

# Activity 1 – Creating a Helical Cutout

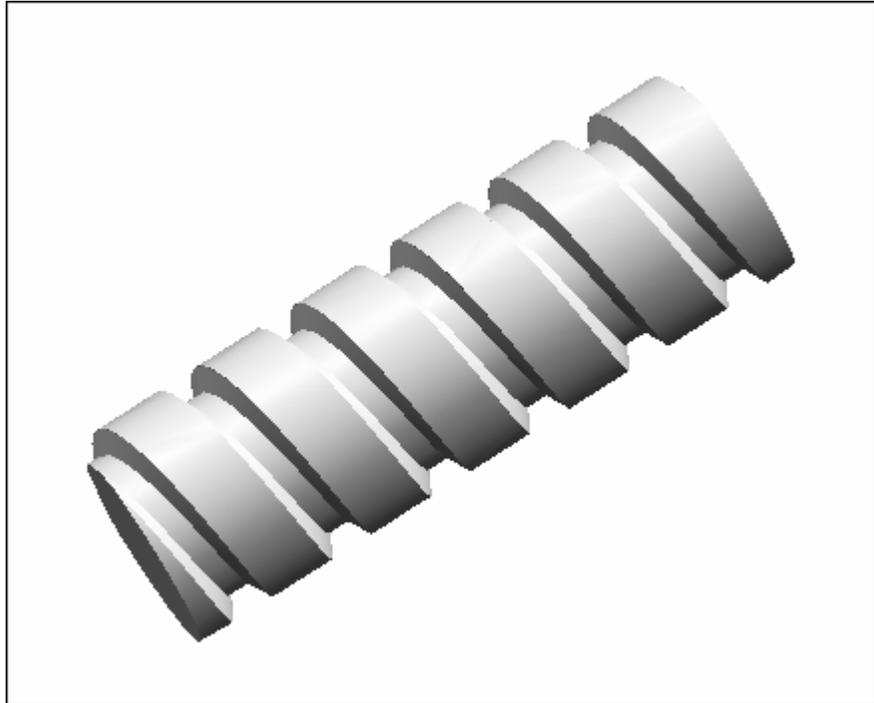
## Overview

In this activity, you will use the Protrusion and Helical Cutout commands to construct a worm gear.

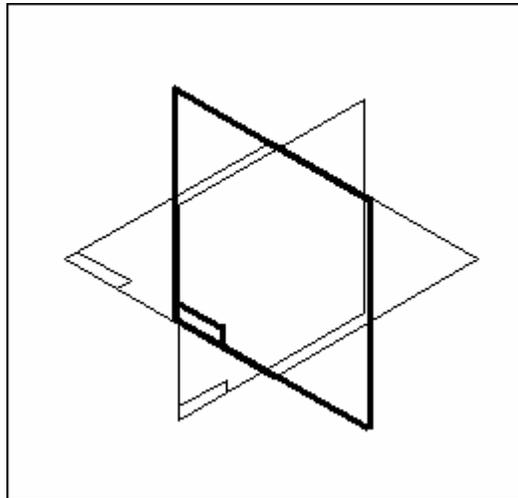
## Objectives

In this activity you will:

- Learn to create and edit a helical cutout feature.



1. Create a new metric part file.
2. In the next few steps you will create a cylindrical-shaped protrusion. This is the feature from which you will remove material using the Helical Cutout command.
  - On the Features toolbar, click the Protrusion command.
  - Select the reference plane shown.



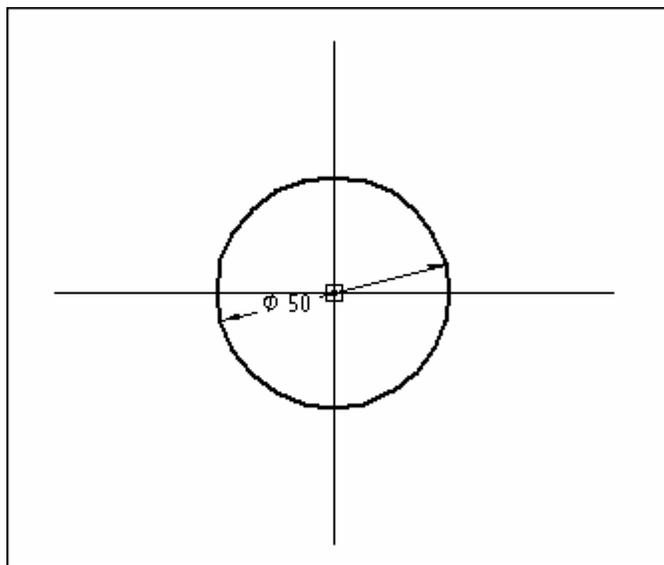
- On the Draw toolbar, click the Circle by Center command.



- On the ribbon bar, in the Diameter box, type 50 mm and press Enter.

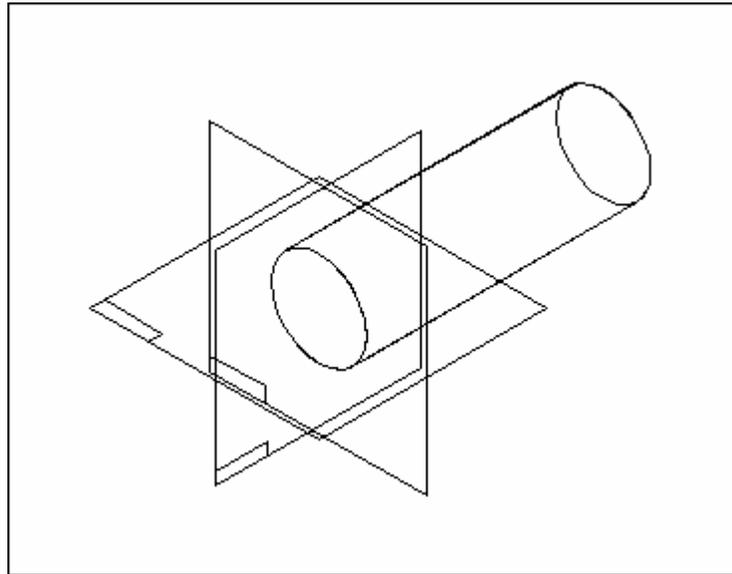


- Construct the circle at the midpoint of the horizontal reference plane, and use the SmartDimension command to place the dimension.



- On the ribbon bar, click Finish to complete the profile.
- On the ribbon bar, type 150 mm in the Distance box, and press ENTER.

- Position the cursor so the material is added to the rear of the profile as shown, and click.



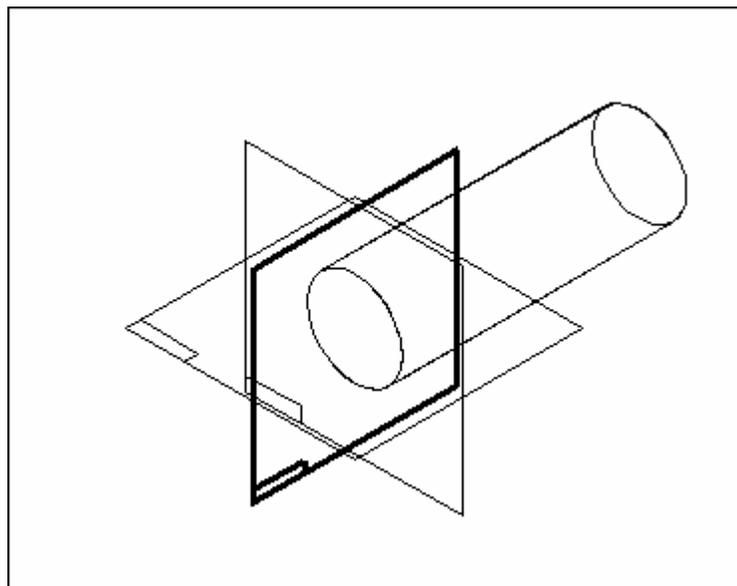
- On the ribbon bar, click Finish to complete the protrusion.

3. In the next few steps you will create a Helical Cutout that removes material from the protrusion you created in the previous step.

- On the Features toolbar, click the Helical Cutout command. This command is on the same fly-out as the Revolved Cutout command.



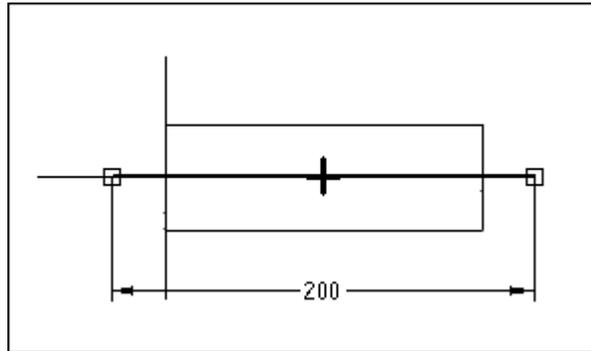
- Select the reference plane shown.



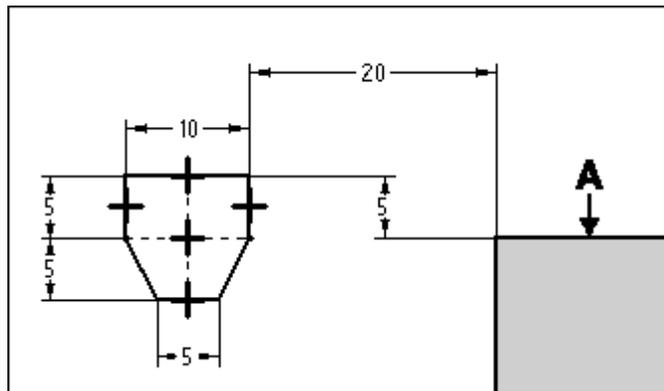
- On the Main toolbar, click the Fit command.



- Construct a line collinear with the horizontal reference plane, and place and edit the dimension shown in the illustration. This line will be the axis of the helical cutout. Be sure to start and end the line segment outside the boundaries of the cylinder, as shown.



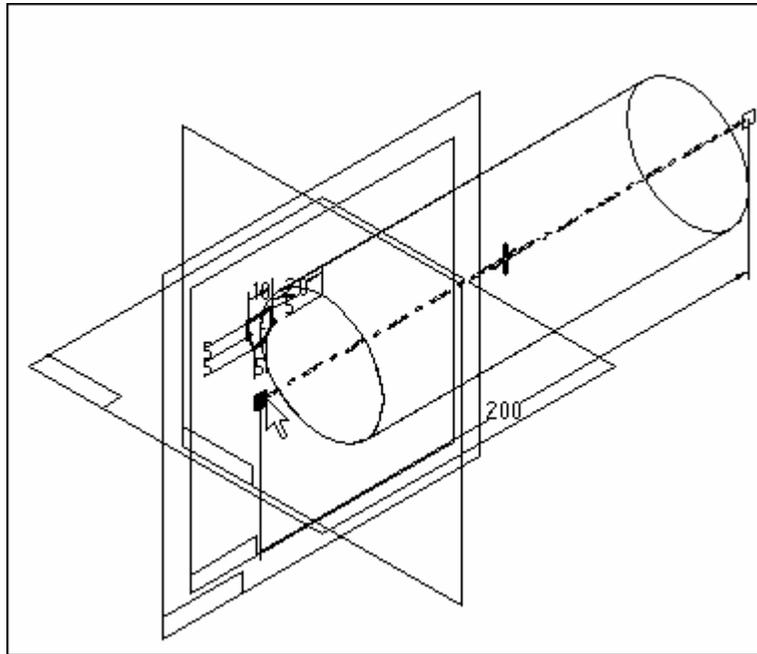
- Construct the profile shown and dimension it horizontally to the top left edge of cylinder labeled A. Reference planes are turned off in the illustration for clarity.



- On the Draw toolbar, click the Axis of Revolution command.



- Select the 200 mm line to be the axis of revolution.
- On the ribbon bar, click Finish to close the profile window.
- Click near the left end of the 200 mm line to define the starting point of the helix.



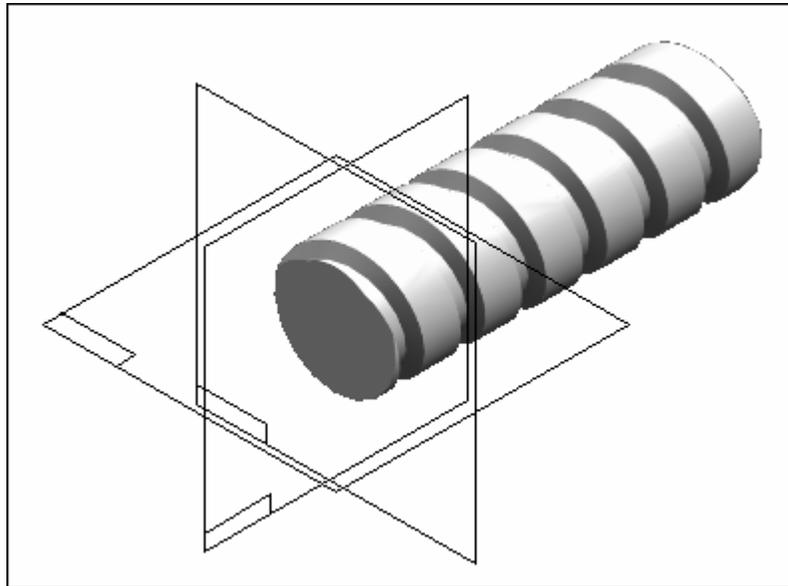
- On the ribbon bar, in the Helix Method list, click the Axis length & Pitch option.



- In the Pitch box, type 25 mm and press ENTER. The length of the helix is determined by the length of the axis of revolution and will therefore be 200 mm.



- On the ribbon bar, click Next and then Preview.



- On the ribbon bar, click Finish to complete the helix.

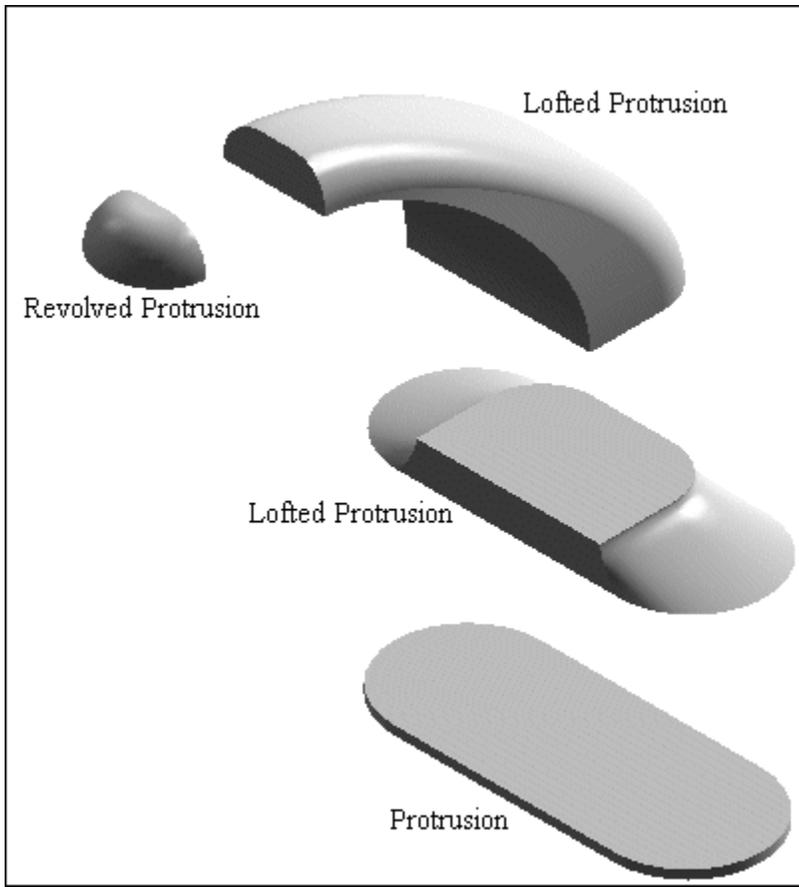
## Activity 2 – Using Options in Lofted Protrusion

The objective of this activity is to heighten your awareness of the Lofted Protrusion command options. By varying your selection of command options and geometry types, you can construct many different variations on the same model.

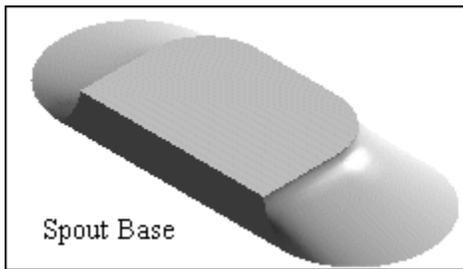
You will be modeling most of the faucet shown in the following illustration. The sketches needed to complete the model are provided. Notice the simplicity of the sketches compared to the complexity of the finished faucet model. Two of the three sketches contain construction elements that provide points for vertex mapping, a method discussed later in this activity.



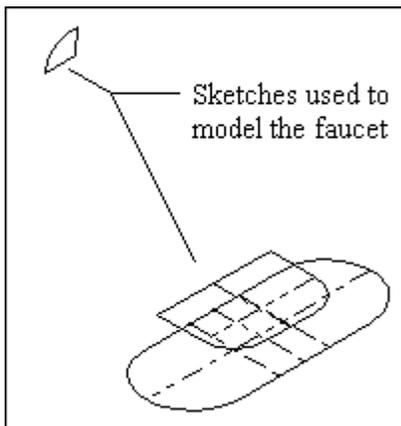
The following illustration breaks down the model into the individual features that make up the faucet.

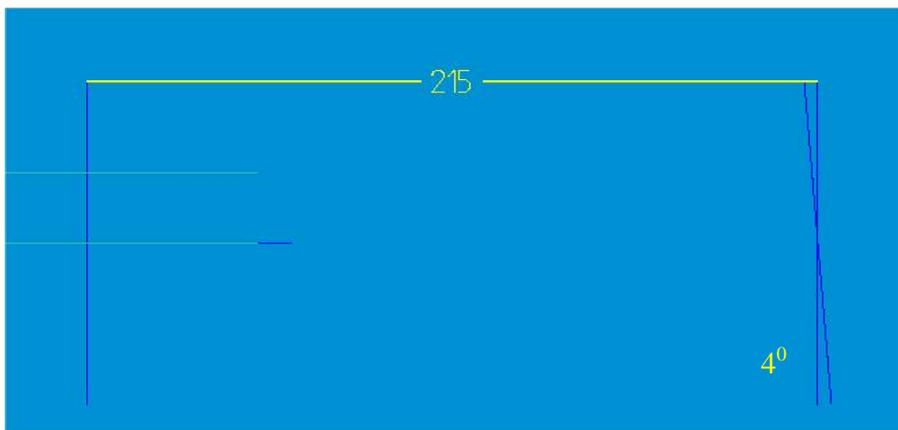
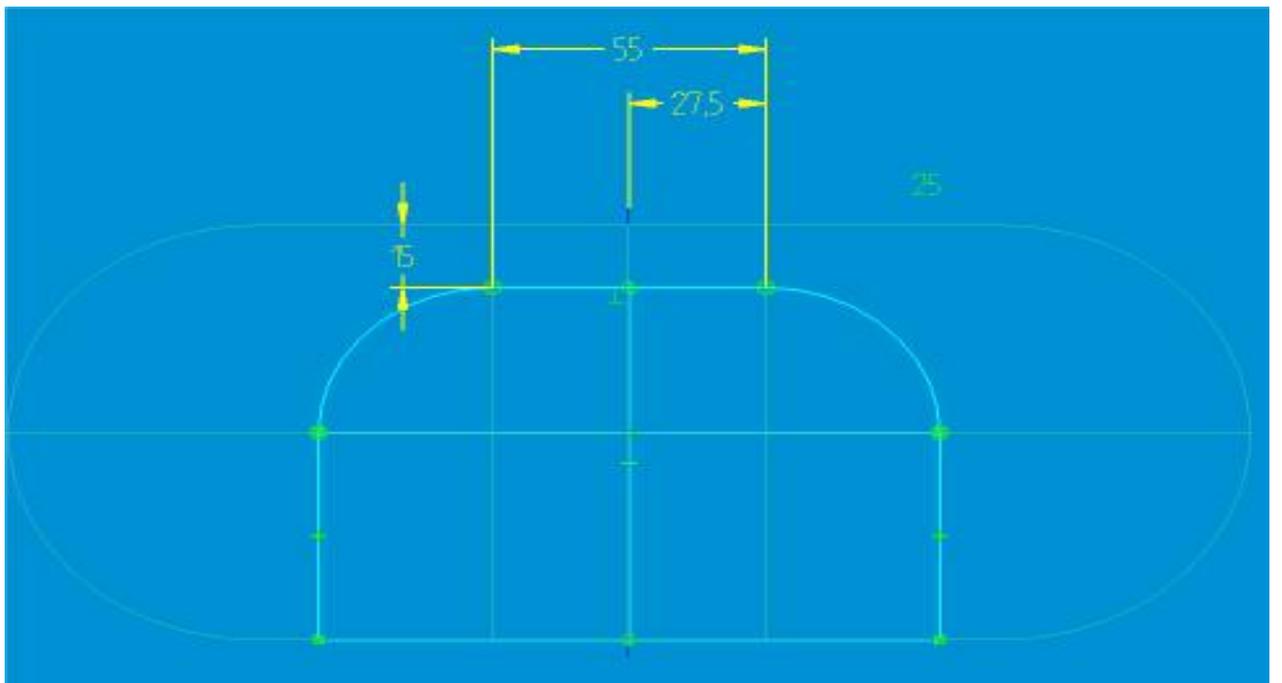
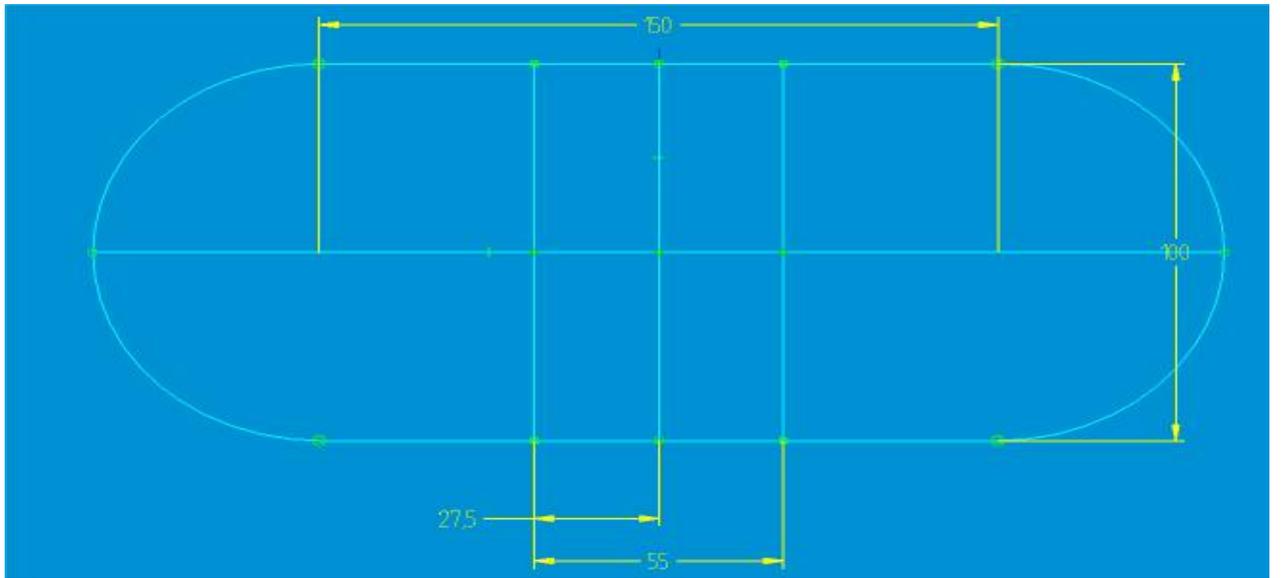


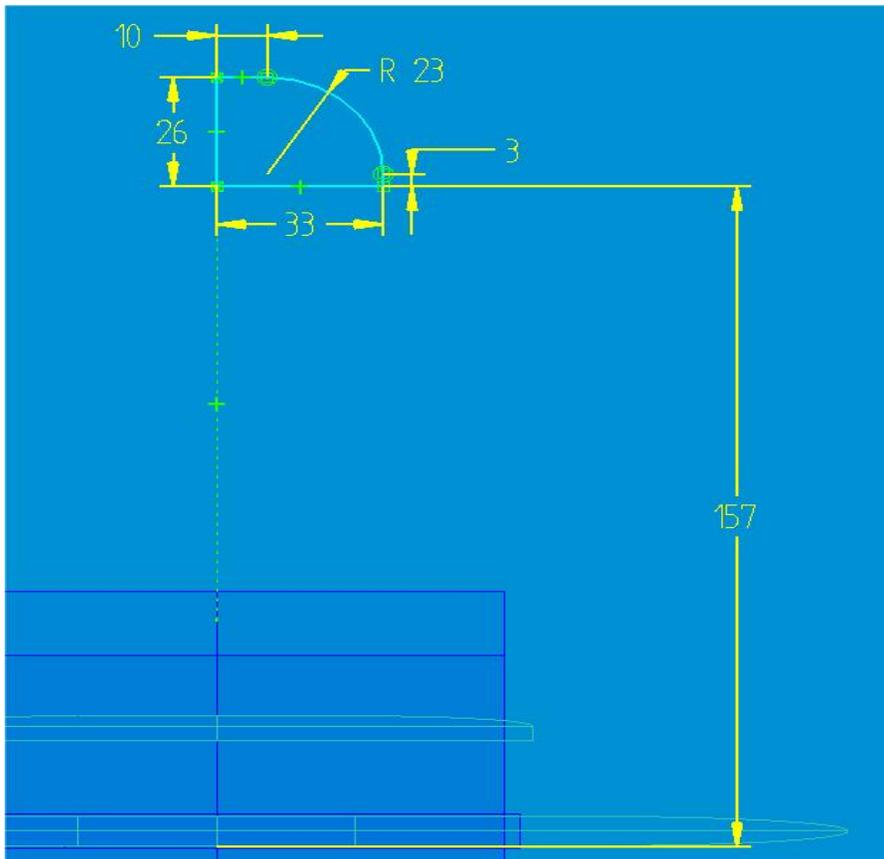
The first model feature you will construct is the base of the spout.



1. The sketches you will use to construct the faucet body are shown in the following illustration.





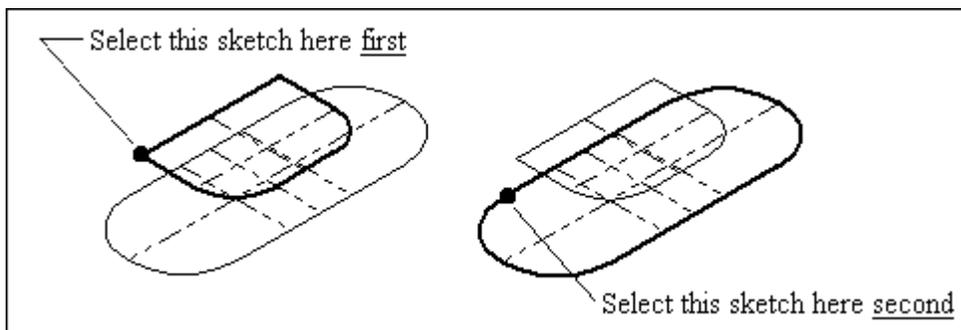


2. You will now construct the first lofted protrusion feature.

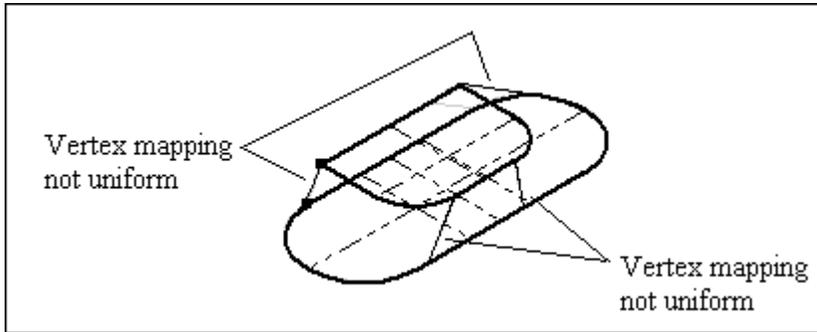
- ❑ On the Features toolbar, click the Lofted Protrusion command.



- ❑ Identify the sketches in the same order and location as shown in the following illustration. You may find it helpful to zoom in on the two sketches.



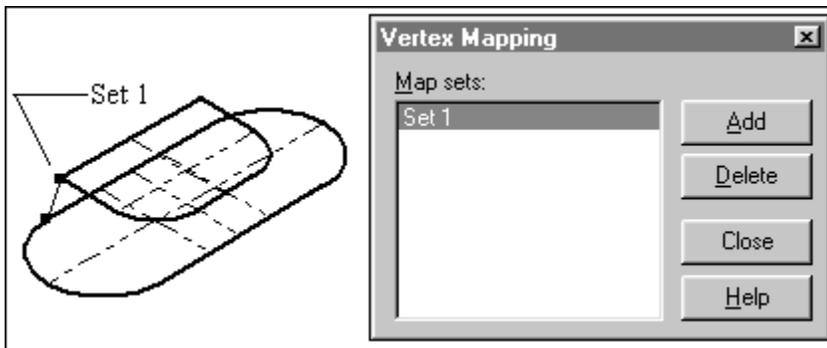
- ❑ On the ribbon bar, click Preview but do not click Finish. Observe the result of the Lofted Protrusion. The transition between sketches is neither smooth nor uniform. This is because the two sketches are different in terms of types and numbers of elements. Lofted Protrusion attempts to transition between the two sketches. When the results of the loft are not satisfactory, you have the option to modify it.



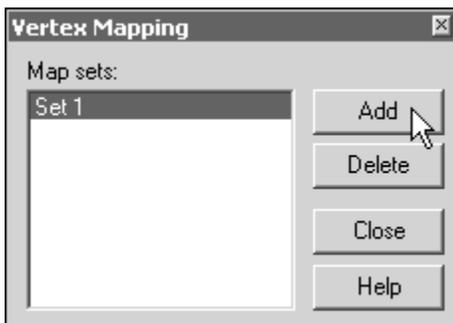
- On the ribbon bar, click the Extent Step option, and then click the Vertex Mapping option. A small dialog box displays, allowing you to add additional vertex mapping to the loft.



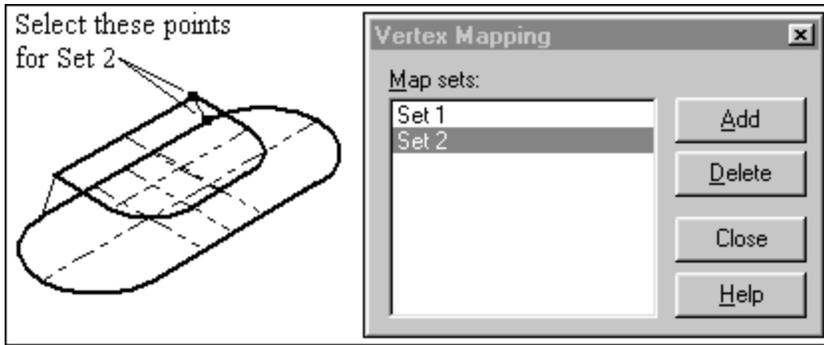
Observe that the Lofted Protrusion command has mapped the first set of vertices (Set 1).



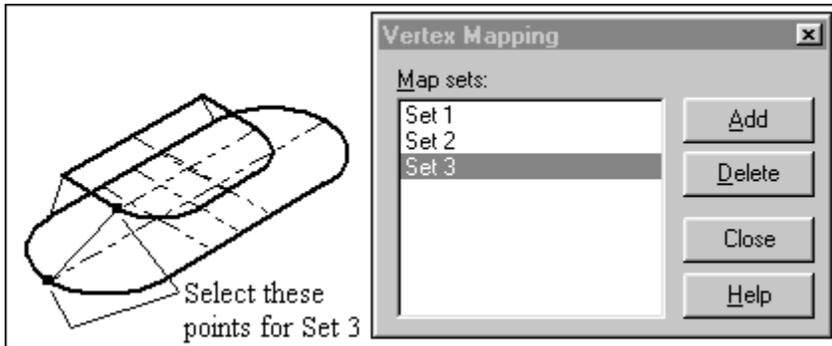
- On the Vertex Mapping dialog box, click Add.



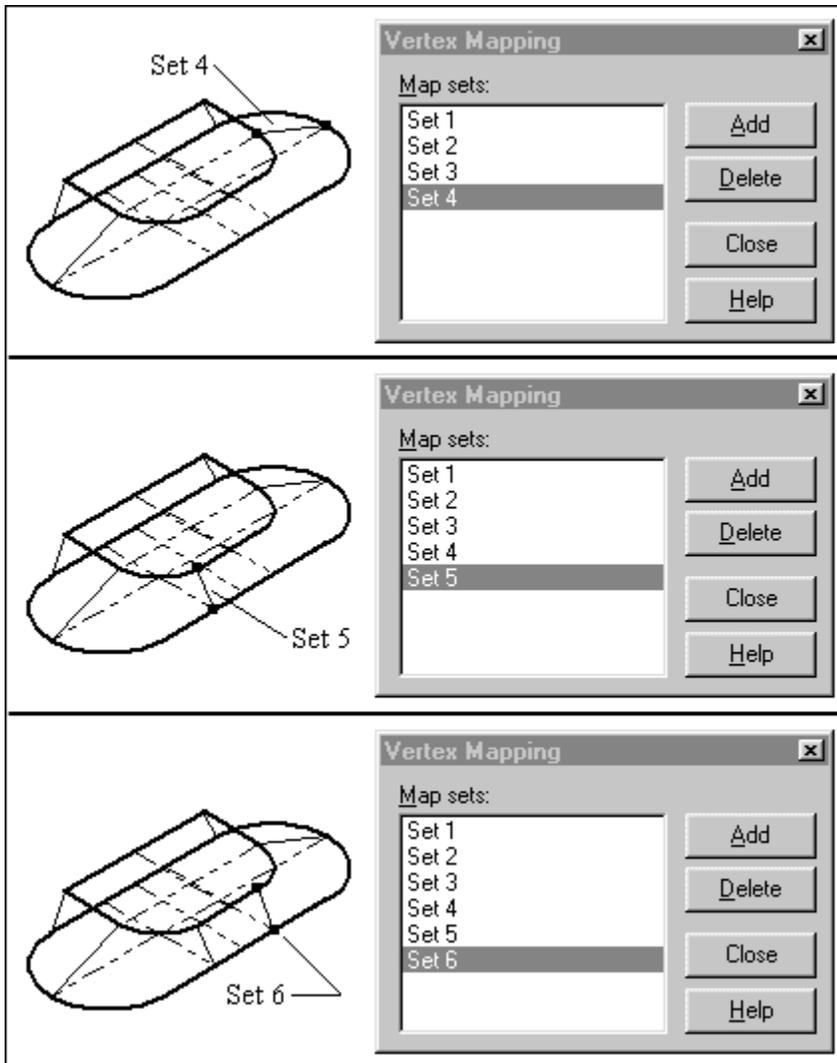
- Select the following points for Set 2.



- Click the Add button, and then select the following points for Set 3.

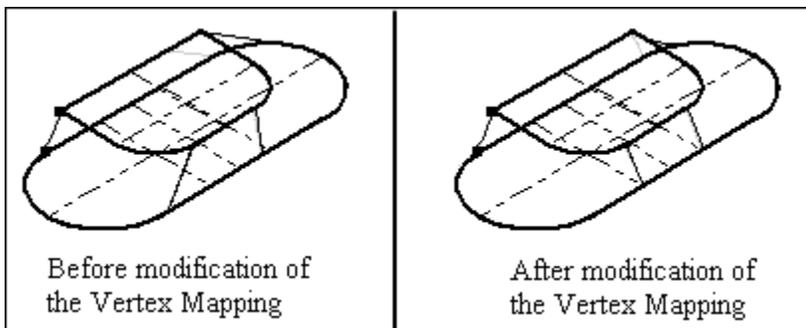


- Continue to add the remaining vertex sets as shown.



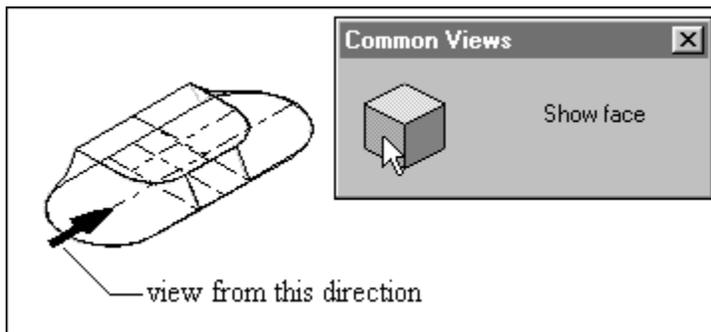
- Close the dialog box. Click Preview and Finish to complete the Lofted Protrusion.

3. Notice the change in the before and after results of vertex mapping. The after result is more uniform. Save the file.

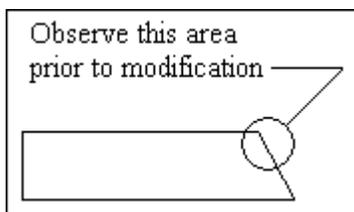


Next, make one last modification to the lofted protrusion of the spout base. Lofted Protrusion permits the modification of either end of the loft. Several end condition options exist. The default end condition is Natural. You will apply the Normal to Section condition to the top (smaller) section or sketch.

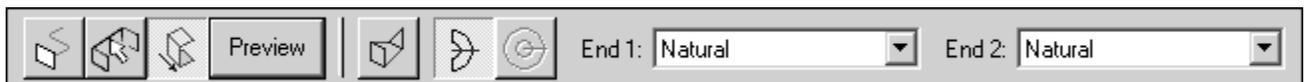
However, prior to modifying one of the end conditions, you may want to rotate the model as shown in the following illustration.



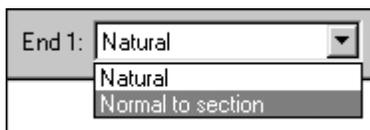
Observe the current end condition nearest the smaller sketch.



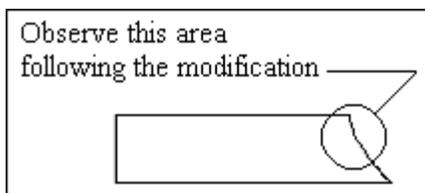
- ❑ Select the Lofted Protrusion of the spout base, and then click the Edit button on the ribbon bar. Keep in mind, when you constructed the Lofted Protrusion in Step 2, you selected the smaller or upper sketch first. Call this End 1.
- ❑ On the ribbon bar, click the Extent Step option. When this is done, the End 1 and End 2 selection boxes display on the ribbon bar.



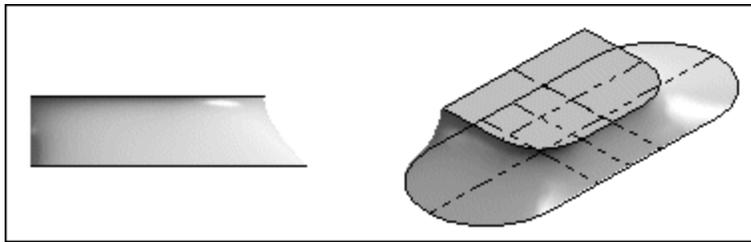
- ❑ Select the 'Normal to Section' option on the End 1 select box, and leave End 2 as Natural.



- ❑ On the ribbon bar, click Preview and then click Finish. Note the results. This modification will create a smoother transition to the spout when you construct it later in the activity.



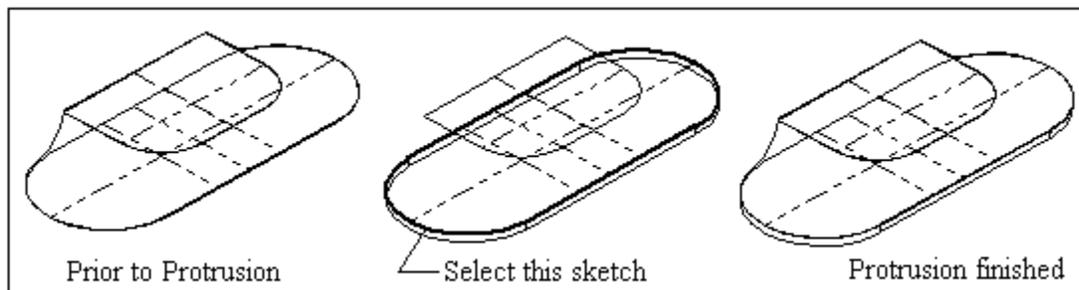
- ❑ Review the results in shaded mode. Leave the sketches on. You will use them again later in the activity.



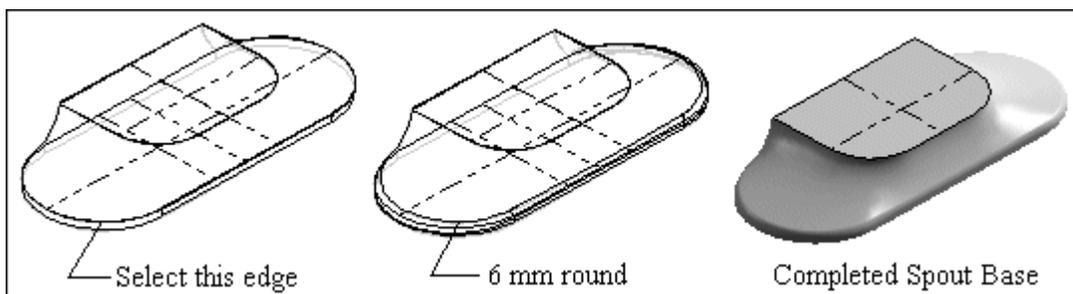
- Save the file.

4. In the following steps, you will use the Protrusion command to add additional material to the bottom of the spout base. Then you will use the Round command to round a single edge.

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- Click the Protrusion command, and select the larger bottom sketch. Make the extent distance 6mm.

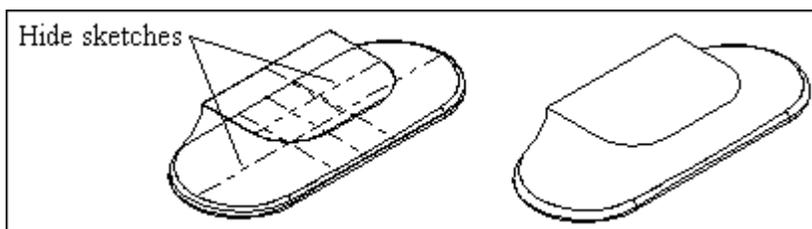


- Click the Round command. Where the top of the protrusion and the bottom of the lofted protrusion meet, select the edge. Add a 6mm round. This completes the spout base.

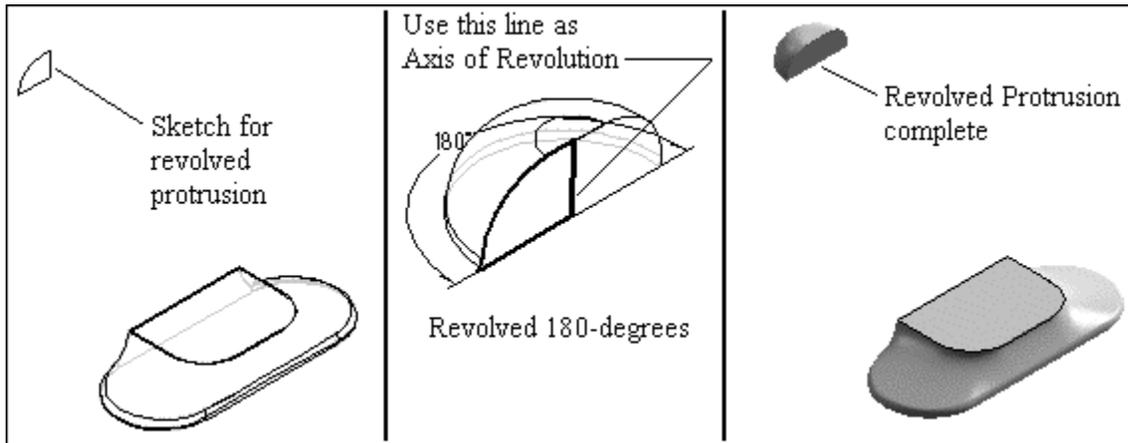


5. Next you will use the Revolved Protrusion command to construct the spout tip.

- Hide the display of the two sketches used in the lofted protrusion.

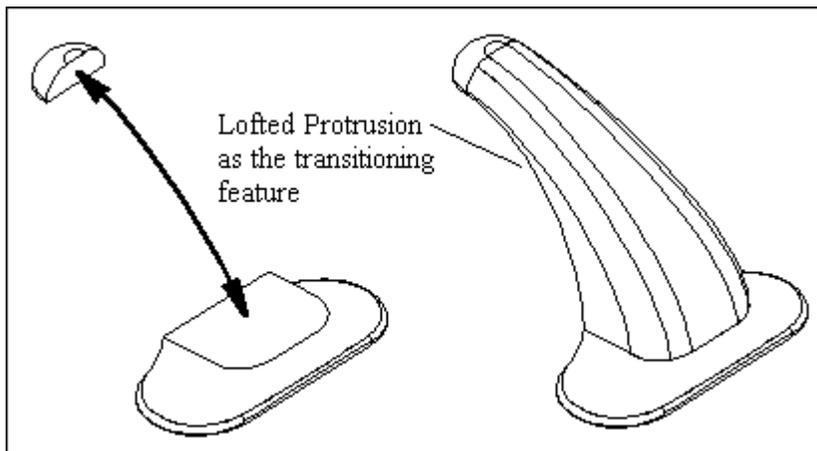


- Click the Revolved Protrusion command. Select the sketch shown below, and revolve the protrusion 180-degrees.

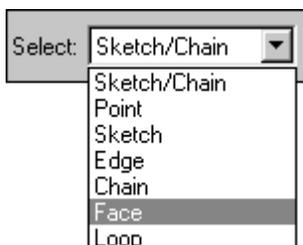


- Hide the last remaining sketch used for the revolved protrusion.

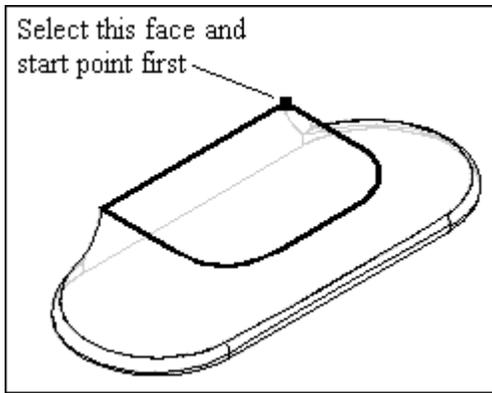
6. The last feature you will construct is the lofted protrusion that links the spout tip to the spout base. Once again, you will use a couple of options within the Lofted Protrusion command to achieve the desired result.



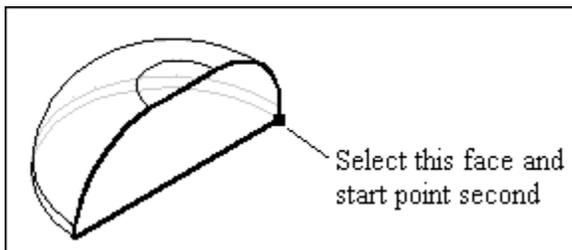
- Click the Lofted Protrusion command.
- Click the Face option on the Select box.



- Select the face and start point on the spout base as shown in the following illustration.

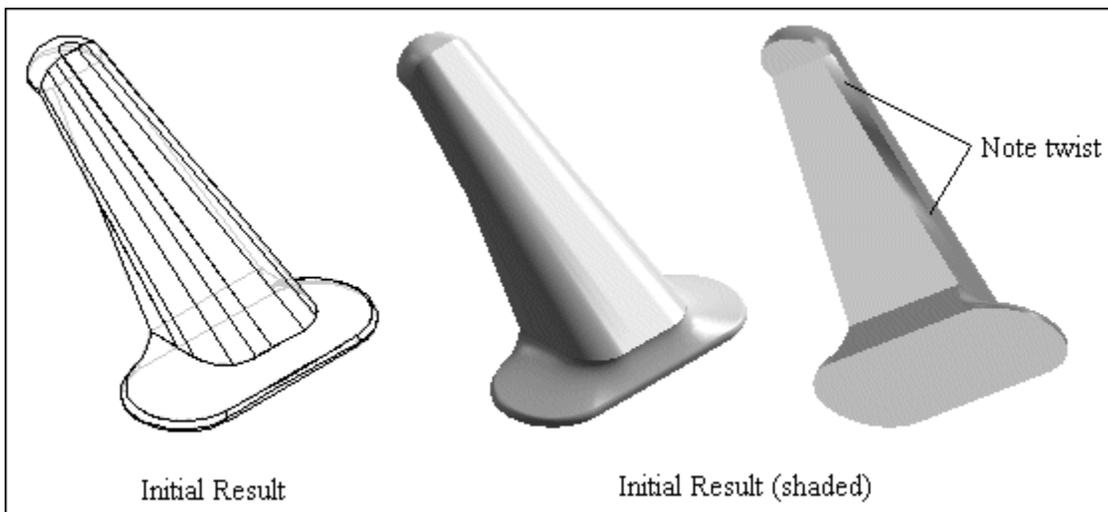


- ❑ Select the face and start point on the spout tip as shown in the illustration.



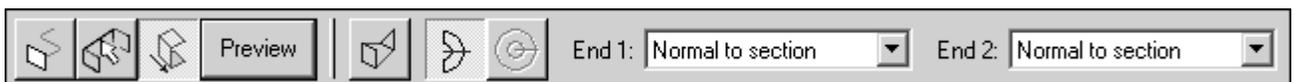
- ❑ On the ribbon bar, click Preview, but do not click Finish. Note the results.

The lofted protrusion has produced a straight transition, and some twist has occurred in the surface as shown in the illustration.

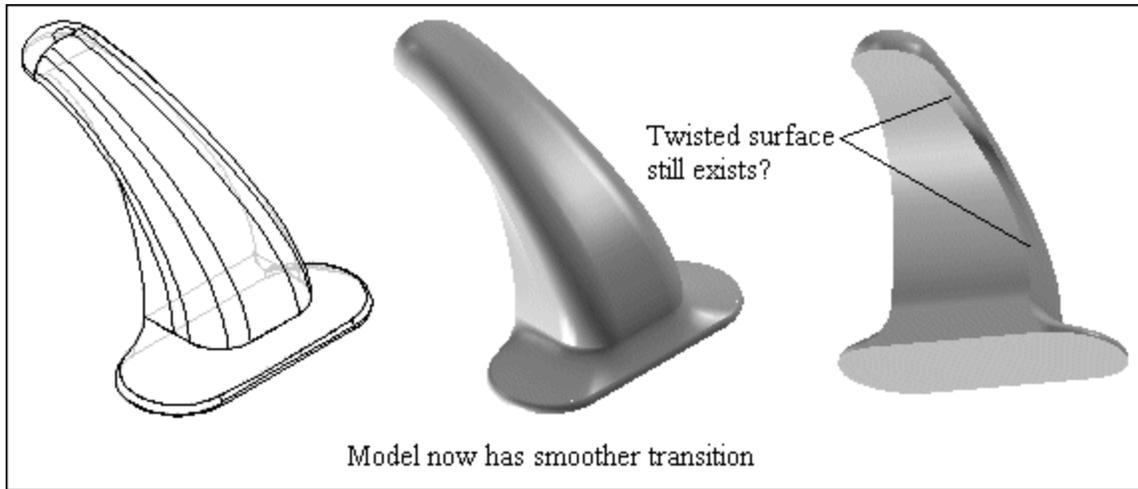


You want a smoother transition for the spout, not the straight-line effect that you have now. To accomplish this, modify the endpoint conditions as you did earlier in this activity.

- ❑ Select the 'Normal to Section' option on the End 1 and End 2 select boxes. Click the Preview button, but do not click Finish.



Observe the results of this modification. Now the transition between the spout base and the spout tip has a smoother look, eliminating the straight-line look of the previous result. Yet, the twisted surface still exists.

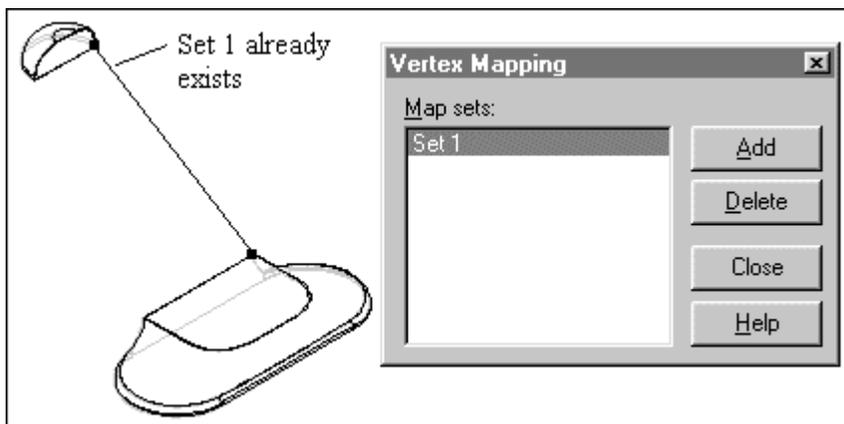


To eliminate the twist in the surface, you must use vertex mapping to gain more control over the lofted protrusion feature. You used this technique earlier in this activity.

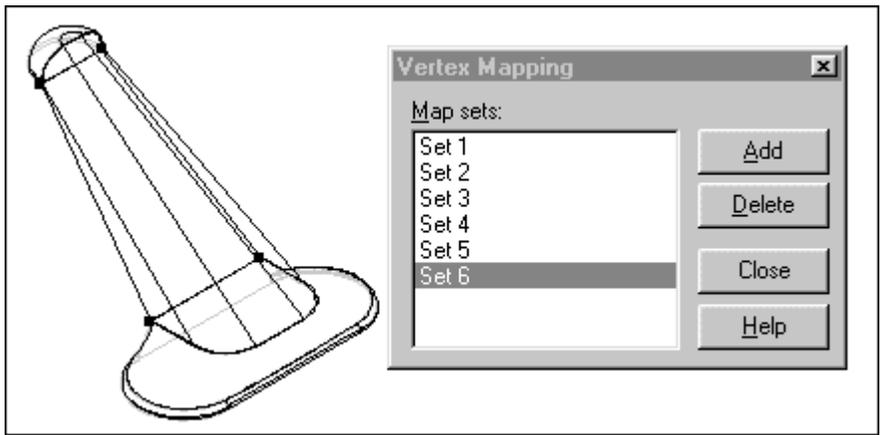
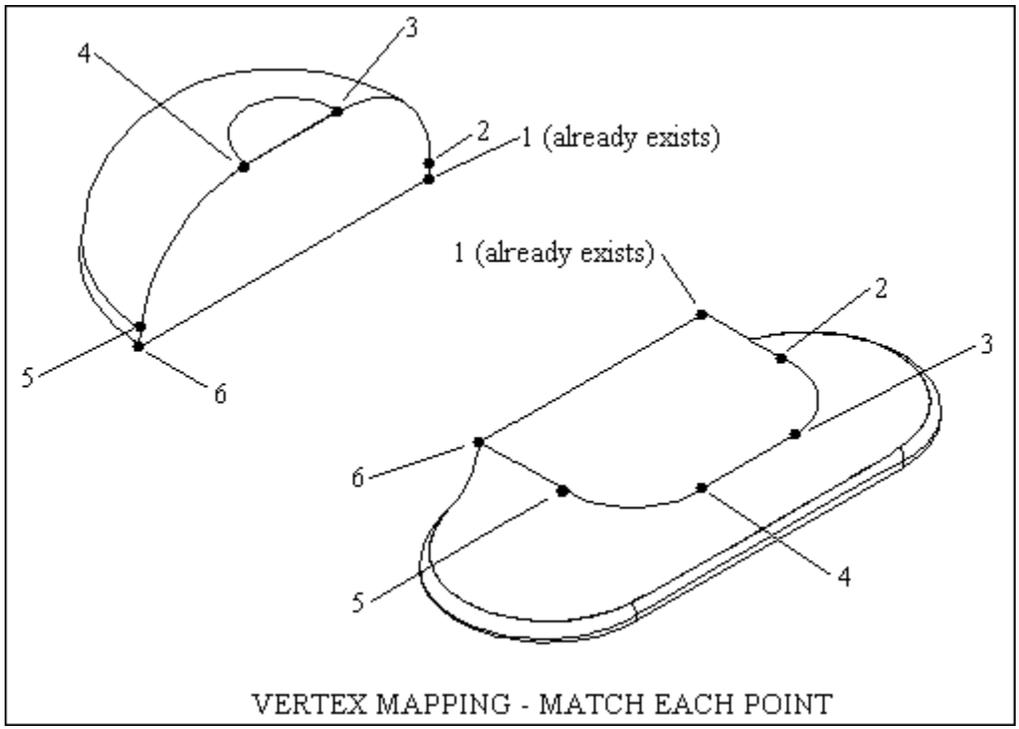
- On the ribbon bar, click the Extent Step option, and then click the Vertex Mapping option. A small dialog box displays for adding additional vertex mapping to the loft.



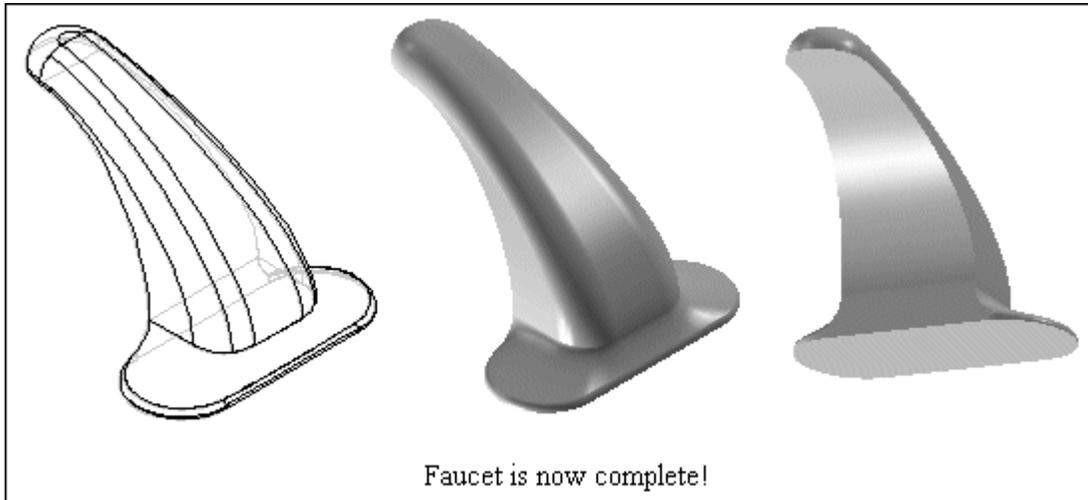
Set 1 already exists. You will add more sets to assure a smooth, twist-free transition for the lofted protrusion.



- Using the diagram in the following illustration, add the remaining sets, close the diagram box, click Preview, and then click Finish.



Again, observe the results of the lofted protrusion after the vertex mapping modification. You have achieved the desired result.



In summary, when trying to achieve a specific result, you must consider and sometimes experiment with many command options. With the Lofted Protrusion command, options to consider include:

- The number of cross-sections used.
- Re-ordering the cross-sections.
- Using guide curves.
- Start point definition.
- Vertex mapping.
- Modifying endpoint conditions.

7. Save and close this file. The activity is complete.