External Copy Geometry

The External Copy Geometry functionality copies geometry from model to model without copying the geometry in the context of the assembly. Dependency on the assembly and all models along the path between the two components is avoided. Source and target components must be relatively positioned, but are independent of the assembly context.

We need only source and target part in session to regenerate the external copy geometry feature.

There are two methods of creating the external copy geometry (ECG) feature.

1. By defining a Copy Geometry feature in part environment
2. By converting an Internal Copy Geometry to ECG

Keep in mind that Internal Copy Geometry feature is usually called only the Copy Geometry.

Differences between CG and ECG

Following are the differences between CG and ECG.

Internal Copy Geometry	External Copy Geometry
The Internal Copy Geometry feature copies geometry from model to model in the context of assembly.	The External Copy Geometry functionality copies geometry from model to model without the context of assembly.
It follows the entire path within the assembly between the target part and the source part.	Dependency on the assembly and all models along the path between the two components is avoided.
CG feature is always located with reference to the coordinate system of the assembly, irrespective of the actual position of the component in the assembly.	Source and target components must be relatively positioned, but are independent of the assembly context.
We need all the assemblies, in the path of source and target parts, in session to regenerate the internal copy geometry feature.	We need only source and target part in session to regenerate the external copy geometry feature.

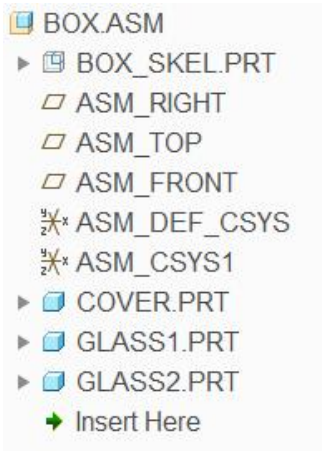
It is recommended that after going through the following two exercises you should again read the above differences to have a clear understanding.

Exercise 1

In this exercise we will look at a simple example to know the difference between a Copy Geometry and External Copy Geometry Feature. We will also see how to convert an Internal Copy Geometry feature to an External Copy Geometry feature.

Set the working directory to BOX folder and open the assembly BOX.ASM

Notice that there are three components assembled with Default constraint.

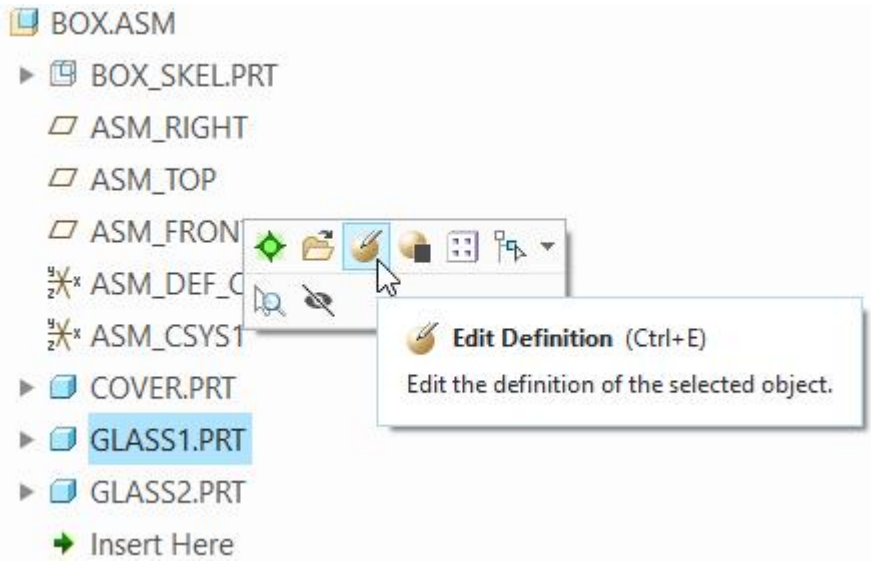


All the parts contain Copy Geometry features that reference the geometry in the skeleton model.

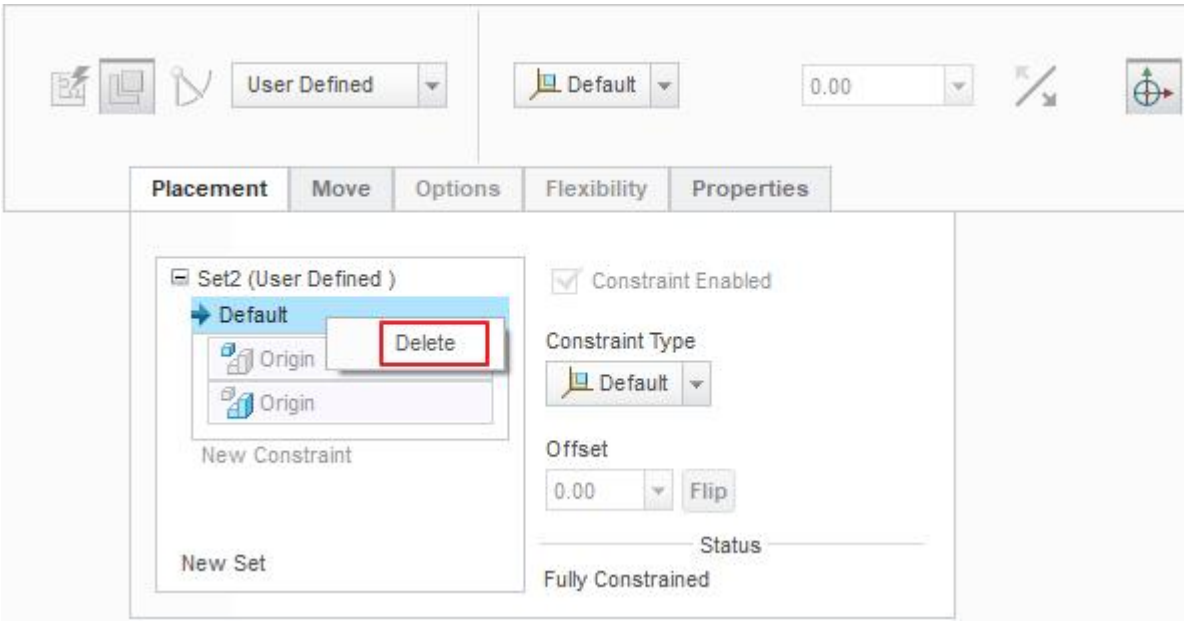
Copy Geometry Behavior

Now we will change assembly constraints for GLASS1 part and see how it behaves after regeneration.

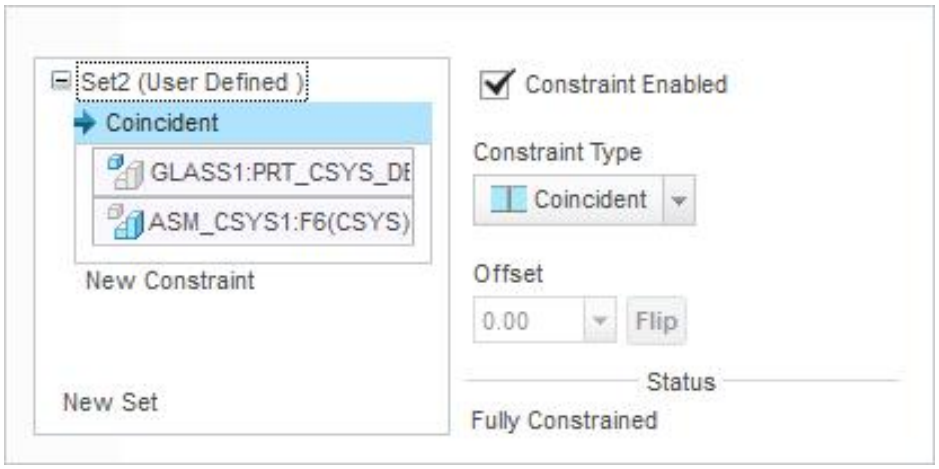
Select the “GLASS1” component and pick  in the pop up menu as shown below.



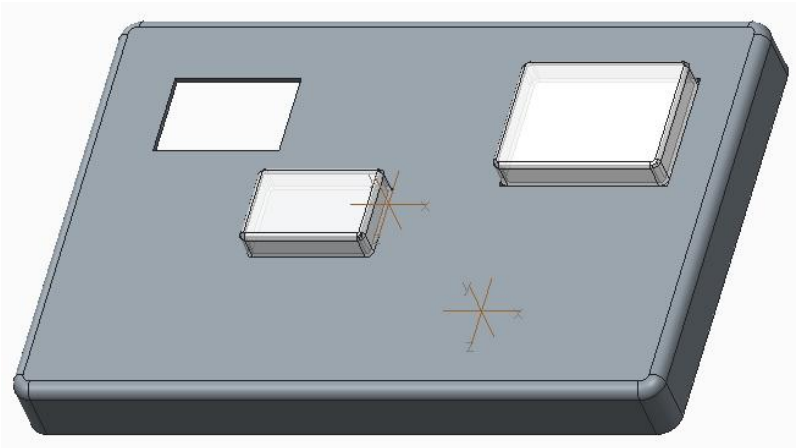
In the Component Placement dashboard, right-click the **Default** constraint and pick **Delete** as shown below.



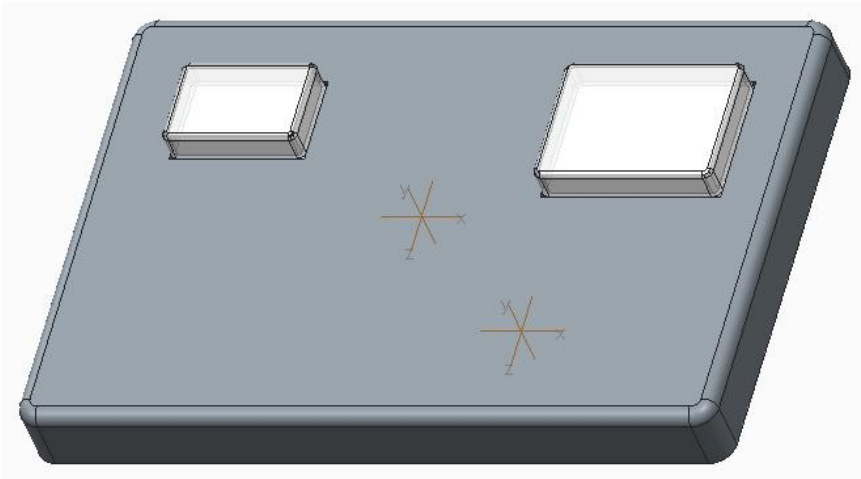
Now select the ASM_CSYS1 from the assembly and PRT_CSYS_DEF from the part as references for assembling the part. (Tip: You can pick these coordinate systems in the model tree if you find it difficult to find them on screen.)



Pick  to apply the changes and exit dashboard. The assembly will appear as shown below.

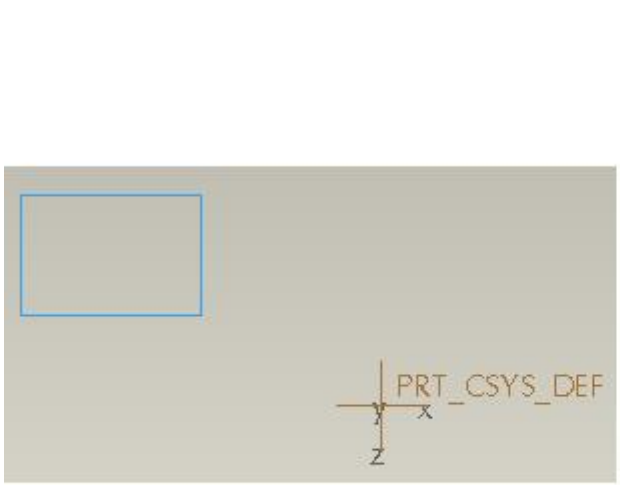


Regenerate the assembly by picking  icon and it will appear as shown below.

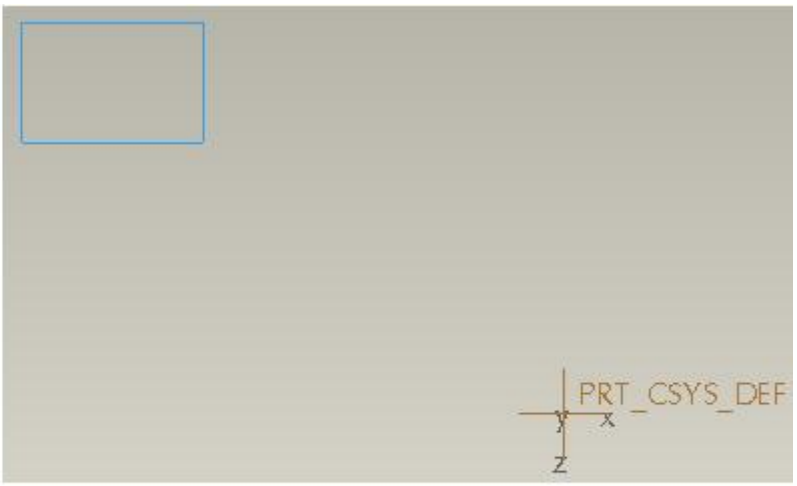


Notice that the location of the part geometry is unchanged in the assembly. It is because the geometry in the part (GLASS1) references the Copy Geometry feature and a CG feature is always located with reference to the coordinate system of the assembly, irrespective of the actual position of the component in the assembly.

The following figure shows the location of Copy Geometry feature in the GLASS1.PRT. The left side figure shows the copy geometry feature when the component was assembled with Default constraint and right side figure shows the location when part is assembled using Coordinate System constraint.



With Default Constraint



With Coordinate System Constraint

Location of CG Feature relative to the Coordinate System

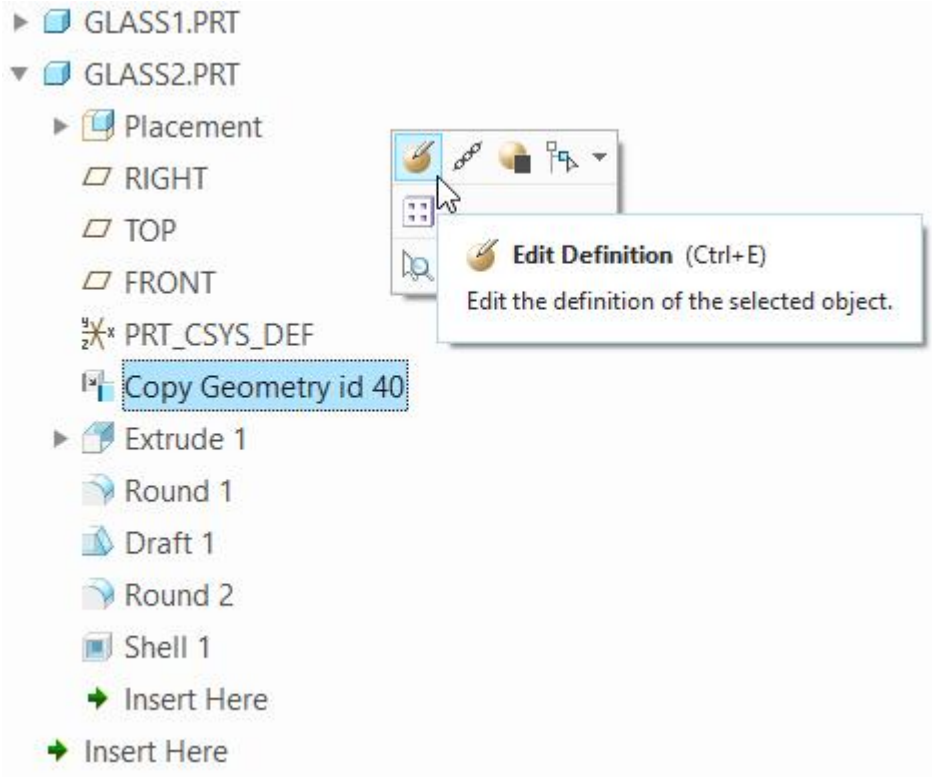
Copy Geometry feature is always located with reference to coordinate system of the assembly, irrespective of the actual position of the component in the assembly.

External Copy Geometry Behavior

Now we will see how the External Copy Geometry feature is affected by the position of component in the assembly.

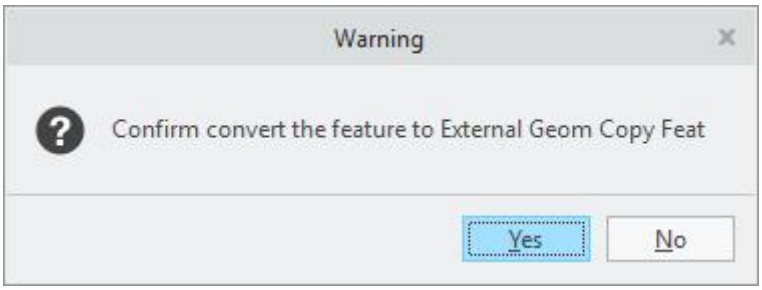
First we will convert a copy geometry feature to external copy geometry in the GLASS2 part and then change its assembly constraints.

So Select the Copy Geometry feature in the GLASS2.PRT and pick 



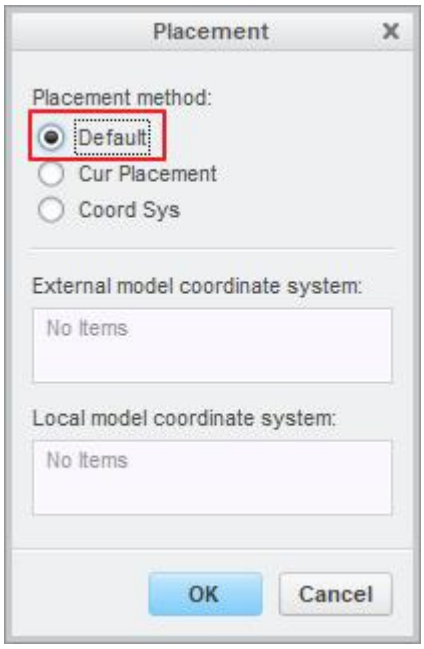
Pick  icon in the dashboard to make this feature External.

System will ask you to confirm the conversion process. So pick Yes to confirm.



Now system will require you to specify how the external copy geometry feature will be located relative to the source part (Copy Geometry feature is referencing curves in the skeleton so skeleton part is source).

Pick **Default** in the Placement dialog box.

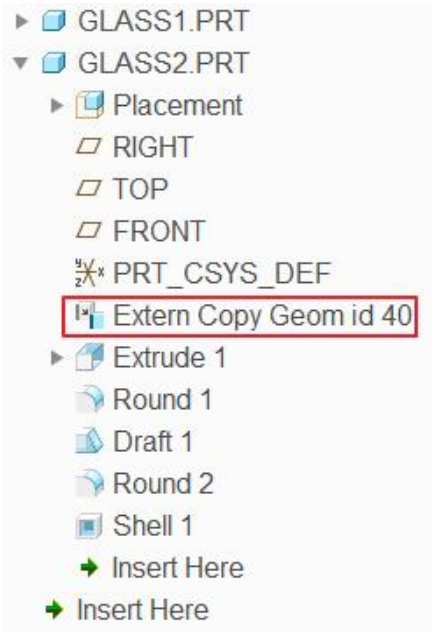


The Default constraint aligns the default system-created coordinate systems of the target component to the default system-created coordinate system of the source part.

Pick OK to proceed.

Pick  to apply the changes and exit the dashboard.

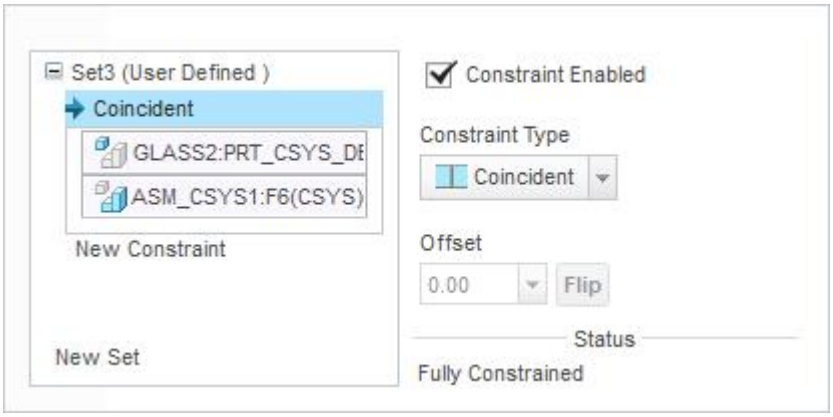
Notice that system has automatically renamed the feature to Extern Copy Geom as shown below.



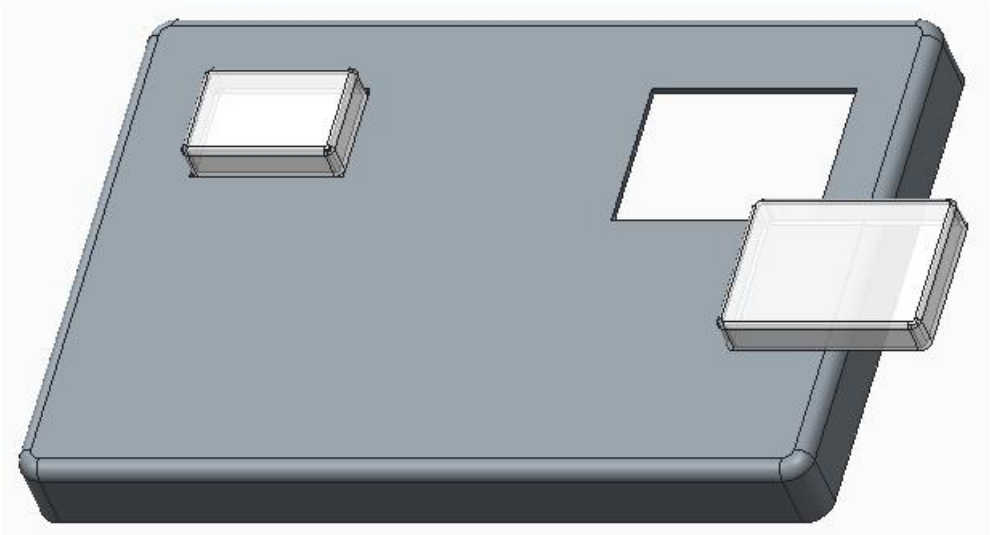
Select the “GLASS2” component in the model tree and pick  in the pop up menu.

In the Component Placement dashboard delete the **Default** constraint.

Now select the ASM_CSYS1 from the assembly and PRT_CSYS_DEF from the part as references for assembling the part.



Pick  to apply the changes and exit the dashboard. The assembly will appear as shown below.

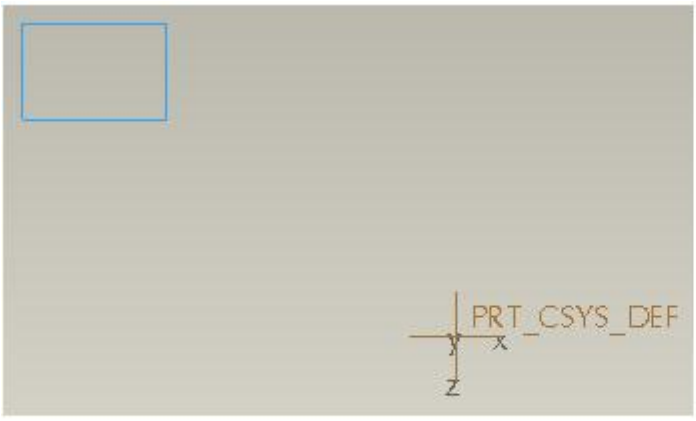


Regenerate the assembly by picking  icon and notice that there is no change on the location of the GLASS2.PRT which is a different behavior from GLASS1 case. It is so because the external copy geometry feature is independent of the assembly. ECG feature is located with reference to the source part.

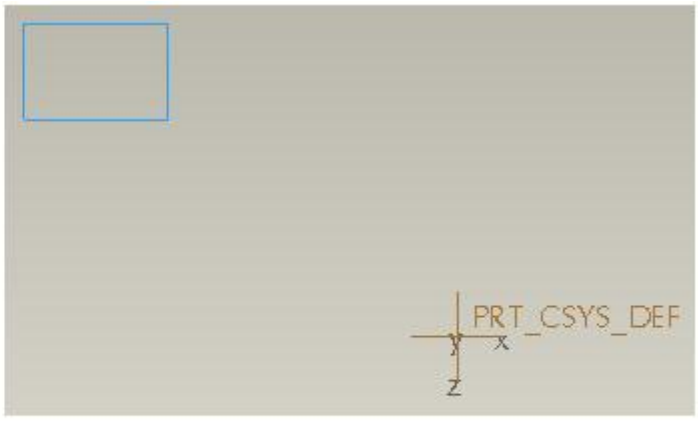
The external Copy Geometry functionality copies geometry from model to model without copying the geometry in the context of the assembly. Source and target components are relatively positioned, but are independent of the assembly context.

The following figure shows the location of Copy Geometry feature in the GLASS2.PRT. The left side figure shows the copy geometry feature when the component was assembled with Default

constraint and right side figure shows the location when part is assembled using Coordinate System constraint.



With Default Constraint



With Coordinate System Constraint

Location of ECG Feature relative to the Coordinate System

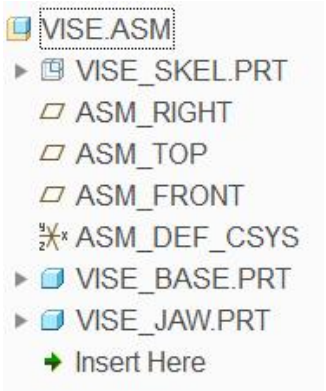
It shows that there is no effect on the location of ECG feature in the part with the change of assembly constraint used to place part.

Exercise 2

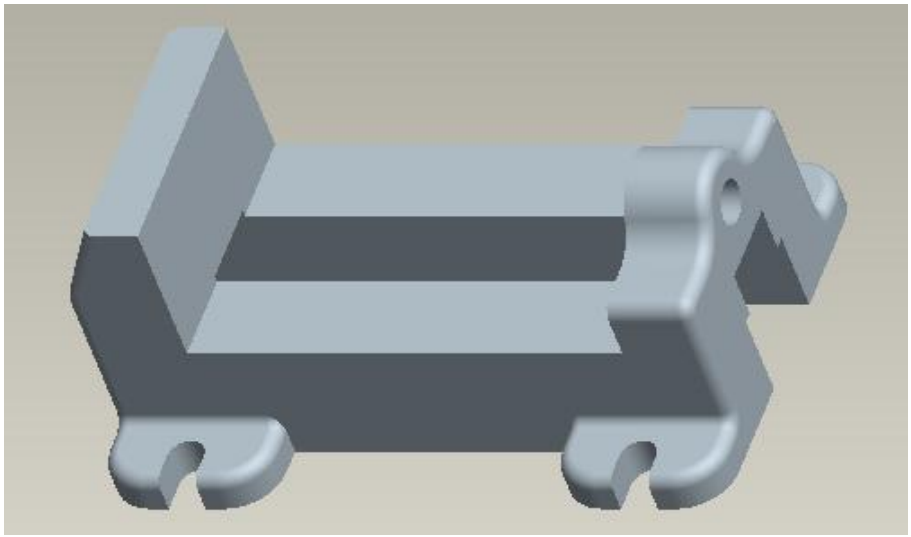
In this exercise we will create an External Copy Geometry feature in a part. Later we will see that what models should be in memory to regenerate a Copy Geometry and External Copy Geometry Feature.

Set the working directory to VISE folder and open the assembly VISE.ASM

Notice that there are two components assembled with Default constraint.



The geometry for the VISE_BASE.PRT has already been defined and it is shown below.



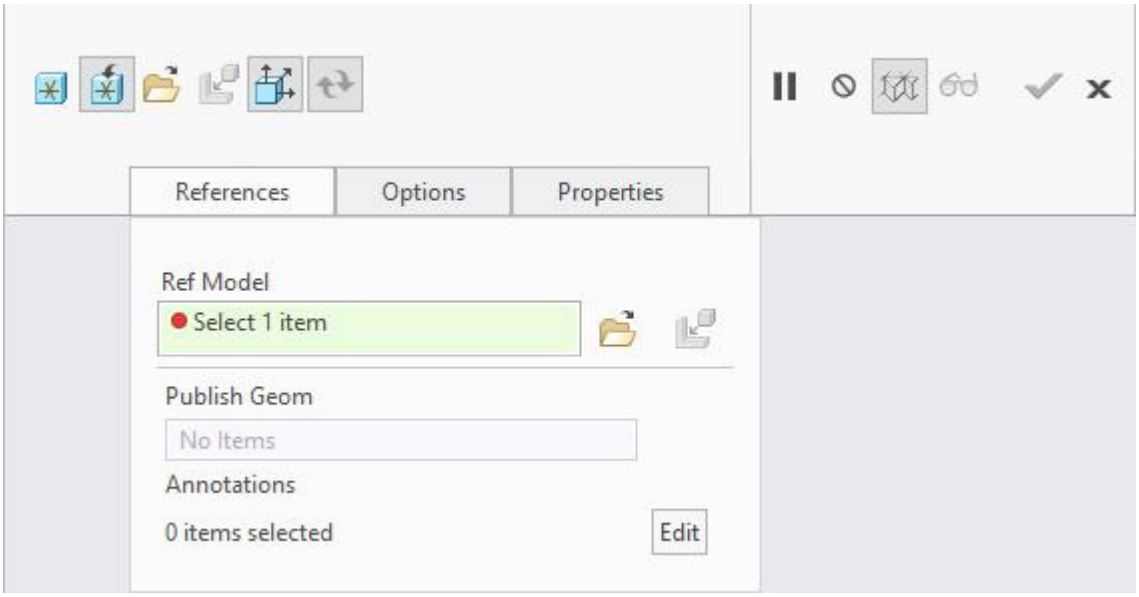
VISE_JAW.PRT only contains the default datum features. Now we will create an external copy geometry (ECG) feature in this part and then create solid features. This ECG feature will reference the Publish Geometry feature in the skeleton part.

We will create the External Copy Geometry feature in the part mode. So Select the VISE_JAW.PRT in the model tree and pick **Open**.

To create a copy geometry feature, pick 

on the Model tab.

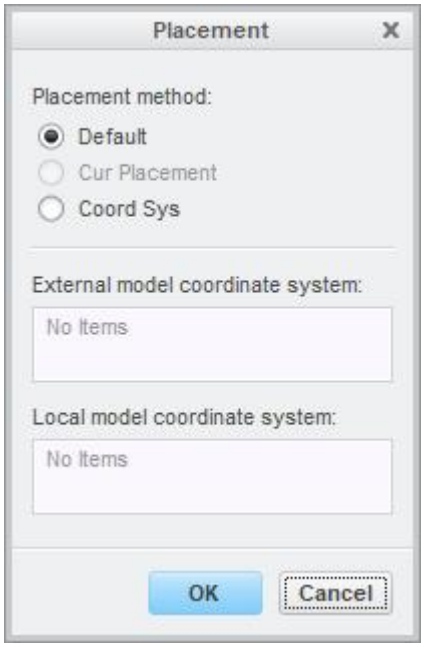
The Copy Geometry dashboard will appear as shown below.



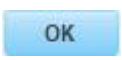
Notice that system requires to know the Ref Model (reference model) from which it will copy the references.

So pick  and select the vise_skel.prt in the Open dialog box.

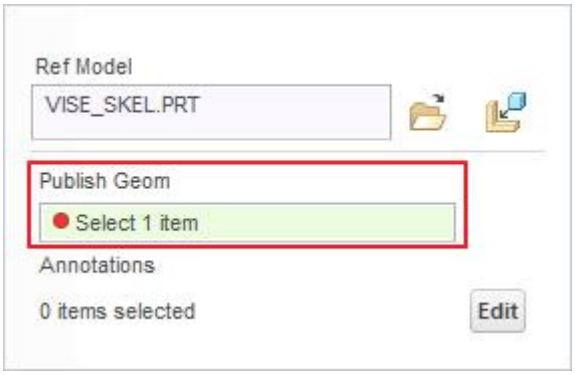
Pick **Default** in the Placement dialog box.



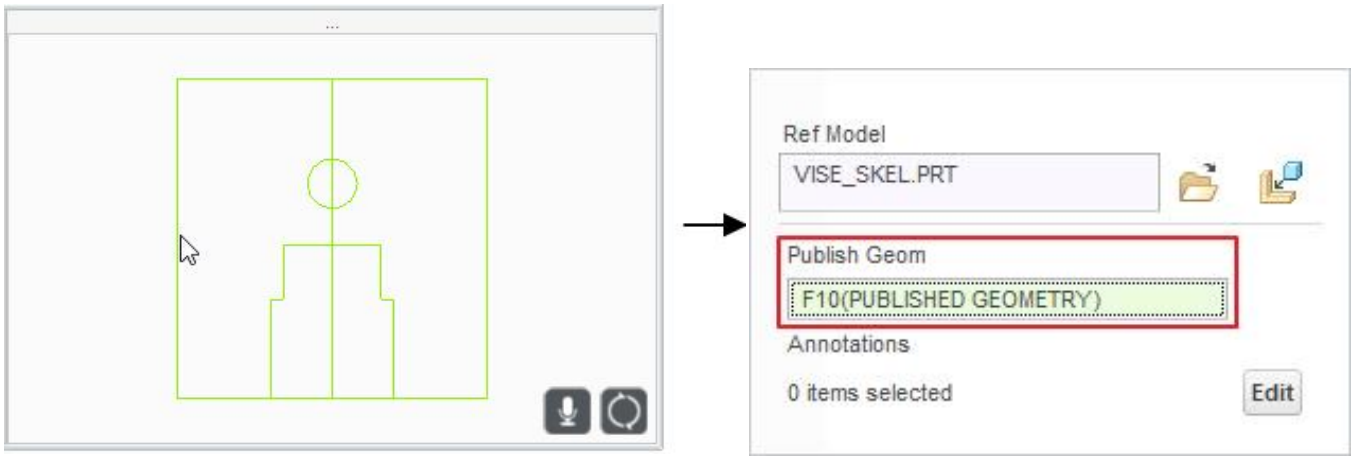
The Default constraint aligns the default system-created coordinate systems of the target component to the default system-created coordinate system of the source part.

Pick  to proceed.

Now pick in the Publish Geom collector as shown below.



System will open the VISE_SKEL.PRT in a separate window and will ask to select the publish geometry feature. So pick the already defined publish geometry feature as shown below.

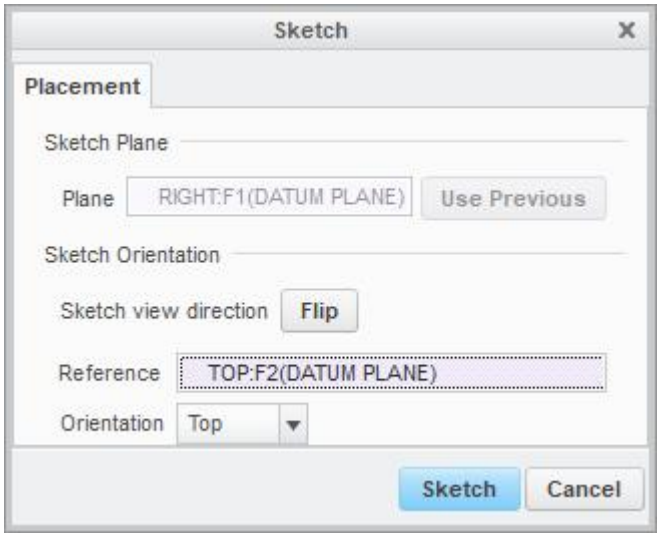


Pick  to apply the changes and exit the dashboard.

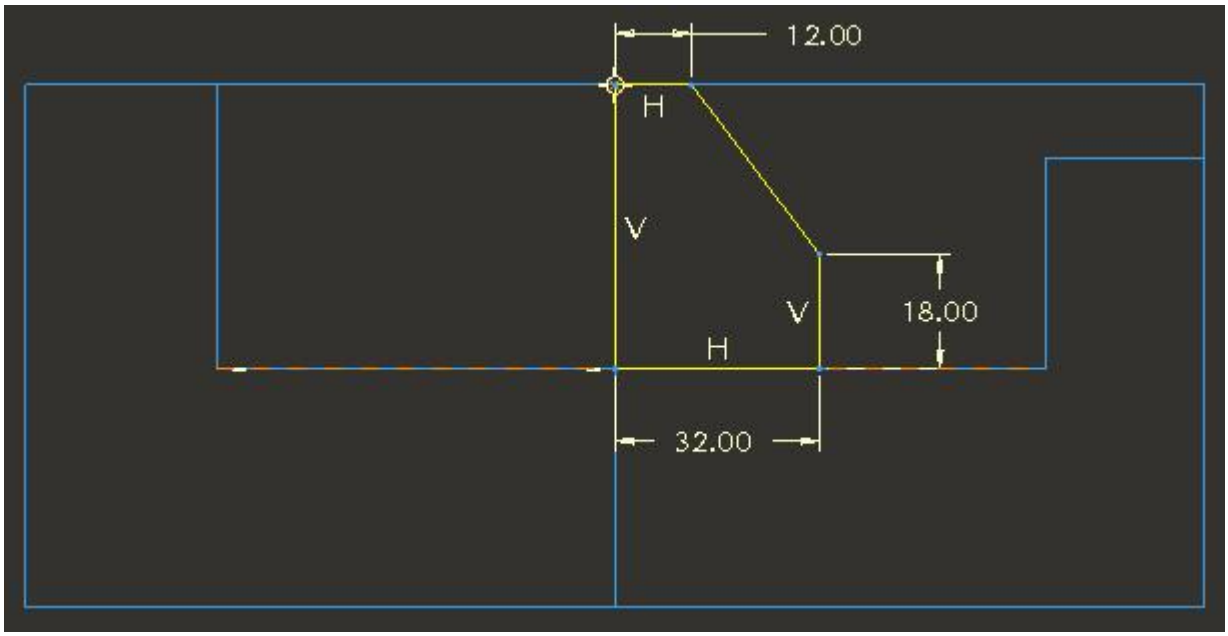
Now we will create extrude features to build the geometry for this part.

Pick  to invoke Extrude tool.

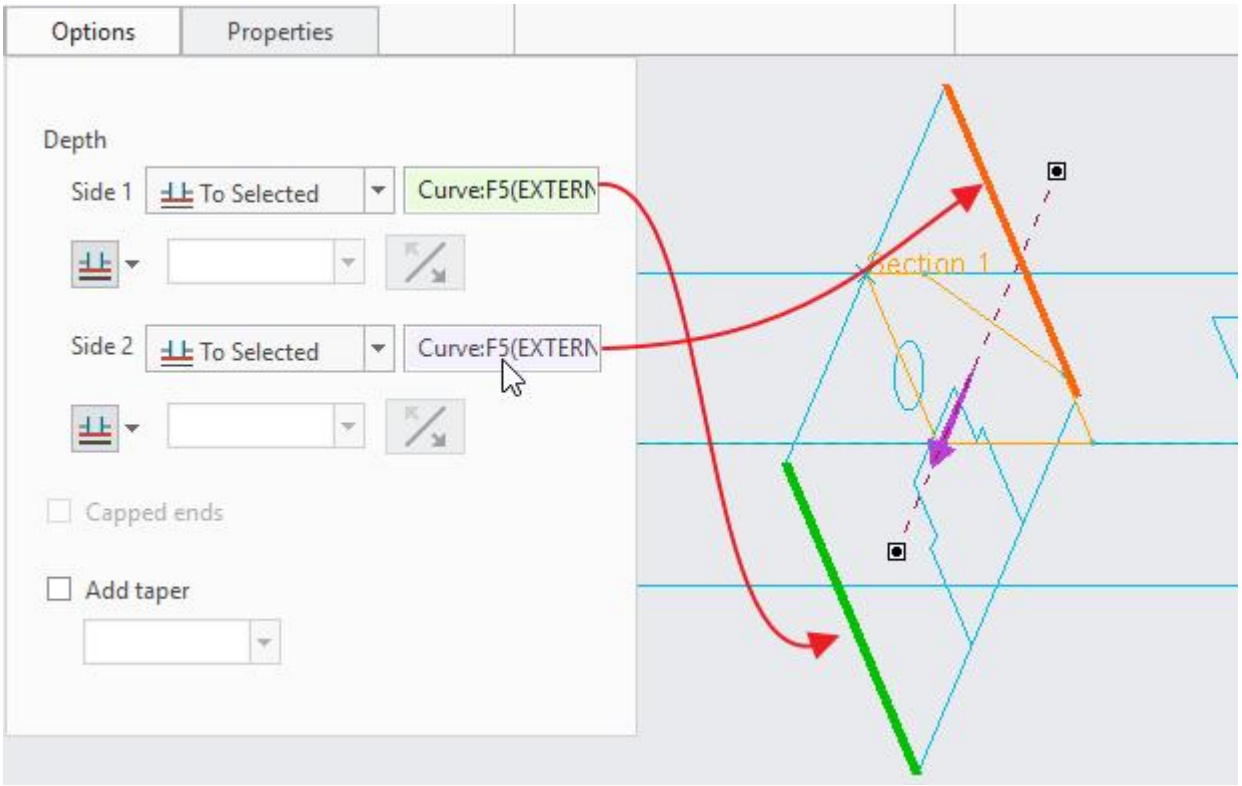
Select the sketching references as shown below



Delete the default references and sketch the section as shown below.



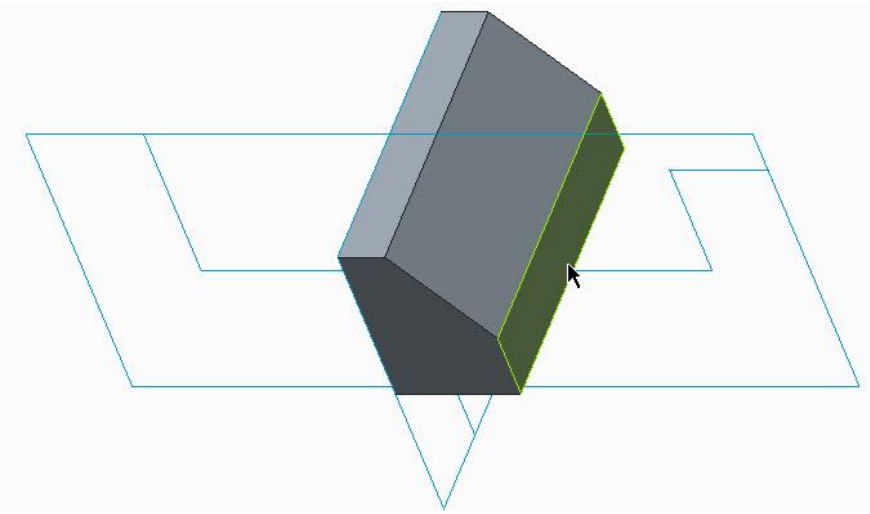
After completing the sketch, select the depth references as shown below.



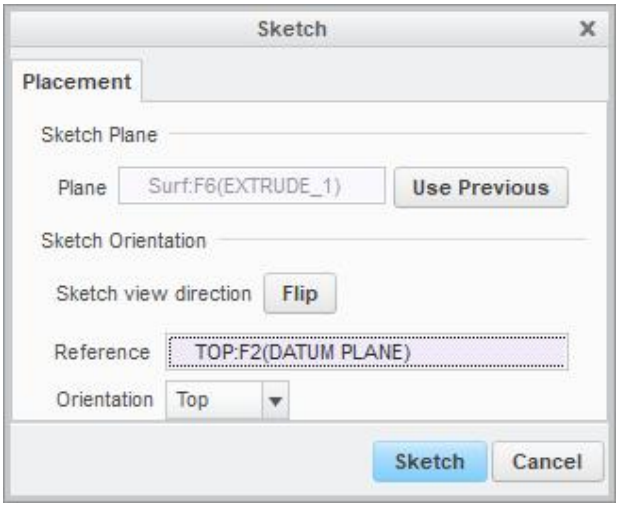
Pick icon or middle-click to complete the feature.

Again pick  to invoke Extrude tool.

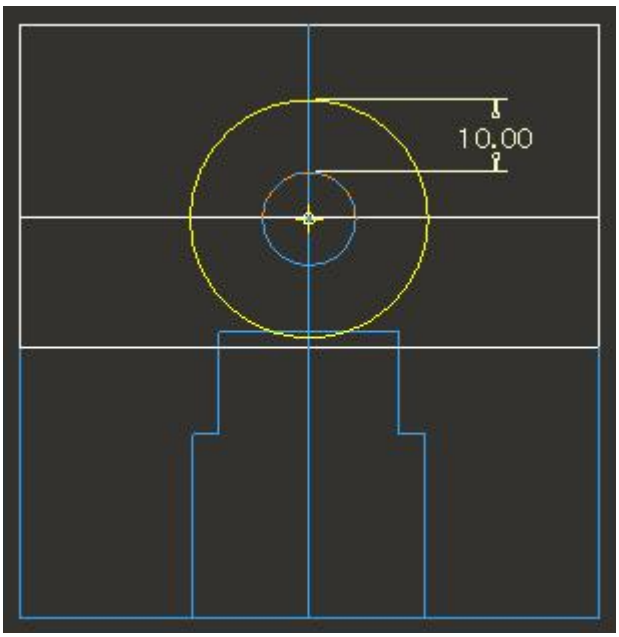
Select the following highlighted surface as sketching plane.



Select the sketching references as shown below



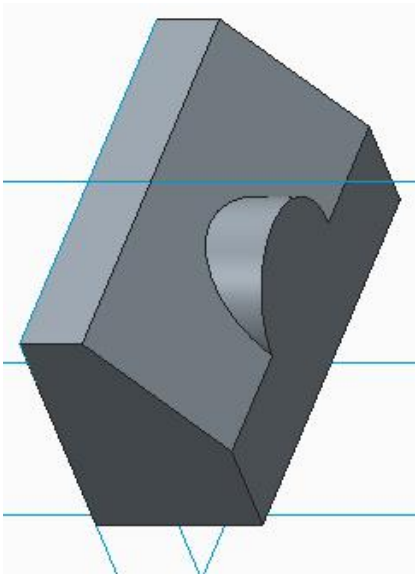
Sketch the section as shown below.



As you can see that by default system is extruding the feature away from the part. So pick the  icon to reverse the direction of feature creation.

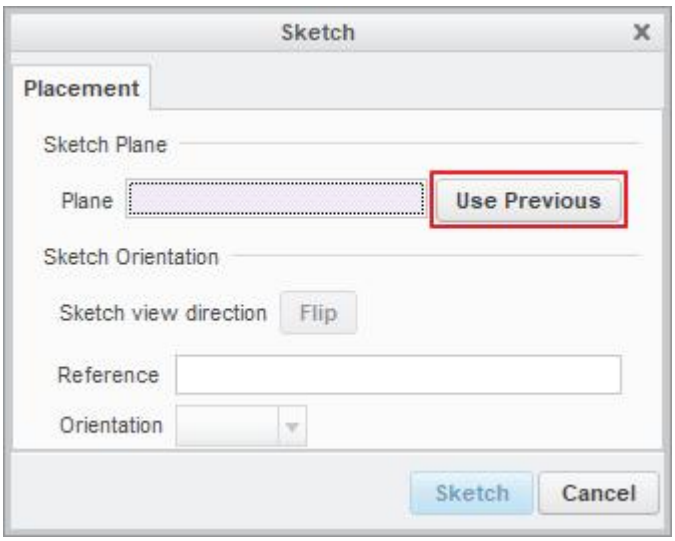
Change the depth option to **To Next Surface** by picking the  icon in the Depth options list.

Pick  icon or middle-click to complete the feature. Part will appear as shown below.

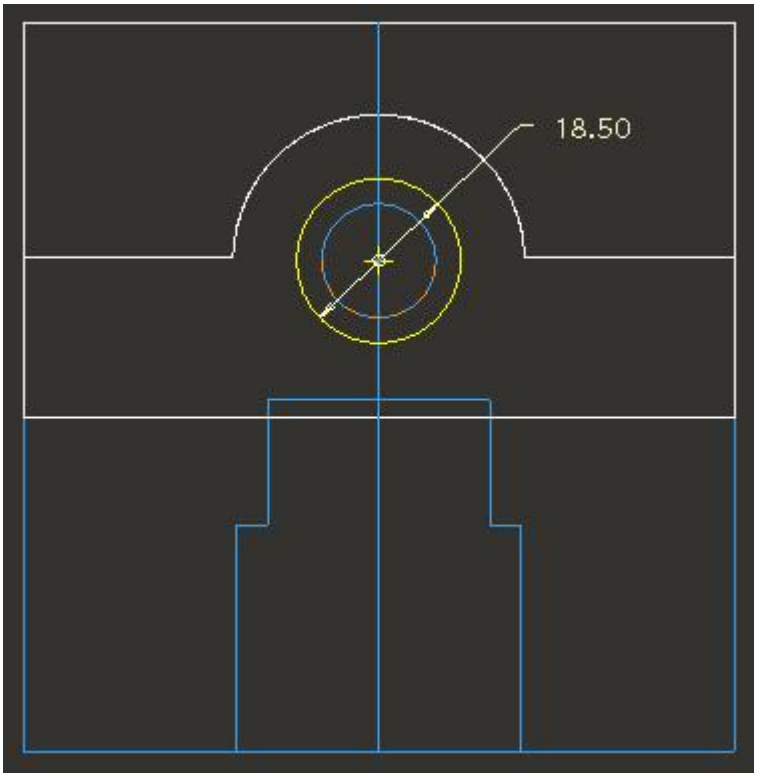


Again pick  to invoke Extrude tool.

Select the same sketch placement references used for previous feature by using the **Use Previous** option in the Sketch dialog box.



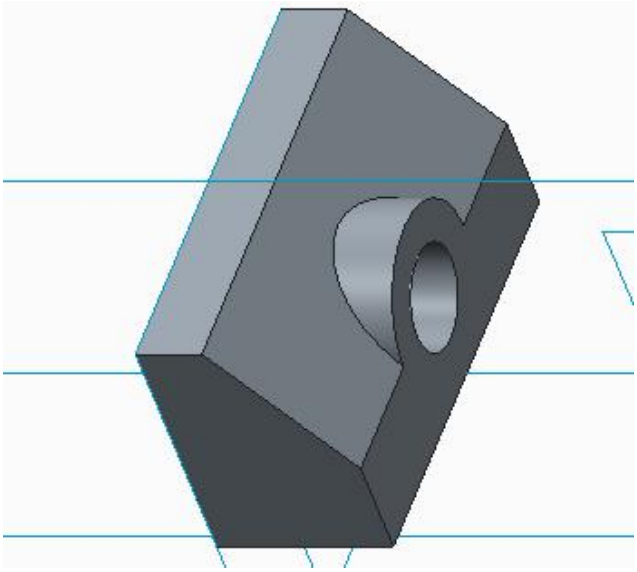
Sketch the section as shown below.



Pick the  icon to reverse the direction of feature creation and enter ***20*** in the depth value box

Pick  icon to create the feature as cut.

Pick  or middle-click to complete the feature. The part will appear as shown below.



This completes the basic geometry for this part.

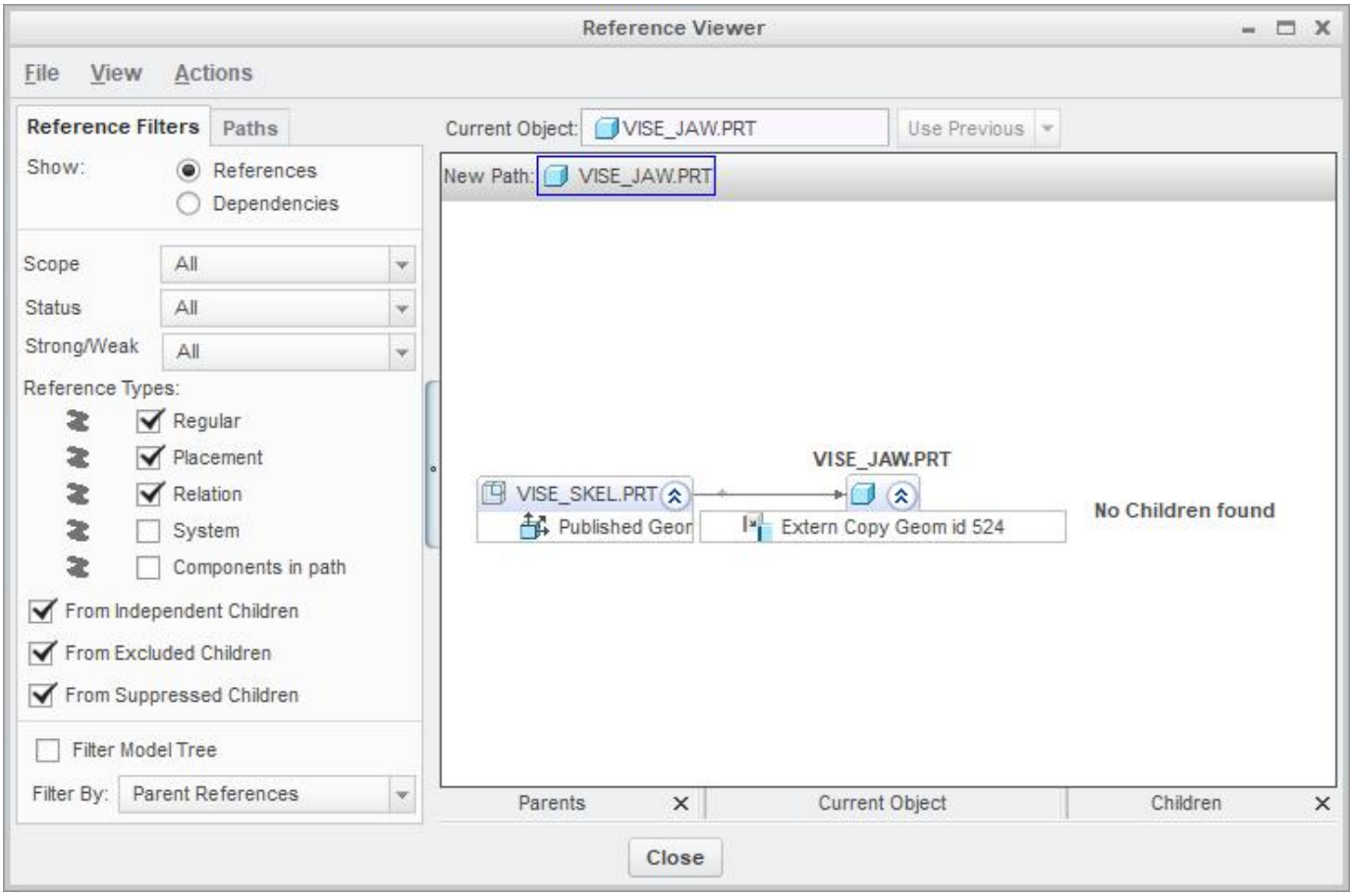
Select **File > Save** to save the work done so far.

Investigating External References

Now we will investigate the external references in this part.

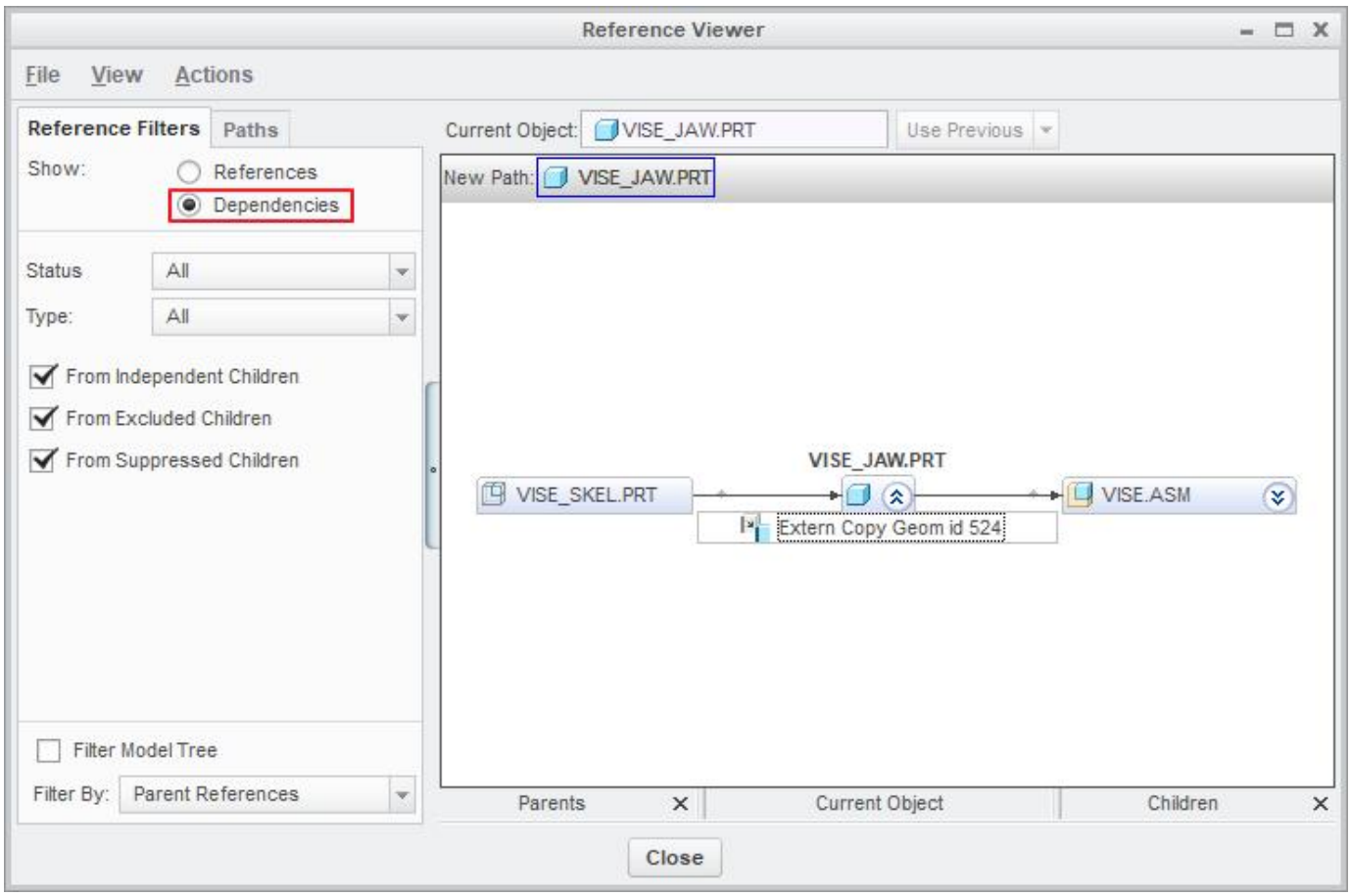
Pick on the Tools tab to open the Reference Viewer.

The Reference Viewer dialog box will appear as shown below.



It can be seen that VISE_SKEL.PRT is the parent of VISE_JAW.PRT because “External Copy Geom” feature is referencing Published Geometry feature in the skeleton.

Pick **Dependencies** as reference filter and dialog box will appear as shown below.

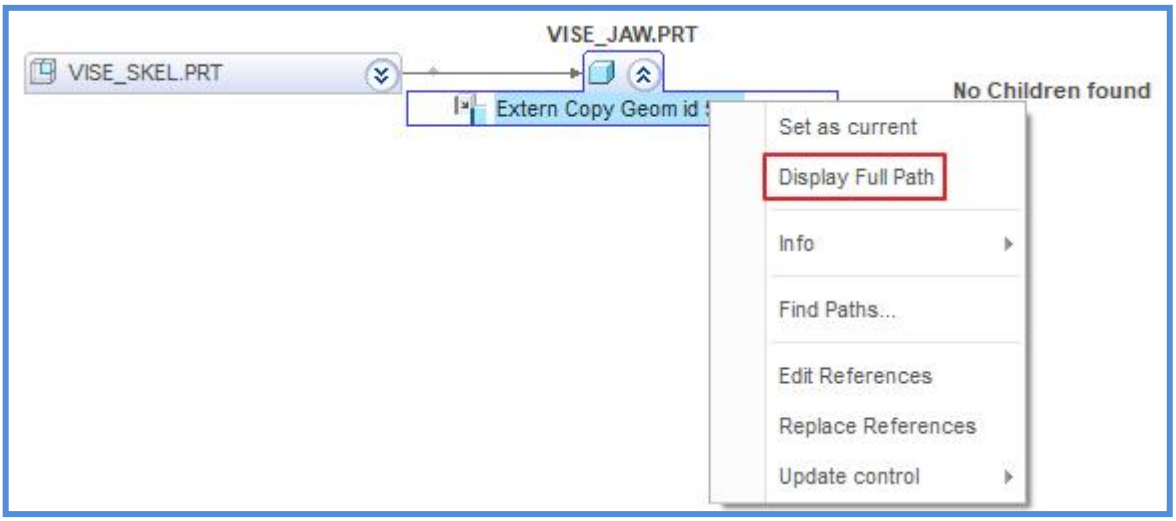


Notice that VISE_JAW.PRT has no dependency on the assembly containing the skeleton. It is only dependent on the skeleton part. The assembly appears as a child of the current object as VISE_JAW.PRT is assembled in VISE.ASM. So for regeneration of VISE_JAW.PRT, the only part needed in session is the skeleton part.

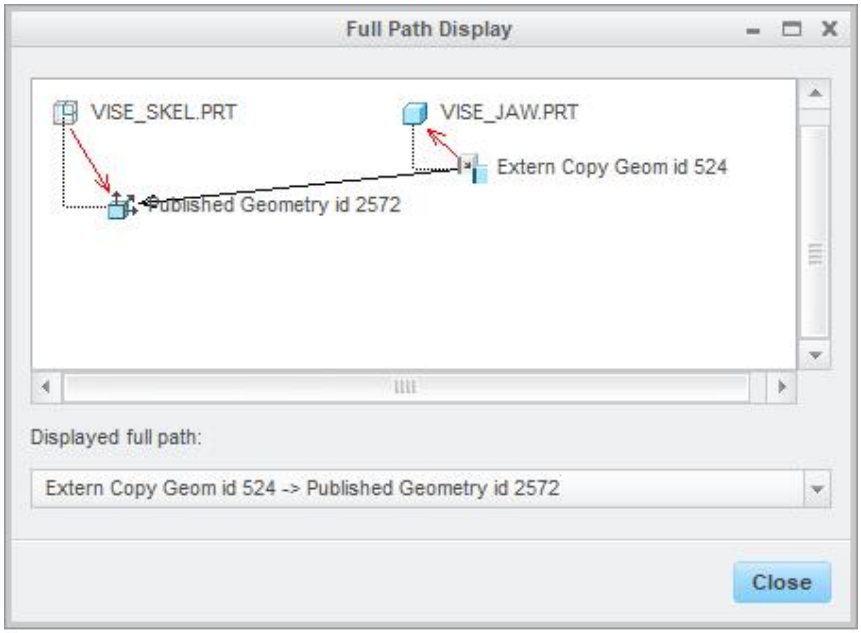
The External Copy Geometry functionality copies geometry from model to model without the context of the assembly.

Pick **References** as reference filter and right-click the copy geometry feature.

Pick **Display Full Path** as shown below.



Full Path Display dialog box will appear as shown below.



It can be clearly seen that the external copy geometry is referencing published geometry feature in the skeleton model without involving the assembly.

Pick Close to close the Full Path Display dialog box.

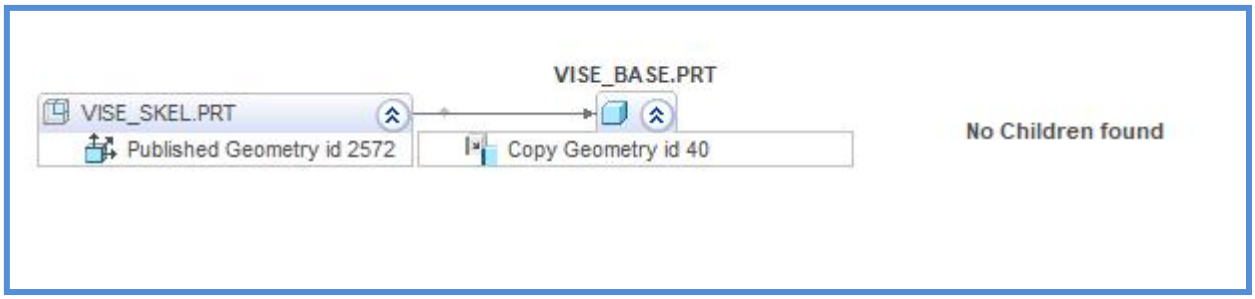
Pick Close to close the Reference Viewer.

Now we will investigate the external references in the VISE_BASE part.

So open the VISE_BASE.PRT in a new window.

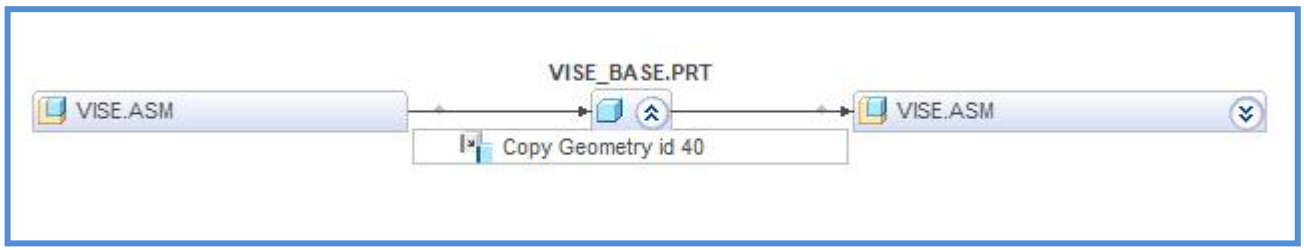
Pick on the Tools tab to open the Reference Viewer.

The Reference Viewer dialog box will appear as shown below.



It can be seen that VISE_SKEL.PRT is the parent of VISE_BASE.PRT because Copy Geometry feature is referencing Published Geometry feature in the skeleton.

Pick **Dependencies** as reference filter and dialog box will appear as shown below.

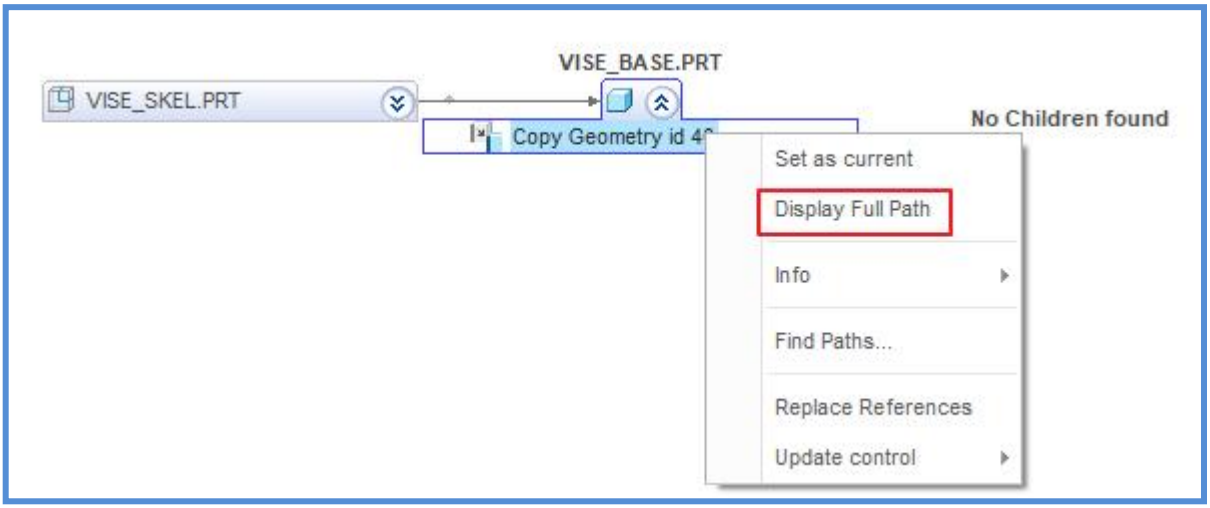


Notice that VISE.ASM is a parent of the VISE_BASE.PRT. It is so because the Copy Geometry feature copies the references from the skeleton in the context of assembly.

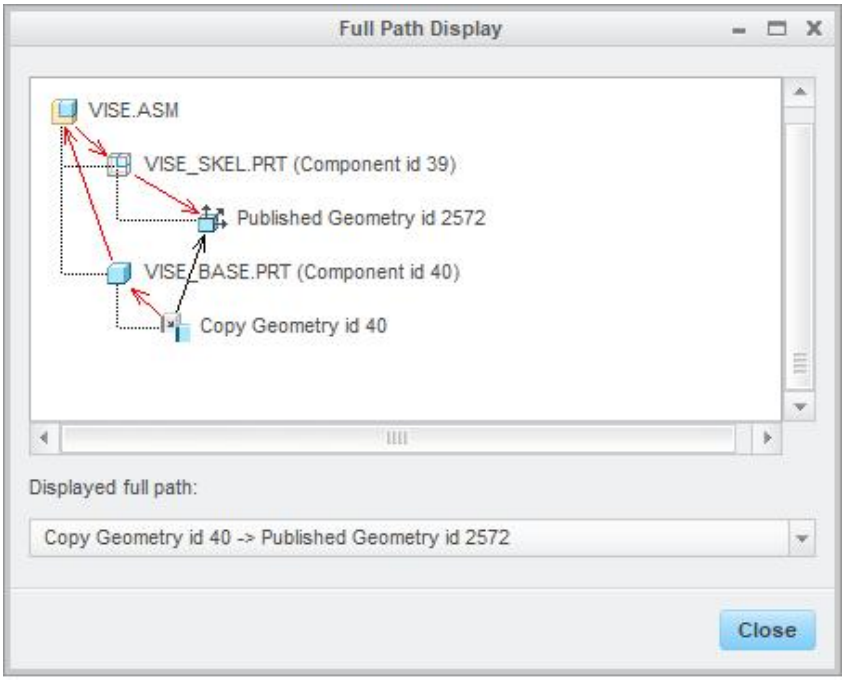
The Internal Copy Geometry feature copies geometry from model to model in the context of the assembly.

Pick **References** as reference filter and right-click the copy geometry feature.

Pick **Display Full Path** as shown below.



Full Path Display dialog box will appear as shown below.



It can be clearly seen that the copy geometry is referencing published geometry feature in the skeleton model in the context of the assembly.

Pick Close to close the Full Path Display dialog box.

Pick Close to close the Reference Viewer.

Propagating the Change

Now we will see which models should be in memory to regenerate a Copy Geometry and External Copy Geometry Feature

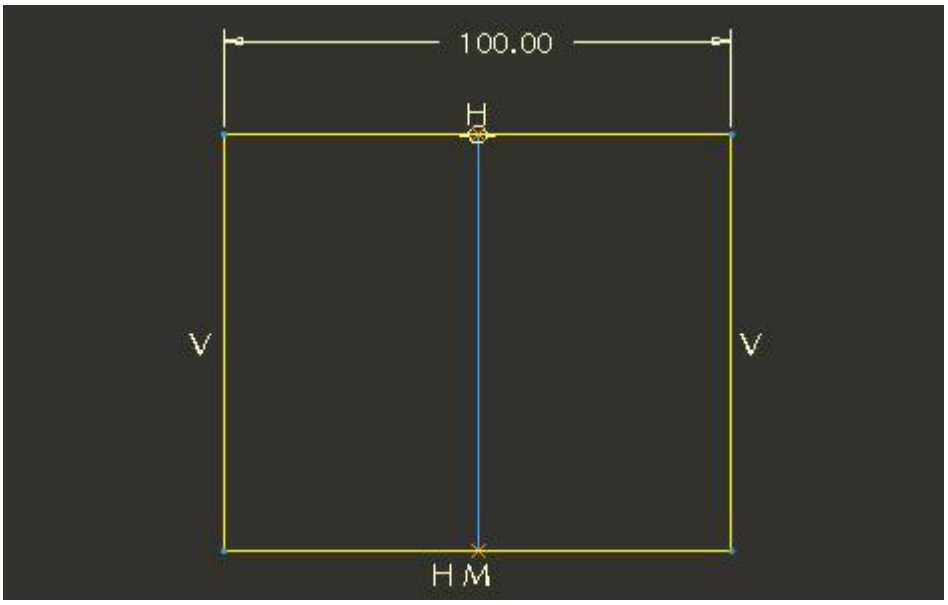
First close all the components but before make sure that you have saved the VISE_JAW.PRT

File > Manage Session > Erase Not Displayed or pick on the Home tab to erase all the objects from session.

Now open the VISE_SKEL.PRT

Select the “BOUNDARY_WIDTH” datum curve in the model tree and pick

Change the width of the section to ***100*** as shown below.



After making this change **File > Save** and then close window.

File > Manage Session >Erase Not Displayed or pick on the Home tab to erase all the objects from session.

Now open the VISE_JAW.PRT and pick to regenerate the part. But you will see the following warning message appearing in the message area.

• All the objects which were not displayed have been erased.
• Reference model VISE_SKEL for feat (id 524) in part VISE_JAW not in session.
⚠WARNING: External ref. for feature/component not found, using old placement.

It is because this part (i.e. external copy geometry feature) references the publish geometry feature in the skeleton. As the skeleton model is not in session so system cannot update the references in the external copy geometry feature (external copy geometry feature is 'frozen' in its last regenerated state). So we need the VISE_SKEL in session to successfully update and regenerate this part.

So pick  and open the VISE_SKEL.PRT

Switch to VISE_JAW.PRT window and again pick  to regenerate the part.

Notice the following text in message area.

• VISE_JAW regeneration completed successfully.

It is because system has successfully updated the external copy geometry feature and regenerated the part.

System needs only source and target part in session to regenerate the External Copy Geometry feature.

Now we will see how the Copy Geometry feature behaves.

So open the VISE_BASE.PRT and pick  to regenerate the part. But you will see the following warning message appearing in the message area.

• Parent assem VISE for feat (id 40) in part VISE_BASE not in session.
⚠WARNING: External ref. for feature/component not found, using old placement.
• Part 'VISE_BASE' not changed since last regen.

It is because this part (i.e. copy geometry feature) references the publish geometry feature in the skeleton in the context of the assembly. As the assembly is not in session so system cannot update the references in the copy geometry feature. So we need the VISE.ASM in session to successfully regenerate this part.

So pick  and open the VISE.ASM

Switch to VISE_BASE.PRT and again pick  to regenerate the part.

Notice the following text in message area.

• VISE_BASE regeneration completed successfully.

It is because system has successfully updated the copy geometry feature and regenerated the part.

System needs all the assemblies, in the path of source and target parts, in session to regenerate the Internal Copy Geometry feature.

So it is less resource demanding to update an External Copy Geometry as compared to Internal Copy Geometry feature.

Exercise 3

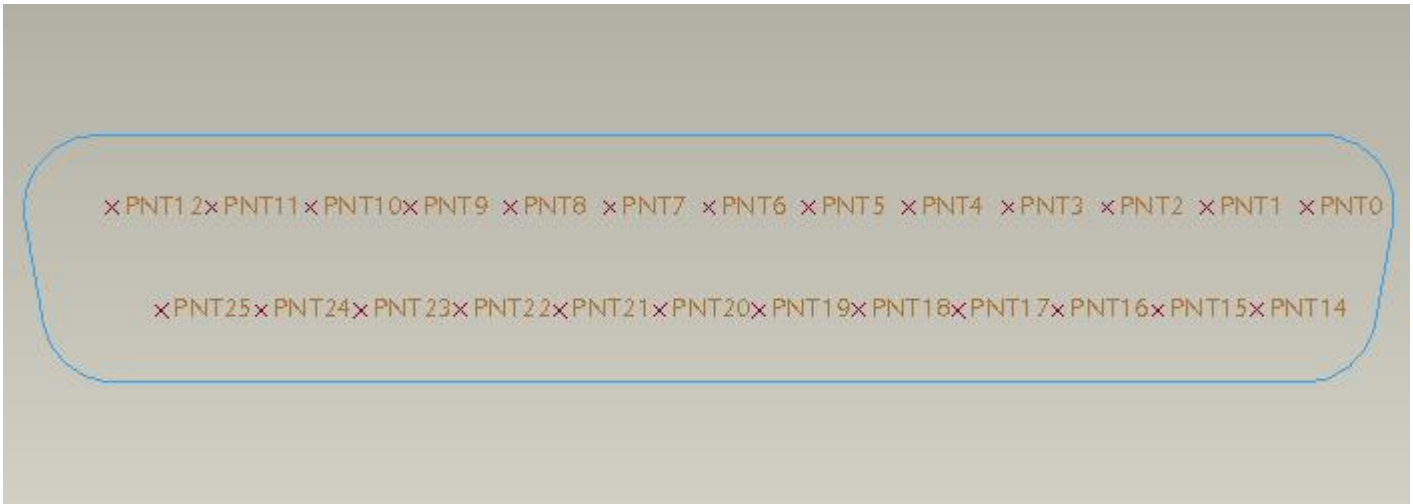
In this exercise we will learn how to create a reference pattern in a component by referencing a pattern in the skeleton model.

Set the working directory to DB25 folder and open the assembly DB25.ASM

Notice that there are two components assembled with Default constraint.

We will create pattern of holes in both of these parts. These patterns will reference the pattern in the skeleton part. We will use two different techniques with the same end results.

Open the DB25_SKEL.PRT in a new window and notice that it has a pattern of datum points as shown below.



First Technique

First we will see how to create a reference pattern by only using an External Copy Geometry feature.

Now we will create External Copy Geometry feature to copy the pattern leader of the datum points from the skeleton to the FEMALE_PLATE.PRT

Switch to the DB25.ASM window.

Pick the FEMALE_PLATE.PRT in the model tree and select **Activate**.

To create a copy geometry feature, pick Copy Geometry on the Model tab.

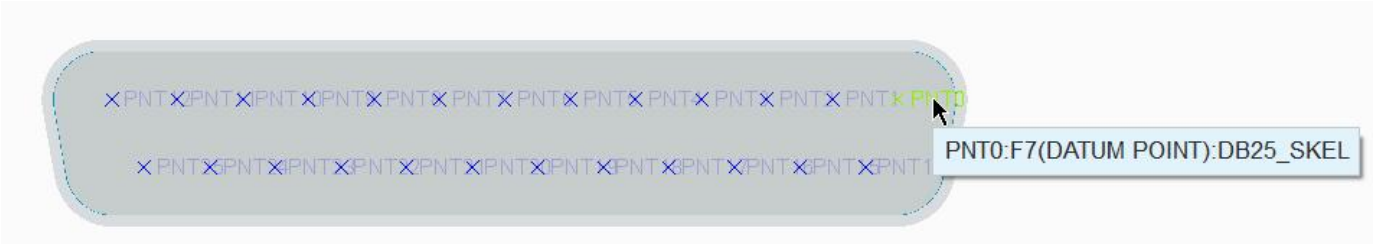
The Copy Geometry dashboard will appear.

Notice that Publish Geometry reference collector is active by default. We do not want to use the publish geometry feature, so pick in the dashboard to deactivate the publish geometry reference collector.

Now pick **References** tab to access References slide-up panel.

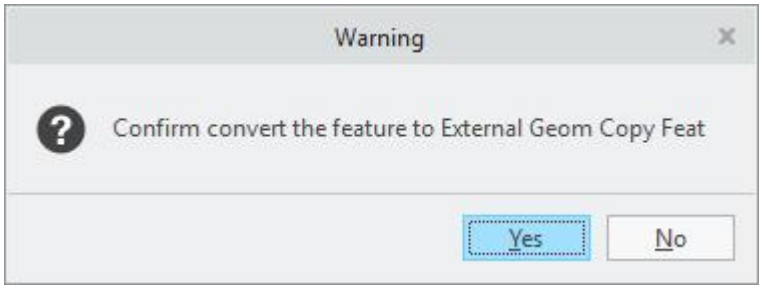
Pick in the Reference collector to activate it.

Pick the pattern leader (PNT0) in the skeleton model as shown in the following figure.

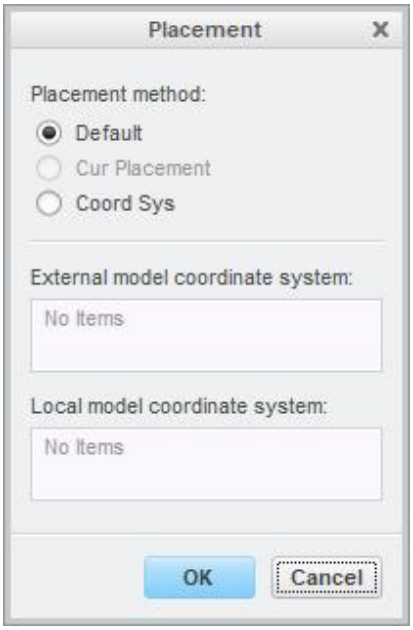


Pick  icon in the dashboard to make this feature External.

System will ask you to confirm the conversion process. So pick Yes to confirm.



Pick **Default** in the Placement dialog box.



The Default constraint aligns the default system-created coordinate systems of the target component to the default system-created coordinate system of the source part.

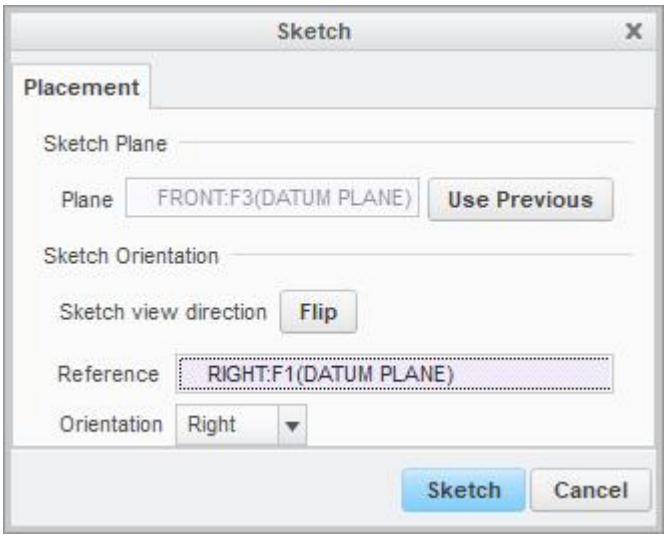
Pick OK to proceed.

Pick  to apply the changes and exit the dashboard.

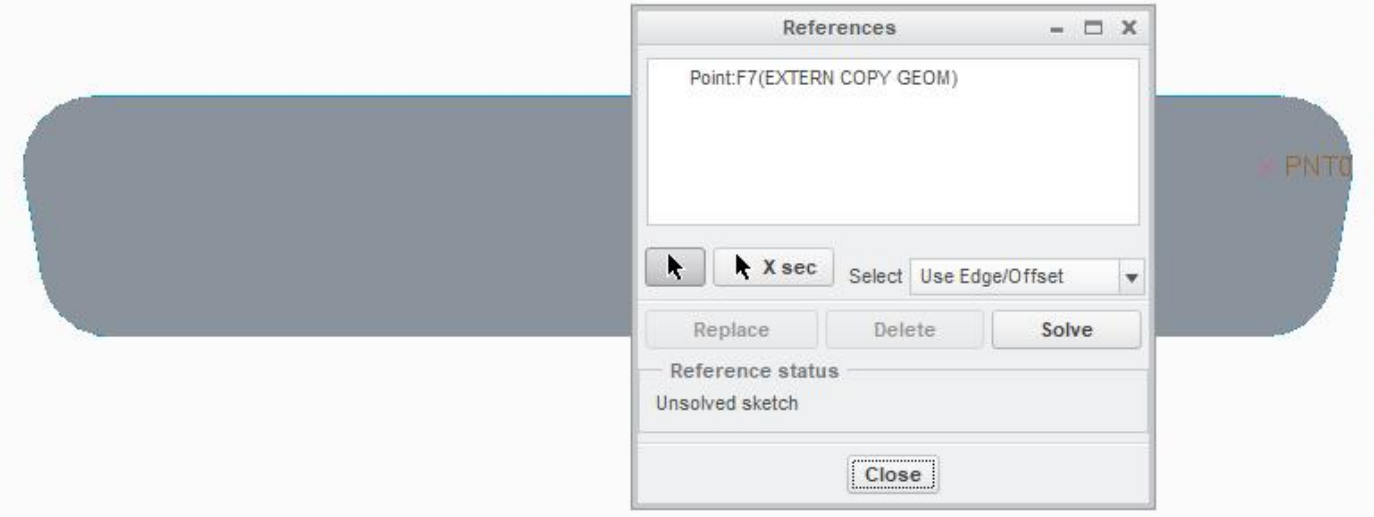
Now open the FEMALE_PLATE.PRT in a separate window.

Pick  to invoke Extrude tool.

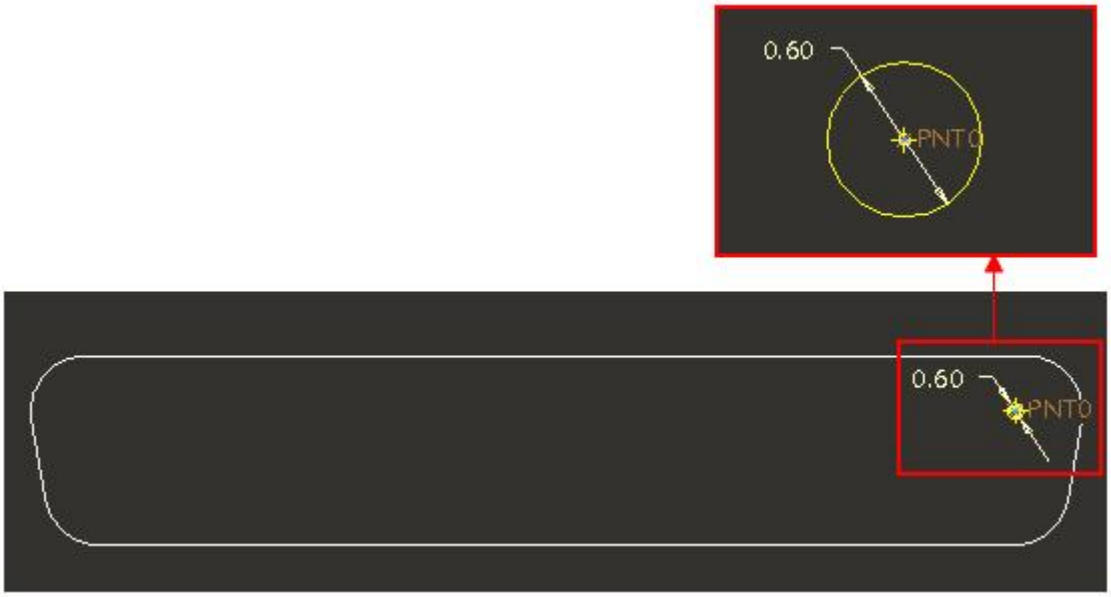
Select the sketching references as sown below.



Select the datum point, copied from the skeleton, as reference and delete all other references.



Sketch as shown below.

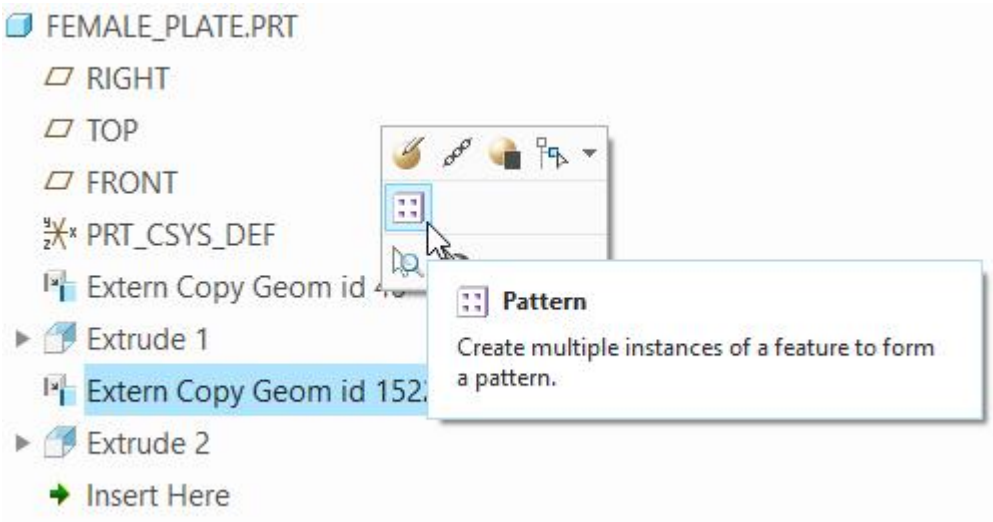


After completing the sketch pick  icon to create the feature as cut.

Specify the **Through All** depth option for both directions.

Pick  icon to complete the feature.

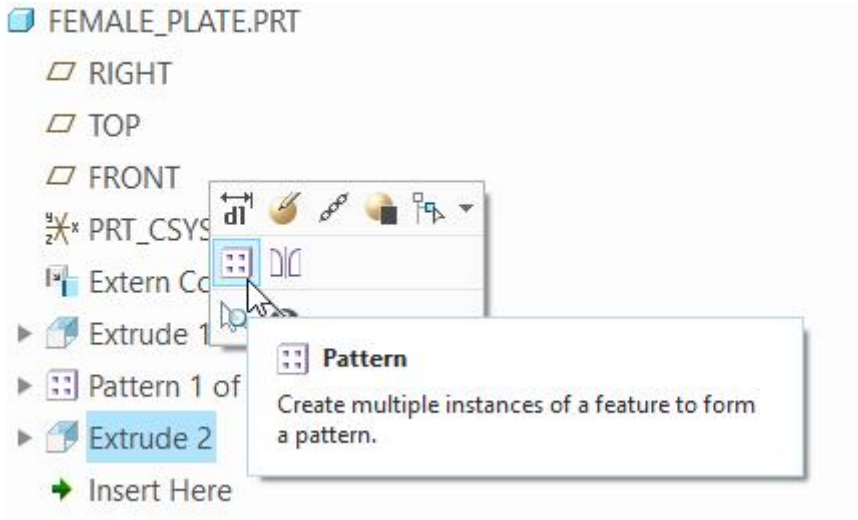
Select the newly created External Copy Geometry feature and pick **Pattern**



Notice that the pattern type is set to **Reference** by default.

Pick  to complete the feature.

Now Select the “Extrude 2” feature and pick **Pattern**



Notice that the pattern type is set to **Reference** by default.

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

Second Technique

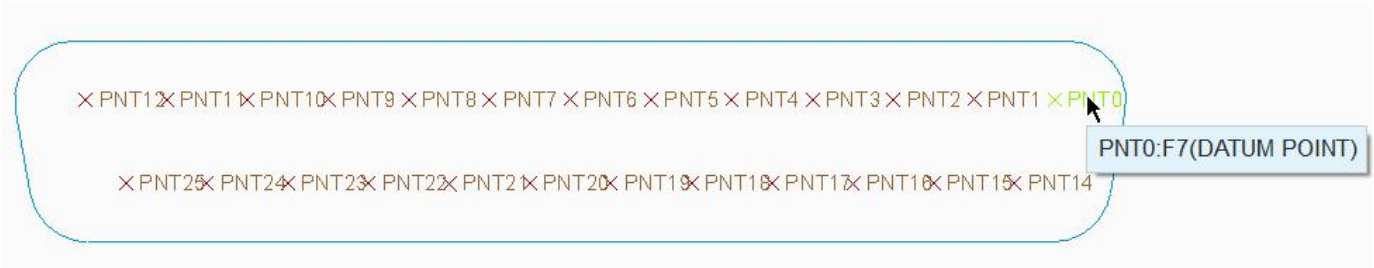
Now we will see how to create a reference pattern by using Publish Geometry and an External Copy Geometry feature.

First we will create the publish geometry feature in the skeleton. So open the skeleton in a new window.

Pick  on the Tools tab.

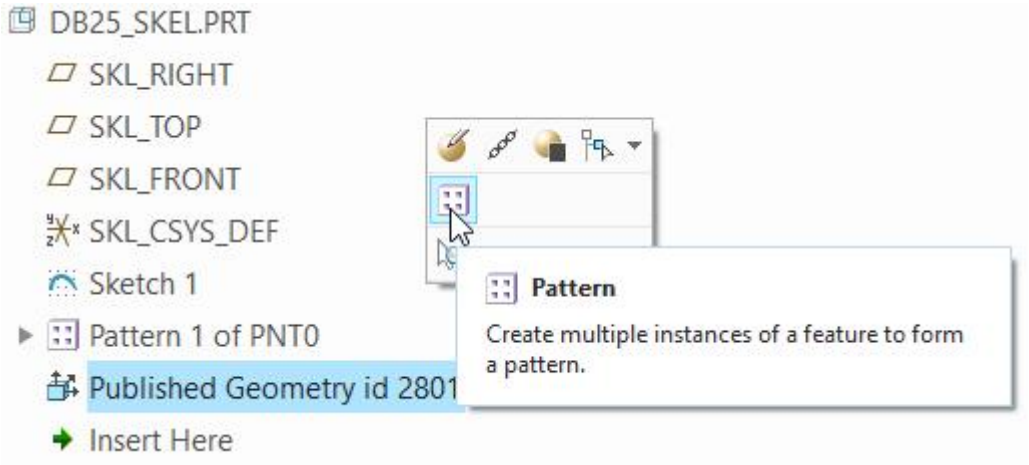
Pick in the Reference collector to activate it.

Pick the pattern leader (PNT0) as shown in the following figure.



Pick to apply the changes and exit the dialog box.

Select the newly created Publish Geometry feature and pick **Pattern**



Change the pattern type to **Reference** if not set by default.

Pick to complete the feature.

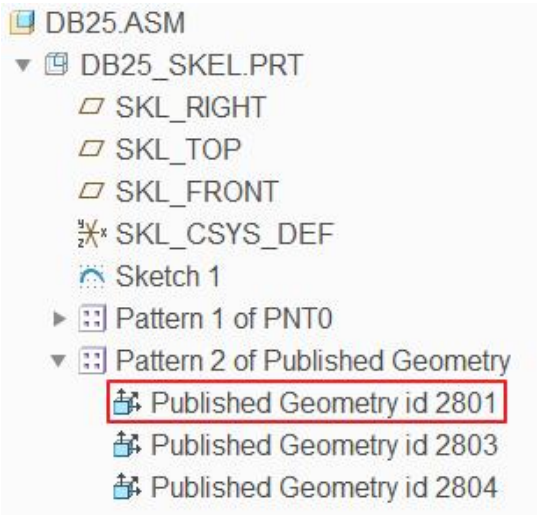
Now we will create External Copy Geometry feature to copy the pattern leader of the Publish Geometry pattern from the skeleton to the MALE_PLATE.PRT

Switch to the DB25.ASM window.

Pick the MALE_PLATE.PRT in the model tree and select **Activate**.

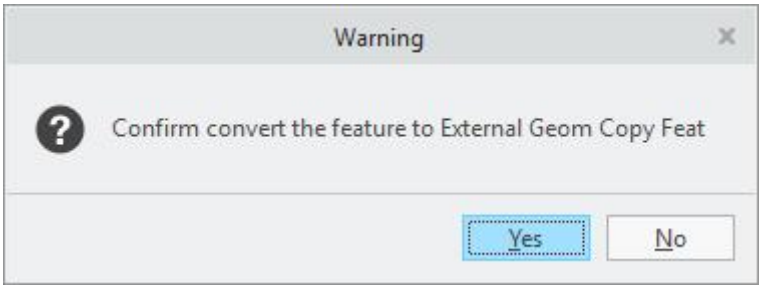
To create a copy geometry feature, pick Copy Geometry on the Model tab.

The Copy Geometry dashboard will appear. Notice that Publish Geometry reference collector is active so pick the pattern leader of PG feature in the skeleton part as shown below.



Pick  icon in the dashboard to make this feature External.

System will ask you to confirm the conversion process. So pick Yes to confirm.



Pick **Default** in the Placement dialog box.

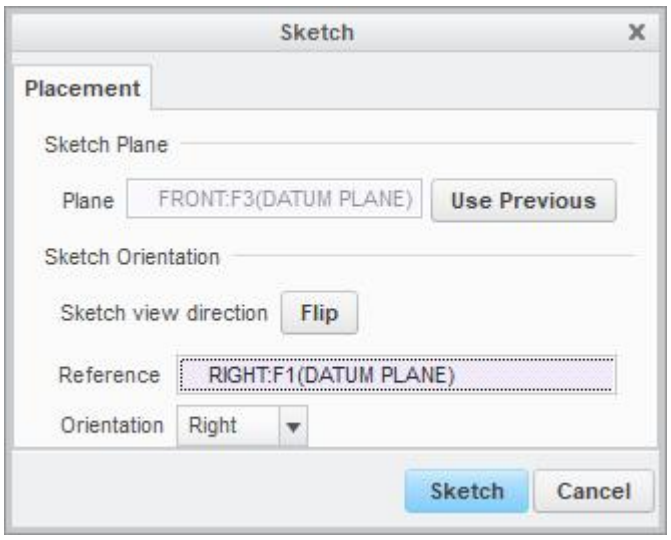
Pick OK to proceed.

Pick  to apply the changes and exit the dashboard.

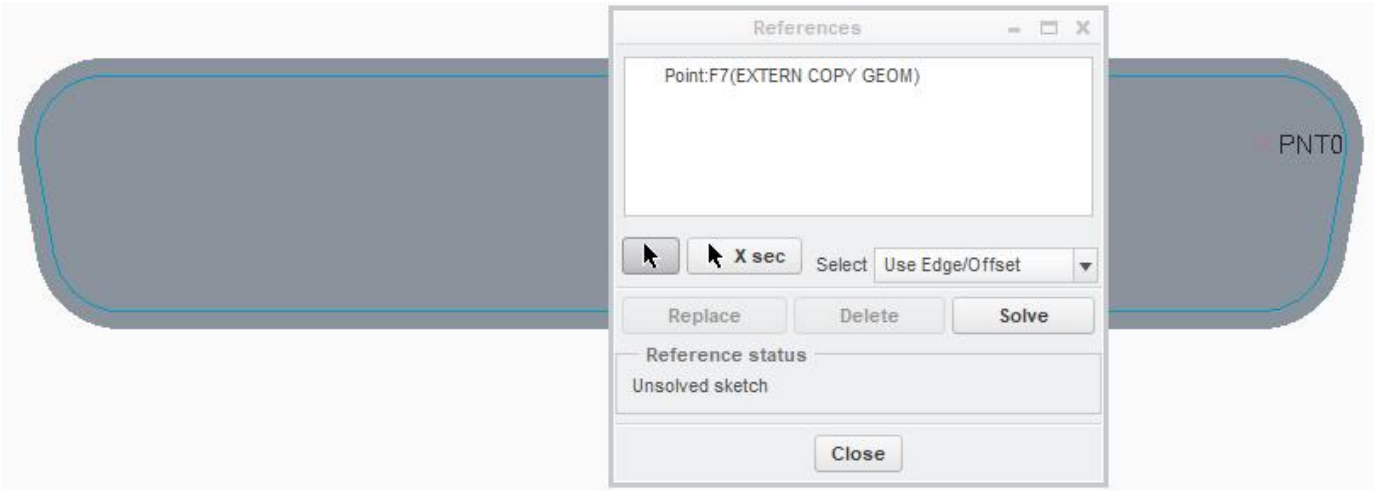
Now open the MALE_PLATE.PRT in a separate window.

Pick  to invoke Extrude tool.

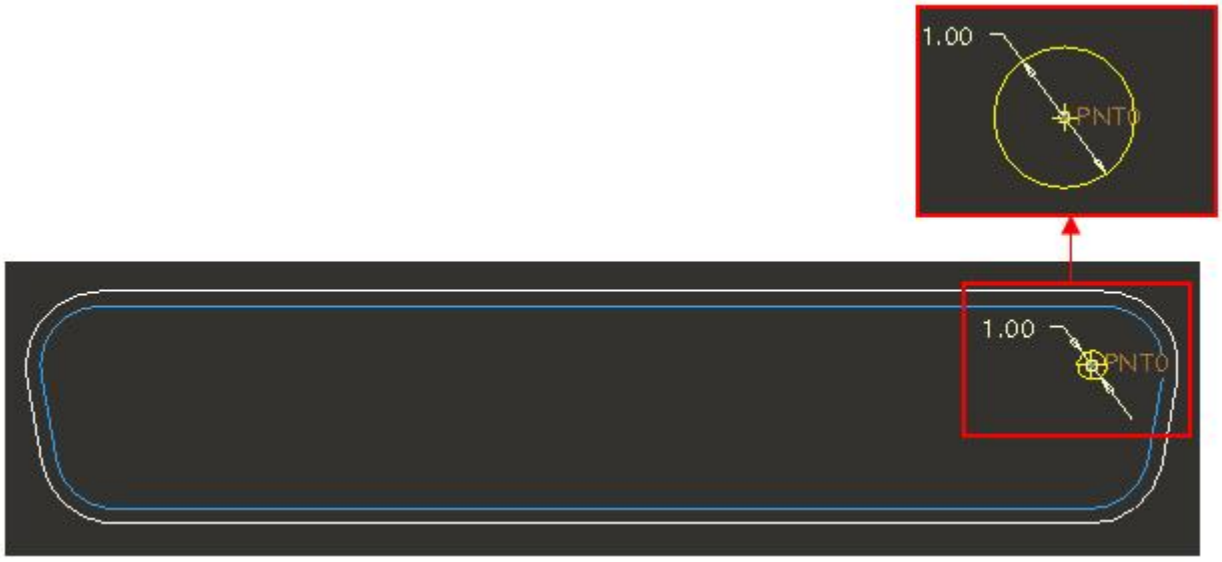
Select the sketching references as sown below.



Select the datum point, copied from the skeleton, as reference and delete all other references.



Sketch as shown below.



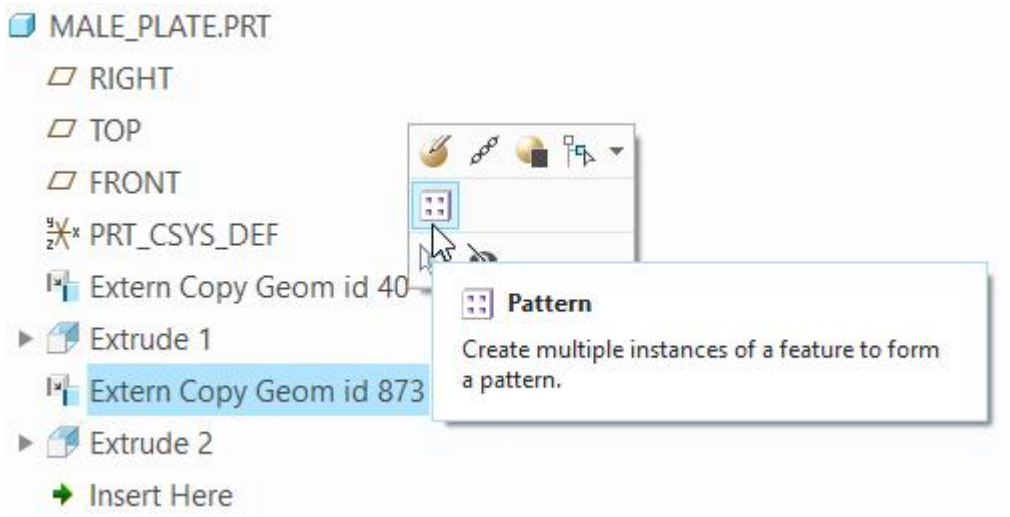
After completing the sketch pick  icon to create the feature as cut.

Specify the **Through All** depth option for both directions.

Pick the  icon to reverse the direction of feature creation.

Pick  icon to complete the feature.

Select the newly created External Copy Geometry feature and pick **Pattern**



Notice that the pattern type is set to **Reference** by default.

Pick  to complete the feature.

Now Select the “Extrude 2” feature and pick **Pattern**

Notice that the pattern type is set to **Reference** by default.

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