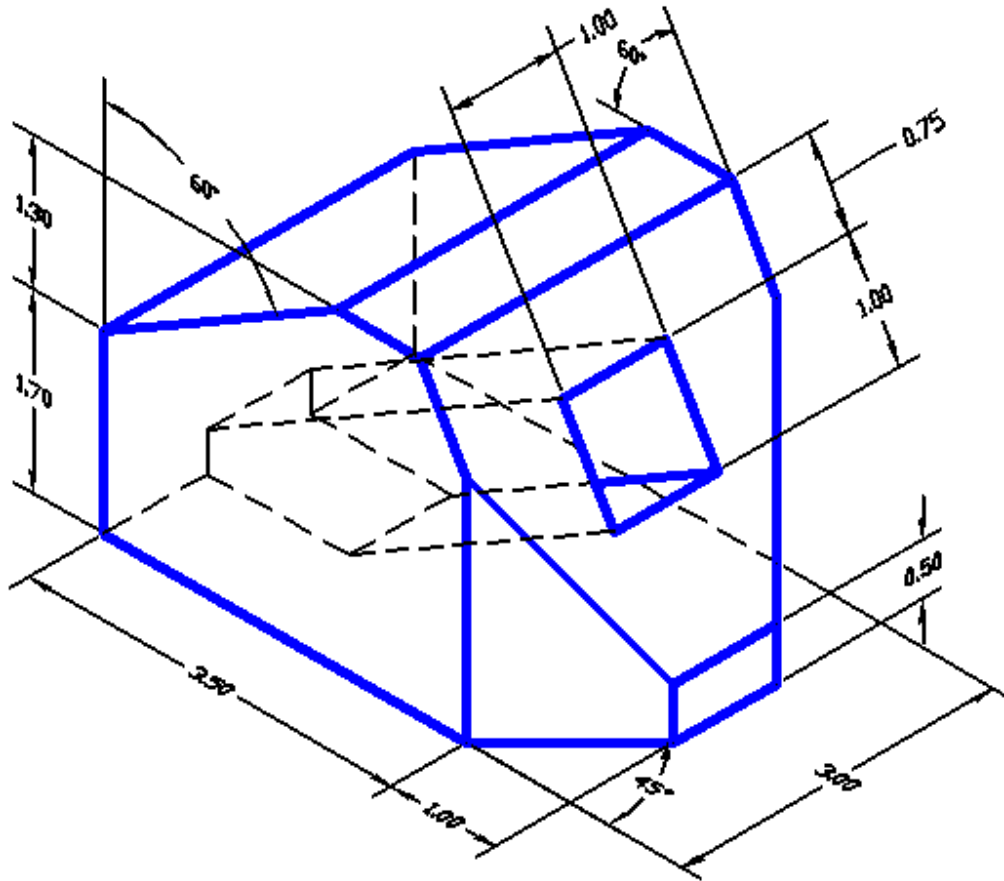
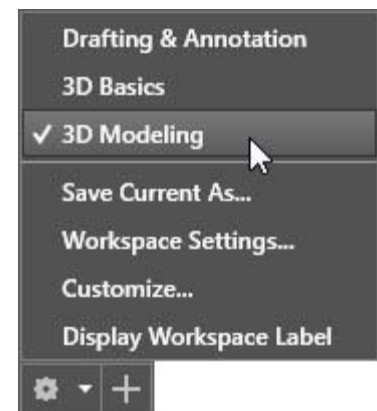


Assignment No. 16 More Solid Modeling

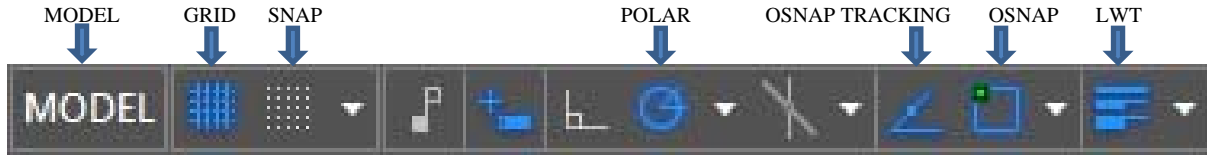
This exercise introduces more advanced techniques of creating solid models, including conversion of two-dimensional entities into three-dimensional primitives.



1. Your AutoCAD is most likely in the *Drafting & Annotation* workspace. Before beginning this lab, click on the *Workspace Switching* button in your status bar and select *3D Modeling* as your current workspace as seen on the right.
2. Start by opening a new file.
3. In the *Select Template* manager, **left-mouse-click** on the *triangular* button to the right of the *Open* button, and select *Open with no Template – Imperial*.
4. In the *Status Bar* area, **right-mouse-click** the *SNAP* tab.
5. In the *Drafting Settings* dialog box, turn *OFF SNAP*. Turn *ON* the *GRID*. Select the *Polar Tracking* tab, set the *Increment Angle* to *15*, and turn *ON Polar Tracking*. Select the *Object Snap*, check the *Endpoint*, *Center*, *Intersection* and *Extension*



- modes, and turn on both *Object Snap* and *Object Snap Tracking*. Close the dialog box.
- In the *Status Bar* also turn on *LWT* and *MODEL* options.



- Create two new layers with the following settings:

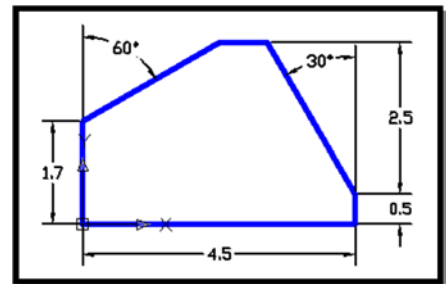
<i>Layer Color</i>	<i>LineType</i>	<i>Line Weight</i>	
Construction	White	Continuous	Default
Object	Blue	Continuous	0.30mm

Note: With the *3D Modeling* workspace active, the *Layers* panel is now on the far right of the *Home* tab.

- Select the **Object** layer as the current layer.
- Click on the **OK** button to accept the settings and exit the *Layer Properties Manager* dialog box.

We will start by creating a two-dimensional region in the *XY* plane that will be converted into a solid.

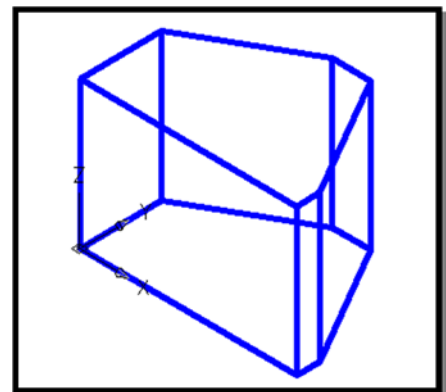
- Create the figure shown as a series of lines. For the two inclined sides, you may want to use the *Polar Tracking*.
- Select the **Region** command icon in the *Draw* toolbar.



- At the prompt “*Select objects:*” select all the sides of the polygon by creating a selection window enclosing all entities.
- Right-mouse-click** to accept selection. This converts all the lines into a single region.
- Switch to the *SE Isometric* view.

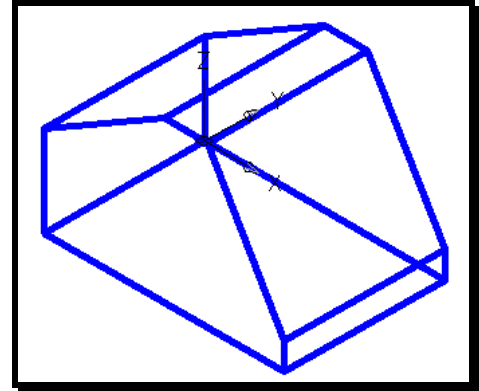
- Select the **Extrude** command icon in the *Modeling* toolbar.

- At the prompt “*Select objects:*” select the region.
- Right-mouse-click** to accept selection.
- At the prompt “*Specify height of extrusion or [path]:*” is displayed. Enter: **3.0 [ENTER]**.
- In the command prompt area, the message “*Specify angle of taper for extrusion <0>:*” is displayed. Press **[ENTER]** to accept the default angle of 0. This converts the region into a solid as shown.

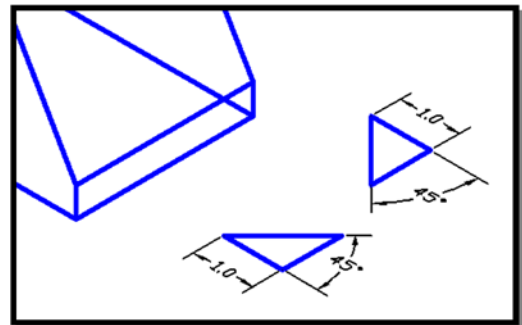


Next, the model needs to be rotated about the *X*-axis. We will use the *Rotate 3D* command that allows rotation about any line in 3D space.

20. Select the **3D Rotate** command in the *Modify* toolbar.
21. At the prompt “*Select objects:*” select the solid, and **right-mouse-click** to finish the selection.
22. At the prompt “*Specify Specify base point:*” select the origin of the UCS.
23. At the prompt “*Pick a rotation axis:*” select the X-axis (red circle).
24. At the prompt “*Specify angle start point or type an angle:*” Enter: **90 [ENTER]**



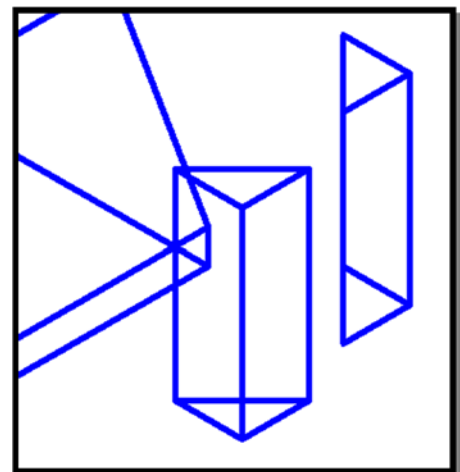
25. At some arbitrary location outside the model, create in the horizontal plane the two right triangles with the given dimensions as shown.
26. Convert each of the two triangles separately into two *regions* using the **Region** command icon in the *Draw* toolbar.



Note that the actual positions of the two triangles are not important because we will later move them into their correct positions. We simply made sure that they are outside the main model so that editing them can be done easily without interfering with the solid model.

Next, we will convert the two triangular regions into solids using the *Extrude* command.

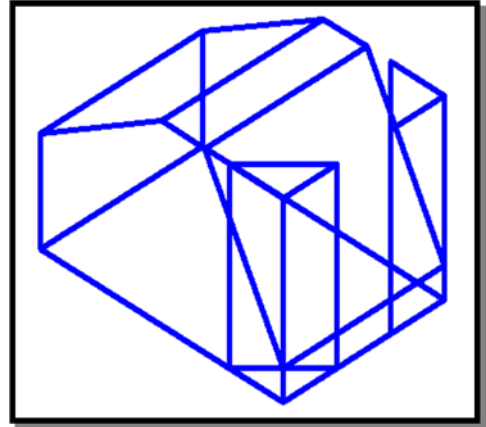
27. Select the **Extrude** command in the *Modeling* toolbar.
28. At the prompt “*Select objects:*” **left-mouse click** the two triangles.
29. **Right-mouse-click** to accept selection.
30. At the prompt “*Specify height of extrusion or [path]:*” is displayed. Enter: **3.0 [ENTER]**.
31. At the command prompt “*Specify angle of taper for extrusion <0>:*” Enter: **0.0 [ENTER]**.



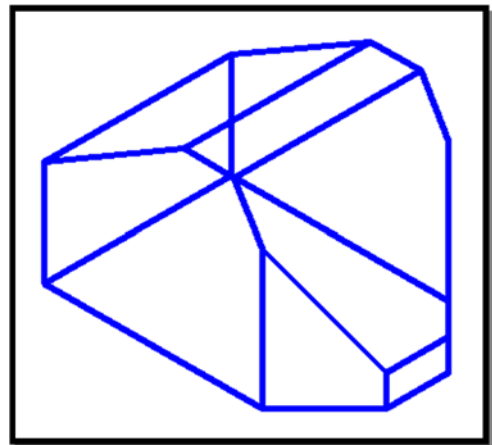
Before subtracting the two triangular solids from our model, we need to move them to their correct positions.

- Using the **Move** command icon in the *Modify* toolbar, move each of the two wedges to their new positions relative to the model as shown.

Next, we will subtract the two wedges from the model using the Boolean operator *Subtract*.



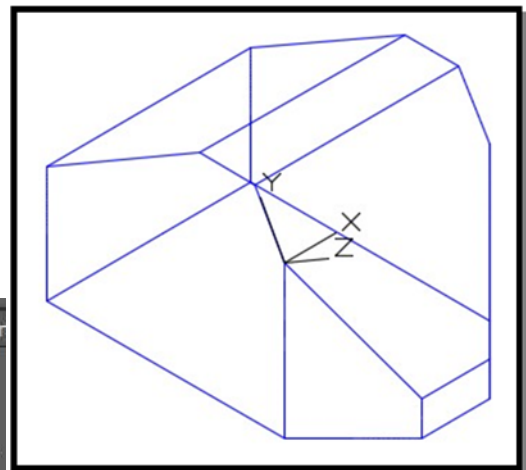
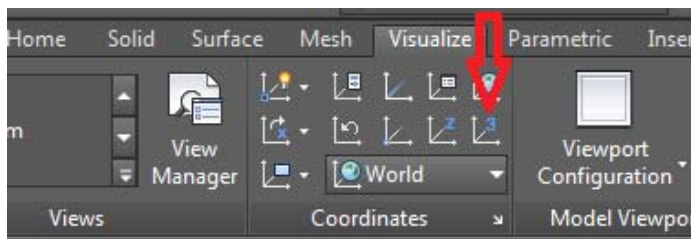
- Select the **Subtract** command icon in the *Solids Editing* toolbar.
- At the command prompt “_subtract Select solids and regions to subtract from .. Select objects:” **left-mouse-click** to pick the main solid model.
- Right-mouse-click** to accept the selection.
- At the prompt “Select solids and regions to subtract.. Select Objects:” pick the two wedges.
- Right-mouse-click** to accept the selection and finish the *Subtract* command.



Creating the Rectangular Hole

- Define the new position of the UCS as shown by selecting in the pull-down menus: **[Tools] => [New UCS] => 3 Point**

You can also click on **Visualize → 3 Point** (from the *Coordinates* toolbar. (See below.)



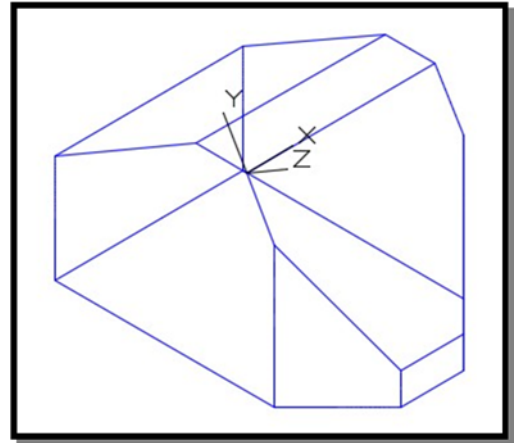
- Select the new origin as the point in the front plane as shown, the corresponding point in the rear plane as the X-axis point, and the point in the inclined plane as shown as the Y-axis point.

3. Move the origin of the UCS by selecting in the pull-down menus.

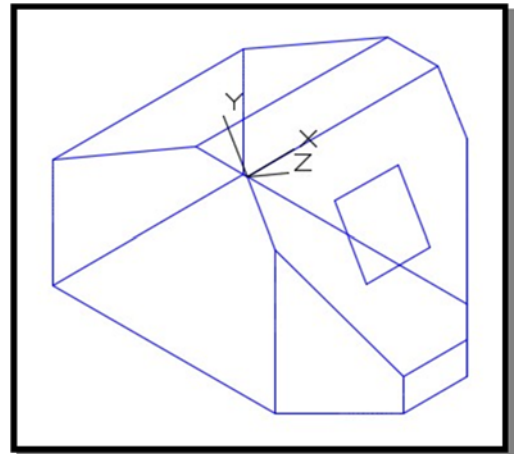
[Tools] => [New UCS] => Origin

You can also click on *Visualize → 3 Point* (from the *Coordinates* toolbar).

4. At the command prompt “Specify new origin point or [Zdepth]<0,0,0>:” **left-mouse-click** on the new UCS origin shown.

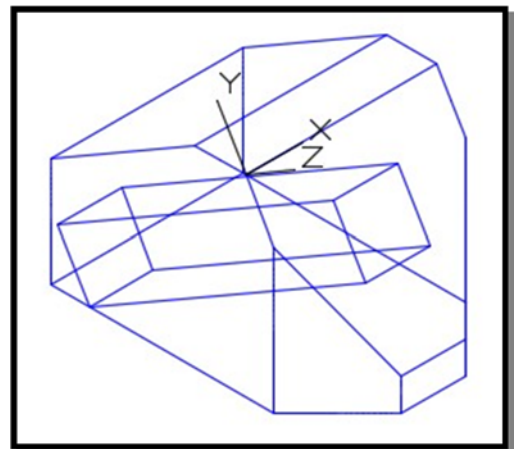


5. Select the **Rectangle** command icon in the *Draw* toolbar.
6. At the command prompt “Specify first corner point or [Chamfer/.../Width]:”
Enter: **1,-.75 [ENTER]**
7. At the command prompt “Specify other corner point or [Dimensions]:”
Enter: **2,-1.75 [ENTER]**

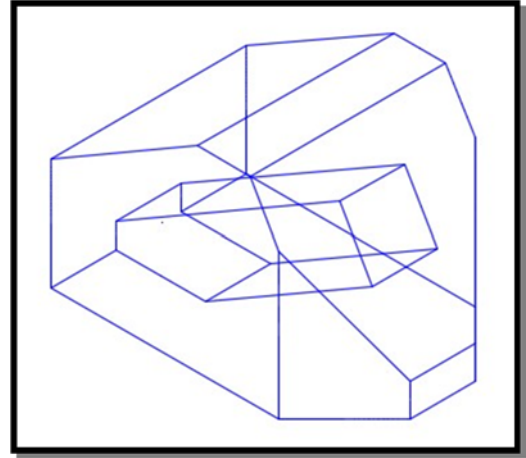


8. Convert the rectangle into a solid box using the **Extrude** command. Use an extrusion height of **-5.0**.

Note that the extrusion height is negative for the extrusion to go in the negative Z-axis. A height of 5.0 is intentionally made longer than the dimensions of the model.



9. Select the **Subtract** command icon in the *Solids Editing* toolbar.
10. At the command prompt “_subtract Select solids and regions to subtract from .. Select objects:” **left-mouse-click** to pick the main solid model.
11. **Right-mouse-click** to accept the selection.
12. At the prompt “Select solids and regions to subtract.. Select Objects:” pick the rectangular box.
13. **Right-mouse-click** to accept the selection and finish the *Subtract* command.
Use the [Tools] => [New UCS] => **Origin** command again to move the UCS back to its original position.



14. Open the *Visualize* tab and use the available **Shades** in the *Visual Styles* toolbar to examine the created solid object.

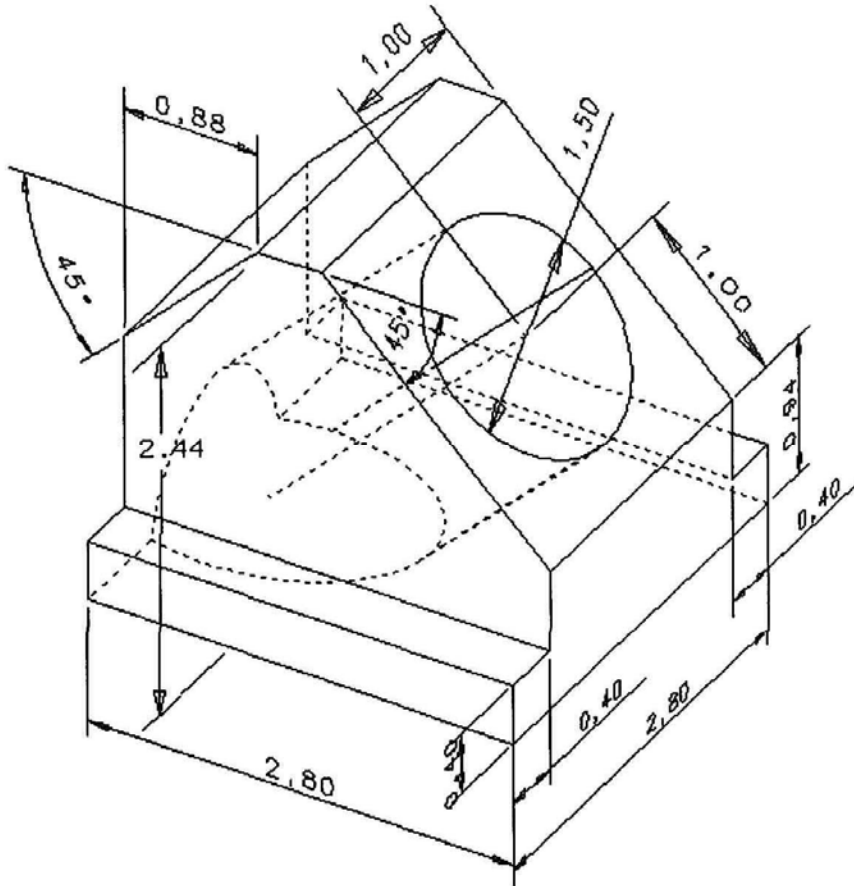


↑
Visual Styles Manager

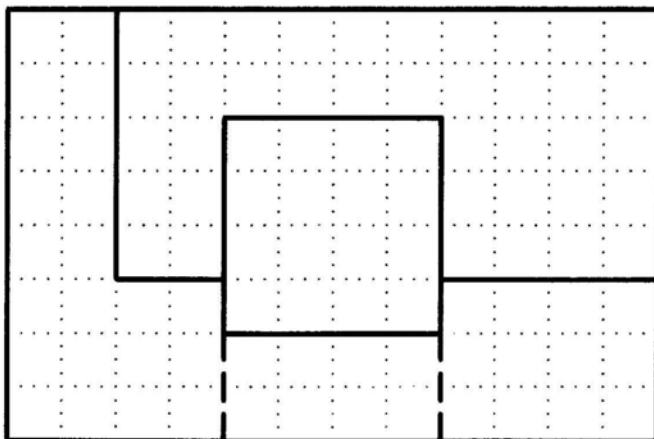
15. Also, use the *Visual Styles Manager* to examine the complete solid.
16. Save the drawing as **Lab16a.dwg**.

Exercises:

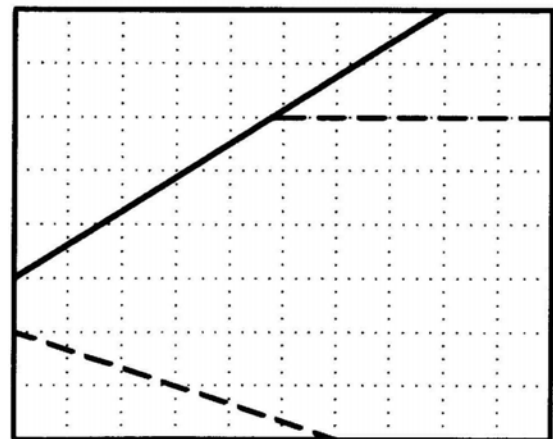
1. Construct a solid model for the object. Dimensions are in inches. (Save as **Lab16b.dwg**.)



2. Given the front and right-side views, create a solid model of the object. (Each grid equals 0.25 inch.) (Save as **Lab16c.dwg**.)



Front View



Right View