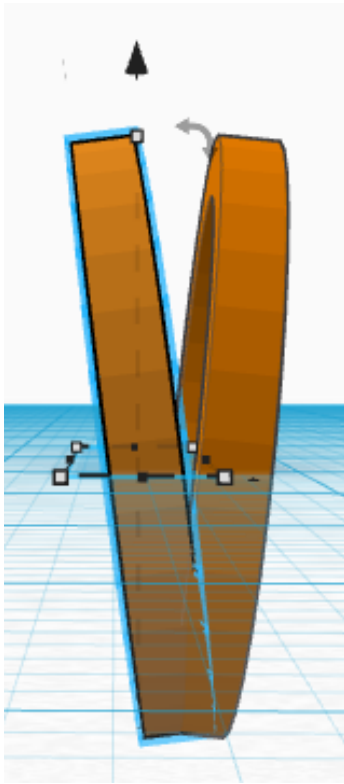
Congratulations! You have learned:

- ✓ How to Create and Rename a TinkerCAD Design
- ✓ How to Add, Scale, Move and Rotate a shape in 3 Dimensions
- ✓ How to Group and Ungroup shapes

Part 2 – Adding the Claws.

1. The claws are made from shapes called Boxes. In the Sidebar on the right, scroll to Geometric shapes and **drag a box** onto the Workplane.
2. Use the white handles on the corners of the box to **resize it** so it has a **width and depth of 2 *mm*** and a **height of 6 *mm*** (or whatever you think looks good).
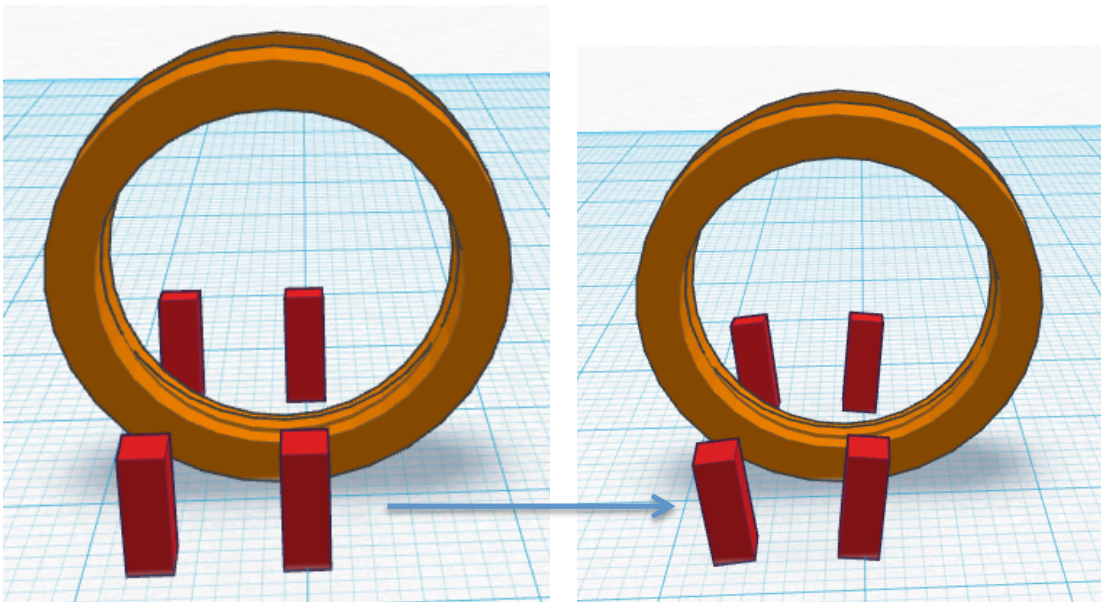3. **Hold Option and Drag** this box to make 4 copies of it.
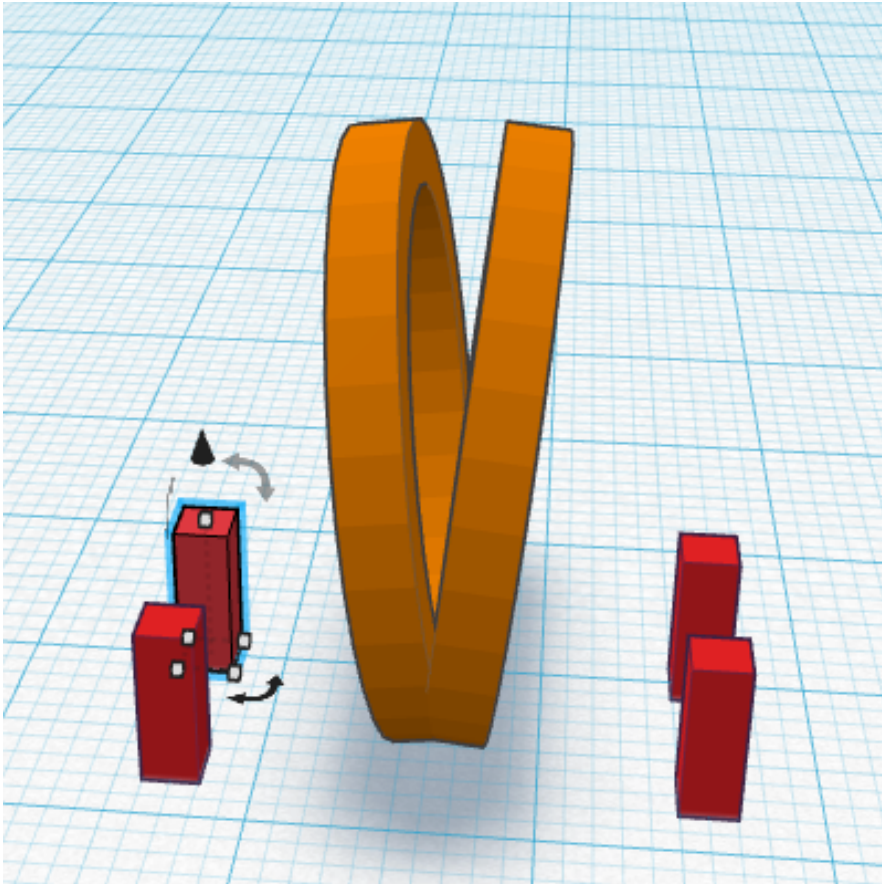
4. We are going to angle each of these claws away from the center of the ring. First we'll tilt it to the side (like we did with the shank tubes). I chose to tilt all of mine by 6 degrees to match the shank.
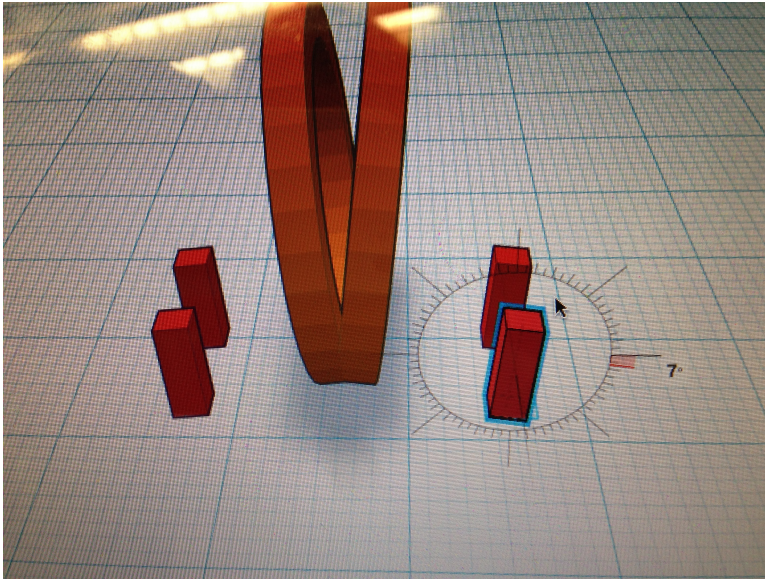

5. Then rotate the view so that you're looking at the shank face-on and tilt the claws outwards in this direction too.

If you've done it right, your claws should all be tilted outward and the overhead view should look something like this:
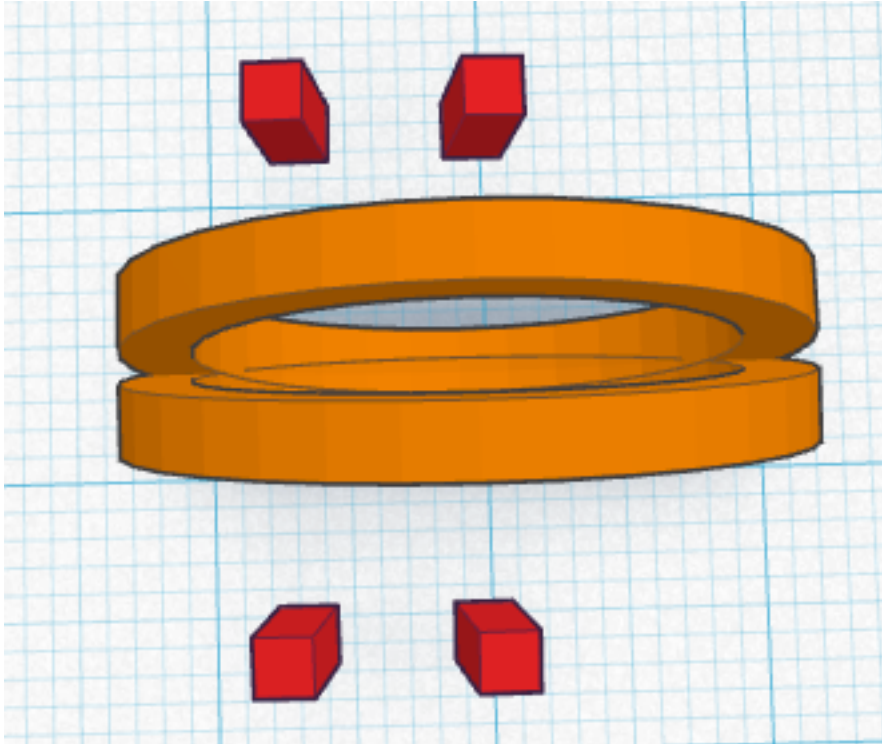
6. Now lets **drag the claws** to the location we want them to join the ring. Don't forget: we can move them vertically using the arrow that floats above them. You may want to select them all and move them vertically together so they stay in line with each other.
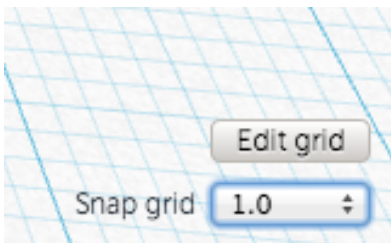

Note: This part can be pretty fiddly so be patient and take your time to get it right.

If you want to move your claws more precisely, change the **snap grid** amount (bottom-right corner). By default it is set to 1.0 mm but you can make it as precise as 0.1 mm.
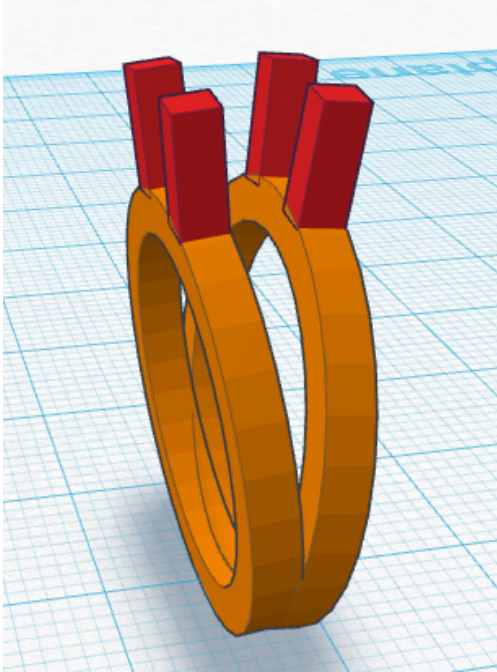
7. When you're happy with the locations, **select all** the shapes (you can **click+drag** a selection rectangle across them all to do this quickly) and **group** them together.
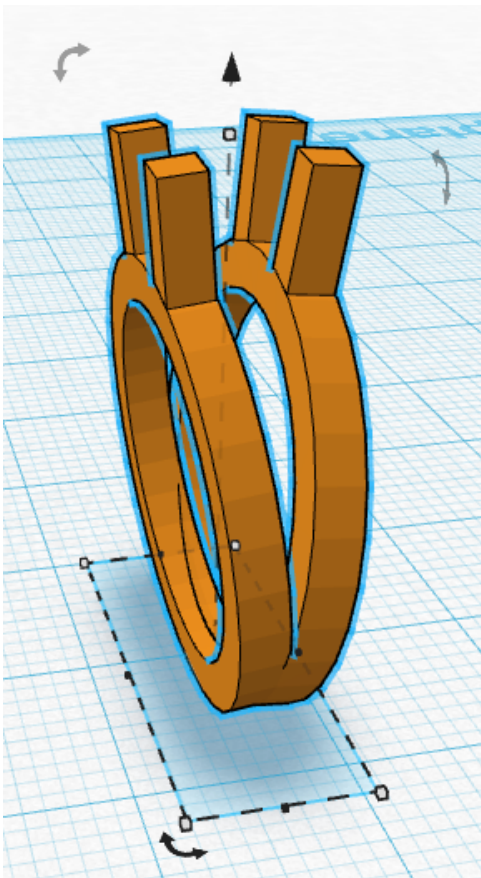
Part 3 – The Diamond

Let's look at two ways to add a diamond to your ring. The first way is much easier, but the second way teaches you more about combining shapes to create more complicated shapes (and its way more fun!). Try both.

If you're feeling creative use this as a starting point to create a collection of jewels to add to your ring.

3A – Using the Built-In Diamond Shape

1. Let's save a copy of the ring as it is now. In the menu bar, go to **Design > Duplicate.**

   Wait for the page to refresh. You should see TinkerCAD rebuild ("render") the model and the name of the design will change to something like "*Copy of* Mr King's Ring". Once it's done this you're ready to carry on.

2. In the sidebar, scroll down to the Symbols section, and **drag** the pre-made **Diamond shape** onto the workplane.
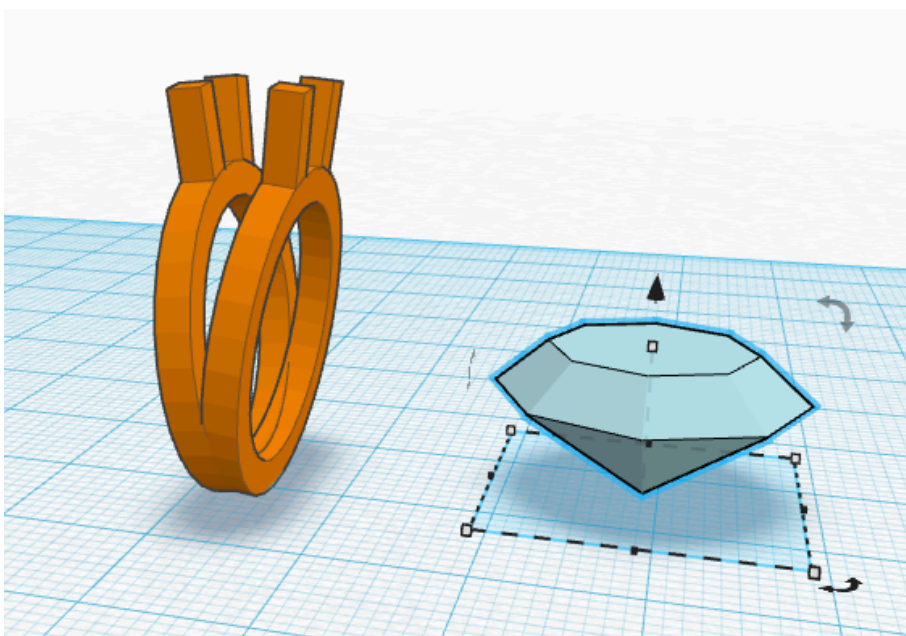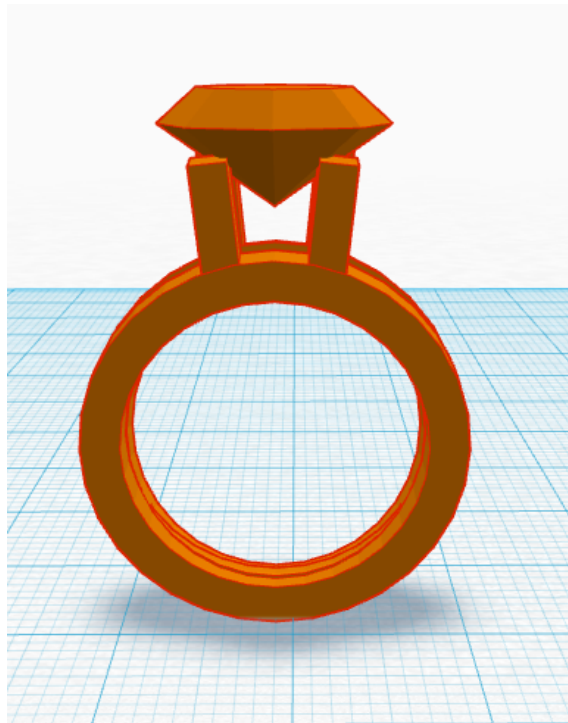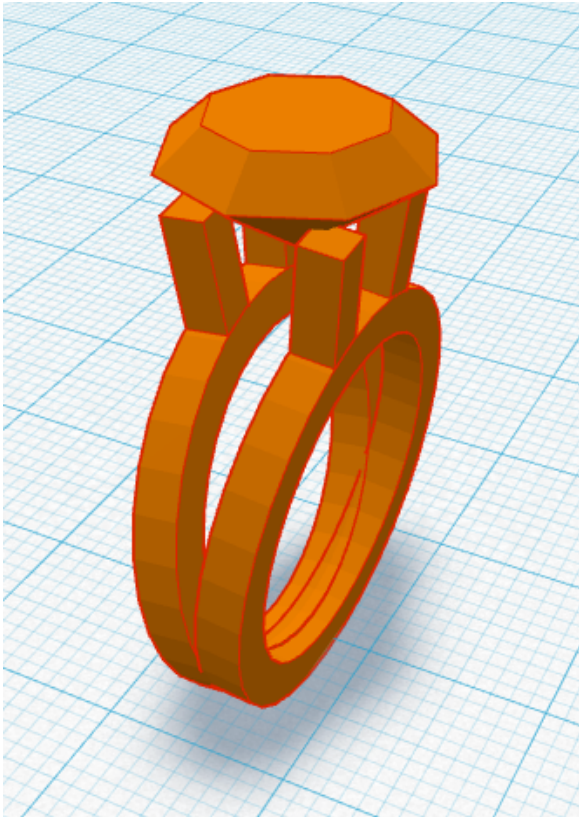

3. **Resize the diamond** to fit in the claws you made, and **move it into position.** Remember: holding shift maintains the proportions as you resize a shape.

Important: In order for the ring to print properly, all the pieces must actually intersect (touch) each other!!

This wont work! ☹	This will work. ☺
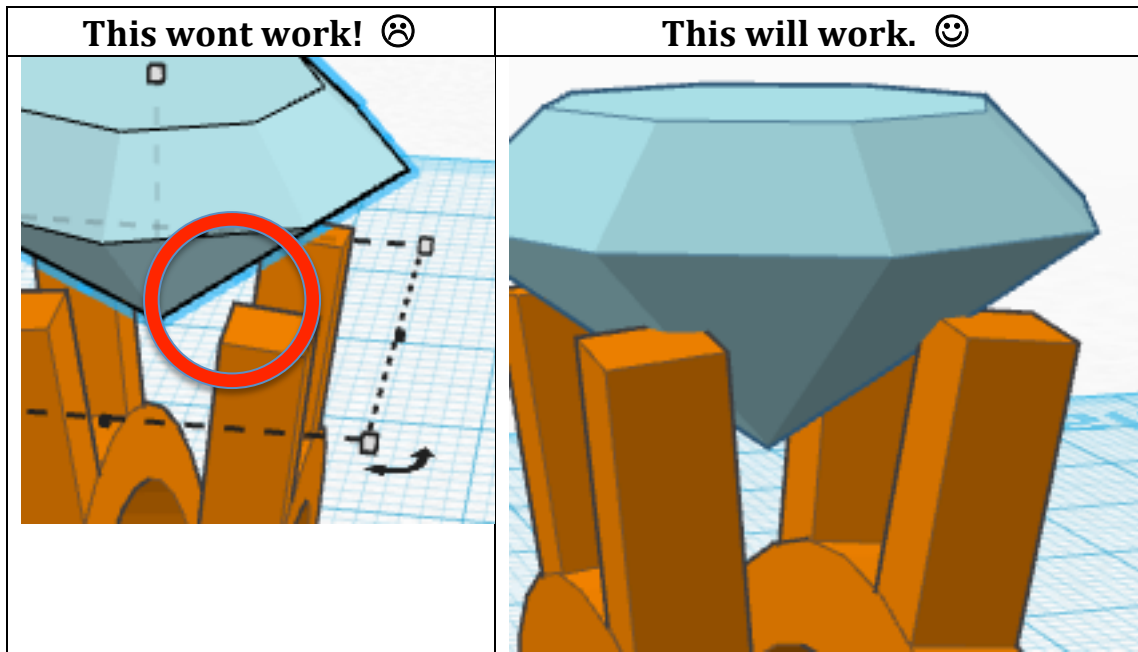
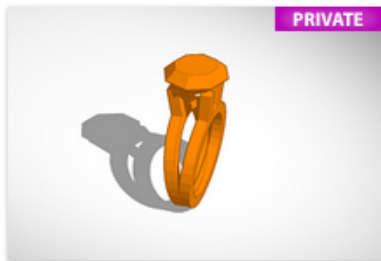4. **Group** the shapes together. You're done the first method!

3B – Creating a Custom Diamond Shape

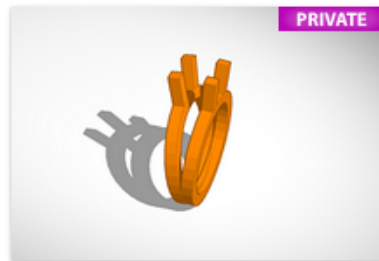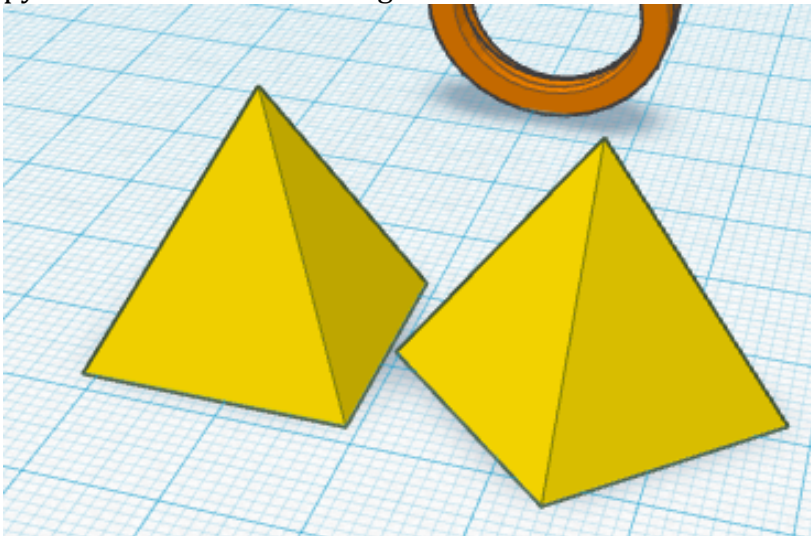1. Click the **Home** button to return to your designs. Go to the copy of the ring you saved in part 3A.
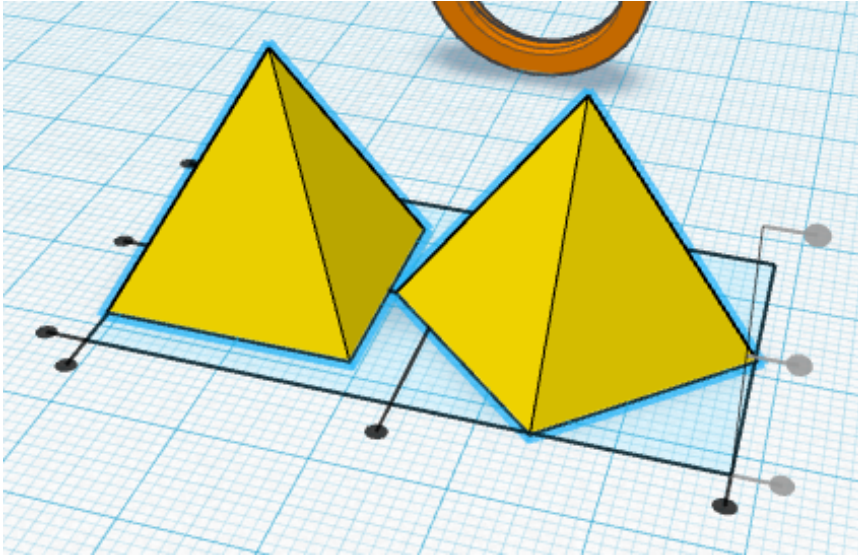

2. Start by **dragging** a **Pyramid shape** onto the Workplane. Create a copy of this pyramid and rotate it 45 degrees.
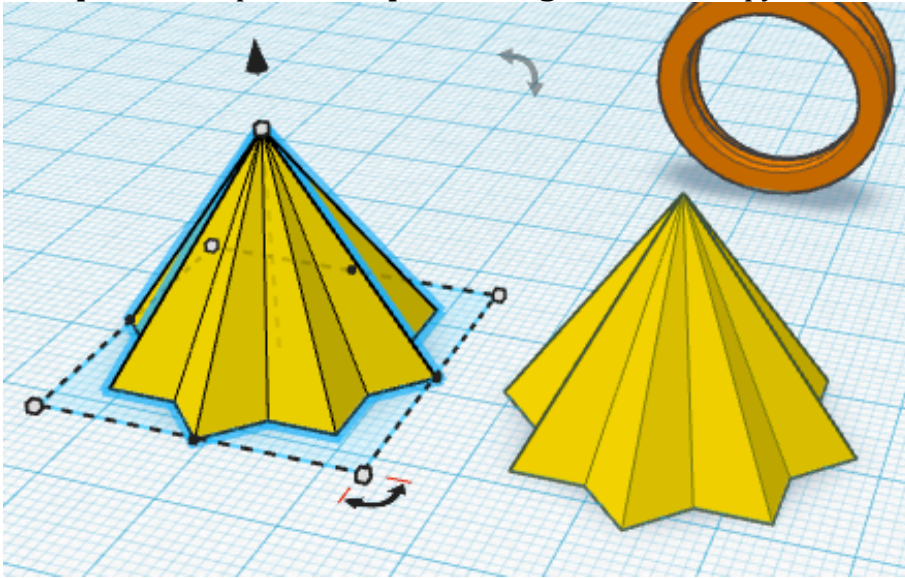
3. **Select both** of these pyramids. In the menu bar, select **Adjust > Align.** Here we see 3 **alignment tabs** for each of the 3 dimensions.


4. **Click** the center dots to **center-align** the pyramids in both of the horizontal directions. *Note: Hovering over the dot will show you a preview of the alignment.*
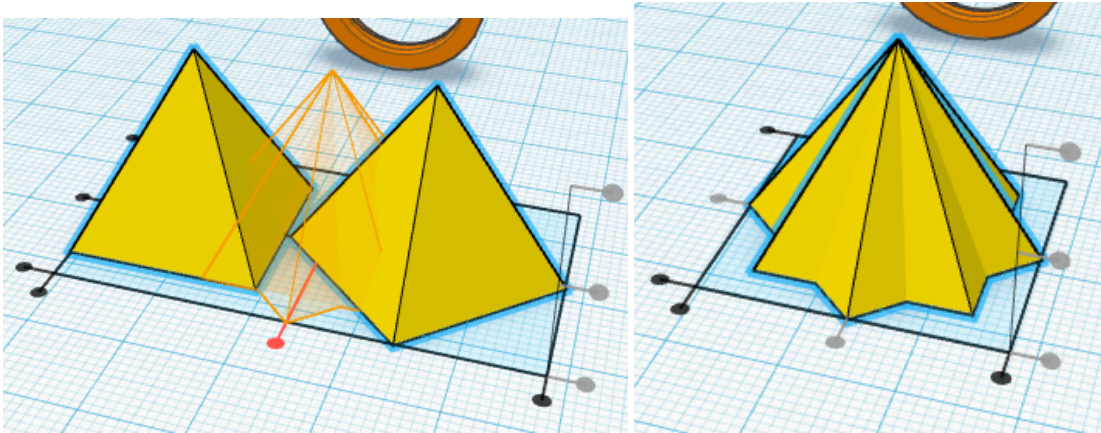
5. **Group these** shapes, then **Option+Drag** to create a copy of the combined shape.

6. **Flip one of the pyramids** so it is upside-down. Then **move** the right-side-up pyramid to be on top of the upside-down one. If you're having trouble lining it up, use the alignment tool.
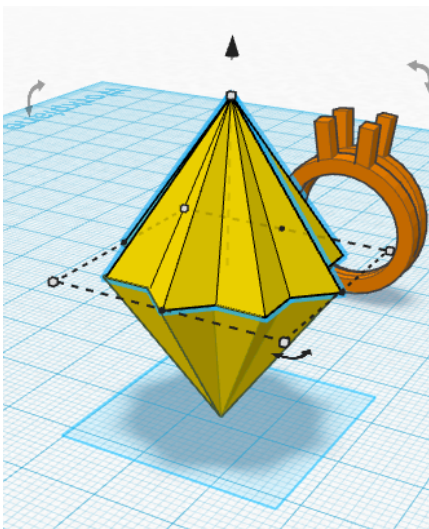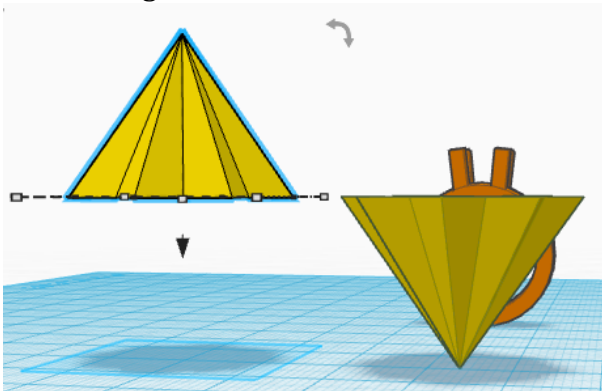
7. Use the white handle on the tip of the **top pyramid** to **decrease its height** to about 12mm**, then **Group the pyramids** into one shape.
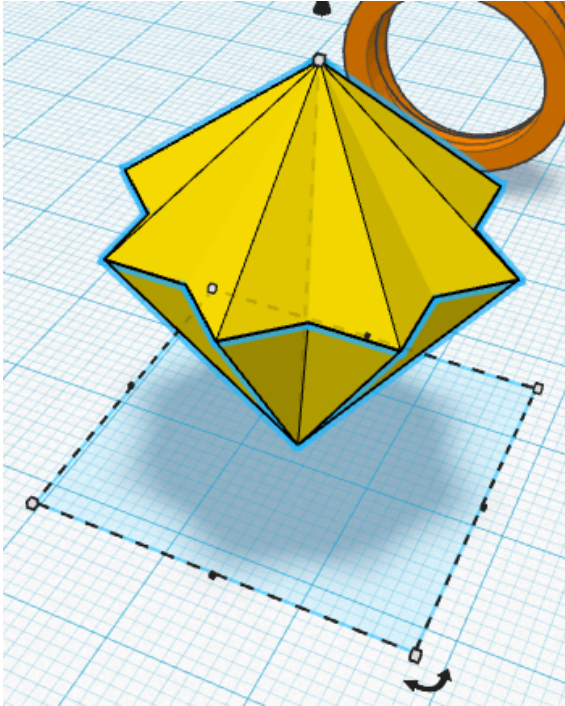
8. Now we'll chop off the top of the pyramid so the diamond has a flat face.

   Drag a new Box onto the workplane. With the box selected, look at the Inspector (top-right of the work space) and **change the box** from a solid (color) **to a hole**.
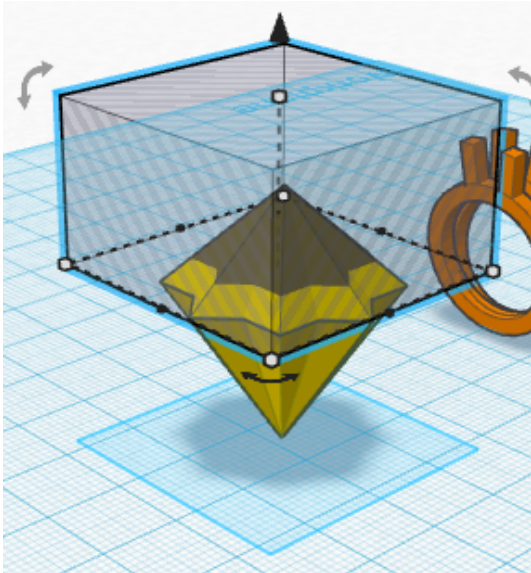
   The box will turn Transparent. This is now in *Hole* mode, which means that it is going to *delete* from any shape we combine it with.
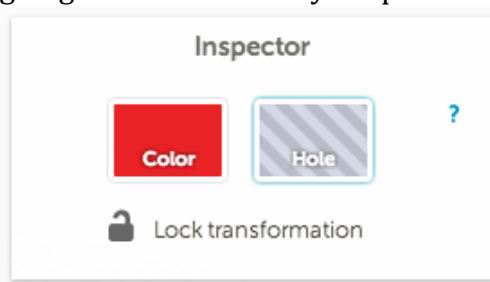
**Tip:** *Hole mode* can also be called "negative space."

It removes whatever is in it!

9. To make things easier, lets make the box wider. Then **move the box** so that it is **cutting off the top** of the pyramid.

10. Change the viewing angle to get a good look at the pyramid. Make sure the *entire face* is being cut off (that you didn't miss any corners). Also check that you aren't accidentally about to cut off part of the shank or claws you made earlier.

    When you've got the box where you want it, **select** the box and the combined pyramids and **Group them**. You should be left with something like this:
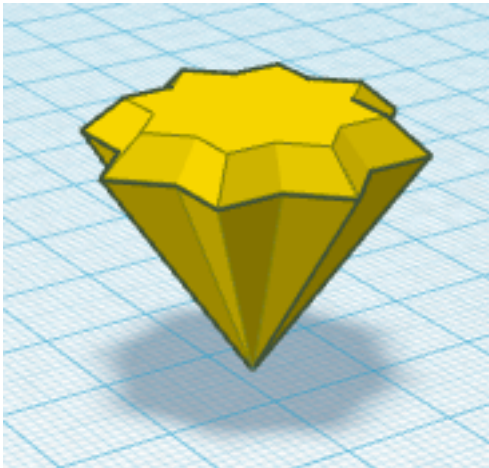
11. Now **resize, move, and group** this to fit with the shank and claws like you did in part 3A.

Here's what I got as my final product:

<div style="border:1px solid black; padding:10px;">
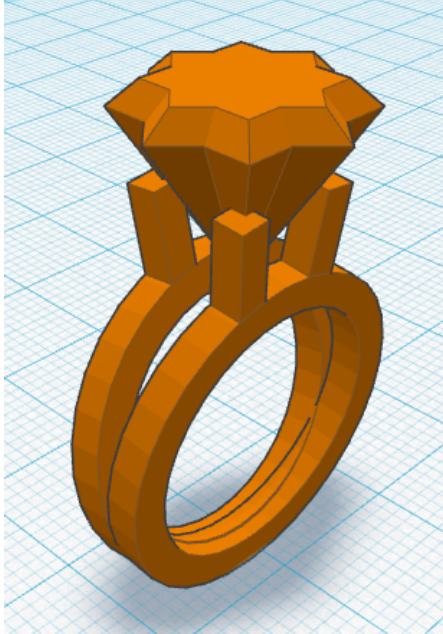
Great work! You've learned:

- ✓ How to duplicate designs
- ✓ How to combine and create new custom shapes
- ✓ How to use holes to delete parts of shapes.

</div>

Now time for one last challenge…

Part 4: Adding a Custom Shape in TinkerCAD

In this section, we will use Adobe Illustrator to create a custom shape that we can import into TinkerCAD. This opens the door to a world of possibilities!

1. Start by going to Google and finding a shape you want to add to your ring. It must be a very simple shape (since it will be so small on the ring).
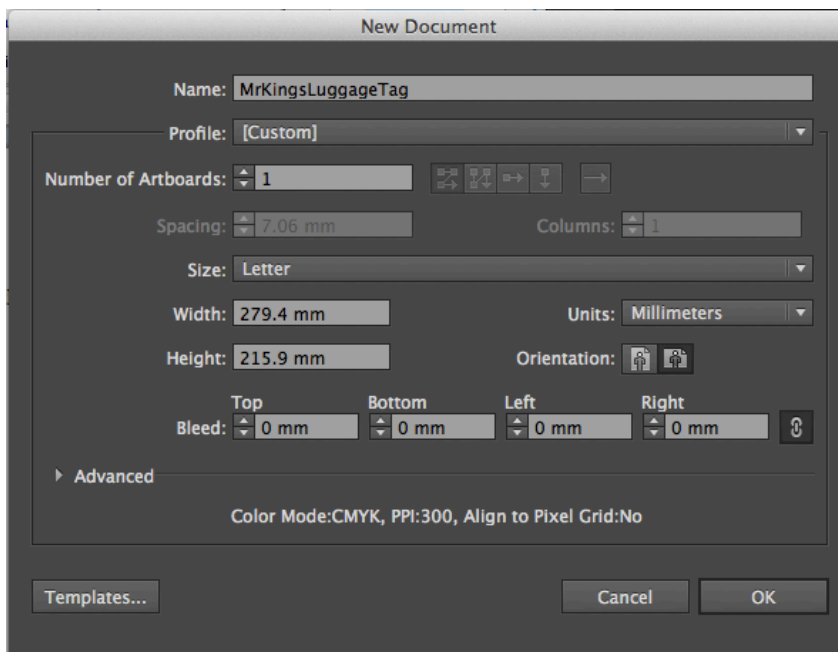
   Your image must:
   - be a **solid colour** or outline only.
   - have a **white or transparent background**

   I'll use this image of a maple leaf.

2. Open Adobe Illustrator and click **File > New.**
   Make your file name **starts with your name**.
   Set the size of the artboard to **Letter.**
   Double-check that the Units are set to **Millimeters.**
   Important: Under **Advanced,** set the Color Mode to **RGB**.
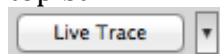   Click **OK**.

3. **Drag** your image on to the Artboard. If it doesn't fit, zoom out (option+scroll) and resize the image to fit.
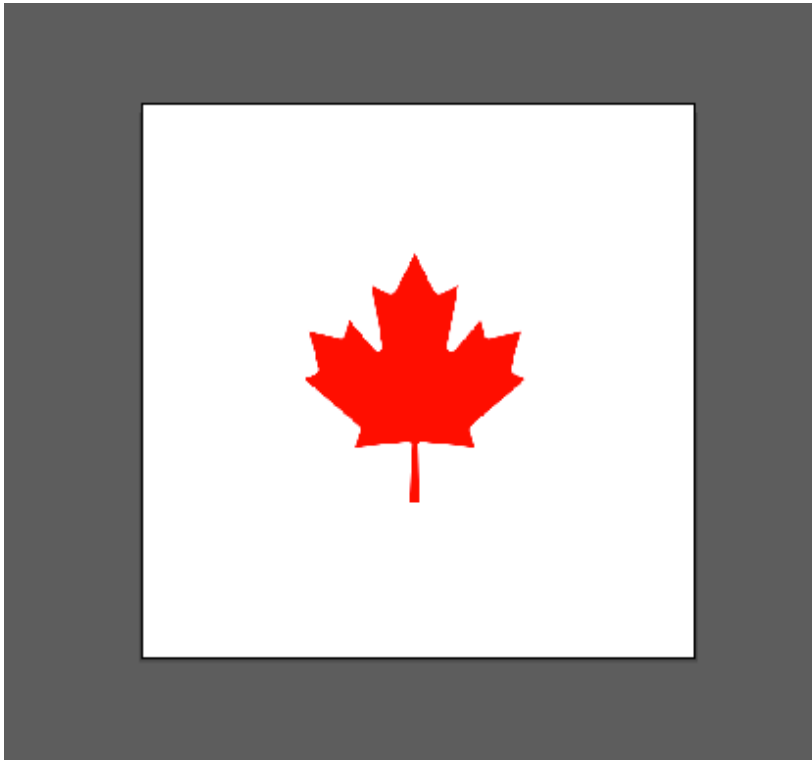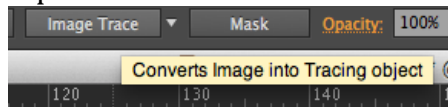

4. Select the image. If you have Illustrator Version CS5 (most of you do), you'll see a button that says "Live Trace." If you have version CS6, this feature has been renamed to "Image Trace".

    a. **On CS5:** Click the **Live Trace** button on the top bar.

    OR

    a. **On CS6:** Click the **Image Trace** button on the top bar.

    b. **On CS5 or CS6**: Select the path you just created, and click **Expand**.

Tip: If you're happy with the way the trace turned out, you can move on to the next step.

If not, **undo** the trace with **Command+Z**, then use the **drop-down triangle** beside the button to redo the trace with **different preset** styles.

If you change settings with the Live Trace window, make sure you **leave the trace mode as Fill.**

5. You will likely end up with two paths that have been grouped together. The first is the **path around the shape**. This is what we want. The other path goes **around the edge** of the image. We don't want this one!

    Right click on the paths and click **Ungroup**.

6. **Click in empty space outside** of the outer rectangle to delesect the paths.
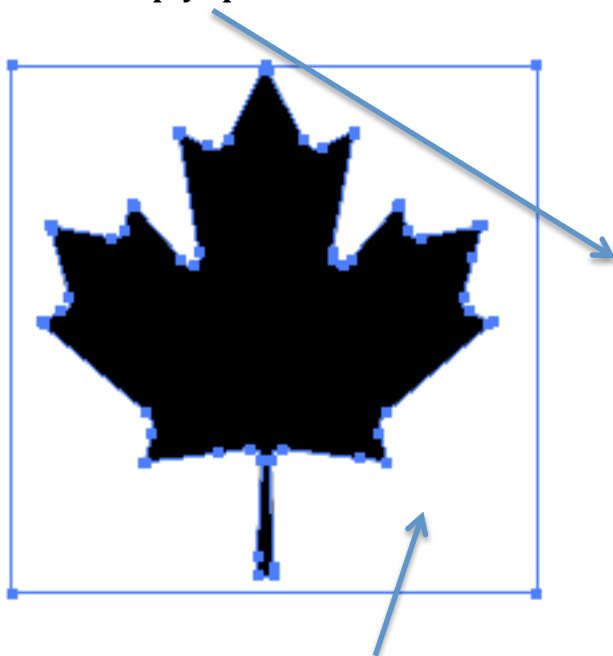
7. Then, **click on the space between** the path you want and the path you don't. Press the **Delete** key.

   You should be left with only this inner path. That's the hard part done!

Digging Deeper into Illustrator

Because we set the Image Trace mode to Fill, Illustrator actually sliced the image into two pieces. They are still called "paths" but they are actually filled in and fit together like puzzle pieces.

When we clicked between the inner and outer lines, we are actually clicking *on* the path that represents the white background of the image.

Essentially, we deleted the background, leaving the Maple Leaf shape we wanted.

8. Go to **File > Save As**. Change the format to **.svg**, then click save.
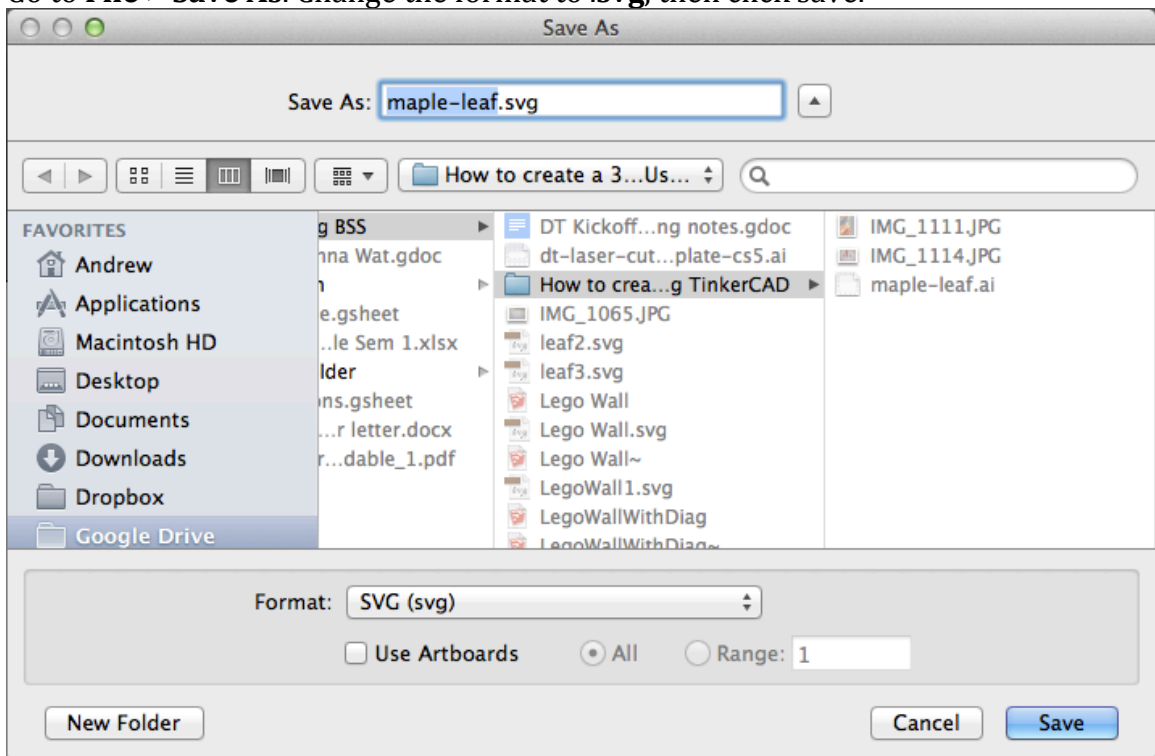
Then in the svg format dialog, check that the Profile is set to **SVG 1.0** and the
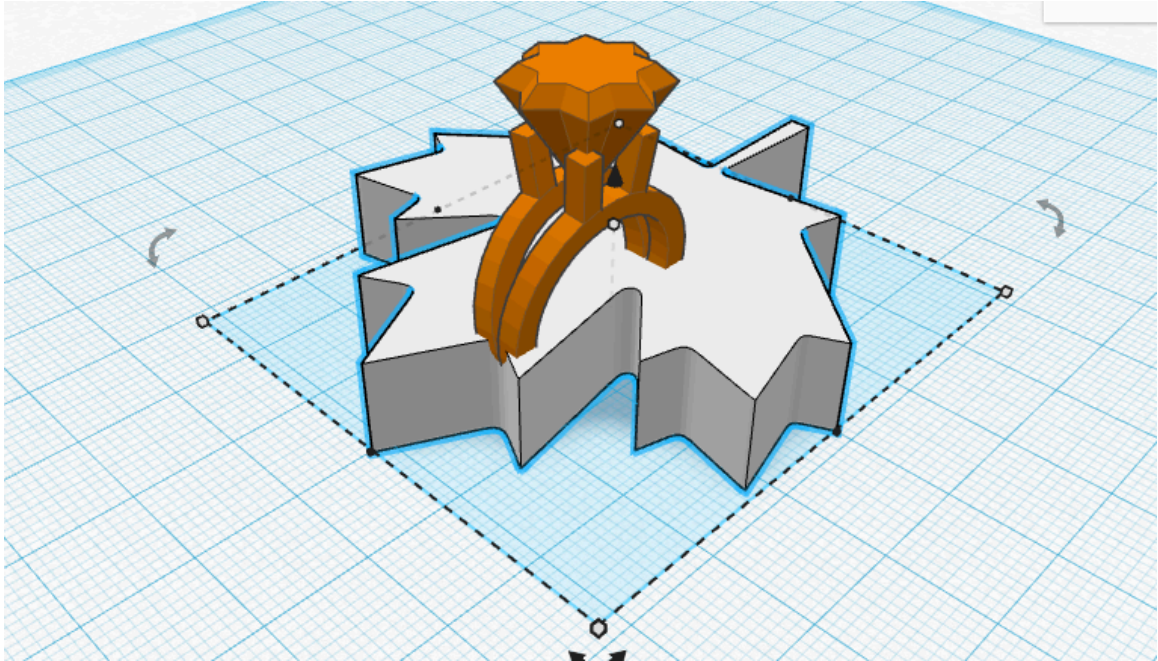Type is set to **SVG**. Click **OK**.
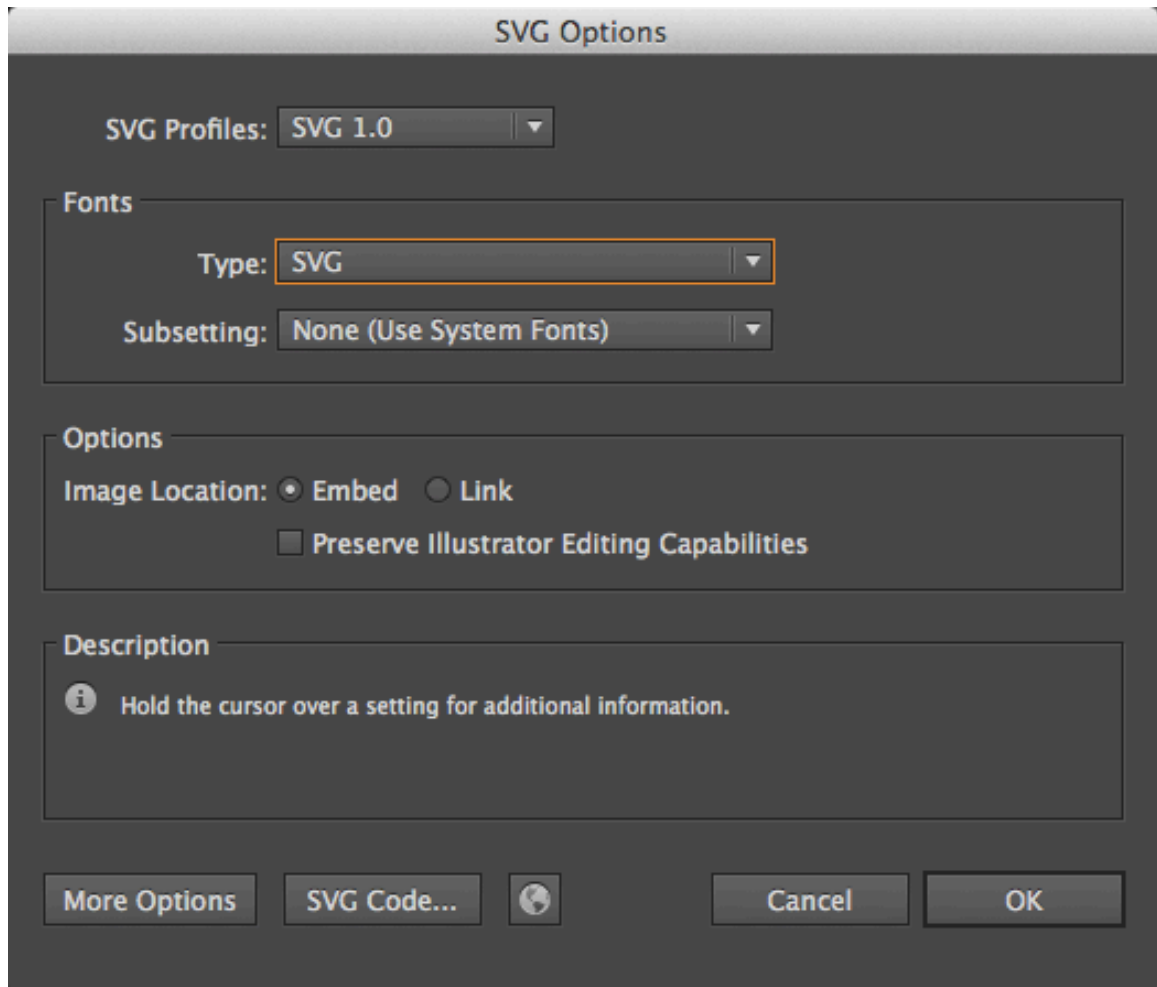
9. Now go back to TinkerCAD, and select **Import** in the Sidebar. Click **Choose File**,
   then find where you just saved your svg file and click **Open**.

   If you wish, you can set the Scale and Height (thickness) here, or you can do it
   after the file has been imported.

   Click **Import**. The image becomes a 3D shape and is dropped in the middle of
   your Workplane.

10. **Resize, move, and group** this shape how you want it to appear on the ring.

   I would suggest making it as big as can reasonably fit on the surface, and that it sticks out from the face by at least 1-2 *mm*.

   Remember that the resolution of your computer and TinkerCAD is much more precise than the 3D Printer. If you make your details too tiny they won't come out the way you expect.
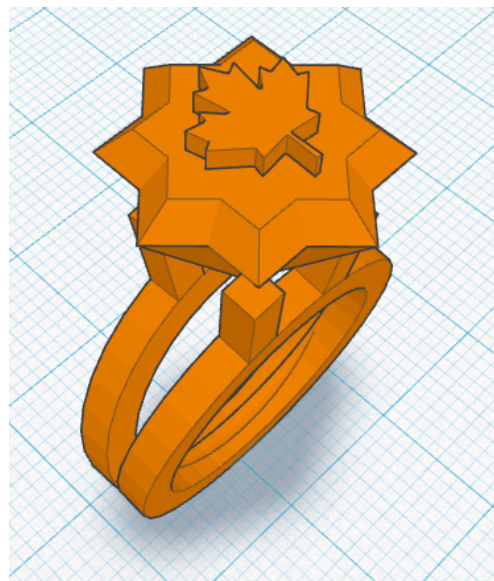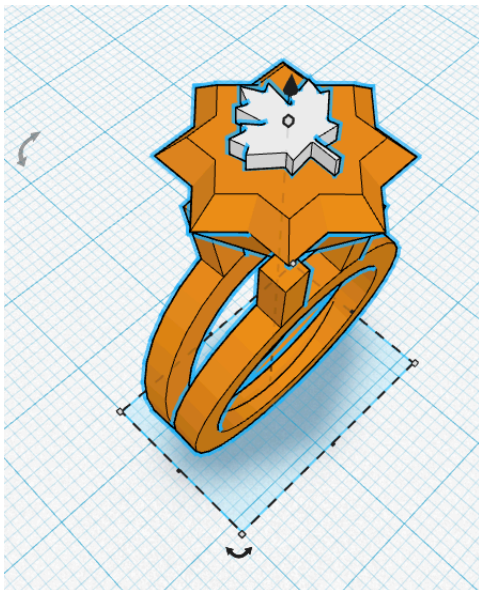
Printing Your Ring

If you want to make this ring on the 3D Printer, simply go to Design > Download for 3D Printing in the Menu Bar. This file is all we need!