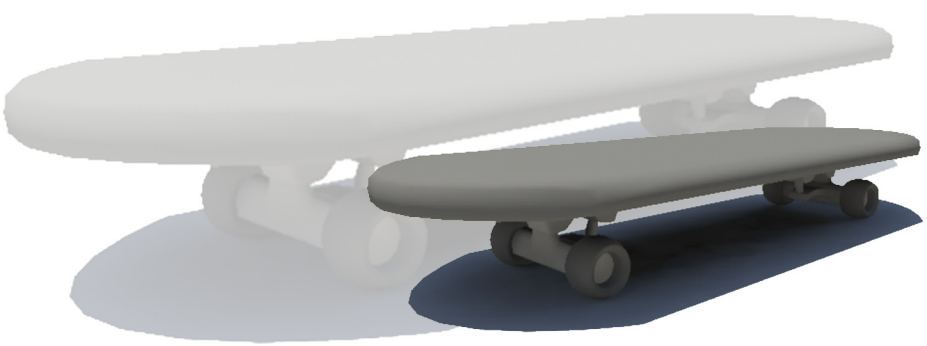
Chapter 4

Polygon Primitives

Learning Objectives

After completing this chapter, you will be able to:

- *Create polygon primitives*
- *Edit polygon surfaces*



INTRODUCTION

In this chapter, you will learn to create polygon surfaces. A polygon is made up of flat surface with *n* number of sides. Each side of a polygon is called a face. Each face can be further classified into edges and vertices. By modifying a face, an edge, or a vertex of an object, you can create a new object depending on your requirement. The creation of a polygon is more rigid than that of a NURBS object because NURBS object has a more pliable and sculptural surface.

POLYGON PRIMITIVES

In Maya, polygon primitives are classified into various objects. These objects are grouped under the **Polygon Primitives** in the main menubar. The method of creating different polygon primitives is discussed next.

Creating a Sphere

Main menubar:	Create > Polygon Primitives > Sphere
Shelf:	Polygons > Sphere

A sphere is a solid object and every point on its surface is equidistant from its centre, as shown in Figure 4-1. The sphere can be created dynamically or by entering the values using the keyboard. Both these methods are discussed next.

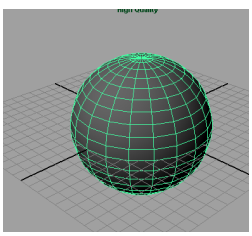


Figure 4-1 *A polygon sphere*

Creating a Sphere Dynamically

To create a sphere dynamically, choose **Create > Polygon Primitives > Sphere** from the main menubar; you will be prompted to drag the cursor on the grid to draw the sphere in the viewport. Press and hold the left mouse button, and drag the cursor up or down to define the radius of the sphere. Now, release the left mouse button to get the desired radius; the sphere will be created in all viewports and will be visible in the wireframe mode. Press the numeric key 5 to change the display to shaded mode. Alternatively, choose **Shading > Smooth Shade All** from the **Panel menu** to change the display to shaded mode. Press the numeric key 4 or choose **Shading > Wireframe** from the **Panel menu** to revert to the wireframe mode.

Creating a Sphere by Using the Keyboard

To create a sphere by using the keyboard, choose **Create > Polygon Primitives > Sphere > Option Box** from the main menubar; the **Polygon Sphere Tool** property window will be displayed on the left of the viewport, as shown in Figure 4-2. In this window, set the properties of the sphere by using the keyboard and then click in the viewport; the sphere will be created in all viewports. Choose the **Reset Tool** button at the top of the **Polygon Sphere Tool** window to reset the settings of the sphere. The properties given in this window are the same as those of other polygon primitives discussed in Chapter 3.

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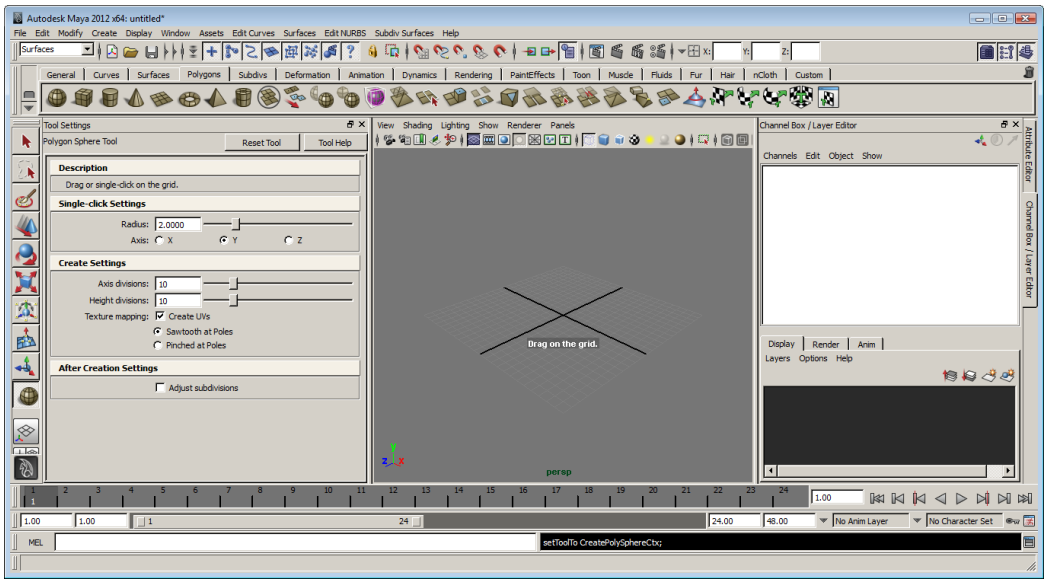

Figure 4-2 *The* ***Polygon Sphere Tool*** *window*

Creating a Cube

Main menubar:	Create > Polygon Primitives > Cube
Shelf:	Polygons >Cube

A cube is a three-dimensional shape with six squares or rectangular faces, as shown in Figure 4-3. A cube can be created dynamically or by entering values using the keyboard. Both these methods are discussed next.

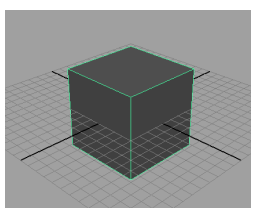

Figure 4-3 *A polygon cube*

Creating a Cube Dynamically

To create a cube dynamically, choose **Create >Polygon > Primitives > Cube** from the main menubar; you will be prompted to drag the cursor on the grid to draw a cube in the viewport. Press and hold the left mouse button, and drag the cursor on the grid to define the base of the cube. Now, release the left mouse button to get the desired base. Next, press and hold the left mouse button again and drag the cursor up to set the height of the cube and then release the left mouse button; the cube will be created in all the viewports.

Creating a Cube by Using the Keyboard

To create a cube by the using the keyboard, choose **Create > Polygon Primitives > Cube > Option Box** from the main menubar; the **Polygon Cube Tool** window will be displayed on the left of the viewport, as shown in Figure 4-4. In this window, set the properties of the cube by using the keyboard and then click in the viewport; the cube will be created in all viewports. Choose the **Reset Tool** button at the top of the **Polygon Cube Tool** window to reset the settings of the cube. The properties in the **Polygon Cube Tool** property window are the same as those of other polygon primitives discussed in Chapter 3.

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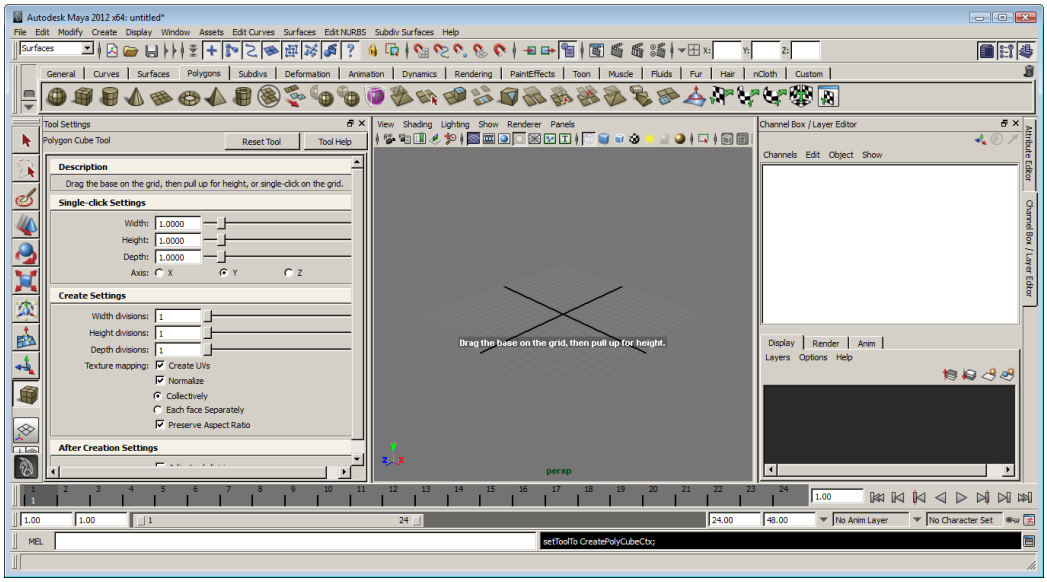

Figure 4-4 *The* ***Polygon Cube Tool*** *window*

Note

By default, polygon primitives are displayed in the wireframe mode. Press 5 on the keyboard to change the mode to shaded. Alternatively, choose ***Shading > Smooth Shade All*** *from the* ***Panel menu****. You can also switch back to the wireframe mode by pressing 4 on the keyboard or by choosing* ***Shading > Wireframe*** *from the* ***Panel menu****.*

Creating a Prism

Main menubar:	Create > Polygon Primitives > Prism
Shelf:	Polygons >Prism

A prism is a semi-regular polyhedron created by combining n-sided polygons and n number of squares, as shown in Figure 4-5. You can create a prism dynamically and by using the keyboard. Both these methods are discussed next.

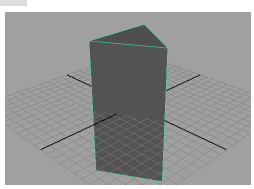

Figure 4-5 *A polygon prism*

Creating a Prism Dynamically

To create a prism dynamically, choose **Create > Polygon Primitives > Prism** from the main menubar; you will be prompted to drag the cursor on the grid to define the base of the prism. Press and hold the left mouse button and drag the cursor; the base of the prism is created. Release the left mouse button. Again, press and hold the left mouse button and drag the cursor up to set the height of the prism, and then release the left mouse button. Again, press and hold the left mouse button to set the thickness of the polygon prism. The polygon prism will be created in all viewports. By default, it will be visible in the wireframe mode. Press 5 on the keyboard to change it to the shaded mode. Alternatively, choose **Shading > Smooth Shade All** from the **Panel menu** to switch to the shaded mode.

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Creating a Prism by Using the Keyboard

To create a prism by using the keyboard, choose **Create > Polygon Primitives > Prism > Option Box** from the main menubar; the **Polygon Prism Tool** window will be displayed on the left of the viewport, as shown in Figure 4-6. In this window, set the properties of the prism by using the keyboard and then click in the viewport; the prism will be created in all viewports. Choose the **Reset Tool** button at the top of the **Polygon Prism Tool** window to reset the settings of the prism. The properties in this window are the same as those of other polygon primitives discussed in Chapter 3.

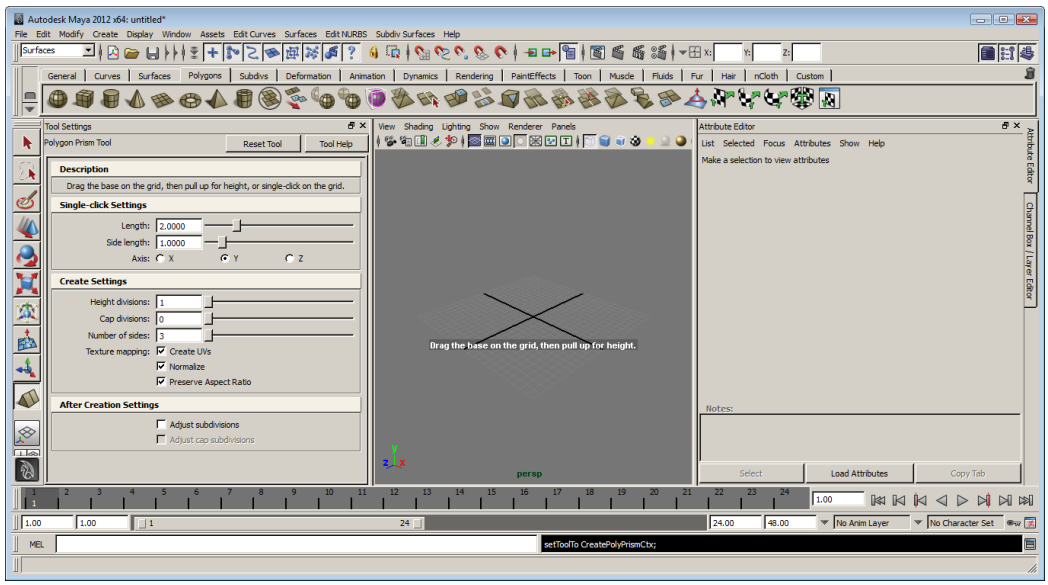

Figure 4-6 *The* ***Polygon Prism Tool*** *window*

Modifying the Name and other Parameters of a Prism

You can modify the name and other parameters of a prism in the viewport. To do so, select the prism and choose **Display > UI Elements > Channel Box / Layer Editor** from the main menubar. The **Channel Box /Layer Editor** will be displayed on the right of the viewport, as shown in Figure 4-7. Click on the **pPrism1** name in the **INPUTS** node and rename it. To modify the properties of the prism, expand the **INPUTS** node; various options will be displayed. Enter the required values in the edit boxes; the changes will be dynamically reflected on the prism in the viewport. Alternatively, select the parameter of the prism that you want to change; the corresponding parameter will be highlighted in the viewport. Now, press and hold the middle mouse button and drag the cursor horizontally to change that particular parameter.

Creating a Pyramid

Main menubar:	Create > Polygon Primitives > Pyramid
Shelf:	Polygons >Pyramid

A pyramid is a geometric shape with a polygonal base and a point called apex. The base and the apex are connected through triangular faces, as shown in Figure 4-8. You can create a pyramid dynamically or by entering values using the keyboard. Both the methods are discussed next.

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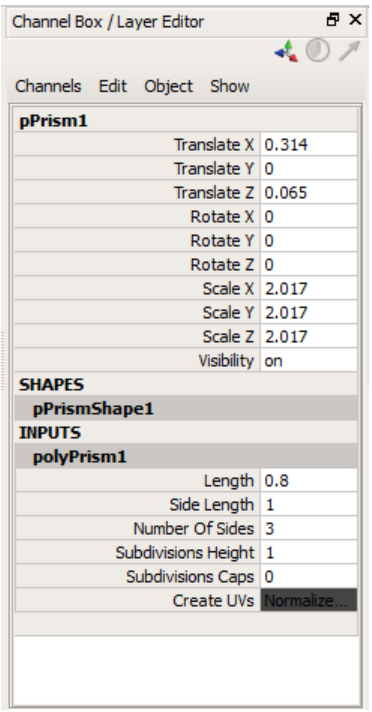

Figure 4-7** The **Channel Box/ Layer Editor

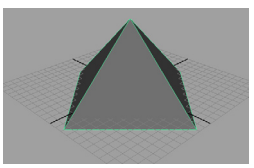

***Figure 4-8** A polygon pyramid*

Creating a Pyramid Dynamically

To create a pyramid dynamically, choose **Create > Polygon Primitives > Pyramid** from the main menubar; you will be prompted to drag the cursor on the grid to define the base of the pyramid. Press and hold the left mouse button and drag the cursor; the base of the pyramid is created. Release the left mouse button. Next, press and hold the left mouse button and drag the cursor up to set the height of the pyramid, and then release the left mouse button. Again, press and hold the button to set the thickness of the polygon pyramid. The polygon pyramid will be created in all viewports. By default, it will be visible in the wireframe mode. Press 5 on the keyboard to change it to the shaded mode. Alternatively, choose **Shading > Smooth Shade All** from the **Panel menu** to switch to the shaded mode.

Creating a Pyramid by Using the Keyboard

To create a pyramid by using the keyboard, choose **Create > Polygon Primitives > Pyramid > Option Box** from the main menubar; the **Polygon Pyramid Tool** window will be displayed on the left of the viewport, as shown in Figure 4-9. In this window, set the properties of the pyramid by using the keyboard and then click in the viewport; the pyramid will be created in all viewports. Choose the **Reset Tool** button at the top of the **Polygon Pyramid Tool** window to reset the settings of the pyramid. The properties in the **Polygon Pyramid tool** property window are the same as those of other polygon primitives discussed in Chapter 3.

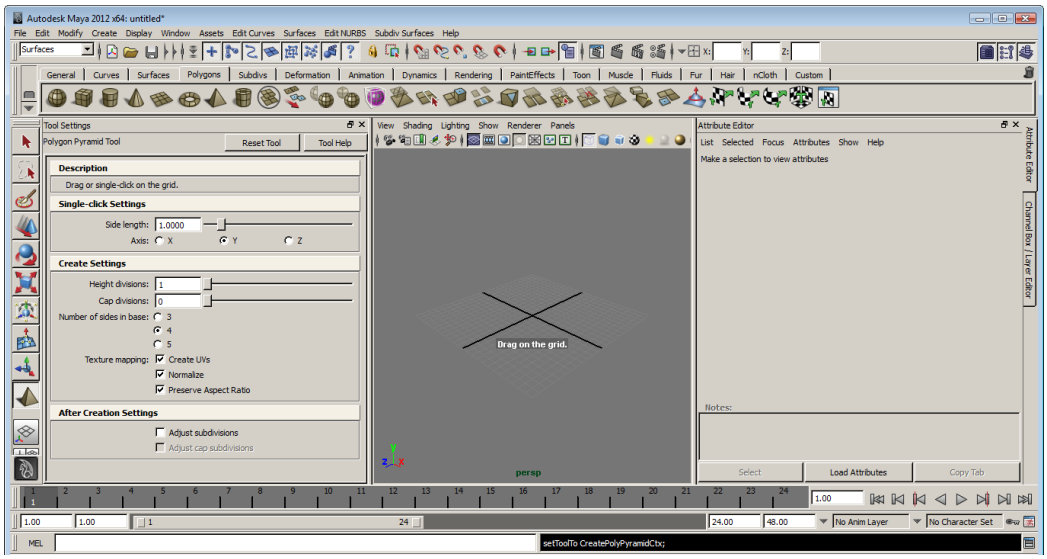

***Figure 4-9** The **Polygon Pyramid Tool** window*

Creating a Pipe

Main menubar:	Create > Polygon Primitives > Pipe
Shelf:	Polygons > Pipe

A pipe is similar to a hollow cylinder. But unlike a cylinder, the top and bottom portions of a pipe are open, as shown in Figure 4-10. You can create a pipe either dynamically or by entering values using the keyboard. Both the methods are discussed next.

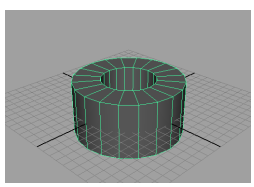

***Figure 4-10** A polygon pipe*

Creating a Pipe Dynamically

To create a pipe dynamically, choose **Create > Polygon Primitives > Pipe** from the main menubar; you will be prompted to drag the cursor on the grid to define the base of the pipe. Press and hold the left mouse button and drag the cursor; the base of the pipe is created. Release the left mouse button. Next, press and hold the left mouse button and drag the cursor up to set the height of the pipe, and then release the left mouse button. Again, press and hold the left mouse button to set the thickness of the polygon pipe. The polygon pipe will be created in all viewports. By default, it will be visible in the wireframe mode. Press 5 on the keyboard to change it to the shaded mode. Alternatively, choose **Shading > Smooth Shade All** from the **Panel menu** to switch to the shaded mode.

Creating a Pipe by Using the Keyboard

To create a pipe by using the keyboard, choose **Create > Polygon Primitives > Pipe> Option Box** from the main menubar; the **Polygon Pipe Tool** window will be displayed on the left of the viewport, as shown in Figure 4-11. In this window, set the properties of the pipe by using the keyboard and then click in the viewport; the pipe will be created in all the viewports. Choose

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the **Reset Tool** button at the top of the **Polygon Pipe Tool** window to reset the settings of the pipe. The properties in this window are the same as those of other polygon primitives discussed in Chapter 3.

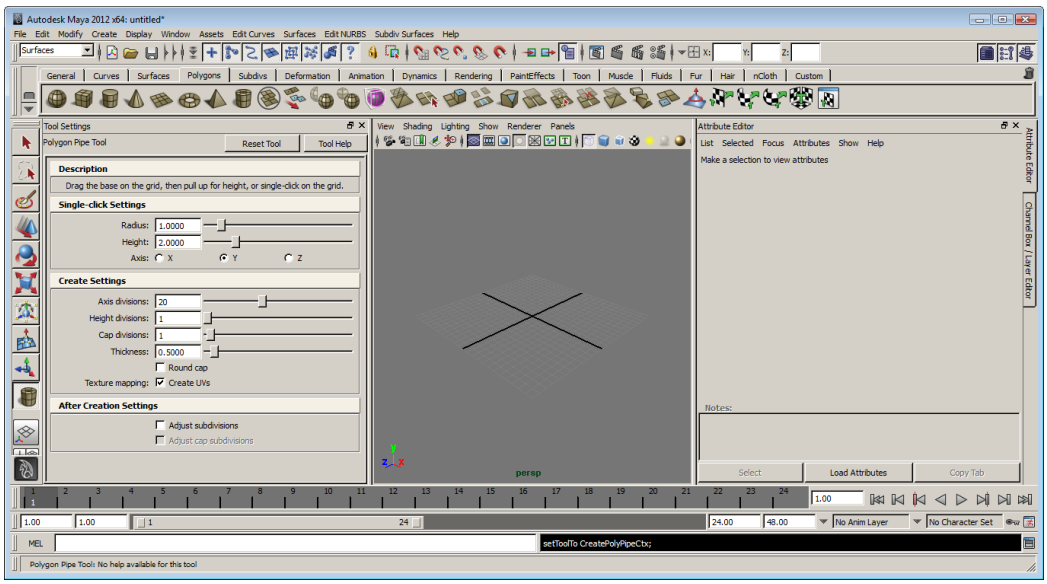

***Figure 4-11** The **Polygon Pipe Tool** window*

Creating a Helix

Main menubar:	Create > Polygon Primitives > Helix
Shelf:	Polygons >Helix

A helix is a three-dimensional curve that lies on a cylinder or a cone, so that its perpendicular angle remains constant to the axis, as shown in Figure 4-12. You can create a helix dynamically or by entering values using the keyboard. Both the methods are discussed next.

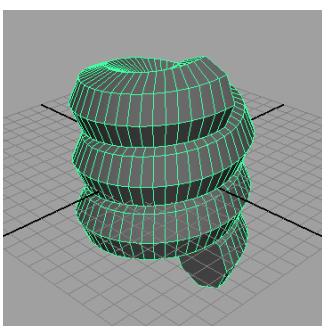

***Figure 4-12** A polygon helix*

Creating a Helix Dynamically

To create a helix dynamically, choose **Create > Polygon Primitives > Helix** from the main menubar; you will be prompted to drag the cursor on the grid. Press and hold the left mouse button and drag the cursor on the grid to define the diameter of the helix and then release the left mouse button. Again, press and hold the left mouse button and drag the cursor up to set the height of the helix, and then release the left mouse button. Next, press and hold the left mouse button and drag the cursor to set the number of coils in the helix. Release the left mouse button after setting the number of coils. Again, press and hold the left mouse button and drag the cursor to set the section radius; the helix will be created in all viewports.

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Creating a Helix by Using the Keyboard

To create a helix by using the keyboard, choose **Create > Polygon Primitives > Helix > Option Box** from the main menubar; the **Polygon Helix Tool** window will be displayed on the left of the viewport, as shown in Figure 4-13. In this window, set the properties of the helix by using the keyboard and then click in the viewport; the helix will be created in all viewports. Choose the **Reset Tool** button at the top of the **Polygon Helix Tool** window to reset the settings of the helix. The properties in this window are the same as of other polygon primitives discussed in Chapter 3.



Tip. *By default, the **Polygon Helix Tool** is not available in the Shelf. But, if the need arises, you can add it to the Shelf. To do so, choose the **Custom Shelf** tab from the Shelf. By default, the **Custom** Shelf tab is empty. This tab can be used to add tools that are frequently used. Press and hold the SHIFT and CTRL keys and choose **Create > Polygon Primitives > Helix** from the main menubar; a helix icon is formed in the **Custom** shelf. Similarly, you can add other tools in the **Custom** Shelf tab for quick reference.*

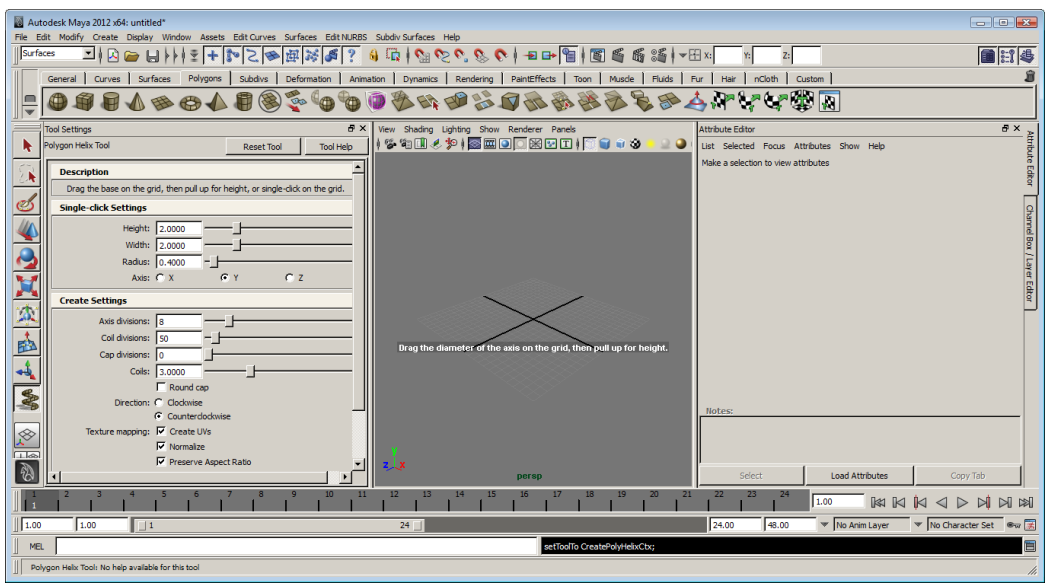

***Figure 4-13** The **Polygon Helix Tool** window*

Creating a Soccer Ball

Main menubar:	Create > Polygon Primitives > Soccer ball
Shelf:	Polygons > Soccer Ball

A soccer ball polygon primitive created in Maya is very much similar to a real-world soccer ball, as shown in Figure 4-14. A soccer ball is formed by an alternate arrangement of hexagons and pentagons. It has total thirty two faces. You can create a soccer ball dynamically or by entering values using the keyboard. Both the methods are discussed next.

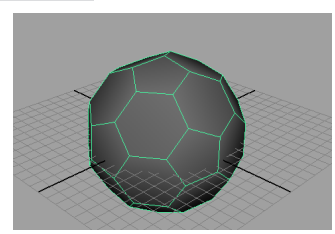

***Figure 4-14** A soccer ball*

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Creating a Soccer Ball Dynamically

To create a soccer ball dynamically, choose **Create > Polygon Primitives > Soccer Ball** from the main menubar; You will be prompted to drag the cursor on the grid. Press and hold the left mouse button and drag the cursor on the grid; the soccer ball will be created in all viewports. By default, it will be displayed in the wireframe mode. Press 5 on the keyboard to switch to the shaded mode. Alternatively, choose **Shading > Smooth Shade All** from the Panel menu to switch to the shaded mode.

Creating a Soccer Ball by Using the Keyboard

To create a soccer ball by using the keyboard, choose **Create > Polygon Primitives > Soccer Ball > Option Box** from the main menubar; the **Polygon Soccer Ball Tool,** window will be displayed on the left of the viewport, as shown in Figure 4-15. In this window, set the properties of the soccer ball by using the keyboard and then click in the viewport; the soccer ball will be created in all the viewports. Choose the **Reset Tool** button at the top of the **Polygon Soccer Ball Tool** property window to reset the settings of the soccer ball. The properties in the **Polygon Soccer Ball Tool** window are the same as those of other polygon primitives that have already been discussed in Chapter 3.

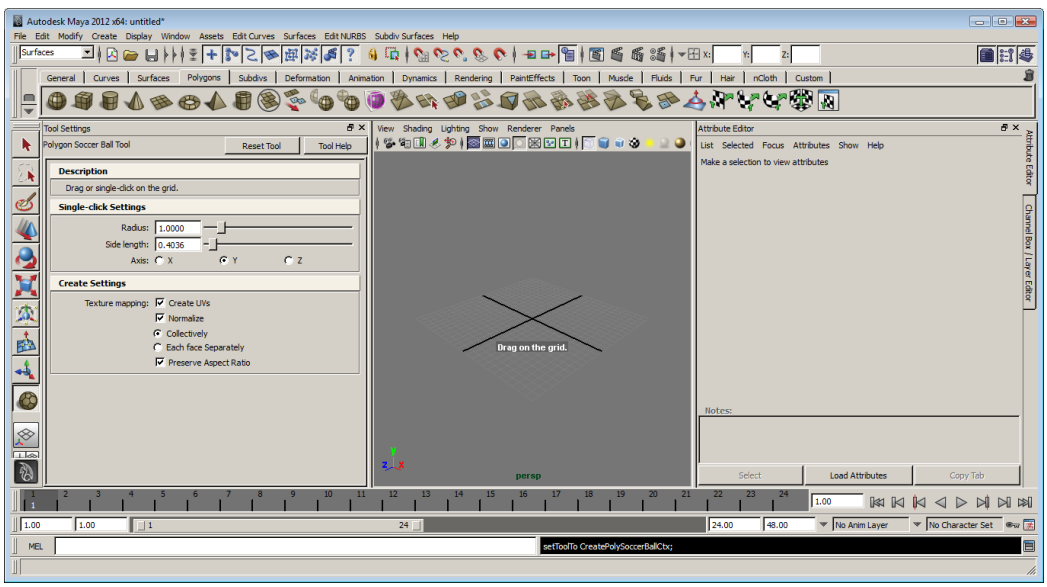

*Figure 4-15 The **Polygon Soccer Ball Tool** window*

Creating a Platonic Solid

Main menubar: Create > Polygon Primitives > Platonic Solids

A platonic solid is a regular polyhedron with every face being a regular polygon of the same size and shape, as shown in Figure 4-16. You can create a platonic solid dynamically or by entering values using the keyboard. Both the methods are discussed next.

Creating a Platonic Solid Dynamically

To create a platonic solid dynamically, choose **Create > Polygon Primitives > Platonic**

Solids from the main menubar; you will be prompted to drag the cursor on the grid. Press and hold the left mouse button and drag the cursor on the grid; the platonic solid will be created in all viewports and it will be displayed in the wireframe mode. Press 5 on the keyboard to change it to the shaded mode. Alternatively, choose **Shading > Smooth Shade All** from the **Panel menu** to switch to the shaded mode.

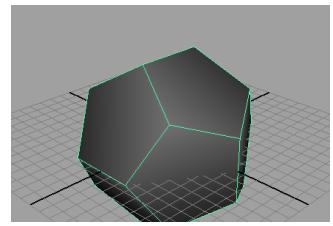

Figure 4-16 *A platonic solid*

Creating a Platonic Solid by Using the Keyboard

To create a **Platonic Solid** by using the keyboard, choose **Create > Polygon Primitives > Platonic Solids > Option Box** from the main menubar; the **Polygon Platonic Solid Tool** window will be displayed on the left of the viewport, as shown in Figure 4-17. In this window, set the properties of the platonic solid by using the keyboard and then click in the viewport; the platonic solid will be created in all viewports. Choose the **Reset Tool** button at the top of the **Polygon Platonic Solid Tool** window to reset the settings of the platonic solid. The properties in the **Polygon Platonic Solid Tool** window are the same as those of other polygon primitives discussed in Chapter 3.

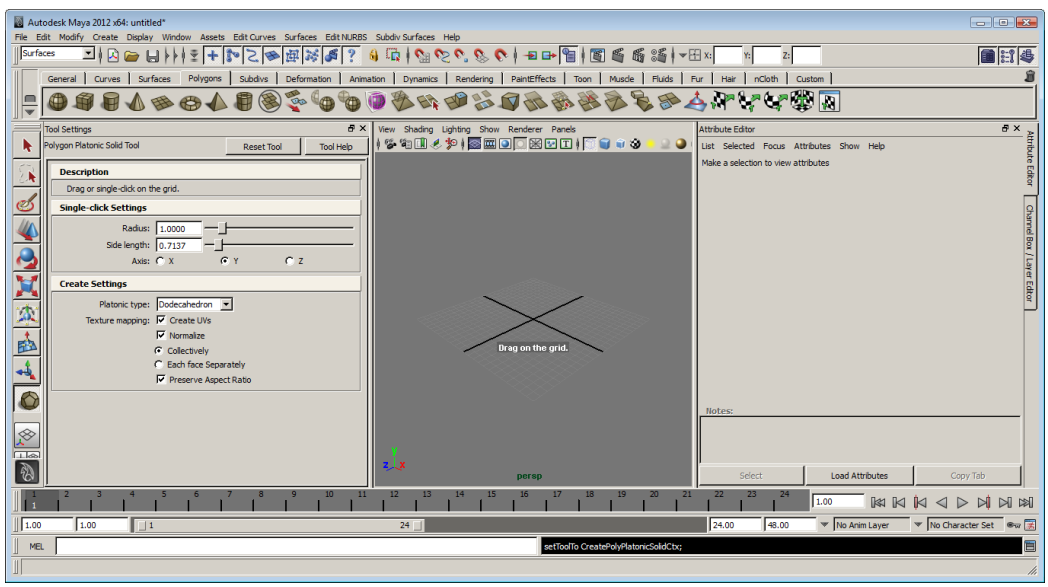

Figure 4-17 *The* ***Polygon Platonic Solid Tool*** *window*

Note

The polygon surfaces that have been created in this chapter are composed of components such as edges, vertices, and faces. You can access these components from the marking menus, as shown in Figure 4-18 (for marking menus, refer to Chapter 1).

Tip. *You can use the shortcut keys for displaying or activating various components of an object. For example, press F8 for object mode, F9 for vertex, F10 for edges, F11 for faces, and F12 for UVs.*

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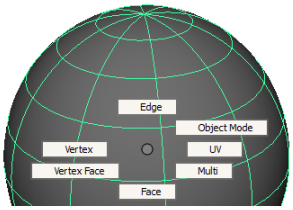

Figure 4-18 *Marking menus for accessing polygon components*

EDITING THE POLYGON SURFACES

In the previous section, you learned to create simple polygon primitives. For creating complex polygon objects, you need to edit the previously created objects. To edit a polygon object, you need to choose the components of a polygon object from the marking menu. To do so, select a polygon object in the viewport and then press and hold the right mouse button over it; the marking menu of the corresponding object will be displayed, consisting of various components of the object, refer to Figure 4-19 through 4-22. To access the various tools for editing the polygon primitives, choose polygon menuset from the status line. Next, choose **Edit Mesh** menu from the main menubar. These editing tools are discussed next.

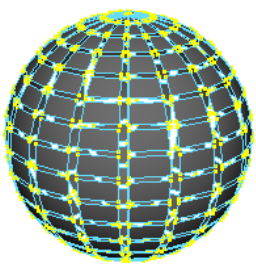

Figure 4-19 *Vertex faces of the sphere*

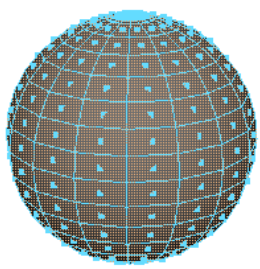

Figure 4-20 *Faces of the sphere*

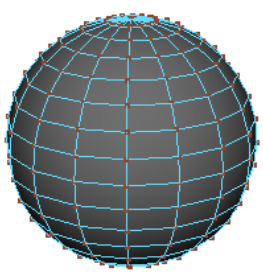

Figure 4-21 *UVs of the sphere*

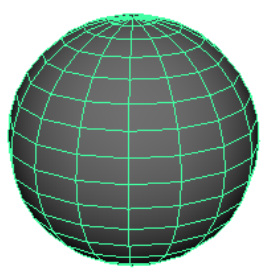

Figure 4-22 *The sphere in object mode*

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Note

1. The face components in the marking menu let you select the faces on the active object. When you move the cursor on a face, the corresponding face will be highlighted in red. Next, when you click over the highlighted face, its color will change to green, which means it is selected now. In this way, you can identify between the selected and the unselected faces.

*2. The **Multi** component allows you to select all components at a time without switching between components. To select all components, press and hold the right mouse button on the selected component, and then choose the **Multi** option from the marking menu. Next, select a face on the object, press and hold the SHIFT key, and then select the next required component.*

Duplicate Face

Main menubar: Edit Mesh > Duplicate Face

The **Duplicate Face** tool helps you create the duplicate copies of the selected faces. For example, create a polygon cube in the viewport. Select the polygon cube, press and hold the right mouse button over it. Next, choose **Face** from the marking menu; the face component of the polygon cube will be activated. Choose the **Move** tool from the toolbox. Next, select a face on the polygon cube and choose **Edit Mesh > Duplicate Face** from the main menubar; a duplicate copy of the selected face will be created in the viewport.

Bevel

Main menubar: Edit Mesh > Bevel

The **Bevel** tool helps you to create beveled transition surfaces on a profile curve. This option is used to add smoothness to a sharp object. The bevel option adds fillet to edges by creating new faces on the selected edge. To do so, create a polygon object in the viewport. Now, select the object and right-click on it; the marking menu will be displayed. Choose **Edge** from the marking menu. Now, select any edge on the object and then choose **Edit Mesh > Bevel** from the main menubar; a beveled transition surface will be created on the selected edge. Figure 4-23 shows a polygon cube before using the **Bevel** tool and Figure 4-24 shows the polygon cube after using the **Bevel** tool on all its edges.

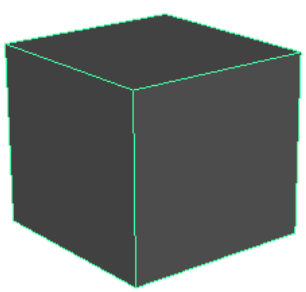

Figure 4-23 *A polygon cube before using the **Bevel** tool*

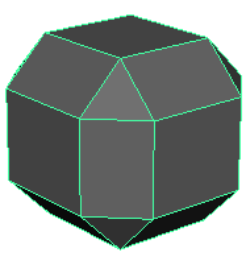

Figure 4-24 *The edges of the polygon cube after using the **Bevel** tool*

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To adjust the bevel parameters, choose **Display > UI Elements > Channel Box/Layer Editor** from the main menubar; the **Channel Box / Layer Editor** will be displayed on the right of the viewport. Select the beveled part of the object in the viewport. Next, expand the **pollybevel1** parameter from the **INPUTS** node of the channel box and then set the bevel parameters; the changes will be reflected on the selected object in the viewport. Alternatively, select the beveled object in the viewport. Choose **Window > Attribute Editor** from the main menubar. Next, choose the **polyBevel1** tab from the **Attribute Editor**; the bevel parameters will be displayed in the **Attribute Editor**, as shown in Figure 4-25. Set the parameters as per your requirement.

Cut Faces Tool

Main menubar: Edit Mesh > Cut Faces Tool

The **Cut Faces Tool** is used to modify a selected object by splitting its faces along a cut line. To use this tool, create a polygonal object in the viewport and choose **Edit Mesh > Cut Faces Tool** from the main menubar. Then, drag the cursor to the selected object in the viewport; the faces of the object will be cut along the cut line.

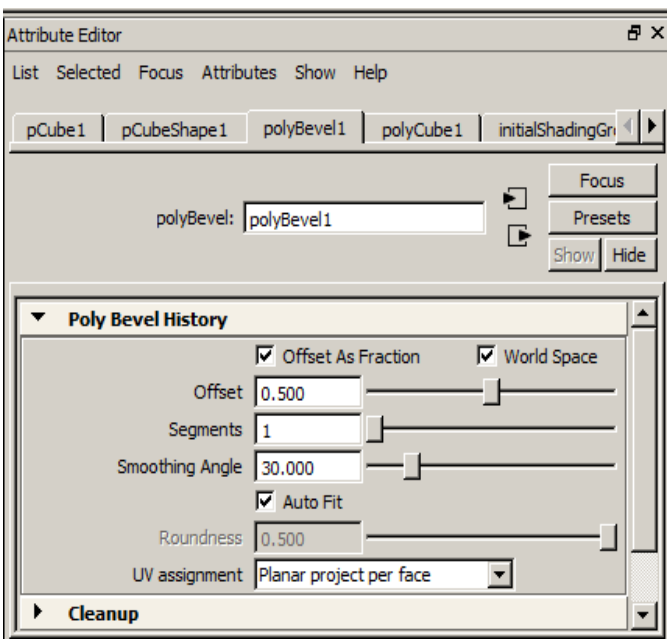

Figure 4-25** Partial view of the various bevel attributes in the **Attribute Editor

Insert Edge Loop Tool

Main menubar: Edit Mesh > Insert Edge Loop Tool

The **Insert Edge Loop Tool** helps in adding segments to the selected object. This tool is different from the **Cut Faces** tool such that the new segment created by using this tool forms a complete ring. In other words, it ends at the same point from where it starts. To use this tool, create a polygon object in the viewport and choose **Edit Mesh > Insert Edge Loop Tool** from the main menubar. Next, click on an edge; a new segment will be created on the

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selected object, as shown in Figure 4-26. Note that the **Insert Edge Loop Tool** works only with the objects that have quads (quads are faces with four sides). If the sides of a face are more or less than four, then this tool will not work. To set the properties of this tool, choose **Edit Mesh > Insert Edge Loop Tool > Option Box** from the main menubar; the **Insert Edge Loop Tool** property window will be displayed on the left of the viewport, as shown in Figure 4-27. You can set the properties of this tool by using this property window.

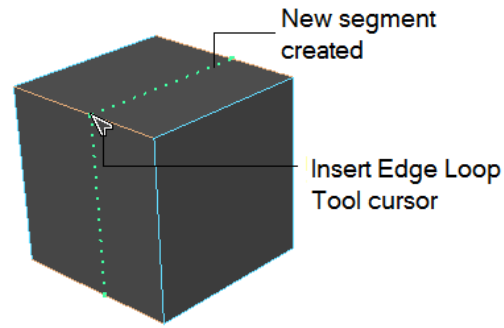

Figure 4-26 *A new segment created using the* ***Insert Edge Loop Tool***

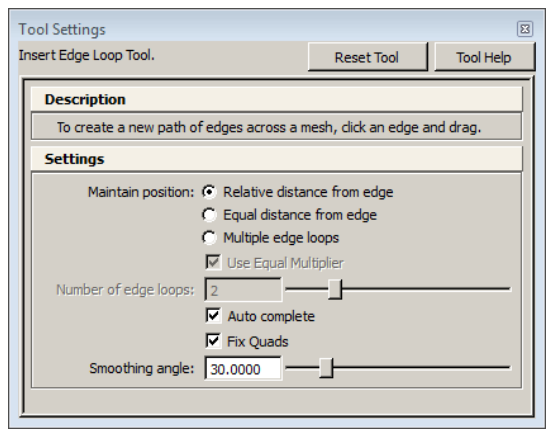

Figure 4-27 *The* ***Insert Edge Loop Tool*** *property window*

Offset Edge Loop Tool

Main menubar: Edit Mesh > Offset Edge Loop Tool

The **Offset Edge Loop Tool** works similar to the **Insert Edge Loop Tool** with the only difference that it creates segments on both sides of the edges selected. To use this tool, create a polygon object in the viewport and choose **Edit Mesh > Offset Edge Loop Tool** from the main menubar. Next, click and drag the cursor to the edges to create new segments on both sides of the selected object, as shown in Figure 4-28.

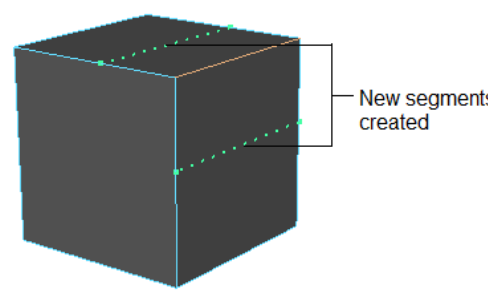

Figure 4-28 *New segments created using the* ***Offset Edge Loop Tool***

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Add Divisions

Main menubar: Edit Mesh > Add Divisions

The Add Divisions tool is used to add segments equally on all faces of an object. To do so, select an object in the viewport and choose **Edit Mesh > Add Divisions** from the main menubar; new segments will be created equally on all faces of the selected object.

Merge

Main menubar: Edit Mesh > Merge

The **Merge** tool is used to merge two or more vertices, faces, edges, or UVs together. To do so, create a polygon object in the viewport and press and hold the right mouse button over it; a marking menu will be displayed. Choose **Vertex** from the marking menu. Now, press and hold the SHIFT key and select the vertices that you want to merge. Next, choose the **Polygon** menuset from the status line. Then, choose **Edit Mesh > Merge** from the main menubar; the selected vertices will merge together. You can also adjust the threshold value of the **Merge** tool. The threshold value is the point at which a particular effect begins to produce. To do so, choose **Edit Mesh > Merge > Option Box** from the main menubar; the **Merge Vertices Options** dialog box will be displayed in the viewport, as shown in Figure 4-29. Set the threshold value in the **Threshold** edit box. More is the threshold value, more easily the polygon components will merge together, even if they are at a distance.

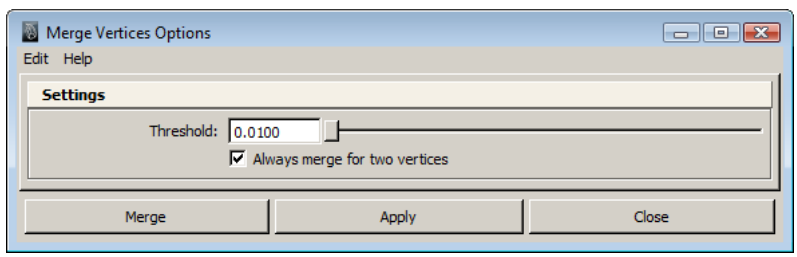

***Figure 4-29** The **Merge Vertices Options** dialog box*

Merge To Center

Main menubar: Edit Mesh > Merge To Center

The **Merge To Center** tool works similar to the **Merge** tool. The only difference is that the **Merge To Center** tool is used to merge vertices together to the center of all the selected vertices.

Merge Vertex Tool

Main menubar: Edit Mesh > Merge Vertex Tool

The **Merge Vertex Tool** is used to merge two vertices together by dragging one vertex toward the other vertex. To do so, select an object in the viewport and press and hold the right mouse button over it; a marking menu will be displayed. Choose **Vertex** from the marking menu. Next, choose **Edit Mesh > Merge Vertex Tool** from the main menubar; the **Merge Vertex Tool** will be activated. Now, select a vertex and drag the selected vertex to the nearby vertex, with which you

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want to merge it. When you drag the cursor from one vertex to the other, a red line appears between the two vertices, indicating that these two points will merge together, as shown in Figure 4-30. You can also use the **Merge Vertex Tool** for merging the selected vertex to the target vertex or to the center of the two vertices. To do so, choose **Edit Mesh > Merge Vertex Tool > Option Box** from the main menubar; the **Merge Vertex Tool** property window will be displayed on the right of the window. Now, you can select the required radio button from this window to perform the respective action.

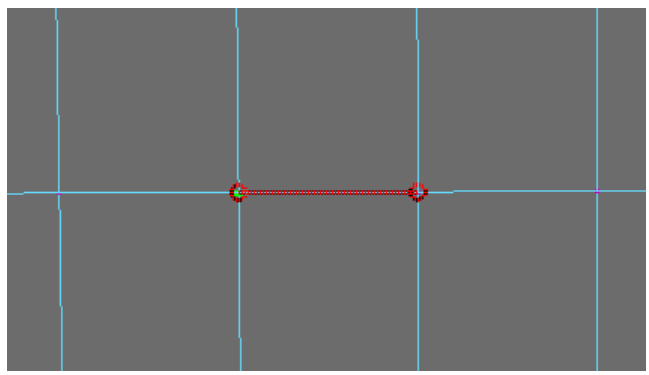

Figure 4-30 *The red line indicating that the two vertices will be merged*

Chamfer Vertex

Main menubar: Edit Mesh > Chamfer Vertex

The **Chamfer Vertex** tool is used to replace a vertex with a flat polygon face. To do so, create a polygon object in the viewport and press and hold the right mouse button over it; a marking menu will be displayed. Choose **Vertex** from the marking menu; the vertex component will be activated on the selected object. Select a vertex from the object. Next, choose **Edit Mesh > Chamfer Vertex** from the main menubar; a new polygon face will be created at the place of the selected vertex, as shown in Figure 4-31.

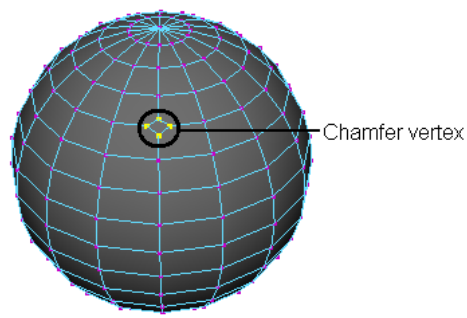

Figure 4-31 *A new face created using the* ***Chamfer Vertex*** *tool*

Smooth

Main menubar: Mesh > Smooth

The **Smooth** option is used to make a polygonal object smooth by adding segments to it. To do so, create a polygonal object in the viewport and then choose **Mesh > Smooth** from the main menubar; the selected polygonal object will be smoothened.

SUBDIVISION SURFACES

Subdivision surfaces are used to divide an object into regions of greater detail. These surfaces exhibit characteristics of both the polygons and NURBS surfaces. The subdivision surfaces are mainly used to model smooth objects with comparatively less control vertices.

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To model an object, it is advisable to start with polygons. After getting the basic shape, it should be converted into a subdivision surface to get greater details with comparatively less control vertices. In other words, a subdivision surface allows you to take the original polygonal model and produce an approximation of the surface by adding vertices and subdividing the existing polygons.

The subdivision surfaces have some default shapes such as sphere, cube, cylinder, cone, plane, and torus. You can access these shapes from the main menubar or the shelf. Choose **Create > Subdiv Primitives** from the main menubar or choose the **Subdivs** shelf from the shelf bar to access the subdivision surfaces.

The process of creating all subdivision surfaces is the same as discussed under the NURBS surfaces and polygon surfaces sections in Chapter 3. To modify a NURBS surface, choose **Display > Subdiv Surfaces** from the main menubar; various components of the subdivision surfaces will be highlighted. Now, you can modify them as per your requirement.

TUTORIALS

Tutorial 1

In this tutorial, you will create the model of an umbrella, as shown in Figure 4-32, using the polygon primitive objects and NURBS curves. **(Expected time: 15 min)**

The following steps are required to complete this tutorial:

a. Create a new project.
b. Create the upper part of the umbrella.
c. Make the stick of the umbrella.
d. Render the final output.
e. Save the model.



Figure 4-32 *The model of an umbrella*

Creating the Project Folder

Before starting a new file, it is recommended that you create the project folder.

1. Create a project with the name *c04_tut1* in the folder *Maya_Tutorials* as discussed in Tutorial 1 of Chapter 3.

Creating the Upper Part of the Umbrella

In this section, you will use the polygon primitive sphere to create the upper part of the umbrella.

1. Choose **Create > Polygon Primitives > Sphere > Option Box** from the main menubar; the **Polygon Sphere Tool** property window is displayed on the left of the viewport. Alternatively, you can choose **Polygon Sphere** from the shelf bar and then double-click on the sphere icon in the shelf to invoke this property window. Enter the required values in the property window, as shown in Figure 4-33.

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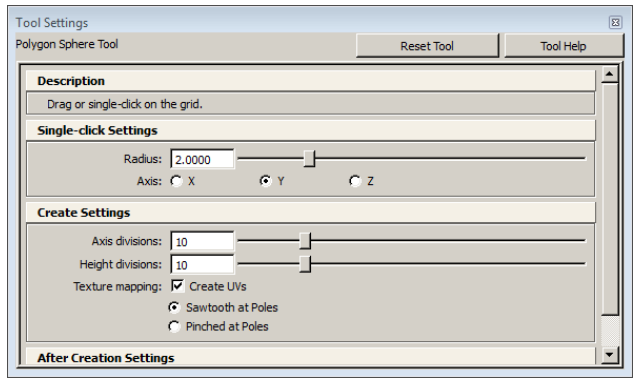

Figure 4-33 *The* ***Polygon Sphere Tool*** *window*

2. Activate the Front viewport. Select the sphere and then press and hold the right mouse button; a marking menu is displayed. Choose **Face** from the marking menu; the face component of the sphere polygon is activated. Press 5 to switch to the shaded mode. Next, select the faces on the lower part of the sphere, as shown in Figure 4-34, and then press the DELETE key to delete the selected faces.

3. Activate the Top viewport. Press and hold the right mouse button and choose **Edge** from the marking menu. Select the edges in the center of the sphere, as shown in Figure 4-35, and then press the DELETE key to delete them.

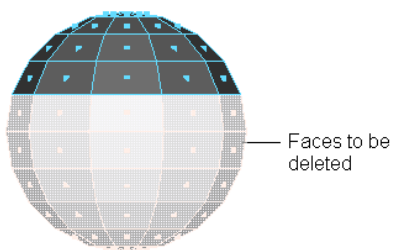

Figure 4-34 *Selecting the faces to be deleted*

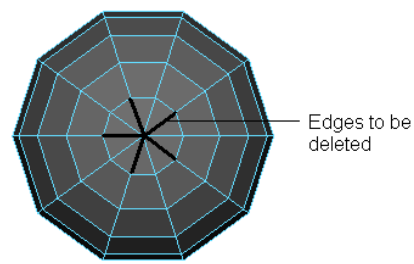

Figure 4-35 *Selecting the edges to be deleted*

4. Choose **Edit Mesh > Insert Edge Loop Tool** from the main menubar and insert the segments into circular segments of the sphere, as shown in Figure 4-36.

5. Repeat step 5 to get the final segment arrangement, as shown in Figure 4-37.

6. Activate the Perspective viewport and select the edges, as shown in Figure 4-38. Similarly, select the other edges on the sphere.

7. Choose the **Scale Tool** from the toolbox and scale all the selected edges to get the output, as shown in Figure 4-39.

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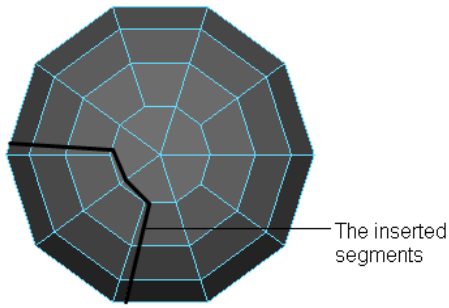

Figure 4-36 *The inserted segments*

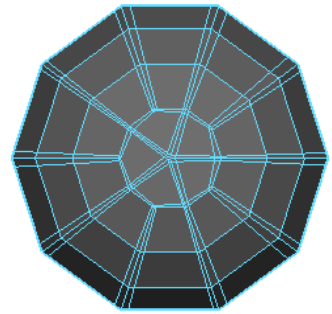

Figure 4-37 *The sphere after inserting all segments*

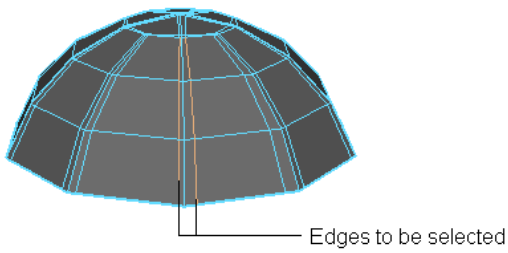

Figure 4-38 *Edges to be selected*



Figure 4-39 *Scaled edges*

8. Choose the **Move Tool** from the toolbox. Press and hold the right mouse button and choose **Vertex** from the marking menu. Next, select the centermost vertex, as shown in Figure 4-40. Next, move the vertex upward in the Y axis to create the tip of the umbrella, as shown in Figure 4-41.

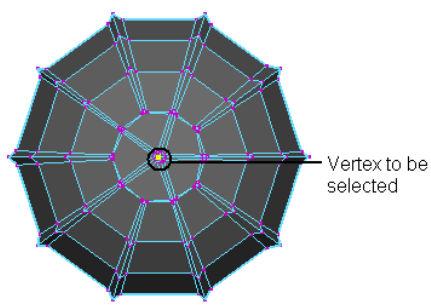

Figure 4-40 *Selecting the vertex*

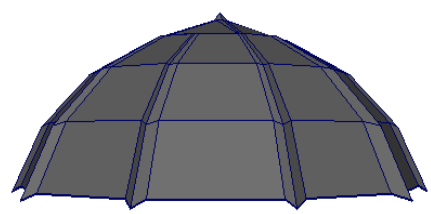

Figure 4-41 *Tip of the umbrella created*

Creating the Stick of the Umbrella

1. Activate the Front viewport. Choose **Create > CV Curve Tool** from the main menubar and then create a profile curve for the umbrella stick, as shown in Figure 4-42.

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2. Activate the Top viewport. Choose **NURBS Circle** from the **Curves** shelf. Next, double-click on the circle icon in the shelf; the **NURBS Circle Tool** property window is displayed on the right of the viewport. Set the value in the **Radius** spinner to **0.05**.

3. Draw the NURBS circle in the viewport and adjust it with the profile curve, as shown in Figure 4-43.

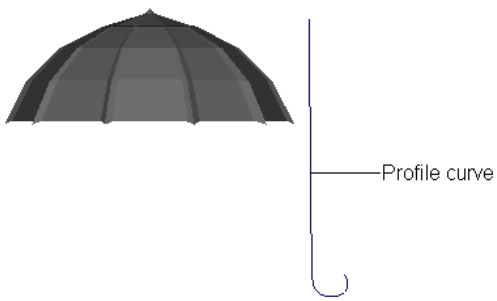

Figure 4-42 *Profile curve for the umbrella stick*

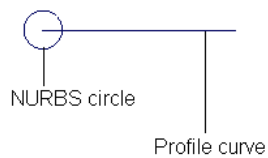

Figure 4-43 *The NURBS circle and the profile curve*

4. Activate the Perspective viewport. Invoke the **Move Tool** from the toolbox. Select the NURBS circle. Next, press and hold the SHIFT key and select the profile curve of the umbrella stick. Choose the **Surfaces** menuset from the status line. Next, choose **Surfaces > Extrude** from the main menubar; the umbrella stick gets extruded.

5. Select the umbrella stick and open the **Channel box**. Next, select the **extrude1** attribute from the **Channel box**; the attributes related to the **extrude1** attribute are displayed. Next, from the **Attribute Editor**, set **Fixed Path** to **on** and the **Use component Pivot** option to **Component Pivot**. The umbrella stick gets its final shape, as shown in Figure 4-44.

6. Invoke the **Move Tool** from the toolbox and adjust the umbrella stick under the umbrella by using the move tool manipulators, as shown in Figure 4-45.



Figure 4-44 *The umbrella stick created*



Figure 4-45 *The umbrella after adjusting the stick*

7. Select the **Polygons** module from the menu set drop-down list in the status line. Select the upper part of the umbrella and choose **Mesh > Smooth** from the main menubar to make the umbrella smooth.

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Rendering the Final Output

1. Activate the Perspective viewport, if it is not already activated.

2. Choose the **Render the current frame (Maya Software)** tool from the status line; the final output is displayed, as shown in Figure 4-46.



Figure 4-46 *The umbrella after rendering*

Saving the File

In this section, you need to save the umbrella model that you have created.

1. Choose **File > Save Scene** from the main menubar; the **Save As** dialog box is displayed.

   As the project folder is already set, by default the path *\Documents\Maya_Tutorials\c04_tut1\scenes* is displayed in **Look In** text box of the dialog box.

2. Enter **c04_tut1** in the **File name** text box and then select **Maya Binary** from the **Files of type** drop-down list. Next, choose the **Save As** button.

You can view the final rendered image of the model by downloading the *c04_Maya_2012_render.zip* file from *http://www.cadcim.com*. The path of the file is as follows:

Textbooks > Animation and Visual Effects > Maya > Autodesk Maya 2012: A Comprehensive Guide

Tutorial 2

In this tutorial, you will create the model of an umbrella, as shown in Figure 4-32, using the polygon primitive objects and NURBS curves. (**Expected time: 45 min**)

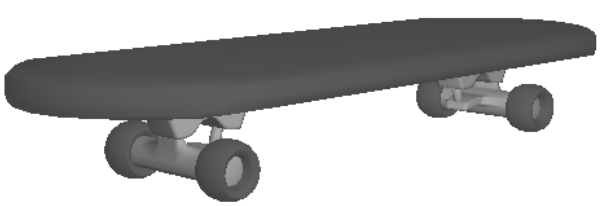

Figure 4-47 *The model of a skateboard*

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The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create the board.
c. Create the axle.
d. Create tyres.
e. Save the model.

Creating the Project Folder

Before starting a new file, it is recommended that you create the project folder.

1. Create a project with the name *c04_tut2* in the folder *Maya_Tutorials* as discussed in Tutorial 1 of Chapter 3.

Creating the Board

In this section, you need to create the board of the skateboard using the **Cube** primitive tool.

1. Activate the Perspective viewport and choose **Create > Polygon Primitives > Cube > Option Box** from the main menubar; the **Polygon Cube Tool** property window is displayed. Set the **Width divisions** to **5** and create a cube in the viewport.

2. Choose **Shading > Wireframe on Shaded** from the **Panel menu** to show the segments on the model created in the viewport.

3. Activate the Top viewport. Press and hold the right mouse button on the cube to display a marking menu and then choose **Vertex** from the marking menu. Now, using the **Move Tool**, adjust the vertices on the cube, as shown in Figure 4-48.

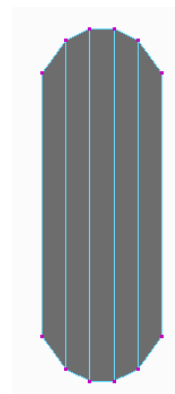

Figure 4-48 *The vertices adjusted*

4. Activate the Front viewport and drag the lower vertices upward to reduce the thickness of the cube. Next, press and hold the right mouse button on the cube to display a marking menu and choose **Object Mode** from the marking menu to set the cube to the object mode.

5. Choose **Polygons** from the menuset in the status line. Next, choose **Edit Mesh > Insert Edge Loop Tool** from the main menubar and create two new segments on the cube in the front viewport, as shown in Figure 4-49.

6. Similarly, activate the Top viewport and create two new segments on the cube, as shown in Figure 4-50.

7. Invoke the **Move Tool** from the toolbox. Select the cube and choose **Mesh > Smooth** from the main menubar; the cube is smoothened.

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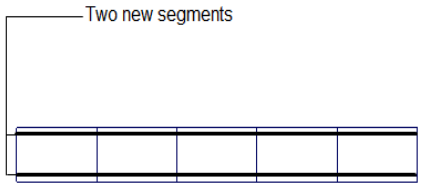

Figure 4-49 *Two new segments created in the front viewport*

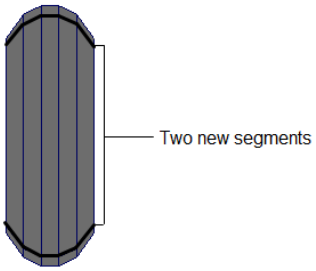

Figure 4-50 *Two segments created in the top viewport*

Creating the Axle Part

In this section, you need to create the axle part using the **Polygon Cube** primitive tool and other edit mesh options.

1. Choose **Create > Polygon Primitives > Cube > Option Box** from the main menubar; the **Polygon Cube Tool** property window is displayed. Set the values of the following parameters in the window and then create a cube in the viewport:

   Width: **0.5** Height: **0.5** Width divisions: **5**

2. Activate the Front viewport. Next, press and hold the right mouse button on the cube created for making the axle and choose **Vertex** from the marking menu displayed. Now, using the **Move Tool**, adjust the vertices on the cube to get the result shown in Figure 4-51.

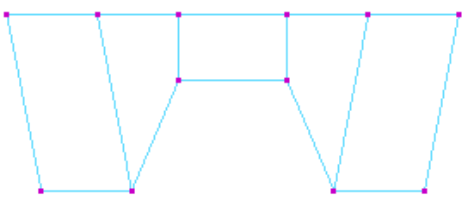

Figure 4-51 *The adjusted vertices*

3. Activate the Side viewport and drag the vertices on the right toward the left side. Reduce the width of the cube proportionate to the size of the board.

4. Activate the Front viewport and choose **Edit Mesh > Insert Edge Loop Tool** from the main menubar. Using this tool, insert four new segments, as shown in Figure 4-52.

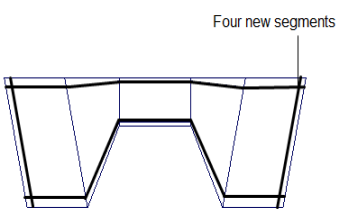

Figure 4-52 *Four new segments inserted in the front viewport*

5. Select the cube and choose **Mesh > Smooth** from the main menubar; the selected object is smoothened.

6. Choose **Create > Polygon Primitives > Cylinder > Option Box** from the main menubar; the **Polygon Cylinder Tool** property window is displayed. Set the values of the following parameters in the window and create a cylinder in the front viewport.

   Radius: **0.03** Height: **0.2** Axis divisions: **10**

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7. Choose **Display > UI Elements > Channel Box/Layer Editor** from the main menubar; a **Channel box** is displayed. In the **Channel Box/ Layer Editor** window, enter **38** as **Rotate Z** value and press the ENTER key.

   Next, invoke the **Move Tool** from the toolbox and align the cylinder in both Front and Side viewports, as shown in Figures 4-53 and 4-54.

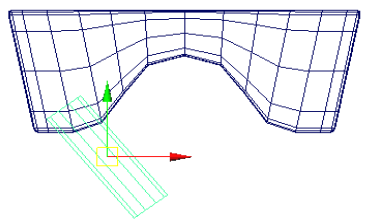

Figure 4-53 *The cylinder rotated and aligned in the front viewport*

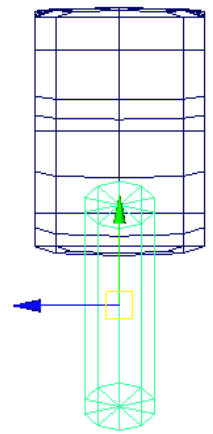

Figure 4-54 *The cylinder rotated and aligned in the side viewport*

8. Choose **Create > Polygon Primitives > Cylinder > Option Box** from the main menubar; the **Polygon Tool** property window is displayed. Set the values of the following parameters in the window and create a cylinder in the Front viewport.

   Radius: **0.08** Height: **0.15** Axis: **Z**
   Axis divisions: **10**

9. Press and hold the right mouse button on the cylinder to display a marking menu and choose **Face** from the marking menu; the face component is activated.

10. Select the face marked as 1, refer to Figure 4-55. Choose **Edit Mesh > Extrude** from the main menubar; the selected face is extruded. Similarly, extrude the face marked as 2.

11. Press and hold the right mouse button on the cylinder and choose **Vertex** from the marking menu displayed; the vertex component gets activated. Adjust the vertices of the cylinder to get the desired shape, as shown in Figure 4-56.

12. Activate the Perspective viewport. Press and hold the right mouse button over the cylinder and choose **Face** from the marking menu displayed; the face component gets activated. Extrude the top and bottom faces of the cylinder; the shape of the cylinder is modified, as shown in Figure 4-57.

13. Press and hold the right mouse button over the cylinder and choose **Object Mode** from the marking menu displayed; the cylinder switches to the object mode. Choose **Edit Mesh >**

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Insert Edge Loop Tool from the main menubar and add new segments to the cylinder, as shown in Figure 4-58.

14. Select the cylinder and choose **Mesh > Smooth** from the main menubar; the cylinder gets smoothened.

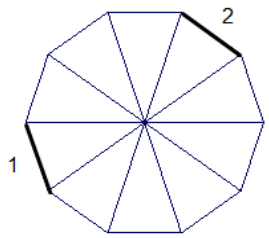

Figure 4-55 *Faces to be selected*

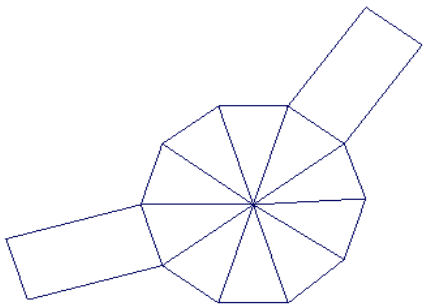

Figure 4-56 *The vertices adjusted*

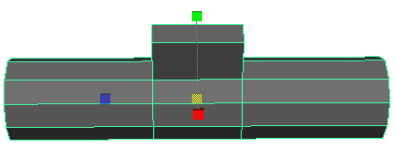

Figure 4-57 *The cylinder after extrusion*

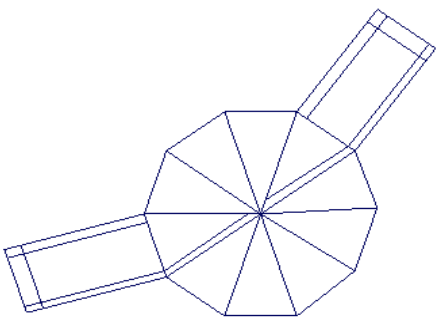

Figure 4-58 *New segments added to the cylinder*

15. Choose the **Move Tool** from the toolbox and align the three components of the axle, as shown in Figures 4-59 and 4-60.

16. Select all the three components of the axle and choose **Mesh > Combine** from the main menubar; the components are combined together.

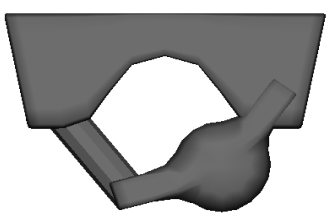

Figure 4-59 *The axle components aligned in the front viewport*

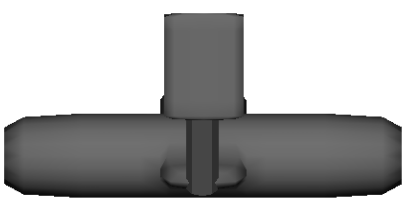

Figure 4-60 *The axle components aligned in the side viewport*

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17. Choose **Display > UI Elements > Channel Box/Layer Editor** from the main menubar; a **Channel box** is displayed on the right in the viewport. In the **Channel Box/ Layer Editor** window, set **90** as **Rotate Y** value and then press the ENTER key.

Creating Tyres

In this section, you need to create tyres for the skateboard using the torus polygon primitive.

1. Choose **Create > Polygon Primitives > Torus > Option Box** from the main menubar; the **Polygon Torus Tool** property window is displayed on the right of the viewport. In this window, enter the values of the following parameters and then create a torus in the perspective viewport:

   Radius: **0.07** Section radius: **0.05**

2. Using the **Move Tool** and the **Rotate Tool** from the toolbox, align the torus with the axle, as shown in Figure 4-61.

3. Select the torus and then press CTRL + d; a duplicate copy of the torus is created. Invoke the **Move Tool** from the toolbox and align the duplicate torus to the other end of the axle, as shown in Figure 4-62.

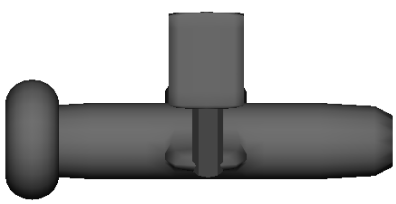

Figure 4-61 *The torus aligned to one end of the axle in the front viewport*

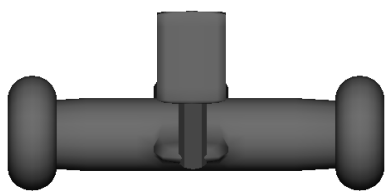

Figure 4-62 *The duplicate torus aligned to another end of the axle*

4. Select the axle and the torus by using the **Move Tool** and then choose **Mesh > Combine** from the main menubar; the selected components will combine to form a single mesh.

5. Choose **Modify > Center Pivot** from the main menubar; the pivot point of the combined mesh is centralized. Next, press CTRL + d on the keyboard to make a duplicate of the selected mesh.

6. Invoke the **Move Tool** and align the combined mesh with the skateboard, as shown in Figure 4-63.



Figure 4-63 *The combined mesh aligned to the skateboard*

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Saving the Model

In this section, you need to save the skateboard model that you have created.

1. Choose **File > Save Scene** from the main menubar; the **Save As** dialog box is displayed.

   As the project folder is already set, by default the path *\Documents\Maya_Tutorials\c04_tut2\scenes* is displayed in **Look In** text box of the dialog box.

2. Enter **c04_tut2** in the **File name** text box and then select **Maya Binary** from the **Files of type** drop-down list. Next, choose the **Save As** button.

You can view the final rendered image of the model by downloading the *c04_Maya_2012_render.zip* file from *http://www.cadcim.com*. The path of the file is as follows:

Textbooks > Animation and Visual Effects > Maya > Autodesk Maya 2012: A Comprehensive Guide

Self-Evaluation Test

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

1. Which of the following geometric shapes is formed by connecting a polygonal base and an apex?

   (a) **Prism** (b) **Pyramid**
   (c) **Sphere** (d) **Cube**

2. Which of the following shortcuts can be used to display an object in the object mode?

   (a) **F8** (b) **F9**
   (c) **F10** (d) **F11**

3. The _____ is used to merge two vertices together by dragging one vertex toward another vertex.

4. A _____ is similar to a hollow cylinder.

5. A helix is a continuous and uniform turn of constant radius that is generally of _____ degrees.

6. All the faces of a _____ solid are equal.

7. The **Insert Edge Loop Tool** is used to create beveled transition surfaces on a profile curve. (T/F)

8. The face components in the marking menu let you select faces on the active object. (T/F)

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9. The **Smooth** option is used to make a polygonal object smooth by adding segments to it.

10. Subdivision surfaces divide an object into regions of greater detail. (T/F)

Review Questions

Answer the following questions:

1. Which of the following tools is used to add smoothness to a sharp edge?

(a) **Extrude** (b) **Duplicate face**
(c) **Bevel** (d) **Revolve**

2. Which of the following primitives is formed by an alternate arrangement of hexagons and pentagons?

(a) **Prism** (b) **Helix**
(c) **Soccer ball** (d) **Sphere**

3. The _____ face option is used to create the duplicate copy of a selected face.

4. The_____ tool is used to add segments on both sides of a selected edge.

5. The function of the **Merge To Center** tool is similar to the _____ tool.

6. The _____ tool is used to replace a vertex with a flat polygon face.

7. A _____ is a three-dimensional curve that lies on a cylinder or a cone such that the perpendicular angle is constant to the axis.

8. The **Merge** tool is used to merge two or more vertices or UVs together. (T/F)

9. The **Channel box** of the **Subdivision Primitives** does not have the INPUTS node. (T/F)

10. The **Merge Vertex Tool** can be used to merge a selected vertex to a target vertex or to the center of vertices. (T/F)

Exercises

Exercise 1

Create the model of a see saw, as shown in Figure 4-64, using the polygon primitive modeling techniques. You can view the final rendered image of this model by downloading the *c04_maya_2012_render.zip* file from *http://www.cadcim.com*. The path of file is as follows: *Textbooks > Animation and Visual Effects > Maya > Autodesk Maya 2012: A Comprehensive Guide*

(**Expected time: 30 min**)

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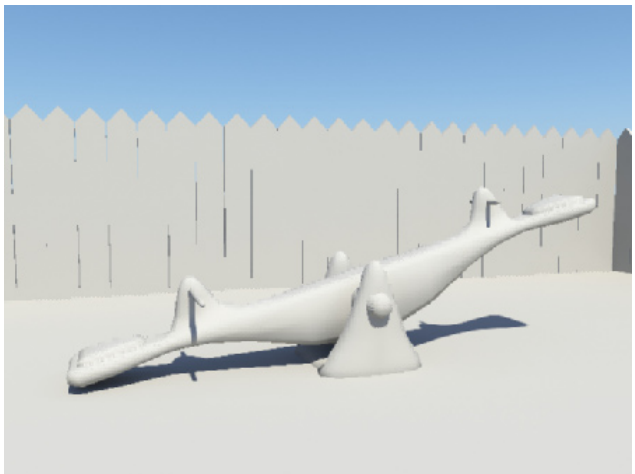

Figure 4-64 *Model of a see saw*

Exercise 2

Create the model of a clock, as shown in Figure 4-65, using the polygon modeling technique. You can view the final rendered image of this model by downloading the *c04_maya_2012_render.zip* file from *http://www.cadcim.com*. The path of the file is same as mentioned in Exercise 1. (**Expected time: 30 min**)

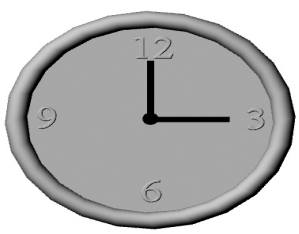

Figure 4-65 *Model of a clock*

Answers to Self-Evaluation Test

1. b, **2.** a, **3. Merge Vertex Tool**, **4.** Pipe, **5.** 360, **6.** Platonic, **7.** F, **8.** T, **9.** T, **10.** T

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