3D Tutorials AutoCAD 2007

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AutoCAD 3D – Chapter 1
3D Interface

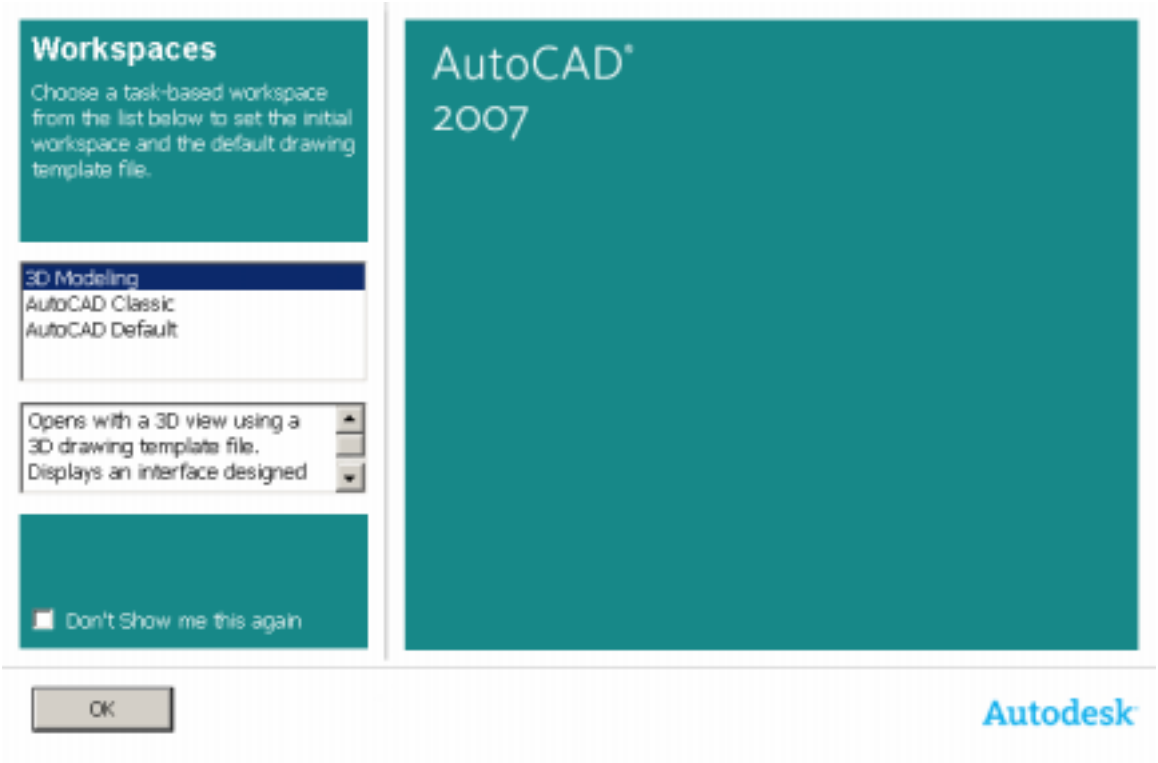
1.1 Launching AutoCAD 3D

1. Choose **Start** from the Windows program manager.
2. Choose **Programs, Autodesk ,AutoCAD 2007**.

Workspaces

AutoCAD workspaces are sets of menus, toolbars and dockable windows (such as the Properties palette, DesignCenter, and the Tool palettes window) that are grouped and organized so that you can work in a custom, task-oriented drawing environment.

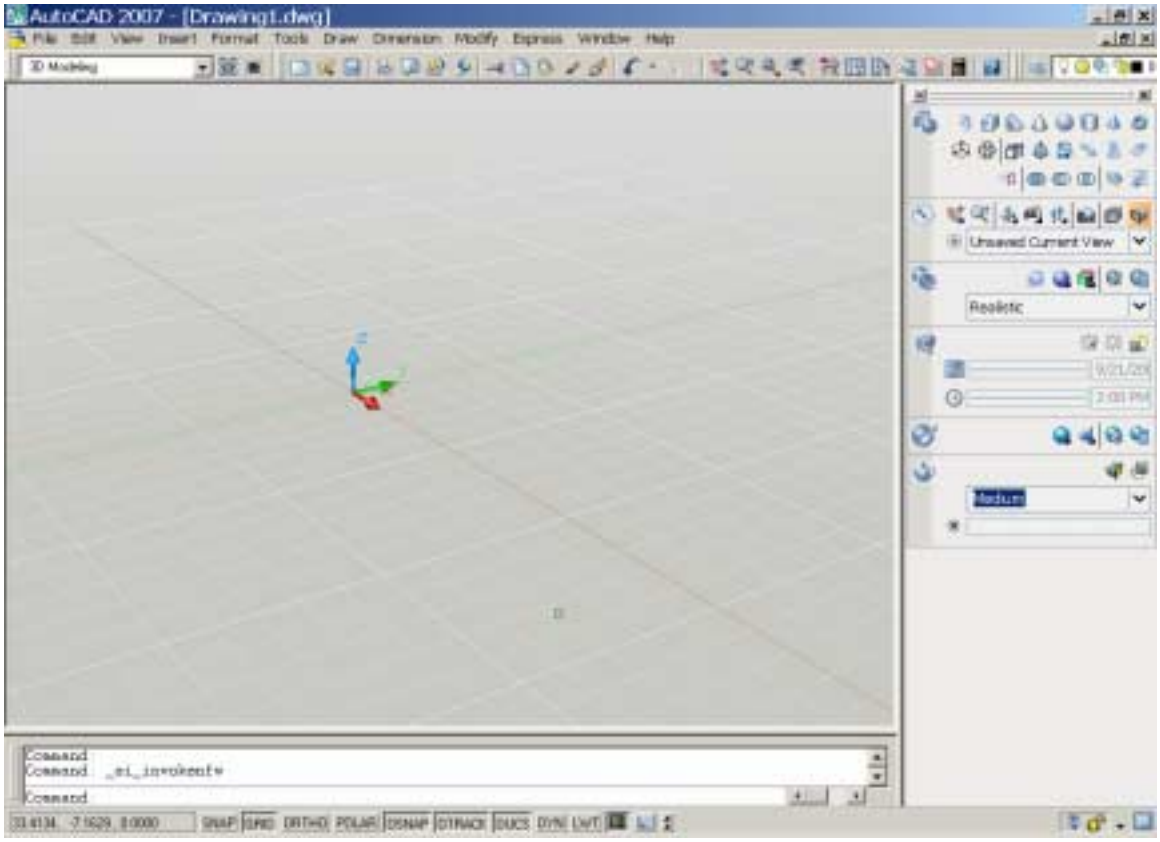
1. Click **3D Modeling** and **OK**.



1.2 3D Interface

AutoCAD's 3D Interface consists of three main areas

- The dashboard
- Anchored palettes
- A 3D workspace



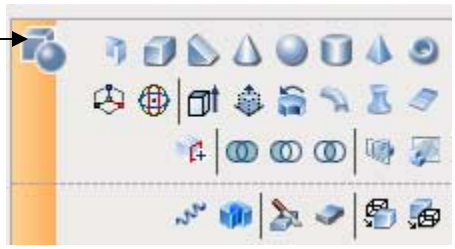
1.3 3D Dashboard

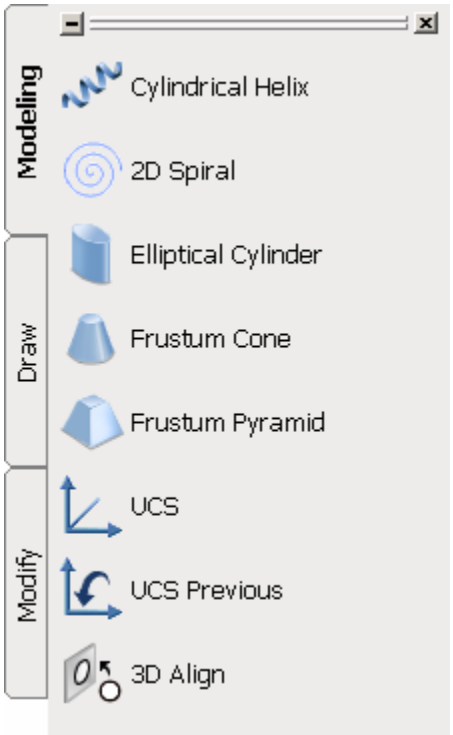
The dashboard consists of a set of control panels organized by function.

For example, the top control panel contains commands that create and modify 3D solids; the second control panel contains commands and controls used to navigate 3D models.

1. Click on one of the panels to expand the display to show a slide-out panel that has additional controls.

Click to expand dashboard panel →





1.4 Viewports

1. Choose **View, Viewports, 4 Viewports**.

   or

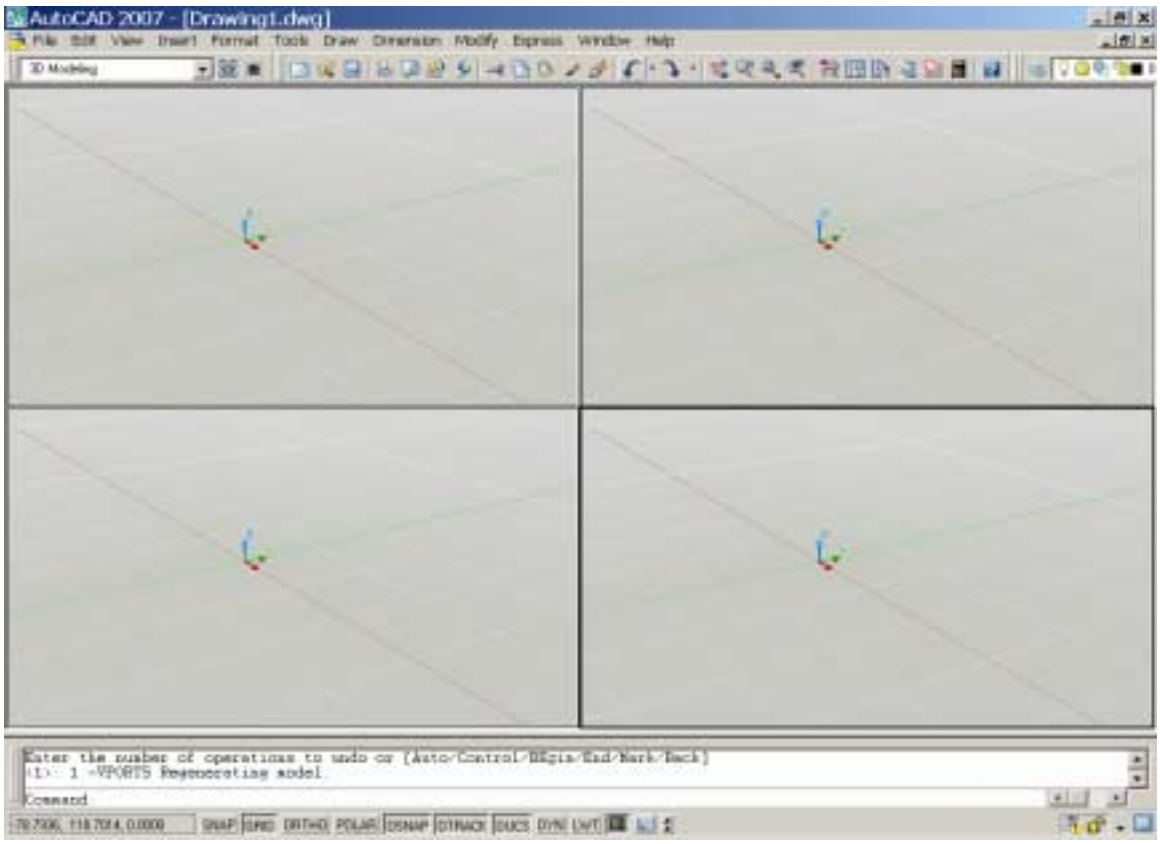
2. Type -VPORTS at the command prompt.

   Command: **-VPORTS**

   Enter an option [Save/Restore/Delete/Join/SIngle/?/2/3/4] **4: enter**

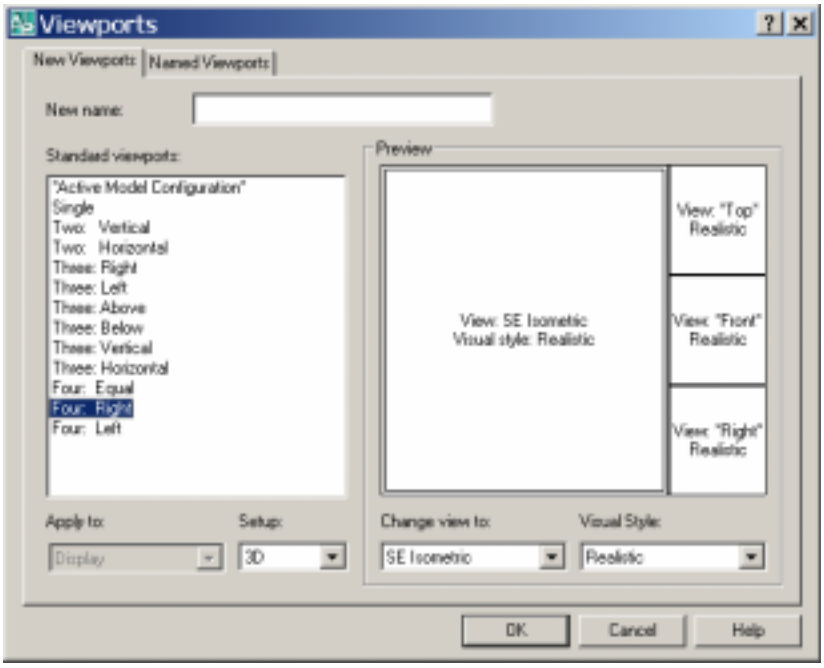
   Enter a configuration option [Horizontal/Vertical/Above/ Below/Left/Right] <Right>: **enter**

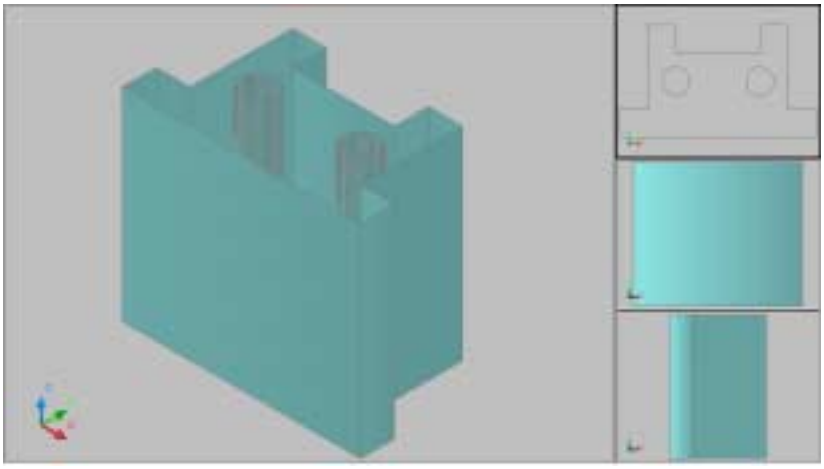
Your screen will look something like the figure below with four views in one AutoCAD drawing.



1.5 Preset 3D Viewports

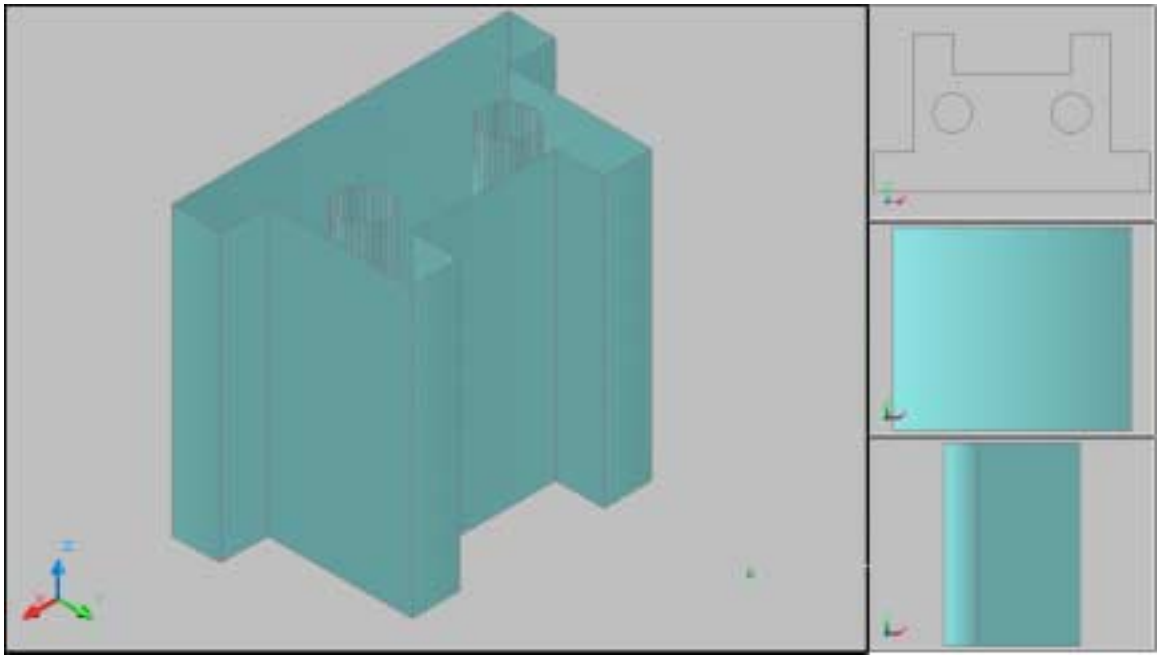
1. Choose **View, Viewports, New Viewports**
2. Click the dropdown option for **Setup** andclick **3D**.
3. Choose **Four: Right** as the viewport option.





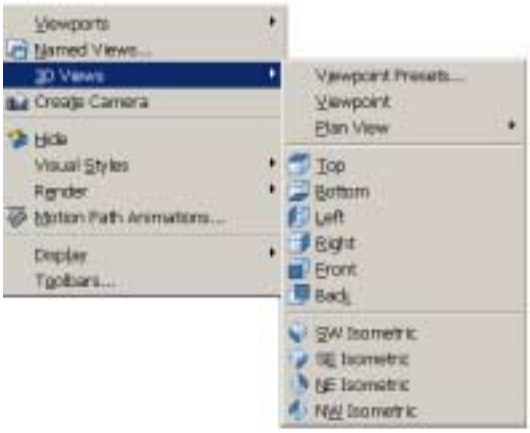
1.6 Named Views

1. Choose View, Named Views…
2. Click the plus **(+)** sign beside **Preset Views**.
3. Click **NE Isometric, Set Current, Apply,**and **OK**.



Tip:

You can also choose View, 3D Views, and any of the preset 3D views.



1.7 VPOINT Command (Tripod)

Displays a compass and tripod for defining a view rotation. The compass represents a two dimensional globe.

1. **Choose** View, 3D Views, point

   or

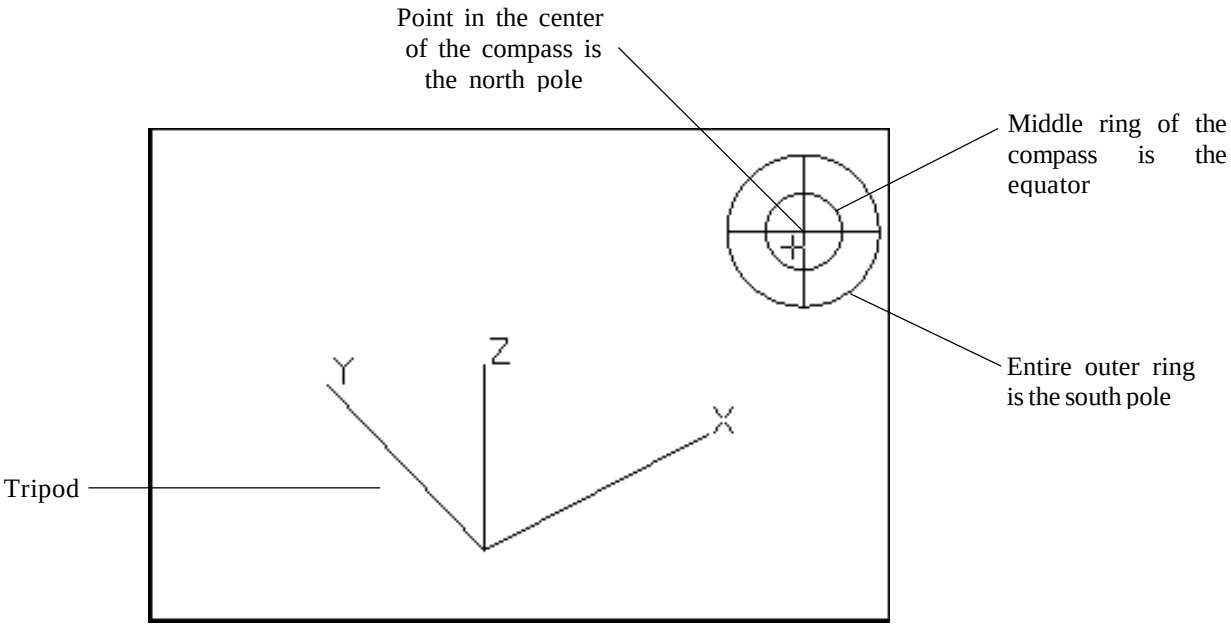
2. **Type** VPOINT at the command

   prompt.

   Command: **vpoint**

   Rotate/<Viewpoint><-0.614,-0.614,0.500>: **(enter)**

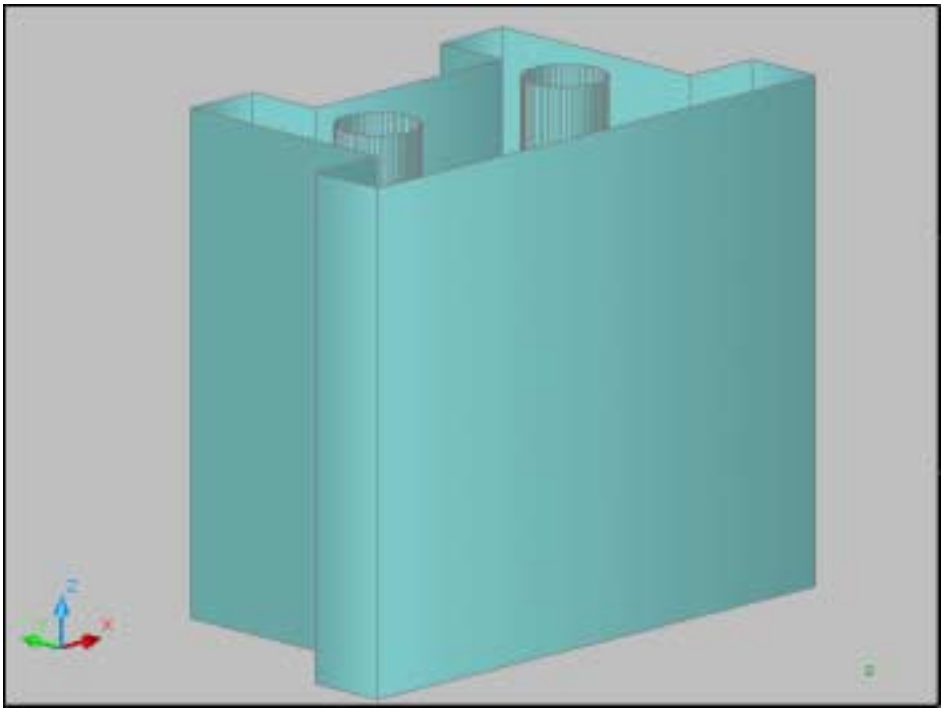
3. **Click** a point on the compass to define the viewing angle.



1.8 VPOINT Command (Rotate)

Enters a rotation angle at the viewpoint prompt.

1. Type VPOINT at the command prompt.
   Command: **vpoint**
   Rotate/<View point> <-0.614,-0.614,0.500>: **R (enter)**
   Enter angle in XY plane from X axis <225>: **225 (enter)**
   Enter angle from XY plane <30>: **15 (enter)**



1.9 DDVPOINT

1. Choose **View, 3D Views, Viewpoint Preset**.

   or

2. Type DDVPOINT at the command prompt.

   Command: **ddvpoint**

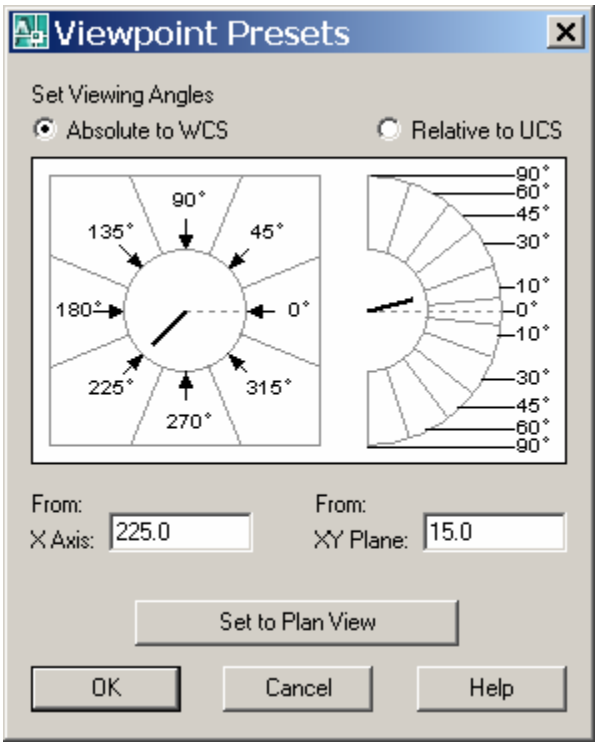
3. Set a viewing angle by typing the From X axis and XY Plane angle.

   or

4. Pick a viewing angle in the 2 graphics Left graphic = From X Axis

   Right graphic = In XY Plane

5. Click **OK**.



1.10 Plan View

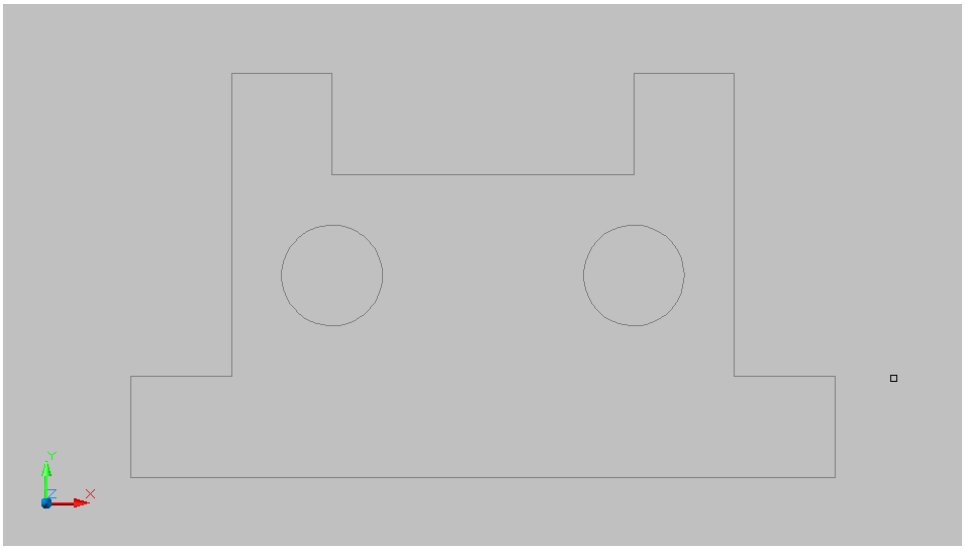
1. Choose **View, 3D Views, Plan View** the one of the following: Current UCS, World UCS, Named UCS

   or

2. Type PLAN at the command prompt.

   Command: **plan**

   Enter an option [Current Ucs/Ucs/World] <Current>: **World**



AutoCAD 3D – Chapter 2
Thickness and Elevation

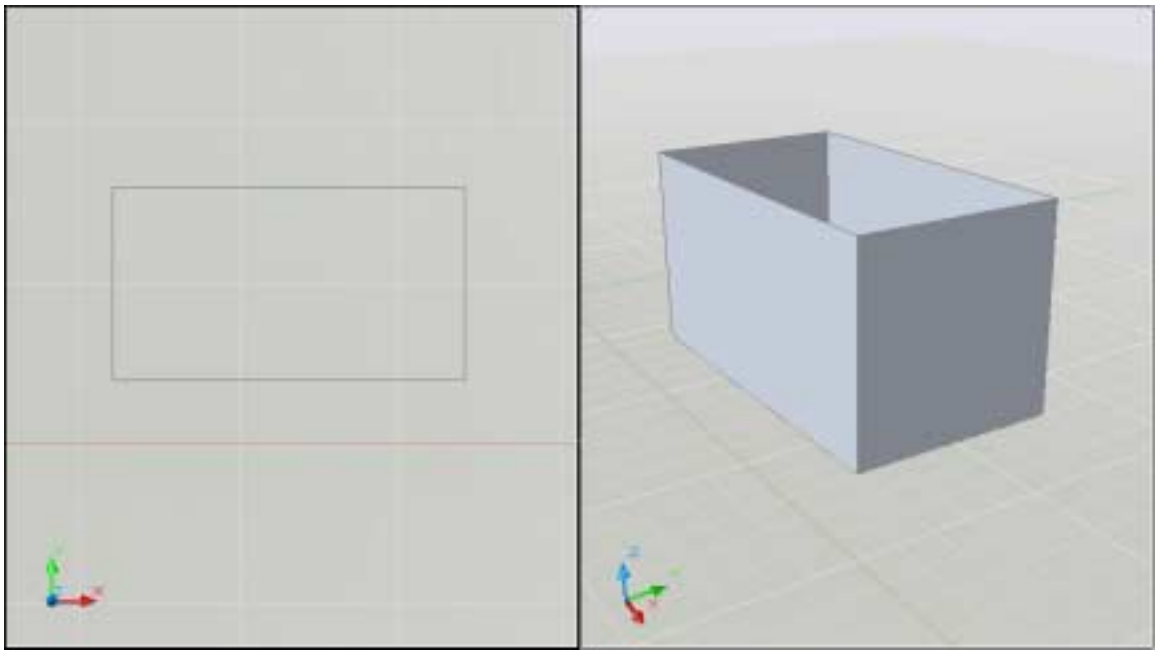
2.1 Thickness Command

1. Begin a new drawing using a 3D Modeling workspace.
2. Choose View, Viewports, 2 Viewports.
3. Press **ENTER** for the default of two vertical viewports.
4. In the left viewport, type **PLAN** and **World**.
5. Type THICKNESS at the command prompt.

   Command: **thickness**

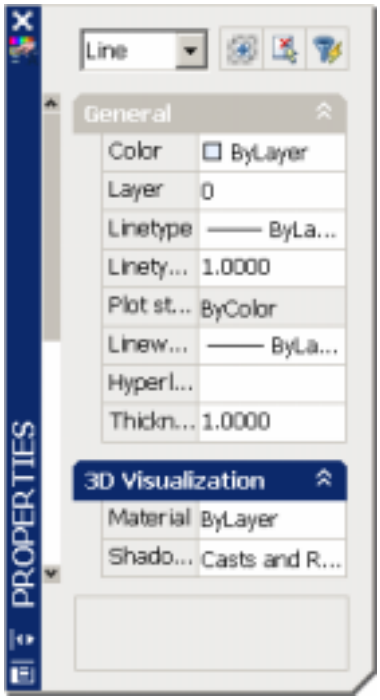
   Enter new value for THICKNESS <0.0000>: **3**
6. In the plan view, draw a rectangle using in the LINE command.

The lines will have a 3D “thickness” that can be seen in the 3D view.

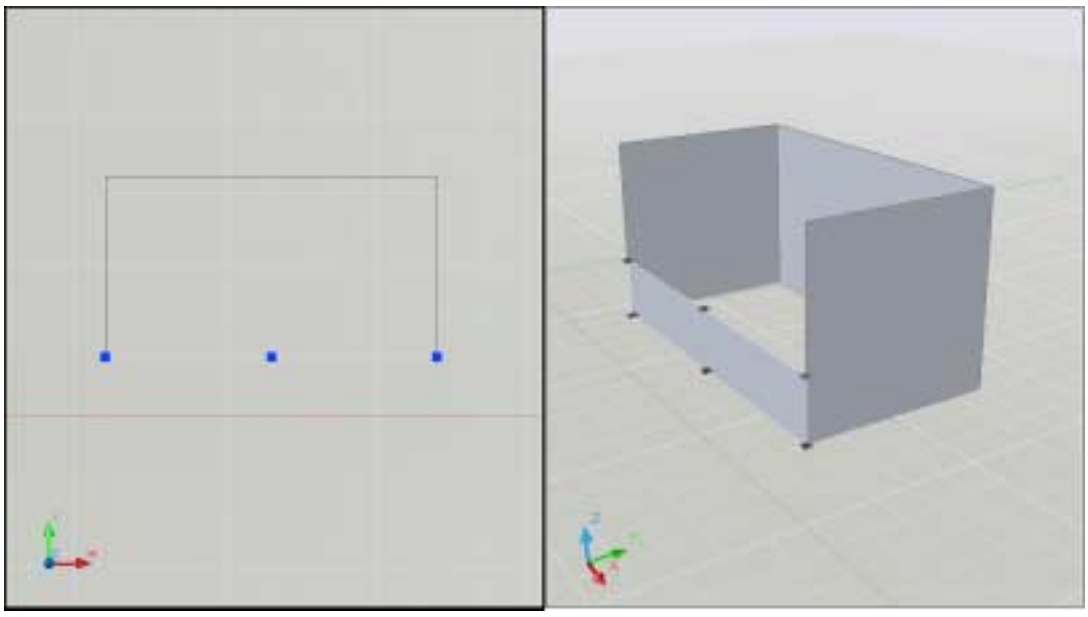


2.2 Change Existing Thickness

1. Select the object whose thickness you would like to change (e.g. one line of the rectangle you drew in 2.1.
2. Choose **Modify, Properties…**or right click and choose Properties…
3. In the Properties dialog box type a new line thickness.



The following result is a new line thickness for the selected object.



2.3 Elevation

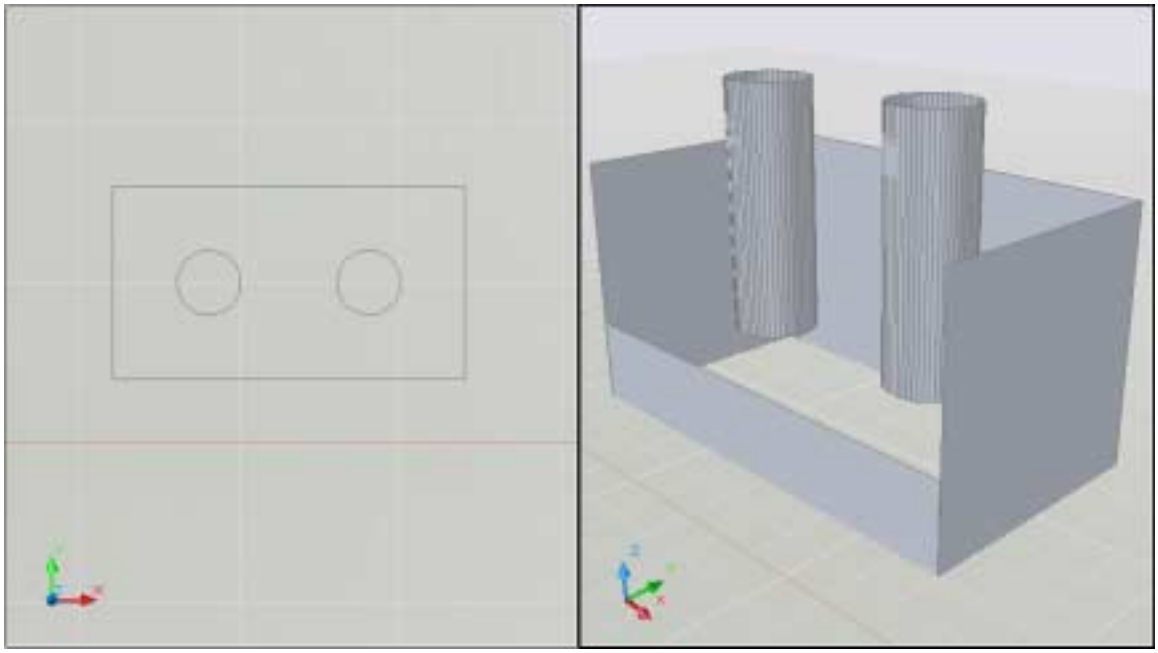
Stores the elevation for new objects relative to the current UCS for the current space.

1. Type ELEVATION at the command prompt.

   Command: **elevation**

   Enter new value for ELEVATION <0.0000>: **1.00**

2. Draw two circles at the new elevation. Note that they appear to be “floating” 1 unit above the ground.



2.4 Elevation Shortcut

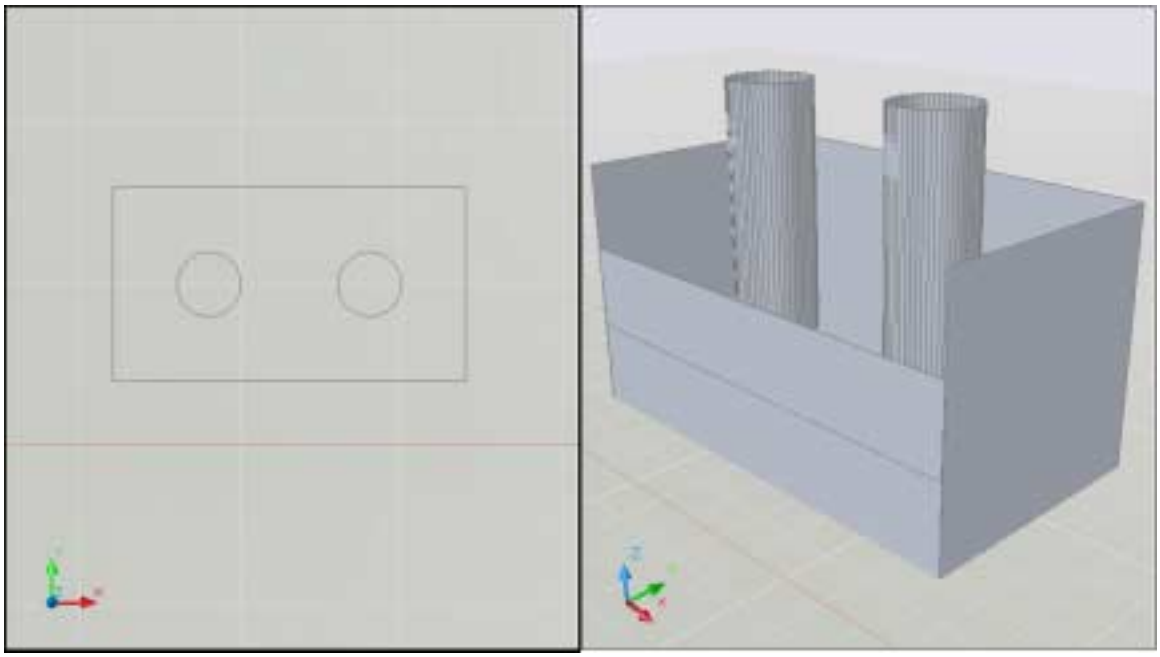
1. Type ELEV at the command prompt.

   Command: **elev**

   Specify new default elevation: <1.0000>: **1**

   Specify new default thickness: <3.000>: **1**

2. Draw a new line to see the elevation and thickness settings.



AutoCAD 3D – Chapter 3
Visualizing Your Model

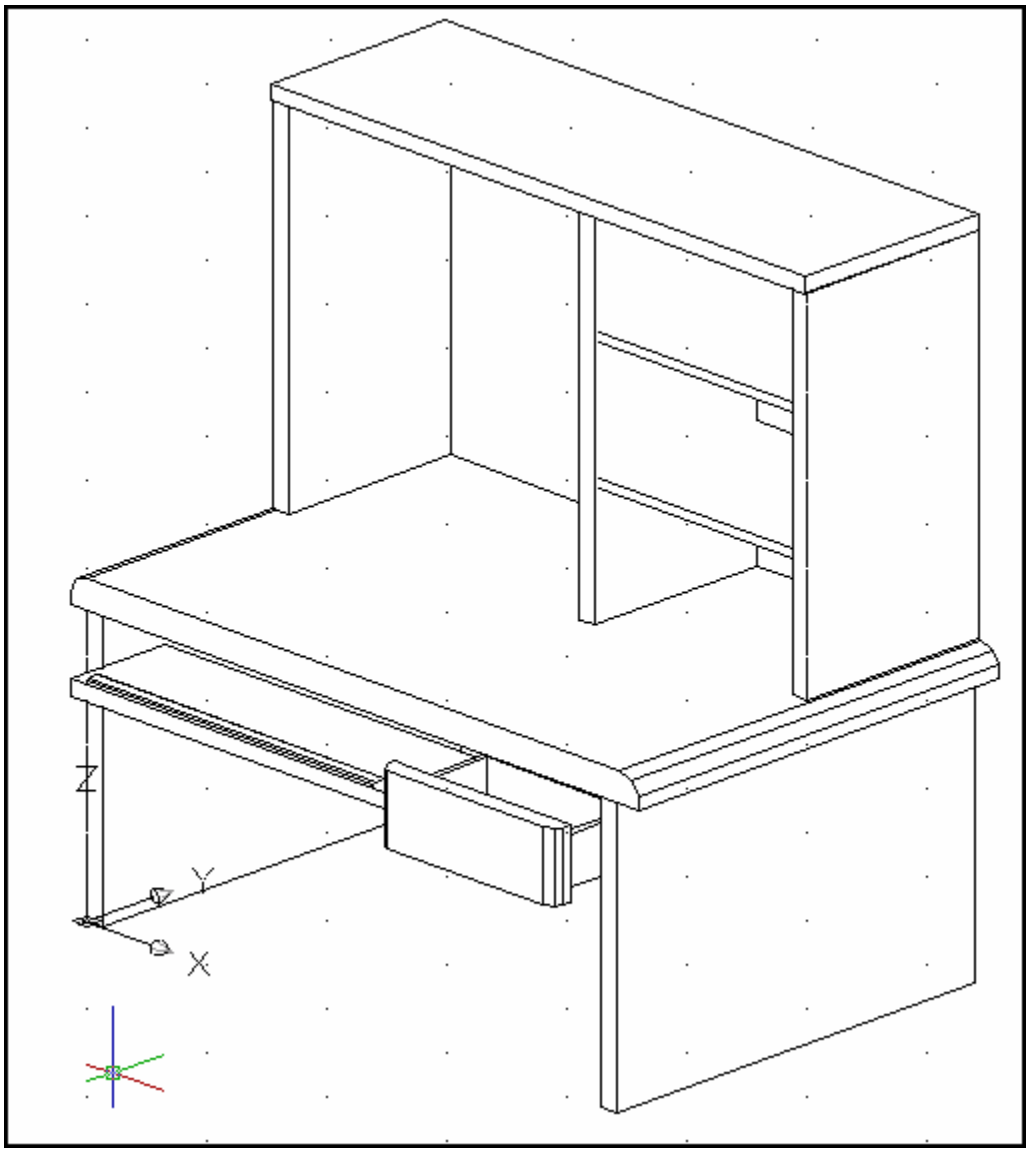
3.1 HIDE Command

Regenerates a three-dimensional model with hidden lines

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Hide**.

   or
3. Type HIDE at the command prompt.

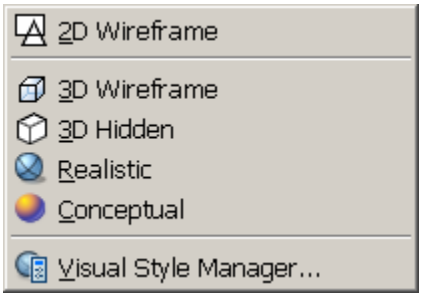
   Command: **hide**



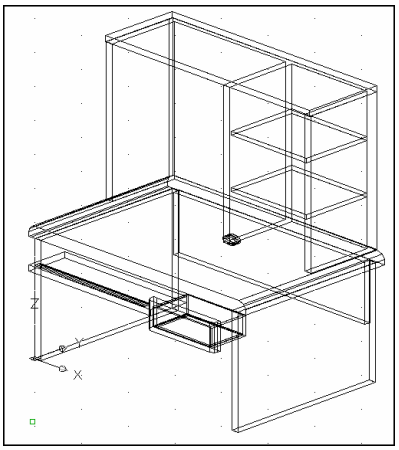
3.2 Visual Styles

A visual style is a collection of settings that control the display of edges and shading in the viewport.

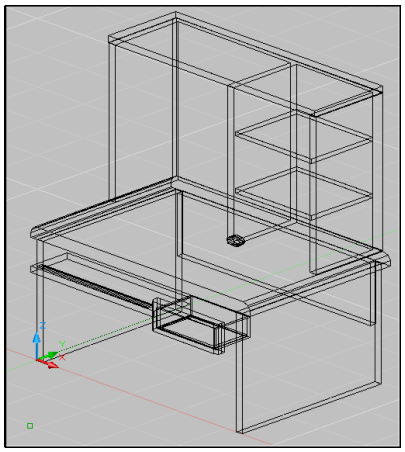
1. Open a drawing with 3D objects and display in a 3D view.
2. Choose View, Visual Styles and one of the following style options.



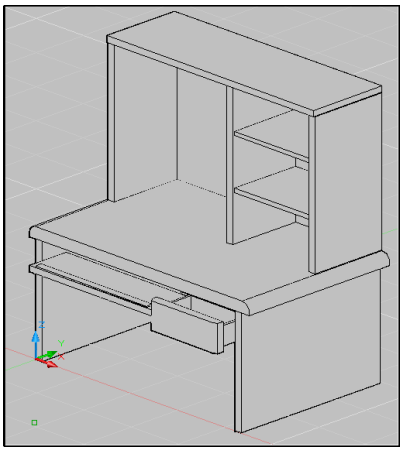
2D Wireframe



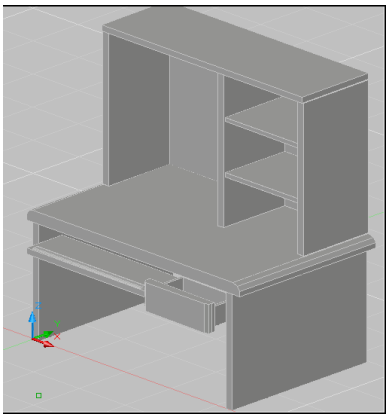
3D Wireframe



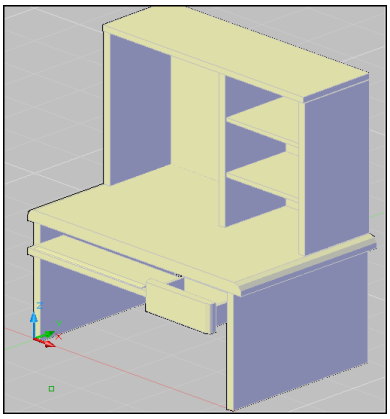
3D Hidden



Realistic



Conceptual



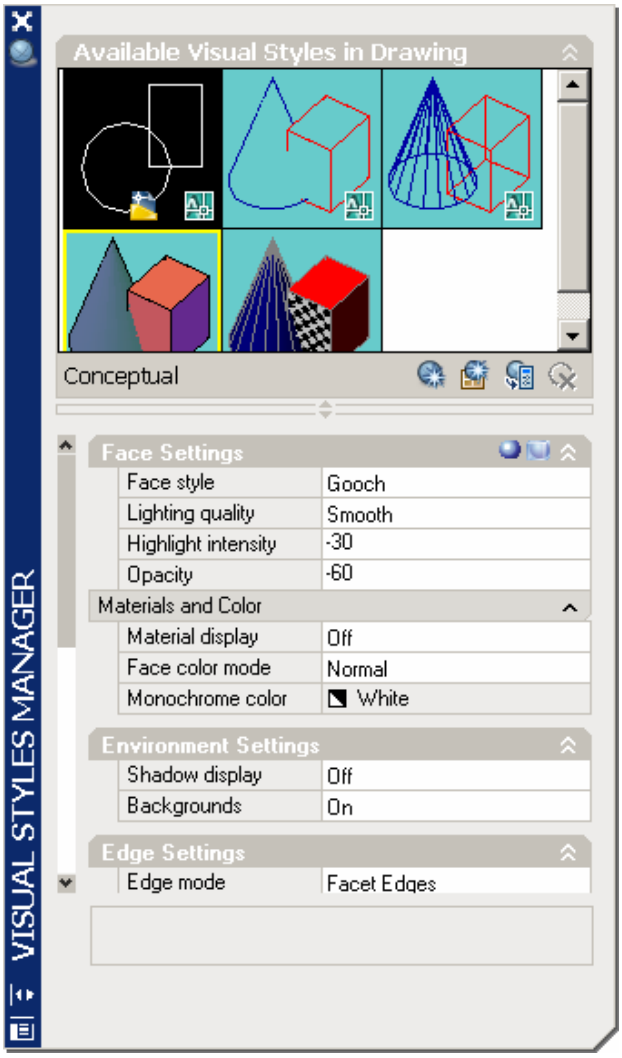
3.3 Visual Style Manager

The Visual Styles Manager displays sample images of the visual styles available in the drawing. The selected visual style is indicated by a yellow border, and its settings are displayed in the panel below the sample images.

1. Choose **View, Visual Styles, Visual Styles Manager…**

   or

2. Type VISUALSTYLES at the command prompt.
   Command: **visualstyles**
3. Choose the desired option from one of those available in the drawing for 2D Wireframe, 3D Wireframe, 3D Hidden, Realistic, or Conceptual options.



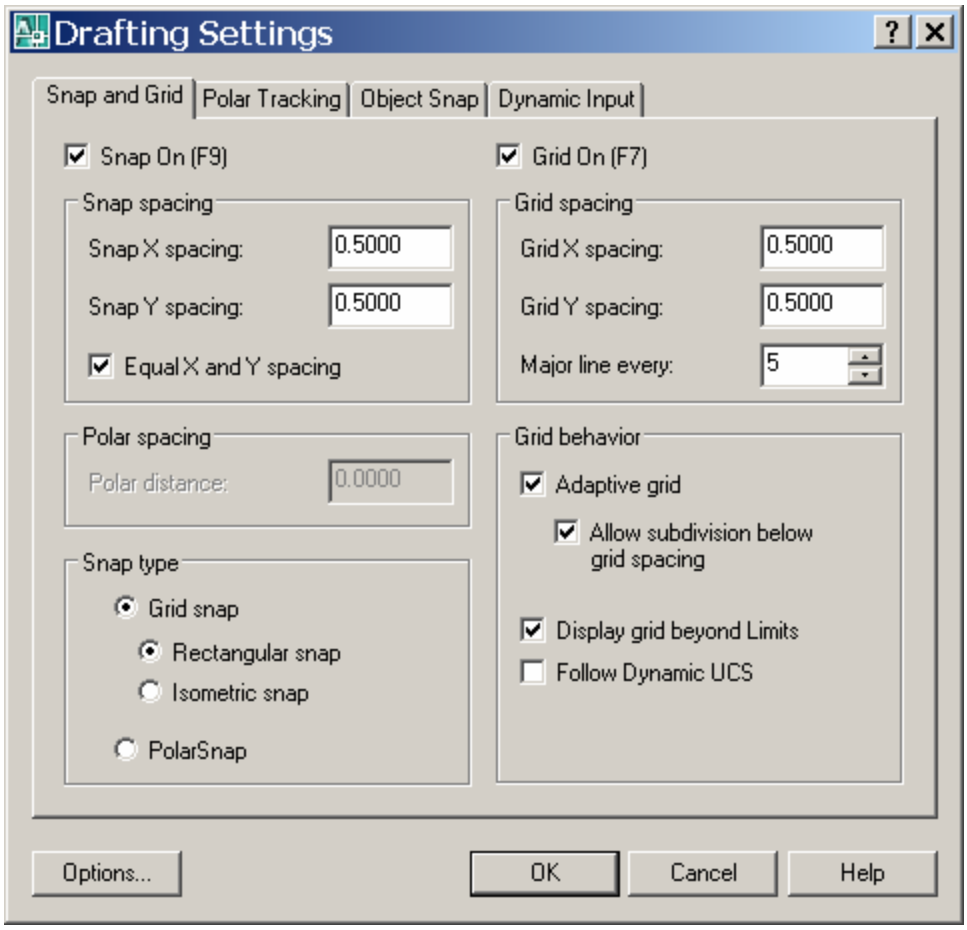
3.4 Adaptive 3D Grid

When you choose a shaded or 3D wireframe visual style, the grid changes from a dotted grid to a rectangular grid. The new grid provides a better sense of a model's orientation in 3D. The rectangular grid supports perspective, can display major and minor grid lines, provides color options, and can automatically control the grid density when zooming in or out (adaptive grid.) You can change the grid settings using the drafting settings dialog box.

1. Choose **View, Visual Styles** and one of the following options: 3D Wireframe, 3D Hidden, Realistic, or Conceptual.

Change the adaptive grid settings

1. Choose **Tools, Drafting Settings,** and the **Snap** and **Grid TAB**.



AutoCAD 3D – Chapter 4
Z Coordinates

4.1 3D Coordinates

Entering 3D Cartesian coordinates (X,Y,Z) is similar to entering 2D coordinates (X,Y). In addition to specifying X and Y values, you specify a Z value.

1. Open a drawing with 3D objects and display in a 3D view.
2. Type 3DPoly at the command prompt.

   Command: **3DPOLY**

   Specify start point of polyline: **1,1,0**

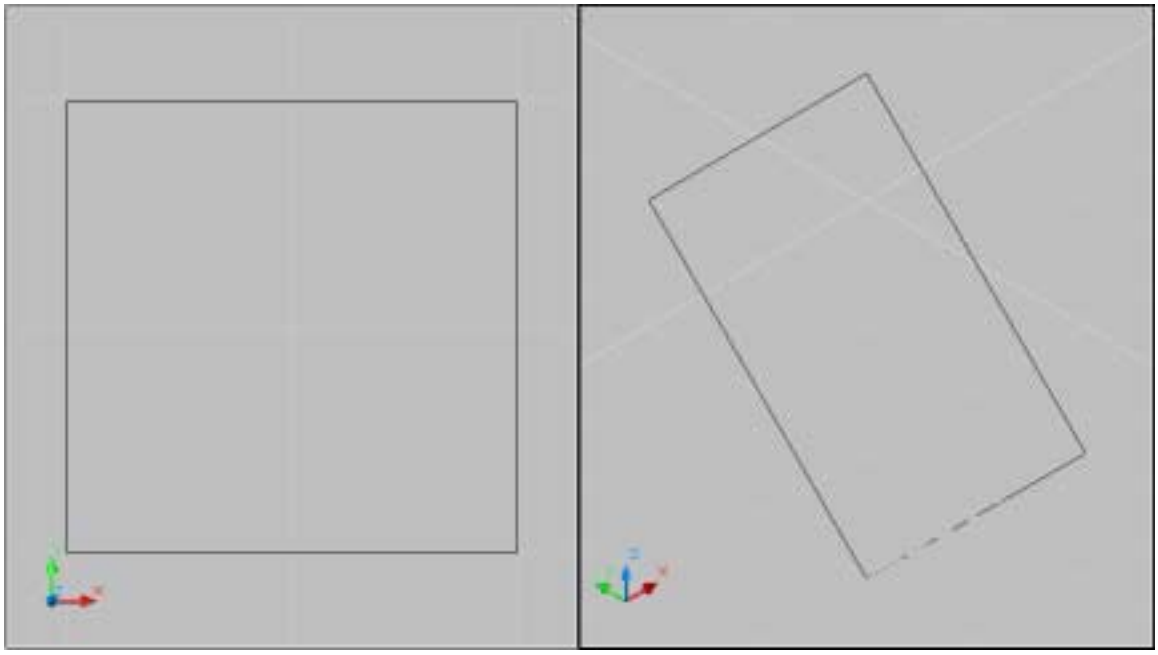
   Specify endpoint of line or [Undo]: **1,2,1**

   Specify endpoint of line or [Undo]: **2,2,1**

   Specify endpoint of line or [Close/Undo]: **2,1,0**

   Specify endpoint of line or [Close/Undo]: **1,1,0**

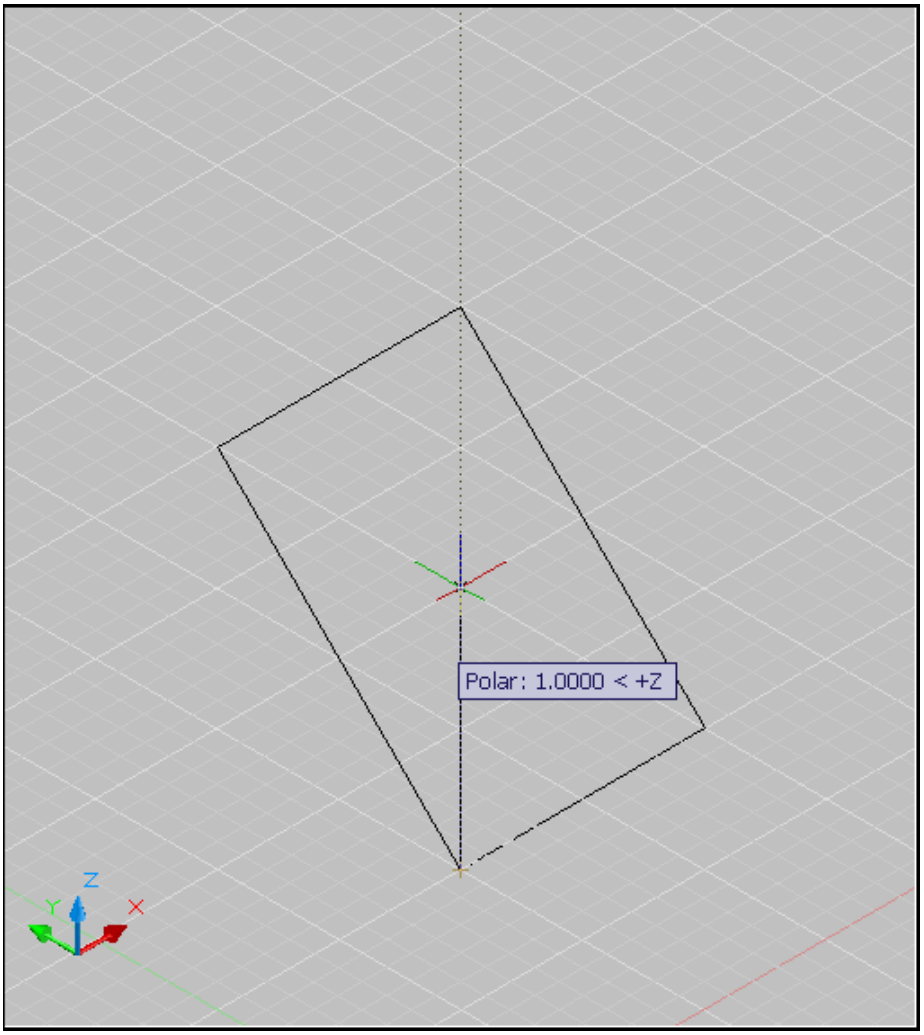
   The result will be the following lines that are drawn in 3D:



4.2 Track in Z Direction

With AutoTrack (polar tracking and object snap tracking), you can track in the Z direction as well as in the XY plane. Similarly, when Ortho mode is turned on, you can lock the cursor to the Z direction.

1. Press **F11** or click **OSnap Tracking** on the status bar if it is not already on.
2. Press **F10** or click **Polar Tracking** on the status bar if it is not already on.
3. In a 3D view, issue the LINE command and draw a line in the Z direction using tracking.



4.3 Move in Z Direction

1. Open a drawing with 3D objects in it.
2. Type MOVE at the command prompt.

   Command: **move**

   Select objects: **pick object in 3D view**

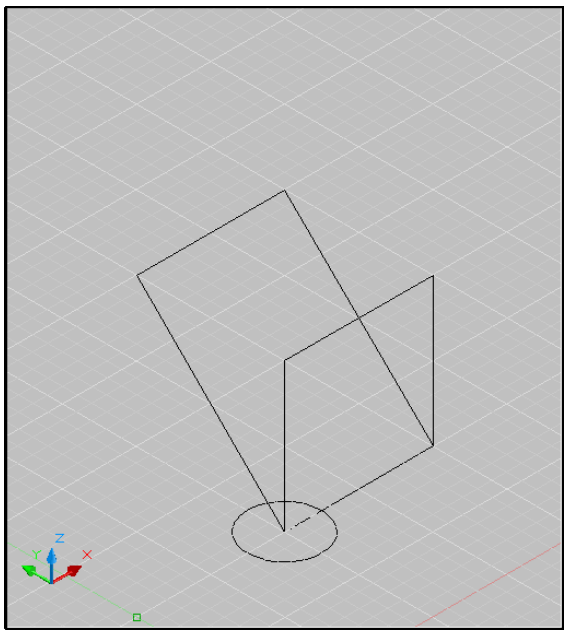
   Select objects: **press enter**

   Specify base point or displacement:

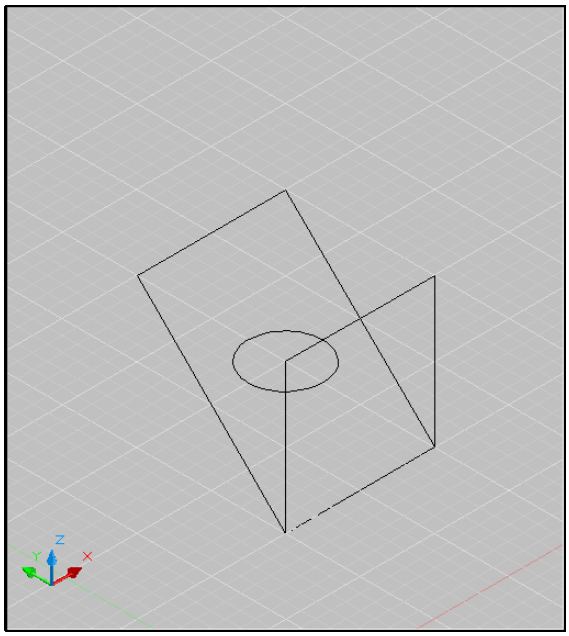
   Specify second point of displacement or

   <use first point as displacement>: 0,0,1 or use polar tracking to move the object.

before move



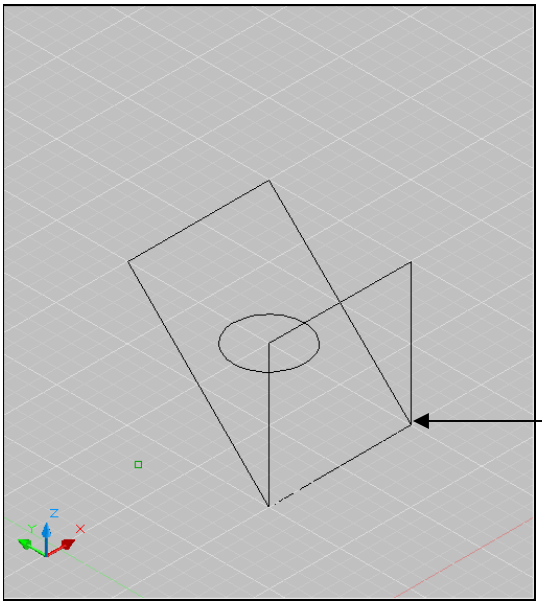
after move



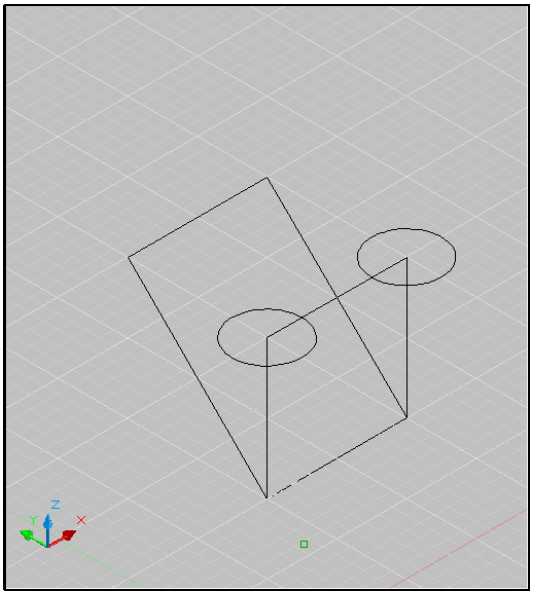
4.4 3D Point Filters

Draws in 3D Z direction by filtering X and Y coordinates.

1. Open a drawing with 3D objects in it.



2. Use the CIRCLE command and place it using 3D point filters (.xy)
3. Command: **circle**
4. Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **.XY**
5. of **pick endpoint to filter**
6. (need Z): **1**
7. Specify radius of circle or [Diameter] <0.2500>: **press enter**

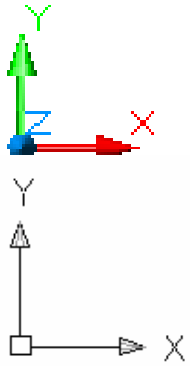


AutoCAD 3D – Chapter 5
User Coordinate System

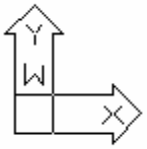
5.1 UCS Icon

The UCS icon represents the orientation of the user coordinate system (UCS) axes and the location of the current UCS origin. It also represents the current viewing direction relative to the *XY* plane. AutoCAD displays the UCS icon differently for 2D, 3D and Paper Space environments.

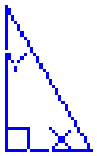
3D UCS icons



2D UCSIcon



Pspace UCSICON



1. Choose **View, Display, UCS Icon**.

   or

2. Type UCSICON at the command prompt.

   Command: **ucsicon**

   Enter an option [ON/OFF/All/Noorigin/ORigin/Properties] <ON>:

ON	Displays the UCS icon.
OFF	Turns off the display of the UCSICON.
All	Affects the display of the UCSICON in all viewports.
Noorigin	Always displays the UCS at the lower left corner.
Origin	Shows the UCS at the 0,0,0 origin of the current UCS**.**
Properties	Changes the display properties of the UCS icons(s)**.**

UCS Icon Properties

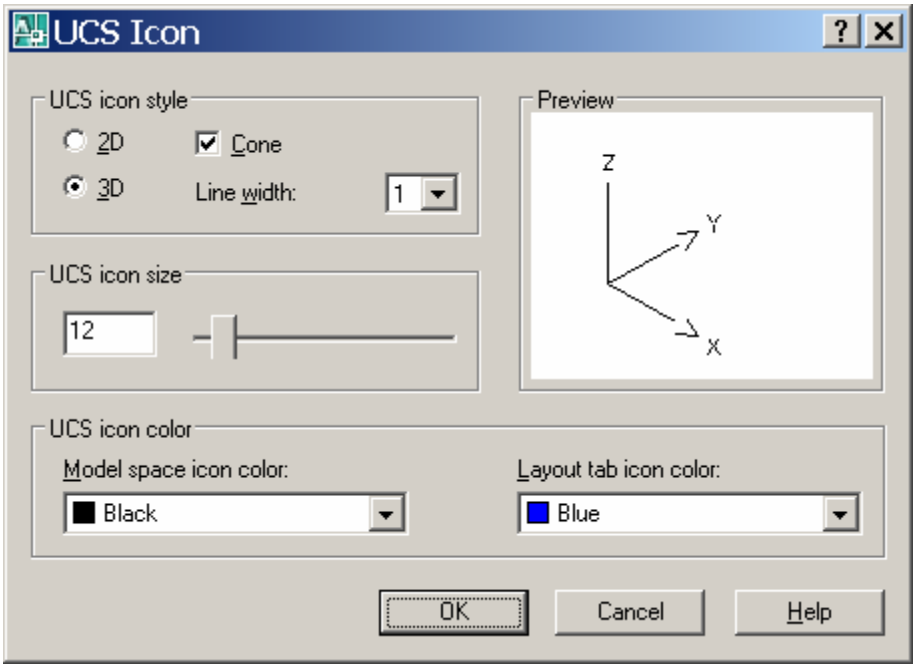
1. Choose **View, Display, UCS Icon, Properties**.

   or

2. Type UCSICON at the command prompt.

   Command: **ucsicon**

   Enter an option [ON/OFF/All/Noorigin/ORigin/Properties] <ON>: **P**



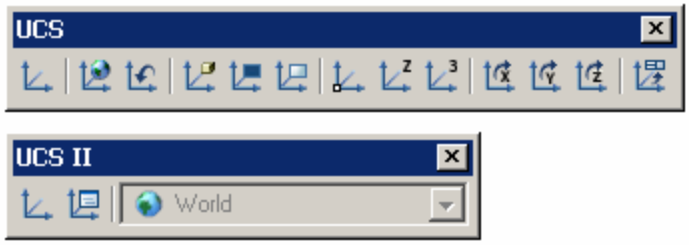
5.2 UCS Overview

The user coordinate system provides an alternate movable coordinate system for coordinate entry, planes of operation, and viewing. Most AutoCAD geometric editing commands are dependent on the location and orientation of the UCS. There are a variety of ways to set the User Coordinate System using the UCS command.

1. Type UCS at the command prompt.
   Command: **ucs**
   Enter an option [New/Move/orthoGraphic/Prev/Restore/ Save/Del/Apply/?/World] <World>:

New	Defines a new coordinate system by one of six methods: Origin, Z Axis, 3 Point, Object, Face, View X, Y, Z
Origin	Defines a new UCS by shifting the origin of the current UCS, leaving the direction of the X,Y, and Z axes unchanged.
ZAxis	Allows you to define a new origin.
3 Point	Specifies a UCS by its origin and a point on the positive X and Y axes.
Object	Lets you define a new UCS by pointing at an object.
Face	Aligns the UCS to the selected face of a solid object.
View	Establishes a new UCS whose XY plane is perpendicular to your viewing direction (e.g. parallel to your screen).
X/Y/Z	Rotates the ucs around a specified axis

UCS Toolbars



5.3 3 Point UCS

The 3 Point option is one of the easiest ways to define a new UCS on a given 3D object.

1. Open a drawing with a simple 3D object (e.g. 3D box)

2. Type UCS at the command prompt.

   Command: **ucs**

   Enter an option [New/Move/orthoGraphic/Prev/Restore/ Save/Del/Apply/?/World] <World>: **N**

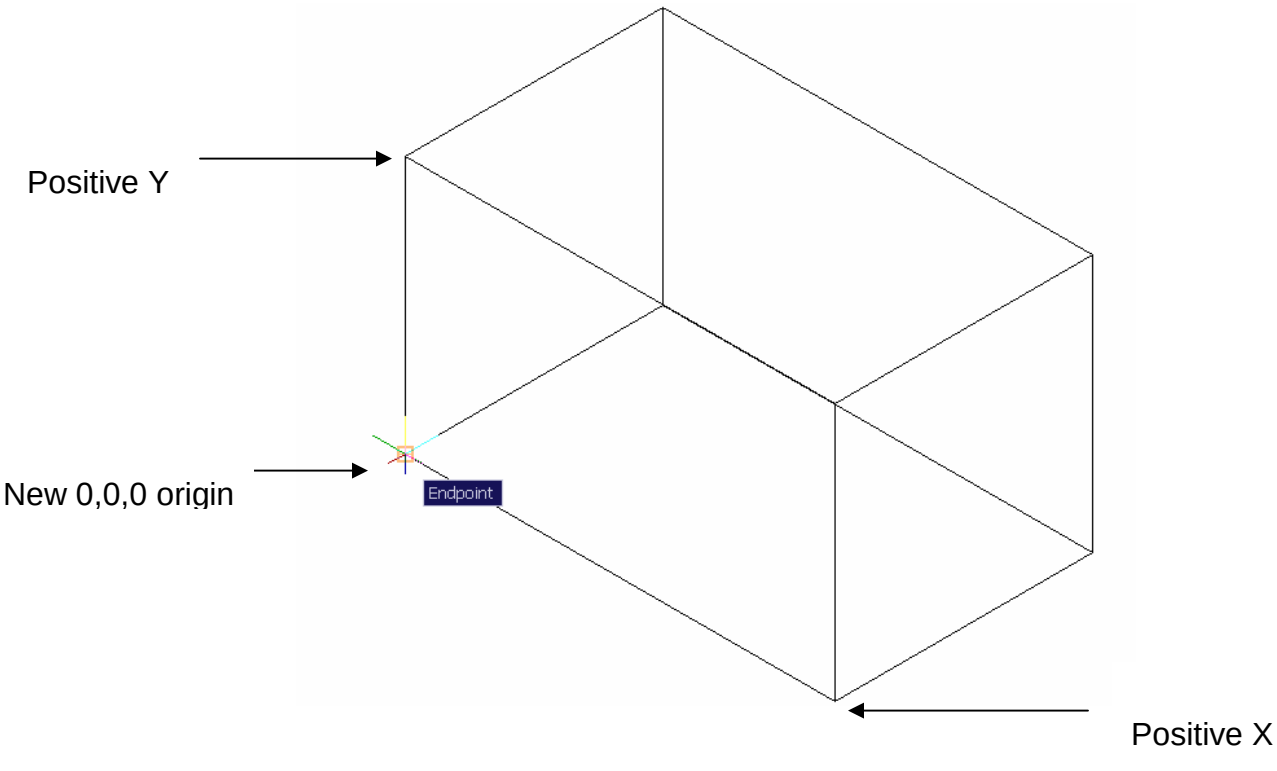
   Specify origin of new UCS or [ZAxis/3point/OBject/ Face/View/X/Y/Z] <0,0,0>: **3**

   Specify new origin point <0,0,0>: **pick origin**

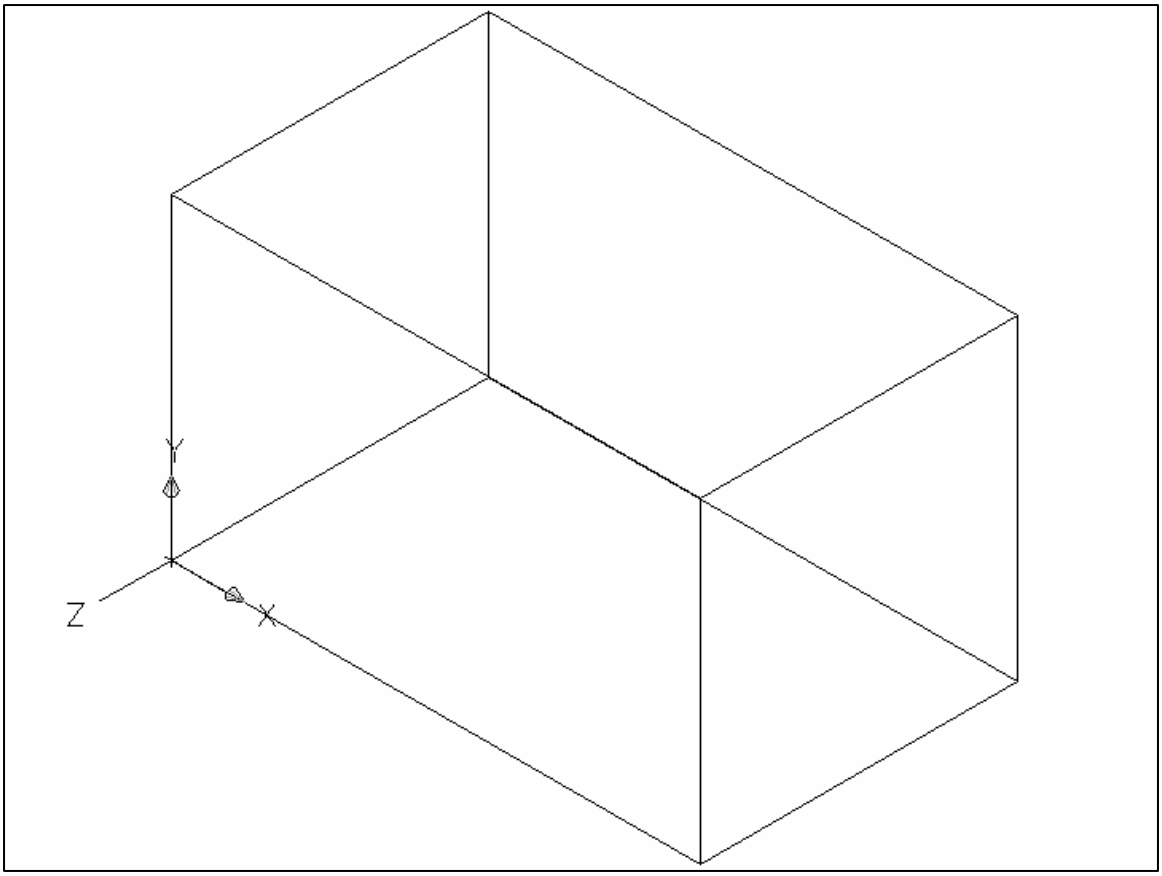
   Specify point on positive portion of X-axis <3.53,7.73,0.00**>: pick point for X direction**

   Specify point on positive-Y portion of the UCS XY plane

   <2.53,8.73,0.00>: **pick point for Y direction**



New UCS



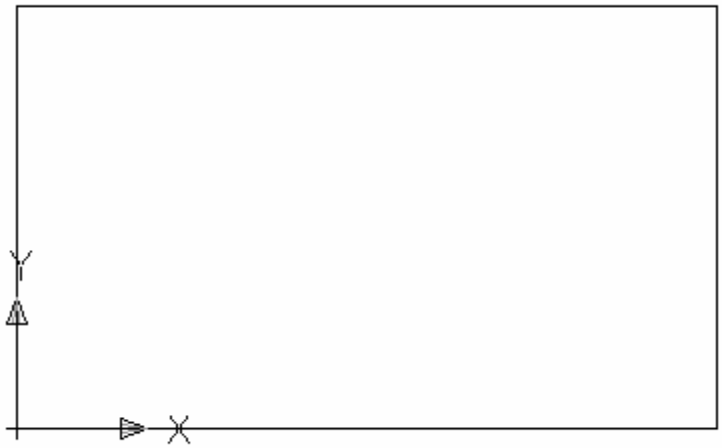
5.4 Plan UCS

To work in the plan view of your new UCS, use the PLAN command with the current UCS option. New entities that you draw will be in relation to this current UCS.

1. Type PLAN at the command prompt.

   Command: **plan**

   Enter an option [Current ucs/Ucs/World] <Current>: **press enter**



5.5 World UCS

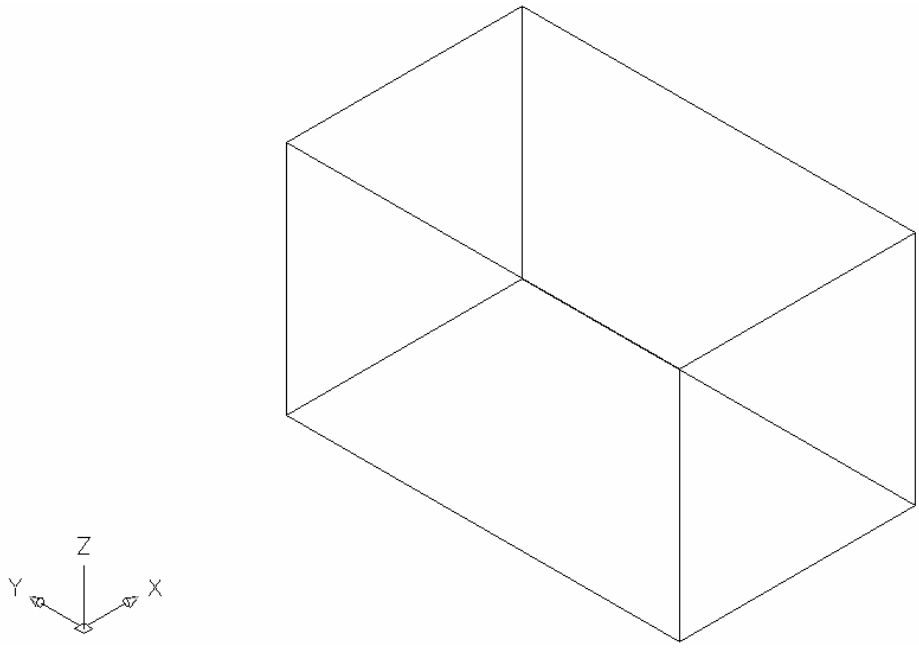
The World UCS is the only UCS guaranteed to be the same in all AutoCAD drawings and can be used to set the UCS back to its original state. This is the UCS you should use when creating Wblocks and inserting Wblocks.

1. Type UCS at the command prompt.

   Command: **ucs**

   Current ucs name: *NO NAME*

   Enter an option [New/Move/orthoGraphic/Prev/Restore/ Save/Del/Apply/?/World] <World> **W**



5.6 View UCS

Establishes a new coordinate system whose XY plane is perpendicular to your viewing direction (i.e. parallel to your screen)

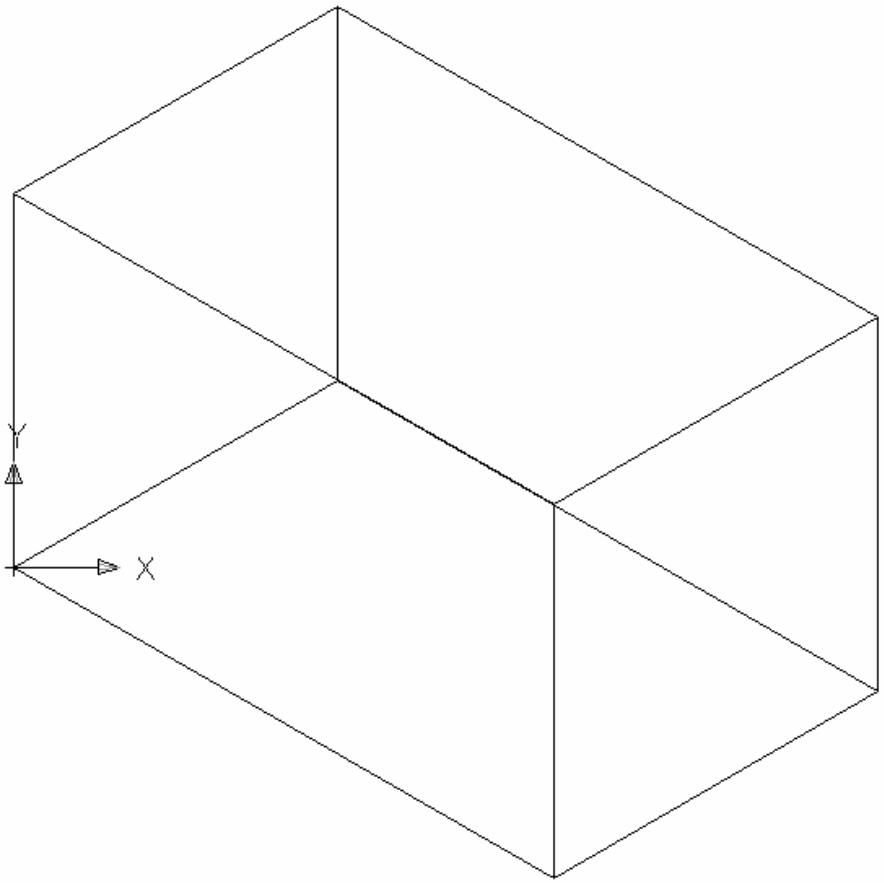
1. Type UCS at the command prompt.

   Command: **ucs**

   Current ucs name: *NO NAME*

   Enter an option [New/Move/orthoGraphic/Prev/Restore/ Save/Del/Apply/?/World] <World>: **N**

   Specify origin of new UCS or [ZAxis/3point/OBject/ Face/View/X/Y/Z] <0,0,0>: vOrigin/ZAxis/3point/ OBject/View/X/Y/Z/Prev/Restore/Save/Del/?/<World>:**V**



5.7 Dynamic UCS

You can use the dynamic UCS to create objects on a planar face of a 3D solid without manually changing the UCS orientation.

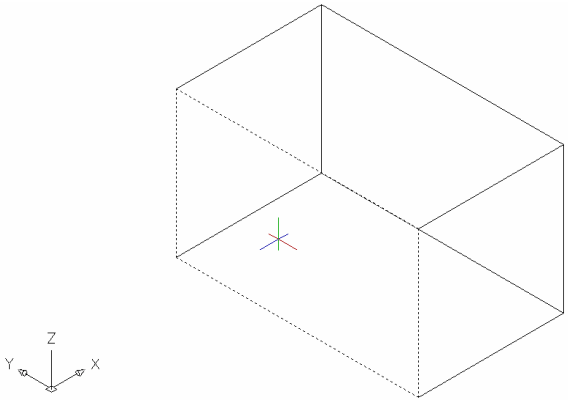
During a command, the dynamic UCS temporarily aligns the XY plane of the UCS with a planar face of a 3D solid when you move the cursor over the face.

When the dynamic UCS is active, specified points, and drawing tools, such as polar tracking and the grid, are all relative to the temporary UCS established by the dynamic UCS. 1.

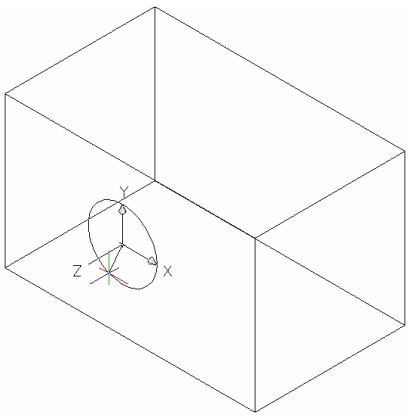
1. Click the DUCS icon

on the status bar or press **CTRL +D**.
2. Type any draw command.

   Command: circle
3. Move the cursor to the face of the 3D object that you would like to draw on.



4. Click to begin drawing your new object.



5.8 Naming and Saving a UCS

User coordinate systems can sometimes be complicated and it is often useful to name and save them so you can quickly recall them.

1. Type UCS at the command prompt.

   Command: UCS

   Specify origin of UCS or
   [Face/NAmed/OBject/Previous/View/World/X/Y/Z/ZAxis]

   <World>: **NA**

   Enter an option [Restore/Save/Delete/?]: **S**

   Enter name to save current UCS or [?]: **LeftSide**

5.9 Restoring a UCS

A named and saved UCS can be restored at any time.

1. Type UCS at the command prompt.

   Command: **UCS**

   Specify origin of UCS or
   [Face/NAmed/OBject/Previous/View/World/X/Y/Z/ZAxis]

   <World>: **NA**

   Enter an option [Restore/Save/Delete/?]: **R**

   Enter name to save current UCS or [?]: **LeftSide**

5.10 UCS Dialog Box

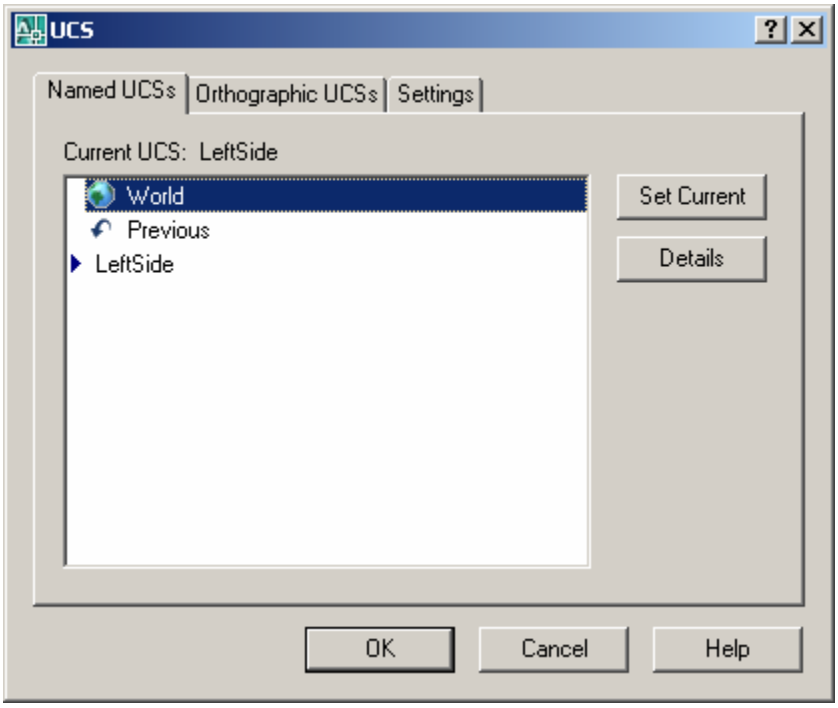
Displays and modifies defined and unnamed user coordinate systems, restores named and orthographic UCSs, and specifies UCS icon and UCS settings for viewports via a dialog box.

1. Chose Tools, Named UCS.

   or

2. Type UCSMAN at the command prompt.

   Command: **ucsman**



AutoCAD 3D – Chapter 6
3D Orbit

6.1 Constrained 3D Orbit

3DORBIT activates a 3D Orbit view in the current viewport. You can view your entire drawing or select one or more objects before starting the command.

When 3DORBIT is active, the target of the view stays stationary and the camera location, or point of view, moves around the target. However, from the user's point of view, it appears as if the 3D model is turning as the mouse cursor is dragged. In this way, you can specify any view of the model.

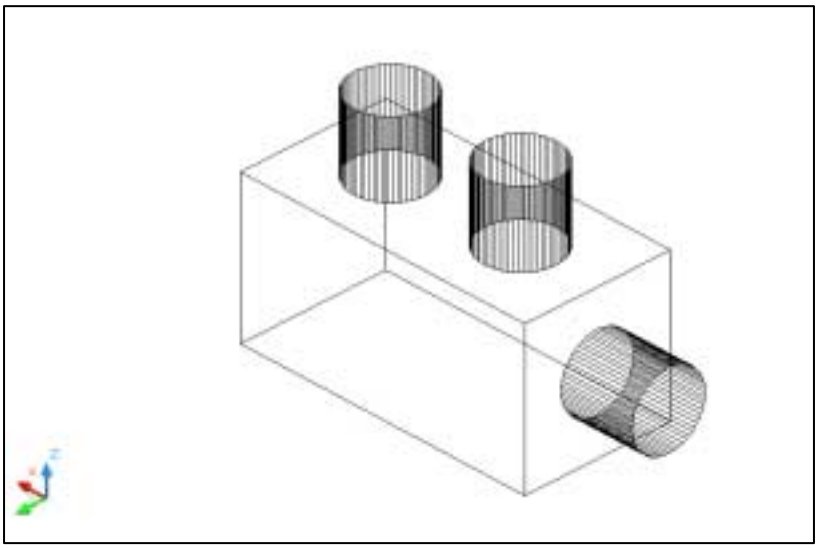
1. Open a drawing with 3D objects.
2. Choose **View, Orbit, Constrained Orbit**.

   or

3. Type 3D Orbit at the command prompt.

   Command: **3DOrbit**

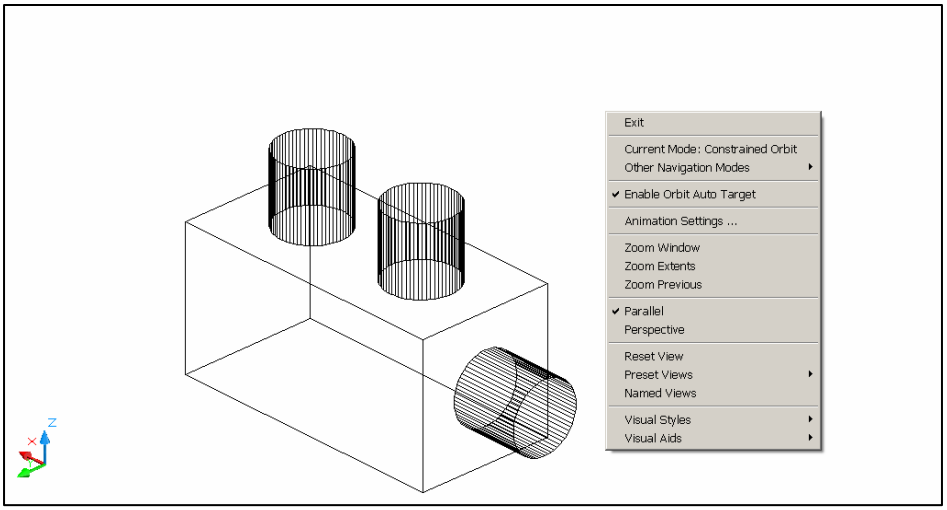
4. Click and drag to move your object in 3D.



6.2 Zoom and Pan in 3D Orbit

Zoom

1. Click with the **right mouse** button while in the 3D Orbit command.
2. Choose **Zoom Window** from the pop-up menu.



3. Zoom to a new area of the 3D drawing.
4. Click with the **right mouse** button while in the 3D Orbit command.
5. Choose **Zoom Previous** or **Zoom Extents** from the pop-up menu.

Pan

1. Click with the **right mouse** button while in the 3D Orbit command.
2. Choose **Other Navigation Modes** from the pop-up menu.
3. Choose **Pan**.
4. Pan to a new area of the drawing.
5. Click with the **right mouse** button while in the 3D Orbit command.
6. Choose **Other Navigation Modes** from the pop-up menu.
7. Choose Constrained Orbit to set the mode back to orbit.

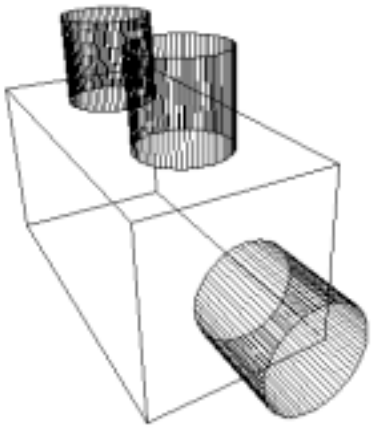
6.3 Projection Mode

1. Click with the **right mouse** button while in the 3D Orbit command.
2. Choose **Perspective**.

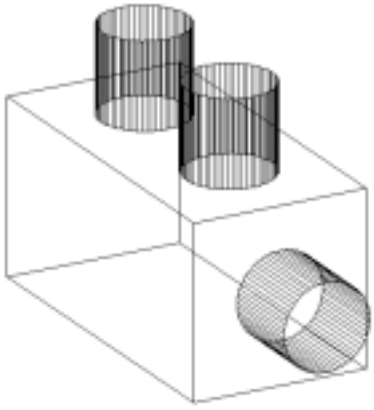
Perspective view displays objects in perspective so that all parallel lines converge at one point. Objects appear to recede into the distance, and parts of the objects appear larger and closer to you. The shapes are some what distorted when the object is very close. This view correlates more closely to what your eye sees.

Parallel view displays objects so that two parallel lines in a drawing never con verge at a single point. The shapes in your drawing always remain the same and do not appear distorted when they are closer.

Perspective View



Parallel View

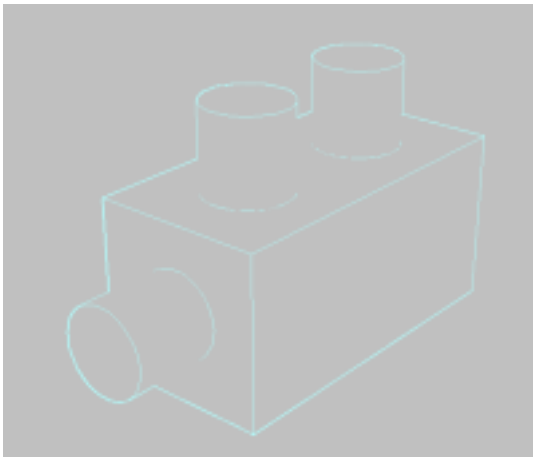


6.4 Visual Styles

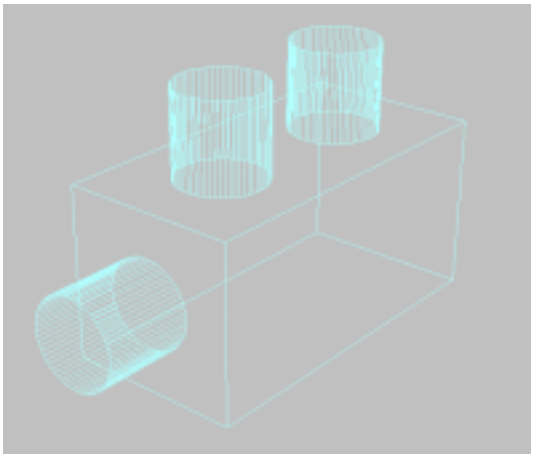
Displays your objects in one of the following selected styles:

1. Click with the **right mouse** button while in the 3D Orbit command.
2. Choose **Visual Styles** from the pop-up menu.
3. Choose **3D Hidden, 3D Wireframe, Conceptual** or **Realistic**.

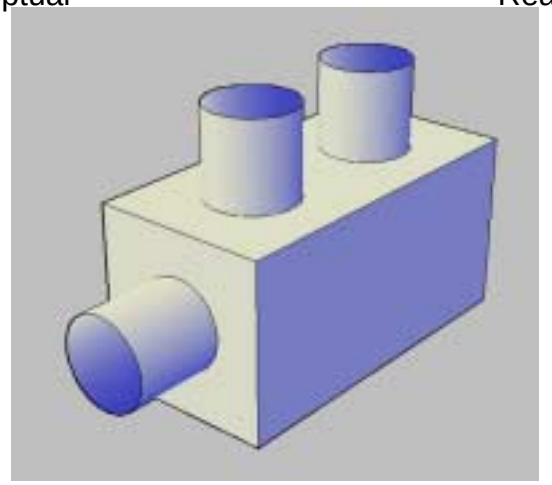
3D Hidden



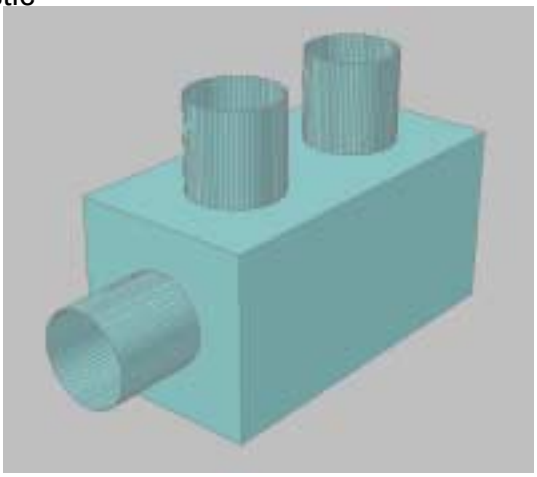
3D Wireframe



Conceptual



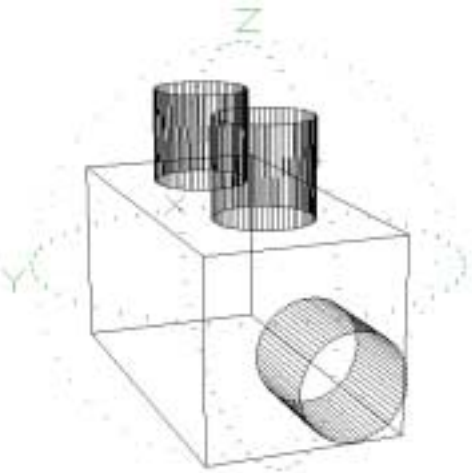
Realistic



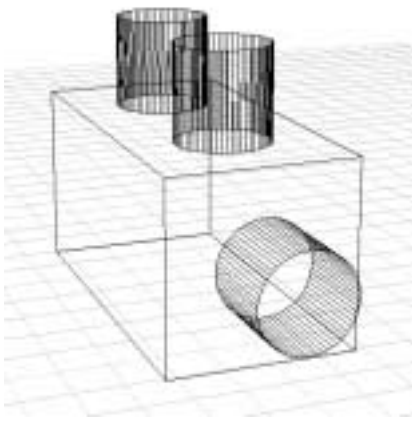
6.5 Visual Aids

1. Click with the **right mouse** button while in the 3D Orbit command.
2. Choose **Visual Aids** from the pop-up menu.
3. Choose **Compass, Grid,** or **UCS Icon**.

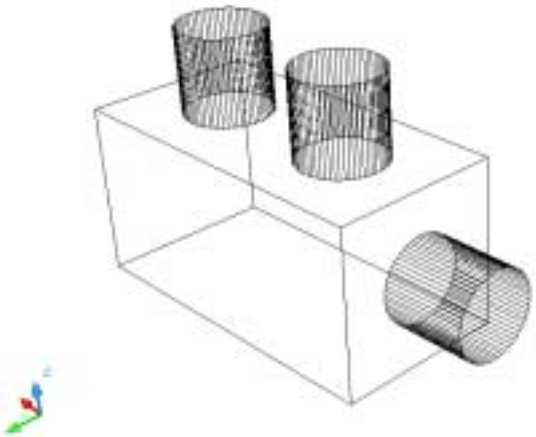
Compass



Grid



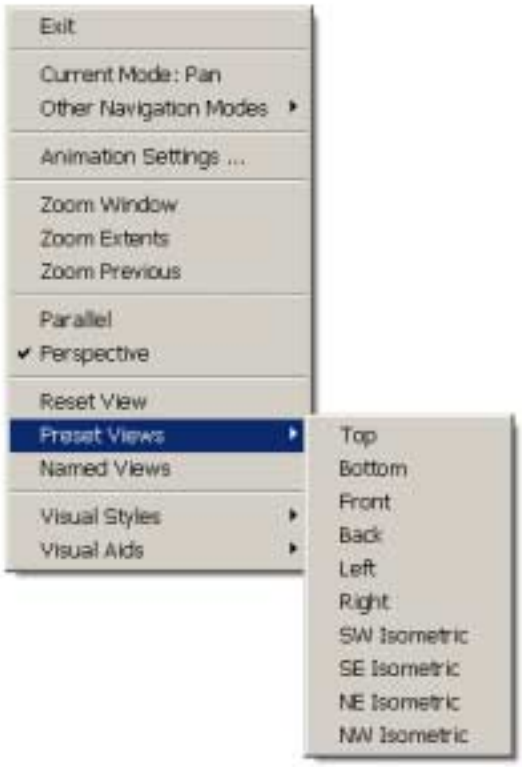
UCS Icon



6.6 Preset Views

Sets the 3D view while in the orbit command

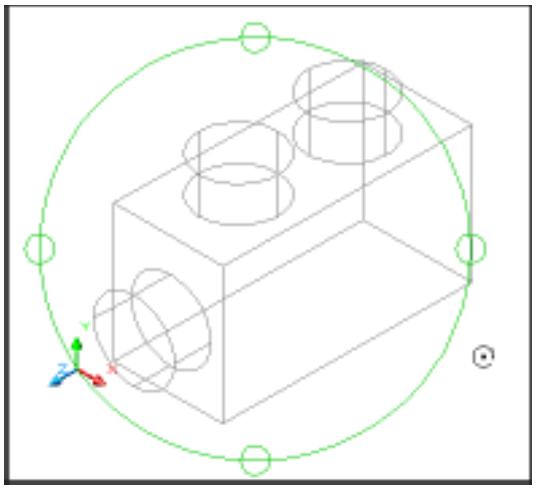
1. Click with the **right mouse** button while in the 3D Orbit command.
2. Choose **Preset Views** from the pop-up menu.
3. Choose one of the following standard 3D views.



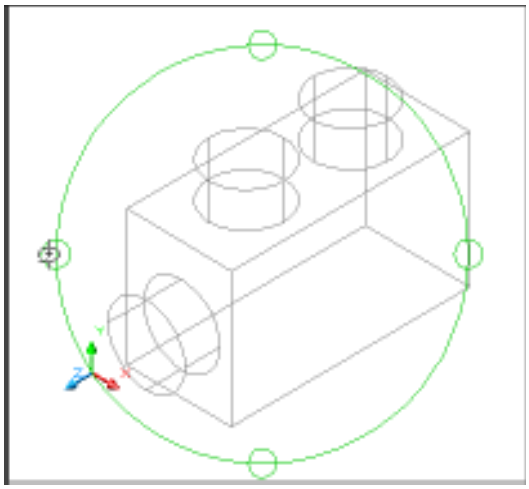
6.7 Free Orbit

1. Choose **View, Orbit, Free Orbit**.
   The 3D Orbit Arcball appears.
2. Click on one of the 3D Orbit arcball locations to move the display of your object(s).

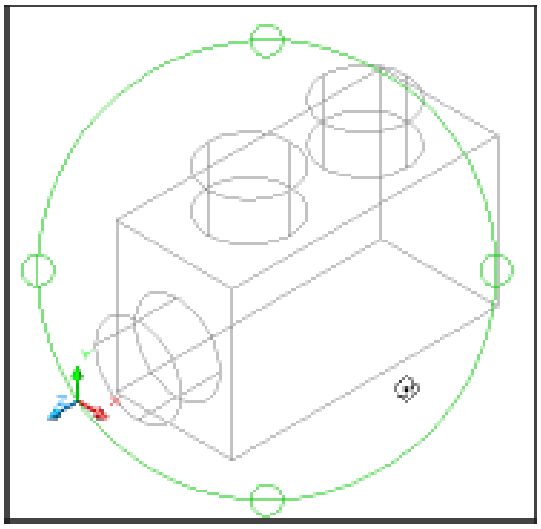
Outside the Arcball - Moves View about an axis that extends through the center (acts like twist)



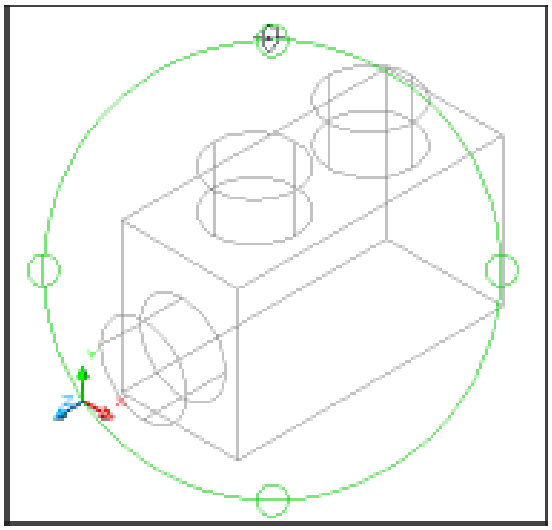
Inside one of the small circles to the left/right - Rotates around the "Y" axis through the center.



Inside the Arcball - Allows movement in any direction



Inside one of the small circles to the top/bottom - Rotates around the "X" axis through the center.



6.8 Continuous Orbit

1. Choose **View, Orbit, Continuous Orbit**.
2. Click and drag to define the direction and speed of a continuous orbit for your object(s).
3. Press **ESC** on the keyboard to stop the orbit.

6.9 Other Navigational Modes

1. Click with the **right mouse** button while in the 3D Orbit command.
2. Choose **Other Navigational Modes** from the pop-up menu.
3. Choose one of the following modes.

Adjust Distance (4)	Simulates moving the camera closer to the object or farther away.
Swivel (5)	Changes the cursor to an arched arrow and simulates the effect of swiveling the camera. See 3DSWIVEL.
Walk (6)	Changes the cursor to a plus sign and enables you to "walk through" a model at a fixed height above the XY plane, by dynamically controlling the location and target of the camera. See 3DWALK.
Fly (7)	Changes the cursor to a plus sign and enables you to "fly through" a model without being restricted to a fixed height above the XY plane. See 3DFLY.
Zoom (8)	Changes the cursor to a magnifying glass with plus (+) and minus (-) sign and simulates moving the camera closer to an object or farther away. Works like the Adjust Distance option. See 3DZOOM.

AutoCAD 3D – Chapter 7
3D Navigation

7.1 Creating a Camera

Sets a camera and target location to create and save a 3D perspective view of objects.

1. Open a drawing with 3D objects.
2. Choose View, Create Camera.

   or

3. Type CAMERA at the command prompt.

   Command: **camera**

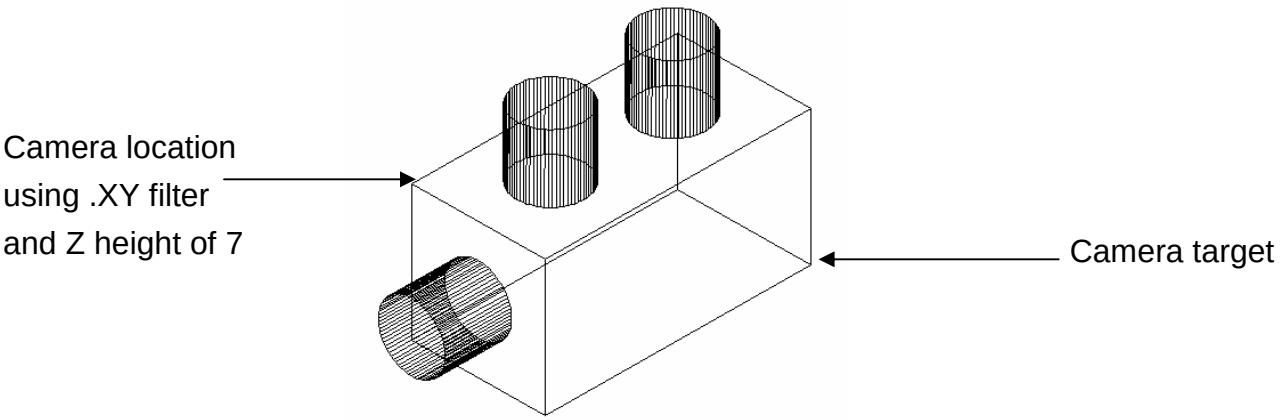
   Current camera settings: Height=5.0000 Lens Length=50.0000 mm

   Specify camera location: **.xy**

   of (need Z): **7**

   Specify target location: **endp**

   Enter an option [?/Name/LOcation/Height/Target/LEns/Clipping/View/eXit]<eXit>: **X**

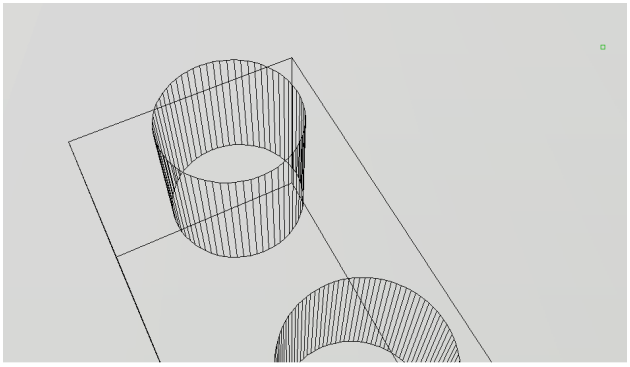


7.2 Viewing a Camera

Once a camera is created, it becomes a named view in the drawing and can be viewed using the Named View Manager. You can also view the camera using the view option when creating the camera.

1. Choose **View, 3D Views, Southwest Isometric** to be sure you are not in an existing camera view.
2. Choose View, Named Views.
3. Click the plus (+) sign beside Model Views.
4. Click Camera1, Set Current, Apply, and OK.

View from Camera

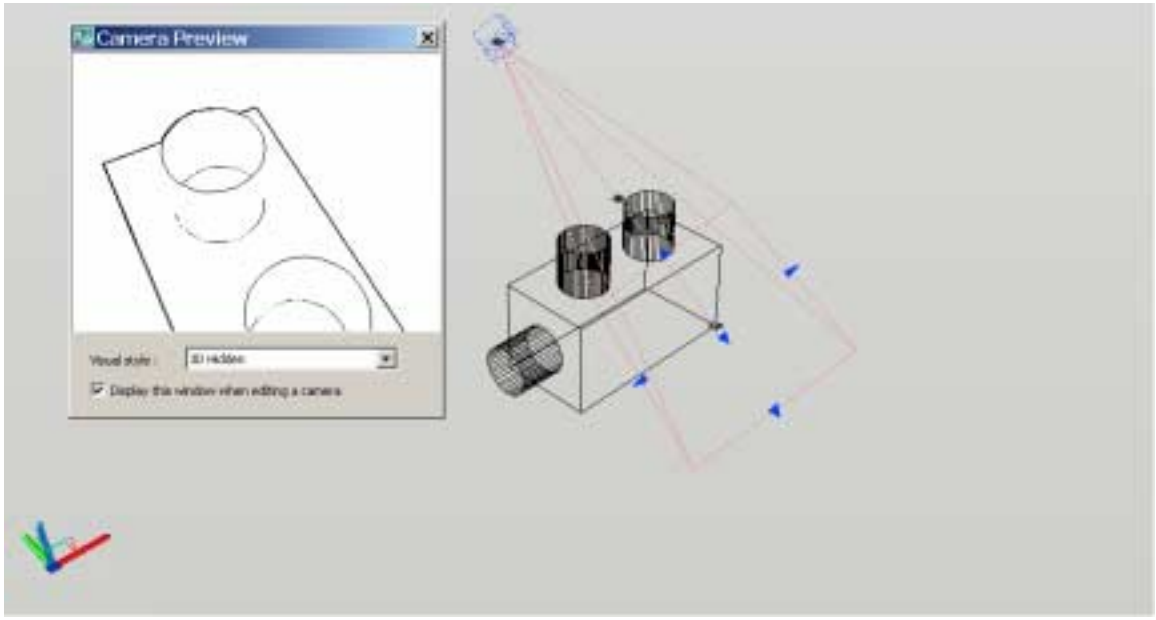


7.3 Camera Preview

Camera preview is a quick and easy way to see the properties of a camera before viewing from the camera.

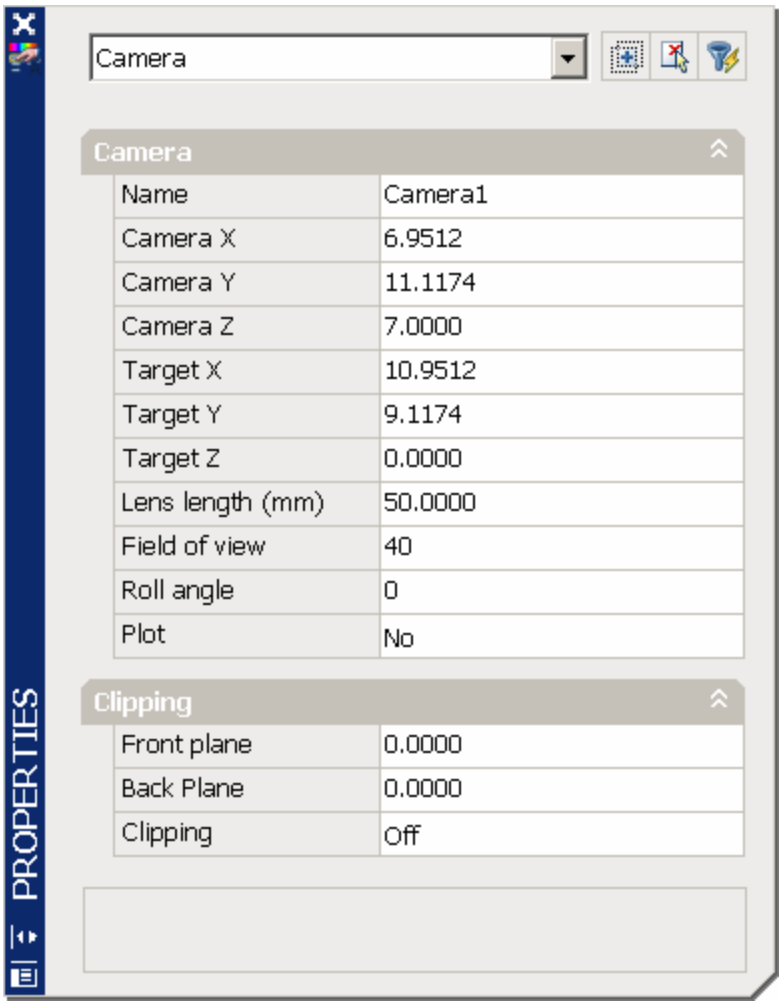
1. Choose **View, 3D Views, Southwest Isometric** to be sure you are not in an existing camera view.
2. Zoom out until you see the camera in your 3D view.
3. Click once on a camera in your view.

The Camera Preview dialog box will show the view from the chosen camera. You can change the Visual style of this preview to 3DHidden, 3DWireframe, Conceptual, or Realistic.



7.4 Camera Properties

1. In a 3D isometric view, double click a camera.



7.5 Displaying and Plotting a Camera

Displaying a Camera

1. Choose **View, Display, Cameras**.

Plotting a Camera

1. If cameras are not already displayed in the drawing, click View, Display, Cameras.
2. Double-click a camera.
3. In the Properties palette, Camera section, Plot option, click Yes or No.

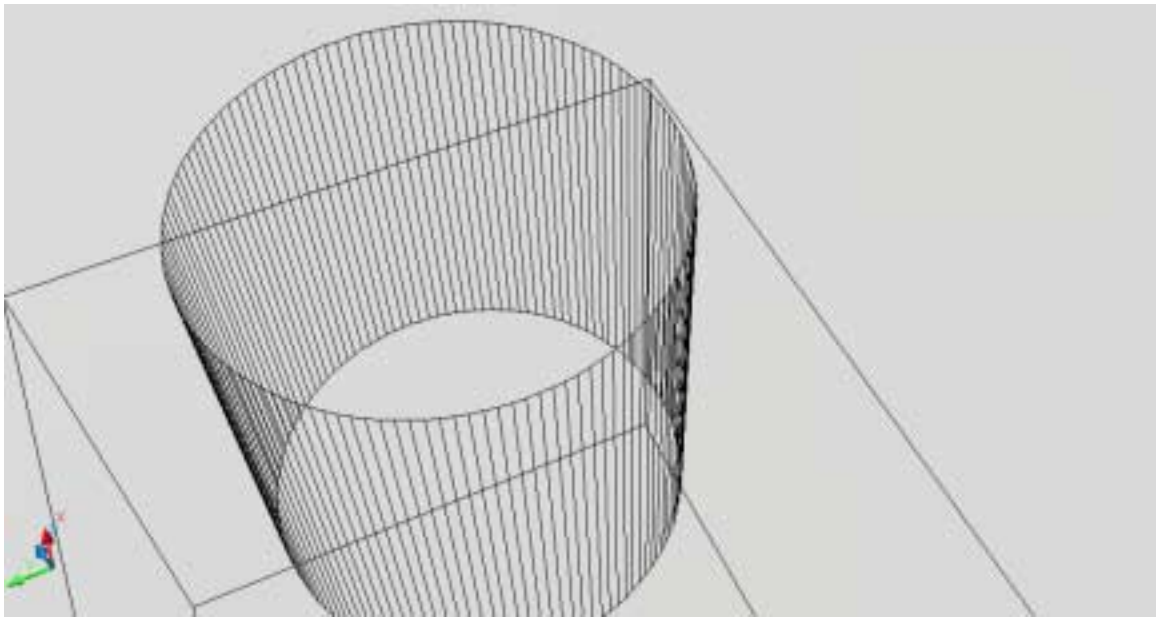
7.6 Adjusting Camera Distances and Swiveling a Camera

Adjust Camera Distance

1. Choose View, Named Views.
2. Click the plus (+) sign beside Model Views.
3. Click Camera1, Set Current, Apply, and OK.
4. Choose View,Camera, Adjust Distance.
5. Click and drag to zoom in or out about the camera,

Swivel a Camera

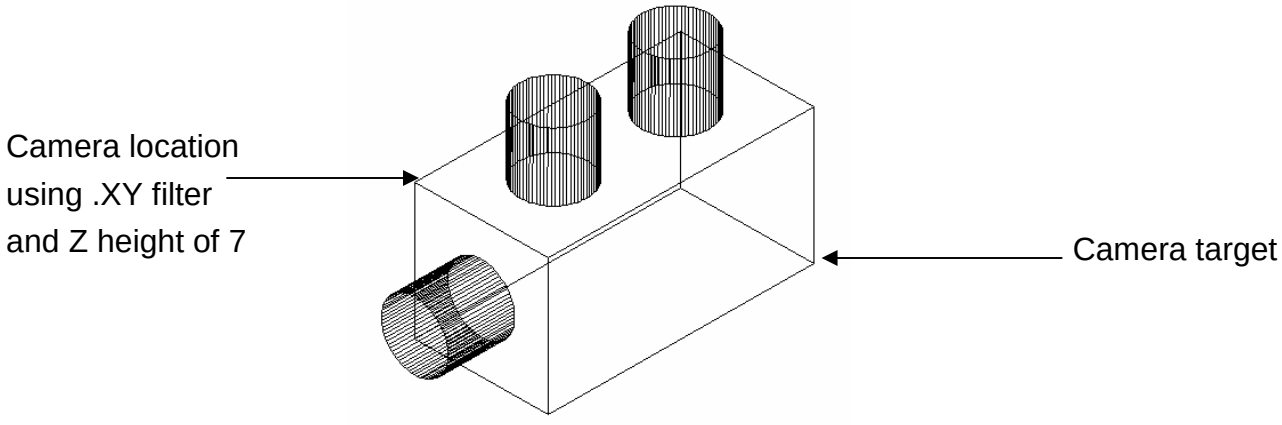
1. Choose View, Camera, Swivel.
2. Click and drag to swivel the camera,



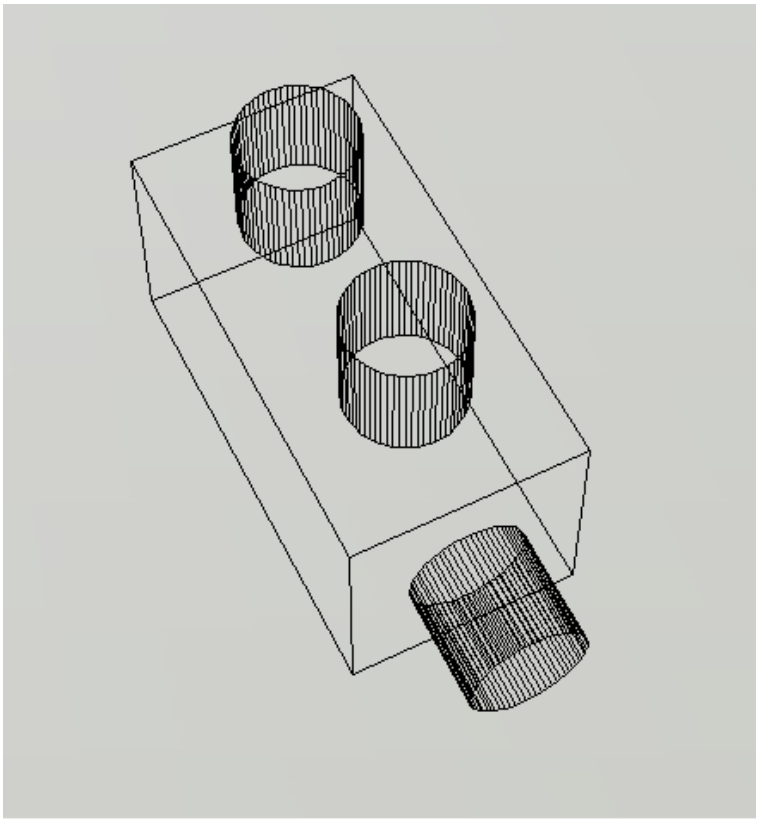
7.7 DView Command

Defines parallel projection or perspective views by using a camera and target.

1. Type DVIEW at the command prompt.
   Command: **dview**
   Select objects or <use DVIEWBLOCK>: **pick objects**
   Enter option
   [CAmera/TArget/Distance/POints/PAn/Zoom/TWist/CLip/Hide/Off/U
   ndo]: **PO**
   Specify target point <3.2567, 4.0405, 7.2994>: **pick target**
   Specify camera point <-4.0520, -3.2436, 14.3538>: **.XY**
   of (need Z): **7**
   Enter option
   [CAmera/TArget/Distance/POints/PAn/Zoom/TWist/CLip/Hide/Off/U
   ndo]: **D**
   Specify new camera-target distance <8.3066>: **click and drag new zoom**
   Enter option
   [CAmera/TArget/Distance/POints/PAn/Zoom/TWist/CLip/Hide/Off/U
   ndo]:
   Regenerating model.



New DView



7.8 Walk and Fly

You can simulate walking and flying through a 3D drawing.

When you walk through a model, you travel along the XY plane. When you fly through a model, you are not constrained by the XY plane, so you appear to “fly” over an area in a model.

The following mappings are available for walking:

Up arrow / W key	Move forward
Down arrow / S key	Move backward
Left arrow / A key	Move left
Right arrow / D key	Move right
Drag mouse	Look around & turn
F key Toggle	Fly mode

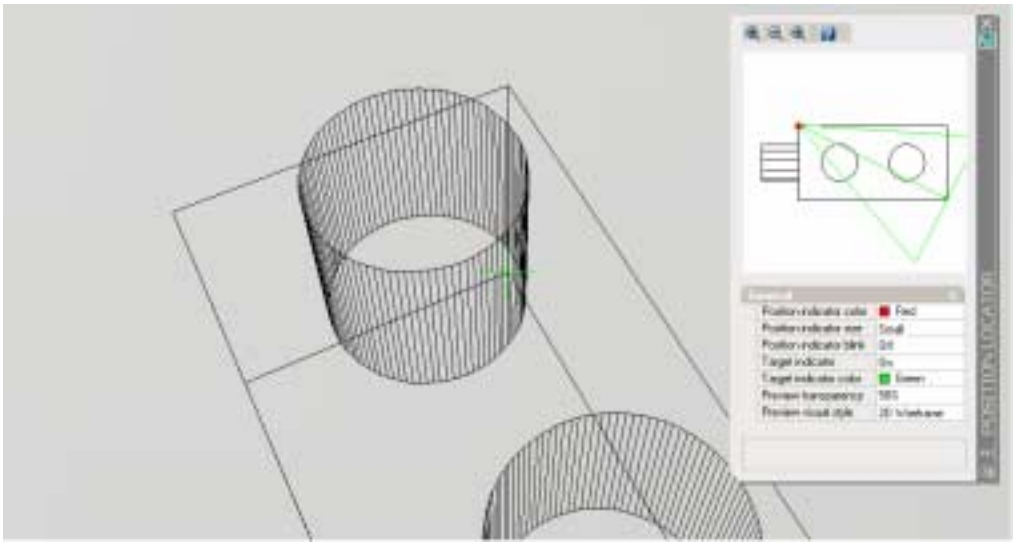
1. Open a drawing with 3D objects and display in a 3D view.
2. Create a camera anywhere in the drawing and set the view to that camera.
3. Choose **View, Walk and Fly, and Walk**.

   or

4. Type 3DWalk or 3DFky at the command prompt.

   Command: **3Dwalk**
5. The following walk and fly navigation mapping settings appear. Briefly look at the navigation keys, then choose close.

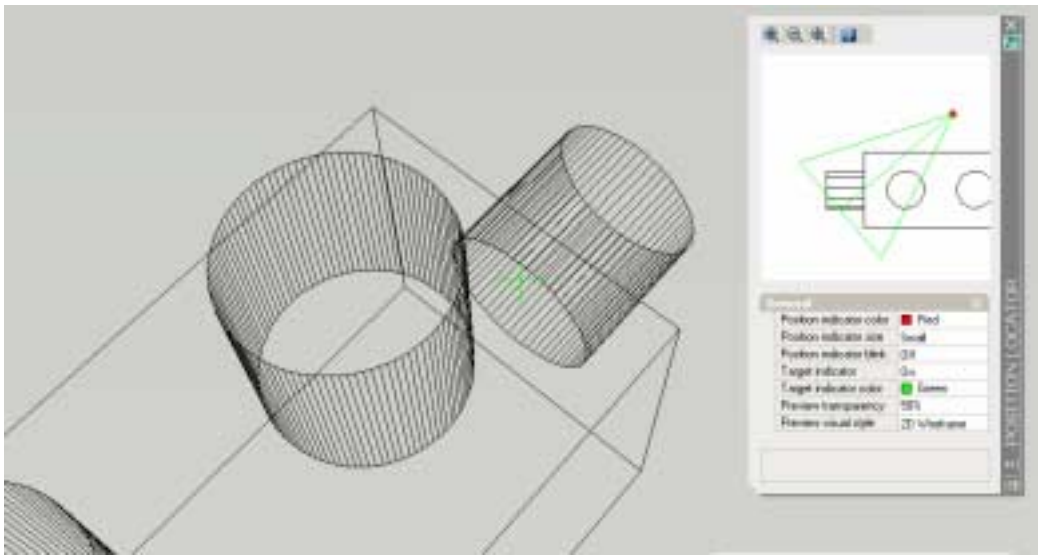
The following Position Locator dialog box will appear that you can use to navigate your drawing.



Press the Up, Down, Left, and Right keys on the keyboard to see how the camera location moves in the drawing and Position Locator dialog box.

Move the camera and target in the Position Locator dialog box.

Click and drag your mouse to “fly” through the drawing.



Close the Position Locator dialog box and try walking and flying using only the keys on the keyboard and mouse.

7.9 Walk and Fly Settings

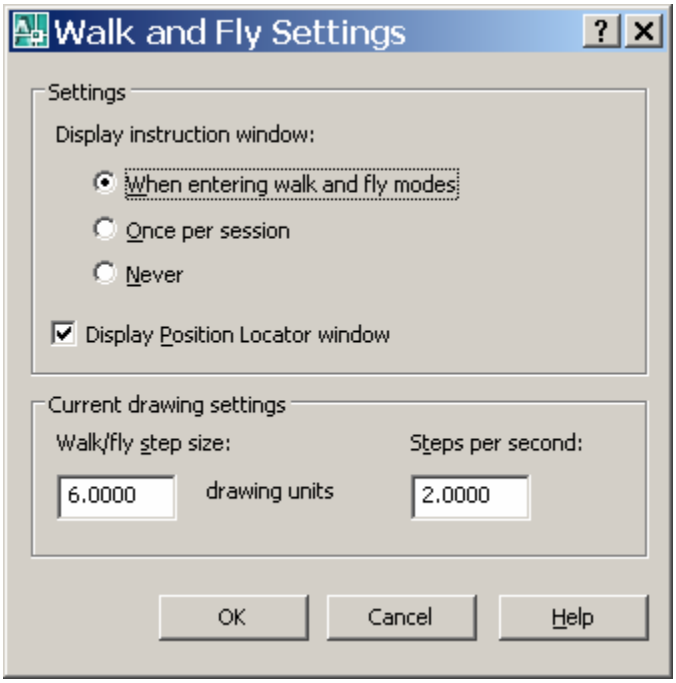
1. Choose **View, Walk and Hide, Walk and Hide Settings**.

   or

2. Type WALKFLYSETTINGS at the command prompt.

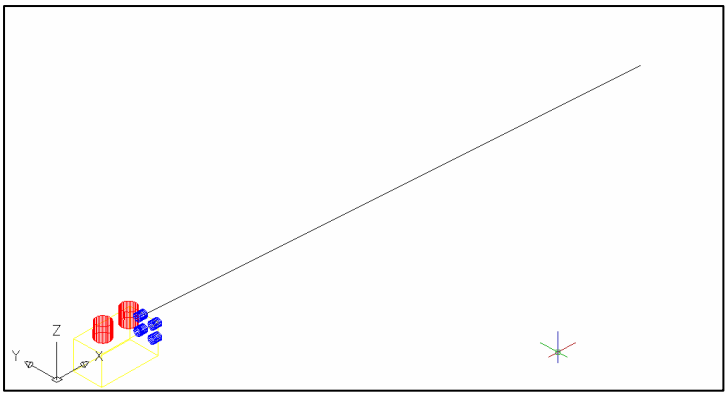
   Command: **walkflysettings**

3. Choose one of the following settings from the Walk and Fly dialog box. If you are working in a drawing with a large architectural scale, be sure to set your drawing units to a large number, similar to the scale of the drawing.



7.10 Animation Paths

1. Open a drawing with 3D objects and display in a 3D view and line or polyline representing a path for an animation



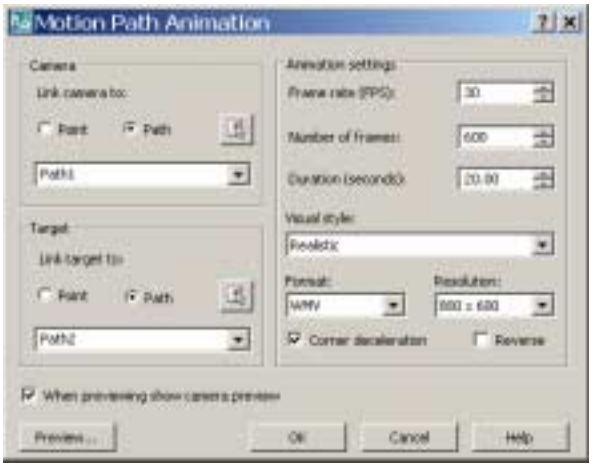
2. Choose View, Motion Path Animations.

   or

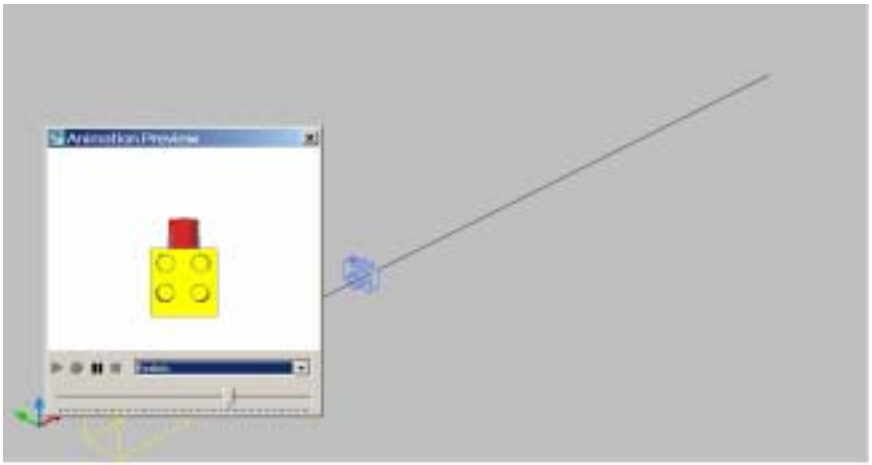
3. Type ANIPATH at the command prompt.

   Command: **anipath**

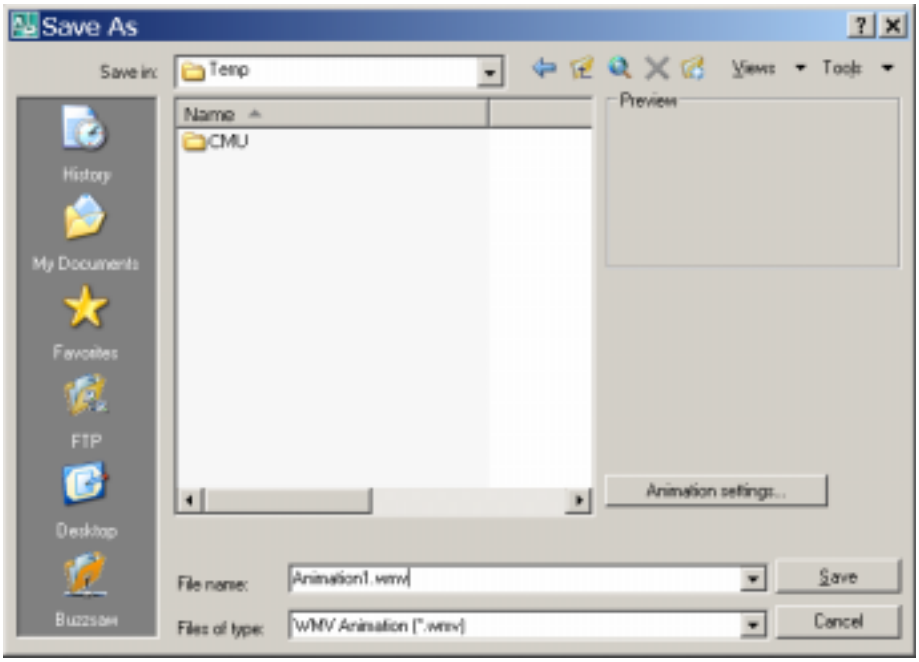
4. Click **Select Path** under the Link camera to: option and click on the line or polyline path.
5. Click OK to the default path name.
6. Click **Select Path** under the Link target to: option and click on the line or polyline path.
7. Click OK to the default path name.
8. Change other animation settings such as the frames per second, duration, resolution, etc.



9. Choose the Preview…button to preview your animation.



10. Close the animation preview and click OK to create an animation file.



11. Play your animation in a Windows or MacIntosh video review application.

7.11 3D Navigation Using the Dashboard

Regenerates a three-dimensional model with hidden lines

1. Choose **Tools, Palettes, Dashboard**.

   or

2. Type DASHBOARD at the command prompt.

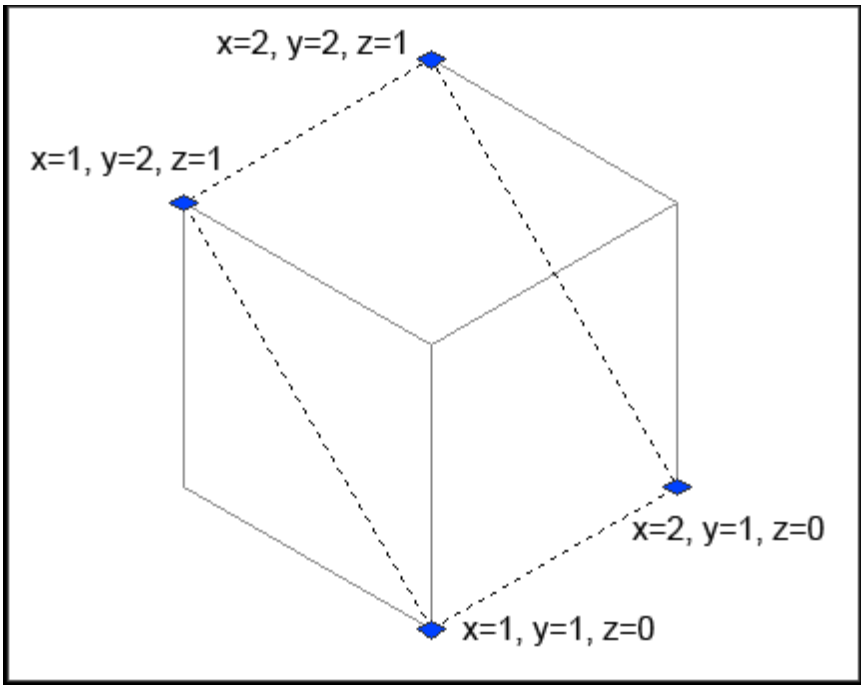
   Command: **dashboard**

AutoCAD 3D – Chapter 8
3D Model Objects

8.1 Wireframes

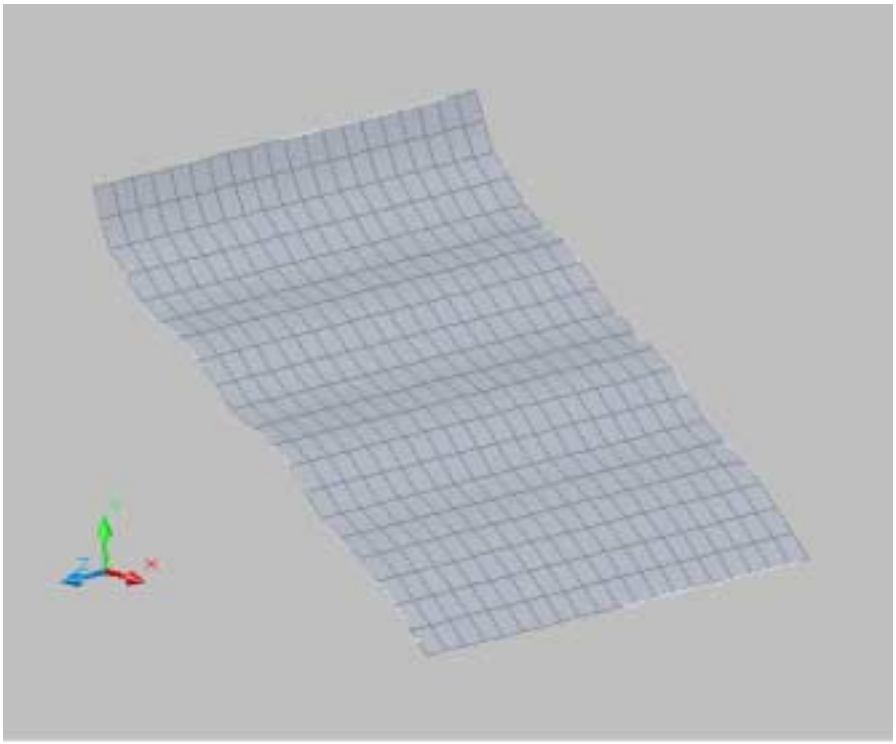
A wireframe model is a skeletal description of a 3D object. There are no surfaces in a wireframe model; it consists only of points, lines, and curves that describe the edges of the object. With AutoCAD you can create wireframe models by positioning 2D objects anywhere in 3D space. AutoCAD also provides some 3D wireframe objects, such as 3D polylines (that can only have a CONTINUOUS linetype) and splines. Because each object that makes up a wireframe model must be independently drawn and positioned, this type of modeling can be the most time-consuming.

Wireframe lines in 3D



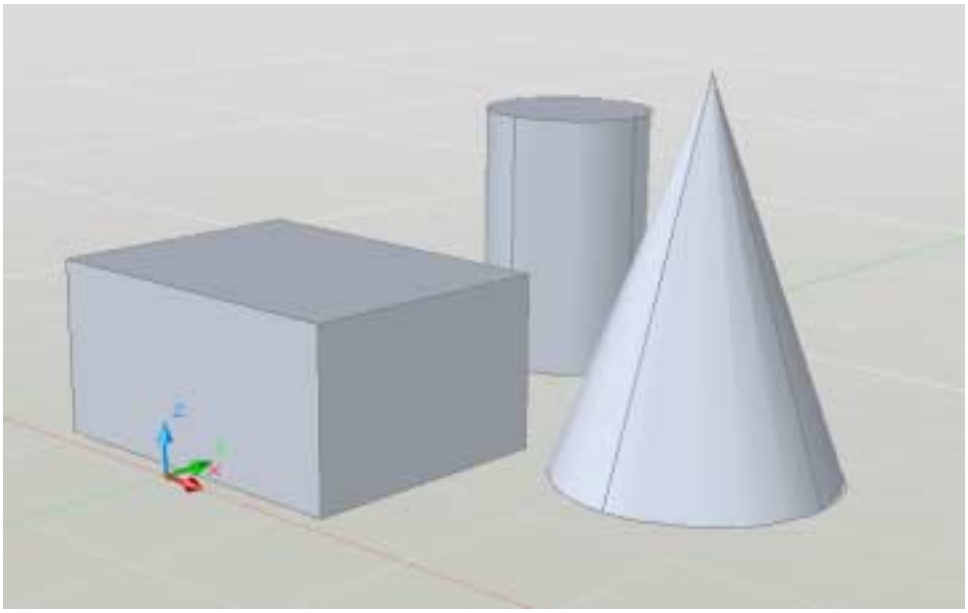
8.2 Surfaces

Surface modeling is more sophisticated than wireframe modeling in that it defines not only the edges of a 3D object, but also its surfaces. The AutoCAD surface modeler defines faceted surfaces using a polygonal mesh. Because the faces of the mesh are planar, the mesh can only approximate curved surfaces.



8.3 Solids

Solid modeling is the easiest type of 3D modeling to use. With the AutoCAD solid modeler, you can make 3D objects by creating basic 3D shapes: boxes, cones, cylinders, spheres, wedges, and tori (do- nuts). You can then combine these shapes to create more complex solids by joining or subtracting them or finding their intersecting (over- lapping) volume. You can also create solids by sweeping a 2D object along a path or revolving it about an axis.



AutoCAD 3D – Chapter 9
2D Solids and 3D Faces

9.1 2D Solid

Creates solid-filled triangles and quadrilaterals.

1. Type SOLID at the command prompt.

   Command: **solid**

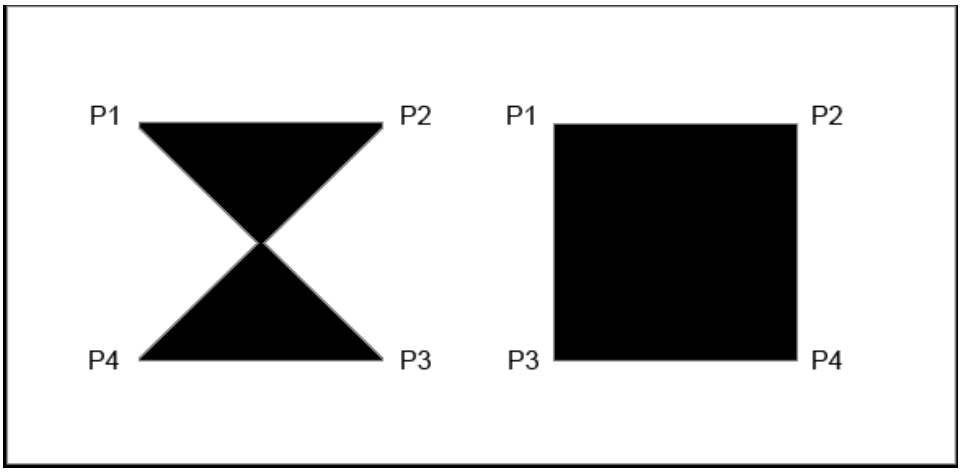
   First point: **P1**

   Second point: **P2**

   Third point: **P3**

   Fourth point: **P4**

   Third point: **enter**



9.2 3D Faces

3DFACE creates a three or four sided surface anywhere in 3D space. You can specify different Z coordinates for each corner point of a 3D face. 3DFACE differs from SOLID, which creates a three- or four-sided surface that is parallel to the current UCS and can be extruded.

1. Type 3DFACE at the command prompt.

   Command: **3dface**

   First point: **pick**

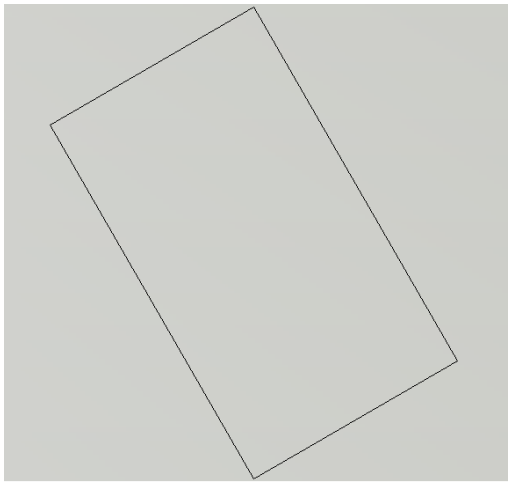
   Second point: **pick**

   Third point: **pick**

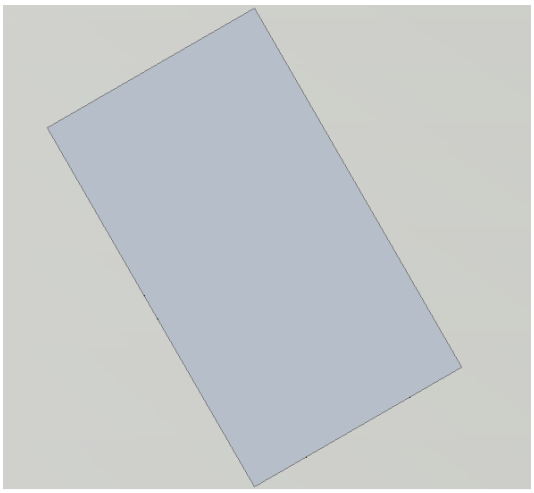
   Fourth point: **pick**

   Third point: **enter**

3D Wireframe Lines



3D Face



9.3 3D Face Invisible Edge

With 3DFACE, you control which edges of a 3D face are visible, allowing accurate modeling of objects with holes. Entering i or invisible before the first point of an edge makes the edge invisible.Type 3DFACE at the command prompt.

1. Type 3DFACE at the command prompt.

   Command: **3Dface**

   First point: **P1**

   Second point: **P2**

   Third point: **i P3**

   Fourth point: **P4**

   Third point: **i P5**

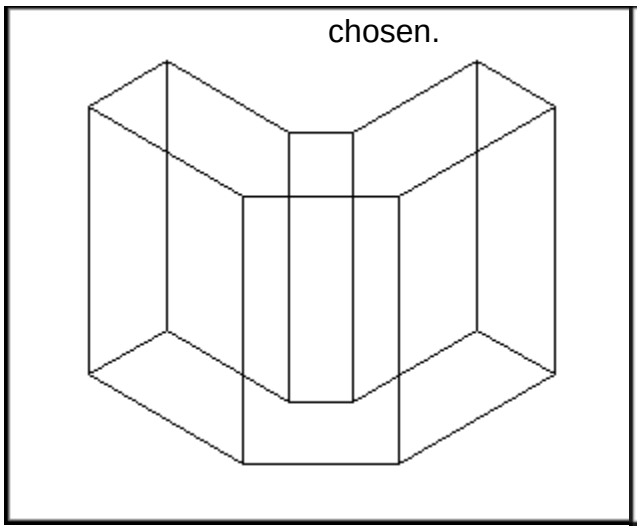
   Fourth point: **P6**

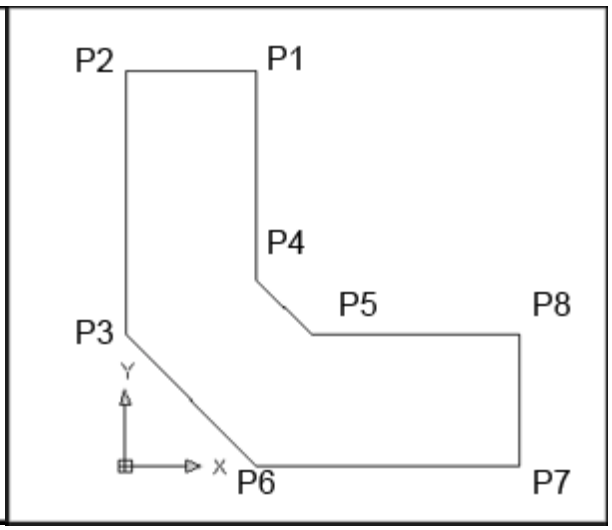
   Third point: **P7**

   Fourth point: **P8**

   Third point: **enter**

   NOTE: You must enter an “i” for invisible before the face is chosen.



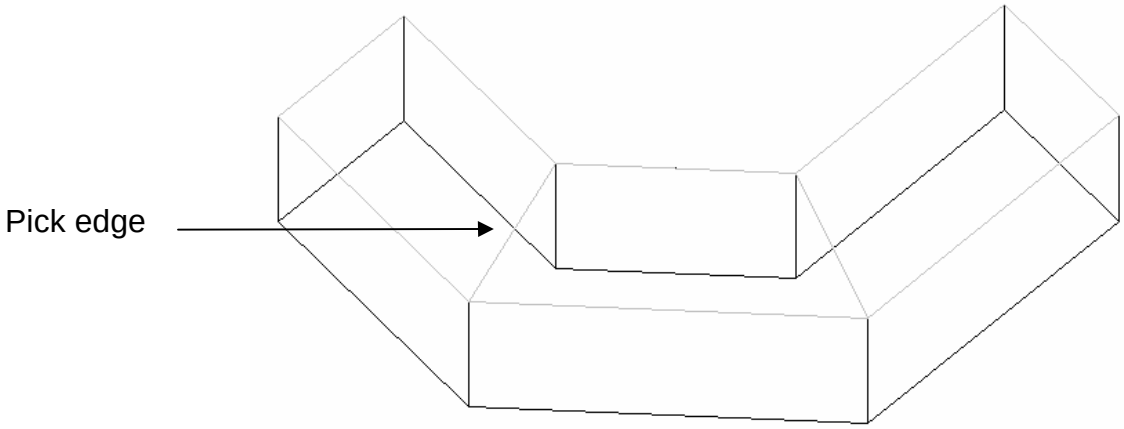


9.4 Edge Command

1. Type EDGE at the command prompt.

   Command: **edge**

   Specify edge of 3dface to toggle visibility or [Display]: **pick edge**

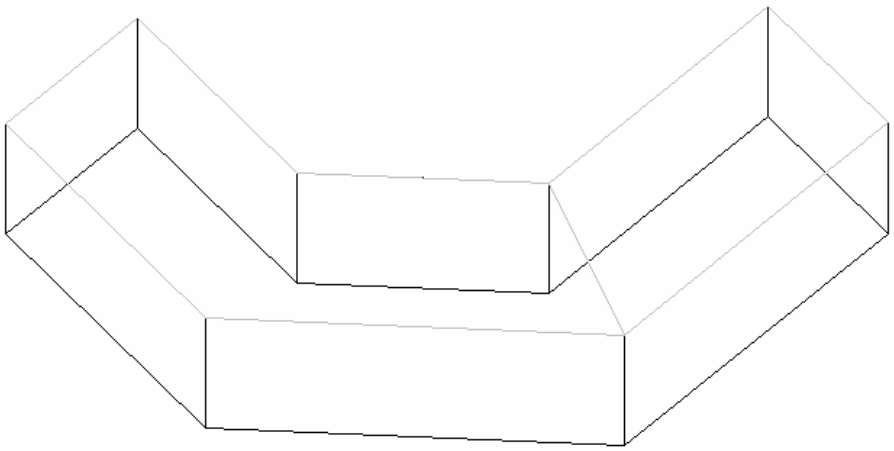


   Specify edge of 3dface to toggle visibility or [Display]: **d**

   Enter selection method for display of hidden edges [Select/All] <All>: **a**

   ** Regenerating 3DFACE objects...done.

   Specify edge of 3dface to toggle visibility or [Display]: **press enter**



9.5 PFace

Creates a three-dimensional polyface mesh vertex by vertex

1. Type PFACE at the command prompt.

   Command: pface

   Specify location for vertex 1: **pick point 1**

   Specify location for vertex 2 or <define faces>: **pick point 2**

   Specify location for vertex 3 or <define faces>: **pick point 3**

   Specify location for vertex 4 or <define faces>: **pick point 4**

   Specify location for vertex 5 or <define faces>: **pick point 5**

   Specify location for vertex 6 or <define faces>: **pick point 6**

   Specify location for vertex 7 or <define faces>: **pick point 7**

   Specify location for vertex 8 or <define faces>: **enter**

   Face 1, vertex 1:

   Enter a vertex number or [Color/Layer]: **type 1**

   Face 1, vertex 2:

   Enter a vertex number or [Color/Layer] <next face>: **type 2**

   Face 1, vertex 3:

   Enter a vertex number or [Color/Layer] <next face>: **type 6**

   Face 1, vertex 4:

   Enter a vertex number or [Color/Layer] <next face>: **type 7**

   Face 1, vertex 5: **enter**

   Enter a vertex number or [Color/Layer] <next face>:

   Face 2, vertex 1:

   Enter a vertex number or [Color/Layer]: **type 2**

   Face 2, vertex 2:

   Enter a vertex number or [Color/Layer] <next face>: **type 3**

   Face 2, vertex 3:

   Enter a vertex number or [Color/Layer] <next face>: **type 4**

   Face 2, vertex 4:

Enter a vertex number or [Color/Layer] <next face>: **type 6**

Face 2, vertex 5:

Enter a vertex number or [Color/Layer] <next face>:

Face 3, vertex 1:

Enter a vertex number or [Color/Layer]: **type 4**

Face 3, vertex 2:

Enter a vertex number or [Color/Layer] <next face>: **type 5**

Face 3, vertex 3:

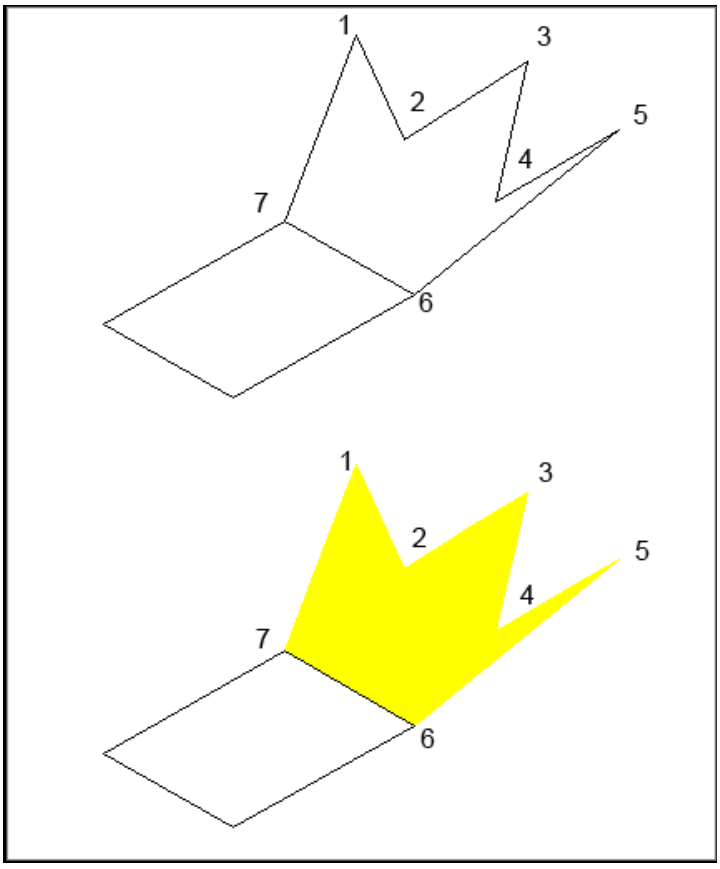
Enter a vertex number or [Color/Layer] <next face>: **type 6**

Face 3, vertex 4:

Enter a vertex number or [Color/Layer] <next face>:

Face 4, vertex 1: **enter**

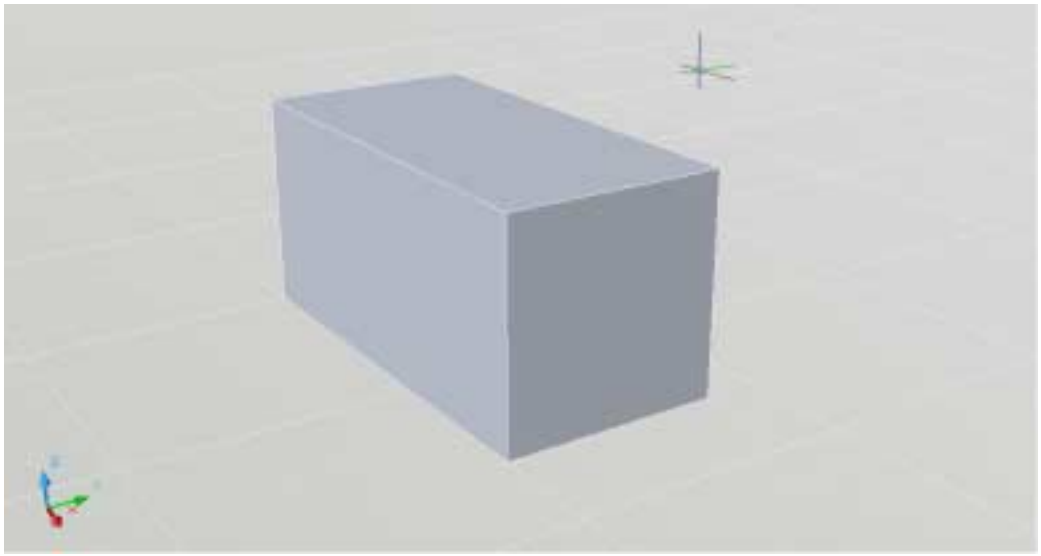
Enter a vertex number or [Color/Layer]:



AutoCAD 3D – Chapter 10
Basic 3D Surfaces

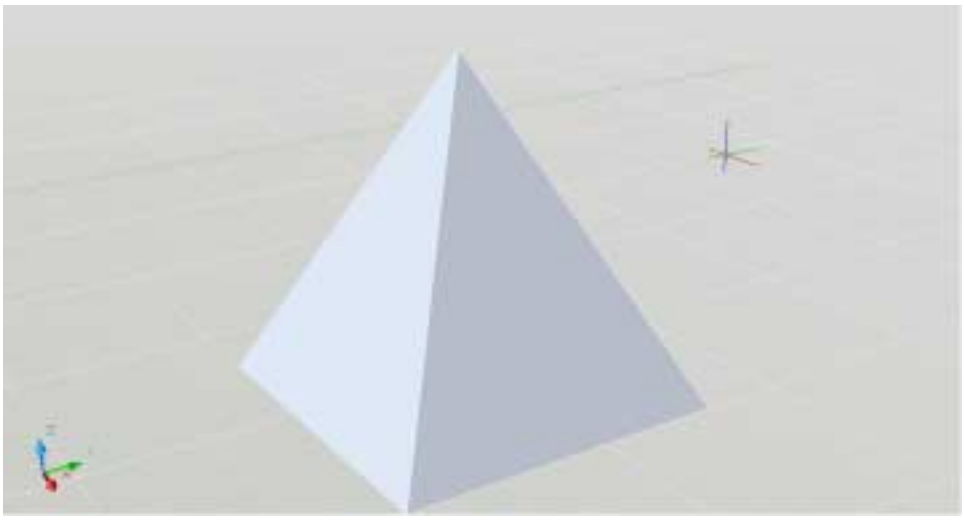
10.1 Box

1. Type AI_BOX at the command prompt.
   Command: **ai_box**
   Initializing... 3D Objects loaded. Corner of box: **pick point**
   Specify length of box: **4**
   Specify width of box or [Cube]: **2**
   Specify height of box: **2**
   Specify rotation angle of box about the Z axis or [Reference]: **0**



10.2 Pyramid

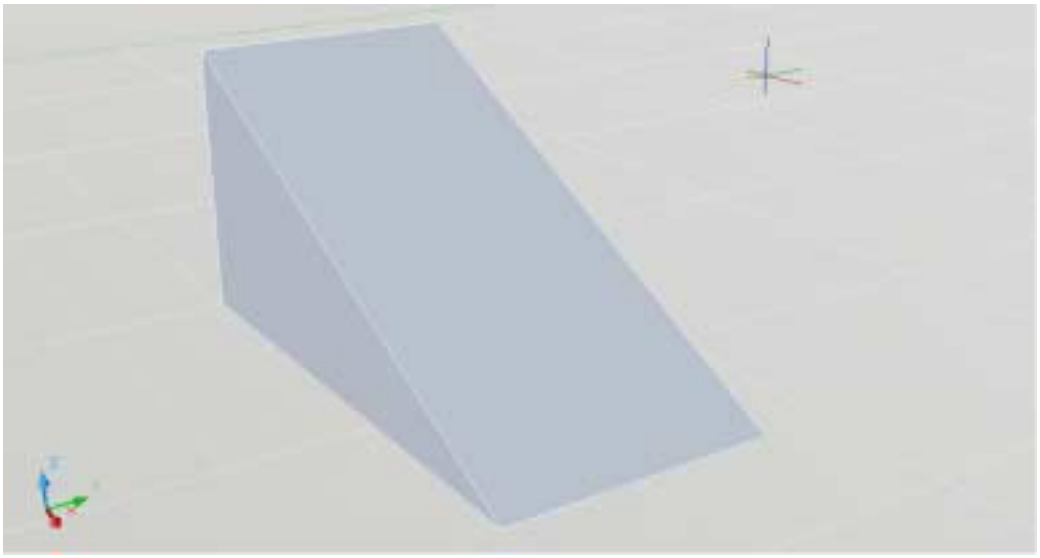
1. Type AI_PYRAMID at the command prompt.
   Command: **ai_pyramid**
   Specify first corner point for base of pyramid: **pick point**
   Specify second corner point for base of pyramid:
   <Ortho on> **4**
   Specify third corner point for base of pyramid: **4**
   Specify fourth corner point for base of pyramid or
   [Tetrahedron]: **4**
   Specify apex point of tetrahedron or [Top]: **.xy**
   of pick
   (need Z): **4**



10.3 Wedge

1. Type AI_WEDGE at the command prompt.

   Command: **ai_wedge**
   Specify corner point of wedge: **pick point**
   Specify length of wedge: **4**
   Specify width of wedge: **2**
   Specify height of wedge: **2**
   Specify rotation angle of wedge about the Z axis: **0**



10.4 Dome

1. Type AI_DOME at the command prompt.

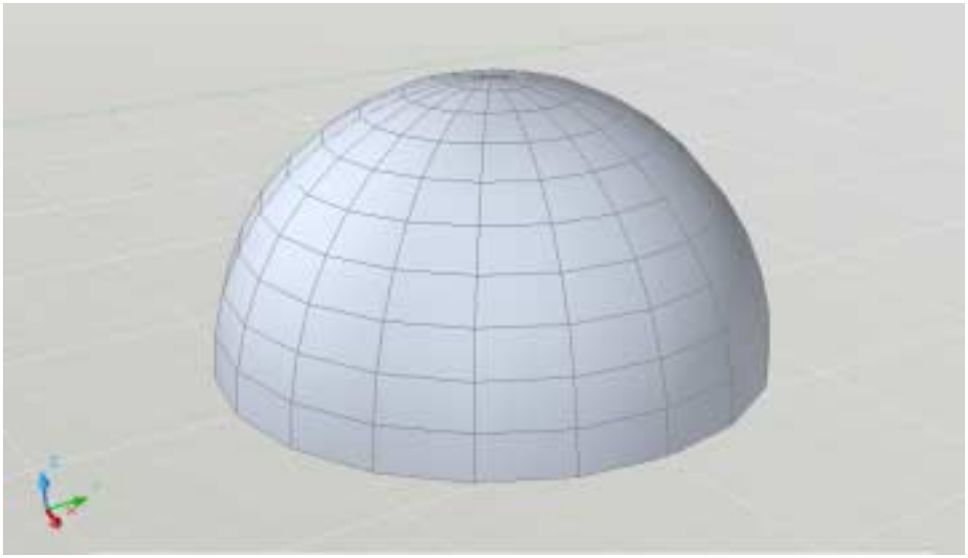
   Command: **ai_dome**

   Specify center point of dome: **pick point**

   Specify radius of dome or [Diameter]: **3**

   Enter number of longitudinal segments for surface of dome <16>: **20**

   Enter number of latitudinal segments for surface of dome <8>: **10**



10.5 Sphere

1. Type AI_SPHERE at the command prompt.

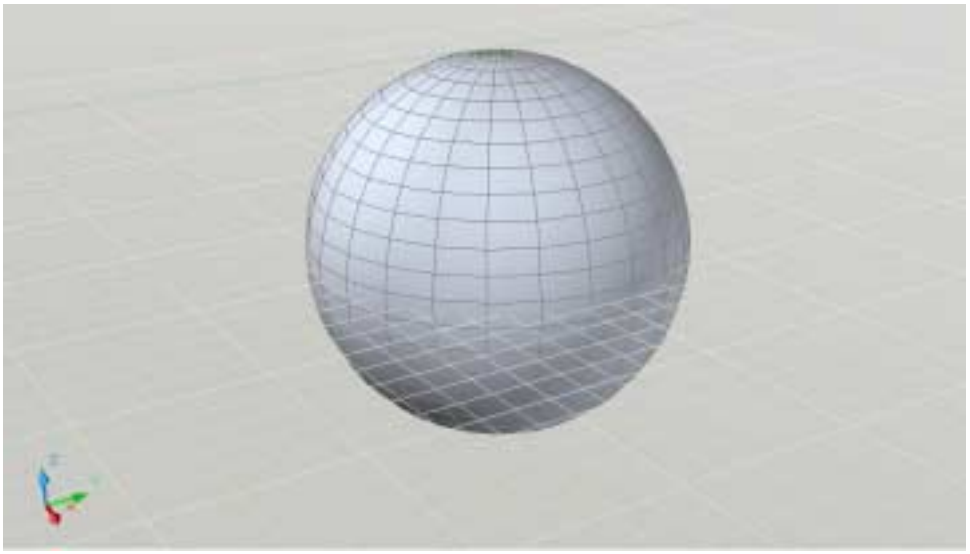
   Command: **ai_sphere**

   Specify center point of sphere: **pick point**

   Specify radius of sphere or [Diameter]: **3**

   Enter number of longitudinal segments for surface of sphere <16>: **25**

   Enter number of latitudinal segments for surface of sphere <16>: **25**



10.6 Cone

1. Type AI_CONE at the command prompt.

Command: **ai_cone**

Specify center point for base of cone: **pick point**

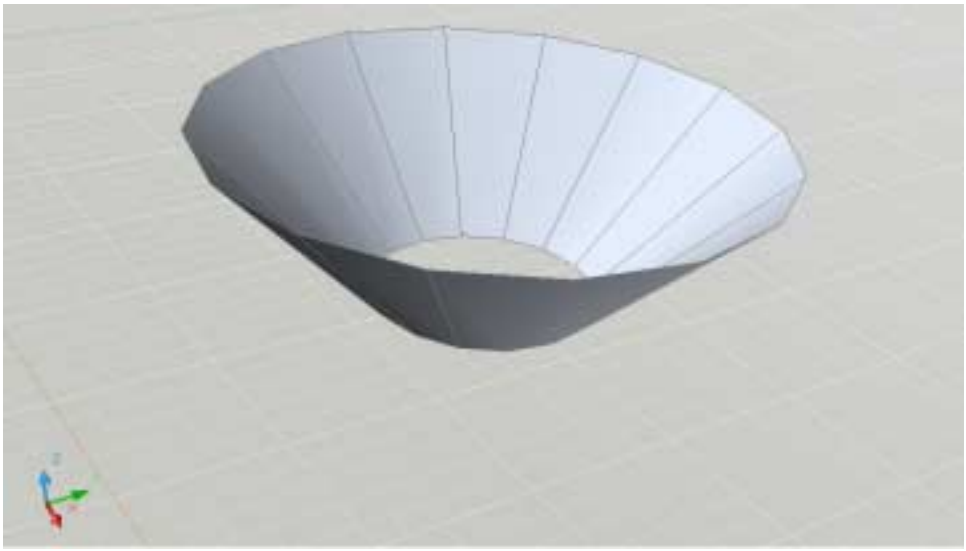
Specify radius for base of cone or [Diameter]: **2**

Specify radius for top of cone or [Diameter] <0>: **5**

Specify height of cone: **3**

Enter number of segments for surface of cone <16>:

enter



10.7 Torus

1. Type AI_TORUS at the command prompt.

   Command: **ai_torus**

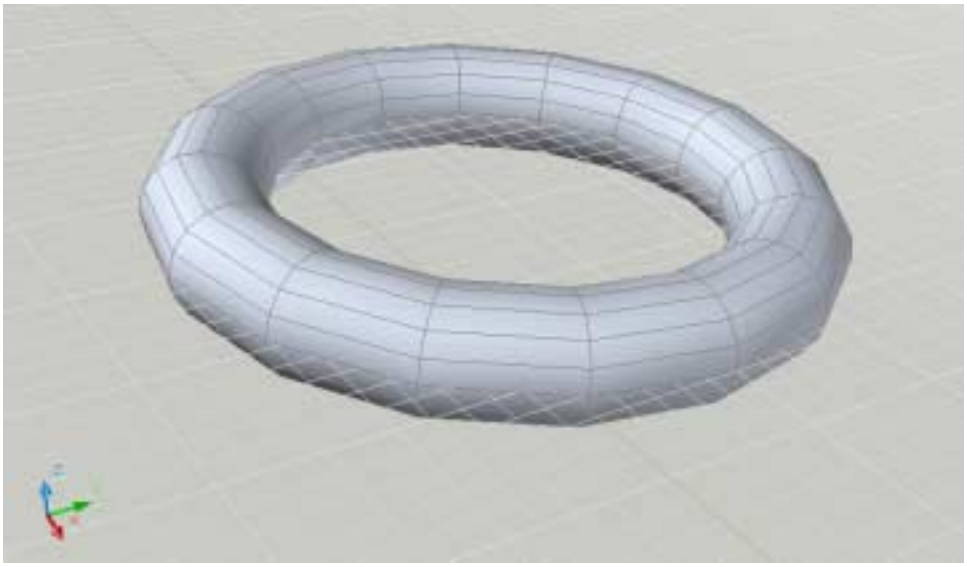
   Specify center point of torus: **pick point**

   Specify radius of torus or [Diameter]: **6**

   Specify radius of tube or [Diameter]: **1**

   Enter number of segments around tube circumference <16>: **enter**

   Enter number of segments around torus circumference <16>: **enter**



10.8 Dish

1. Type AI_DISH at the command prompt.

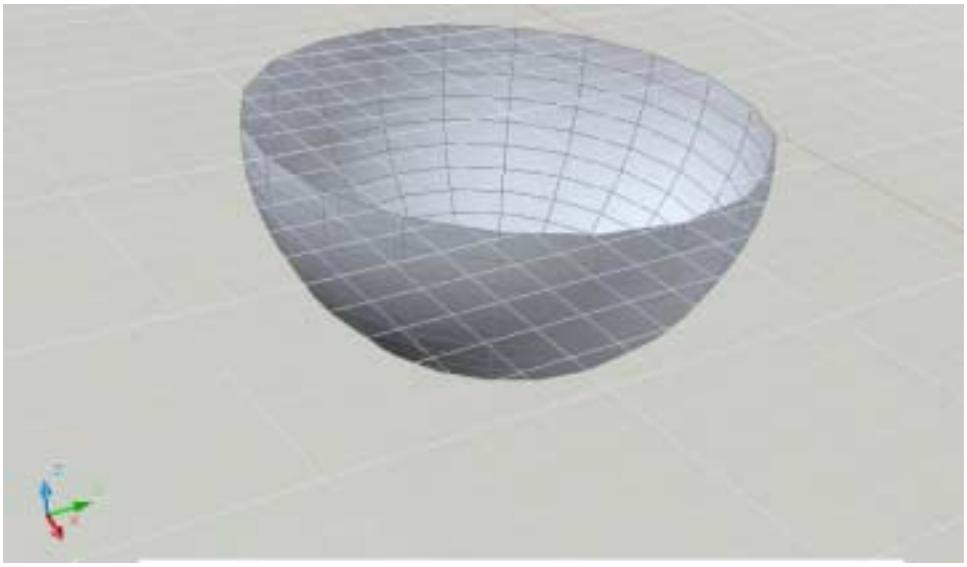
   Command: **ai_dish**

   Specify center point of dish: **pick point**

   Specify radius of dish or [Diameter]: **3**

   Enter number of longitudinal segments for surface of dish <16>: **20**

   Enter number of latitudinal segments for surface of dish <8>: **15**



10.9 Mesh

1. Type ai_mesh at the command prompt.

   Command: **ai_mesh**

   Initializing... 3D Objects loaded. Specify first corner point of mesh: **1,1,1**

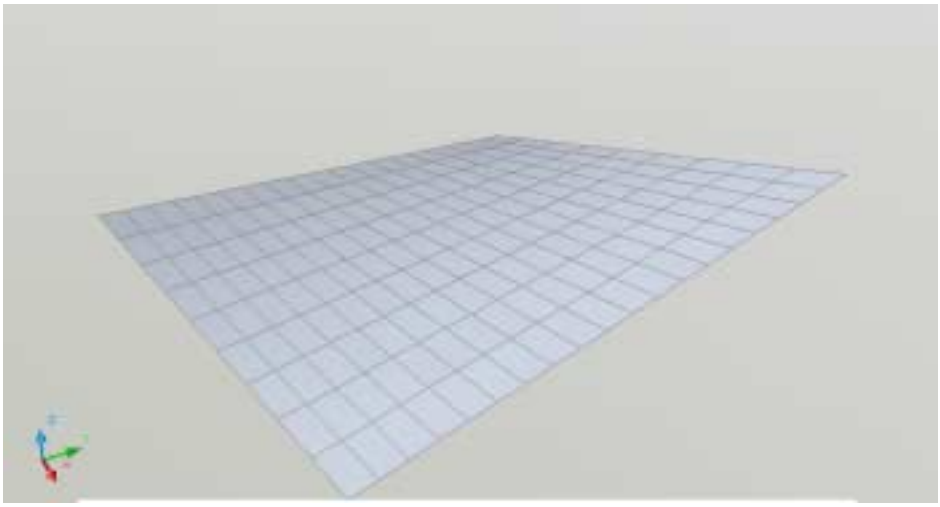
   Specify second corner point of mesh: **4,1,1**

   Specify third corner point of mesh: **4,4,2**

   Specify fourth corner point of mesh: **1,4,1**

   Enter mesh size in the M direction: **20**

   Enter mesh size in the N direction: **10**



AutoCAD 3D – Chapter 11
Complex Surfaces

11.1 Revolved Surfaces

Regenerates a three-dimensional model with hidden lines

1. Type Revsurf at the command prompt.

Command: **revsurf**

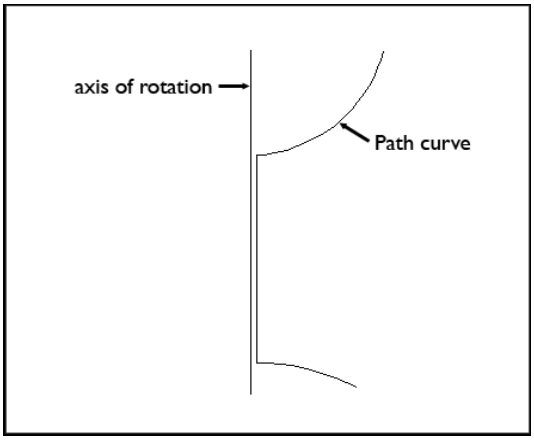
Current wire frame density: SURFTAB1=6 SURFTAB2=6

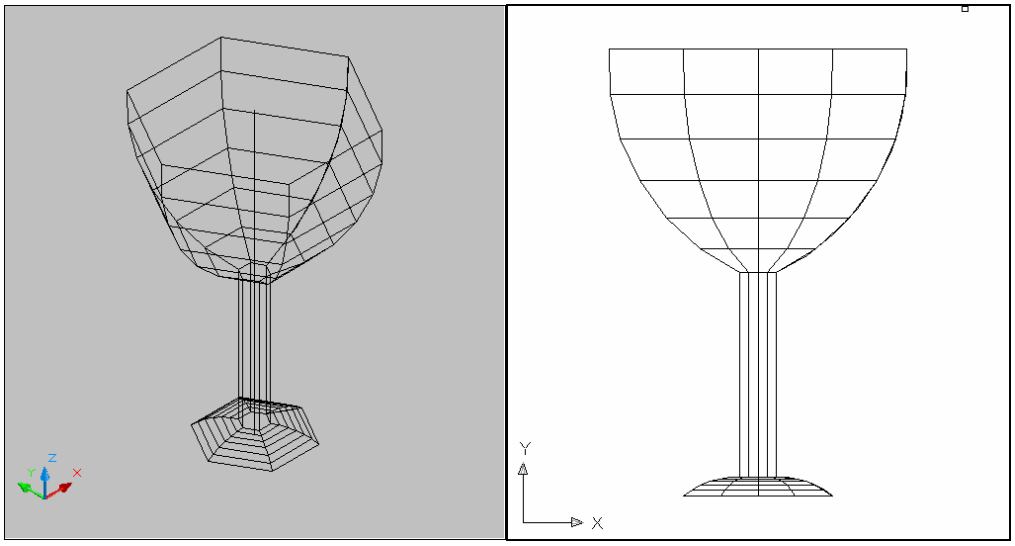
Select object to revolve: **pick path curve**

Select object that defines the axis of revolution: **pick line**

Specify start angle <0>: **enter**

Specify included angle (+=ccw, -=cw) <360>: **enter**





11.2 Surftab Variables

Sets the number of tabulations for both directions to be generated for RULESURF and TABSURF. Also sets the mesh density in ROTATE3D the M direction for REVSURF and EDGESURF commands.

1. Type Surftab1 at the command prompt.
   Command: **surftab1**
   Enter new value for SURFTAB1 <6>: **30**
2. Type Surftab2 at the command prompt.
   Command: **surftab2**
   Enter new value for SURFTAB2 <6>: **30**
3. Type Revsurf at the command prompt.

   Command: **revsurf**

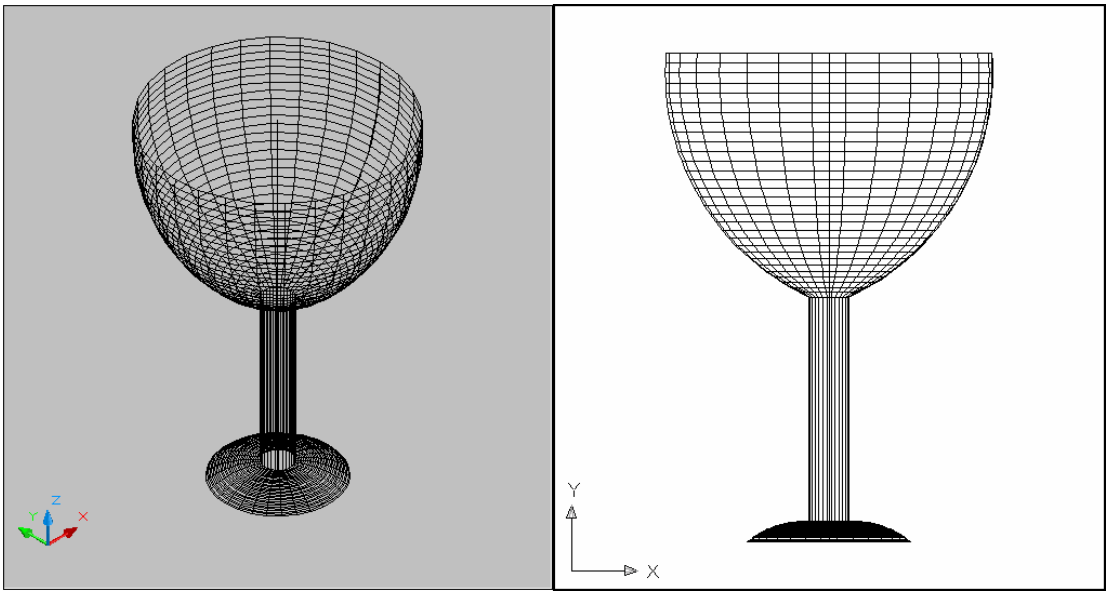
   Current wire frame density: SURFTAB1=30 SURFTAB2=30

   Select object to revolve: **pick path curve**

   Select object that defines the axis of revolution: **pick line**

   Specify start angle <0>: **enter**

   Specify included angle (+=ccw, -=cw) <360>: **enter**

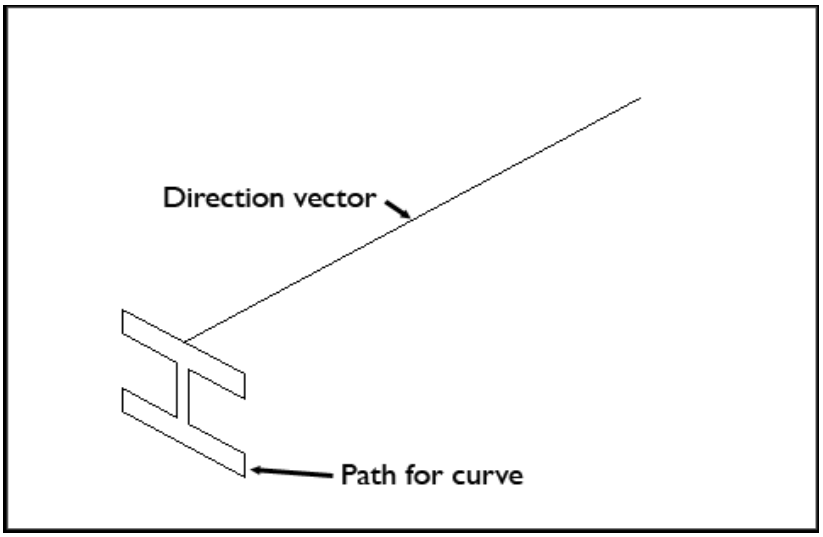


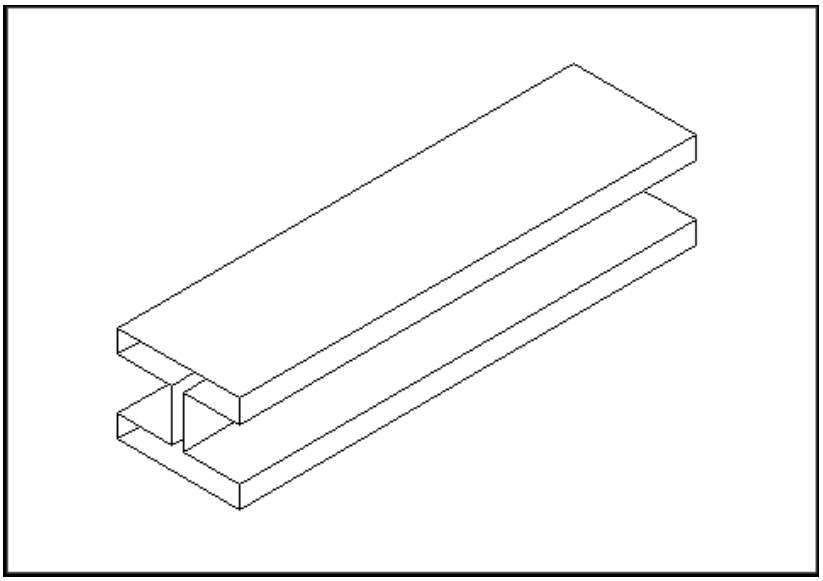
11.3 Tabulated Surfaces

1. Type TABSURF at the command prompt.

   Command: **tabsurf**

   Select object for path curve: Select object for direction vector:





11.4 Ruled Surfaces

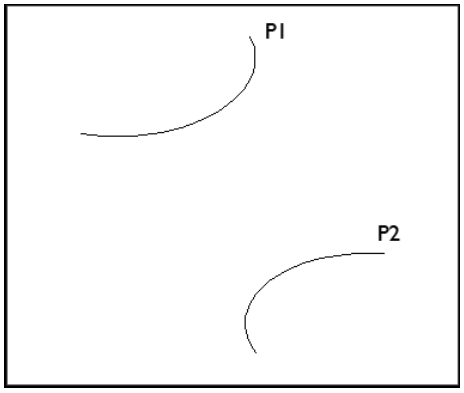
1. Type RULESURF at the command prompt.

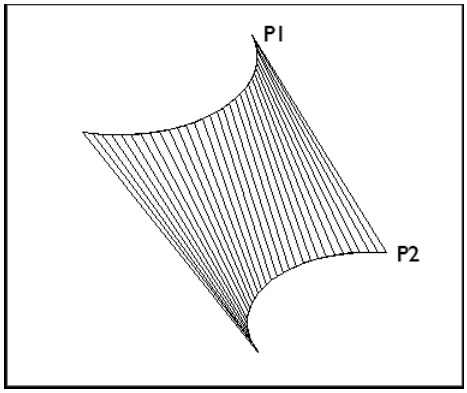
   Command: **rulesurf**

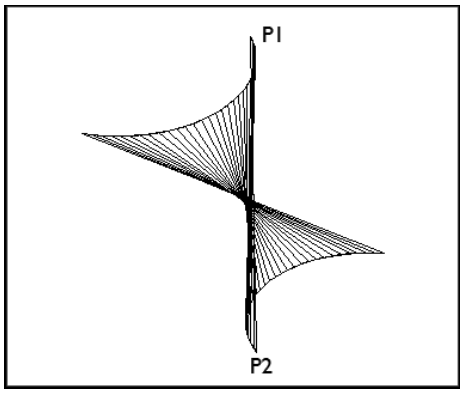
   Current wire frame density: SURFTAB1=6

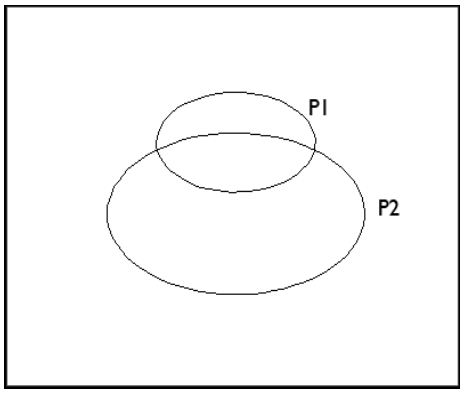
   Select first defining curve: **P1**

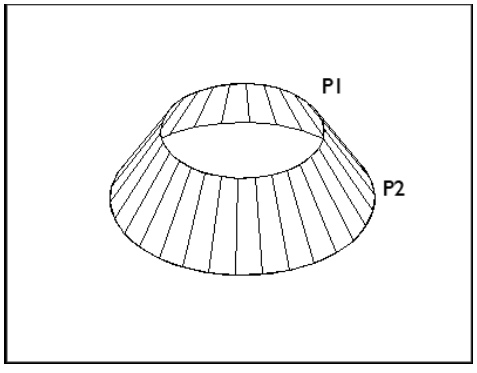
   Select second defining curve: **P2**











11.5 Edge Surfaces

Regenerates a three-dimensional model with hidden lines

1. Type EDGESURF at the command prompt.

   Command: **edgesurf**

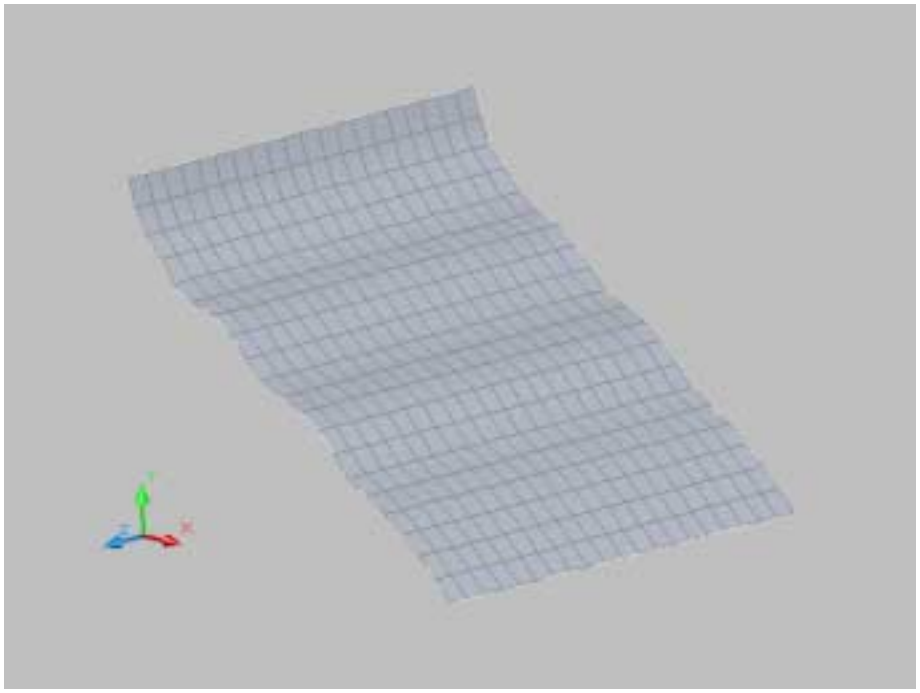
   Current wire frame density: SURFTAB1=20 SURFTAB2=10

   Select object 1 for surface edge: **P1**

   Select object 2 for surface edge: **P2**

   Select object 3 for surface edge: **P3**

   Select object 4 for surface edge: **P4**

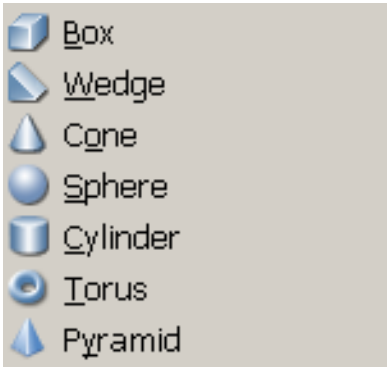


AutoCAD 3D – Chapter 12
Creating Solids

12.1 Solid Primitives

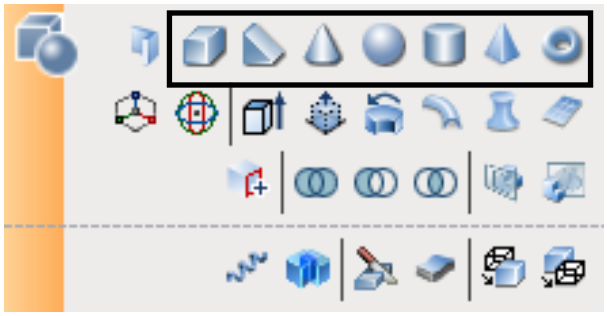
Solid primitives can easily be drawn from both the Draw pulldown menu and from Autodesk's dashboard.

1. Choose **Draw, Modeling**, and one of the following solid primitives.



or

2. Choose the solid primitive from AutoCAD's Dashboard.



12.2 Polysolid Command

With the POLYSOLID command, you can convert an existing line, 2D polyline, arc, or circle to a solid with a rectangular profile. A polysolid can have curved segments, but the profile is always rectangular by default.

1. Open a drawing with a closed 2D polyline and display in a 3D view.
2. Choose **Draw, Modeling, Polysolid**.

   or

3. Type POLYSOLID at the command prompt.

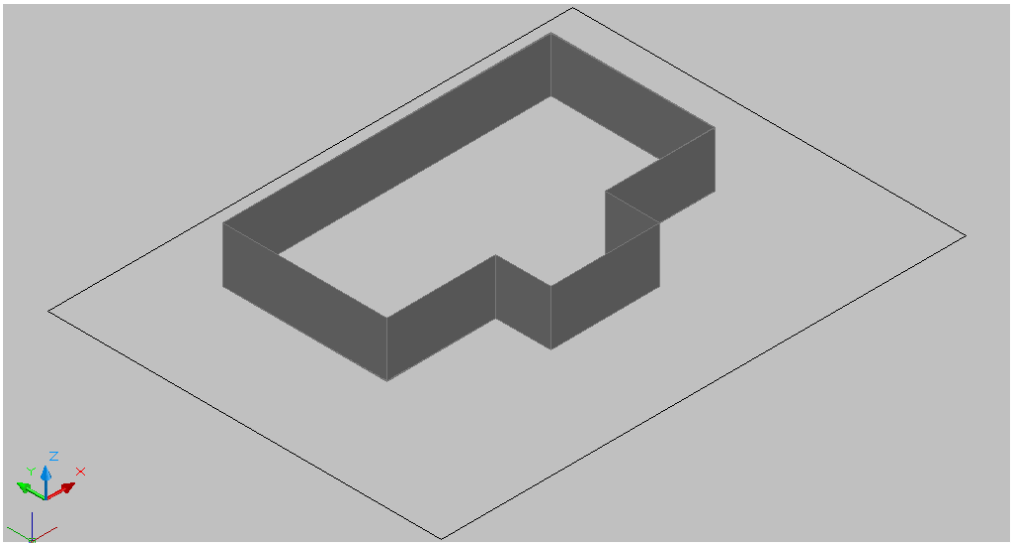
   Command: **polysolid**

   Specify start point or [Object/Height/Width/Justify] <Object>: **h**

   Specify height <0'-4">: **10'**

   Specify start point or [Object/Height/Width/Justify] <Object>: **o**

   Select object: **Pick polygon**



12.3 Helix

Creates a 2D or 3D spiral.

1. Begin a new drawing.
2. Choose **Draw, Helix**.

   or

3. Type HELIX at the command prompt.

   Command: **helix**

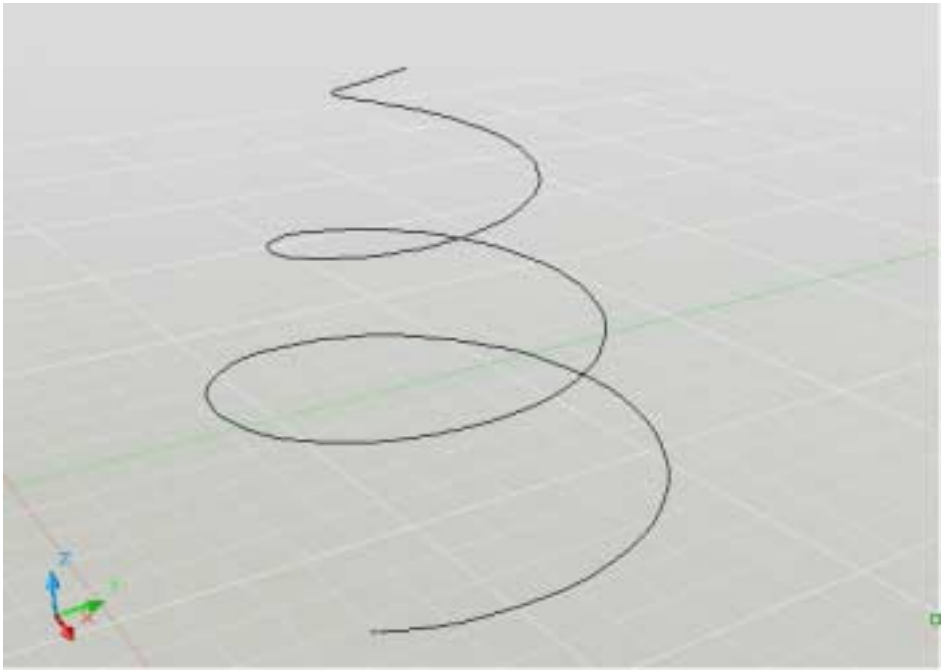
   Number of turns = 3.0000 Twist=CCW

   Specify center point of base: **pick point**

   Specify base radius or [Diameter] <1.0000>: **enter or drag and pick**

   Specify top radius or [Diameter] <11.0776>: **enter or drag and pick**

   Specify helix height or [Axis endpoint/Turns/turn Height/tWist] <1.0000>: **enter or drag and pick**



12.4 Extrude

Creates unique solid primitives by extruding existing two-dimensional objects. You can extrude multiple objects with EXTRUDE.

1. Type EXTRUDE at the command prompt.

   Command: **extrude**

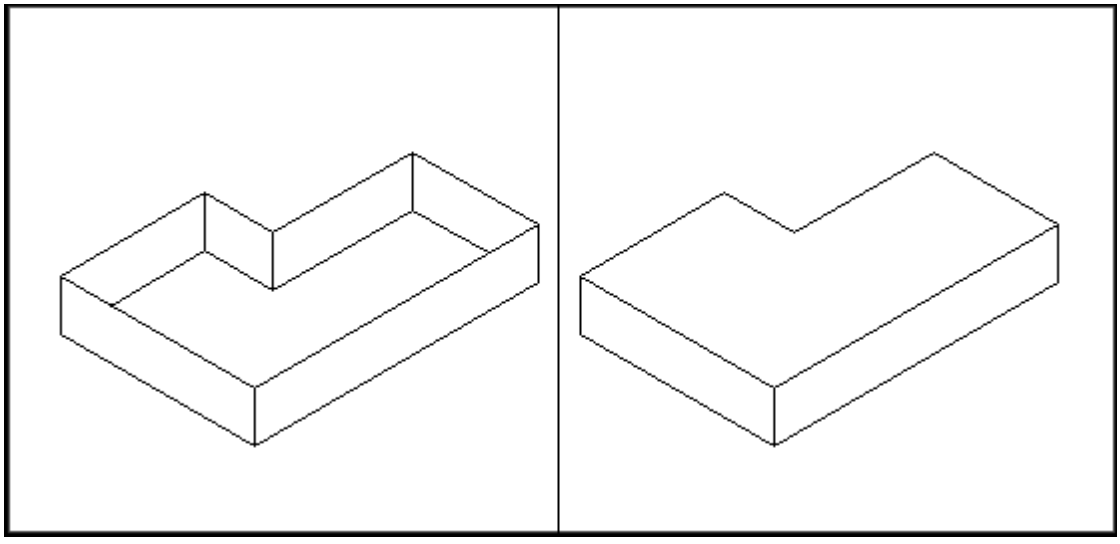
   Current wire frame density: ISOLINES=4

   Select objects: **pick objects**

   Select objects: **enter**

   Specify height of extrusion or [Direction/Path/Taper angle]: **2**

Lines with a Thickness of 2” *Lines Extruded 2”*



12.5 Extrude with Taper

1. Choose **Draw, Modeling, Extrude**.

   or

2. Type EXTRUDE at the command prompt.

Command: **extrude**

Current wire frame density: ISOLINES=4

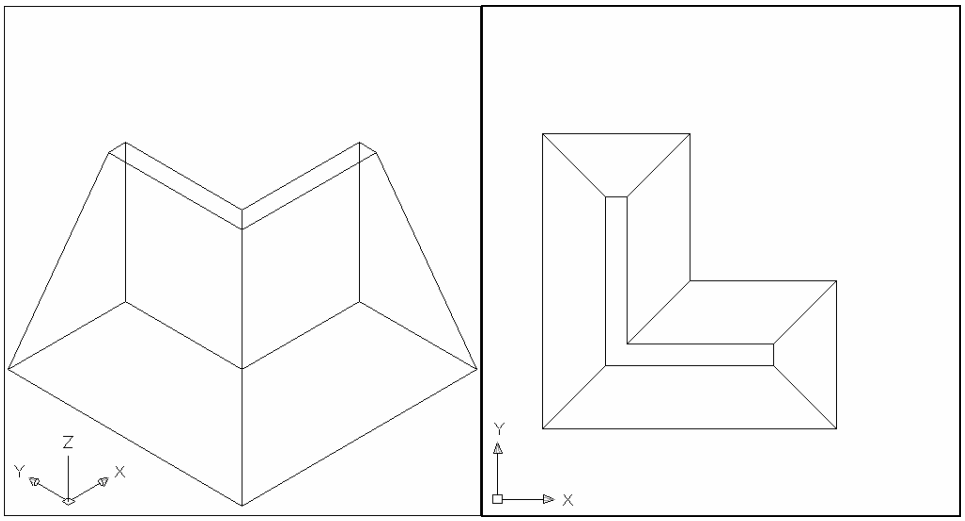
Select objects to extrude: **pick object to extrude**

Select objects to extrude: **enter**

Specify height of extrusion or [Direction/Path/Taper angle] <8.9509>: **T**

Specify angle of taper for extrusion <0>: **15**

Specify height of extrusion or [Direction/Path/Taper angle] <8.9509>: **4**



12.6 Extrude with Path

1. Choose **Draw, Modeling, Extrude**.

   or

2. Type EXTRUDE at the command prompt.

   Command: **extrude**

   Current wire frame density: ISOLINES=4

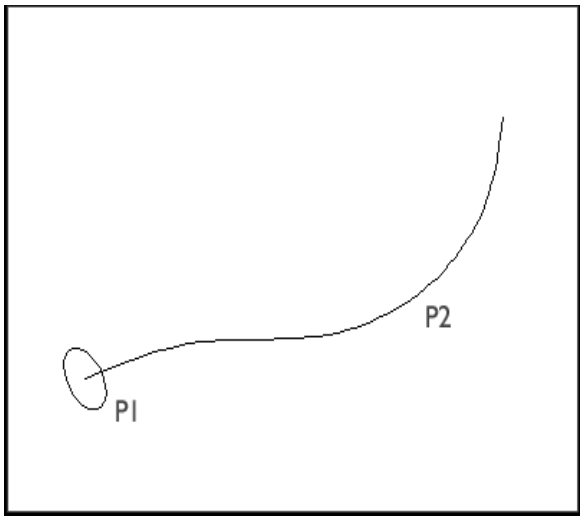
   Select objects to extrude: 1 found

   Select objects to extrude: **pick circle (P1)**

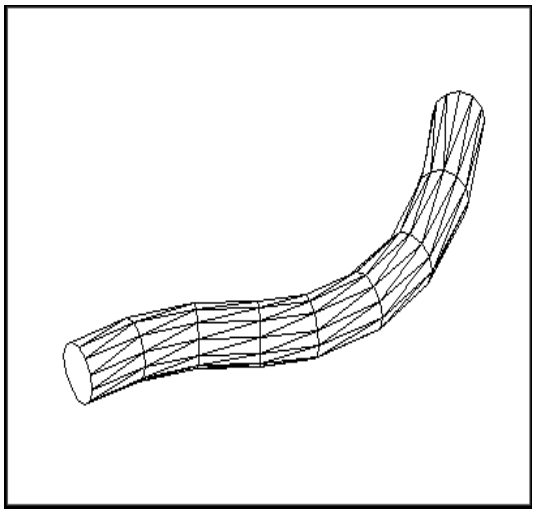
   Specify height of extrusion or [Direction/Path/Taper angle] <4.0000>: **p**

   Select extrusion path or [Taper angle]: **pick P2**

Circle Extruded Along a Path



Hidden Line Removal of Extruded Circle



12.7 Revolve Command

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Draw, Modeling, Revolve**.

   Or

3. Type REVOLVE at the command prompt.

   Command: **revolve**

   Current wire frame density: ISOLINES=4

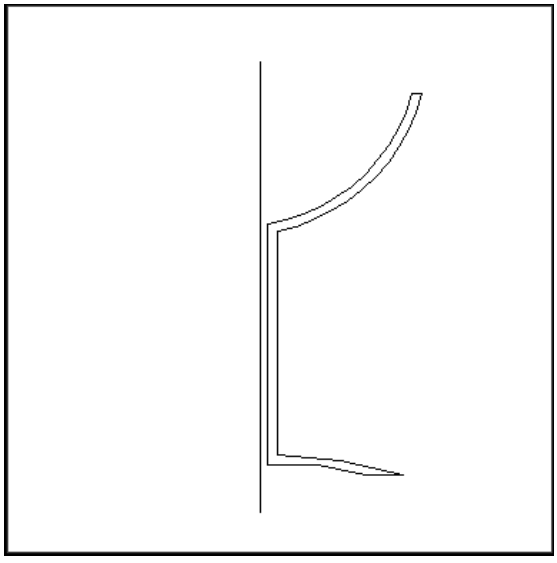
   Select objects: **pick profile**

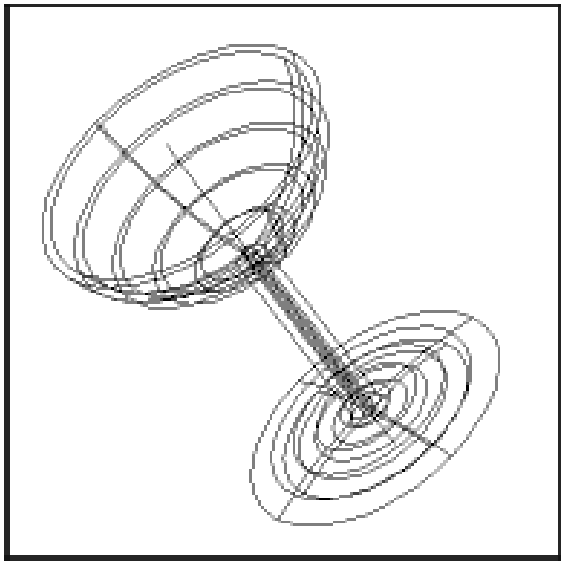
   Select objects: **enter**

   Specify start point for axis of revolution or define axis by [Object/X (axis)/Y (axis)]: **o**

   Select an object: **pick axis**

   Specify angle of revolution <360>: **enter**





12.8 Sweep Command

1. Open a drawing with 2D objects to sweep and display in a 3D view.
2. Choose **Draw, Modeling, Sweep**.

   or

3. Type SWEEP at the command prompt.

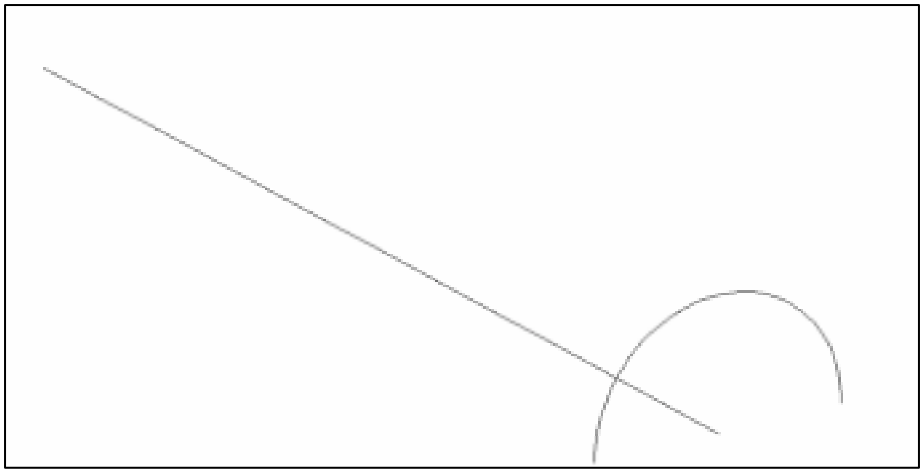
   Command: **sweep**

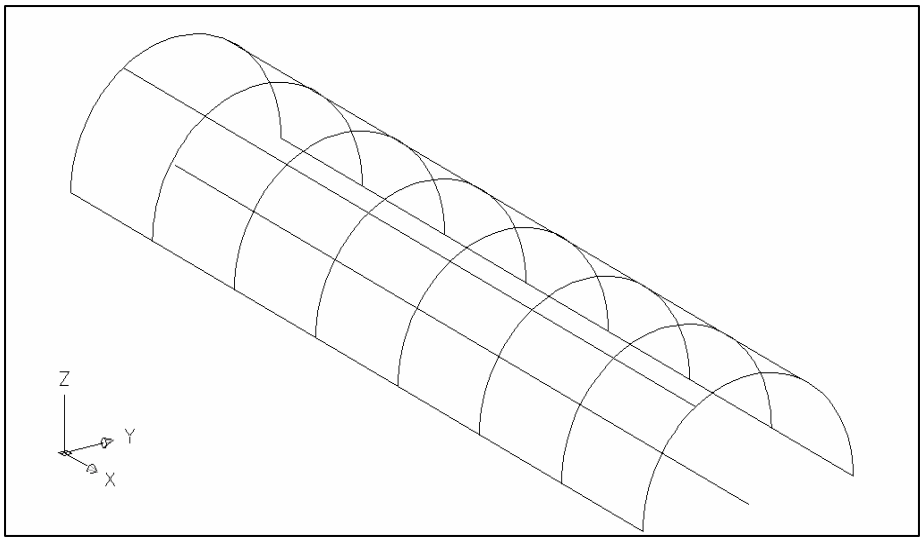
   Current wire frame density: ISOLINES=4

   Select objects to sweep: **pick arc**

   Select objects to sweep:

   Select sweep path or [Alignment/Base point/Scale/Twist]: **pick path**





12.9 Loft Command

1. Open a drawing with 2D objects to sweep and display in a 3D view.
2. Choose **Draw, Modeling, Loft**.

   or

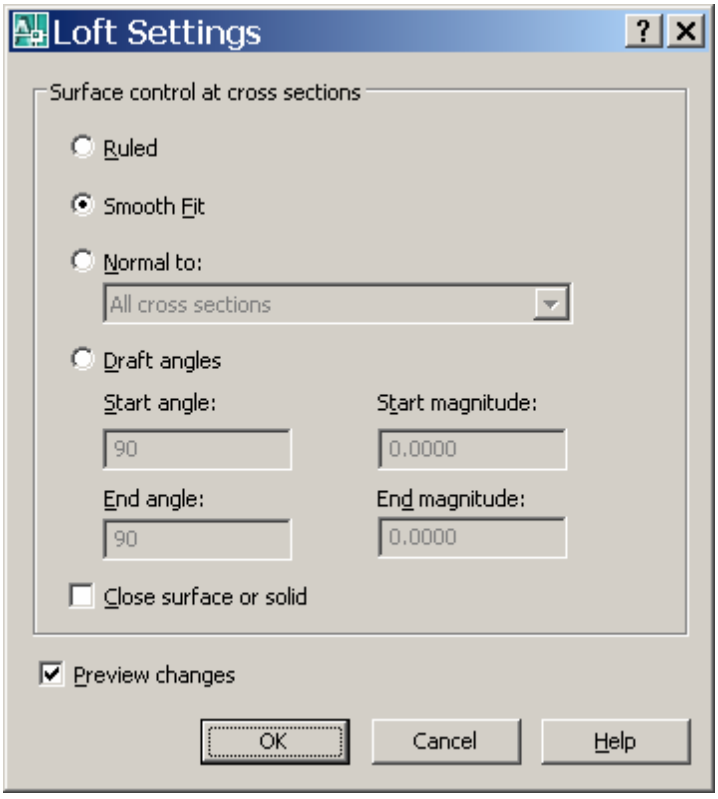
3. Type LOFT at the command prompt.

Command: **loft**

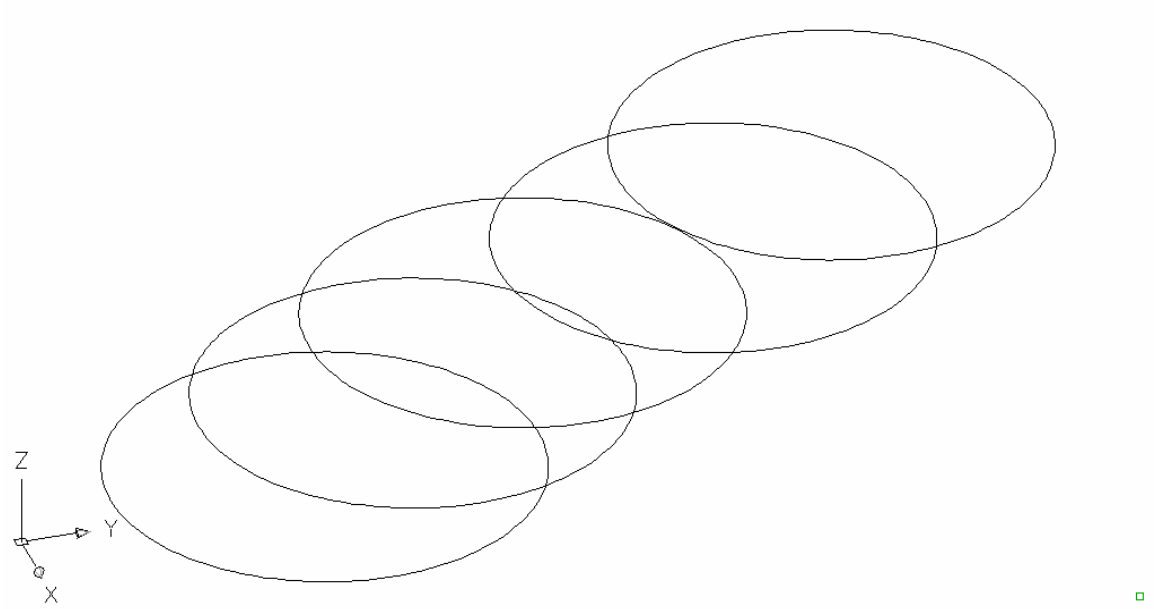
Select cross-sections in lofting order: **pick circles**
Specify opposite corner: 5 found

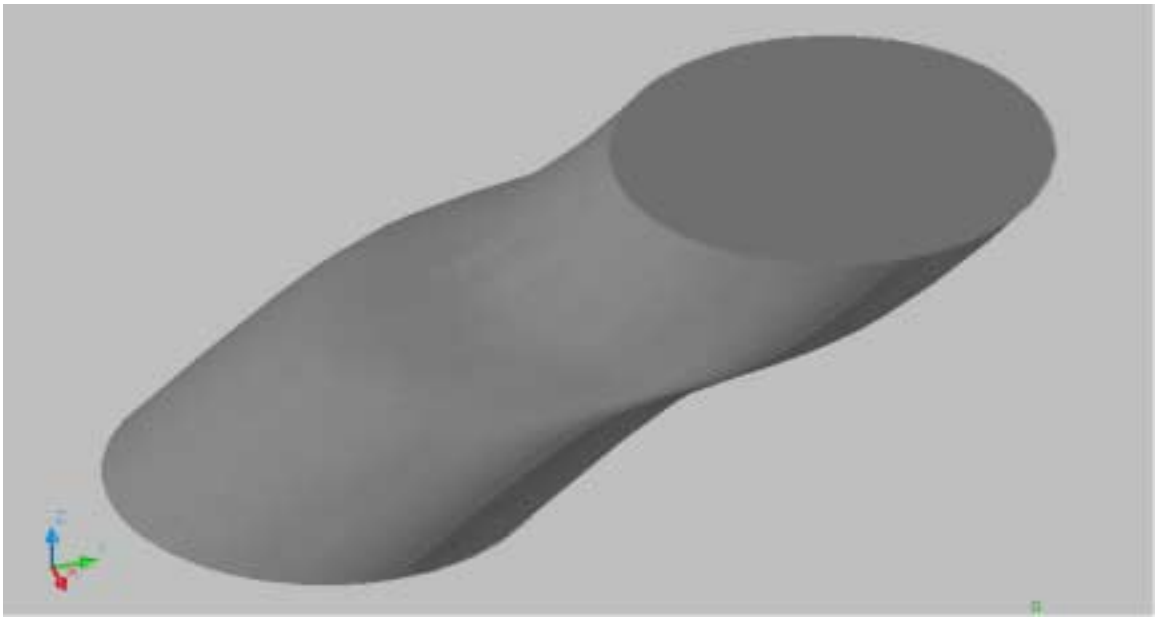
Select cross-sections in lofting order:

Enter an option [Guides/Path/Cross-sections only] <Cross-sections only>: **enter**



Click OK.


Z
Y
X



AutoCAD 3D – Chapter 13
3D Edits

13.1 Convert to Solid

Converts polylines and circles with thickness to 3D solids. With the CONVTOSOLID command, you can convert the following objects into extruded 3D solids:

Uniform-width wide polylines with thickness
Closed, zero-width polylines with thickness
Circles with thickness

Note You cannot use CONVTOSOLID with polylines that contain vertices with 0 width or that contain segments of variable width

1. Open a drawing with 2D polylines or circles with thicknesses and display in a 3D view.
2. Choose **Modify, 3D Operation, Convert to Solid**.

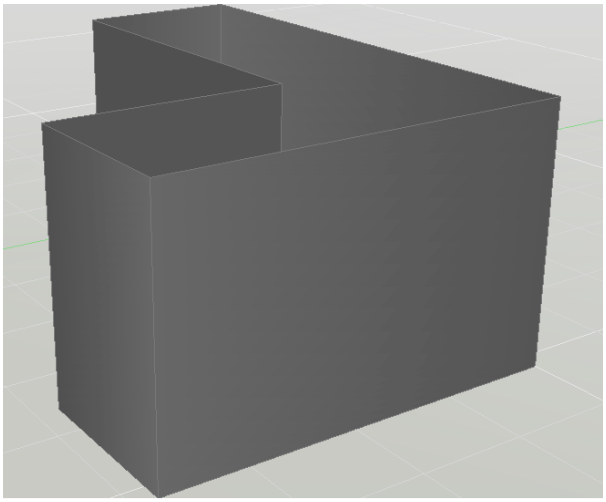
   or

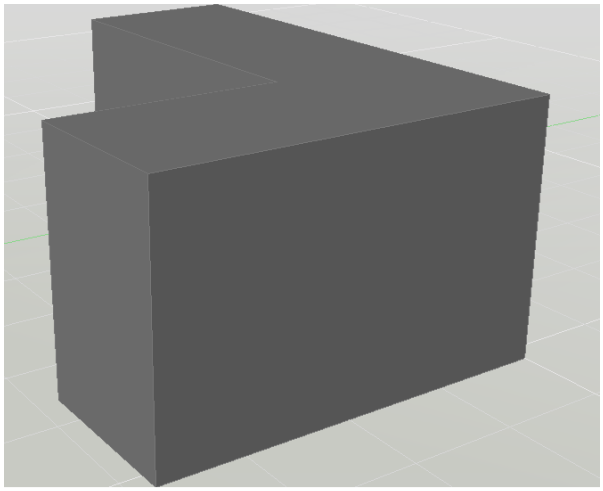
3. Type CONVTSOLID at the command prompt.

Command: **convtosolid**

Select objects: pick circle or polyline 1 found

Select objects: press enter





13.2 Convert to Surface

Converts polylines and circles with thickness to surfaces.

1. Open a drawing with 2D polylines or circles with thicknesses and display in a 3D view.
2. Choose **Modify, 3D Operation, Convert to Surface**.

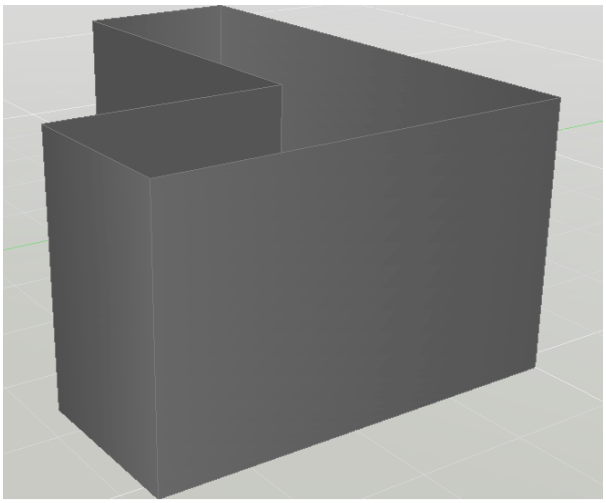
or

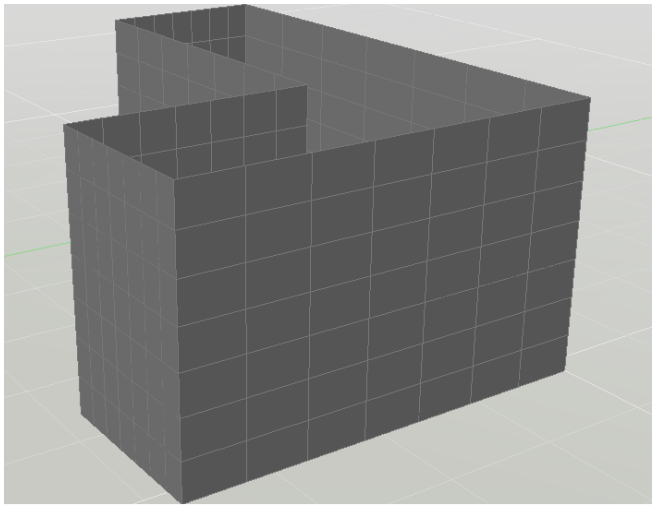
3. Type CONVTSURFACE at the command prompt.

Command: **convtosurface**

Select objects: 1 found

Select objects:





13.3 3D Move

Displays the move grip tool in a 3D view and moves objects a specified distance.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operations, 3DMove**.

   or

3. Type 3DMOVE at the command prompt.

   Command: **3Dmove**

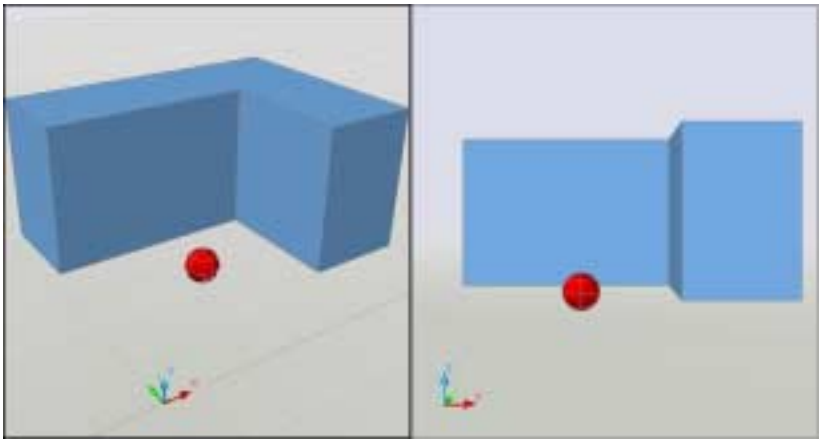
   Select objects: **pick object to move**

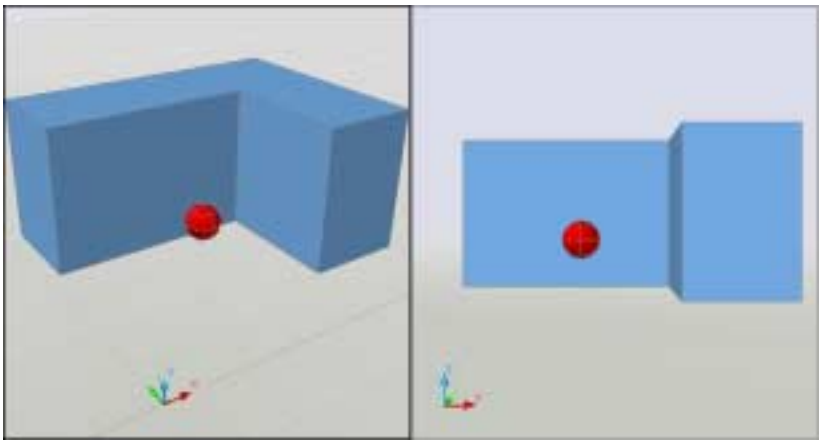
   1 found

   Select objects: enter

   Specify base point or [Displacement] <Displacement>: **D**

   Specify displacement <0.0000, 0.0000, 0.0000>: **0,0,2**





13.4 3D Rotate

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operations, 3DRotate**.

   or

3. Type 3DROTATE at the command prompt.

   Command: **3DROTATE**

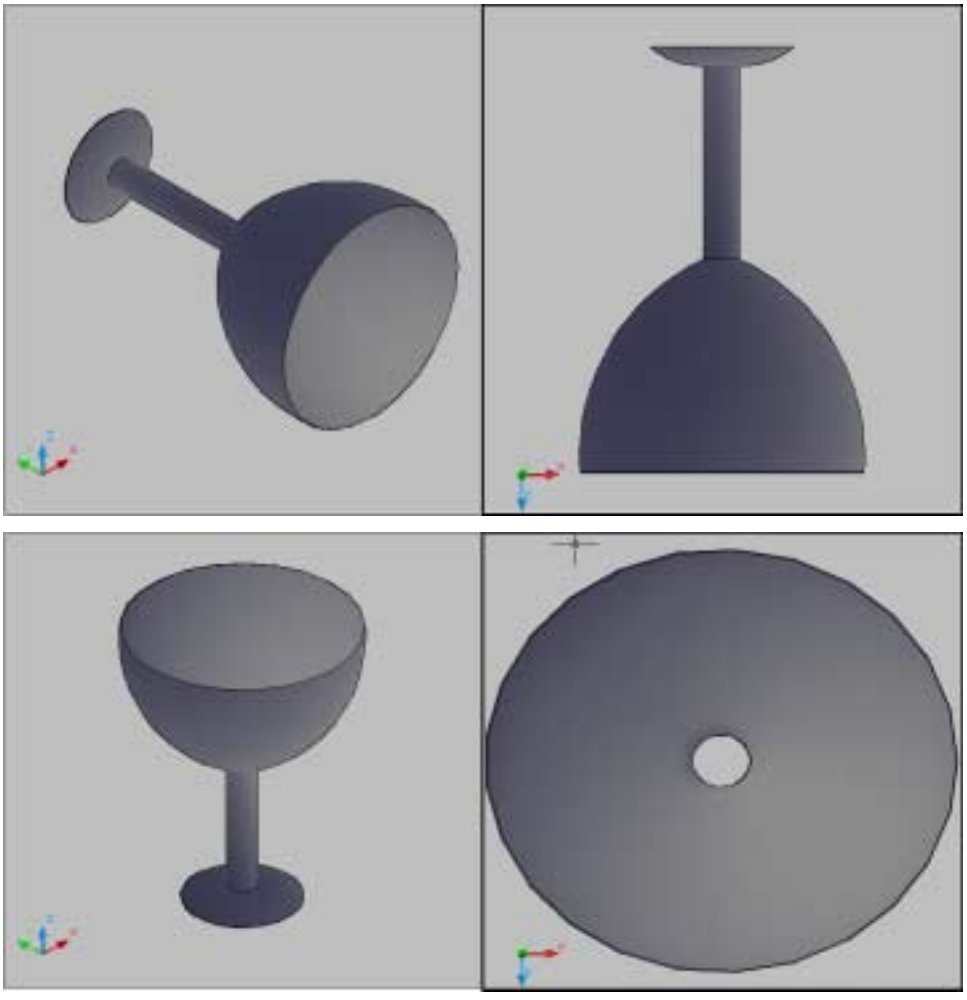
   Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0

   Select objects: **pick object and press enter**

   Specify base point: **pick point**

   Pick a rotation axis: **select X axis**

   Specify angle start point: **-90**



13.5 3DAlign

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operations, 3DAlign**.

   or

3. Type 3DALIGN at the command prompt.

   Command: **_3dalign**

   Select objects: **pick and press enter**

   Specify source plane and orientation ...

   Specify base point or [Copy]:

   Specify second point or [Continue] <C>:

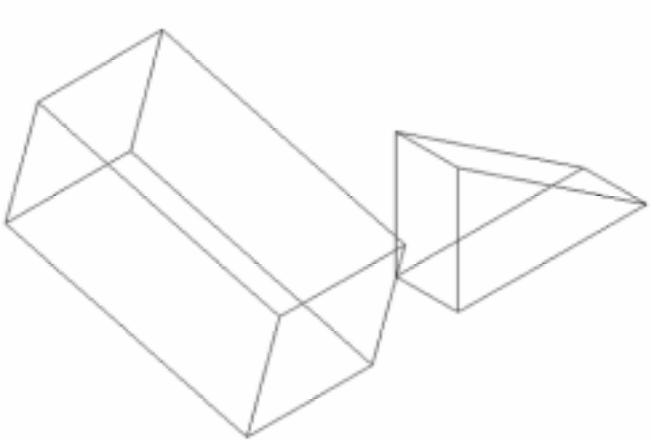
   Specify third point or [Continue] <C>:

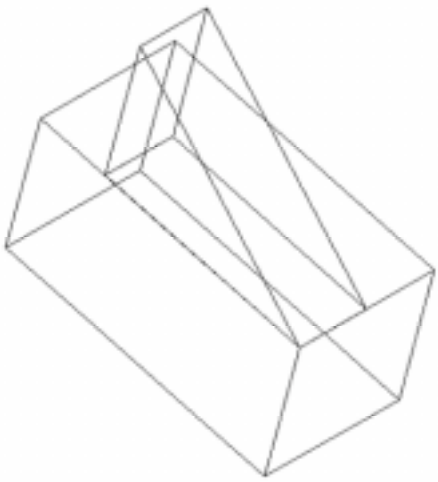
   Specify destination plane and orientation ...

   Specify first destination point:

   Specify second destination point or [eXit] <X>:

   Specify third destination point or [eXit] <X>:





13.6 3D Mirror

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operations, 3DMirror**.

or

3. Type MIRROR3D at the command prompt.

Command: **mirror3D**

Select objects: **pick the circle**

Select objects: **enter**

Specify first point of mirror plane (3 points) or

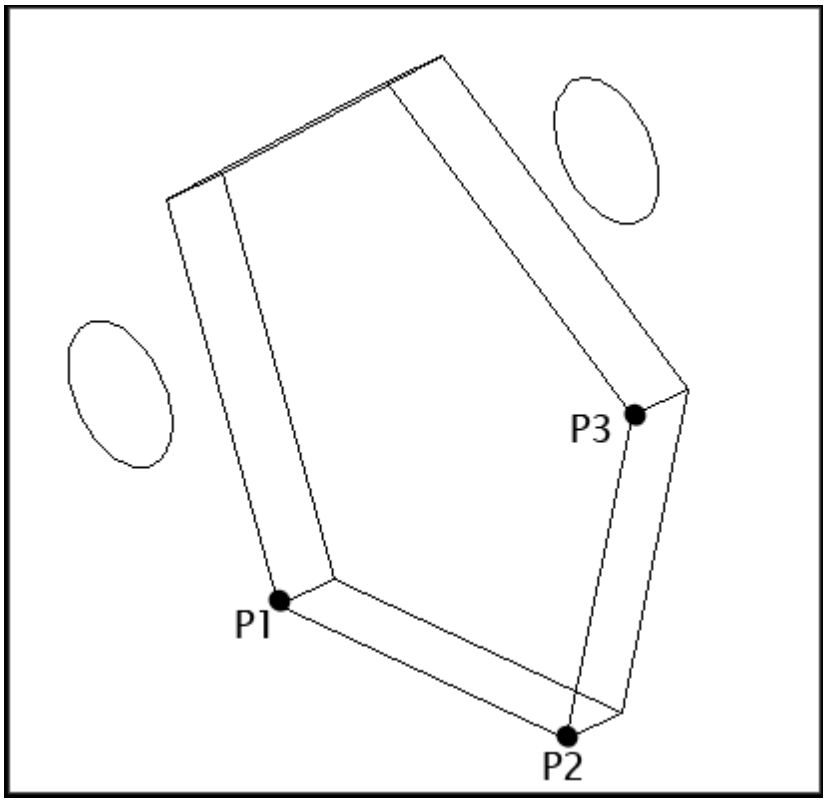
[Object/Last/Zaxis/View/XY/YZ/ZX/3points] <3points>: **P1**

Specify second point on mirror plane: **P2**

Specify third point on mirror plane: **P3**

Delete source objects? [Yes/No] <N>: **enter**

Circle Mirrored around 3 Points



13.7 3D Rectangular Array

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operations, 3DArray**.

or

3. Type 3DARRAY at the command prompt.

Command: **3darray**

Select objects: pick object and press enter

Enter the type of array [Rectangular/Polar] <R>: **R**

Enter the number of rows (---) <1>: **3**

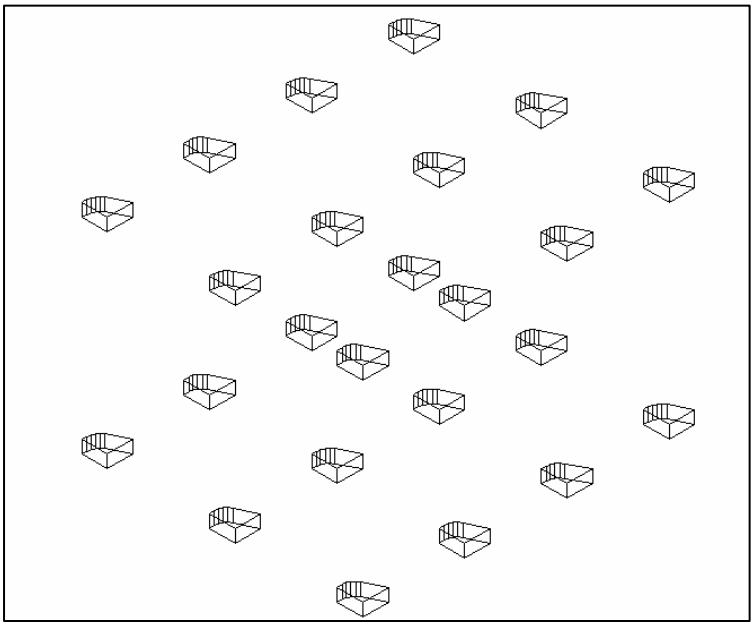
Enter the number of columns (|||) <1>: **4**

Enter the number of levels (...) <1>: **2**

Specify the distance between rows (---): **5**

Specify the distance between columns (|||): **4**

Specify the distance between levels (...): **8**



13.8 3D Polar Array

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operations, 3DArray**.

or

3. Type 3DARRAY at the command prompt.

Command: **3darray**

Select objects: **pick cube**

Select objects: **enter**

Enter the type of array [Rectangular/Polar] <R>: **P**

Enter the number of items in the array: **5**

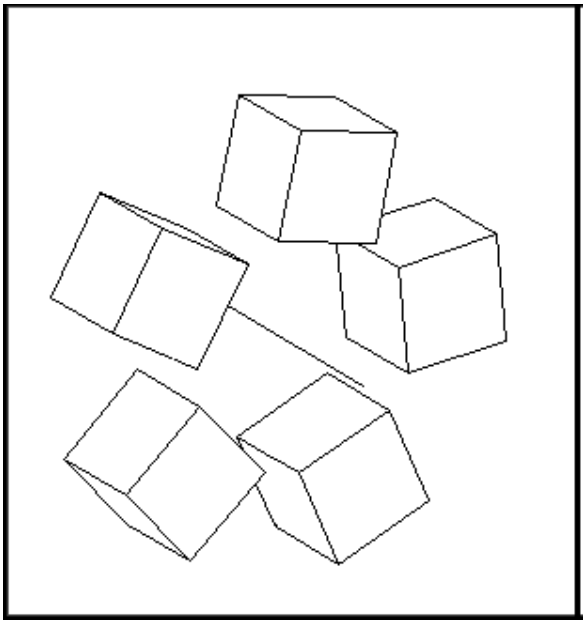
Specify the angle to fill (+=ccw, -=cw) <360>: **enter**

Rotate arrayed objects? [Yes/No] <Y>: **enter**

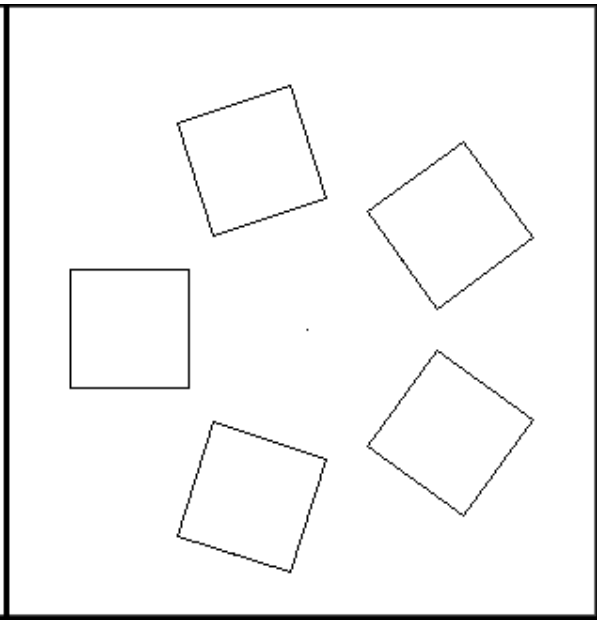
Specify center point of array: **mid of axis line**

Specify second point on axis of rotation: **pick**

Arrayed Objects Around a Line



Arrayed Objects in Plan View



13.9 Extract Edges

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operations, Extract Edges**.

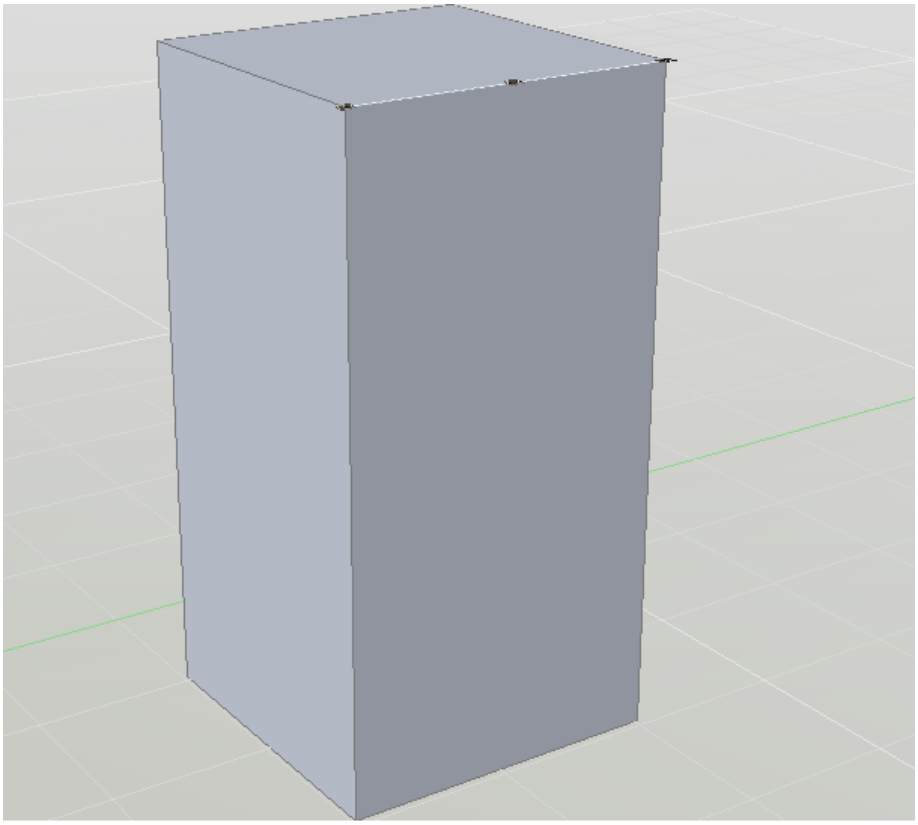
   or

3. Type XEDGES at the command prompt.

   Command: **_xedges**

   Select objects: **pick object**

   Select objects: **enter**



13.10 Facetres

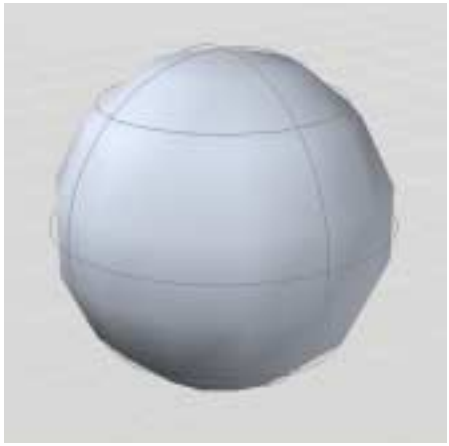
Adjusts the smoothness of shaded and rendered objects and objects with hidden lines removed. Valid values are from 0.01 to 10.0.

1. Open a drawing with 3D objects and display in a 3D view.
2. Type FACETRES at the command prompt.

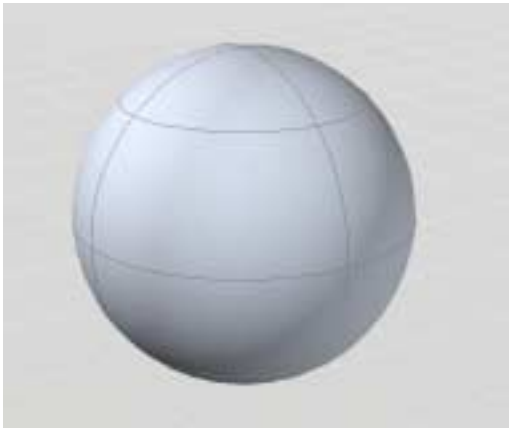
   Command: **FACETRES**

   Enter new value for FACETRES <0.5000>: **10**

Facetres=.1



Facetres=10



13.11 Isolines

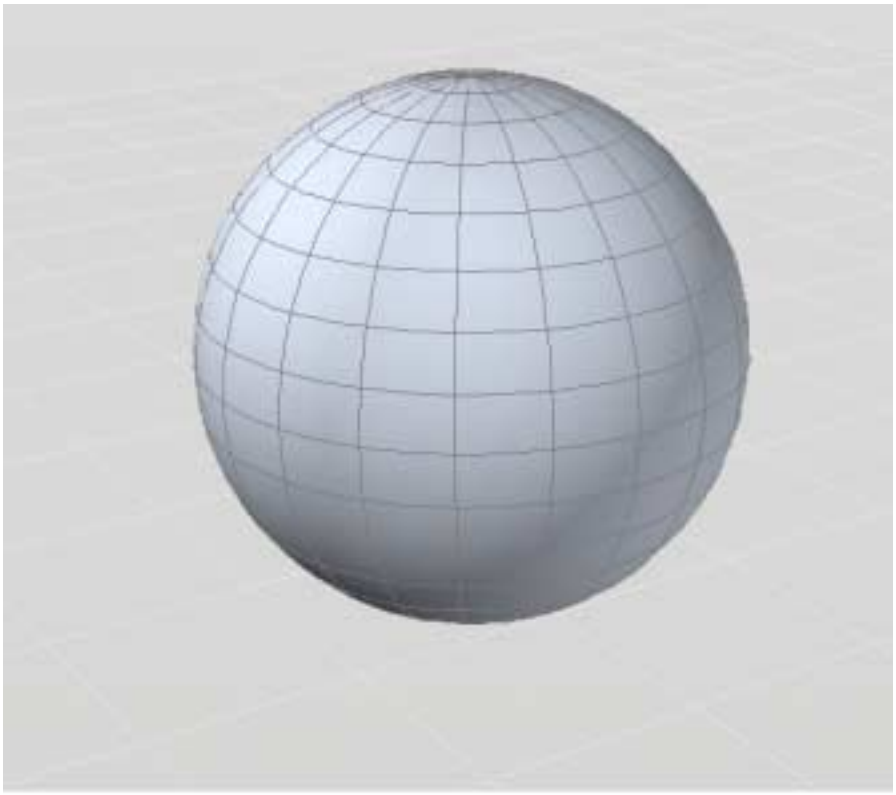
1. Open a drawing with 3D objects and display in a 3D view.
2. Type ISOLINES at the command prompt.

   Command: **isolines**

   Enter new value for ISOLINES <4>: **20**

   Command: **regen**

   REGEN Regenerating model.



AutoCAD 3D – Chapter 14
Solid Composites

14.1 Union

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, Solids Editing, Union**.

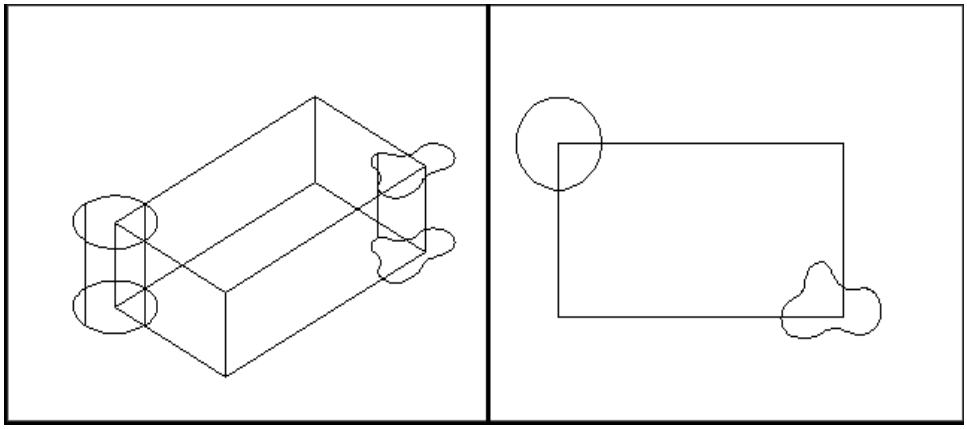
   or

3. Type UNION at the command prompt.

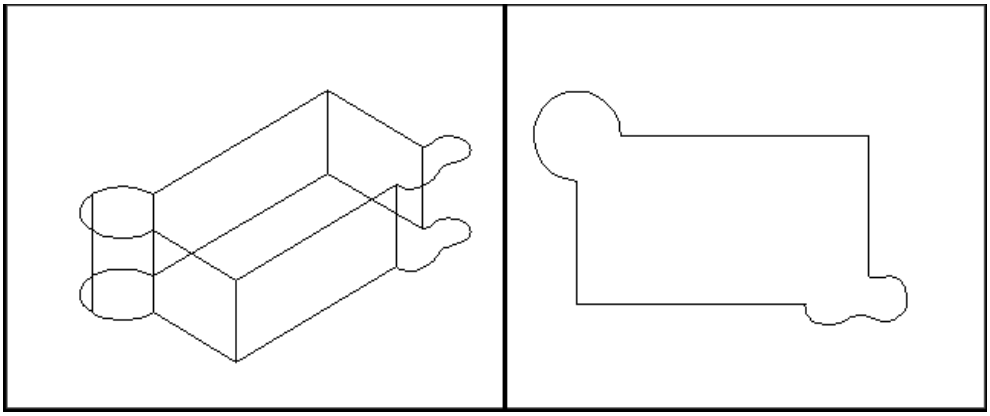
   Command: **union**

   Select objects: **pick objects to union**

   Select objects: **enter**



Solid Objects Unioned Together



14.2 Subtract

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, Solids Editing, Subtract**.

   or

3. Type SUBTRACT at the command prompt.

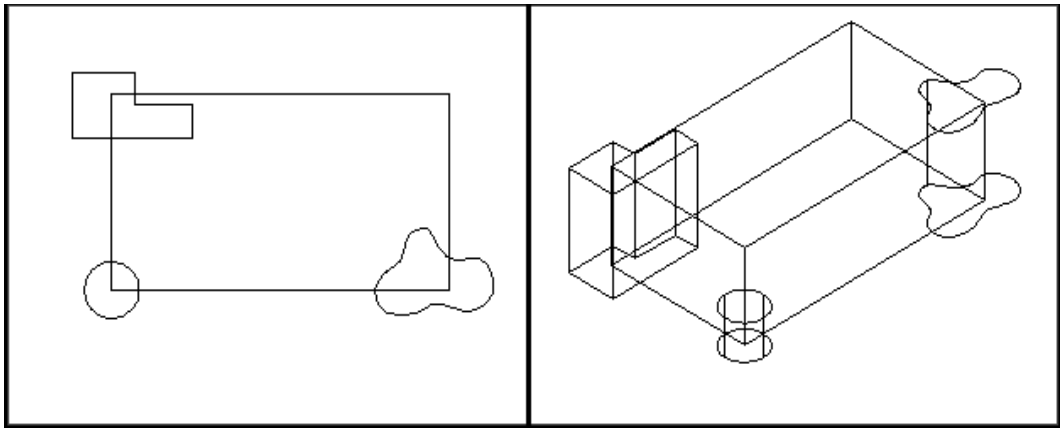
   Command: **subtract**

   SUBTRACT Select solids and regions to subtract from...

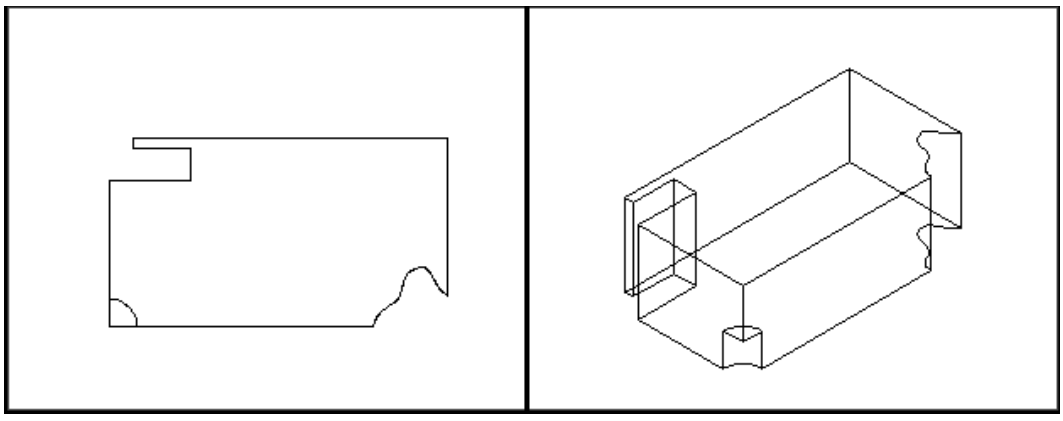
   Select objects: **pick the box**

   Select objects: **(press enter)**

   Select solids and regions to subtract... Select objects: pick the cylinder Select objects: enter



Objects Subtracted from Box



14.3 Intersect

1. Choose **Modify, Solids Editing, Intersect**

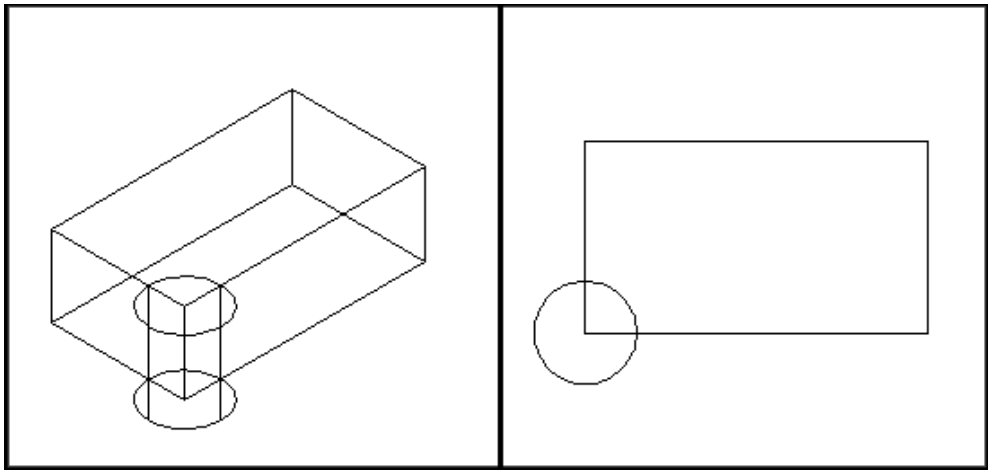
or

2. Type INTERSECT at the command prompt.

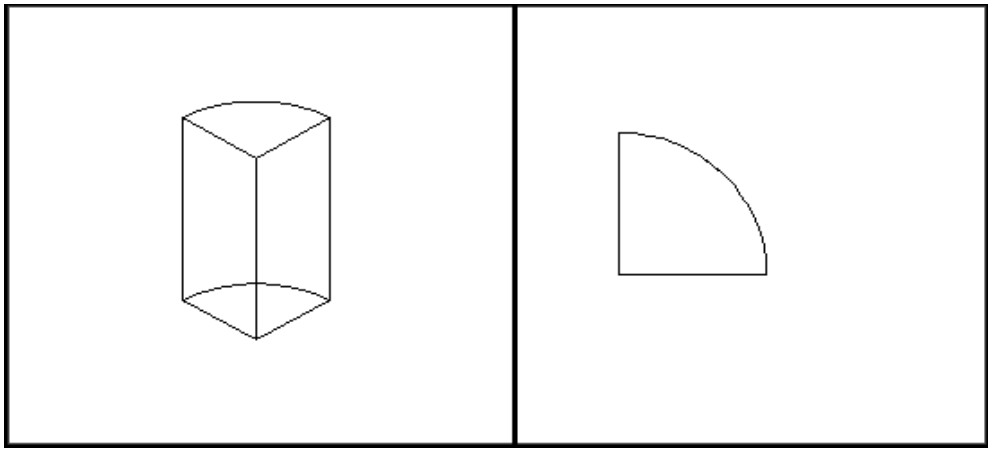
Command: **intersect**

Select objects: **pick objects**

Select objects: **enter**



Intersection of Cylinder and Box



14.4 Thicken

Creates a 3D solid by thickening a surface.

1. Open a drawing with 3D surface and display in a 3D view.
2. Choose **Modify, 3D Operation, Thicken**.

or

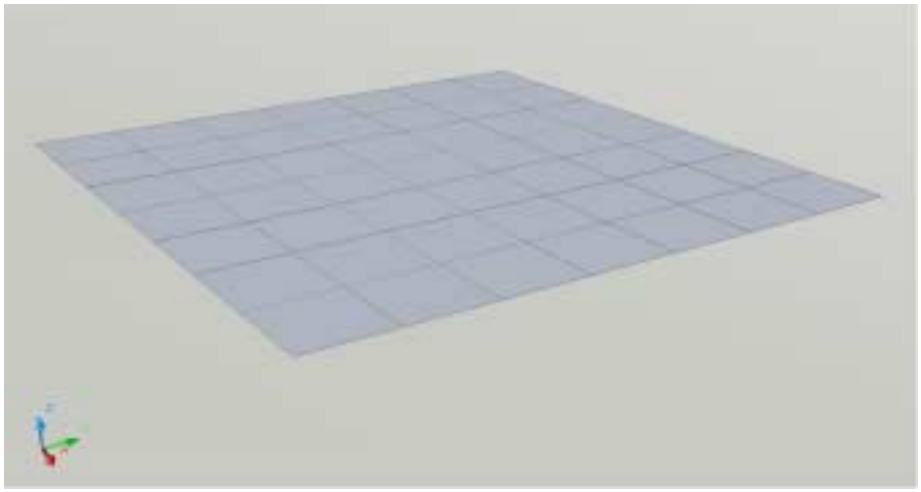
3. Type THICKEN at the command prompt.

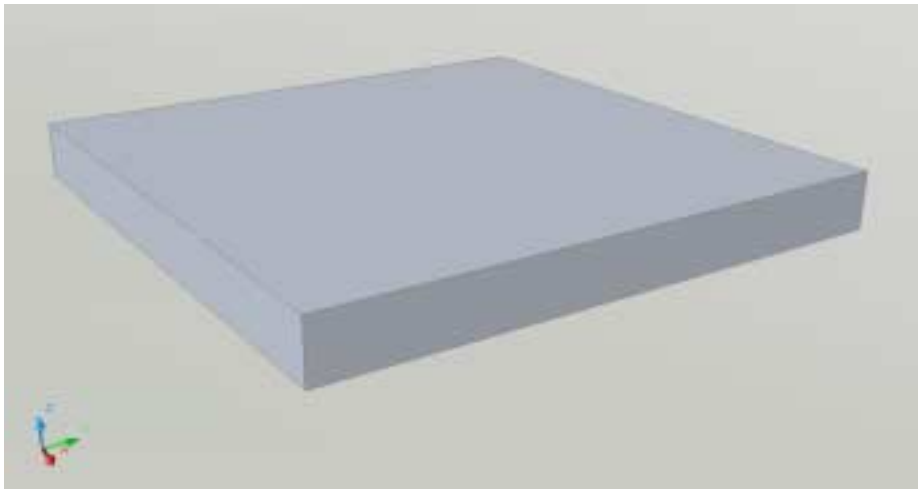
Command: t**hicken**

Select surfaces to thicken: 1 found

Select surfaces to thicken:

Specify thickness <0.0000>: **1**





14.5 Interference Checking

Highlights 3D solids that overlap.

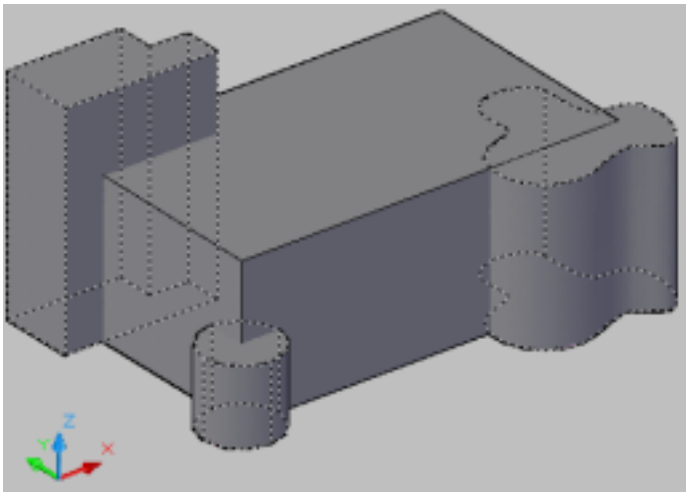
1. Open a drawing with 3D objects that overlap and display in a 3D view.
2. Choose **Modify, 3D Operations, Interference Checking**.

   or

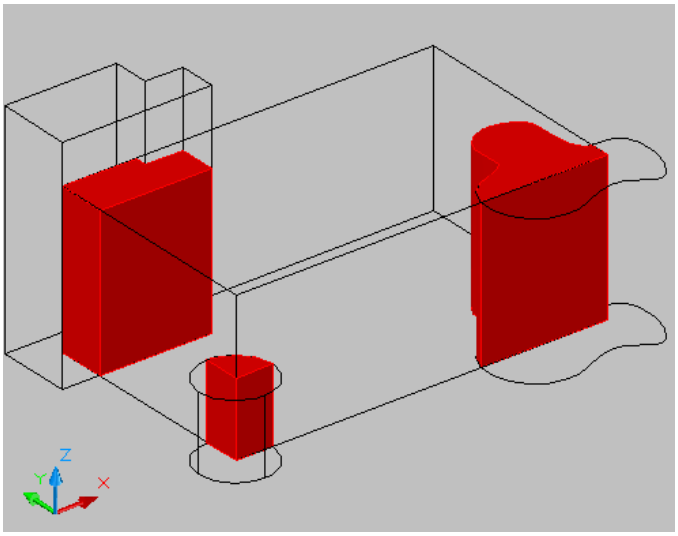
3. Type INTERFERE at the command prompt.

   Command: **interfere**

   Select first set of objects or [Nested selection/Settings]: **pick objects and press enter**.

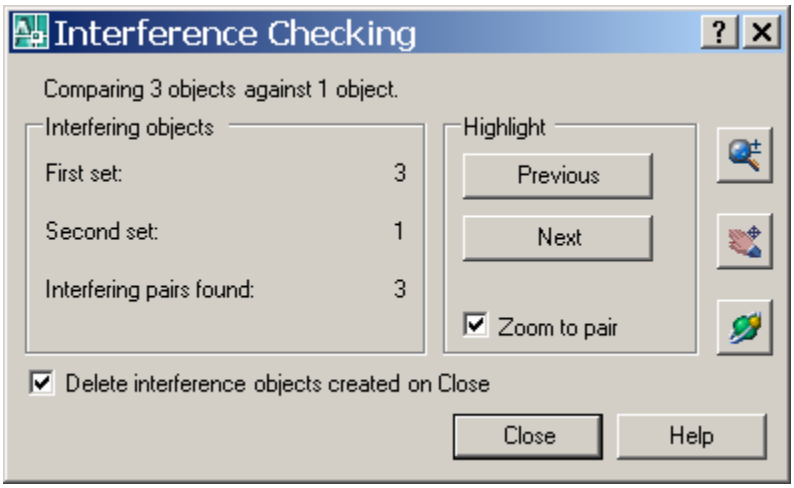


   Select second set of objects or [Nested selection/checK first set] <checK>: **pick rectangle and press enter**



The following dialog box allows you to change the zoom and display of the drawing to better see the interfering objects.

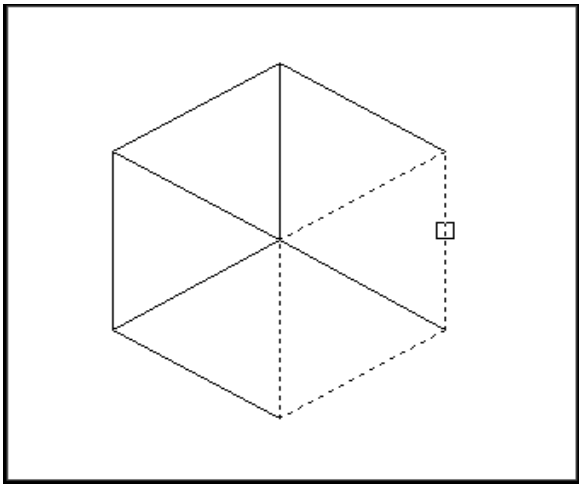
You can also choose to retain the interference objects by turning the check box off for “Delete interference objects created on Close”



AutoCAD 3D – Chapter 15
Modifying Solid Faces

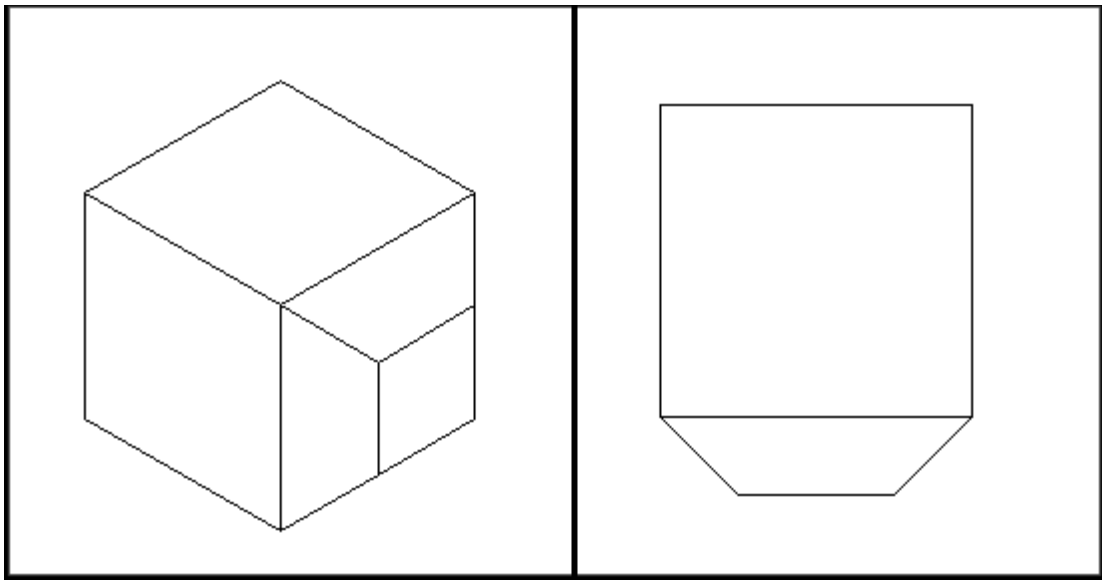
15.1 Extrude Face

1. Choose **Modify, Solid Editing, Extrude face**.
   NOTE: Must be a solid to extrude the face.
2. Choose a face to extrude. If you choose more than one face, hold the SHIFT key to deselect unwanted faces.
3. **Press ENTER**.
4. Specify height of extrusion or [Path]: .**25**
5. Specify angle of taper for extrusion <0>: **45**



Select Face

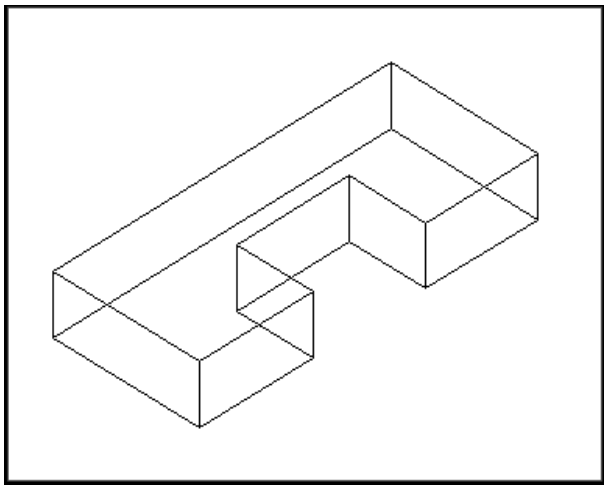
Extruded Face



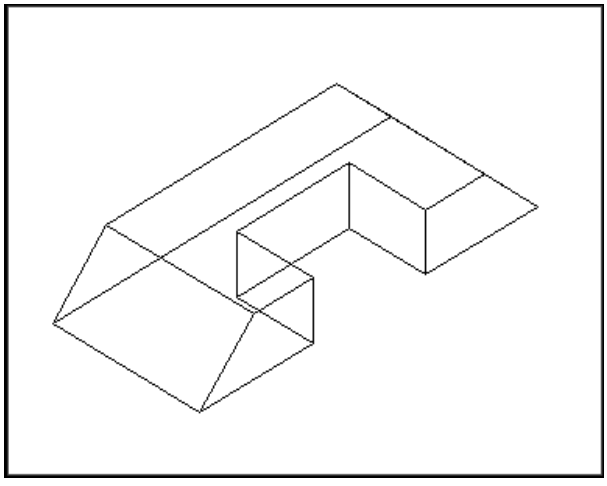
15.2 Taper Face

1. Choose **Modify, Solid Editing, Taper face.**
2. Choose a face(s) to taper. If you choose more than one face, hold the SHIFT key to deselect unwanted faces.
3. **Press ENTER.**
4. Specify the base point: **pick the back left corner**
5. Specify another point along the axis of tapering: **pick point**
6. Specify the taper angle: **45**
   Solid validation started. Solid validation completed.

Before Taper

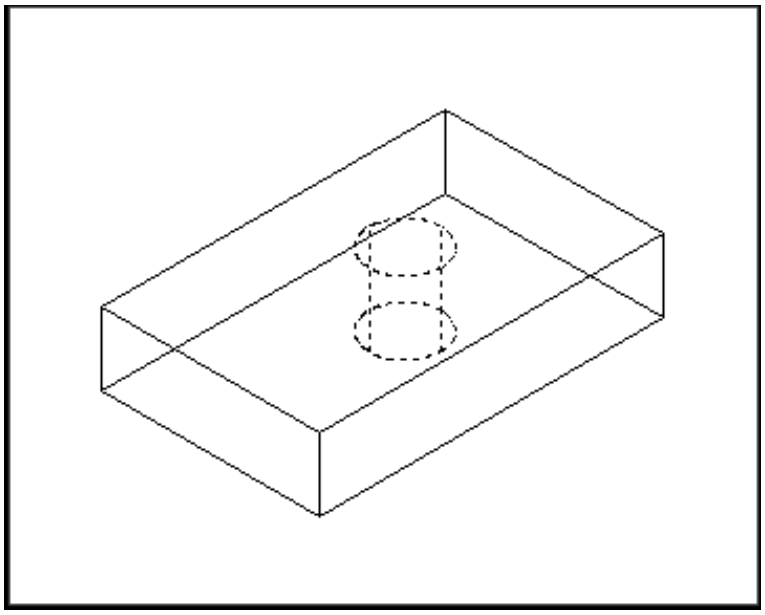


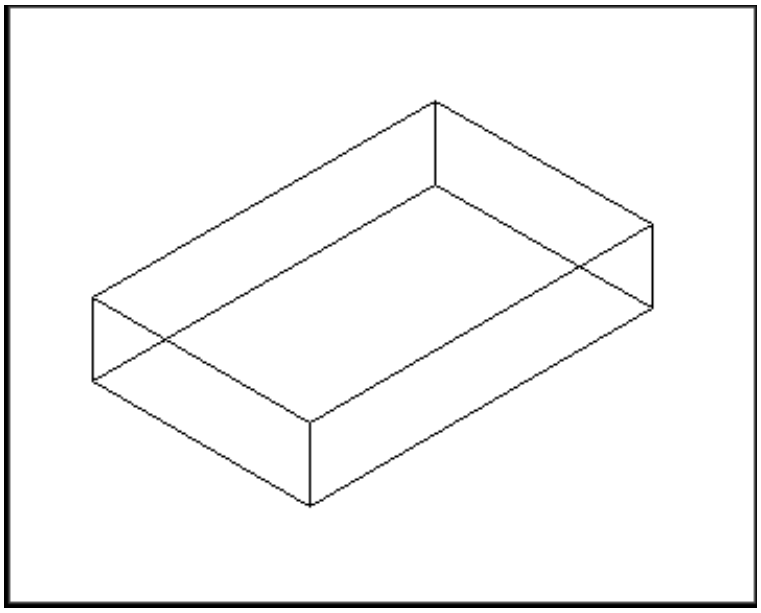
After Taper



15.3 Delete Face

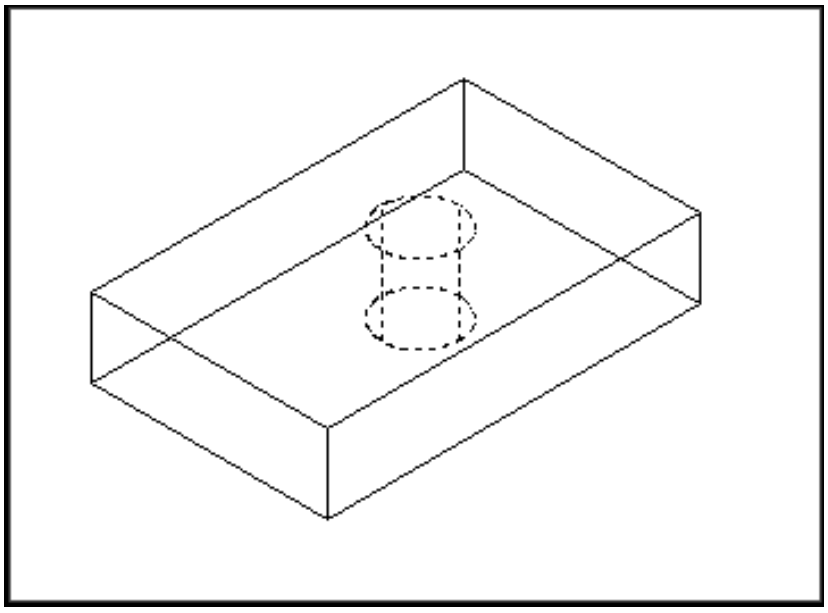
1. Choose **Modify, Solid Editing, Delete face**.
2. Choose a face to delete. If you choose more than one face, hold the SHIFT key to deselect unwanted faces.
3. **Press ENTER**.
4. Choose the face to delete.

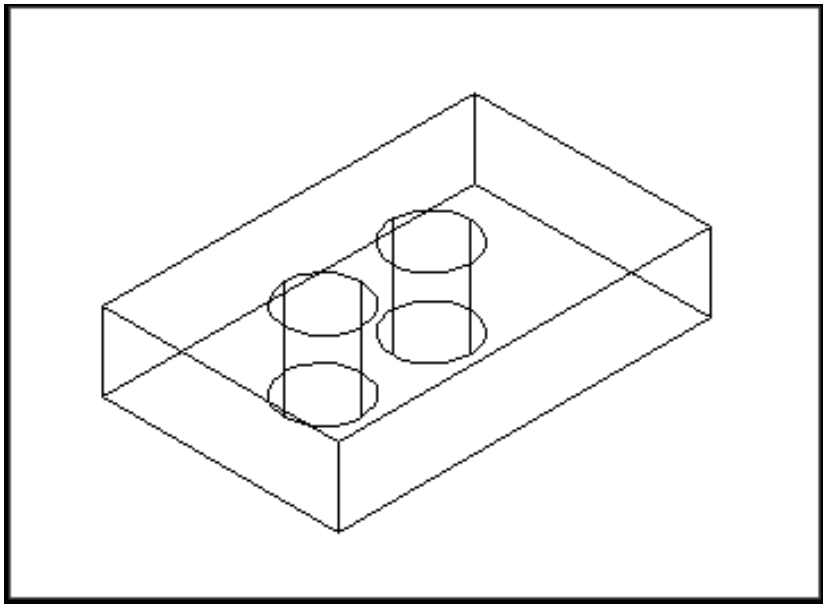




15.4 Copy Face

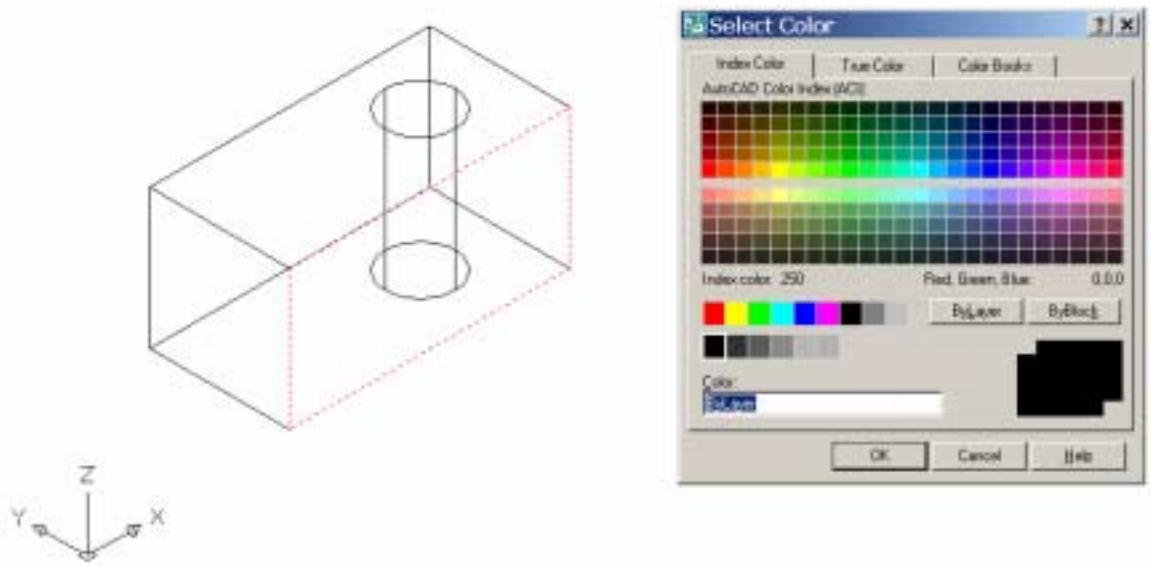
1. Choose **Modify, Solid Editing, Copy face**.
2. Choose a face to copy . If you choose more than one face, hold the SHIFT key to deselect unwanted faces.
3. **Press ENTER**.
4. Pick the solid face to copy.
5. Pick a new location.





15.5 Color Face

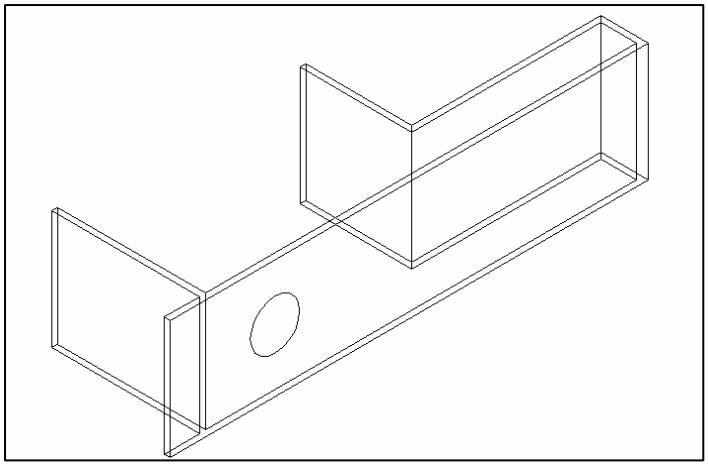
1. Choose **Modify, Solid Editing, Color face**.
2. Choose a face to change the color of. If you choose more than one face, hold the SHIFT key to deselect unwanted faces.
3. **Press ENTER**.
4. Choose a color to change the face to.

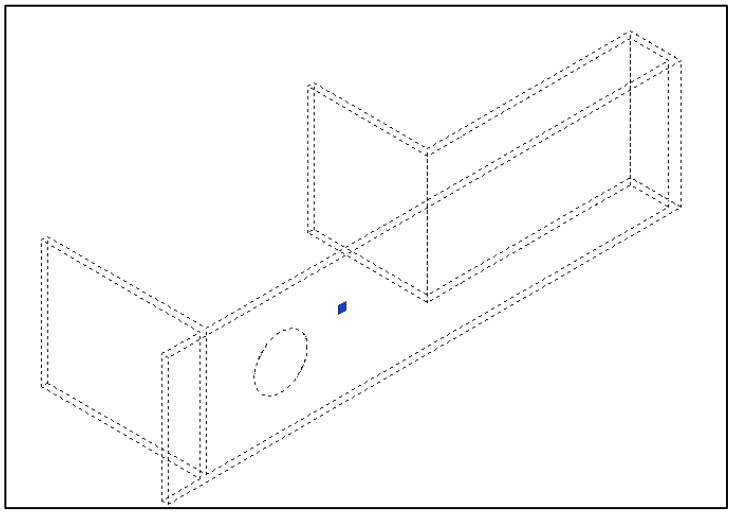


15.6 Imprint

Imprints an object on the selected solid. The object to be imprinted must intersect one or more faces on the selected solid in order for imprinting to be successful. Imprinting is limited to the following objects: arcs, circles, lines, 2D and 3D polylines, ellipses, splines, regions, bodies, and 3D solids

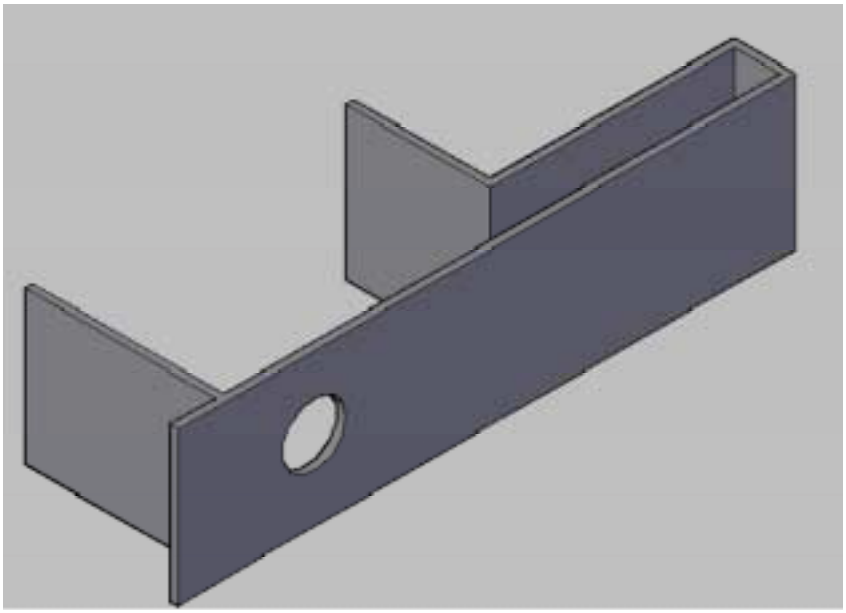
1. Extrude objects (i.e. walls) to create a solid object.
2. Change the UCS and draw an object on a face of one of the walls.
3. Choose **Modify, Solid Editing, Imprint**.
4. Select a 3D solid: **pick solid**
5. Select an object to imprint: **pick circle**
6. Delete the source object <N>: **Y**





15.7 Extrude Imprint

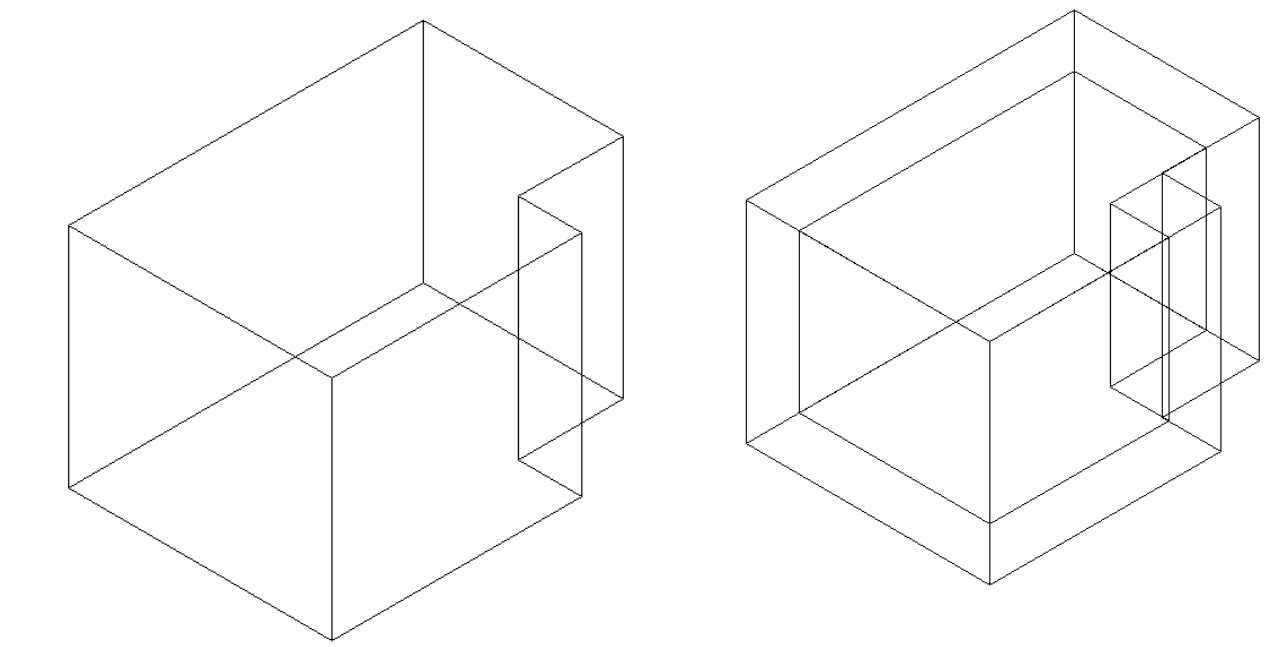
1. Choose **Modify, Solid Editing, Extrude Faces**.
2. Select the circle that was imprinted in 15.6.
3. Deselect any unwanted faces.
4. **Type -8** as the height of extrusion (or desired height).



15.9 Shell

You can create a shell or a hollow thin wall with a specified thickness from your 3D solid object. AutoCAD creates new faces by offsetting existing ones inside or outside their original positions. AutoCAD treats continuously tangent faces as single faces when offsetting.

1. Choose **Modify, Solid Editing, Shell**.
2. Select a 3D solid: **pick solid**
   Remove faces or [Undo/Add/ALL]: **enter**
   Enter the shell offset distance: **.5**

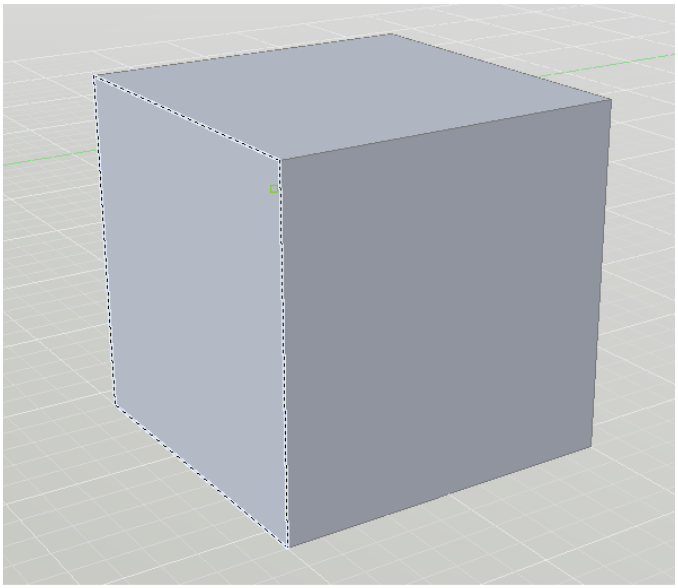


AutoCAD 3D – Chapter 16
Editing Solids

16.1 Select and Manipulate Subobjects

You can select one subobject, or create a selection set of more than one subobject on any number of solids. Your selection set can also include more than one type of subobject.

1. Open a drawing with 3D solid object and display in a 3D view.
2. Hold the CTRL key and select the solid.
3. While holding CTRL, toggle to other subobjects within the solid.
4. Once selected, click and drag to modify the solid.



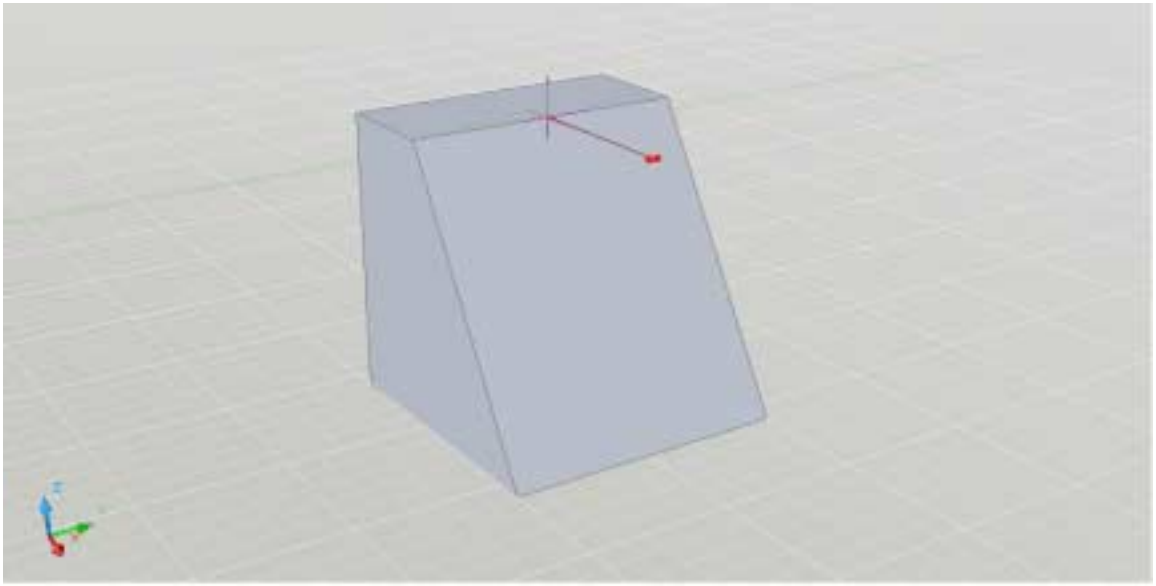
16.2 Use Grip Tools

Grip tools are icons that you use in a 3D view to easily constrain the movement or rotation of a selection set of objects to an axis or a plane.

There are two types of grip tools:

- Move (3DMOVE command)
- Rotate (3DROTATE command

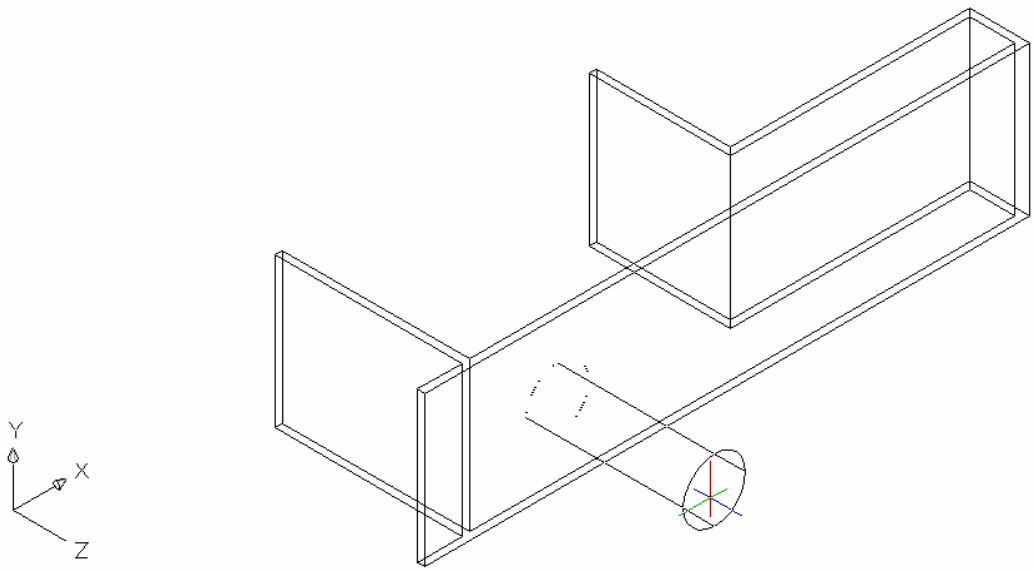
1. Open a drawing with 3D solid object and display in a 3D view.
2. Hold the CTRL key and select the solid.
3. While holding CTRL, toggle to other subobjects within the solid.
4. Once selected, click and drag to modify the solid using the grip tool.



16.3 Press or Pull Bounded Areas

You can press or pull bounded areas by pressing and holding CTRL + ALT, or by clicking the Presspull button on the dashboard and then picking the bounded area. The area must be bounded by coplanar lines or edges.

1. Open a drawing with a 3D object and imprinted object and display in a 3D view.
2. Hold the **CTRL** and **ALT** keys and select the imprinted object or solid face to manipulate it.
3. Click and drag to a new location.



AutoCAD 3D – Chapter 17
Sections from 3D Models

17.1 Sectionplane Command

The SECTIONPLANE command creates a section object that exposes the interior details of a model created with 3D objects.

Once you create a section object, you can move and manipulate it to fine-tune the sectional view you want.

1. Open a drawing with 3D solid objects and display in a plan and 3D view.
2. Choose **Draw, Modeling, Sectionplane**.

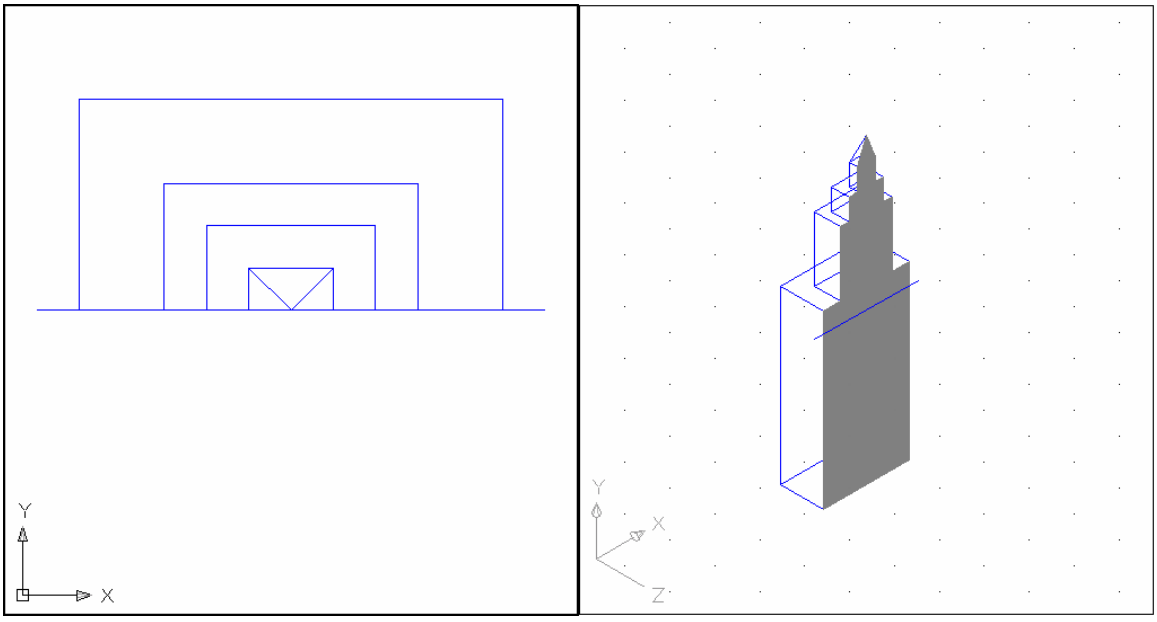
   or

3. Type SECTIONPLANE at the command prompt.

   Command: **sectionplane**

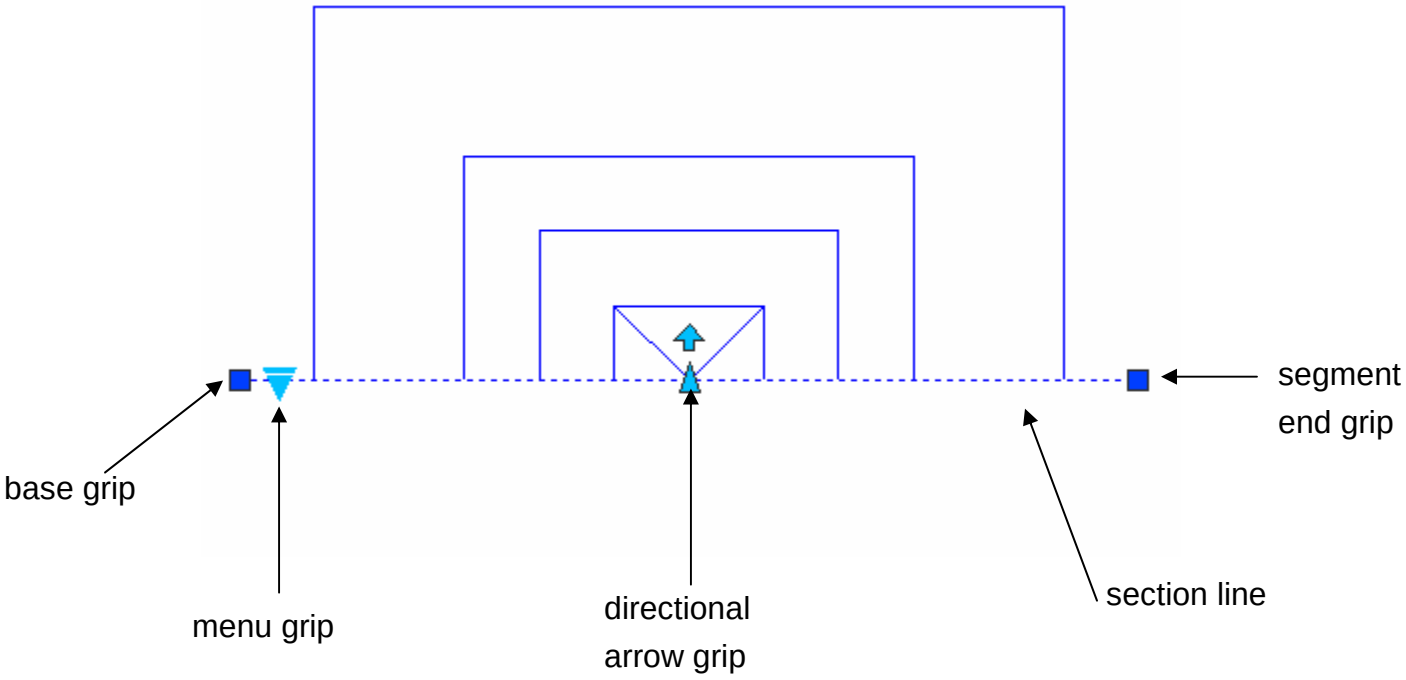
   Select face or any point to locate section line or [Draw section/Orthographic]: **O**

   Align section to: [Front/bAck/Top/Bottom/Left/Right] <Front>: **enter**



17.2 Manipulate Section Using Grips

1. Click on a section line created using the SECTIONPLANE command.
2. Click on one of the grips to manipulate the section.



Base grip - moves the entire section object

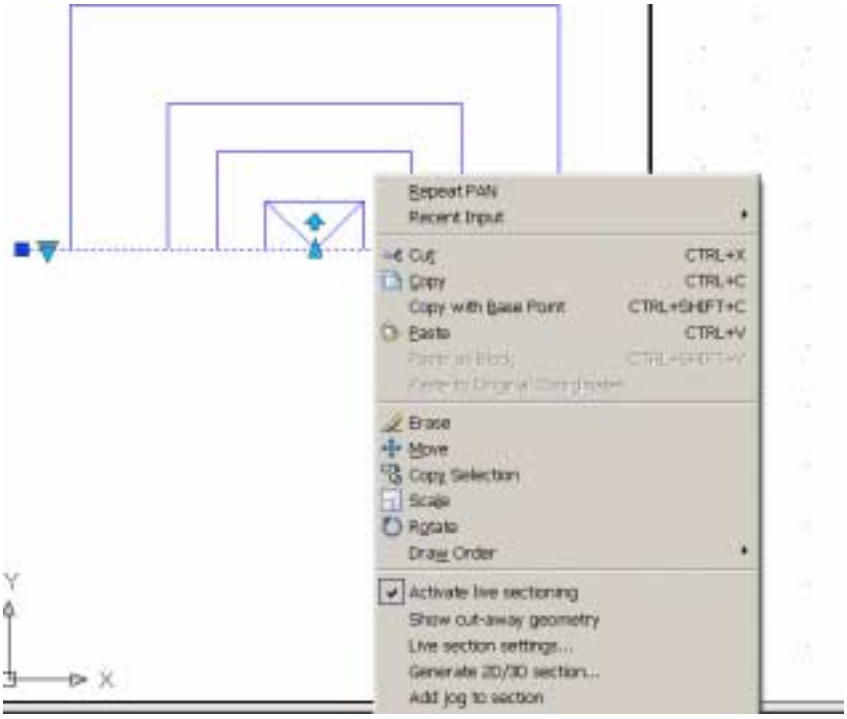
Directional arrow grip – changes the cutting plane direction

Segment end grip - rotates the section object around the base grip

Menu grip - moves between the three states

17.3 Section Shortcut Commands

1. Right-click on a section line to see the following section options.

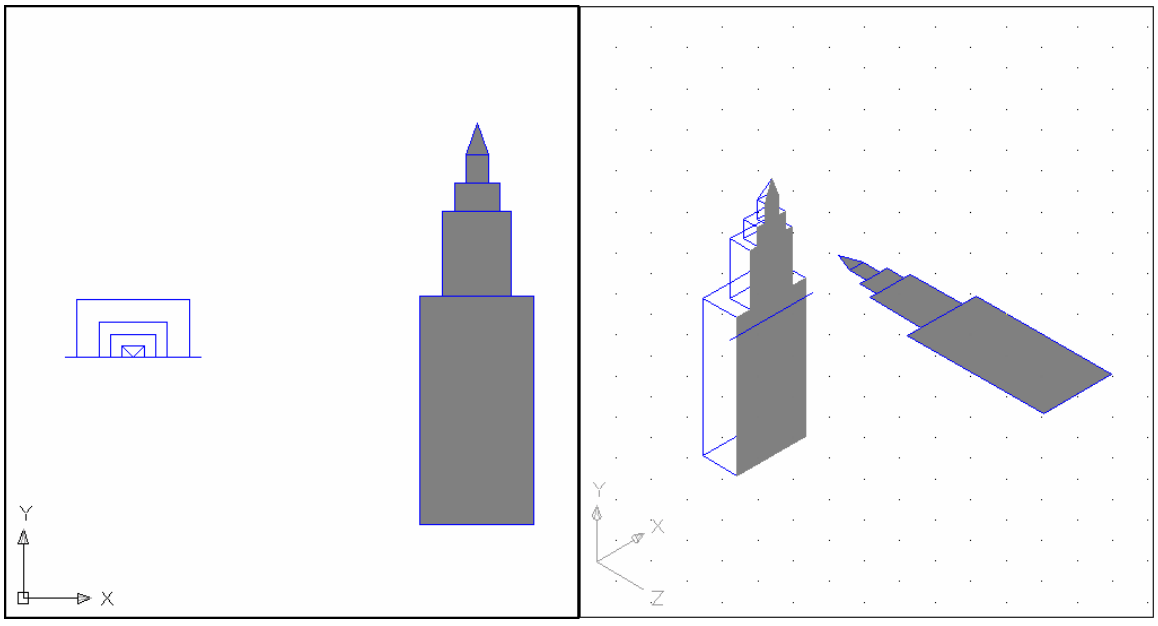


2. Click the various section options.

17.4 Generate 2D and 3D Sections

1. **Right-click** on a section line.
2. Click **Generate 2D/3D section…**
3. From the following dialog box, click the down arrow to see all of the section options.

4. Choose **2D Section** and **Create**.
5. Click an insertion point and scale for the 2D section block.



17.5 Section Command

Uses the intersection of a plane and solids to create a region

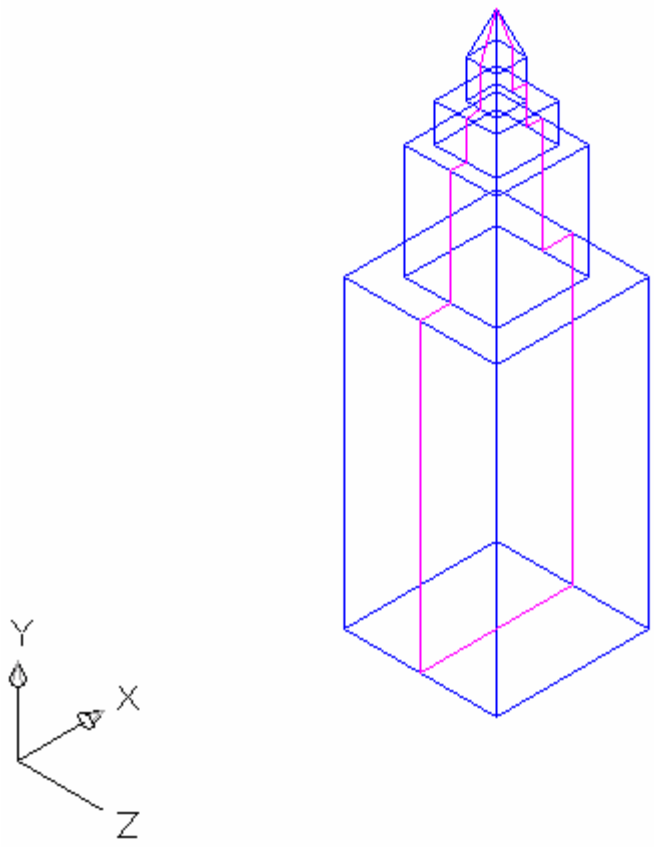
1. Open a drawing with 3D objects and display in a 3D view.
2. Type SECTION at the command prompt.

Command: **section**

Select objects: **pick solid and press enter**

Specify first point on Section plane by
[Object/Zaxis/View/XY/YZ/ZX/3points] <3points>: **XY**

Specify a point on the XY-plane <0,0,0>: **MID of**



17.6 Slice Command

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **Modify, 3D Operation, Slice**.

   or

3. Type SLICE at the command prompt.

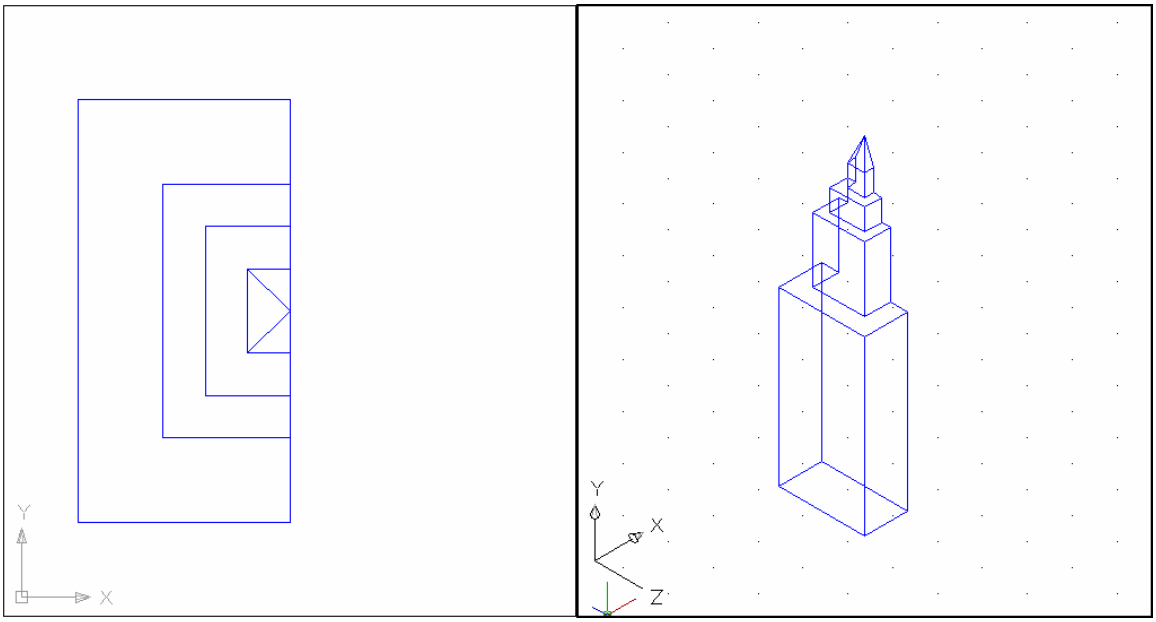
   Command: **slice**

   Select objects to slice: 1 found

   Specify start point of slicing plane or [planar Object/Surface/Zaxis/View/XY/YZ/ZX/3points] <3points>: **YZ**

   Specify a point on the YZ-plane <0,0,0>: **MID of**

   Specify a point on desired side or [keep Both sides] <Both>:



17.7 Solview

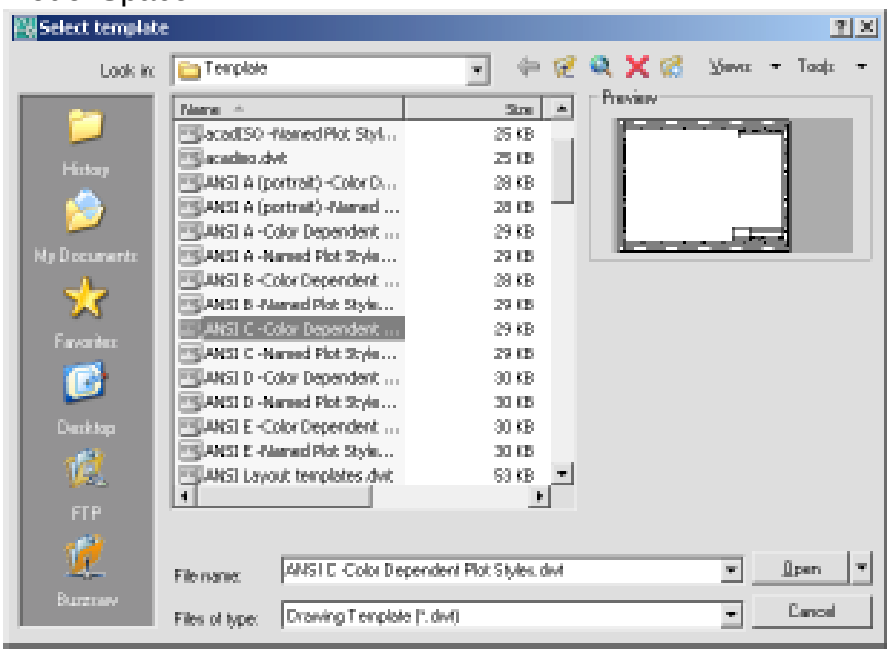
1. Choose File, New...

2. Choose “Use a Template” from the startup dialog.

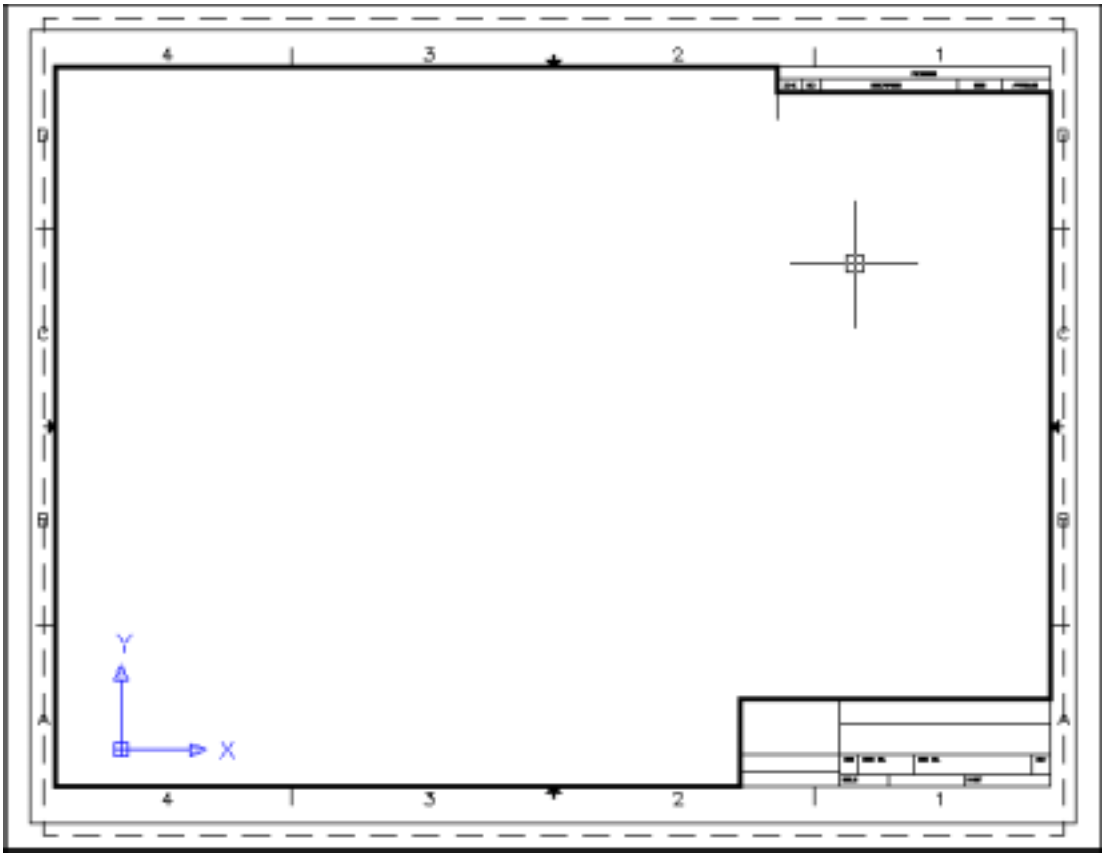
3. Double-click Ansi_c.dwt as the template file to start from. This creates a new drawing with a border and one floating Model Space.

4. Double-click MODEL from the Status Bar and note the change to Paper Space.

5. Double-click PAPER from the Status Bar to toggle back to Model Space.



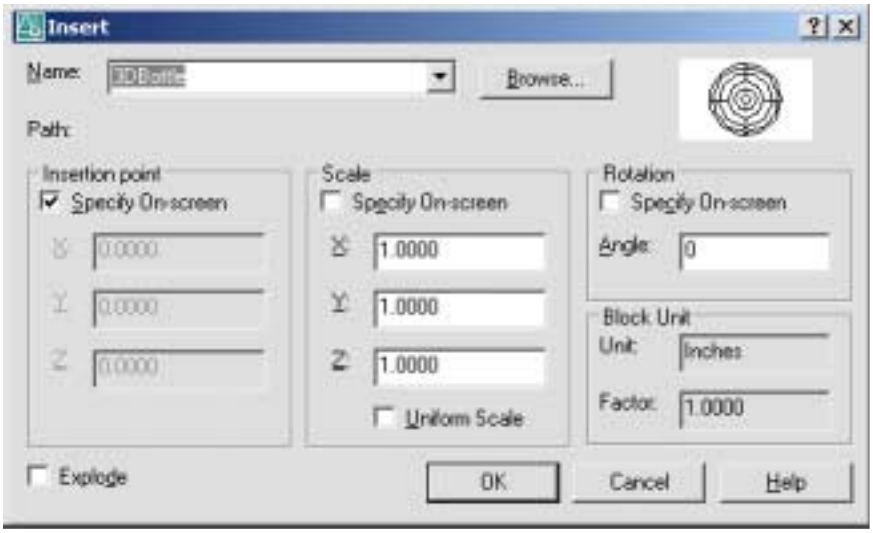
Drawing with a Model Space View



6. Choose Insert, Block...

7. Choose the drawing called 3DBOTTLE.DWG to insert.

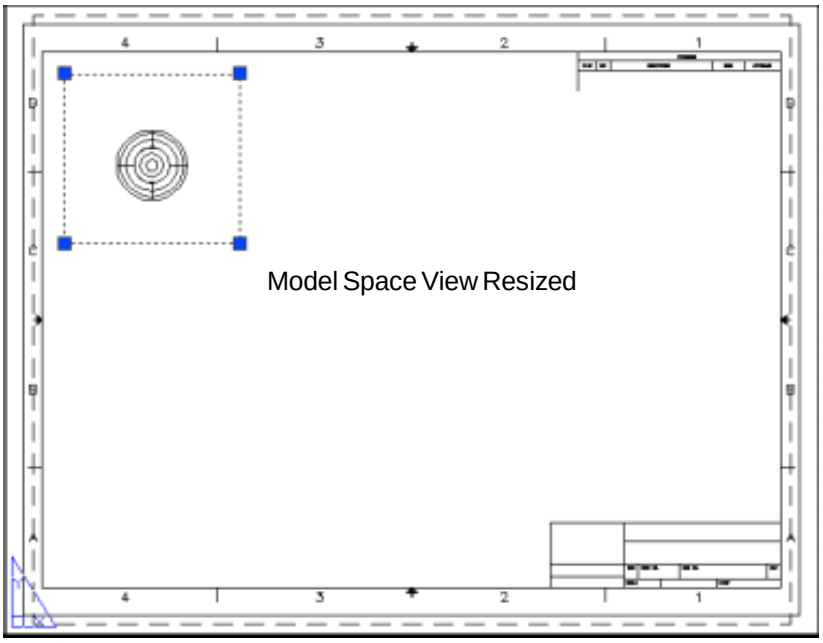
8. Insert the block anywhere in the Model Space view at a scale of 1 and rotation 0.



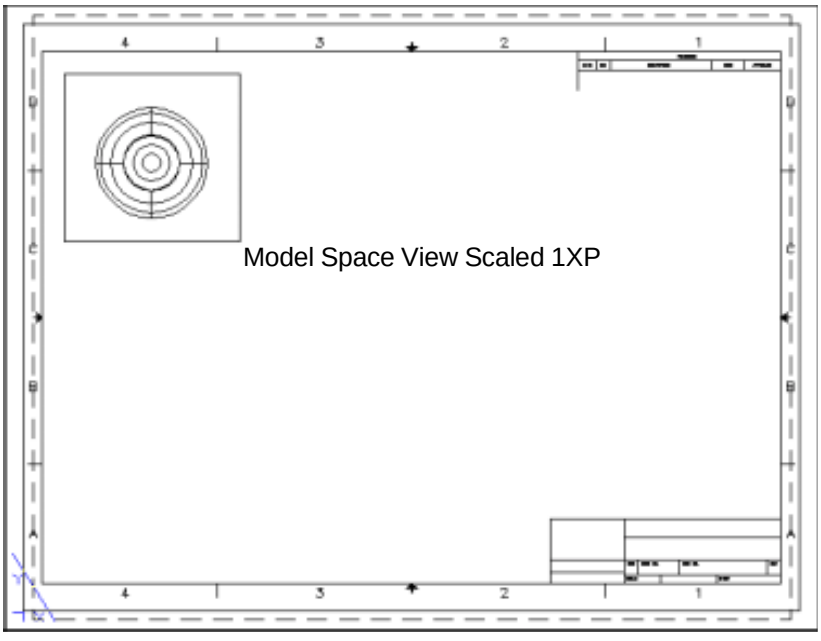
9. Double-click MODEL at the Status Bar and resize the Model Space view port in Paper Space.

10. Double-click PAPER at the Status Bar to return to Model Space.

11. Type ZOOM, 1XP at the command prompt.



Model Space View Resized



Model Space View Scaled 1XP

17.8 Create an Orthogonal View

1. Choose **Draw, Modeling, Setup, View**.

or

2. Type SOLVIEW at the command prompt.

Command: **solview**

Ucs/Ortho/Auxiliary/Section/<eXit>: **O**
Pick side of viewport to project: **P1**

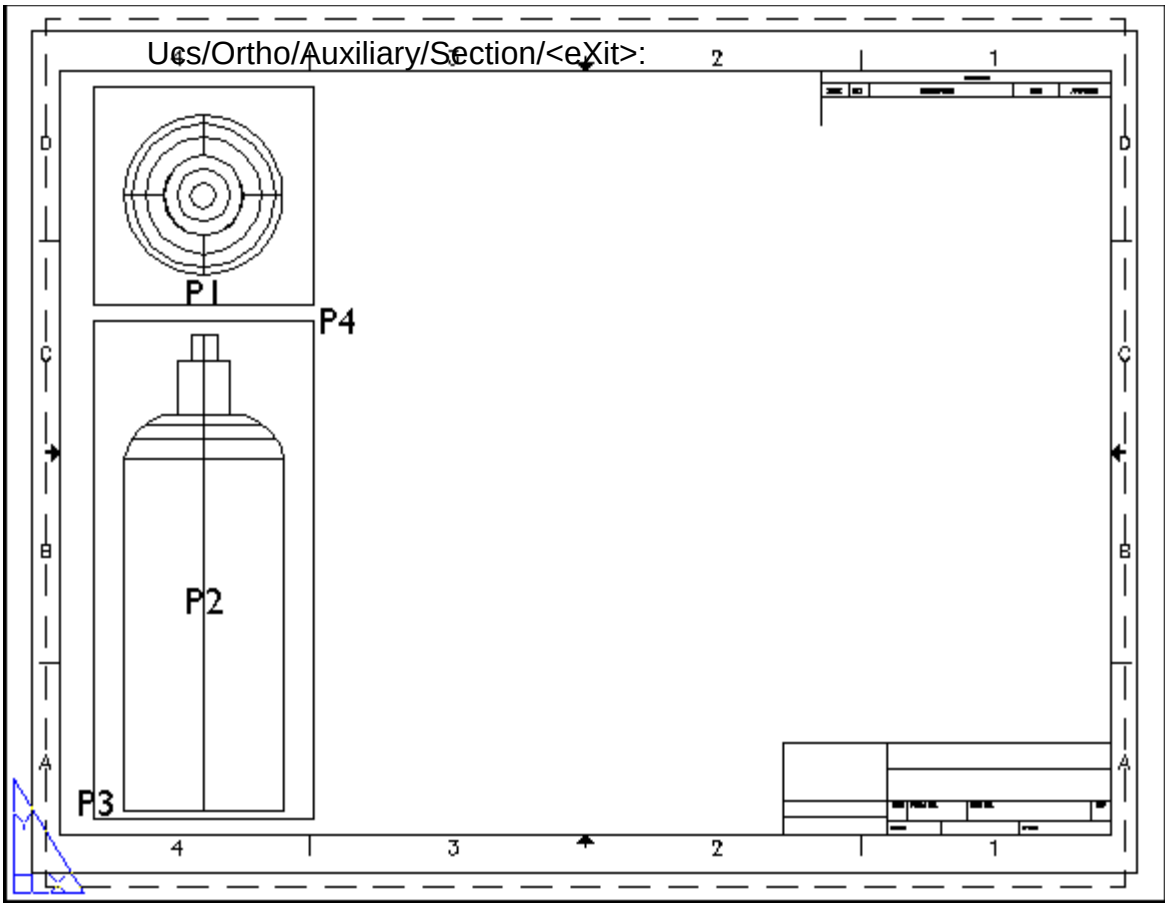
View center: **P2**

Clip first corner: **P3**

Clip other corner: **P4**

View name: **front**

Ucs/Ortho/Auxiliary/Section/<eXit>:



17.9 Soldraw

Generates profiles and sections in viewports created with SOLVIEW. SOLDRAW can only prepare viewports that have been created with SOLVIEW.

1. Choose **Draw, Modeling, Setup, Drawing**.

   or

2. Type SOLDRAW at the command prompt

   Command: **soldraw**

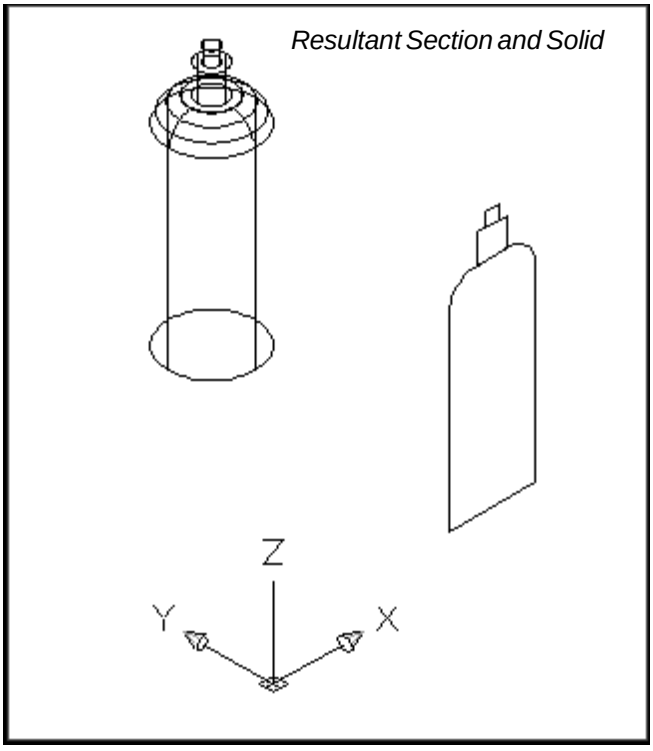
   Select viewports to draw: **P1**

   Select objects: 1 found

   Select objects: **enter**

   3 solids selected.

NOTE: If your object was an inserted block, you need to first explode it so it becomes a solid.



17.10 Create 3D View UCS

1. Click MSPACE and the plan view of the 3D Bottle.

2. Choose **View, 3D Viewport, SW Isometric...**

3. Type UCS at the command prompt.

   Command: **ucs**

   Origin/ZAxis/3point/OBject/View/X/Y/Z/
   Prev/Restore/Save/Del/?/<World>: **view**

   This sets the current UCS parallel to the screen. We now need to save this ucs.

4. Type UCS at the command prompt.

   Command: ucscs Origin/ZAxis/3point/OBject/View/X/Y/Z/
   Prev/Restore/Save/Del/?/<World>: **save**

   ?/Desired UCS name: **3dview**

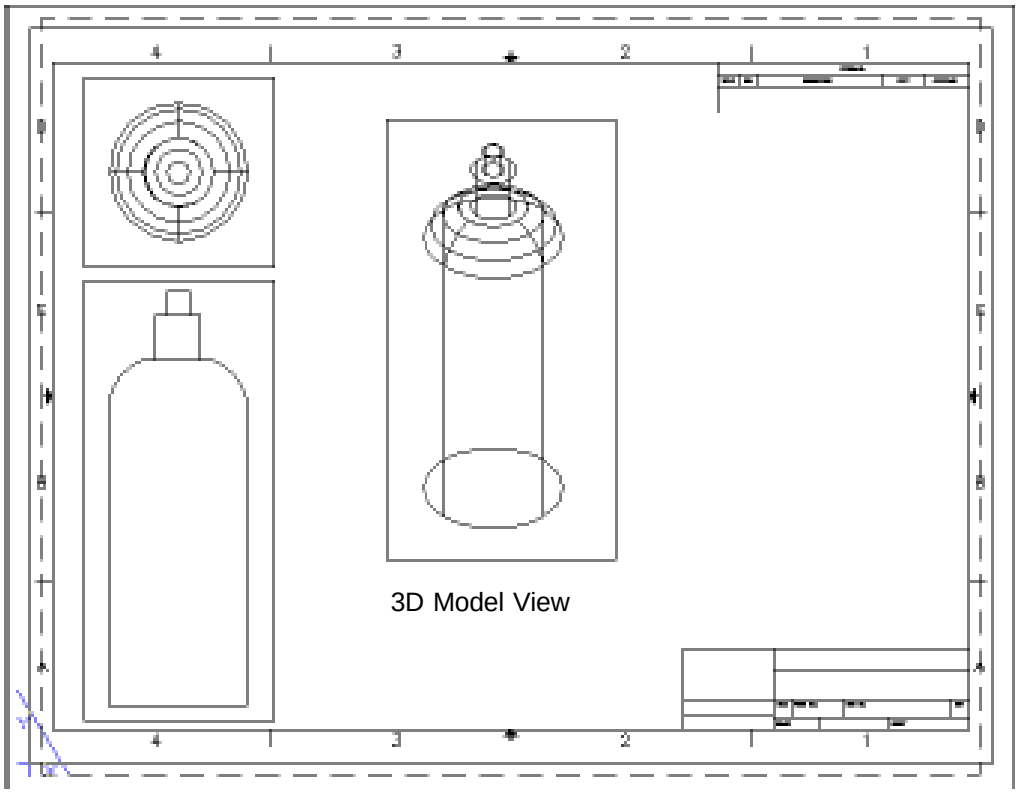
5. Click PSPACE at the command prompt.

6. Choose **Draw, Solids, Setup, View**

   Command: solview Ucs/Ortho/Auxiliary/Section/<eXit>: **u**
   Named/World/?/<Current>: **n**

   Name of UCS to restore: 3dview Enter view scale<1.0000>:
   enter View center: **pick**

   View center: **pick**


3D Model View

17.11 Solprof

1. Double-click MODEL to return to Model Space.
2. Choose **Draw, Modeling, Setup, Profile**.

   or

3. Type SOLPROF at the command prompt.

   Command: **solprof**
   Select objects: **pick solids**
   Select objects: **enter**
   Display hidden profile lines on separate layer? <Y>: **enter**
   Project profile lines onto a plane? <Y>: **enter**
   Delete tangential edges? <Y>: **enter**
   3 solids selected.

AutoCAD 3D – Chapter 18
Introduction to Rendering

18.1 Render Command

Creates a photorealistic or realistically shaded image of a three-dimensional wireframe or solid model.

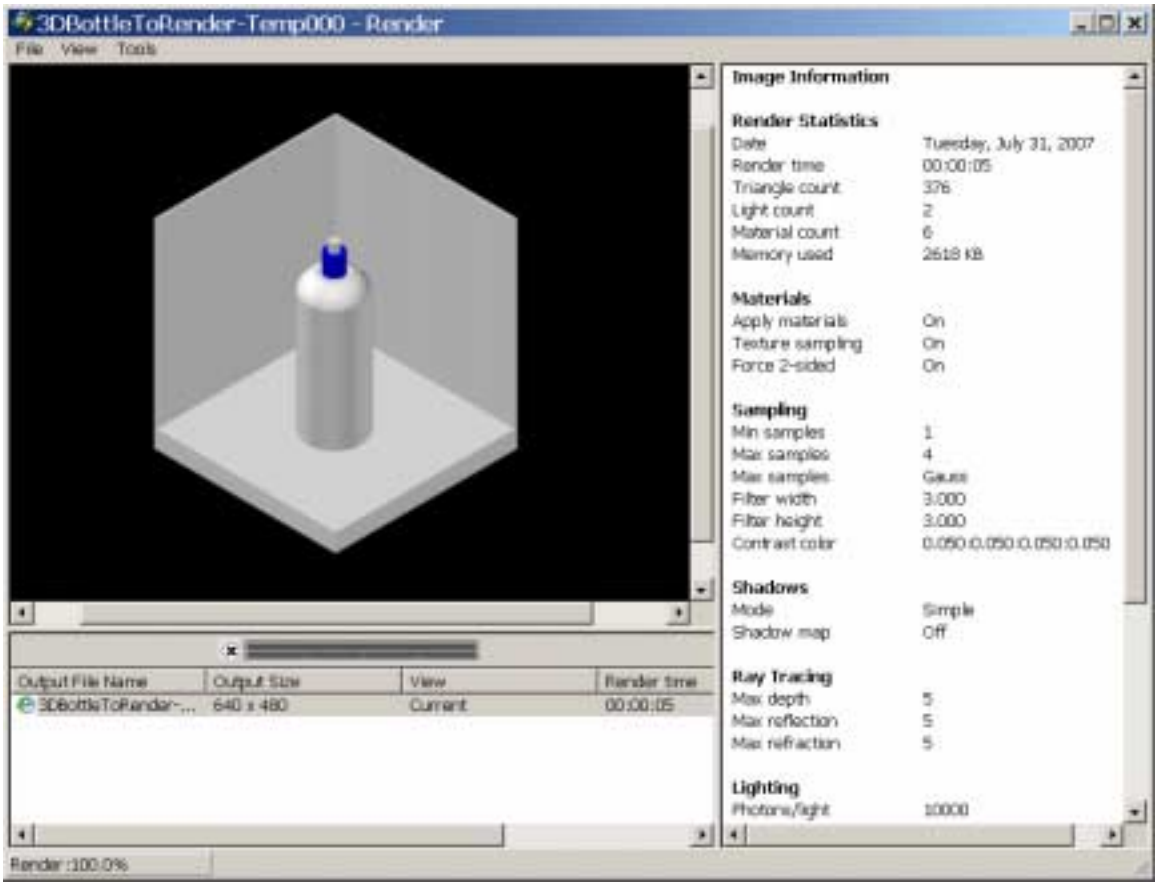
1. Open an AutoCAD drawing with 3D objects to render.
2. Choose **View, Render, Render...**

   or

3. Type RENDER at the command prompt.

   Command: **render**

The following render window is the result of default rendering



18.2 Render Destination

You are able to determine the output site that the renderer uses to display the rendered image. Two options are the render window and viewport.

1. Open an AutoCAD drawing with 3D objects to render.

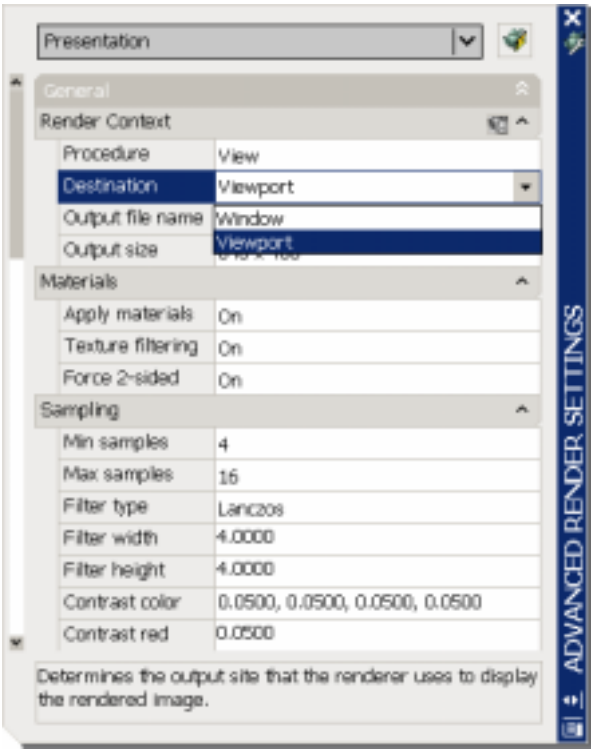
2. Choose **View, Render, Advanced Render Settings...**

   or

3. Type RPREF at the command prompt.

   Command: **rpref**

4. Click the dropdown option for destination and choose **Viewport**.



5. Close the render preferences and render your objects to the viewport.

18.3 Render Quality

1. Open an AutoCAD drawing **with 3D objects to render**.

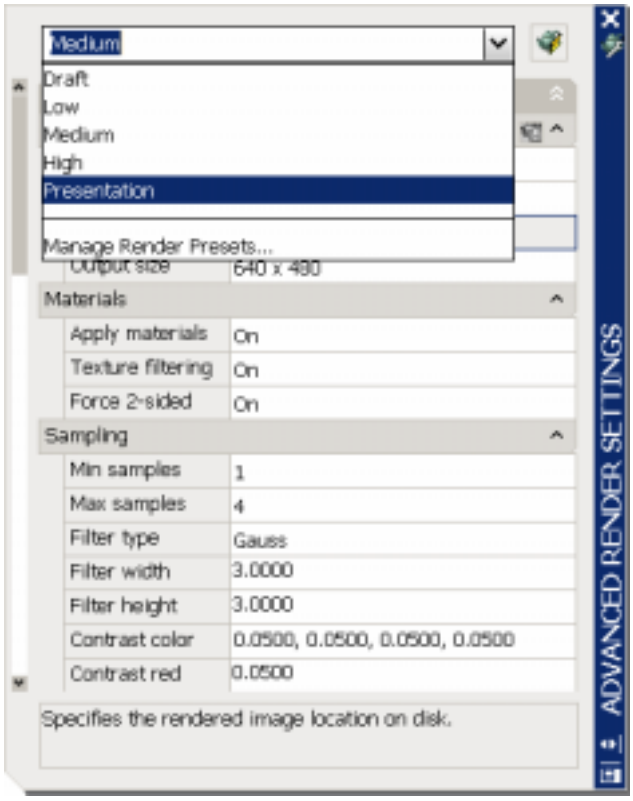
2. Choose **View, Render, Advanced Render Settings...**

   or

3. Type RPREF at the command prompt.

   Command: **rpref**

4. Click the dropdown option for the render quality and choose **Presentation.**



5. Close the render preferences and render your view.

   Note: Depending on the objects, lights, materials, etc. in your model, rendering in presentation mode might take a long time.

18.4 Render Selection

Controls the parts of the model that gets processed during rendering. The render procedure has three settings: View, Crop, and Selected.

1. Open an AutoCAD drawing **with 3D objects to render**.

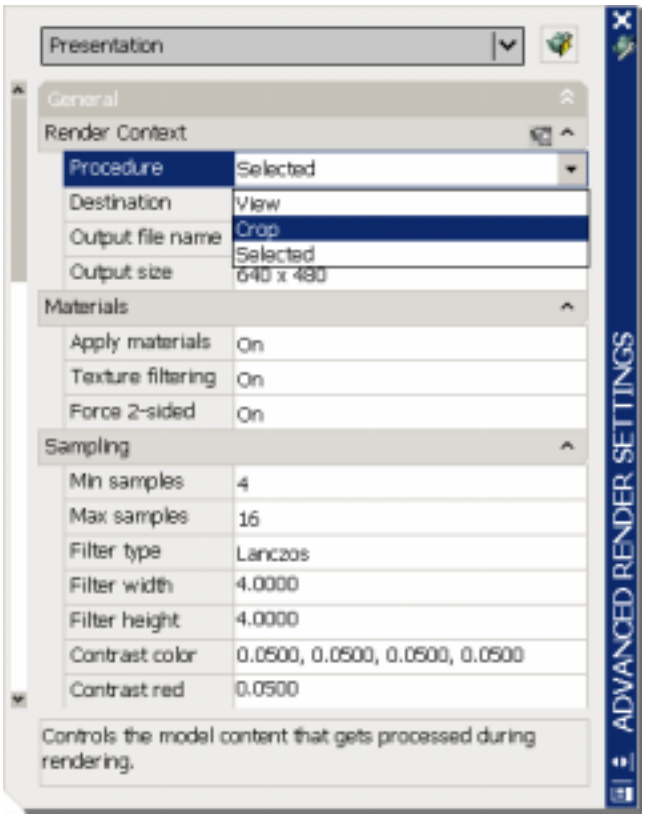
2. Choose **View, Render, Advanced Render Settings...**

   or

3. Type RPREF at the command prompt.

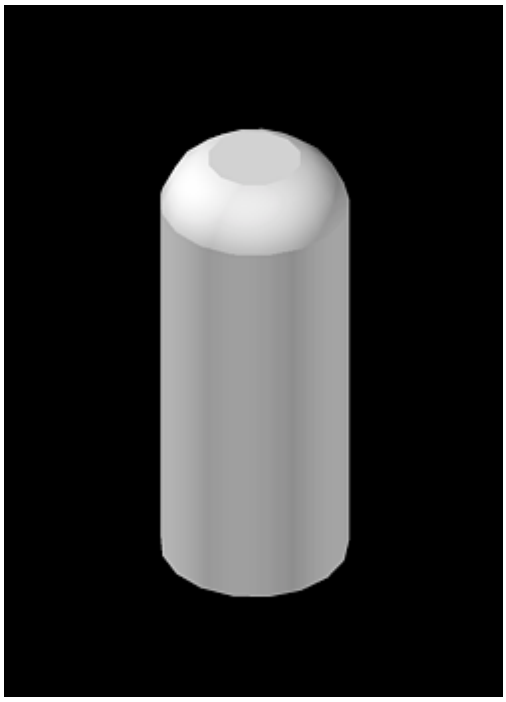
   Command: **rpref**

4. Click the dropdown option for Procedure and choose **Selected.**



5. Close the render preferences and render your selected objects.

This result is a selected object in the drawing that is rendered.



18.5 Render Cropped Window

1. Open an AutoCAD drawing **with 3D objects to render**.

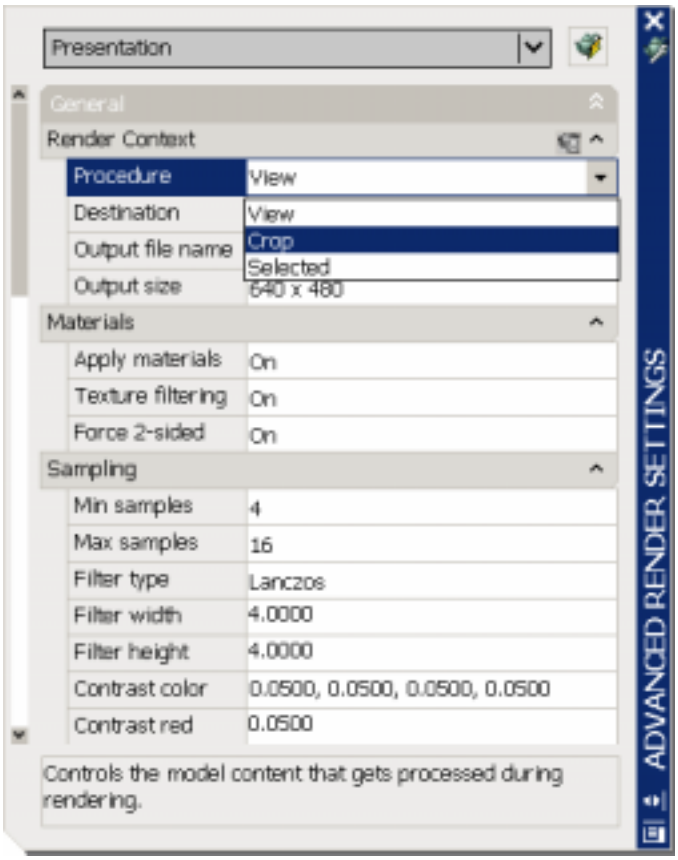
2. Choose **View, Render, Advanced Render Settings...**

   or

3. Type RPREF at the command prompt.

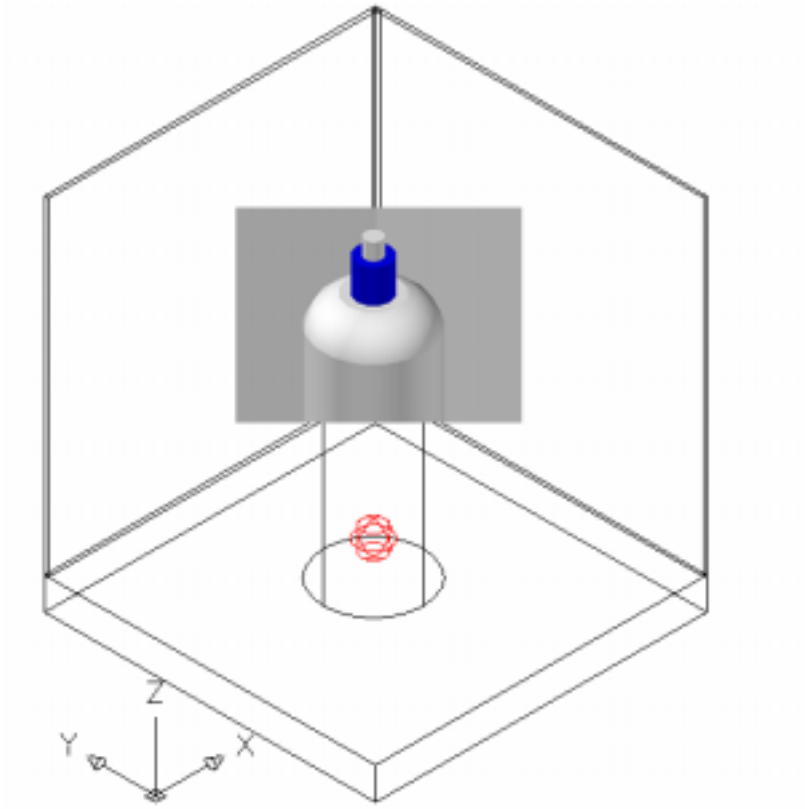
   Command: **rpref**

4. Click the dropdown option for Procedure and choose **Crop.**



5. Close the render preferences and render your objects.

The result is a cropped portion of the drawing that is rendered.



18.6 Render to File

1. Open an AutoCAD drawing **with 3D objects to render**.

2. Choose **View, Render, Advanced Render Settings...**

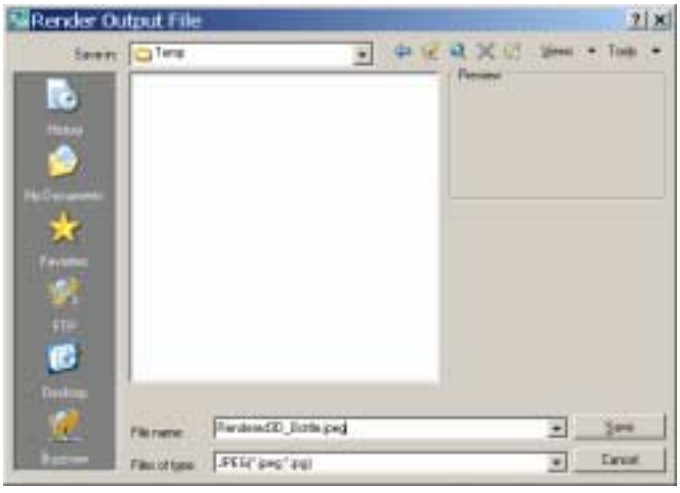
   or

3. Type RPREF at the command prompt.

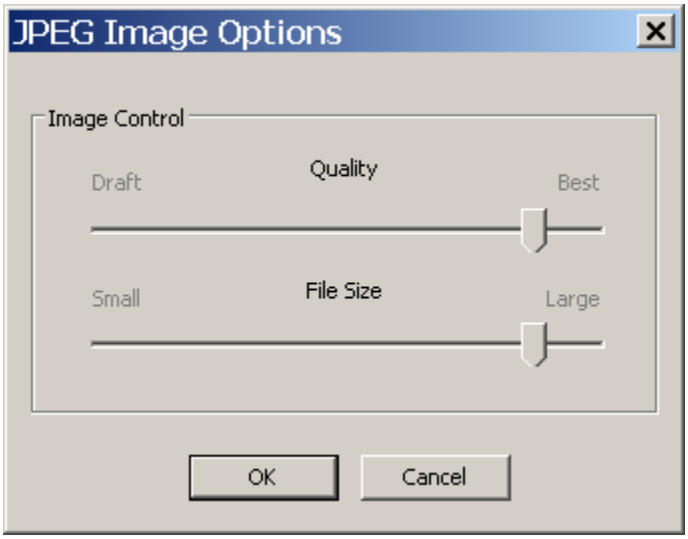
   Command: **rpref**

4. Click the option for Output file name**.**

5. Choose a location, format, and file name for your rendered objects.

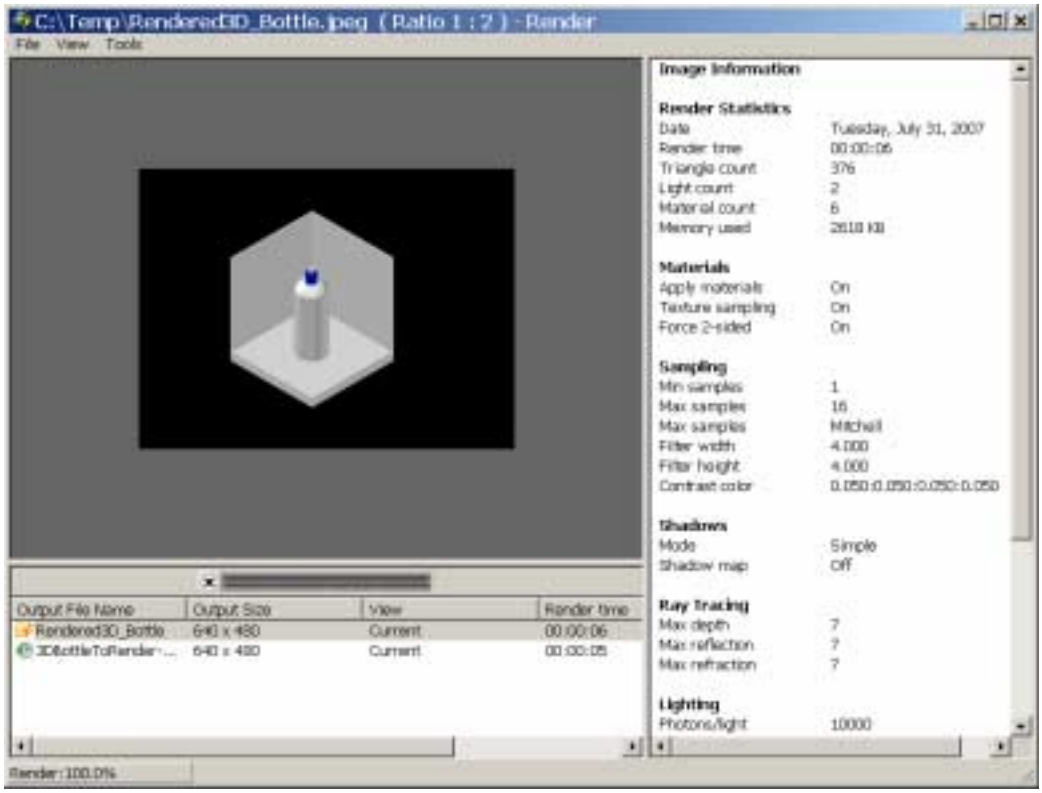


6. Adjust the image quality and click OK.



7. Close the render preferences and render your objects.

The result is a rendered image to a file that you can copy , print, or manipulate in any imaging software application.



18.7 Turn Off Render to File

1. Open an AutoCAD drawing **with 3D objects to render**.

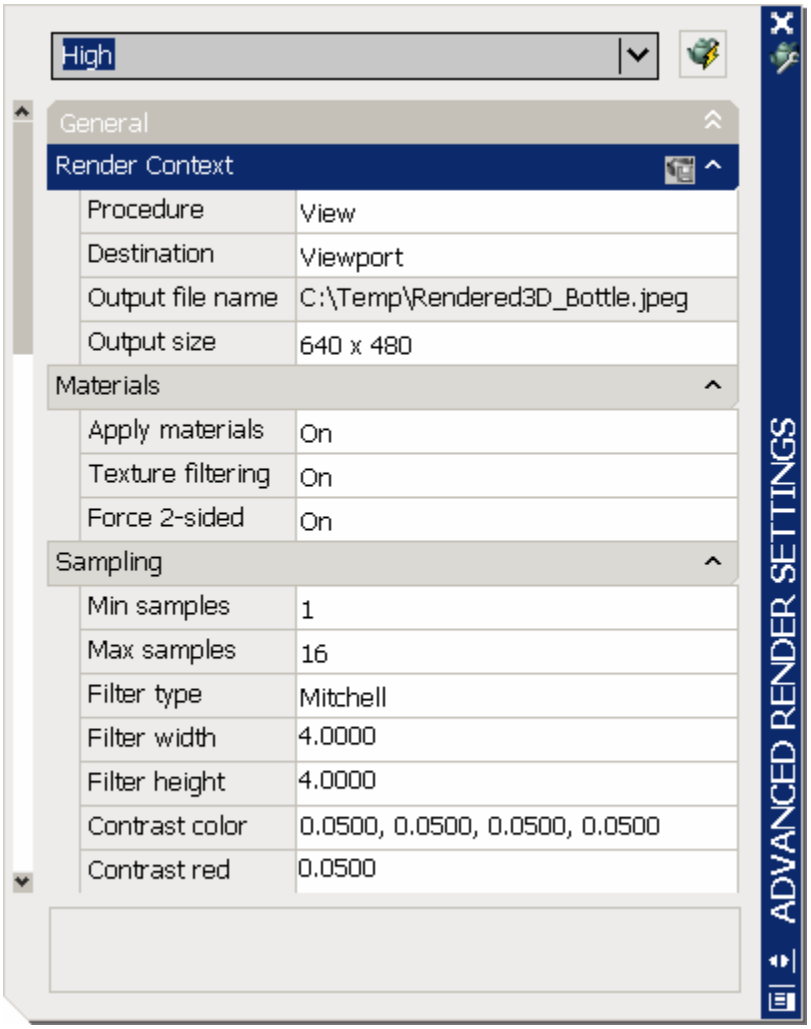
2. Choose **View, Render, Advanced Render Settings...**

   or

3. Type RPREF at the command prompt.

   Command: **rpref**

4. Click the small disk beside the title for “Render Content”. You will notice that the Output file name option will be grayed out.



AutoCAD 3D – Chapter 19 Materials

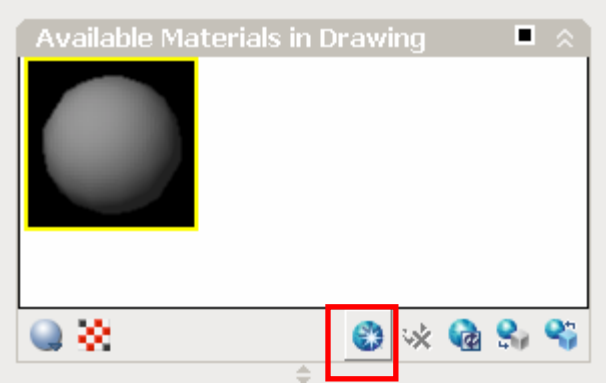
19.1 Adding Material to a Drawing

1. Open an AutoCAD drawing with 3D objects to add materials to.
2. Choose **View, Render, Materials**...

   or
3. Type MATERIALS at the command prompt.

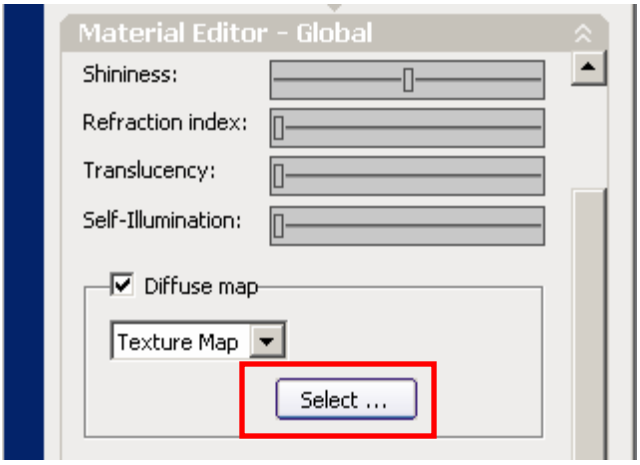
   Command: **materials**

4. Click the **Create New Material Button** under the Available Materials in Drawing section.

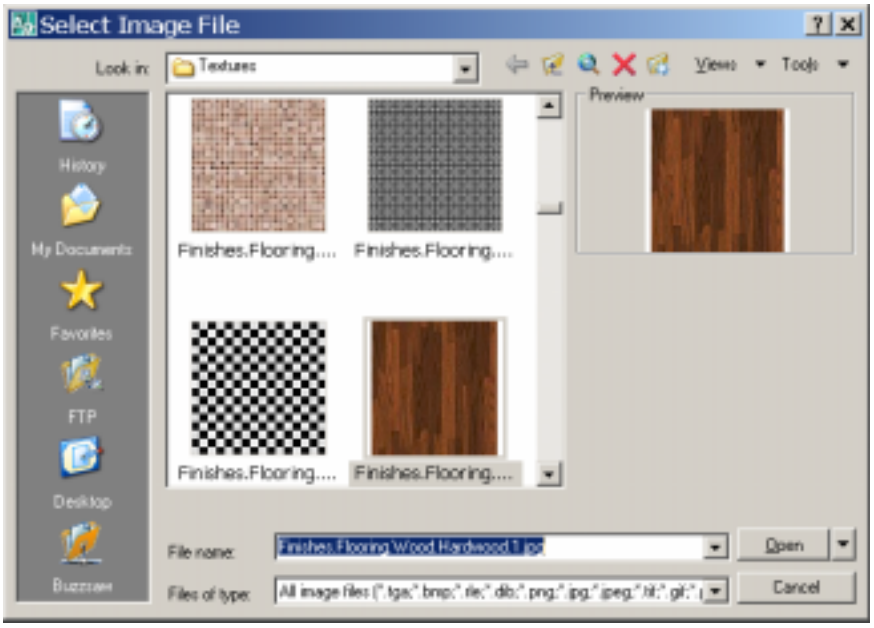


5. Type a name and description for the new material.

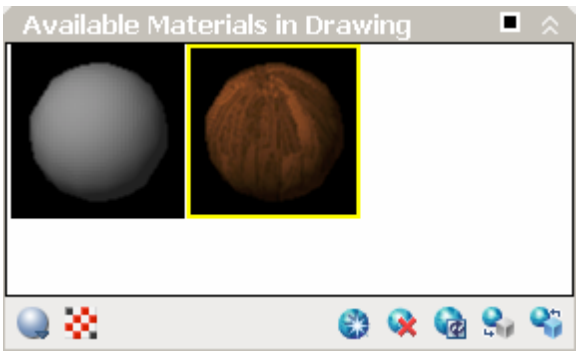
6. Click the **Select…** button under the **Diffuse Map** section of the Material Editor.



7. Navigate to a location where material textures are located, select a material image to add, and click Open.



The material will be added to your drawing in the current material slot.



19.2 Applying Materials by Attach

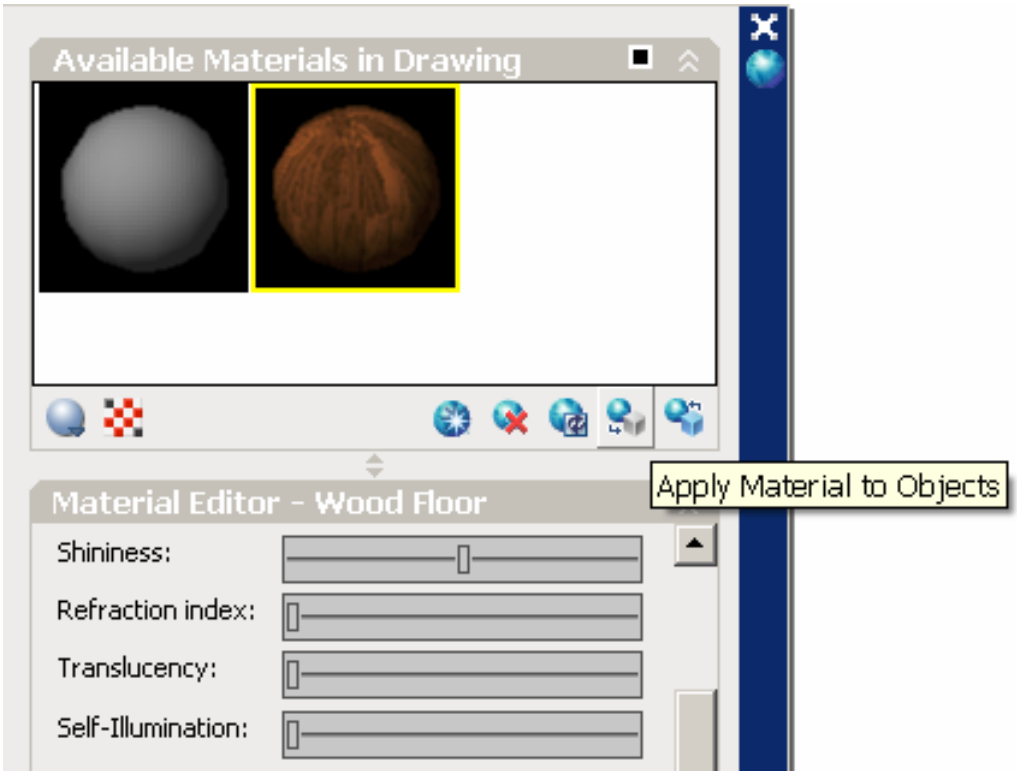
1. Choose **View, Render, Materials**...

   or

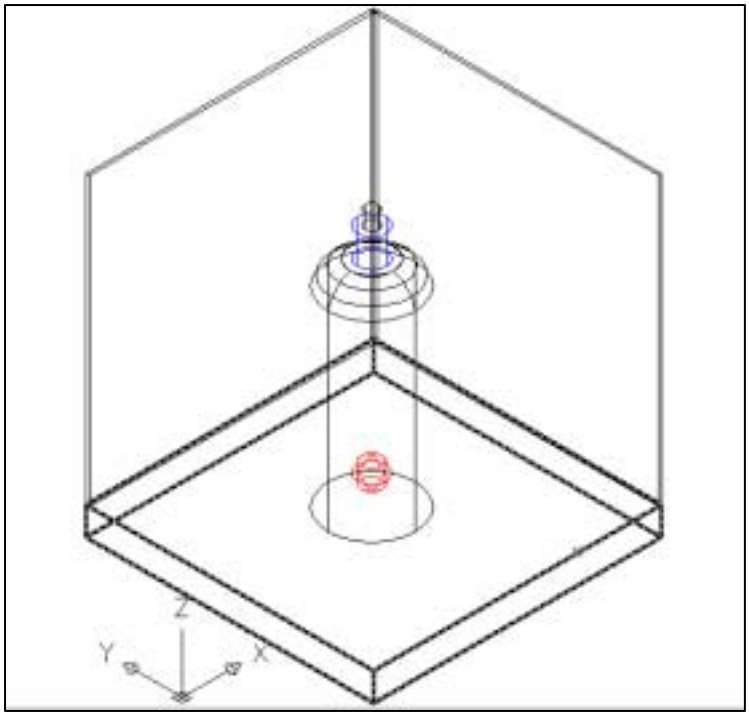
2. Type MATERIALS at the command prompt.

   Command: **materials**

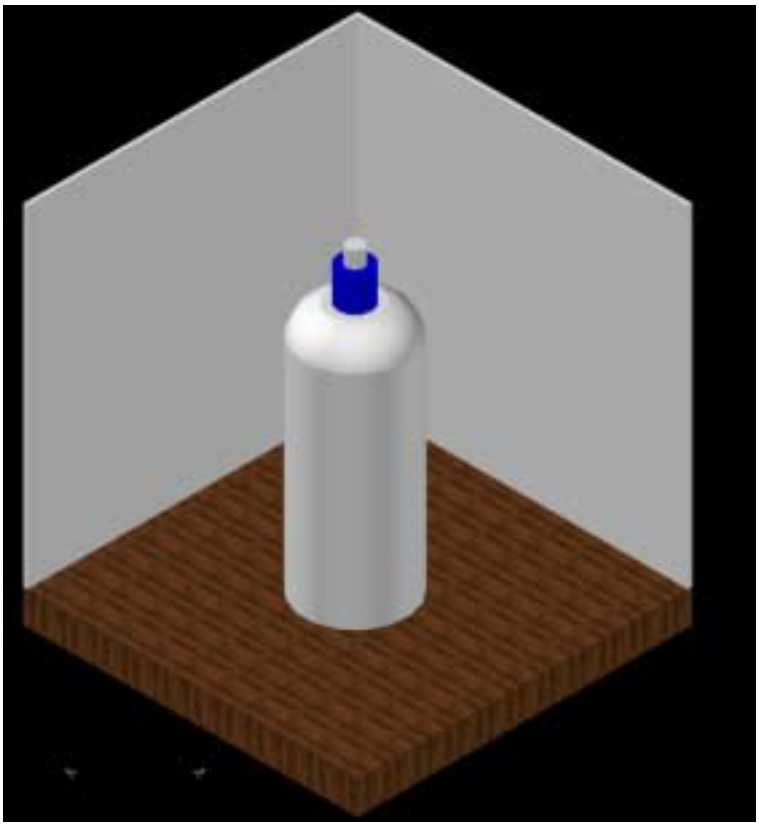
3. Click the **Apply Material to Objects** button under the **Available Materials in Drawing** section.



4. Use the pick box to select an object to apply the material to.



5. Press **enter**.
6. Type RENDER at the command prompt to see the new material applied in the drawing.



19.3 Adjust Material Scale

Materials such as hard wood might not map properly to objects at different scales. The follow section shows how to adjust the scale of materials.

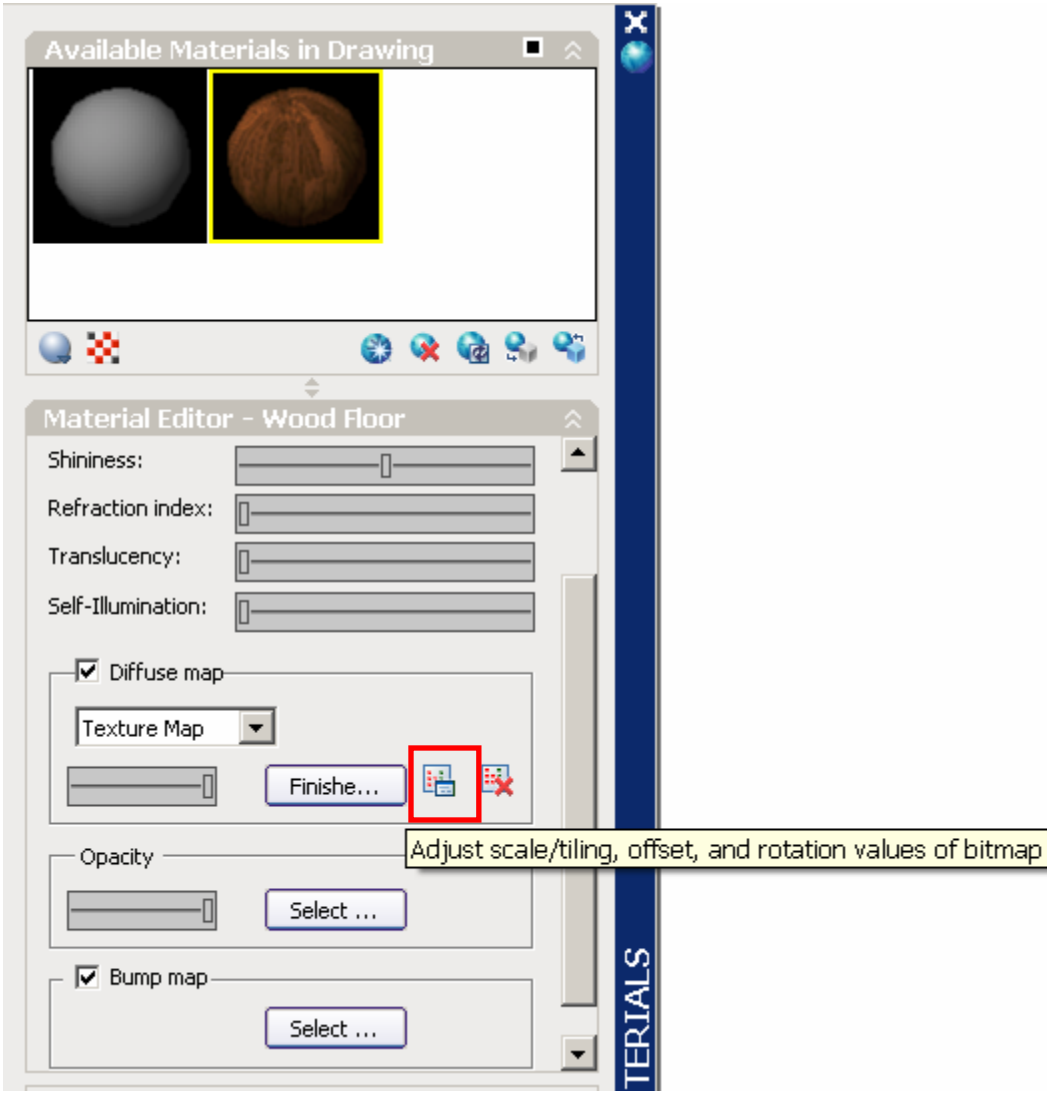
1. Choose **View, Render, Materials**...

   or

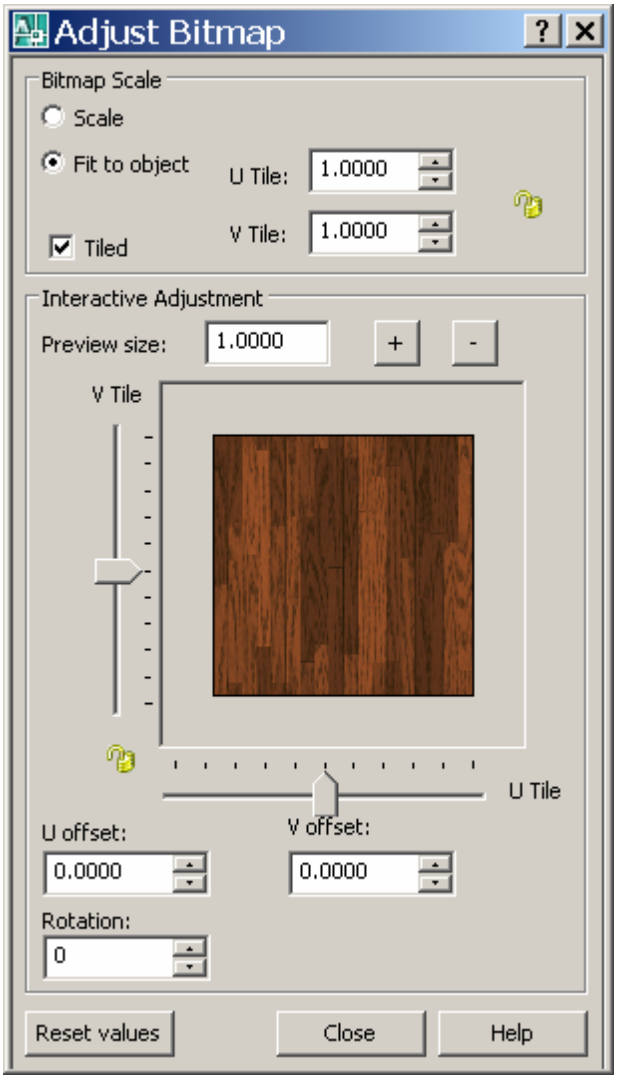
2. Type MATERIALS at the command prompt.

   Command: **materials**

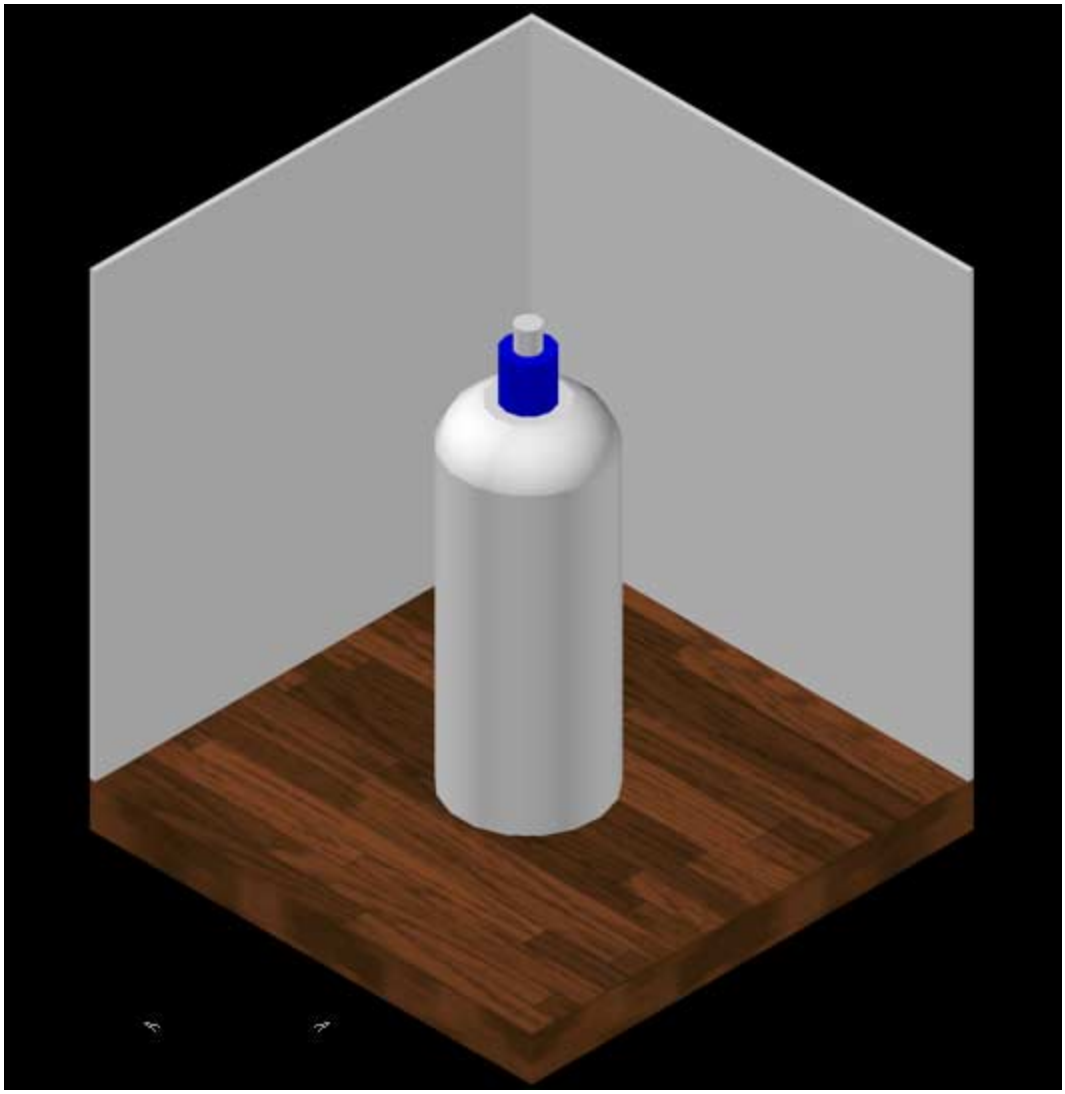
3. Click the **Adjust Button** under the Diffuse Map section of the Material Editor.



4. Click the Adjust Button under the Diffuse Map section of the Material Editor.
5. Click Fit to object under the Bitmap Scale option and click Close.



6. Render the drawing to see the newly mapped material.



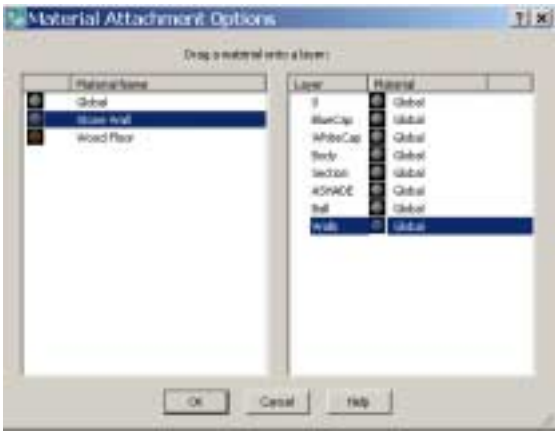
19.4 Applying Materials by Layer

You can attach a material to an entire layer using the Material Attach command.

1. Create a new material.
2. Type MATERIALATTACH at the command prompt.

   Command: **materialattach**

3. Click and drag the material onto the desired layer.

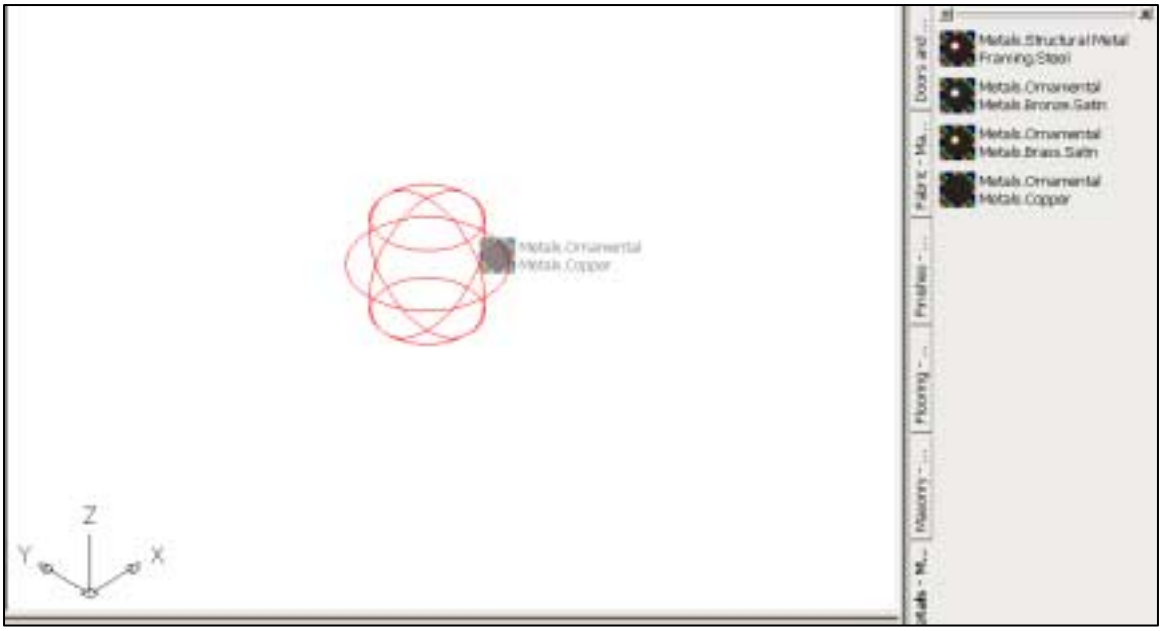


4. Adjust the material to the object and render to see the results.

19.5 Applying Materials from Tool Palette

1. Click **Tools, Palettes, Tool Palettes.**
   Note: If materials are not shown on the Tool Palette, load them from the materials section on the Dashboard.

2. Click and drag a material on to an object.



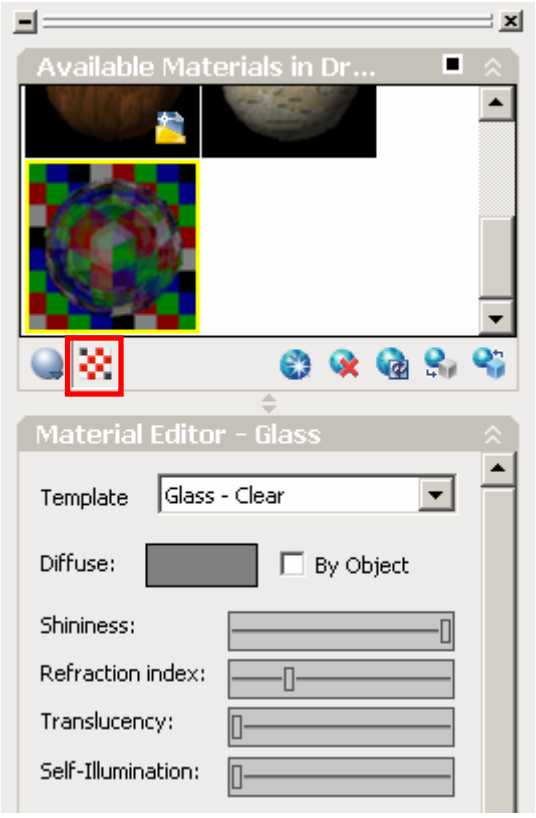
19.6 New Material

1. Choose **View, Render, Materials**...

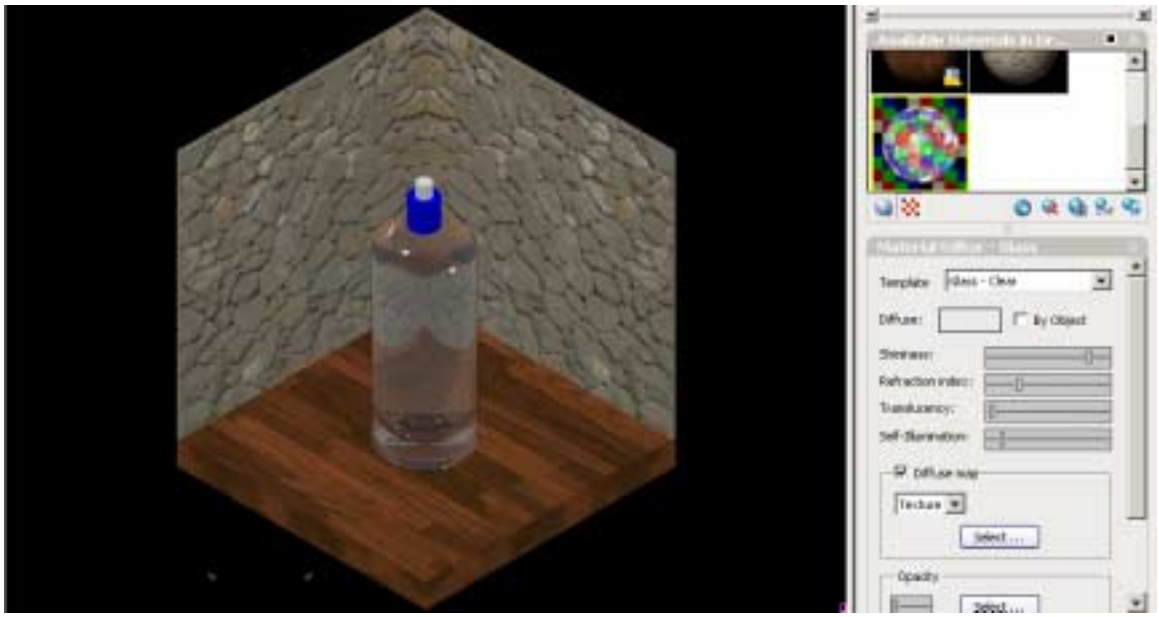
   or

2. Type MATERIALS at the command prompt.
   Command: **materials**

3. Click the **Create New Material** button and create a material called **Glass** for the bottle.
4. From the Template dropdown, click **Glass - Clear**.
5. Click the **Checkered Underlay** option to see the glass properties.



6. Adjust other glass properties as desired and apply the material to the bottle.


Template:
Glass - Clear
Diffuse:
By Object
Shininess:
Refraction index:
Translucency:
Self-Illumination
Diffuse map
Texture
Select...
Opacity
Select...

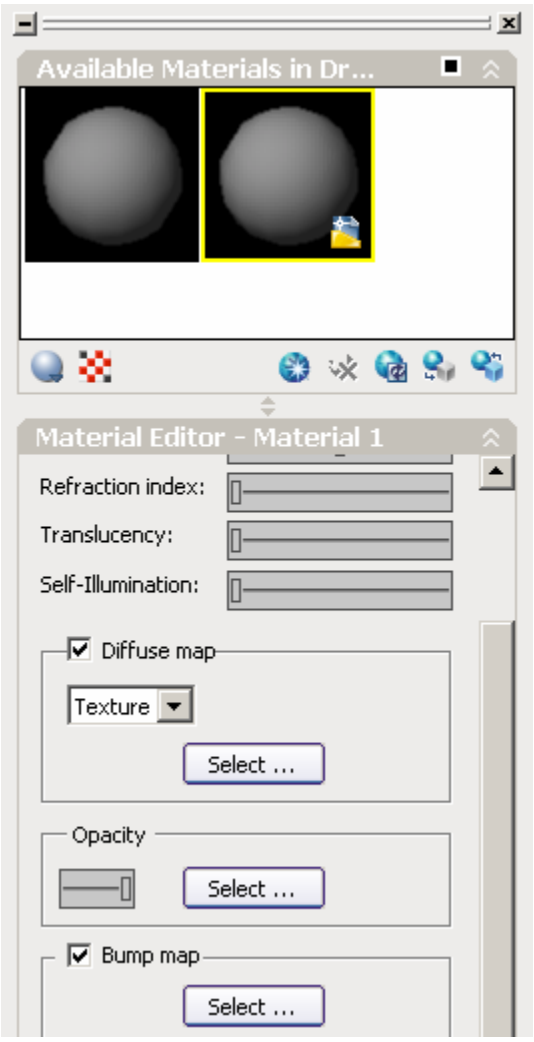
19.7 Opacity Materials

1. Choose **View, Render, Materials**...

   or

2. Type MATERIALS at the command prompt.
   Command: **materials**

3. Click the **Create New Material** button and create a material called **Opacity Material**.
4. Click Select…beside Opacity and choose the opacity material.



5. Apply the material to an object and render.

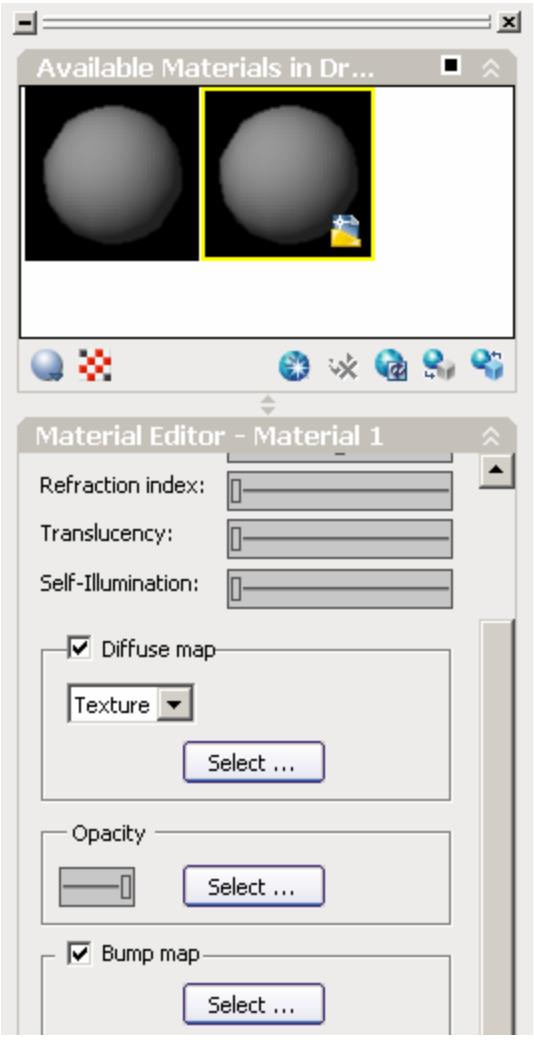
19.8 Bump Map Materials

1. Choose **View, Render, Materials**...

   or

2. Type MATERIALS at the command prompt.
   Command: **materials**

3. Click the **Create New Material** button and create a material called **Bump Material**.
4. Click Select…beside Bump Map and choose the opacity material.



5. Apply the material to an object and render.

19.9 Removing Materials

1. Open an AutoCAD drawing **with 3D objects to render**.

2. Choose **View, Render, Advanced Render Settings...**

   or

3. Type RPREF at the command prompt.

   Command: **rpref**

5. Click the small disk beside the title for “Render Content”. You will notice that the Output file name option will be grayed out.

AutoCAD 3D – Chapter 20 Lights

20.1 Point Light

A point light radiates light in all directions from its location.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Render, Light, New Point Light**.

   or

3. Type POINTLIGHT at the command prompt.

   Command: **pointlight**
4. Click Yes to the following viewport lighting prompt:

   Specify source location <0,0,0>: **.XY**

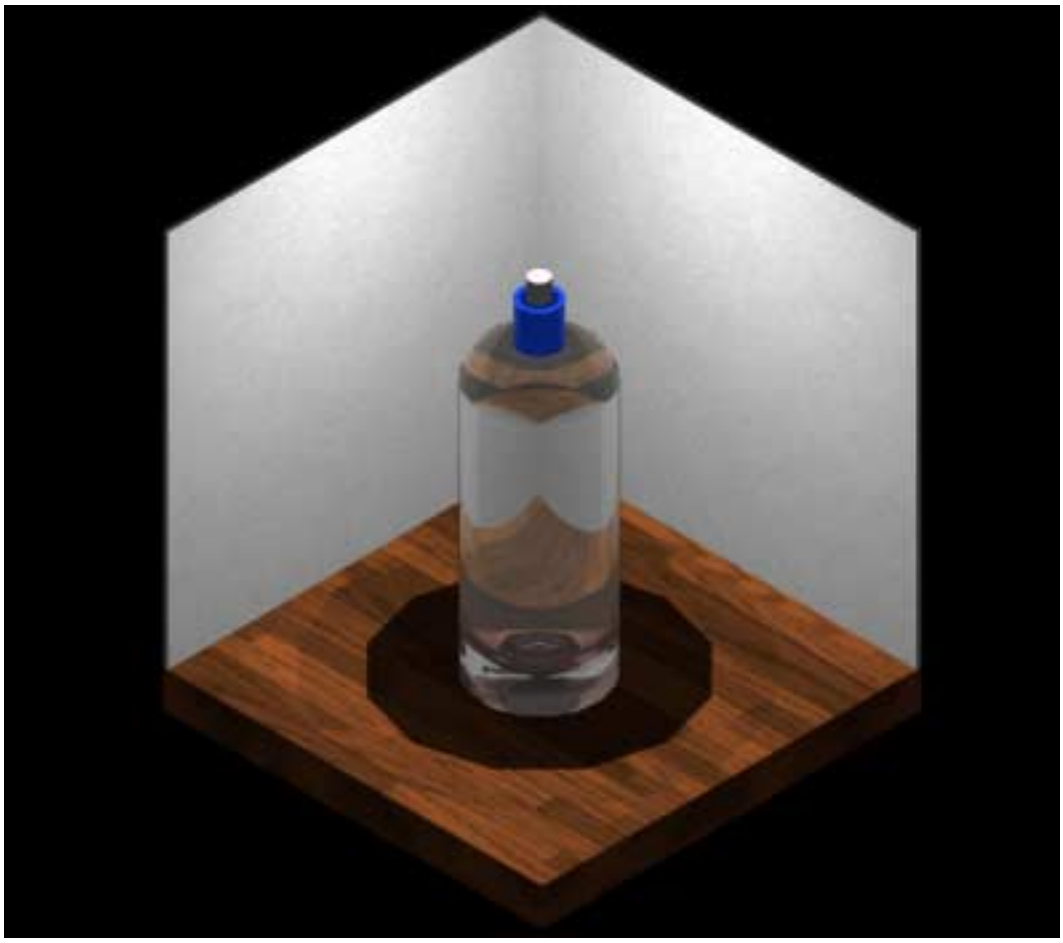
   of pick center of bottle

   (need Z): **10**

   Enter an option to change [Name/Intensity/Status/shadoW/Attenuation/Color/eXit]

   <eXit>: **enter**
5. Render the current viewport.

View rendered using a point light



20.2 Spot Light

A spotlight emits a directional cone of light.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Render, Light, New Spot Light**.

   or

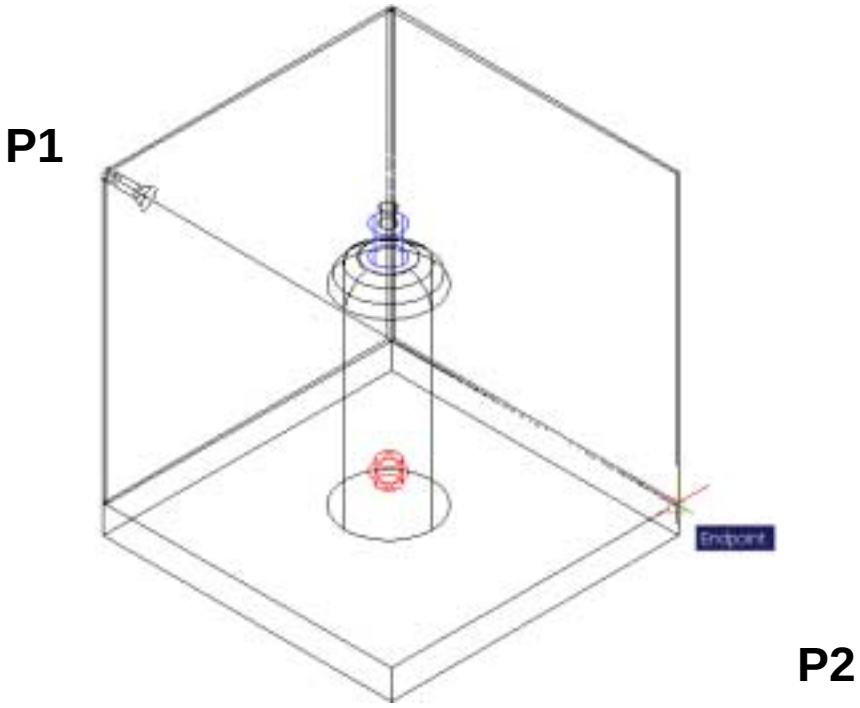
3. Type SPOTLIGHT at the command prompt.

   Command: **spotlight**

   Specify source location <0,0,0>: **P1**

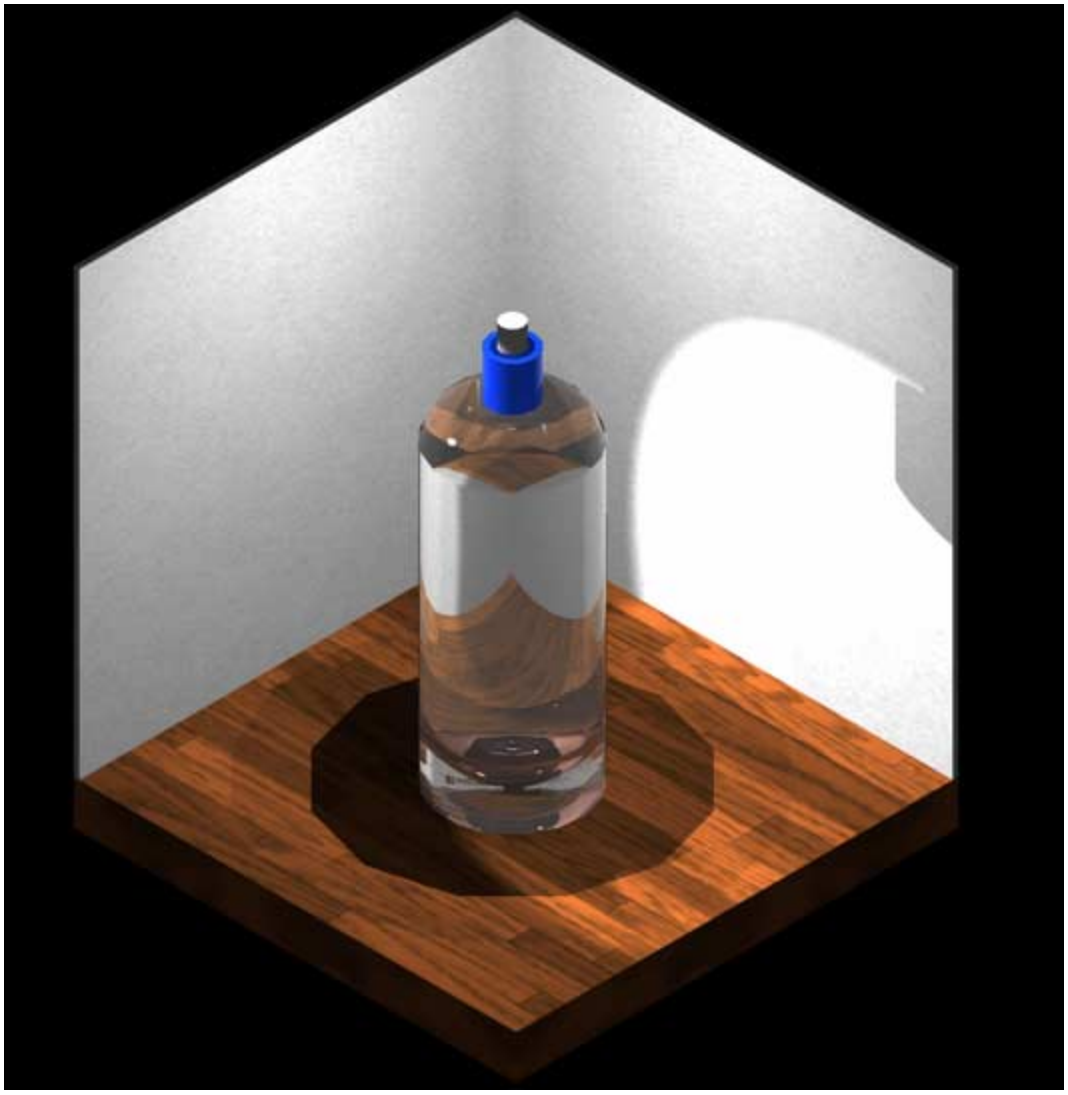
   Specify target location <0,0,-10>: **P2**

   Enter an option to change [Name/Intensity/Status/Hotspot/Falloff/shadoW/Attenuation/Color/eXit] <eXit>: **enter**



4. Render the current viewport.

View rendered using a point and spotlight



20.3 Light List

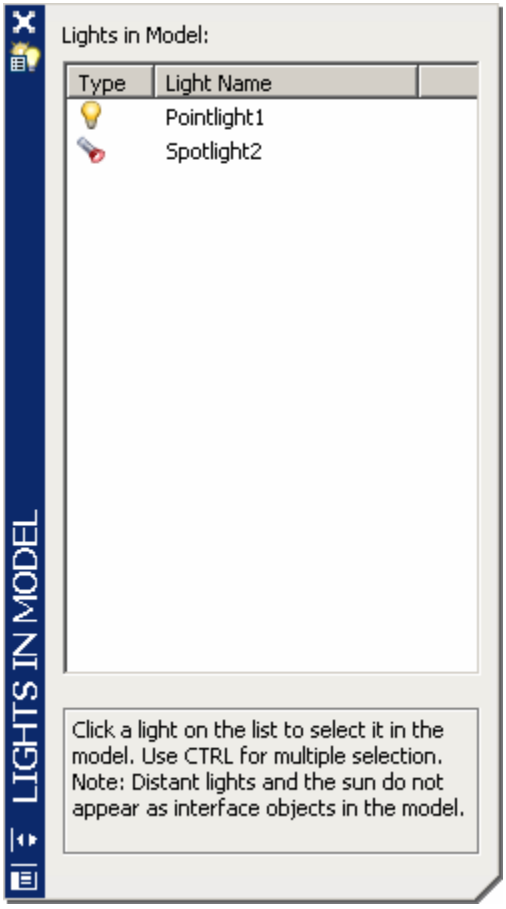
The lightlist command allows you to modify lights in a drawing. This includes turning lights off, deleting lights, or changing the properties of one or more lights.

1. Open a drawing with lights.
2. Choose **View, Render, Light, Lightlist**.

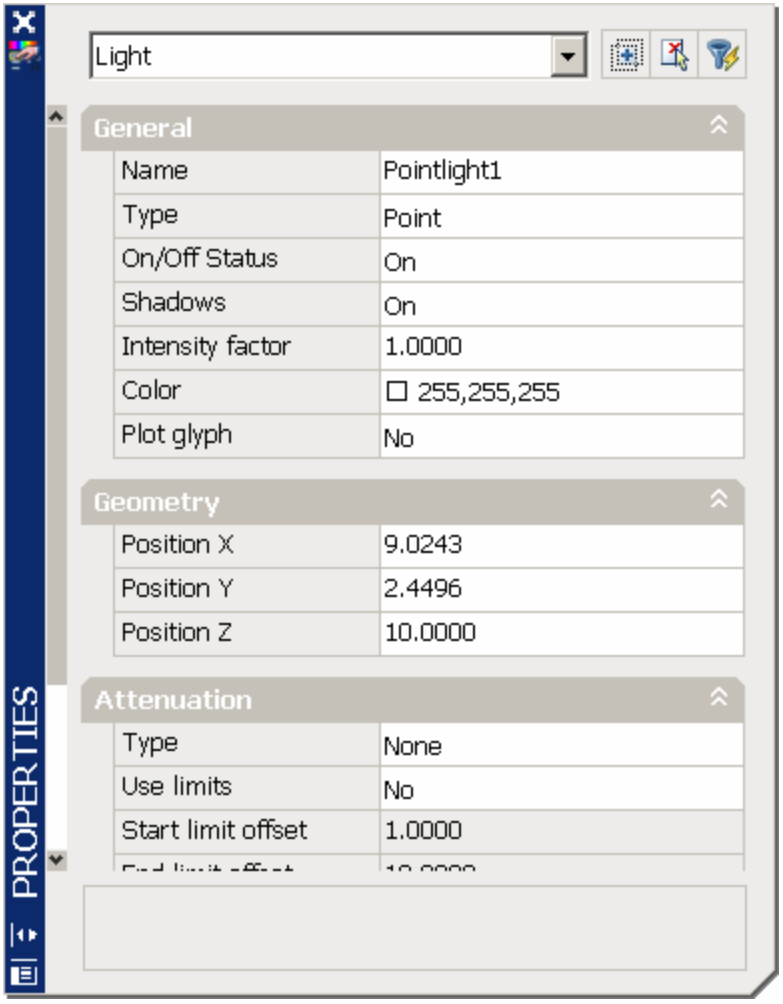
   or

3. Type LIGHTLIST at the command prompt.

   Command: **lightlist**



4. Double-click one of the lights in the drawing to modify its properties.



20.4 Distant Light

A distant light emits uniform parallel light rays in one direction only. You specify a FROM point and a TO point anywhere in the viewport to define the direction of the light. There is no light glyph to represent a distant light in your drawing.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Render, Light, New Distant Light**.

   or

3. Type DISTANTLIGHT at the command prompt.

   Command: **distantlight**

   Specify light direction FROM <0,0,0> or [Vector]: **.XY**

   of **MID P1**

   of (need Z): **5**

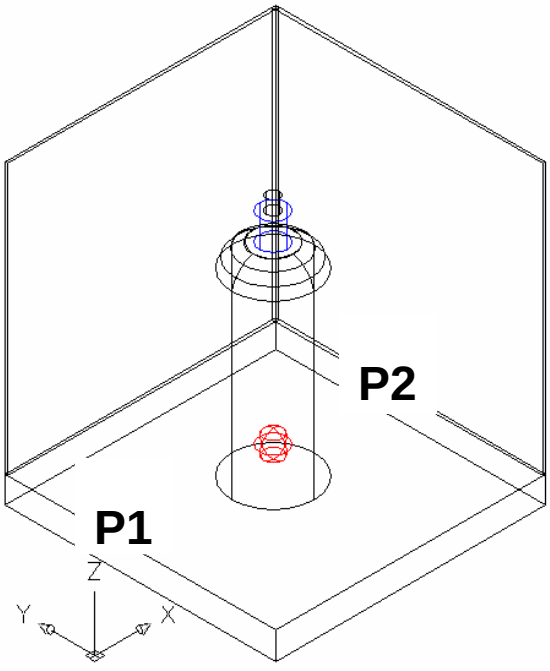
   Specify light direction TO <1,1,1>: **.XY**

   of **MID P2**

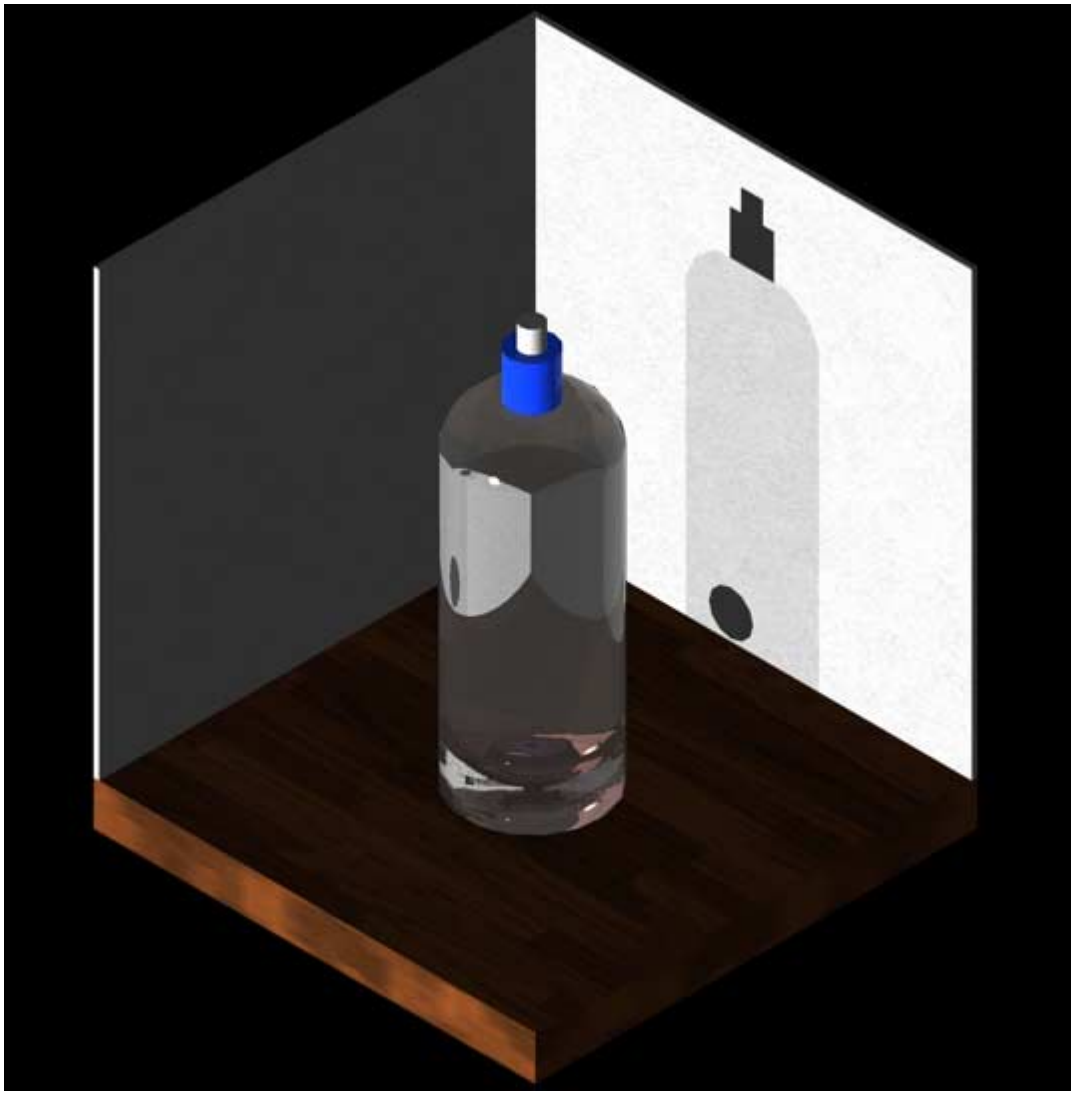
   of (need Z): **5**

   Enter an option to change

   [Name/Intensity/Status/shadoW/Color/eXit] <eXit>: **enter**



View rendered using a point and spotlight



20.5 Geographic Locations

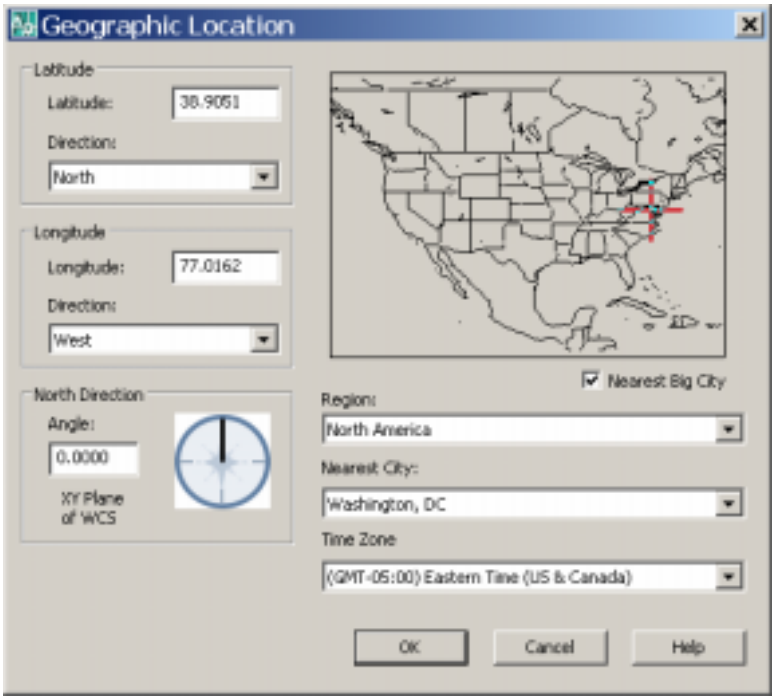
Specifies the latitude and longitude of a location for the sunlight.

1. Open a drawing with lights.
2. Choose **View, Render, Light, Geographic Location**.

   or

3. Type GEOGRAPHICLOCATION at the command prompt.

   Command: **geographiclocation**
4. Pick the desired geographic location for your model and click OK.



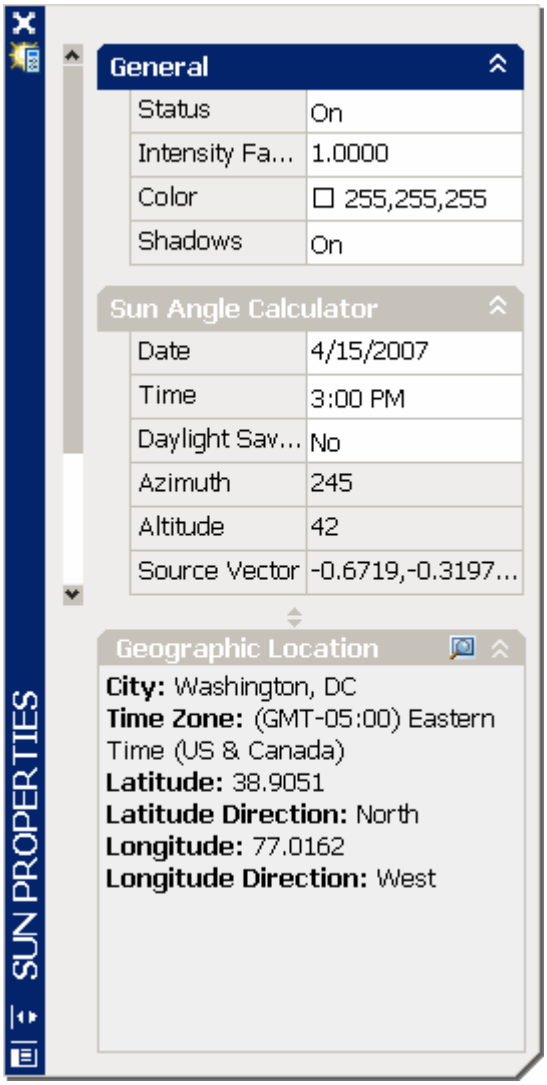
20.6 Sun Properties

1. Open a drawing with a geographic location identified.
2. Choose **View, Render, Light, Sun Properties**.

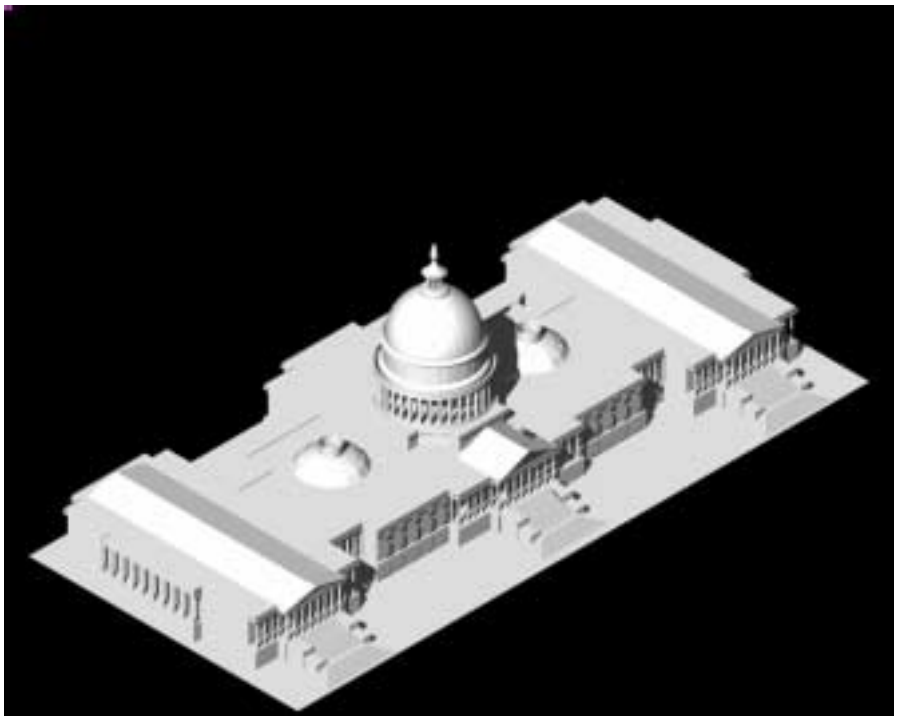
   or

3. Type SUNPROPERTIES at the command prompt.

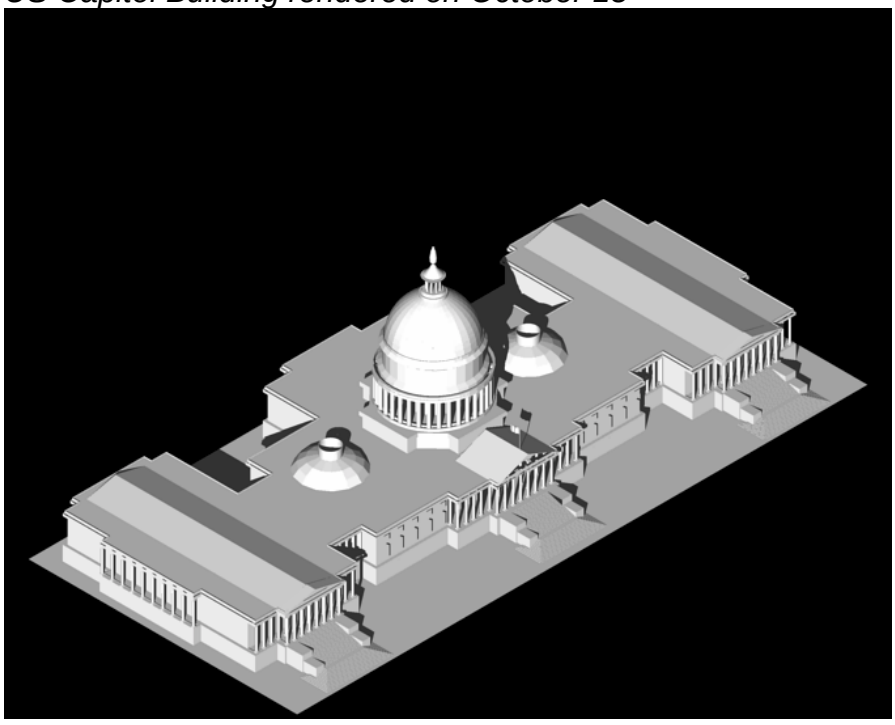
   Command: **sunproperties**
4. From the Sun Properties dialog box, click the Status dropdown and click **ON**.
5. Change the date to **April 15, 2007** (income tax due date.)
6. Change other properties as desired and render the model.



US Capitol Building rendered on April 15



US Capitol Building rendered on October 15



AutoCAD 3D – Chapter 21

Advanced Render Commands

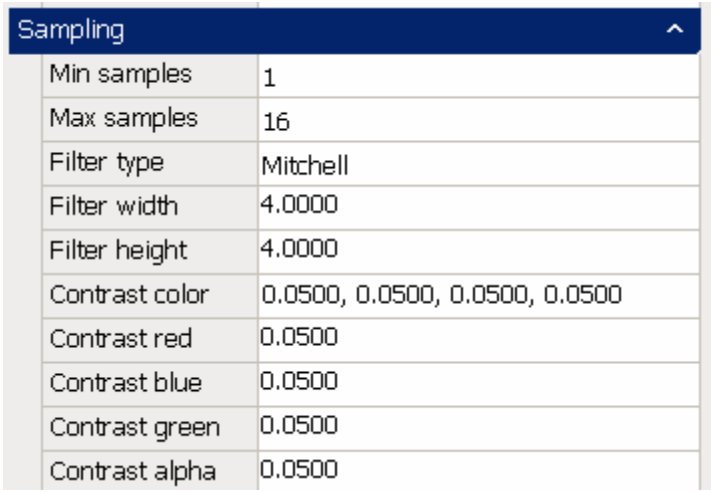
21.1 Sampling

Controls how the renderer performs sampling.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose View, Render, Advanced Render Settings...

   or
3. Type RPREF at the command prompt.

   Command: **rpref**



21.2 Shadows

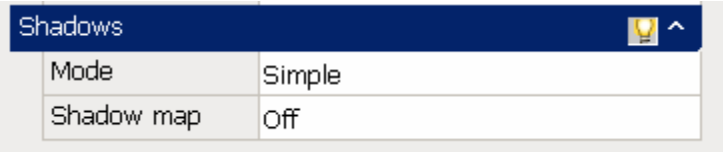
Contains settings that affect how shadows appear in the rendered image.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose View, Render, Advanced Render Settings...

   or

3. Type RPREF at the command prompt.

   Command: **rpref**



21.3 Ray Tracing

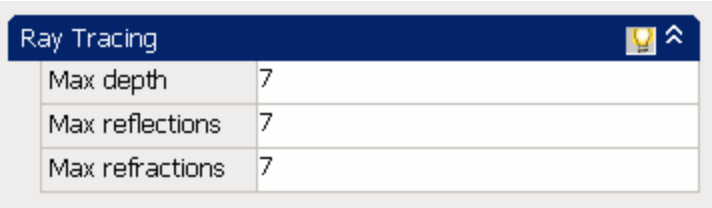
Contains settings that affect the shading of a rendered image.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose View, Render, Advanced Render Settings...

   or

3. Type RPREF at the command prompt.

   Command: **rpref**



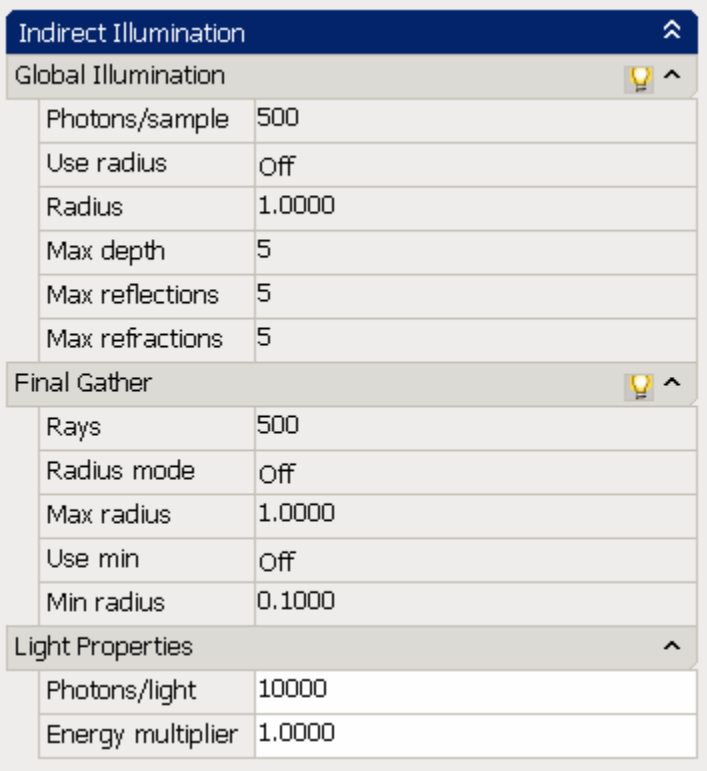
21.4 Illumination

Affects how your scene is illuminated.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Render, Advanced Render Settings...**

   or
3. Type RPREF at the command prompt.

   Command: **rpref**



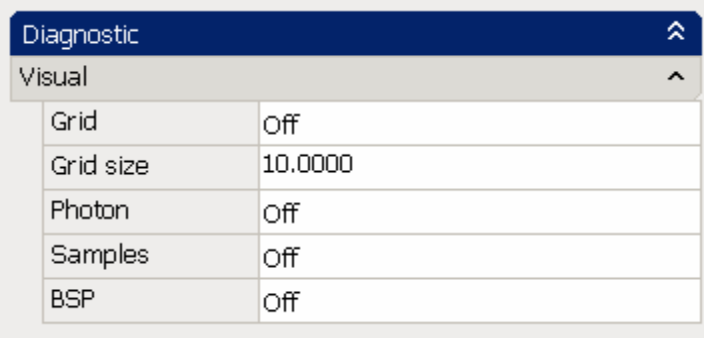
21.5 Diagnostic

Helps you understand why the renderer is behaving in a certain way.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose View, Render, Advanced Render Settings...

   or
3. Type RPREF at the command prompt.

   Command: **rpref**

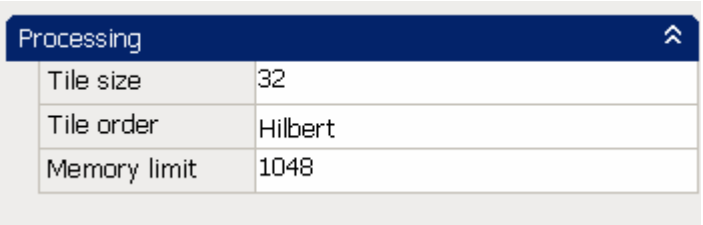


21.6 Processing

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose View, Render, Advanced Render Settings...

   or
3. Type RPREF at the command prompt.

   Command: **rpref**



AutoCAD 3D – Chapter 22

Render Environments and Background

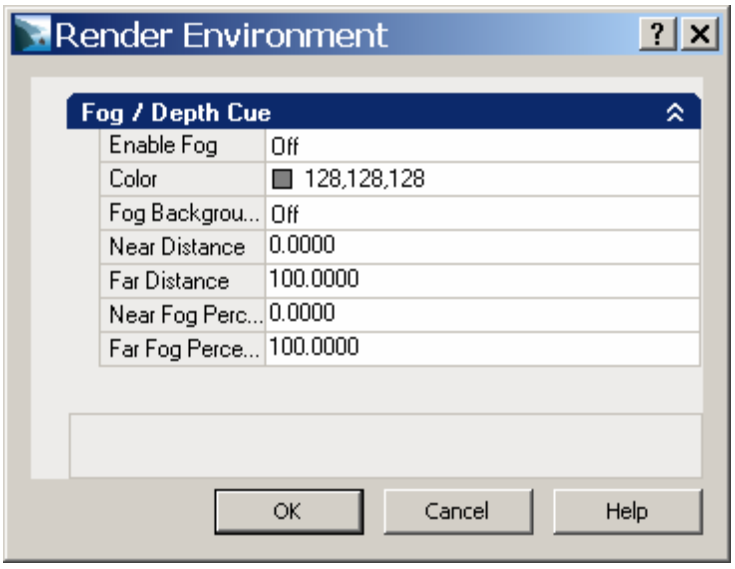
22.1 Render Environment

You can use environmental features to set up atmospheric effects or background images.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Render, Advanced Render Environment...**

   or
3. Type RENDERENVIRONMENT at the command prompt.

   Command: **renderenvironment**



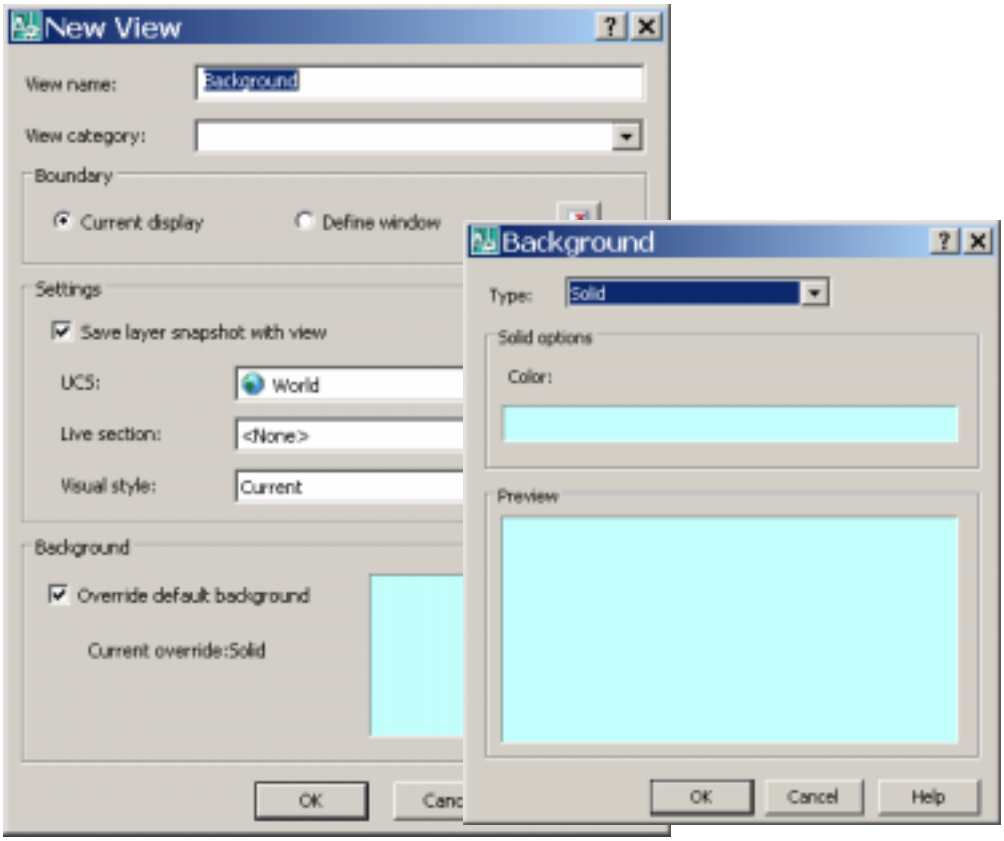
22.2 Solid Background

A background is a backdrop that displays behind your model. Backgrounds can be a single color, a multi-color gradient, or a bitmap image.

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Named Views**.

   or
3. Type VIEW at the command prompt.

   Command: **view**
4. Choose **New…**
5. Type a name for your new view.
6. Click the check box beside background.
7. Choose a color for your solid background.



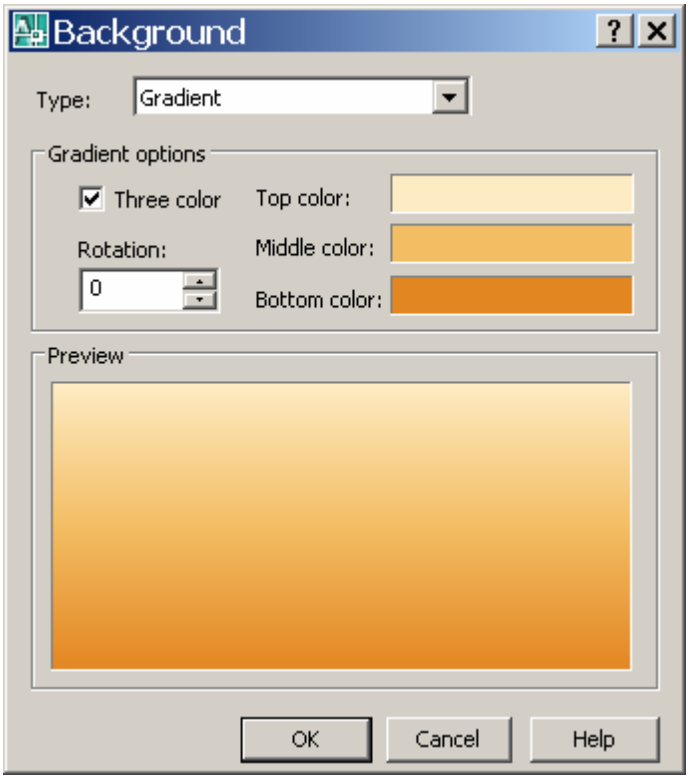
22.3 Gradient Environment

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Named Views**.

   or

3. Type VIEW at the command prompt.

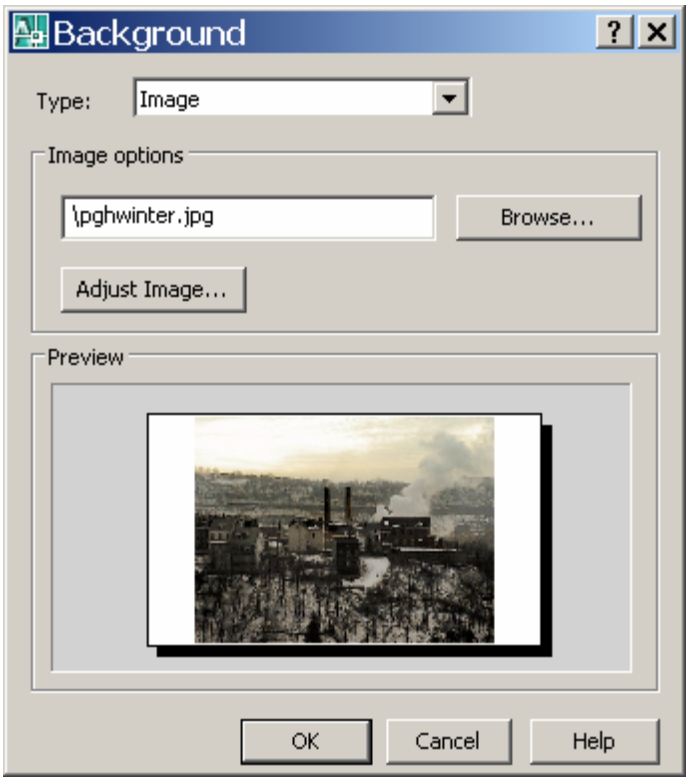
   Command: **view**
4. Choose **New…**
5. Type a name for your new view.
6. Click the check box beside background.
7. Choose the dropdown option for background type and choose gradient.
8. Choose colors for your gradient background.



22.4 Image Background

1. Open a drawing with 3D objects and display in a 3D view.
2. Choose **View, Named Views**.

   or

3. Type VIEW at the command prompt.

   Command: **view**
4. Choose **New…**
5. Type a name for your new view.
6. Click the check box beside background.
7. Choose the dropdown option for background type and choose image.
8. Click the Browse button and choose an image for your background.