Chapter 9

Deformation Tools

Learning Objectives

After completing this chapter, you will be able to:
- *Create shapes and loft them*
- *Use the deformation tools such as Scale, Twist, Teeter, Bevel, and Fit on a loft object*

TUTORIAL DESCRIPTION

In this tutorial, you will draw a circle as a shape and loft it along a line used as the path. Next, you will use the deformation tools such as **Scale**, **Twist**, **Teeter**, **Bevel**, and **Fit** to modify the loft object to obtain different shapes.

Creating and Lofting Shapes

1. First, reset the 3ds Max Design 2013 by selecting **Reset** from the **Application Menu**. Then, pick the **Yes** button in the **3ds Max** message box.

2. Pick the **Maximize Viewport Toggle** button to display all four viewports.

3. Right-click on the **3D Snap** button; the **Grid and Snap Settings** dialog box is displayed. In the **Snaps** tab, select the **Grid Points** check box, if it is not already selected. Choose the **Close** button to close the dialog box.

4. Pick the **Shapes** button in the **Create** tab of the **Command Panel**. Then, use the **Line** and **Circle** buttons in the **Object Type** rollout to create a line and a circle in the Top viewport. Pick the **Zoom Extents All** button.

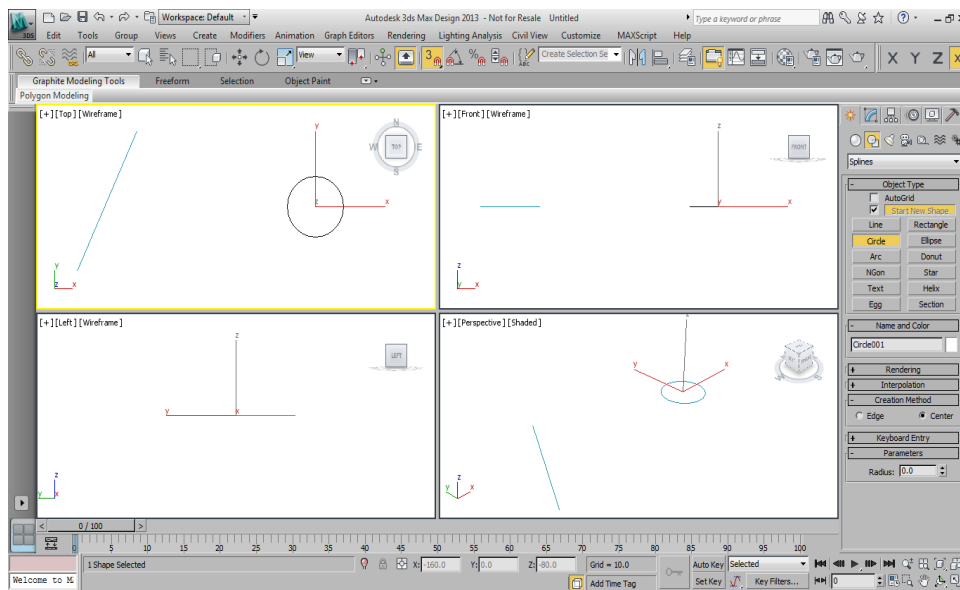A line and a circle are created, **Figure 9-1**.

Figure 9-1 A line and a circle drawn

Note
Create the line from bottom to top in the Top viewport.

5. Select the line, if not already selected.

6. Pick the **Geometry** button in the **Create** tab of the **Command Panel** and then
    select **Compound Objects** from the drop-down list. In the **Object Type** rollout,
    pick the **Loft** button.

7. In the **Creation Method** rollout, pick the **Get Shape** button and then select the circle.

The circle is lofted along the line.

8. In the **Skin Parameters** rollout, enter 3 in the **Shape Steps:** spinner and enter10 in the
    Path Steps: spinner.

9. Pick the **Zoom Extents All Selected** button to zoom the loft object to its extents,
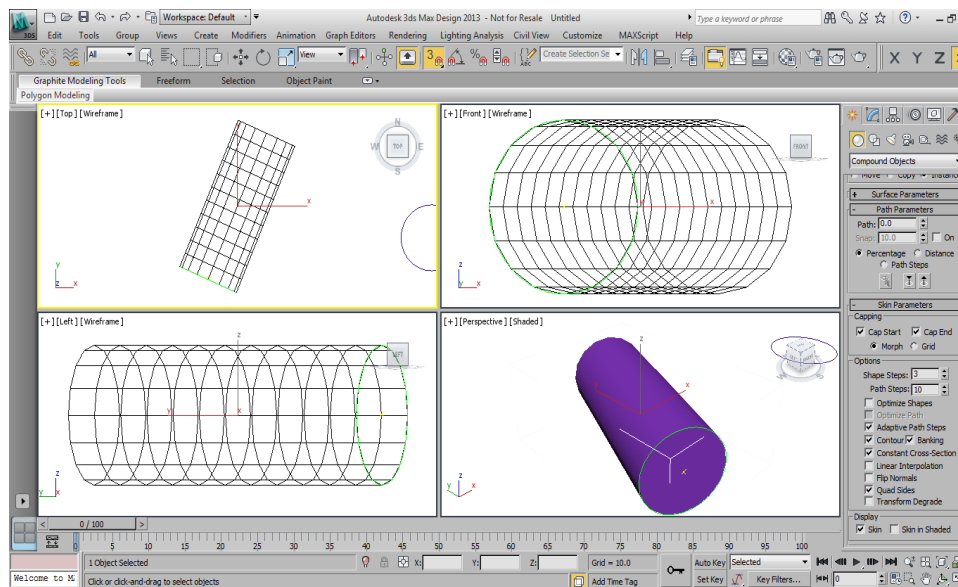   **Figure 9-2**.

Figure 9-2 *The circle lofted along the line*

10. Save the scene as *Chapter09.max* in the folder of your choice.

Using the Scale Deformation

1. With the loft object selected, pick the **Modify** tab in the **Command Panel**.

2. Expand the **Deformations** rollout.

The five deformation buttons are listed in this rollout.

3. Pick the **Scale** button in the **Deformations** rollout.

The **Scale Deformation(X)** dialog box is displayed, **Figure 9-3**. The horizontal red line represents the path steps along the X axis of the loft object. The left point of the line represents the first vertex of the path. The number in the ruler at the top represents the length of the path in percentage. The vertical location of the line in the dialog box represents the scale in percentage, as noted on the vertical ruler. The left and right vertices at the same vertical point (100) show that the loft object is not scaled.
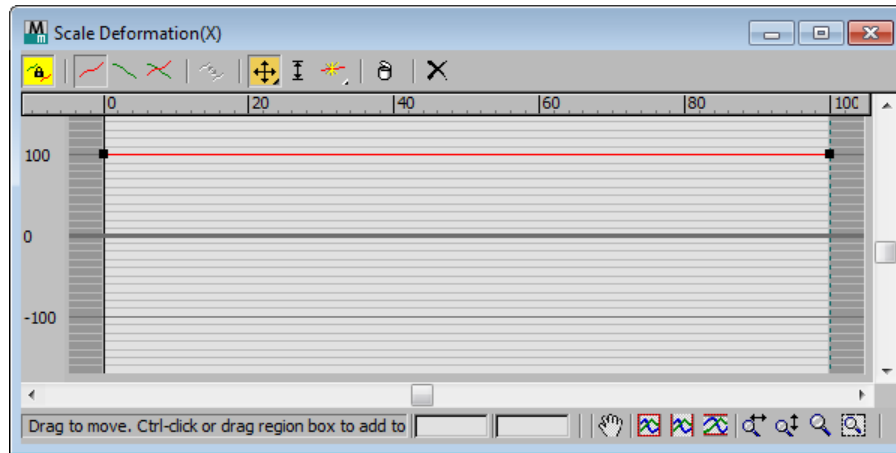

Figure 9-3 *The **Scale Deformation(X)** dialog box*

4. Pick the **3D Snap** button from the **Snaps Toggle** flyout to turn snaps on.

Selecting any of the snap buttons will make the cursor snap to the vertical gridlines in the **Scale Deformation** dialog box.

5. Pick the **Move Control Point** button in the **Scale Deformation(X)** dialog box, if it is not already picked.

6. Move the right-hand vertex down by six lines until 40 is displayed in the right-hand text box at the bottom of the dialog box, **Figure 9-4**.

The lofted object tapers to 40% of its original size at the last vertex, **Figure 9-5**.

7. Pick the **Insert Corner Point** button in the **Scale Deformation(X)** dialog box and then click on the red line near 40 (refer to the ruler at the top).

A vertex is added at this point. To move the vertex to the precise position, enter 40 in the left-hand text box at the bottom of the dialog box and then press the ENTER key. This way, the corner vertex is inserted at the precise position.

8. Pick the **Move Control Point** button and move this new vertex straight up above the top (100%) line by two lines, until 120 is displayed in the right-hand text box at the bottom of the dialog box.
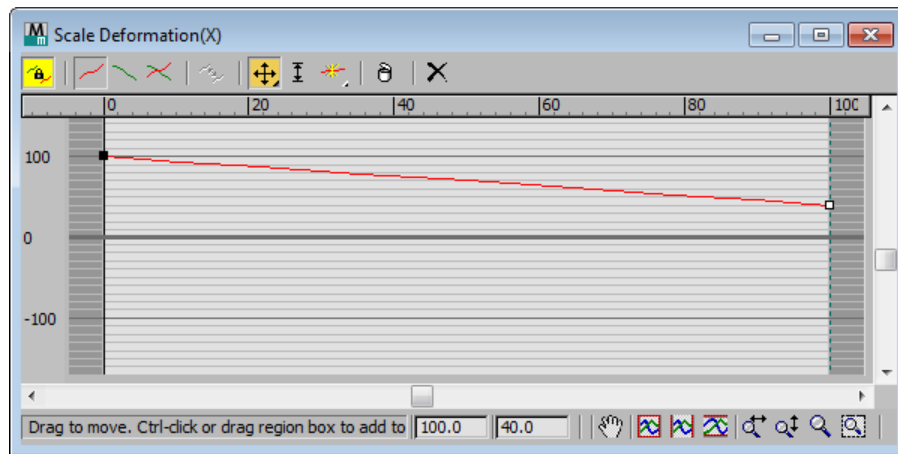
*Figure 9-4 The vertex moved in the **Scale Deformation(X)** dialog box*
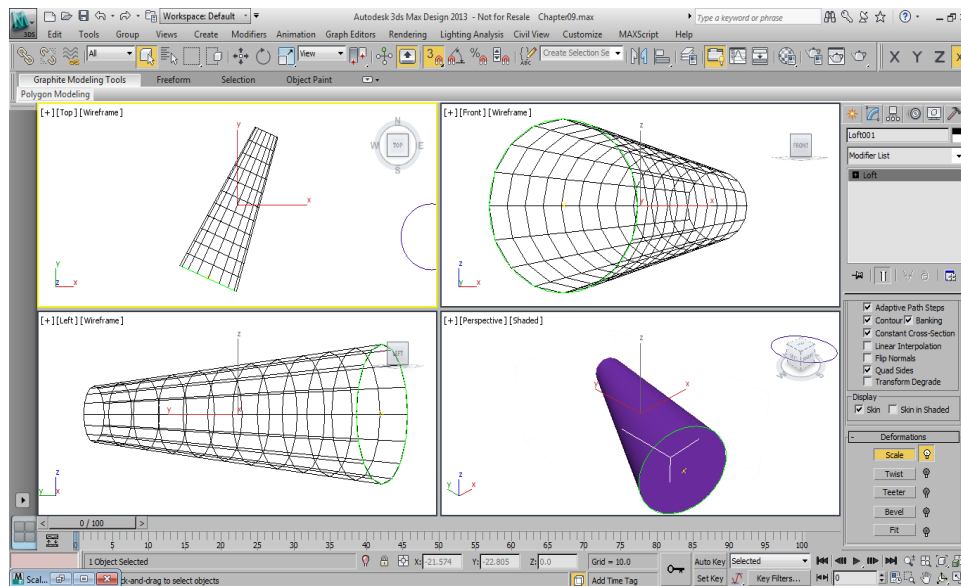

*Figure 9-5   The lofted object tapered after moving the vertex in the **Scale Deformation(X)** dialog box*

9.   Pick the **Insert Corner Point** button and then click on the red line near 60 (refer to the ruler at the top). Next, enter 60 in the left-hand text box and then press the ENTER key to place the vertex at the precise position.

10. Pick the **Move Control Point** button and move this new vertex below the top (100%) line by nine lines until 10 is displayed in the right-hand text box at the bottom of the dialog box, **Figure 9-6**.

A complex shape is created for the lofted object and is displayed in the viewports, **Figure 9-7**.
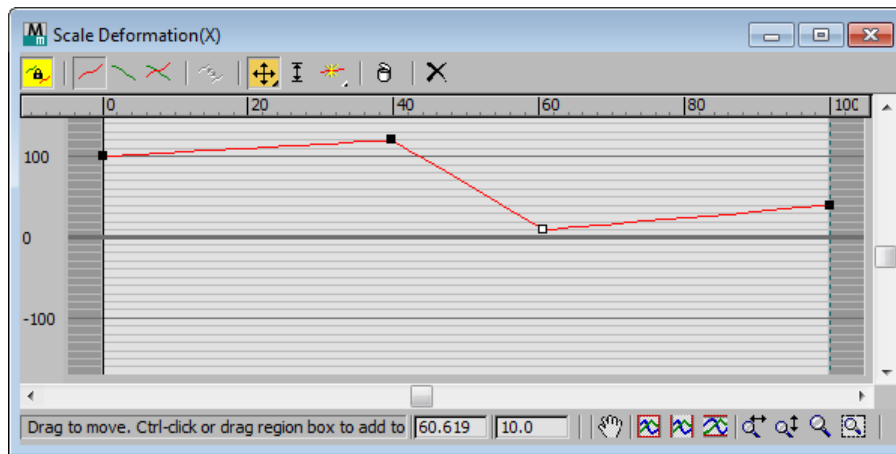
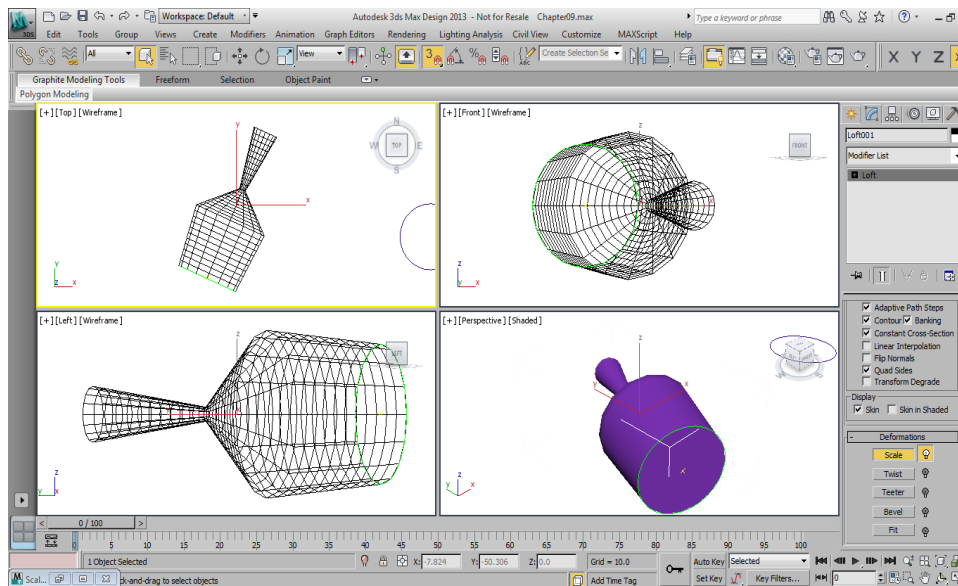**Figure 9-6** *Two vertices added and moved in the **Scale Deformation(X)** dialog box*

Figure 9-7 *The loft object modified after adding and moving the vertices*

Note

*You can right-click on the control point to display the shortcut menu from which you can select **Bezier-Smooth** or **Bezier-Corner** to display the handles. By adjusting these handles, you can make curved deformations.*

11. Close the **Scale Deformation(X)** dialog box.

Notice that the **Lightbulb** button next to the **Scale** button in the **Deformations** rollout is now activated, indicating that the deformation operation is on. Pick the **Lightbulb** button next to the **Scale** button to turn the deformation off.

Using the Twist Deformation

1. In the **Deformations** rollout, pick the **Twist** button.

The **Twist Deformation** dialog box is displayed, which is similar to the **Scale Deformation** dialog box, but with the red horizontal line at the 0 position. The horizontal line represents the degree of twist along the path axis.

2. Pick the **Insert Corner Point** button in the dialog box and then click on the red line near 40 (refer to the ruler at the top). Next, enter 40 in the left-hand text box and then press the ENTER key to insert the point at the precise position.

3. Pick the **Move Control Point** button and move the left vertex up to 200° (200 is displayed in the right-hand text box). If 200 is not visible in the graph, use the scroll bar to view the point, **Figure 9-8**.
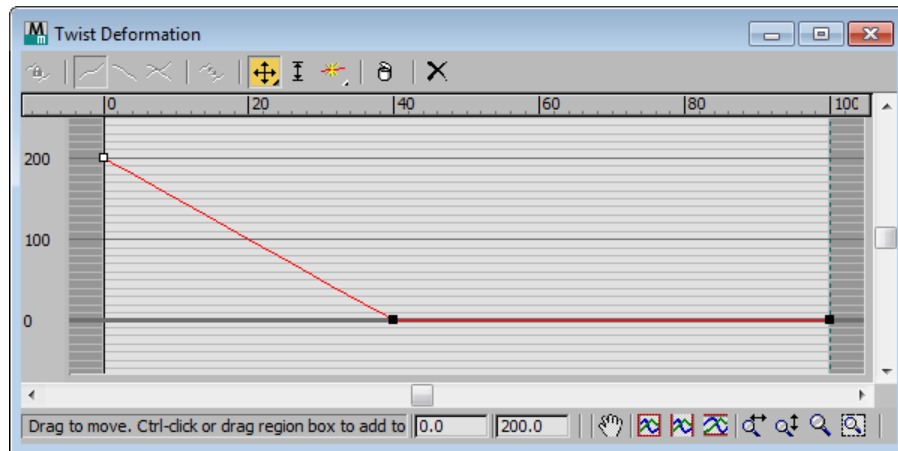

Figure 9-8 *Adjusting the vertex*

The lofted object twists 200° between the starting point of the path and a point at 40% of the path's overall length, **Figure 9-9**.

4. Close the **Twist Deformation** dialog box.

Note
*If the twist is not readily visible in the shaded viewport, right-click on the **Realistic** label to display the shortcut menu and then choose **Edged Faces** from the shortcut menu to get a better display.*

5. In the **Deformations** rollout, pick the **Lightbulb** button next to the **Twist** button to turn the deformation off.
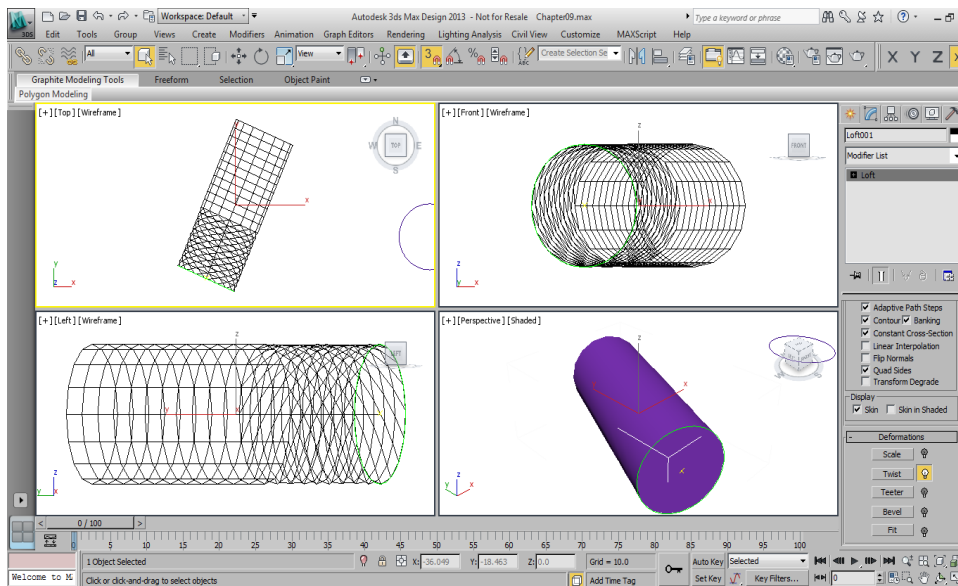
Figure 9-9   *The loft object modified after adding a vertex and moving the left vertex*

Using the Teeter Deformation

1.   In the **Deformations** rollout, pick the **Teeter** button.

The **Teeter Deformation(Y)** dialog box is displayed. The red horizontal line at the 0 position represents the teeter along the X axis.

2.   The **Make Symmetrical** button is on by default. Pick this button to turn it off. Then, pick the **Display Y Axis** button.

The red line turns green. This allows the lofted object to be teetered along the Y axis. The title bar of the dialog box indicates the presently displayed axis.

3.   Pick the **Insert Corner Point** button in the dialog box and then click on the green line (Y axis) near 60. Enter 60 in the left-hand text box and press the ENTER key to place the vertex at the precise position.

4.   Pick the **Move Control Point** button in the dialog box and move the right-hand vertex up by five lines so that 50 is displayed in the right-hand text box in the dialog box, as shown in **Figure 9-10.**

The end of the lofted object is tilted 50° along the Y axis, **Figure 9-11**.

5.   Close the **Teeter Deformation(Y)** dialog box.

6.   In the **Deformations** rollout, pick the **Lightbulb** button next to the **Teeter** button to turn the deformation off.
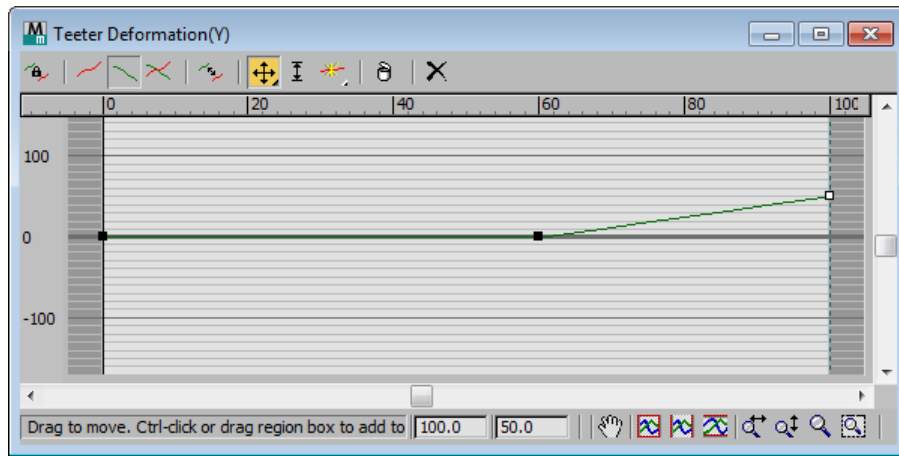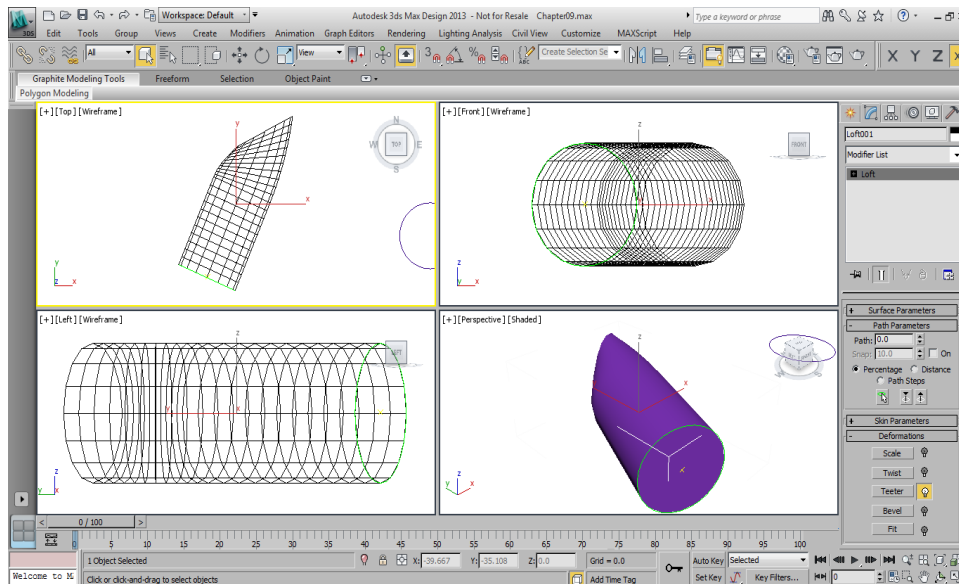
Figure 9-10 Adjusting the vertex

Figure 9-11 The lofted object tilted along the Y axis

Using the Bevel Deformation

1. In the **Deformations** rollout, pick the **Bevel** button.

The **Bevel Deformation** dialog box is displayed. The **Bevel Deformation** dialog box works similar to the **Scale Deformation** dialog box. This dialog box is used to bevel the object equally on both X and Y axes.

2. Pick the **Insert Corner Point** button and then click on the red line near 40. Then, enter 40 in the left-hand text box and press the ENTER key to place the vertex precisely. Similarly, place another corner point at 50.

3. Insert another corner point near 60. Then, enter 60 in the left-hand text box and press the ENTER key to place the vertex precisely.

4. Pick the **Move Control Point** button and at the point near to 60, move the vertex at point 50 down by 4 lines so that – 40 is displayed in the right-hand text box, **Figure 9-12**.
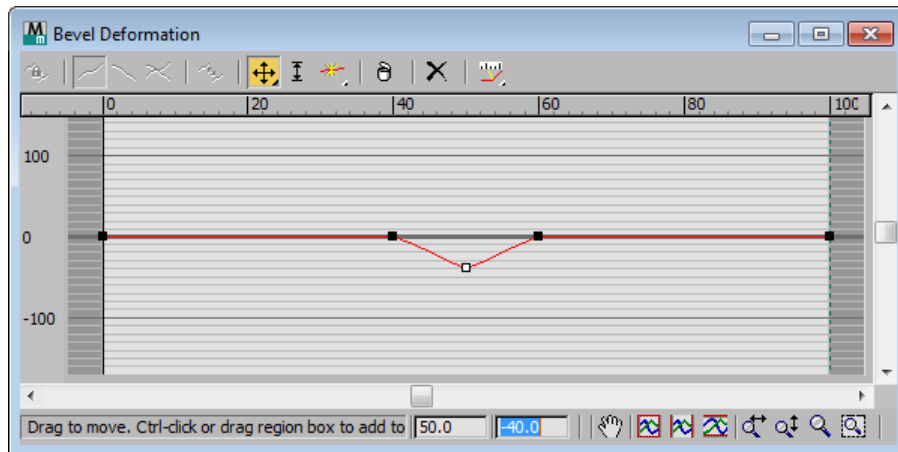

*Figure 9-12   The three vertices added in the **Bevel Deformation** dialog box and the middle vertex moved down*

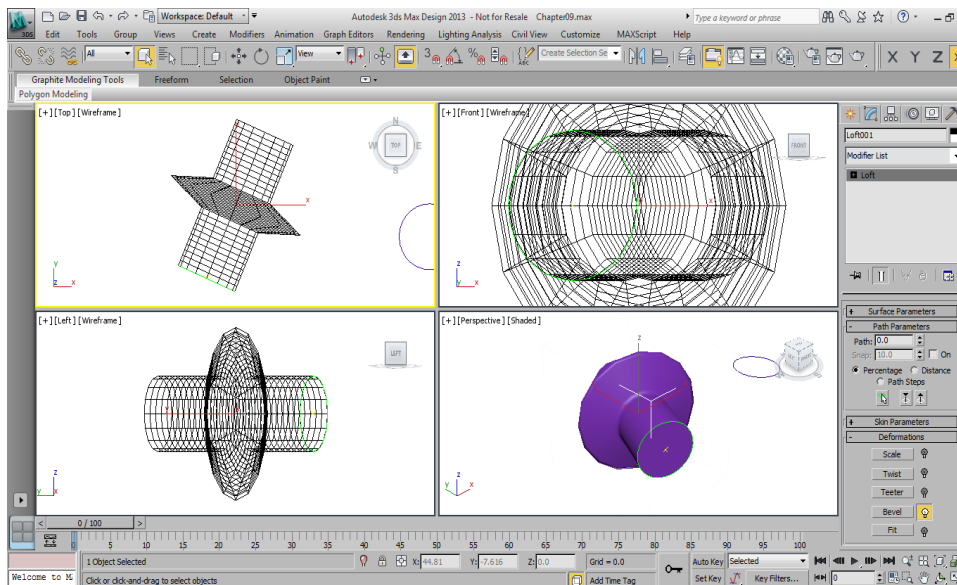A lofted object is beveled at this point, **Figure 9-13.**

Figure 9-13   The lofted object beveled after inserting three vertices and moving the middle one

5. Close the **Bevel Deformation** dialog box.

6. In the **Deformations** rollout, pick the **Lightbulb** button next to the **Bevel** deformation to turn the deformation off.

Using the Fit Deformation

1. Pick the **Create** tab in the **Command Panel**. Pick the **Shapes** button and then the **Line** button. In the Top viewport, use the **Line** tool to draw a closed shape that represents the way you want the side view of the loft object to appear. Make the shape approximately of the same length as the loft object. Name the line as **Fit Shape (Side)**. Draw another closed shape that represents the way you want the loft object to appear when viewed from the top. Name this line as **Fit Shape (Top)**. Pick the **Zoom Extents All** button, **Figure 9-14**.
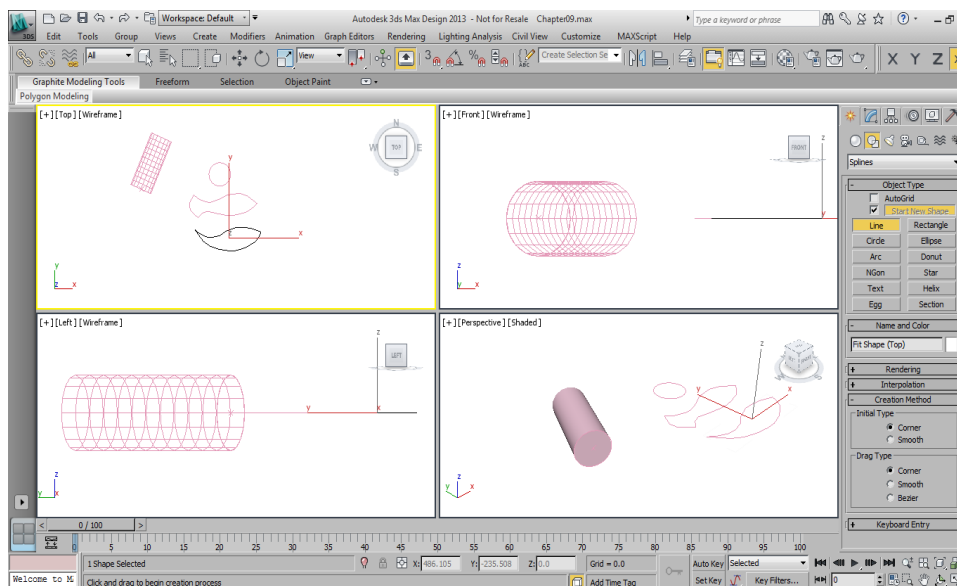

Figure 9-14 *Two closed shapes created in the Top viewport*

To draw the fit shape, maximize, zoom, and pan the viewport as needed. Edit the lines at the vertex sub-object level to get the desired shapes. In order to easily visualize the results of the fit deformation, both the shapes drawn should be of full size, and they should have the same length.

2. Select the lofted object and pick the **Modify** tab in the **Command Panel**. In the **Deformations** rollout, pick the **Fit** button.

The **Fit Deformation(X)** dialog box is displayed. Unlike the other deformation tools, the **Fit Deformation(X)** dialog box enables you to deform the loft object by loading the shapes, rather than by editing a baseline. The top and side profiles of the lofted object are adjusted so that they can be fitted inside the shapes you select as the fit shapes.

3. In the **Fit Deformation(X)** dialog box, pick the **Make Symmetrical** button to turn the forced symmetry off. Pick the **Display X Axis** button. Pick the **Get Shape** button at the top of the dialog box and select the *Fit Shape (Top)* in any of the viewports. You must select the shape using the cursor.

The *Fit Shape (Top)* object is displayed in the **Fit Deformation(X)** dialog box, **Figure 9-15**. Pick the **Zoom** tool and zoom in the graph to view the entire *Fit Shape (Top)*.
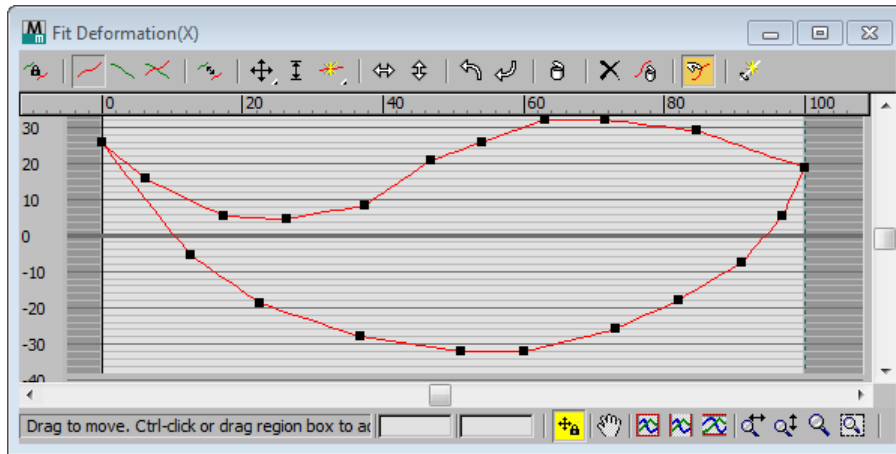

Figure 9-15 *The Fit Shape (Top) displayed in the **Fit Deformation(X)** dialog box*

4.   Pick the **Display Y Axis** button. Pick the **Get Shape** button at the top of the dialog box and select the *Fit Shape (Side)* in any of the viewports.

The *Fit Shape (Side)* object is displayed in the **Fit Deformation(Y)** dialog box, **Figure 9-16**.
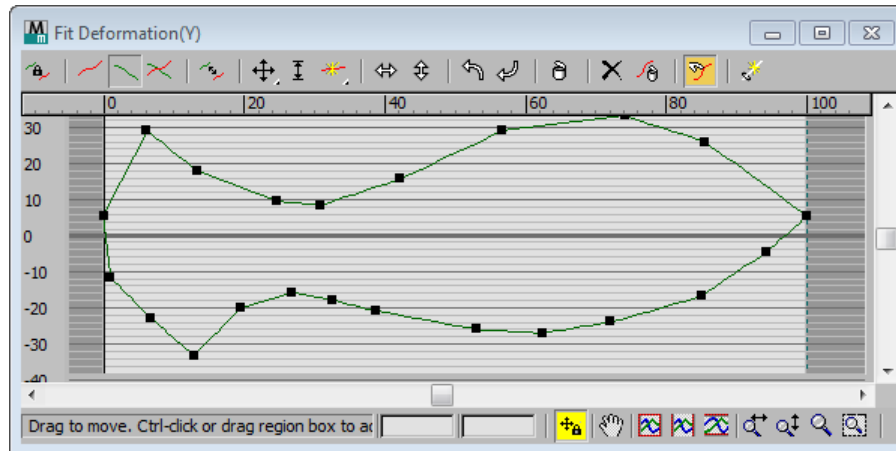

Figure 9-16 *The Fit Shape (Side) displayed in the **Fit Deformation(Y)** dialog box*

> **Note**
> *You can adjust the fit shapes at the vertex sub-object level in the **Fit Deformation** dialog box. The lofted object will be automatically updated in the viewports to reflect the change.*

5.   Close the **Fit Deformation** dialog box. Pick the **Zoom Extents All Selected** button.

The lofted object is displayed in the viewports. The shape of the lofted object is clearly determined by the fit shapes, **Figure 9-17**.
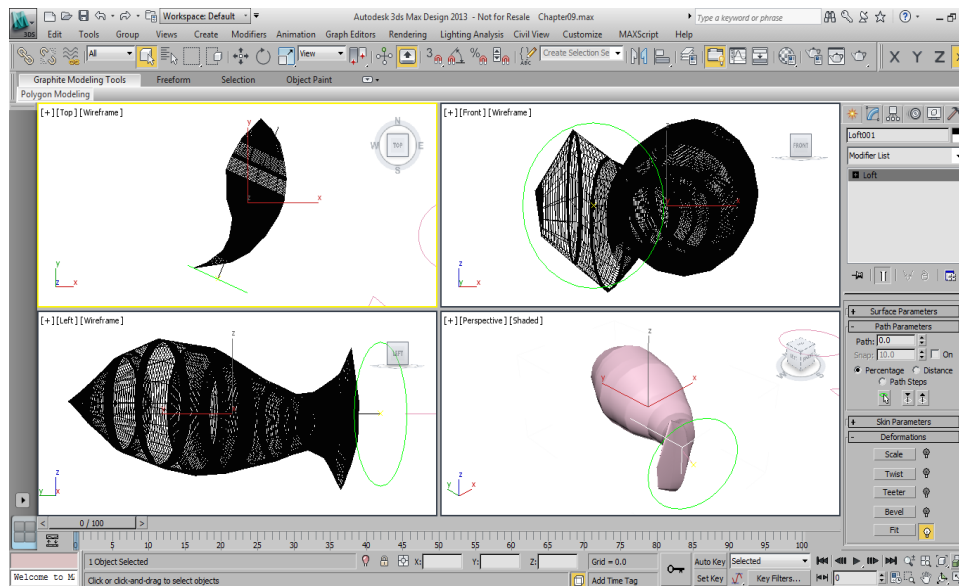
Figure 9-17 *The lofted object showing the effect of fit shapes*

6.   Save the scene.

In the **Deformations** rollout, experiment by turning on the different deformations individually, and in combinations by picking the **Lightbulb** buttons next to the deformation names. Note the effects of an individual deformation and the combination of deformations in the viewports.

Note
*While applying the **Scale**, **Teeter**, or **Fit** deformation to a lofted object, you can make changes to the X and Y axes separately by using the **Make Symmetrical** button.*

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1.   In the **Scale Deformation** dialog box, the horizontal red line represents the _____ of a loft object.

2.   When using the **Insert Corner Point** button in the **Scale Deformation** dialog box, enter a value in the _____ text box and then press the ENTER key to precisely place the vertex at a specific point.

3.   You can right-click on the control point in the **Scale Deformation** dialog box to display a _____, from which you can select **Bezier-Smooth** or **Bezier-Corner** to display the handles.

4.   In the _____ dialog box, the horizontal line represents the degree of twist along the path axis.

5. In the **Teeter Deformation** dialog box, the currently displayed axis is indicated in the _____ of the dialog box.

6. The **Bevel Deformation** dialog box is used to bevel an object equally on both X and Y axes. (T/F)

7. The **lightbulb** buttons next to the deformation names are used to turn on or off the effects of deformations. (T/F)

8. When you apply a fit deformation to a loft object, the shapes used to create the loft are replaced with the fit shapes. (T/F)

9. A maximum of three deformations can be applied to a loft object. (T/F)

10. When applying the **Scale**, **Teeter**, or **Fit** deformation to a loft object, you can make changes to the X and Y axes separately by making the **Make Symmetrical** button inactive. (T/F)

Review Questions

Answer the following questions:

1. The _____ button is used to insert new values in the **Scale Deformation** dialog box.

2. The _____ button is used to create 3D objects by lofting 2D objects along a spline path.

3. Which of the following buttons in the **Fit Deformation** dialog box is used to move control vertices?

   (a) **Insert corner Point**   (b) **Move Control Point**
   (c) **Scale Control Point**   (d) **Delete Control Point**

4. In the **Fit Deformation** dialog box, the green horizontal line represents the X axis. (T/F)

5. To turn on the grids in the viewport, press the H key. (T/F)

6. The **Bevel Deformation** dialog box works similar to the **Scale Deformation** dialog box. (T/F)

Exercise

Exercise 1

In this exercise, you will create a propeller using a circle and an ellipse, refer to **Figure 9-18.** Both these shapes will be lofted along straight lines, **Figure 9-19**. Add material, lights, and camera and render the model, **Figure 9-20**.

You can view the rendered image of this model by downloading *c09_maxdesign_2013_exr.zip* from the CADCIM website as discussed in earlier chapters.
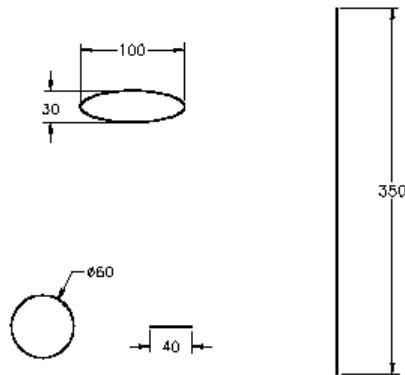

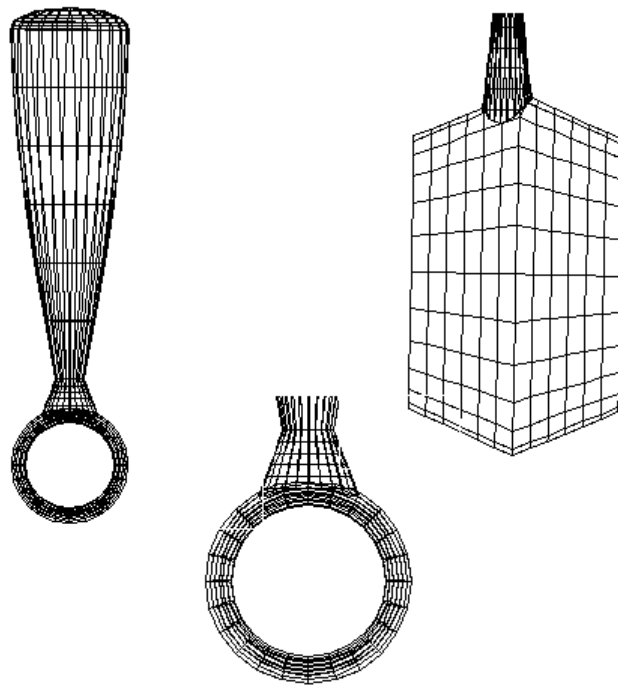***Figure 9-18*** *The crcular and ellipse shapes*

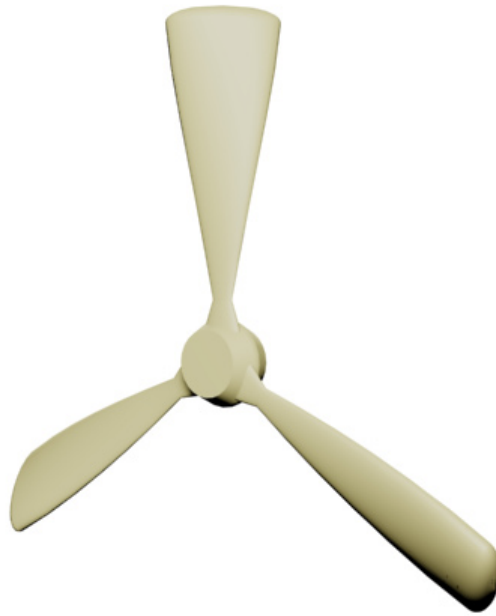***Figure 9-19*** *Shapes to be lofted*

Figure 9-20 *The propeller model*

Answers
The following are the answers of Self-Evaluation Test:

1. path steps on the X axis; 2. left-hand; 3. shortcut menu; 4. **Twist Deformation**; 5. title bar; 6. T; 7. T; 8. T; 9. F; 10. T