

UNIT B: 3D Modeling

Competency: D402.00

Demonstrate 3D solid modeling techniques.

Objective: D402.01

Explain techniques for creating 3D geometry.

Introduction: The purpose of this unit is to build on the 3D CAD concepts and commands that were learned in Drafting I. When covering the 3D CAD material, it is recommended that one of the following constraint-based CAD programs be used: Inventor[®], ProDesktop[®], SolidWorks[®], or SolidEdge[®]. Although it is possible to use AutoCAD[®] (not AutoCAD[®] LT) for most of the concepts, engineering firms that do serious 3D part modeling are using constraint-based or parametric modelers.

Basic methods for creating geometry

C. Extruding a profile

1. Select a construction plane.
2. Create a 2D profile on the selected construction plane.
3. Specify the direction of the extrude.
4. Specify the distance of the extrude.
5. Specify the taper angle.

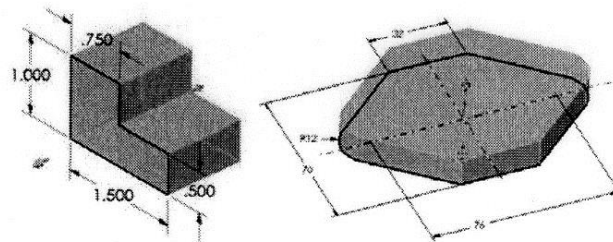


Figure 1. Extruding a Profile.

D. Revolving a profile

1. Select a construction plane.
2. Create a 2D profile on the selected construction plane.
3. Create or select an axis to rotate the profile about (axis must be in the same plane as the 2D profile).
4. Specify the direction of the revolve.
5. Specify the angle of the revolve.

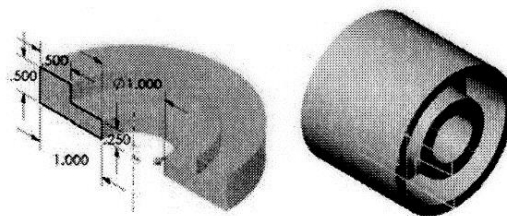


Figure 2. Revolving a Profile.

- E. Making linear cuts to remove material
1. Select a construction plane.
 2. Create a 2D profile on the selected construction plane.
 3. Specify the direction of cut.
 4. Specify the distance of the cut (through the whole object or to a specified depth).

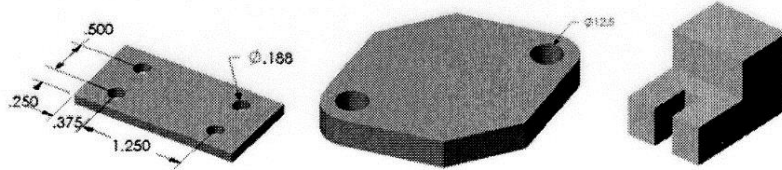


Figure 3. Making Cuts in Existing Parts.

- F. Making revolved cuts to remove material
1. Select a construction plane.
 2. Create a 2D profile with a centerline on the selected construction plane.
 3. Specify the direction of cut.
 4. Specify the angle of revolution.

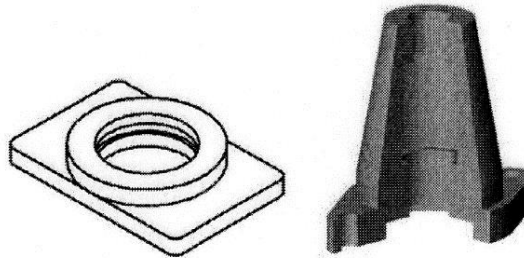


Figure 4. Making Revolved Cuts in Existing Parts.

Advanced Feature Creation Commands

- A. Creating New Construction Planes or Workplanes - Most objects that require more than just simple extrudes or revolves usually require construction planes other than the 3 default planes within the software. Typical methods for constructing new planes include:
1. Offset a new construction plane from an existing surface or plane.
 2. Creating a new construction plane parallel to an existing surface or plane through a point.
 3. Creating a new construction plane at an angle to an existing surface or plane.

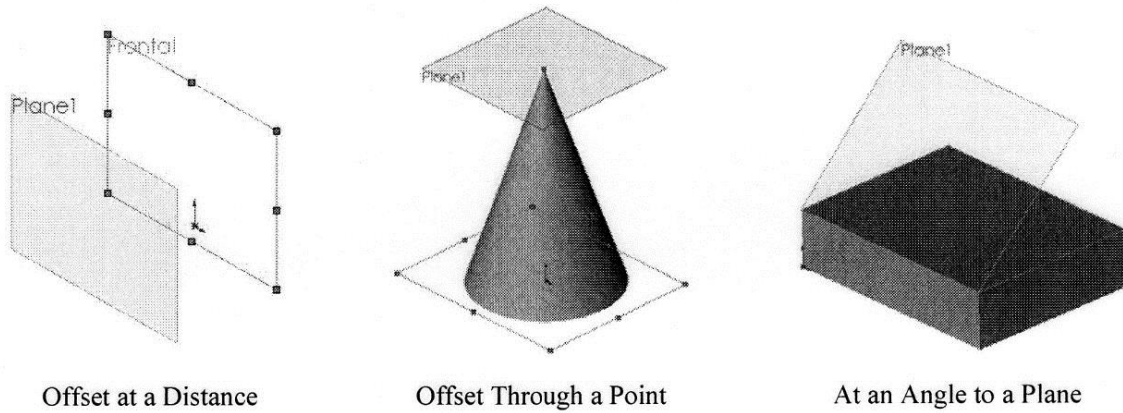


Figure 5. Creating a New Construction Plane or Workplane

B. Lofting - Lofting is a 3D modeling technique where the user creates at least two, 2D profiles on separate construction planes and the software interpolates the solid geometry between the two profiles. Most constraint-based software allows the user to add or remove material with a loft.

1. Create construction planes for each 2D profile.
2. Construct the 2D geometry on each profile.
3. Activate the loft command and select each profile.
4. Identify any guide curves or rails used to help the computer with the interpolation between the profiles.

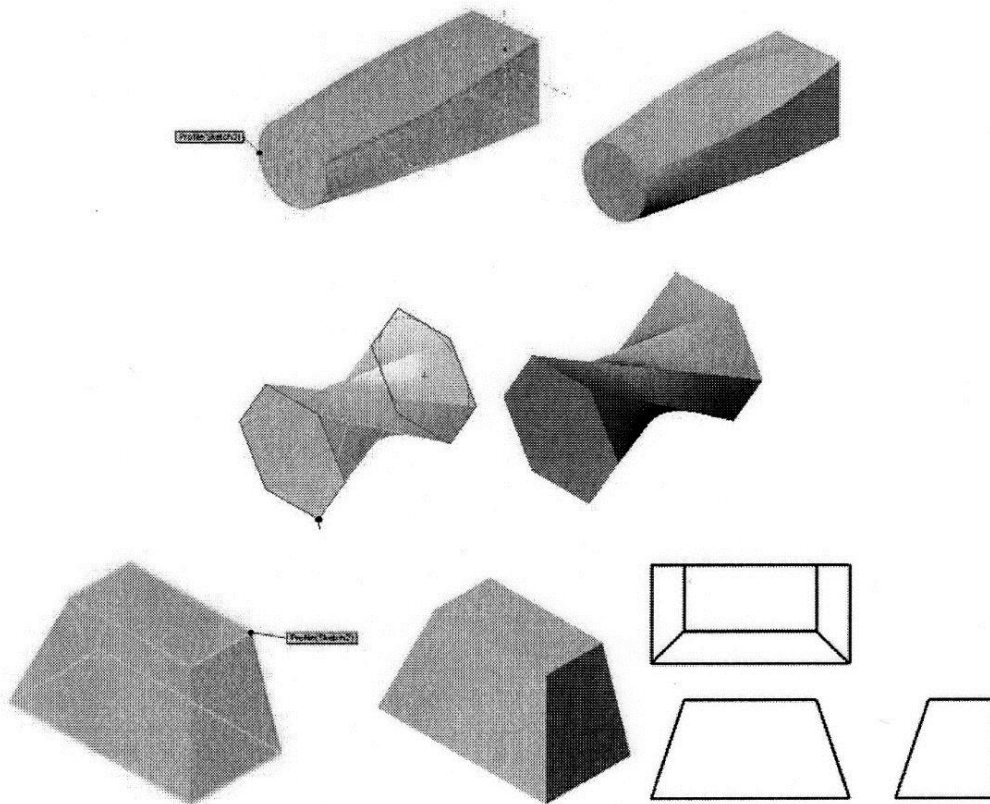


Figure 5. Lofted Objects.

- C. Sweeps - Sweeps are typically defined by a profile and a path. The profile determines the cross-section of the sweep and the path defines the direction of the sweep. As with the loft, most constraint-based software allows the user to add or remove material with a sweep.
1. Create a sketch to define the path of the sweep.
 2. Create a sketch to define the profile of the sweep. Make sure the profile and the path intersect.
 3. Activate the sweep command and select the profile and the path.

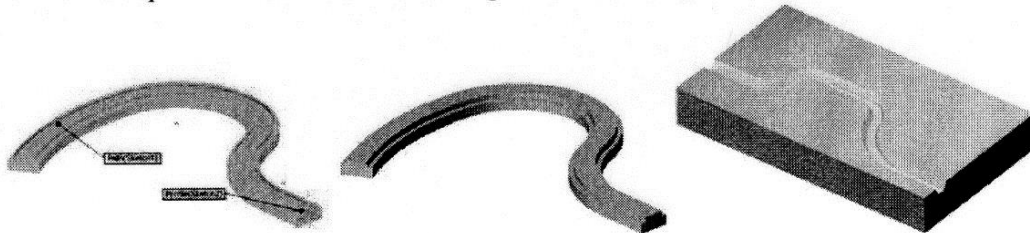


Figure 6. Swept Objects.