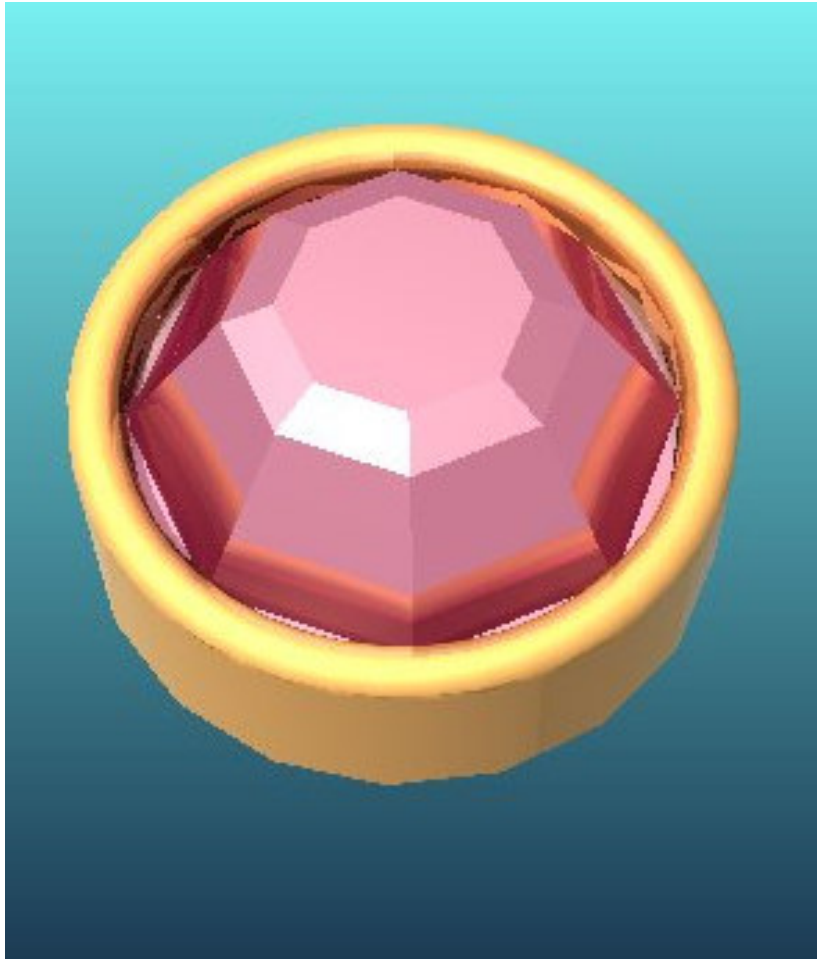


Earring Tutorial

Pro/DESKTOP version 8

Subject - Extrusion of Multiple Levels

Prepared by Lynn Basham



What you should be familiar with before starting this tutorial.

- Use of basic shape tools
- Use of selection techniques
- Extrusion
- Manipulating views
- Browser Window
- Photo Album

What you will learn by completing this tutorial.

- Working with millimeters
- Construction line use
- Building levels of an object
- Assembly of parts

This tutorial has been designed to introduce students to the fundamentals of building parts in sections using **Pro/DESKTOP 8**. The goal of this project is to complete and assemble the parts for an earring. Good luck!

Conventions of this Tutorial

Since most people who attempt this tutorial will have had some exposure to **Pro/DESKTOP**, there are extensive descriptions of operations and concepts. When features are first introduced, the tutorial will show the operations using icon-based instructions. Subsequent instructions will introduce keyboard shortcuts. These will be shown as capital letters within brackets [**]. Feature commands (**extrude**, **revolve**, etc.) will also be shown in brackets but with the **Control key** or **Alternate key** followed by a **plus sign (+)** as a preface, and multiple key strokes separated by a comma.

Example, to create an extrusion using keys rather than the icon, one would first press down the **Alt key**, then while holding it, press and release the **R** key once, then press and release the **E** key, and finally release the **Alt Key**.

In notation form, extrusion looks like this: **[Alt + R, E]**.

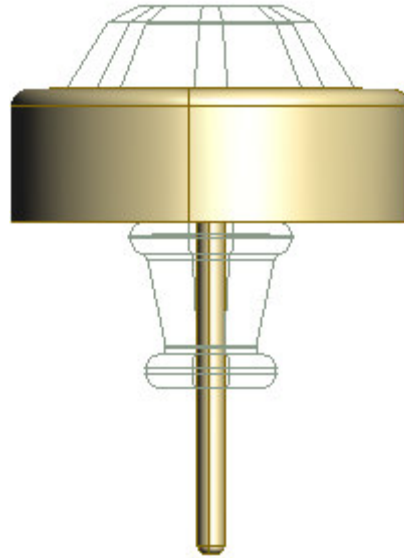
Sequential operations will be indicated by commands separated by an arrow [**>**]. For example, the following command "**[C] > Drag a circle**" means - type the letter "**C**" key on your keyboard to select the circle sketching tool, and then drag a circle.

Set Up

There are a few things you will need to do to get your computer ready for this tutorial. This project has been done in **millimeters**. The first thing you will need to do is make sure that the unit of measurement on your computer is set to **millimeters**.



Open Pro/DESKTOP

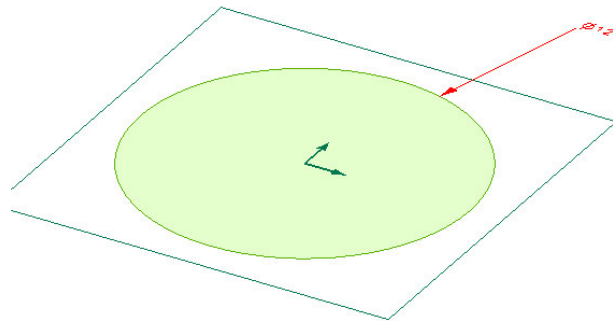
- Start > Programs > **PTC Pro/DESKTOP 8**.
- From the file menu > go to Tools > Options.
- Select the Units tab > change the units to millimeters in the top field, leaving the paper set for inches > **OK**.




Earring Fitting

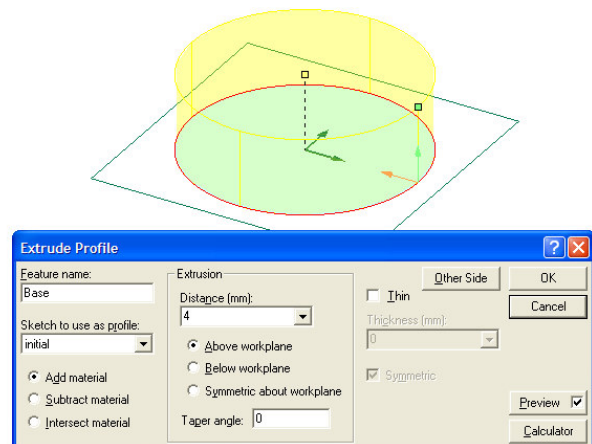
1. Extrude a cylinder

- Open a new design. [Ctrl + N]
- Maximize the design window, and then use the circle tool  or [C] > Drag a 12 mm circle.
- Label the size of the circle using the dimension tool  or [Z].



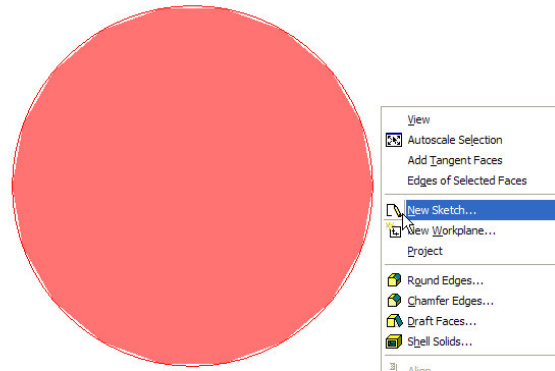
2. Extrude the Base

- [Alt + R, E] or .
- Name the feature "Base".
- Add material
- Above workplane
- Distance: 4
- OK.



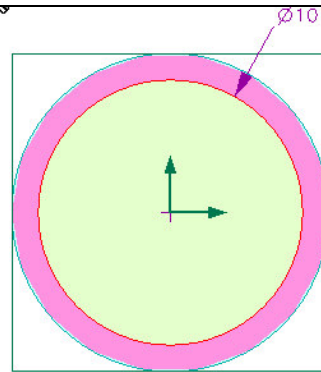
3. Add a New Sketch

- While the face is selected, right click > **New Sketch**.
- This will allow a new circle to be sketched for the next feature.




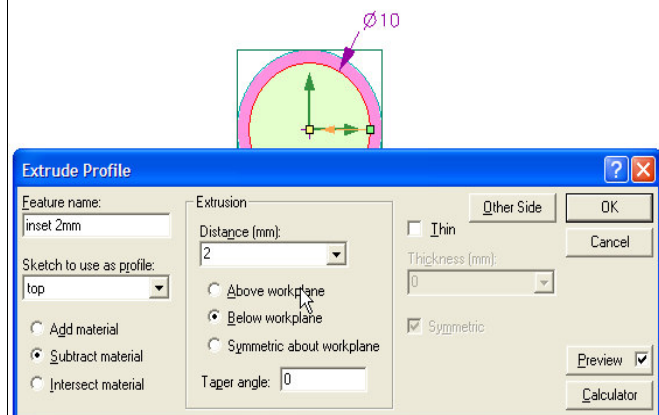
4. Sketch A New Circle

- [C] > Drag a **10 mm** circle centered on the axis.
- Label the diameter of the circle.



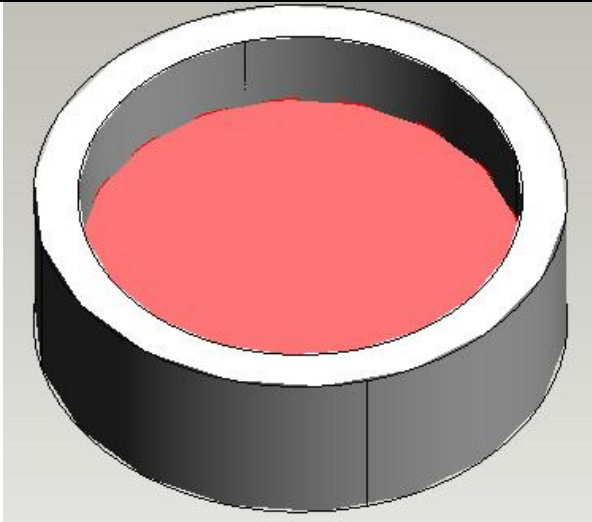
5. Make an Inset for the Stone

- Open the extrusion menu  or [Alt + R, E]
- Name the feature **Inset 2 mm**.
- Subtract material
- Below Workplane
- Distance of **2**.
- OK.



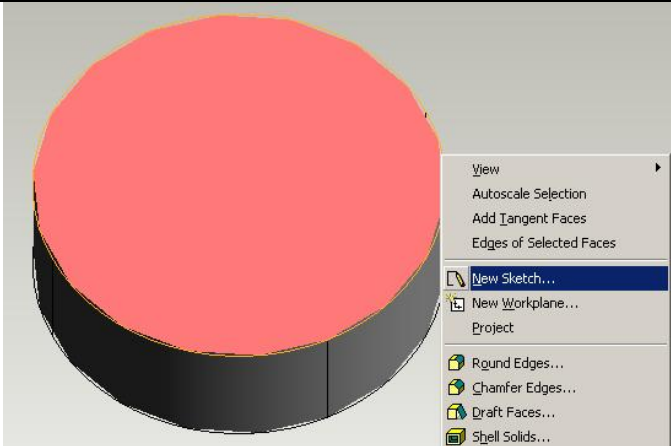
6. Look at the Top and Bottom Views

- Using the arrow keys on your keyboard, rotate the object so that you can see the 3-dimensional effect from the top.
- Next, rotate the object so that you are looking directly at the bottom. You are going to add a post for the earing.



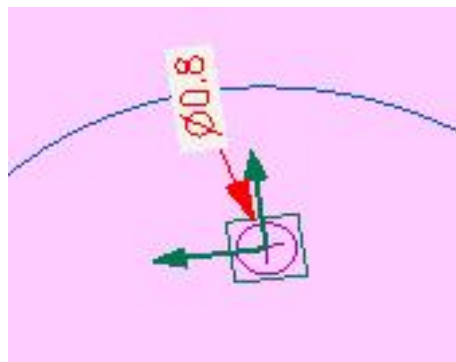
7. Add a New Sketch

- Select the Bottom Surface, [F] or 
- Right Click > New Sketch



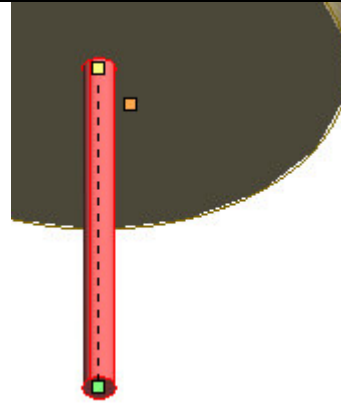
8. Sketch a Circle on the Bottom

- [C]. Drag a 0.8 mm Circle, centered on the Axis.
- Dimension it to 0.8 mm (if you dragged it out to 0.8 mm, you will not have to change the number.)



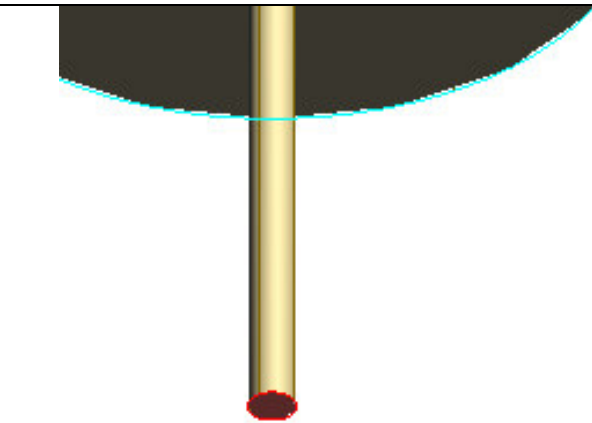
9. Extrude the Post

- Name the feature **Post**
- Check **Add material**
- **Above workplane**
- Distance: **10**
- **OK.**



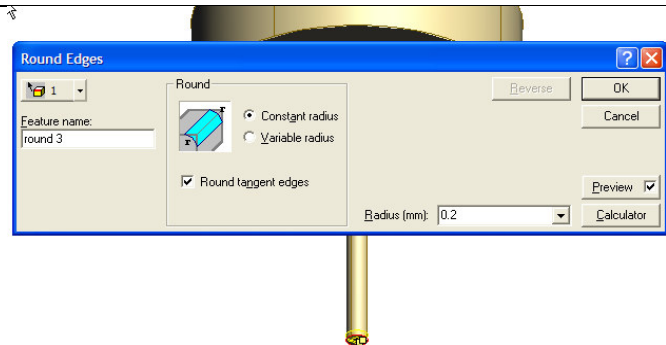
10. Round the Post Bottom

- **[F]**, or  to select the bottom surface
- Right Click or  to open the **Round Edges** menu.





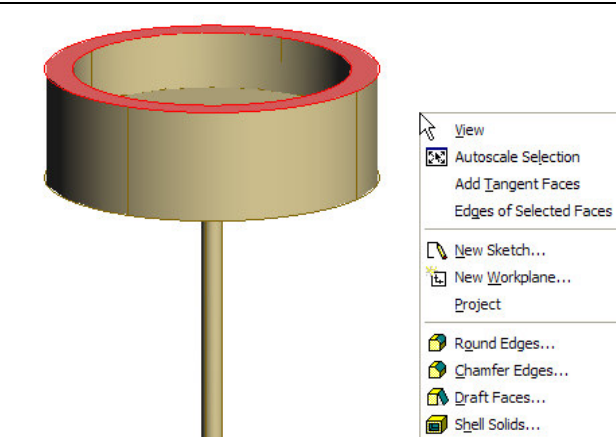
11. Set the Radius for the Round

- Name the feature **Post bottom**
- Type a radius of **0.2**
- **OK.**

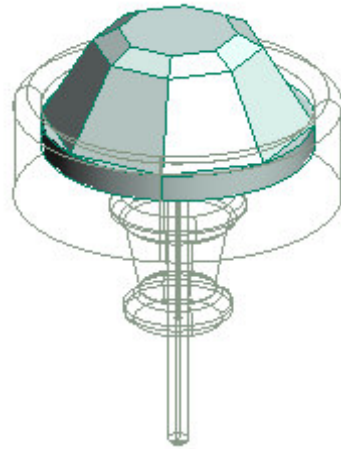
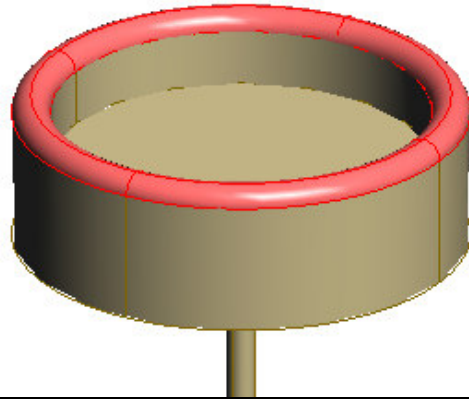


12. Rounding the Earring Top

- **[F]** or,  to select the top surface of the earring.
- Right Click > **Round Edges** or 
- Name the feature **Top**
- Type a radius of **0.5**
- **OK.**




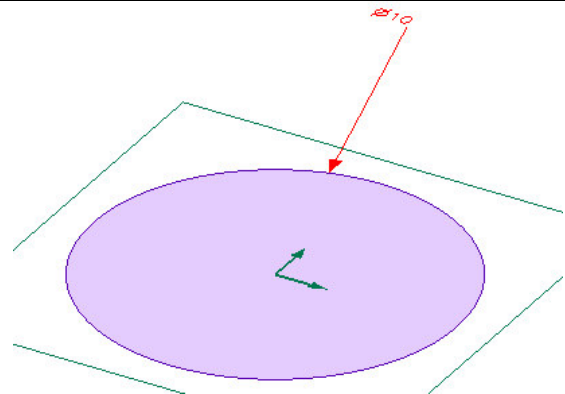
This completes the earring base
Save the earring base [Ctrl + S] to your Desktop for easy retrieval.
Next, the stone will be designed.




Earring Stone

1. Sketch the First Section


- Open a new design, [Ctrl + N]
- [C] > Drag a 10 mm circle > add a sketch dimension. [Z] or 

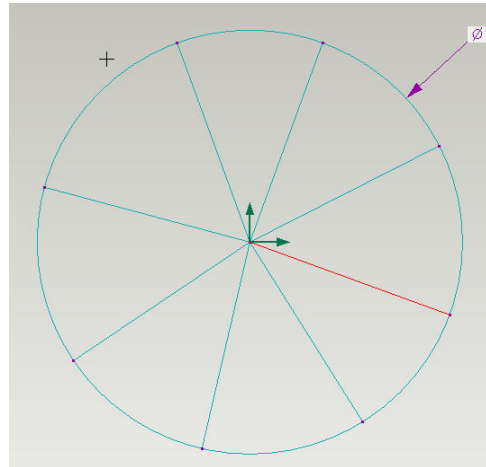


In order to make the round stone faceted, it will be built on several workplanes. On this initial sketch, an octagon has to be constructed.

- Change the view to look directly onto the workplane. [Shift + W] or 

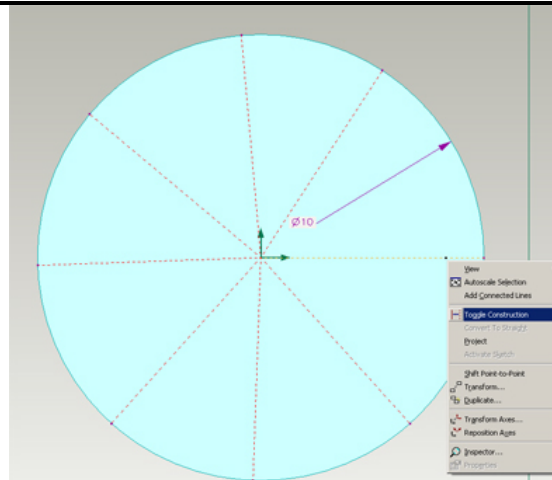
Draw Lines for the Octagon

- Choose the Line Tool  or [S]
- Draw 8 lines from the center of the circle to the edge of the circle.
- The lines do not need to be perfectly spaced.




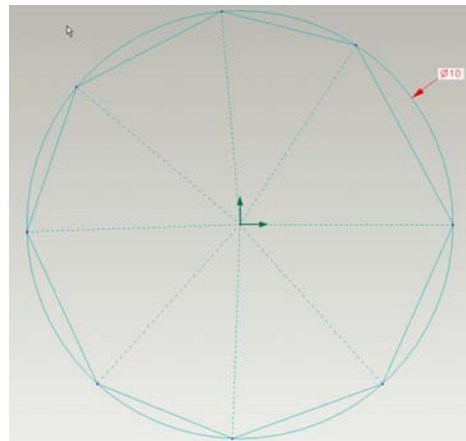
Make the lines *Construction Lines*

- Select the 8 lines by highlighting one. Hold [Shift] and highlight the others.
- Right Click and choose Toggle Construction.
- The lines will become dashed.



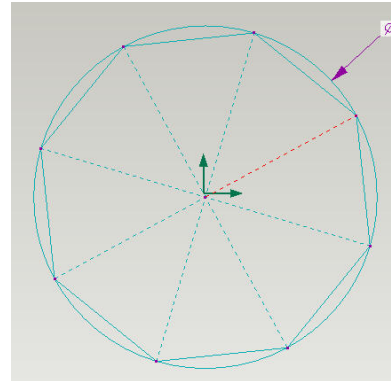
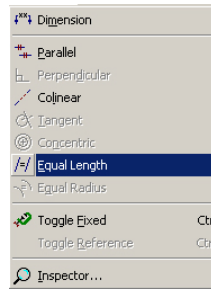
Make the Octagon

- [S] or  and draw lines from each construction line where it meets the circle, to the next construction line.




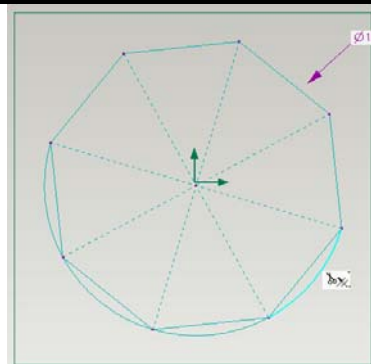
Make the Connector Lines equal

- Select one line, then hold shift to select the other seven.
- Click on **Constraint** from the **Menu Bar**, then choose **Equal Length**
- The Connector lines should all be equal, making 8 equal "Pie Pieces"

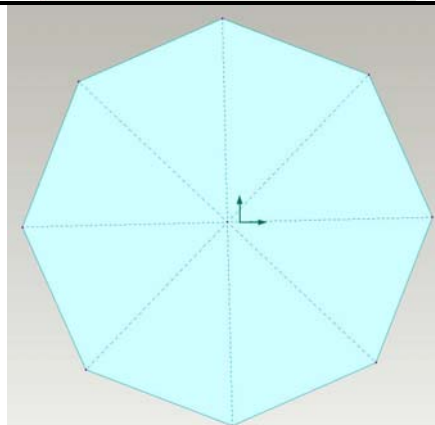


Delete Circle Segments

- [D] or 
- Carefully cut each segment of the circle from around the octagon



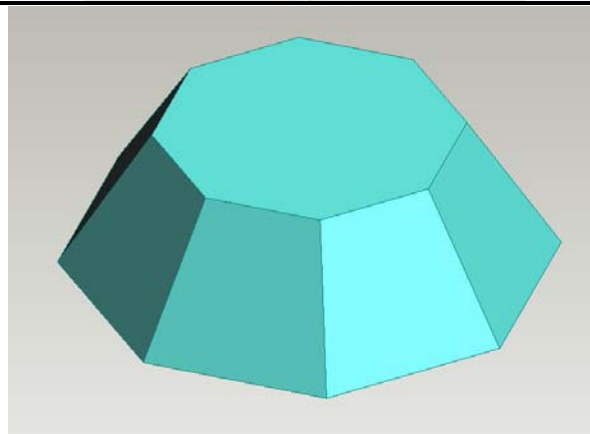
The Octagon should look like the figure to the right




Extrude the Octagon to look like the figure to the right.

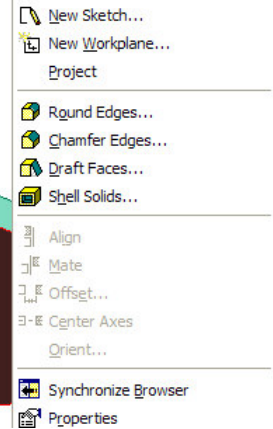
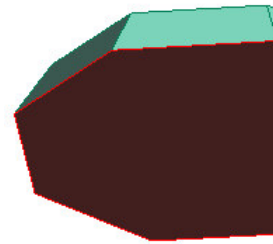
This is a portion of the earring stone that will appear above the earring base. Next, a round section that will fit into the base will be added.

***Note:** You will have to use the Taper option in the Extrude Dialogue Box.




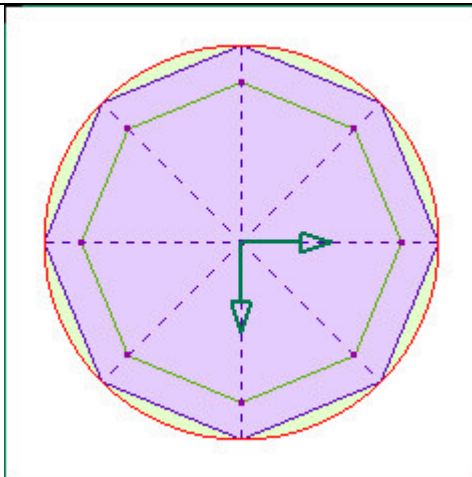
Add a New Sketch to the Bottom Face

- Rotate the model so that the bottom surface is visible.
- **[F]** or  to select the bottom surface.
- Right Click > **New Sketch**.
- Manipulate the view so the bottom is viewed directly.



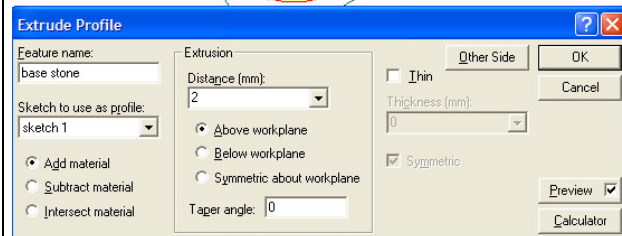
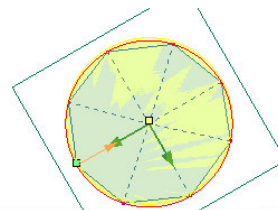
Sketch the Circle

- **[C]** or  > Drag a **10-mm** circle from the center axis. It should show as touching each point of the octagon.

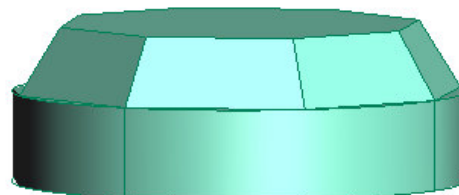


Extrude the Stone Base


- With the circle selected, open the extrusion menu. **[Alt + R, E]**
- Name the feature **BaseStone**.
- **Add material**
- **Above Workplane**
- **Distance: 2**
- **OK**.

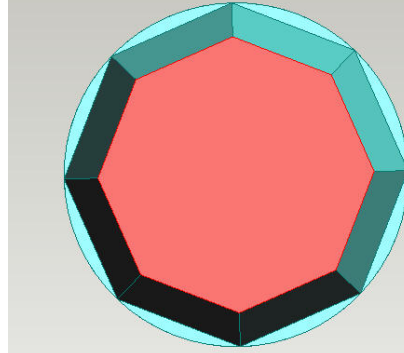


Two levels of the stone are now complete




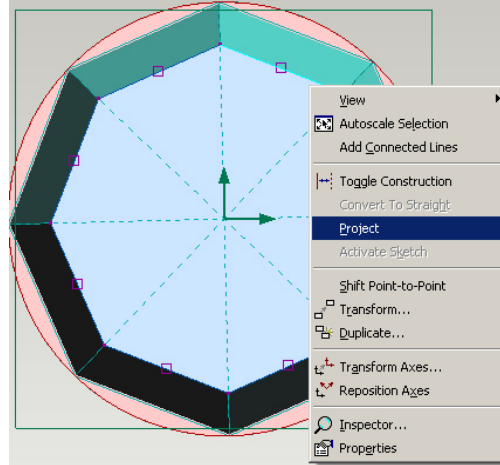
The Top Section of the Stone

- Rotate the model so that the top surface is visible.
- Select the Top Face > [F] or 
- Right Click > **New Sketch**
- Name the New Sketch "Top Facet".




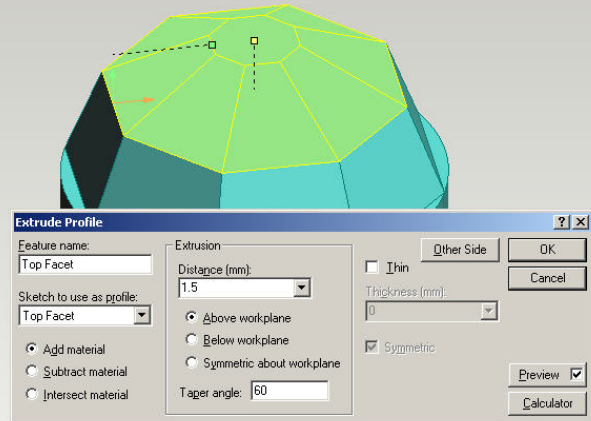
Project the Edges onto the "Top Facet" sketch as Lines

- Select the eight Edges
([E] or ) by selecting one edge > hold shift > select the remaining edges.
- **Right Click > Project**
- "Project" creates lines from the projected edges.



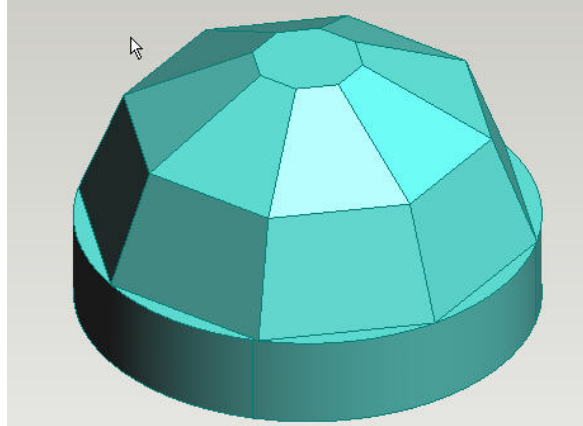
Extrude Top

- [Alt + R, E] or 
- Name the feature **Top Facet**.
- **Add material**
- **Above workplane**
- **Distance: 1.5 mm**
- **Taper angle: 60**
- **OK.**

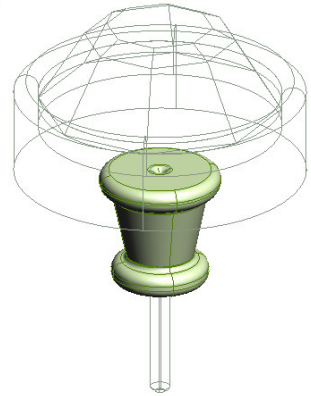


The Completed stone should look like the image to the right.



- [Ctrl + S] Save the file as Whole Stone in your Earring Folder
- You can change the Top Facet extrusion to reflect your taste in earring stones by Right Clicking the extrusion > Redefine.

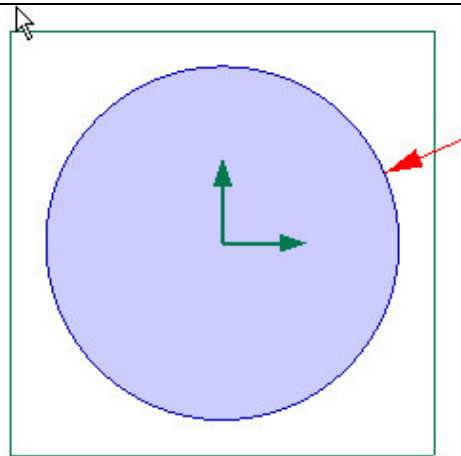


Earring Back



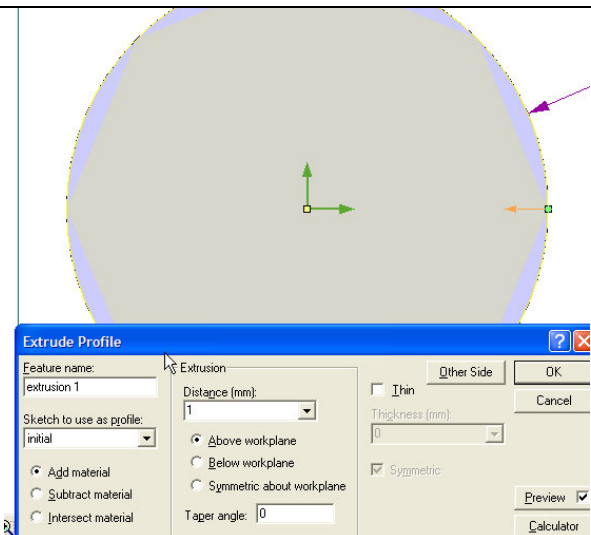
Sketch a Circle

- Open a new design. [Shift + N]
- [C] or  > Drag a 5 mm circle.
- Label the size [Z] or 



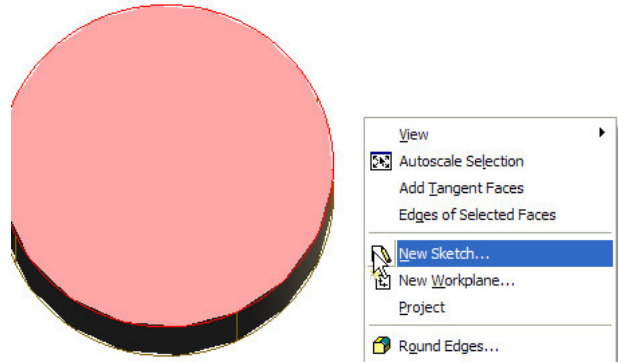
Extrude the Bottom Section

- [Alt + R, E]
- Name the feature **Bottom**.
- **Add material**
- **Above workplane**
- Distance: 1mm
- **OK.**




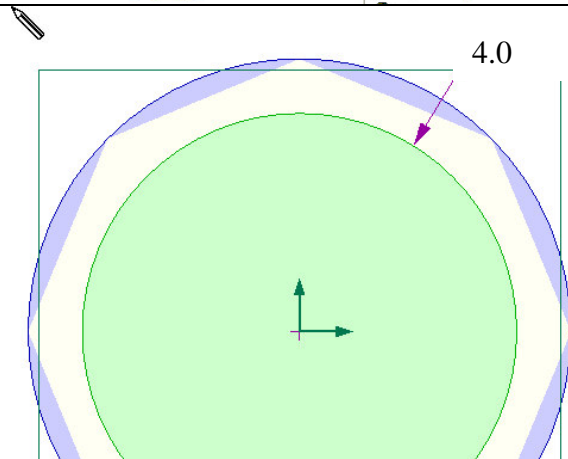
Add a New Sketch

- Select the top face of the cylinder
- Right Click > **New Sketch**
- Name the new sketch **Cone**.

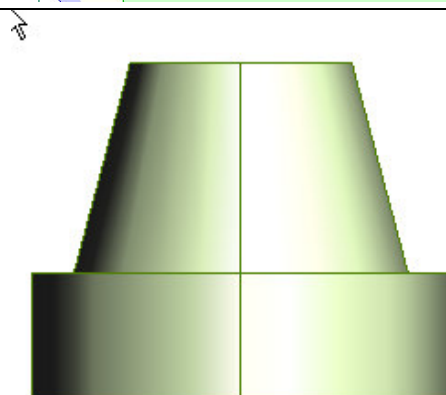


Sketch and extrude the Cone




- **[C]** or  > Drag a **4 mm** circle centered on the axis.
- **[Alt + R, E]**
- Above the workplane
- Add Material
- Distance: **3mm**
- Taper angle: **15**
- **OK**.

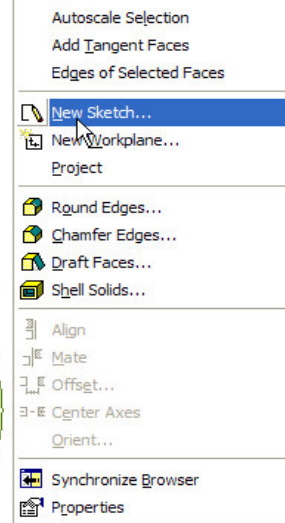
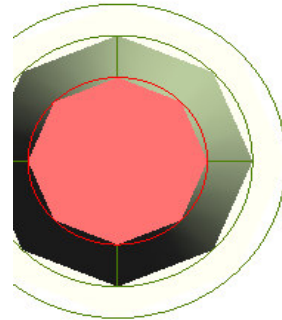


The extruded object should look like the image to the right.



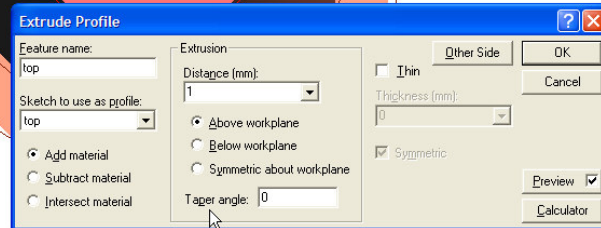
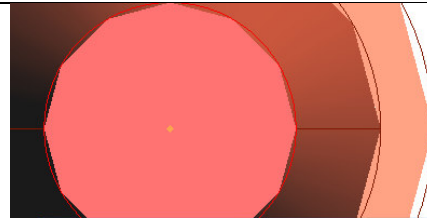
Begin the Top Section

- Select the top surface. [F] or 
- Right Click > **New Sketch**.
- [C] or  > Drag a **4mm** circle from the center axis.
- Add the sketch dimension. [Z] or 

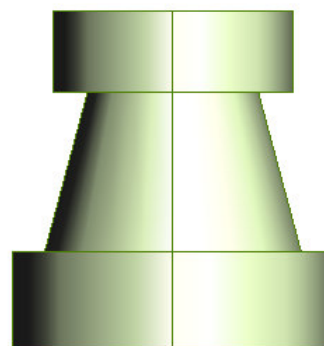


Extrude the Top Section

- [Alt + R, E]
- Name the feature **Top**
- **Add material**
- **Above workplane**
- Distance: **1mm**
- **OK**.



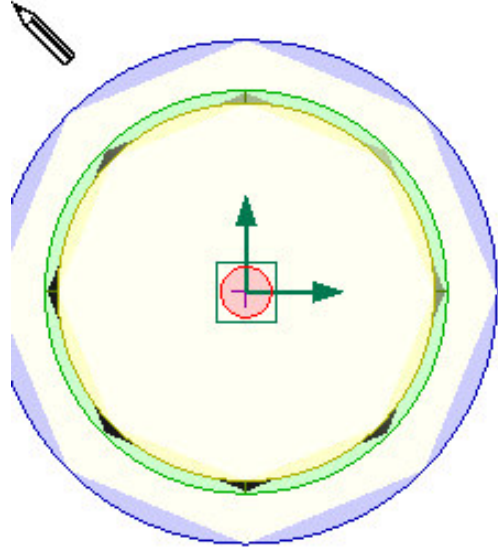
The object should now look like the image to the right when extruded



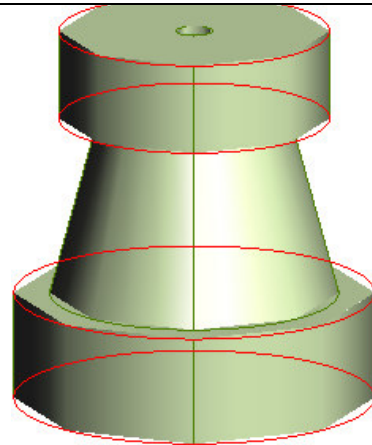
Sketch and extrude Post Hole

For the earring backer to fit the post, a hole must now be added.

- **[F]** > Select the top face > Right Click > **New Sketch**.
- **[C]** > Drag a 0.8 circle from the center axis.
- **[Alt + R, E]**
- Name the feature **Hole**
- **Subtract material**
- **Below workplane**
- Distance: **5mm**
- **OK**.

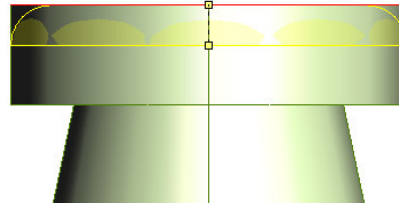


The hole should extend all the way through the object. Manipulate the model to see each end of the hole. Next you will round all the sharp edges of the finding.

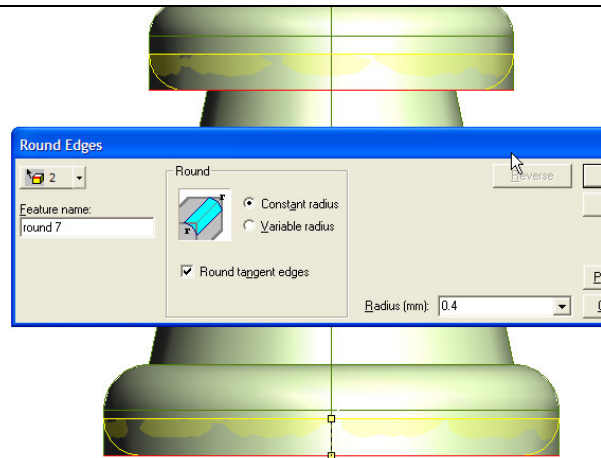


Round Top Edge

- [E] > Select the edge of the top.
- Right Click > Round Edges
- Radius: 0.4 mm
- OK.

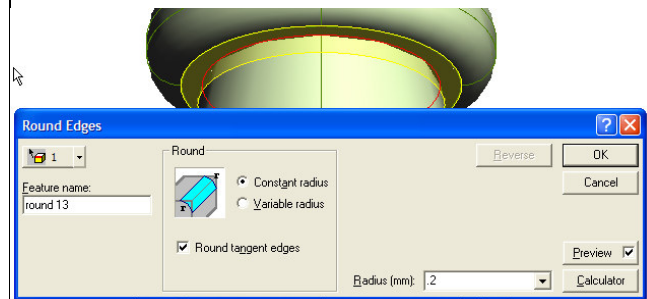


Repeat the process for each cylinder edge



Round Inside Edges

- [E] > Select the top edge > hold [Shift] > Select bottom edges of the cone portion of the finding.
- Right Click > Select Round Edges
- Radius: 0.2 mm
- OK.

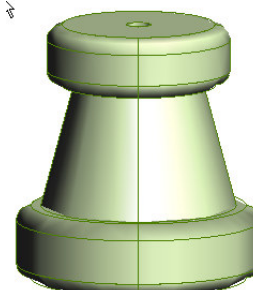


Round the Post Hole

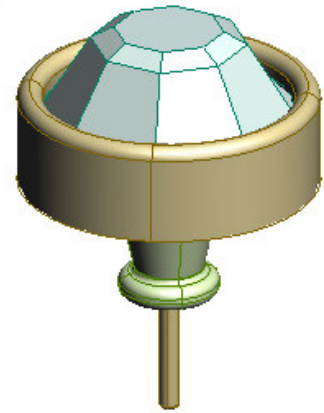
- [E] > Select the edges of each end of the hole.
- Right Click > Select Round Edges
- Radius: 0.05 mm
- OK



The finished finding should look like the image to the right

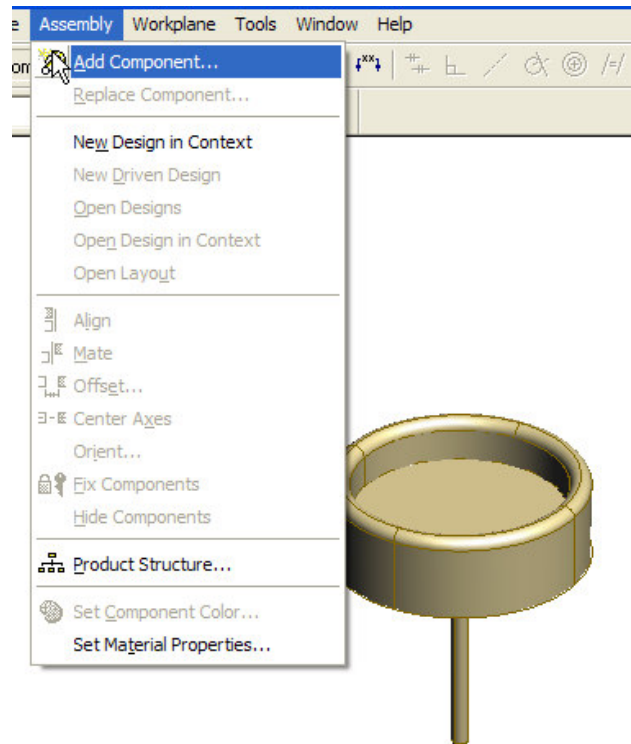


Earring Assembly



Open a new design file for the assembly and add the Base

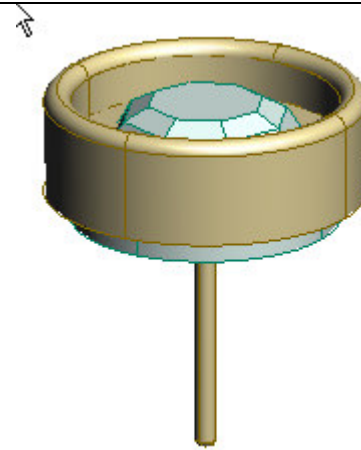
- Open a new design. [Ctrl + N]
- Maximize the design window.
- [Ctrl + S] Save the new design on your Desktop as **Earring Assembly**.
- From the **Assembly** menu > **Add Component**, [Alt + A, A]
- Select **Earring Base**
- While the **Earring Base** is selected (Red) Right click > **Fix Component**.



Add the Stone to the Assembly

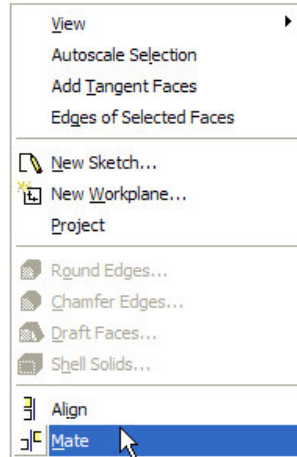
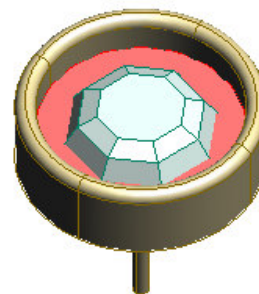
- [Alt + A, A]
- Select the **Stone design**

The new part may appear inside the fixed part. It can be moved by selecting the new part and moving it with the mouse, or by the next steps.



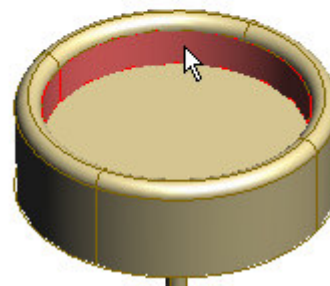
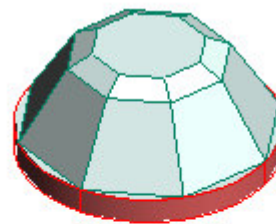
Mate the Stone and Earring Inset

- [F] > Select the bottom face of the stone > Hold [Shift]
- Select the top face of the earring inset
- Right Click > Select **Mate**.



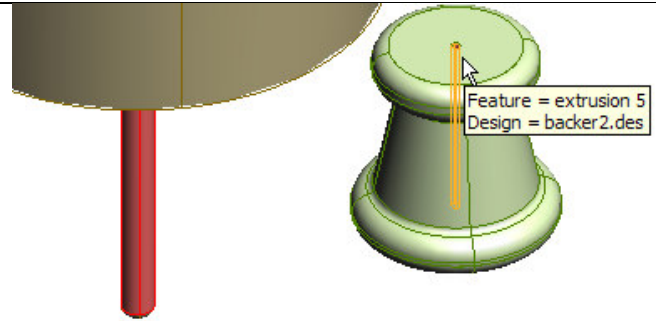
Center the Stone and Earring Inset

- [F] > Select the outside cylindrical surface of the round stone bottom > Hold [Shift]
- Select the inside cylindrical surface of the earring inset
- Right Click > Select **Center Axes**.



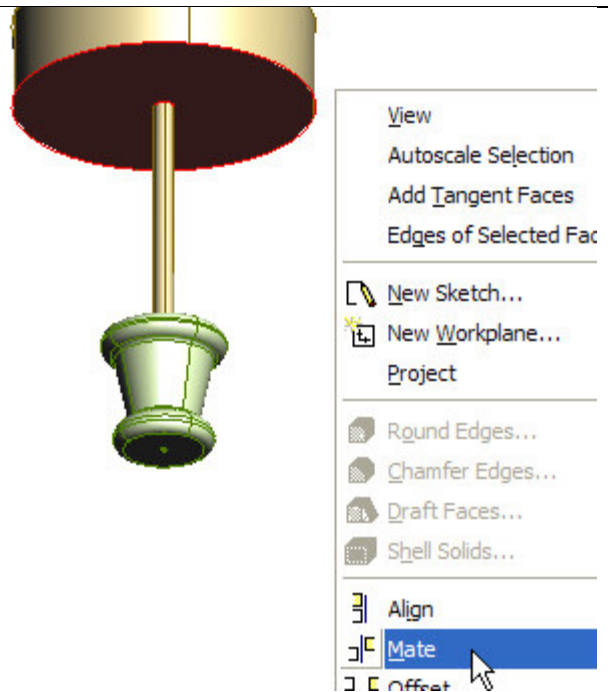
Add the Backer to the Assembly and Center

- [Alt, A + A] > Select the Backer
- [F] > Select the outside surface of the post cylinder > Hold [Shift]
- Select the inside surface of the hole through the Backer
- Right click > **Center Axes.**



Mate the Earring Backer to the Earring

- [F] > Select the bottom surface of the Earring Base > Hold [Shift]
- Select the wider flat surface of the Backer
- Right Click > **Mate.**



The Earring Assembly is now complete!

[Ctrl + S] > Save the assembly. Now you can to open a new Photo Album [Ctrl + Shift + A] and open the Assembly. Apply materials and colors to suit your taste. **Congratulations!**

