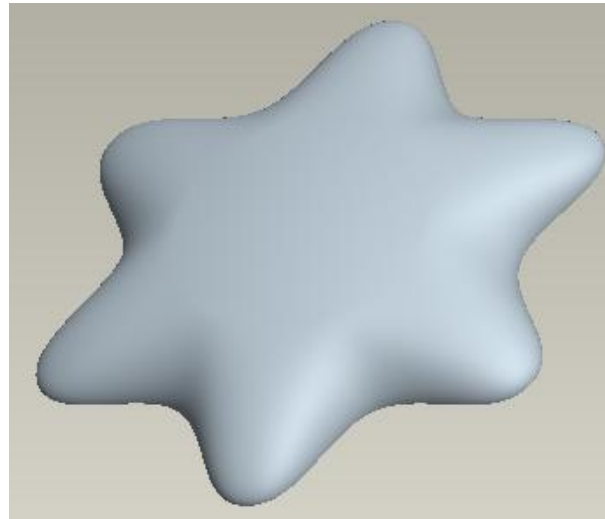
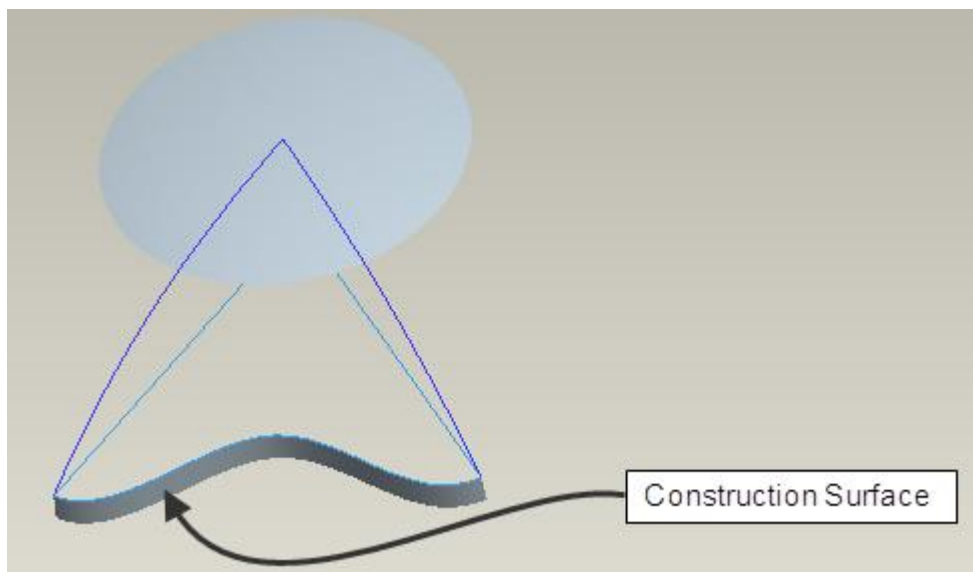


Exercise 19

In this exercise we will create a surface model for outer body of clock. The completed part is shown below.




Set the working directory to the EXAMPLES folder and open the model CLOCK.PRT
The part will appear as shown below.

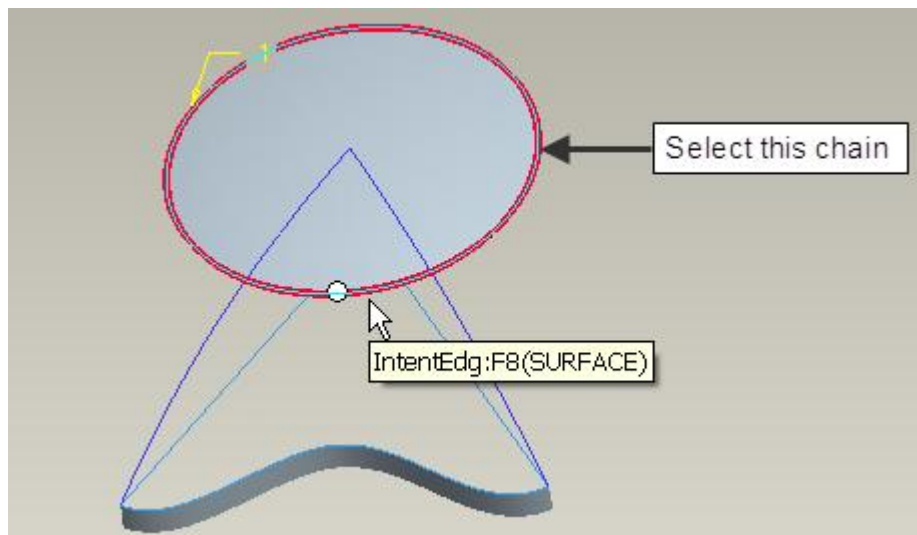


You can see a swept surface in the above figure. This will be used as a construction surface to control the draft of a boundary blended surface.

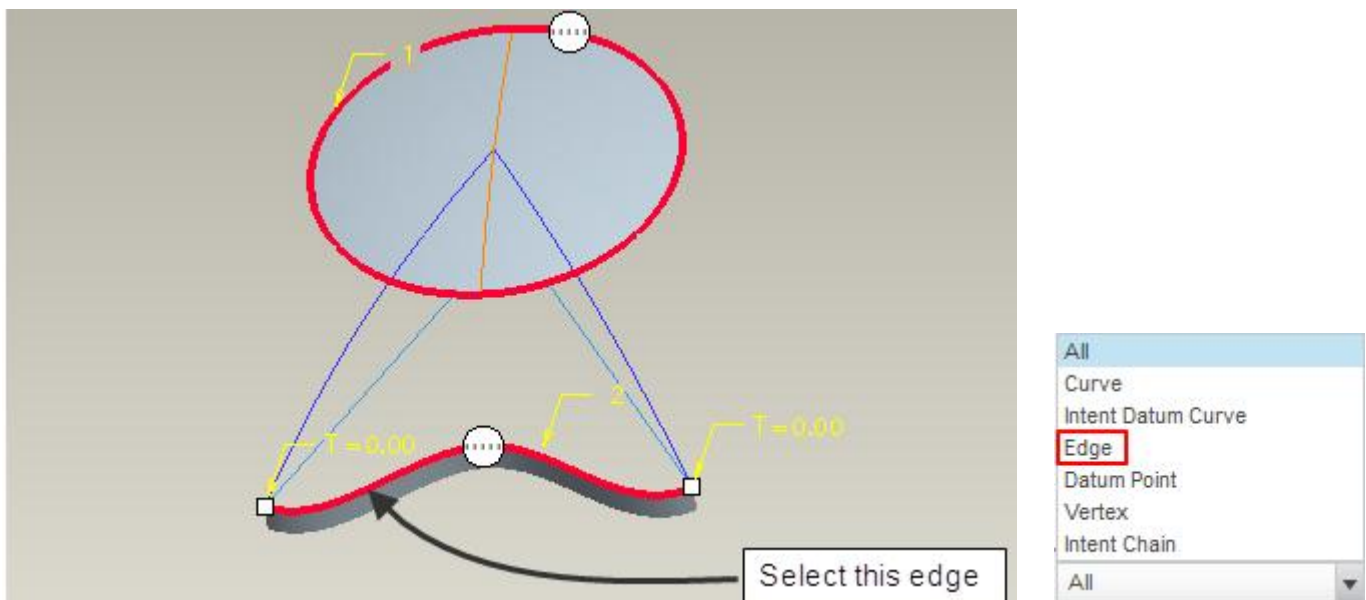
⇒ **Creating the surface**

Now we will create a surface with Boundary Blend Tool.

Pick  and select the edge chain shown in the figure below by using Intent Chain option.

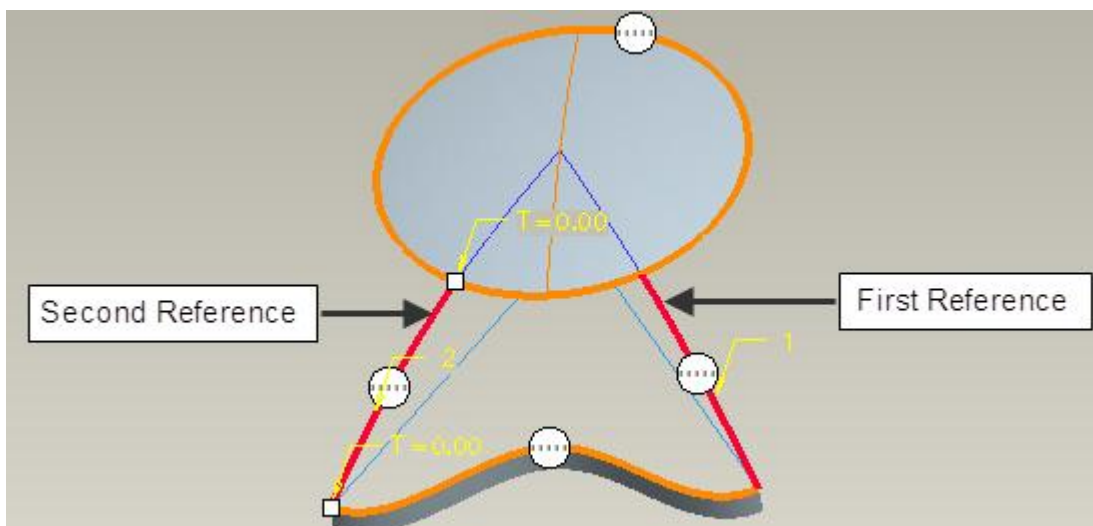


Now hold down the Ctrl key and pick the edge of swept surface as second chain as shown in figure below.

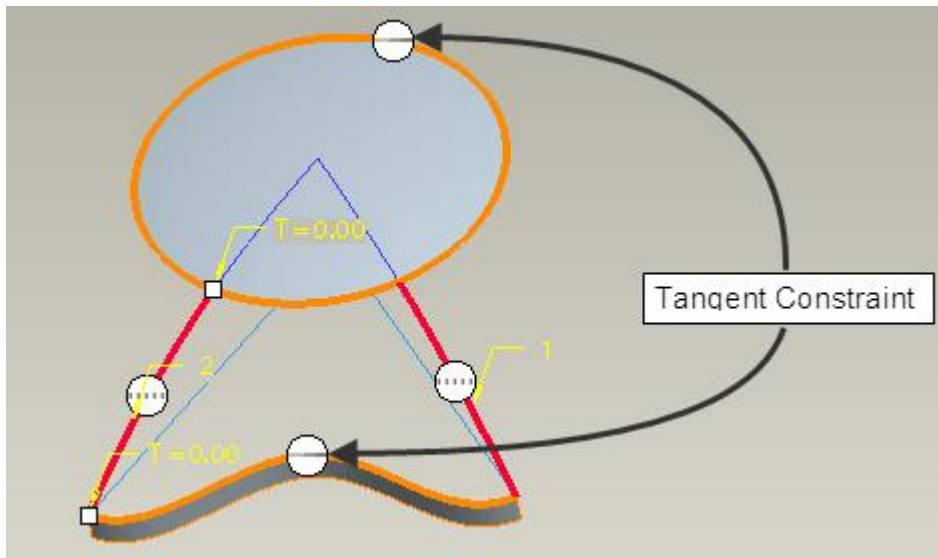



Pick in the **Second Direction Chain Collector** to activate it.

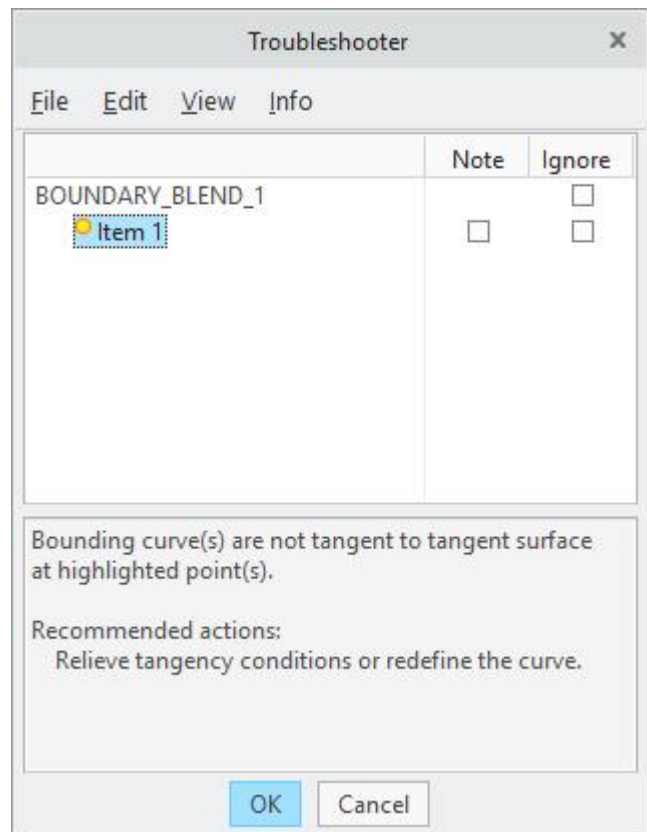
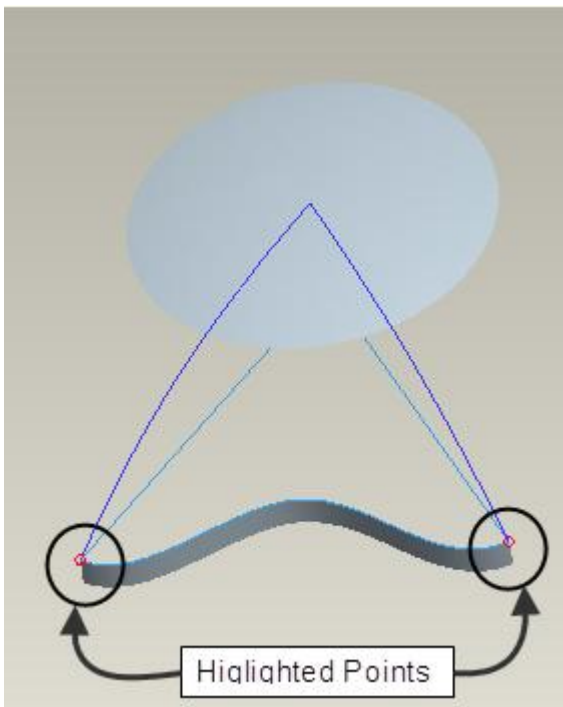
Select the references shown in the figure below as first and second chains in second direction.



Apply the **Tangent** constraint for the chains shown in figure below.



Pick  to verify the surface and Troubleshooter dialog box will appear. Pick "Item 1" in the dialog box and system will highlight the troubled point as shown below.



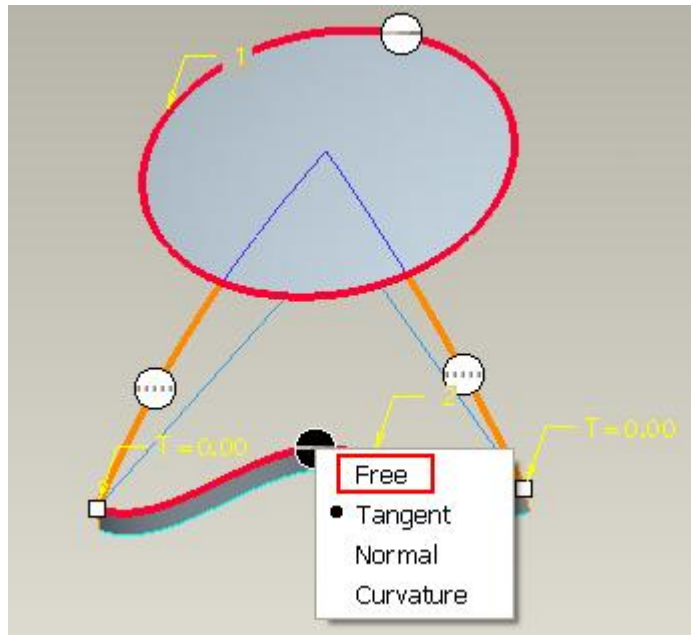
It is because the underlying datum curves are not tangent to the swept surface.


For a surface to be normal or tangent to a reference, underlying datum curves must be normal or tangent respectively to desired reference.

So first we will make the underlying datum curve tangent to the construction surface and then apply the tangent constraint to surface.


Now close Troubleshooter dialog box and pick  to Resume the boundary blended surface.

Right-click over the constraint balloon and apply the **Free** constraint for the chain shown in figure below.

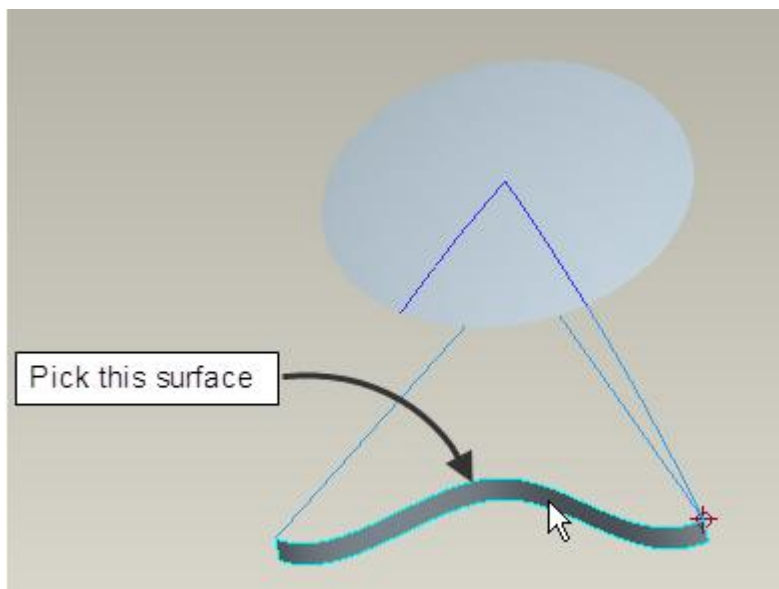


Pick  to apply the changes and exit the dashboard.

Select the CURVE_RIGHT feature in the model tree and pick .

Pick  tab and change the End condition for Start Point to Tangent

Select the swept surface as reference as shown below.

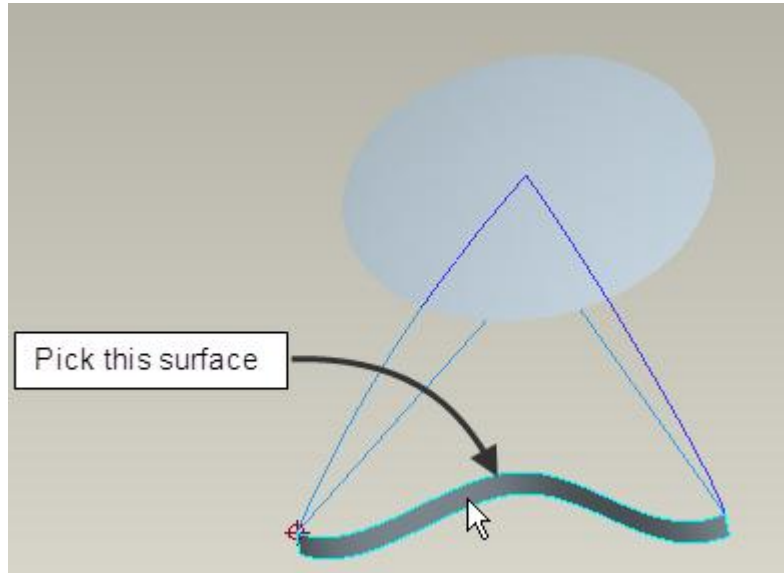


Pick  to complete the feature.


Now Select the CURVE_LEFT feature in the model tree and pick .

Pick tab and change the End condition for End Point to Tangent

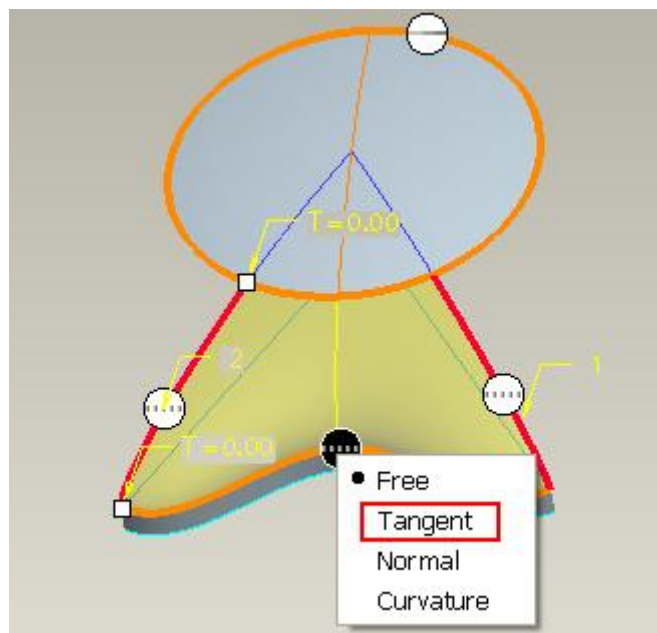
Select the swept surface as reference as shown below.



Pick to complete the feature.

Now Select the Boundary Blend feature and pick .

Apply the **Tangent** constraint for the chain shown in figure below.



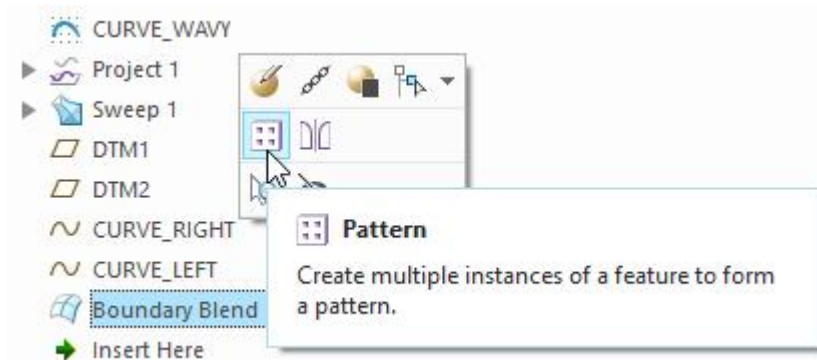
This tangent constraint will make sure that the surface will have the required draft.

Pick  icon or middle-click to complete the feature.

⇒ Pattern the surface


Now we will pattern the boundary blended surface.

Select the **Boundary Blend 1** in the model tree and pick **Pattern**.



Change the pattern type to **Axis** and select axis A_7

Enter **6** as the number of pattern members.


Pick  and enter **360** as the angular extent then hit Enter key.

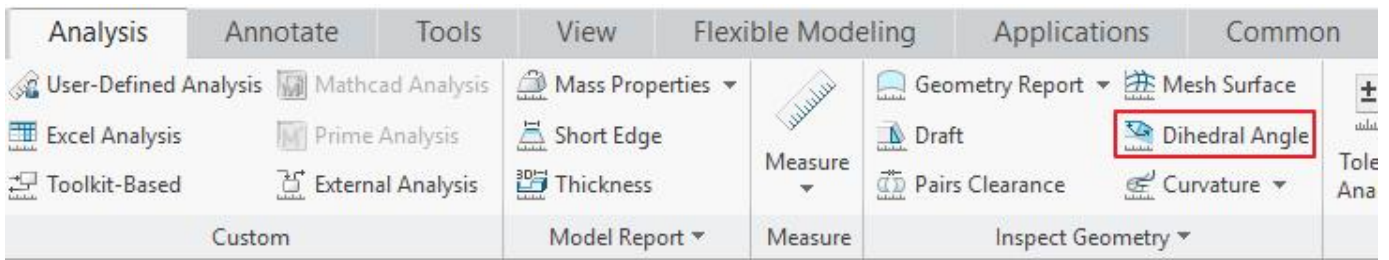


Pick  to complete the pattern.

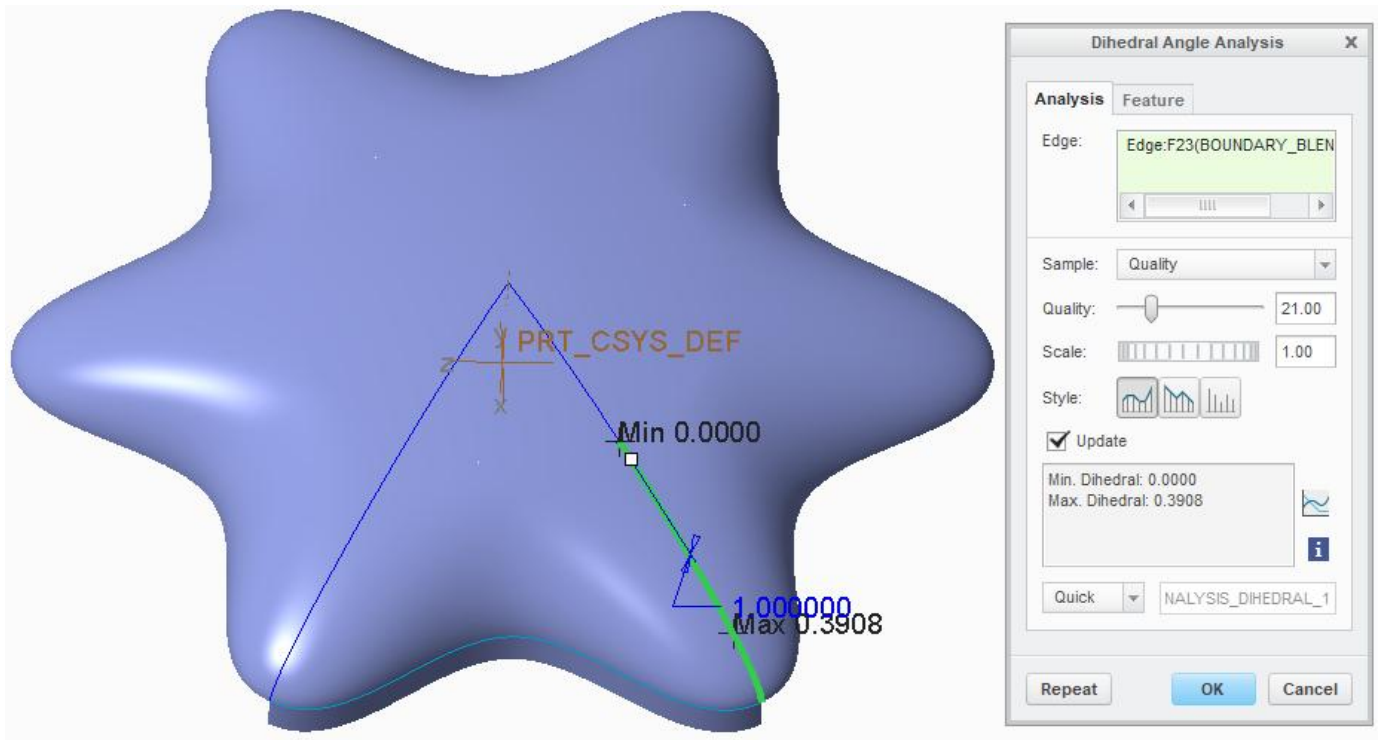
⇒ Analyzing the Quilt

Now we will analyze the quilt with Dihedral Angle tool to determine the level of tangency across patterned surface.

So pick  on the Analysis tab to access the Dihedral Angle tool.



Now system will ask you to select an edge to be analyzed. So pick the edge shown in the figure below.

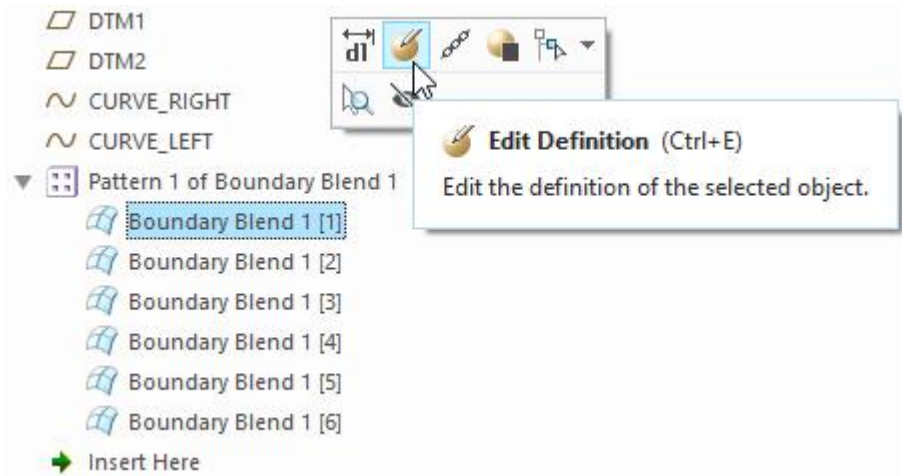


You should notice that maximum dihedral angle is not zero for this edge which means surface patches on both side of the edge are not tangent to each other. So we need to fix this surface patch.

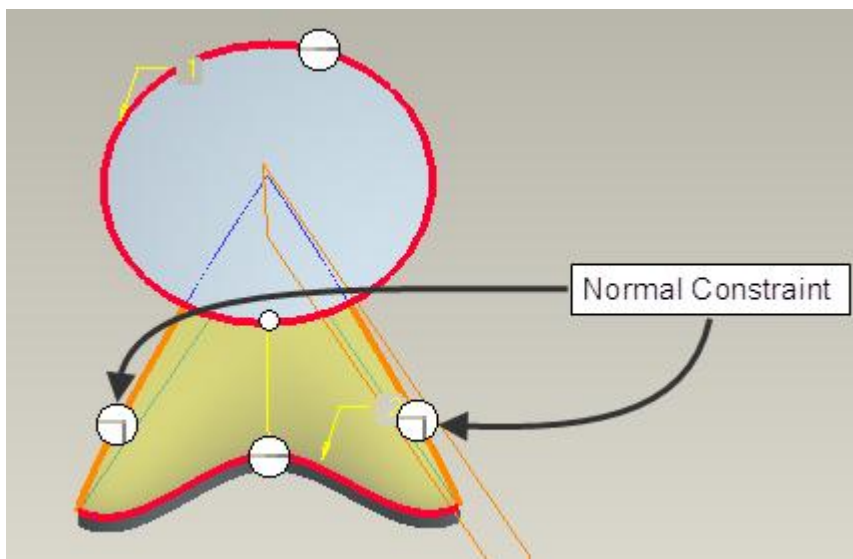
To make the patterned and parent surface tangent to each other we need to make the parent surface normal to a plane lying on boundary.


➡ Modify the surface

Select the first feature of pattern in model tree and select  as shown in figure below.




Apply the **Normal** constraint for the chains as shown below.

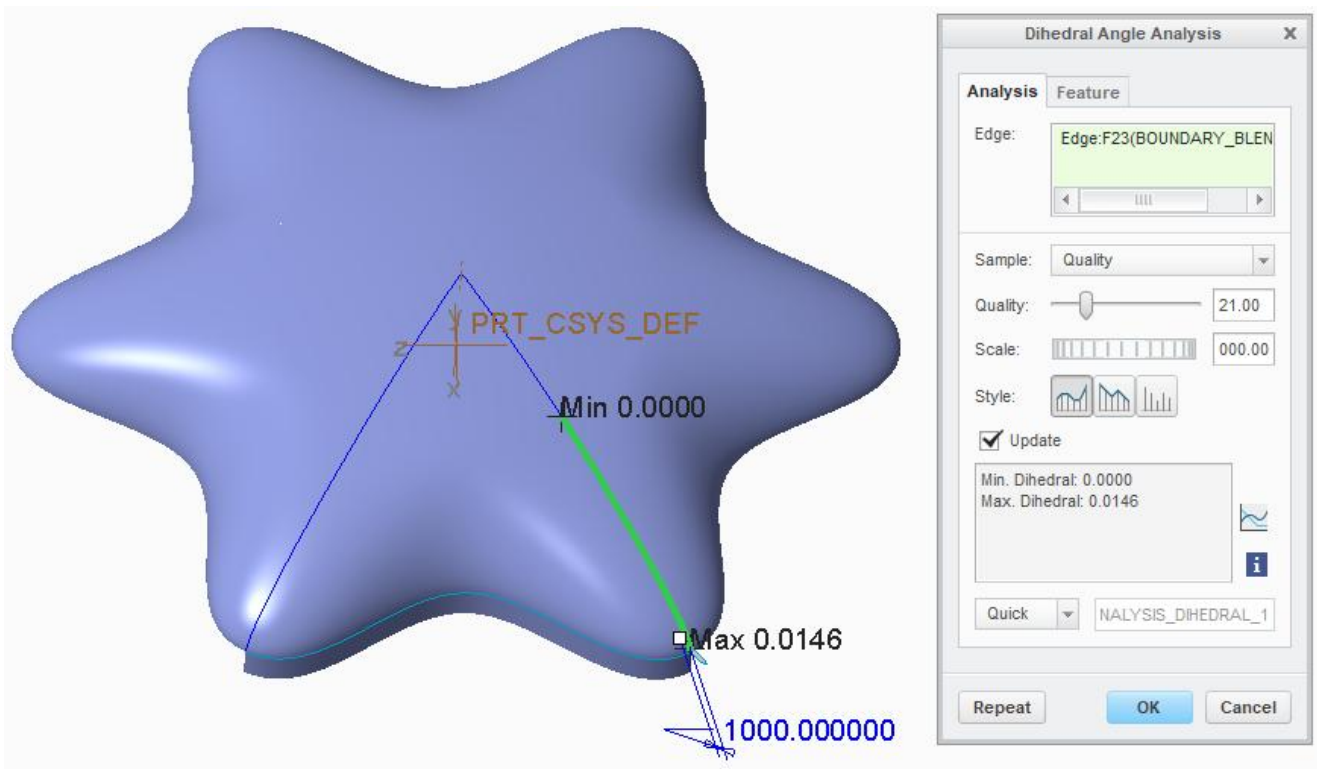


Pick  to apply the changes and exit the dialog box.

Now we will again analyze the quilt with Dihedral Angle tool to determine the level of tangency across merged surface.

So pick  on the Analysis tab to access the Dihedral Angle tool.

Pick the edge shown in the figure below.

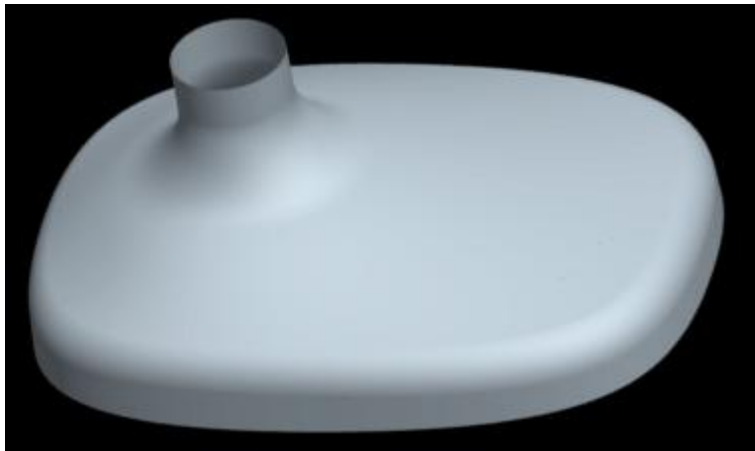


You should notice that minimum and maximum dihedral angle is approximately 0 which means surface patches on both side of the edge are tangent to each other.

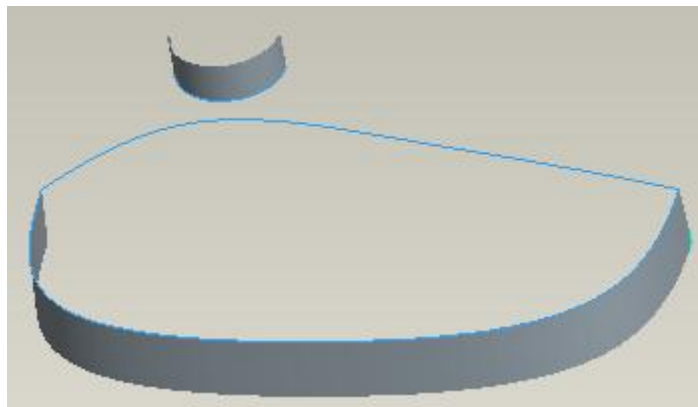
Select **File > Save** to save the work done so far.

Exercise 20

In this exercise we will create the surface model of a table-fan base. The completed part is shown in the figure below.



Set the working directory to the EXAMPLES folder and open the model FAN_BASE.PRT and it will appear as shown below.

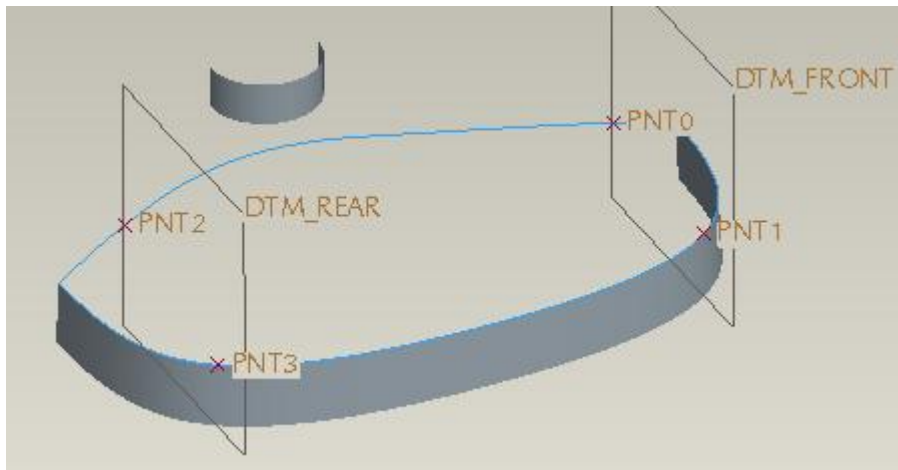


Because this part is symmetrical so we will create half side of the part and then mirror it.


We need to build surfaces that cover the top of this part. We can easily create a boundary blended surface from the existing curves, but it will result in singularities. So we will create the surface using a technique that does not create singularity. This technique requires additional datum curves so first we will create two sketched datum curves.

⇒ Creating the datum curves

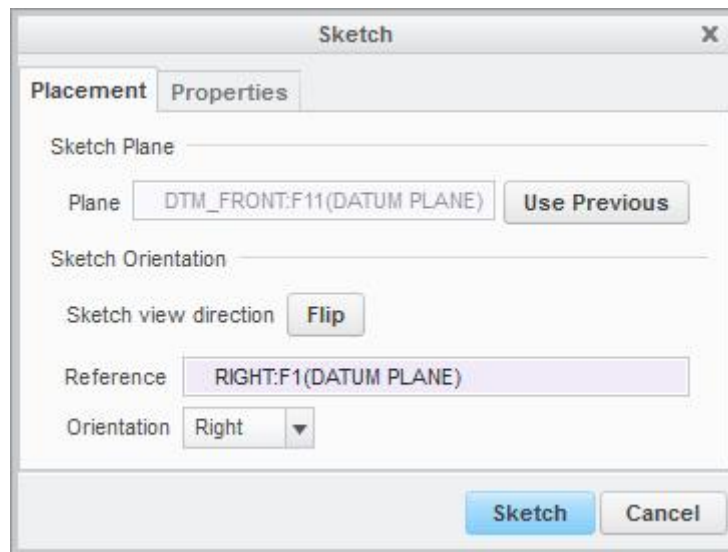
Turn the display of datum planes and points “ON” and part will appear as shown below.



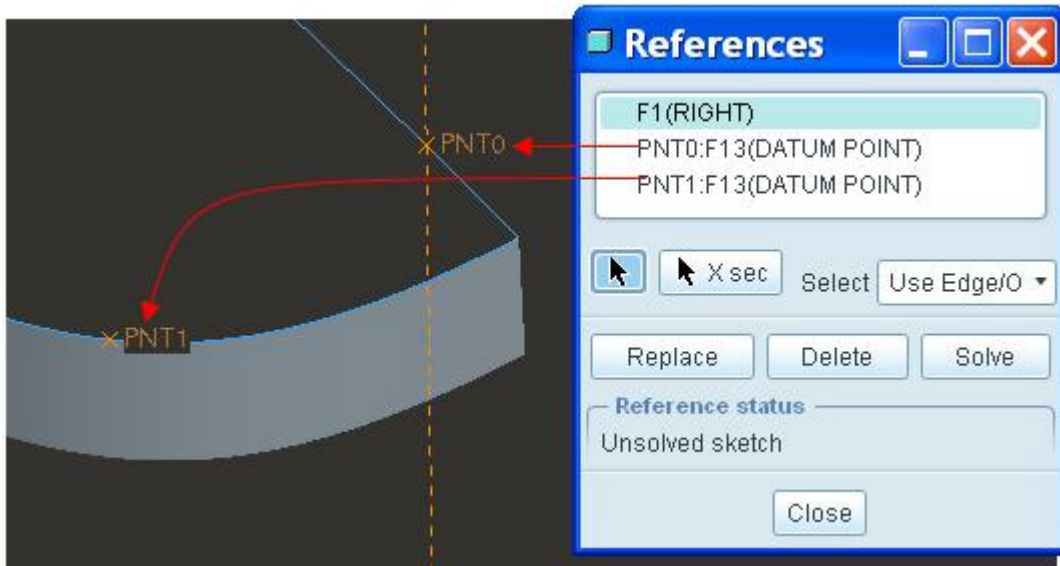
These datum planes and datum points will be used as references during curve definition. We already created them for your convenience. You should notice that datum points lie at the intersection of datum planes and datum curves.


To create the sketched curve, pick  icon.

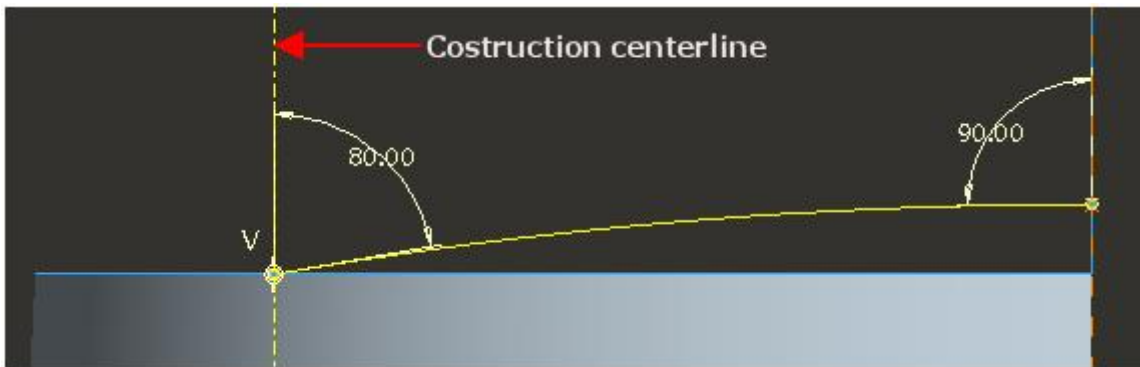
Pick DTM_FRONT as sketching plane.




Select the datum points PNT0 and PNT1 as reference.



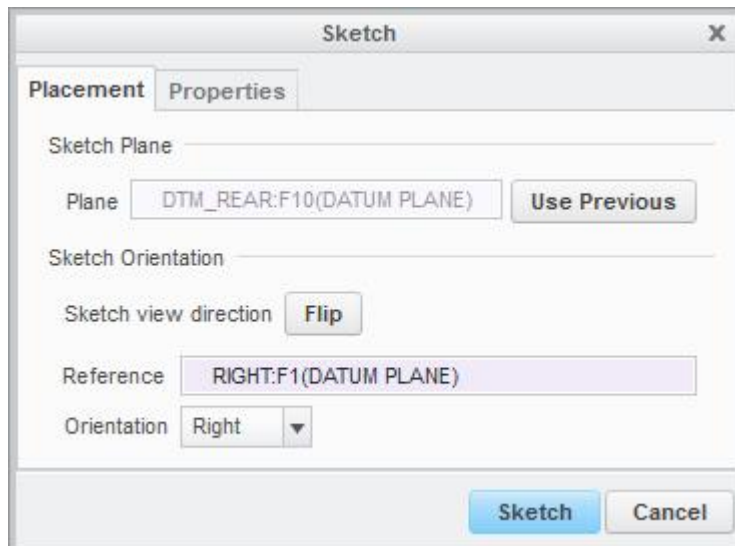
Pick  Spline and sketch a two point spline whose end points lie on datum points. Then create the tangency dimensions as shown below. (You also need to create a centerline to define tangency dimension)



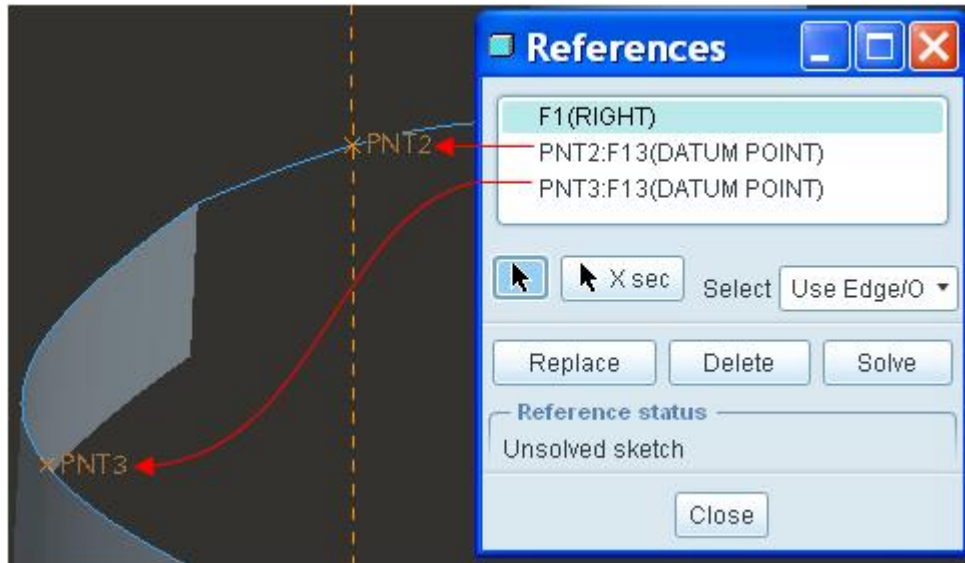
Pick  after completing the sketch.


To create the second sketched curve, again pick  icon.

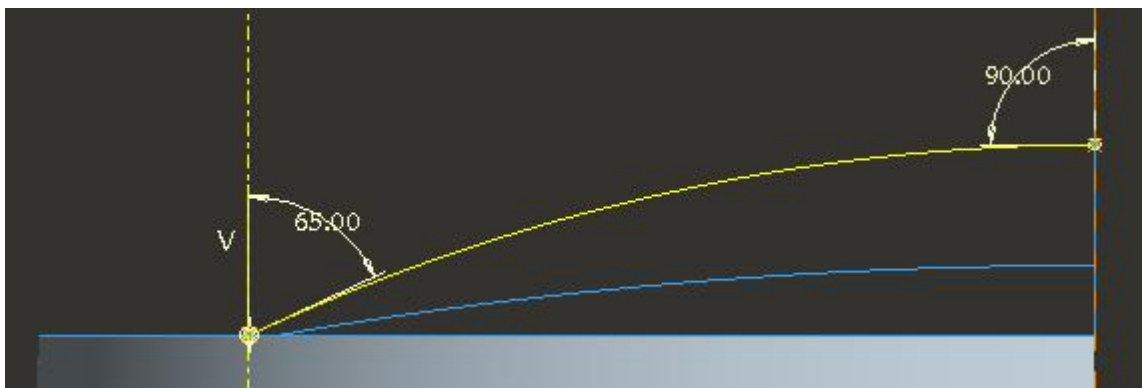
Pick DTM_REAR as sketching plane.



Select the datum points PNT2 and PNT3 as reference.




Pick  Spline and sketch a two point spline whose end points lie on datum points. Then create the tangency dimensions as shown below.

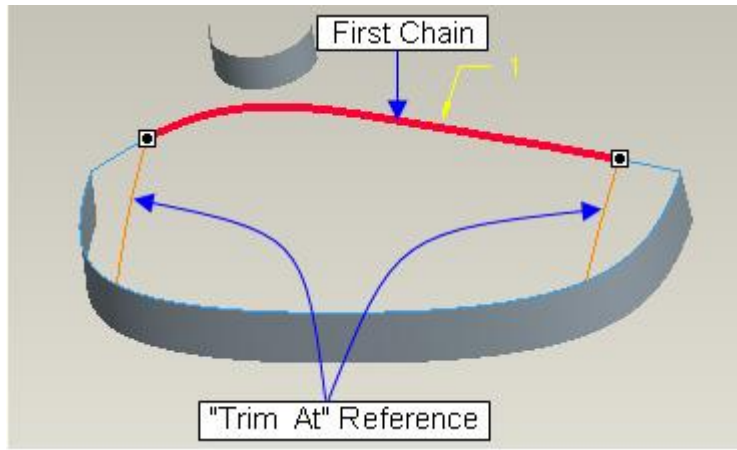


Pick  after completing the sketch.

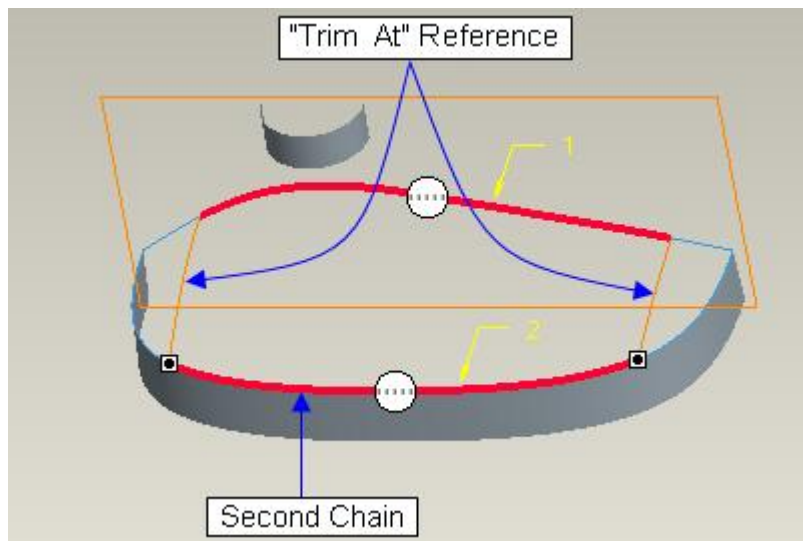
Creating the first surface

Now we will create a boundary blended surface with four chains.

Pick  and select first chain, then trim it at both ends as shown in the figure below.

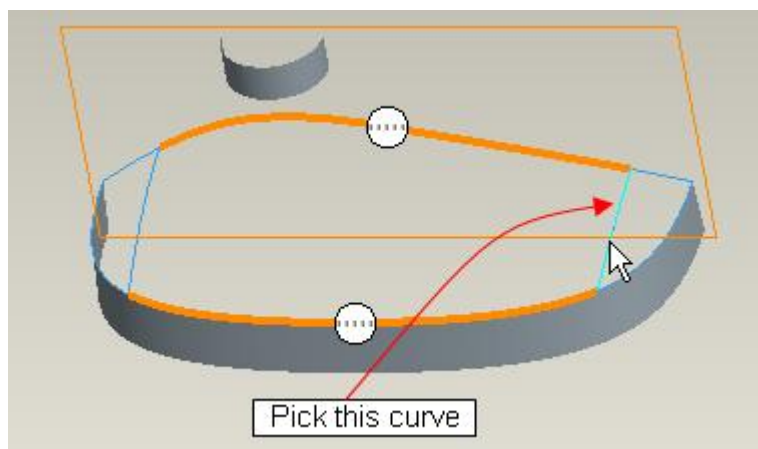


Now hold down the Ctrl key and pick second chain, then trim it at both ends as shown in the figure below.

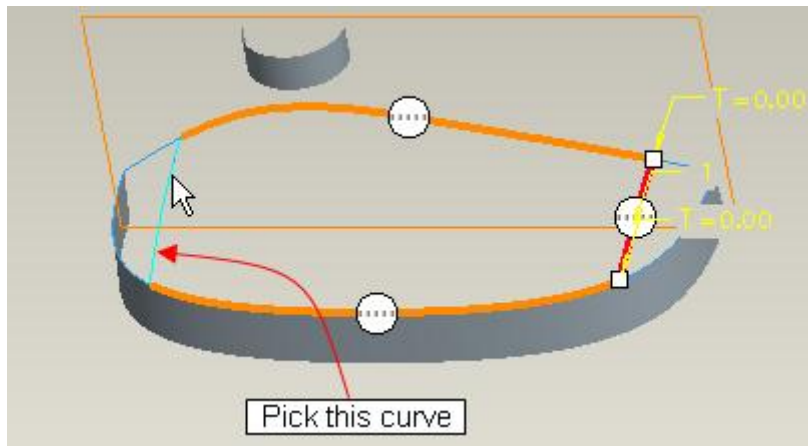


Pick in the Second Direction Collector to activate it.

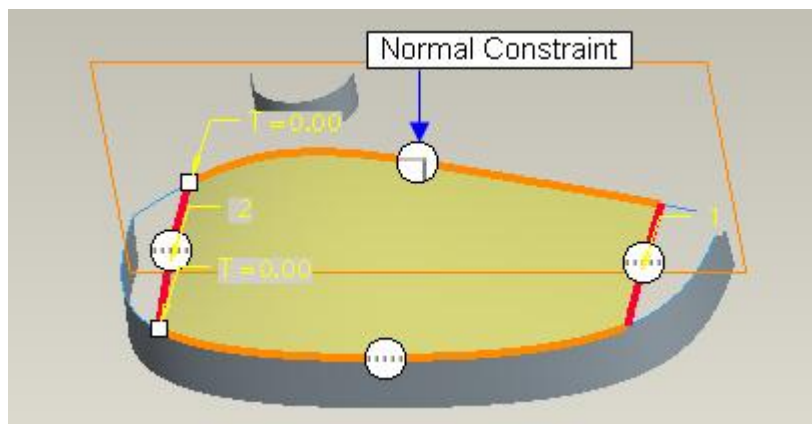
Select the curve shown in the figure below as first chain in second direction.



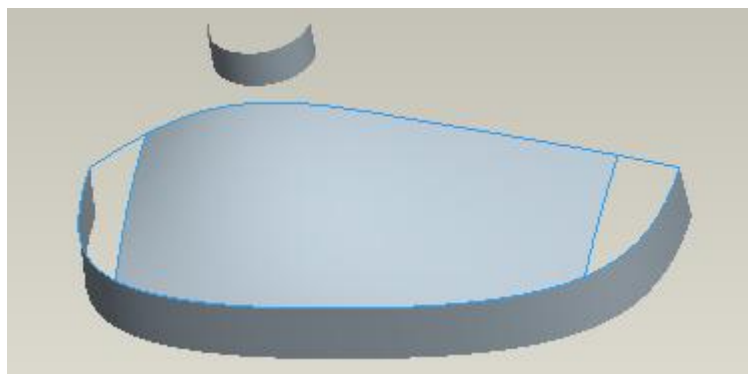
Hold down the Ctrl key and pick the following curve as second chain.



Apply the **Normal** constraint for the chain that lies on RIGHT datum plane (because we will mirror the part about RIGHT datum plane) as shown below.



Pick to complete the feature and it will appear as shown below.

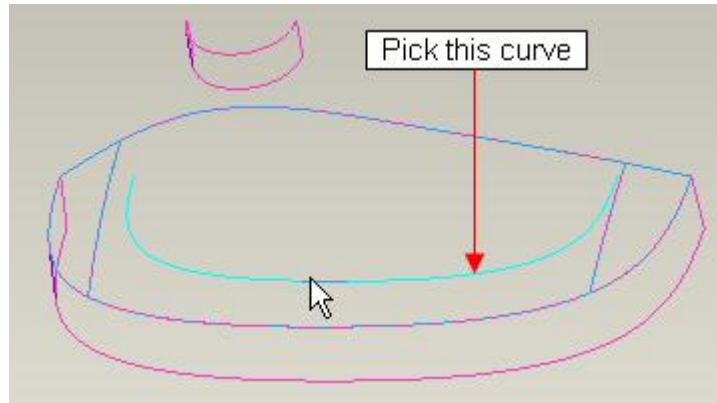



⇒ Trimming the Surface


Now we will trim this surface in such a way that we can build another boundary blended surfaces without any singularity. Datum curves required for trimming operation have already been created but hidden.

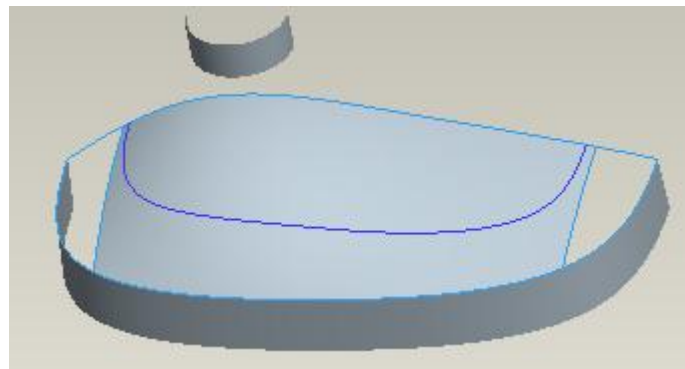
So right-click the “TRIM_MAIN” feature in the model tree and pick **Show** and curve will appear on screen.

Select the TRIM_ MAIN datum curve on screen as shown below.



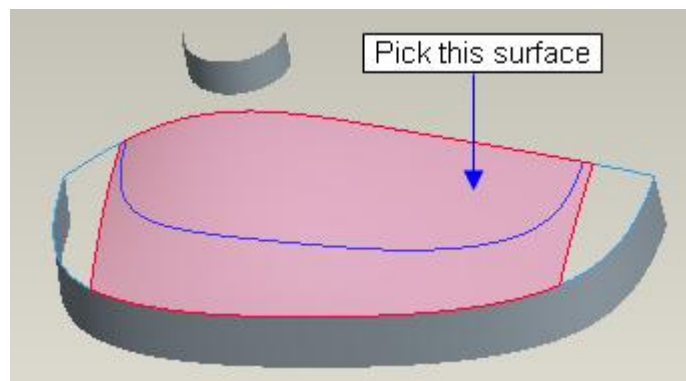
Pick  Project on the Model tab to invoke the Project tool and select the newly created boundary blended surface to project selected curve onto.


Pick  to complete the feature and curve will appear as shown below.



Now we will trim the boundary blended surface with projected curve.

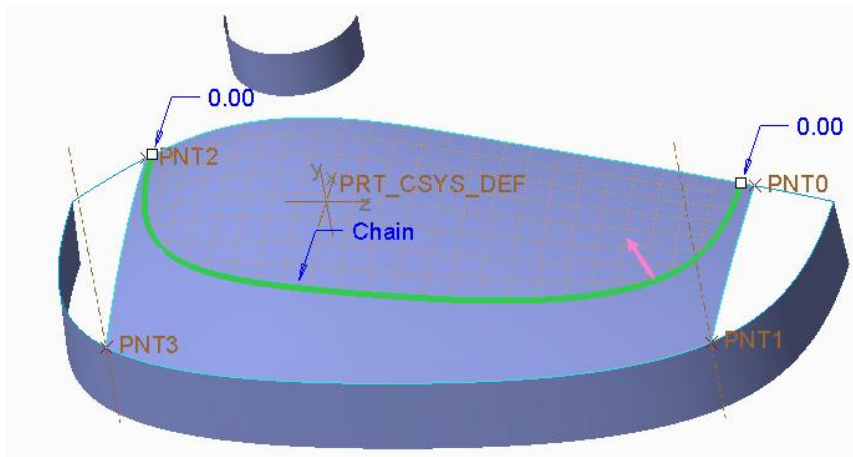
So first select the surface.




Pick  Trim on the Model tab to invoke Trim tool.

Select the projected datum curve as trimming object.


Flip the direction of the arrow to remove the outer side of the surface so that preview appears as shown below.

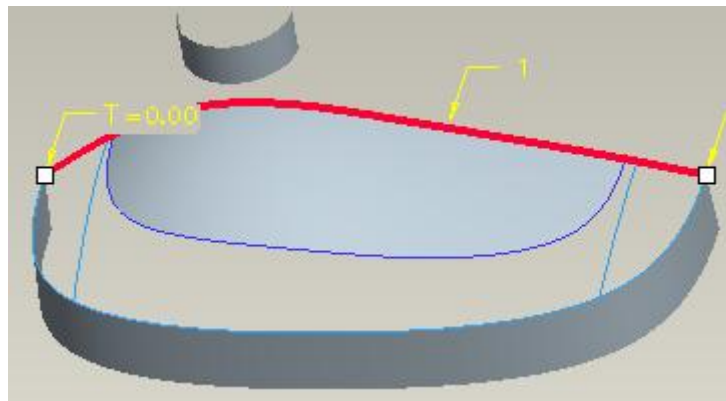


Pick  or middle-click to complete the feature.

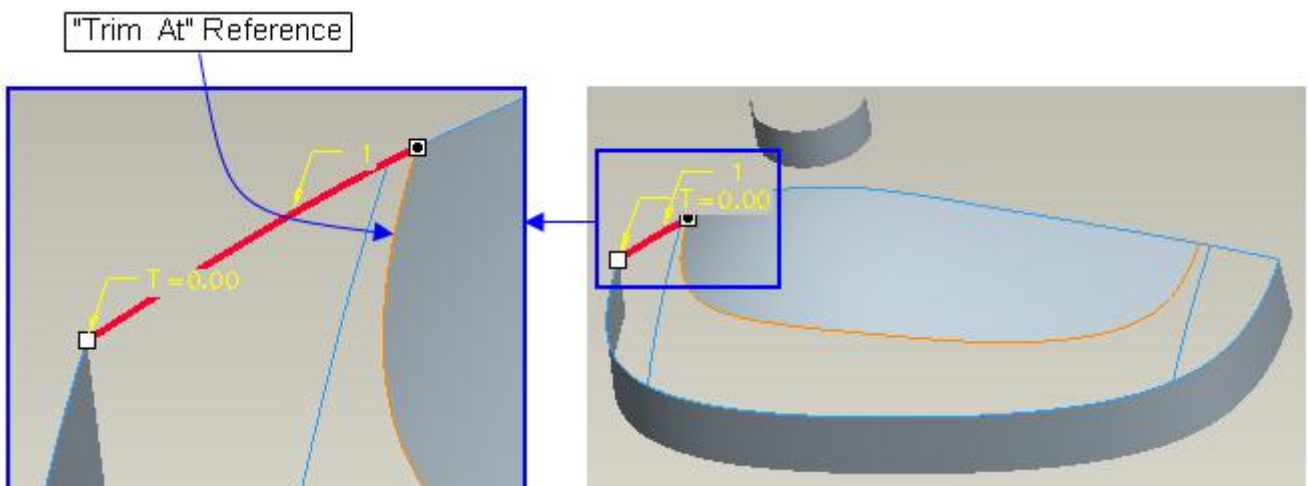
Creating the second surface

Now we will create another boundary blended surface to fill the remaining gaps.

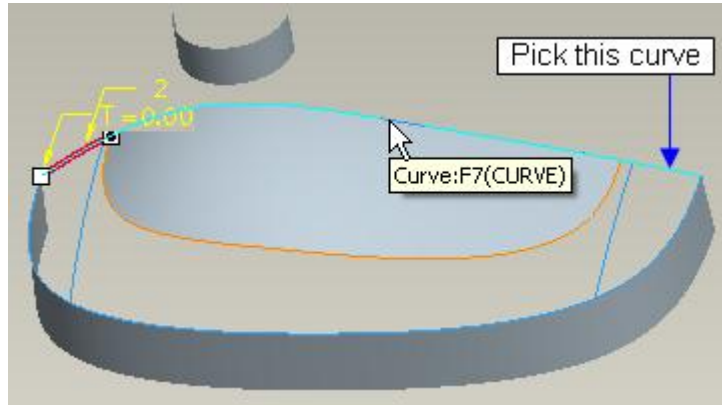
Pick  and select the curve shown in the figure below.



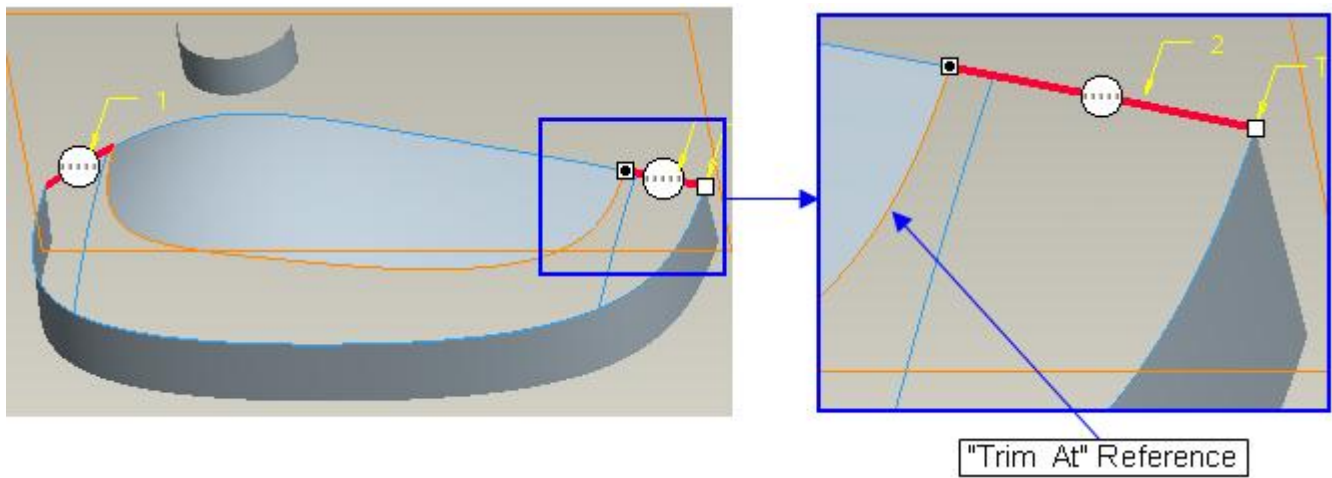
Trim it at right end as shown in the figure below.



Now hold down the Ctrl key and pick curve shown in the figure below.

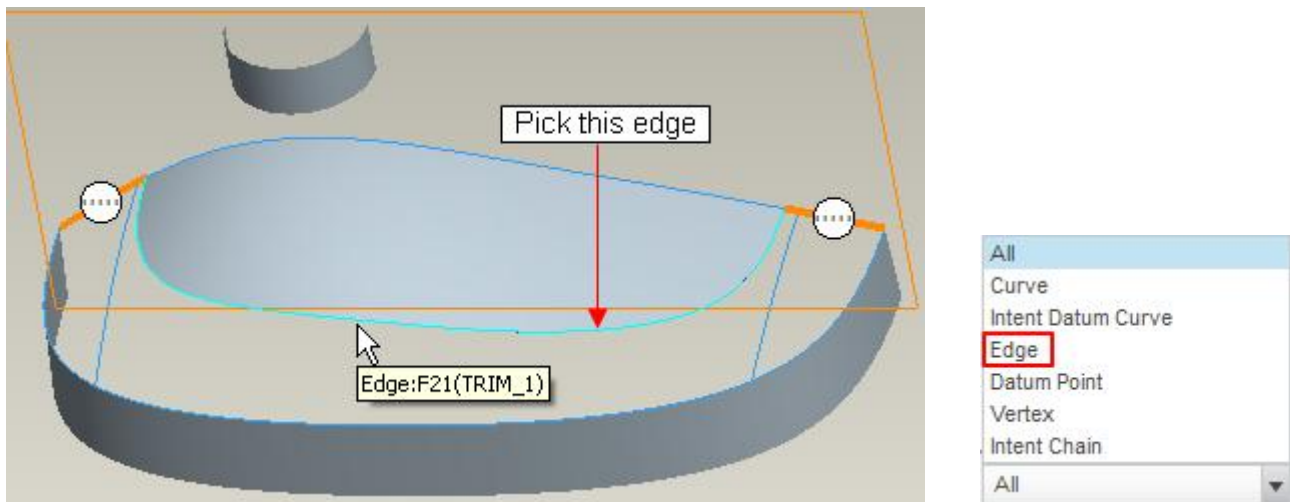


Trim it at left end as shown in the figure below.

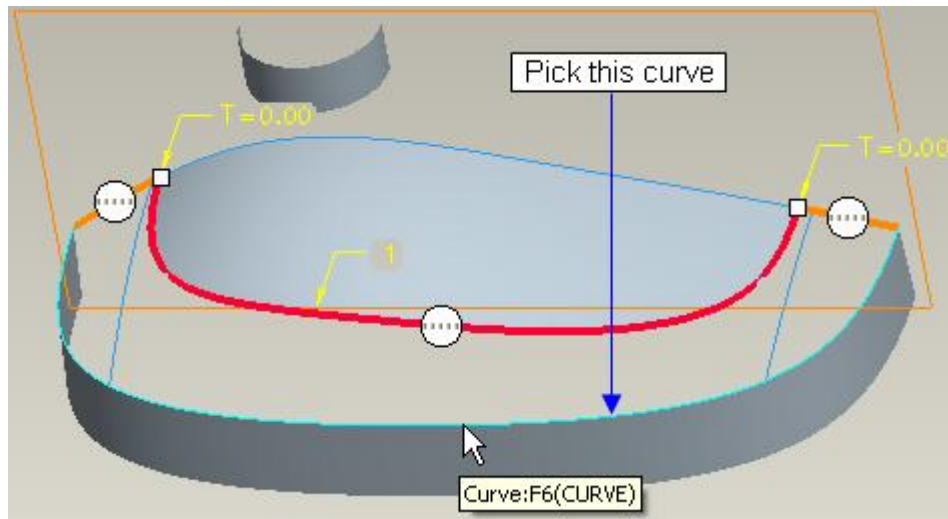


Pick in the **Second Direction Collector** to activate it.

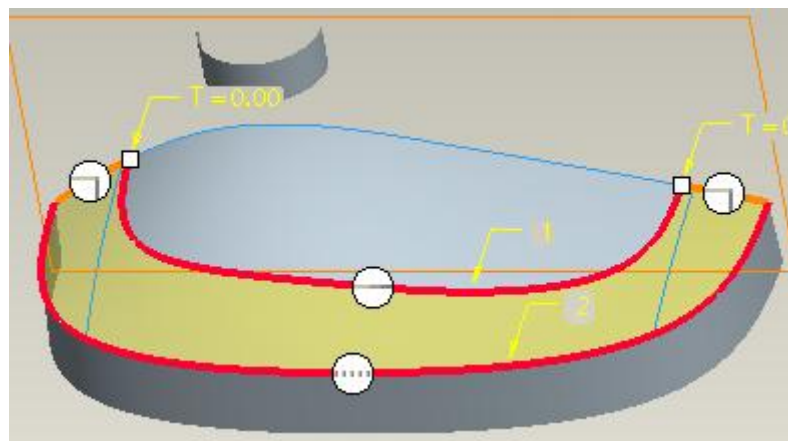
Pick the edge of surface as first chain in second direction as shown in the figure below. (Use the Edge filter to make sure that you select the edge and not the overlapping curve)




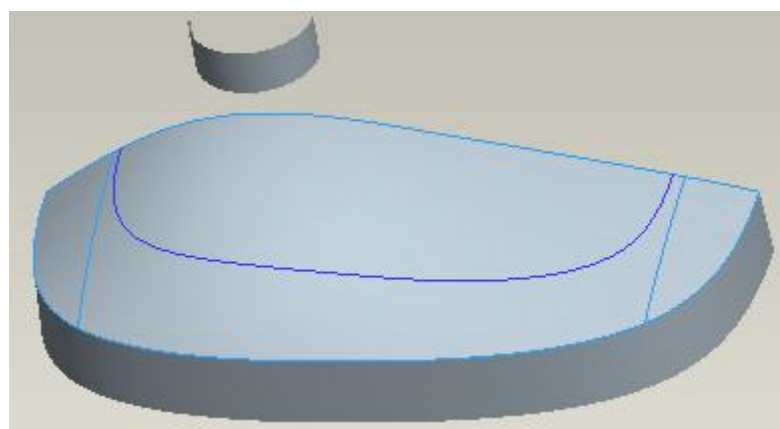
Hold down the Ctrl key and pick the following curve as second chain.



Apply the **Normal** constraint for the chains that lies on RIGHT datum plane (because we will mirror the part about RIGHT datum plane) and **Tangent** constraint for the boundary chain adjacent to the boundary blended surface as shown below.



Pick  to complete the feature and it will appear as shown below.

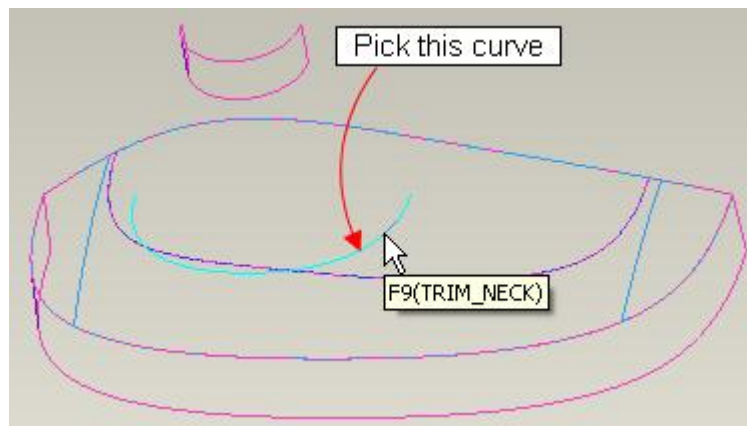


Creating the Neck

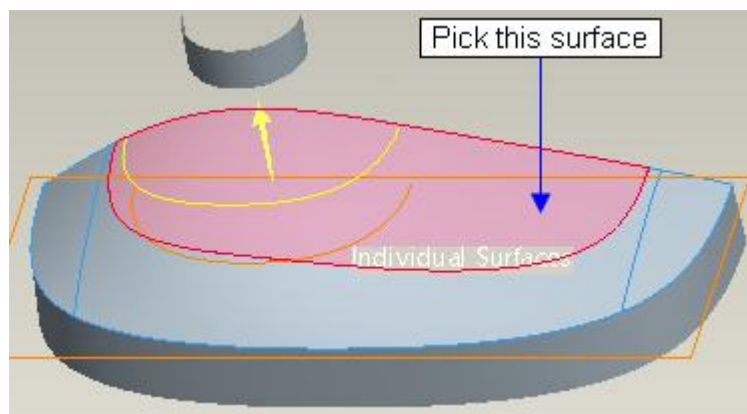
Now we will create a surface for the neck. For this purpose, first we will trim the top surface. Datum curves required for trimming operation have already been created but hidden.

Right-click the "TRIM_NECK" feature in the model tree and pick **Show** and curve will appear.

Select the TRIM_NECK datum curve on screen as shown below.



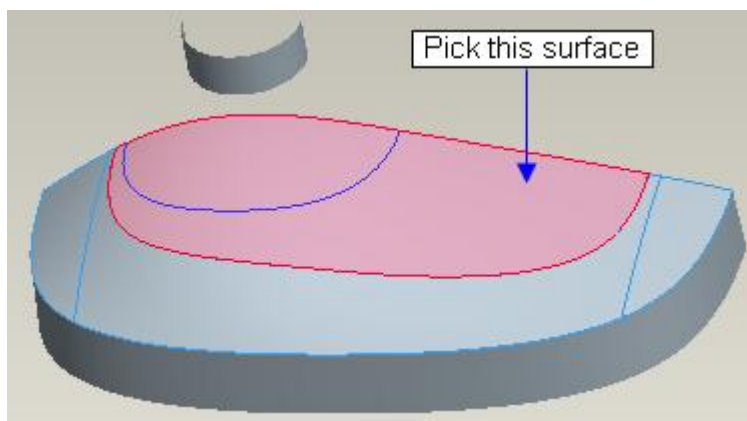
Pick  Project on the Model tab to invoke the Project tool and select the surface, shown in the figure below, to project selected curve onto.



Pick  to complete the feature.

Now we will trim the surface with projected curve.

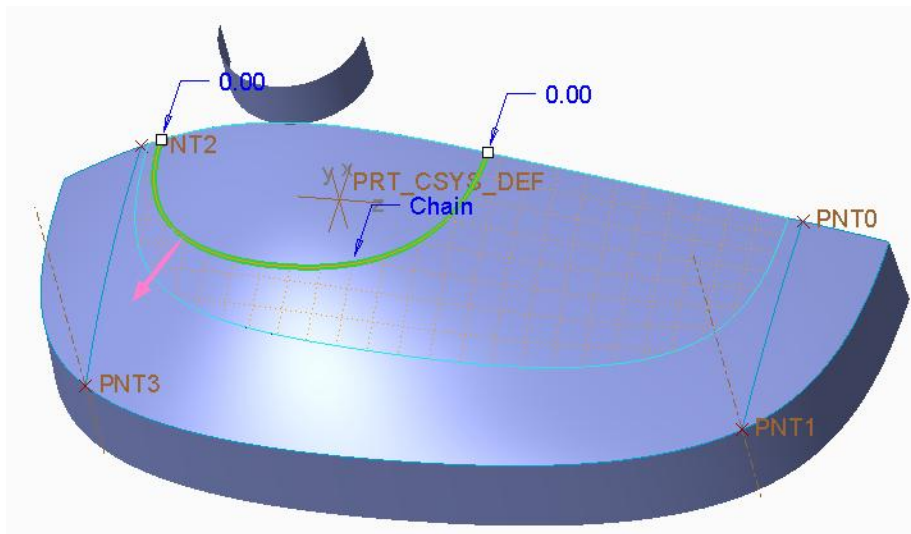
So first select the surface.



Pick  Trim on the Model tab to invoke Trim tool.


Select the projected datum curve as trimming object.

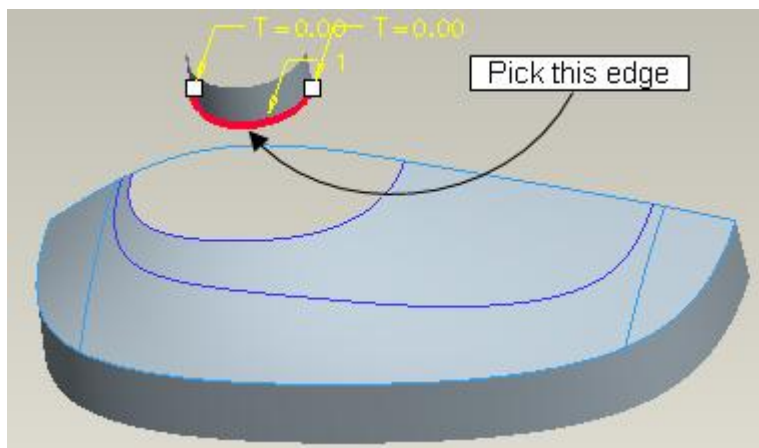
Flip the direction of the arrow to remove the inner side of the surface so that preview appears as shown below.



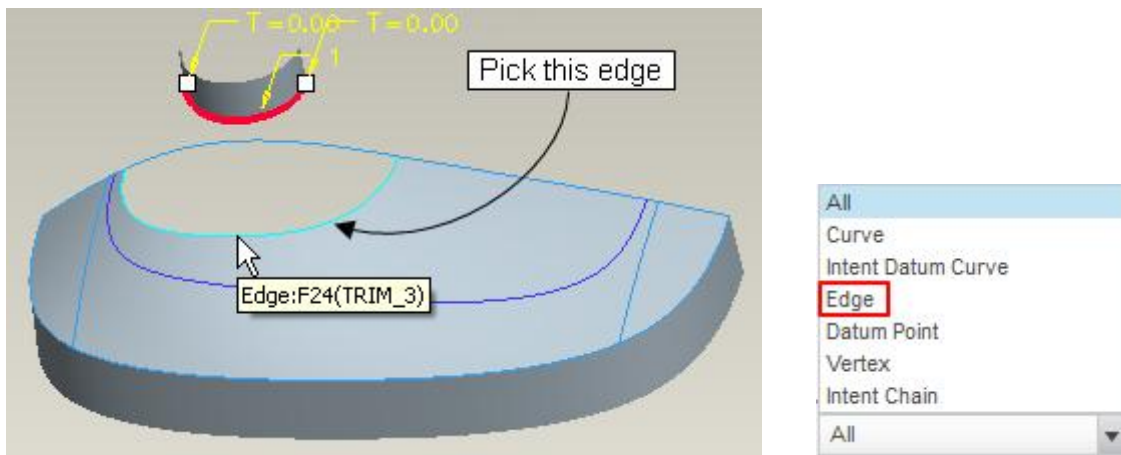
Pick  or middle-click to complete the feature.

Now we will create a boundary blended surface.

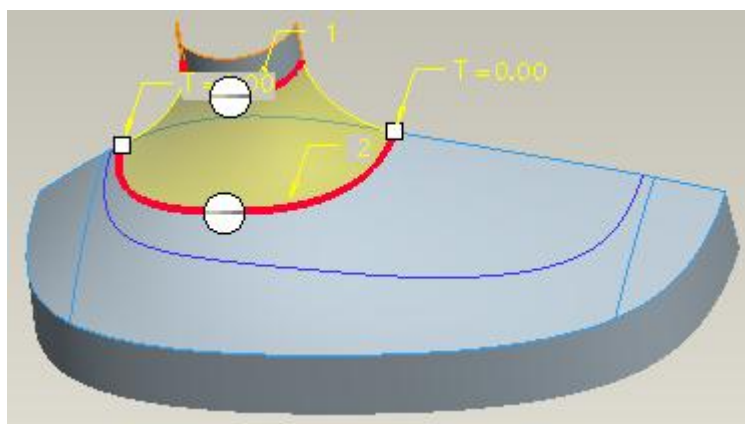
Pick  and select the edge shown in the figure below.



Hold down the Ctrl key and pick trimmed edge as second chain as shown in the figure below. (Use the Edge filter to make sure that you select the edge and not the overlapping curve)



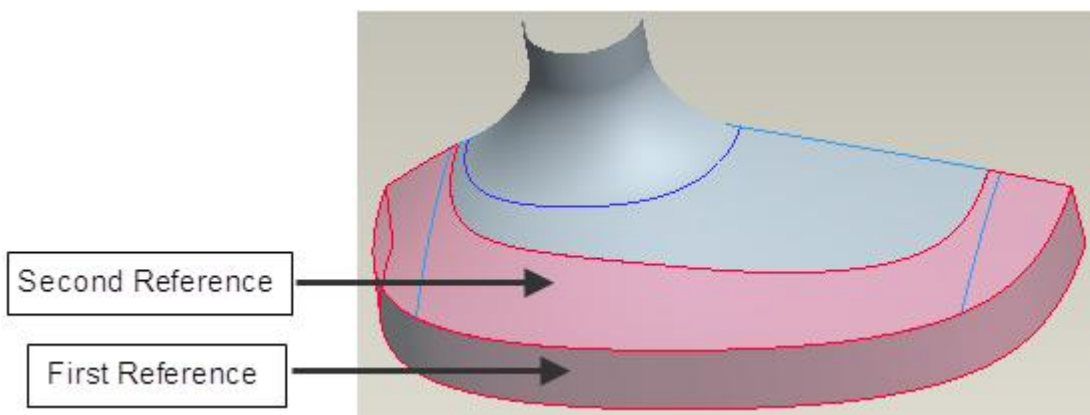
Apply **Tangent** constraint for the both chains as shown below.




⇒ Merging the surfaces


Now we will merge the surfaces together.

So select two surfaces, shown in the figure below, while holding down Ctrl.

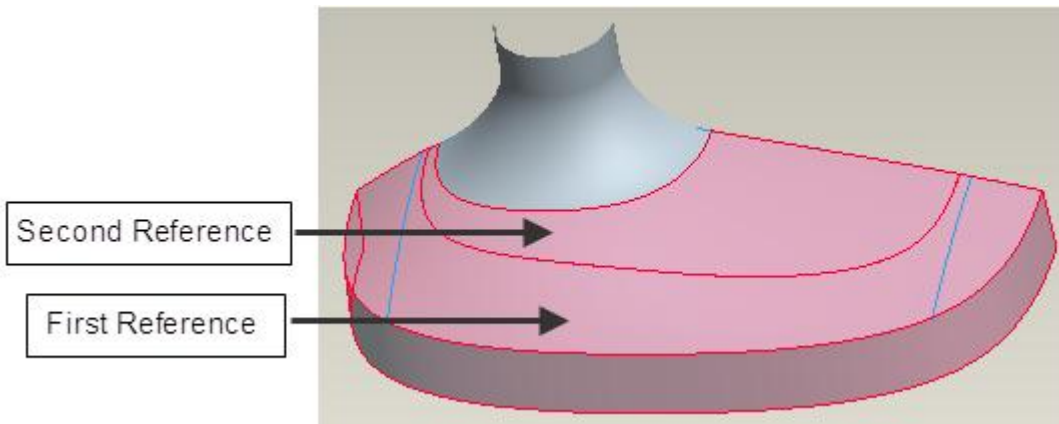



Pick  Merge on the Model tab to invoke Merge tool.

Pick  Options tab and change the merge type to **Join**.


Pick  or middle-click to complete the merge feature.

Now select the merged quilt and surface, shown in the figure below, while holding down Ctrl.

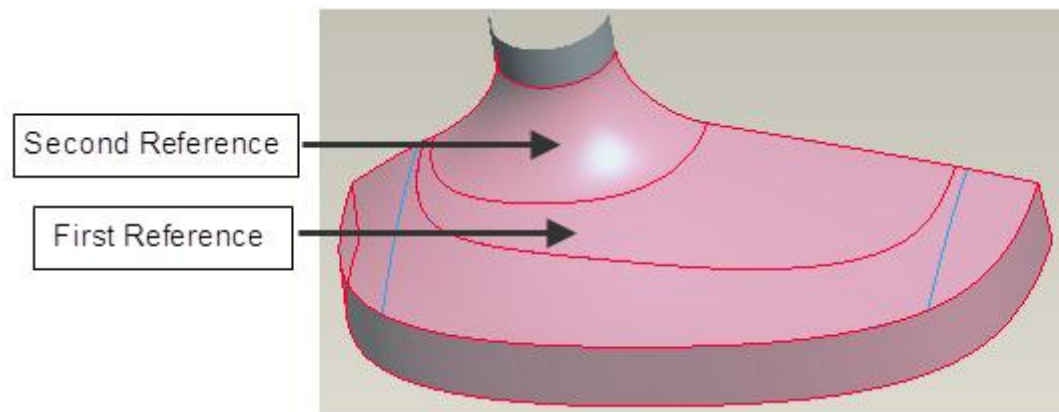



Pick  Merge on the Model tab to invoke Merge tool.

Pick  Options tab and change the merge type to **Join**.


Pick  or middle-click to complete the merge feature.

Now select the merged quilt and surface, shown in the figure below, while holding down Ctrl.

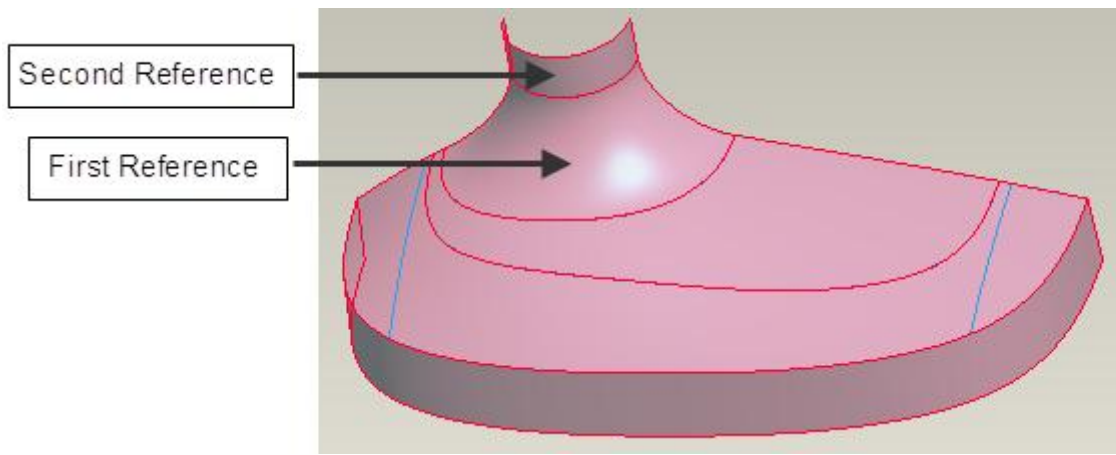



Pick  Merge on the Model tab to invoke Merge tool.


Pick  Options tab and change the merge type to **Join**.


Pick  or middle-click to complete the merge feature.

Now select the merged quilt and surface, shown in the figure below, while holding down Ctrl.




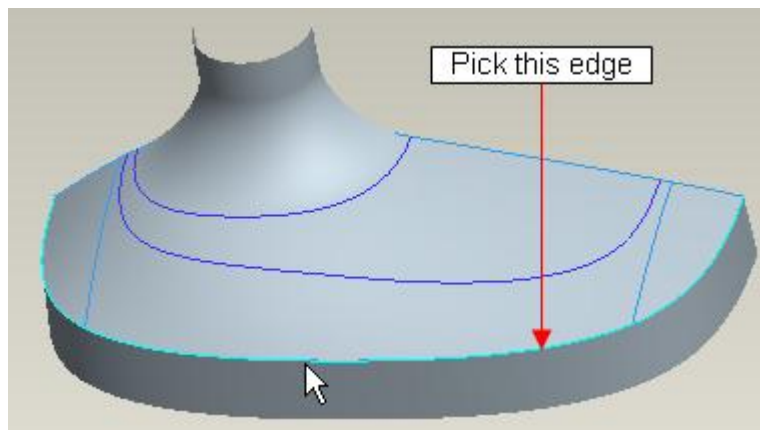
Pick  Merge on the Model tab to invoke Merge tool.

Pick  Options tab and change the merge type to **Join**.


Pick  or middle-click to complete the merge feature.

⇒ Applying Round

Pick  and select the following edge for applying round.




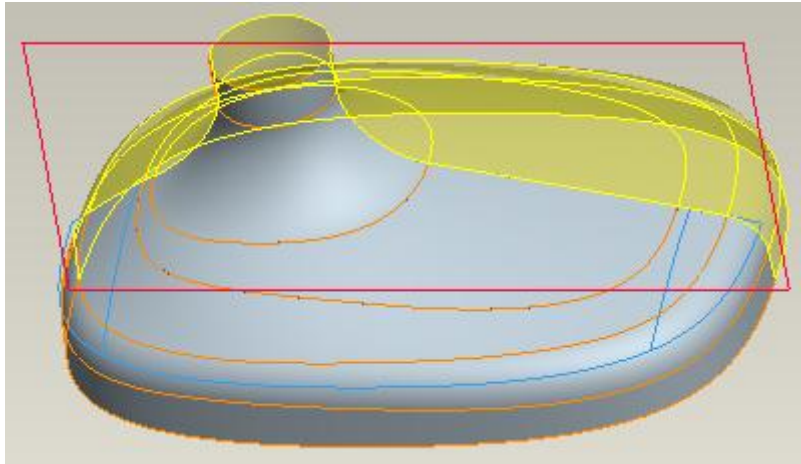
Enter **20** as the radius value

Pick  icon to complete the feature.

⇒ Mirroring the quilt

Now we will mirror the merged quilt. So select the merged quilt by picking it on screen.

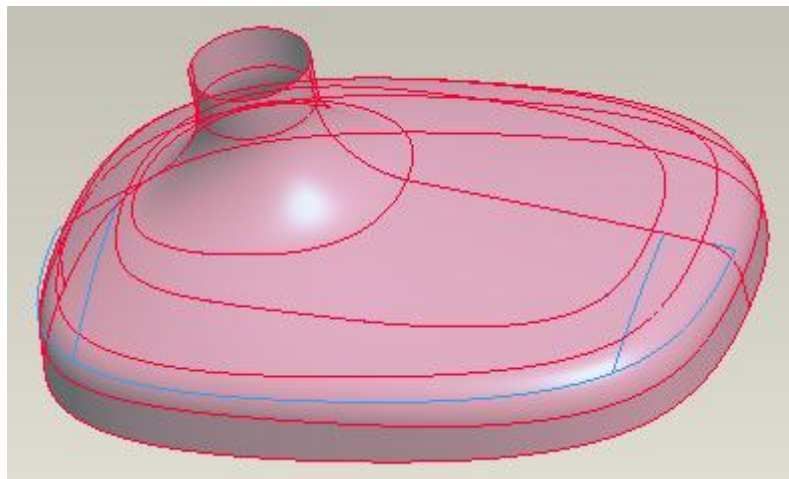
Pick  Mirror on the Model tab to invoke Mirror tool and select the **RIGHT** datum as Mirror plane. Preview will appear as shown below.




Pick  to complete the feature.


Now we will merge the quilts together.

So select the mirrored and its parent quilt, shown in the figure below, while holding down Ctrl key.




Pick  Merge on the Model tab to invoke Merge tool.

Pick  Options tab and change the merge type to **Join**.

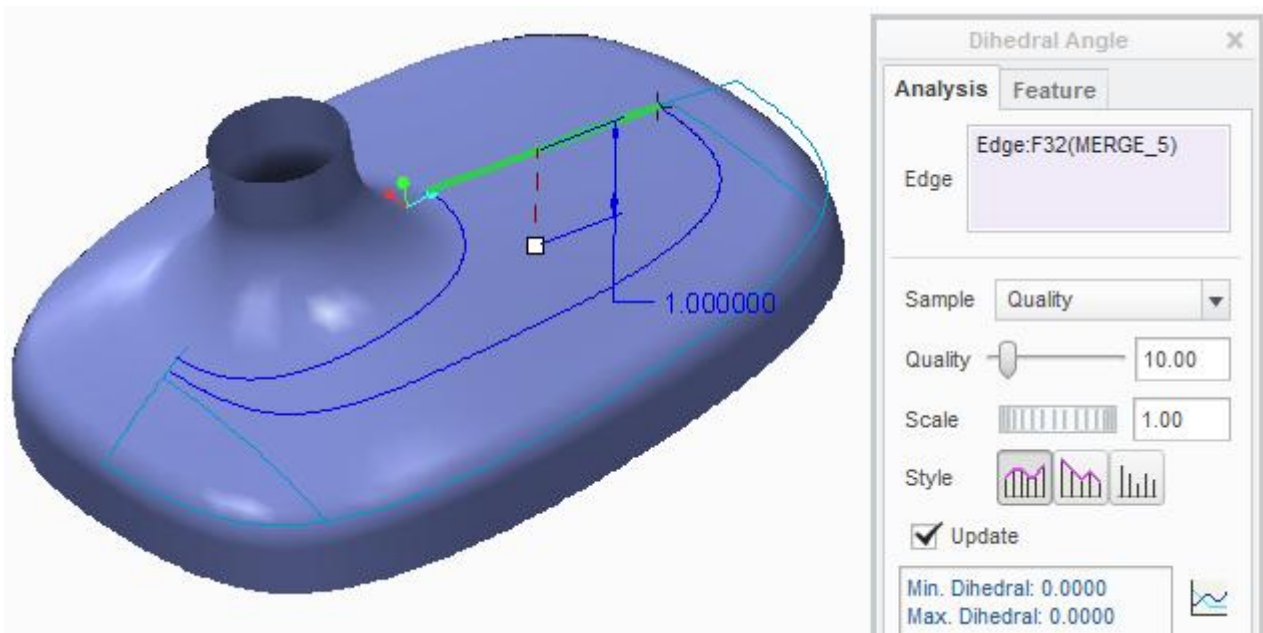
Pick  or middle-click to complete the merge feature.

Analyzing the Quilt

Now we will analyze the quilt with Dihedral Angle tool to determine the level of tangency across merged surfaces.

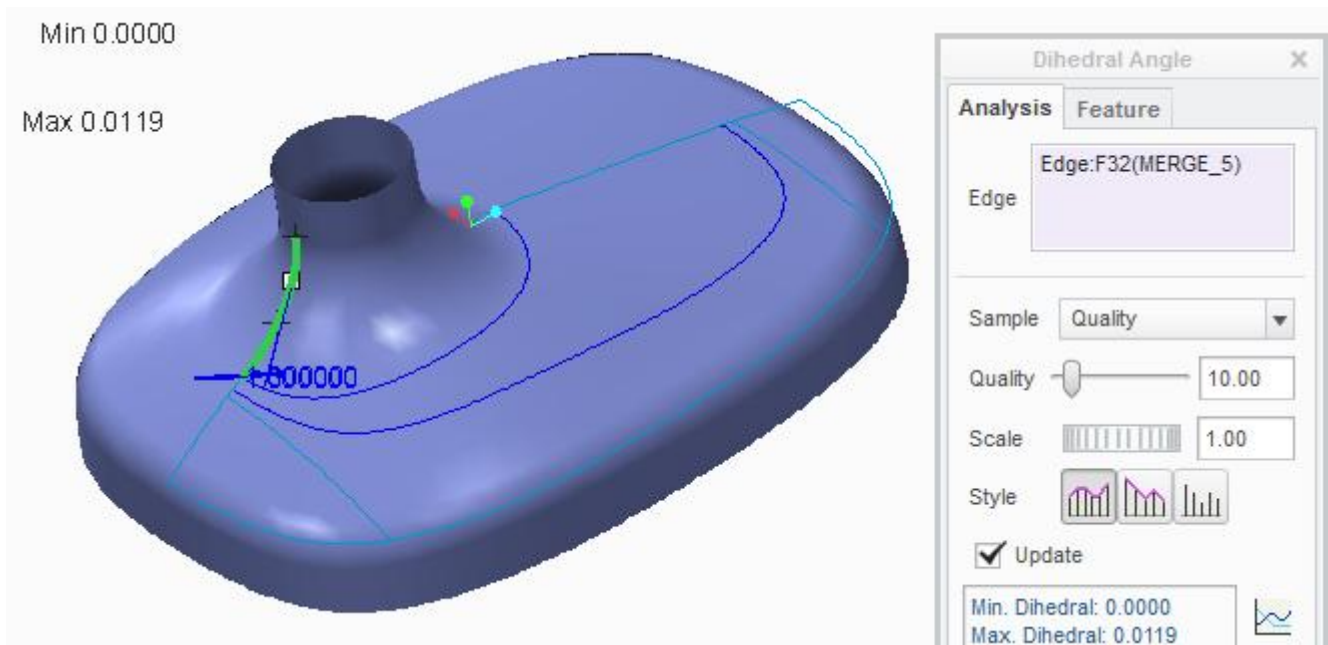
So pick  Dihedral Angle on the Analysis tab to access the Dihedral Angle tool.

Now system will ask you to select an edge to be analyzed. So pick the edge shown in the figure below.



You should notice that minimum and maximum dihedral angle is “0” which means surface patches on both side of the edge are tangent to each other.

Now pick the edge shown in the figure below.



You should notice that minimum and maximum dihedral angle is not zero for this edge which means surface patches on both side of the edge are not tangent to each other. So we need to fix this surface patch.

To make the mirrored and parent surface tangent to each other, we need to make the parent surface normal to mirror plane.

⇒ Modify the surface

To make the surface tangent to the mirror plane (RIGHT datum plane), we will add two more datum curves before the boundary blended surface so that we can apply Normal constraint.

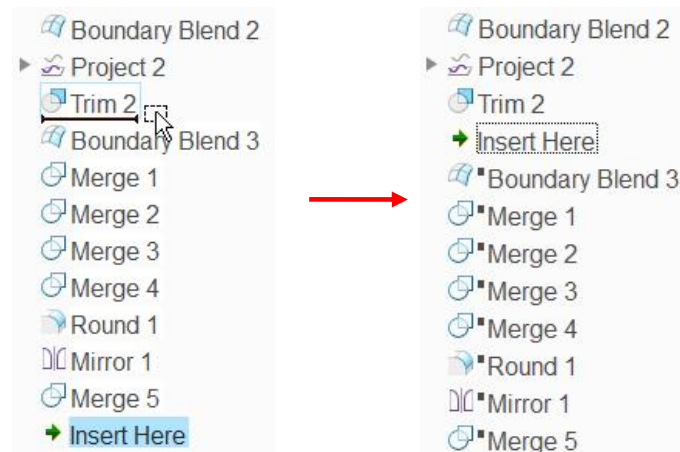
Position the mouse pointer over the Insertion Locator on the Model Tree.



The Insertion Locator indicates where features will be inserted upon creation. By default, its position is always after all items listed in the Model Tree.

Press and hold the left mouse button and drag the pointer above the “Boundary Blend 3” feature.

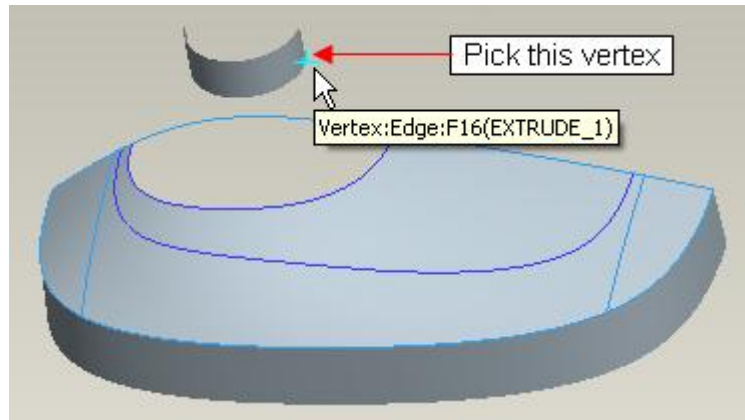
Release the left mouse button. The insertion locator is in the new location and the model rolls back to this location.



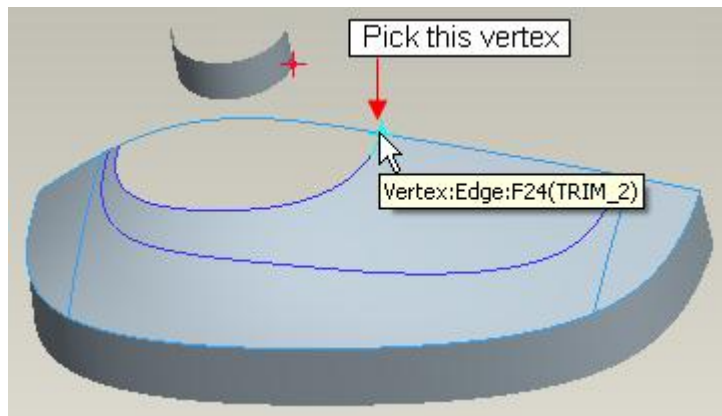
Now we will create a datum curve using Through Points option.

Pick  Curve from Equation on the Model tab to invoke Curve through Points tool.

Pick the following vertex as first point for curve.

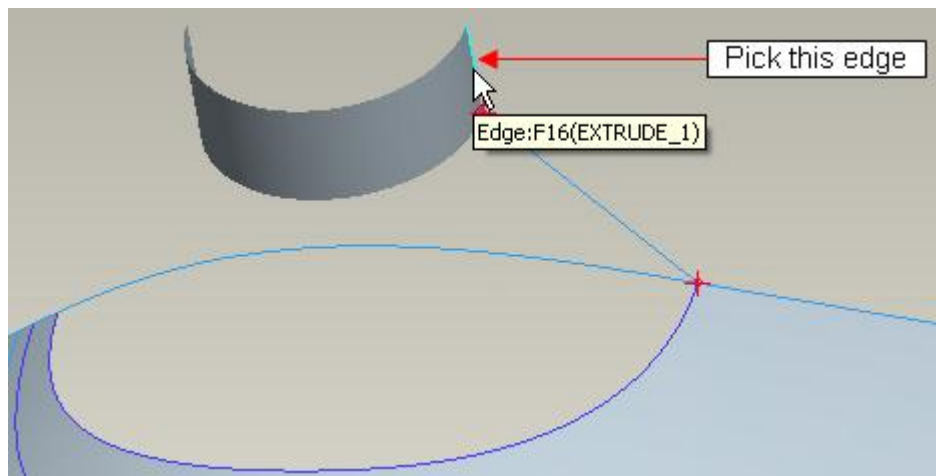


Pick the vertex, shown in the figure below, as second point.

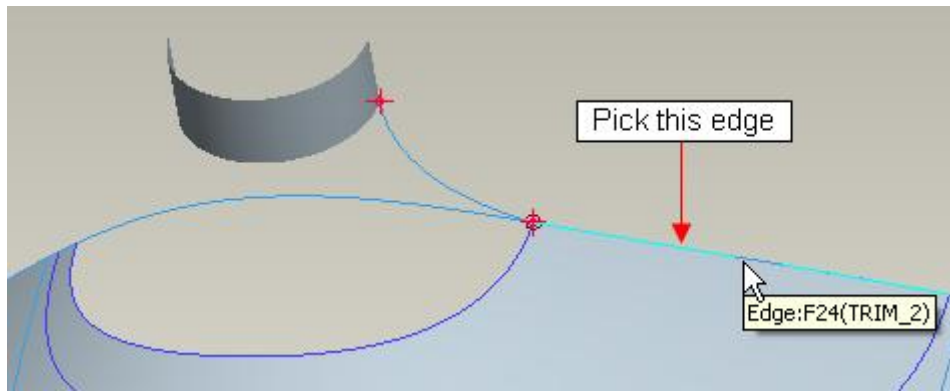



So pick tab and change the End condition for Start Point to Tangent.


Now system wants to know a reference to which the new curve will be tangent, so pick the following edge to make the new datum curve tangent to it at the start point.

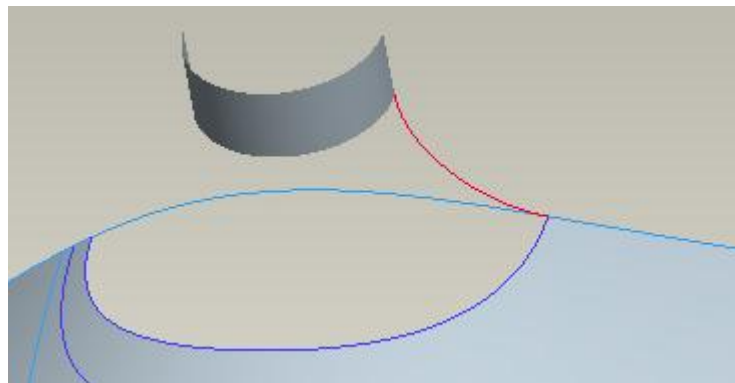


Now change the End condition for End Point to Tangent and pick the following edge as reference.



Pick  to reverse the direction of constraint if curve appears twisted.

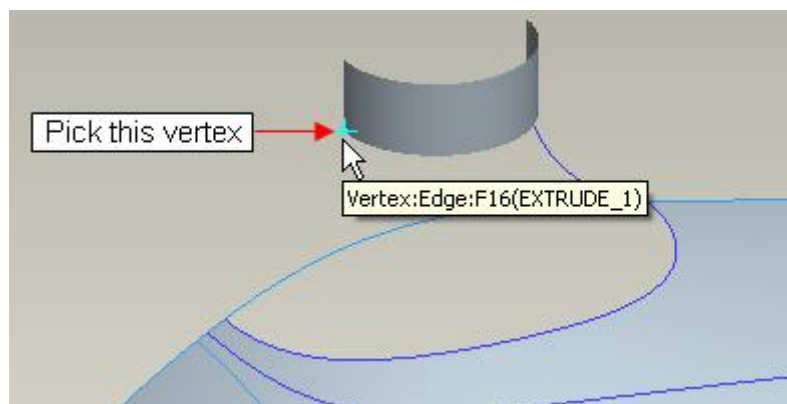
Pick  to complete the feature. The datum curve will appear as shown below.



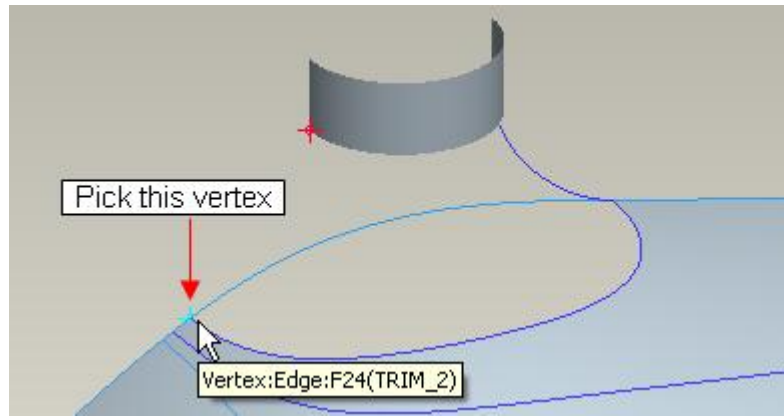
Now we will create another datum curve using Through Points option.

Pick  Curve from Equation on the Model tab to invoke Curve through Points tool.

Pick the following vertex as first point for curve.

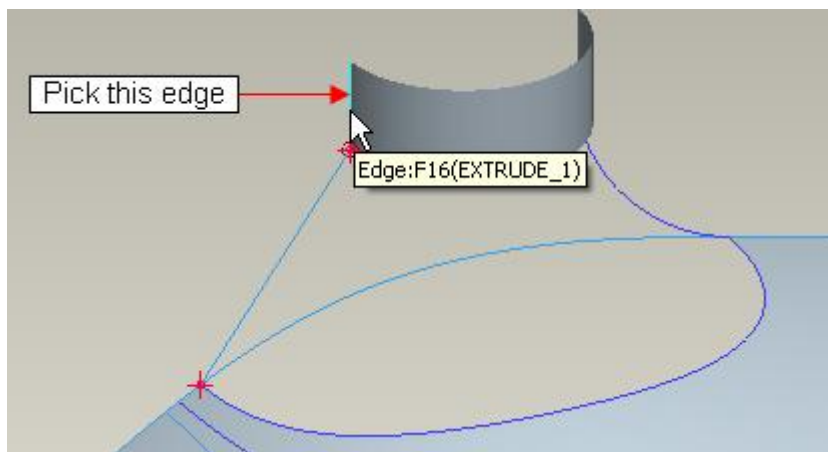


Pick the vertex, shown in the figure below, as second point.



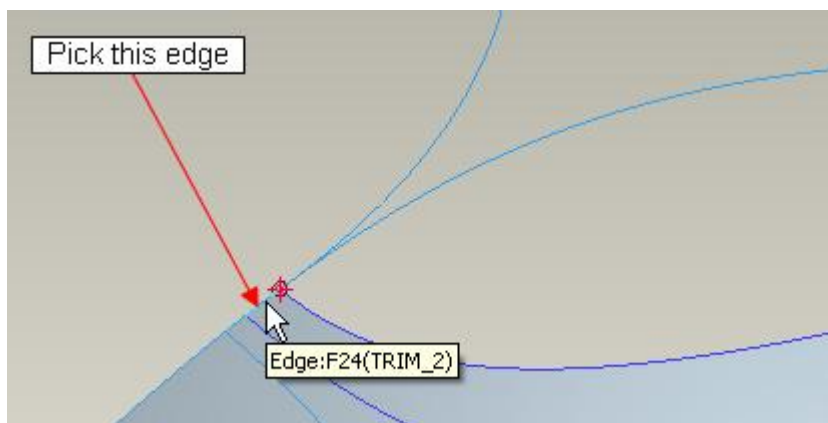
So pick tab and change the End condition for Start Point to Tangent.

Now system wants to know a reference to which the new curve will be tangent, so pick the following edge to make the new datum curve tangent to it at the start point.

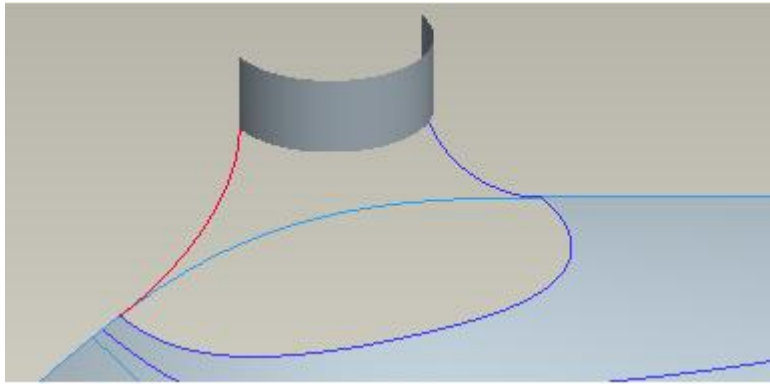


Pick to reverse the direction of constraint if curve appears twisted.

Now change the End condition for End Point to Tangent and pick the following edge as reference.




Pick to complete the feature. The datum curve will appear as shown below.



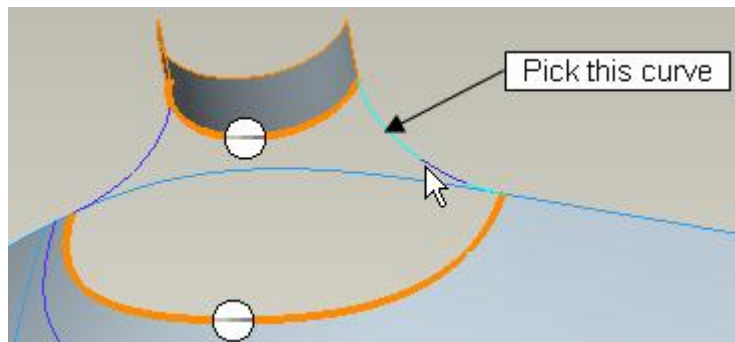
Now move the Insertion Locator after the “Boundary Blend 3” feature as shown below.



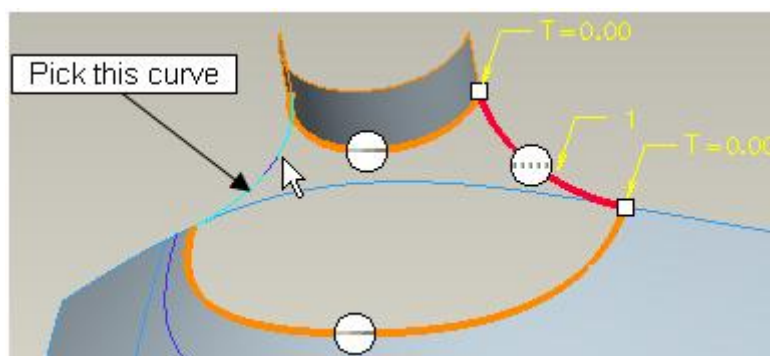
Right-click the “Boundary Blend 3” in model tree and select .

Pick in the **Second Direction Collector** to activate it.

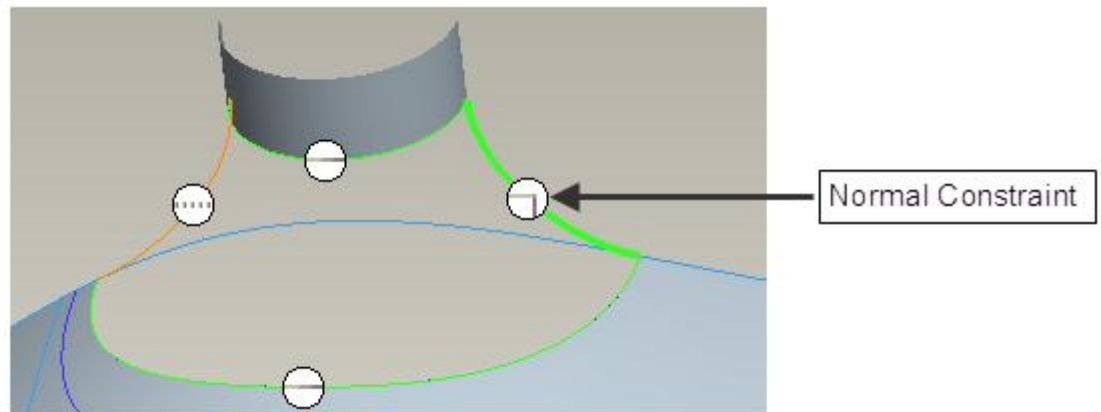
Select the curve shown in the figure below as first chain in second direction.



Hold down the Ctrl key and select the curve shown in the figure below as second chain.



Apply the **Normal** constraint for the first chain in second direction as shown below.

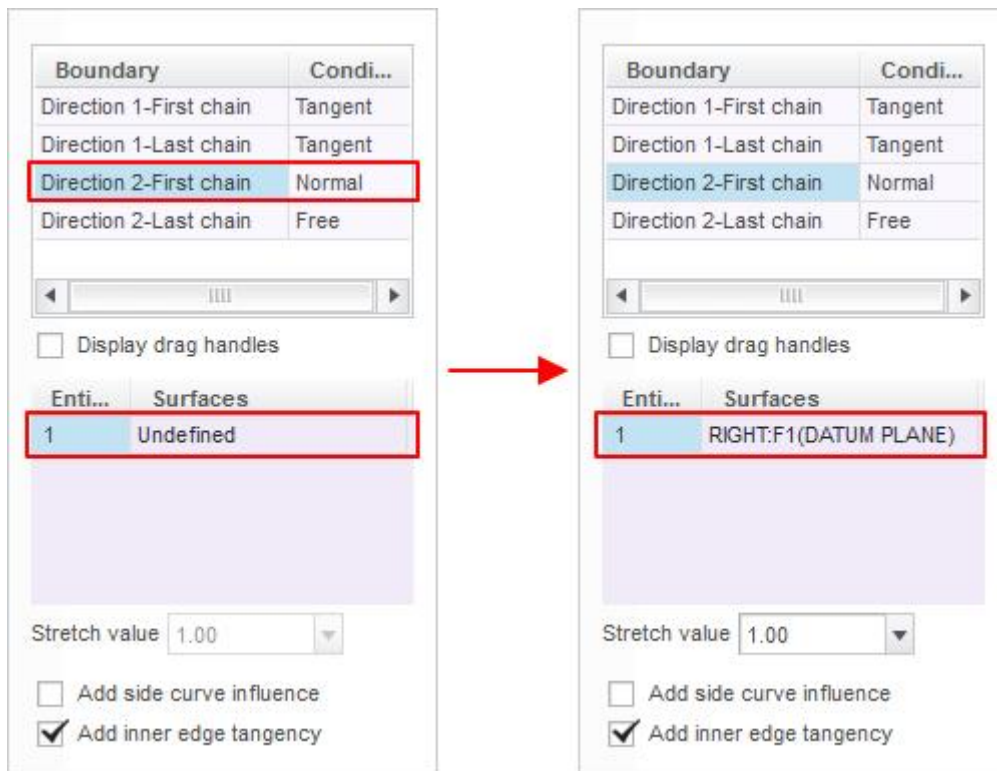


Now notice that system is unable to apply the Normal constraint for this chain and displays the following message

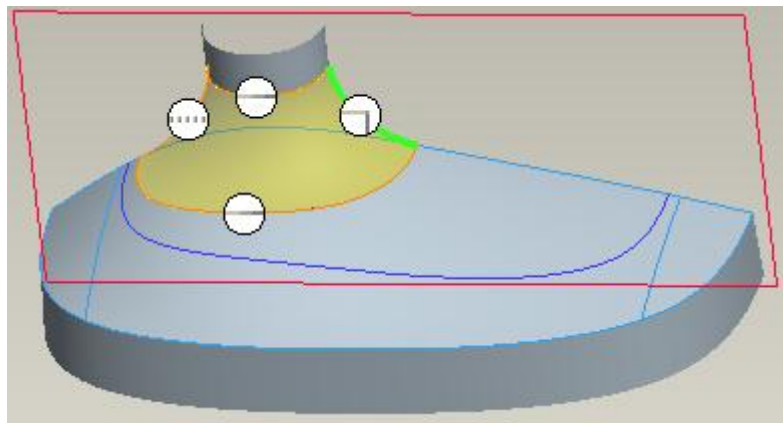
➔ Select a surface that lies on the highlighted boundary component.

It is because system does not know to which reference (a surface or datum plane) our created surface should be normal to. There are two ways to fix this issue; one is to select the desired reference during the surface definition and the second is to redefine the underlying datum curve and constrain it to lie in the desired surface or plane. In this exercise we will use the first approach. (The second approach was shown in a previous exercise while working on JUG.PRT. You are encouraged to first complete this exercise as explained below and later use the second approach for constraining the surface, as we did for JUG.PRT)

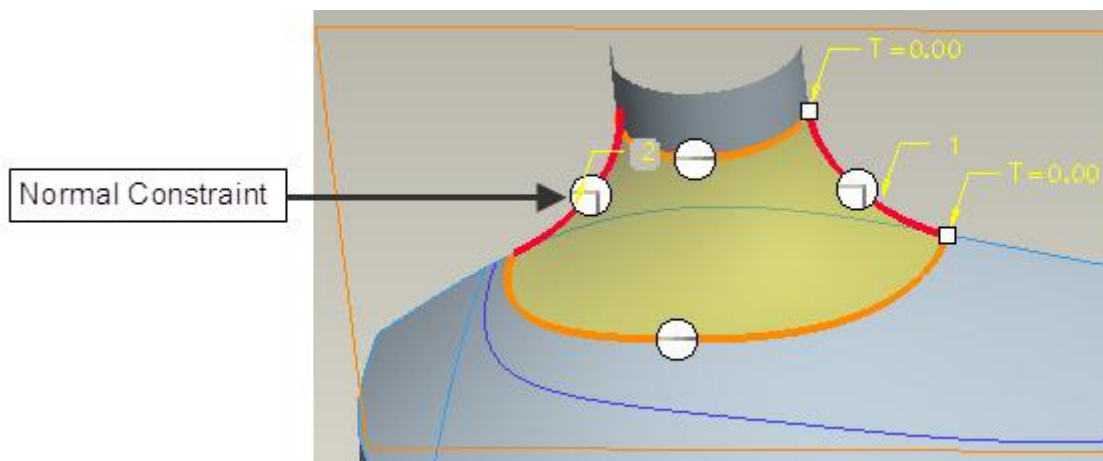
Pick **Constraints** icon to access the Constraints panel and pick "Direction2-First chain". Then pick in the Reference collector to make it active and select the **RIGHT** datum plane either on screen or in model tree as shown below.




Now preview will appear as shown in figure below.

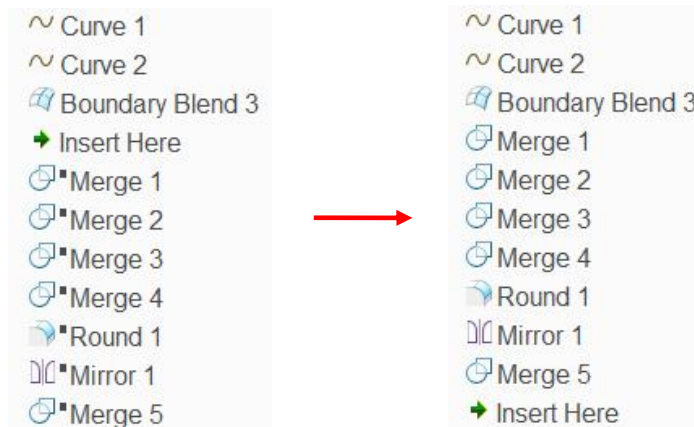


In the same way apply **Normal** constraint for the second chain in second direction as shown below.




Pick  to apply the changes and exit the dialog box.

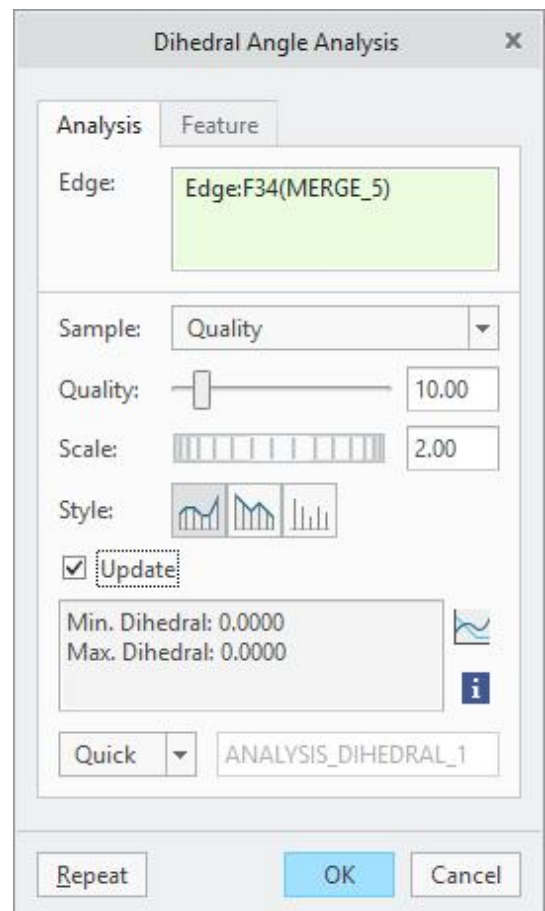
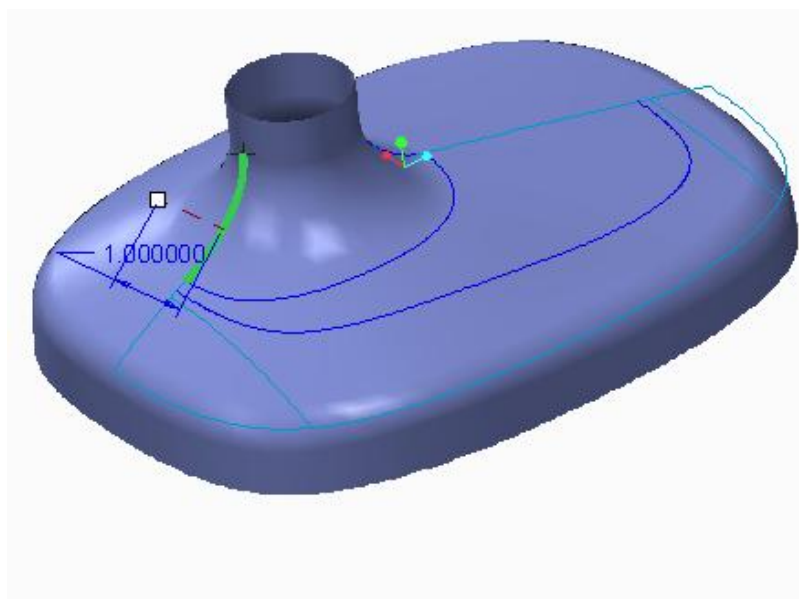
Now move the Insertion Locator at the end of feature list as shown below.



Now we will again analyze the quilt with Dihedral Angle tool to determine the level of tangency across merged surface.

So pick  Dihedral Angle on the Analysis tab to access the Dihedral Angle tool.

Pick the edge shown in the figure below.

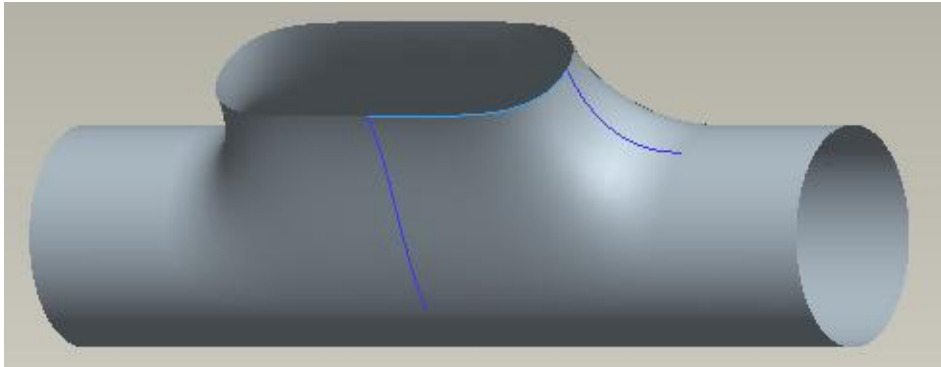


You should notice that minimum and maximum dihedral angle is “0” which means surface patches on both side of the edge are tangent to each other.

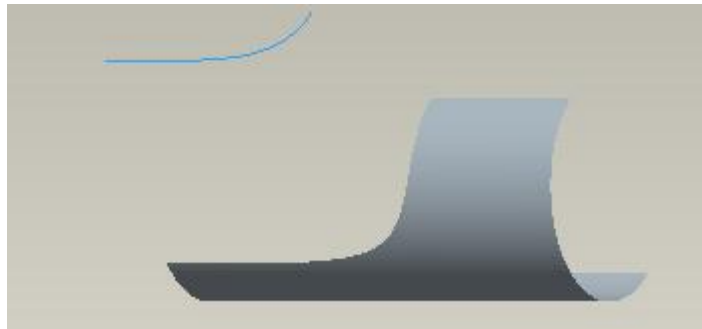
Select **File > Save** to save the work done so far.

Exercise 21

In this exercise we will build a pipe intersection of different cross-sections. The completed model is shown in the figure below.



Set working directory to the EXAMPLES folder and open the model PIPE_INTERSECTION.PRT. Part will appear as shown below.



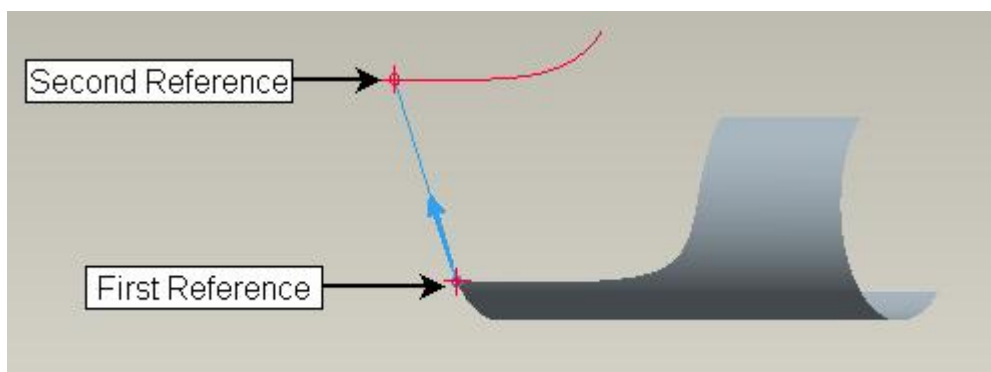
Because this part is symmetrical about two datum planes so we will create only a quarter of the part and then mirror it.

⇒ Creating the first datum curve

Now we will create datum curves to build transition.

Pick  Curve from Equation on the Model tab to invoke Curve through Points tool.

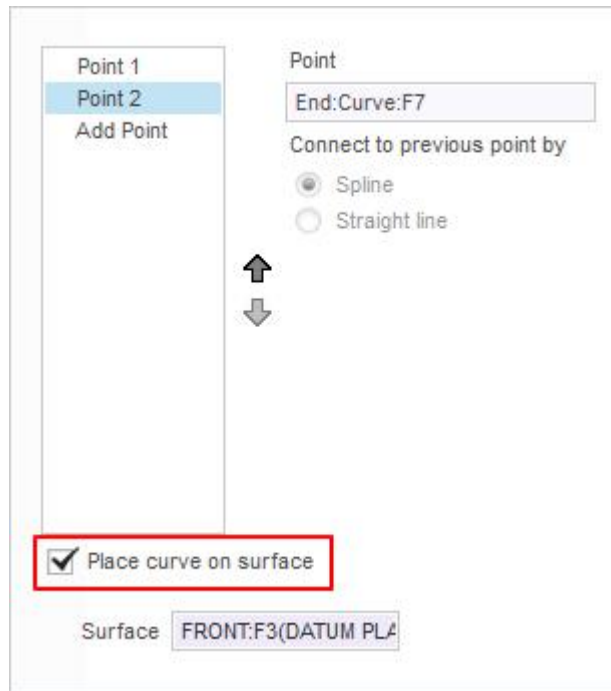
Pick the vertices as references, as shown in the figure below.



This curve will be used to build a surface that will be constrained Normal to FRONT datum plane. So this curve will be constrained to lie within FRONT datum plane. It will help to apply constraint while building the surface.

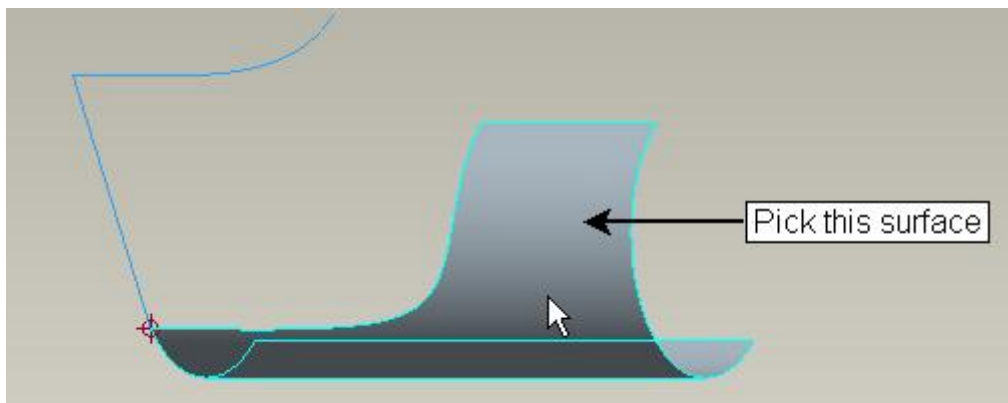
Pick **Placement** to access the Placement panel and check the 'Place curve on surface' option.

Pick the **FRONT** datum plane as reference.



Pick **Ends Condition** tab and change the End condition for Start Point to Tangent.

Pick the following surface to make the datum curve tangent to it.



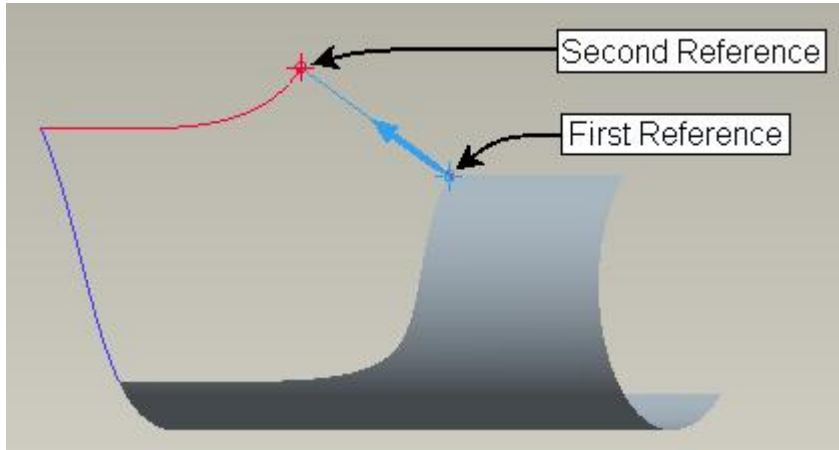
Now change the End condition for End Point to Normal and select the **DTM_RECT_EXIT** datum plane as reference.

Pick  to complete the feature.

⇒ Creating the second datum curve

Again pick  Curve from Equation on the Model tab to invoke Curve through Points tool.


Pick the vertices as references, as shown in the figure below.



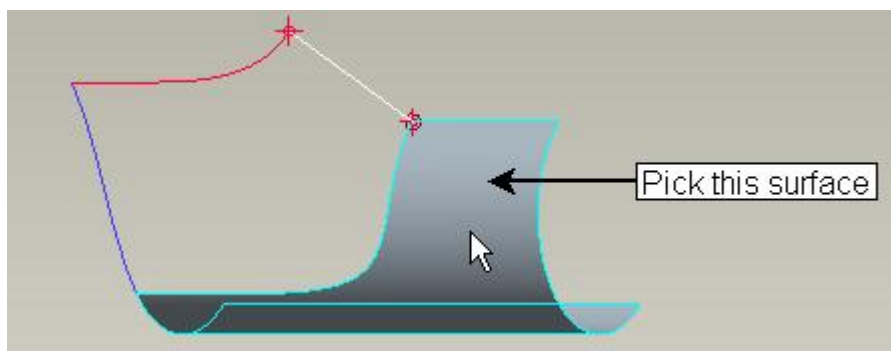
This curve will be used to build a surface that will be constrained Normal to RIGHT datum plane. So this curve will be constrained to lie within RIGHT datum plane. It will help to apply constraint while building the surface.

So pick  to access the Placement panel and check the 'Place curve on surface' option.

Pick the **RIGHT** datum plane as reference.

Pick  tab and change the End condition for Start Point to Tangent.

Pick the following surface to make the datum curve tangent to it.

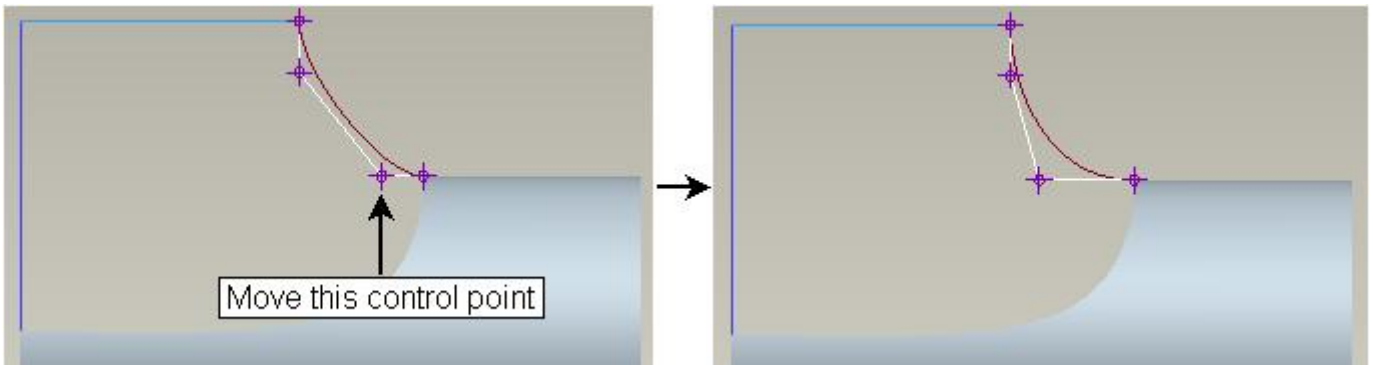


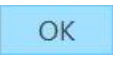
Now change the End condition for End Point to Normal and select the **DTM_RECT_EXIT** datum plane as reference.

Now we will tweak this curve so pick  tab and check **Tweak curve** option .

Pick  and Modify Curve dialog box will appear.

Set the view to LEFT and move the control point so that curve appears approximately as shown below.




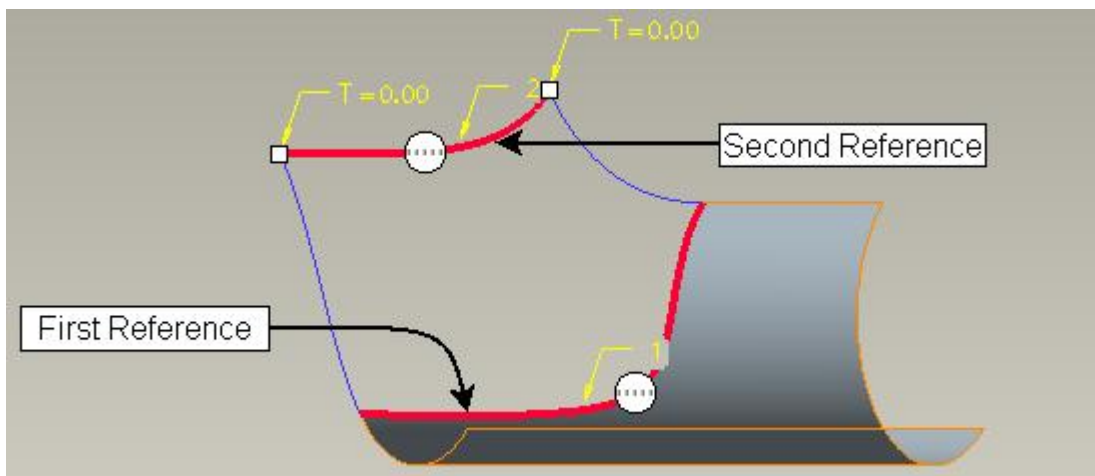
Pick  to quit Modify Curve dialog box after tweaking the curve.

Pick  to complete the feature.

Creating the surface

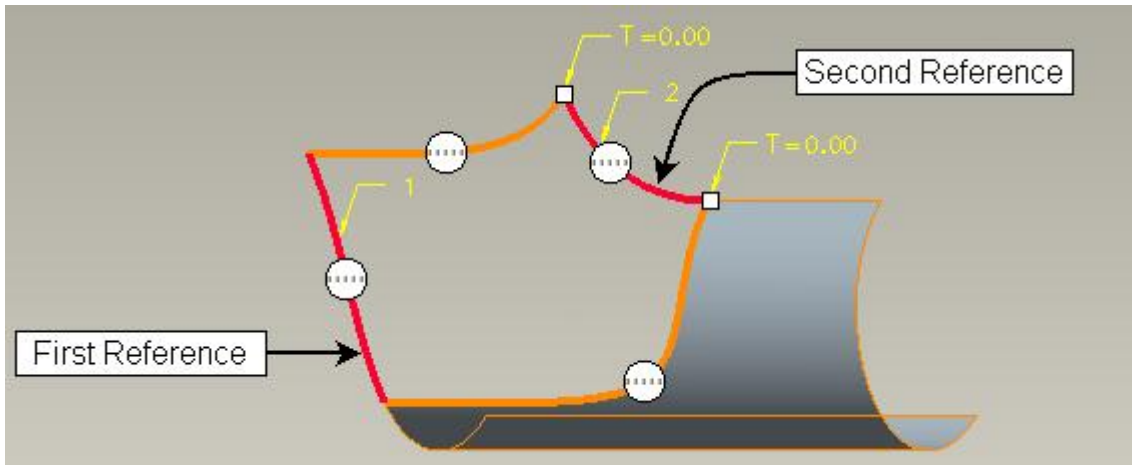
Now we will create the boundary blended surface.

Pick  and select the references shown in the figure below as first and second chains.

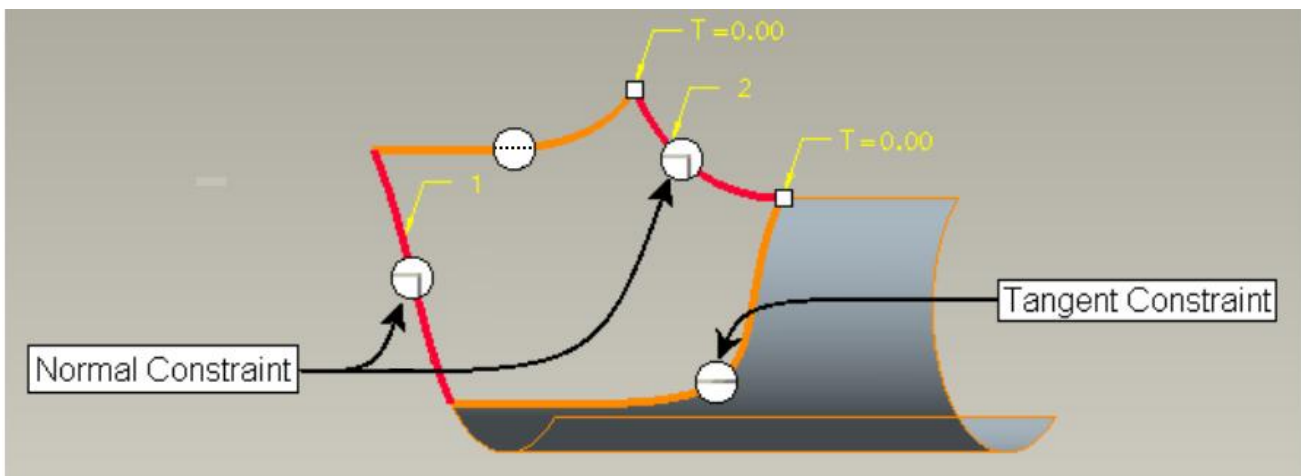


Pick in the **Second Direction Chain Collector** to activate it.

Select the reference shown in the figure below as first and second chains in second direction.



Apply the **Tangent** and **Normal** constraint for the chains shown in figure below.

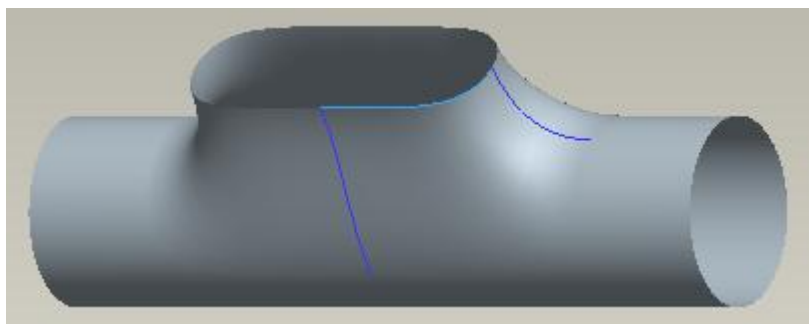


This surface will be mirrored about FRONT and RIGHT datum planes. Therefore to maintain tangency between original and mirrored surface, the surface has been constrained Normal to the FRONT and RIGHT datum planes.


To make the mirrored and parent surface tangent to each other we need to make the parent surface normal to mirror plane.

Pick  icon or middle-click to complete the feature.

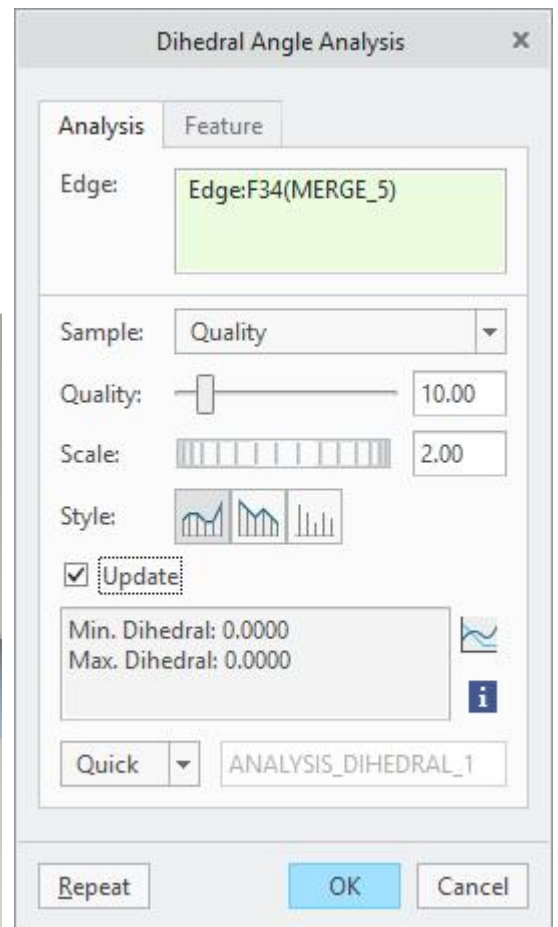
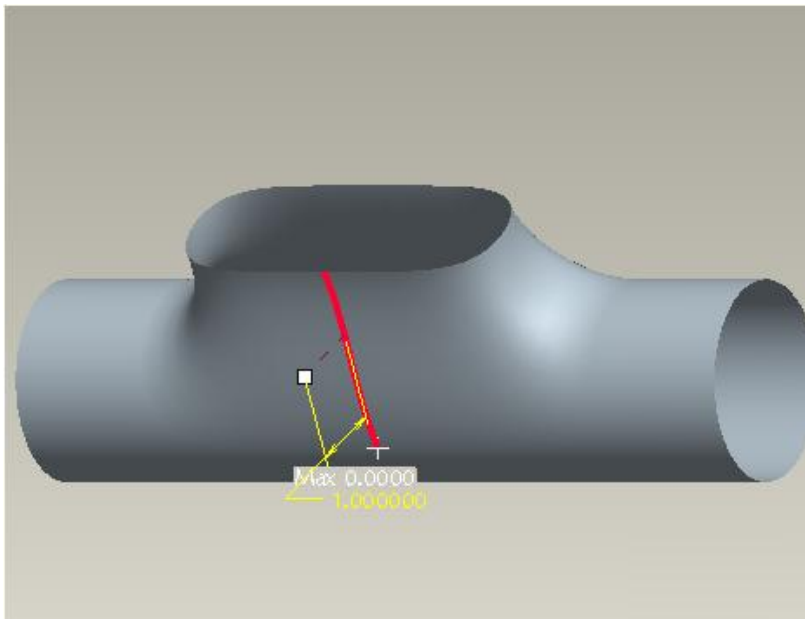
Now merge the surfaces and perform two mirror operations so that part appears as shown below.



Now we will again analyze the quilt with Dihedral Angle tool to determine the level of tangency across merged surface.

So pick  Dihedral Angle on the Analysis tab to access the Dihedral Angle tool.

Pick the edge shown in the figure below.



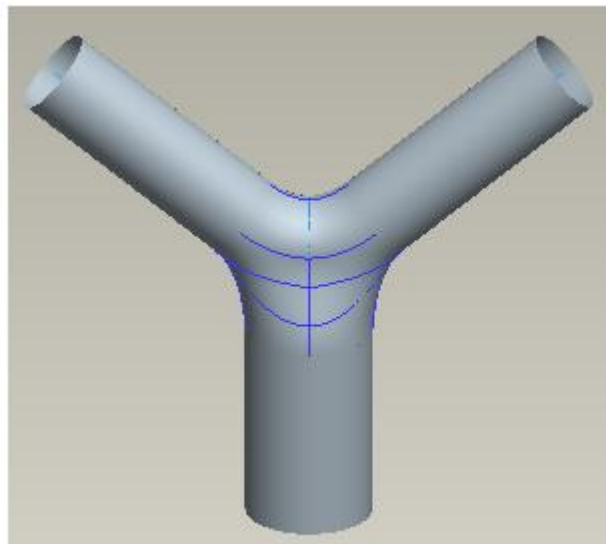
You should notice that minimum and maximum dihedral angle is "0" which means surface patches on both side of the edge are tangent to each other.

Select **File > Save** to save the work done so far.

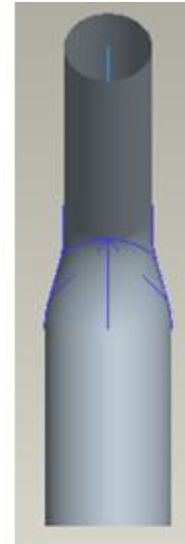
Exercise 22

In this exercise we will build a pipe intersection of three cross-sections.

The completed model is shown in the figure below.

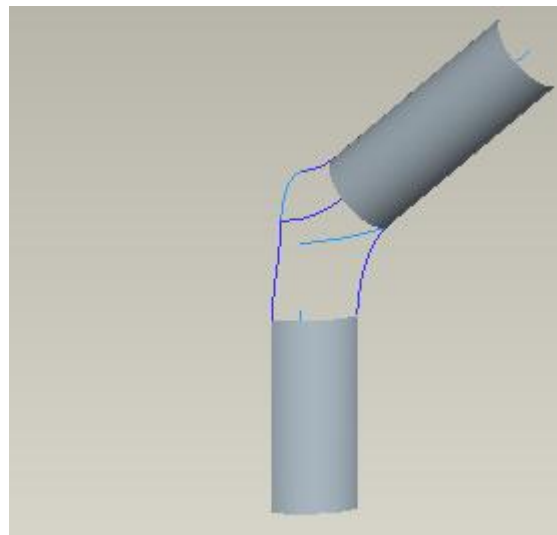


Isometric View



Side View


Set the working directory to the EXAMPLES folder and open the model PIPE_Y.PRT
Part will appear as shown below.

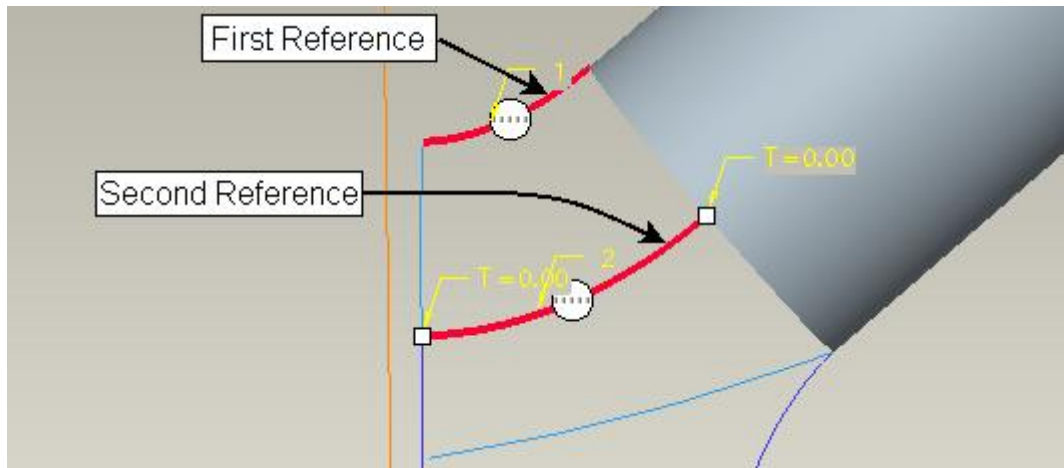


Because this part is symmetrical about two datum planes so we will create only a quarter of the part and then mirror it.

⇒ Creating the surface

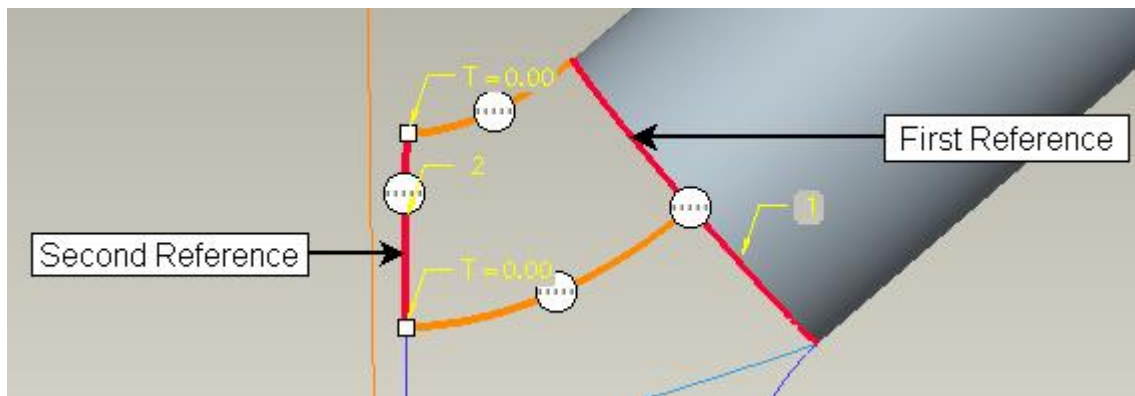
First we will create a boundary blended surface.

Pick  and select the references shown in the figure below as first and second chains.

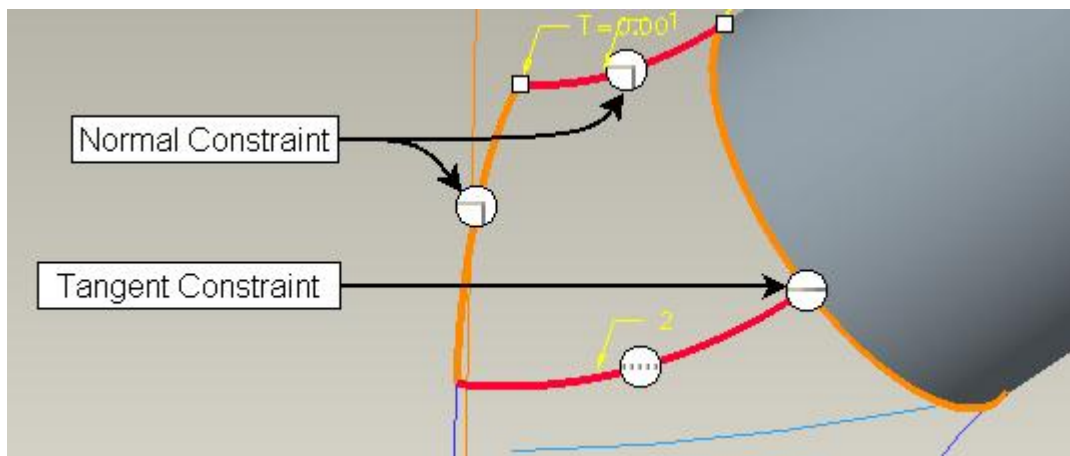


Pick in the **Second Direction Chain Collector** to activate it.

Select the references shown in the figure below as first and second chains in second direction.



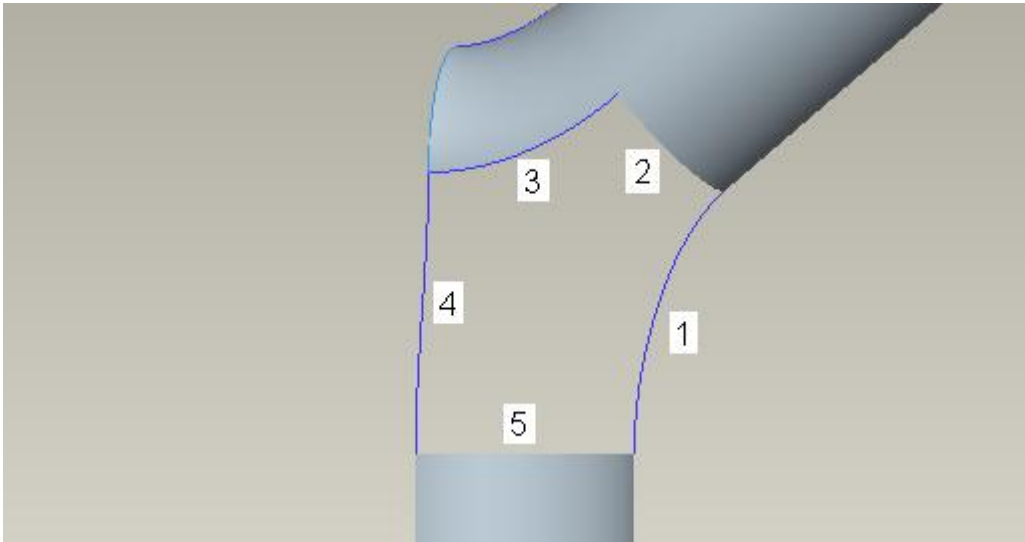
Apply the **Tangent** and **Normal** constraint for the chains shown in figure below.



This surface will be mirrored about FRONT and RIGHT datum planes. Therefore to maintain tangency between original and mirrored surface, the surface has been constrained Normal to the FRONT and RIGHT datum planes.

Pick  icon or middle-click to complete the feature.

If you look at the part, you will notice that the gap that we need to fill has five sides (elaborated in the figure below). So we cannot build a boundary blend surface to fill this gap.



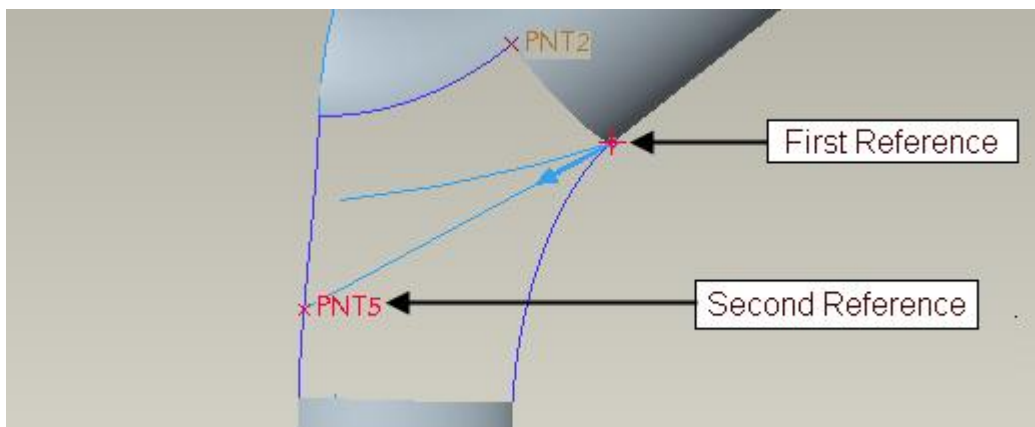
To solve this problem, we will create datum curves to divide this area into two regions. Then we will build two boundary blended surfaces each having four chains.


⇒ Creating the datum curve

Datum points required to create the curves have already been created. So turn the display of datum points “ON”

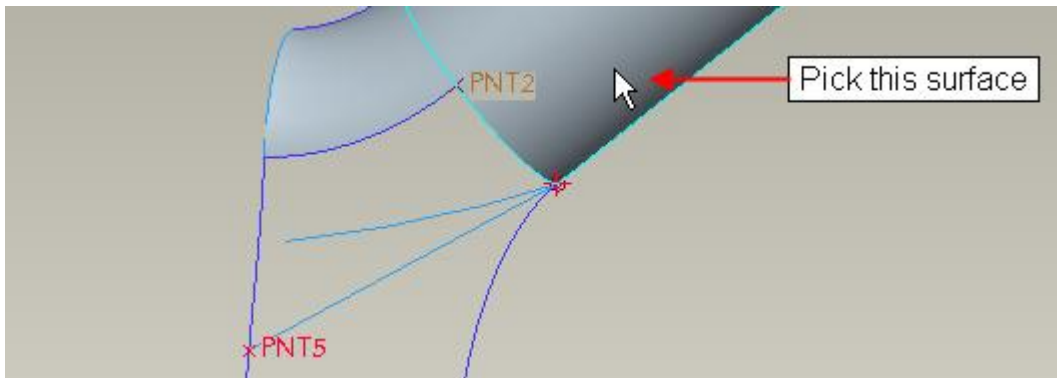
Pick  Curve from Equation on the Model tab to invoke Curve through Points tool.

Pick the vertices as references, as shown in the figure below.



So pick  tab and change the End condition for Start Point to Tangent.

Pick the following surface to make the datum curve tangent to it.



Now change the End condition for End Point to Normal and select the **RIGHT** datum plane as reference.

Pick to reverse the direction of constraint if curve appears twisted.

This curve has been constrained normal to the datum plane because it will be used to build a surface that will be constrained normal to RIGHT datum plane.

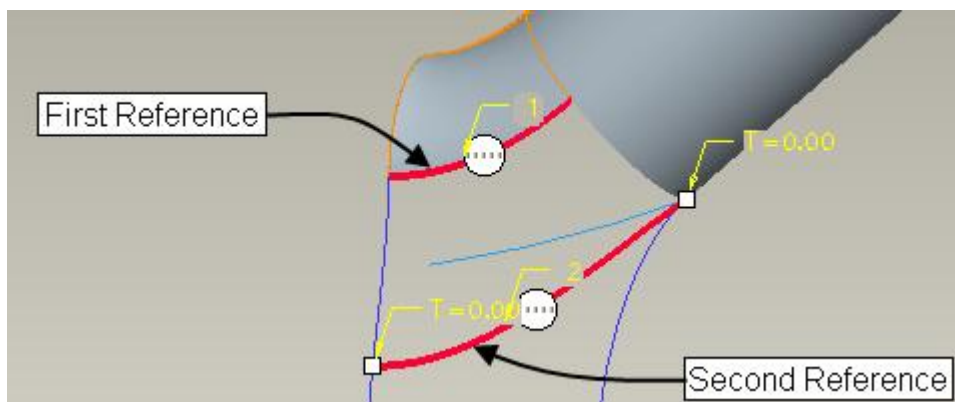
For a surface to be normal or tangent to a reference, underlying datum curves must be normal or tangent respectively to desired reference.

Pick to complete the feature.

➡ Creating the surface

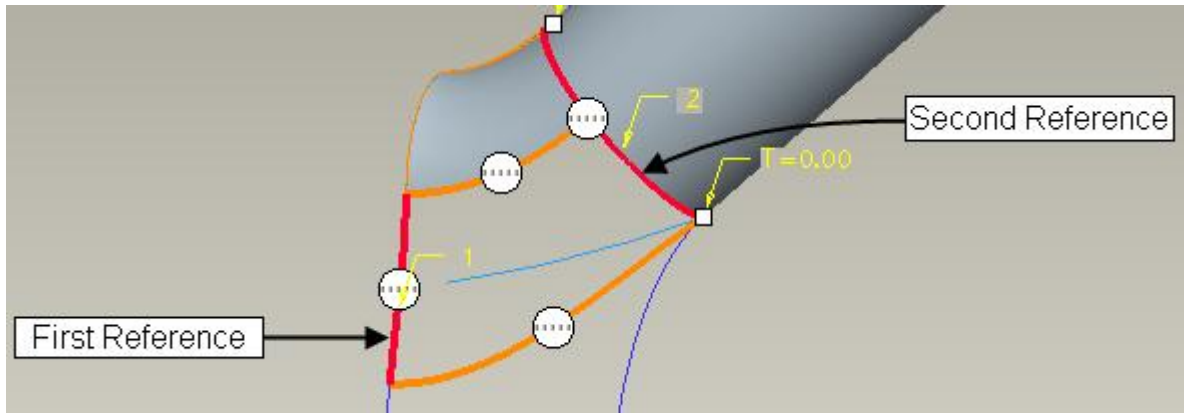
Now we will create the boundary blended surface.

Pick and select the references shown in the figure below as first and second chains. (Make sure that first reference is the edge of the surface and not the underlying curve)

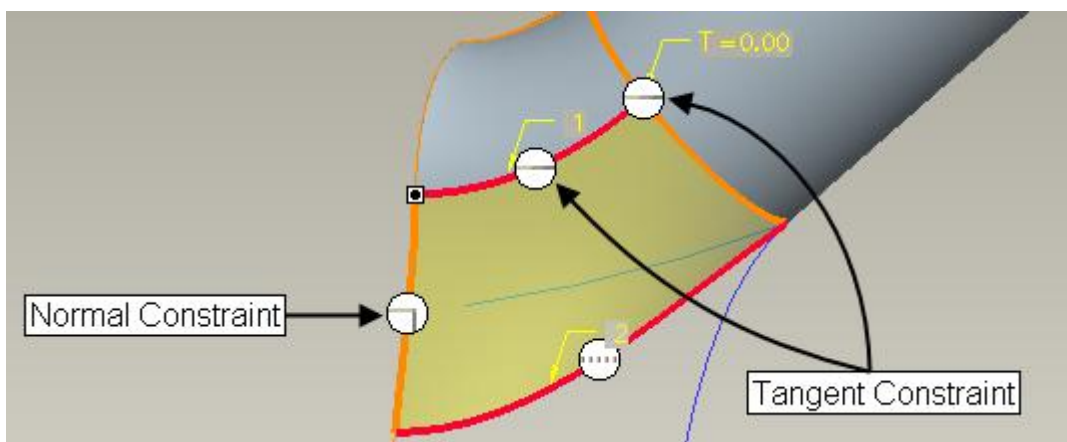


Pick in the **Second Direction Chain Collector** to activate it.

Select the references shown in the figure below as first and second chains in second direction.



Apply the **Tangent** and **Normal** constraint for the chains shown in figure below.



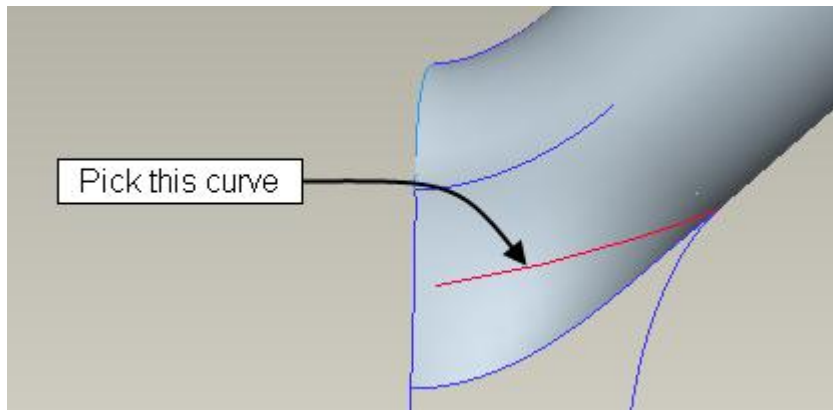
This surface will be mirrored about RIGHT datum plane. Therefore to maintain tangency between original and mirrored surface, the surface has been constrained Normal to the RIGHT datum plane.


Pick  icon or middle-click to complete the feature.

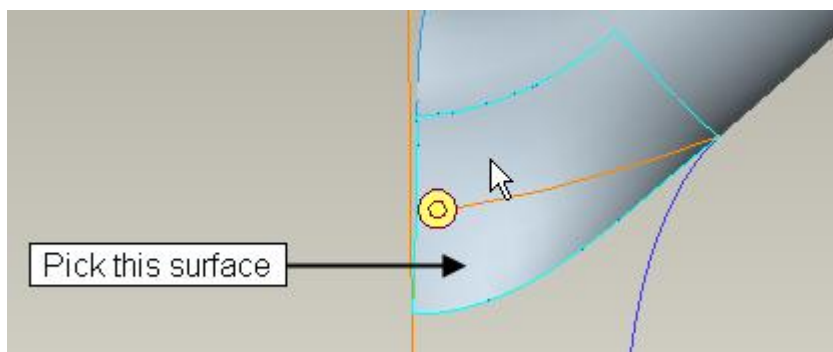
Trimming the Surface

Although now a four-sided boundary blended surface can be created to fill the remaining gap but due to the shape of gap the new surface will not be of good quality. So first we will trim existing surface in such a way that we can build a good quality boundary blended surface. Datum curve required for trimming operation has already been created.

Select the datum curve on screen as shown below.



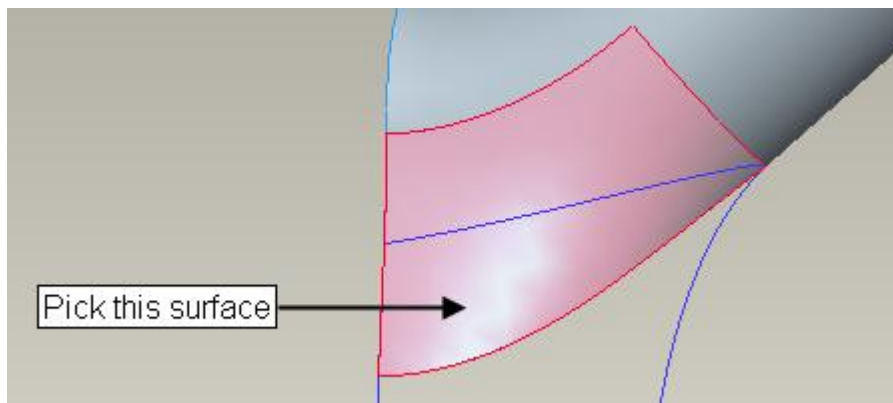
Pick  Project on the Model tab to invoke the Project tool and select the boundary blended surface to project selected curve onto.




Pick  to complete the feature.


Now we will trim the quilt with the curve.

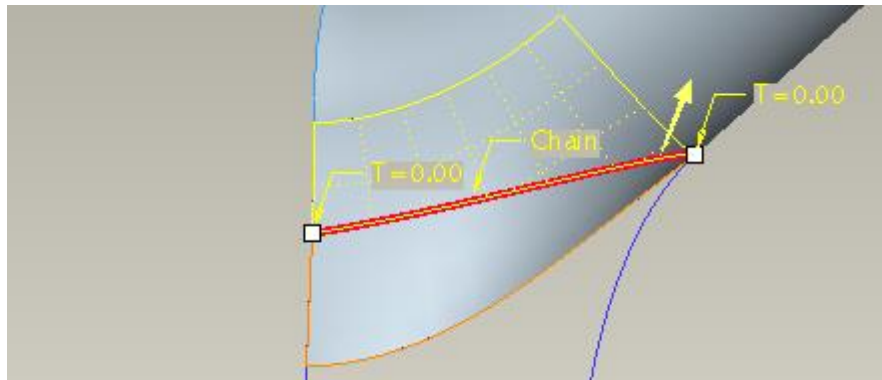
So first select the quilt.




Pick  Trim on the Model tab to invoke Trim tool.

Select the projected datum curve as trimming object.


Pick  to flip the quilt side to keep so that the preview appears as shown below.

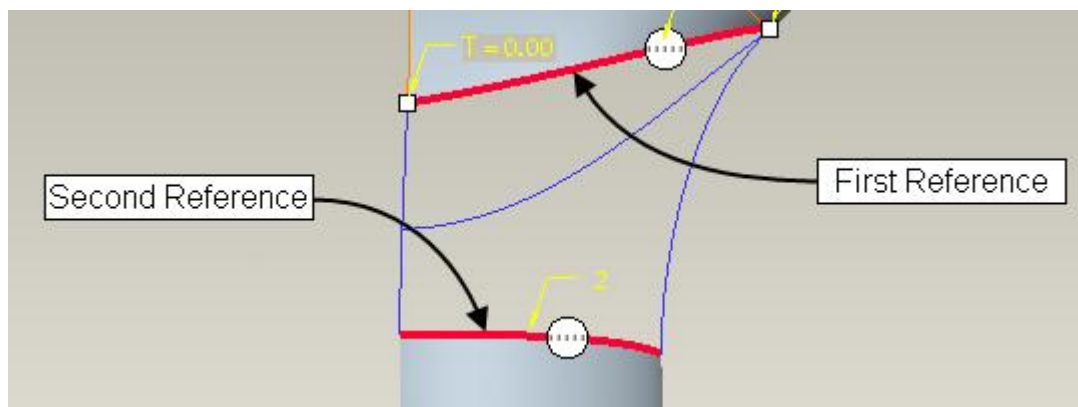


Pick  or middle-click to complete the feature.

Creating the surface

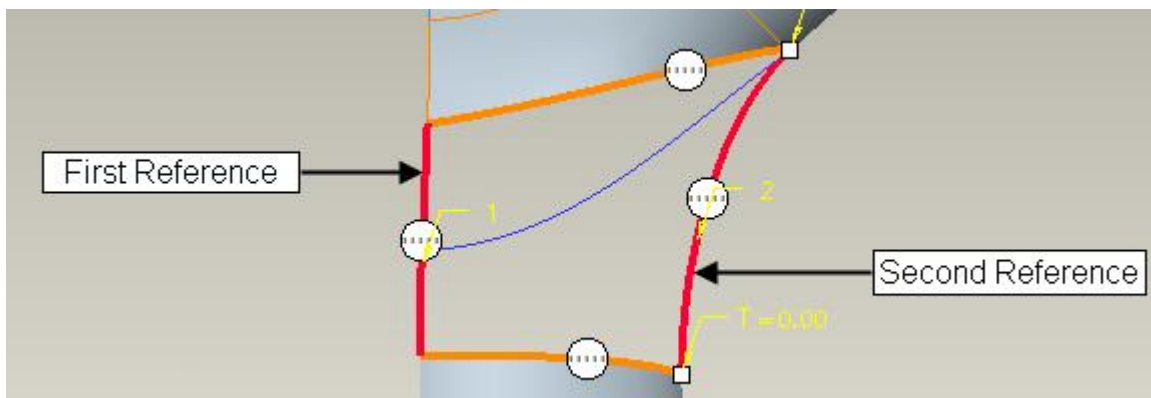
Now we will create the boundary blended surface.

Pick  and select the references shown in the figure below as first and second chains.

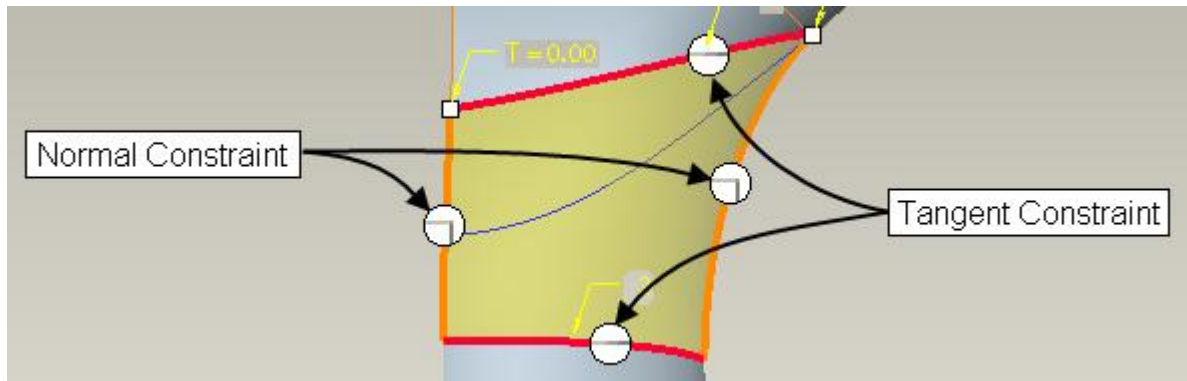


Pick in the **Second Direction Chain Collector** to activate it.

Select the references shown in the figure below as first and second chains in second direction.



Apply the **Tangent** and **Normal** constraint for the chains shown in figure below.

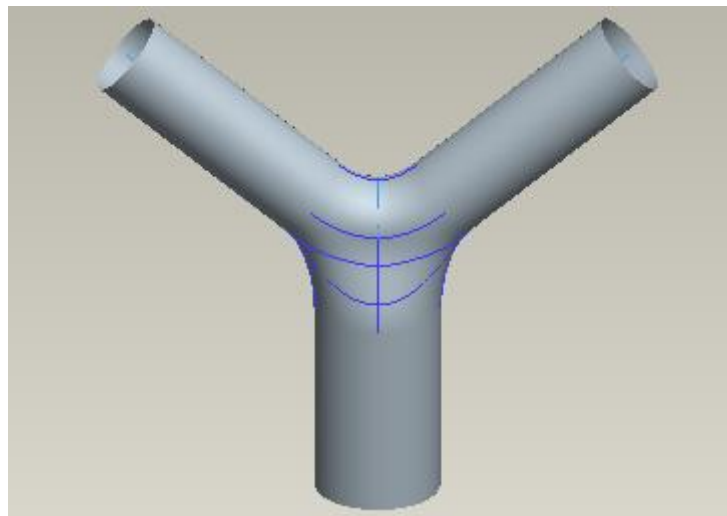


This surface will be mirrored about RIGHT and FRONT datum planes. Therefore to maintain tangency between original and mirrored surface, the surface has been constrained Normal to these planes.

To make the mirrored and parent surface tangent to each other, we need to make the parent surface normal to mirror plane.

Pick  icon or middle-click to complete the feature.

Now merge the surfaces and perform two mirror operations so that part appears as shown below.

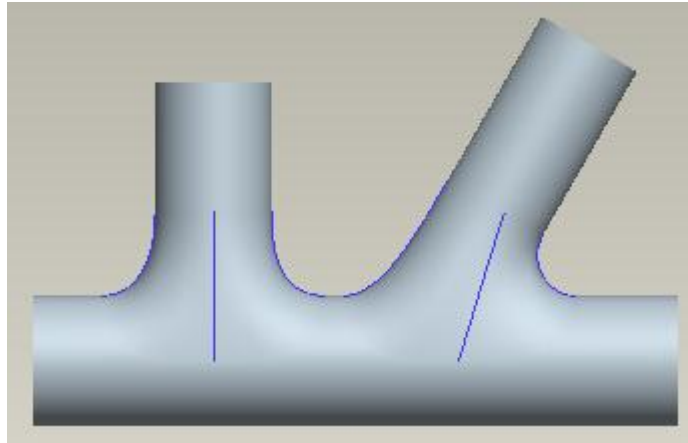


Select **File > Save** to save the work done so far.

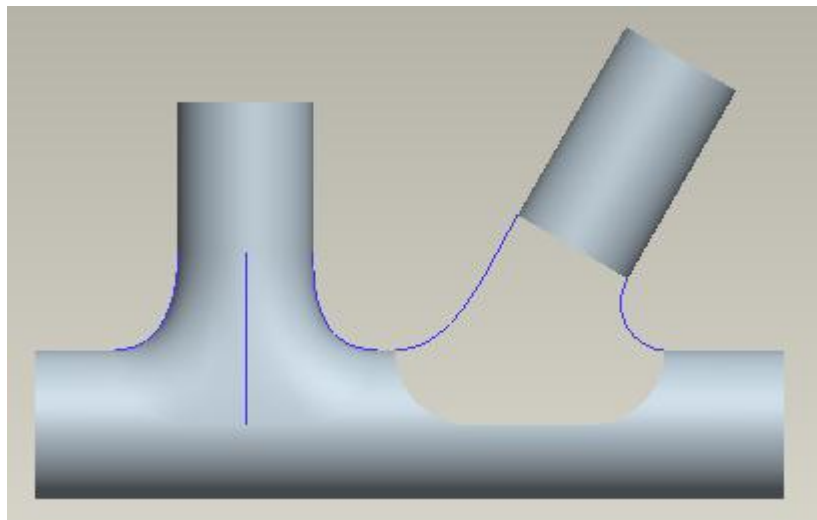
Exercise 23

In this exercise we will build a pipe intersection of four cross-sections.

The completed model is shown in the figure below.




Set the working directory to the EXAMPLES folder and open the model PIPE_MULTI.PRT. Part will appear as shown below.

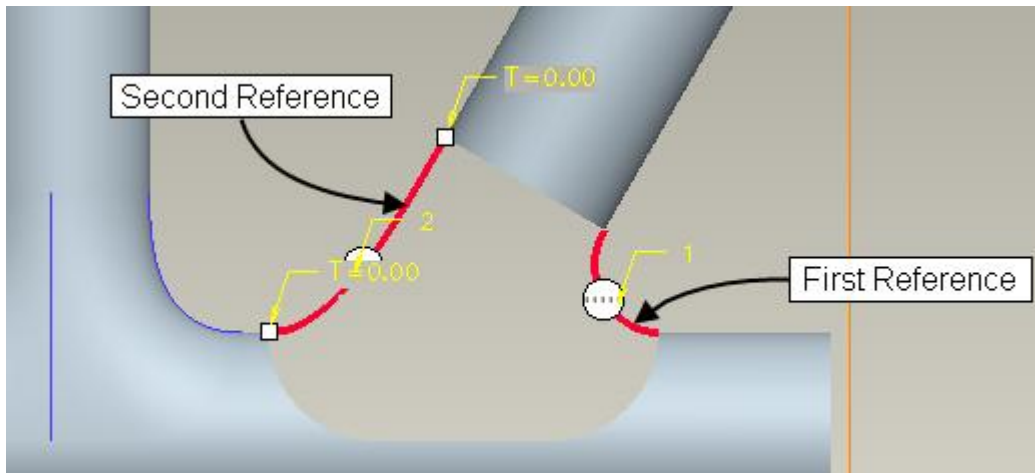


Because this part is symmetrical so we will create half side of the part and then mirror it.

⇒ Creating the surface

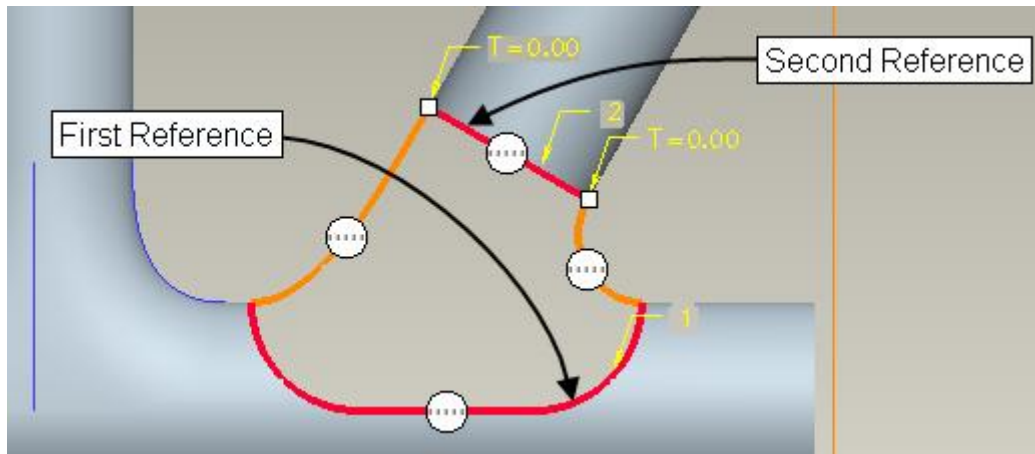
Now we will create the boundary blended surface to fill the gap shown in figure above.

Pick  and select the references shown in the figure below as first and second chains.

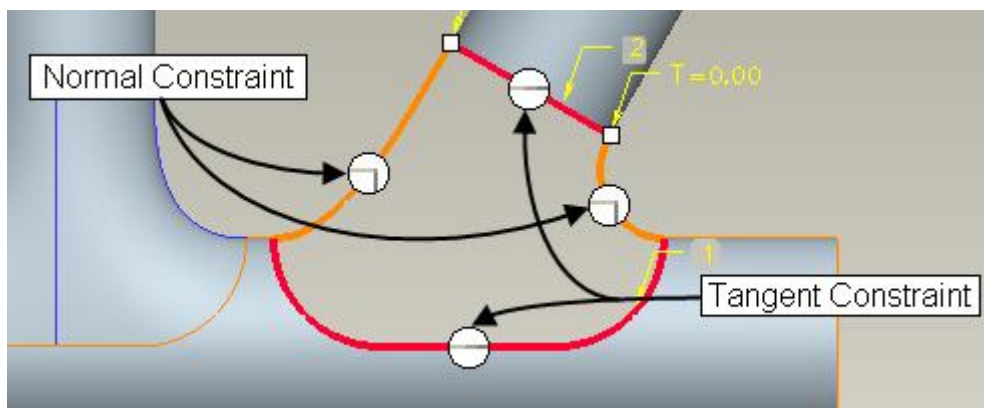


Pick in the **Second Direction Chain Collector** to activate it.


Select the references shown in the figure below as first and second chains. (Please note that to select the first chain, you should use Tangent chain construction technique. Don't forget that you need to hold down the Shift key while using this technique)

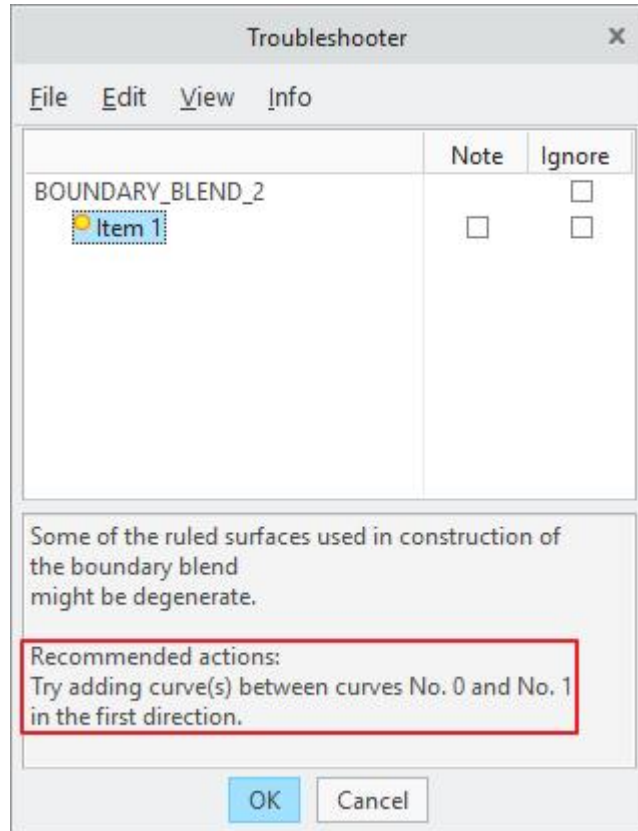


Apply the **Tangent** and **Normal** constraints for the chains shown in figure below.




This surface will be mirrored about RIGHT datum plane. Therefore to maintain tangency between original and mirrored surface, the surface has been constrained Normal to the RIGHT datum plane.

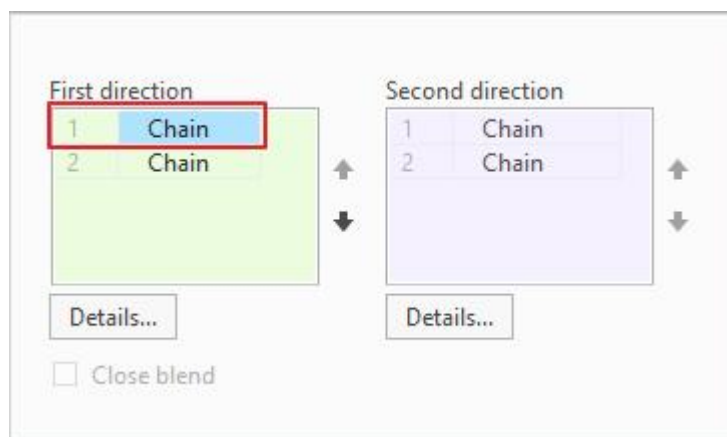
Now pick  and notice that system is unable to build the surface. System also shows a Troubleshooter dialog box with the details of cause of problem as shown below.




In the dialog box, there is a recommendation to add more curves in first direction between first and second chains.

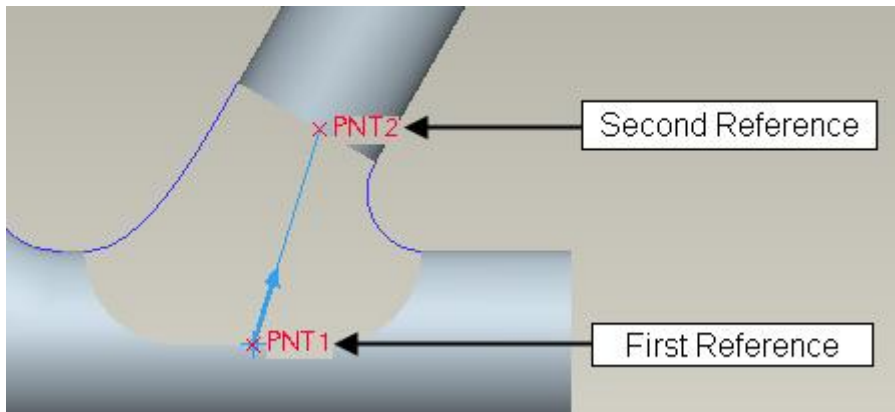
Now we will create a datum curve on the fly. So close Troubleshooter dialog box and pick  to Resume the boundary blended surface.

In the Curves slide-up panel, pick on first chain in the First Direction collector to make it active.



Pick  Curve from Equation on the Model tab to invoke Curve through Points tool. (You do not need to exit the boundary surface dialog box to create the curve)


Pick the datum points shown in figure below as references.



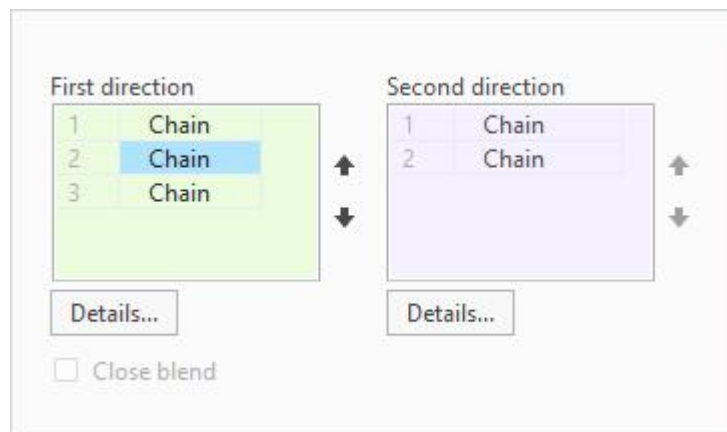
So pick **Ends Condition** tab and change the End condition for Start Point to Tangent and select the adjacent surface as references.

Now change the End condition for End Point to Tangent and pick the adjacent surface as reference.

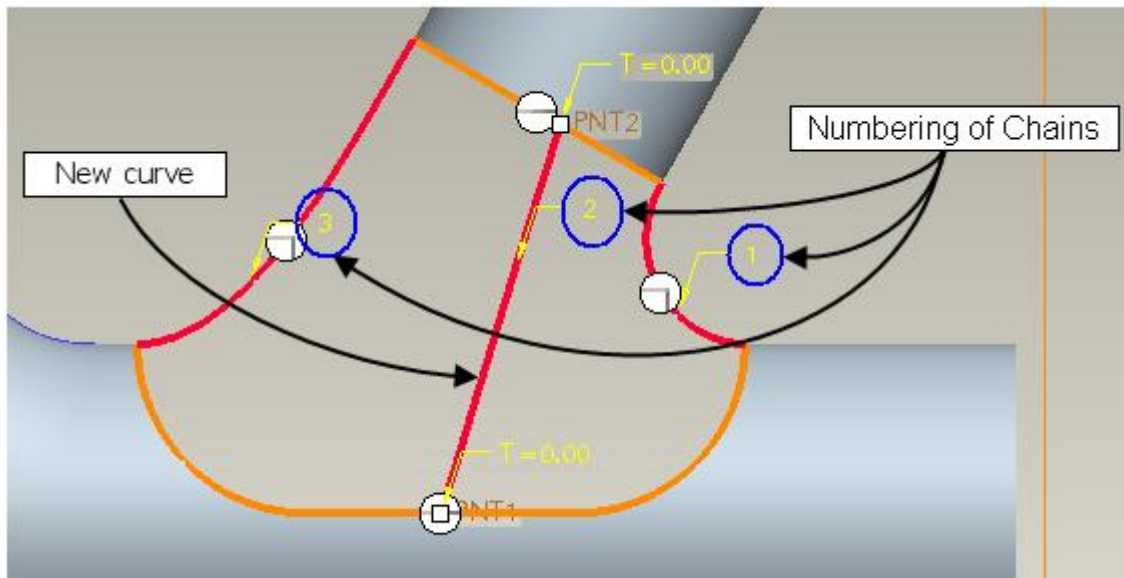
Pick  icon or middle-click to complete the feature.

Pick  to Resume the boundary blended surface.

Notice that new curve appears in the First direction reference collector at second position as shown below.



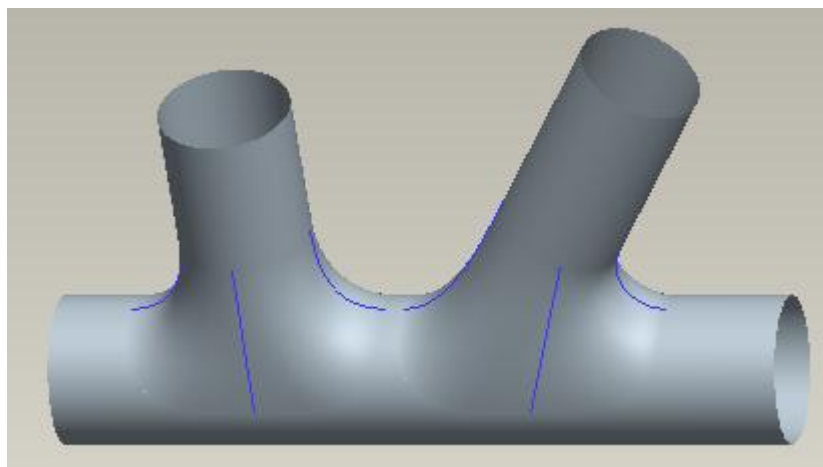
Also notice the sequence of numbering of chains on screen.



System has numbered the newly selected chain as "2" because we activated first chain in the slide-up panel and system inserted new curve between first and last chain.

Pick  icon or middle-click to complete the feature.

Now you can merge surfaces together to form a quilt and then mirror about RIGHT datum plane. Final part will appear as shown below.

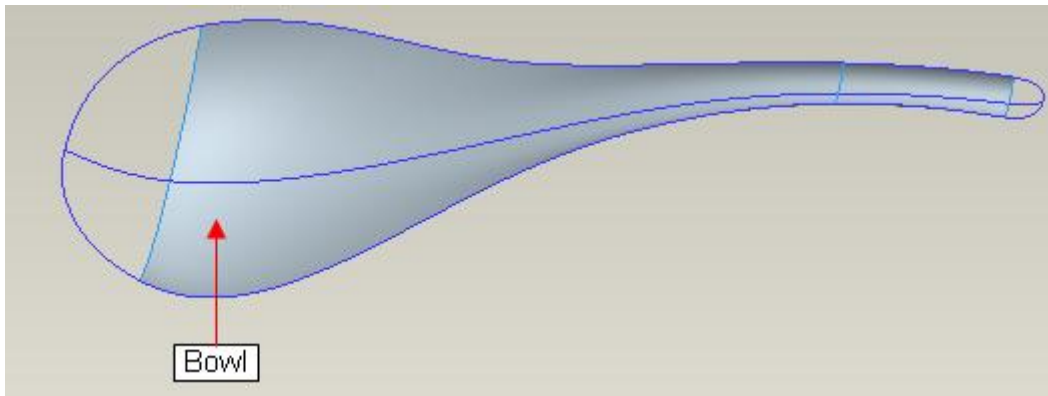


Select **File > Save** to save the work done so far.

Exercise 24

In this exercise we will create the end details of a soup spoon.

Set the working directory to the EXAMPLES folder and open the model SOUP_SPOON.PRT Part will appear as shown below.



Notice that this part is not symmetrical.

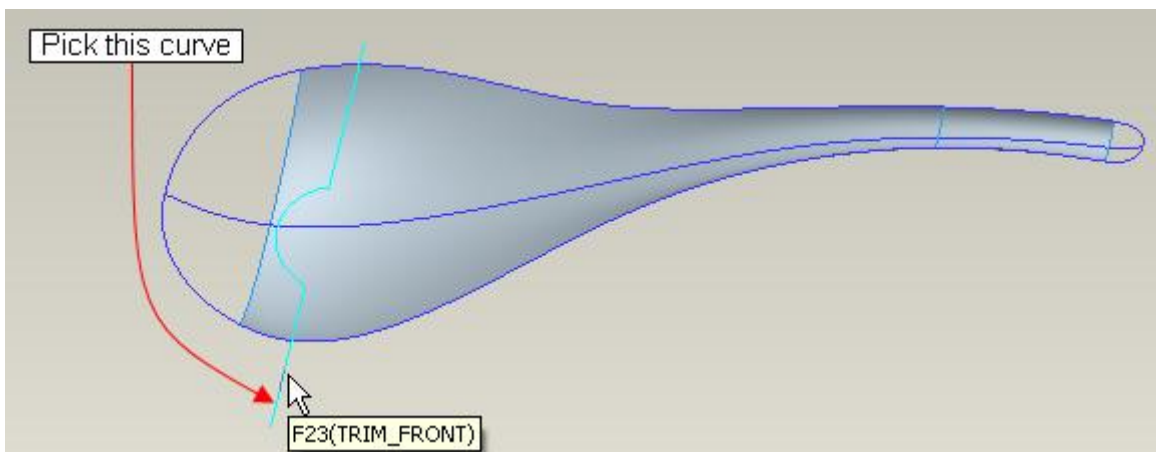
Datum curves for building the end details of “Bowl” can be seen in the above figure. We can easily create a boundary blended surface from these curves but it will result in singularities. So we will create the end surface using a technique that does not create singularity.

⇒ Trimming the Surface

Now we will trim this surface in such a way that we can build a boundary blended surfaces with four chains. Datum curves required for trimming operation have already been created but hidden.

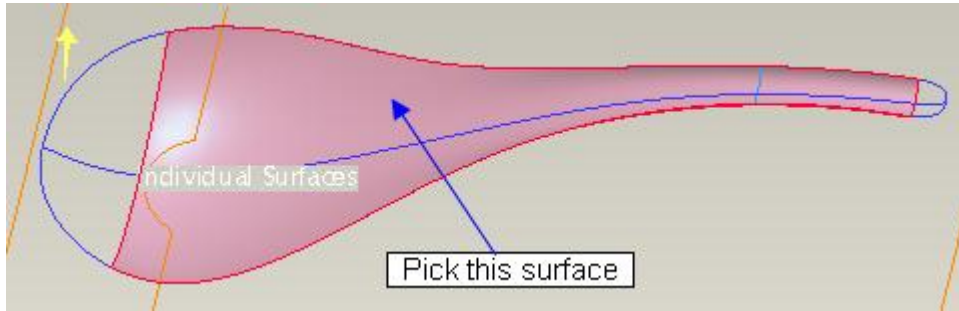
So right-click the “TRIM_FRONT” feature in the model tree and pick **Show** and curve will appear on screen.


Select the TRIM_FRONT datum curve on screen as shown below.



Pick  Project on the Model tab to invoke the Project tool.

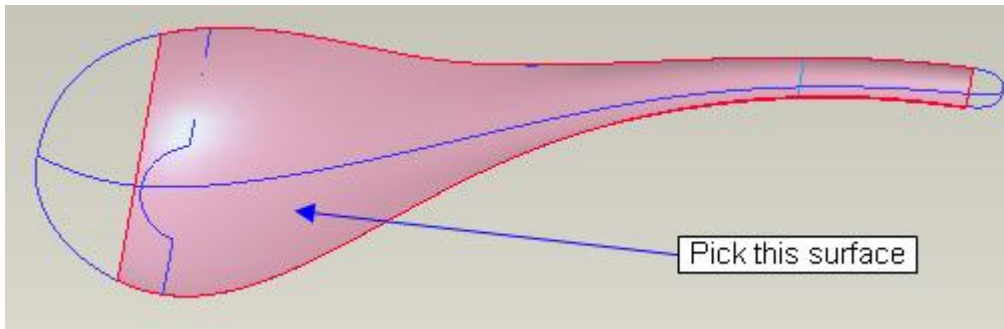
Select the boundary blended surface, as shown in the figure below, to project selected curve onto.




Pick  to complete the feature.

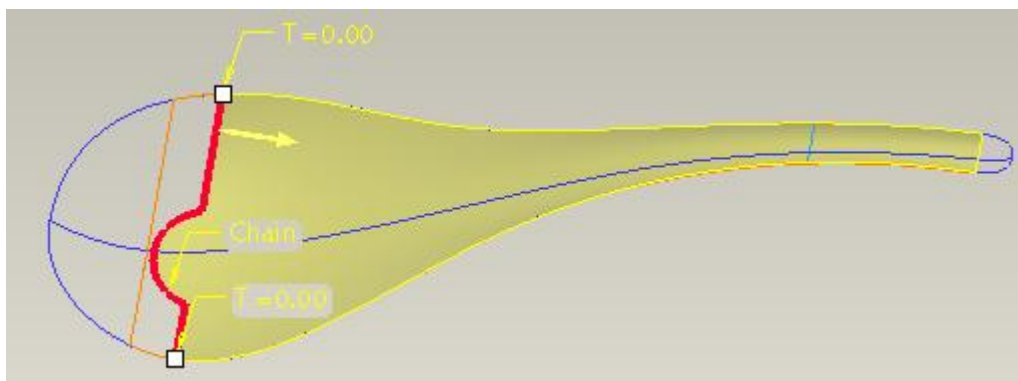
Now we will trim the boundary blended surface with these curves.

So first select the surface.



Pick  on the Model tab to invoke Trim tool.


Select the projected datum curve as trimming object and preview will appear as shown below.

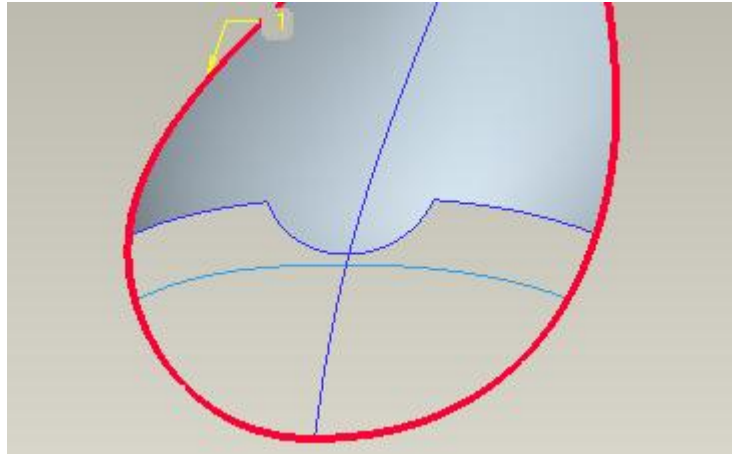


Pick  or middle-click to complete the feature.

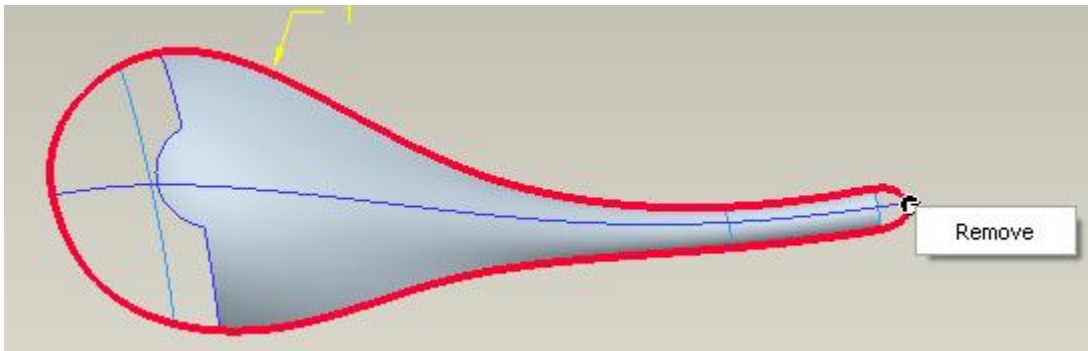
Creating the surface

Now we will create a boundary blended surfaces to fill the remaining gaps.

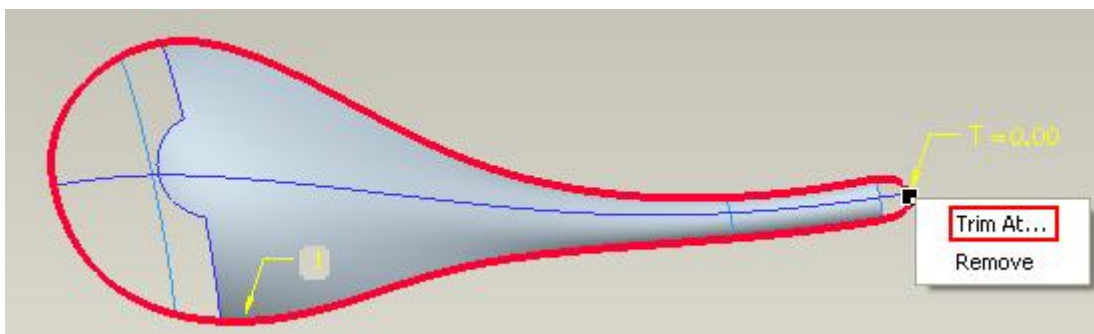
Pick  and select the curve shown in the figure below.



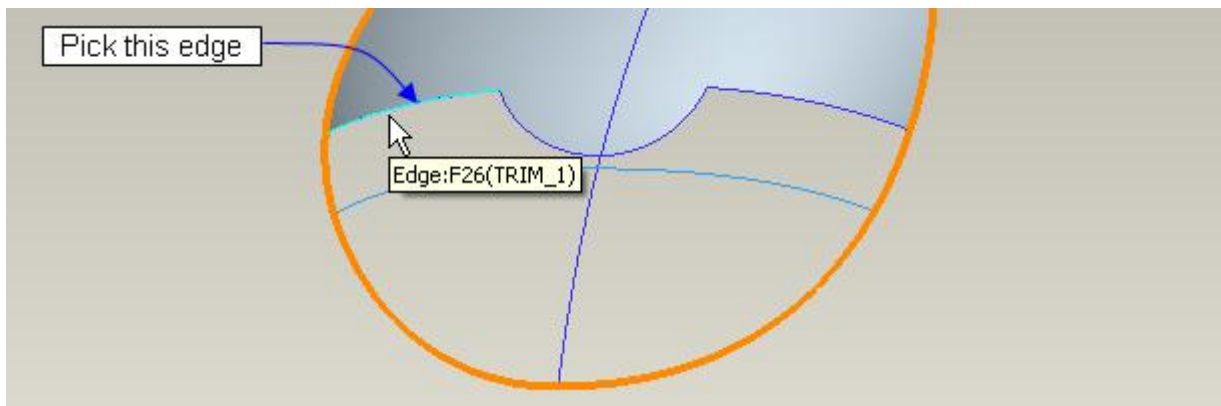
Right-click over the Start Point (small circle) and pick **Remove** as shown in the figure below.



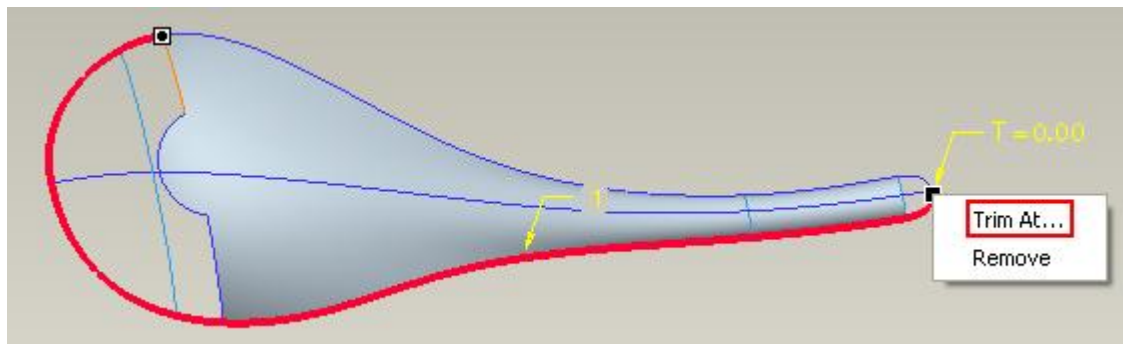
We need to trim the selected chain. So right-click over the drag handle and pick **Trim At** as shown below.



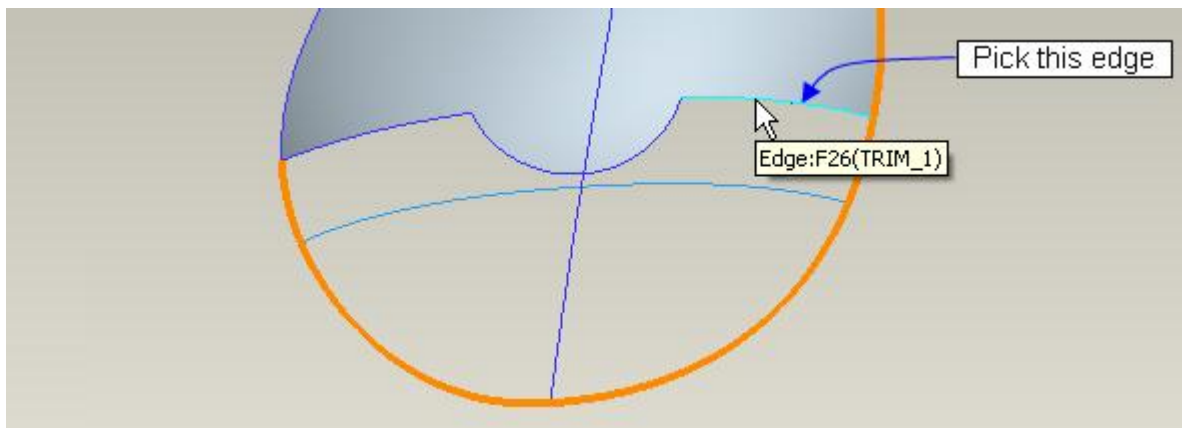
Select the edge, shown in the figure below, as trimming reference as.



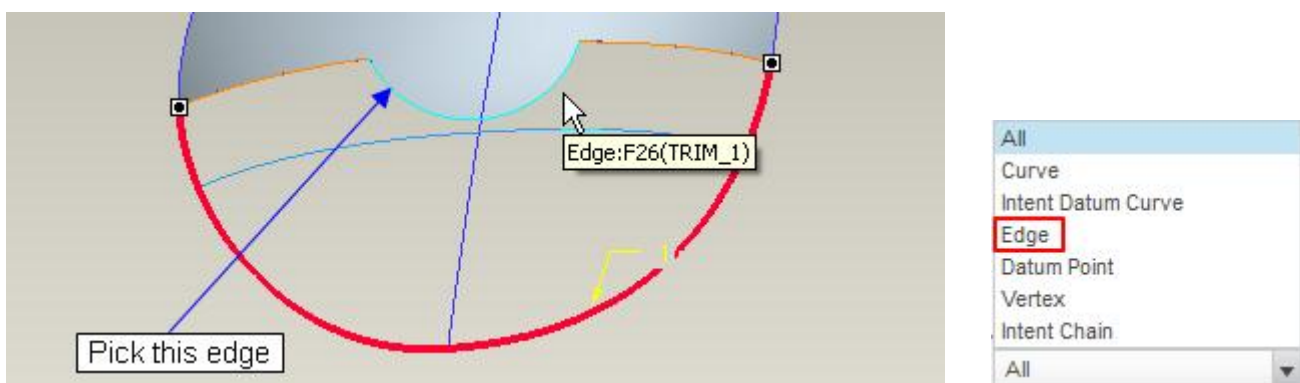
Now right-click over the second drag handle and pick **Trim At** as shown below.



Select the edge, shown in the figure below, as trimming reference as.

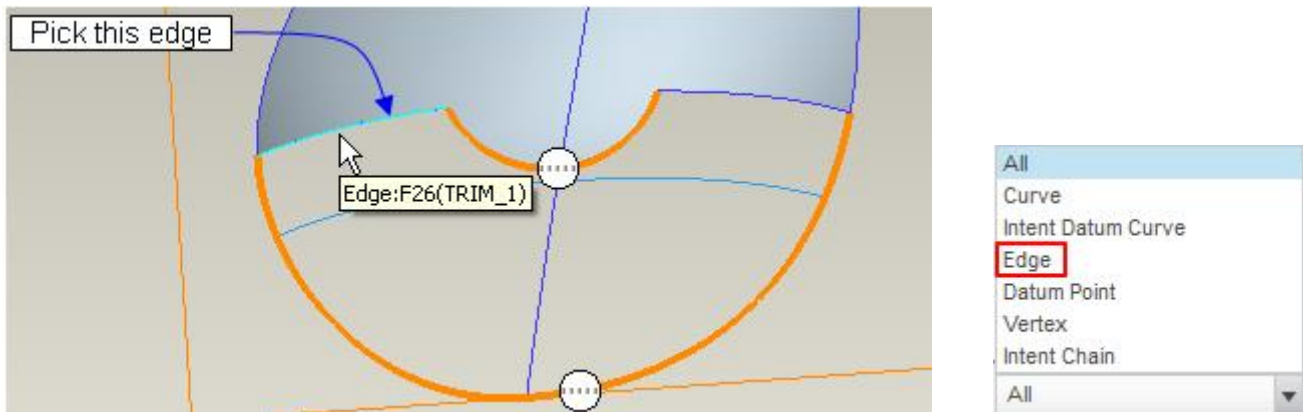


Now hold down the Ctrl key and pick the edge of surface as second chain, as shown in the figure below.

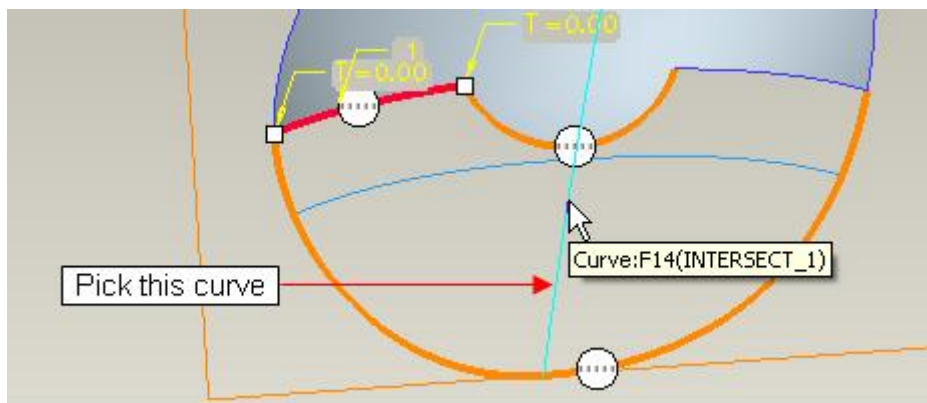


Pick in the **Second Direction Collector** to activate it.

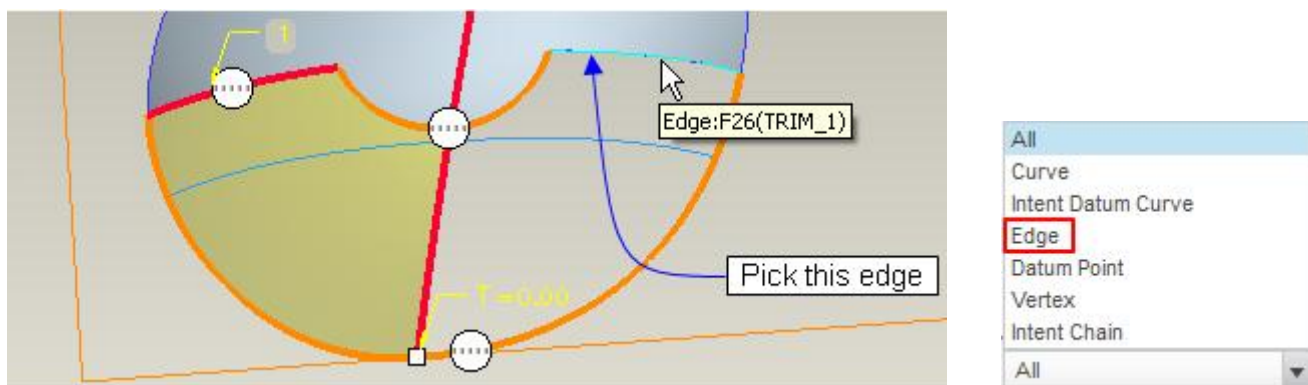
Pick the edge of surface as first chain in second direction as shown in the figure below.



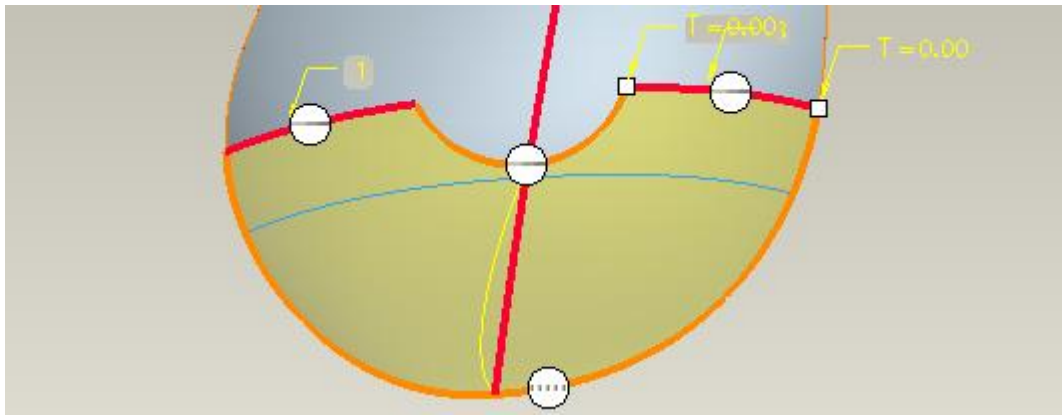
Hold down the Ctrl key and pick the following curve as second chain.




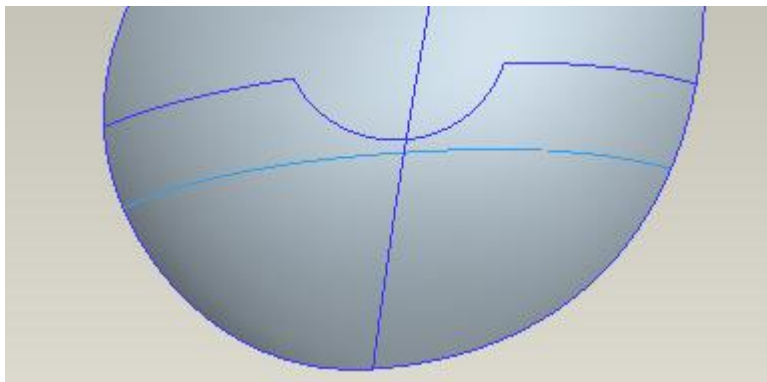
Hold down the Ctrl key and pick the following edge as third chain.



Apply the **Tangent** constraint for the boundary chains adjacent to the existing surface as shown below.



Pick  to complete the feature and it will appear as shown below.



Now you can merge surfaces together to form a quilt.

Select **File > Save** to save the work done so far.