

# Chapter 2

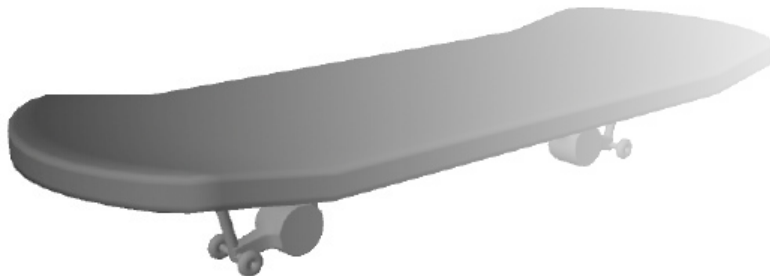
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## Polygon Modeling

### Learning Objectives

**After completing this chapter, you will be able to:**

- *Create polygon primitives*
- *Edit polygon primitives*
- *Modify the components of polygon primitives*
- *Create models using polygon primitives*



## INTRODUCTION

In this chapter, you will learn to create and edit polygon shapes using polygon modeling techniques. A polygon is made up of different closed planar shapes having straight sides. The most commonly used shapes in 3D polygons are triangles and quadrilaterals. These shapes are formed by vertices, edges, and faces. An edge is a straight line formed by joining two vertices. In a polygon, three vertices join to each other by three edges to form a triangle and four vertices join to each other by four edges to form a quadrilateral. By modifying faces, edges, and vertices of an object, you can create a polygon model as per your requirement.



### Note

*If you want to create polygon objects using click-drag operations, you need to turn on the **Interactive Creation** option available in the menubar. To do so, choose **Create > Objects > Polygon Primitives > Interactive Creation** from the menubar. The **Interactive Creation** option works with all primitives. There are certain parameters that cannot be controlled via interactive creation. These parameters can only be changed from the settings window of the tool.*

*This option also affects how Maya shows the tool settings. For example, if the **Interactive Creation** option is selected and you choose **Create > Objects > Polygon Primitives > Sphere > Option Box** from the menubar, the **Tool Settings (Polygon Sphere Tool)** panel will be displayed. In this panel, you can set non-interactive attributes such as **Axis divisions** and **Height divisions** and then click-drag in the viewport to interactively define the radius of the sphere. If you want to create a sphere with the current settings specified in the panel, just click on the viewport instead of clicking and dragging. You can reset the settings by choosing the **Reset Tool** button available at the top-right corner of the panel.*

*If the **Interactive Creation** option is not selected, the **Polygon Sphere Options** window will be displayed. In this window, specify the attributes and then choose the **Create** button to create sphere with specified settings.*

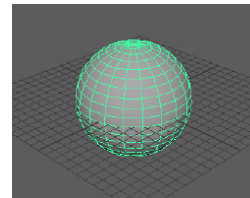
## POLYGON PRIMITIVES

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

### Creating a Sphere

<b>Menubar:</b>	Create > Objects > Polygon Primitives > Sphere
<b>Shelf:</b>	Polygons > Polygon Sphere

A sphere is a solid object in which every point on its surface is equidistant from its center, as shown in Figure 2-1. The sphere can be created interactively or by entering the values using the keyboard.



**Figure 2-1** A polygon sphere

## Creating a Cube

**Menubar:** Create > Objects > Polygon Primitives > Cube  
**Shelf:** Poly Modeling > Polygon Cube

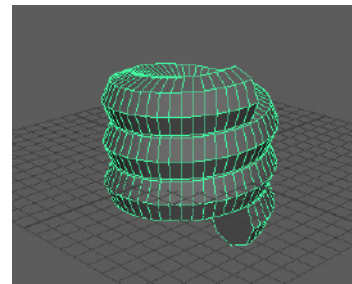
A cube is a three-dimensional shape with six sides or rectangular faces. To create a cube interactively, choose **Create > Objects > Polygon Primitives > Cube** from the menubar; you will be prompted to drag the cursor on the grid to draw the cube in the viewport.

Press and hold the left mouse button, and drag the cursor on the grid to define the base of the cube. Next, release the left mouse button to get the desired base. Now, 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.

## Creating a Helix

**Menubar:** Create > Objects > Helix

A helix is a geometry in three dimensional space that lies on a cylinder and subtends a constant angle to a plane perpendicular to its axis, as shown in Figure 2-2. To create a helix interactively, choose **Create > Objects > Polygon Primitives > Helix** from the 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 and then release the left mouse button. Again, press and hold the left mouse button and drag the cursor to set the section radius; the helix will be created.

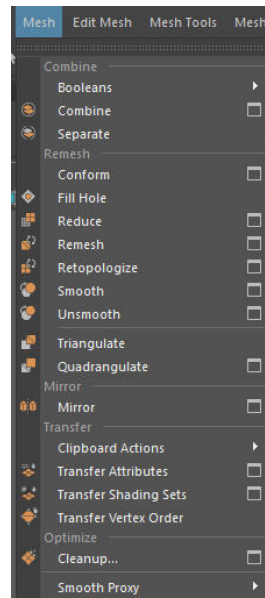


*Figure 2-2 A polygon helix*

## POLYGON EDITING TOOLS

In Maya, the tools are grouped according to the function they perform. For example, the **Boolean**, **Combine**, and **Separate** tools are combined in the **Combine** group, refer to Figure 2-3. The polygon editing tools are used to perform different operations on the polygon objects. These editing tools are available in the **Mesh**, **Edit Mesh**, and **Mesh Tools** menus of the **Modeling** menu set. The most commonly used tools under this menu are discussed next.



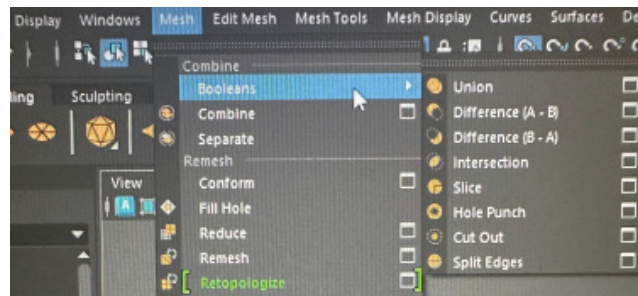


*Figure 2-3 The Mesh menu*

## Booleans

**Menubar:** Mesh > Combine > Booleans

The booleans tools are used to combine the polygon objects to create a new object. Using these tools, you can perform different operations to modify the shape of the new object. The boolean tools are shown in Figure 2-4.



*Figure 2-4 The Boolean tools*

In Maya 2026, the **Boolean** tool has been improved due to introduction of a new option called **Volume**. Earlier, boolean operations worked only on polygon surfaces, which often caused broken or messy geometry. The new **Volume** option changes this by first converting the objects into volumes, performing the Boolean operation, and then turning them back into clean polygon shapes. This makes the result smoother and easier to edit. It works very well for creating both hard and soft shapes without errors. You can choose **Mesh** or **Volume** mode by choosing the **Mesh** menu and then choosing the **Booleans** option from it. Overall, this update makes Boolean modeling faster, cleaner, and more reliable.

Some boolean tools are: **Difference (A-B)**, **Difference (B-A)**, **Slice**, **Hole Punch**, **Cut Out**, and **Split Edge**. Also, in **Attribute Editor**, the **PolyBoolean** tab is added in which a list of boolean geometries are listed. Three buttons are displayed on the right side of the geometries listed. First is the **Boolean Operations** button. When you choose this button, a list of boolean operations will be displayed in the flyout. Second is the **Visibility** button. When you choose this button, a list of options for visibility of geometry will be displayed in the flyout. The visibility options are: **Shaded**, **Wireframe**, **Bounding Box**, **X-Ray**, and **Hidden**. The last button, **Enable/Disable**, is used to turn on and off the operation. The boolean tools are discussed next.

## Combine

**Menubar:** Mesh > Combine > Combine

The **Combine** tool is used to group two or more polygon objects into a single polygon object. To do so, select the polygon objects to be combined in the viewport and then choose **Mesh > Combine > Combine** from the menubar; the selected polygon objects are combined into a single polygon object.

## Smooth

**Menubar:** Mesh > Remesh > Smooth

The **Smooth** tool is used to make a polygon object smooth by adding divisions to it. To do so, create a polygonal object in the viewport and then choose **Mesh > Remesh > Smooth** from the menubar; the **polySmoothFace1** In-View Editor will be displayed in the viewport. Set the desired smoothing level by entering a value in the **Divisions** edit box. The default subdivision level is 1.

## EDITING THE POLYGON COMPONENTS

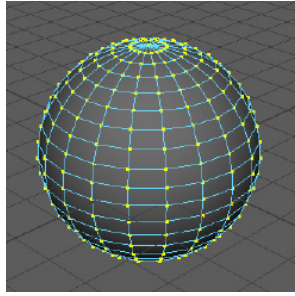
In the previous section, you learned to modify simple polygon primitives. In this section, you will learn to edit the components of polygon primitives to create complex objects from it. To do so, select a polygon object in the viewport and then press and hold the right mouse button over it; the marking menu of the corresponding object will display various components of the object such as vertex, edge, face, and UV, refer to Figures 2-5 to 2-8. To access various tools for editing the polygon primitives, select **Modeling** from the **Menuset** drop-down list in Status Line. Next, choose the **Edit Mesh** menu from the menubar. The most commonly used component editing tools are discussed next.



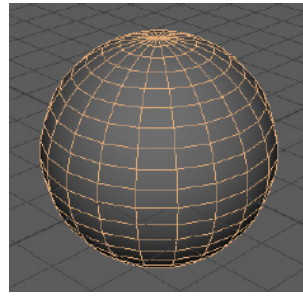
### Note

1. The face selection mode in the marking menu allows you to select the faces of the active object. When you move the cursor on a face, the face will be highlighted in red. Next, when you click on the highlighted face, it will turn green indicating that it is now selected. In this way, you can identify the selected and unselected faces.

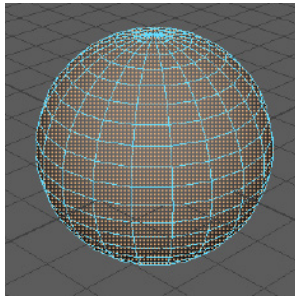
2. The **Multi** option allows you to select all components at a time without switching between the components. To select all components, press and hold the right mouse button on the already selected component, and then choose the **Multi** option from the marking menu. Next, select a face on the object,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



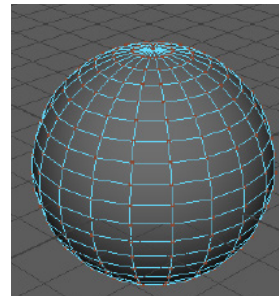
*Figure 2-5 Vertices of the sphere*



*Figure 2-6 Edges of the sphere*



*Figure 2-7 Faces of the sphere*



*Figure 2-8 UVs of the sphere*

## Bevel

**Menubar:** Edit Mesh > Components > Bevel

The **Bevel** tool is used to expand the vertex or the face of a polygon object. This adds smoothness his adds smoothness to a sharp object by adding fillets on the edges. The bevel operation adds fillet to the edges by creating new faces on the selected polygon object. To do so, create a polygon object in the viewport and select it. Next, choose **Edit Mesh > Components > Bevel** from the menubar; the selected polygon object will be beveled. The **Bevel** tool is also used to bevel the components such as face, vertex, and edge of a polygon object individually. Create a polygon object in the viewport and right-click on it; the marking menu will be displayed. Next, choose **Edge** from the marking menu; the edge selection mode will be activated. Now, select any edge of the object and then choose **Edit Mesh > Components > Bevel** from the menubar; the selected edge will be beveled.

## Bridge

The **Bridge** tool is used to construct faces between pair of the border edges. The connection between the edges or faces can be straight or curved, depending on the options you choose from the **Bridge Options** window.

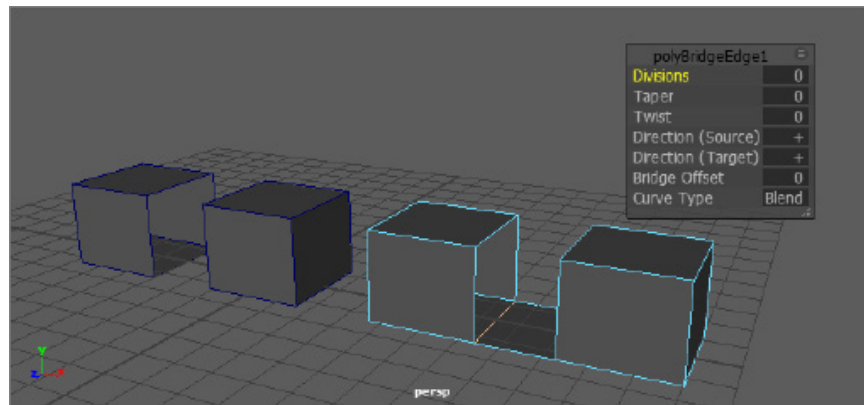
To create a bridge between the border edges of an object, select the edges and then choose **Edit Mesh > Components > Bridge > Option Box** from the menubar; the **Bridge Options** window

will be displayed. In this window, choose the type of bridge you want to create by selecting the radio button corresponding to the **Bridge type** attribute and then choose the **Bridge** or **Apply** button; a bridge will be created, as shown in Figure 2-9.



### Note

To create a bridge between two separate objects, you need to combine the two objects by choosing **Mesh > Combine > Combine** from the menubar.

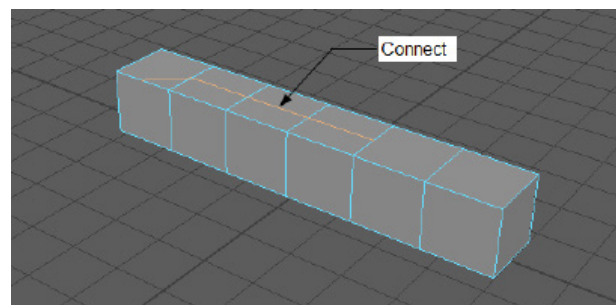


**Figure 2-9** The **Bridge** connection between the two edges

## Connect

**Menubar:** Edit Mesh > Components > Connect

The **Connect** tool is used to connect selected vertices or faces via edges. To use this tool, select faces or edges on an object and then choose **Edit Mesh > Components > Connect** from the menu bar to connect the selected component, refer to Figure 2-10.



**Figure 2-10** The connected edge displayed

the selected vertex gets split into multiple vertices, refer to Figure 2-53. This tool also detaches the faces. When faces of an object are selected and you use this tool, it detaches the face selection along its perimeter edges.



## Smart Extrude

**Menubar:** Edit Mesh > Components > Smart Extrude

The **Smart Extrude** tool in Maya is used for interactively extruding faces within the viewport. It simplifies tasks like merging and stitching faces, cutting meshes, and executing complex cut-throughs, thus significantly reducing the need for manual cleanup. This tool enhances the modeling process by providing a more efficient and intuitive way to create and refine geometry. To extrude a face, select the face that needs to be extruded. Next, choose **Edit Mesh > Components > Smart Extrude** from the menubar; the selected face will be extruded. Activate the **Move** tool by pressing the W key and move the extruded faces, as shown in Figure 2-56.

## TUTORIALS

The tutorials given next are available in video format.

### Tutorial 1

In this tutorial, you will create the model of a skateboard, as shown in Figure 2-11, using the polygon modeling techniques. (Expected time: 30 min)



*Figure 2-11 The model of a skateboard*

The following steps are required to complete this tutorial:

- a. Create a project folder.
- b. Create the deck.
- c. Create the base.
- d. Create the wheels.
- e. Change the background color of the scene.
- f. Save and render the scene.

### Creating a Project Folder

Before starting a new scene, it is recommended that you create a project folder. It will help you keep all the files of a project in an organized manner. To do so, open Windows Explorer and browse to the *Documents* folder. In this folder, create a new folder with the name *maya2026*. The *maya2026* folder will be the main folder and it will contain all the projects folders that you will create while doing tutorials of this textbook. Now, you will create a project folder for Tutorial 1 of this chapter. To do so, you need to follow the steps given next.



1. Start Autodesk Maya 2026 by double-clicking on its icon on the desktop.
2. Choose **File > Project > Project Window** from the menubar; the **Project Window** is displayed. Choose the **New** button; the **Current Project** and **Location** text boxes are enabled. Now, enter **c02\_tut1** in the **Current Project** text box.
3. Click on the folder icon next to the **Location** text box; the **Select Location** dialog box is displayed. In this dialog box, browse to the `\Documents\maya2026` folder and choose the **Select** button to close the dialog box. Next, choose the **Accept** button in the **Project Window** dialog box; the `\Documents\maya2026\c02_tut1` folder will become the current project folder.
4. Choose **Save Scene** from the **File** menu; the **Save File As** dialog box is displayed.

**Note**

The scenes created in Maya are saved with the `.ma` or `.mb` extension. As the project folder is already created, the path `\Documents\maya2026\c02_tut1\scenes` is displayed in the **Look in** drop-down list of the **Save As** dialog box.

**Tip**

After setting the project folder, when you open or save a scene, Maya uses the scenes folder inside the project folder by default.

5. Enter **c02tut1** in the **File name** edit box and then choose the **Save As** button to close the dialog box.

**Note**

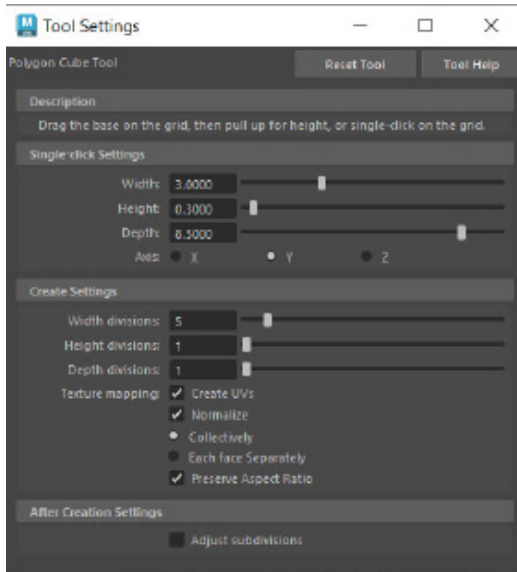
It is recommended that you frequently save the file while you are working on it by pressing the **CTRL+S** keys.

## Creating the Deck

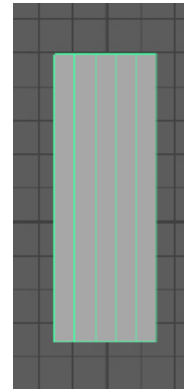
In this section, you need to create the deck of the skateboard using the **Cube** tool.

1. Maximize the top-Y viewport. Choose **Create > Objects > Polygon Primitives > Cube > Option Box** from the menubar; the **Tool Settings (Polygon Cube Tool)** panel is displayed on the left of the viewport. Enter the required values in the **Tool Settings (Polygon Cube Tool)** panel, as shown in Figure 2-12. Next, click in the top-Y viewport; a cube is created in the top-Y viewport, as shown in Figure 2-13. Close the **Tool Settings (Polygon Cube Tool)** panel.
2. In the **Channel Box / Layer Editor**, click on **pCube1**. Next, enter **deck** in the text box and press **ENTER**; the **pCube1** is renamed as **deck**.
3. In the top-Y viewport, press and hold the right mouse button on **deck**; a marking menu is displayed. Choose **Vertex** from the marking menu; the vertex selection mode is activated. Next, select the vertices, as shown in Figure 2-14. Next, choose the **Scale Tool** by pressing the **R** key and scale the vertices uniformly, refer to Figure 2-15.
4. Similarly, scale the other vertices to create the basic shape of **deck**, as shown in Figure 2-16.

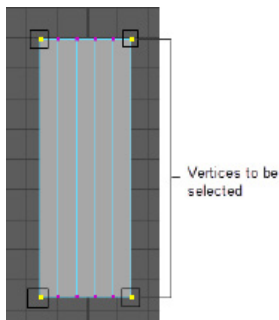
5. Press and hold the right mouse button on *deck*; a marking menu is displayed. Next, choose **Object Mode** from the marking menu; the object selection mode is activated. Select *deck* and maximize the front-Z viewport.
6. Make sure the **Modeling** menuset is selected from the **Menuset** drop-down list in the Status Line. Next, choose **Mesh Tools > Tools > Insert Edge Loop** tool from the menubar; the shape of the cursor changes. Click on the top and bottom vertical edge and create two new segments on *deck*, as shown in Figure 2-17.



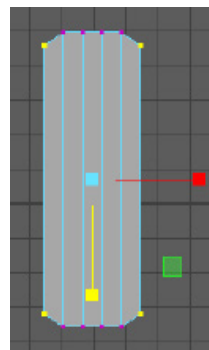
**Figure 2-12** The Tool Settings (Polygon Cube Tool) panel



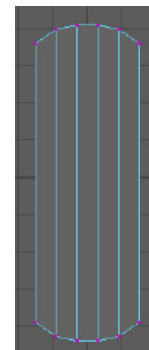
**Figure 2-13** A cube created



**Figure 2-14** The vertices selected



**Figure 2-15** The selected vertices scaled

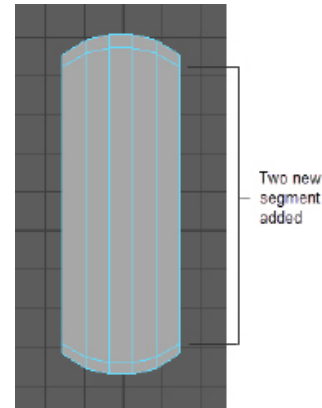


**Figure 2-16** The basic shape of the deck

7. Maximize the top-Y viewport and repeat the previous step to create two segments on *deck*, as shown in Figure 2-18. Choose the **Select Tool** to deactivate the **Insert Edge Loop** tool.



**Figure 2-17** Two new segments created in the front-Z viewport



**Figure 2-18** Two segments created in the top-Y viewport

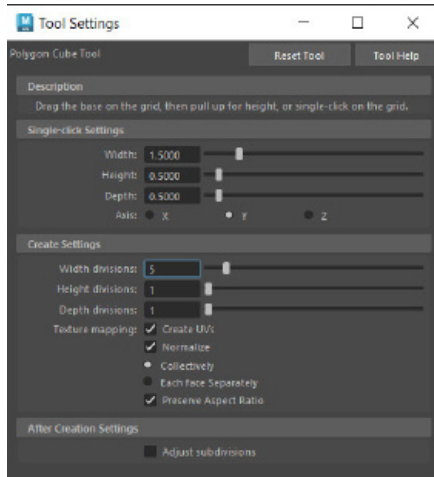
8. Press and hold the right mouse button on *deck*; a marking menu is displayed. Choose **Object Mode** from the marking menu; the object selection mode is activated.
9. Make sure *deck* is selected and choose **Mesh > Remesh > Smooth > Option Box** from the menubar; the **Smooth Options** window is displayed. In the **Smooth Options** window, make sure the **Division levels** value is set to **1**. Now, choose the **Smooth** button; the geometry of *deck* is smoothened.

## Creating the Base

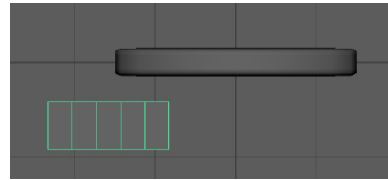
In this section, you need to create the base of the skateboard using the **Cube** polygon primitive.

1. Maximize the front-Z viewport. Choose **Create > Objects > Polygon Primitives > Cube > Option Box** from the menubar; the **Tool Settings (Polygon Cube Tool)** panel is displayed in the viewport. Enter the required values in the **Tool Settings (Polygon Cube Tool)** panel, as shown in Figure 2-19. Next, click in the front-Z viewport; a cube is created in the front-Z viewport, as shown in Figure 2-20.
2. In the **Channel Box / Layer Editor**, click on **pCube1** tab. Next, enter **base** in the text box and press ENTER; **pCube1** tab is renamed as *base*.
3. In the front-Z viewport, press and hold the right mouse button on *base*; a marking menu is displayed. Choose **Vertex** from the marking menu; the vertex selection mode is activated. Next, select the two bottom center vertices and then choose the **Move Tool** from the Tool Box. Now, adjust the vertices on *base* to get the result shown in Figure 2-21.

4. Maximize the side-X viewport. Select the left most vertices in the side-X viewport and then drag them along the -Z axis to reduce the size of *base*, as shown in Figure 2-22.

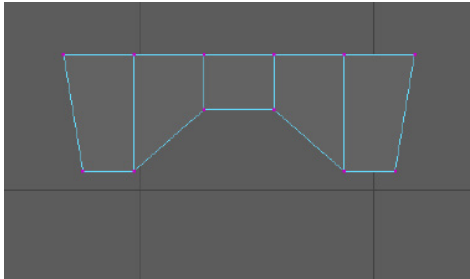


**Figure 2-19** The Tool Settings (Polygon Cube Tool) window

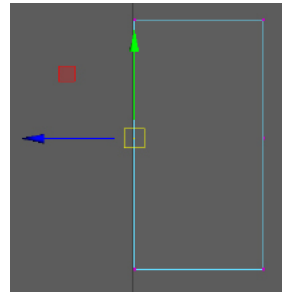


**Figure 2-20** The cube created

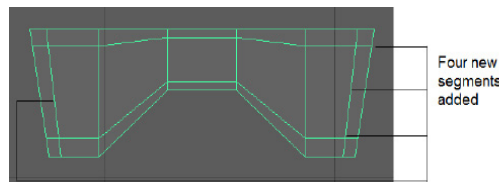
5. Press and hold the right mouse button on *base*; a marking menu is displayed. Next, choose **Object Mode** from the marking menu; the object selection mode is activated.
6. Select *base* and maximize the front-Z viewport. Next, choose **Mesh Tools > Tools > Insert Edge Loop** tool from the menubar. Using this tool, insert four new segments, as shown in Figure 2-23. Choose the **Select Tool** to deactivate the **Insert Edge Loop** tool.



**Figure 2-21** The adjusted vertices of the base



**Figure 2-22** Dragging the selected vertices along the -Z axis

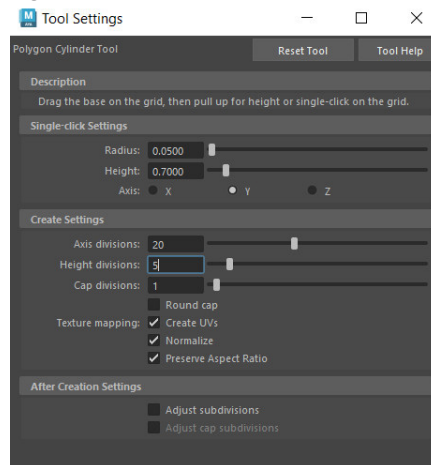


**Figure 2-23** Four new segments inserted in the front-Z viewport

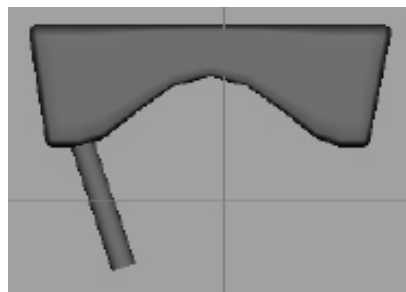
7. Press and hold the right mouse button on *base*; a marking menu is displayed. Choose **Object Mode** from the marking menu; the object selection mode is activated.
8. Select *base* and choose **Mesh > Remesh > Smooth** from the menubar; the geometry of *base* is smoothened.

Next, you need to create the bolts.

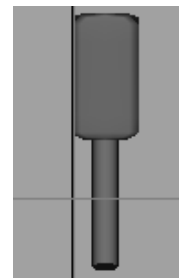
9. Choose **Create > Objects > Polygon Primitives > Cylinder > Option box** from the menubar; the **Tool Settings (Polygon Cylinder Tool)** panel is displayed. Enter the required values in the **Tool Settings (Polygon Cylinder Tool)** panel, as shown in Figure 2-24. Click in the front-Z viewport; a cylinder is created.
10. In the **Channel Box / Layer Editor**, click on **pCylinder1**. Next, enter **bolt** in the text box and press ENTER; **pCylinder** is renamed as *bolt*.
11. Choose **Move Tool** from the Tool Box and align *bolt* with *base* in all viewports. Next, choose the **Rotate Tool** from the Tool Box to rotate and align it with both front-Z and side-X viewports, as shown in Figures 2-25 and 2-26.



**Figure 2-24** The Tool Settings (Polygon Cylinder Tool) panel



**Figure 2-25** The cylinder rotated and aligned in the front-Z viewport



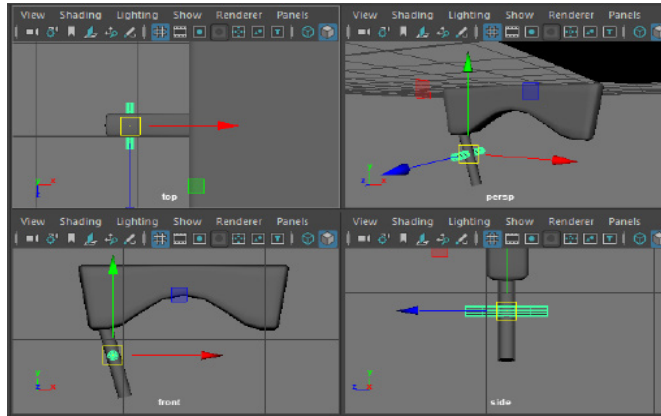
**Figure 2-26** The cylinder rotated and aligned in the side-X viewport

12. Activate the side-X viewport. Make sure *bolt* is selected and press CTRL+D; a duplicate copy of *bolt* is created with the name *bolt1*. Set the following parameters in the **Channel Box / Layer Editor** of *bolt1*:

Rotate X: **90**

Rotate Z: **0**

13. Choose the **Scale Tool** from the Tool Box and scale *bolt1* uniformly. Next, choose the **Move Tool** from the Tool Box and align it in all viewports, as shown in Figure 2-27.



*Figure 2-27 Aligning bolt1 in all viewports*

Next, you need to create *truck*.

14. Maximize the front-Z viewport. Choose **Create > Objects > Polygon Primitives > Cylinder > Option box** from the menubar; the **Tool Settings (Polygon Cylinder Tool)** panel is displayed in the viewport. In the **Tool Settings (Polygon Cylinder Tool)** panel, set the parameters as follows:

Radius: **0.25**

Height: **1**

Axis: **Z**

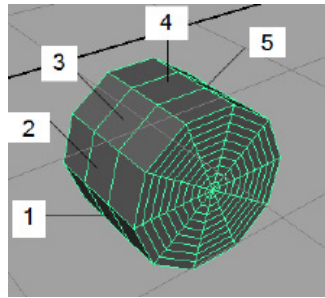
Axis divisions: **10**

Height divisions: **3**

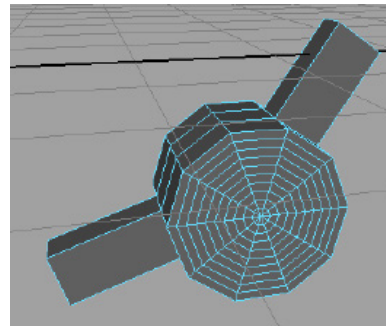
Cap Divisions: **10**

Next, click in the viewport; the cylinder is created .

15. In the **Channel Box / Layer Editor**, click on **pCylinder1**. Next, enter **truck** in the text box and press ENTER; the **pCylinder1** is renamed as *truck*.
16. Maximize the persp viewport. Press and hold the right mouse button over *truck* and choose **Face** from the marking menu displayed; the face selection mode is activated. Select the faces 1 and 5 of *truck*, refer to Figure 2-28. Next, choose **Edit Mesh > Components > Extrude** from the menubar; the **polyExtrudeFace2** In-View Editor is displayed. Enter **1** in the **Thickness** edit box; the faces of *truck* are extruded, as shown in Figure 2-29.

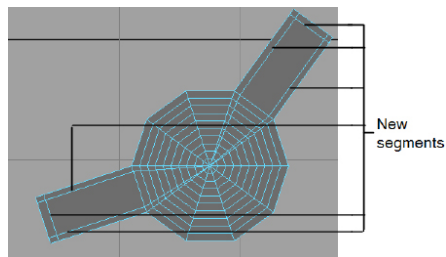


**Figure 2-28** The cylinder after extrusion in the persp viewport

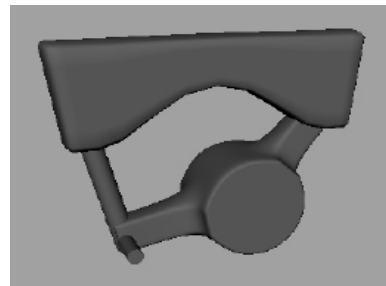


**Figure 2-29** The cylinder after extrusion in the persp viewport

17. Maximize the front-Z viewport. Choose the **Mesh Tools > Tools > Insert Edge Loop** tool from the menubar and add new segments to *truck*, as shown in Figure 2-30. Choose **Select Tool** to deactivate the **Insert Edge Loop** tool.
18. Press and hold the right mouse button on *truck*; a marking menu is displayed. Choose **Object Mode** from it; the object selection mode is activated. Next, select *truck* and choose **Mesh > Remesh > Smooth > Option Box** from the menubar; the **Smooth Options** window is displayed.
19. In the window, enter **2** in the **Division levels** edit box and then choose the **Smooth** button; the geometry of *truck* is smoothened. Next, align *truck*, *base*, *bolt* and *bolt1* in all viewports using **Move Tool**, **Rotate Tool**, and **Scale Tool** uniformly, refer to Figure 2-31.
20. Press and hold the SHIFT key and select *base*, *truck*, *bolt*, and *bolt1* in the persp viewport. Next, choose **Mesh > Combine > Combine** from the menubar; the selected parts are combined and a group with the name **base1** is created.



**Figure 2-30** New segments added to truck



**Figure 2-31** The parts aligned with base in the front-Z viewport

21. In the **base1** area of the **Channel Box / Layer Editor**, enter **90** in the **Rotate Y** edit box and then press the ENTER key.
22. Align **base1** in all viewports using the **Move Tool** and the **Scale Tool** from the Tool Box to make it proportional with the deck, as shown in Figure 2-32.



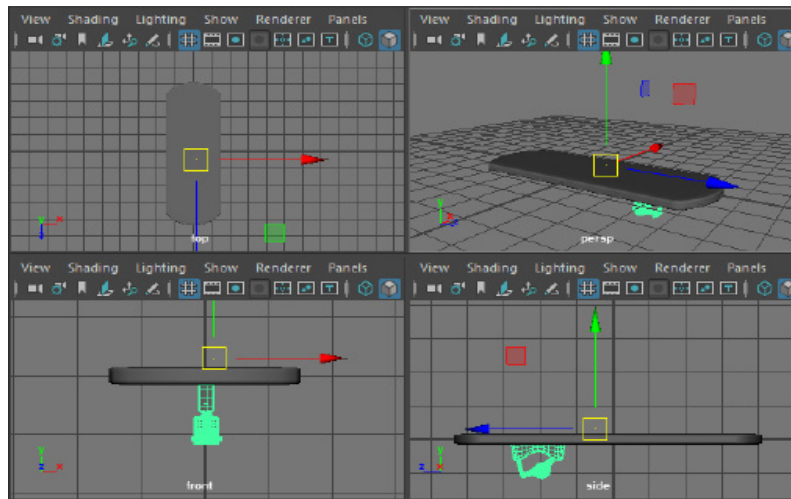
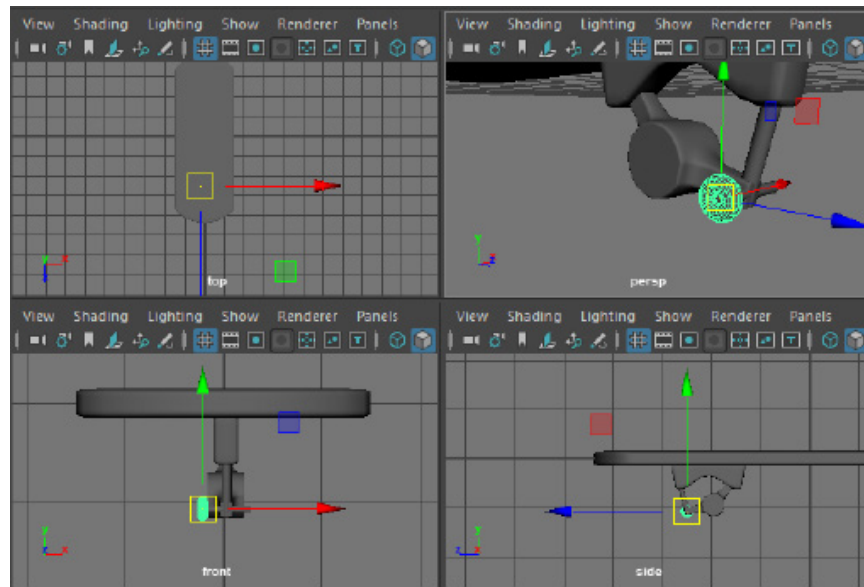


Figure 2-32 The *base1* aligned in all viewports

## Creating Wheels

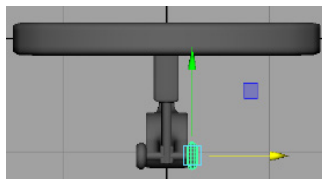
In this section, you need to create wheels for the skateboard using the **Torus** polygon primitive.

1. Choose **Create > Objects > Polygon Primitives > Torus** from the menubar. Next, click in the top-Y viewport to create a torus.
2. In the **INPUTS** area of the **Channel Box / Layer Editor**, expand the **polyTorus1** node and set the following parameters:  
  
 Radius: **0.1**              Section Radius: **0.1**
3. In the **pTorus1** area of the **Channel Box/Layer Editor**, enter **90** in the **Rotate Z** edit box.
4. In the **Channel Box / Layer Editor**, rename **pTorus1** as *wheel*, as done earlier.
5. Scale and align *wheel* with *bolt1* in all viewports using the **Move Tool** from the Tool Box, as shown in Figure 2-33.



**Figure 2-33** The wheel aligned with bolt1 in all viewports

6. Maximize the front-Z viewport. Make sure wheel is selected and then press CTRL+D; a duplicate copy of wheel is created with the name *wheel1*. Next, move *wheel1* in a direction opposite to *wheel*, as shown in Figure 2-34.
7. Maximize the persp viewport. Select *base1*, *wheel*, and *wheel1* by using the SHIFT key and then choose **Mesh > Combine > Combine** from the menubar; the selected parts are combined to form a single polygon object with the name **base2**.
8. Choose **Modify > Pivot > Center Pivot** from the menubar; the pivot point of the combined **base2** is set to center. Next, press CTRL+D; a duplicate copy of the selected mesh is created in the viewport.
9. Maximize the side-X viewport. Next, move *base3* along the Z axis to align with *deck* and also enter **180** in the **Rotate Y** edit box to rotate *base3*, refer to Figure 2-35.

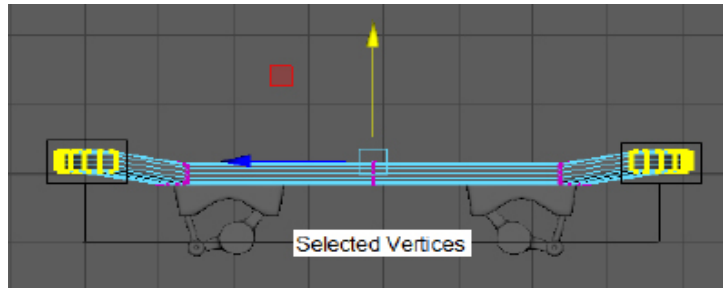


**Figure 2-34** The wheel1 moved to opposite direction of wheel



**Figure 2-35** The base3 moved and rotated

10. Select *deck*. Press and hold the right mouse button on *deck*; a marking menu is displayed. Choose **Vertex** from the marking menu; the vertex selection mode is activated. Next, select the vertices and move up along the Y axis using **Move Tool**, as shown in Figure 2-36.



**Figure 2-36** Moving the selected vertices up along the Y axis

11. Press and hold the right mouse button on *deck*; a marking menu is displayed. Choose **Object Mode** from the marking menu; the object selection mode is activated.
12. Maximize the persp viewport and select all parts of the skateboard in the persp viewport. Next, choose **Mesh > Combine > Combine** from the menubar; the selected parts are combined.

## Changing the Background Color of the Scene

In this section, you will change the background color of the scene.

1. In the **Outliner** window, click on the **persp** camera; the **perspShape** tab is displayed in the **Attribute Editor**.



### Note

*If the **Attribute Editor** is not visible in the interface, press CTRL + A to make it visible.*

2. In the **perspShape** tab, expand the **Environment** area and drag the **Background Color** slider bar toward right to change the background color to white.

## Saving and Rendering the Scene

In this section, you will save the scene that you have created and then render it. You can view the final rendered image of the model by downloading the *c02\_maya\_2026\_rndr.zip* file from [www.cadcim.com](http://www.cadcim.com). The path of the file is as follows: *Textbooks > Animation and Visual Effects > Maya > Autodesk Maya 2026: A Tutorial Approach*.

1. Choose **File > Save Scene** from the menubar.
2. Maximize the persp viewport if not already maximized. Choose the **Display render setting** button from the Status Line; the **Render Settings** window is displayed. In this window, select **Maya Software** from the **Render Using** drop-down list and then close the window. Choose the **Render the current frame** button from the Status Line to render the scene.

## Tutorial 2

In this tutorial, you will create model of a coffee mug shown in Figure 2-37 using the polygon modeling techniques. (Expected time: 20 min)



*Figure 2-37 The model of a coffee mug*

The following steps are required to complete this tutorial:

- a. Create a project folder.
- b. Create the basic shape of the mug.
- c. Create the handle of the mug.
- d. Change the background color of the scene.
- e. Save and render the scene.

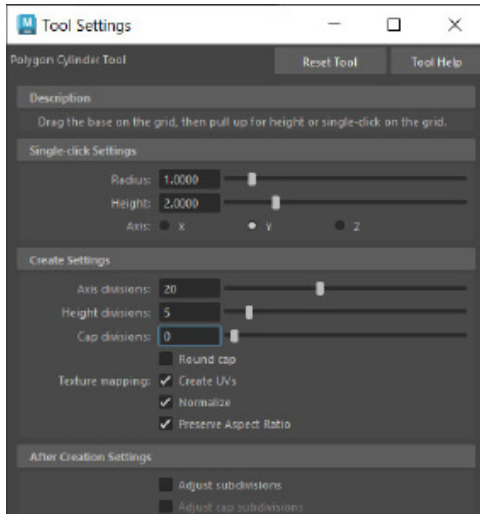
### Creating a Project Folder

Create a new project folder with the name `c02_tut2` at `|Documents|maya2026` and then save the file with the name `c02tut2`, as discussed in Tutorial 1.

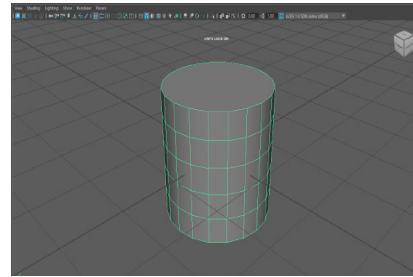
### Creating the Basic Shape of the Mug

In this section, you will use the **Cylinder** polygon primitive to create the basic shape of the mug.

1. Choose **Create > Objects > Polygon Primitives > Cylinder > Option Box** from the menubar; the **Tool Settings (Polygon Cylinder Tool)** panel is displayed in the viewport. Enter the values in the **Tool Settings (Polygon Cylinder Tool)** panel, as shown in Figure 2-38.
2. Click in the persp viewport; a cylinder is created, refer to Figure 2-39. Close the **Tool Settings (Polygon Cylinder Tool)** panel.
3. In the **Channel Box / Layer Editor**, click on the **pCylinder1** tab; a text box is activated. Next, type **mug** in the text box and press ENTER; the **pCylinder1** tab is renamed as **mug**.



**Figure 2-38** The Tool Settings (Polygon Cylinder Tool) panel



**Figure 2-39** Cylinder created in the viewport

4. Hover the cursor in the persp viewport and press SPACEBAR; the four viewports are displayed. Next, hover the cursor on the front-Z viewport and press SPACEBAR; the front-Z viewport is maximized.

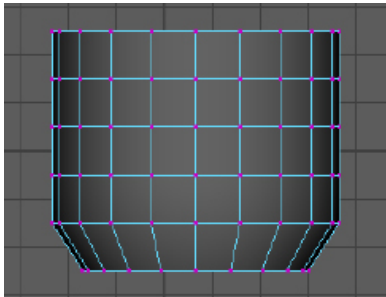
Select *mug* if it is not selected and then press and hold the right mouse button; a marking menu is displayed.

5. Choose **Vertex** from the marking menu; the vertex selection mode is activated.
6. Select the vertices at the bottom of *mug*, refer to Figure 2-40. Next, invoke the **Scale Tool** by pressing the R key.

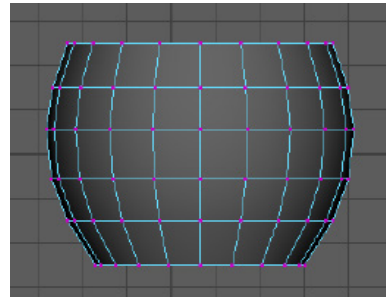


**Figure 2-40** Bottom vertices of the cylinder selected

7. Scale down the selected vertices of *mug* inward uniformly, as shown in Figure 2-41. Similarly, select the other loops of vertices and scale them to form the shape of a mug, refer to Figure 2-42.



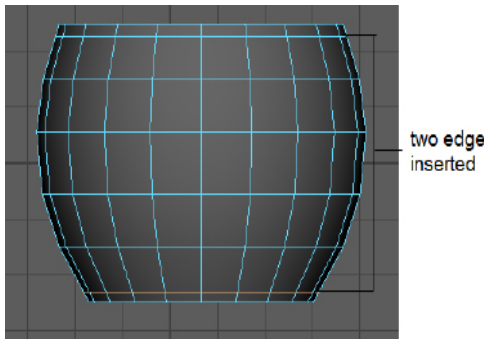
**Figure 2-41** Bottom vertices of the cylinder scaled



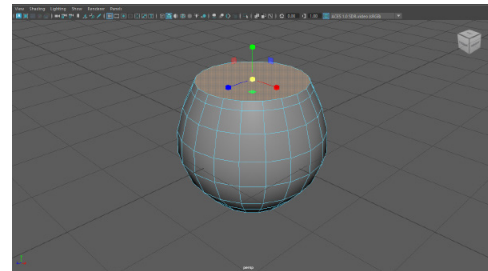
**Figure 2-42** Basic shape of the mug created

Next, you need to add segments at the top and bottom of the cylinder.

8. Make sure the **Modeling** menuset is selected in the **Menuset** drop-down list. Choose **Mesh Tools > Tools > Insert Edge Loop** from the menubar. Next, click at the top and bottom region of *mug*; two edges are inserted, refer to Figure 2-43. Deactivate the **Insert Edge Loop** tool by pressing the W key. Select *mug* if it is not selected and then press and hold the right mouse button; a marking menu is displayed. Choose **Vertex** from the marking menu; the vertex selection mode is activated. Select the vertices of the new segment. Next, invoke the **Scale Tool** by pressing the R key and scale them to form the shape of a mug.
9. Maximize the persp viewport. Make sure *mug* is selected and then press and hold the right mouse button; a marking menu is displayed. Choose **Face** from the marking menu; the face selection mode is activated. Now, select the top face of *mug* using the SHIFT key, refer to Figure 2-44.

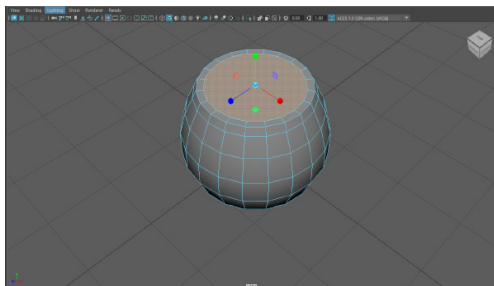


**Figure 2-43** Two edges inserted at the top and bottom of the cylinder

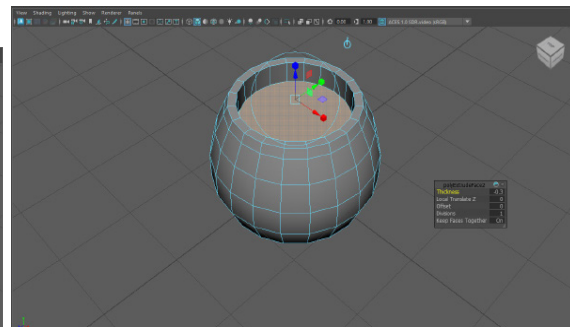


**Figure 2-44** Top faces of the cylinder selected

10. Invoke the **Scale Tool** and hold the SHIFT key and scale down the selected faces uniformly, refer to Figure 2-45.
11. Again, choose **Edit Mesh > Components > Extrude** from the menubar; the **polyExtrudeFace#** In-View Editor is displayed in the viewport, refer to Figure 2-46. Enter **-0.3** in the **Thickness** edit box of the **polyExtrudeFace#** In-View Editor, refer to Figure 2-47; the shaded faces are extruded.



**Figure 2-45** The top selected faces of the mug scaled down using the **Scale Tool**



**Figure 2-46** The **polyExtrudeFace#** In-View Editor displayed

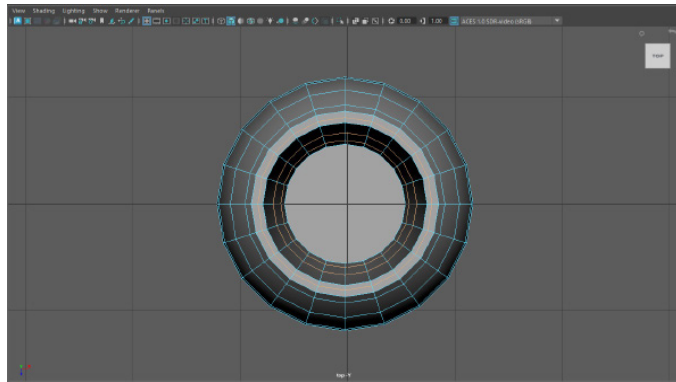
12. Press the G key to invoke the **Extrude** tool again and enter the value **-1.4** in the **Thickness** edit box; the top faces of *mug* are extruded downward.



### Note

*The G key is used to repeat the last performed action in Maya.*

13. Press G again to invoke the **Extrude** tool, and enter the value **-1.5** in the **Thickness** edit box. Next, enter **0.2** in the **Offset** edit box; the selected polygon is extruded inward. Deactivate the **Extrude** tool.
14. Maximize the top-Y viewport such that you can view the inner area of *mug*. Press 3 to view the object in the smooth mode. To rectify the distortion in the geometry, you need to add edges. Press 1 and choose **Mesh Tools > Tools > Insert Edge Loop** tool; the shape of the cursor changes and then insert three edge loops inside the mug, refer to Figure 2-47. Deactivate the **Insert Edge Loop** tool by pressing W.



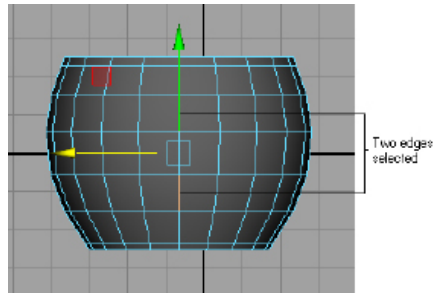
*Figure 2-47 Three edge loops added inside the mug*

## Creating the Handle of the Mug

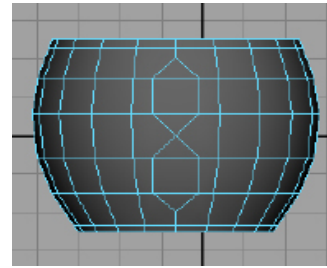
In this section, you need to create the handle of the mug.

1. Maximize the side-X viewport. Move the cursor over *mug* and then press and hold the right mouse button; a marking menu is displayed. Choose **Edge** from the marking menu; the edge selection mode is activated.
2. Select two edges of *mug*, refer to Figure 2-48. Next, choose **Edit Mesh > Components > Bevel > Option Box**; the **Bevel Options** window is displayed. Now, enter **1** in the **Width** edit box and choose the **Bevel** button; the selected edges are beveled, as shown in Figure 2-49.
3. Move the cursor over *mug* and then press and hold the right mouse button; a marking menu is displayed. Choose **Face** from the marking menu; the face selection mode is activated. Next, select a face of *mug*, as shown in Figure 2-50.
4. Choose **Edit Mesh > Components > Extrude** from the menubar. Next, invoke the **Scale Tool** by pressing the R key and scale down the selected face of *mug* uniformly upto 70%. You can check the scale size in the status line, as shown in Figure 2-51.

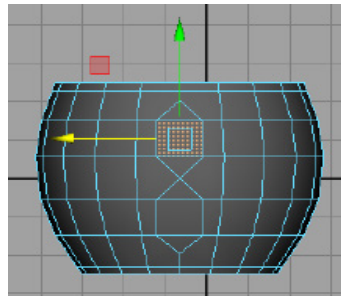




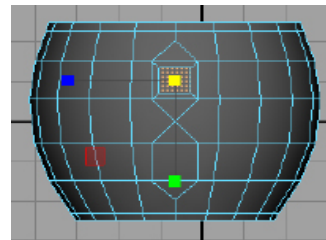
**Figure 2-48** Two edges of mug selected



**Figure 2-49** Selected edges beveled

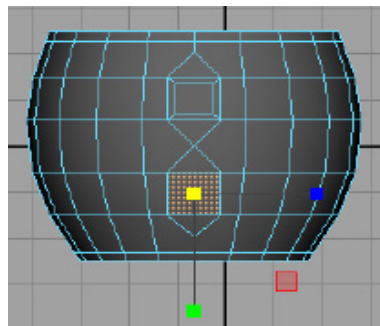


**Figure 2-50** A face of mug selected

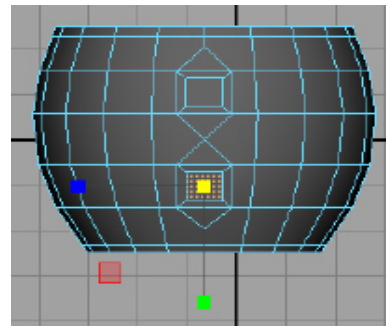


**Figure 2-51** Face of the mug scaled down

5. Select the face of *mug*, as shown in Figure 2-52. Repeat the procedure as done in Step 4 to scale down the face, refer to Figure 2-53.

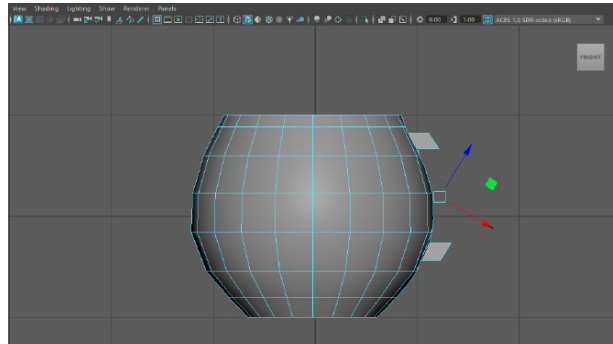


**Figure 2-52** A face of the mug selected



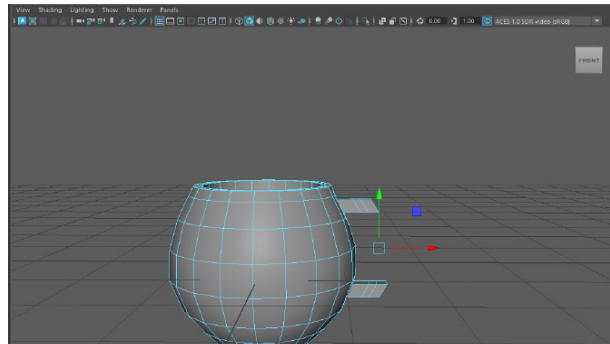
**Figure 2-53** A face of the mug scaled down

6. Maximize the persp viewport. Make sure that both the scaled faces are selected, and then invoke the **Smart Extrude** tool by choosing **Edit Mesh > Components > Smart Extrude** from the menubar. Next, maximize the Front-Z viewport and move the selected faces by pressing W key, as shown in Figure 2-54.



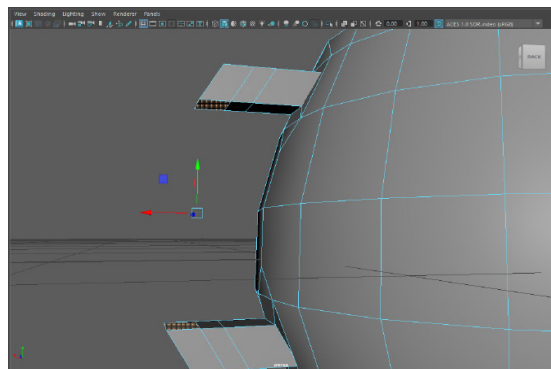
*Figure 2-54 The Faces are extruded*

7. Repeat the procedure as done in Step 6 to extrude the faces twice, refer to Figure 2-55.

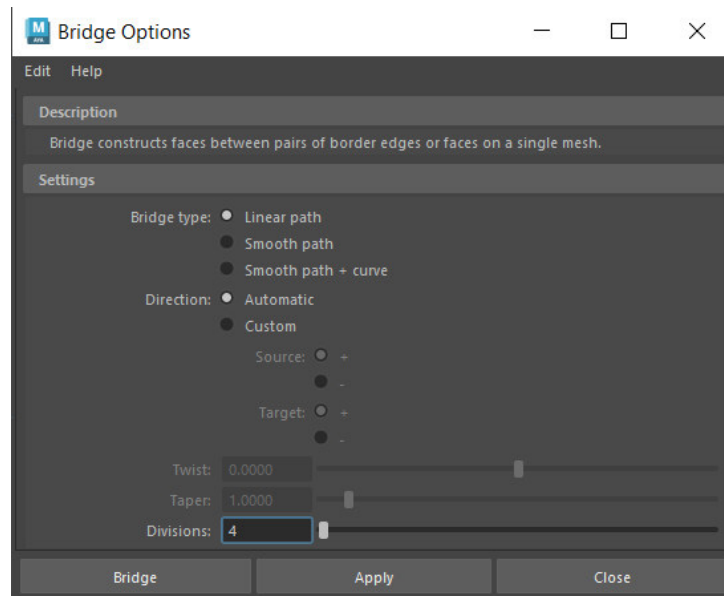


*Figure 2-55 The Faces are extruded twice*

8. Deactivate the **Extrude** tool by pressing the W key. Make sure the two extruded faces are selected, as shown in Figure 2-56. Next, choose **Edit Mesh > Components > Bridge > Option Box** from the menubar; the **Bridge Options** window is displayed. In the **Settings** area, enter 4 in the **Division** slider in the **Bridge Options** window, as shown in Figure 2-57. Next, choose the **Apply** button and close the window; the extruded faces are connected to each other, as shown in Figure 2-58.

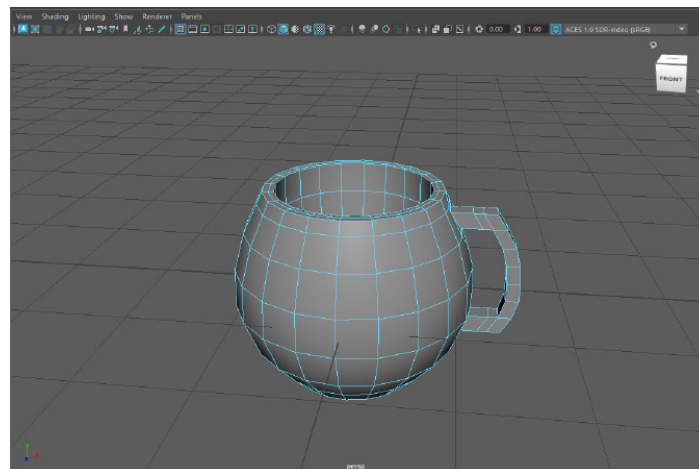


*Figure 2-56 Two extruded faces selected*

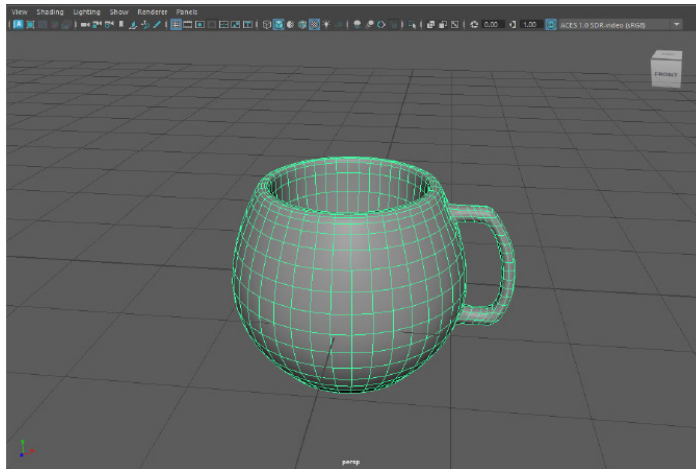


*Figure 2-57 The Bridge Options window*

9. Make sure *mug* is selected and then press and hold the right mouse button on it; a marking menu is displayed. Next, choose **Object Mode** from the marking menu; the object selection mode is activated.
10. Select *mug* and then choose **Mesh > Remesh > Smooth** from the menubar; the mesh of *mug* is smoothened. The *mug* after applying **Smooth Tool** is shown in Figure 2-59.



*Figure 2-58 The extruded faces are connected to each other*



*Figure 2-59 The mug after applying the **Smooth** tool*

## Changing the Background Color of the Scene

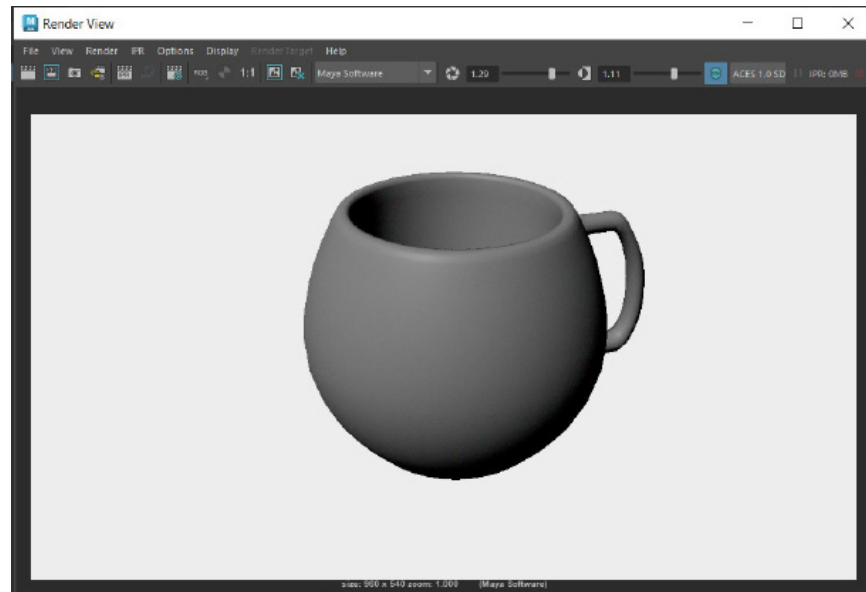
In this section, you will change the background color of the scene.

1. In the **Outliner** window, click on the **persp** camera; the **perspShape** tab is displayed in the **Attribute Editor**. the **perspShape** tab is displayed in the **Attribute Editor**.
2. In the **perspShape** tab, expand the **Environment** node and drag the **Background Color** slider bar toward right to change the background color to white.

## Saving and Rendering the Scene

In this section, you will save the scene that you have created and then render it. You can view the final rendered image of the scene by downloading the *c02\_maya\_2026\_rndr.zip* file from [www.cadcim.com](http://www.cadcim.com). The path of the file is as follows: *Textbooks > Animation and Visual Effects > Maya > Autodesk Maya 2026: A Tutorial Approach*

1. Choose **File > Save Scene** from the menubar.
2. Maximize the persp viewport if not already maximized. Choose the **Display render setting** button from the Status Line; the **Render Settings** window is displayed. In this window, select **Maya Software** in the **Render Using** drop-down list and then close the window. Choose the **Render the current frame** button from the Status Line to render the scene and set the **Exposure** and **Gamma**, as shown as shown in Figure 2-60.



*Figure 2-60 The mug after applying the **Smooth** tool*

### Self-Evaluation Test

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

1. A polygon is primarily made up of which of the following components?
  - (a) Edges, vertices, and faces
  - (b) Points, lines, and circles
  - (c) Curves, arcs, and splines
  - (d) Layers, strokes, and fills
2. In Maya, which polygon primitive lies on a cylinder and subtends a constant angle to a plane perpendicular to its axis?
  - (a) **Cube**
  - (b) **Helix**
  - (c) **Sphere**
  - (d) **Torus**
3. The **Smooth** tool is used to add \_\_\_\_\_ to a polygon object, making it smoother.
4. The **Smart Extrude** tool can be used to extrude faces, but it does not support cut-throughs. (T/F)
5. The **Multi** option allows the user to select only vertices in a polygon object. (T/F)

## Review Questions

Answer the following questions:

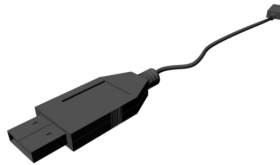
1. Which menu option must be enabled to create polygon objects using click-drag operations?  
(a) **Boolean Creation** (b) **Polygon Interactive Mode**  
(c) **Interactive Creation** (d) **Primitive Creation**
2. The **Bridge** tool is used to construct faces between pairs of \_\_\_\_\_ edges.
3. The Boolean operations available in Maya 2026 include Union, Difference (A-B), and Split Edge. (T/F)
4. The **Add Divisions** tool is used to smoothen out an object by increasing subdivisions. (T/F)
5. A sphere is a solid object in which every point on its surface is equidistant from its center. (T/F)

## EXERCISES

The rendered output of the models used in the following exercises can be accessed by downloading the file *c02\_maya\_2026\_exr.zip* from [www.cadcim.com](http://www.cadcim.com). The path of the file is as follows: *Textbooks > Animation and Visual Effects > Maya > Autodesk Maya 2026: A Tutorial Approach*

### Exercise 1

Using various polygon modeling techniques, create the model of a USB cable, as shown in Figure 2-61. (Expected time: 30 min)

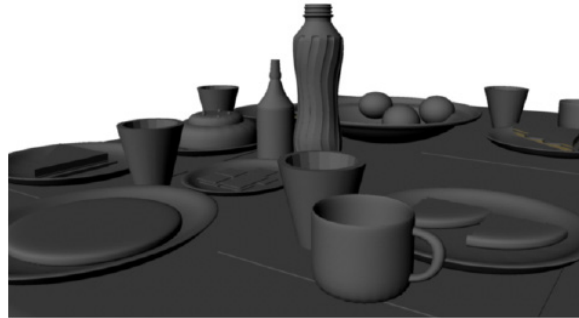


*Figure 2-61 Model to be created in Exercise 1*

**Exercise 2**

Using various polygon modeling techniques, create a scene, as shown in Figure 2-62.

(Expected time: 30 min)



*Figure 2-62 Scene to be created in Exercise 2*



**Answers to Self-Evaluation Test**

1. a, 2. b, 3. Divisions, 4. F, 5. F