Mirror

Mirror tool is used to create copies of features and geometry and then mirror them about a datum plane or planar surface.

You can mirror surfaces, curves, patterns, datum features or complete geometry of a part about a mirror plane.

By default Mirror tool is inactive and becomes active when we make any valid selection (Object-Action behavior of Creo).

Exercise 1

In this exercise we will learn how to mirror a surface.

Set working directory to the BASICS folder and open the model MIRROR1.PRT
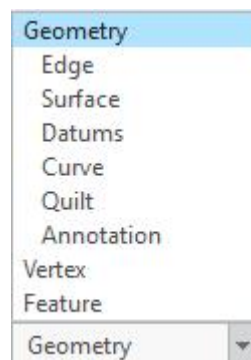
The model will appear as shown below.

We will mirror the side surface about the RIGHT datum plane so that part appears as shown below.

The surface can be mirrored either as a feature or as geometry. It depends upon what you select before invoking the Mirror tool. In this exercise we will see how to mirror the surface as geometry and not the feature.
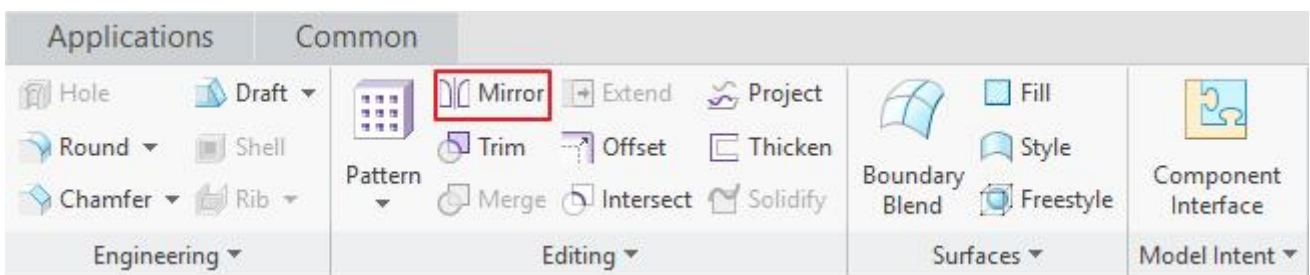
First make sure that Geometry filter is selected. (This is selected by default)
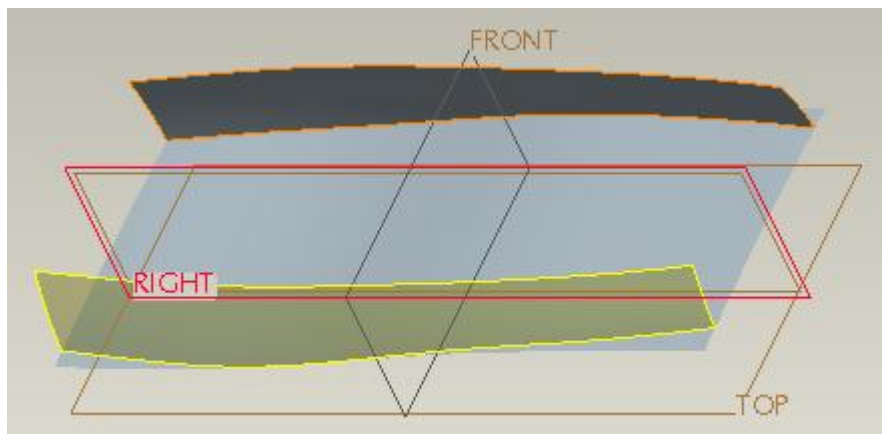
Then pick on the side surface. The system will select the surface feature.
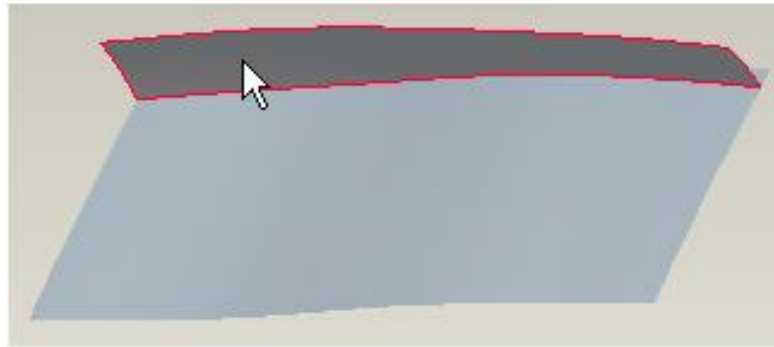
While the surface geometry is selected, pick the Mirror Tool icon ⬙⬙ Mirror to invoke Mirror tool.

Pick the **RIGHT** datum as Mirror plane. The preview will appear as shown below.

Pick ✔ to complete the feature.

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

Move

Move tool is used to create copies of features and geometry by

1. Translating in a direction specified by a reference.
2. Rotating about a reference.
3. Applying multiple translation and rotation transformations in a single move feature

You can move features, surfaces, quilts, datum curves, patterns and datum features with the Move tool.

The Move tool is only accessed through the **Copy** ( ) and **Paste Special** ( ) functions.
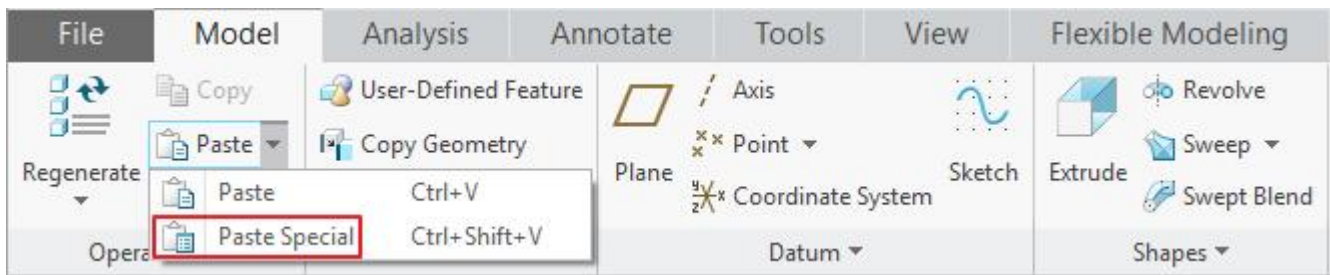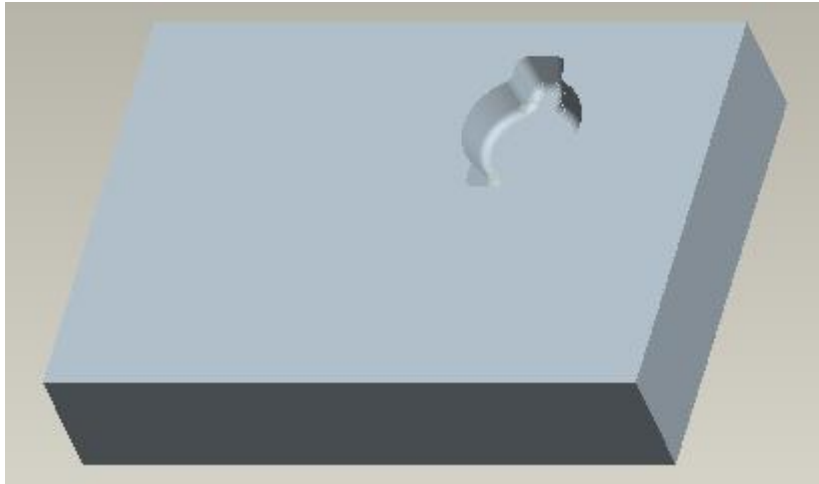

The Copy icon becomes active when we make any valid selection and Paste Special icon becomes active when we copy some object.

Exercise 1

In this exercise we will learn to translate copied surfaces.

Set working directory to the BASICS folder and open the model MOVE1.PRT

The part will appear as shown below.

We will copy the inside surfaces of cavity shown in the above figure and then move the copied surface.

The surfaces that we want to select for copy surface feature are shown highlighted in the figure below.
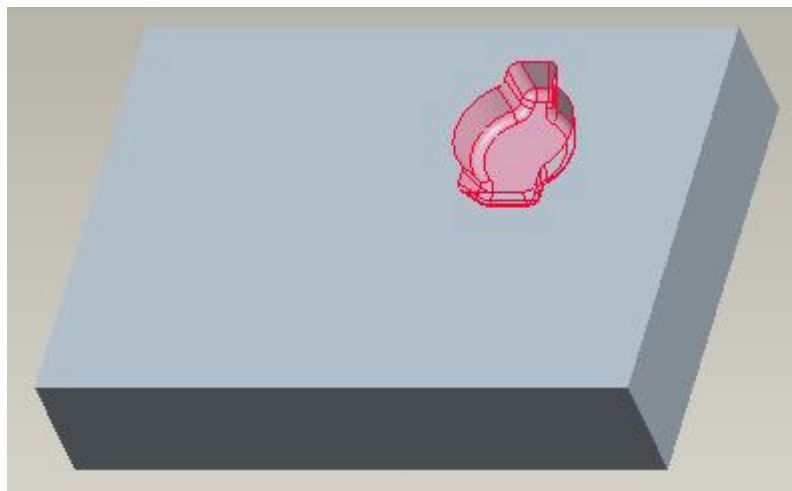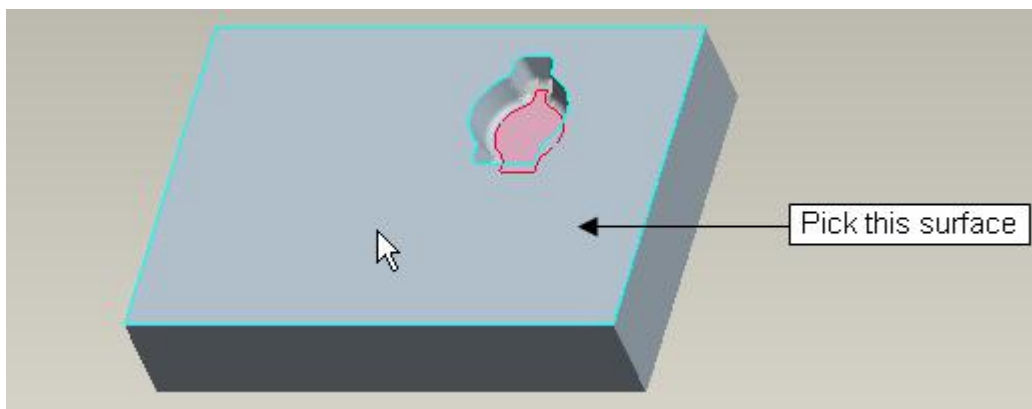

Picking these surfaces individually is time consuming, so we will use the Seed and Boundary selection technique to select the surfaces.
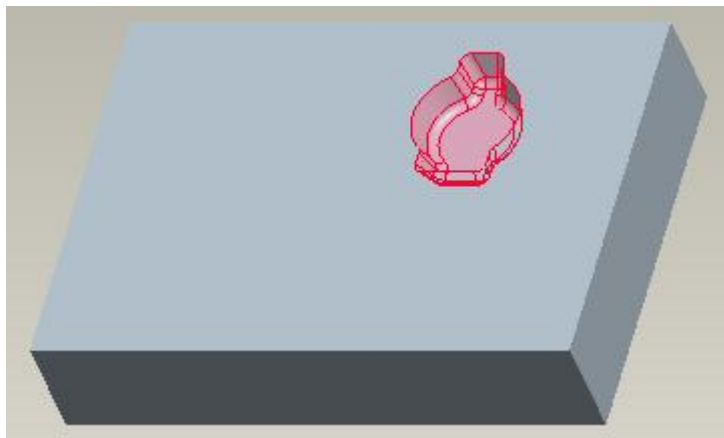
Pick on any surface inside the cavity. (This surface will be referred as Seed surface.)
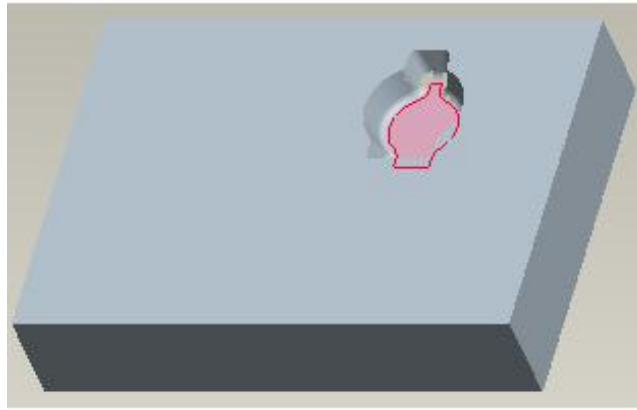
Now hold down the Shift key and select the following surface. (This surface will be referred as Boundary surface.)

Pick this surface

When you will leave the Shift key, the system will automatically select all the surfaces that form the cavity as shown below.

The system includes the Seed surface and all its neighboring surfaces until the Bounding surfaces. The bounding surface acts as the limiting object. This technique is called Seed and Boundary selection method.
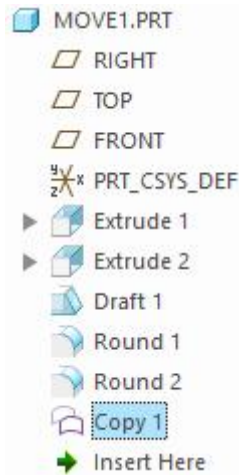
Pick copy icon ( ) on the Model tab or press Ctrl+C on the keyboard.

Pick paste icon ( ) on the Model tab or press Ctrl+V on the keyboard.

Pick ✅ icon to complete the feature.

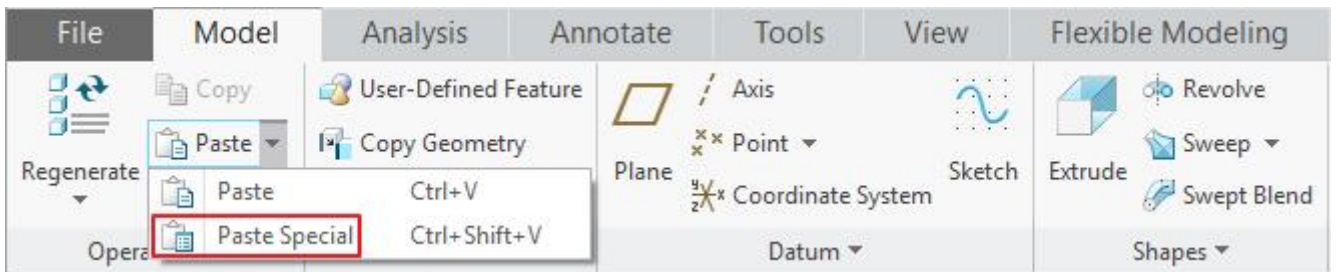Copy Surface feature will appear as "Copy 1" in the model tree.

Now select the **Copy 1** feature in the model tree.

Alternatively you may pick the copy surface feature in the graphics window to select it.

While the feature is selected, pick copy icon (▤) on the Model tab or press Ctrl+C on keyboard.
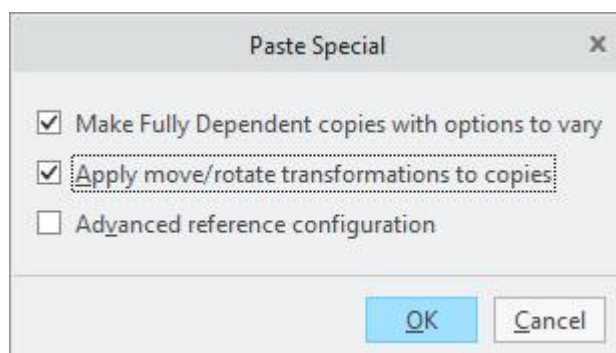
Pick paste special icon (▤) on the Model tab

The Paste Special dialog box will appear. Here check the following two options

1. Make Fully Dependent copies with options to vary
2. Apply Move/Rotate transformation to copies

In the dialog box, check the first two options as shown below.

When "Make Fully Dependent copies with options to vary" is checked then the copies of the original feature are fully dependent on all attributes, elements, and parameters of the original feature. The changes in the original features are associatively reflected in the copied instances.

When "Apply Move/Rotate transformations to copies" is checked the system shows the Move Dashboard to apply Move or Rotate transformation to the copied item.
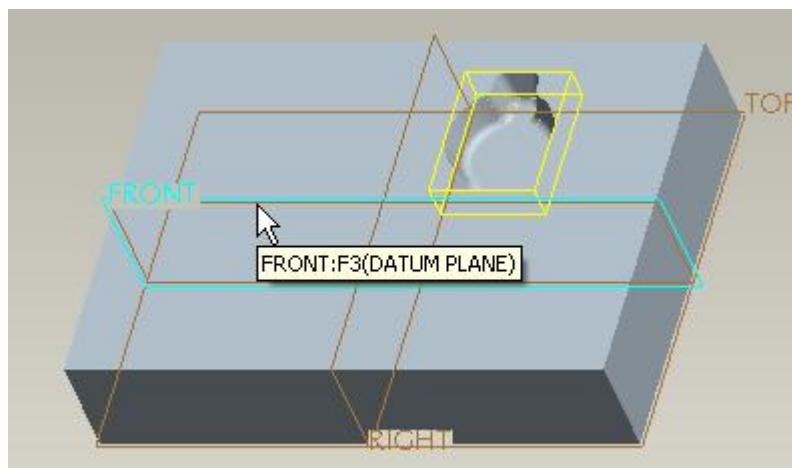
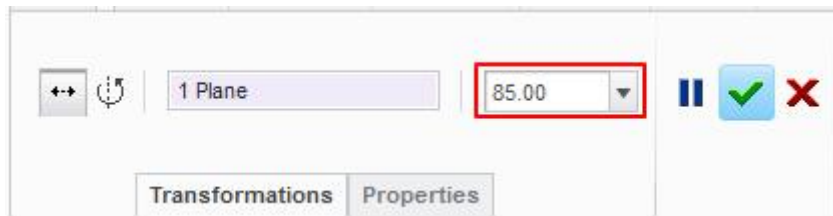Pick OK and the Move dashboard will appear as shown below.

Notice that Translate Mode is active by default.

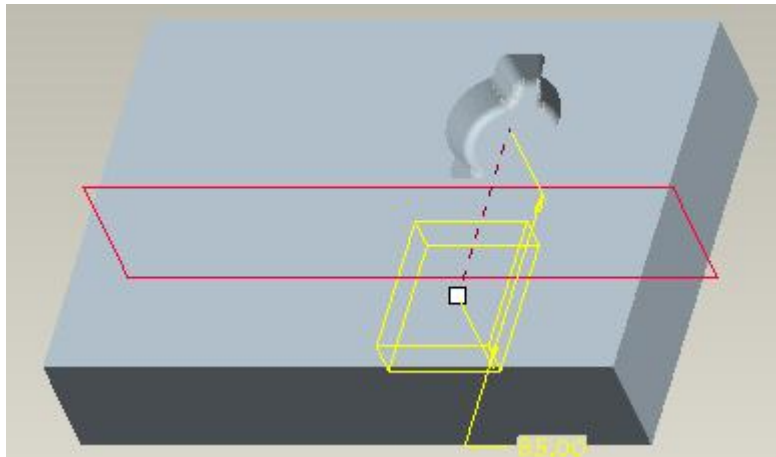In Translate Mode you can move an item along a reference.

As Direction Reference collector is active so select the **FRONT** as Direction Reference.
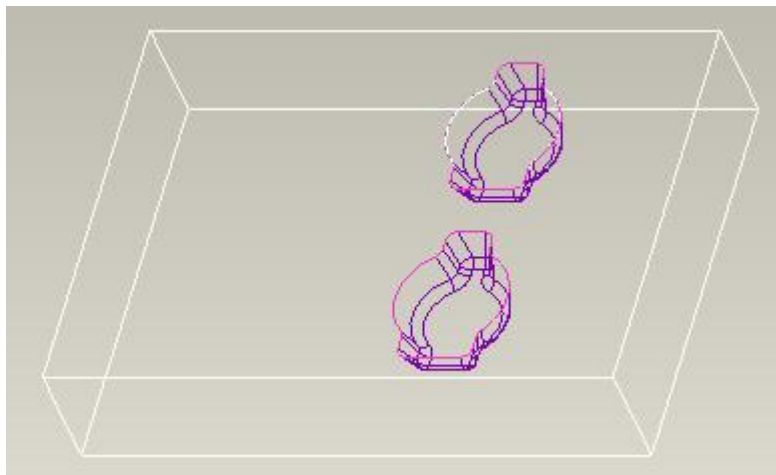

Enter *85* as the translation value and hit Enter key.

The preview will appear with a bounding box representing the new copied feature, as shown below

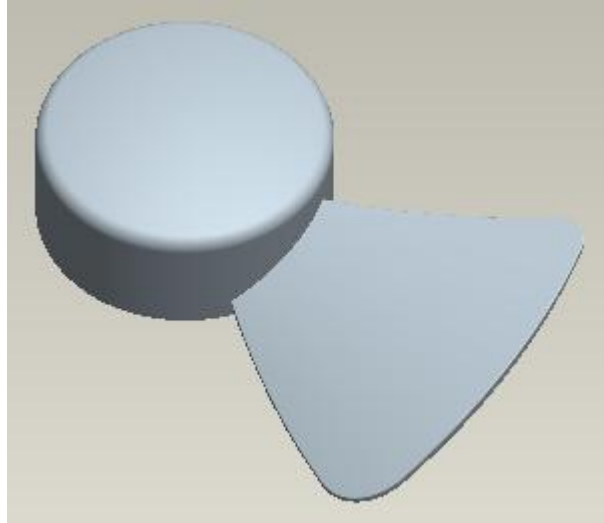Pick icon to complete the feature. The part will appear as shown below.

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

Exercise 2

In this exercise we will learn to rotate a copied surface feature.
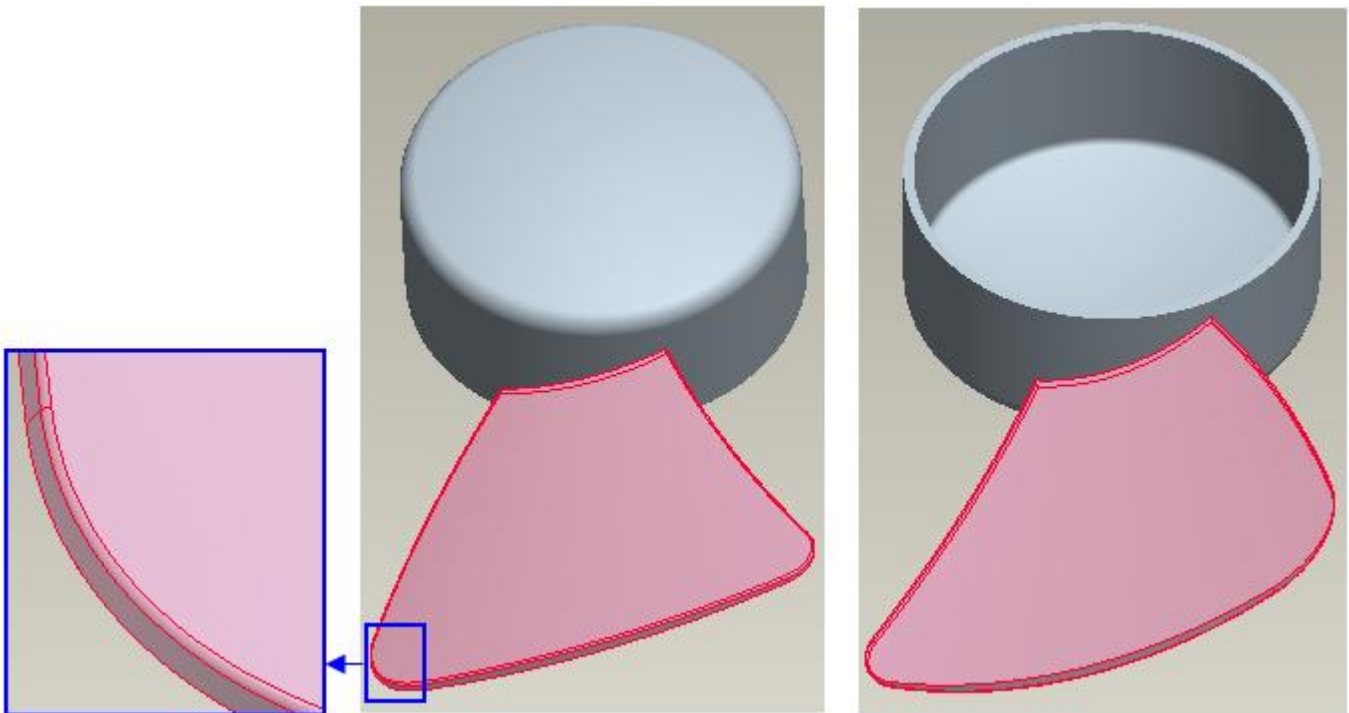
Set working directory to the BASICS folder and open the model REVOLVE1.PRT

The part will appear as shown below.

We will copy the surfaces that form the blade of the rotor and then rotate the copied surface.

The surfaces we want to select for copy surface feature are shown highlighted in the figure below
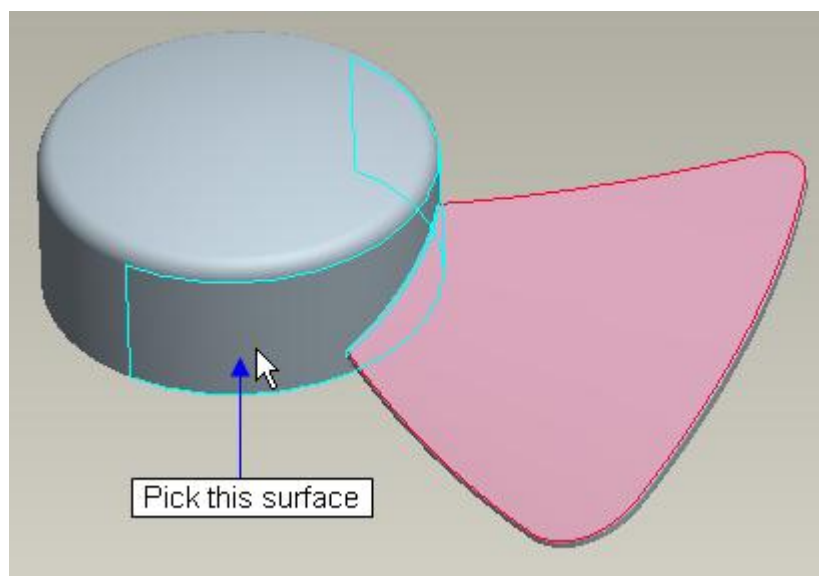

Picking these surfaces individually is time consuming, so we will use the Seed and Boundary selection technique to select the surfaces.
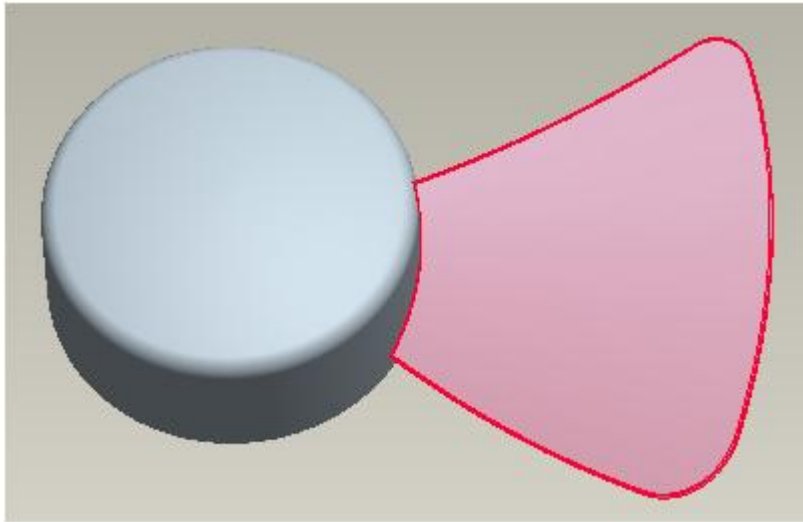
Pick on any surface that forms the blade. (This surface will be referred as Seed surface.)
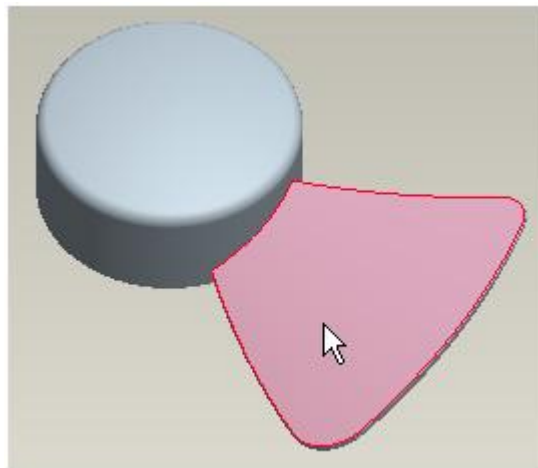
Now hold down the Shift key and select the following surface. (This surface will be referred as Boundary surface.)

Pick this surface

When you will leave the Shift key, the system will automatically select all the surfaces that form the blade as shown below.

The system includes the Seed surface and all its neighboring surfaces until the Bounding surfaces. The bounding surface acts as the limiting object. This technique is called Seed and Boundary selection method.
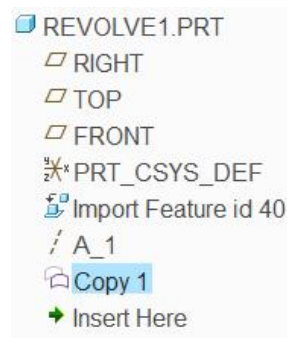
Pick copy icon ( ) on the Model tab or press Ctrl+C on the keyboard.

Pick paste icon ( ) on the Model tab or press Ctrl+V on the keyboard.

Pick icon to complete the feature.

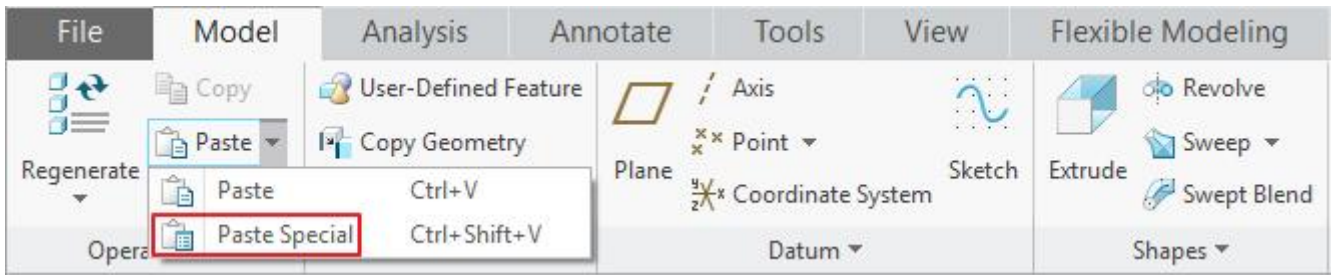Copy Surface feature will appear as "Copy 1" in the model tree.

So select the **Copy 1** feature in the model tree.

Alternatively you may pick the copy surface feature in the graphics window to select it.

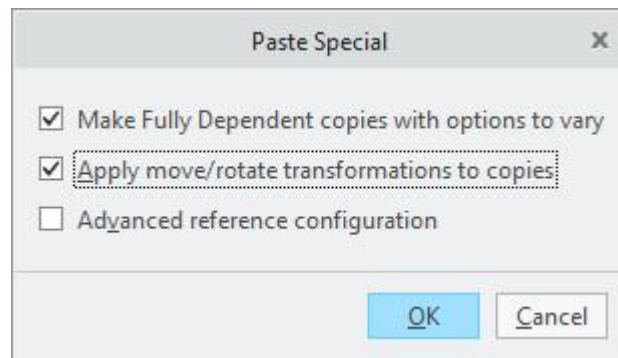While the feature is selected, pick copy icon ( ) on the Model tab or press Ctrl+C on the keyboard.

Pick Paste Special icon ( ) on the Model tab

The Paste Special dialog box will appear. Here check the following two options

1. Make Fully Dependent copies with options to vary
2. Apply Move/Rotate transformation to copies

In the dialog box, check the first two options as shown below.

When "Make Fully Dependent copies with options to vary" is checked then the copies of the original feature are fully dependent on all attributes, elements, and parameters of the original feature. The changes in the original features are associatively reflected in the copied instances.

When "Apply Move/Rotate transformations to copies" is checked the system shows the Move Dashboard to apply Move or Rotate transformation to the copied item.

Pick   OK   and the Move dashboard will appear.

Notice that Translate Mode is active by default. So pick 🔄 icon on the dashboard to switch to Rotate Mode.

In Rotate Mode you can rotate an item about an existing axis, linear edge, curve, or about one of the axes of the coordinate system.
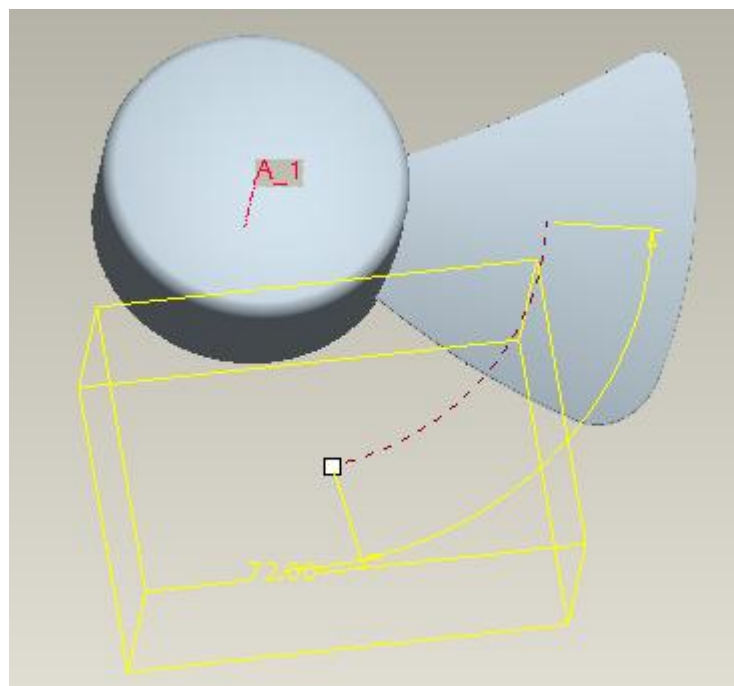
As Direction Reference collector is active so select the axis **A_1** as Direction Reference.
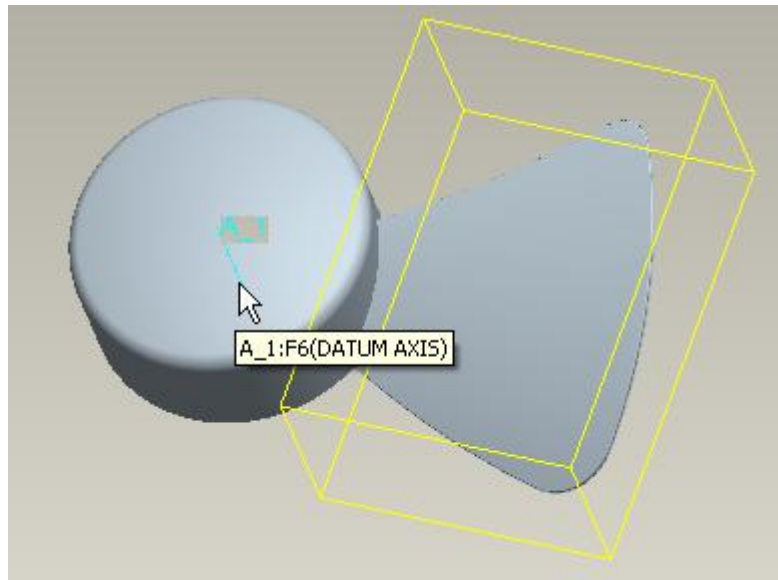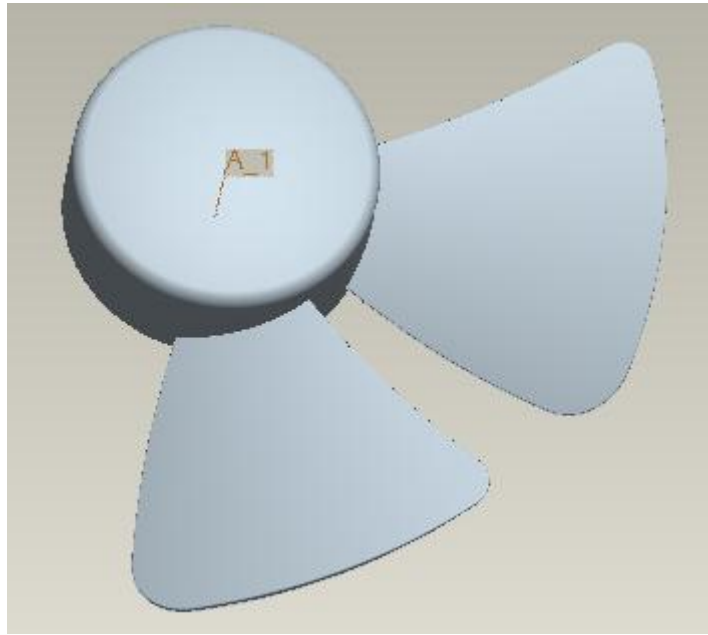
Enter **72** as the Rotation Angle and hit Enter key.

The preview will appear with a bounding box representing the new copied feature, as shown below

Pick ![check icon] icon to complete the feature. The part will appear as shown below.

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

Merge

Merge tool is used to unite two or more quilts together. Merge feature combines the individual quilts into one continuous quilt. There are two methods used to merge quilts.

1. Join
2. Intersect

Join

Join is used to merge quilts together when the edges of one quilt lie on the surfaces of the other quilt. In the figure below two quilts are shown before the merge operation. After the merge operation is performed two quilts are merged or joined into a single quilt. You can notice that edge of one quilt lie on the edge of second quilt.
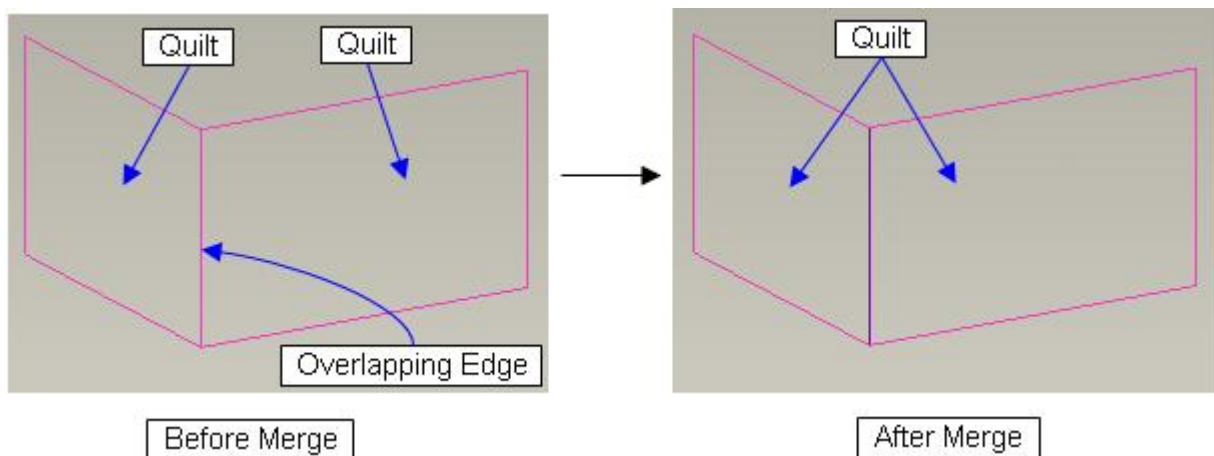

Figure 1: Merge Operation with Join Option

Intersect

Intersect is used to merge the quilts together when the quilts intersect each other. In the figure below two intersecting quilts are shown before the merge operation. After the merge operation is performed two quilts are merged or joined into a single quilt.
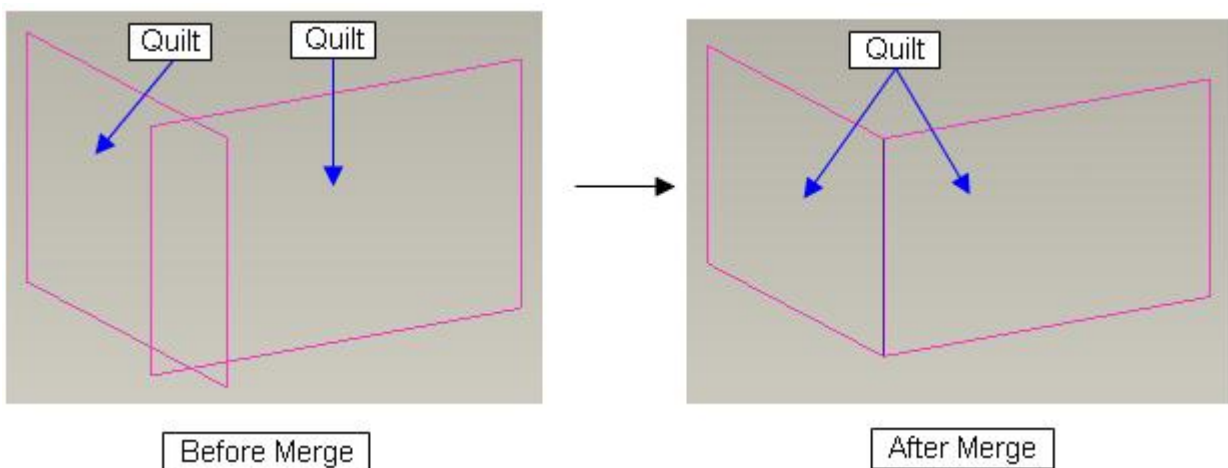

Figure 2: Merge Operation with Intersect Option

It is important to remember that if the "merge feature" is deleted, the original quilts remain.

To get the information about quilts visually it is important to view the model in Wireframe mode. In wireframe mode, colors of edges have a significant importance. Color of a surface edge gives the information if it is a one sided edge or two sided edge. The pink edges in Figure 3 is a one-sided and magenta edge is a two-sided edge. Figure 3 explains this.
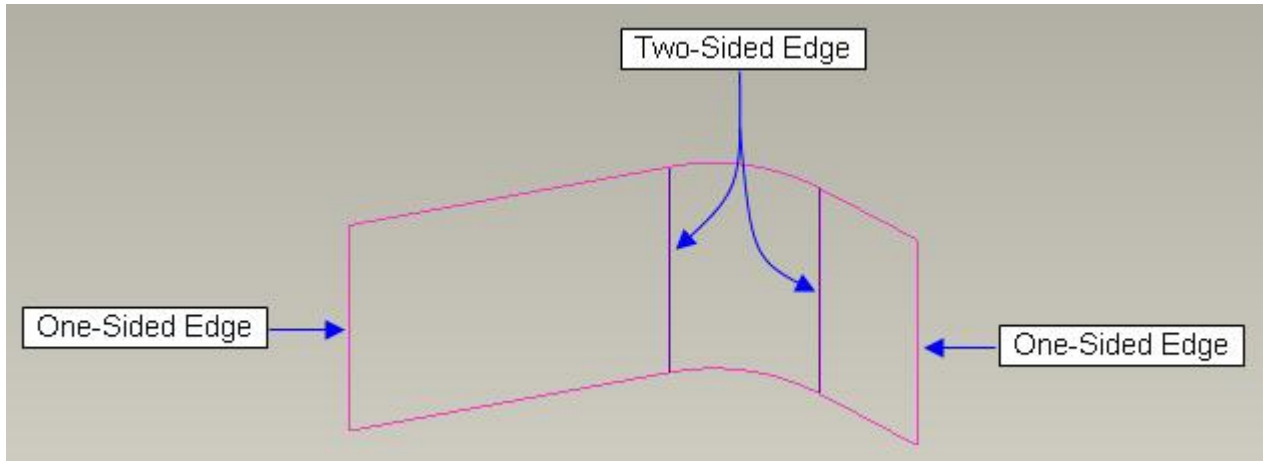

Figure 3: A quilt consisting of three surface patch

A two sided edge means the continuity of a quilt while a one sided edge means the border of quilt. So magenta color or two-sided edge means that the adjacent surface patches belong to same quilt. Therefore the color of an edge helps to identify what surface patches are included in a quilt. For example in the Figure 3, there are three surface patches belonging to a single quilt.

Now if you look in the Figure 4, you can notice that there is a pink edge between the first and second surface patch (counting from right). This means that these patches do not belong to a single quilt. So there are two quilts in the Figure 4, left quilt consists of three patches and right quilt consists of only one patch.
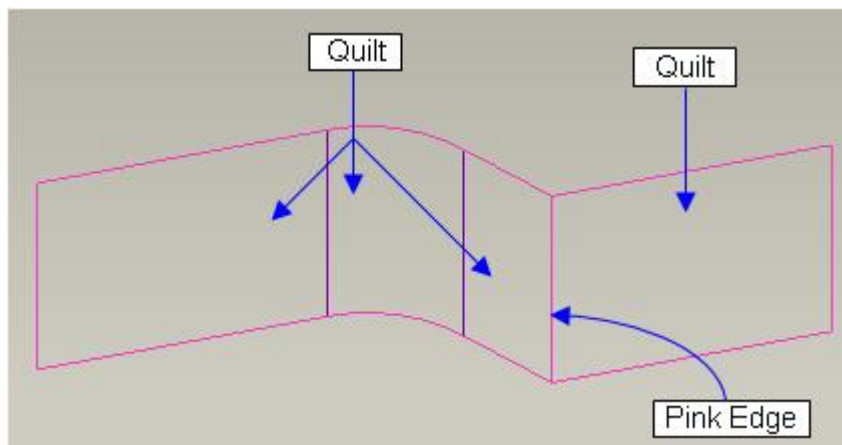

Figure 4: A model consisting of two quilts

If we want to create a single quilt out of two quilts shown in Figure 4, then we need to perform a Surface Merge operation. The merge operation will combine both quilts into a single quilt and the edge between the quilts will appear in magenta color as shown in Figure 5.
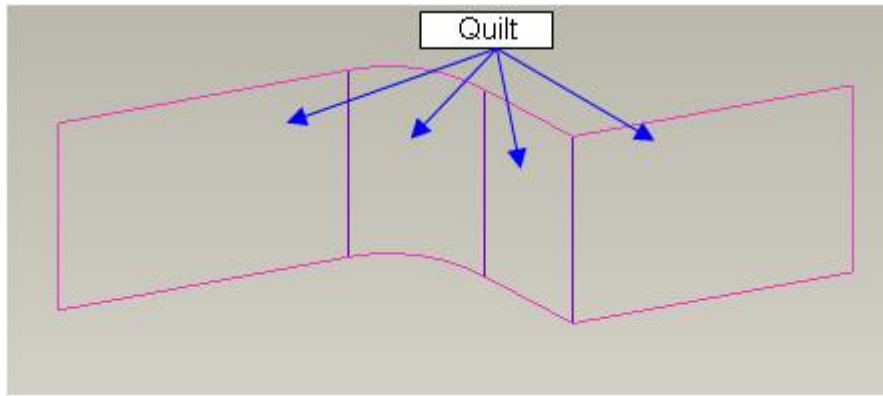
Figure 5: Single quilt created by merge operation

You should remember that in shade mode it cannot be judged if it is a single quilt or not. Look at the figure below and you will notice this.
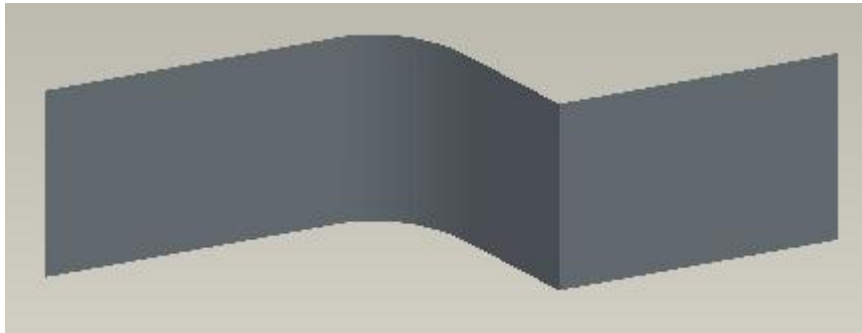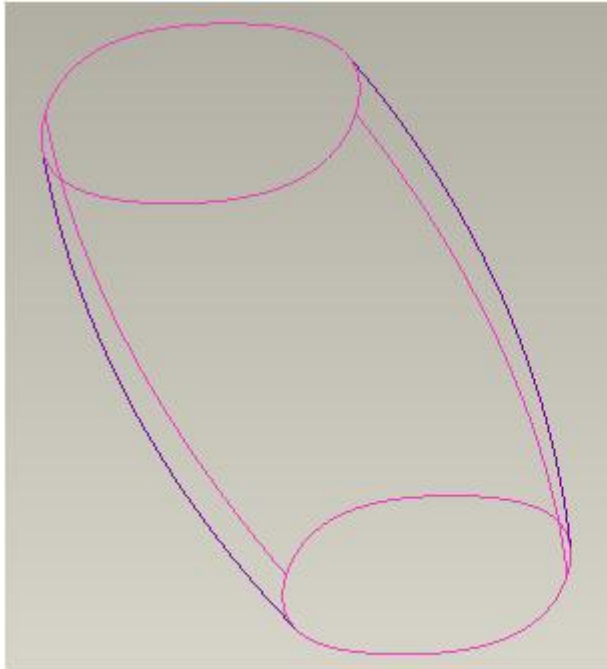

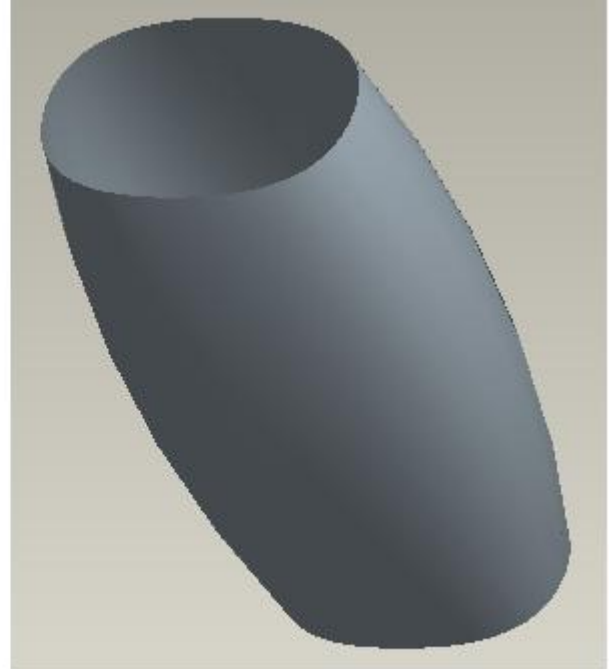Figure 6: Quilt shown in shade mode

Exercise 1

In this exercise we will learn how to merge surfaces.

Set working directory to the BASICS folder and open the model MERGE1.PRT

The model will appear as shown below.

Model in Wireframe mode   Model in Shading mode

In Shade mode it seems as model consists of one quilt but if you look at the model in Wireframe mode, you will notice that the model consists of two quilts. So we will use the merge tool to join the two quilts into a single quilt.

To merge the two quilts first we need to select them and Merge icon will become active.

Merge tool only becomes active if appropriate reference are selected.

To select a quilt, we can use either the Geometry filter or the Quilt filter. We will use the Geometry filter which is active by default.
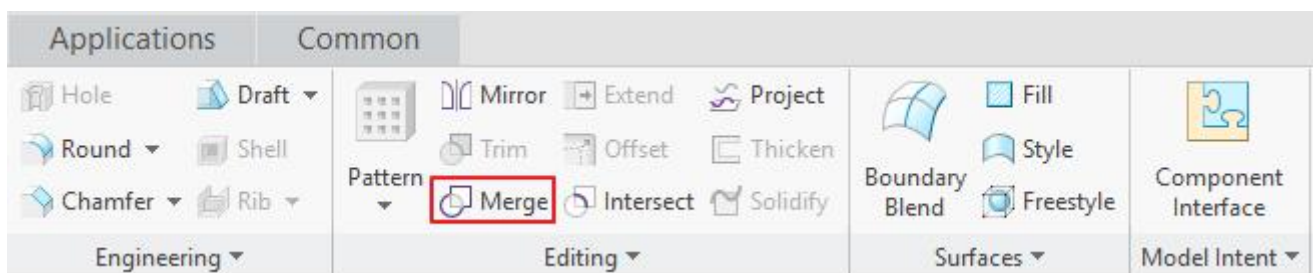
Right-click over the quilt until "Quilt" tooltip appears and then pick with left mouse pick.
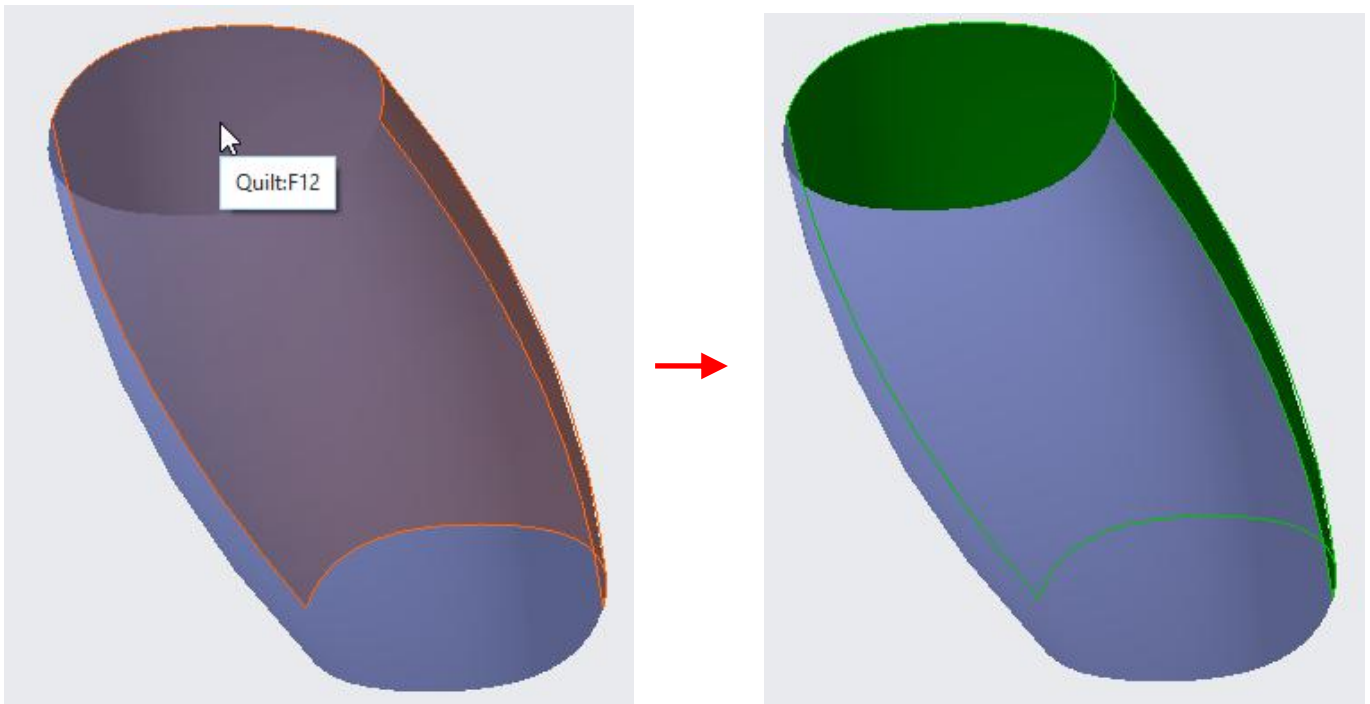
Now hold down the Ctrl key and pick the second quilt.
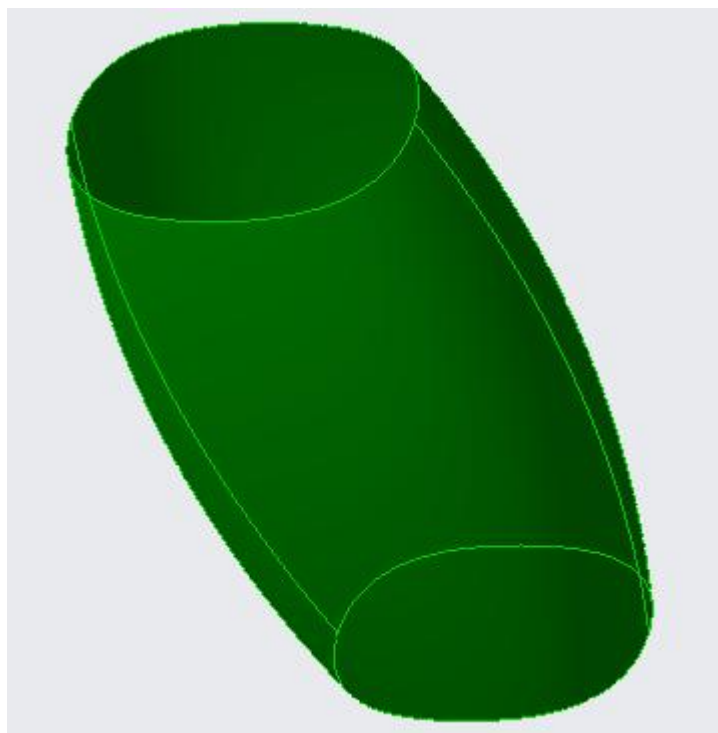

Pick Merge icon ( ) on the Model tab as shown below.

Keep in mind that Merge icon will become active only after picking the appropriate references.

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

Join option is used when two surfaces have a common edge. Join option is faster than Intersect option.

Pick ✔ or middle-click to complete the merge feature. The part will appear as shown below.
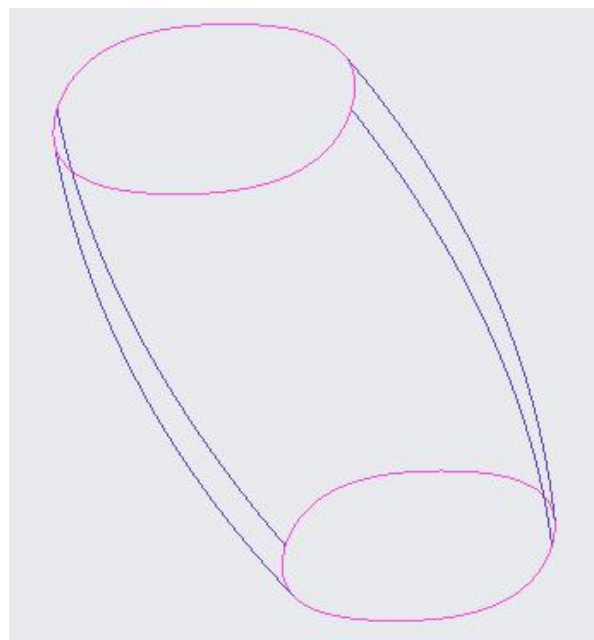
Notice that the joint between both quilts appears magenta which means that both surfaces have been merged into single quilt.

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

To select a quilt for merge operation, both Geometry and Quilt filters can be used. If Geometry filter is used, then right-click over the quilt until "Quilt" tooltip appears. If Quilt filter is used, a quilt can be selected directly.

Exercise 2

In this exercise we will learn how to merge two quilts.

Set working directory to the BASICS folder and open the model MERGE2.PRT

The model will appear as shown below.
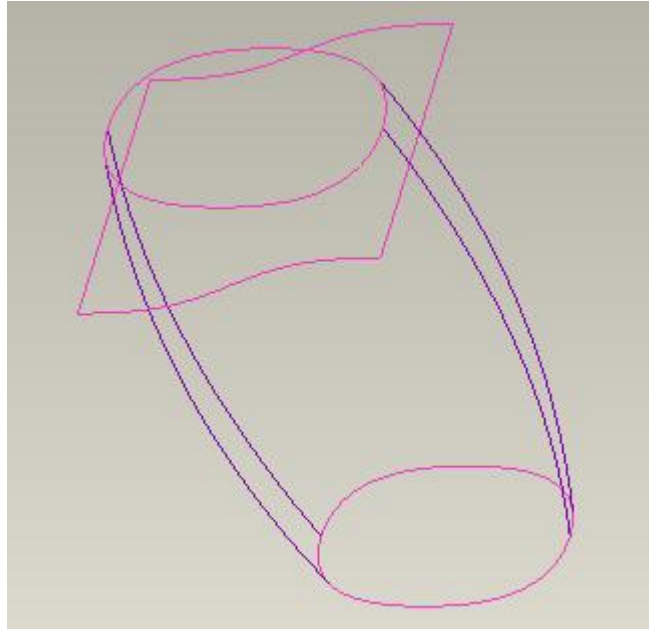
To merge the two quilts first we need to select them and Merge icon will become active only after picking the appropriate references.

In this exercise we will use region selection technique. So click an empty area in the graphics window and drag the pointer over the both quilts to select them.
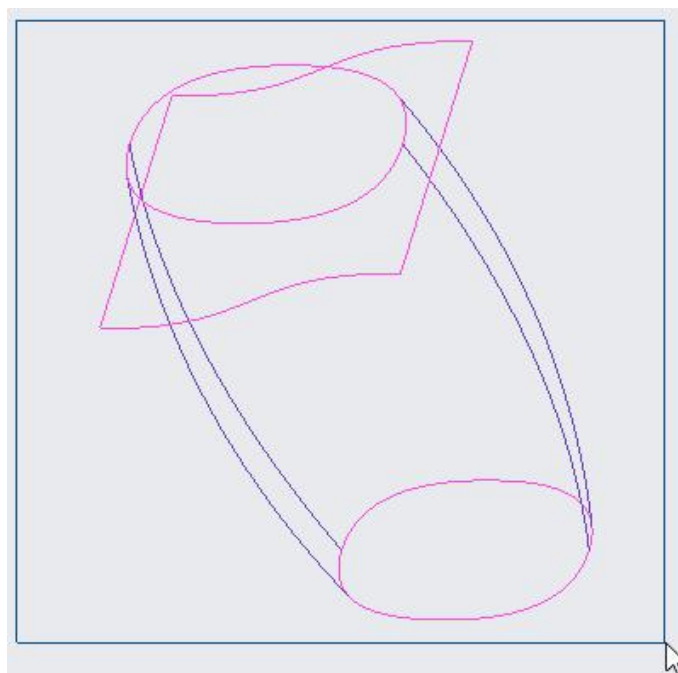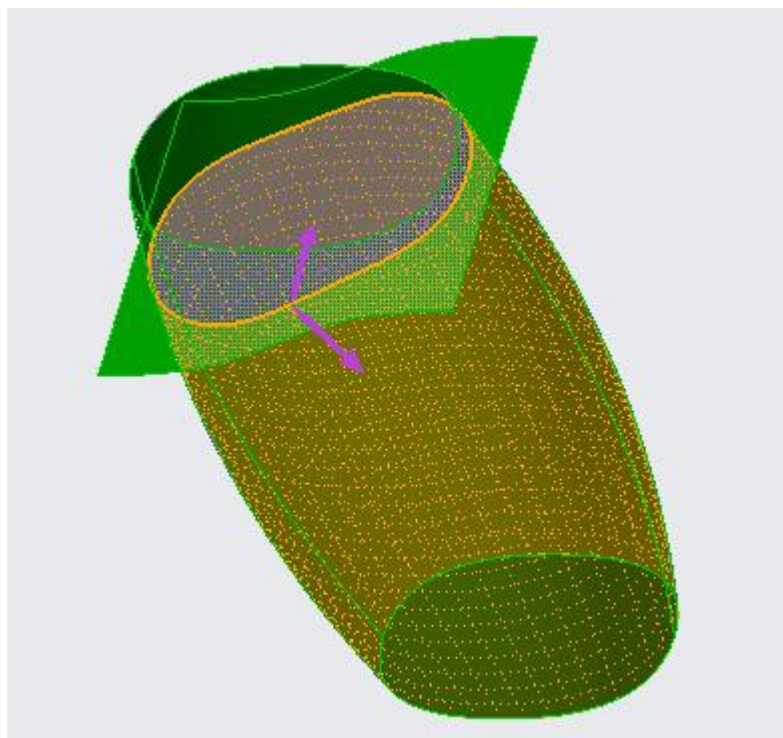

When using the region selection technique, the required quilts must be completely inside the region to be selected. Also make sure that datum feature are not shown on screen.

Both quilts will be selected as shown below.

Pick Merge icon ( ) on the Model tab.

The preview should appear as shown below.

The arrows in the above figure show which side of the quilt will be included in the merge. Their direction can be reversed either by picking on the arrow or clicking icons in the dashboard.

The dashboard will appear as shown below.

icons in the dashboard are used to reverse the side of the first or second quilt to be included in the merge respectively.

Pick or middle-click to complete the merge feature. The part will appear as shown below.
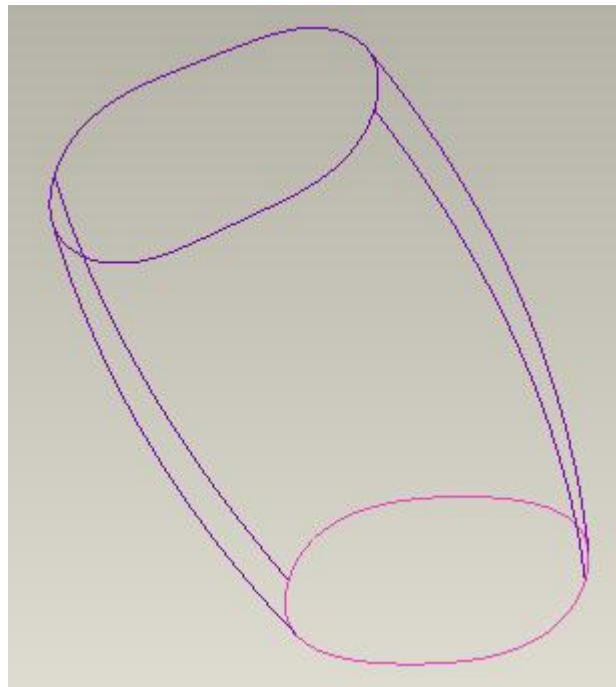
Notice that the joint between both quilts appears magenta which means that both quilts have been merged into single quilt.

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

Trim

Trim tool is used to cut or split a quilt. This tool is usually used to remove a segment from a quilt to create a certain shape or to split material. You can trim quilts by:

1. Trimming at an intersection with another quilt or datum plane
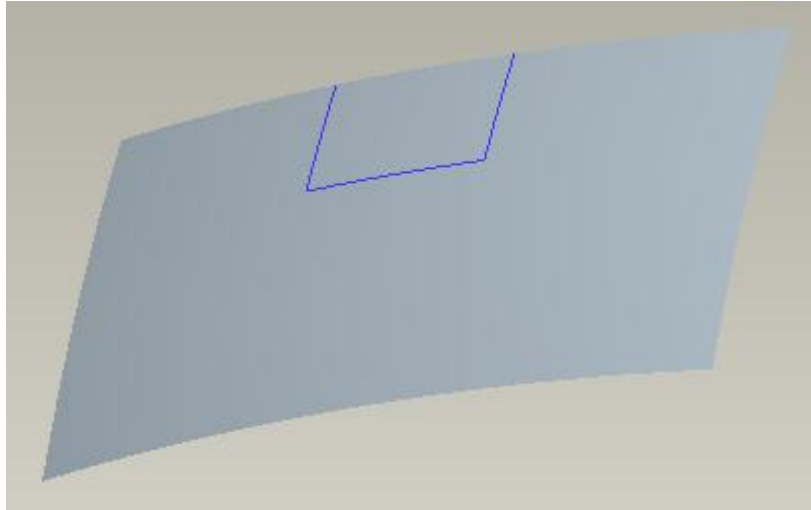2. Using a datum curve that lies on a quilt

During the trimming process, you can specify what part of the trimmed surface or curve you want to keep.
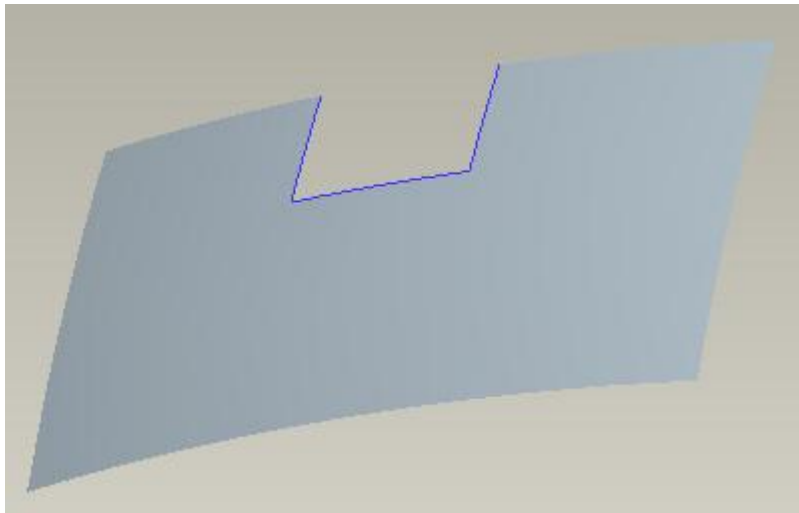
Exercise 1

In this exercise we will learn how to trim surfaces.

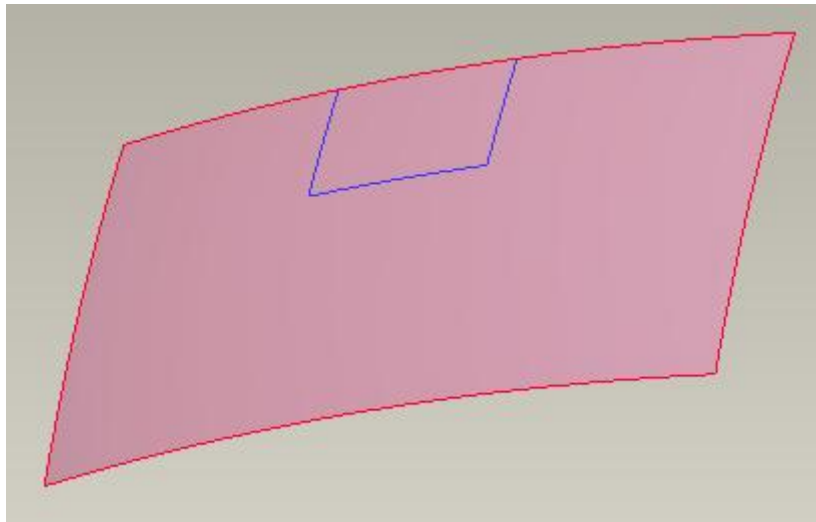Set working directory to the BASICS folder and open the model TRIM1.PRT
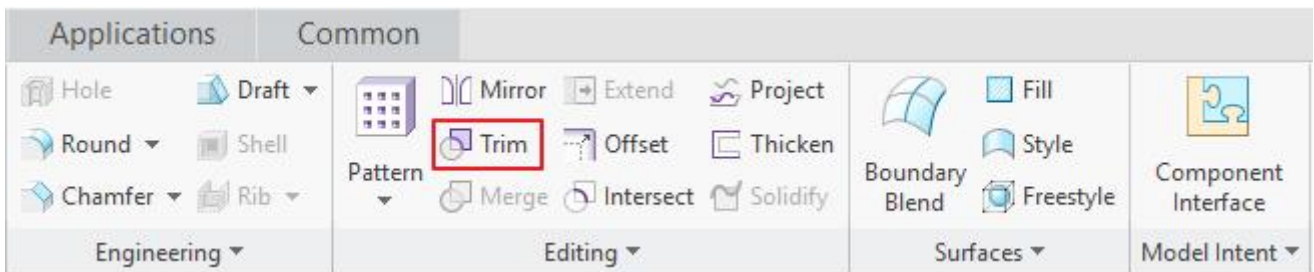
The model will appear as shown below.

We will use the trim tool to remove the area of surface lying inside the projected datum curve. After trimming operation the surface will appear as shown below.

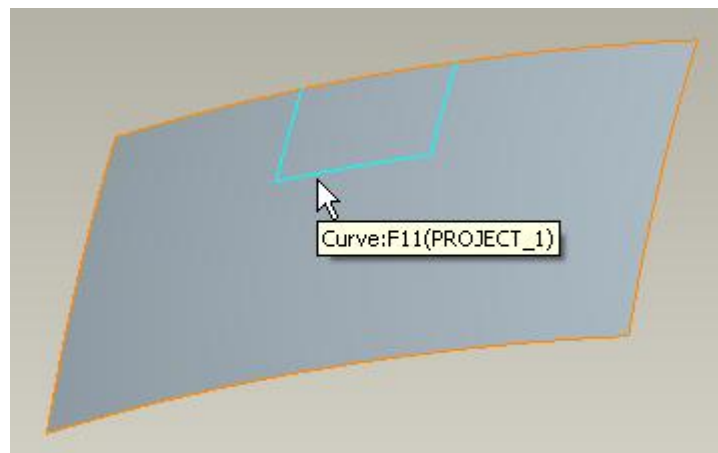So first select the following quilt.

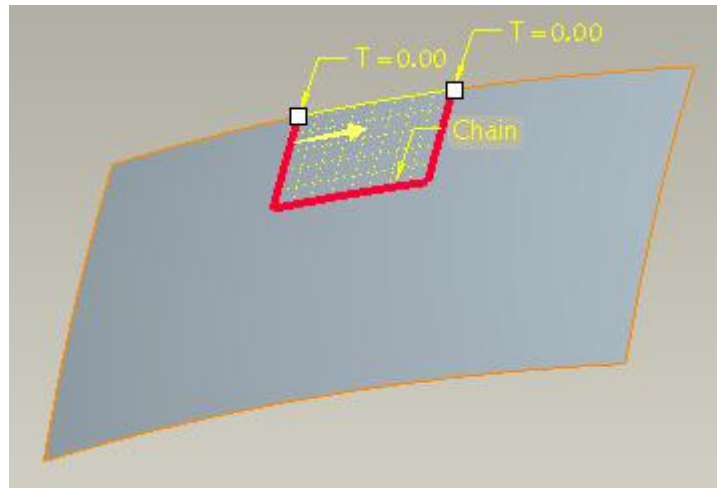Pick Trim icon (⬚) on the Model tab as shown below.

Keep in mind that Trim icon will become active only after picking the appropriate references.

Now system will ask to select a trimming object. So select the projected datum curve as shown below.
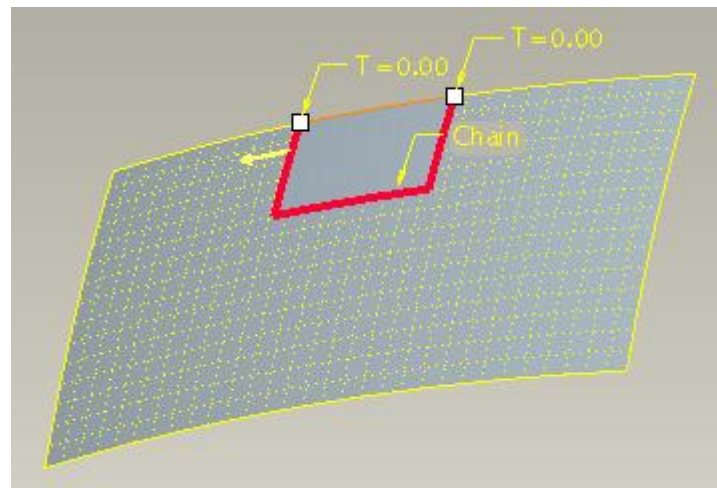

Curve:F11(PROJECT_1)

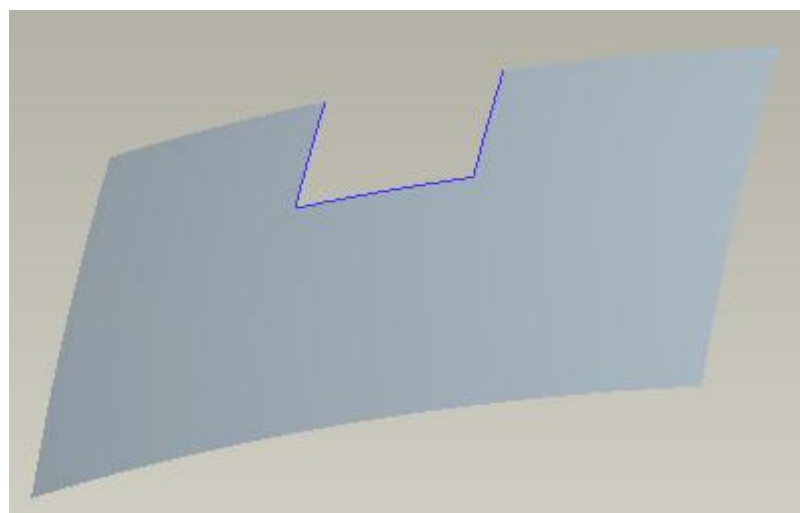The trimming object is used as the trimmer.

The preview will appear as shown below.

The direction of arrow shows that system will keep the inside part of the surface. But we want to remove the inside part, so pick [icon] in the dashboard to reverse the direction of arrow. Now the preview will appear as shown below.

Pick [icon] or middle-click to complete the feature. The surface will appear as shown below.

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

Extend

Surface Extend tool is used to extend a quilt. You need to specify which boundary edge is going to be extended. There are two ways to specify the length of extension operation, either by a specified distance or up to a plane.
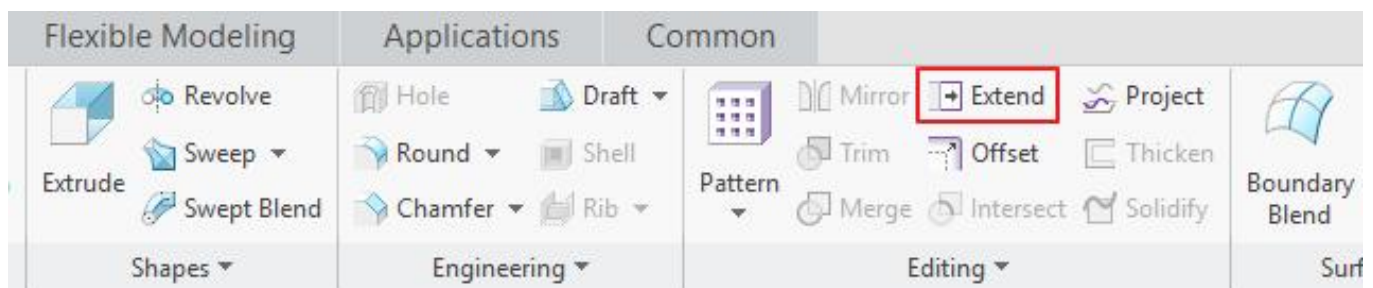
Exercise 1

In this exercise we will learn how to extend a surface.

Set working directory to the BASICS folder and open the model EXTEND1.PRT

So first select the following edge of the surface.
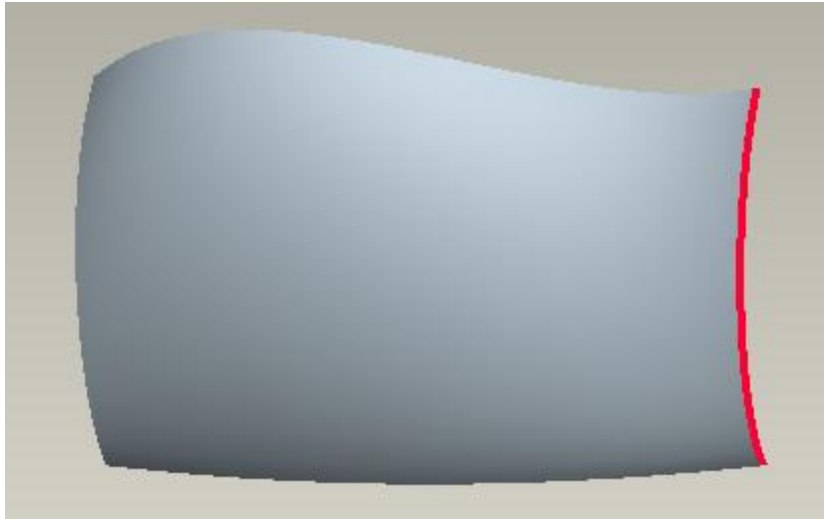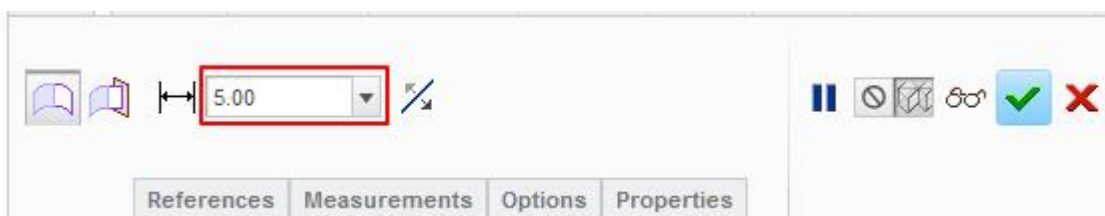

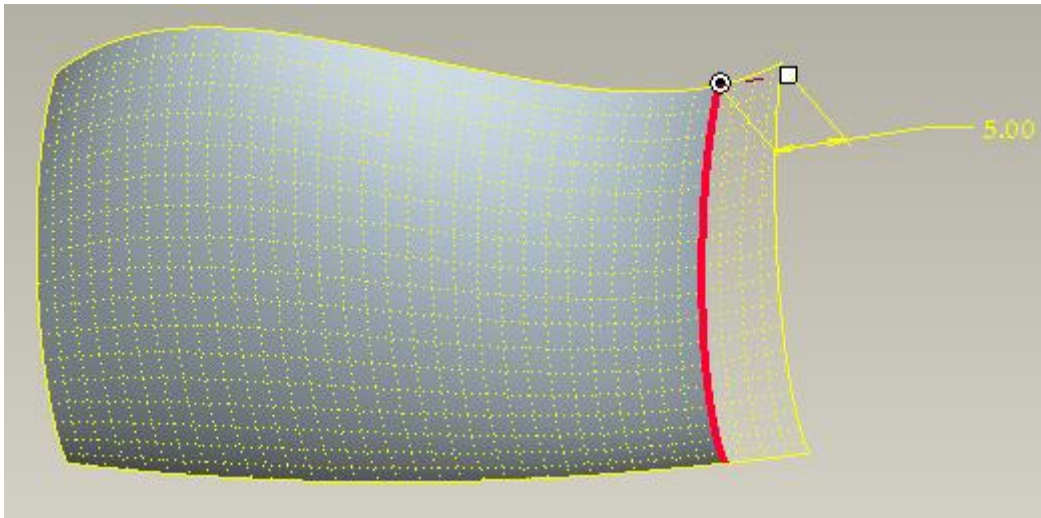Pick to invoke Extend tool.

Keep in mind that Extend icon will become active only after picking the appropriate references.
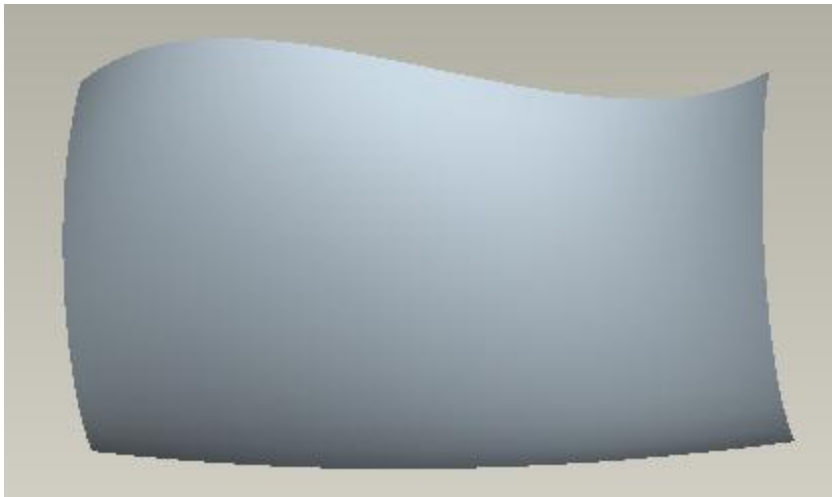
Enter **5** as the Distance to extend and hit Enter key.

The preview will appear as shown below.

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

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

Converting Surface to Solid

After building the desired shape of a part with surface modeling techniques, usually it is converted to a solid. This solid shape then has mass properties and can be used e.g. for FEA analysis, NC machining or building production tools or molds.

There are two tools in Creo for converting the surface model into solid.

1. Thicken
2. Solidify

Thicken tool gives the thickness to the surface to convert it into a solid.

Solidify tool requires the surface model first to be completely closed and then converts the closed quilt into a solid model.

Exercise 1

In this exercise we will learn how to solidify a quilt.

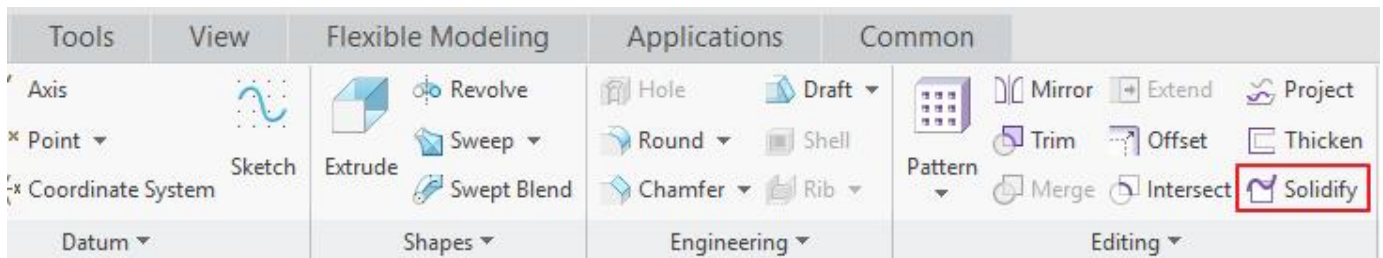Set working directory to the BASICS folder and open the model SOLID1.PRT
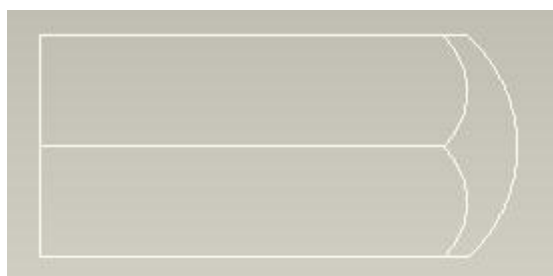
The part will appear as shown below.
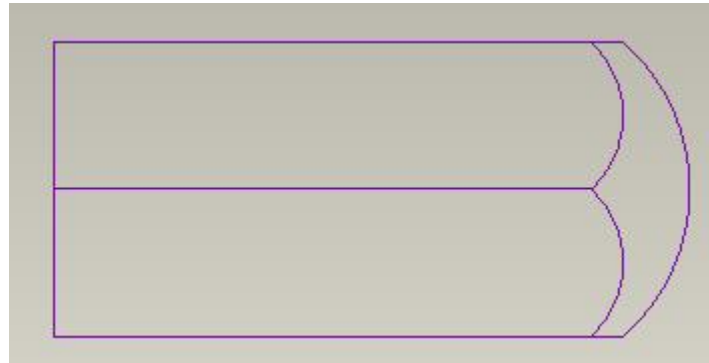
As all the edges of the quilt appear magenta, it means the quilt is closed. So we can convert it into a solid.

So first select the quilt.

Pick to invoke Solidify tool.

We do not need to make any change in the dashboard. So Pick or middle-click to complete the feature. The solid will appear as shown below.
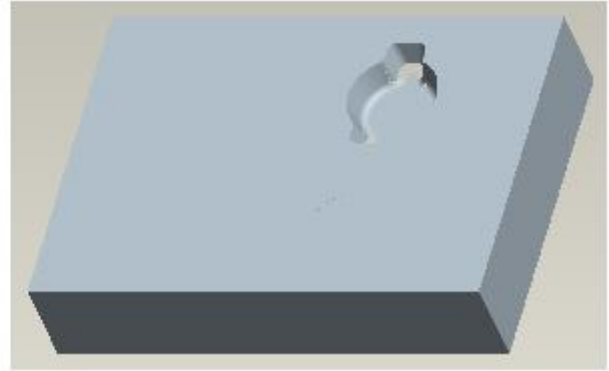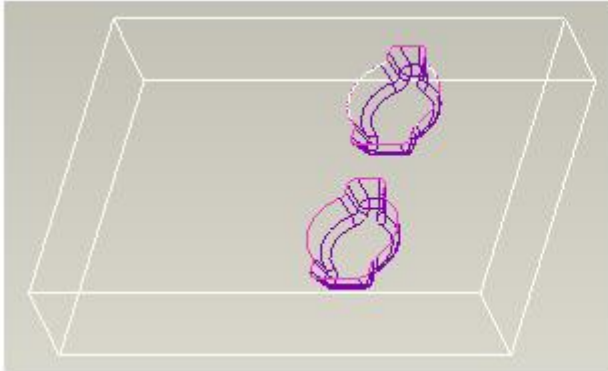

Select **File>Save** to save the work done so far.

Exercise 2

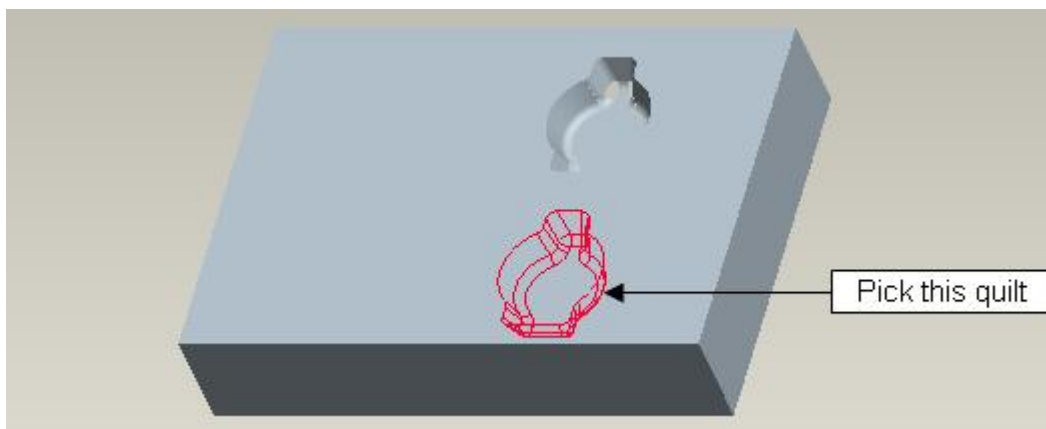In this exercise we will learn how to remove material by using a quilt.

Set working directory to the BASICS folder and open the model SOLID2.PRT

The part will appear as shown below.

You can see one cavity in the part. We will create another cavity by using the already created quilt.

So first select the following quilt. (Tip: You can use Quilts collector to select the quilt)
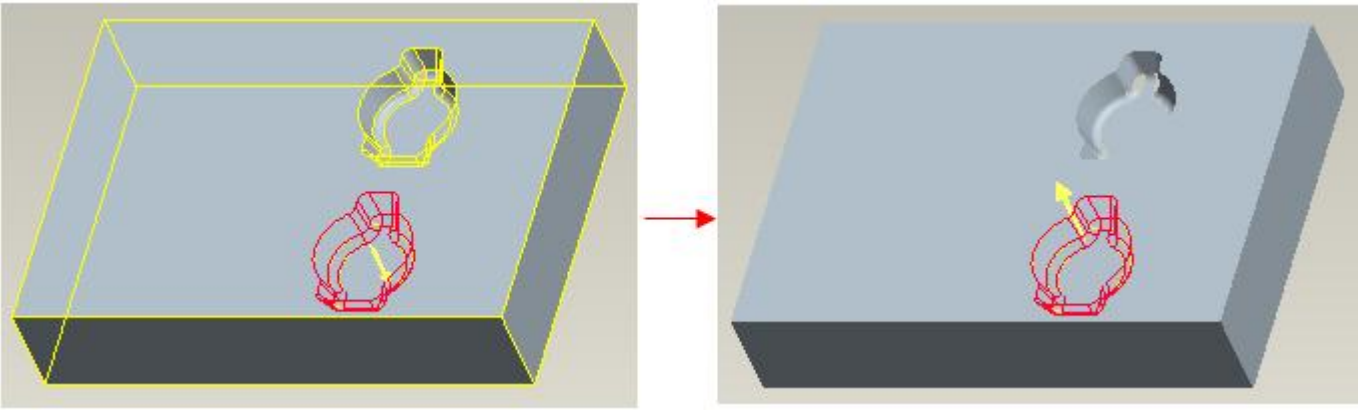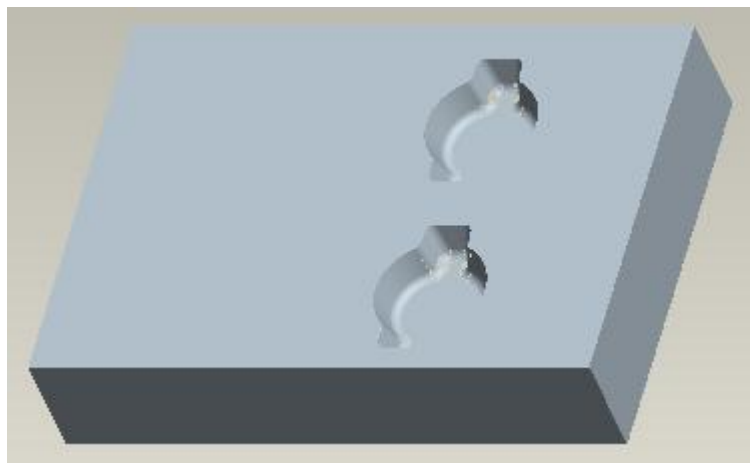

Pick ⬒ to invoke Solidify tool.

Pick ◩ to remove the material from the solid.

Pick ⚹ to flip the direction of material removal.

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

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