Create a 3D-Printable Easter Egg

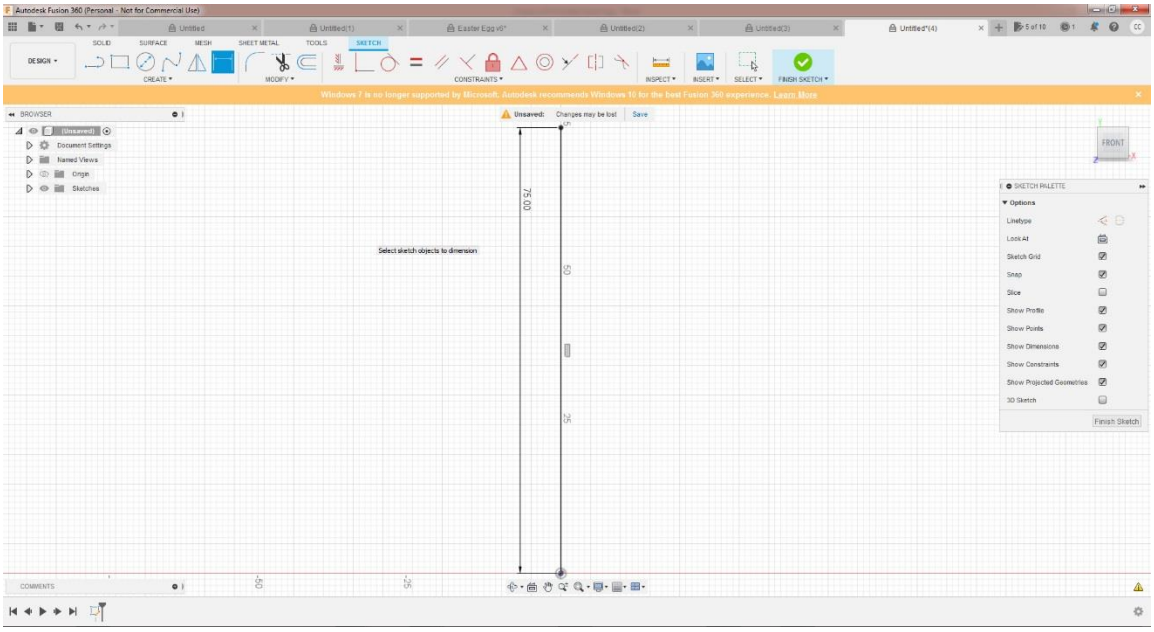
The accompanying video tutorial is available @ CADenvy.com

Lesson 1: Sketch the Egg Shape

Topics covered in this lesson:

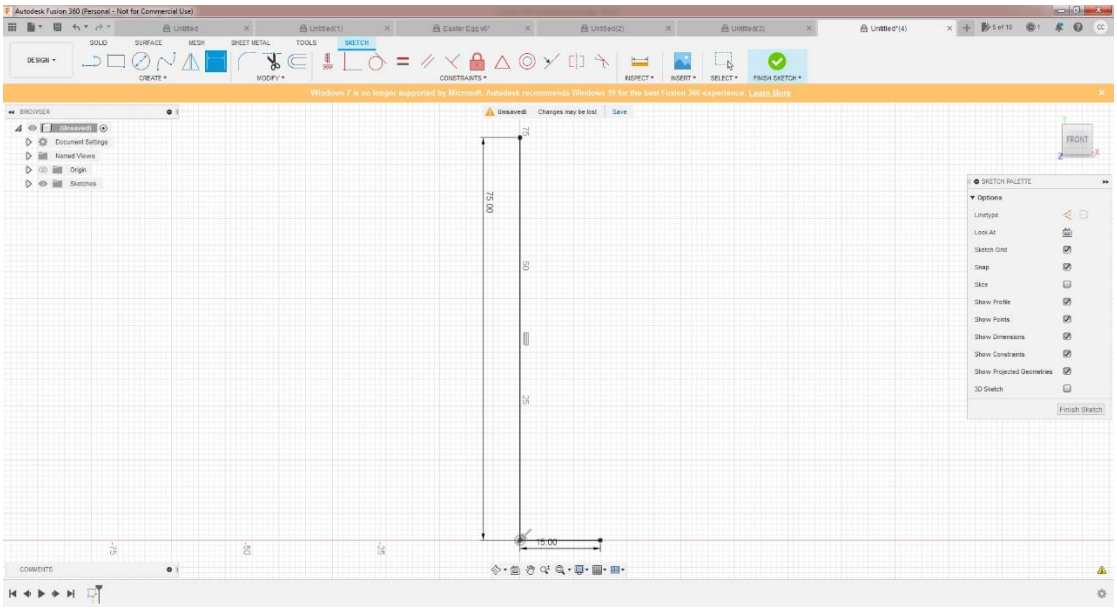
- Create a new project and a new design.
- The importance of choosing a logical file name when you create the file.
- The importance of regularly saving your work.
- How to start a new sketch.
- How to sketch and dimension lines and splines.

1. Create a new project named "**Easter Egg**".
2. Create a new sketch.
3. Select a plane to sketch on using the X-Y axis.
4. **<u>Create the Egg Height</u>**: Create a line from the Origin to the egg top – ***75mm*** long. The top point will be the anchor point for the top of the spline. Use the **Dimension** command, (**Modify / Dimension or "D"**) to set the exact length.



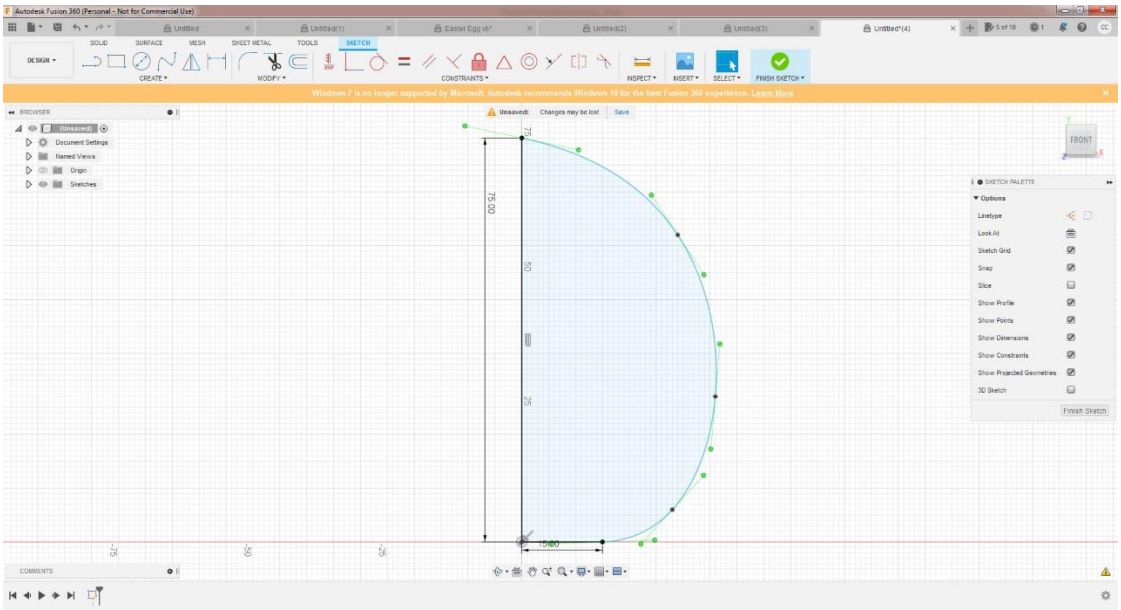
(75mm Height Line Dimensioned)

5. **<u>Create the Base Line</u>**: Draw a second line from the origin outwards along the **X** axis ***15mm*** in length. Save the file.



(15mm Base Line Dimensioned)

6. **<u>Draw the Spline</u>**: Use the (**Fit Point**) Spline tool to draw three new points. Click on the top of the height line to anchor the spline, draw three points approximately where they appear on the reference drawing, and click the outside of the base line to anchor the spline. Right-click to display the **radial tool menu** and select **OK**.



(Rough Spline Points Added)

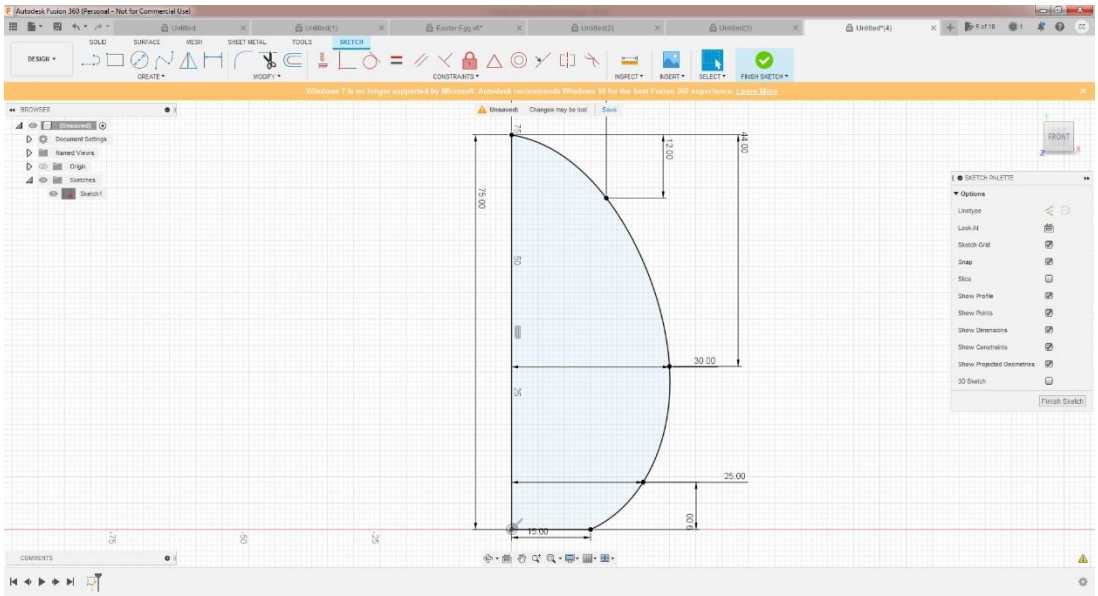
7. **<u>Close the Sketch</u>**: Press the "***Finish Sketch***" button.

Lesson 2: Dimension the Spline Points:

Topics covered in this lesson:

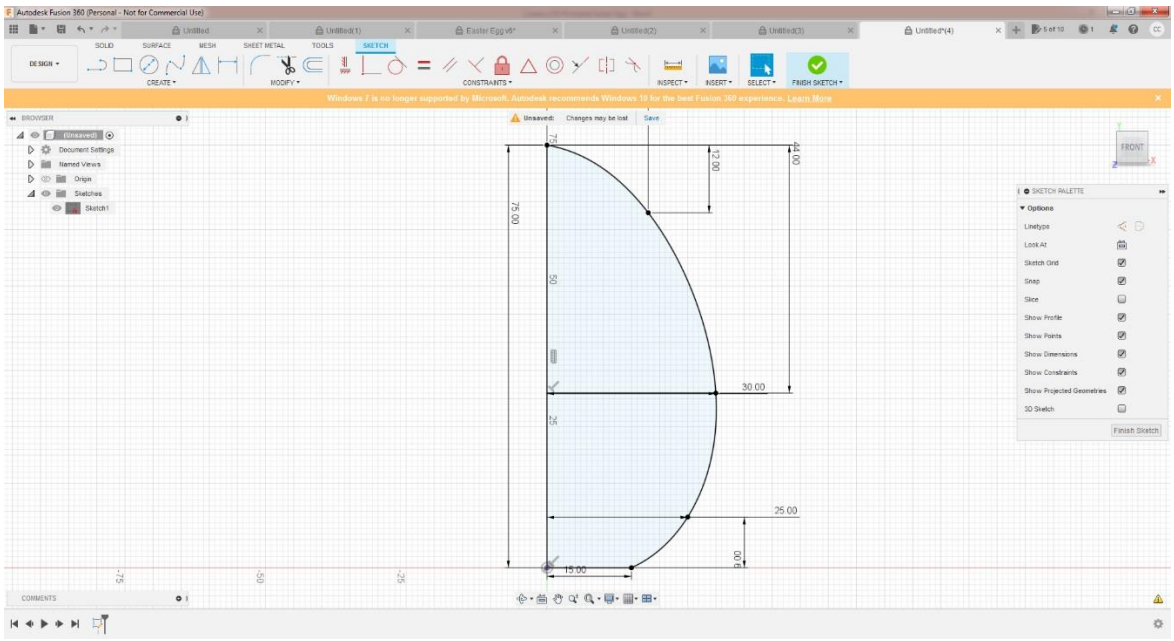
- Dimension.
- Using the Search function by pressing the key **S** on your keyboard.

1. **<u>Edit the First Sketch Containing the Spline</u>**. Right-click on the browser sketch icon and select "**Edit Sketch**".
2. **<u>Dimension the Spline Points</u>**: Use the reference drawing to dimension the spline points. Select the **Dimension** tool , click on the top/outer point, then click on the top line point, drag out and set the X position measurement to ***18 mm***. Select the top / outer point, then select the top anchor point, drag down and enter ***12 mm*** to get the Y positioning point (in relation to the top anchor point). Dimension the remaining two outer spline points.



(Spline Dimensioned)

3. **<u>Draw and Dimension the Top/Bottom Dividing Line</u>**: Draw a line from the center spline point to the vertical line. Press the escape key to close the tool.



(Center Divide Line Established)

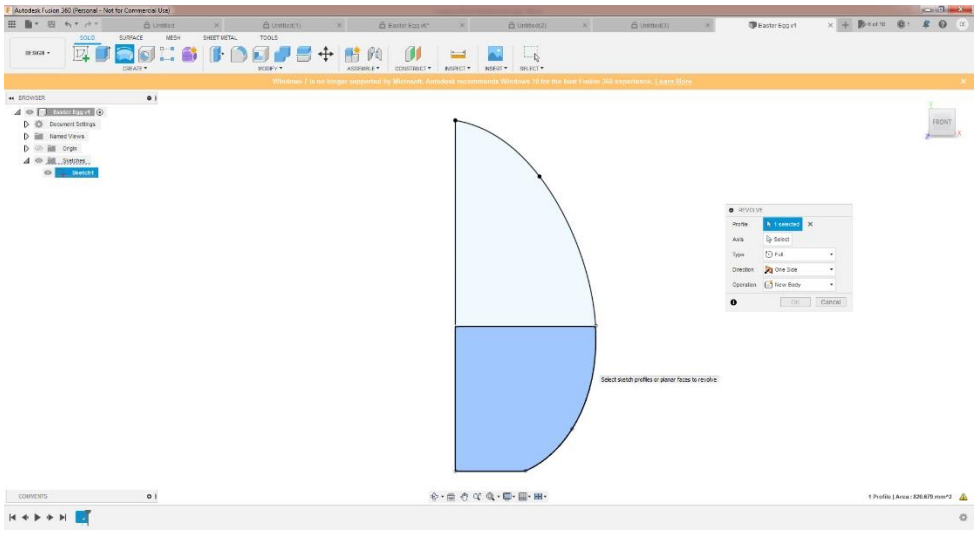
4. Finish the Sketch and save the file. Only one sketch is present because the first sketch was edited.

Lesson 3: Revolve the Top and Bottom

Topics covered in this lesson:

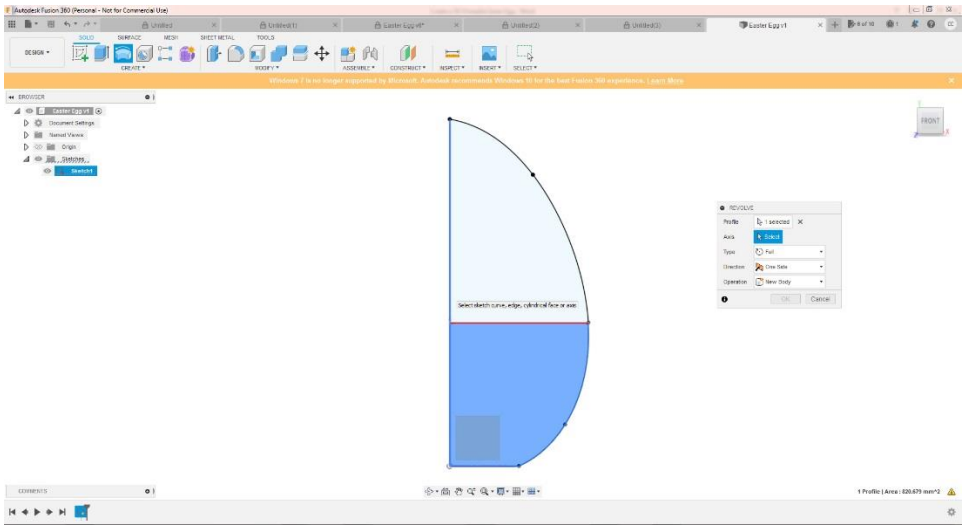
- Revolve
- Re-use sketch
- Re-name sketches

1. **<u>Select the Outer Edge Profile to Revolve the Lower Half</u>**: Select the **Revolve** (***Create / Revolve***) tool. When the dialog box opens, (Profile is the default selection) left-click the lower/outer edge to select the profile to be revolved around.

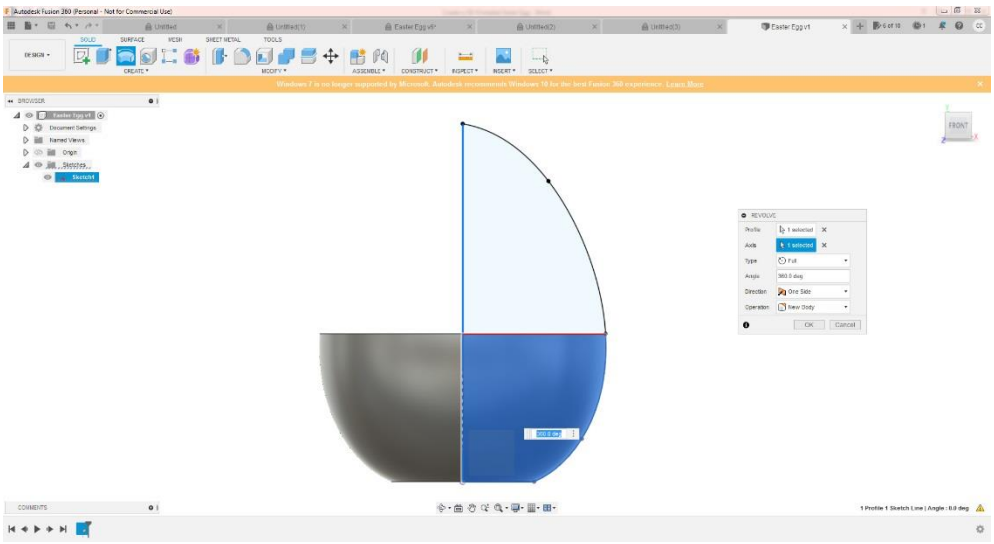


(Lower Profile Selected)

2. **<u>Select the Lower Half Axis to Revolve Around</u>**: Select the **Axis** option, then left-click on the centerline vertical axis line. The lower half will revolve around the **Y axis**.

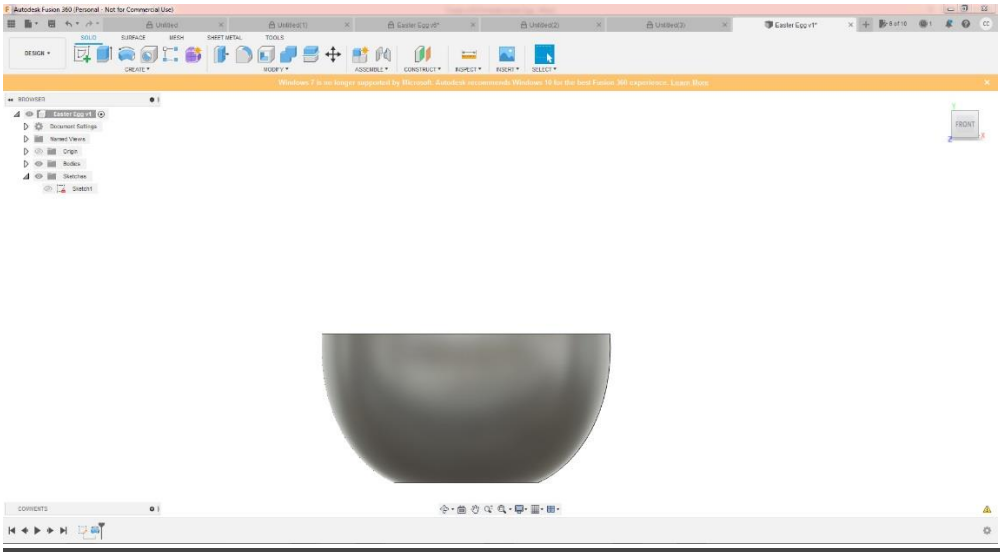


(Y Axis Selected for the Revolve Tool)



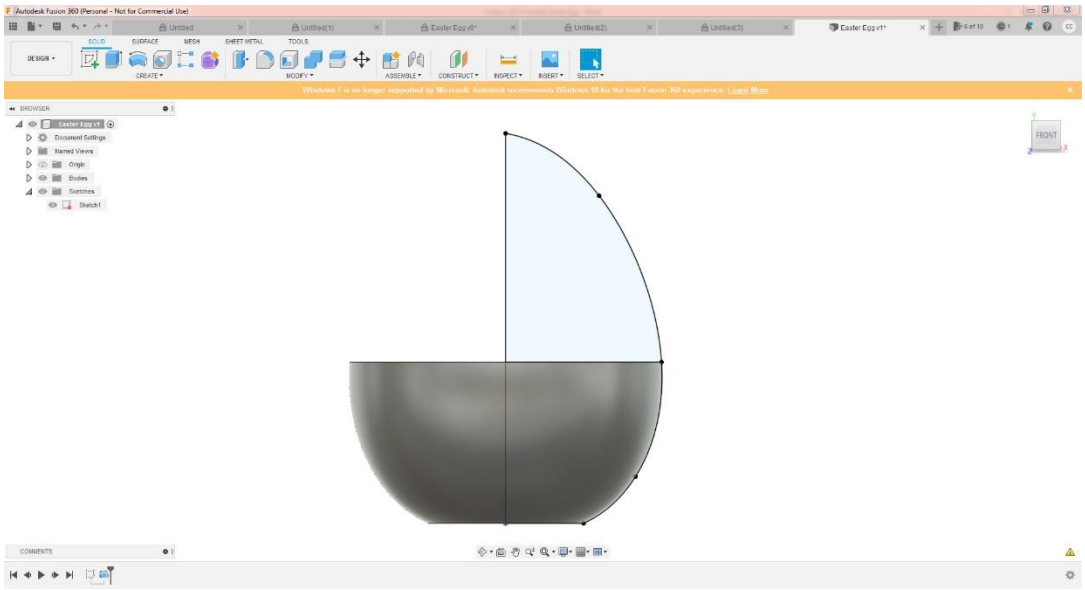
(Lower Half Revolved)

3. **<u>Separate the Upper and Lower Halves by Dividing Them into Two Bodies</u>**: Ensure the "**New Body**" option is selected in the **Operation** entry. Press **OK** to close the dialog box. The top profile vanishes and only the lower body is visible. Save the file.



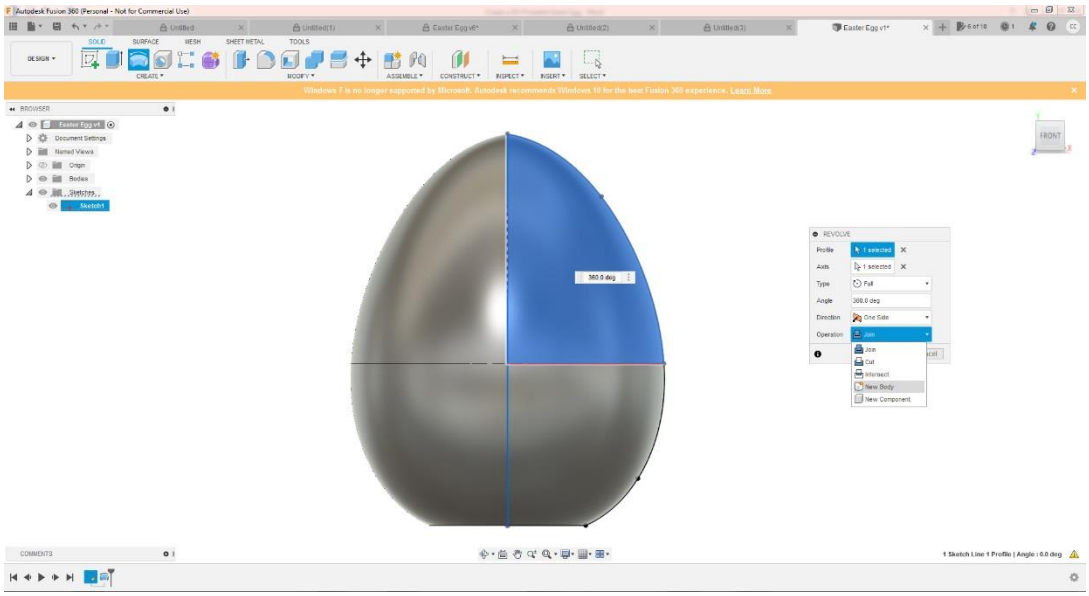
(Bottom Body Visible)

4. **<u>Make the Top Profile Visible</u>**: Left-click on the Sketch 1 visibility icon, (the eye) to make the upper half profile visible.



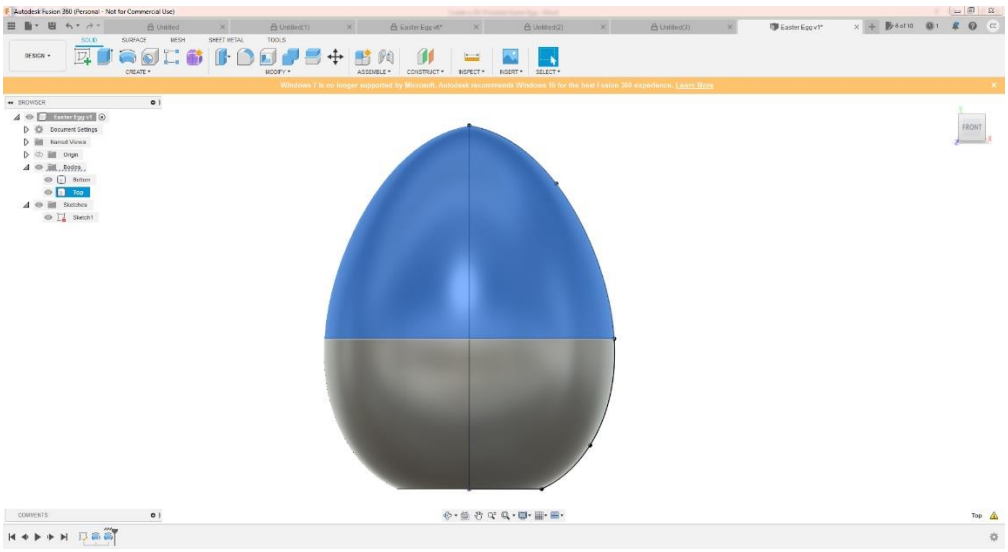
(Top Profile Visible)

5. **<u>Revolve the Top Half</u>**: Perform this the same way as the lower half, but change the **Operation** from "**Join**" to "**New Body**" after the upper profile revolves, otherwise, the top and bottom half will not be separate.



(Top Half Revolved)

6. **<u>Name the Two Bodies</u>**: Select each Body in the browser by double-clicking each name to highlight; name the Top Half "**Top**" and the bottom half "**Bottom**". Turn off the visibility for the sketch profile since it is no longer needed. Save the file.



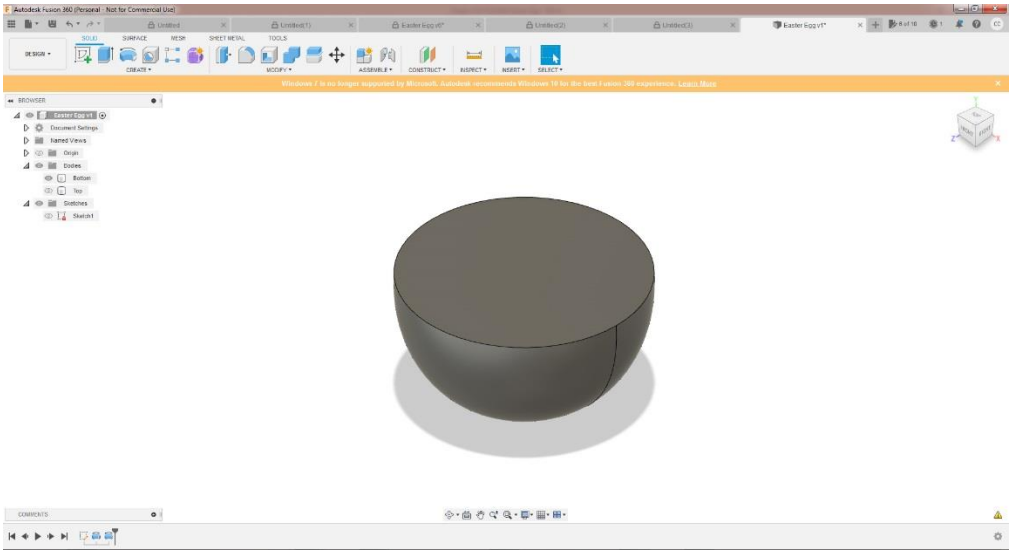
(Body Naming)

Lesson 4: Make the Shell

Topics covered in this lesson:

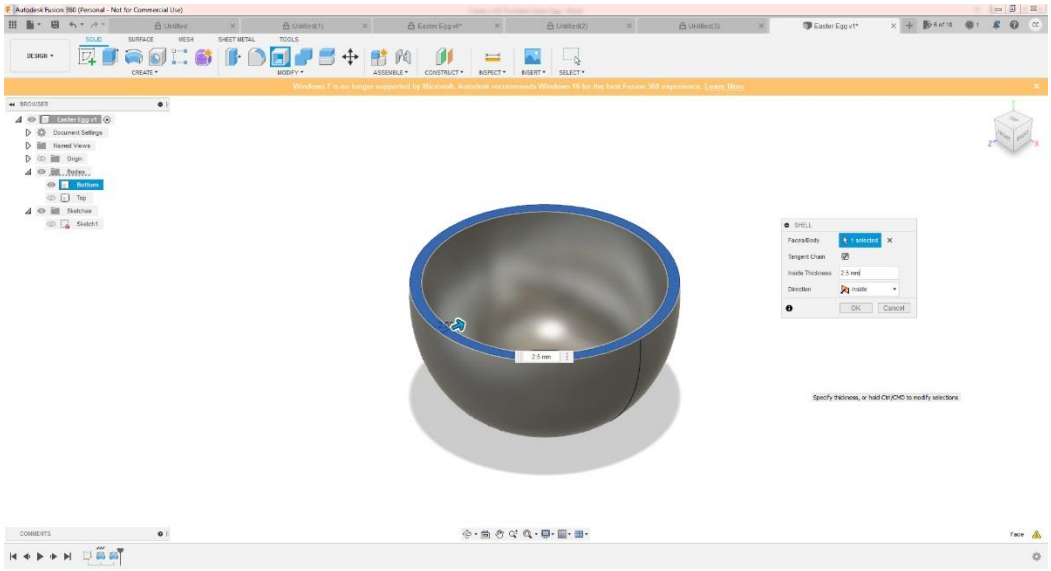
- Shell tool.
- Make bodies visible and invisible

1. **<u>Unclutter the Workspace</u>**: Select the visibility icon for the top half to only display the bottom half.



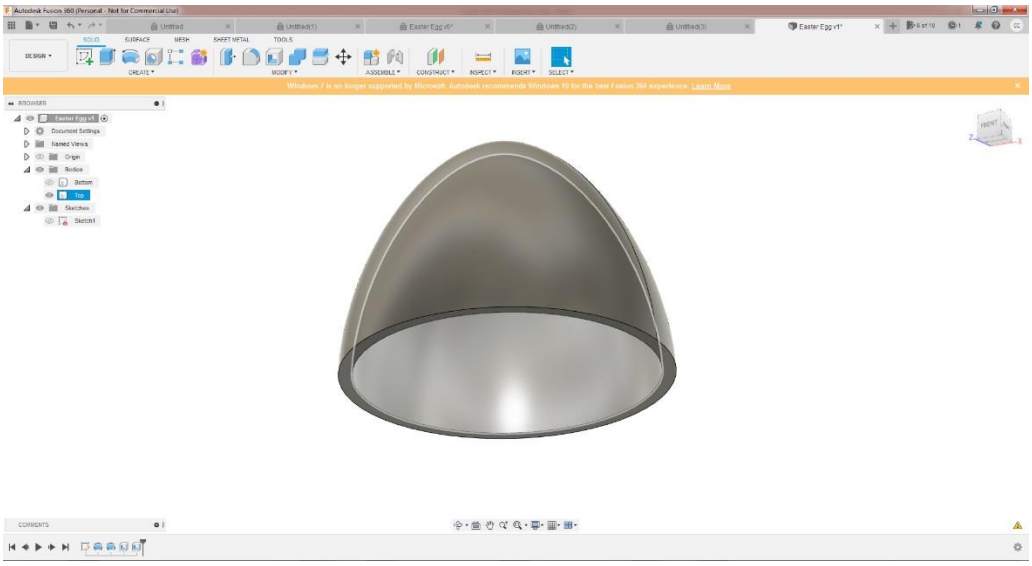
(Lower Body Visible)

2. **<u>Activate the Shell Tool</u>**: Select the **Shell** tool and left-click on the top plane of the bottom body. Set the **Shell Thickness** to ***2.5 mm***.



(Bottom Half Shell Defined)

3. **<u>Create a Top Half Shell</u>**: Swap the visibility icons for the top and bottom halves and repeat step 2 for the Top body. Save the file.



(Top Half Shell Defined)

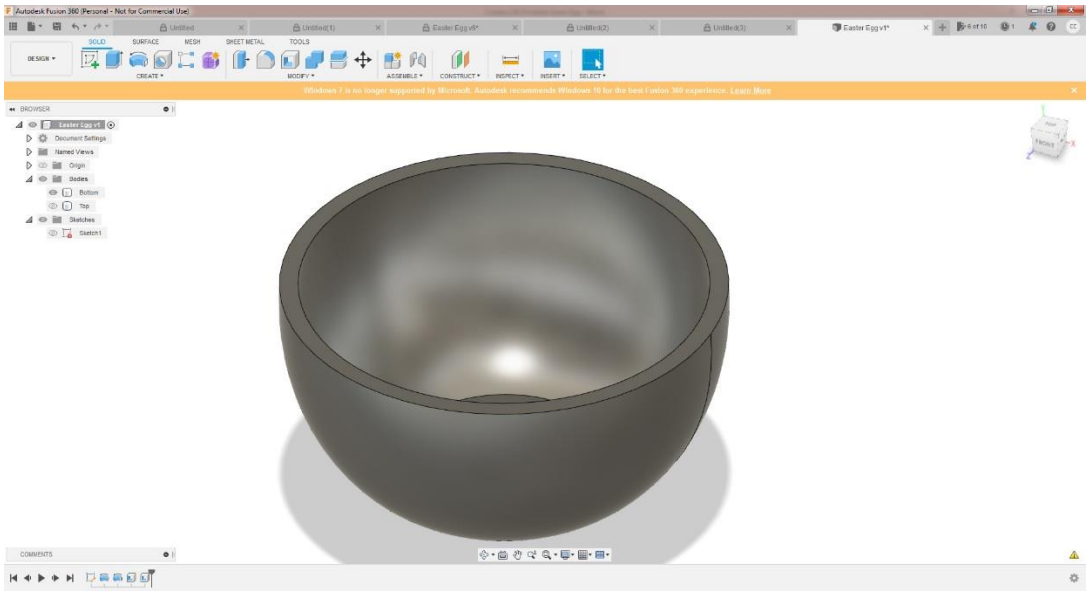
4. **<u>Opacity Control</u>**: If it is desirable to view into the part to view your work, either body can be selected and the **Opacity Control** adjusted by right-clicking on the body and selecting the Opacity Control option from the drop-down menu.

Lesson 5: Make the Connection Parts:

Topics covered in this lesson:

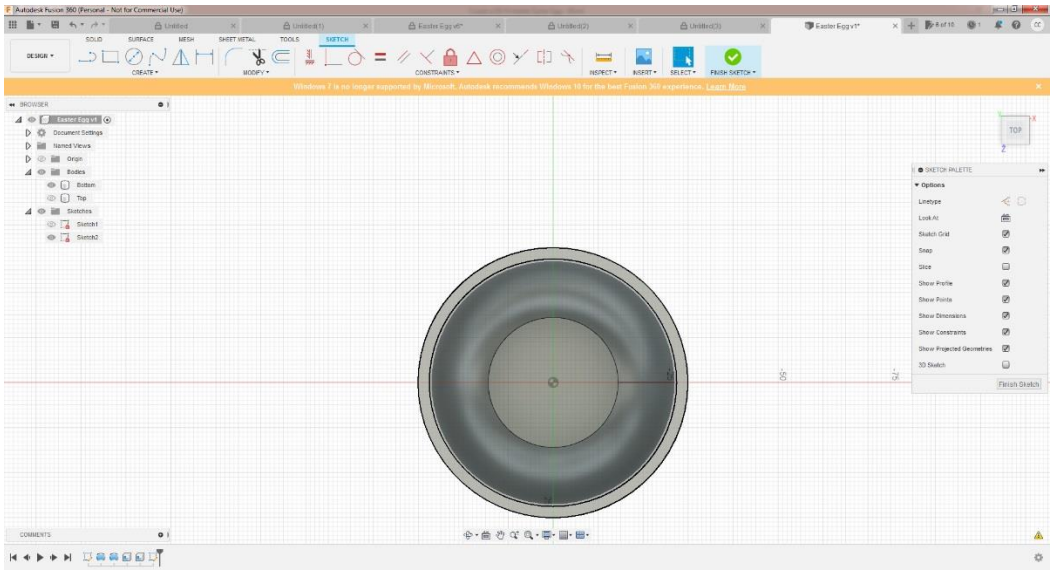
- Sketch on a face.
- Project geometry.
- Extrude.
- Dimensions.

1. **<u>Unclutter the Workspace</u>**: Make the Top body invisible using the body's visibility icon.



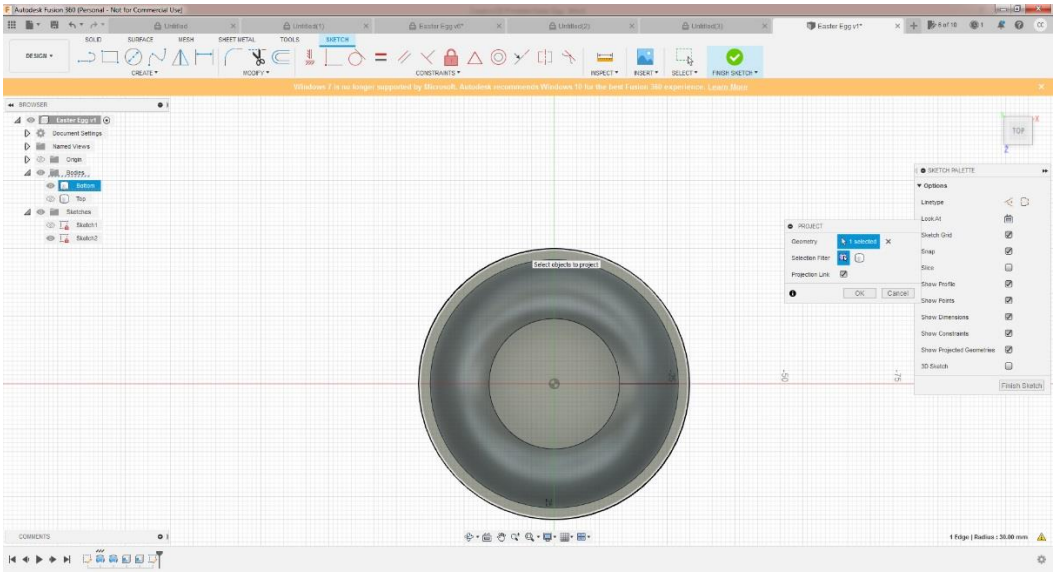
(Bottom Body Visible)

2. **<u>Define the Sketch Plane</u>**: Select "**New Sketch**" and left-click on the top edge. The view orientation will change to the top-down view.



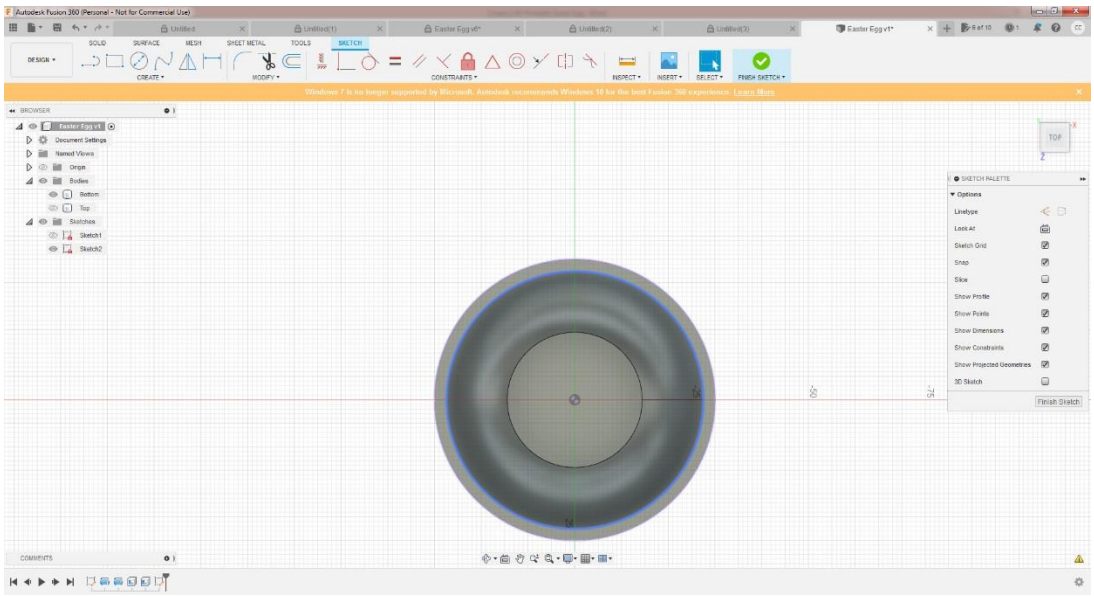
(Bottom Half Sketch Plane Defined)

3. **<u>Define the Outer Lip Edge</u>**: Start by defining the outer edge of the top. Select **Create / Project/Include / Project**, and left-click on the outer edge.



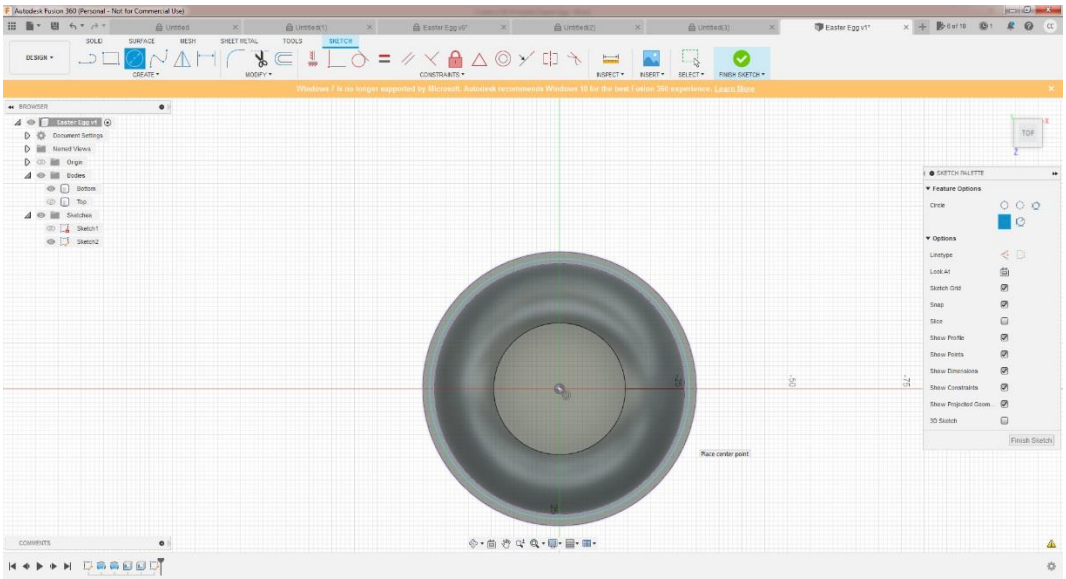
(Bottom Half Outer Edge Selected for Projection)

4. **<u>Define the Inner Lip Edge</u>**: Repeat step 3, but apply it to the inner edge.



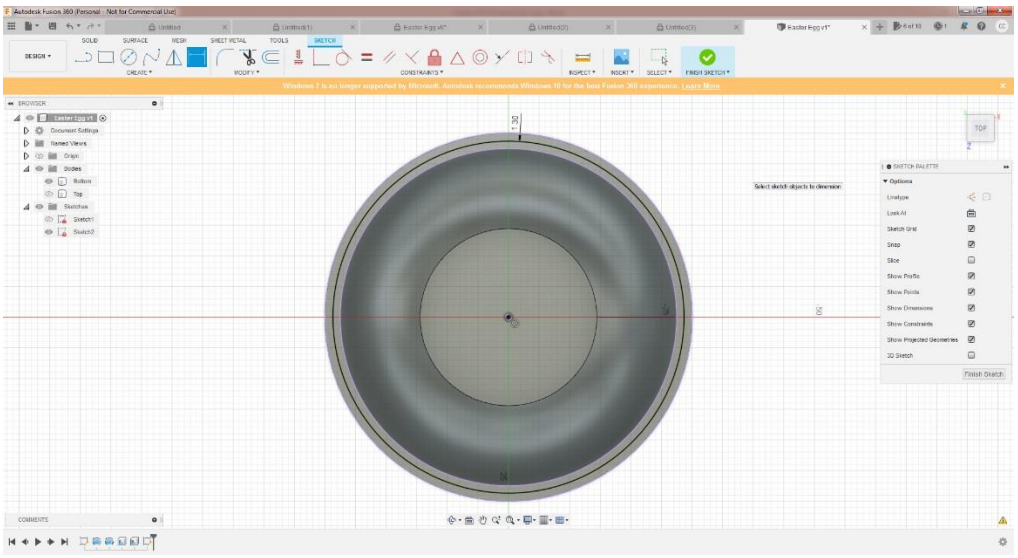
(Highlighted Bottom Half Inner Edge Selected for Projection)

5. **<u>Define the Lip Edge to Extrude</u>**: In the Top-down view, select **Create / Circle / Center Diameter Circle** and draw a circle from the origin to the approximate center of the top edge. Press escape to close the tool.



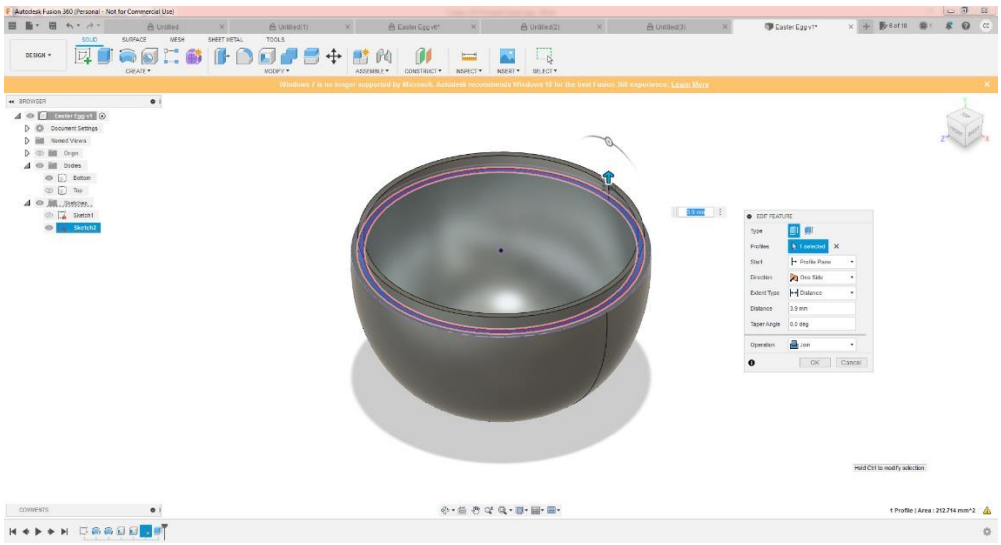
(Extrusion Edge Defined)

6. **<u>Dimension the Outer Edge to the Center Extrusion Line Width</u>**: Select the **Dimension** tool and left-click on the outer edge followed by the center extruder edge. Set the dimension to ***1.3 mm***.



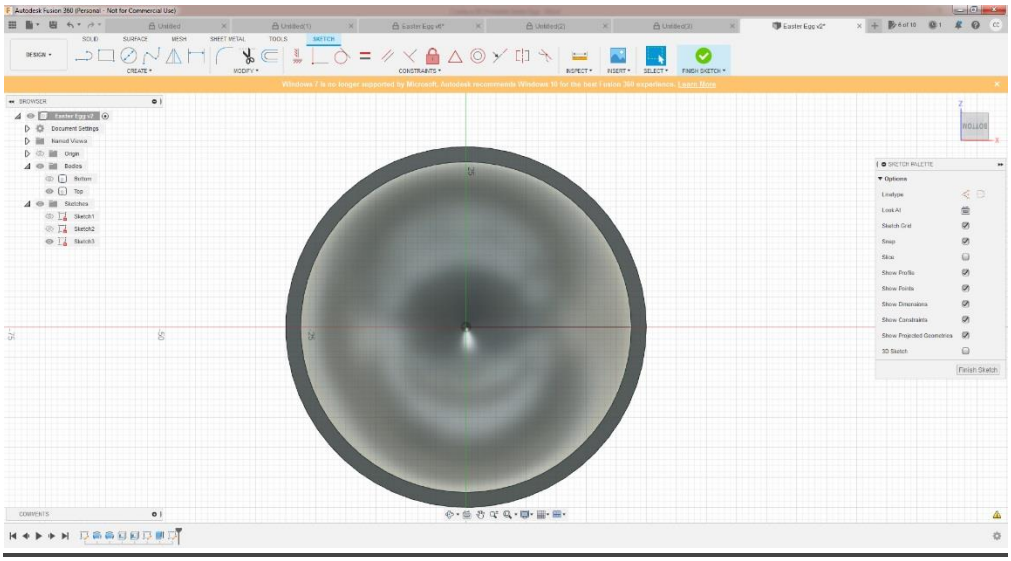
(Extrusion Edge Width Dimensioned)

7. **<u>Extrude the Lower Lip</u>**: The **Extrude** command can be used directly or press the **Finish Sketch** button. (In this example, Finish Sketch has been selected prior to invoking the Extrude tool.) Open the **Extrude** tool and select the inner border. Extrude the profile ***3.9 mm***. Ensure the **Operation** is set to "***Join***" so the extruded edge isn't left floating in space.



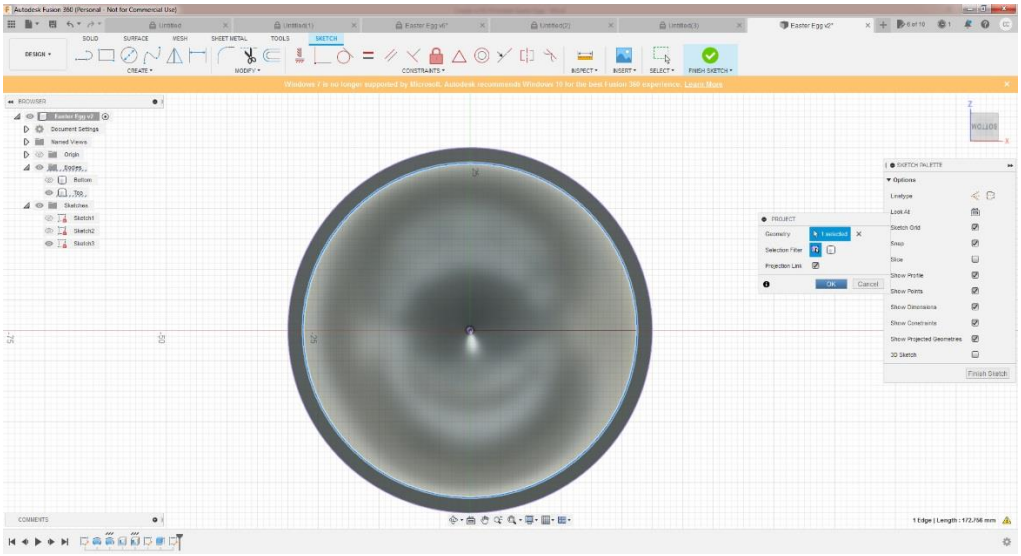
(Lower Lip Extruded)

8. **<u>Prepare the Top Half for Extruding</u>**: Switch visibility for the top and bottom halves so only the top half is visible. Create a **New Sketch** and select the edge border to reorient the viewing plane as shown in the next figure.



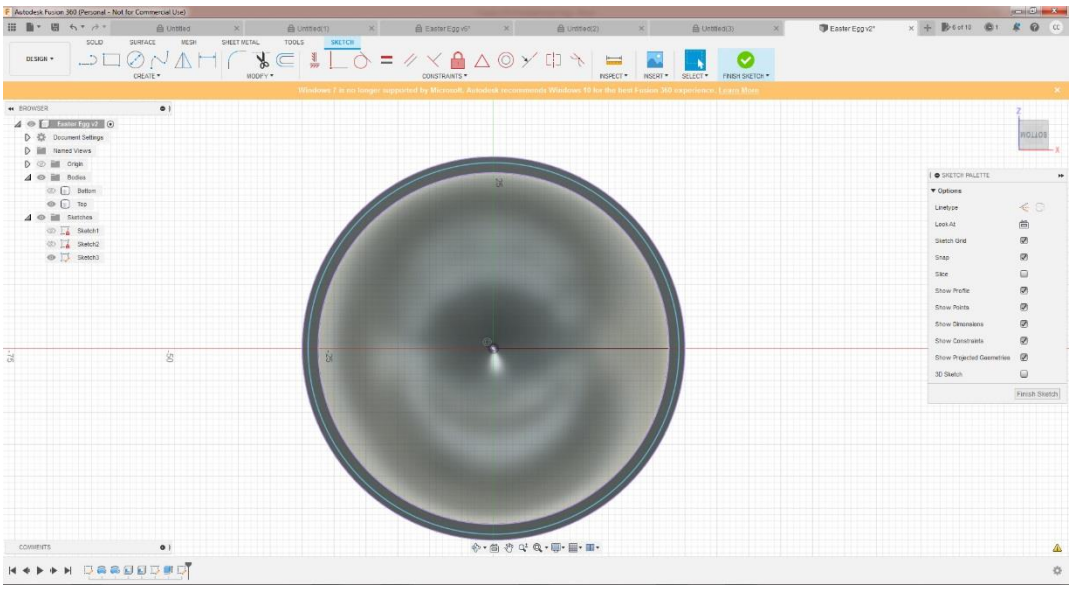
(Top Border View)

9. **<u>Define the Inner and Outer edges of the Border Plane</u>**: Repeat steps 3 and 4 for the border plane.



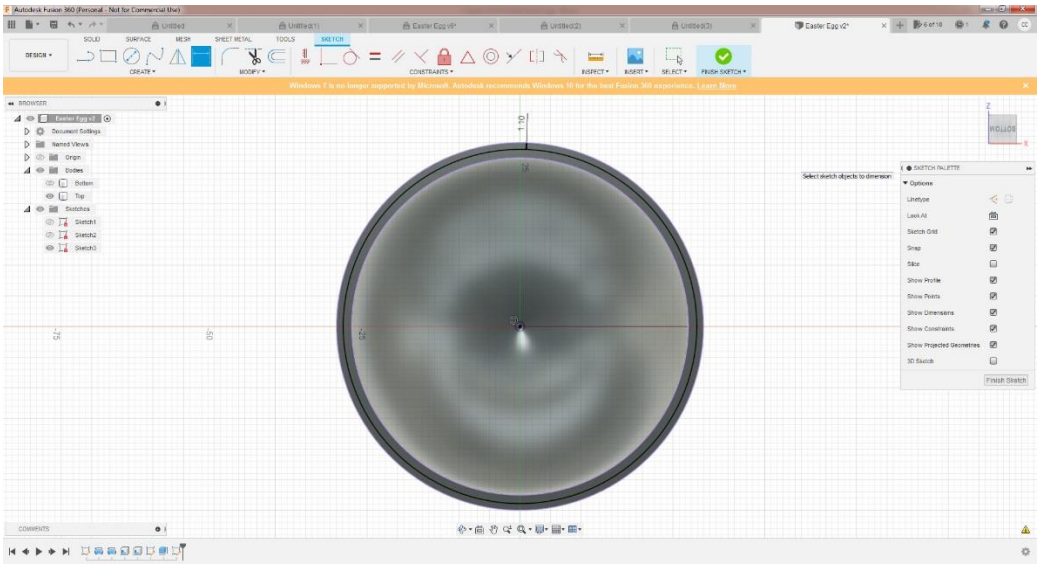
(Border Edge Projected – Inner Shown)

10. **<u>Place a Centerline Border on the Extrusion Edge</u>**: Use the **Circle Center Diameter** tool repeating Step 5 to define the approximate center of the plane. Close the tool with the escape key.



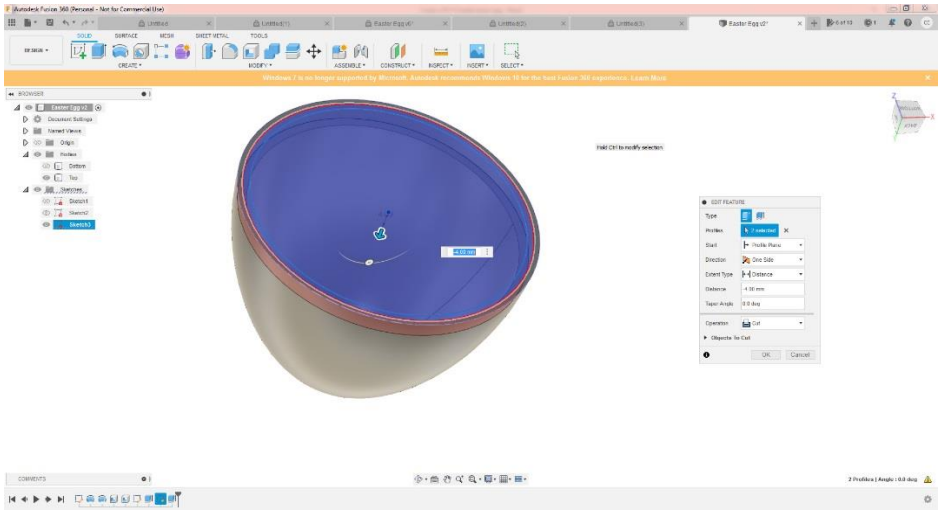
(Top Half Border Plane Approximate Centerline)

11. **<u>Dimension the Outer-to-Center Edge</u>**: Select the **Dimension** tool and left-click on the outer and center lines. Set the dimension to ***1.1 mm***.

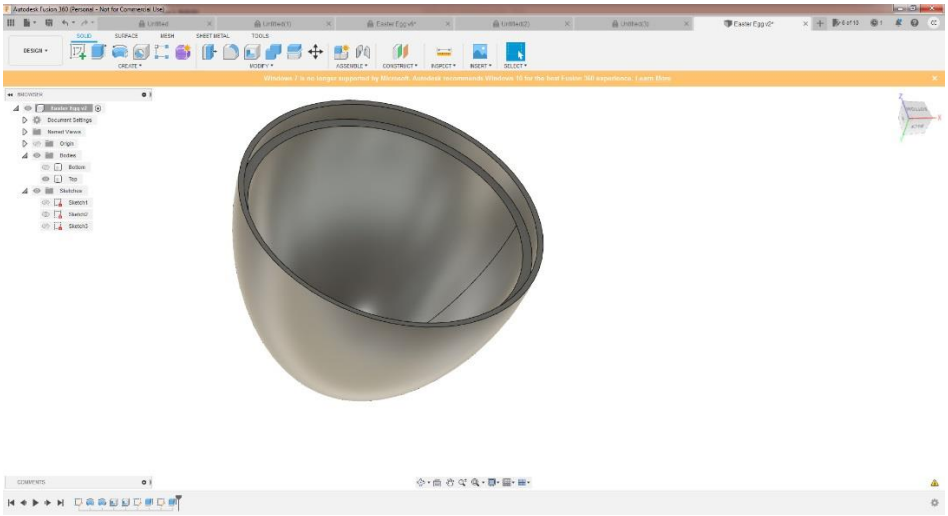


(Top Half Extrusion Width Defined)

12. **<u>Extrude the Top Half Inner Lip</u>**: Select the **Extrude** tool followed by the inner border. Extrude the inner border ***-4 mm***. This extrude move is slightly different in that we want to select "***Cut***" for the **Operation**. If only the border is selected, the inner shell wall will not follow the extrusion, so both the inner border and inner shell have to be selected to obtain the desired effect. 2 Profiles are selected. After extruding, save the file.



(Inner Border and Inner Shell Wall Selected for Extrusion)



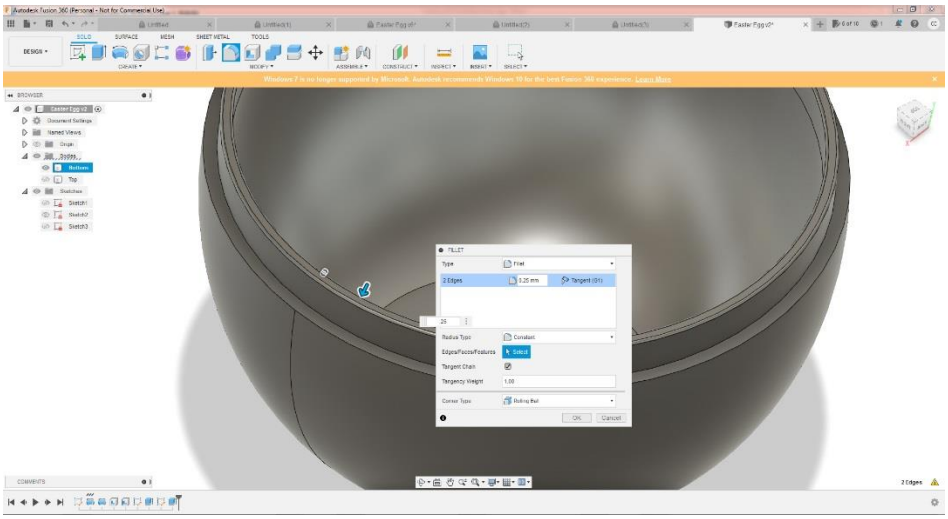
(Completed Top Half Extrusion)

Lesson 6: Fillets and Chamfers

Topics covered in this lesson:

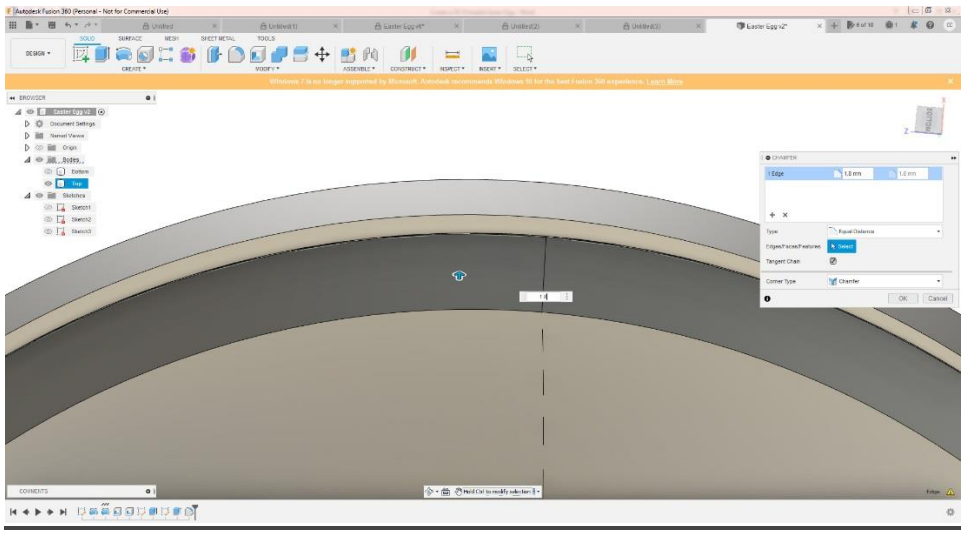
- Fillet tool
- Chamfer tool

1. **<u>Add Bottom Lip Fillets</u>**: Hide the top half using the visibility icon and zoom to the bottom half lip edges. Select the **Fillet** tool and select the two outer lip edges. Set the fillet distance to ***.25 mm***.



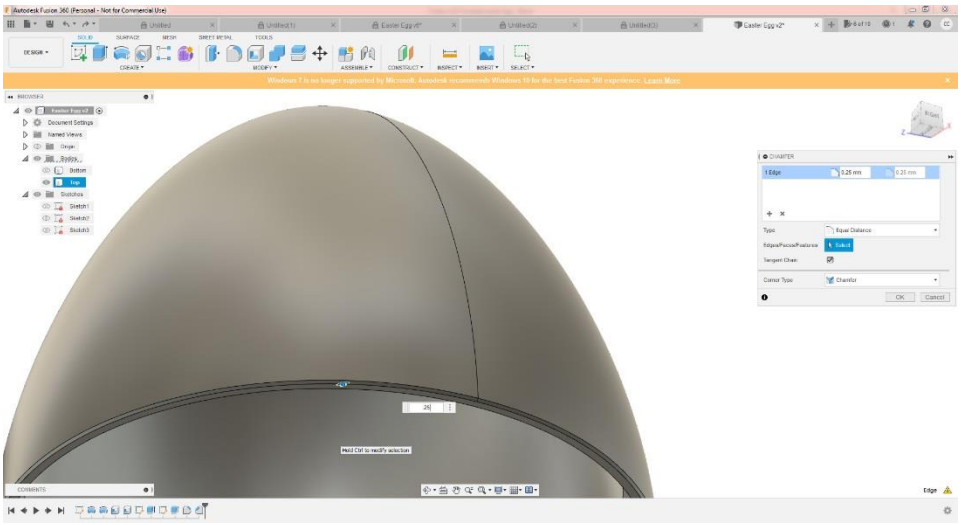
(Bottom Lip Fillets Defined)

2. **<u>Apply a Chamfer to the Top Half Inner Edge</u>**: Switch visibility between the halves so only the top half is visible. Select the **Modify / Chamfer** tool and select the inner edge. Set the chamfer to ***1.8 mm*** which is a far as can be set back without over-constraining the ledge width and generating an error message.



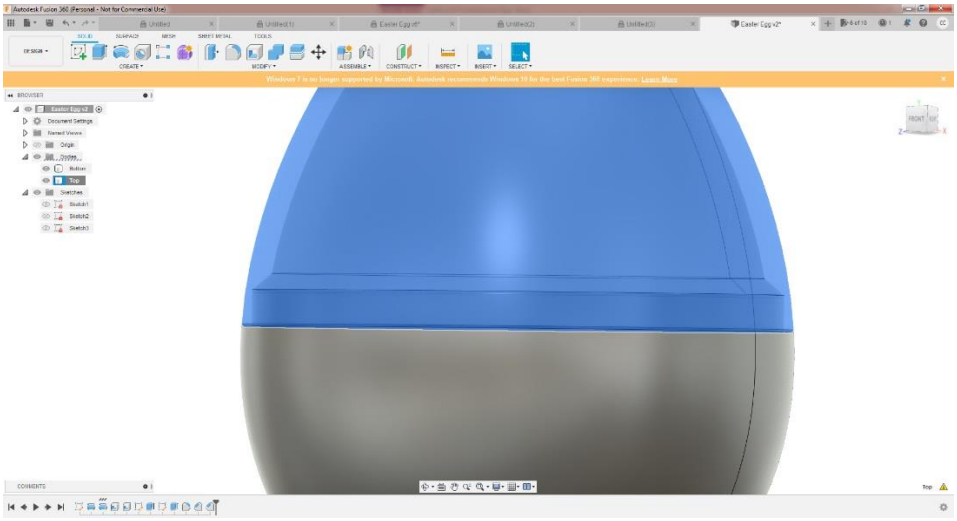
(Top Half Inner Edge Chamfer)

3. **<u>Chamfer The Top Half Outer Edge</u>**: Open the **Chamfe**r tool, select the outer edge, and enter a Chamfer value of ***.25 mm***.



(Top Half Outer Edge Chamfer)

4. **<u>Inspect:</u>** With both halves visible, and the top half @ ***50% opacity***, the Easter Egg should look similar to this chamfer profile when viewed from the side:



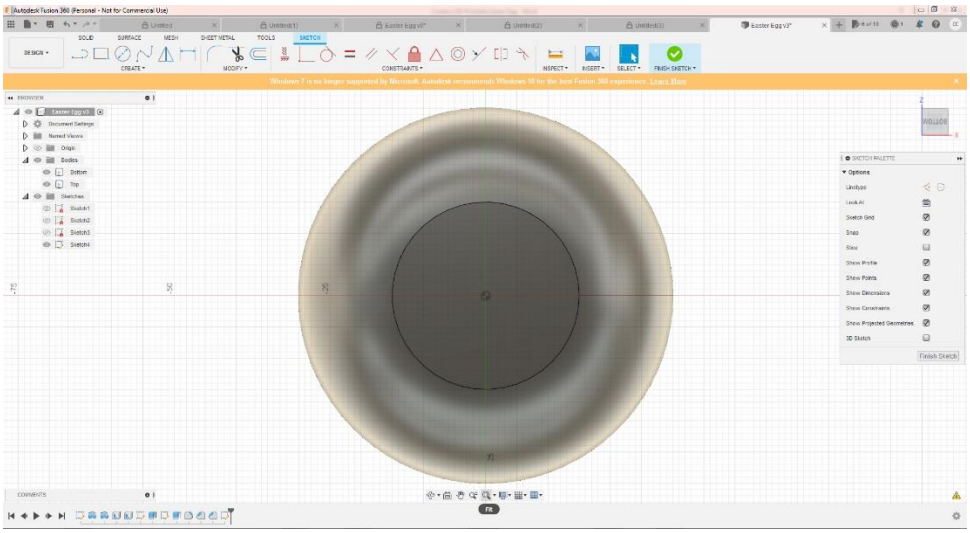
(Chamfer Side Profile)

Lesson 7: Add Text to the Bottom

Topics covered in this lesson:

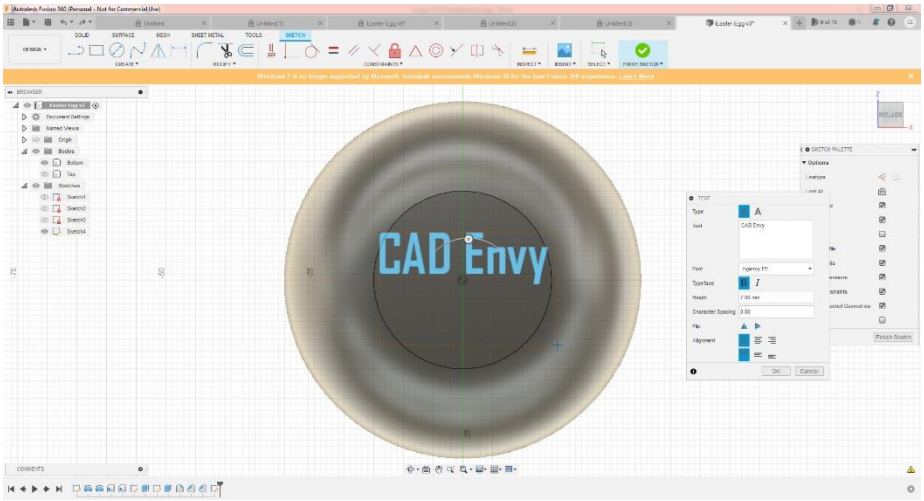
- Create new sketch
- Text tool
- Extrude – cut

1. **<u>Establish a New Sketch Plane to Add Text</u>**: Select **Create Sketch** and select the bottom of the egg to reorient the view to the bottom-up.

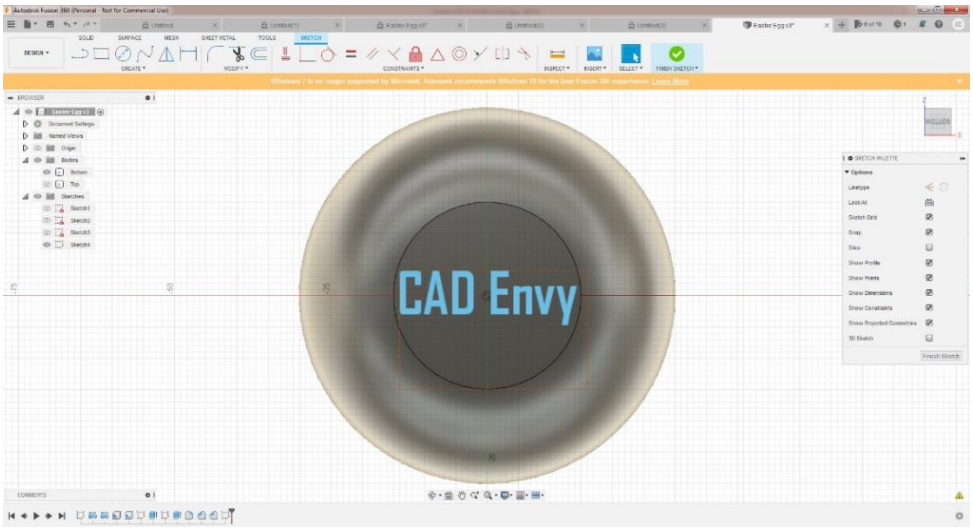


(Bottom View)

2. **<u>Create Text</u>**: Select the bottom and open the **Create / Text** tool. Left-click and drag the first (left side) corner to define the left side of the text box and then select the right side corner to define the entire text box size. Enter the text, (***CAD Envy***) font, (***Agency FB***) and size, (***7 mm***) and press **OK**. Right-click on the text and select **Move** from the radial menu to center it on the bottom.

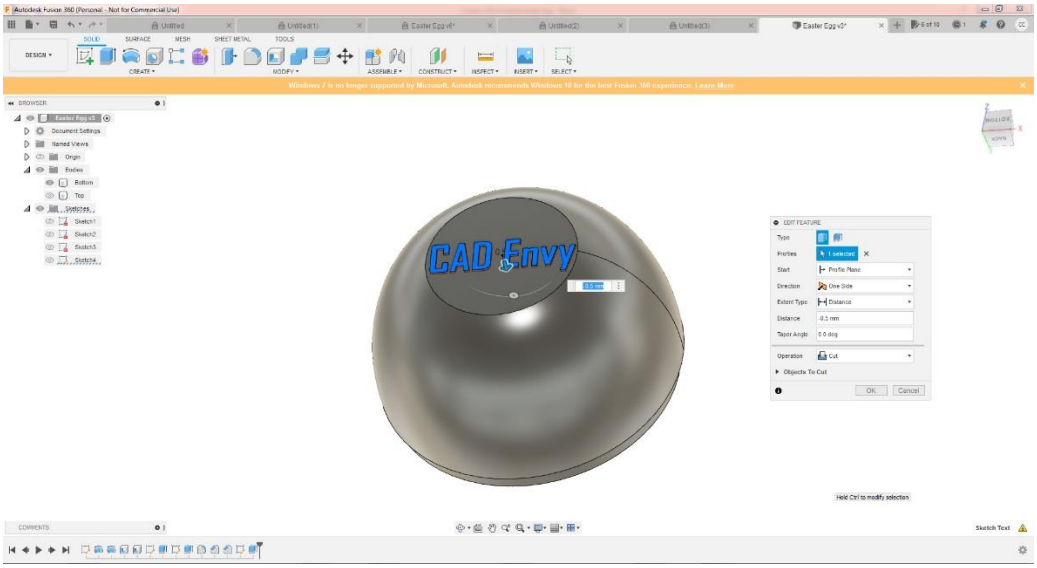


(Text Entry)

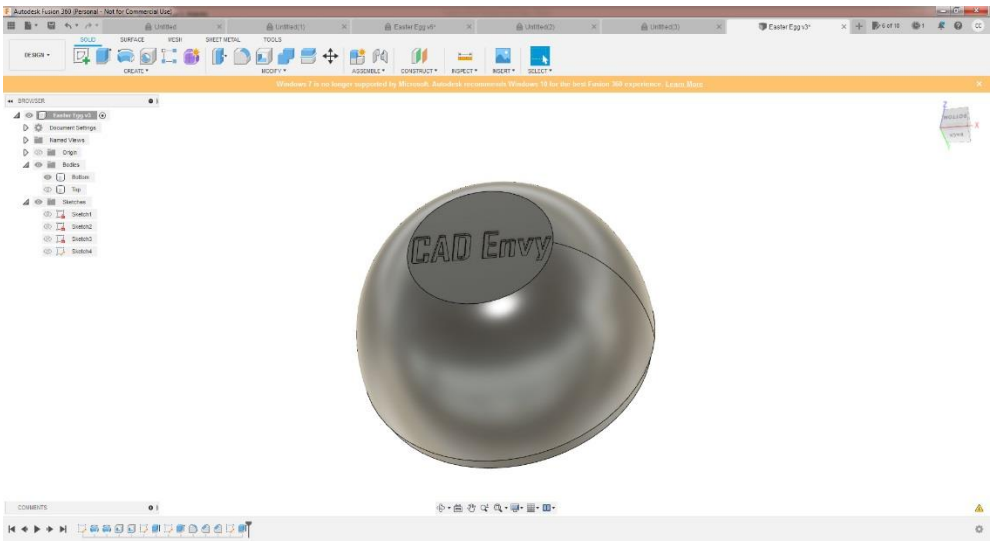


(Text Centered)

3. **<u>Inset the Text</u>**: Select the text and open the **Extrude** tool. Extrude the text ***- .5 mm*** to engrave it into the bottom.



(Text Extrusion Settings)

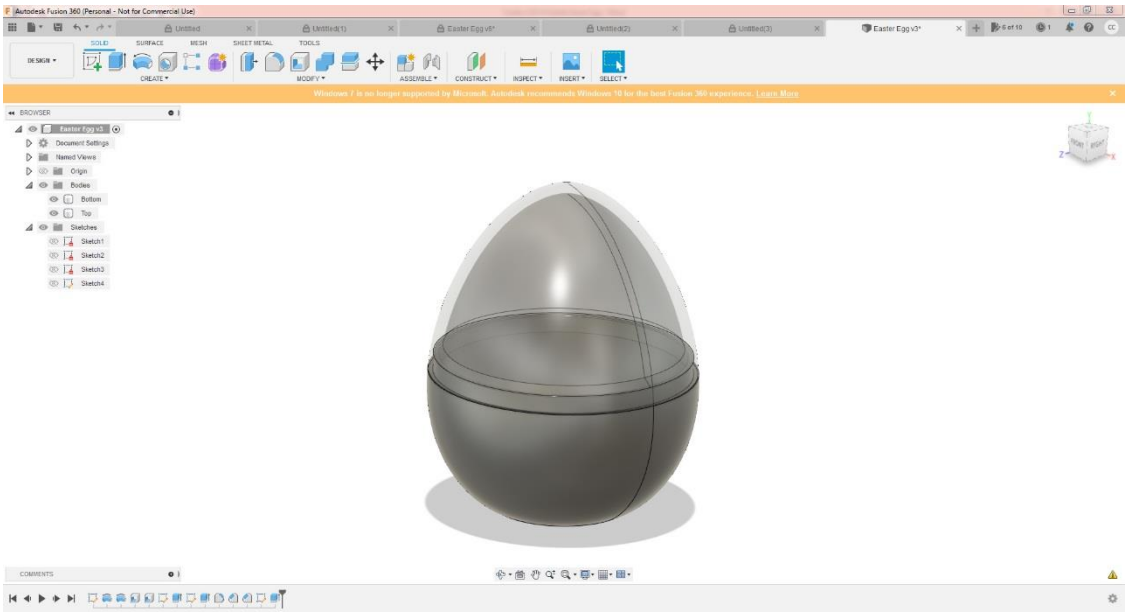


(Text Extruded)

Lesson 8: Material and Color

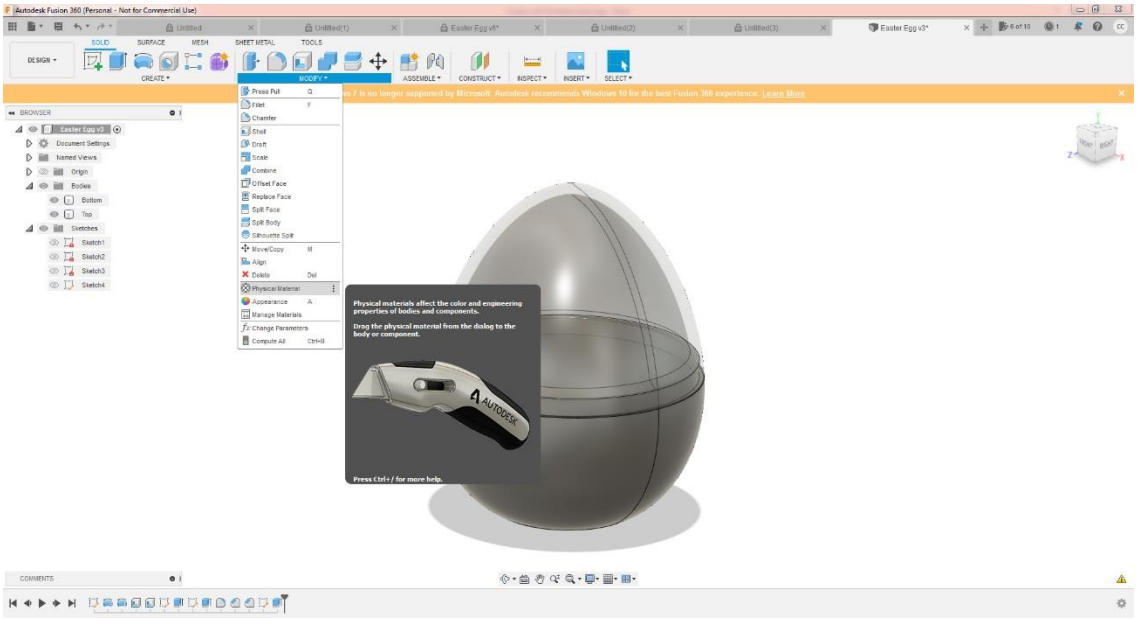
Topics covered in this lesson:

- Physical properties
- Appearance
- Create a new color in appearances

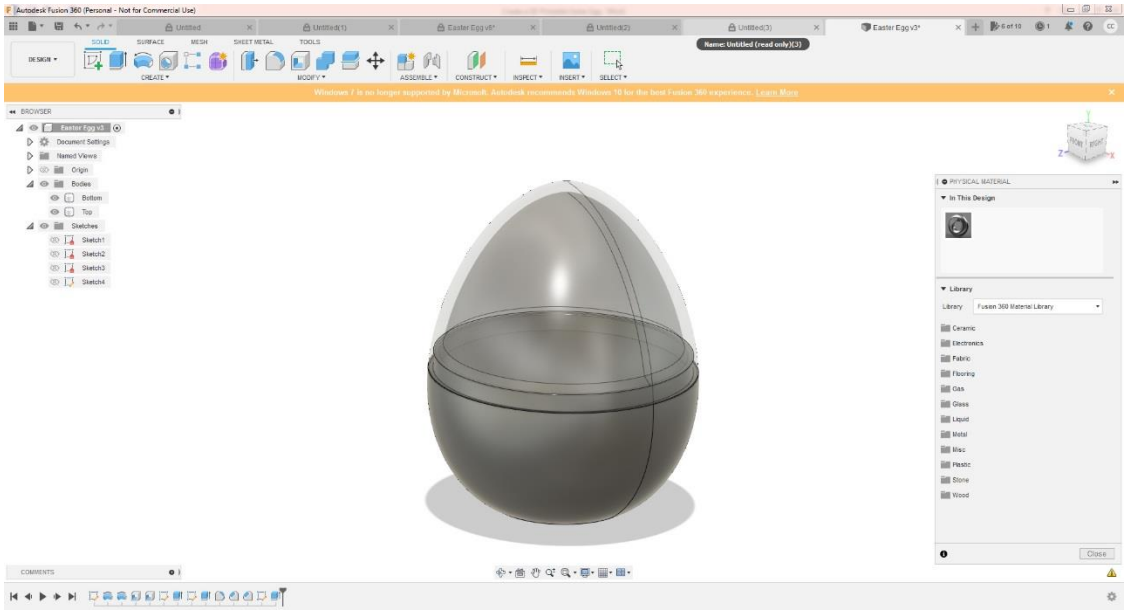


(Easter Egg Ready for Surfacing)

1. **<u>Open the Physical Materials Dialog Box</u>**: To begin surfacing, open the **Physical Materials** menu located under **Modify / Physical Materials**.

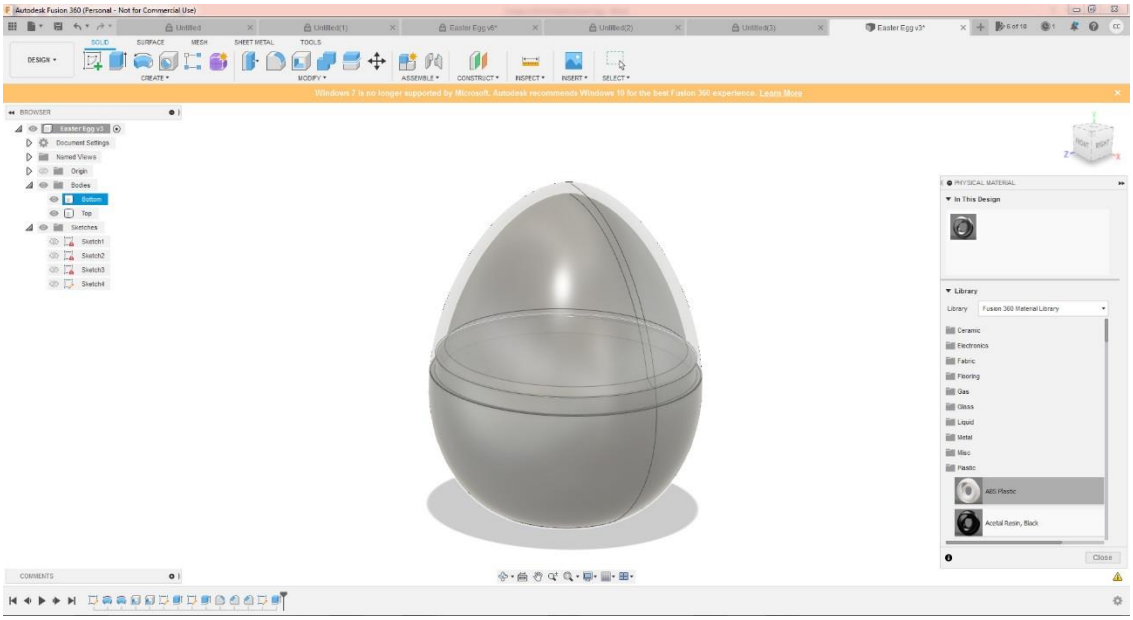


(Physical Materials Menu Location)

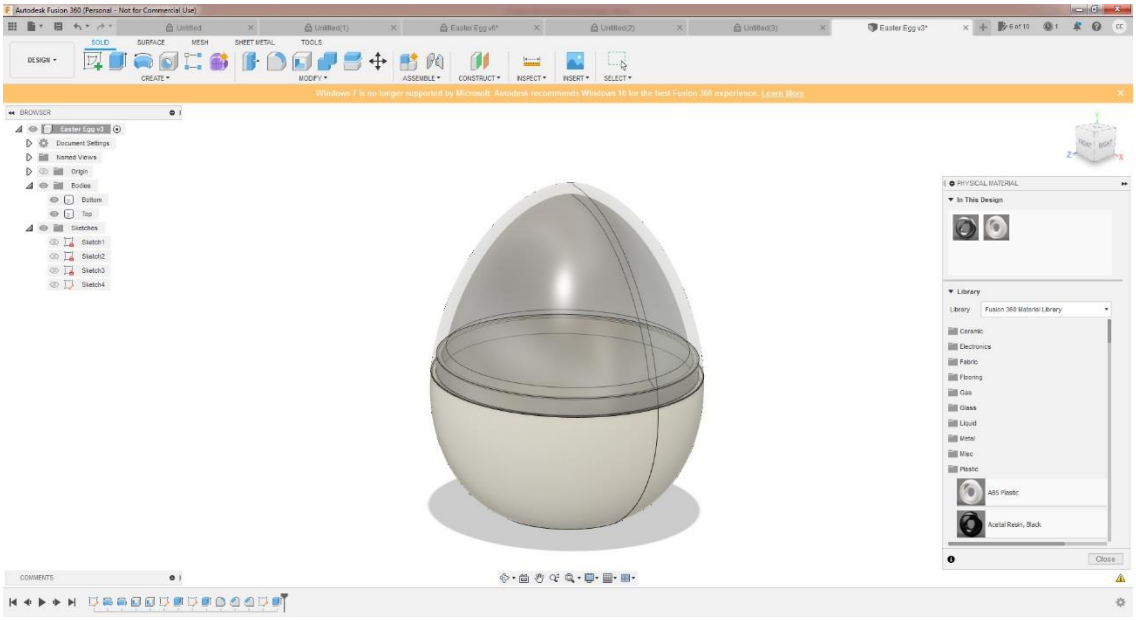


(Physical Materials Dialog Box)

2. **<u>Apply the Material</u>**: From the **Plastic** folder in the **Physical Materials** dialog box, left-click and drag the **ABS Plastic** material (at the top of the list) onto the bottom half. Release the mouse button and the material will be applied to the bottom half.

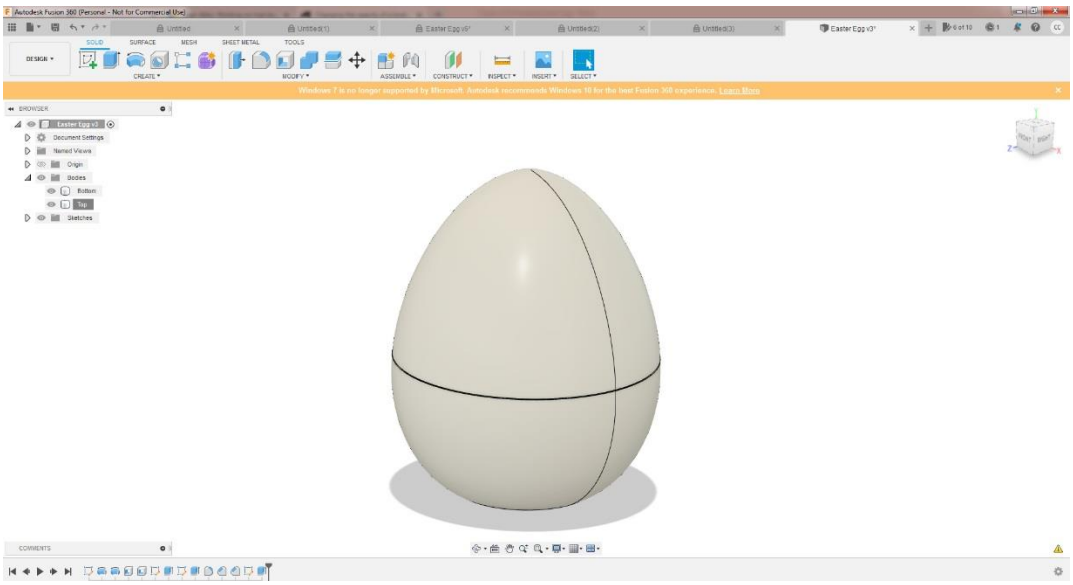


(ABS Plastic Material Selection)



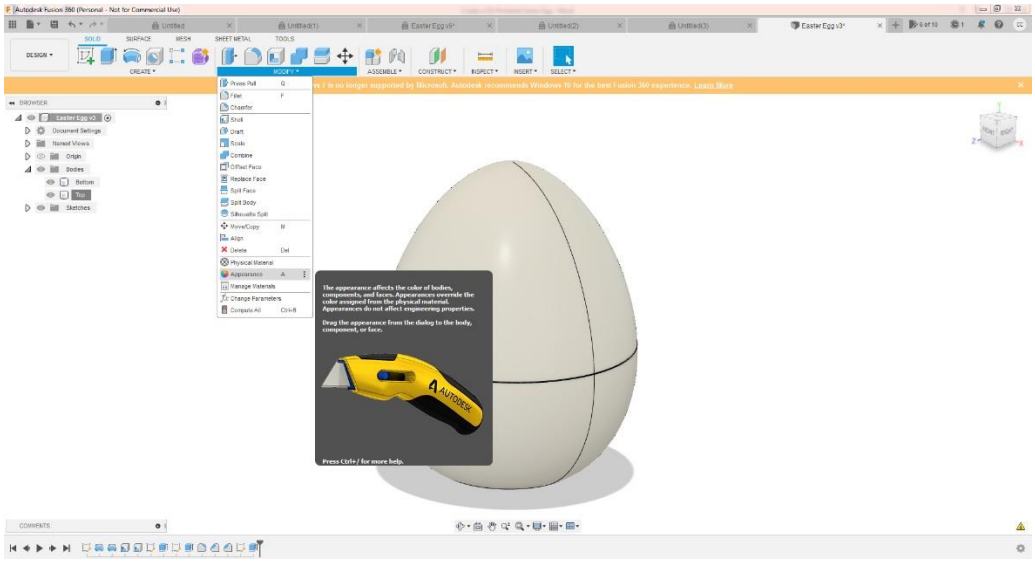
(ABS Plastic Material Applied)

3. Repeat step 2 for the top half.

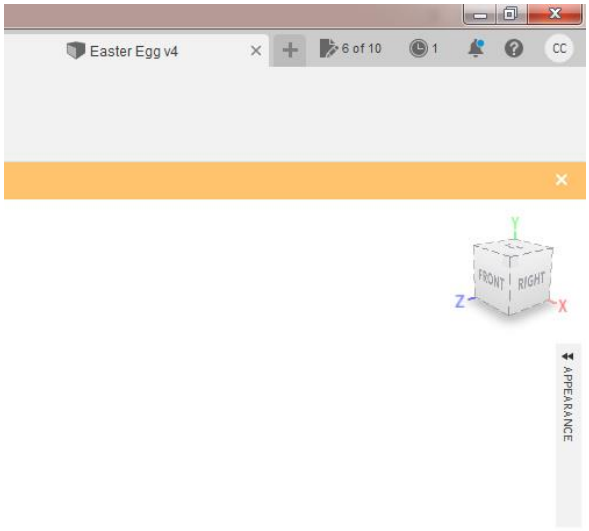


(Material Applied to Both Halves)

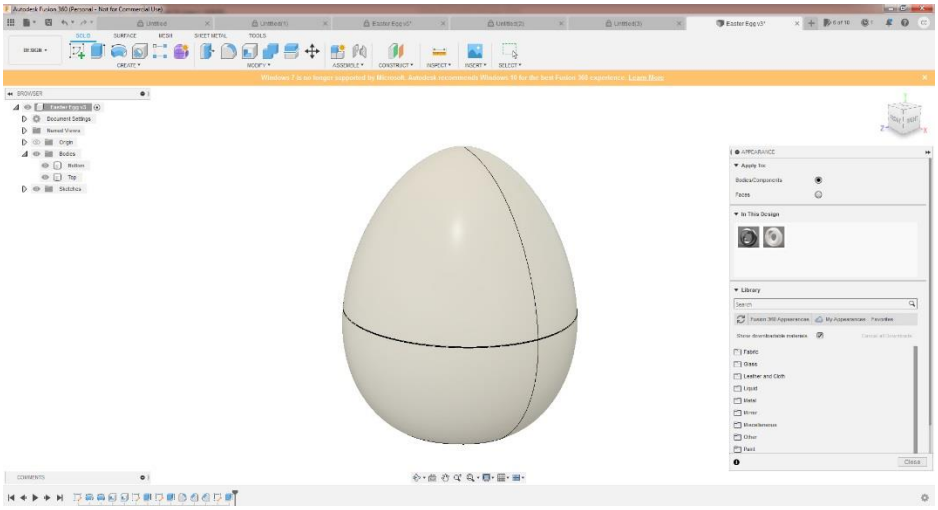
4. **<u>Open the Appearance Dialog box to Apply Color</u>**: Access the **Appearance** panel by selecting **Modify / Appearance**. If the panel doesn't open completely, look on the right side of the workspace for an "***Appearance***" fly-out panel. Left-click on the arrow to open the panel.



(Appearance Panel Menu Location)

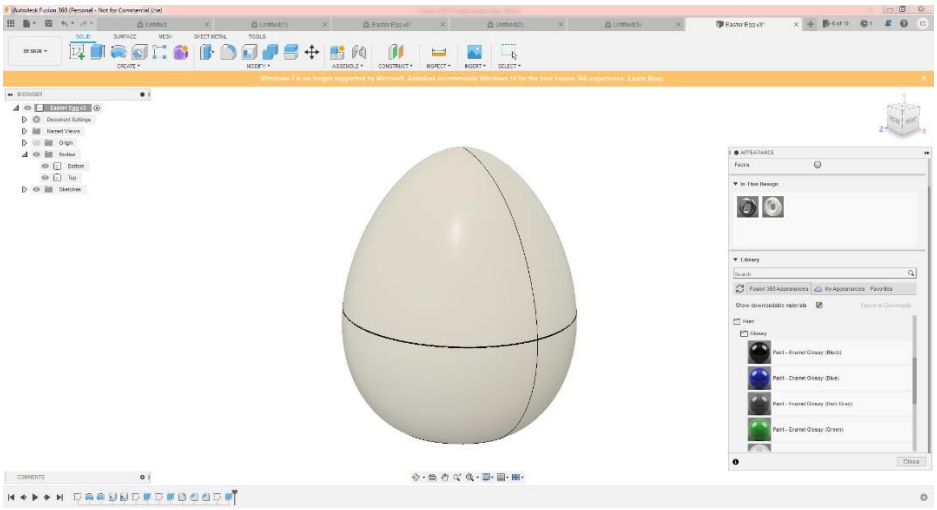


(Appearance Panel Fly-out Menu Location)

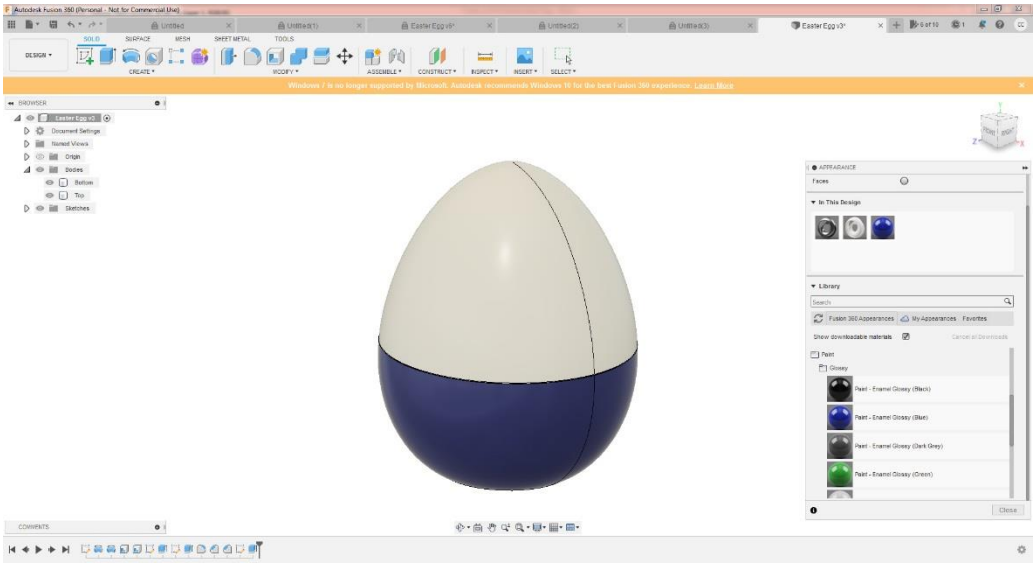


(Appearance Panel Open)

5. **<u>Select the Paint to Apply</u>**: In the **Paint** folder is a folder called **Glossy Paint**. Open it and select a color to apply to the bottom half of the egg. In this example, I've applied blue paint. Color is applied the same way as a material – by left-clicking and dragging the color onto the desired body.

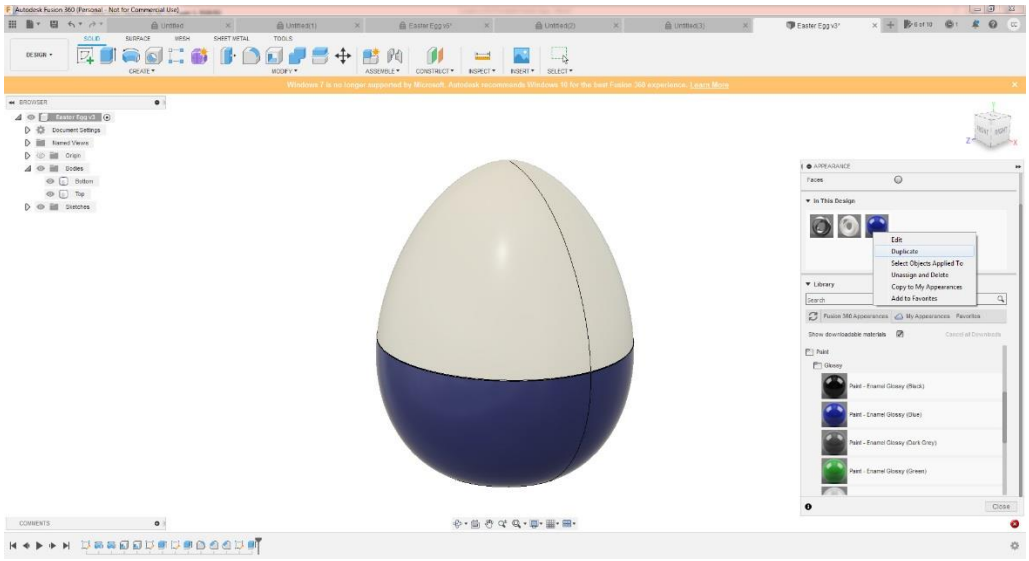


(Glossy Paint Selection Location)

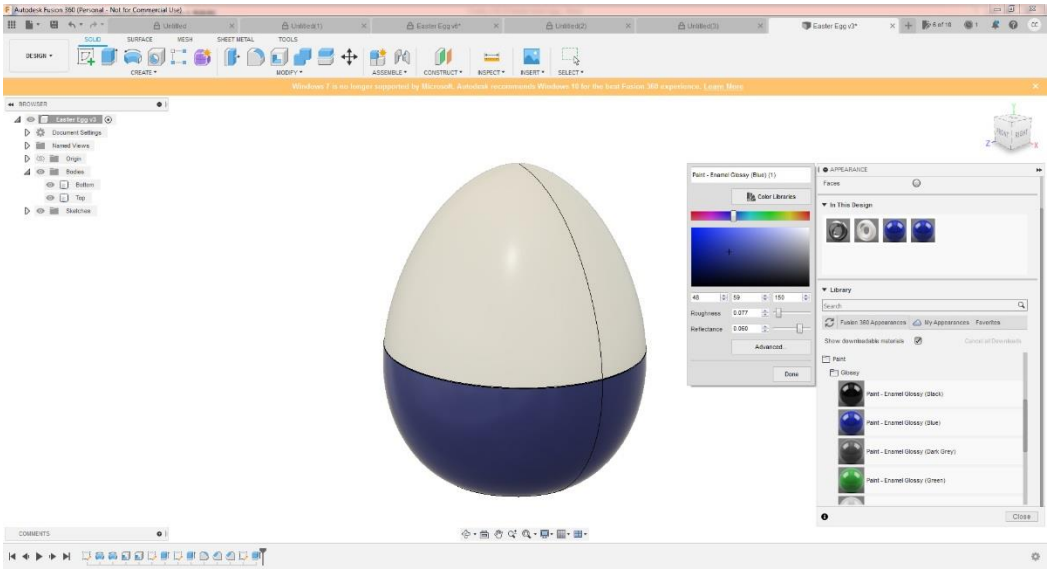


(Glossy Paint Applied to Egg Bottom)

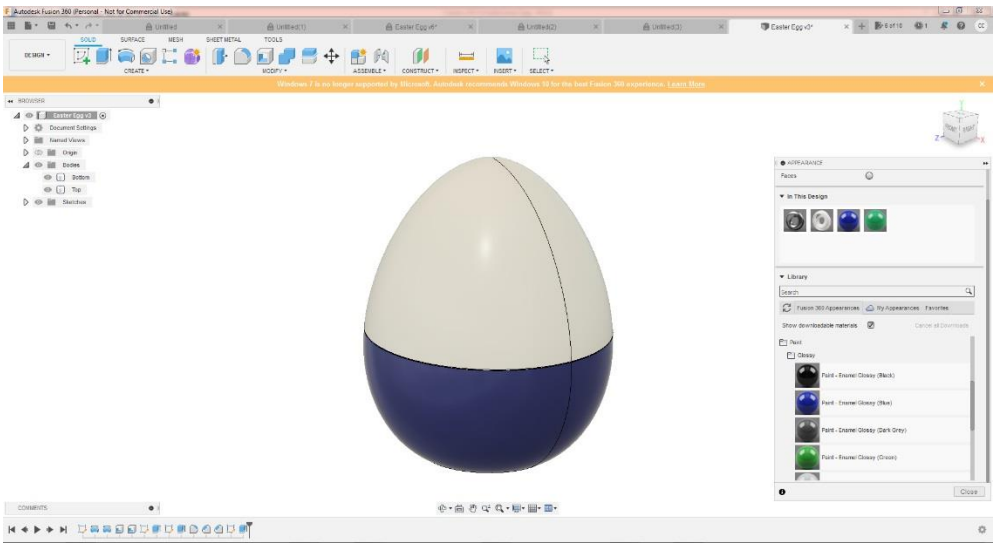
6. **<u>Applying a Custom Color</u>**: If a desired color isn't in the paint list, it's easy to create one. Right-click the blue paint icon in the "***In this Design***" section of the dialog box and select **Duplicate**. When the color box appears, use the left mouse button to select the desired color using the slider and palette, then press **Done**. The color icon will update to the custom color and can be applied by left-clicking and dragging it to the desired body.



(Duplicate Menu Selection Location)

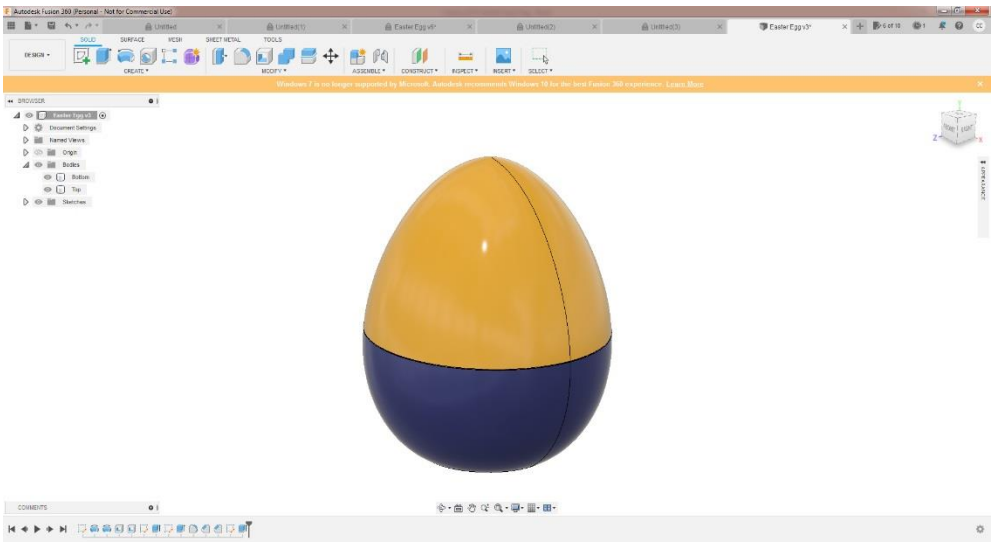


(Color Box Enabled)



(New Color Created)

1. **<u>Apply the Top Color</u>**: Scroll through the color selection menu (or create a custom color) and apply it to the top half of the egg. Save the file.



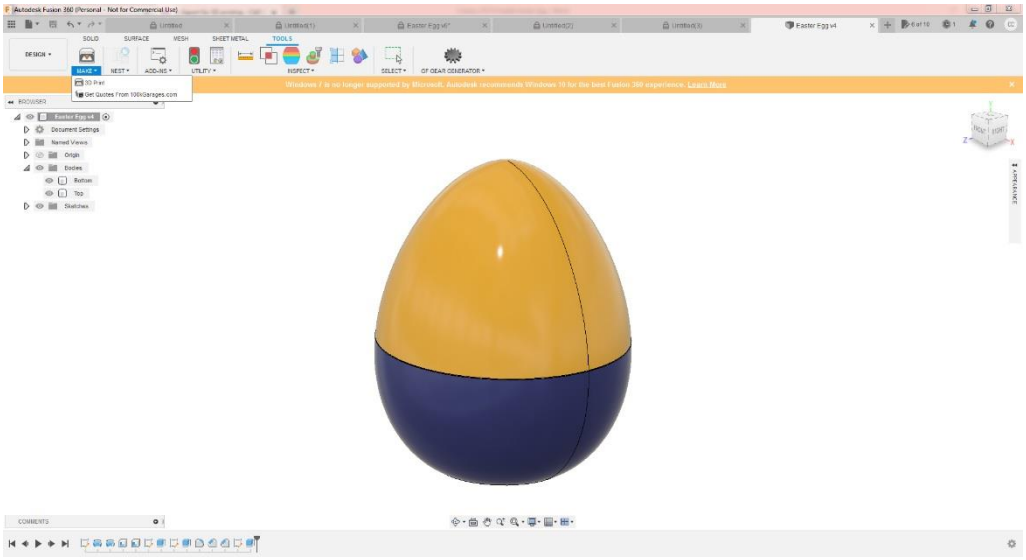
(Color Applied to Top Half)

Lesson 9: Export for 3D Printing

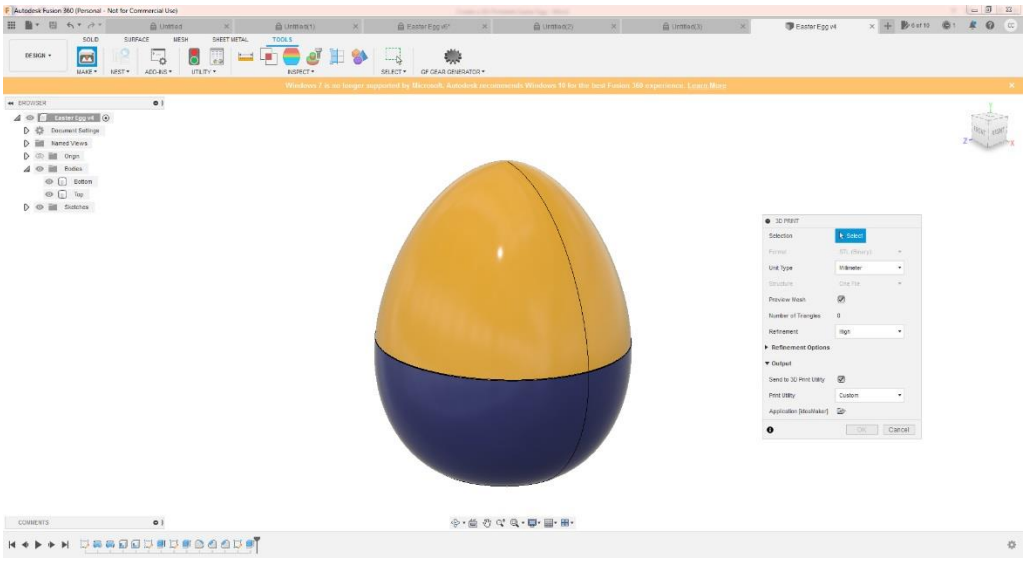
Topics covered in this lesson:

- Export as STL format for 3D printing.

1. **<u>Open the 3D Print Dialog Box</u>**: A file for each printed section of the egg needs to be created. Both files will be in the **STL** format. The 3D Export function is located under **Tools / Make / 3D Print**.



(3D Print Option Location)



(3D Print Dialog Box)

2. **<u>Disable the "Send to 3D Print Utility" Option</u>**: Unless you want to use Autodesks' Meshmixer or another slicer, disable this option, located under the **Output** menu.
3. **<u>Select the Smoothing Level</u>**: Under the **Refinement** dropdown menu, select ***High*** for the smoothest output. This will create a larger file, but the

polygons will not be as prominent as the lower option selections. For faster performance, disable the "***Preview Mesh***" option.

4. **Select the Top Body to be 3D-Printed**: Left-click on the top section of the egg and press the **Okay** button. A "***Save STL"*** browser window will open allowing you to specify where the export file will be saved.
5. **Select the Top Body to be 3D-Printed**: Repeat step 2 for the bottom half of the Easter egg.
6. **Editing Functions**: If any changes are required to modify the size of the egg, the appropriate setting in the timeline can be edited and the changes will flow through the complete timeline and update in the workspace.

Your egg halves are ready for slicing and printing!