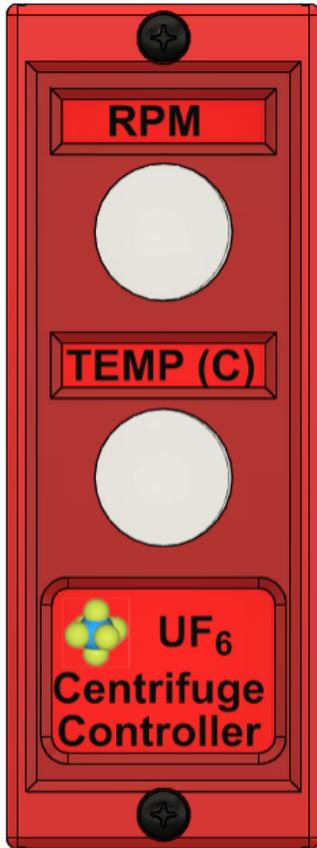


Creating a Panel Label with Fusion and Inkscape

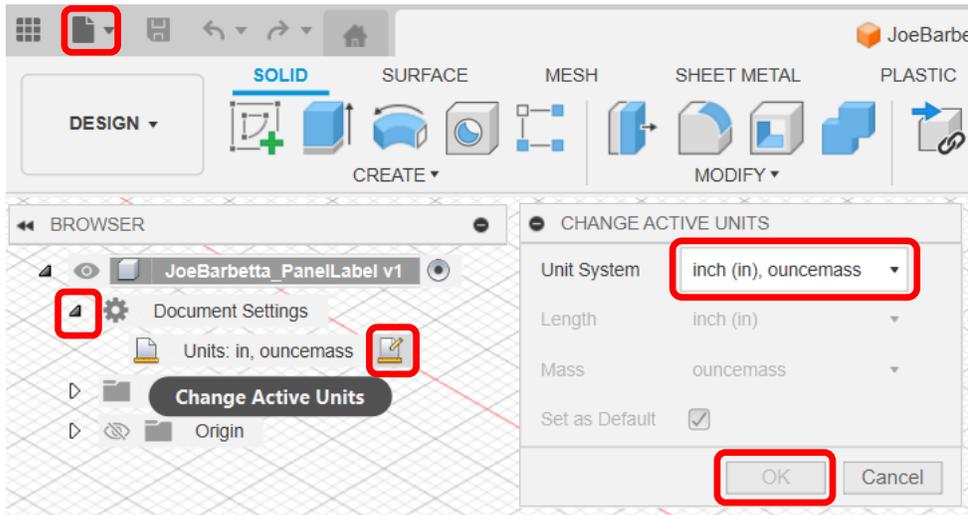


Contents

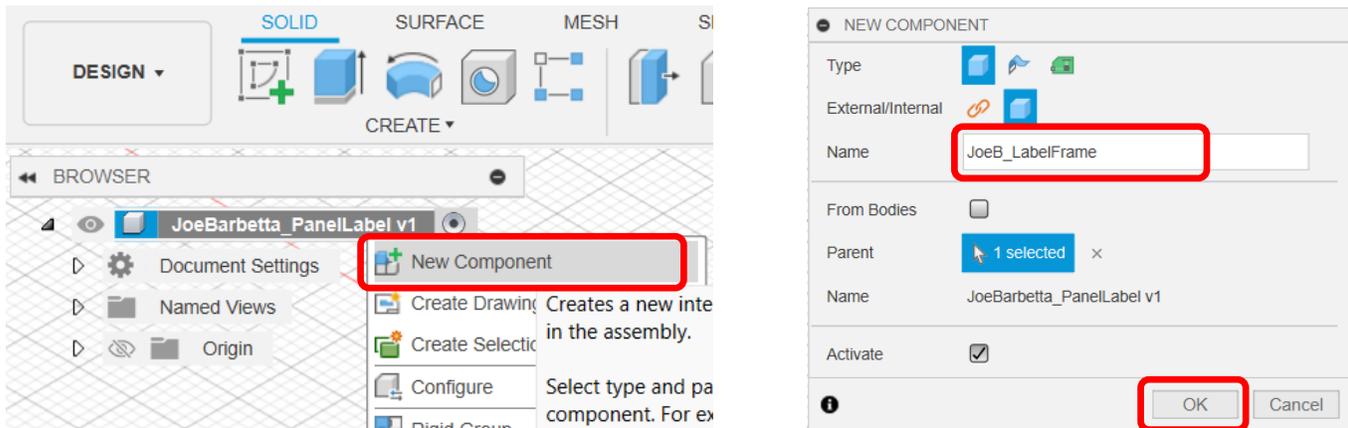
Fusion – Starting the Label Frame.....	3
Inkscape - Downloading and Installing.....	14
Inkscape - Starting an Inkscape Drawing	18
Inkscape – Enable Mousewheel Zoom.....	19
Inkscape – Importing DXF file.....	23
Inkscape – Using the Transform tool	26
Inkscape – Using the Fill and Stroke tool	28
Inkscape – Creating an Offset Rectangle.....	29
Inkscape – Setting Fill Color and Stroke	30
Inkscape – Adding Text	31
Inkscape – Product Nameplate	33
Inkscape – Adding a Graphic	38
Inkscape – Printing the Label	42
Cutting Out the Label	43
Fusion – Completing the Frame	44
Fusion – Adding Rebar	51
Fusion – Applying a Material and Setting a Color	56
Fusion – Inserting a Decal	59
Selecting Mounting Screws	66
Fusion – Inserting a McMaster-Carr part	68

Fusion – Starting the Label Frame

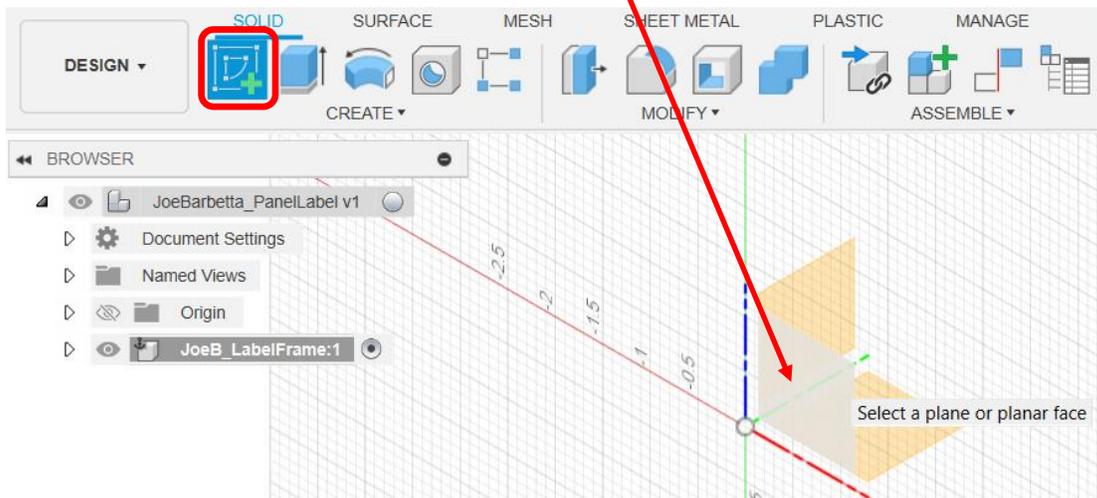
- click on the arrow for Document Settings and click on the Edit icon
- if the **Units** are not **inch (in), ouncemass**, change it to that option and click OK
- from the top **File** icon select **Save** and save the project starting with your **name, followed by “_PanellLabel”**, e.g. “JoeBarbetta_PanellLabel”



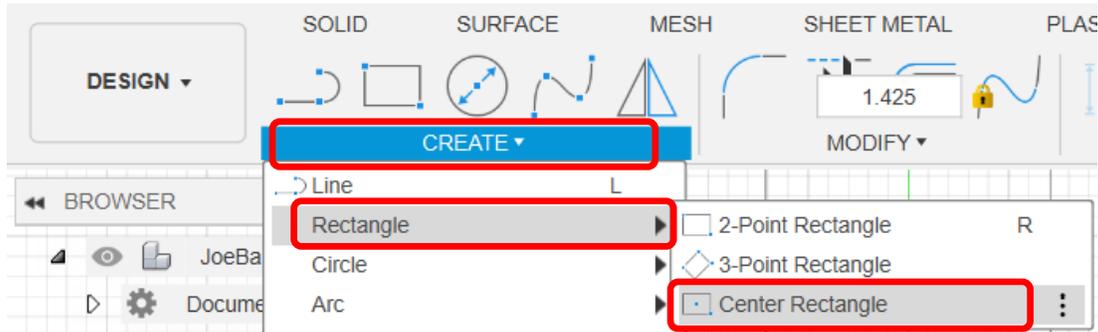
- right-click on the project name and select **New Component**
- set the **Name** as your **first name and last name initial followed by “_LabelFrame”**, e.g. “JoeB_LabelFrame”, and click **OK**.



- select the **Create Sketch** tool and click on the **Front plane**



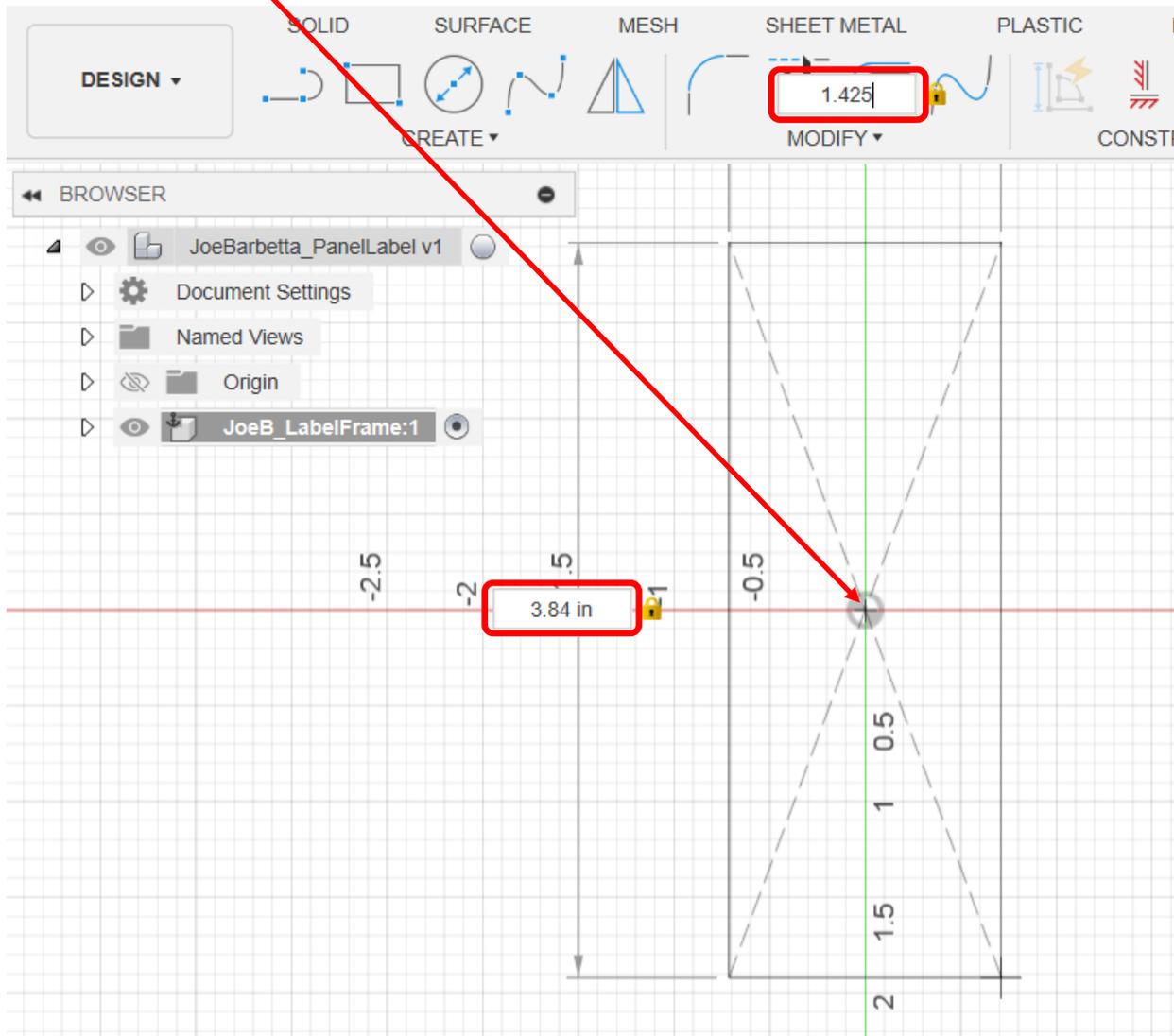
- from the **CREATE** menu select **Rectangle** and **Center Rectangle**



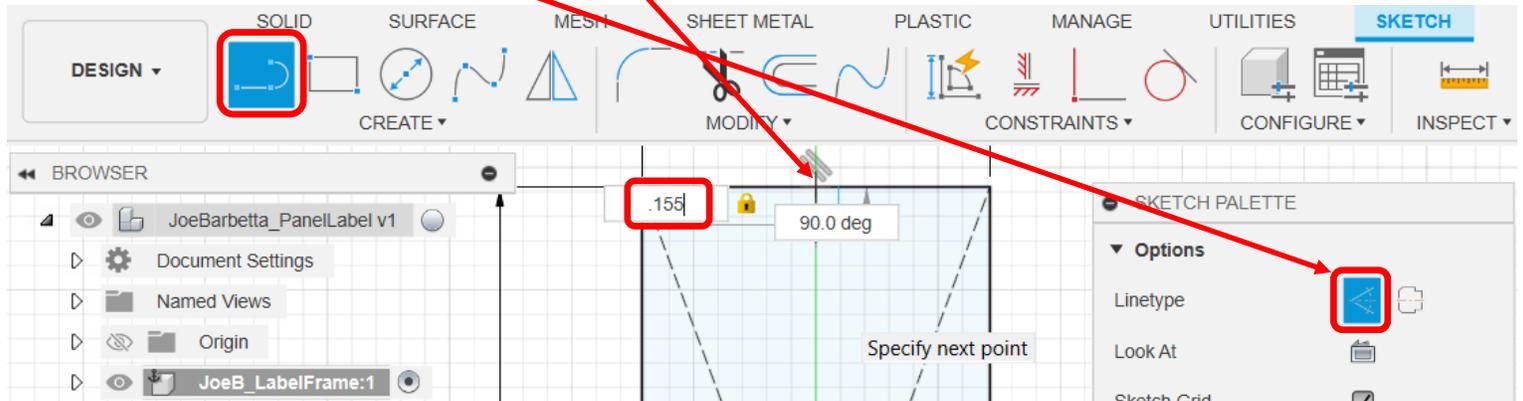
- click on the **Origin** to start the rectangle and drag the outline out

- type **3.84**, press the **Tab** key, type **1.425**, and then press the **Enter** key

The Tab key toggles between multiple values of an object, such as Height and Width, in this case.

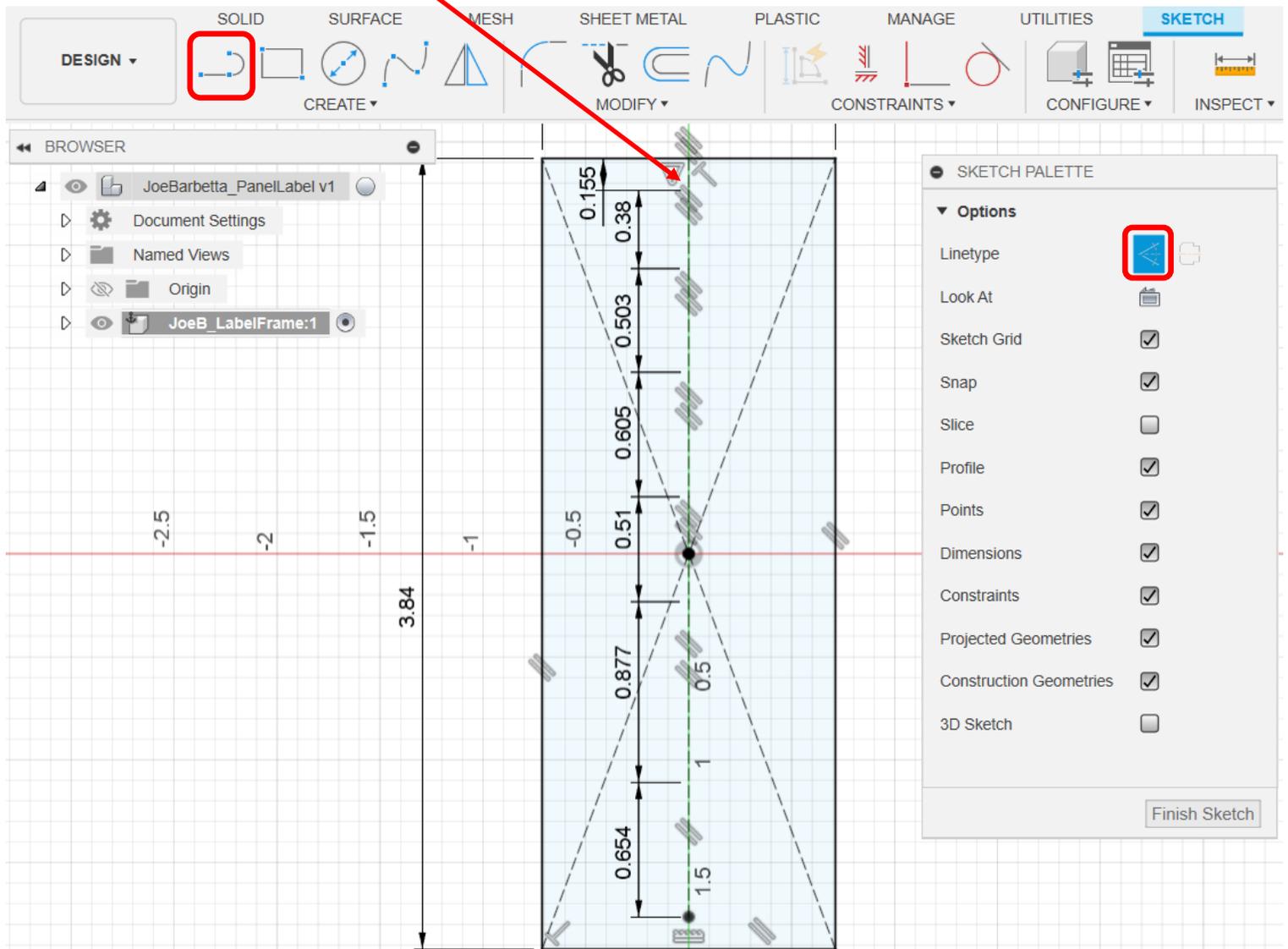


- click on the **Construction** Linetype icon to highlight it blue. This should result in dashed lines being drawn.
- select the **Line** tool and click on the **center of the top edge** of the rectangle and extend the line downward
- type **0.155** and press the **Enter** key

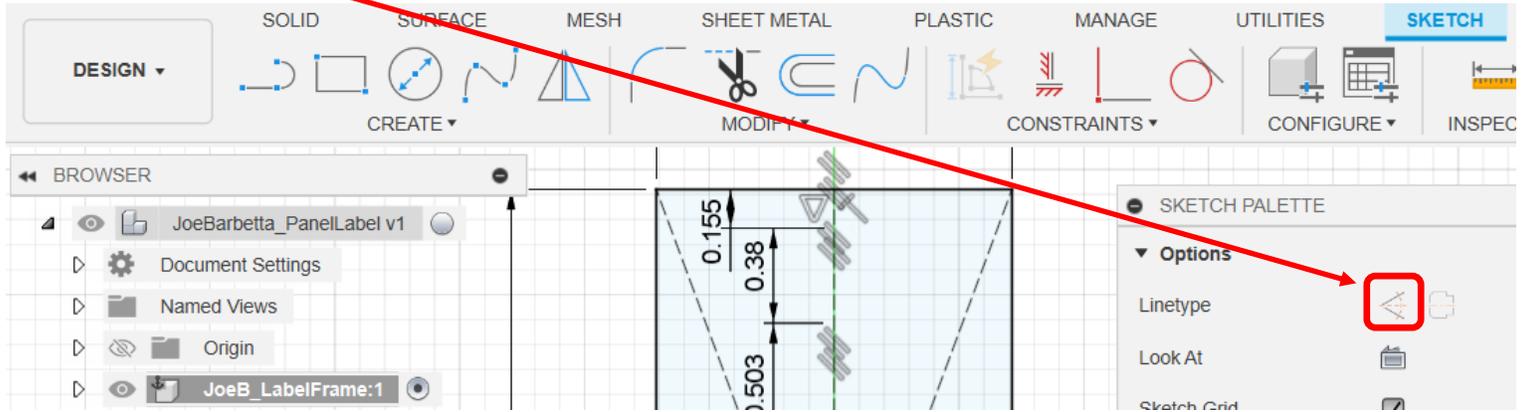


- start a new line at the **bottom end** of that just created and use a value of **0.38**
- **continue creating lines one after the other using the values shown below** starting with **0.503**

It is OK if the dimension lines look different. The dimension values can be dragged to change their placement.



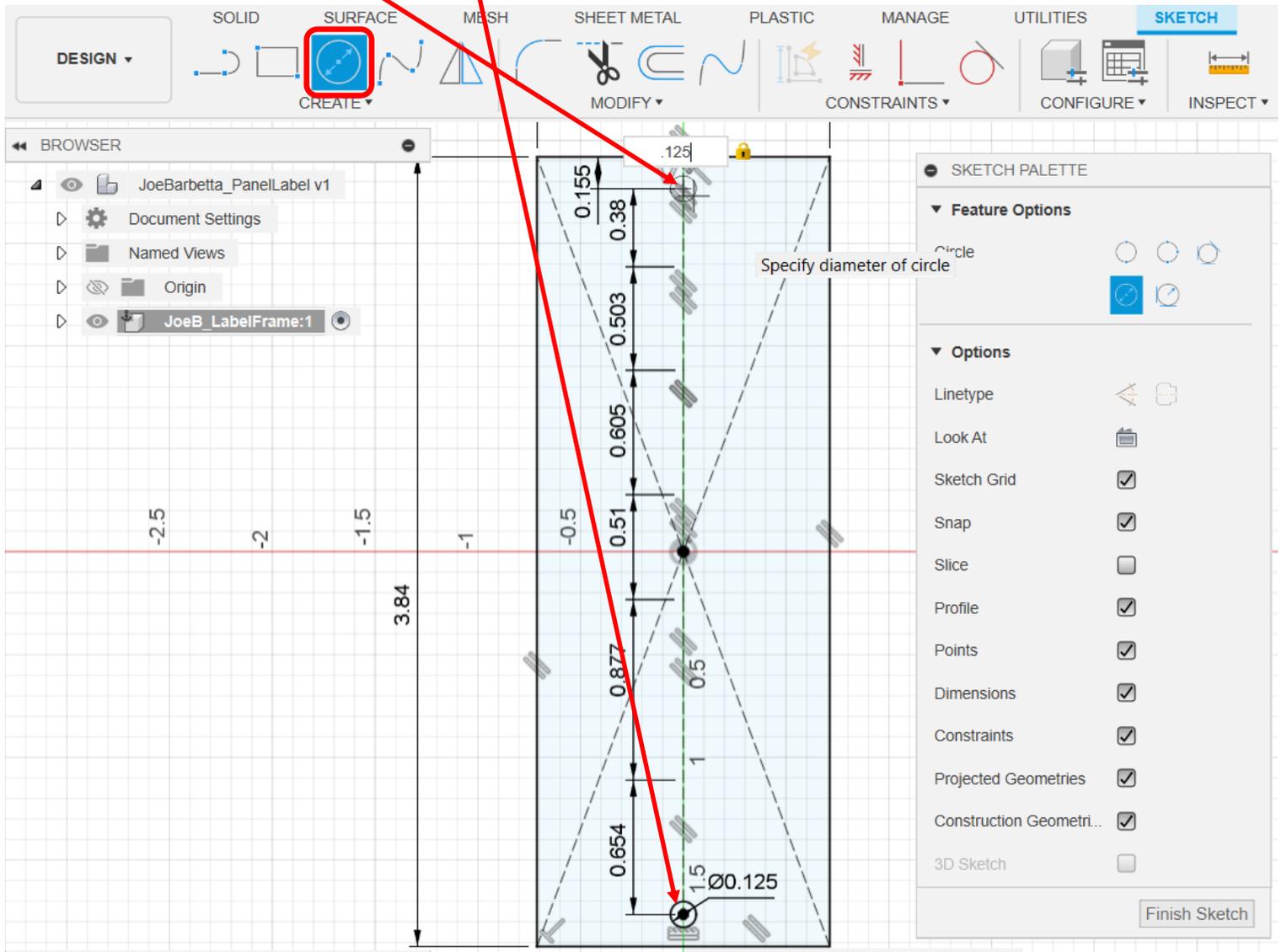
- click on the **Construction** Linetype icon to removed the blue highlight. This should result in solid lines being drawn.



- select the **Center Diameter Circle** tool. If it is not visible select it from the **CREATE** menu.

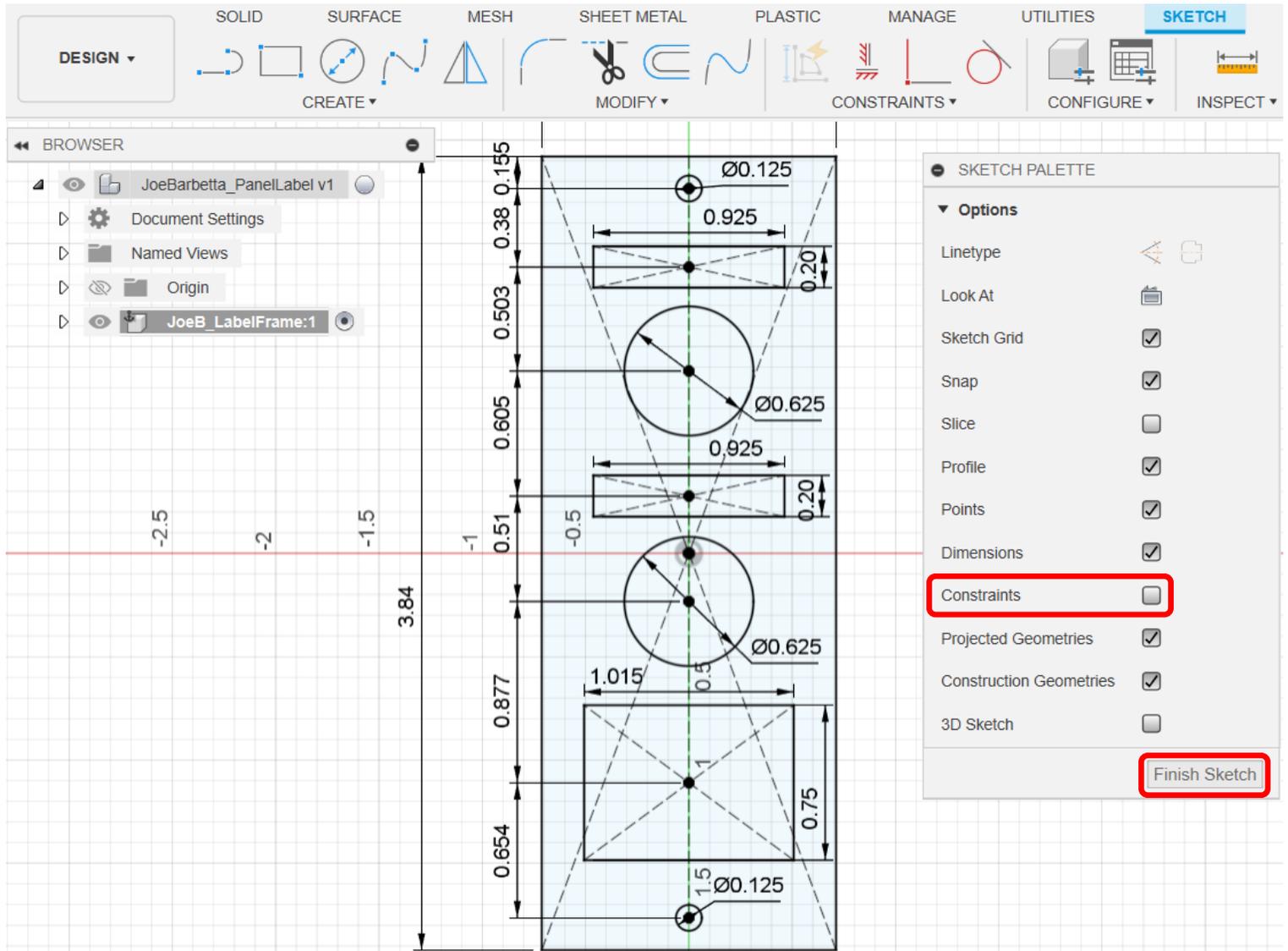
- click on the **bottom of the top line**, drag the circle outward, and enter **0.125**

- create the same diameter circle at the bottommost point also

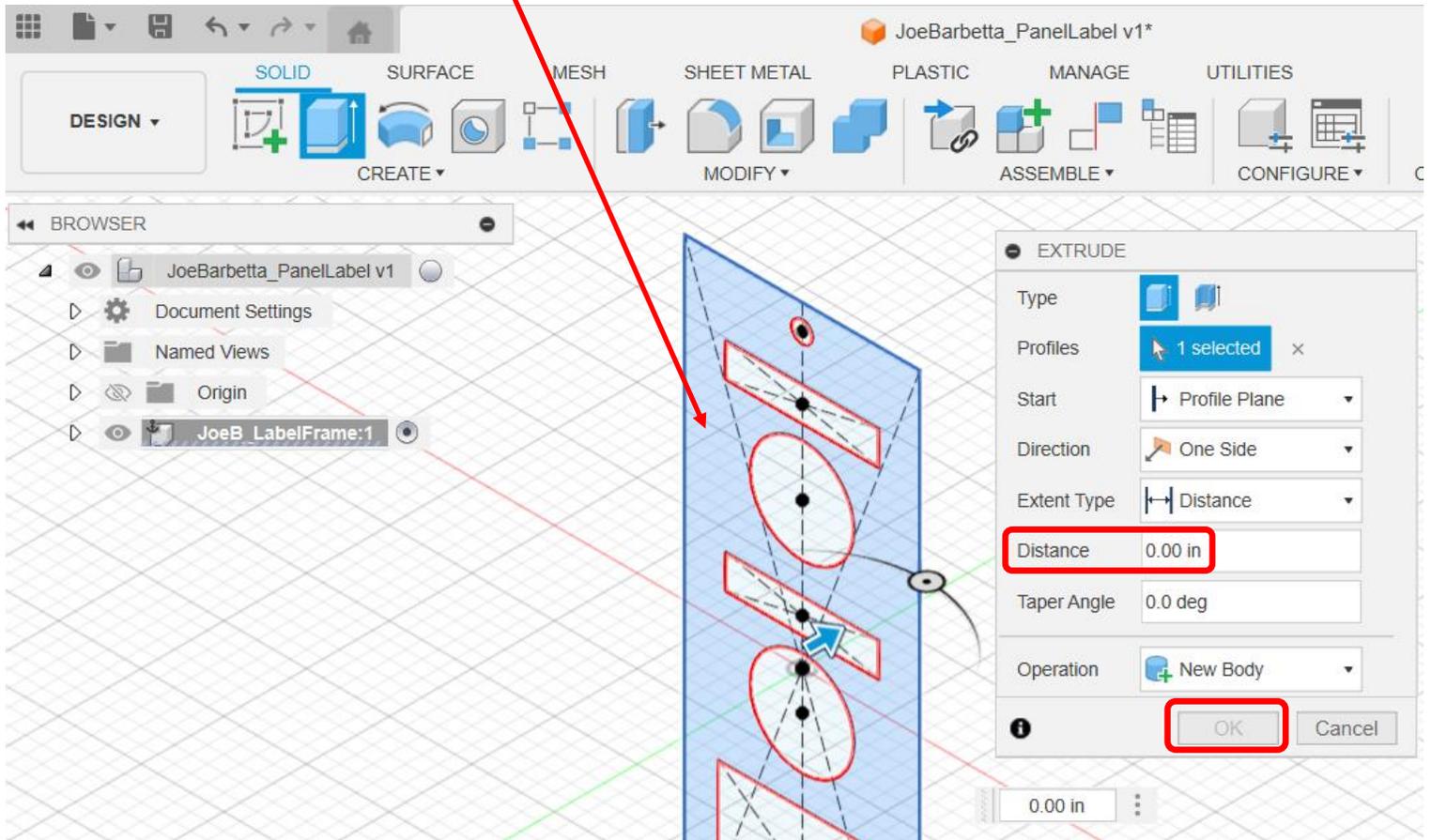


- uncheck the **Constraints** option to reduce some clutter on the Sketch
- use the **Circle** tool again to create **two 0.625 diameter circles** at the points shown. Any points mentioned are at the end points of the vertical construction lines that were previously created.
- use the **Center Rectangle** tool to create the **two 0.20 x 0.925 rectangles** at the points shown
- use the **Center Rectangle** tool to create the **one 0.75 x 1.015 rectangle** at the point shown
- check the **Constraints** option to bring the constraints back
- click **Finish Sketch**

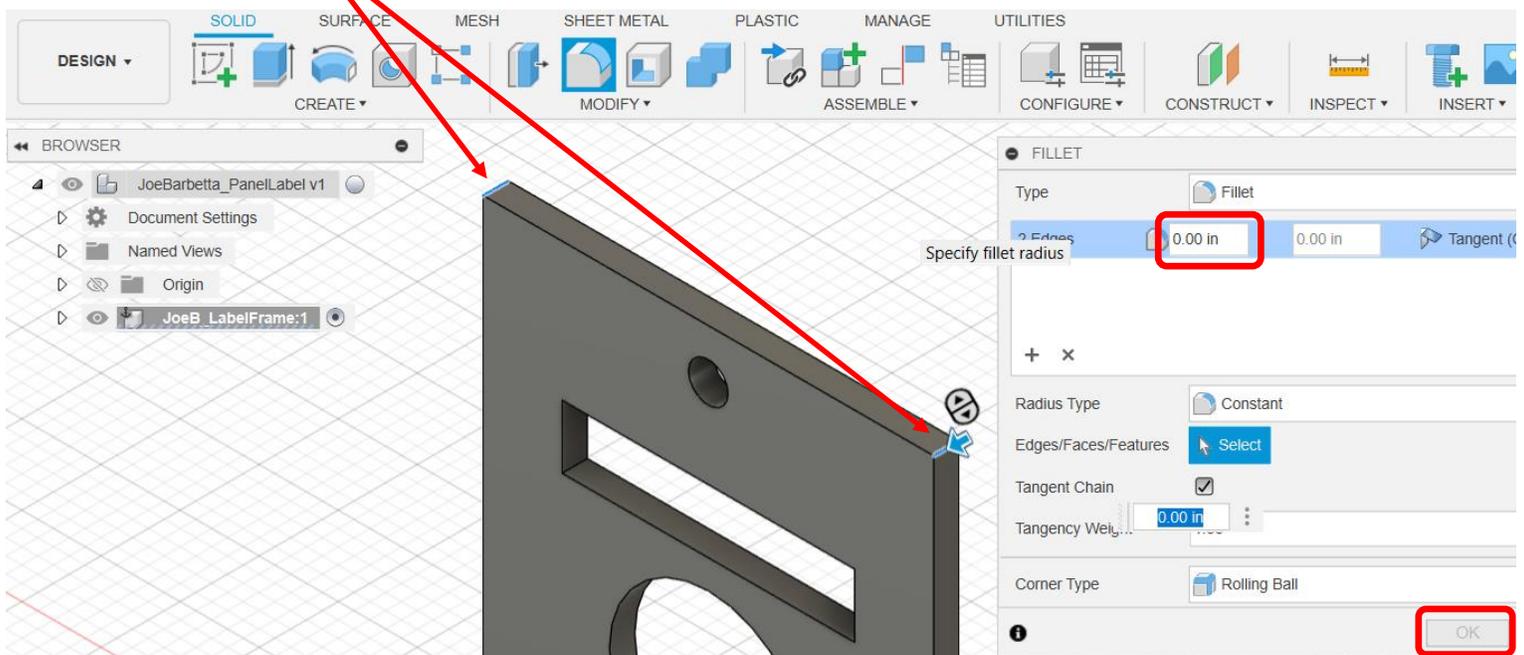
What are all these crazy dimensions? These are the perfect dimensions resulting from many years of panel development.



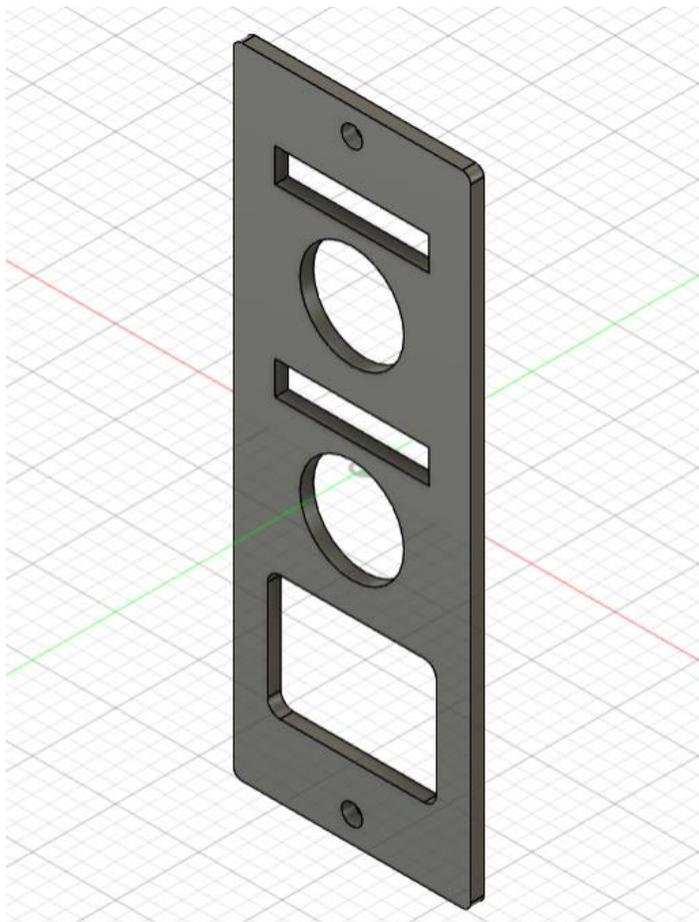
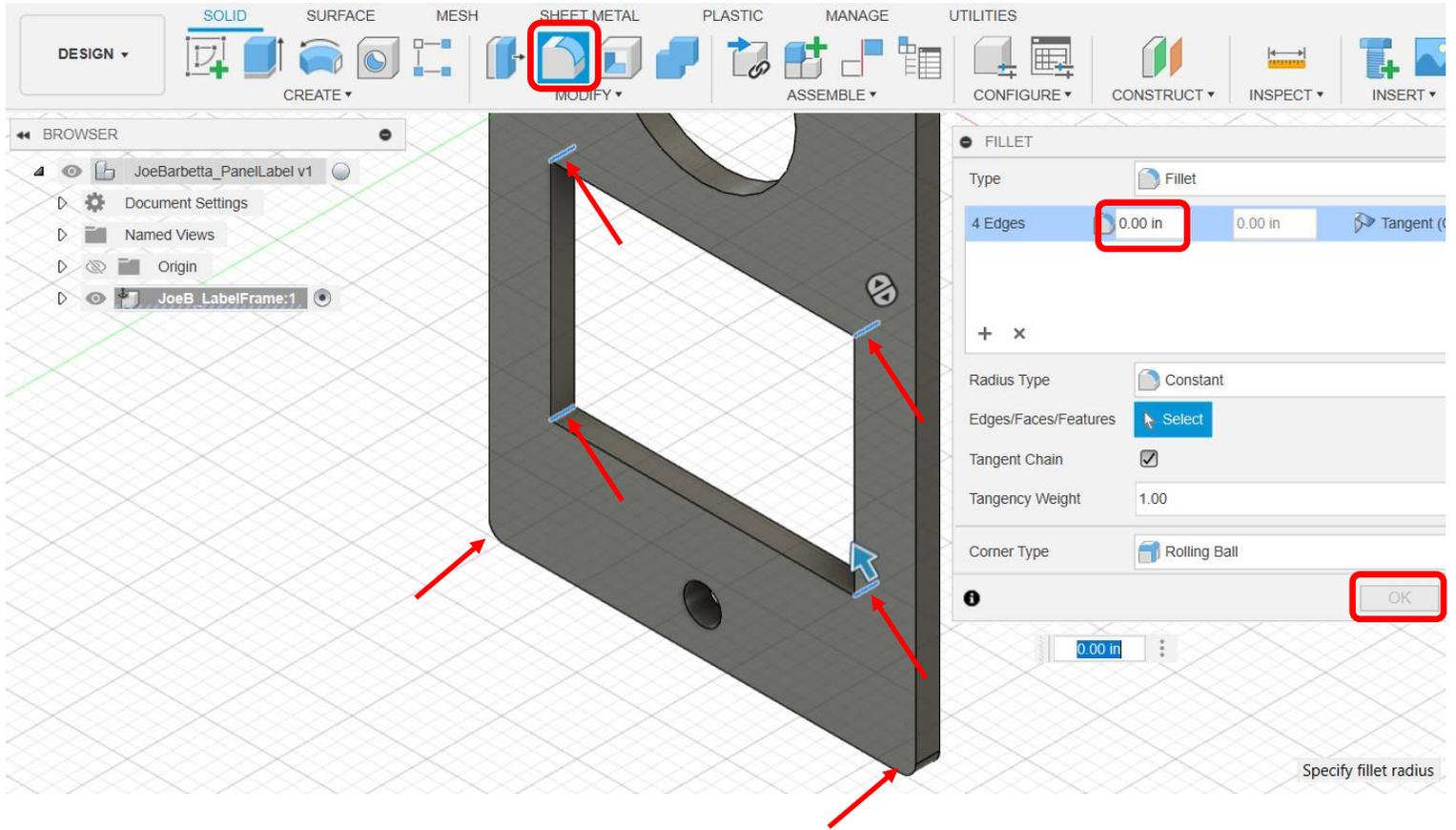
- click on the **Home** icon at the **View Cube**
- select the **Extrude** tool and click on the sketch
- enter **-0.08** (note the minus sign) for distance and click **OK**



- zoom in to the top of the frame
- select the **Fillet** tool. If it is not visible, select it from the **MODIFY** menu.
- click on the **two top edges**, which should highlight them blue
- enter **0.05** and click **OK**



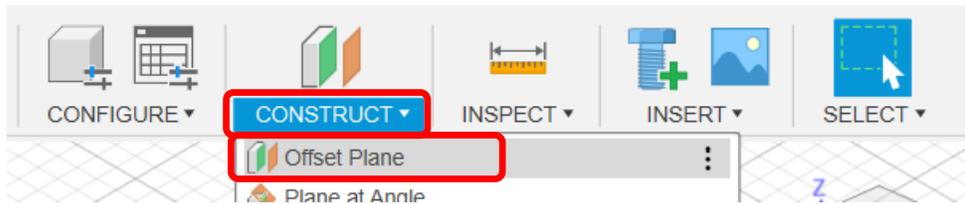
- zoom in to the bottom of the frame
- select the **Fillet** tool and click on the **4 inner edges** of the bottom cutout, enter a value of **0.075**, and click **OK**
- as done with the top 2 corners add a **0.05 fillet** to the **bottom corners**



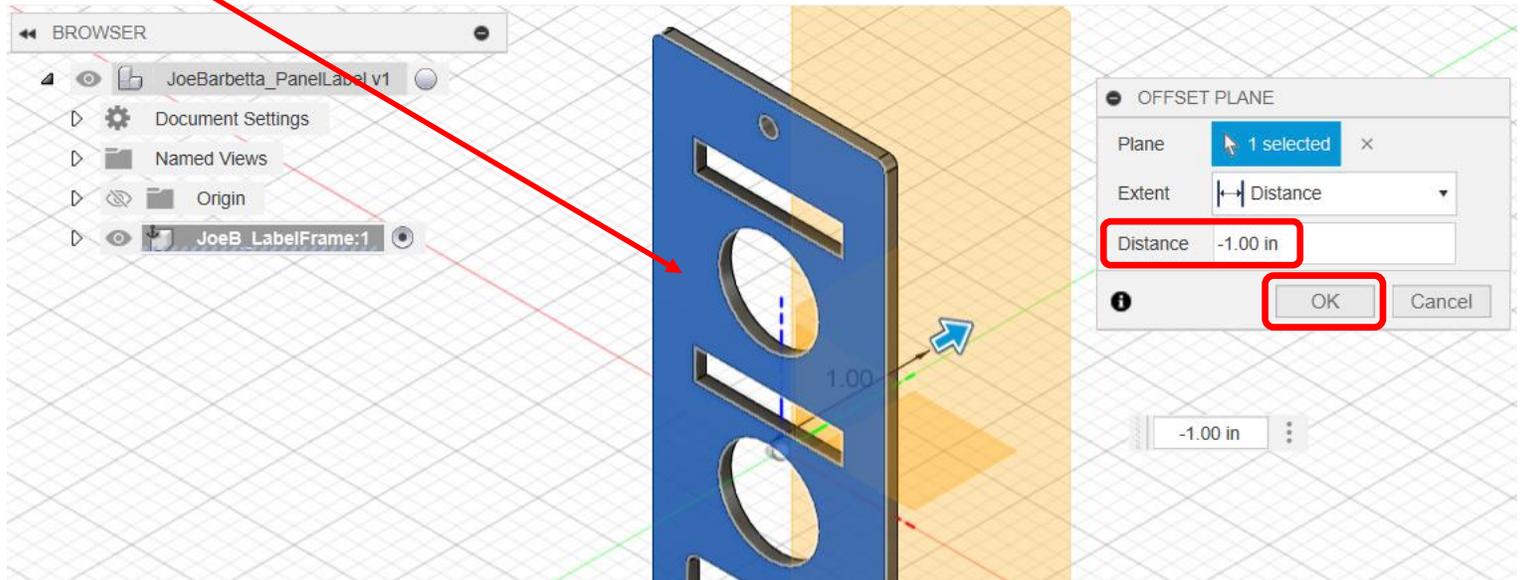
This should be the result of the design so far.

At a later point this design will be modified further, but at this point we have enough to produce a label.

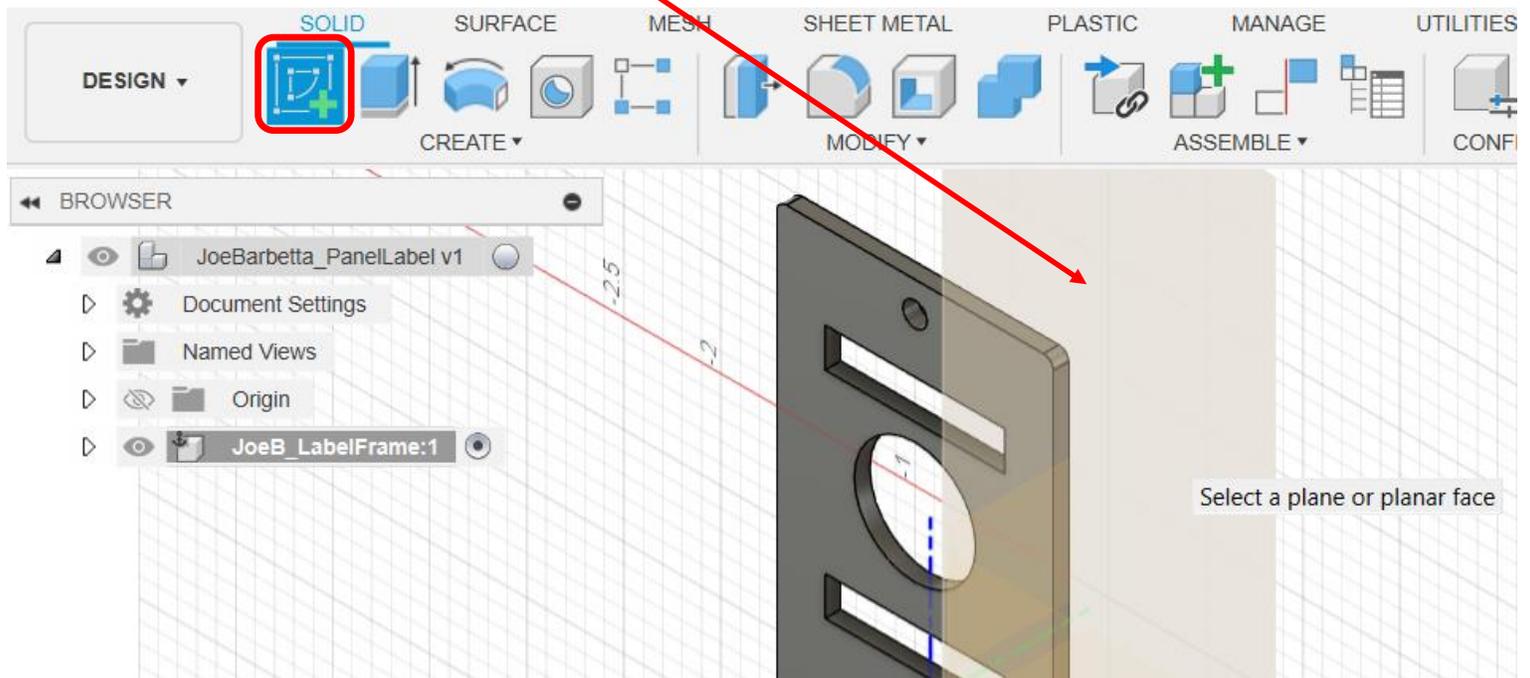
- from the top left of the Fusion screen select **Offset Plane** from the **CONSTRUCT** menu



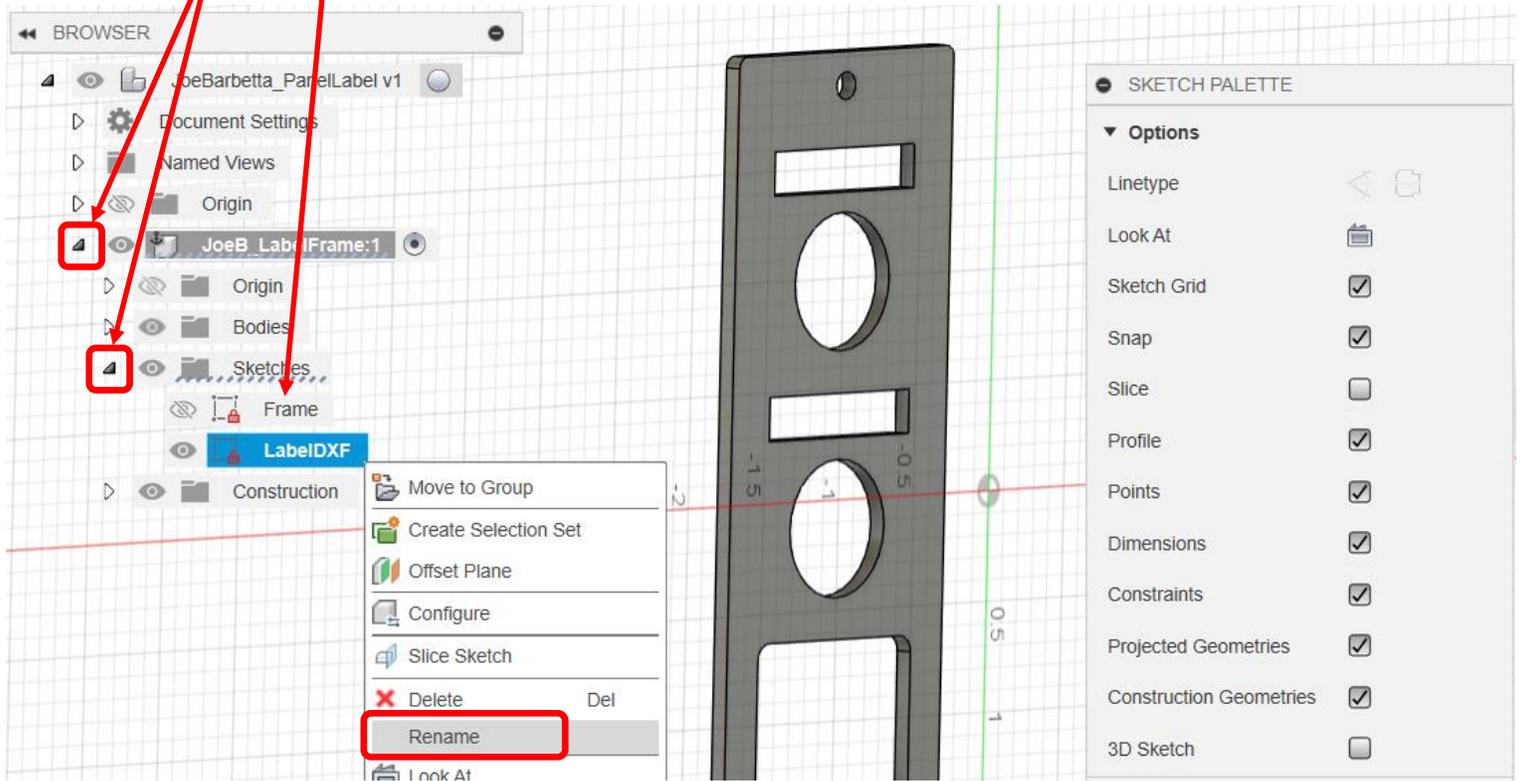
- click on the **face** of the frame, enter **-1.00** (note the minus sign) for **Distance** and click **OK**



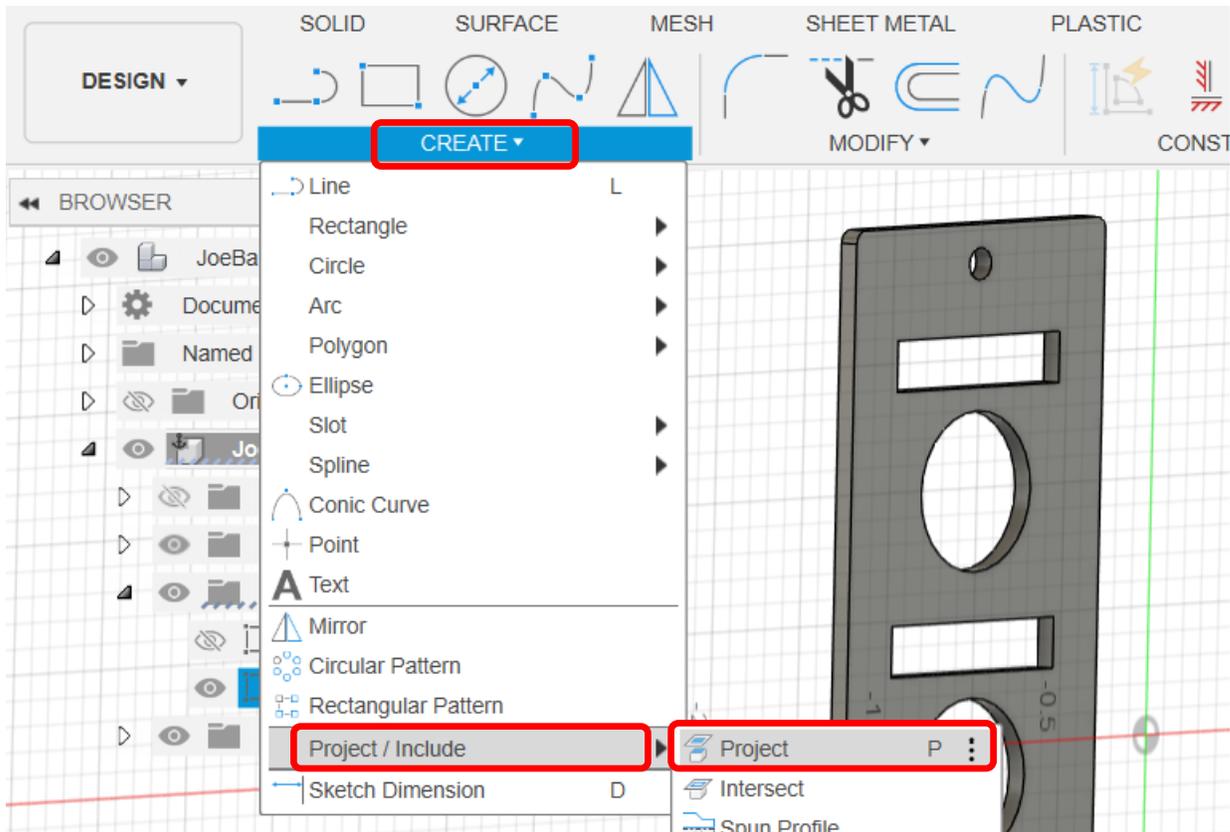
- select the **Create Sketch** tool and click on the **Construction Plane**



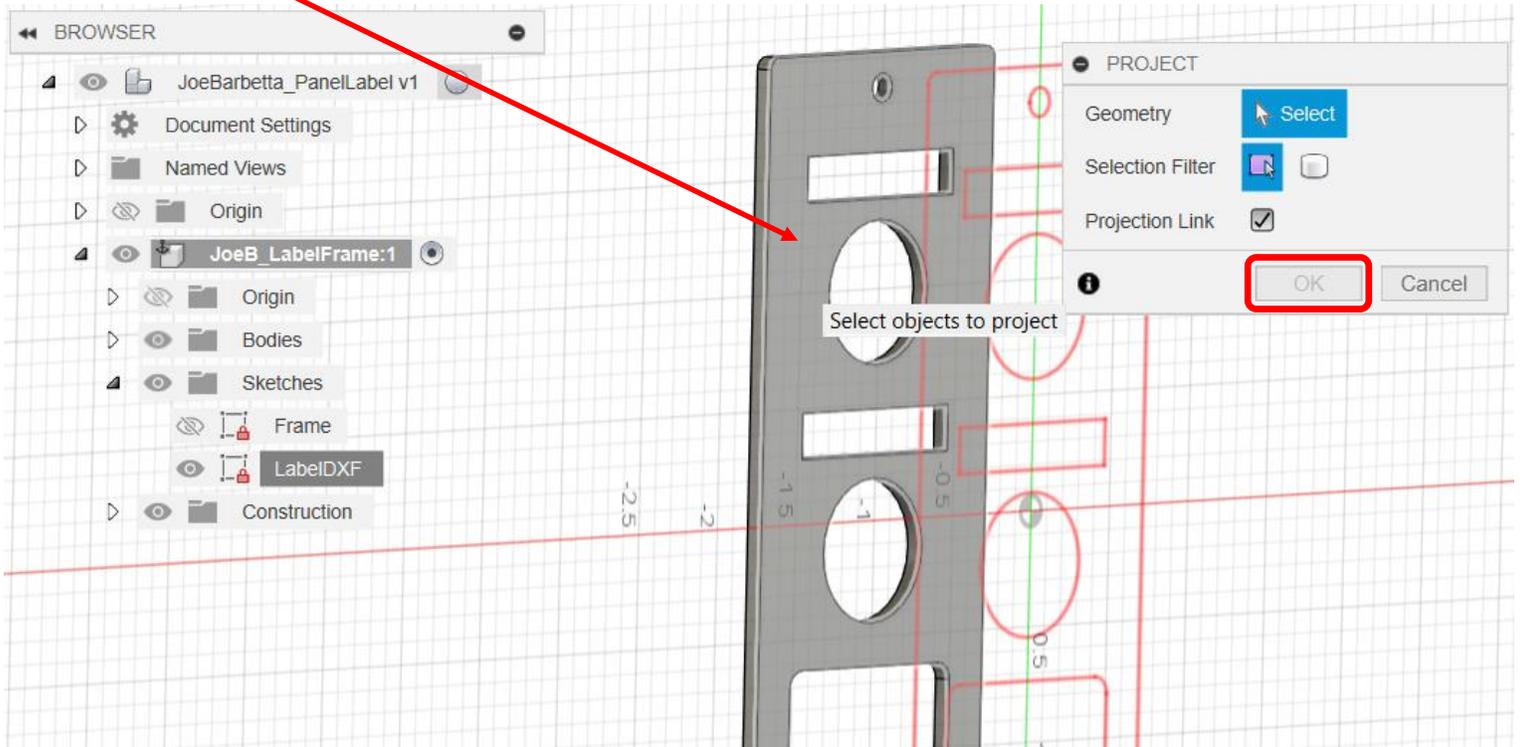
- turn the View cube to access the rear of the frame
- click on the **arrows to the left to the Component** and then to the left of the **Sketches** folder
- right-click on each **Sketch name** and select **Rename** and rename as **Frame** and **LabelDXF** as shown



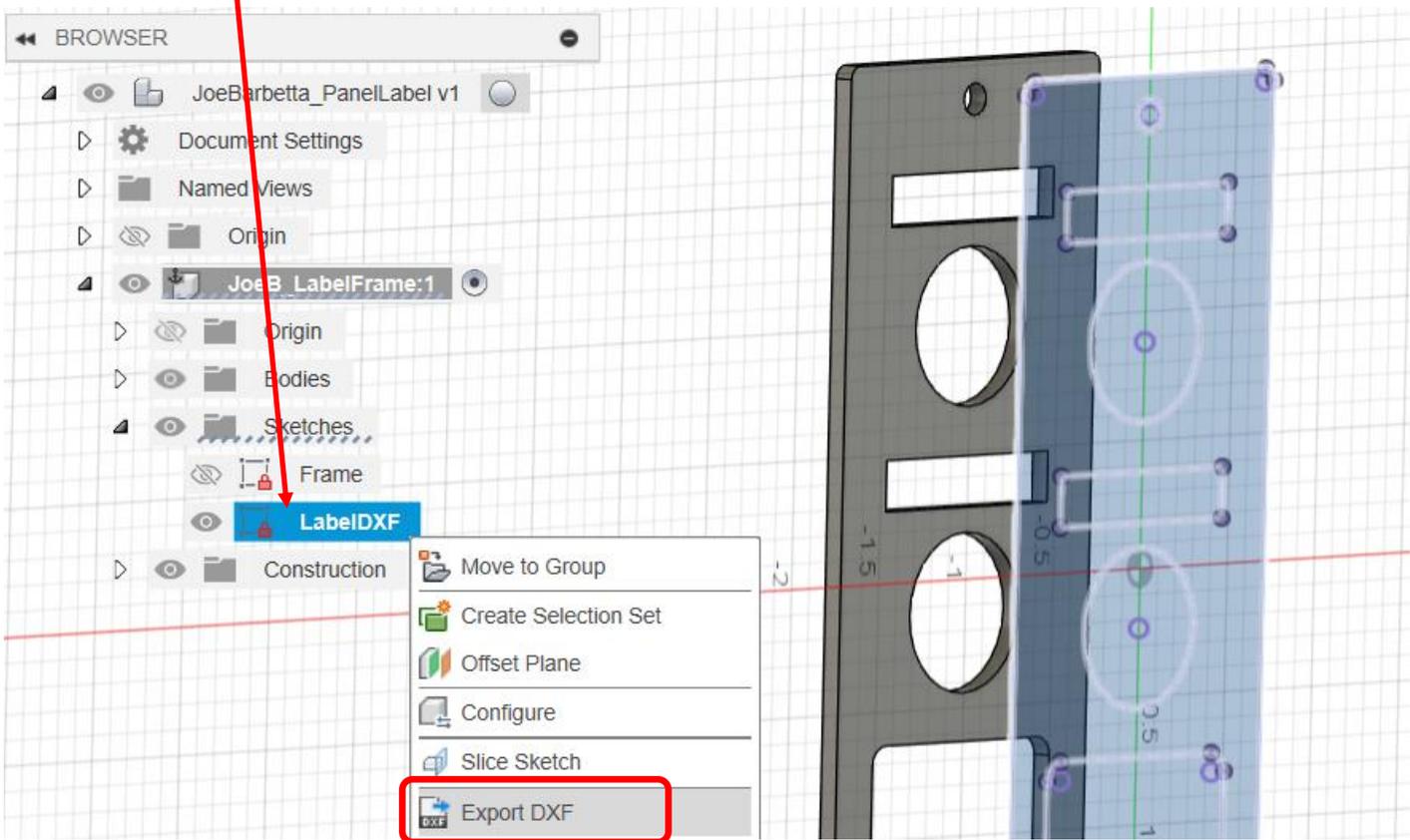
- from the **CREATE** menu select **Project / Include** and **Project**



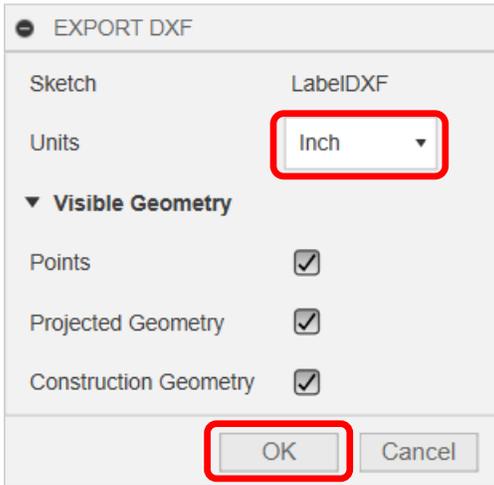
- click on the **rear face** of the Frame. Before clicking, when the mouse is over the face, red lines will appear as shown.
- click **OK**



- right-click on **LabelDXF** and select **Export DXF**



- set the **Units** to **Inch** and click **OK**



EXPORT DXF

Sketch LabelDXF

Units **Inch**

▼ **Visible Geometry**

Points

Projected Geometry

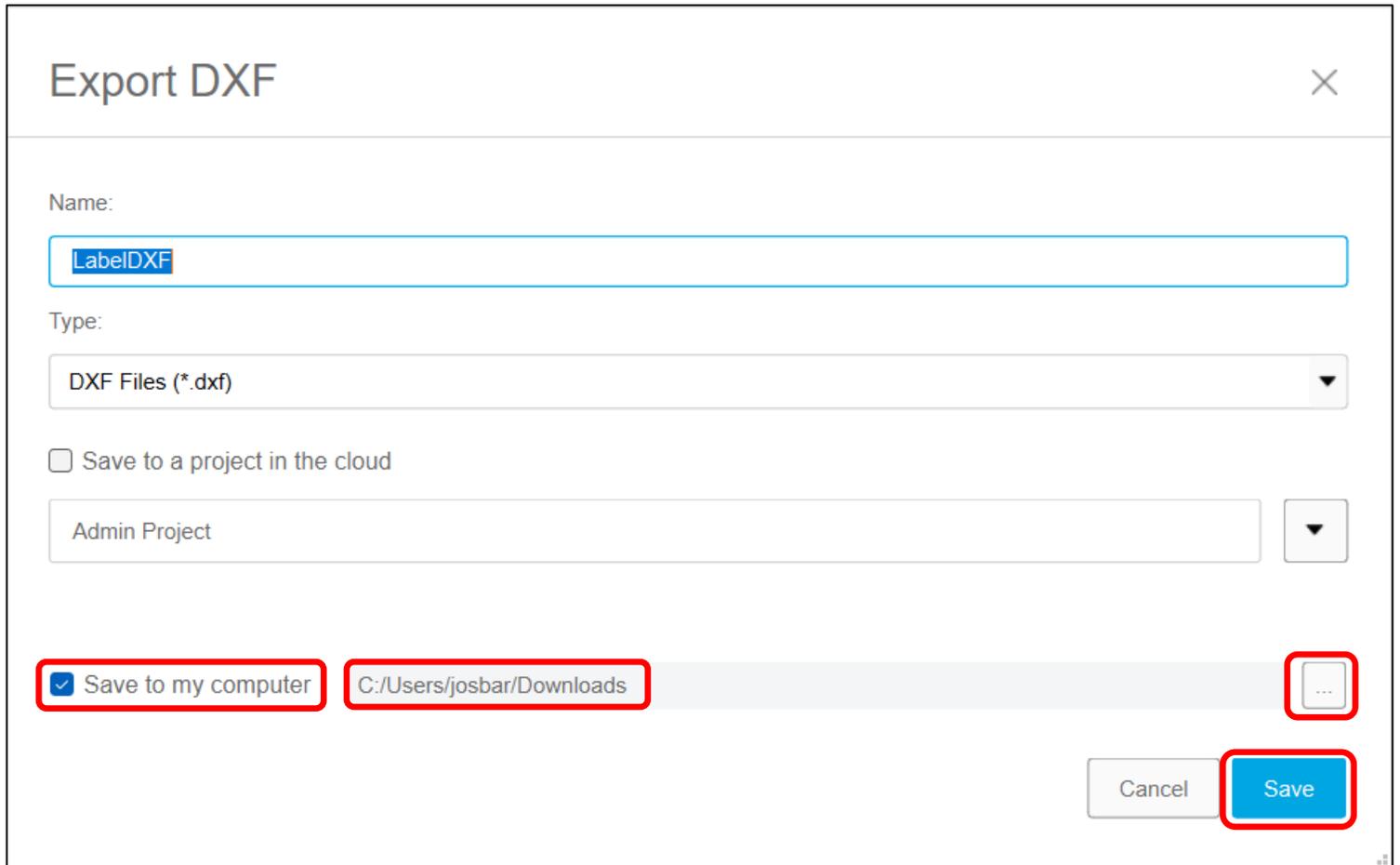
Construction Geometry

OK Cancel

- ensure **that Save to my computer** is checked

- make note of the save location and if desired, the location can be changed with the right ... **icon**

- click **Save**



Export DXF

Name:

Type:

Save to a project in the cloud

Save to my computer

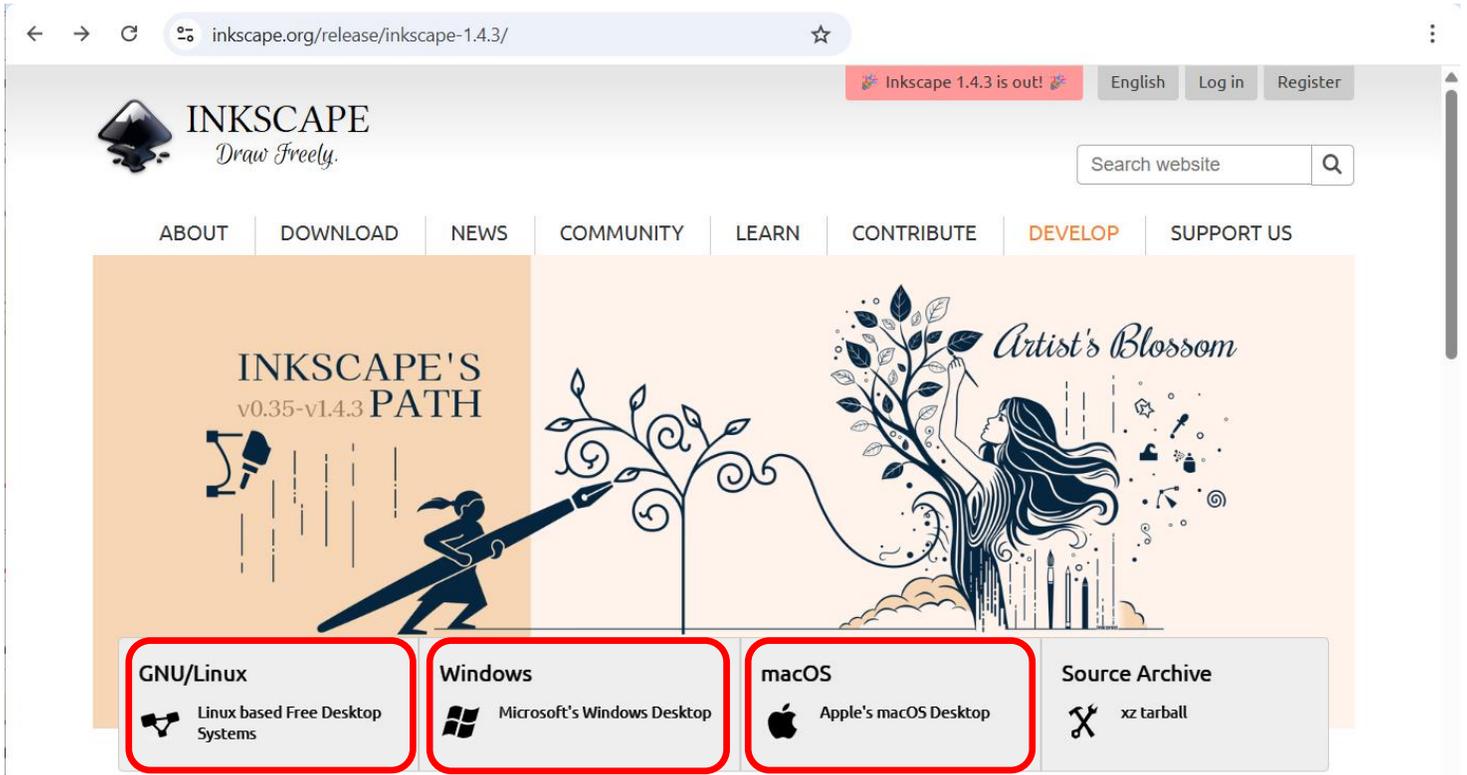
Cancel **Save**

Inkscape - Downloading and Installing

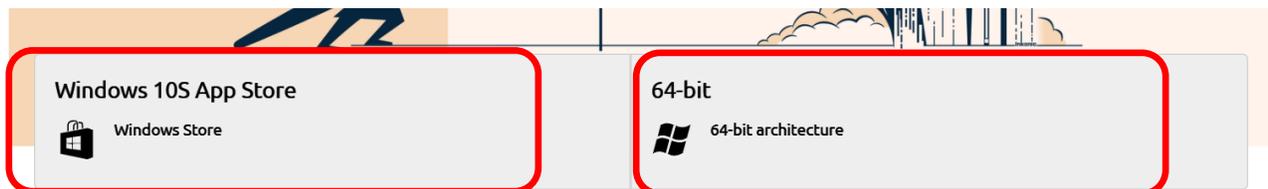
Inkscape is a free alternative to Adobe's Illustrator, which is only available as a paid subscription model. Adobe Illustrator also uses about 2000 MB of disk space, as opposed to about 600 MB for Inkscape.

This tutorial is based on using **Inkscape version 1.4.3**. When you use this document there may be a later version of Inkscape available. You can choose to install the latest version or version 1.4.3 to ensure it is identical to that used for this tutorial.

This link, <https://inkscape.org/release/inkscape-1.4.3/>, will bring you to the page for version 1.4.3, as shown below. One can choose to install the **Linux** version (for hard-core programmers), **Windows**, or **Mac** versions.

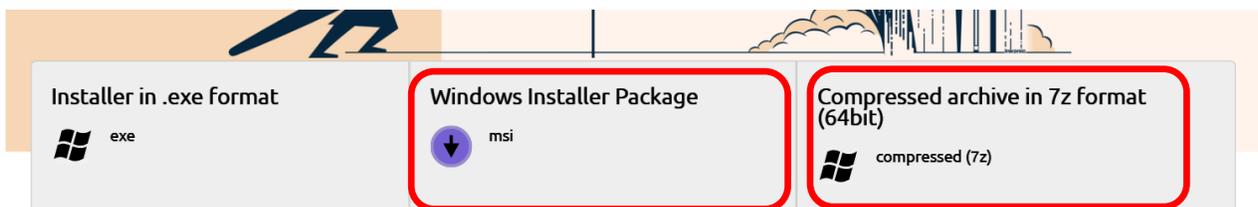


- If this is a school or business computer it may be "locked down" and not have administrator privileges. In this case, select the right side **64-bit option**. The left side allows installing the software from the Windows App Store.



- If this is a school or business computer without administrator privileges, select the right side **Compressed archive** option. Otherwise, the middle **Windows Installer Package** will provide an easier installation.

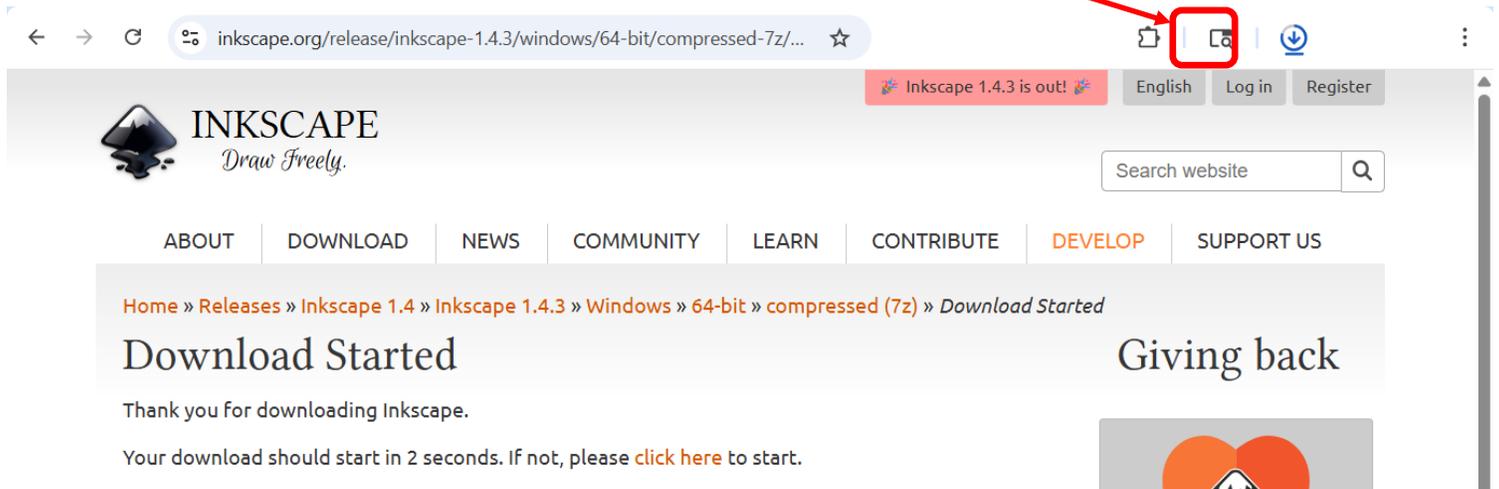
A good strategy is to **first try the Windows App Store or the Windows Installer Package**. If an error occurs or a message, such as needing administrator privileges, blocks the installation, then use the **Compressed archive**.



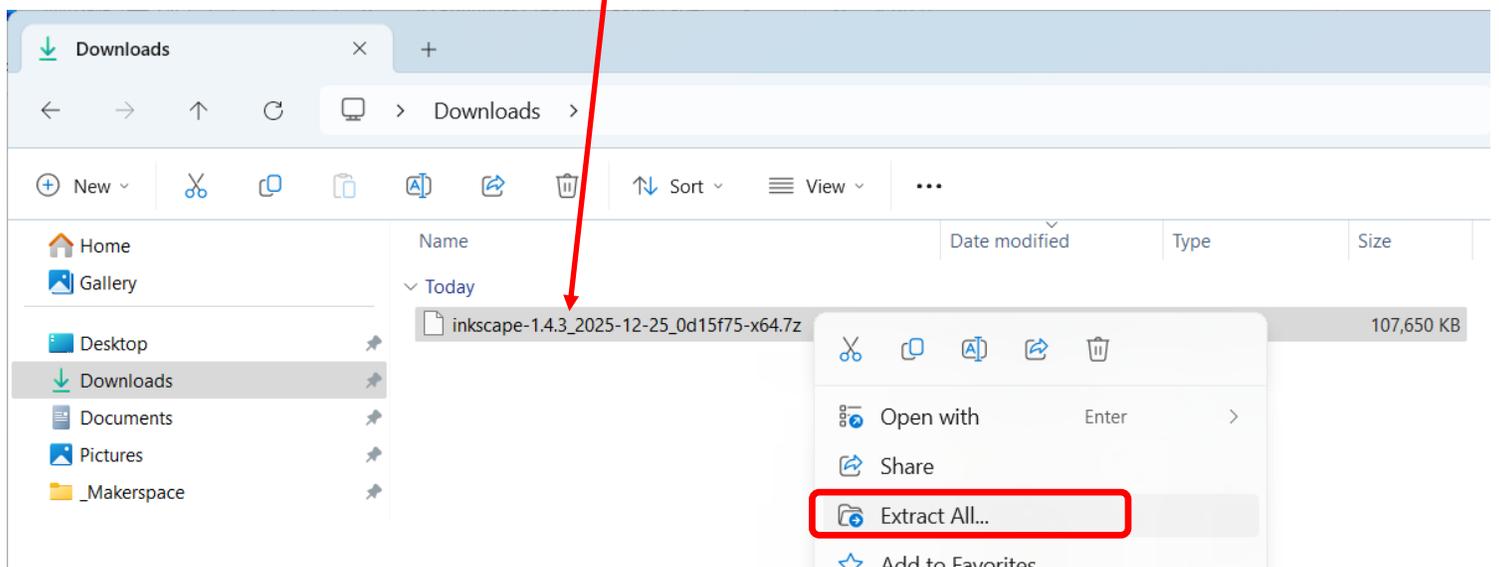
If the **Windows App Store** or **Windows Installer Package** was used successfully, skip a few pages and continue with the **“Inkscape - Starting an Inkscape Drawing”** section.

This and the following two pages covers the use of the Compressed archive, which could be considered the “portable” version of the software. A “portable” installation does not change make any changes to files in the operating system that would need administrator privileges.

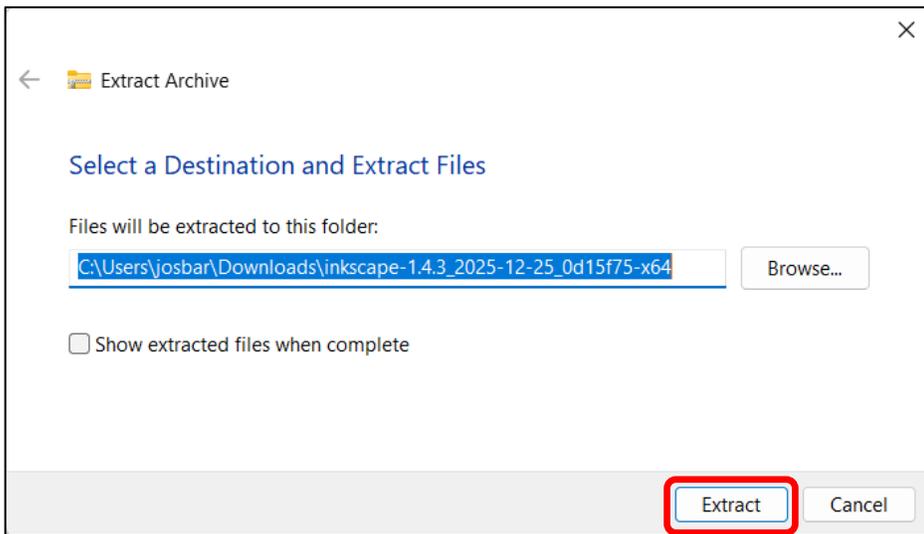
If the **Compressed archive** option was selected, a download should start and the **Downloads** icon will indicate the progress.



- in your **Downloads** folder, right click on the **inkscape** file just downloaded and select **Extract All...**

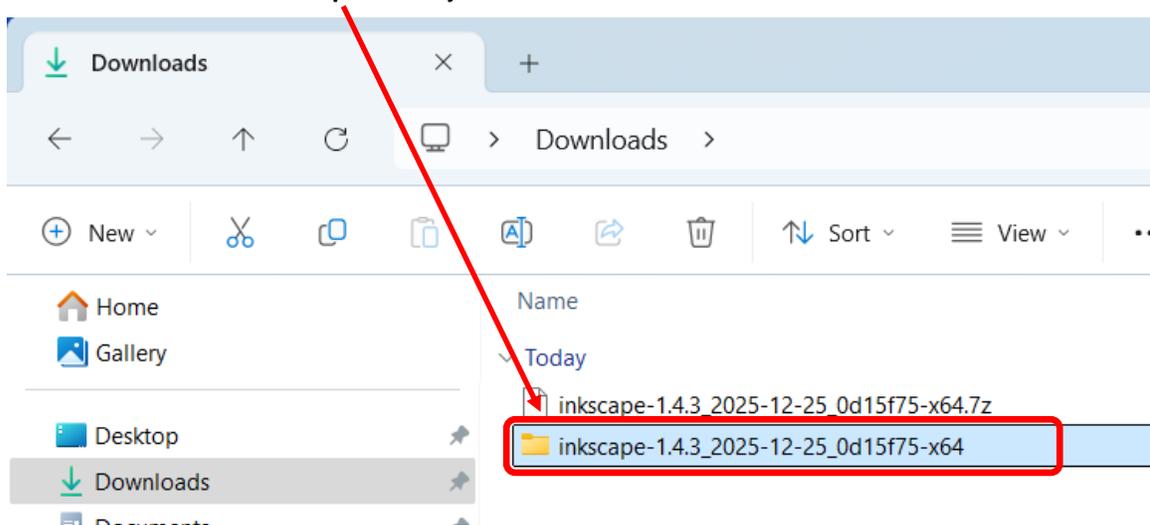


- click on **Extract**

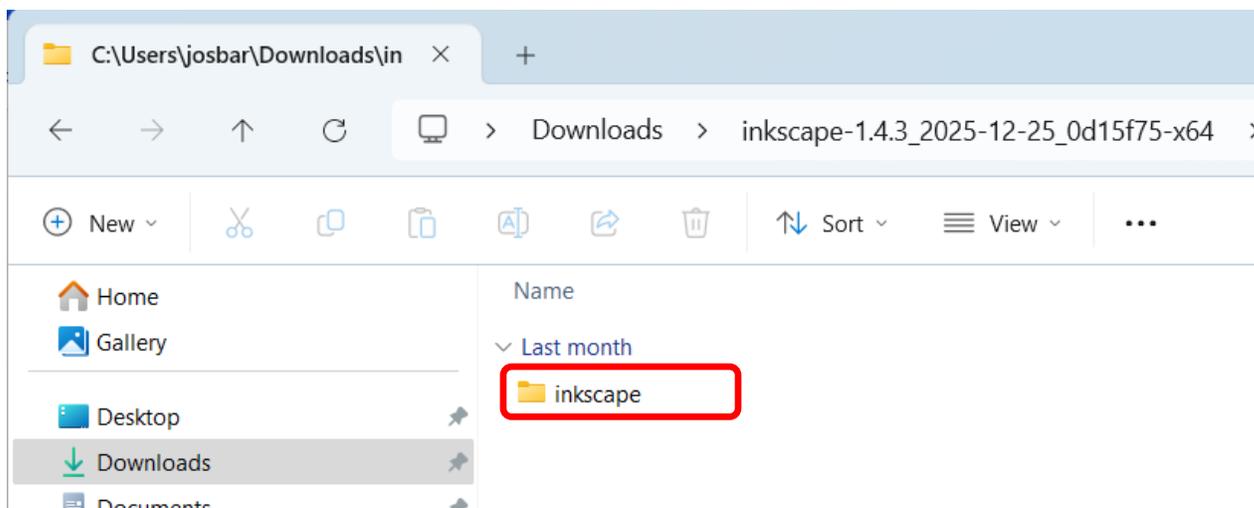


- if desired, delete the original zipped file. It is not needed any longer.

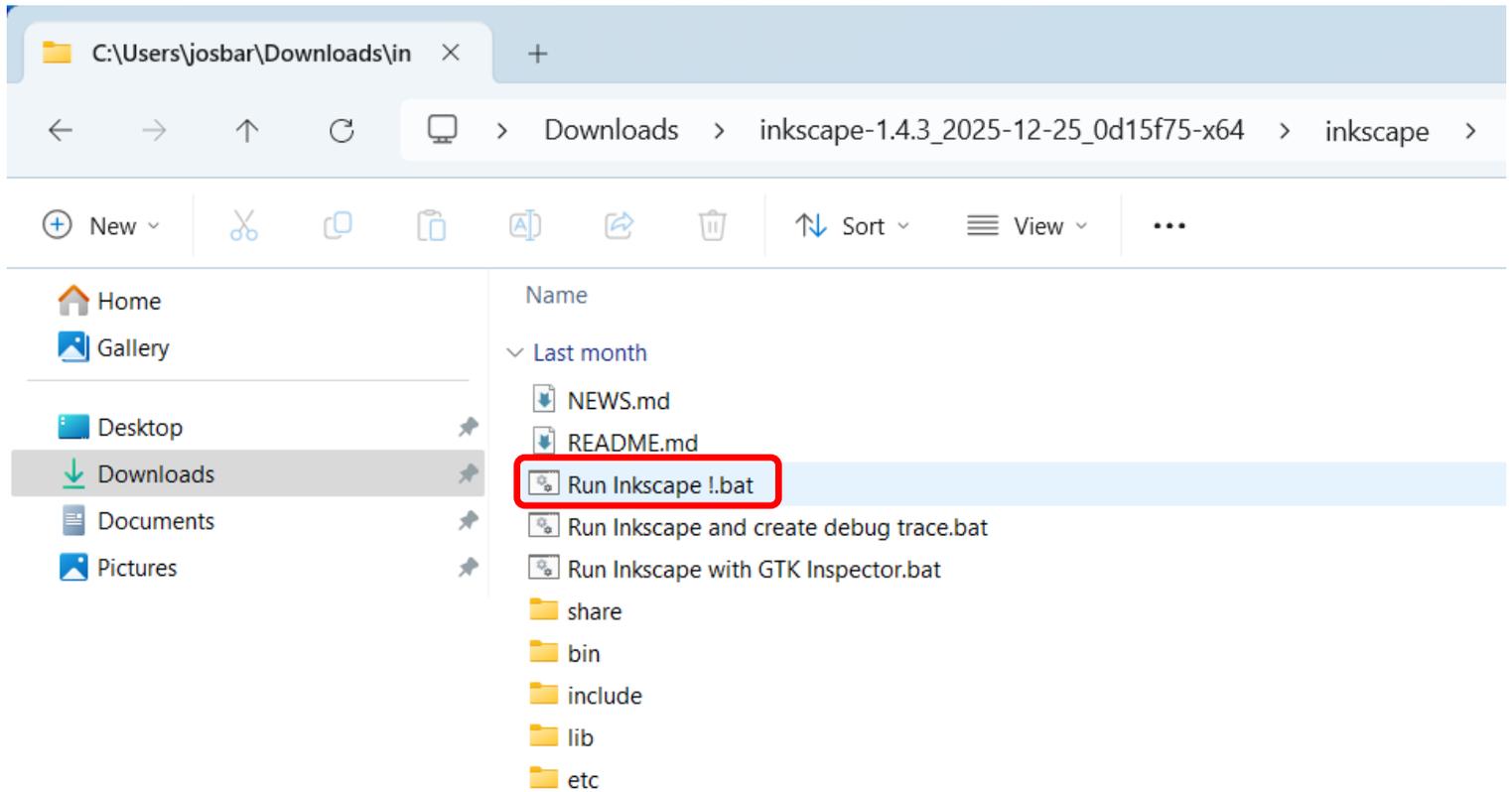
- **double click** on the **inkscape folder** just created.



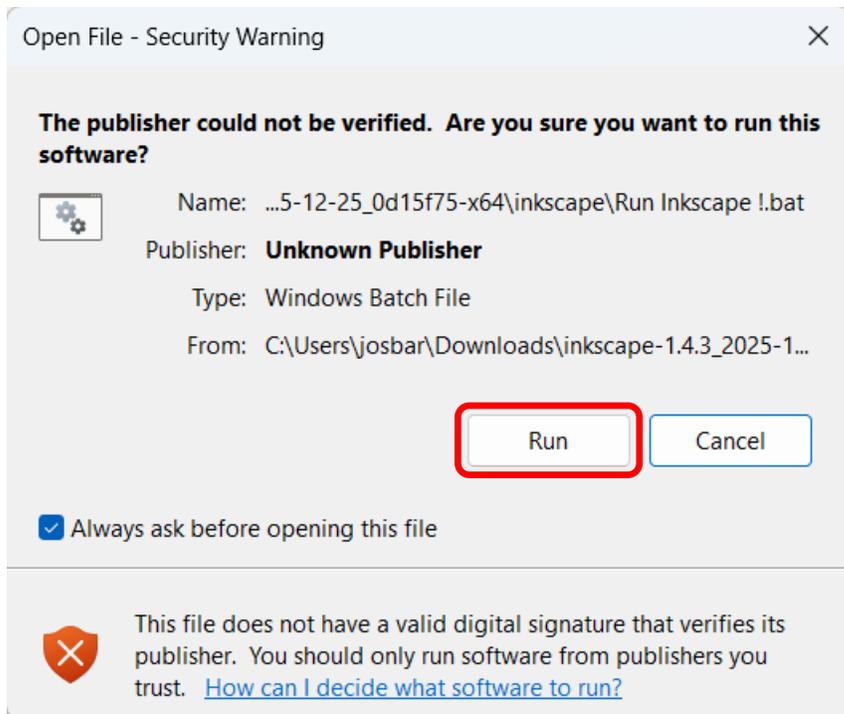
- **double click** on the **inkscape folder**



- to run the program now or in the future double click on **Run Inkscape !.bat**

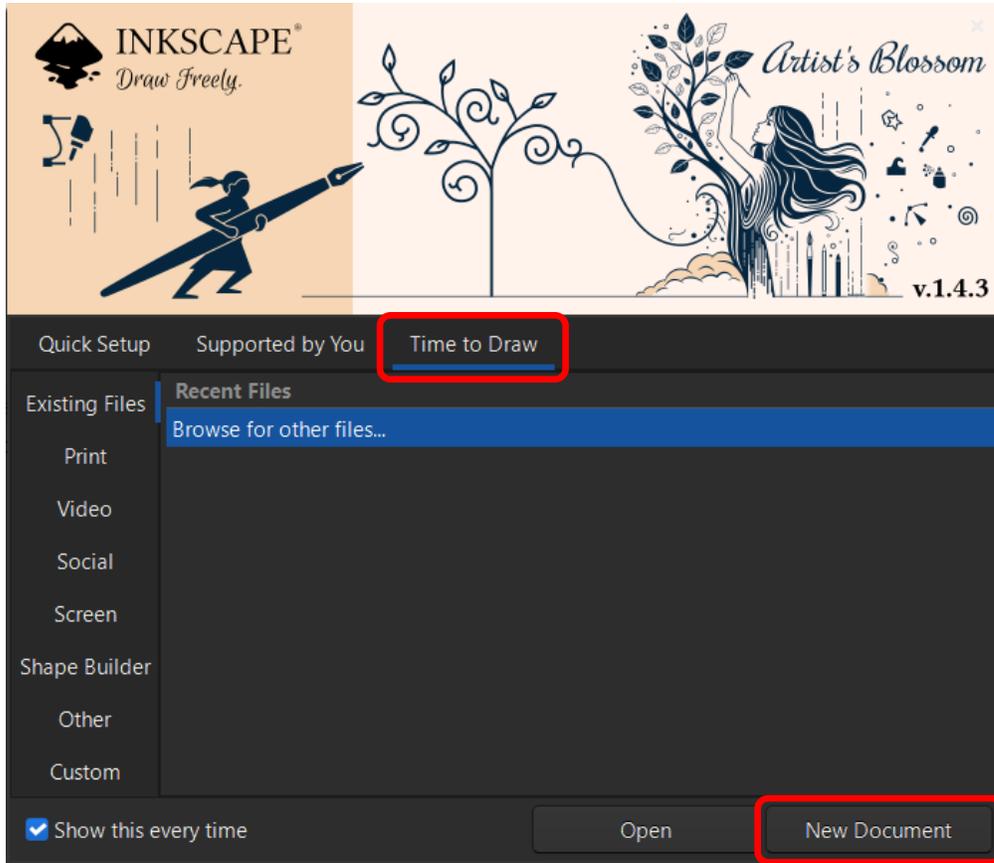


- if this window shows, click **Run**

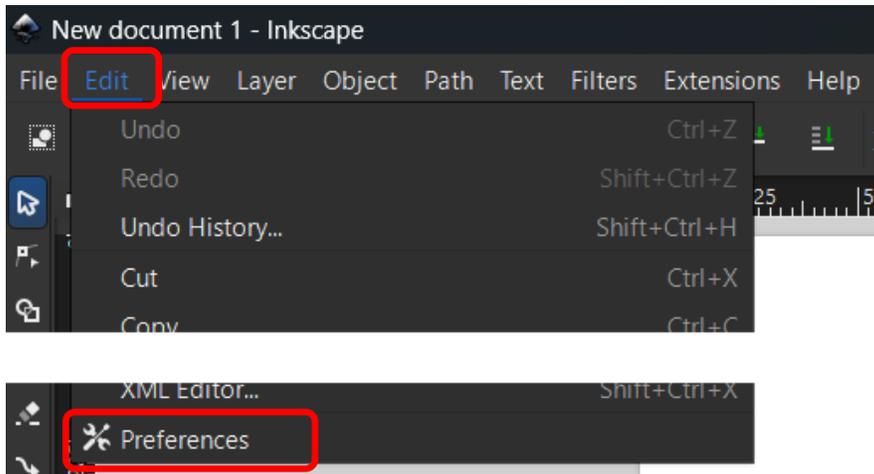


Inkscape - Starting an Inkscape Drawing

- select the **Time to Draw** tab
- click **New Document**



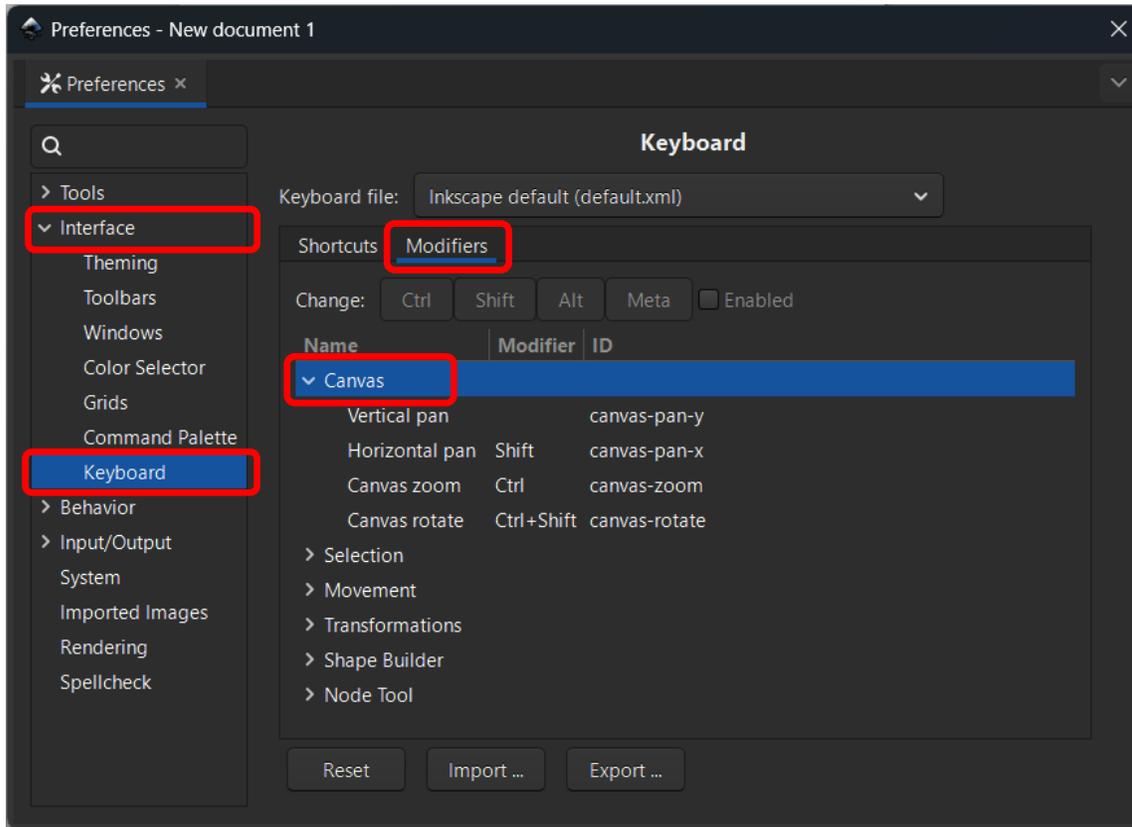
- from the **Edit** menu select **Preferences**, which is near the bottom of the menu list



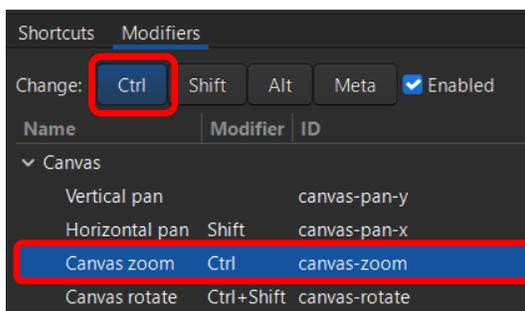
Inkscape – Enable Mousewheel Zoom

By default Inkscape uses the Mousewheel for scrolling (Vertical pan). The following instructions will allow the Mousewheel to control Zoom In/Out, which is the same as in Fusion.

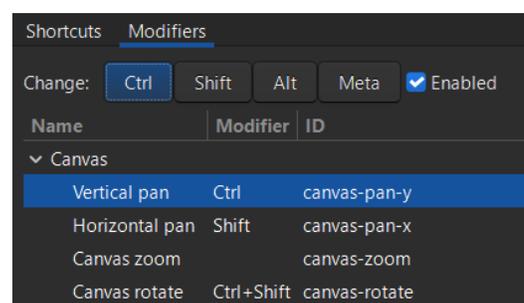
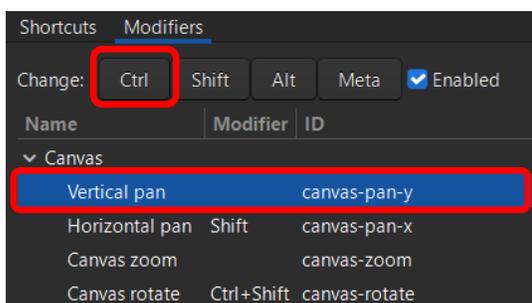
- in the left side section, select the **Interface** group and select **Keyboard**
- select the **Modifiers** tab and select the **Canvas** group



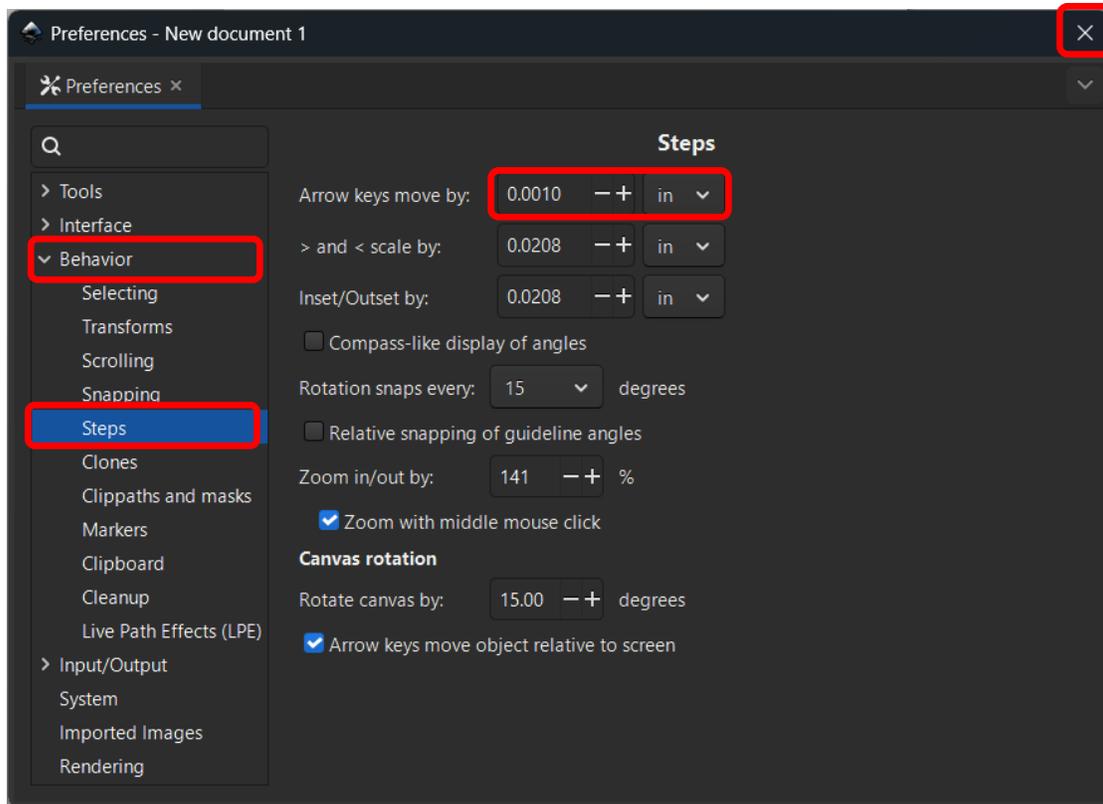
- select the **Canvas zoom** row and click on **Ctrl** to deactivate the Ctrl Modifier



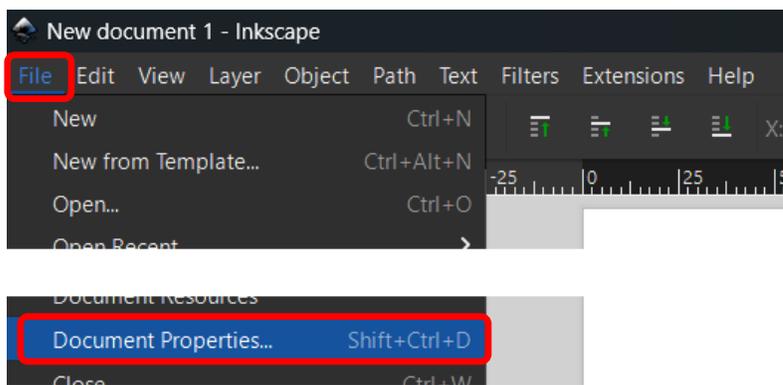
- select the **Vertical pan** row and click on **Ctrl** to activate the Ctrl Modifier. The result is that in the right screenshot.



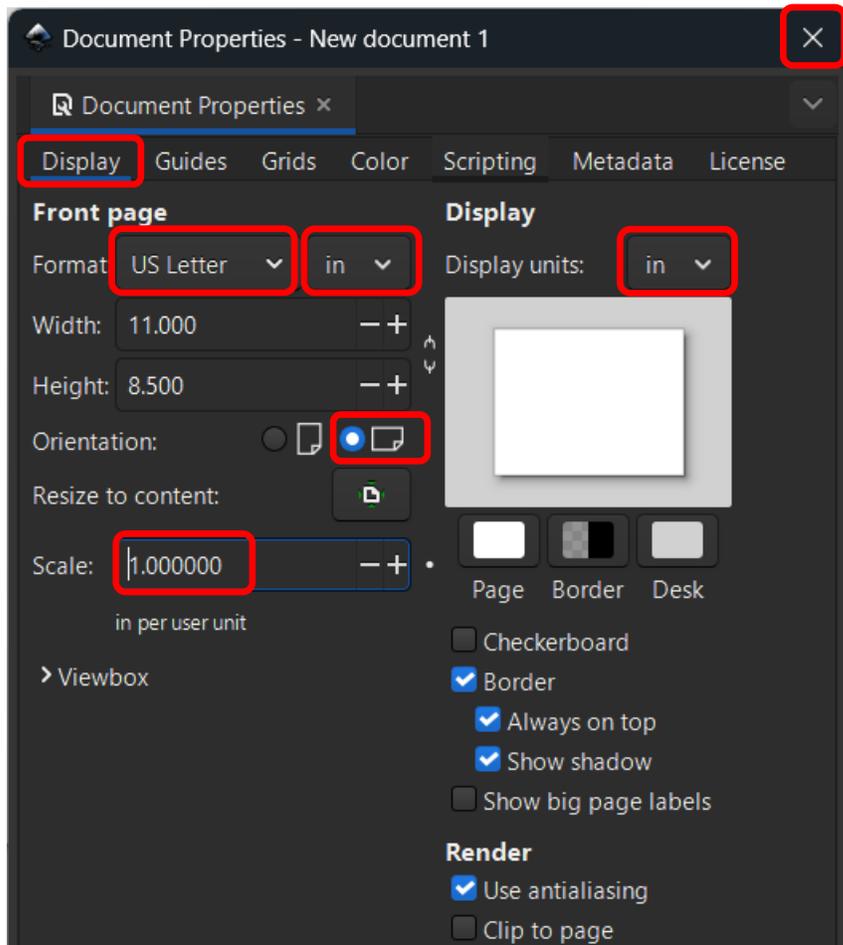
- in the left side section, select the **Behavior** group and select **Steps**
- for **Arrow key move by:** select **in** as the units and set the value to **0.0010**
- close the **Preferences** window



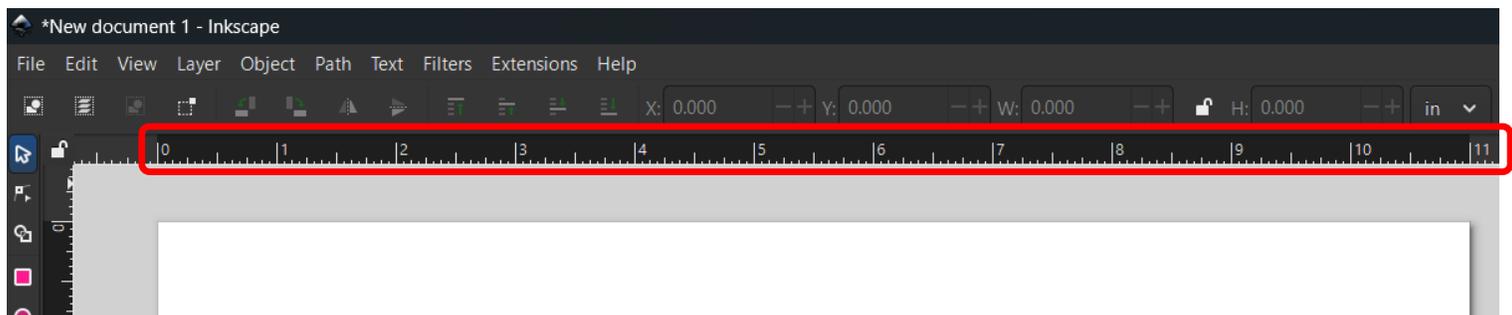
- from the **File** menu select **Document Properties...**, which is near the bottom of the menu list



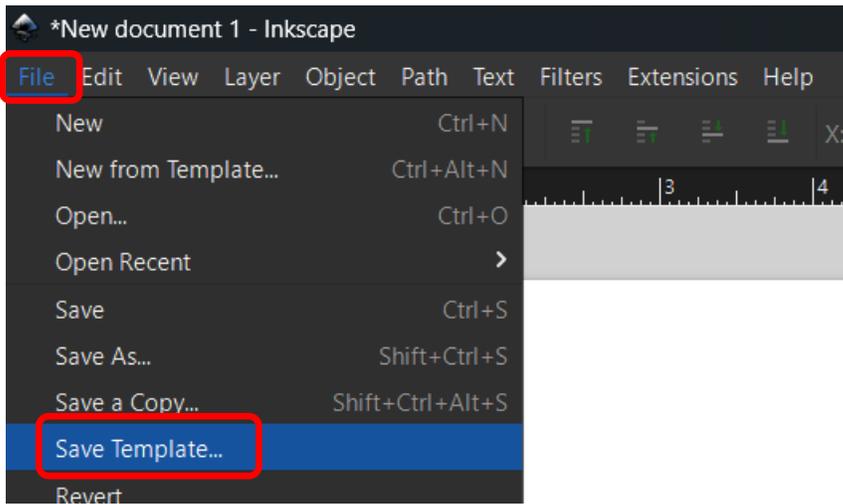
- select the **Display** tab
- change the **Format** units to **in** and the **Format** to **US Letter** (in the **US** group)
- change the **Display units:** to **in**
- set the **Orientation** to Landscape (2nd option)
- set **Scale** to **1.000000**
- close the window



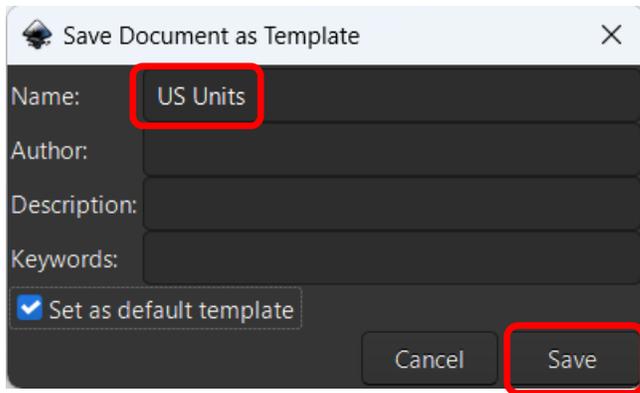
Note that the **top ruler** of the Inkscape canvas should show the page from **0** to **11**



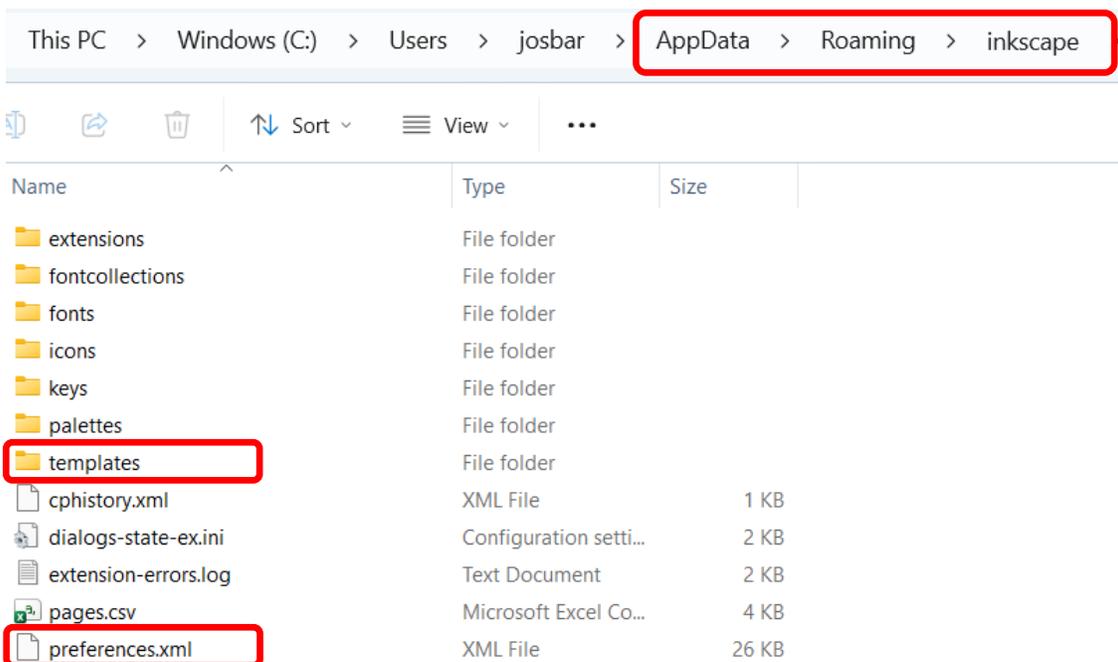
- from the **File** menu select **Save Template...**



- set the **Name** to **US Units** and click **Save**

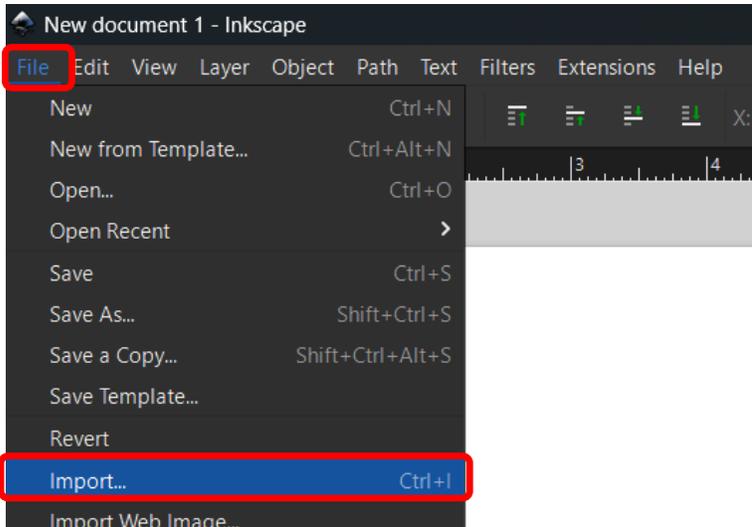


This does not need to be checked, but for information only, Inkscape creates a folder in AppData\Roaming for Templates and Preferences.

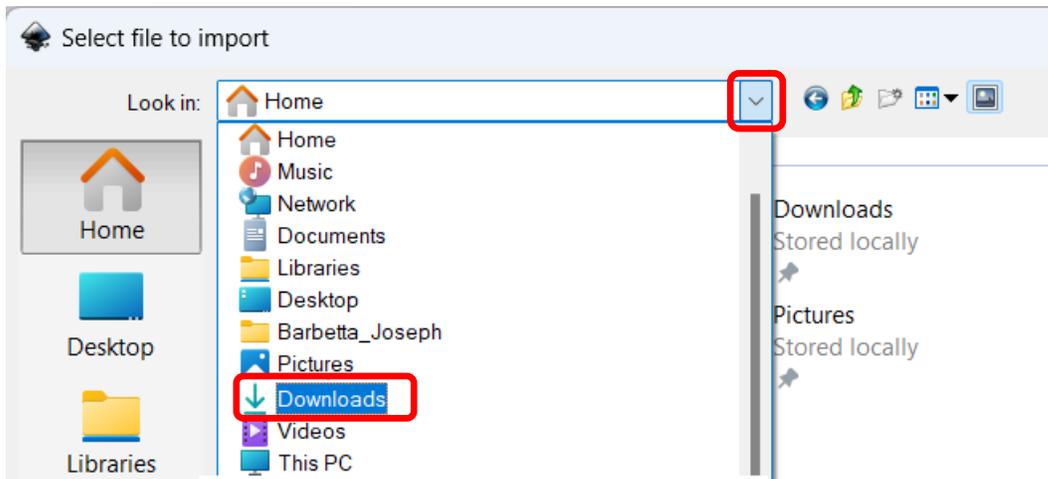


Inkscape – Importing DXF file

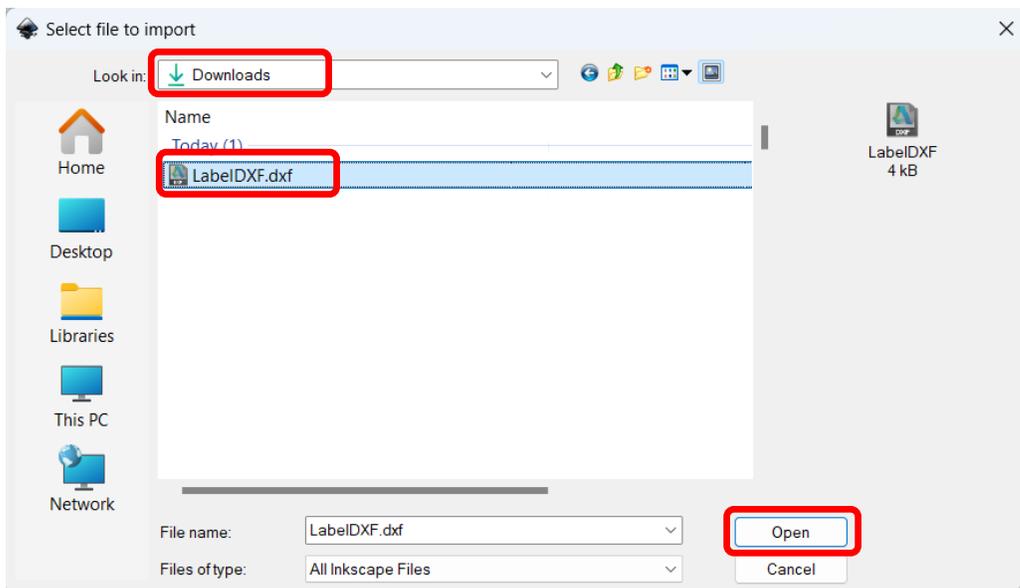
- from the **File** menu select **Import...**



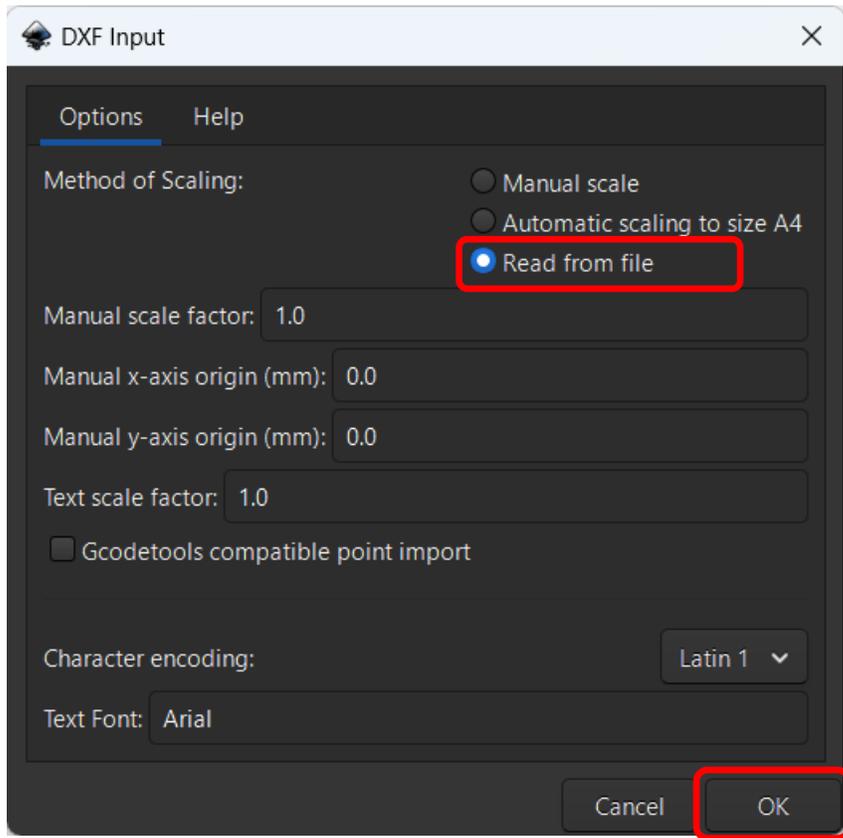
- use dropdown list to select **Downloads** or another location where the DXF file is



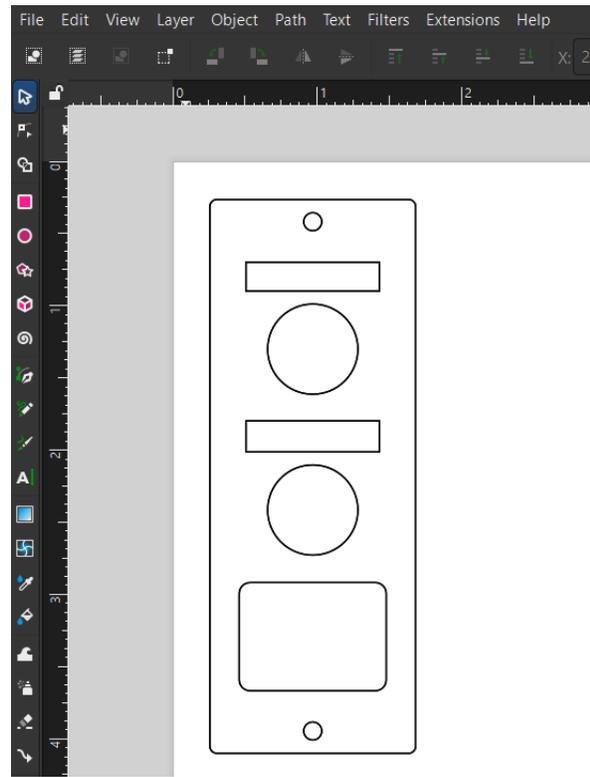
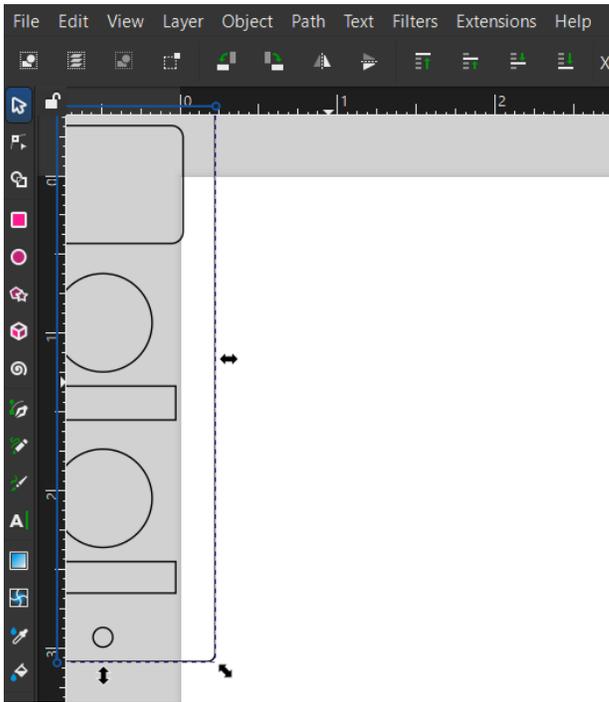
- select **LabelDXF.dxf** and click **Open**



- check the **Read from file** option



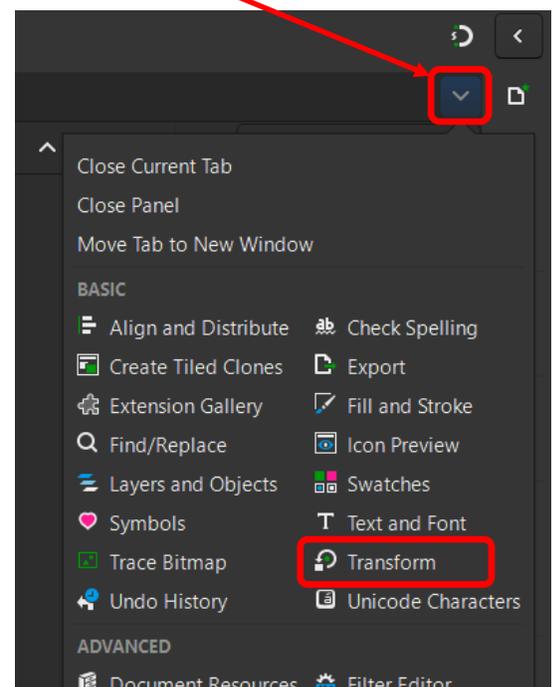
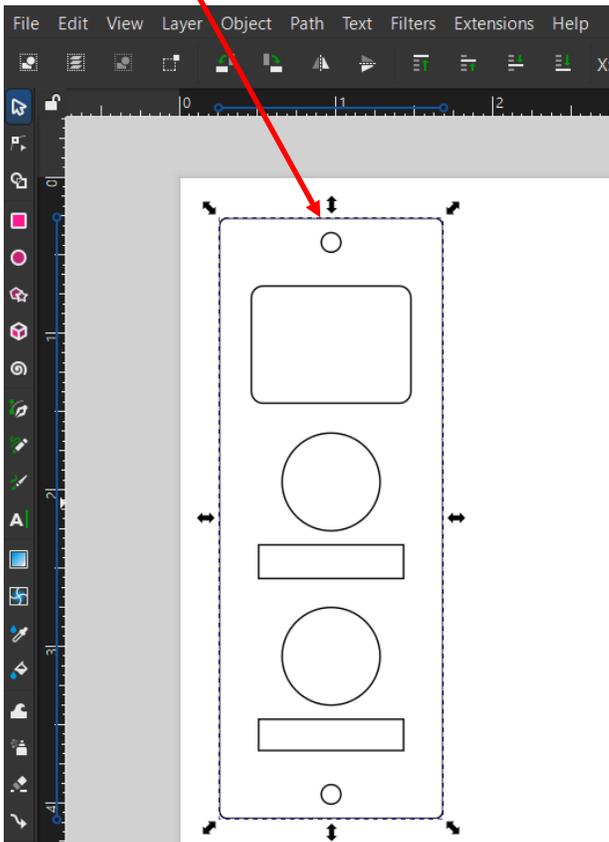
- click on the **Selector** tool (**arrow icon**) and click on the DXF drawing just imported and drag it to the right, as shown on the right. The position is not critical. It is just on the sheet.



Depending on the orientation of the bezel in Fusion or the way the Sketch was created, the DXF may be rotated or mirrored.

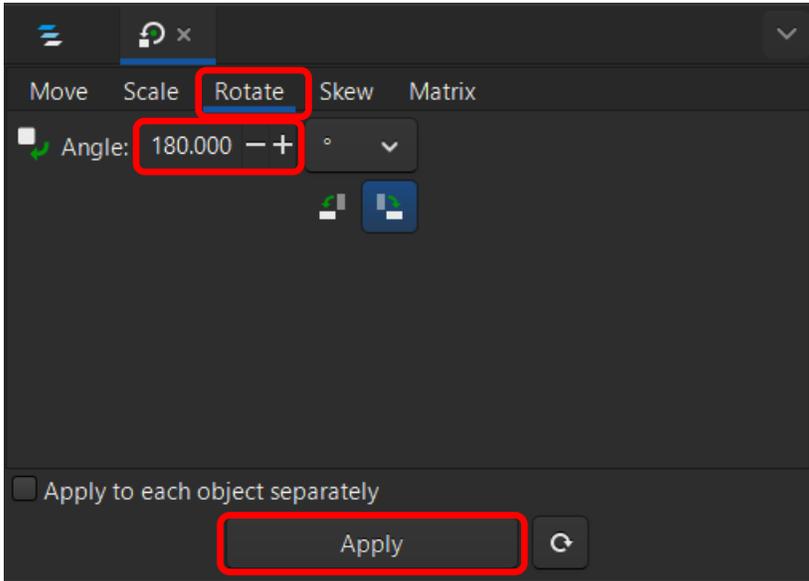
- if the sketch is rotated (as it is here) or flipped say **“What the sigma!”** and on the right side of the Inkscape screen use the **down arrow** to select the **Transform** tool

- click on the Sketch drawing to select it and on the right side of the Inkscape screen use the **down arrow** and select **Transform**

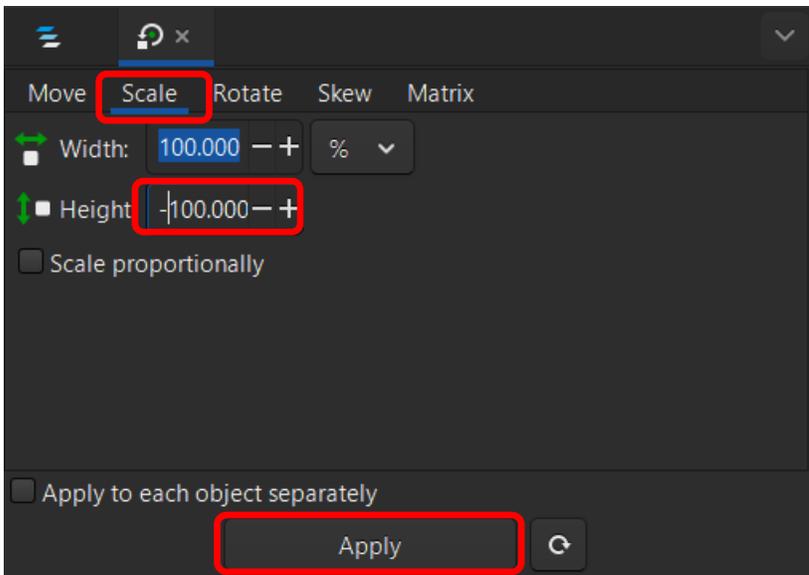


Inkscape – Using the Transform tool

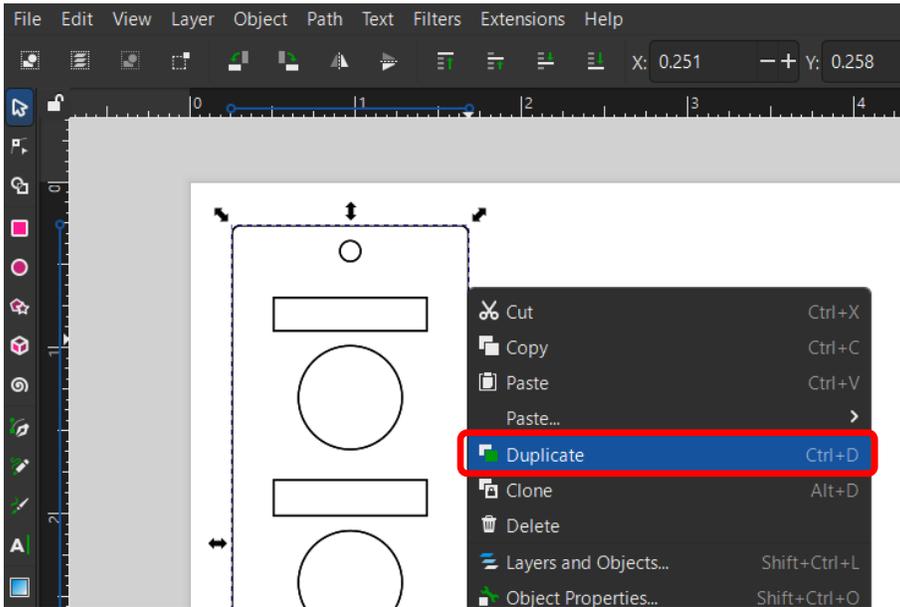
- if the sketch needs to be rotated select the **Rotate** tab, enter **180** for the **Angle** and click the **Apply** button



- if the Sketch needs to be flipped, select the **Scale** tab
- if the Sketch needs to be flipped vertically change the **Height** value from 100 to **-100** (note the minus sign)
- if the Sketch needs to be flipped horizontally change the **Width** value from 100 to **-100** (note the minus sign)
- click the **Apply** button



- right click on the sketch and select **Duplicate**.



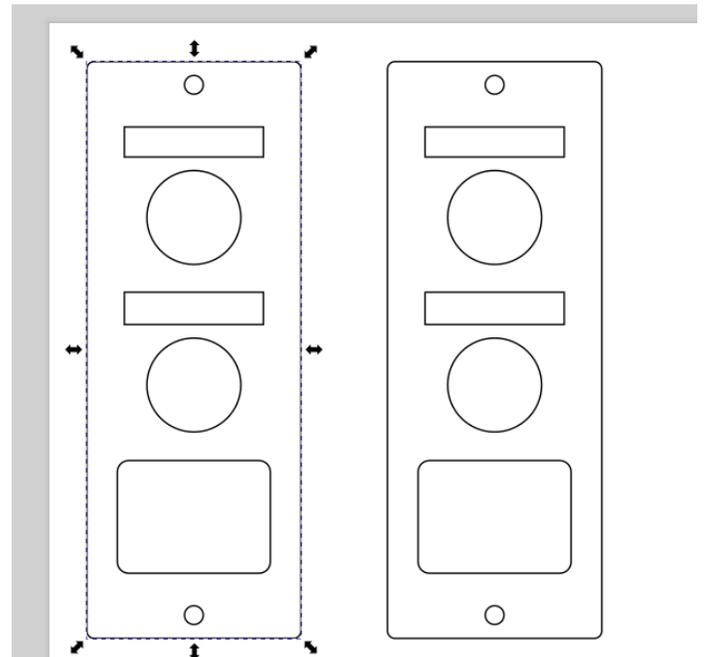
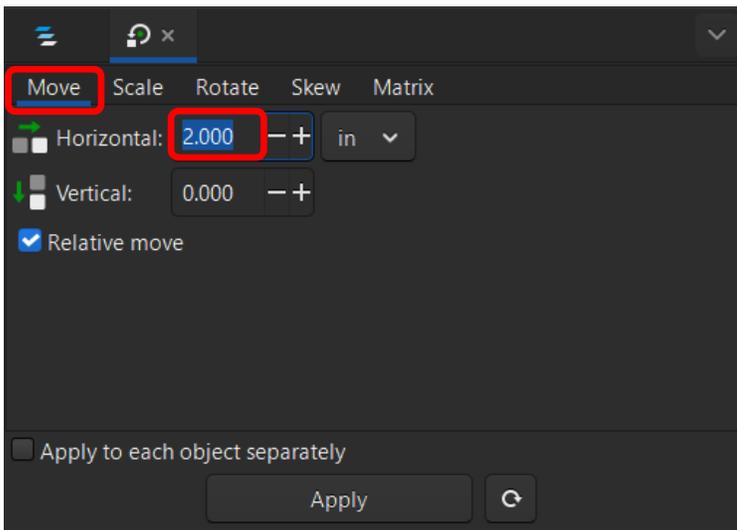
Inkscape has both a **Duplicate** and **Clone** feature.

The **Duplicate** feature creates an **“independent”** copy of the object that can be edited later to be **different from the original**.

The **Clone** feature creates a **“linked”** copy of object. When the original object is edited, all clones will match.

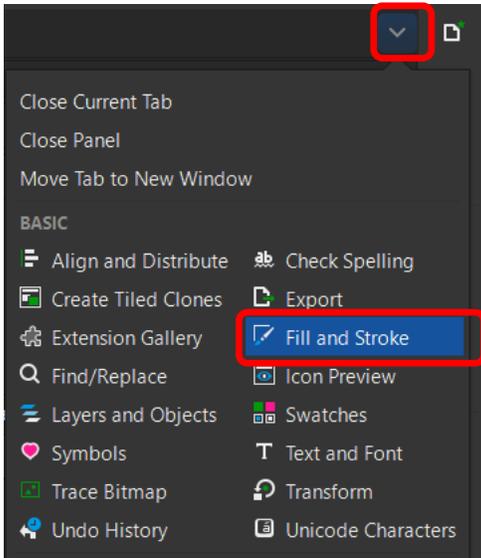
- for the **Transform** tool select the **Move** tab and change the **Horizontal** value from **0.000** to **2.000**. The value of 2.000 is not critical. It is just to move the duplicated object away from the original.

The result is on the right.

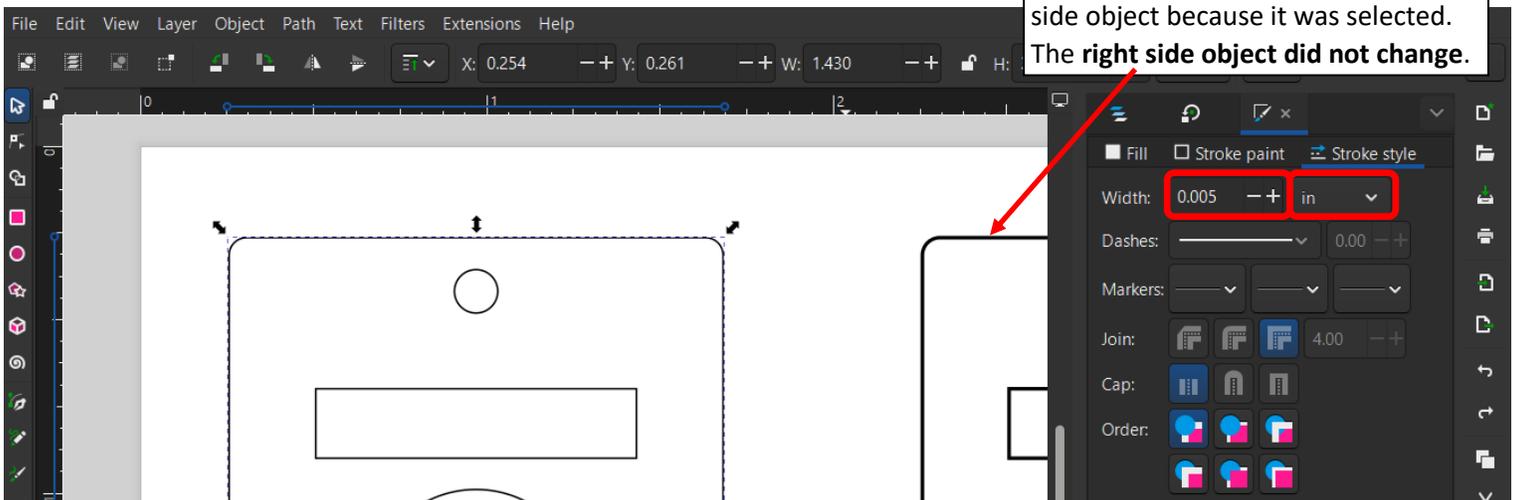


Inkscape – Using the Fill and Stroke tool

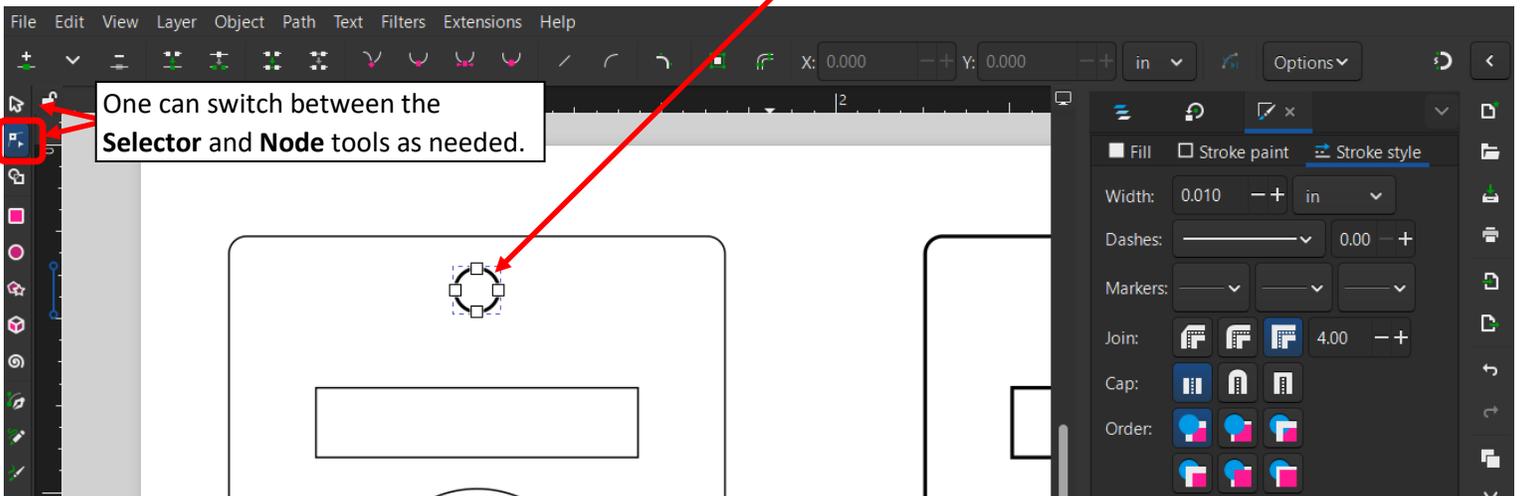
- on the right side of the Inkscape screen use the **down arrow** and select **Fill and Stroke**



- select the **Stroke style** tab, ensure the units are **in**, and change **Width** to **0.005**

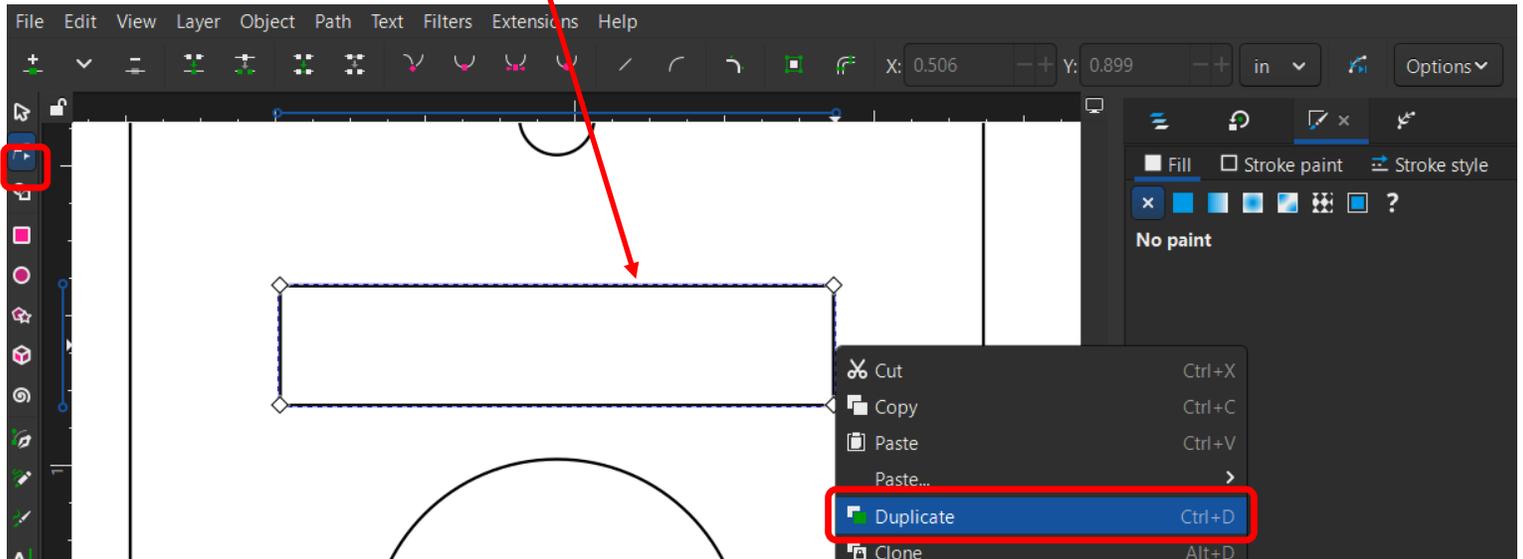


- select the **Node** tool in the left side "tool box" and click on the **small circle**. Change the **Width** to **0.010** to increase the width of that circle only. Press the **Ctrl** and **z** keys (Ctrl+z) to undo this change.

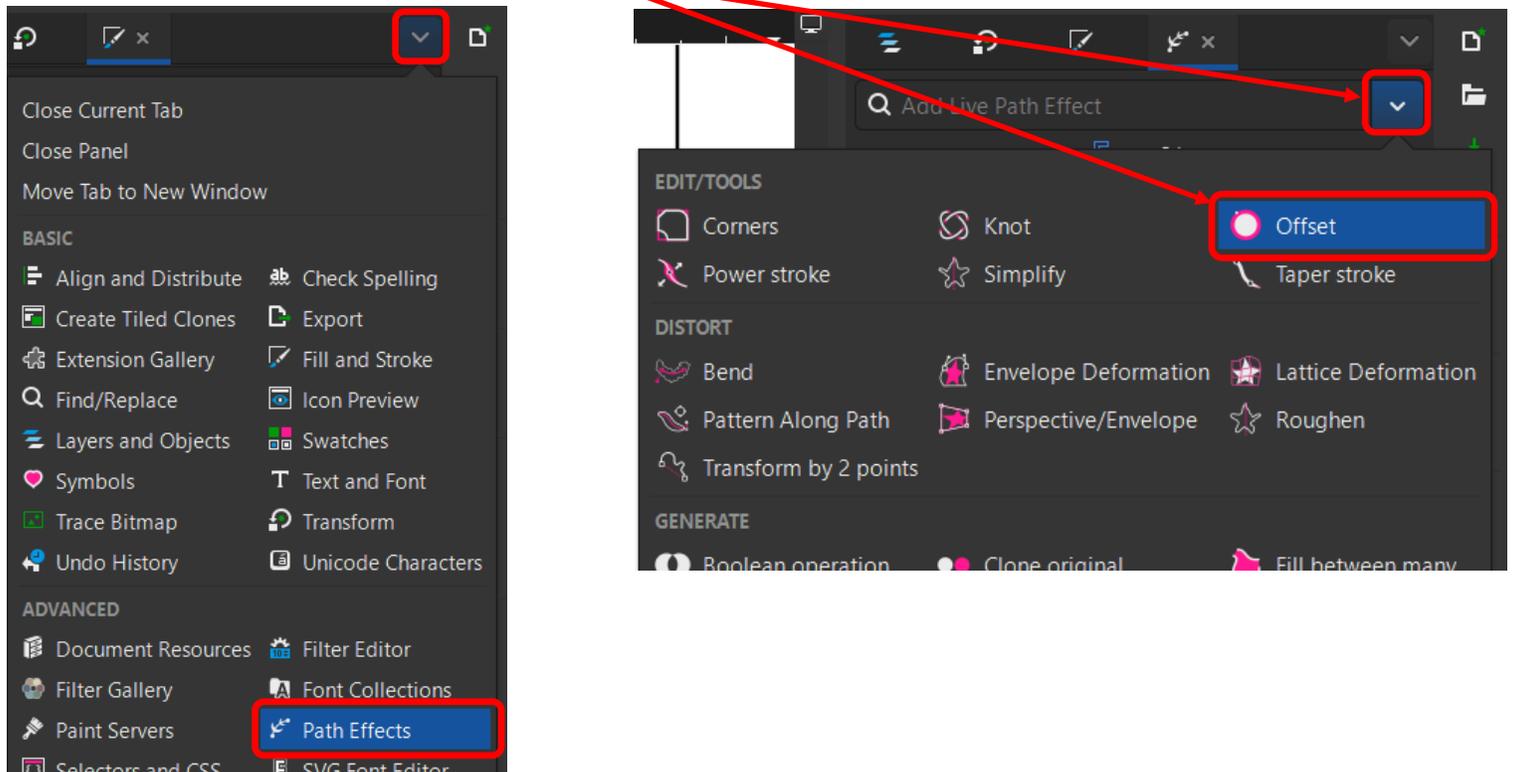


Inkscape – Creating an Offset Rectangle

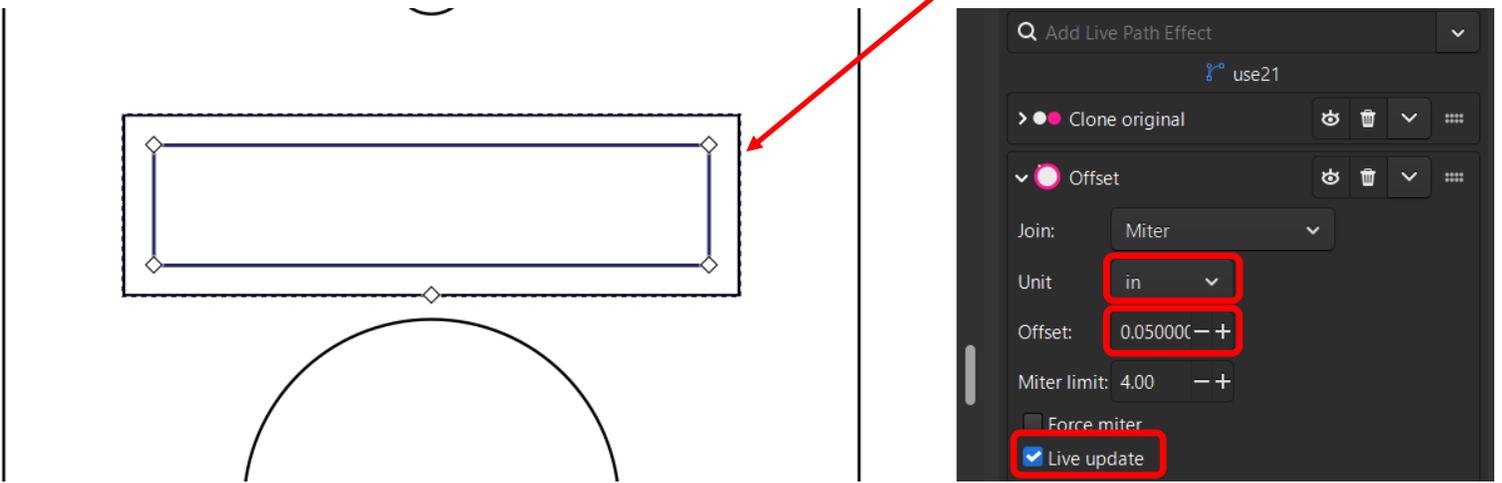
- hold the **Space key** and click anywhere on the Canvas to **pan the page up**. One can also use the right-side or bottom scroll bars, but using the Space key to pan with the mouse is convenient.
- select the **Node** tool and click on the **rectangle** to select it
- **right-click** on the **rectangle** indicated, and select **Duplicate**



- on the right side of the Inkscape screen use the **down arrow** and select **Path Effects**
- click on the new **down arrow** and select **Offset**



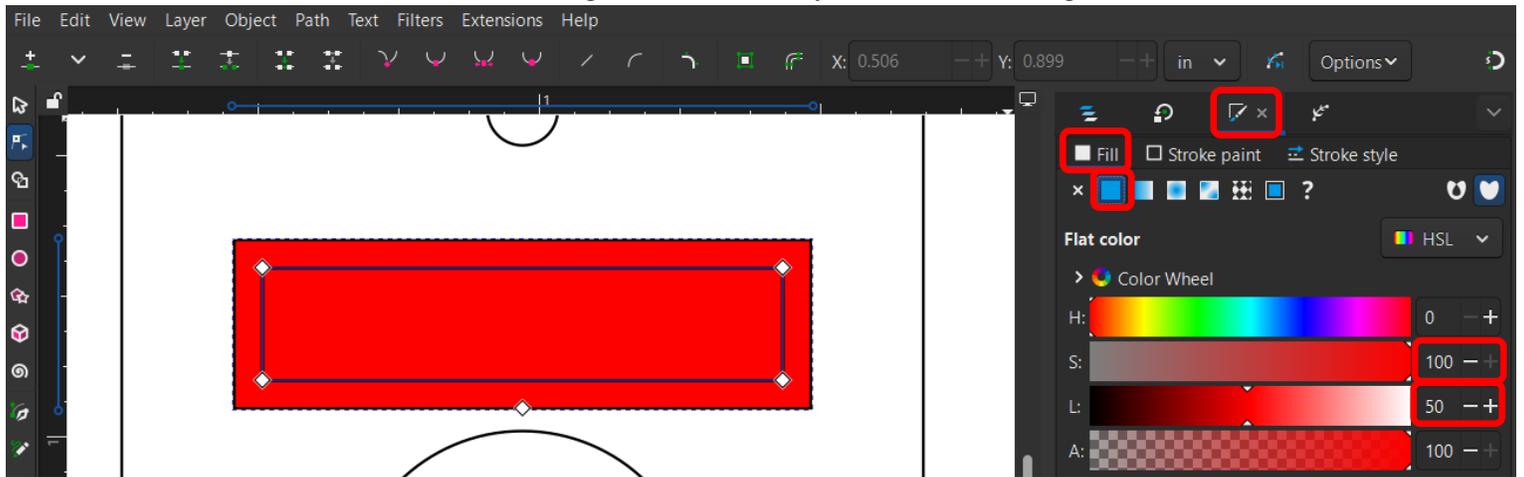
- ensure that **Live update** is checked
- change **Unit** to **in** and change **Offset** to **0.05** and press the **Enter** key. An outer rectangle should appear as below.



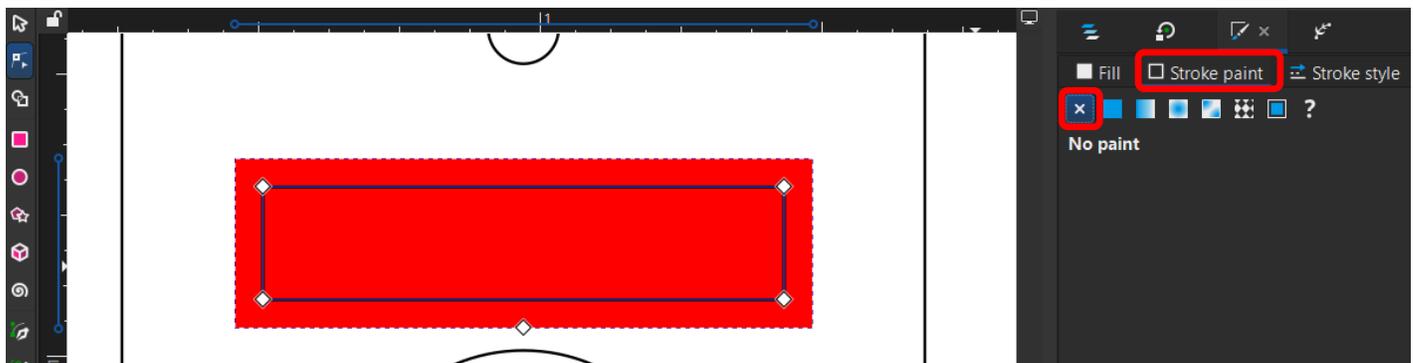
Inkscape – Setting Fill Color and Stroke

- select **Fill and Stroke** and select the **Fill** tab
- select the **Flat color** icon
- type **100** for the **Saturation** value and **50** for the **Luminance** value and press the **Enter** key

The rectangle should be filled in red. The Hue value (before Saturation) is 0 by default, but the value can be changed to adjust the color. The Luminance value, which was changed to 50 can be adjusted to darken or lighten the color.

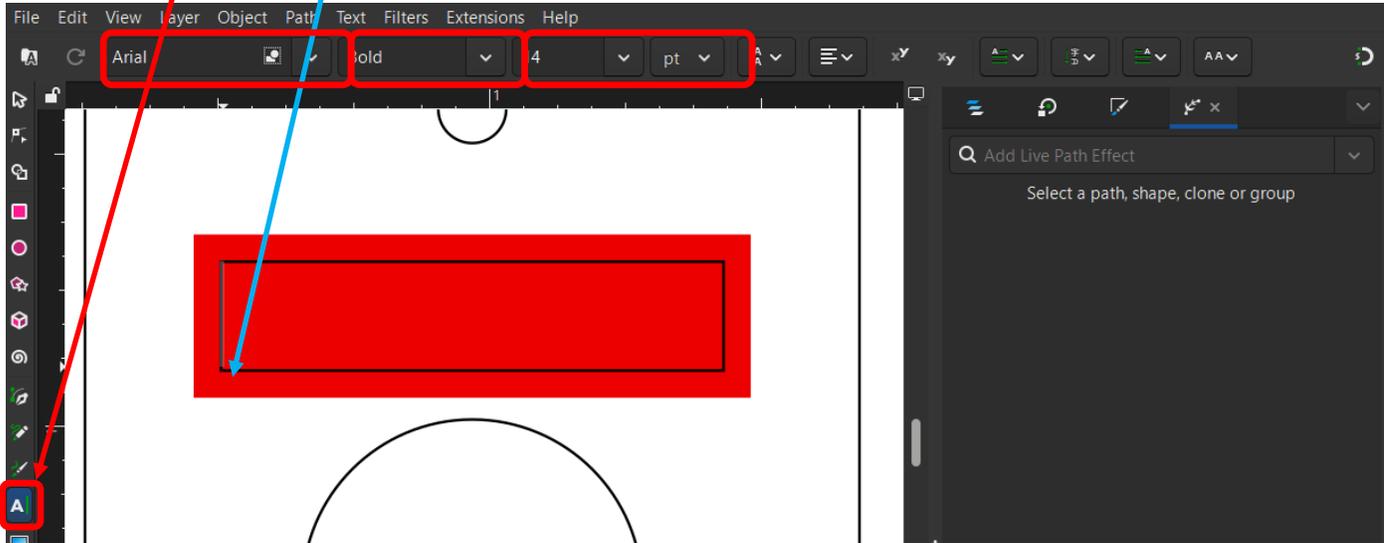


- select the **Stroke Paint** tab and click on the **x** icon to remove the outline of the red rectangle

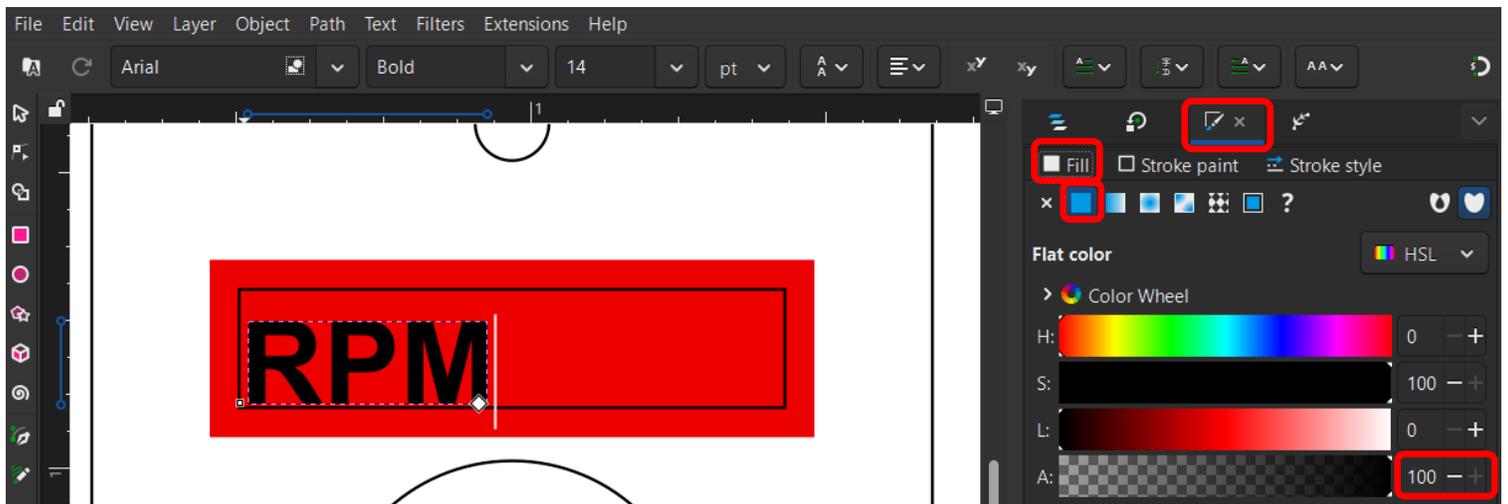


Inkscape – Adding Text

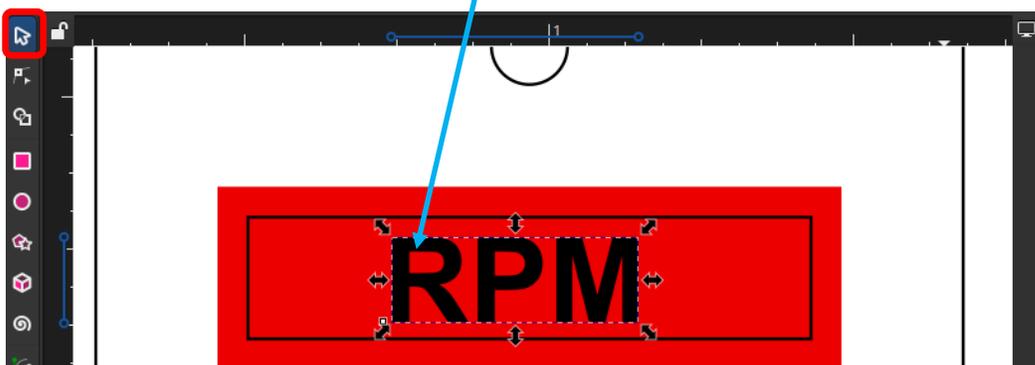
- select the **Text** tool and set the **Font Family** to **Arial**, the **Font style** to **Bold**, and the **Font size** to **14 pt**
- and click on the **bottom left corner** of the rectangle



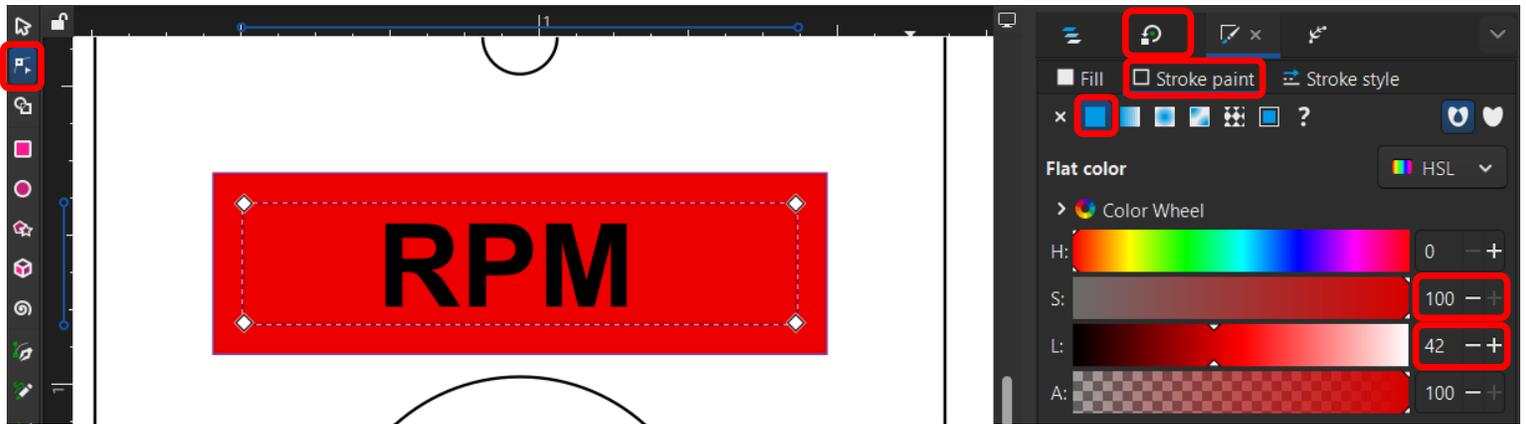
- type the **desired text**. The text may not show because the color is set to red.
- select **Fill and Stroke** and select the **Fill** tab
- select the **Flat color** icon, type **0** for the **Luminance** value and press the **Enter** key, which should make the text black.
- if needed change the **Text size** if needed and there is also a **Bold Condensed and other options**. The goal is to have the text contained in the inner rectangle with some space around the text.



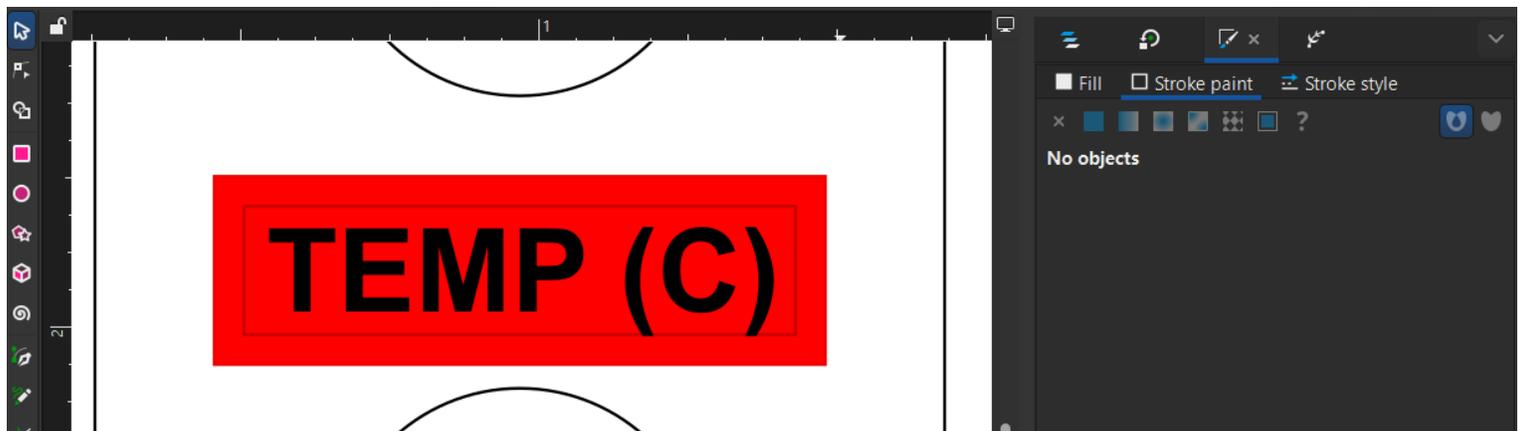
- select the **Selector** tool, click on the text and move it to the center of the rectangle



- select the **Node** tool and click on the **inner rectangle**
- select the **Stroke paint** tab, select the **Flat color** option, set **Saturation** to **100** and **Luminance** to **42**. This will make the inner rectangle only slightly visible to serve as a guide if changing text.



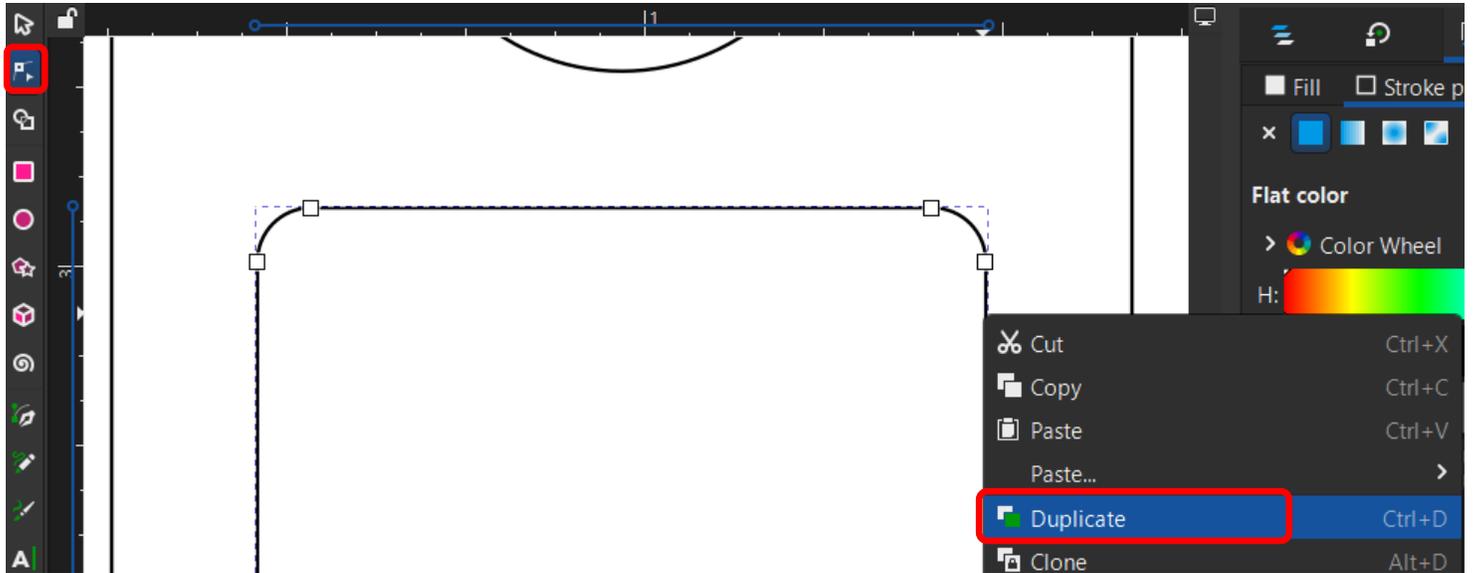
- scroll down to the 2nd rectangle and perform the same operations that were done with the 1st rectangle starting with "Inkscape – Creating an Offset Rectangle". This text will be set to "TEMP (C)" for temperature in degrees C.



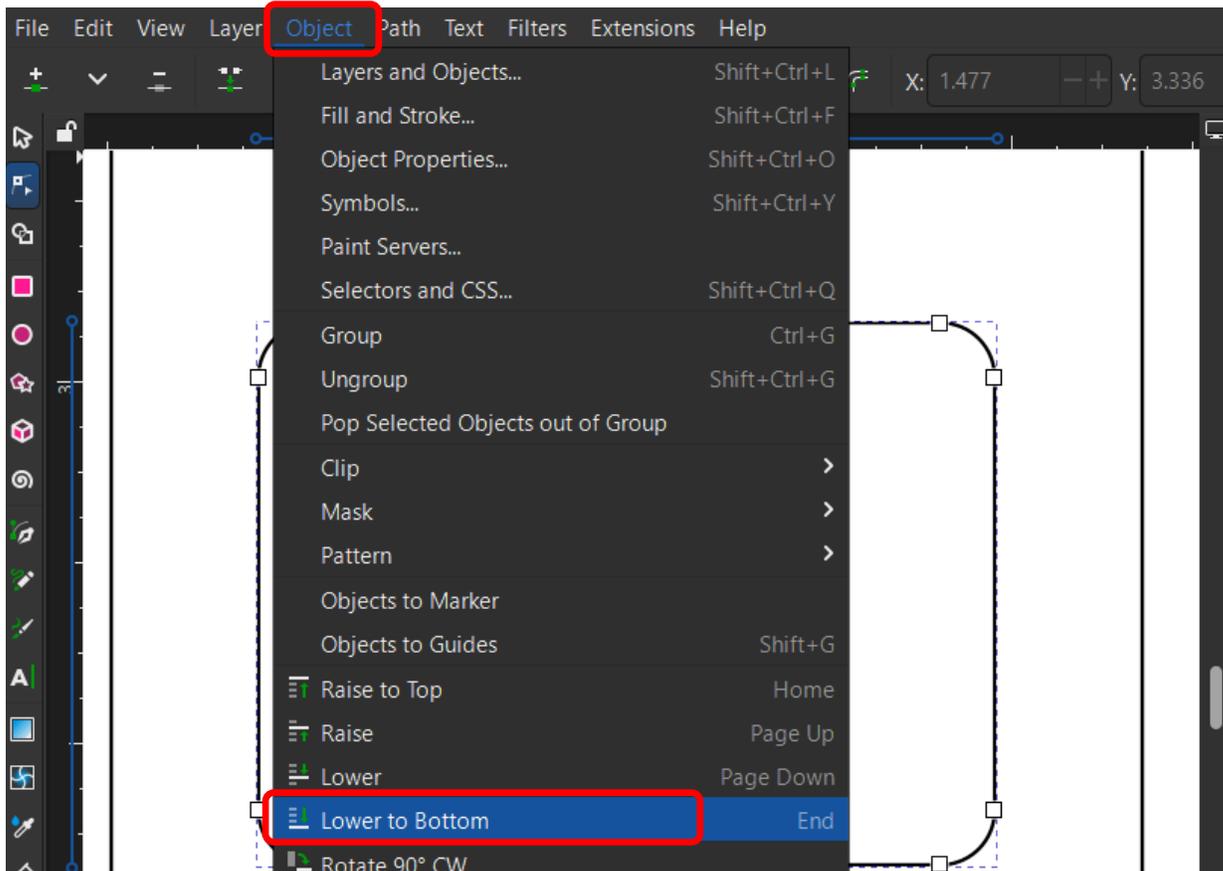
Inkscape – Product Nameplate

Every industrial product should have a nice “nameplate” indicating the company name, product name and model, etc. Instead of creating a separate nameplate, it can become part of the label frame and this is the reason for the bottom rectangle.

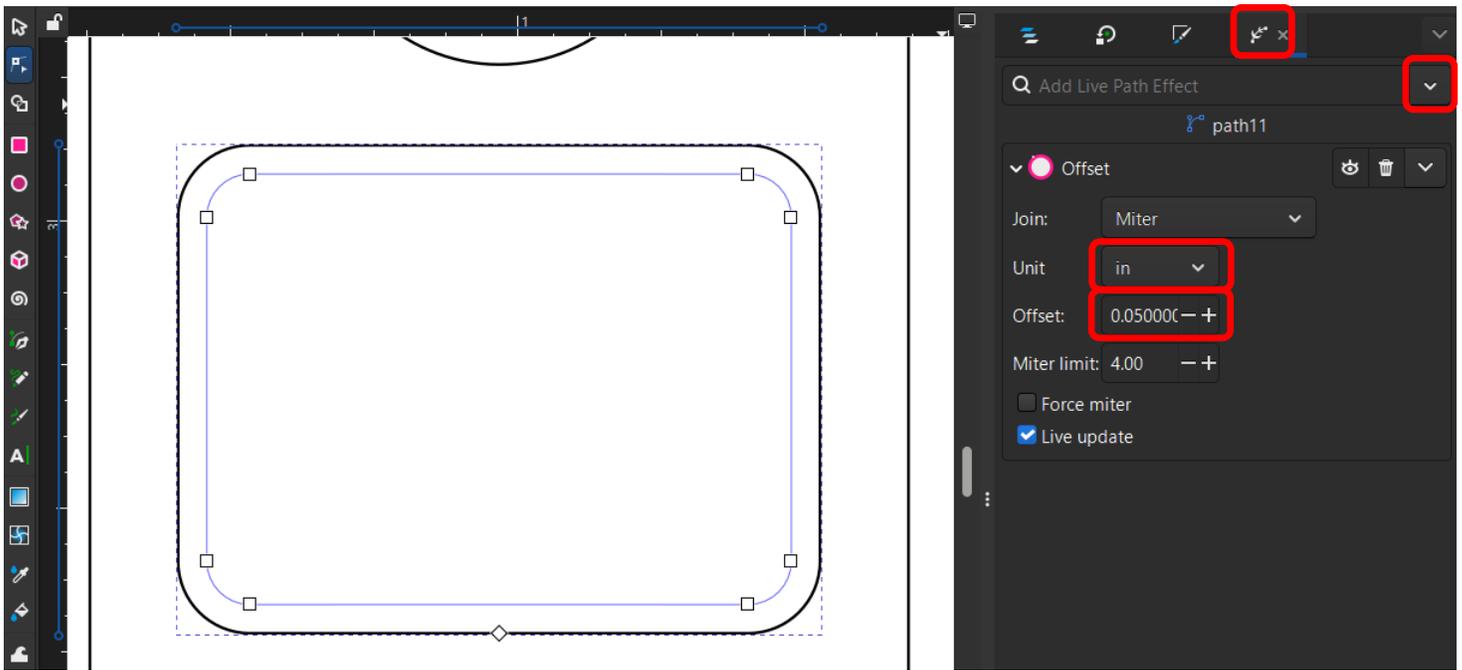
- scroll down to the **bottom rounded rectangle**
- select the **Node** tool and select the **rounded rectangle**
- right-click on the rounded rectangle and select **Duplicate**



- from the **Object** menu select **Lower to Bottom**. Some software will call the the bottom of the Z-Order. This will cause something visible to happen, but will place the new rectangle “under” the original. The purpose of this is to keep the original rectangle visible to help ensure that text is placed properly.

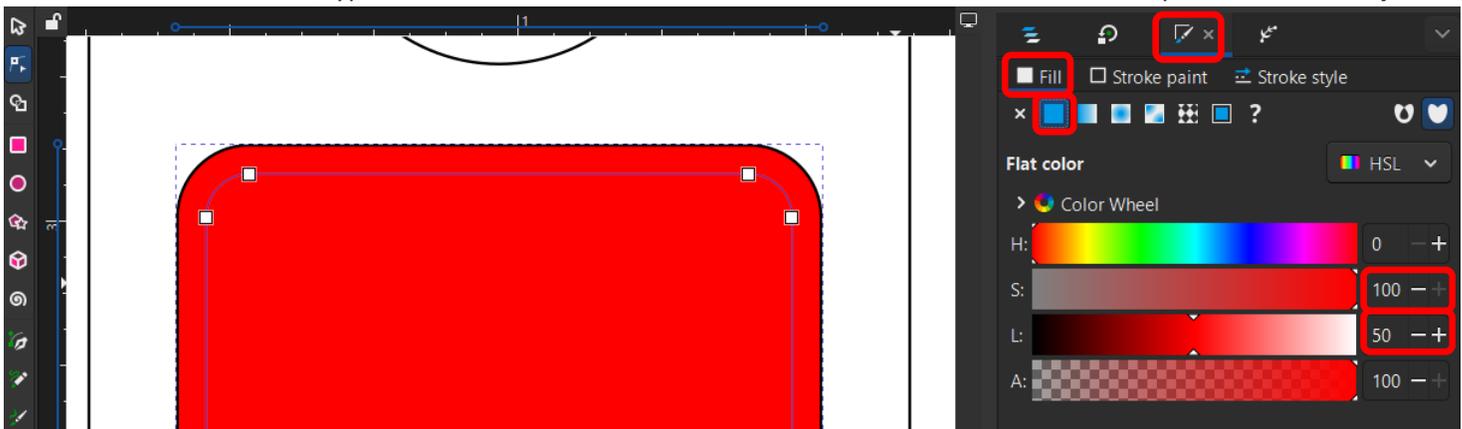


- perform an offset of **0.05** as was done previously for the two upper rectangles. If the Offset settings are not visible select the **Path Effects** tab and use the **down arrow** to select the **Offset** function.

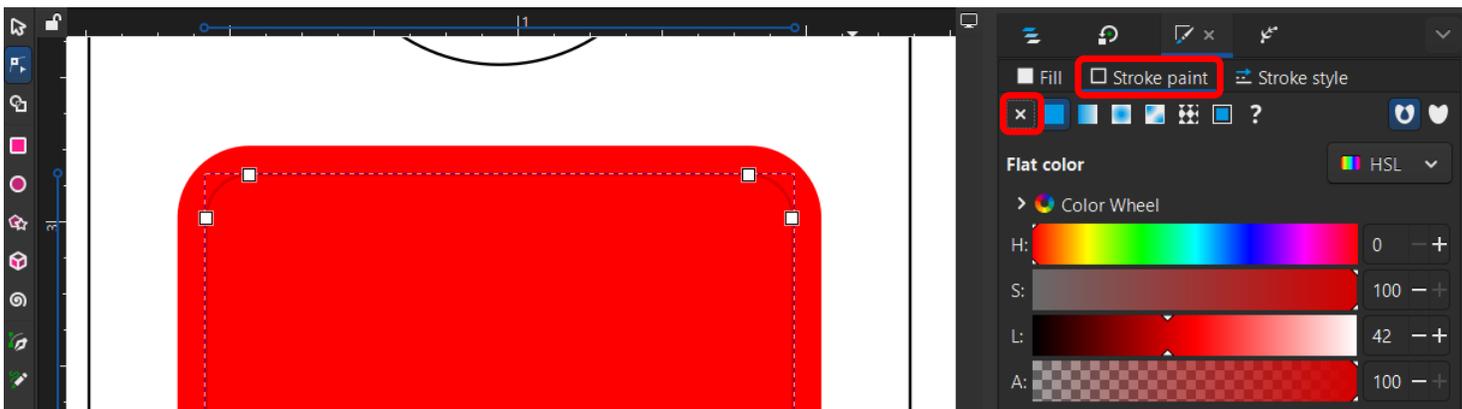


- select **Fill and Stroke** and select the **Fill** tab

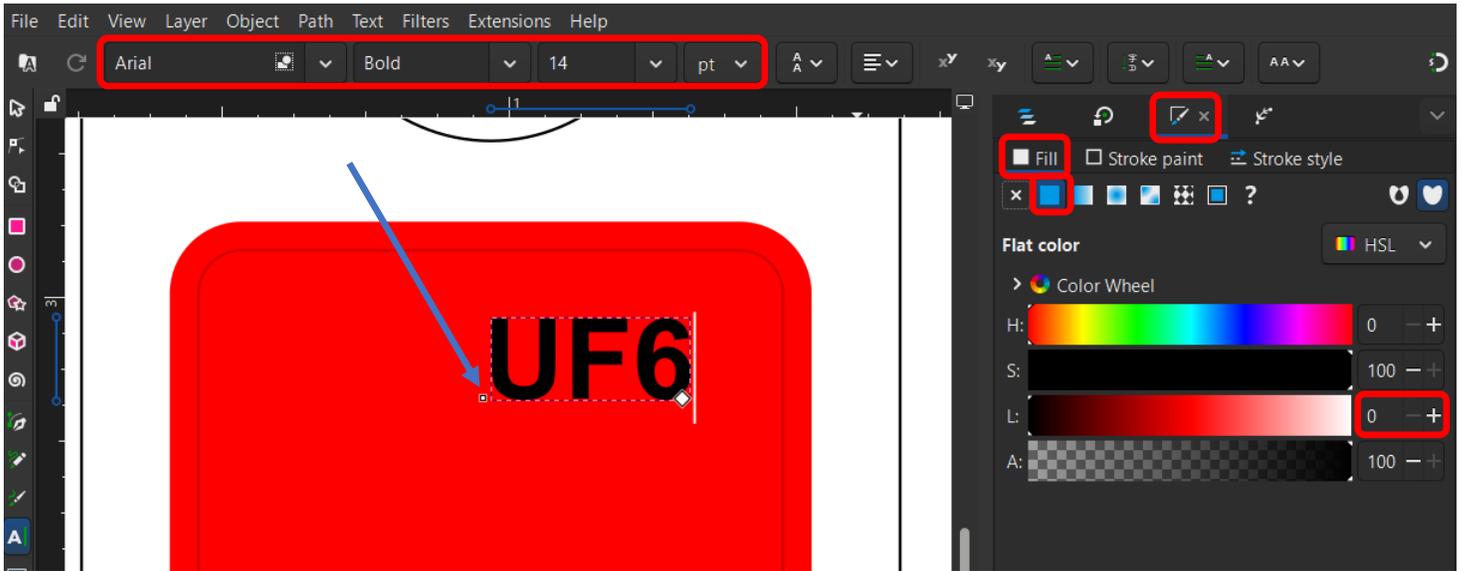
- select the **Flat color** icon, type **100** for the **Saturation** value and **50** for the **Luminance** value and press the **Enter** key



- select the **Stroke Paint** tab and click on the **x** icon to remove the outline of the red rectangle



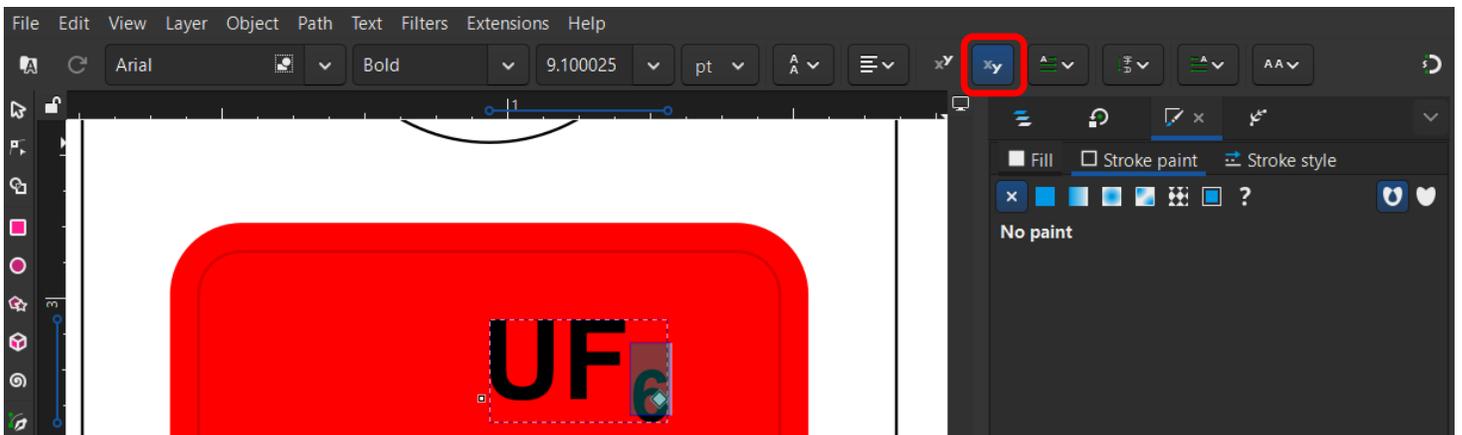
- select the **Text** tool and click on the location indicated. This does not need to be accurate. It can be repositioned later.
- type **UF6**, which may not show at first
- select **Fill and Stroke** and select the **Fill** tab
- select the **Flat color** icon, type **0** for the **Luminance** value and press the **Enter** key, which should make the text black.
- ensure that the **Font**, **Font style**, and **Size** are set as shown



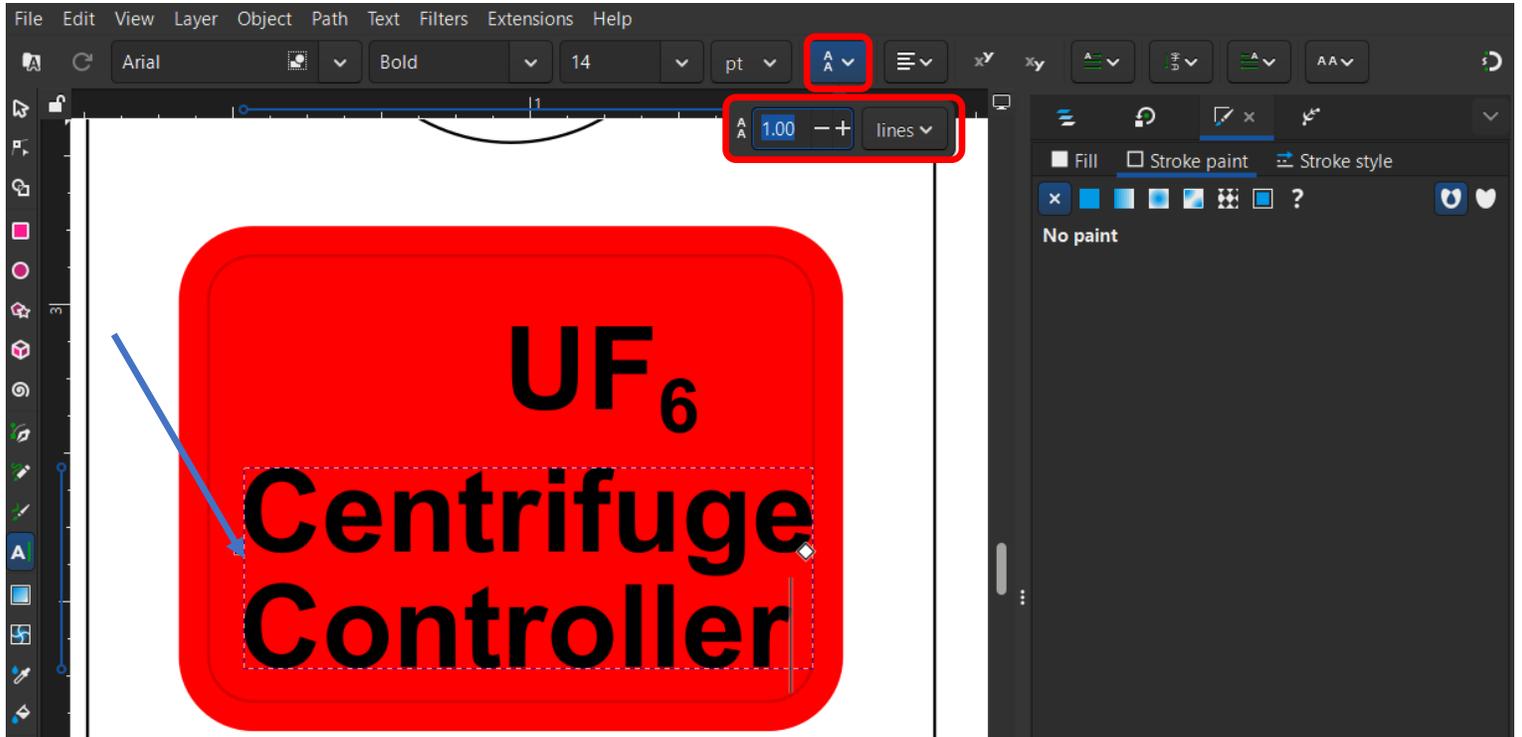
- select **Stroke paint** and select the **x** to remove any outline around the text



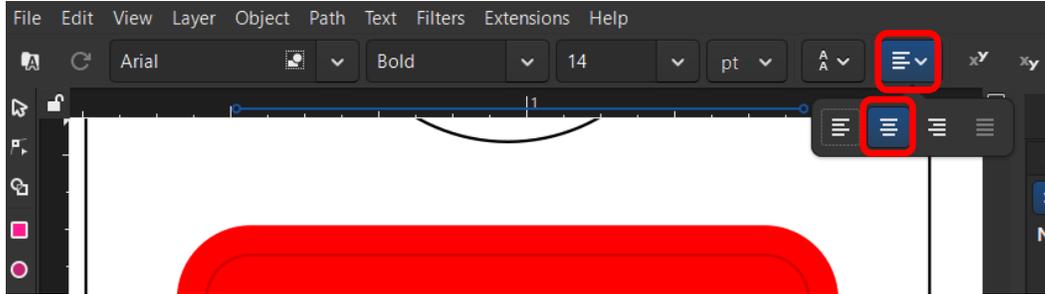
- select the **6** in the text and click on the **Subscript** button



- select the **Text** tool and click on the location indicated. This does not need to be accurate. It can be repositioned later.
- type **Centrifuge**, then press the **Enter key**, and then type **Controller**. If the text does not appear on two lines click on the **Line spacing icon** and set the value to **1.00**. This value can be changed to set the spacing between multiple lines of text.

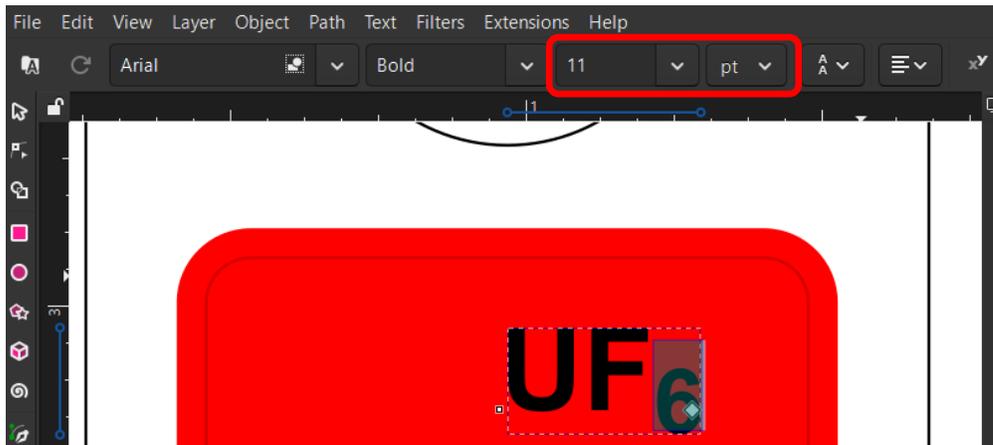


- click on the **Text alignment** icon and select the **Align center** option



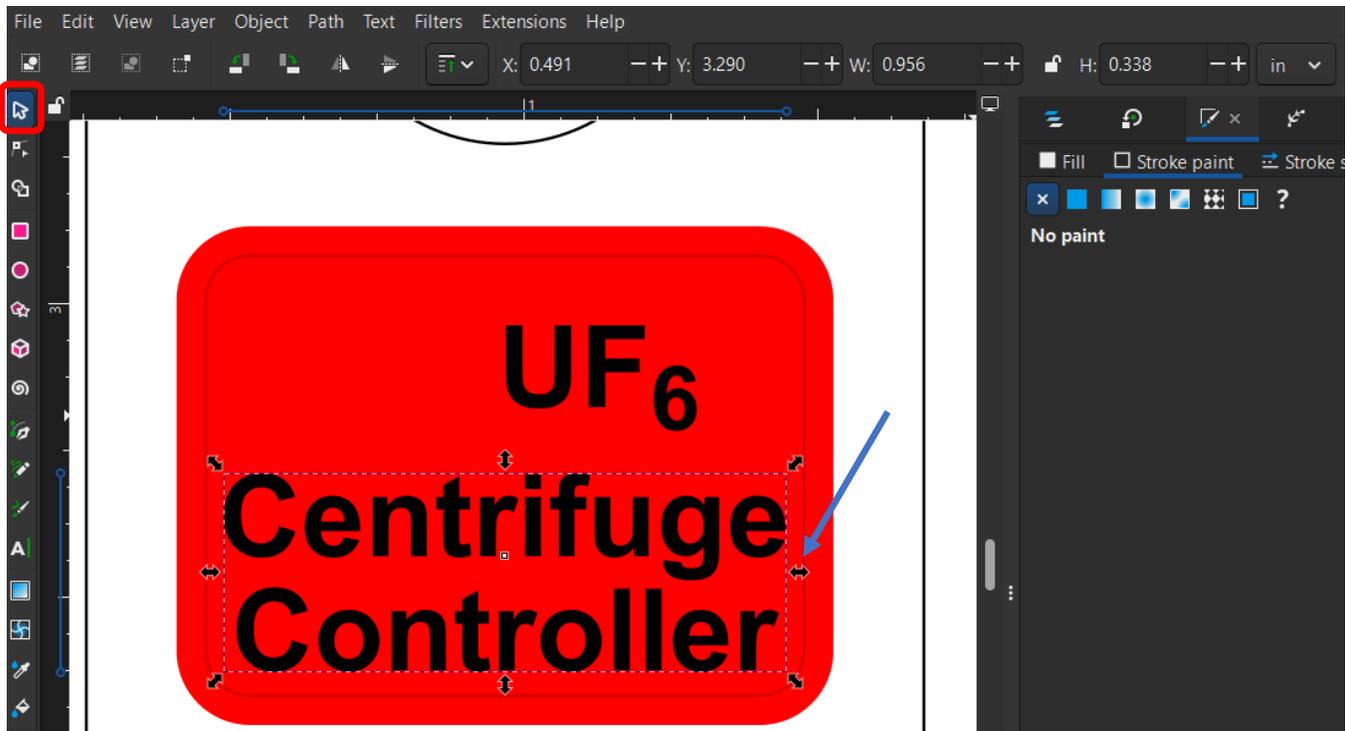
The 6 subscript looks a little wimpy.

- select the **6** and then change the size to **11**



- select the **Selector** tool
- click on the **text** and **move it so it is centered at the bottom**, as shown.
- if the text does not fit, one can **drag the handle**, indicated by the blue arrow, to the left to compress the text.

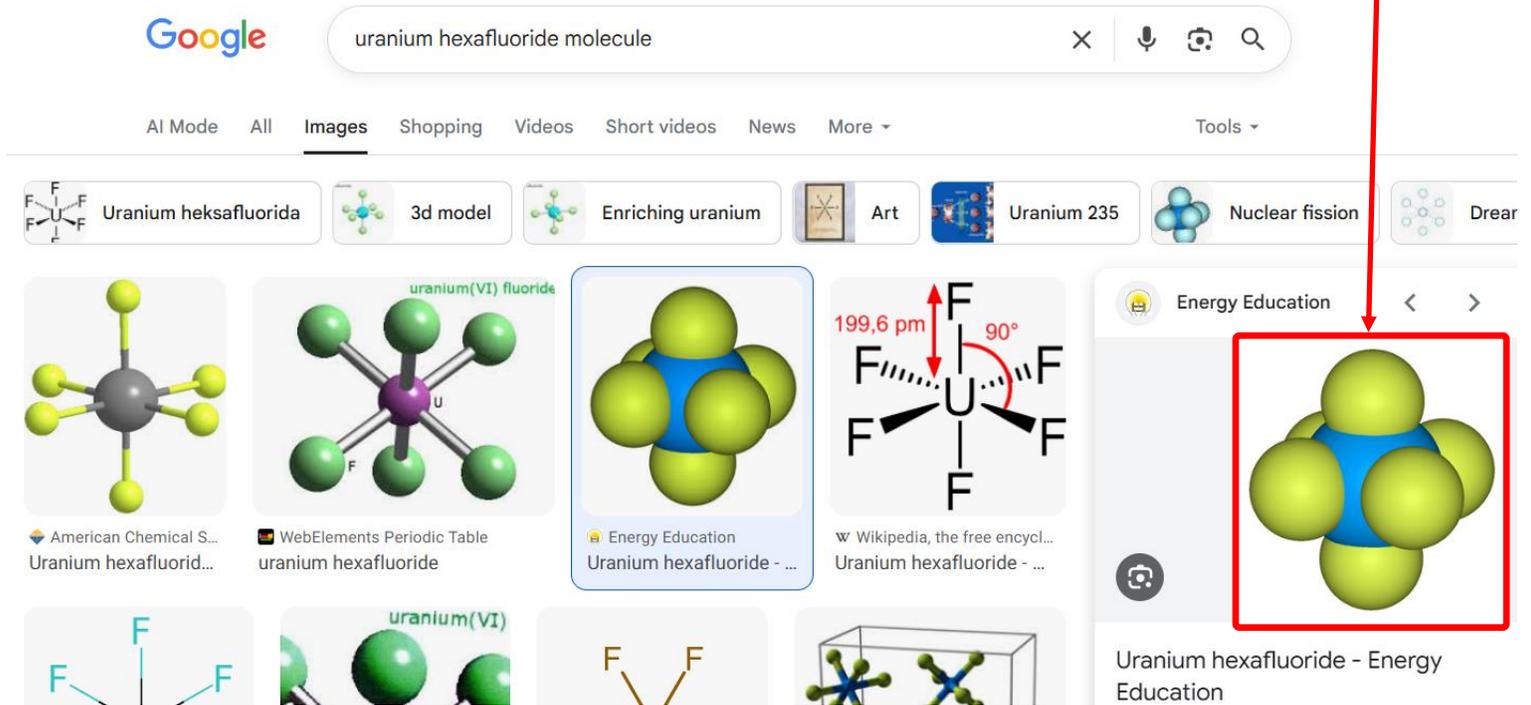
Note how there is some spacing between the edges of any letters and the inner rounded rectangle. The inner rectangle represents the window in the 3D printed frame. Because it may be difficult to perfectly align the printed label with the frame there needs to be some spacing so that no text is covered by the frame. It also doesn't look good if any text is right at the edge of the frame.



Inkscape – Adding a Graphic

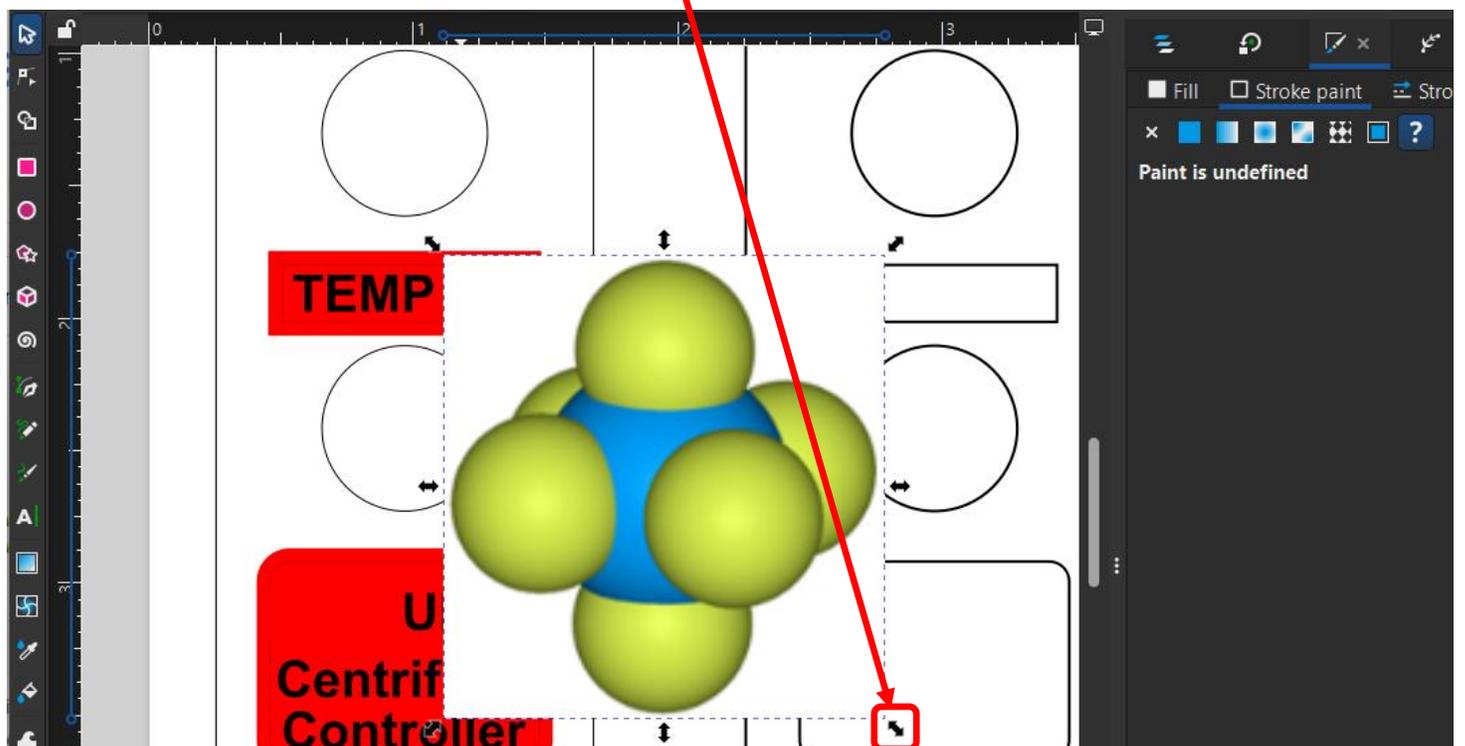
A Google Images search was performed for uranium hexafluoride molecule, as shown below.

- hold the **Shift, Windows,** and **s** keys to start a screen shot and drag the selection rectangle around the **larger molecule image** on this page. You don't have to perform the search in Google. This should copy the image to the clipboard.

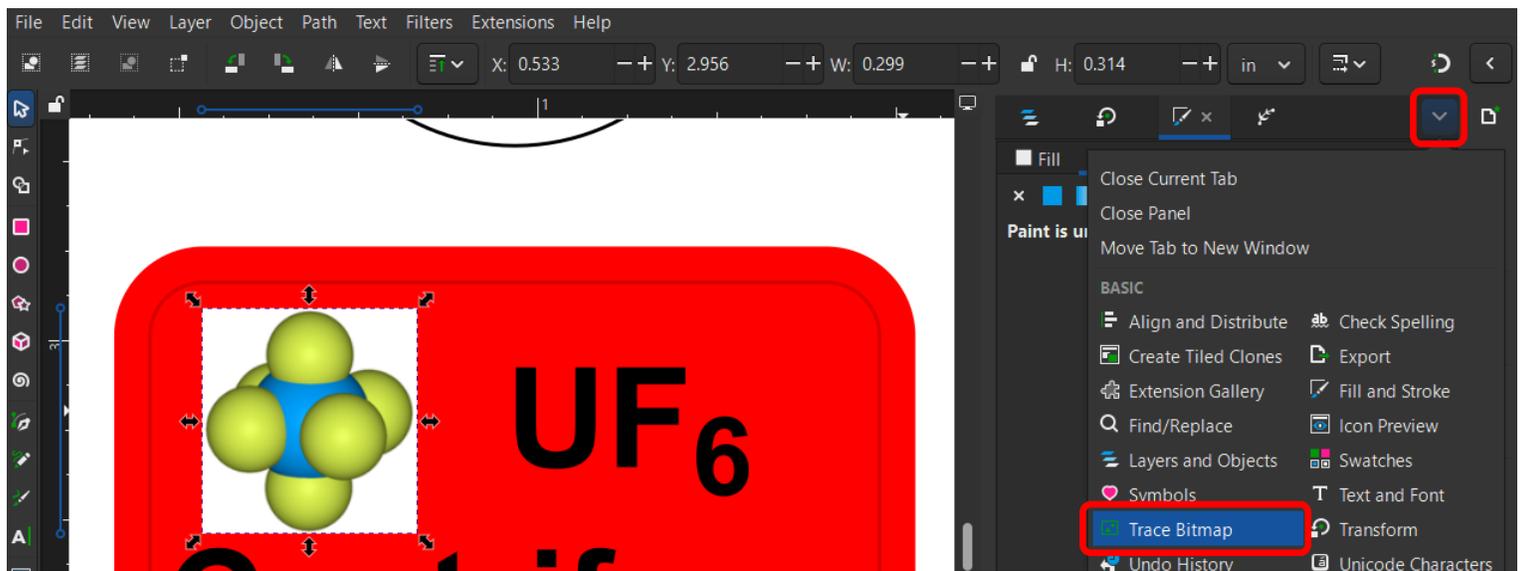


- zoom out using the mousewheel and press the **Ctrl and v** keys (Ctrl+v) to paste the image on the Inkscape canvas.
- hold the **Ctrl** key while dragging the **bottom right resize arrow** to resize the image to fit on the label.

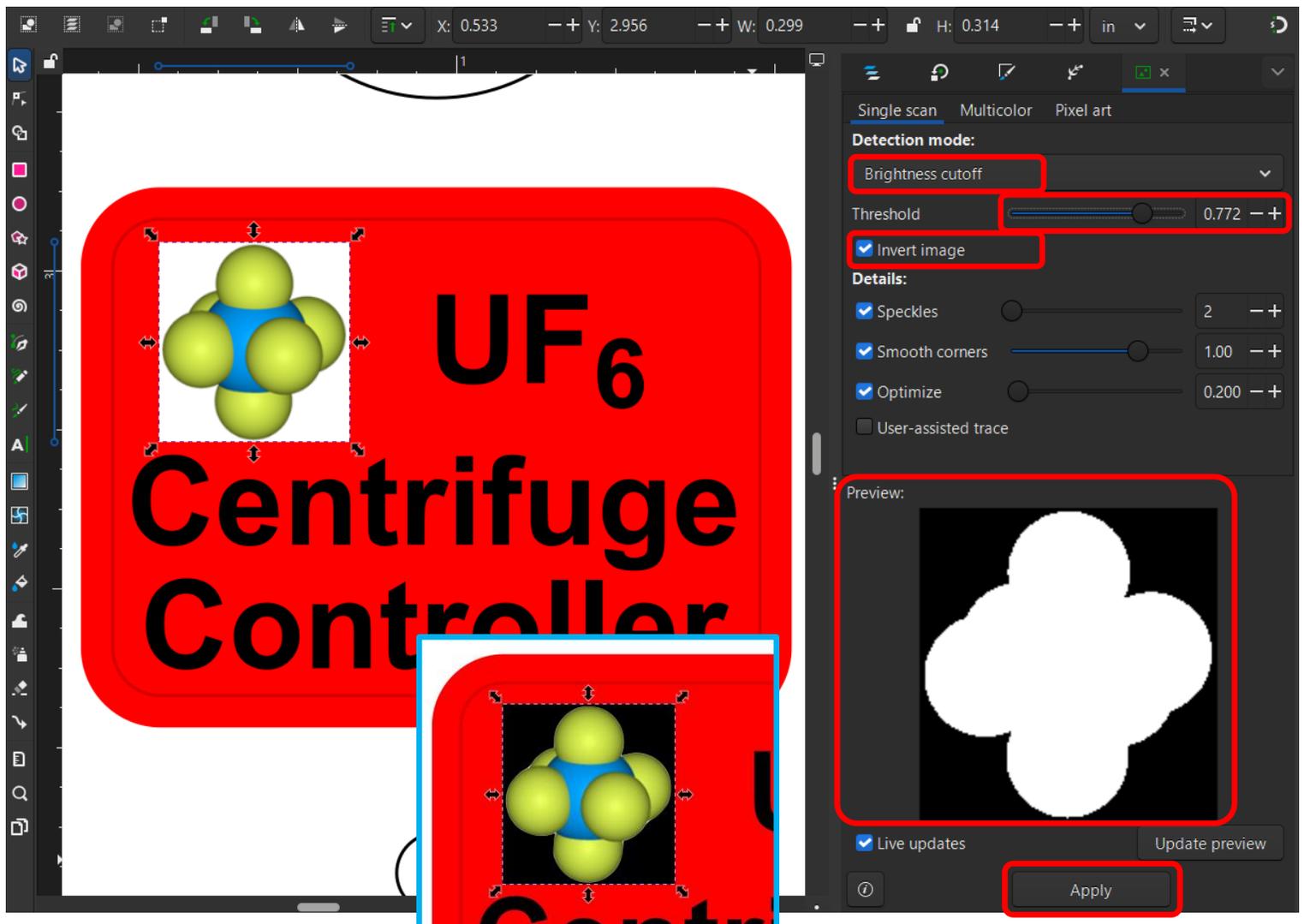
Note that depending on the zoom value when viewing this document or the source of the image, it may be larger or smaller than shown. The next steps will demonstrate scaling of the image. If one wishes to use an image file, select Import... from the File menu.



- zoom in to the label and resize again if needed and move the image as shown
- click on the arrow to reveal the tool list and select **Trace Bitmap**



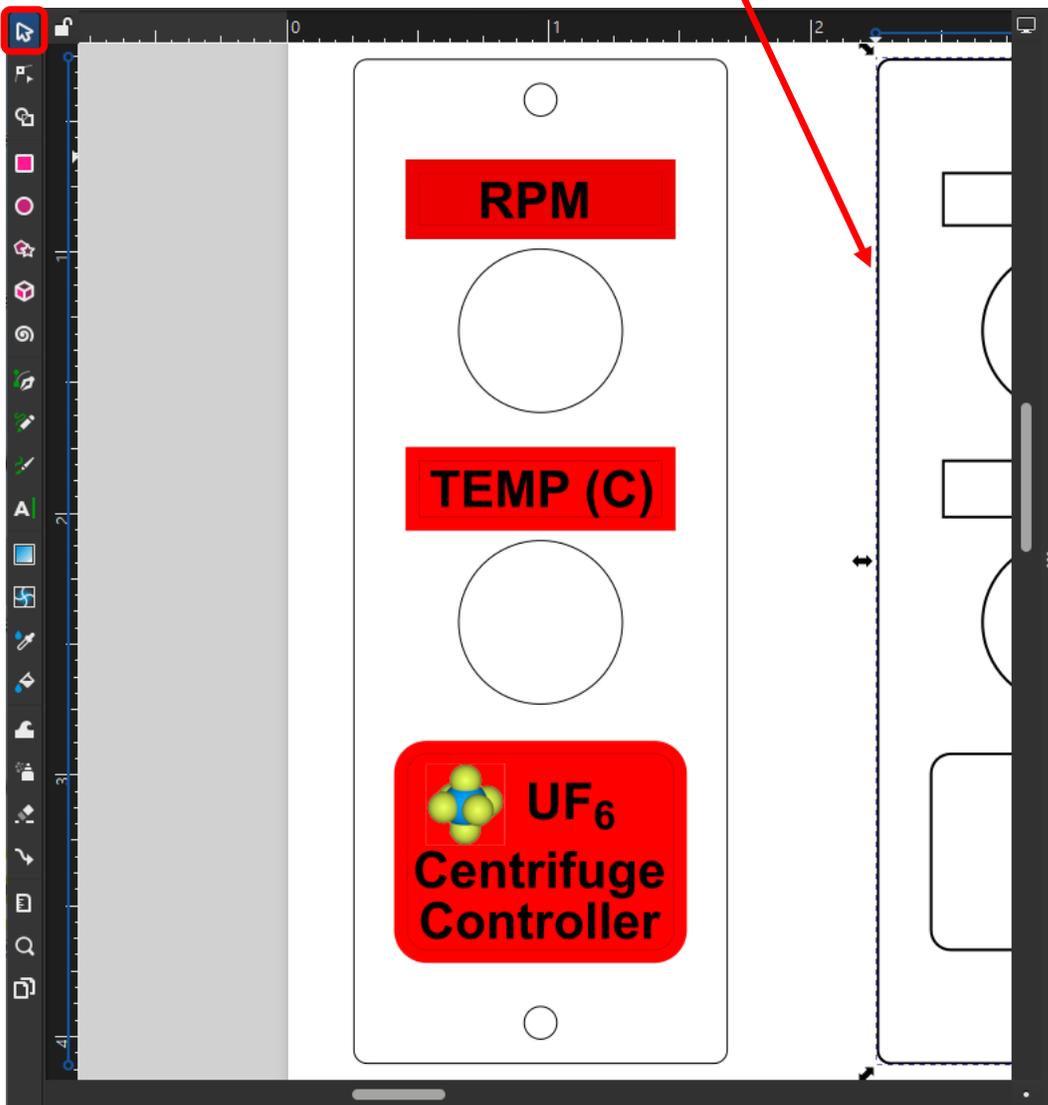
- ensure the **image is selected** and that **Brightness cutoff** is selected and **Invert image** is checked
- increase the **Threshold** value until the Previews shows the **area of the image as fully white** and the **surrounding area as black**.
- click the **Apply** button, which should cause the region around the image to turn black, as shown in the lower insert image.



- select **Fill and Stroke** and select the **Fill** tab
- select the **Flat color** icon, change the **Saturation** value to **100** and the Luminance value to **50**, which should cause the area around the graphic to match the surrounding color.

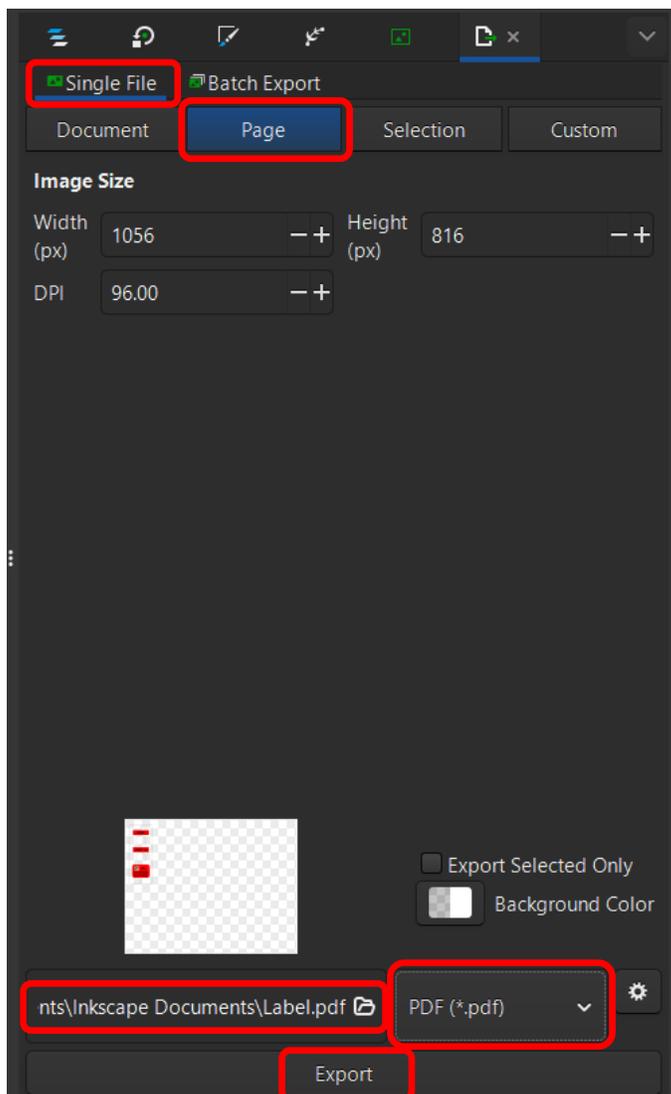
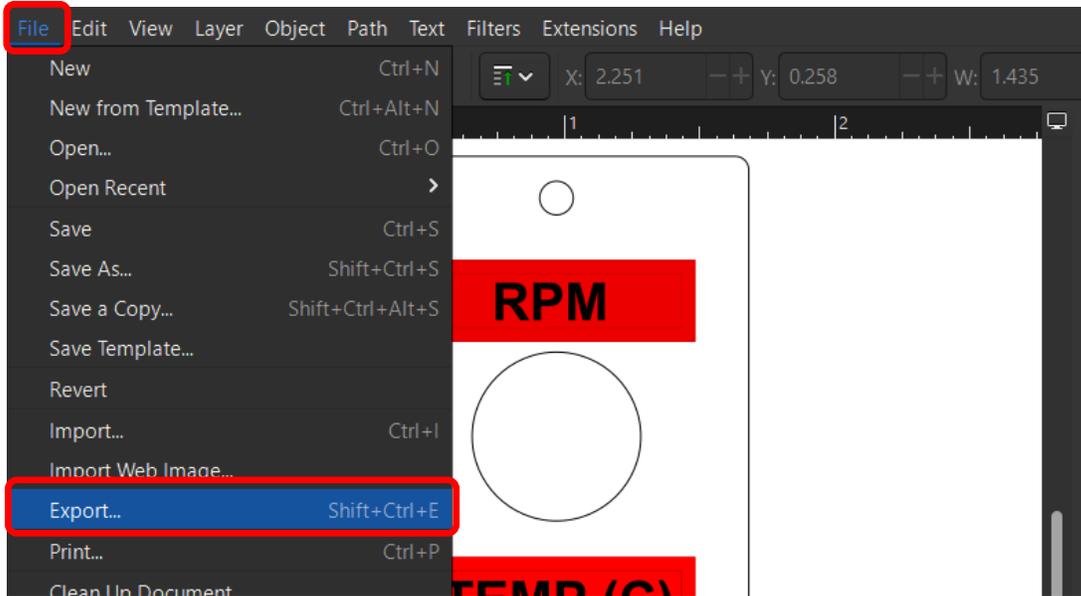


- zoom out, admire your creation, and save your project using **Save** from the **File** menu
- the copy on the right can remain, but it desired it can be selected and deleted



- from the **File** menu select **Export...**

Note that there is a Print... item below Export, but it has been found that printing from Inkscape has some bugs where images may be cropped.



The right side of the Inkscape screen will show the Export options.

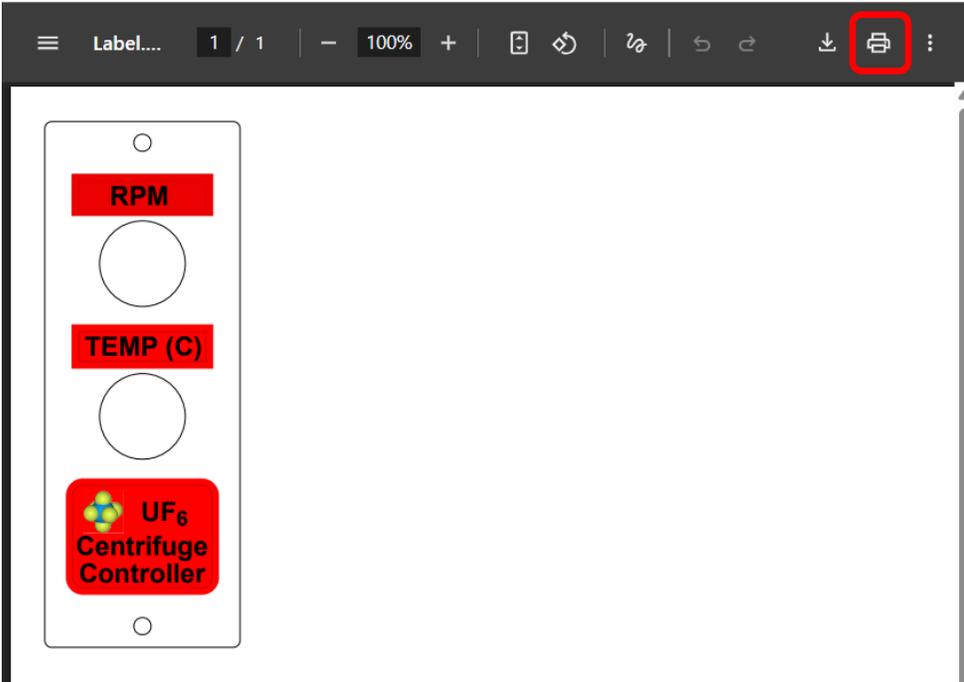
- ensure that the **Single File** tab is selected and the **Page** option is selected.
- near the bottom change the output type to **PDF (*.pdf)**
- the bottom Path box should show the folder the PDF file will be saved in. If desired, click on its **folder** icon to change the file location.
- click **Export** at the bottom

If this is being done as a class assignment you are done. You will be submitting the PDF just created and a screenshot of the Inkscape screen.

If this is for a project, continue with this document.

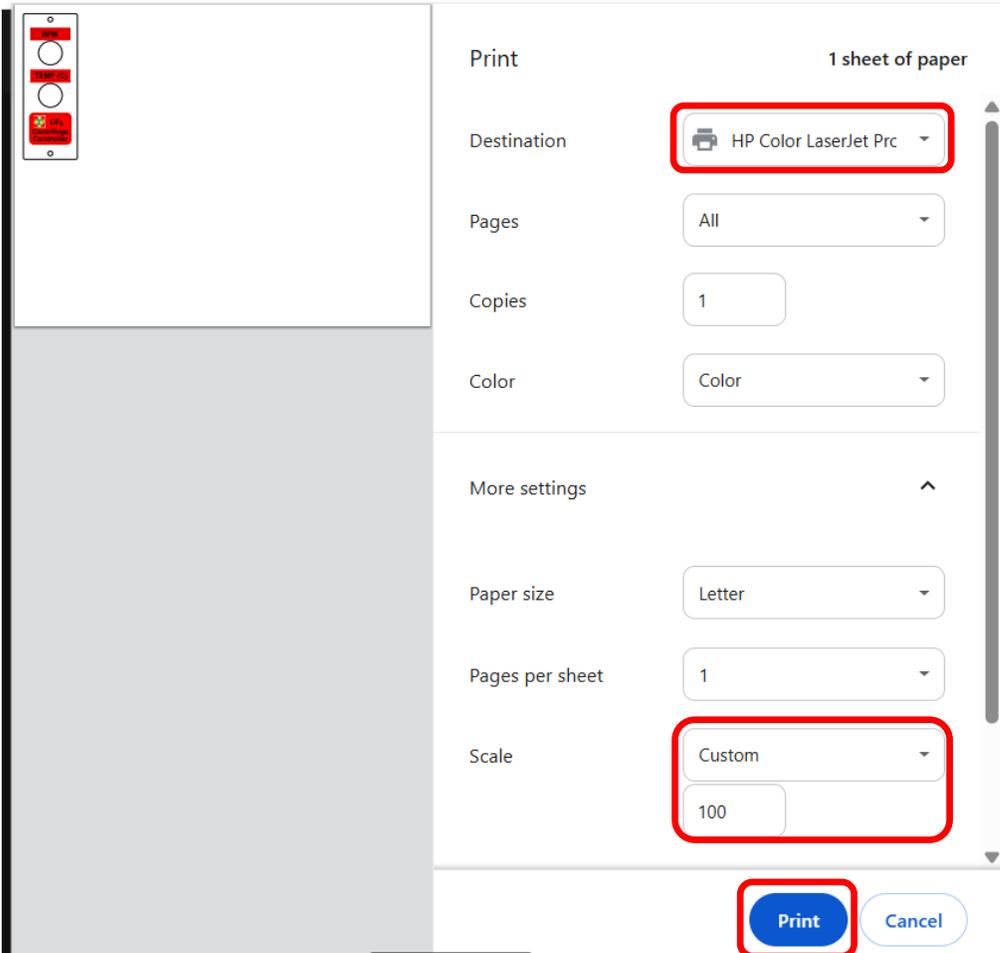
Inkscape – Printing the Label

- open the PDF file in Chrome, as shown below, and click on the Printer icon



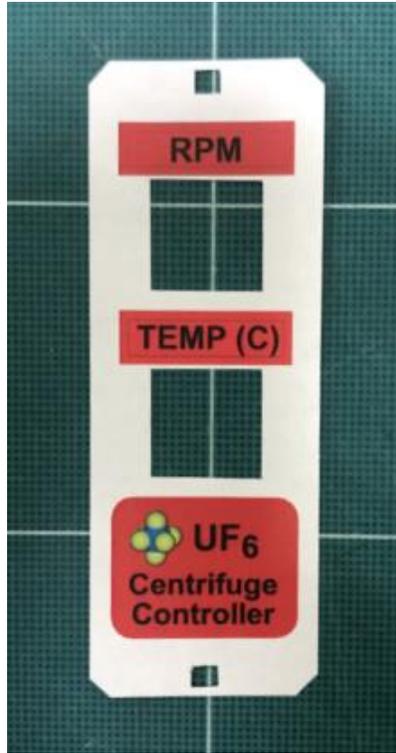
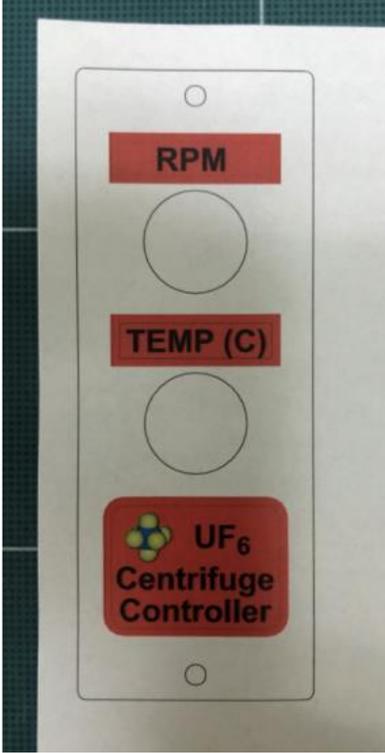
- select the **Destination** (Printer)

- change the **Scale** to **Custom** and **100** and click the **Print** button



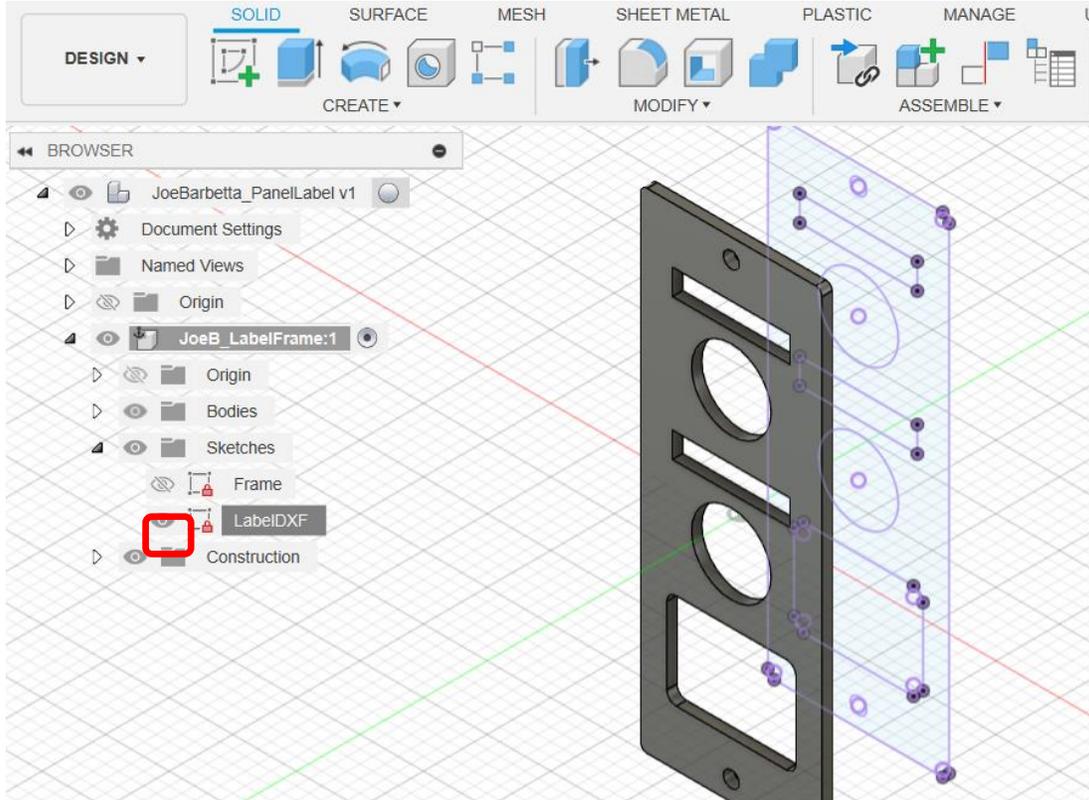
Cutting Out the Label

- if desired, spray both sides of the label with an acrylic clear spray or apply clear tape over the label
- using an X-Acto knife (remember Do Not Run with an X-Acto knife) and a proper cutting surface, cut around any knob or switch holes and hole locations.
- continue cutting the outline, just slightly inside the outer reactangle.
- the label can then be secured behind the 3D printed frame

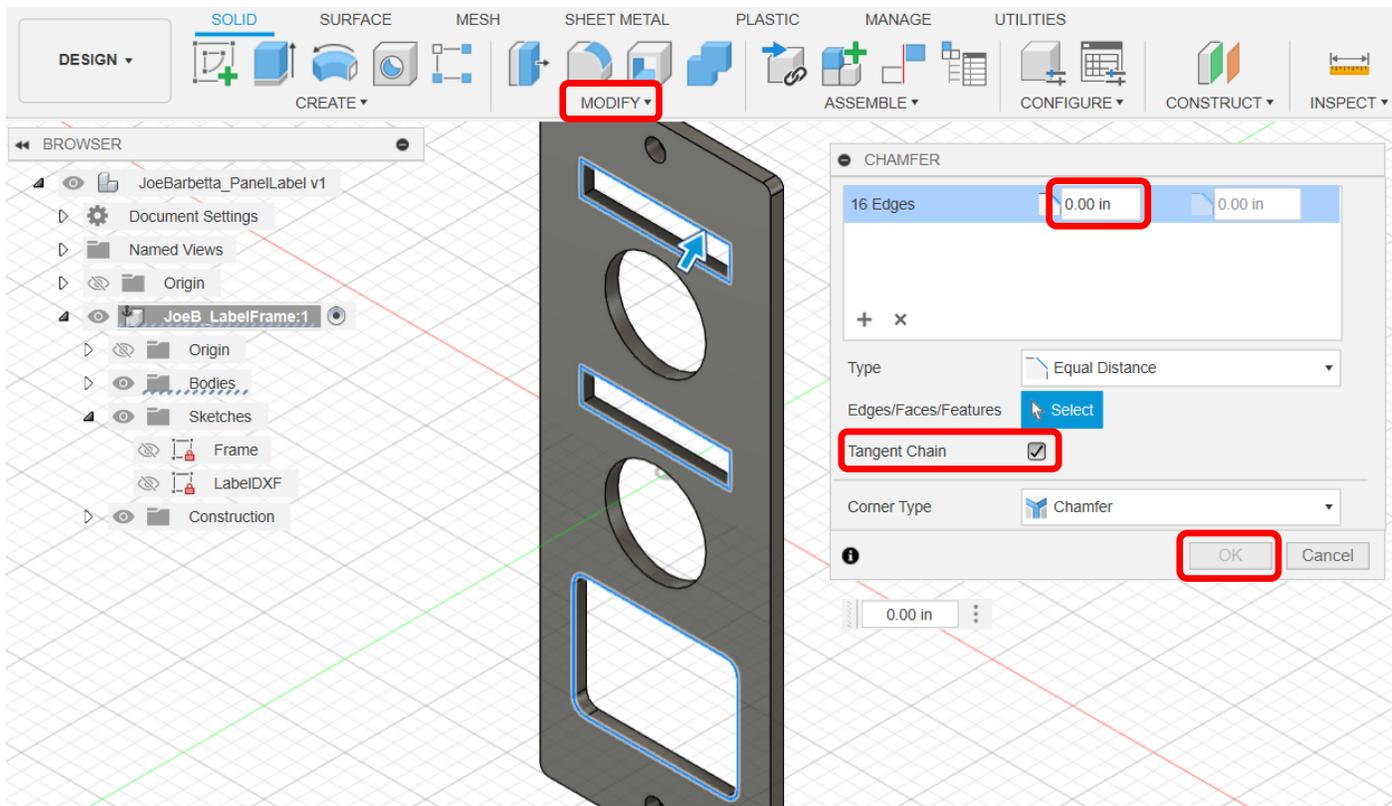


Fusion – Completing the Frame

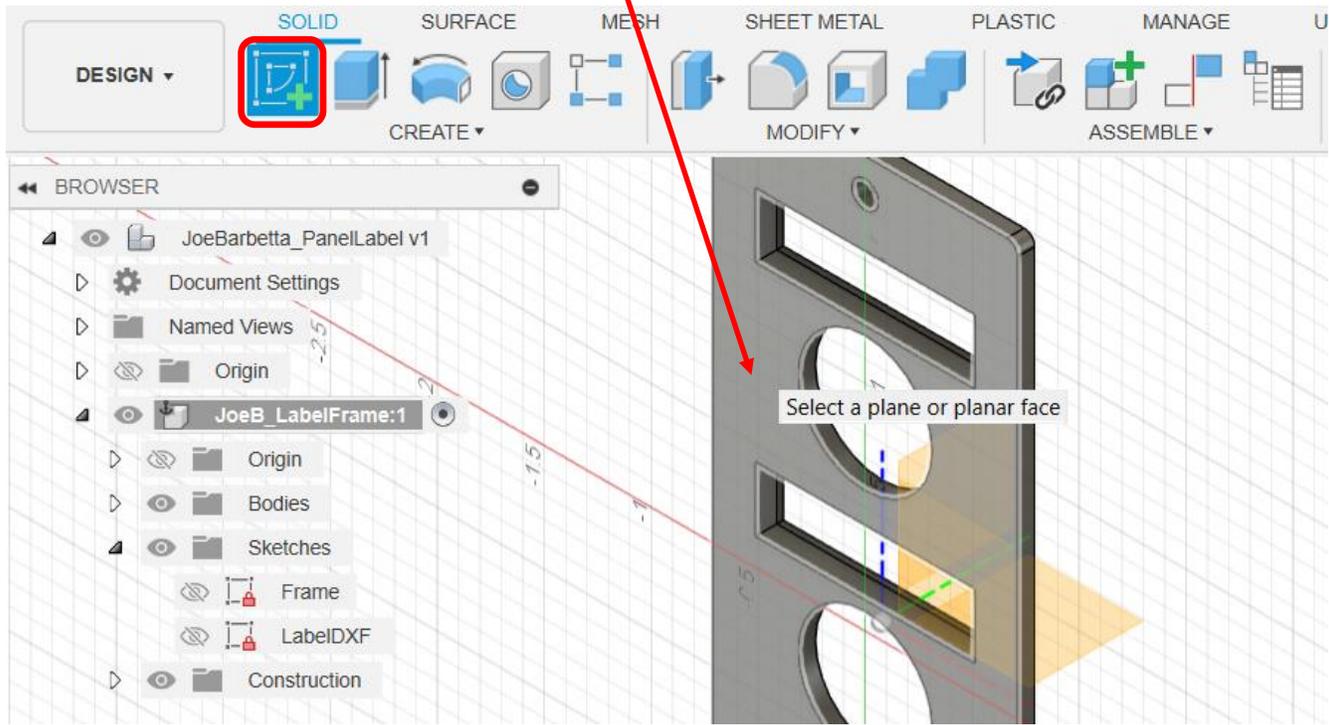
- use the **Home** icon at the **View Cube** to achieve the below view
- click on the **eye** icon for **LabelDXF** to hide the Sketch



- from the **MODIFY** menu select **Chamfer** and ensure that **Tangent Chain** is checked
- click on each of the front edges of each top rectangle to turn them blue
- click on an edge of the bottom rounded rectangle, which should turn all its edges blue
- set the chamfer value to **0.05** and click **OK**



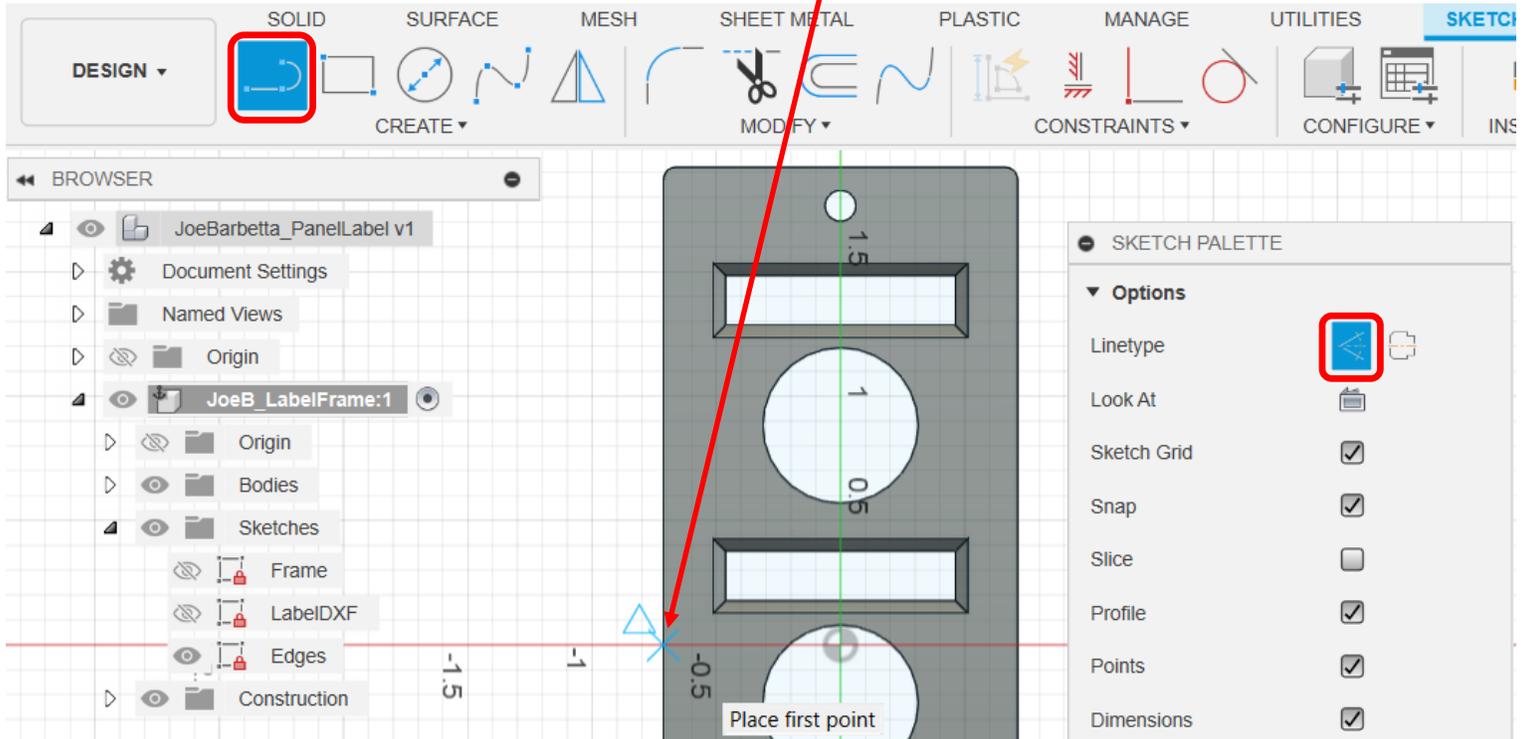
- select the **Create Sketch** tool and click on the **front face** of the frame



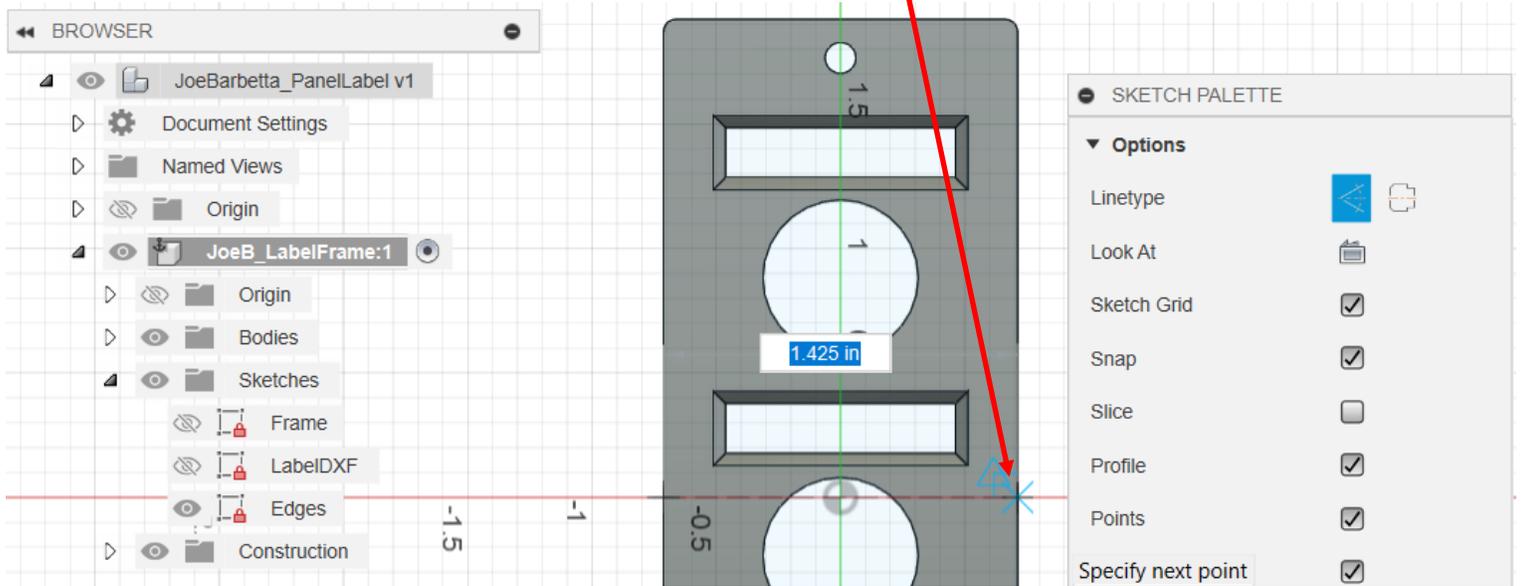
- zoom to a view similar to that below and rename the Sketch to **Edges**

- select the **Line** tool and click on the Linetype **Construction** icon to highlight it blue

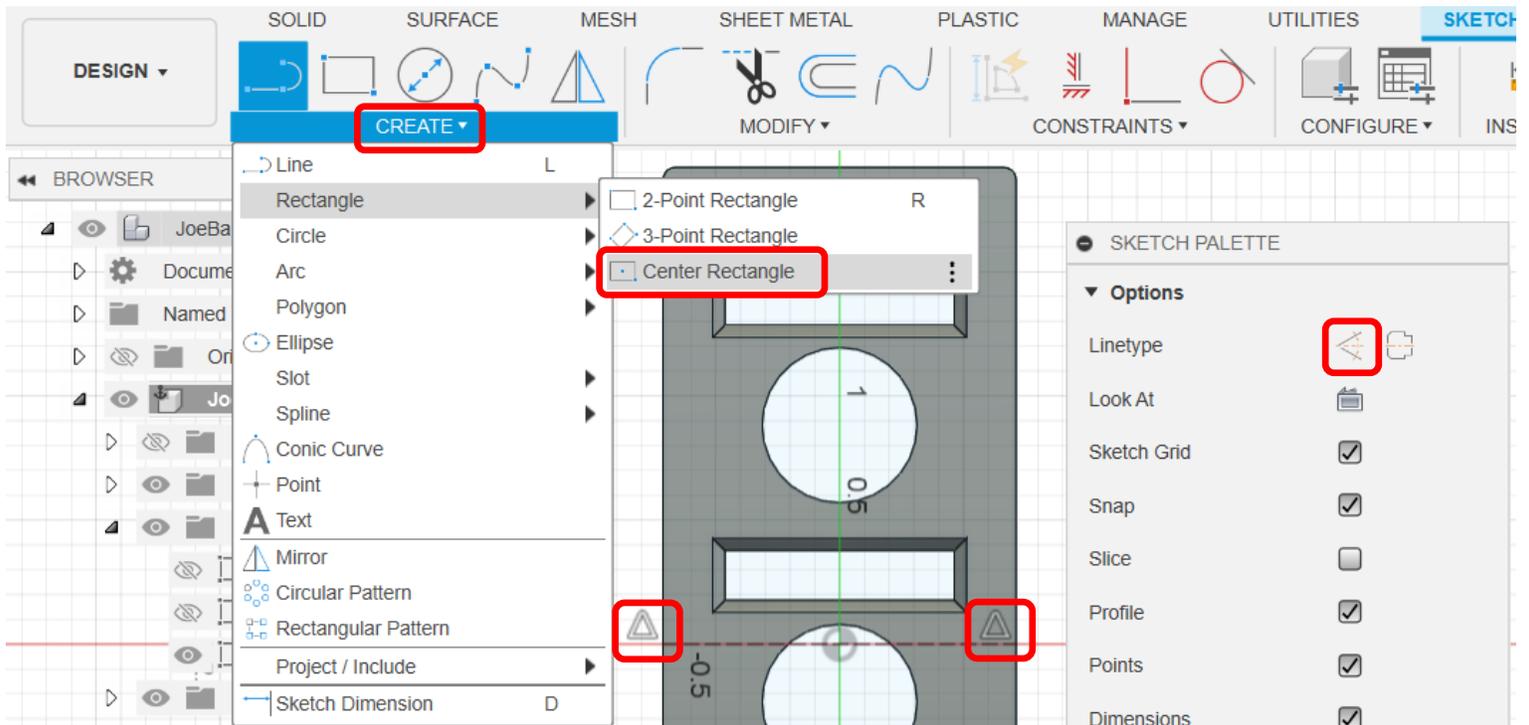
- move the mouse along the left edge of the frame until the **blue triangle** appears and then click at that point to start the line. The blue triangle indicates that the mouse is at the center of an edge. For this example it should be on the axis line, but for future designs it may not be.



- extend the line to the right and when the other edge is reached an x should appear
- click on that point to finish the line



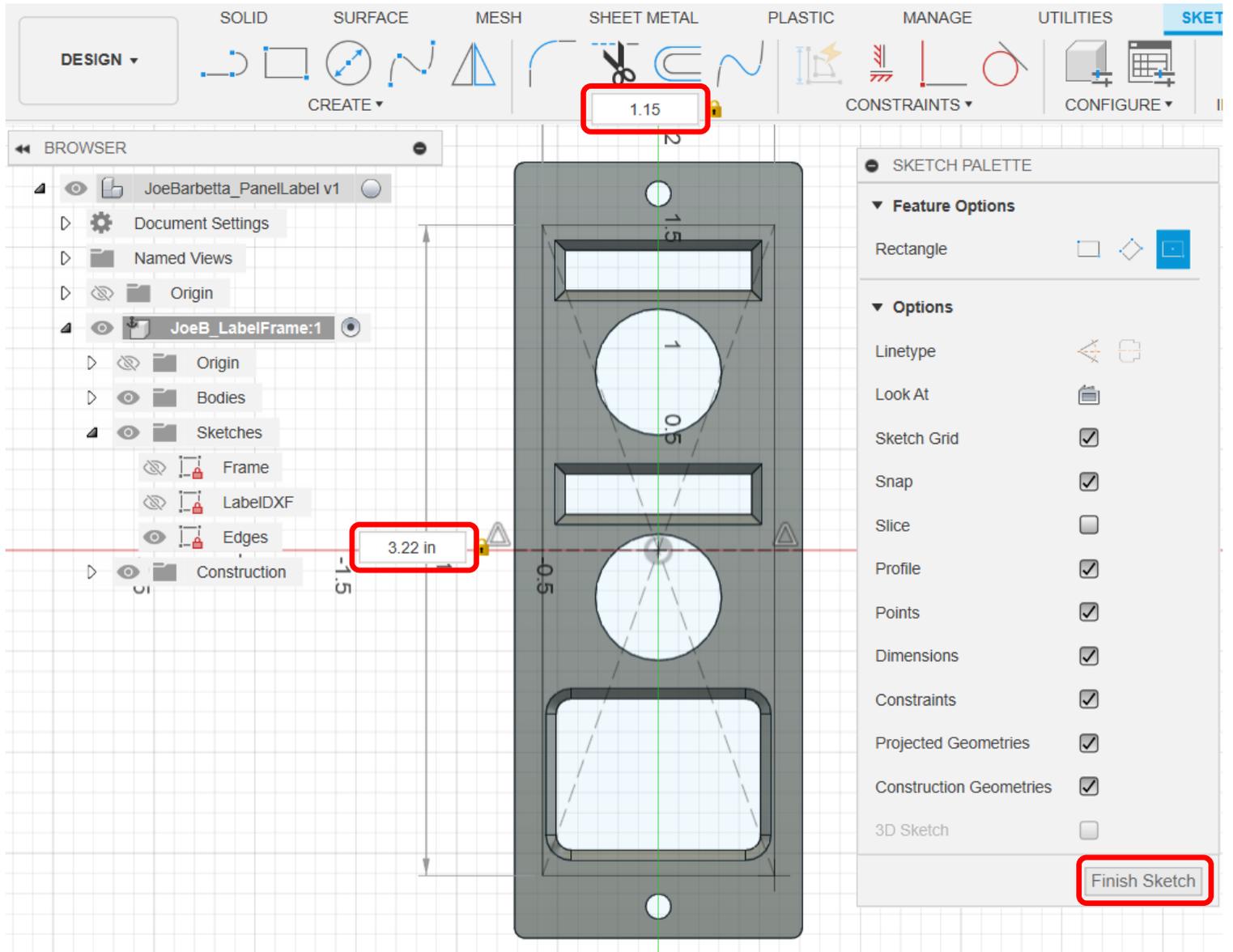
- note that there is a **triangle near each end of the line** to indicate that it starts and ends at center points
- click on the Linetype **Construction** icon to turn off the blue highlighting
- from the **CREATE** menu select **Center Rectangle**



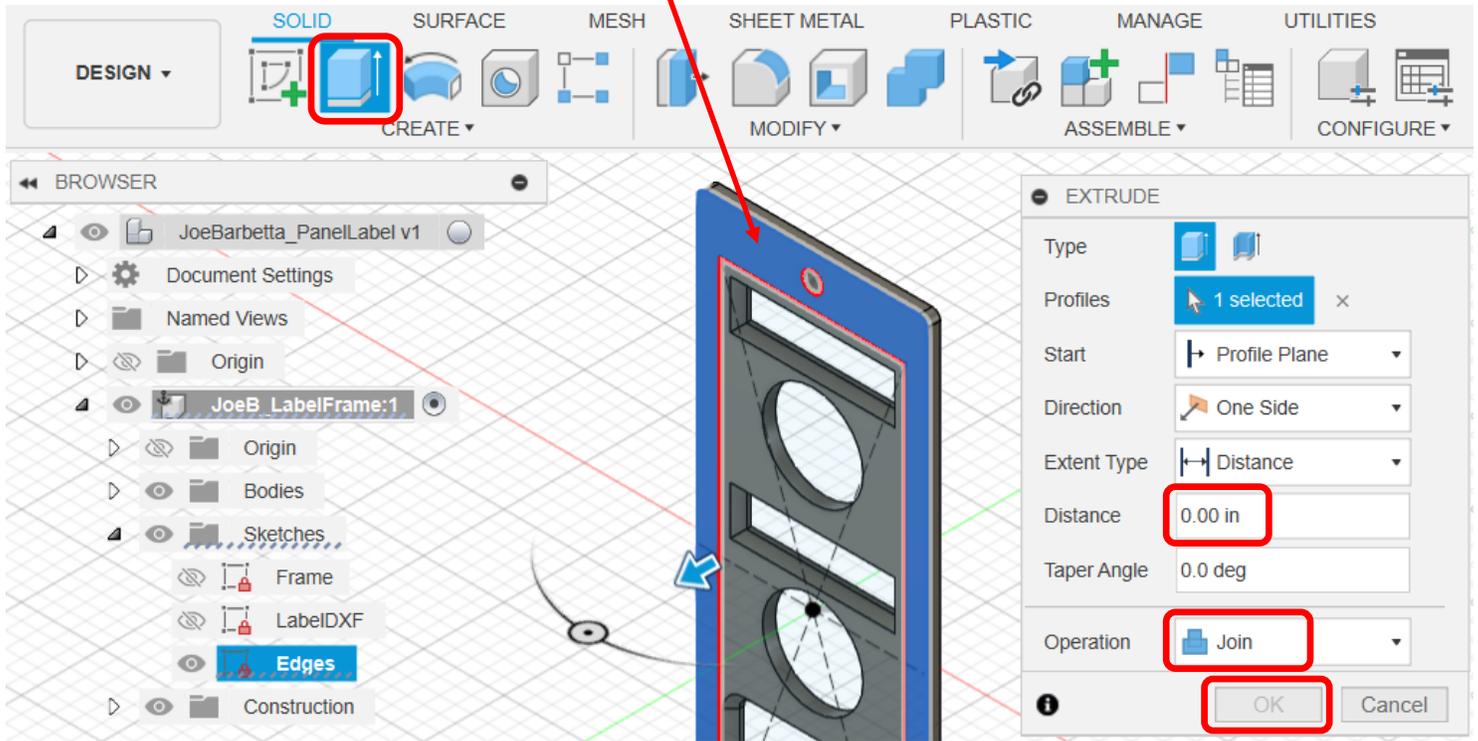
- click at the **center of the construction line** that was just created and **extend the rectangle downward**
- type **3.22** for the height, press the **Tab key**, type **1.15** for the width, and press the **Enter key**
- click **Finish Sketch**

The width was chosen to make the region around this rectangle as large as possible without intersecting any holes or chamfers around holes. Note how there is still a small amount of space, which happens to be 0.018" here, between the chamfer of the large bottom rectangular hole and this rectangle.

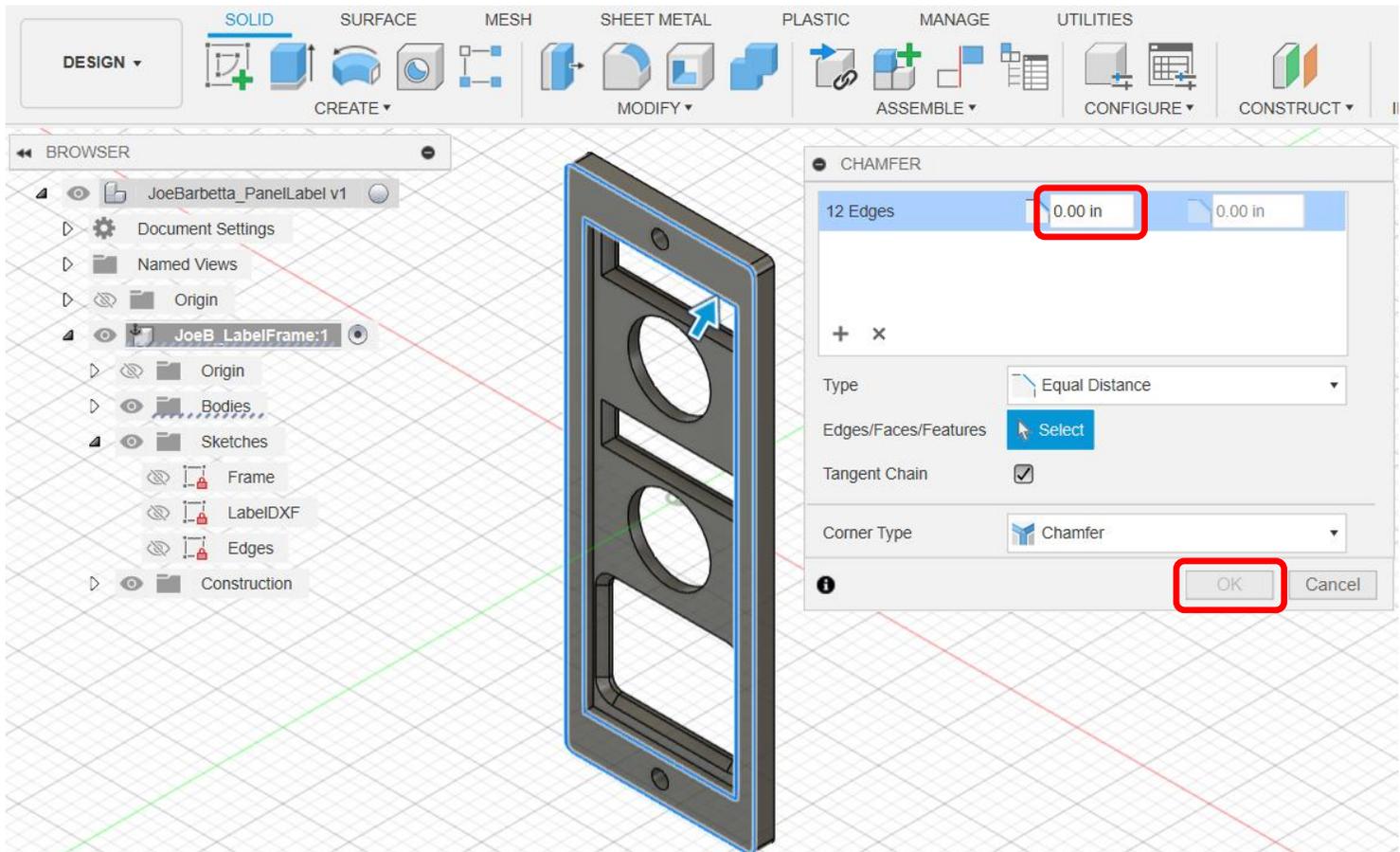
The height was chosen to ensure the top and bottom small mounting holes are between the rectangle and the top or bottom edges of the frame.



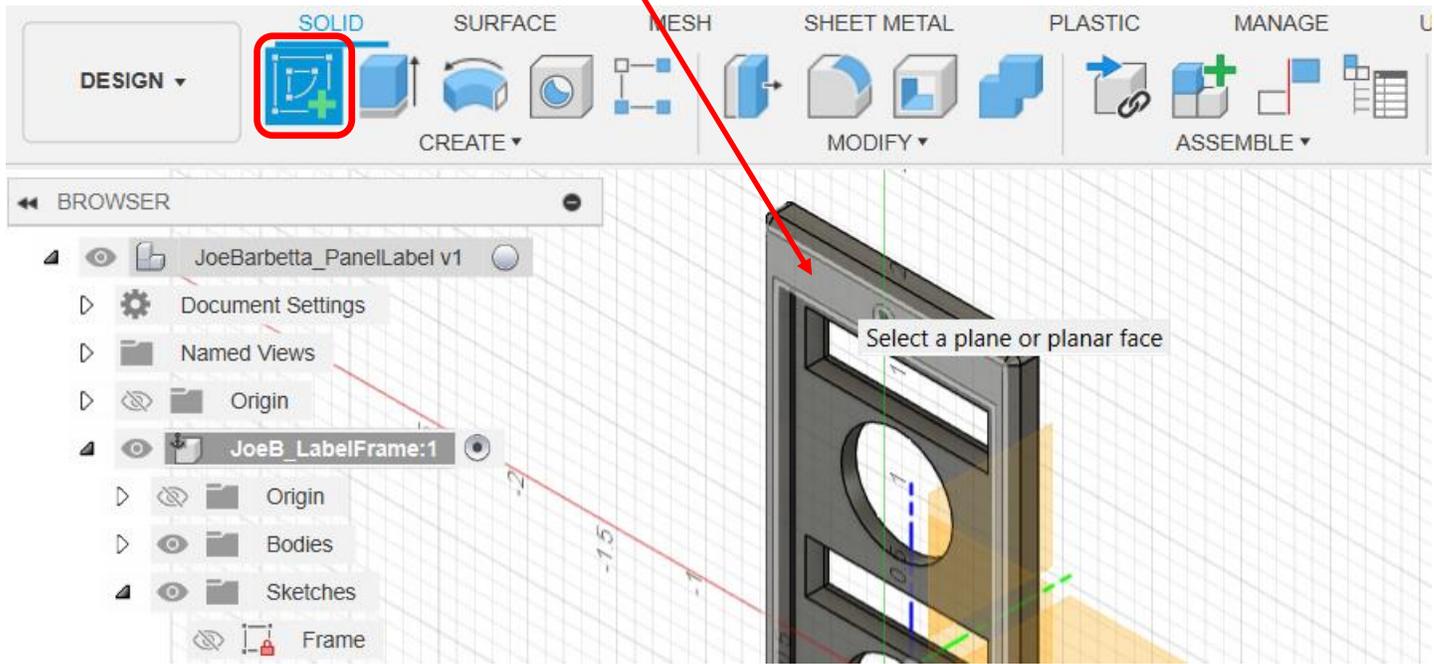
- click on the **Home** icon at the **View Cube**
- select the **Extrude** tool and click on the **region between the rectangle just created and the outer edge**
- ensure that the **Operation** is set to **Join**
- enter **0.07** for distance and click **OK**



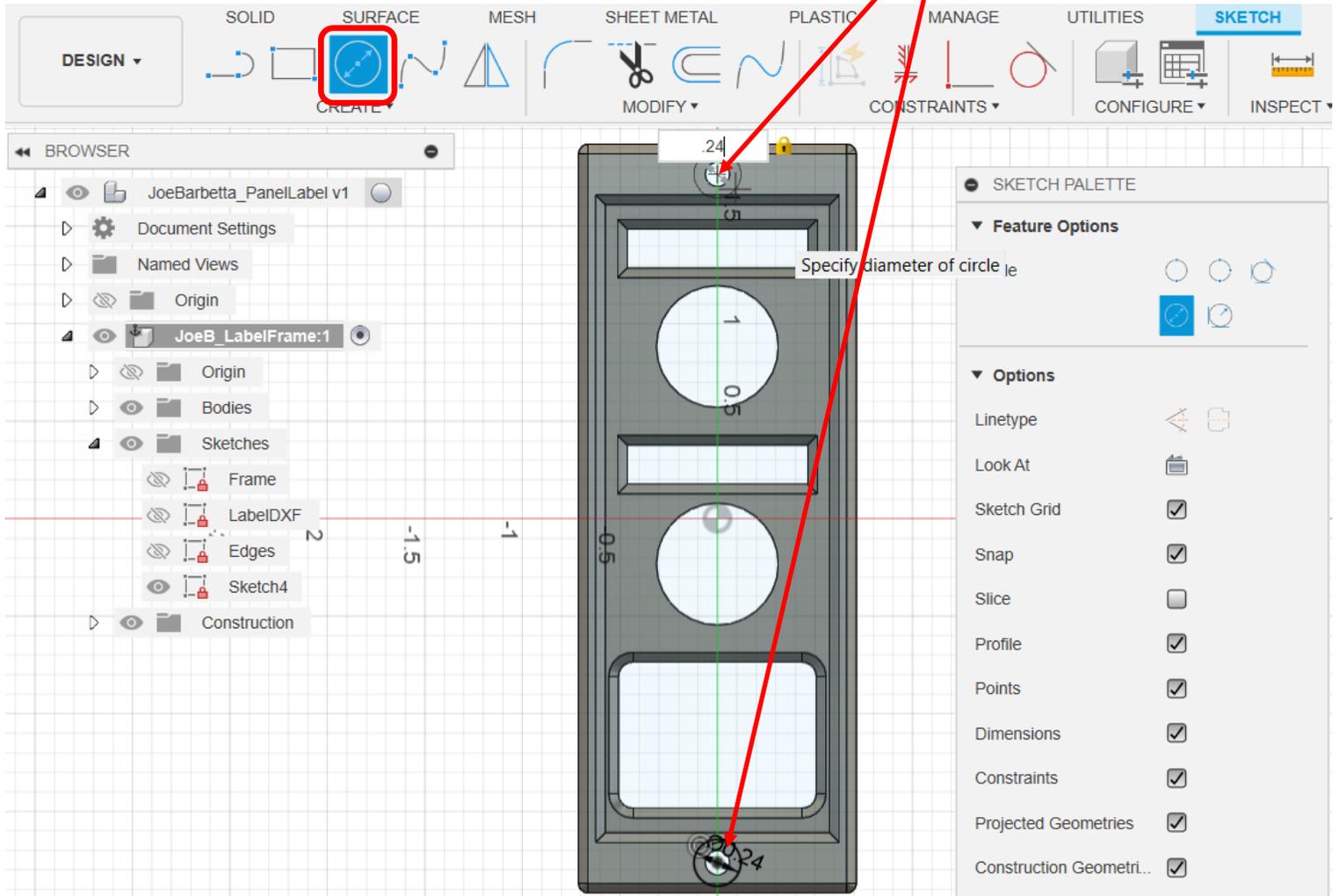
- from the **MODIFY** menu select **Chamfer** and select the **edges of the inner edges of the extruded section and the outer edges**
- enter a value of **0.05**



- select the **Create Sketch** tool and click on the **top surface** of the extruded section

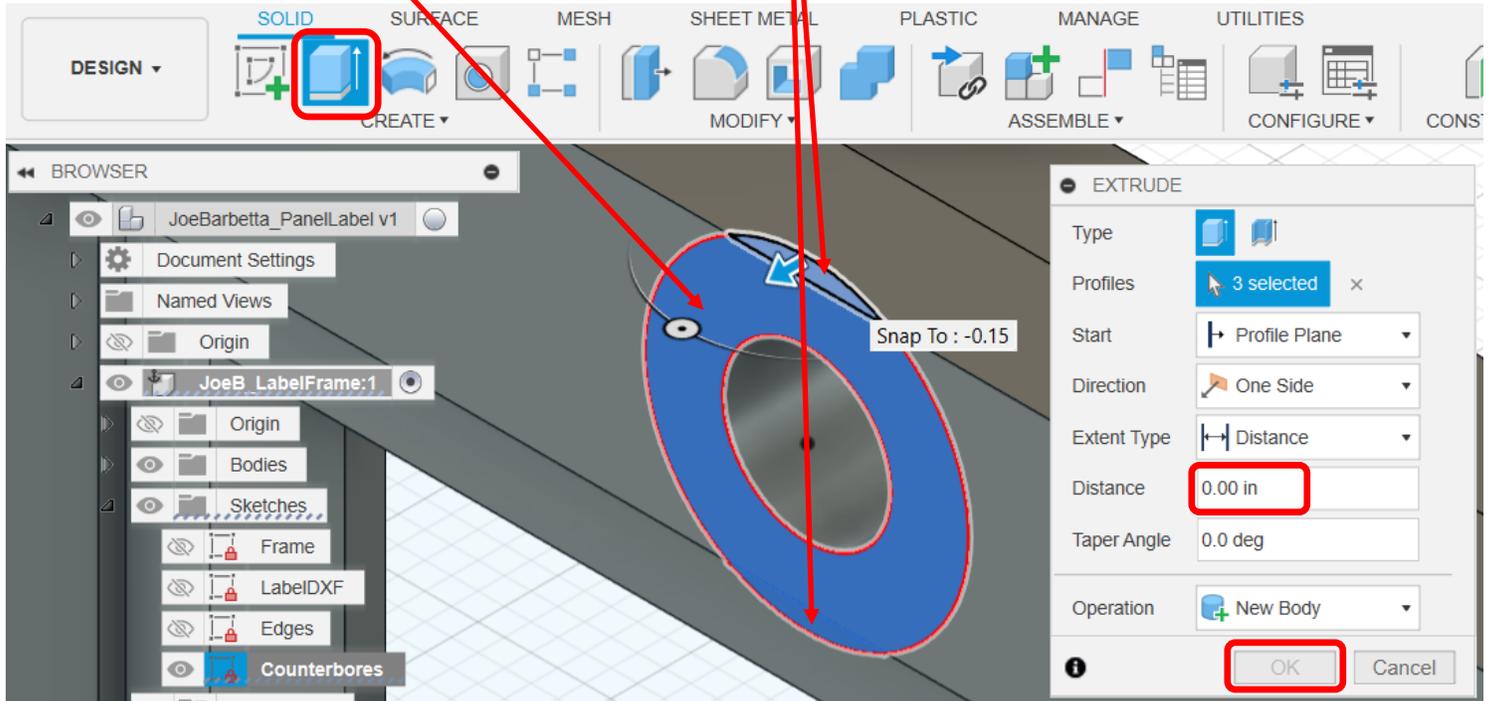


- select the **Center Diameter Circle** tool and add a **0.24** diameter circle around the **top and bottom holes**
The mouse should “snap” to the center of the holes before clicking on the center point.
- rename this Sketch to **Counterbores** and click **Finish Sketch**

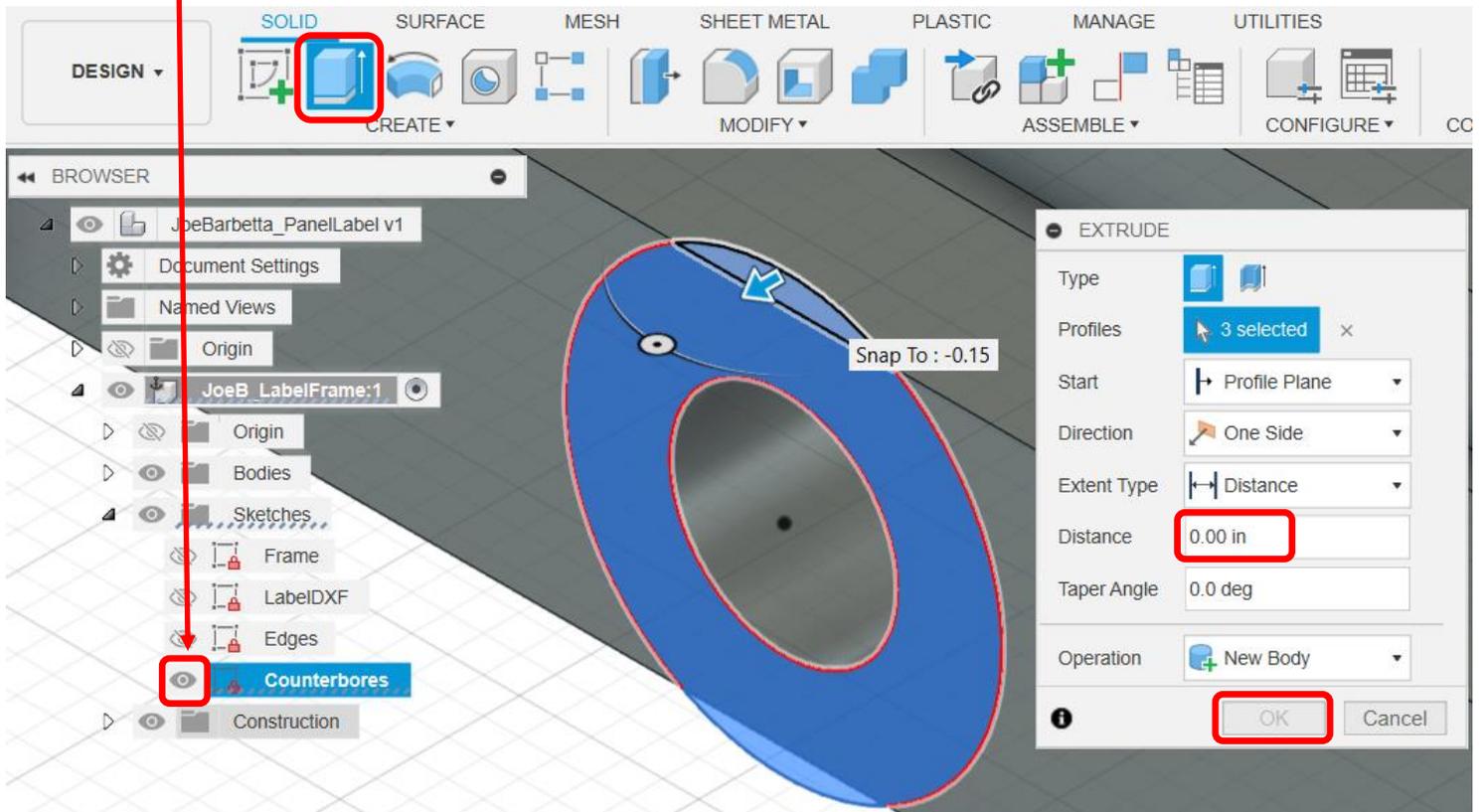


- zoom in to the **top hole** and select the **Extrude** tool
- click on the **region around the hole** and the **small bottom and top sections** to have a **complete blue ring**
- enter a **-0.05** (note the minus sign) for **Distance** and click **OK**

This creates a counterbore for the mounting screw. It looks much better to have the screw head recessed as opposed to resting right on the outermost surface.



- zoom in to the bottom hole
- click on the **eye icon** for the **Counterbores** Sketch to make it visible again
- perform the **same Extrude operation as the top hole** and then **click on the eye icon again** to hide the Sketch

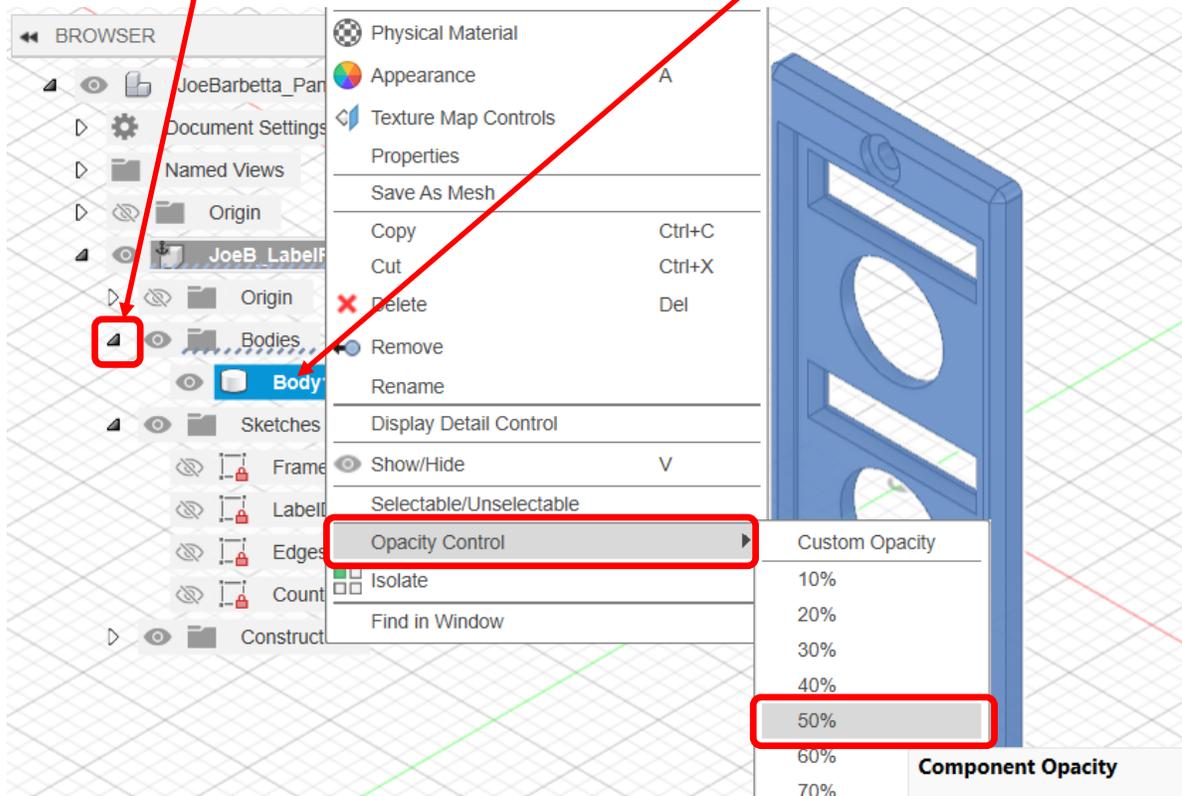


Fusion – Adding Rebar

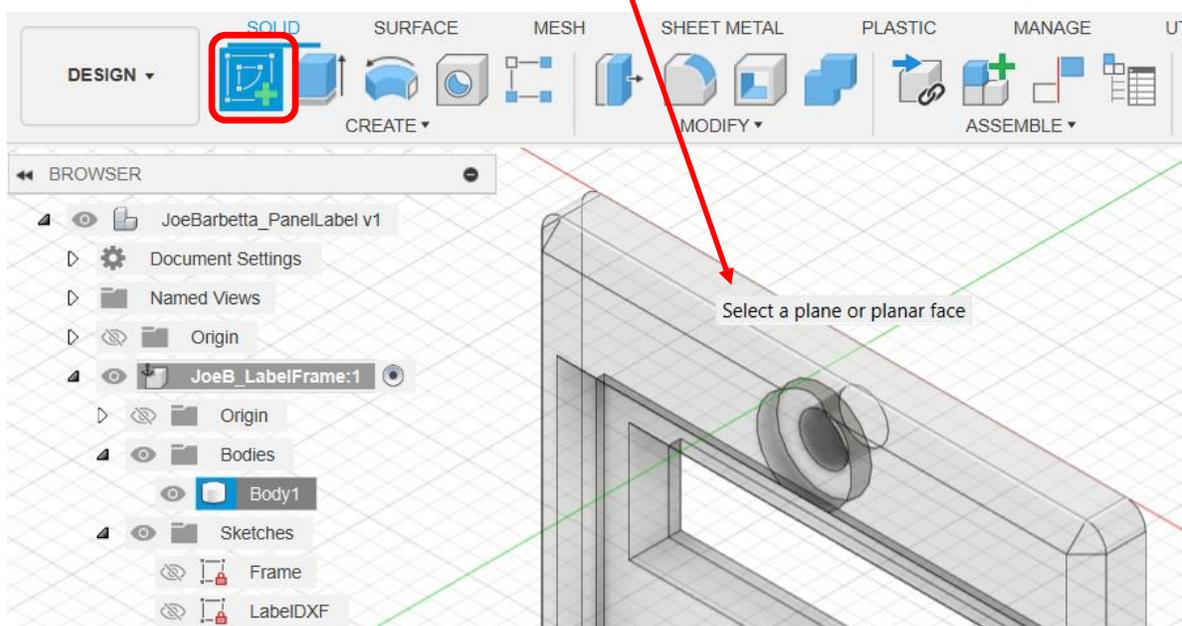
Rebar is short for **Reinforcing Bar** and consists of steel bars that are embedded in concrete to add strength. Here we are using the term loosely to refer to steel rods that can be embedded in a 3D printed part to add rigidity and encourage any desired curvature of the part. We can thus create a slight bend in the part to ensure that the center of the frame produces some force against the panel. This will help secure the label and prevent the center of the frame from bowing out from the panel surface.

This is just a suggested technique for a long frame supported by screws at the frame ends. A different frame may have center screws, that would not need any rebar. The rebar will consist of **0.062"** diameter **steel** or **stainless steel** rod from **McMaster-Carr** that will be inserted into the channels in the frame.

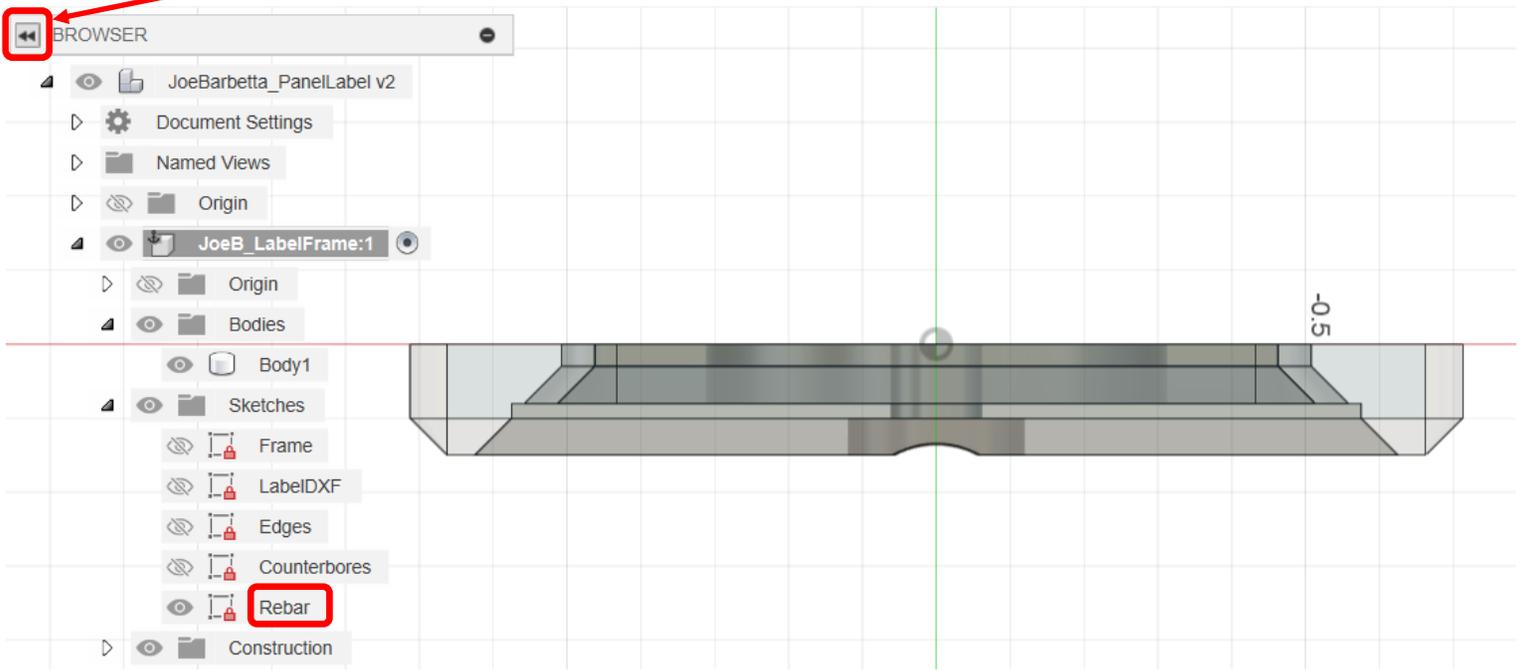
- click on the **arrow** for the **Bodies** folder and right-click on **Body1** and select **Opacity Control** and **50%**



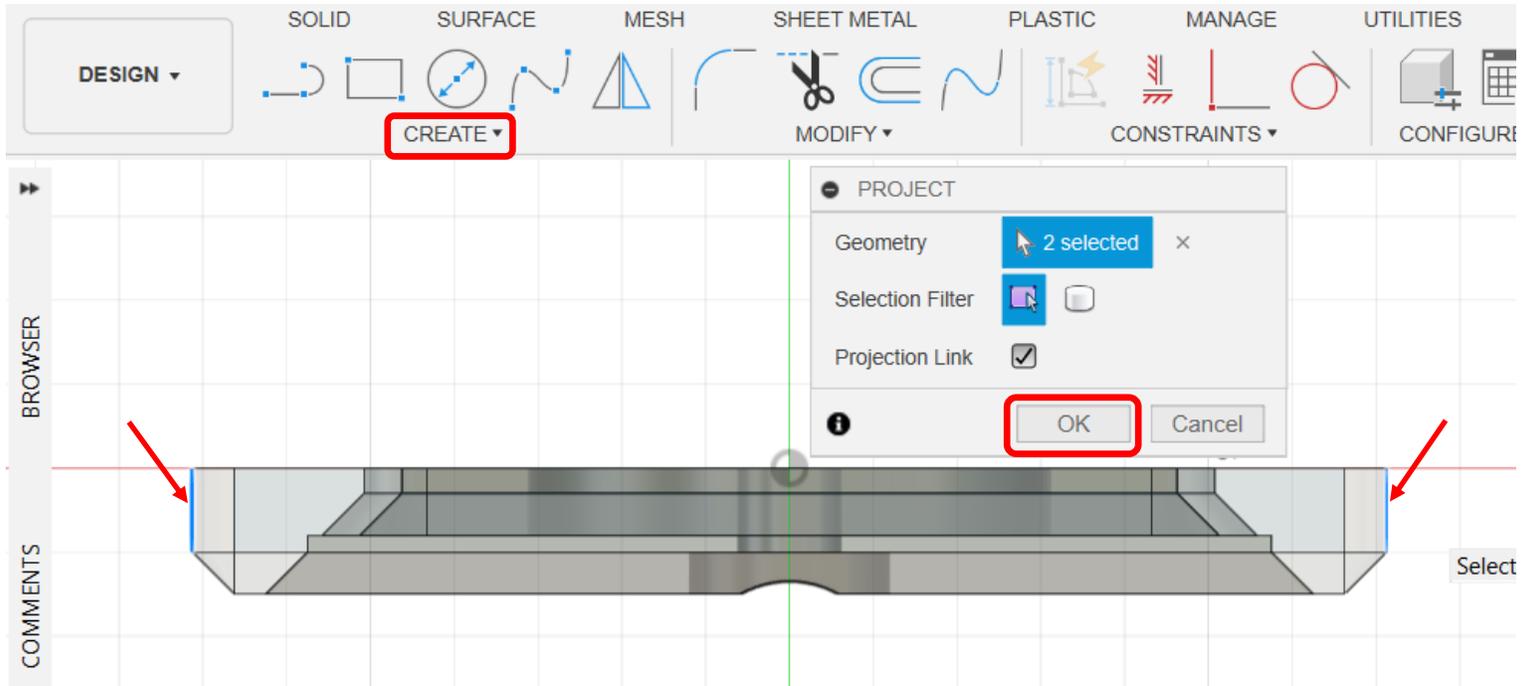
- select the **Create Sketch** tool and click on the **top surface** of the frame



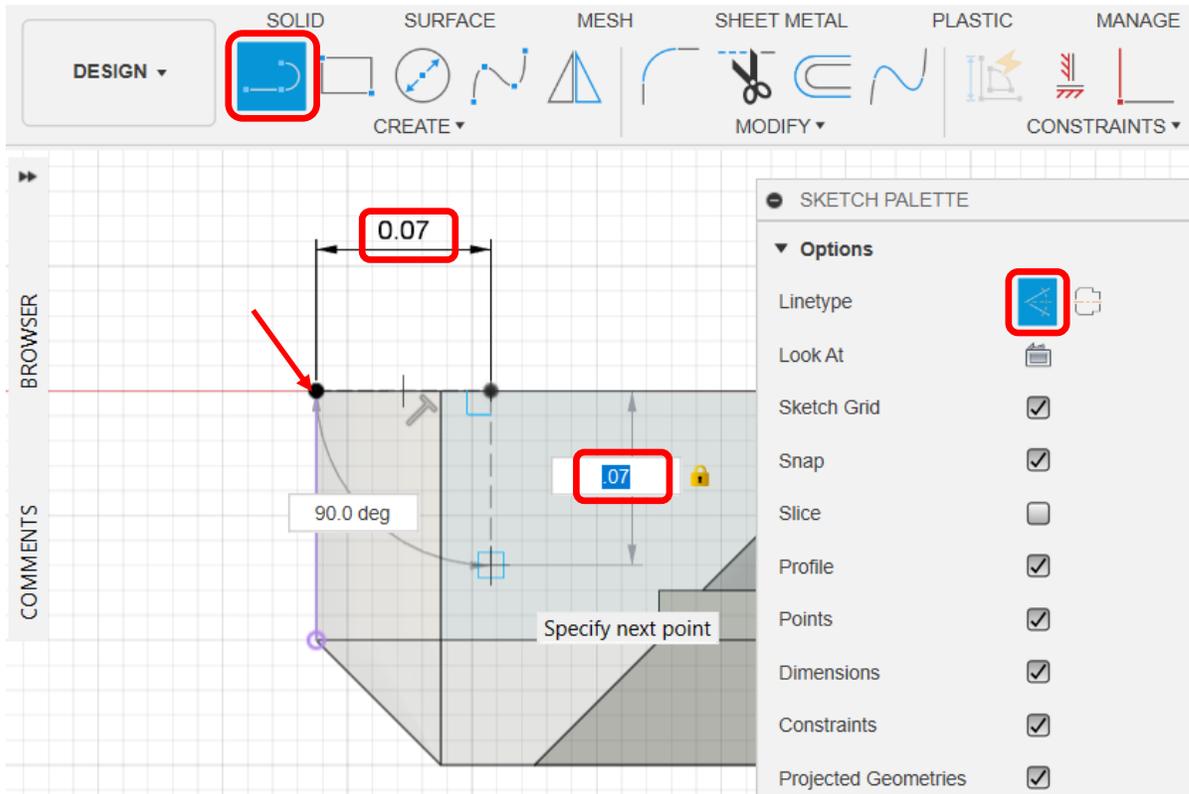
- rename the new Sketch to **Rebar**
- click the **double arrow** for the BROWSER to hide it. These arrows can be used later to reopen the BROWSER when needed.



- from the **CREATE** menu select **Project / Include** and **Project**
- click on the **two line segments** as indicated by the arrows, which should cause these edges to turn blue, and click **OK**. Be careful not to select the rectangles at the ends. Only the two line segments should be highlighted blue.

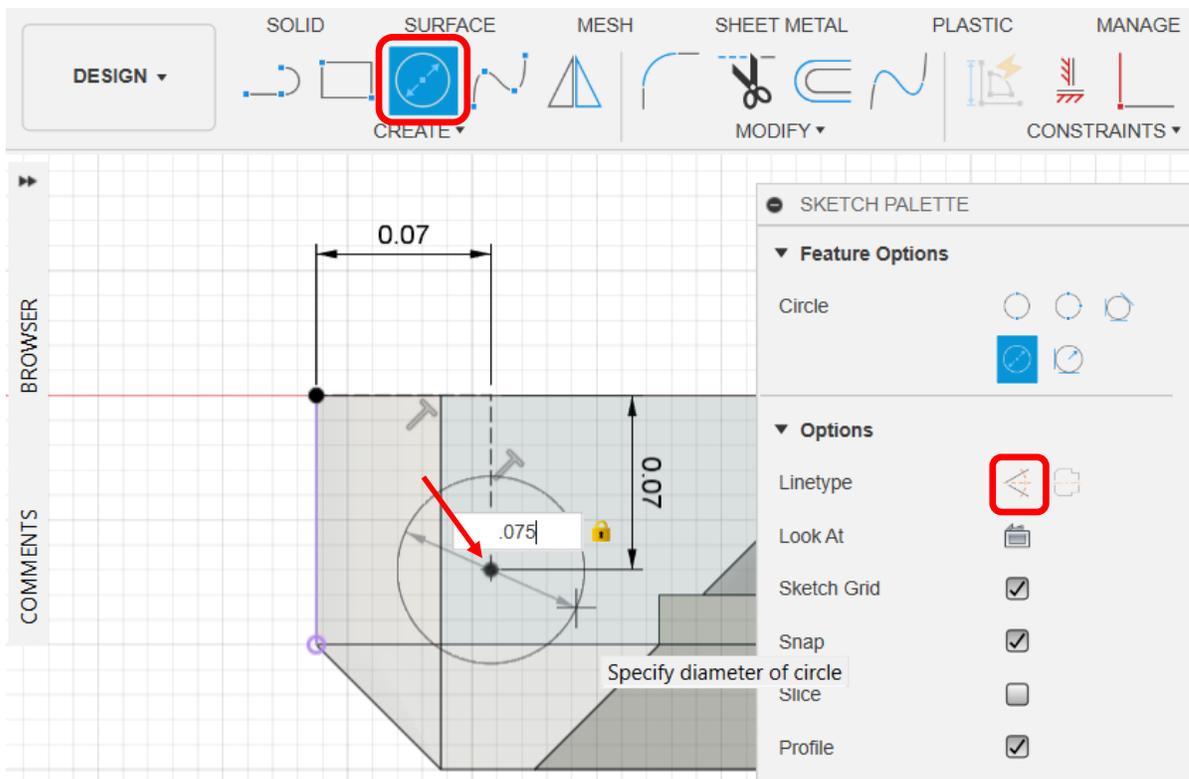


- zoom in to the **left side of the frame** as shown
- select the **Line** tool and click on the Linetype **Construction** icon to highlight it blue.
- create a line starting at the arrow and extended to the left by **0.07**
- from the **end of that line**, create a line downward by **0.07**

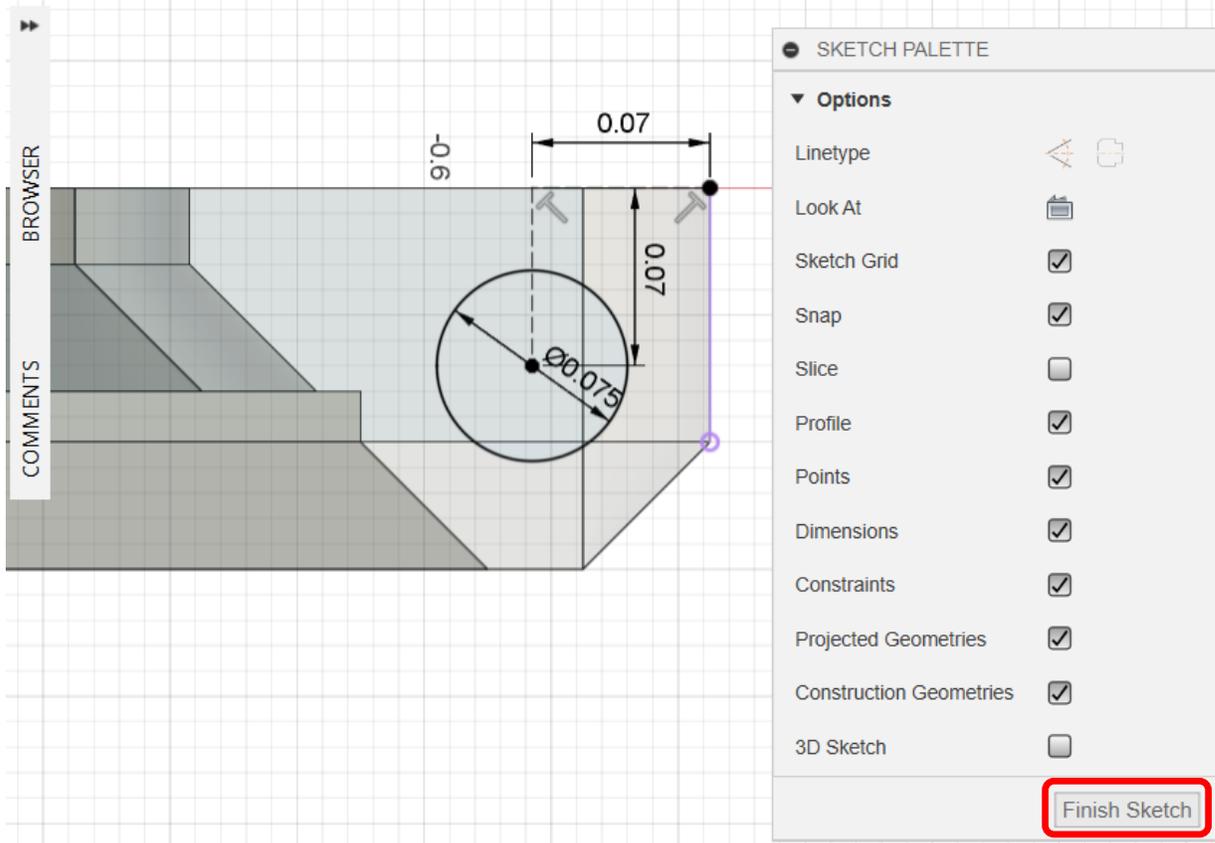


- select the **Center Diameter Circle** tool and click on the Linetype **Construction** icon to remove the blue highlighting.
- click at the **end of the last line created**, extend the circle outward, and enter **0.075**. Do **Not** click Finish Sketch.

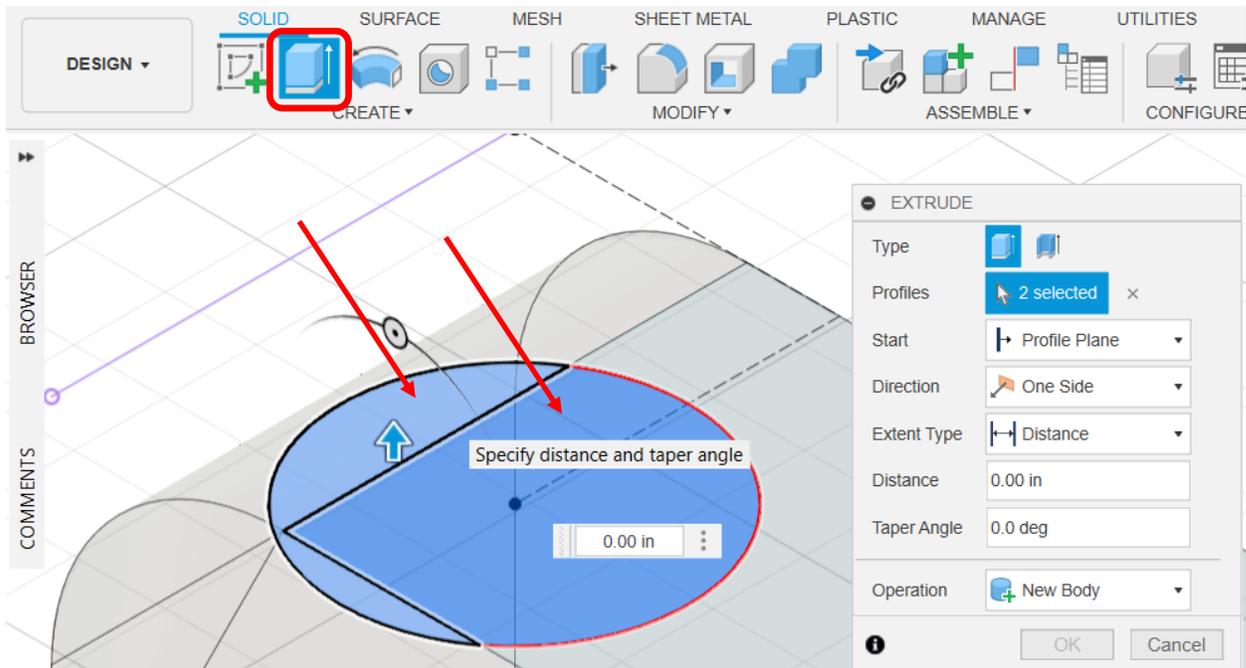
The purpose of setting the Opacity to 50% was to help determine if the rebar channel being created would intersect any walls.



- pan to the other side of the frame and create the same **two Construction lines** and the same **Circle**
- click **Finish Sketch**



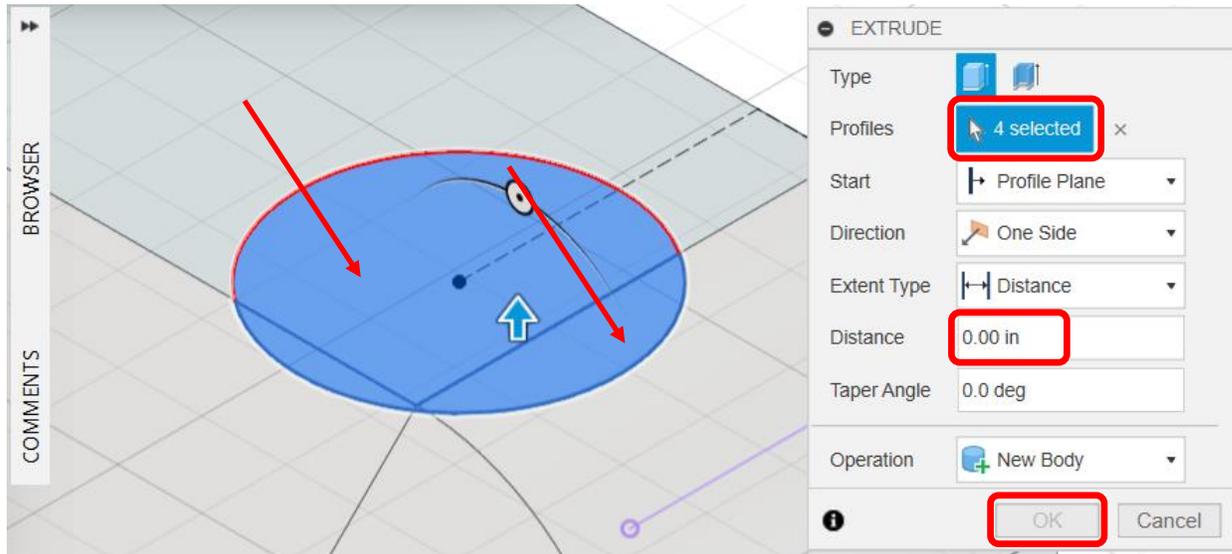
- zoom in to the a top hole and select the **Extrude** tool
- click on the **two sections** shown to highlight the entire circular area blue. Do Not enter a distance value or click OK yet. Two sections needed to be click on because the circular area covers a flat surface, but also a filleted and chamfered region. In other cases, only a single click may be needed to select the entire circular area.



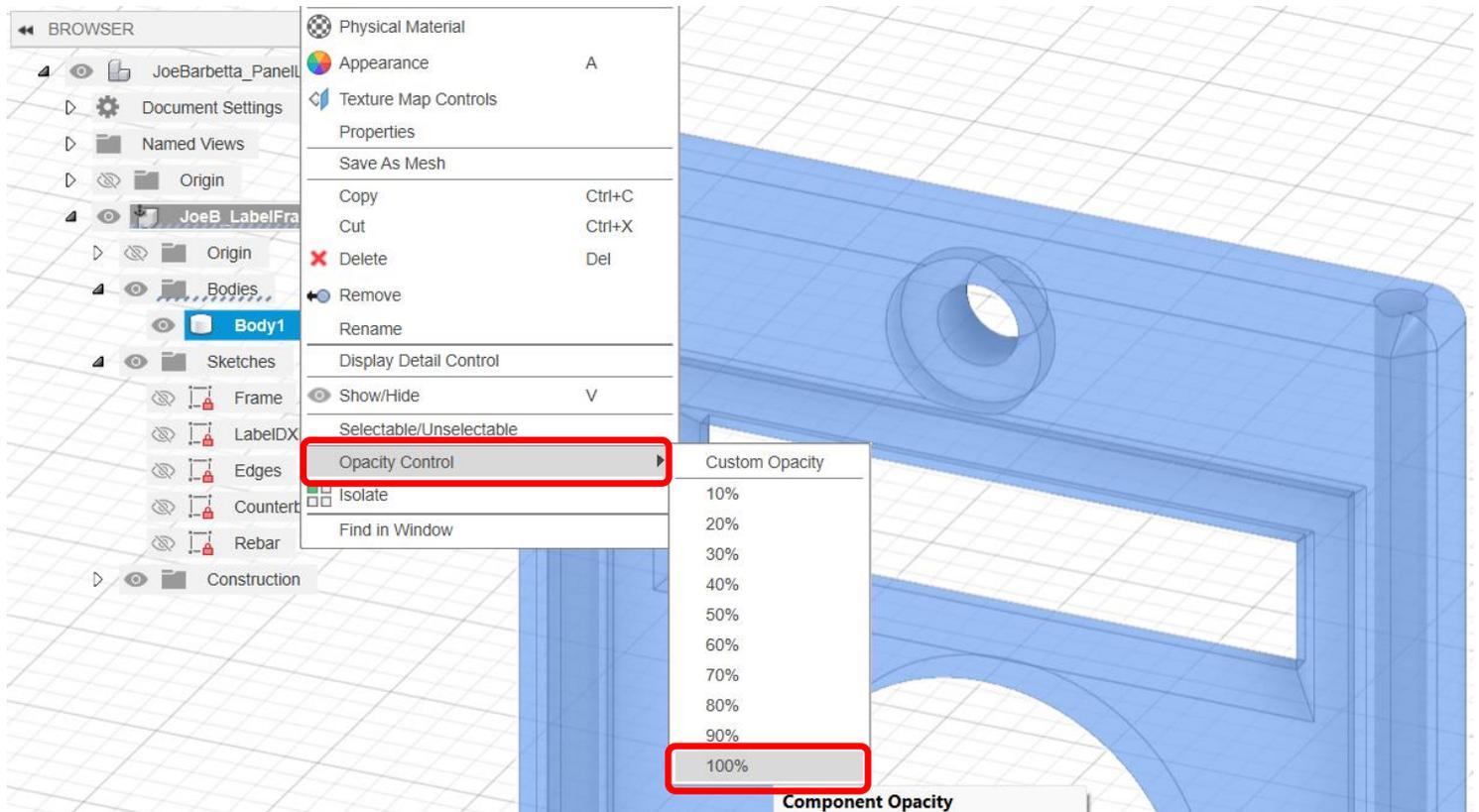
- pan over to the other hole and select the **two sections** shown to highlight the entire circular area blue
- check that Profiles shows 4 selected, which will indicate that a total of 4 sections were selected. Note that an option could be to perform the extrude operation twice for these holes.

- for **Distance** enter **-5** (note the minus sign) and click **OK**

The value of -5 was used to ensure the hole is cut through the entire body. This value just needs to be greater than the length of the frame.



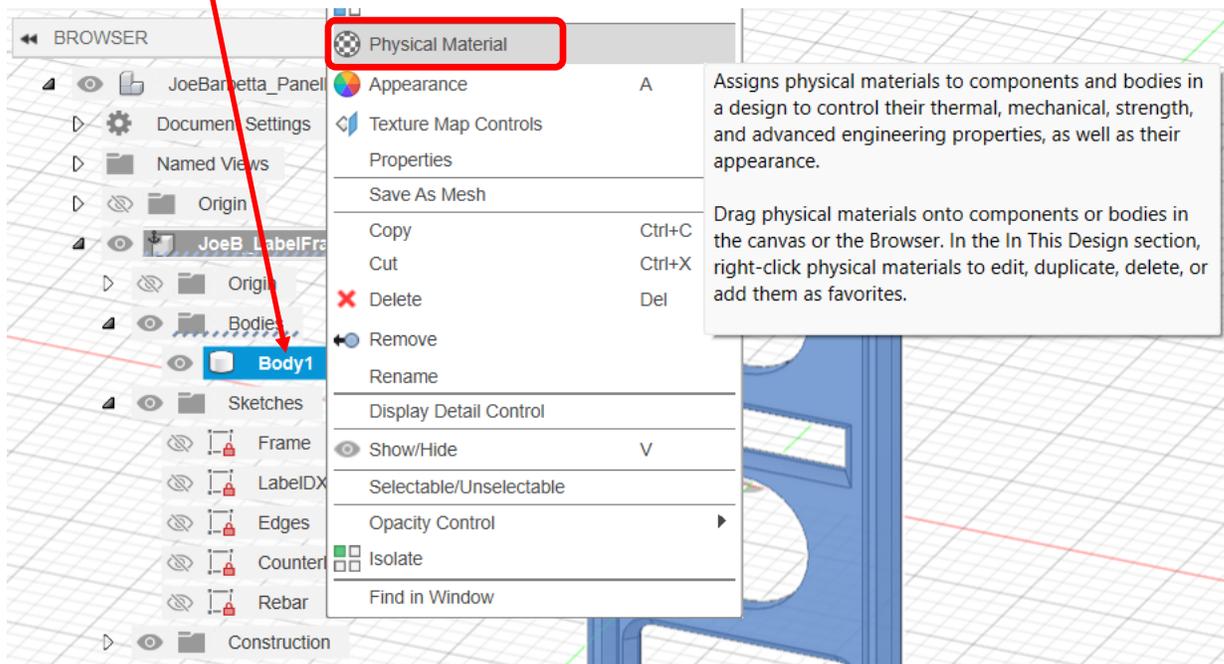
- click on the **double arrows** to reopen the BROWSER
- right-click on **Body1** and select **Opacity Control** and **100%**. The earlier change to 50% was to allow seeing if the circle for the rebar holes would intersect any surfaces.



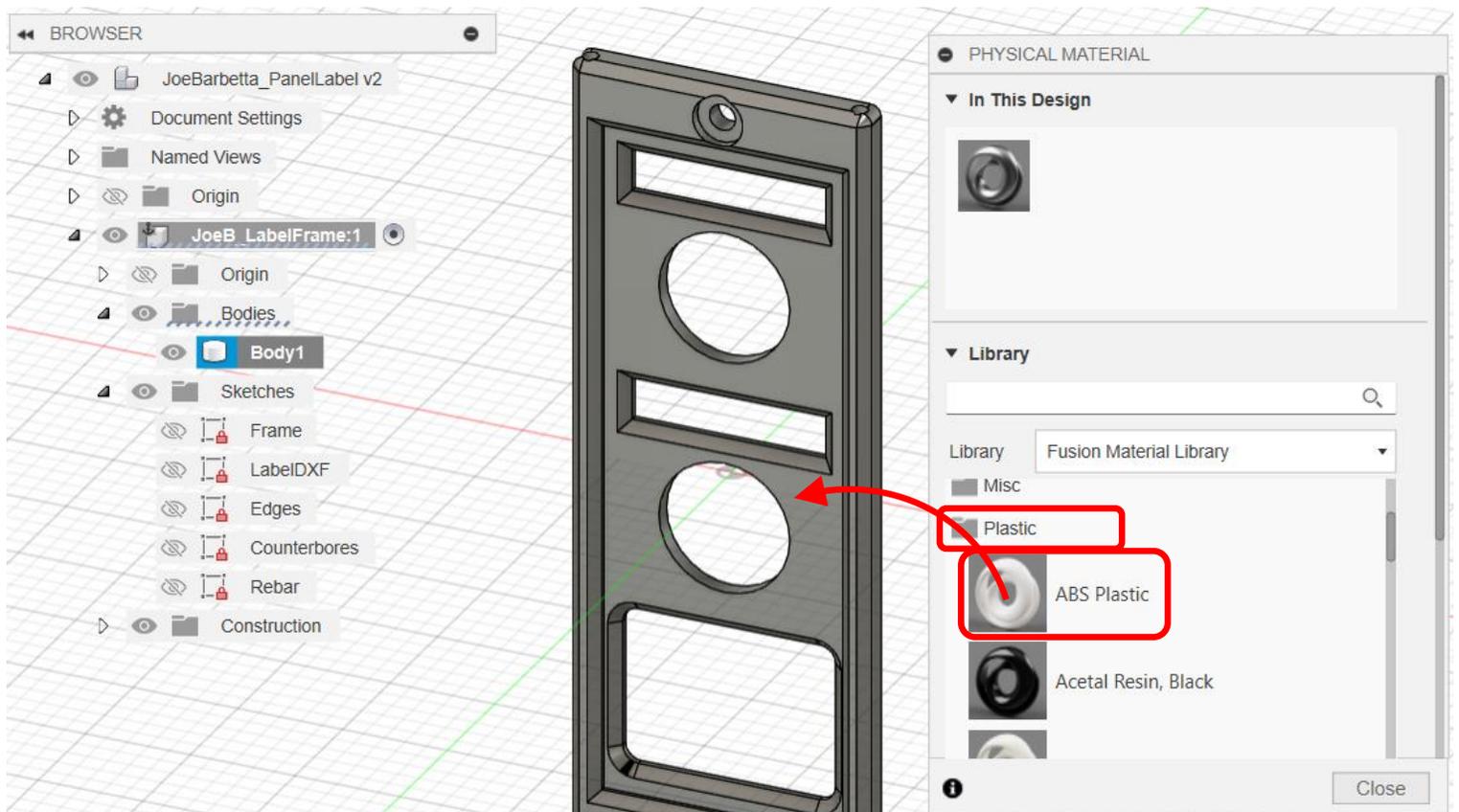
Fusion – Applying a Material and Setting a Color

The default material that Fusion assigns to a body is steel and hence the gray color. The material can be kept as is because for a 3D printed object, the filament loaded into the printer determines the material (often PLA) and color. However, one can choose to apply a material and color in Fusion for the aesthetics of the design in CAD.

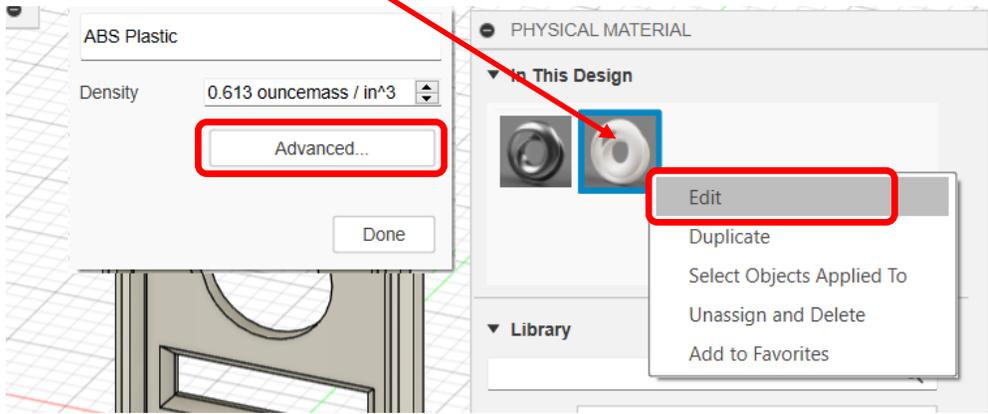
- right-click on **Body1** and select **Physical Material**



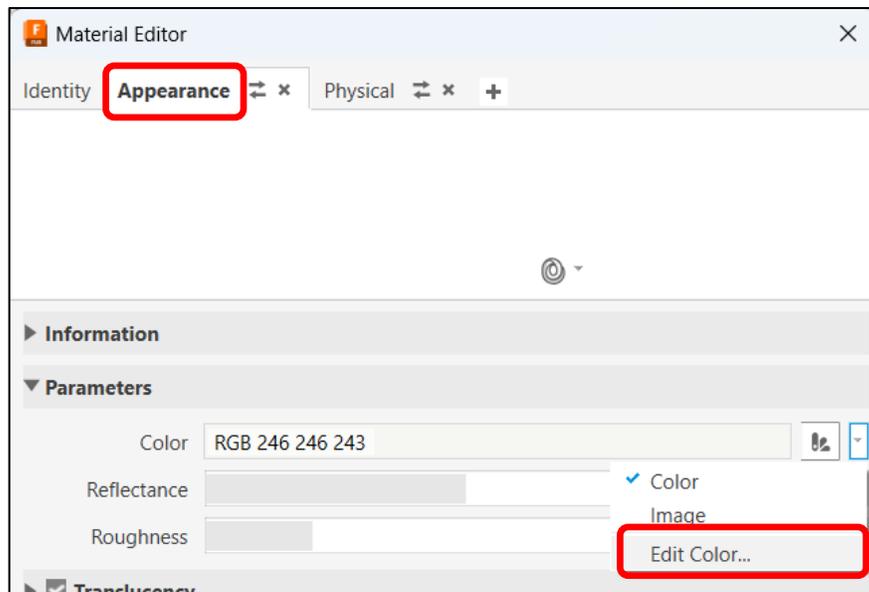
- Scroll down in the Material list and click on the **Plastic** folder to open it
- drag the **ABS Plastic** icon on to the frame body



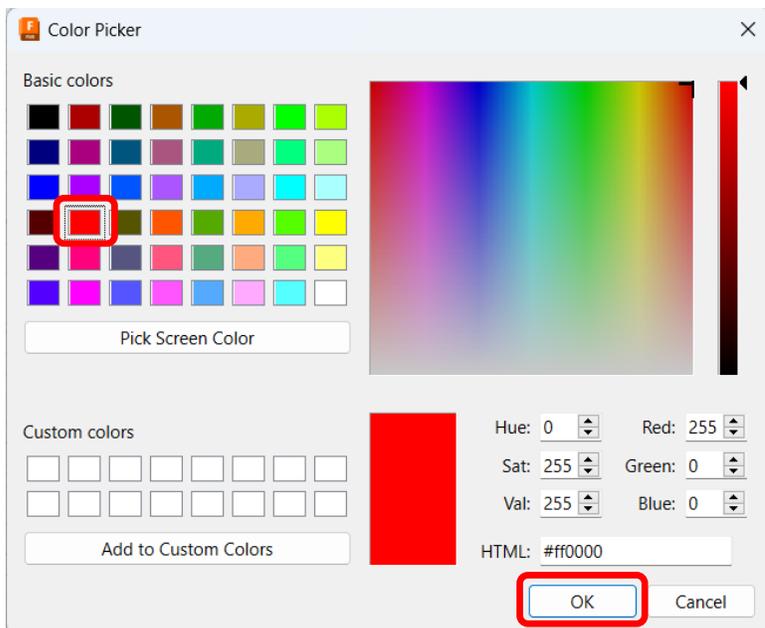
- right-click on the **ABS Plastic** icon that appears at the top and select **Edit**
- click the **Advanced...** button



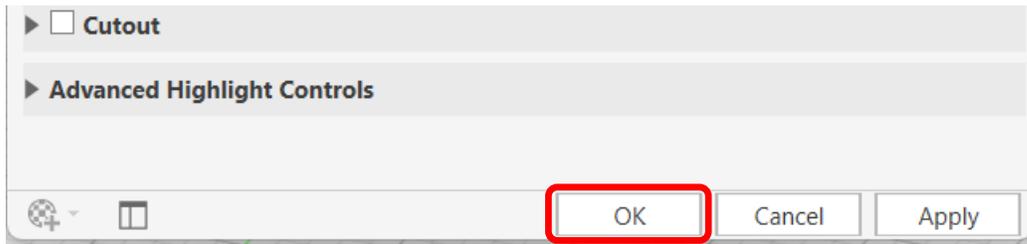
- click on the **Appearance** tab and click on the **drop-down list arrow** and select **Edit Color...**



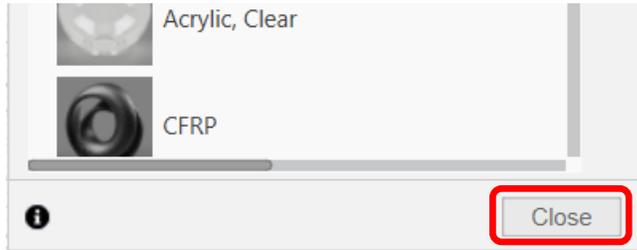
- select a color and click **OK**



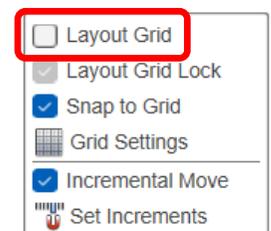
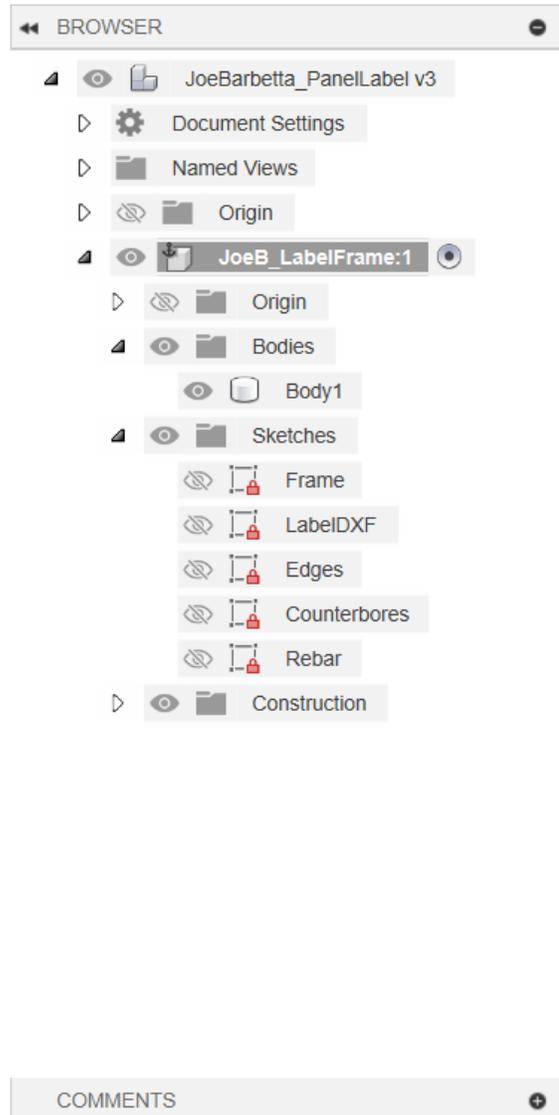
- click **OK** at the bottom of the **Material Editor** window



- click **Close** at the bottom of the **PHYSICAL MATERIAL** window



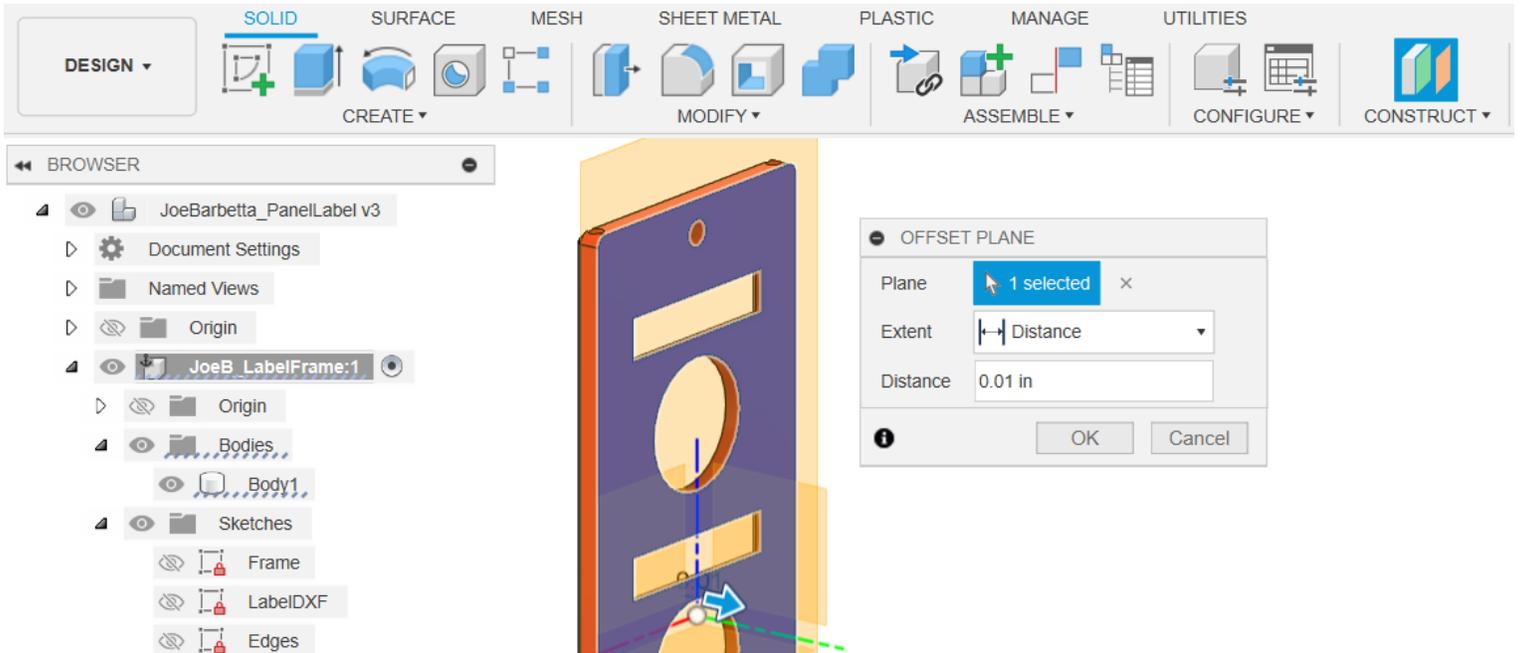
- at the bottom of the Fusion screen, click on the **Grid and Snaps** icon and uncheck the **Layout Grid** box to turn off the grid. Having the grid visible or hidden is personal preference, however, turning the grid off allows for a screenshot of a design.



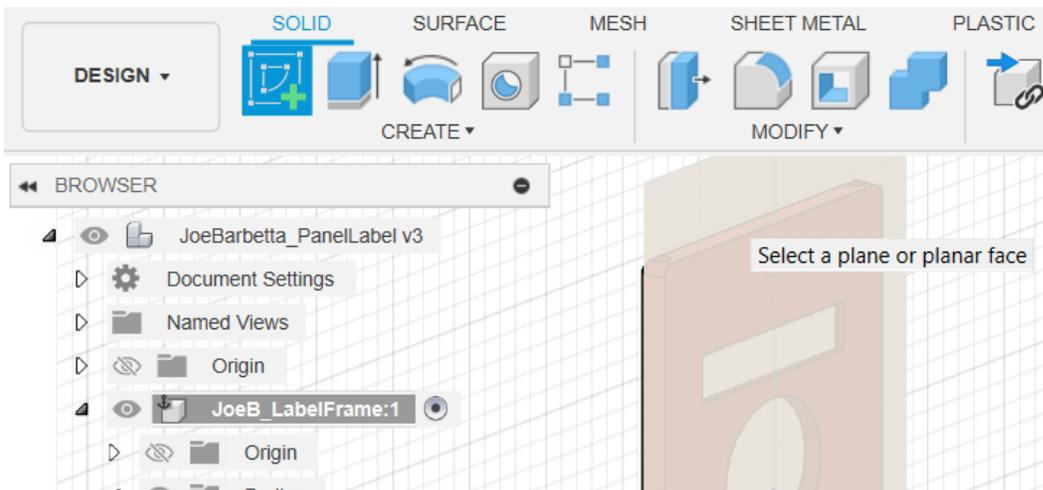
Fusion – Inserting a Decal

If one wishes to realize an accurate product depiction in Fusion, the label graphic created in Inkscape can be imported into Fusion. First one needs to create a body to serve as a surface for the decal.

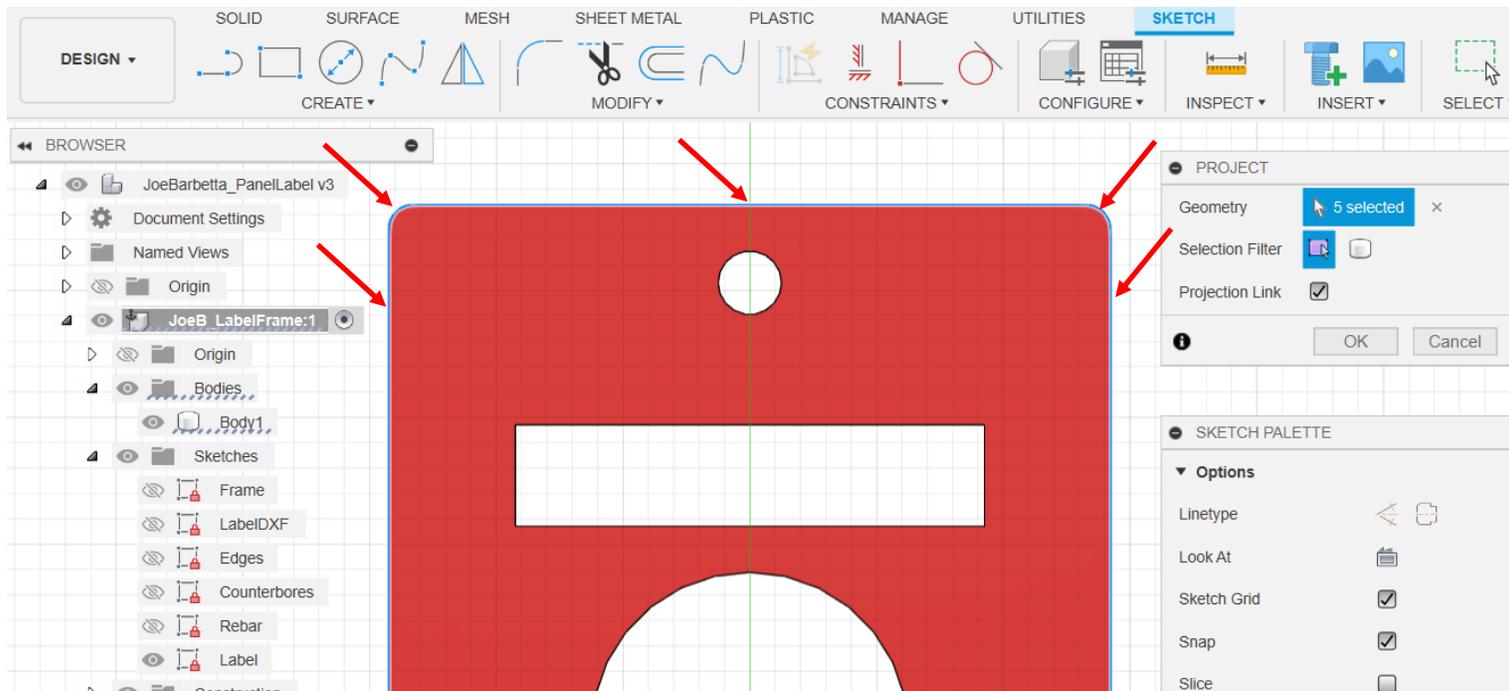
- rotate the view using the **View Cube** to access the rear of the frame
- from the **CONSTRUCT** menu select **Offset Plane**
- click on the **back of the frame** and enter **0.01** for **Distance** and click **OK**



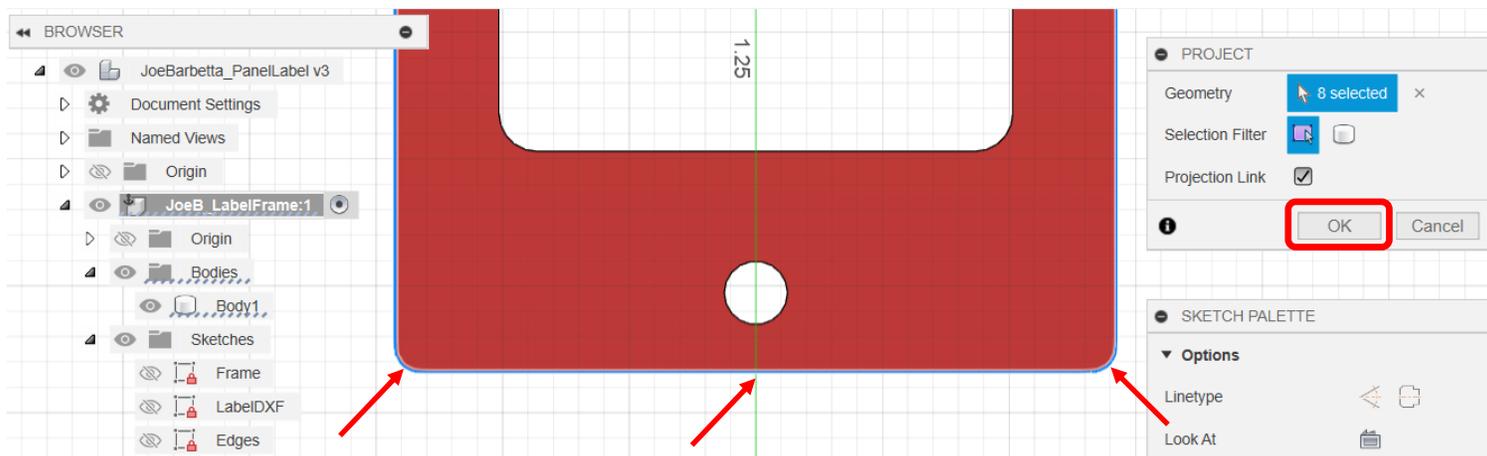
- select the Create Sketch tool and click on the Construction plane



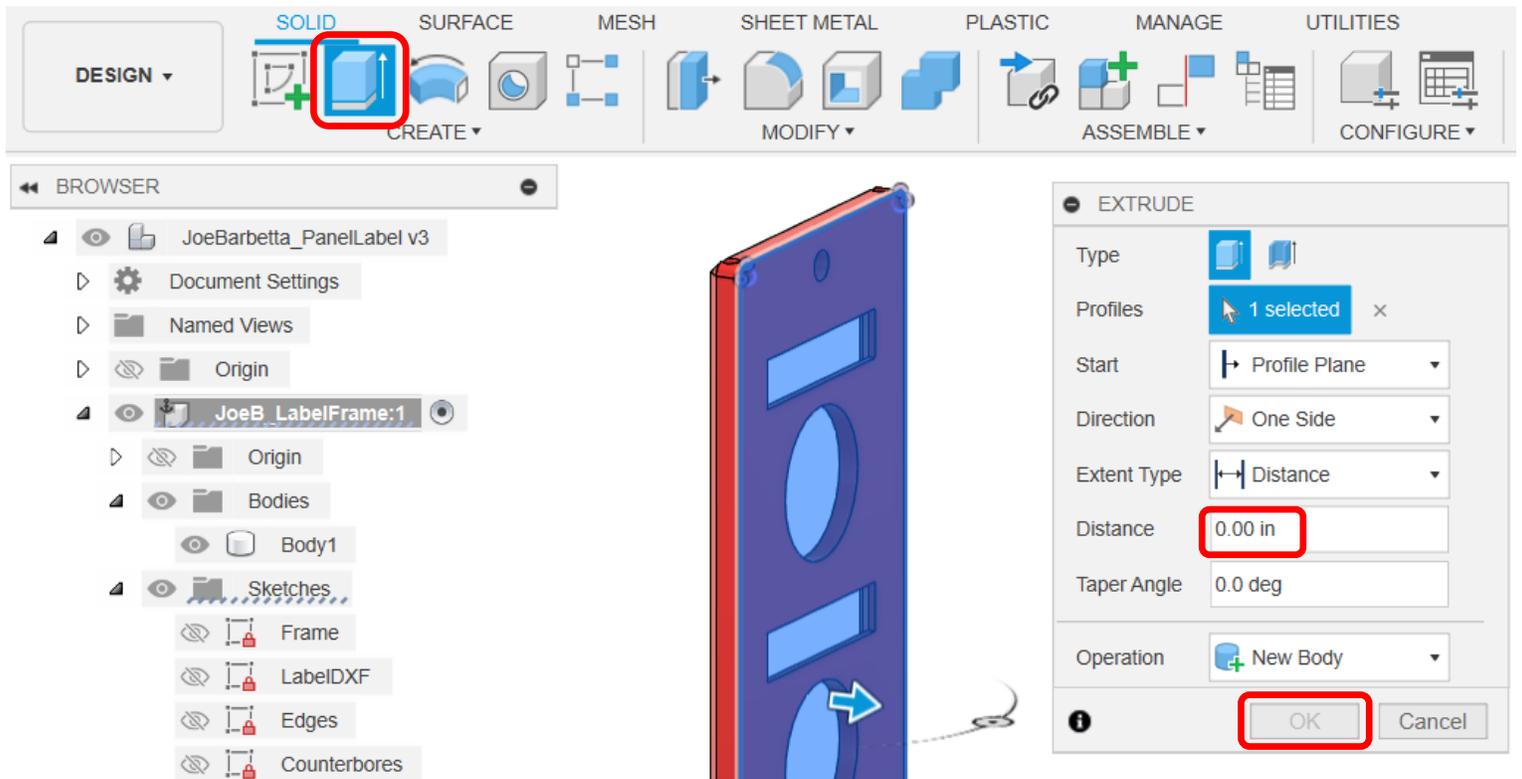
- zoom into the top of the frame
- rename the Sketch to **Label**
- from the **CREATE** menu select **Project / Include** and **Project**
- click on the **straight edges and filleted edges** as indicated by the arrows



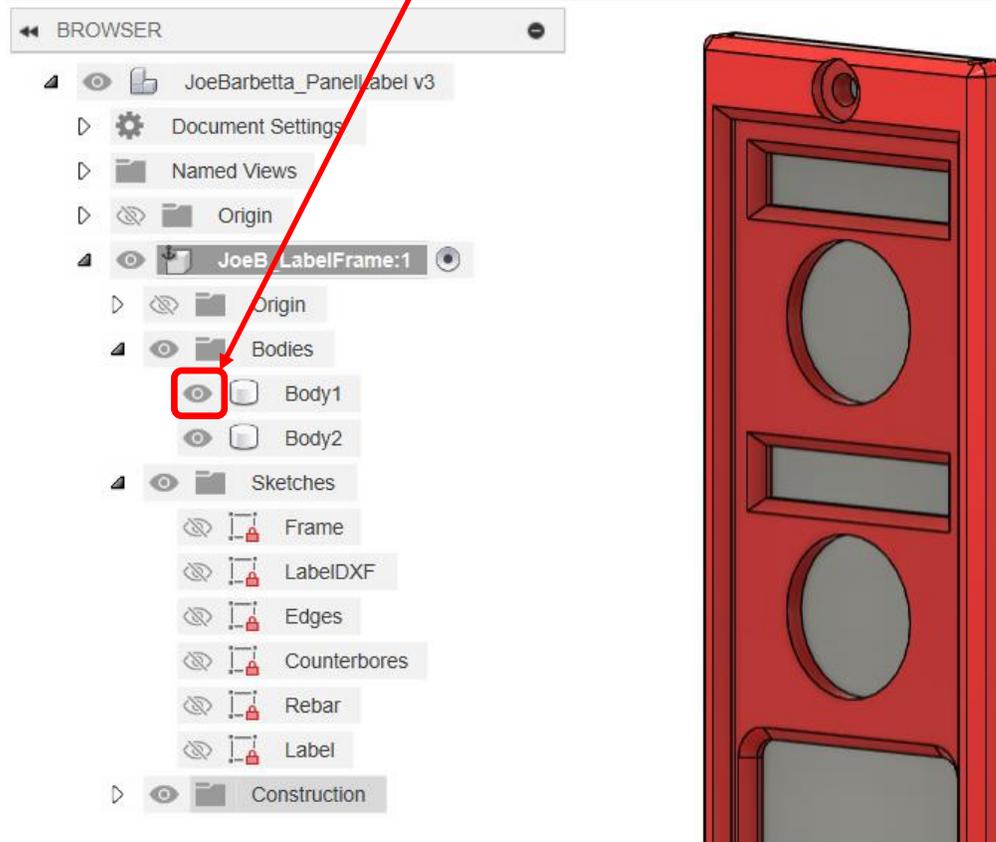
- zoom in to the bottom of the frame
- click on the remaining **straight edge and filleted edges** as indicated by the arrows
- click **OK** and **Finish Sketch**



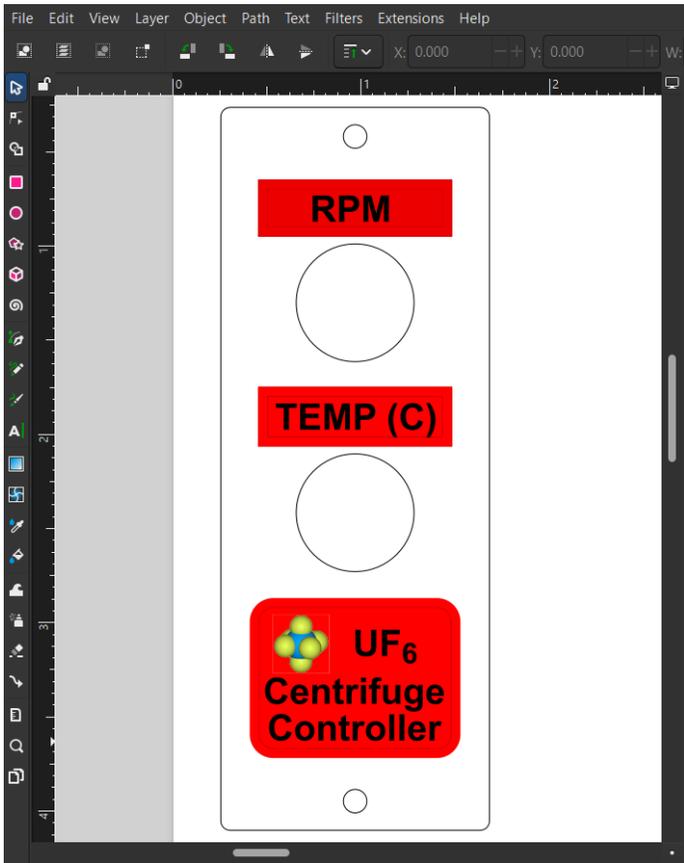
- zoom out
- select the **Extrude** tool and extrude the new sketch by **0.01** and click **OK**



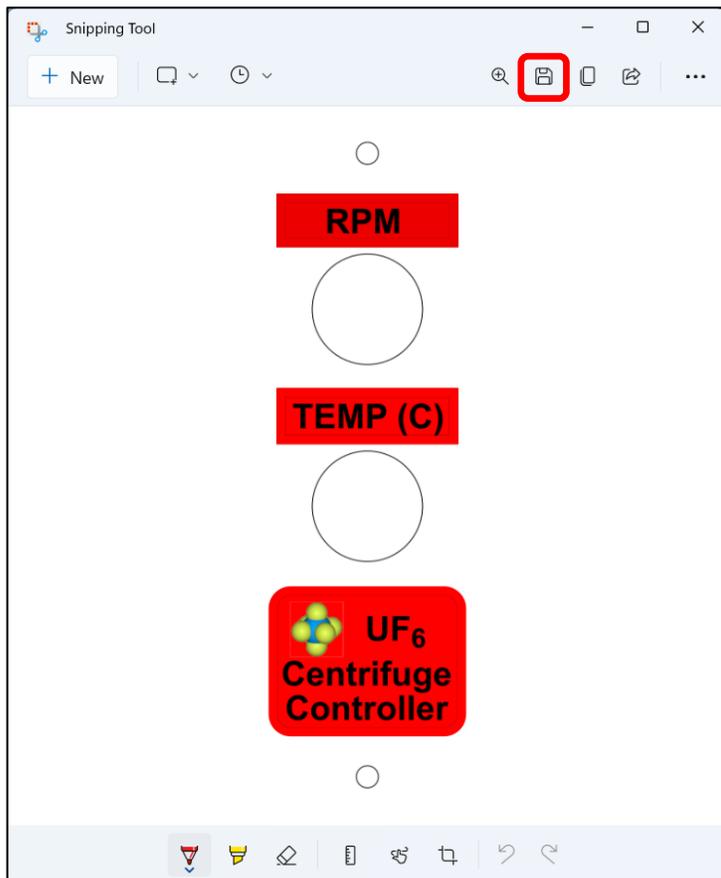
- adjust the view and click on the **eye** icon for **Body1** to hide the frame



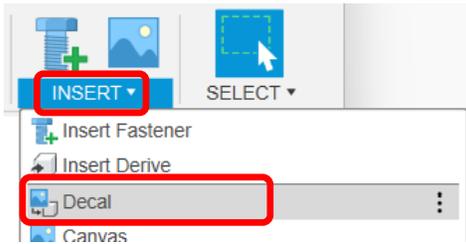
- return to Inkscape or the .pdf that was created and use the shift, Window, and s keys to take a screenshot and save it as .png. When defining the screenshot region, it should be just inside the outer rectangle.



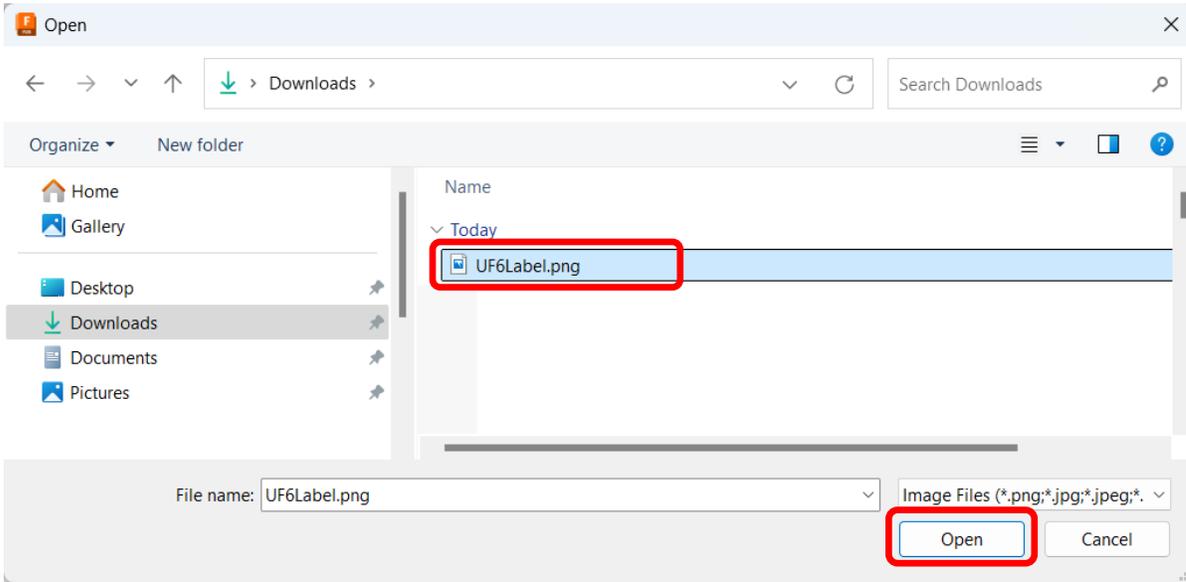
- after taking a screenshot the Snipping Tool window will allow saving the screenshot as a .png file



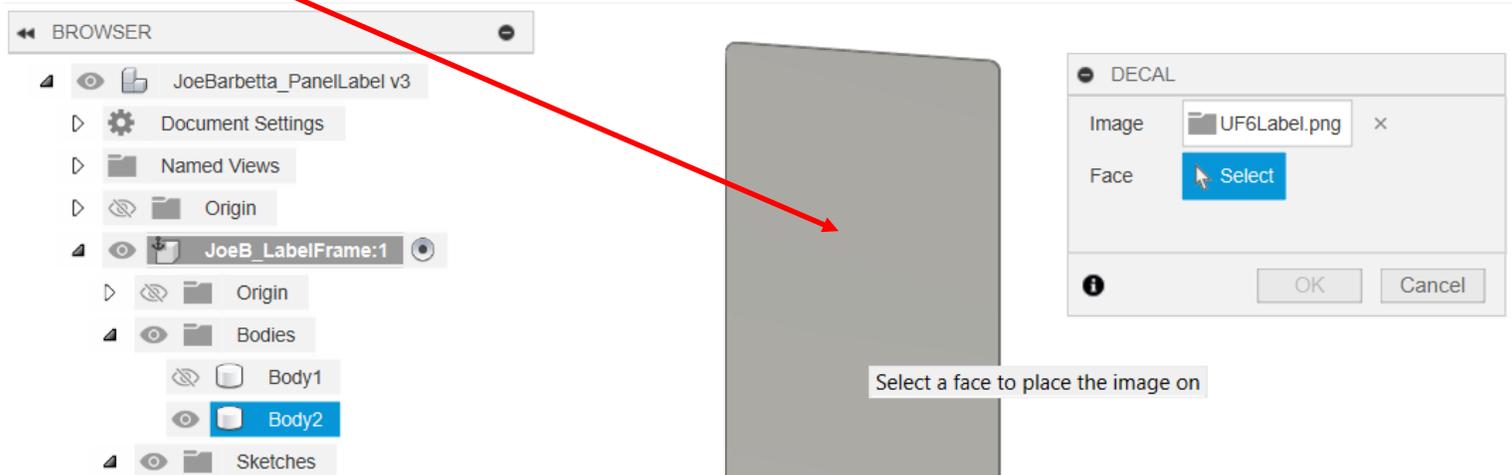
- at the top right of the Fusion screen select **Decal** from the **INSERT** menu



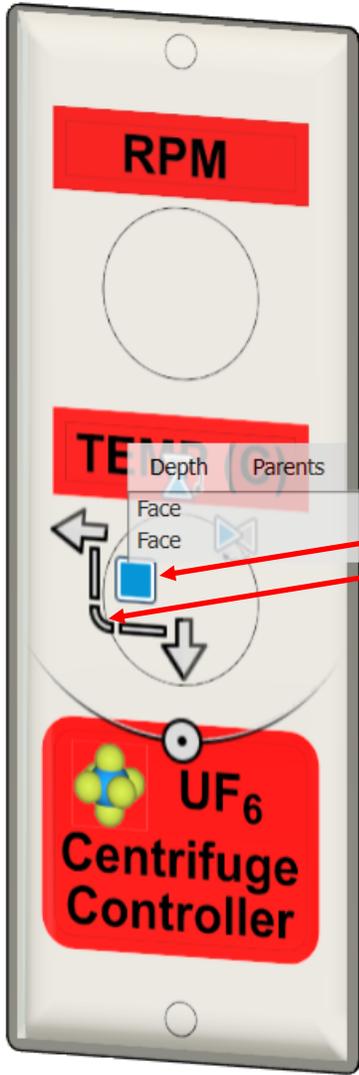
- select the .png that was saved from the screenshot and click **Open**



- click on the **surface of body** created for the label



- if the label is flipped vertically or horizontally, click on the **Horizontal Flip** and/or **Vertical Flip** to correct this
- adjust the scaling and position of the decal on the label body and click **OK**



DECAL

Image UF6La... x

Face Select

Chain Faces

Opacity 100

Keep Aspect Ratio

Width 1.336 in

Height 3.773 in

X Distance -0.054 in

Y Distance 0.408 in

Z Angle 0.0 deg

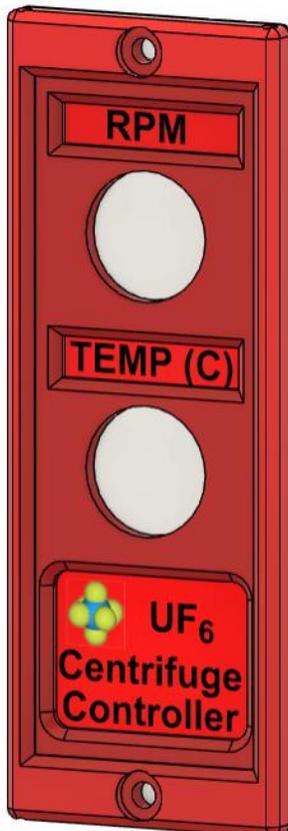
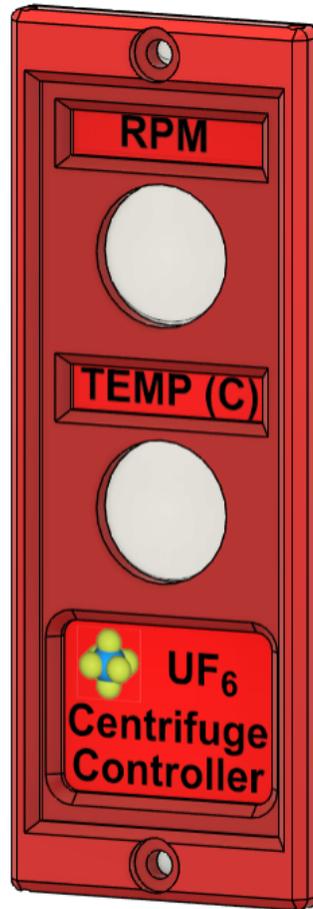
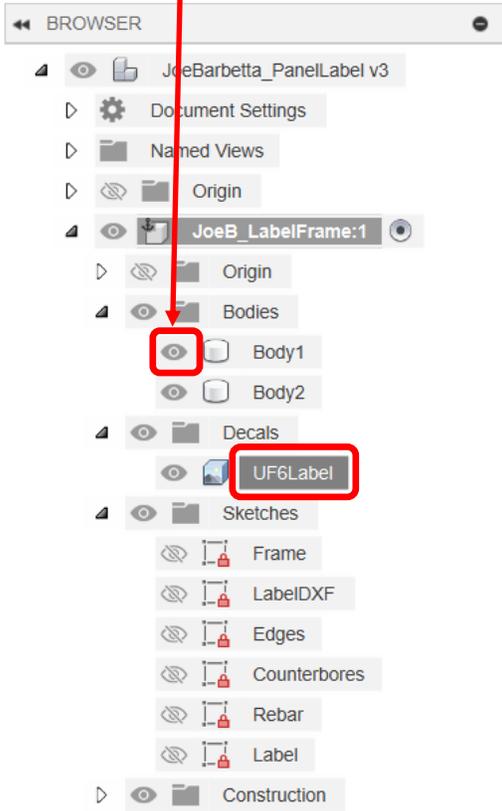
Horizontal Flip

Vertical Flip

OK Cancel

The **curved corner** allows for scaling the label and the **blue square** allows for positioning the label.

- click on the **eye** icon for Body1 to make the frame visible again
- if the decal needs further positioning or scaling to ensure text is within the frame “windows”, right-click on the **Decal name** and select **Edit Decal** to access the scaling and moving controls again.



This is the result from some slight adjustments. You are one step closer to enriching Uranium 235.

Selecting Mouting Screws

McMaster-Carr is the GOAT for parts that are always in stock!

For label frames such as this, either #4 (used for this frame) or #2 (smaller size), are ideal screw sizes.

One will find that mostly stainless-steel or zinc-plated steel screws are available. These will have the typical metallic color. The screws shown here from the McMaster-Carr website are the versions of these screws with a Black-oxide finish. The black color gives a product a more finished look, but this is personal preference.

The screw selection on this page and the next include both **Tapping Screws** and **Machine Screws**. Tapping screws work well if the frame is being attached to other 3D printed components. A pilot hole of about 0.1" designed into the other 3D printed part will work well for #4 self tapping screws. Machine screws should be used if a nut on the other side of a panel will be used or if a threaded insert is used in a 3D printed part.

Filter by [Clear all](#)

System of Measurement
Inch

Thread Size [Hide](#)

Search

- 4-40
- 4-48
- 5-40
- 5-44
- 6-32
- 6-40
- 8-32
- 8-36

Finish [Hide](#)

- Acrylic Coated
- Black Oxide
- Cadmium Plated
- Chrome Plated
- Painted
- Zinc Plated

Two selections were made on the left side Filter section on the McMaster-Carr website.

▶ About Tapping Screws
[More](#)

Self-Tapping #4 Black-Oxide screws

Steel Phillips Rounded Head Screws for Sheet Metal



These steel screws are available with corrosion-resistant finishes. They penetrate 0.025" and thinner sheet metal. Length is measured from under the head.

Black-oxide steel screws are mildly corrosion resistant in dry environments.

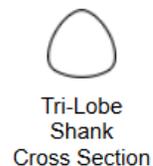
Head			Drive Size	Drill Bit Size	Approximate Threads per Inch	Threading	Pkg. Qty.	Pkg.
Lg.	Dia.	Ht.						
Black-Oxide Steel								
No. 4								
1/4"	0.219"	0.08"	No. 1	No. 44	24	Fully Threaded	100	90935A131 \$4.28
3/8"	0.219"	0.08"	No. 1	No. 44	24	Fully Threaded	100	90935A133 4.67
1/2"	0.219"	0.08"	No. 1	No. 44	24	Fully Threaded	100	90935A135 4.77
3/4"	0.219"	0.08"	No. 1	No. 44	24	Fully Threaded	100	90935A137 6.96

Steel Phillips Rounded Head Thread-Forming Screws for Plastic



Length is measured from under the head.

Inch-size screws are comparable to Plastite screws. They have a tri-lobe shank that presses tightly against formable plastic, such as polypropylene, to resist loosening. These screws may have a slightly different diameter than screws with round shanks.



Head			Drive Size	Drill Bit Size	Approximate Threads per Inch	Shank Cross Section	Pkg. Qty.	Pkg.
Lg.	Dia.	Ht.						
Black-Oxide Steel								
No. 4								
1/4"	0.219"	0.08"	No. 1	No. 37	20	Tri-Lobe	50	90417A116 \$6.51
5/16"	0.219"	0.08"	No. 1	No. 37	20	Tri-Lobe	100	90417A117 7.67
3/8"	0.219"	0.08"	No. 1	No. 37	20	Tri-Lobe	50	90417A118 6.76
1/2"	0.219"	0.08"	No. 1	No. 37	20	Tri-Lobe	50	90417A119 7.12
5/8"	0.219"	0.08"	No. 1	No. 37	20	Tri-Lobe	100	90417A121 9.01
3/4"	0.219"	0.08"	No. 1	No. 37	20	Tri-Lobe	100	90417A122 6.76

Stainless Steel Pan Head Phillips Screws



These stainless steel pan head Phillips screws won't rust or corrode when exposed to moisture and chemicals. They have a moderate height and width profile, offering a middle ground between narrower button heads and wider truss heads. The Phillips drive easily aligns with drivers and withstands more torque than slotted drives, but drivers slip when you apply too much force.

Length is measured from under the head.

Black-Oxide 18-8 Stainless Steel—Typically chosen for their appearance, these screws have a dark, matte coating to create a finished look. They won't rust in wet and outdoor environments, but they don't hold up to the harsh chemicals that 316 stainless steel can.

Military Specification—These screws are manufactured and tested to meet strict U.S. military standards for material and construction.

Head				Tensile Strength, psi	Specs. Met	Mil. Spec.	Pkg. Qty.	Pkg.	
Lg.	Dia.	Ht.	Threading						
Black-Oxide 18-8 Stainless Steel									
4-40									
1/8"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A101	\$6.66
3/16"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A102	7.73
3/16"	0.219"	0.08"	Fully Threaded	80,000	Fed. Spec. FF-S-92	MS51957-12B	25	90988A011	7.07
1/4"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A105	7.37
1/4"	0.219"	0.08"	Fully Threaded	80,000	Fed. Spec. FF-S-92	MS51957-13B	25	90988A012	7.21
5/16"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A107	8.10
3/8"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A108	8.10
3/8"	0.219"	0.08"	Fully Threaded	80,000	Fed. Spec. FF-S-92	MS51957-15B	25	90988A014	7.79
7/16"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A109	7.95
1/2"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A111	8.14
1/2"	0.219"	0.08"	Fully Threaded	80,000	Fed. Spec. FF-S-92	MS51957-17B	25	90988A016	9.00
9/16"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A112	8.76
5/8"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A115	10.31
11/16"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	50	91249A616	10.07
3/4"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A119	10.62
3/4"	0.219"	0.08"	Fully Threaded	80,000	Fed. Spec. FF-S-92	MS51957-19B	25	90988A018	9.50
7/8"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A120	13.35
1"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	100	91249A123	13.26
1 1/8"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	50	91249A617	8.59
1 1/4"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	50	91249A310	10.78
1 1/2"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	50	91249A126	9.08
1 3/4"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	50	91249A618	10.61
2"	0.219"	0.08"	Fully Threaded	70,000	ASME B18.6.3	—	50	91249A129	13.74

Steel Pan Head Phillips Screws



Our most popular steel pan head screws. They have a moderate height and width profile, offering a middle ground between narrower button heads and wider truss heads. The Phillips drive easily aligns with drivers and withstands more torque than slotted drives, but drivers slip when you apply too much force.

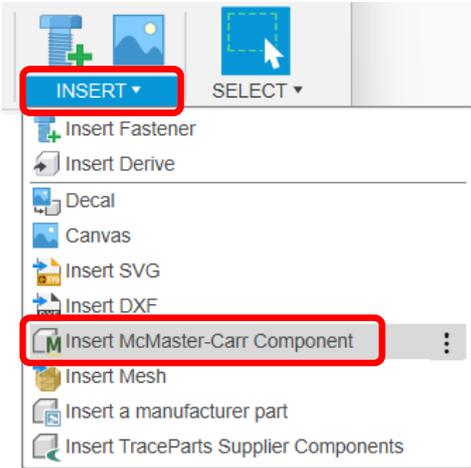
Length is measured from under the head.

Black-Oxide Steel—Typically chosen for their appearance, these screws have a dark, matte coating to create a finished look. They offer minimal corrosion resistance, so they're best for dry environments.

Head				Tensile Strength, psi	Specs. Met	Pkg. Qty.	Pkg.	
Lg.	Dia.	Ht.	Threading					
Black-Oxide Steel								
4-40								
3/16"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A111	\$5.49
1/4"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A112	5.36
5/16"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A113	5.64
3/8"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A114	5.71
7/16"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A115	10.97
1/2"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A116	5.72
9/16"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A117	9.65
5/8"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A118	6.47
11/16"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A119	10.48
3/4"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A120	7.06
7/8"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A121	10.07
1"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A122	13.62
1 1/4"	0.219"	0.08"	Fully Threaded	60,000	ASME B18.6.3	100	92224A123	12.07

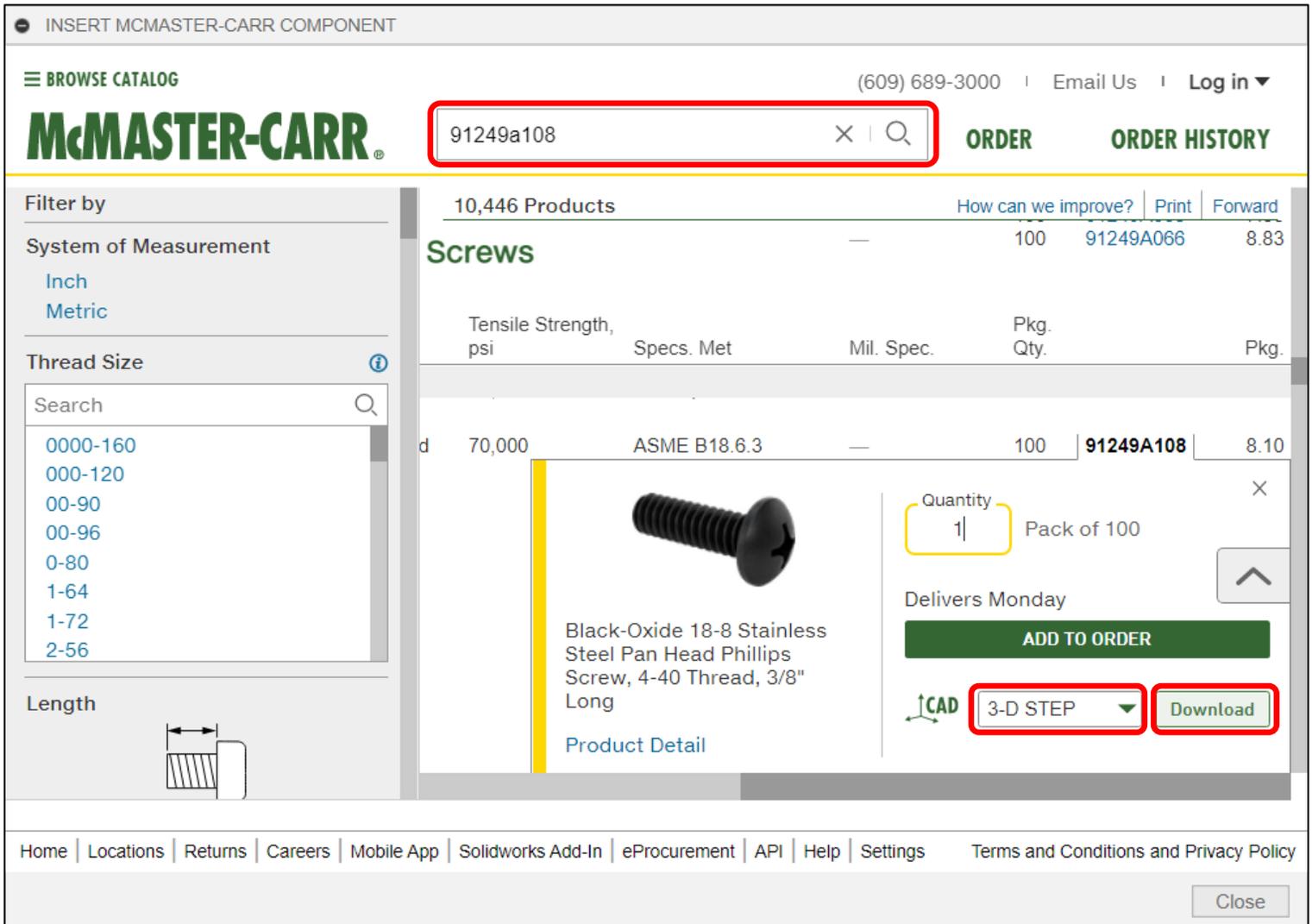
Fusion – Inserting a McMaster-Carr part

- from the top right of the Fusion screen select **Insert McMaster-Carr Component** from the **INSERT** menu



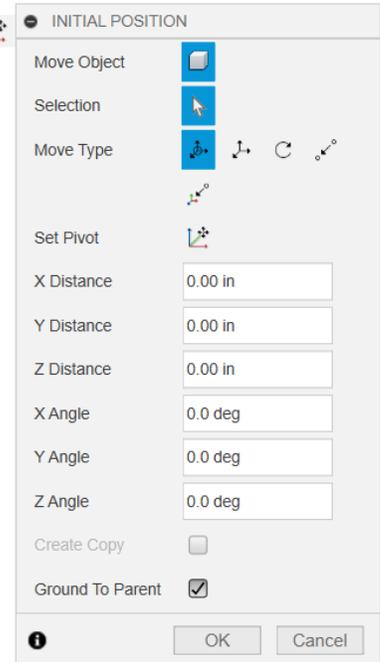
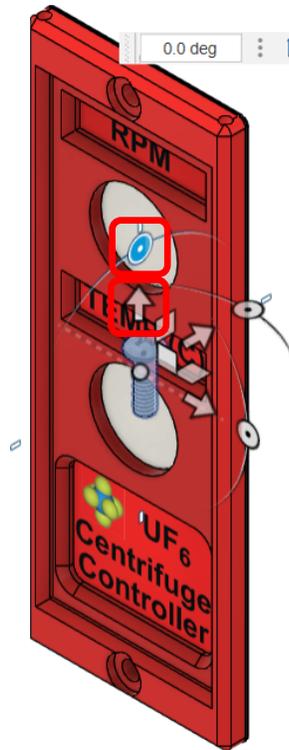
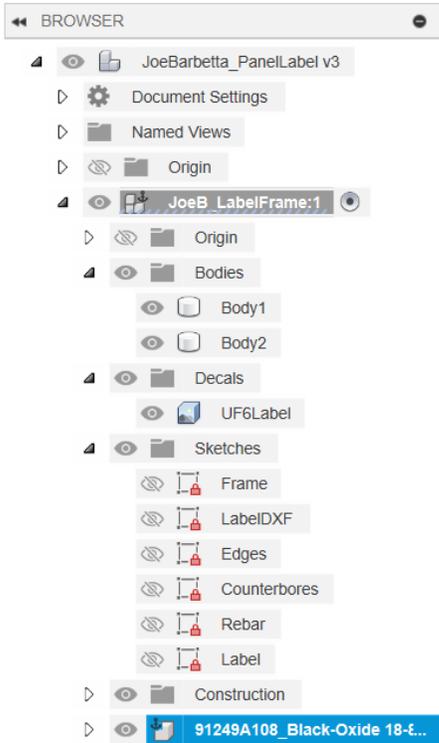
- enter the McMaster-Carr part number into the **search box**. Here we are importing part number **91249a108**.

- scroll on the page to find the part info box, as shown below, select **3-D STEP** in the CAD box and click **Download**.

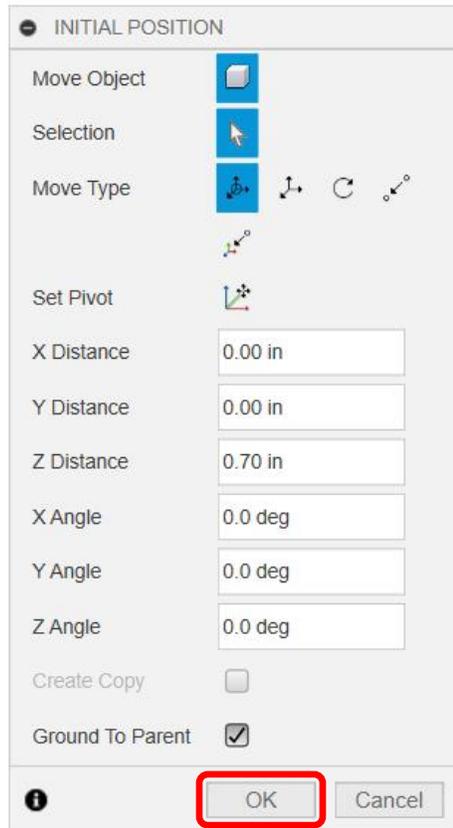
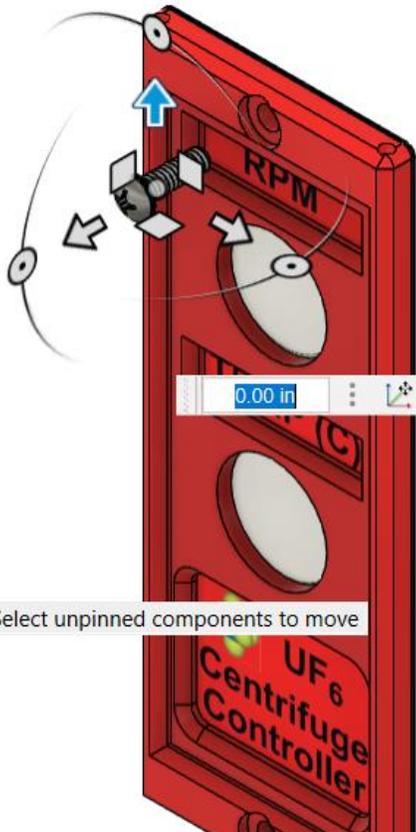


The image shows a screenshot of the McMaster-Carr website. The search bar at the top contains the part number '91249a108', which is highlighted with a red box. Below the search bar, the results show '10,446 Products' and a list of 'Screws'. The specific product 'Black-Oxide 18-8 Stainless Steel Pan Head Phillips Screw, 4-40 Thread, 3/8" Long' is highlighted with a yellow bar. To the right of the product image, there is a 'Quantity' field set to '1' and a 'Pack of 100' option. Below this, there is a 'Delivers Monday' notification and an 'ADD TO ORDER' button. At the bottom right of the product details, there is a 'CAD' dropdown menu with '3-D STEP' selected, and a 'Download' button, both highlighted with red boxes. The footer of the page contains navigation links: Home, Locations, Returns, Careers, Mobile App, Solidworks Add-In, eProcurement, API, Help, Settings, Terms and Conditions and Privacy Policy, and a 'Close' button.

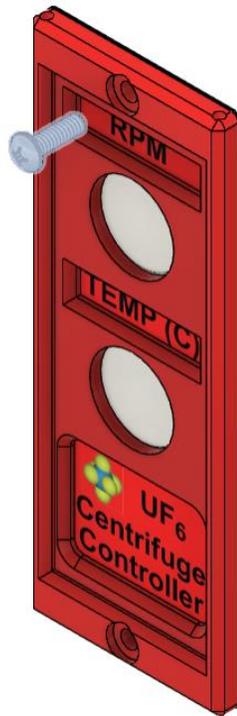
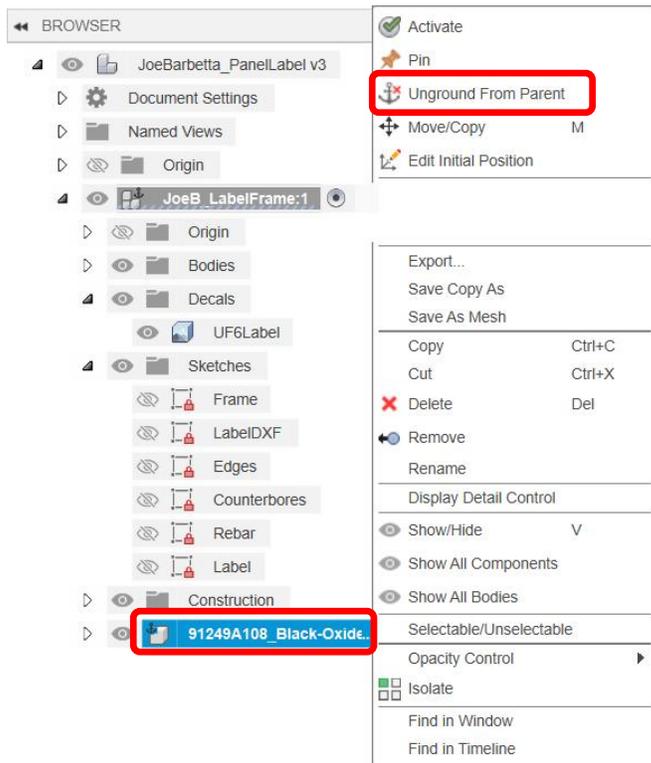
- use the proper **rotation handle** and **move arrows** to rotate the part and position it over the top hole. The positioning is not critical. An alignment operation will be used later on.



- when the screw is over the hole, click **OK**



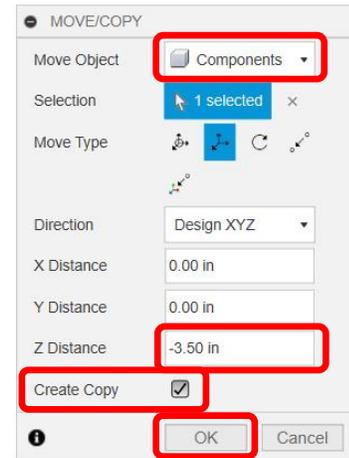
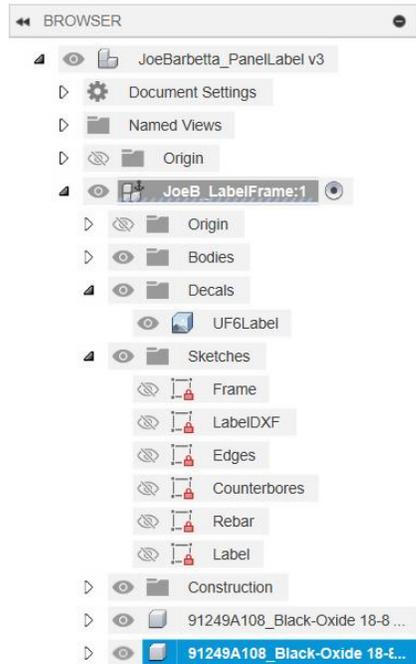
- right-click on the screw **Component** and select **Unground From Parent** all the way at the top of the menu list



- from the **MODIFY** menu select **Move/Copy**

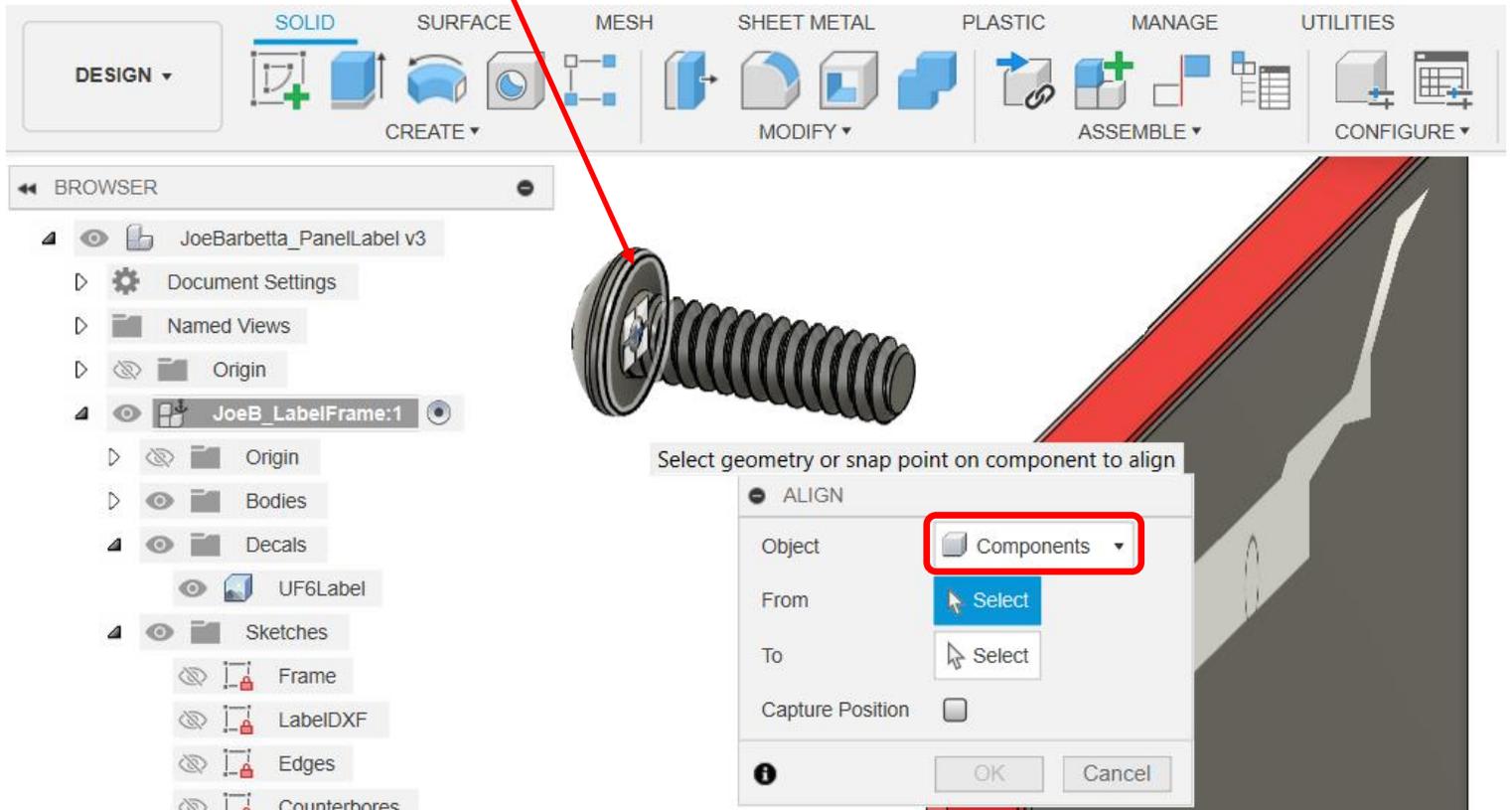
- in the MOVE/COPY window select **Components** and check **Create Copy**

- **click on the screw** and enter **-3.50** (note the minus sign) for **Z Distance** and click **OK**. Note that one can always drag the direction arrows to position components as well.

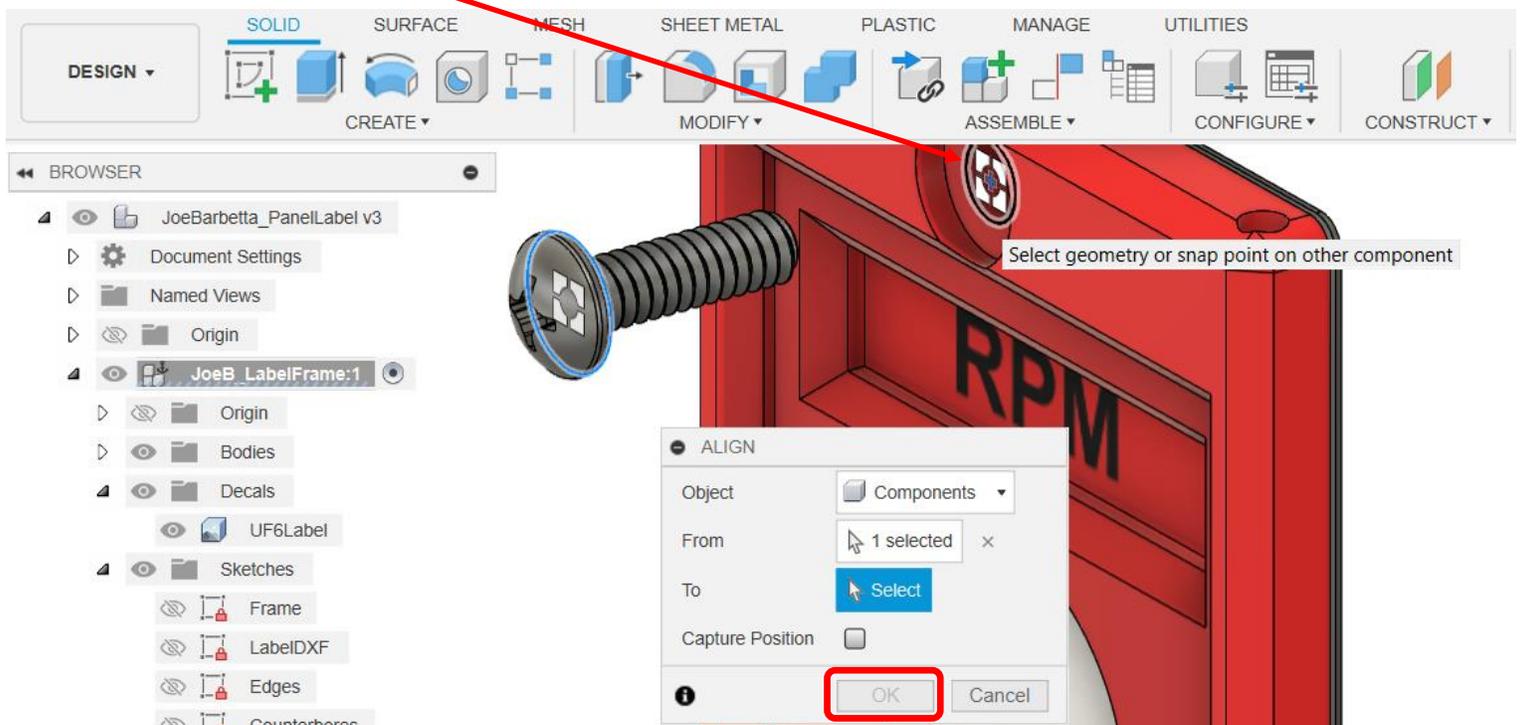


-3.50 in

- adjust the view to access the underside of the top screw head, as shown below
- from the **MODIFY** menu select **Align**
- select **Components** and click on a **circular part of the screw** closest to the end of the screw, which should result in a white target mark showing in the center of that circle.



- adjust the view to view the top of the screw hole in the frame
- click on the **top edge of the hole**, which should result in another white target mark
- click **OK**

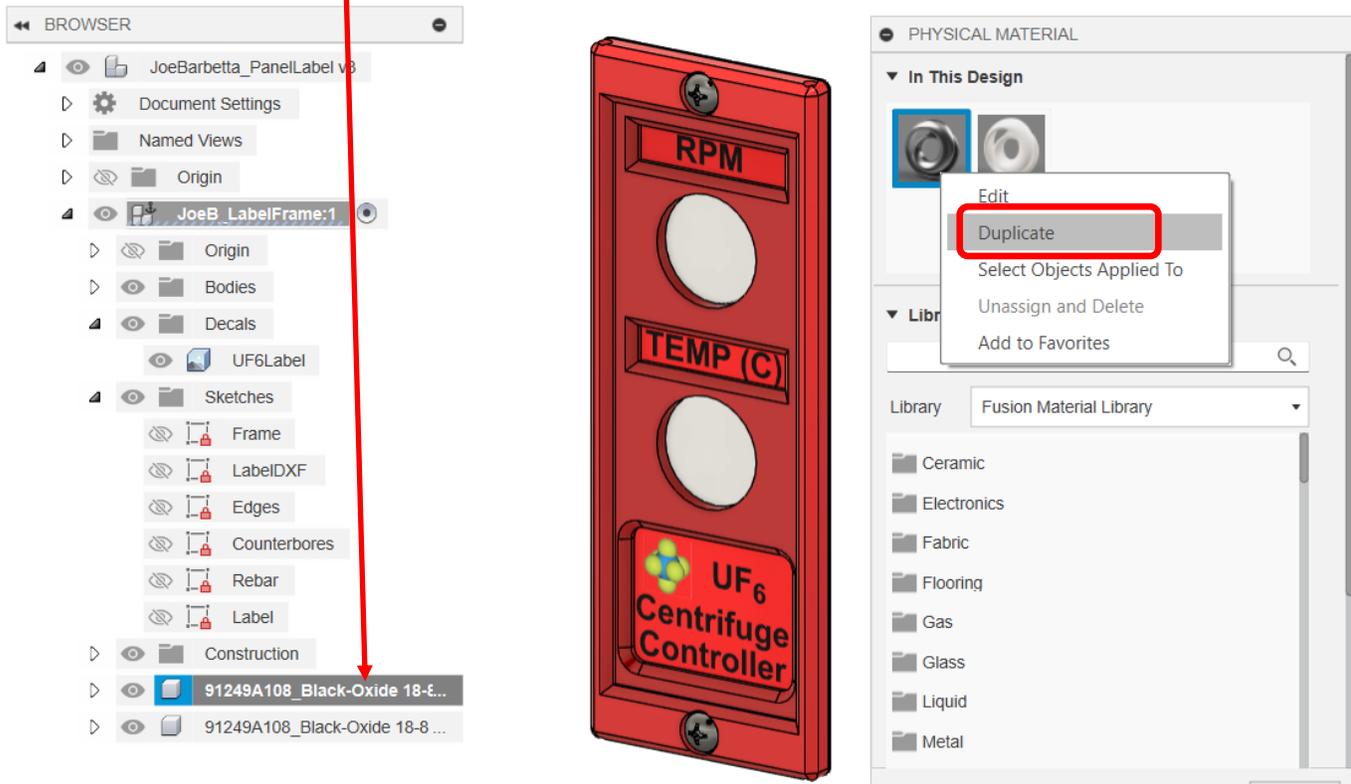


- Yell I am so tired of this assignment! I can't believe there is more! I don't care about that art credit anymore!

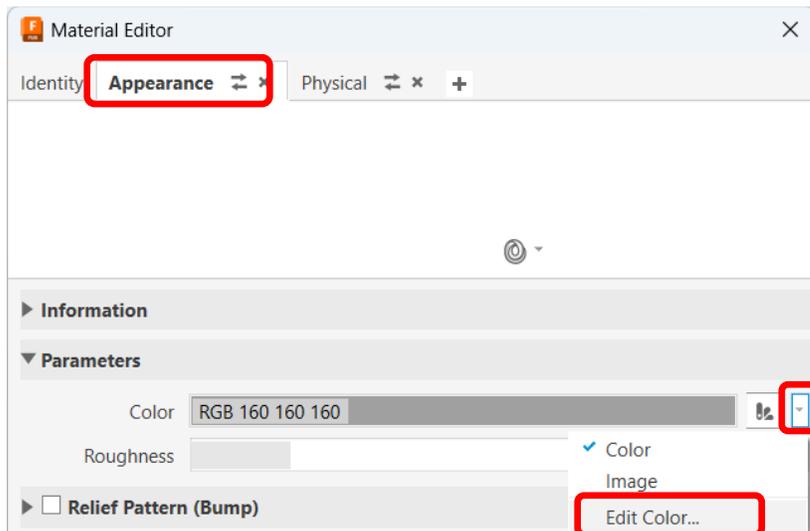
Yes. This is going a little overboard, but the screws look like normal steel and not black-oxide. Let's fix this.

- right-click on a **screw Component** and select **Physical Material**

- right-click on the **steel icon** and select **Duplicate**



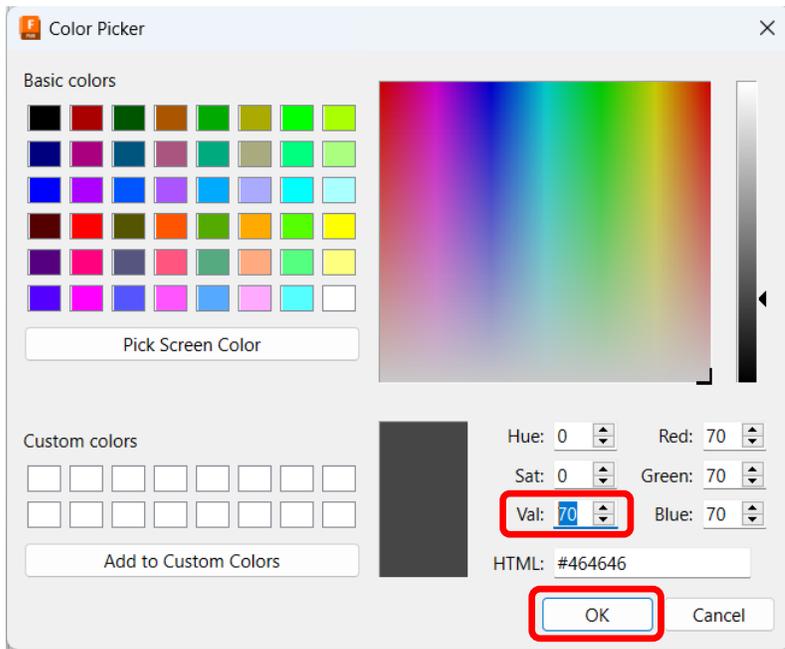
- right-click on the new **Material icon** and select **Edit** and click **Advanced** on the next window



- select the **Appearance** tab

- click the drop-down menu arrow and select **Edit Color...**

- change **Val:** to **70**. This is Luminance, which will darken the color.
- click **OK**



- click **OK** at the bottom of the Material Editor window



- drag the new **Material icon** on to a **screw**, which should cause both screws to darken
- admire your panel, as shown on the right
- press the undo button a few hundred times and repeat the entire process

