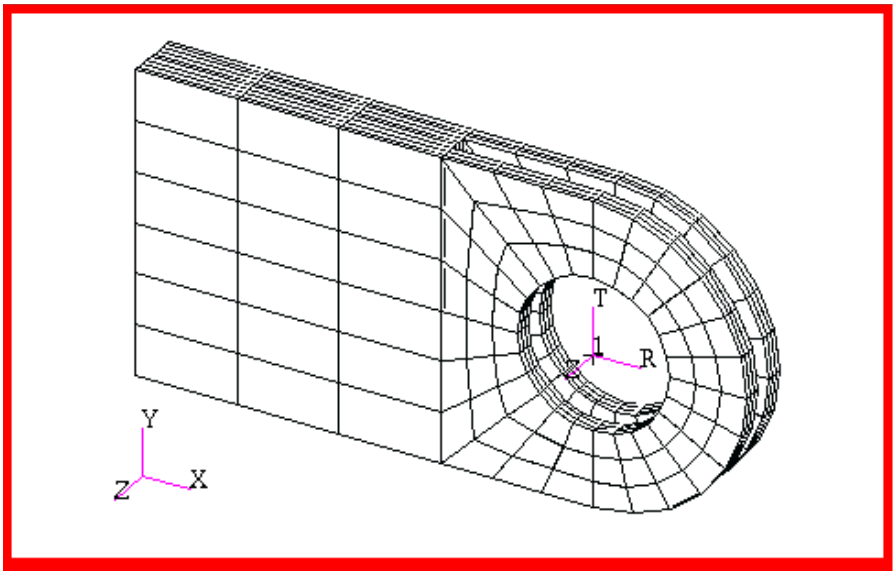
LESSON 2

Geometry Model of a 3-D Clevis

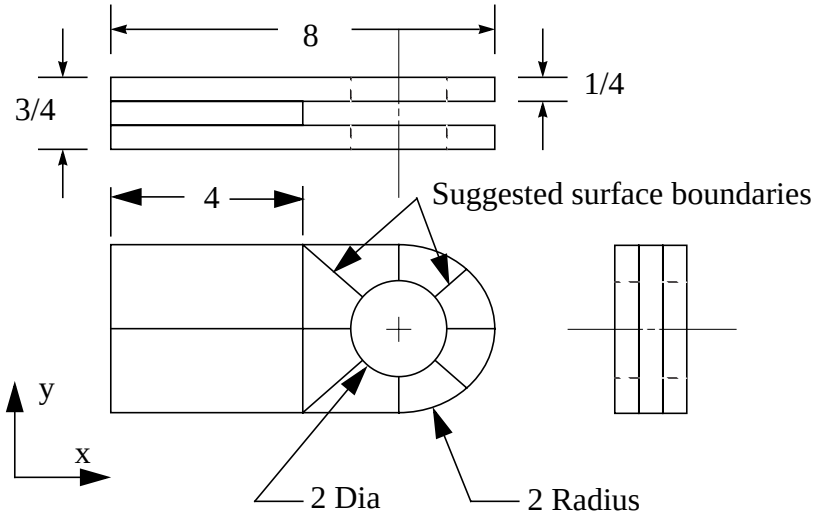


Objectives:

- Create a new database.
- Create geometry to be used later.
- Change the graphics display.

Model Description:

In this exercise you will create an analytic solid model of a clevis by defining MSC/PATRAN points, curves, surfaces, solids, and a user defined coordinate system. Throughout this exercise you will become more familiar with the use of the MSC/PATRAN select menu. You will also be introduced to another viewing method and shown how to change your model's render style. Shown below is a drawing of the model you will build and suggested steps for its construction.



Suggested Exercise Steps:

- Create a new database and name it **Clevis.db**.
- Set geometry preference to PATRAN 2 convention.
- Create a surface model of the top half of the clevis as shown in the front view above. Place the center of the hole at [0,0,0].
- Create solids that represent the first third of the solid model's total width.
- Use the **Viewing/Transformations…** option to change the model's current view to an isometric view.
- Create the bottom half of your model by mirroring all of the solids about the y-axis mirror plane located at y=0.
- Create the remaining solids that represent the last two thirds of your model in the width direction (z-direction).
- Turn all the entity labels off and render your model in a hidden line render style.

Exercise Procedure:

1.Create a new database called **Clevis.db.**

File/New...

New Database Name: **Clevis**

OK

In the New Model Preference form set the following:

Tolerance: ◆**Default**

Analysis Code: **MSC/NASTRAN**

Analysis Type: **Structural**

OK

2. Create a point on the inner radius of the hole in the clevis.

◆**Geometry**

Action: **Create**

Object: **Point**

Method: **XYZ**

❑ **Auto Execute**

Point Coordinates List **[1 0 0]**

Apply

3.Use the point you just created to sweep 4 curves that will define the upper half of the radius of the hole in the clevis.

Action: **Create**

Object: **Curve**

Method: **Revolve**

■ **PATRAN 2 Convention**

Axis: **{[0 0 0],[0 0 1]}**

Total Angle: **180**

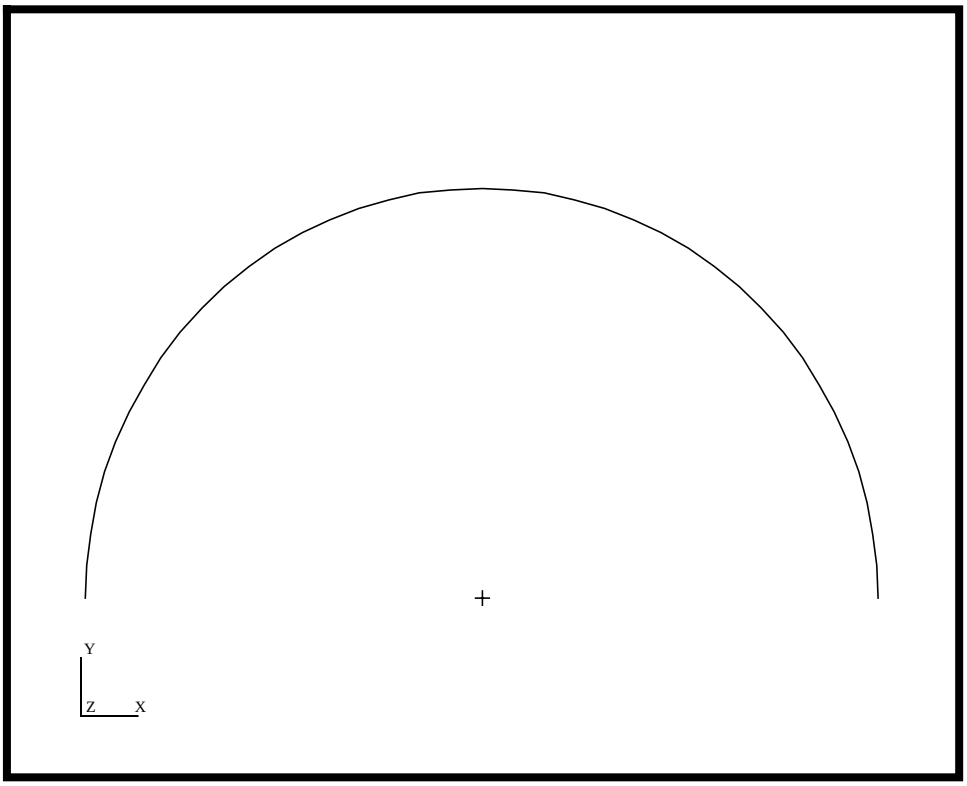
Curve per Point: **4**

❑ **Auto Execute**

Point List: **Point 1**

Apply

Your model should appear as follows:



4. You will now use Curvilinear Transformation to create the outer radius of the lug by radially translating the curves that define a quarter of the hole.

   To accomplish this you will first need to create a cylindrical coordinate. frame located at the center of the hole.

Action: **Create**

Object: **Coord**

Method: **3 Point**

Type: **Cylindrical**

Apply

Action: **Transform**

Object: **Curve**

Method: **Translate**

Type of Transformation: ◆ **Curvilinear in Refer. CF**

Refer. Coordinate Frame **Coord 1**

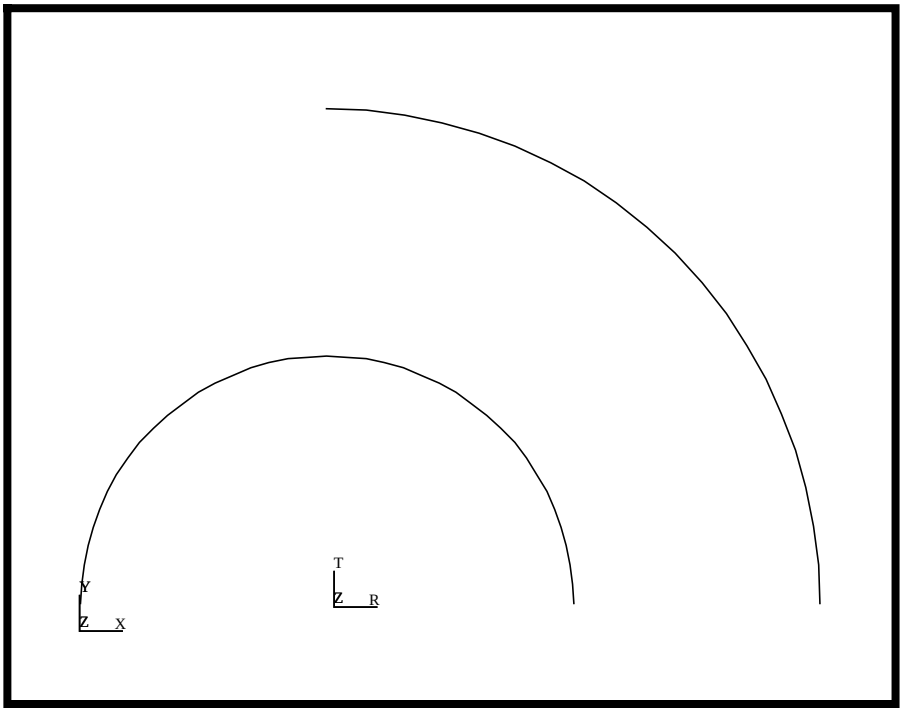
Translation Vector **<1 0 0>**

❑ **Auto Execute**

Curve List: **Curve 1 2**

Apply

The model should now appear as follows:



5. You have now created all the curves that you will need to complete your clevis model. Next, you will create the necessary surfaces for the model. You will start by creating a 4x2 Surface that defines part of the upper half of the clevis body.

Action:	**Create**
Object:	**Surface**
Method:	**XYZ**
Vector Coordinates List:	**<-4 2 0>**

❑ **Auto Execute**

Origin Coordinates List:	**[-2 0 0]**

Apply

6. The next series of Surfaces will be created using the *Curve* Method:

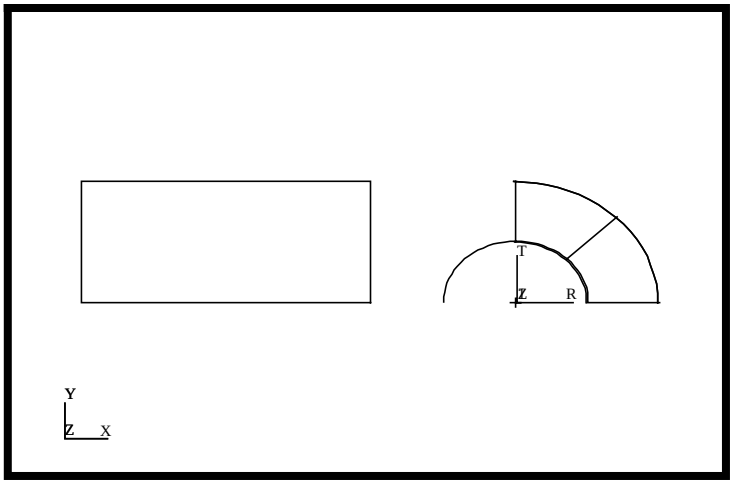
Action:	**Create**
Object:	**Surface**
Method:	**Curve**

❑ **Auto Execute**

Starting Curve List:	**Curve 1 2**
Ending Curve List:	**Curve 5 6**

Apply

The model should appear as follows:



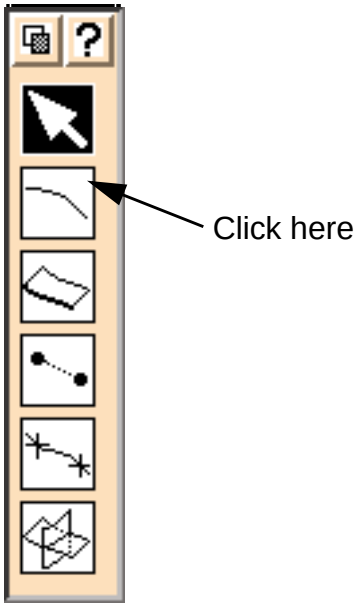
Show Labels

To create the next surface you will use the *Select Menu* to help you define an existing curve and surface edge as the boundaries of the new surface.

Display Lines

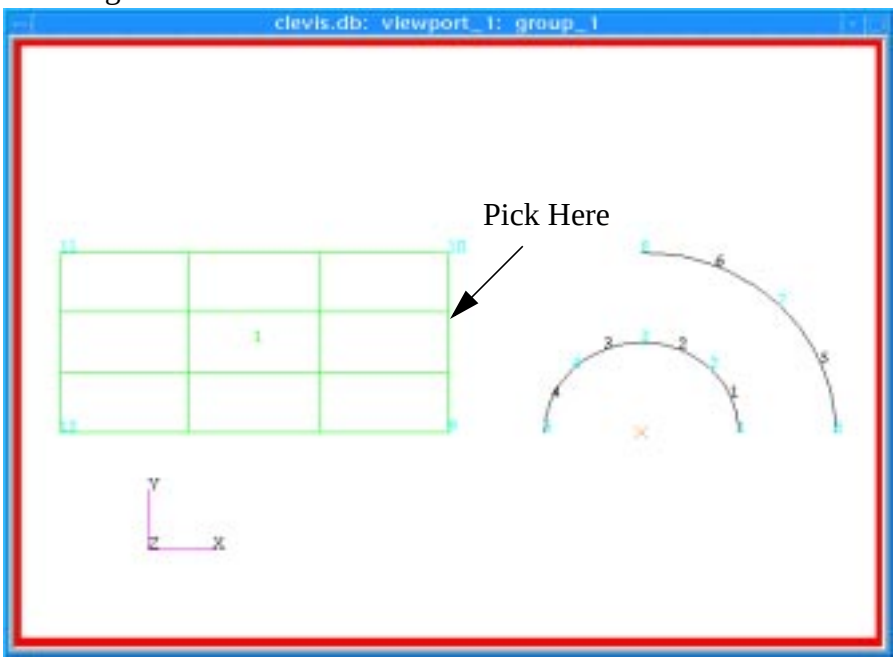
Starting Curve List: **Curve 4**

Next, click in the *Ending Curve List* databox, and then select the Surface Edge icon on the select menu as shown below



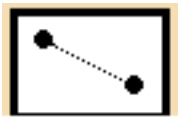
Apply

In the viewport, pick the edge of **Surface 1** as shown in the figure below.



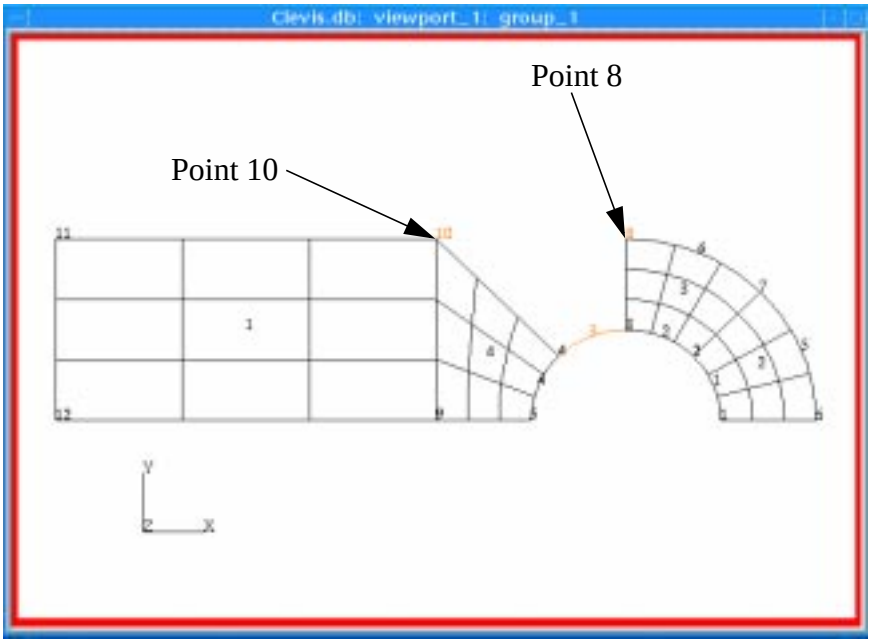
Change the *Starting Curve List* to **Curve 3**. Remember to select the curve icon from the *Select Menu* before you select **Curve 3.**

Click in the *Ending Curve List* databox. Select the 2-point icon in the *Select Menu.*



2-point icon

In the viewport, pick **Points 8** and **10** as shown below.



Apply

7. You will now use the Surfaces you have just created as patterns to define solids (3-dimensional entities).

Action:	**Create**
Object:	**Solid**
Method:	**Normal**
Thickness:	**0.25**

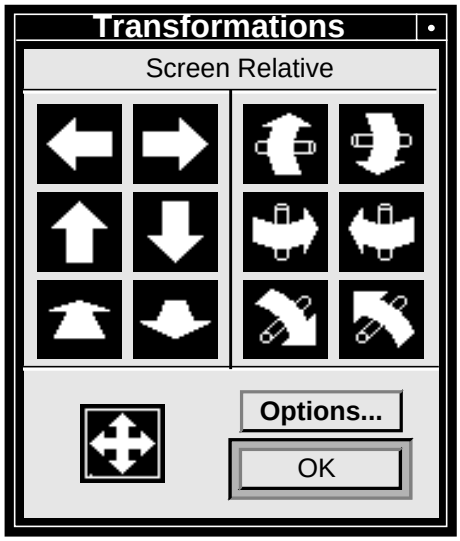
❑ **Auto Execute**

Surface List:	**Surface 1:5**

Apply

8. To obtain a more descriptive view of the solids you will now change the model's view by using the new interface to the Transformations View option.

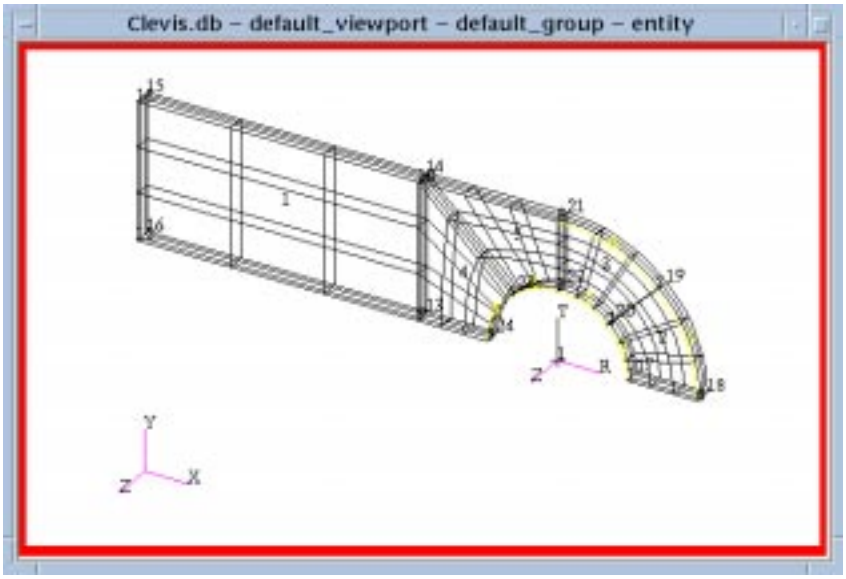
Click on **Viewing** in the *Main Form* and select **Transformations…** from the pull-down menu. The following form appears.



Click once on 

and once on 

to rotate the view 30^o about the screens y-axis and 30^o about the screens x-axis respectively. Your model should now be oriented similar to the one shown below. Click on the **OK** button to close the *Transformation* form.



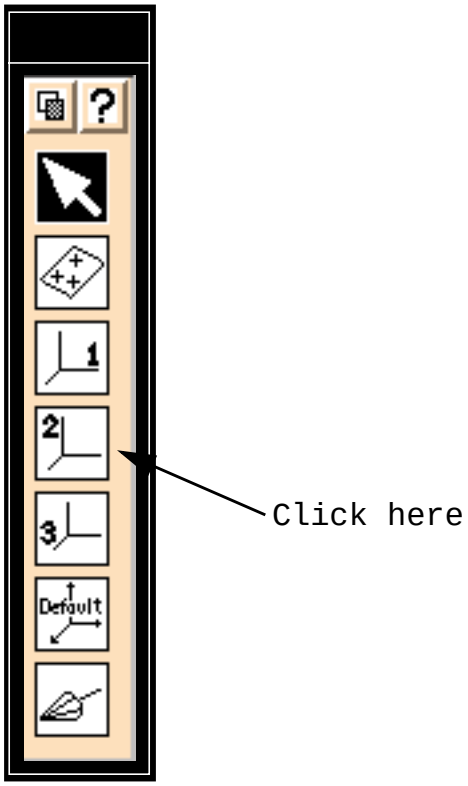
You will now perform a series of transformations on the solids to create the remainder of your geometry model.

9.Create the lower half of this part of the clevis model.

Action:	**Transform**
Object:	**Solid**
Method:	**Mirror**

Click in the *Define Mirror Plane Normal* databox. Notice that the mirror plane is no longer limited to solely X, Y, or Z and that now mirroring can be performed about any arbitrary mirror normal vector defined by a base and a tip

The mirror plane for this model is the global XZ-plane. The vector perpendicular to that plane points in the global Y-direction. Notice that global Y is aligned with the ‘2’ direction of your local coordinate frame 1. To use the 2-axis to identify the orientation of the mirror plane, select the icon indicating **coordinate axis 2** from the *Select Menu* as shown below.



Next, click on the axis located in the lower left in your viewport.

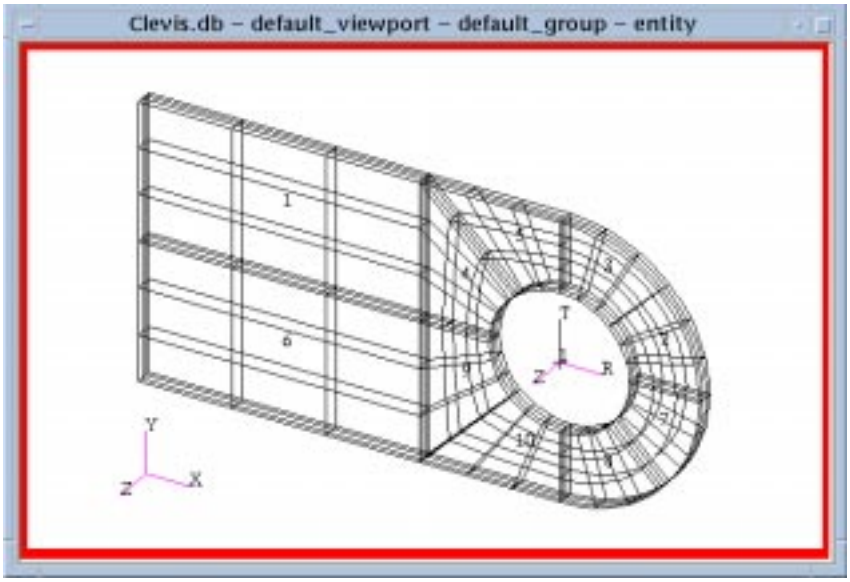
Define Mirror Plane Normal: **Coord 0.2**

❑ **Auto Execute**

Solid List: **Solids 1:5**

Apply

The new model should appear in the Viewport as shown below.



10.The remaining solids will be created using the translate method.

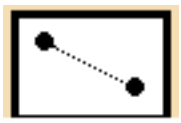
Action:	**Transform**
Object:	**Solid**
Method:	**Translate**
Translation Vector:	**< 0 0 -0.25>**
Repeat Count:	**2**
❒ **Auto Execute**	
Solid List:	**Solid 1 6**

Apply

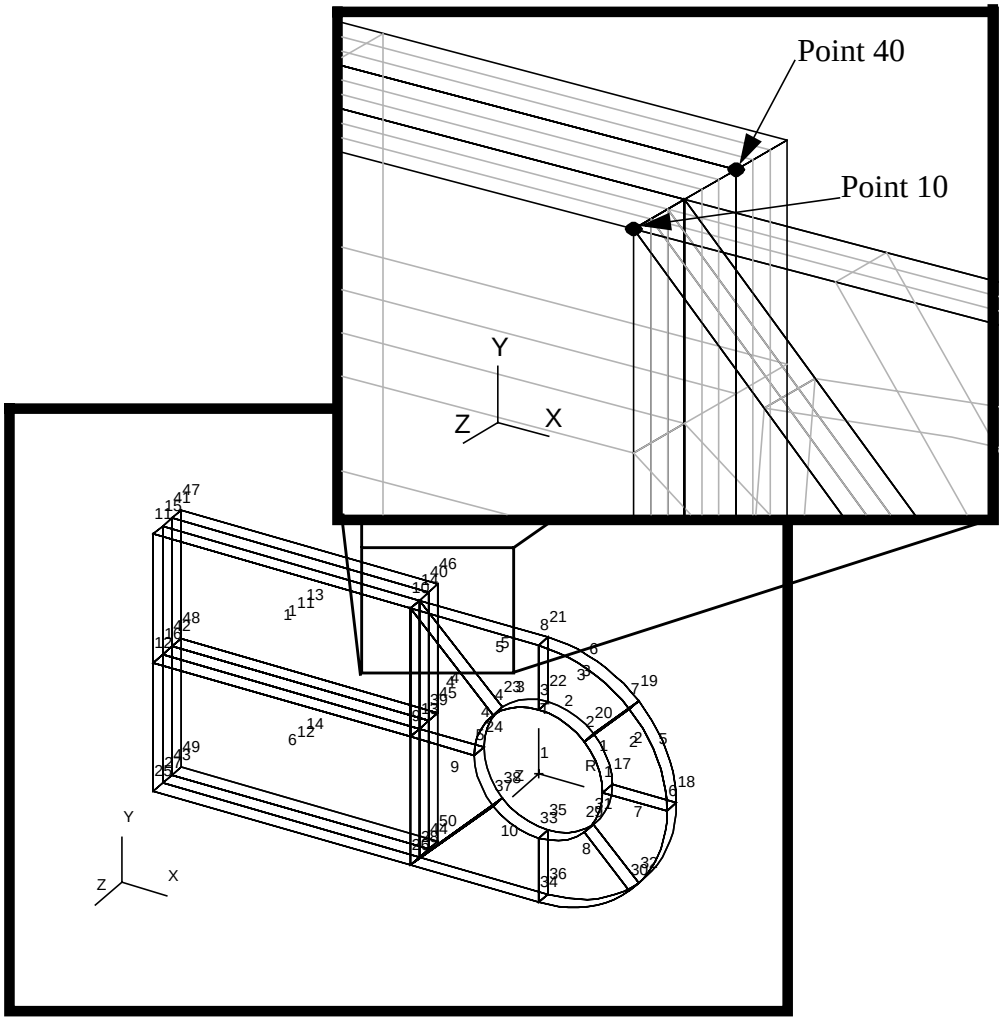
Your last construction step is to translate copies of the solids that surround the hole to create the final solids.

Click in the Translation Vector databox.

From the *Select Menu* pick the tip and base points icon.



To define the translation vector, pick **Point 10** then **Point 40** as shown below. Use **Select Corners** from **Viewing** to zoom in. After selecting the points use **Fit View** from **Viewing** to zoom out.



Repeat Count: **1**

Solid List: **Solid 2:5 7:10**

Apply

11.Change the model to get a clear view of the solid object.

Display/Entity Color/Label/Render...

Hide All Entity Labels

Apply

Cancel

Change the *Render Style* of your model from **Wireframe** to **Hidden Line** as follows:

Display/Entity Color/Label/Render...

Render Style: **Hidden Line**

Apply

Change the *Render Style* back to **Wireframe**.

Render Style: **Wireframe**

Apply

Cancel

Quit MSC/PATRAN when you are finished with this exercise.

Do not delete the database from your directory since you will use it for future exercises.