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Software: Mastercam 2020

Date: August 19, 2019

ISBN: 978-1-77146-859-6

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# Table Of Contents


**Getting Started** ..... **11**

Introduction “What Is “Mastercam“? ..... 12

The Mastercam® User Interface ..... 13

Setting The Grid ..... 14

Home Tab Attributes, Organize Groups And The Mini Toolbar ..... 15

Data Entry Shortcuts ..... 17

The Right Mouse Click Menu ..... 18

AutoCursor ..... 19

Introduction To The Graphic Views, Planes & The Coordinate Systems ..... 20

Mastercam® Parameter Dialog Boxes ..... 21

Mastercam® Work Flow: ..... 22

Surface Toolpath Descriptions ..... 27

Conventions Used In This Book ..... 30

**About Planes & Views** ..... **33**

Introduction ..... 34

Set PreDefined Planes And Create New Planes ..... 36

Graphics View ..... 36

Construction Plane (Cplane) ..... 37

Tool Plane (TPlane) ..... 38

About Construction Depth (Z Depth) ..... 39

Standard Construction Planes ..... 41

Creating A New Construction Plane ..... 43

Planes From Geometry ..... 44

Dynamic Planes ..... 46

Planes By Normal ..... 52

**3D Wireframe & Solid Geometry Creation** ..... **55**
Introduction ..... 56
Create Drawing #1 Wireframe ..... 58
Create Drawing #1 Solid ..... 61
Create Drawing #2 Wireframe ..... 63
Create Drawing #2 Solid ..... 64
Create Drawing #3 Wireframe ..... 66
Create Drawing #3 Solid ..... 68
Create Drawing #4 Wireframe ..... 69
Create Drawing #4 Solid ..... 71
Create Drawing #5 Wireframe ..... 72
Create Drawing #5 Solid ..... 75
Create Drawing #6 Wireframe ..... 77
Create Drawing #6 Solid ..... 80
Creating Curves ..... 83
Create A Curve On One Edge ..... 84
Create Curves On All Edges ..... 84
Create A Curve At The Intersection Between Two Surfaces ..... 84
Create Drawing #7 Wireframe ..... 85
Create Drawing #7 Solid ..... 89
**Surface Pocket, Area Rough, Contour, Waterline, Scallop & Pencil Toolpaths** ..... **93**
About Surface Toolpaths ..... 94
High Speed Surface Toolpaths ..... 94
Mastercam® Surface Toolpath Work Flow ..... 96
Surface Roughing Toolpath Process ..... 97
Surface High Speed Toolpath Process ..... 101
Toolpath Used ..... 106
Surface Rough Pocket A Boss Shape ..... 110

Surface High Speed Area Roughing To Machine A Boss Shape ..... 118
Surface Finish Contour ..... 124
Surface High Speed Waterline ..... 131
Surface High Speed Scallop ..... 135
Surface High Speed Pencil ..... 138
**Geometrical Surface Creation ..... 143**
Introduction ..... 144
Revolved Surfaces & Solids ..... 149
Create Surface Drawing #1 ..... 149
Create The Solid For The Surface Drawing #1 ..... 152
Create Surface Drawing #2 ..... 153
Create The Solid For The Surface Drawing #2 ..... 154
Draft Surfaces ..... 155
Create Surface Drawing #3 ..... 155
Flat Boundary Surface ..... 156
Extruded Surface ..... 158
Creating Primitives ..... 159
Create A Sphere ..... 159
Create A Torus ..... 160
Create A Cylinder ..... 160
**Area Roughing - Rest Material, Stock Model, Hybrid & Scallop - Rest Passes ..... 161**
Introduction ..... 162
Toolpath Used ..... 163
Surface High Speed Area Roughing To Machine Cavities ..... 167
Surface High Speed Area Roughing - Rest Material ..... 170
Stock Model ..... 173
Surface High Speed Hybrid ..... 175

Surface High Speed Scallop Rest Passes ..... 178
**Equal Scallop With Curves** ..... **181**
Introduction ..... 182
Toolpath Used ..... 182
Surface High Speed OptiRough Review ..... 186
Surface High Speed Equal Scallop ..... 190
**Free Form Surfaces Creation - Part 1** ..... **197**
Introduction ..... 198
Lofted/Ruled Surfaces & Solids ..... 202
Create A Ruled Surface ..... 203
Create A Loft Surface ..... 204
Create A Ruled Solid ..... 205
Create A Lofted Solid ..... 205
Ruled Synchronization ..... 206
Ruled/Loft Window Selection ..... 208
Net Surfaces ..... 209
Create Surface Drawing #5 ..... 209
Solid Trimmed With A Net Surface ..... 212
Window Selection ..... 213
Net Surfaces Using Styles ..... 215
Net Surface With Appex Points ..... 217
Create Surface Drawing #6 ..... 218
Create Surface Drawing #7 ..... 220
Power Surfaces ..... 221
Power Surface Geometry ..... 221
Power Surface And UV Control Points ..... 222
Using Surface Vector Or Plain Of Chain ..... 223
X- Axis Projection Versus Surface Vector ..... 224

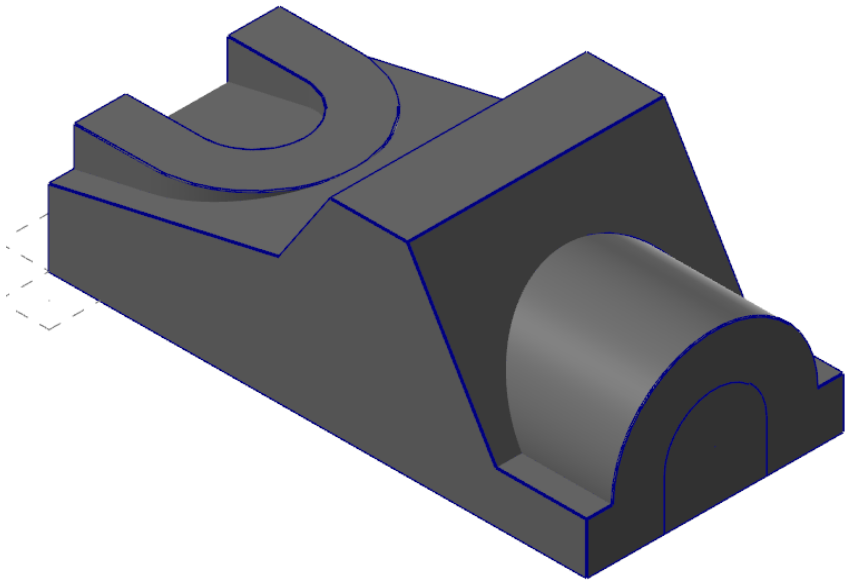
Power Surface Trimming Options ..... 225
**OptiRough, Horizontal Area & Project ..... 227**
Introduction ..... 228
Toolpath Used ..... 229
Surface High Speed Dynamic OptiRough ..... 232
Stock Model ..... 237
Surface High Speed Horizontal Area ..... 238
Surface High Speed Scallop - The Boss Shape Only ..... 242
Surface High Speed Scallop (Rest Passes) - Creating A Fillet ..... 245
Surface High Speed Project - Engrave Letters ..... 248
**Free Form Surfaces Creation - Part 2 ..... 251**
Introduction ..... 252
Sweep Surfaces & Solids ..... 256
Sweep - One Across And Two Along Contours ..... 256
Sweep - Two Across And One Along Contours ..... 257
Sweep - Two Across Closed Contours Rotate Along One ..... 258
Sweep - One Across Contour And One Along Contour ..... 259
Create Surface Drawing #8 ..... 261
Create Surface Drawing #9 ..... 262
Sweep Surfaces And Curves Review ..... 264
Create A Sweep Solid ..... 268
Solids Sweep Options ..... 273
Fence Surfaces ..... 279
Fence Surface Options ..... 279
**Review Dynamic OptiRough & Hybrid ..... 281**
Toolpaths Used ..... 282
Surface High Speed Dynamic OptiRough - Pocket Shape ..... 285

Surface High Speed Dynamic OptiRough - Rest Material ..... 290
Stock Model ..... 292
Finish The Cavity With Surface High Speed Hybrid ..... 293
**Derived Surfaces** ..... **297**
Introduction ..... 298
Instructor Demonstration: ..... 299
Offset Surfaces ..... 300
Create Surface Drawing #11 ..... 300
Trim To Curves ..... 302
Trim Surface To Surface ..... 306
Trim Surface To Plane ..... 310
Trim Surface To Plane & Create Fillet Surface ..... 310
Fillet Surfaces ..... 314
Create A Fillet Surface Between Two Sets Of Surfaces ..... 314
3 Fillet Blend Surface ..... 321
Review Surfaces ..... 332
**Review HS Horizontal & Waterline** ..... **333**
Toolpath Used ..... 334
Instructor Demonstration ..... 336
Surface High Speed Dynamic OptiRoug Review ..... 337
Surface High Speed Dynamic OptiRough - Rest Material ..... 339
Surface High Speed Waterline Review ..... 341
Surface High Speed Horizontal Area Review ..... 343
**Spiral, Hybrid Max TP & Transform Rotate** ..... **345**
Toolpaths Used ..... 346
Create A Stock Model To Be Used In A Toolpath ..... 351
OptiRough Rest Material Calculated From Stock Model ..... 352
Surface High Speed Spiral ..... 355

Surface High Speed Waterline Review ..... 358
Finish One Pocket Using Surface HS Hybrid ..... 360
Semifinish The Pocket Using Maximum Stock Engagement ..... 362
Transform Rotate Toolpath ..... 363
**Surface Finish Toolpaths & Compare To Model ..... 365**
Toolpaths Used ..... 366
Surface Rough Pocket A Cavity Shape ..... 369
Surface Finish Flowline Toolpath ..... 372
Surface High Speed Radial Toolpath ..... 377
Surface Finish Blend Toolpath ..... 381
Compare To Model ..... 383
**Surface Plunge, Raster, Pencil & Project Toolpath ..... 387**
Toolpath Used ..... 388
Surface Rough Plunge Toolpath ..... 391
Surface High Speed Raster ..... 394
Surface High Speed Pencil With Limited Passes ..... 398
Surface High Speed Finish Project Curves ..... 401
Surface High Speed Project A Toolpath ..... 403
**OptiRough Rest Material From An STL File ..... 407**
Toolpath Used ..... 408
Surface High Speed OptiRough - Rest Material From An Stl File ..... 410
Multi Setup ..... 415
**Import And Machine CAD Files ..... 419**
Toolpath Used ..... 420
Importing And Machining A Step File ..... 424
OptiRough Toolpath Review ..... 426
High Speed Horizontal Toolpath Review ..... 427

Surface High Speed Raster Review ..... 427
Importing And Machining A SolidWorks File ..... 430
Orientate The Part Using Dynamic Transform ..... 430
Set A New Origin ..... 431
Rough Out And Finishe Part ..... 432
**Model Prep & Toolpaths** ..... **435**
Introduction ..... 436
Use Dynamic Transform To Rotate The Part ..... 439
Modify Solid Feature Command ..... 440
Push/Pull Command ..... 441
Move Command ..... 442
Remove Solid Fillets Command ..... 444
Push/Pull To Change Fillets ..... 444
Rough And Finish The Part ..... 447
**3D Skills Test** ..... **451**
**Appendix - Drawings** ..... **454**

# 3D Wireframe & Solid Geometry Creation



## INTRODUCTION

This lesson will further your knowledge of the geometry creation tools that you will need for creating your own Solid geometry to define toolpaths or for creating supplemental geometry to graphically control the toolpath motions in Mastercam. The main goal of the geometry lessons is to give you the basic understanding of how to create 3D wireframe and solid geometry in Mastercam so that you can practice to become as proficient as your job requires.

While Mastercam offers a large number of geometry creation tools, this workbook focuses on fundamental tools for most shapes. Other geometry tools work in a similar manner to the ones shown in this lesson and can be used as needed for unique constructions. We have selected what we consider to be the most useful tools.

Until now, you have used wireframe geometry to model parts. Wireframe entities work well for relatively simple parts, but they are limited since they contain no information about the faces or interior of the model and cannot be shaded. 3D wireframe models can be difficult to create and change.

## OVERVIEW OF EXERCISE:

In this lesson we will continue to become familiar with the Mastercam screen components and learn tools and shortcuts to begin creating basic 3D wireframe and solid geometry shapes. We will also be introduced to some specialty geometry tools that are useful for preparing geometry for toolpaths.

## NEW CONCEPTS COVERED IN THIS LESSON:

- Create 3D Wireframe
- Create solids using extrude, trim by plane commands.
- Create Curve One Edge
- Create Curve All Edges
- Create Curve At Intersection

## INSTRUCTOR DEMONSTRATION PREVIEW

*Note: This entire lesson is a joint Instructor / Student exercise. No instructor demo for this lesson.*

**Topics:**

- **Create 3D Wireframe**
- **Create Solid Geometry**
- **Create Curves**

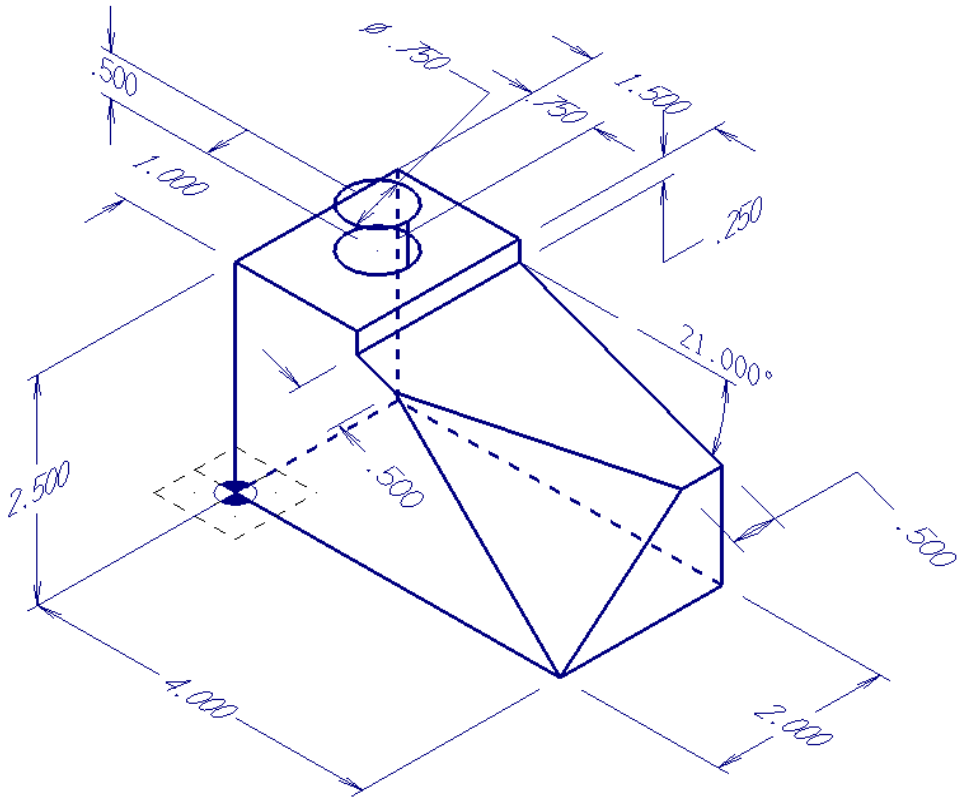
## NOTES:

# 3D WIREFRAME & SOLID GEOMETRY CREATION

*Note: In this lesson the students and instructor will work through the topics as a group.*

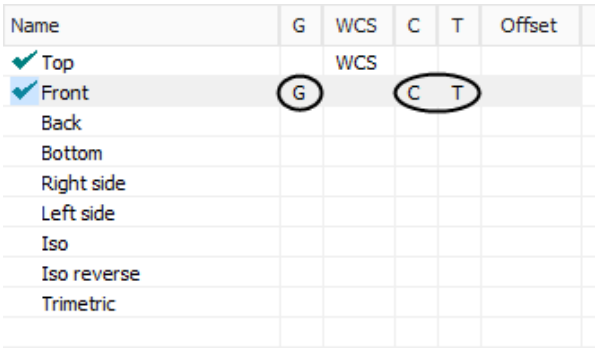
## CREATE DRAWING #1 WIREFRAME

*Full sized drawings can be found at the back of the book*



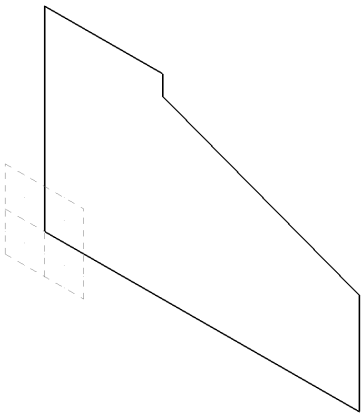

*1. Create The 2D Geometry In The Front Cplane*

- Set the **Cplane** and the **Gview** to **Front**.



Use the following commands:

- **Wireframe/Rectangle.**
- **Wireframe/Line Parallel.**
- **Wireframe/Line Endpoints.**
- **Wireframe/Trim Break Extend - Trim 2 entities.**
- The geometry should look as shown.



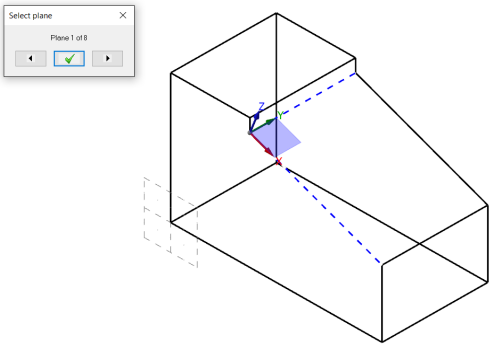
*2. Create The 3D Geometry Using Translate*

*Note: When changing the **Gview** to **Isometric**, the **Cplane** changes to **Top** plane due to settings in **Configuration**. Reselect the plane in the **Planes Manager** panel before starting the **Translate** command.*

- Select **Translate** from **Transform** ribbon.
- Enable the **Join** option and enter in the **delta Z -2.0".**

*3. Define A New Plane*

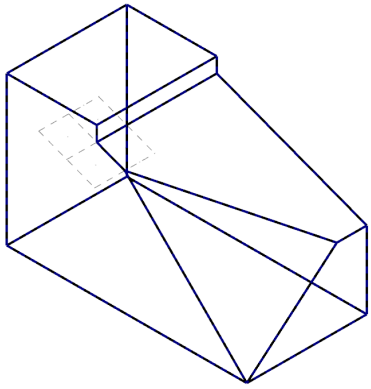
- In the **Planes Manager**, click on the drop down arrow next to the **Create a new plane** icon and select **From geometry**.
- Select first the line that you want to be the **X Axis** and then the second line that will defined **Y Axis**.
- The **Z Axis** should point outwards, otherwise select the **Forward** button until all the axes are pointing as shown.
- Give a name to the new plane and enable **Set as Cplane.** The plane origin will be automatically set at the intersection between the **X** and **Y Axis**.



*4. Create The 2D Geometry In The New Cplane*

Use the following commands:

- **Wireframe/Line Parallel.**
- **Wireframe/Line Endpoint.**
- **Wireframe/Trim Break Extend - Trim 1 entity.**
- The geometry should look as shown.

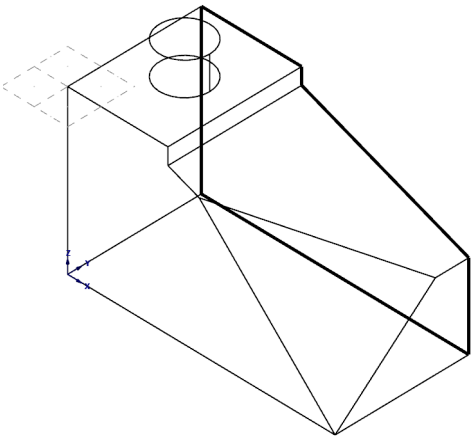


*5. Create The Cylinder In The Top Cplane*

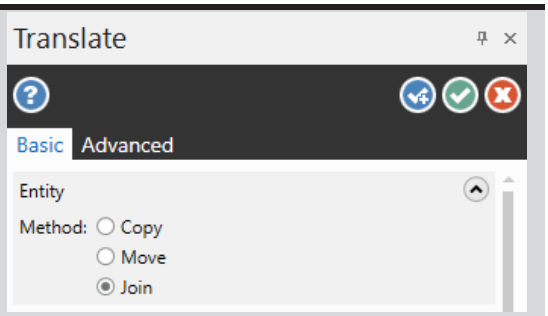
*Note: Make sure that you change the plane to **Top Cplane** and **Z depth** to **2.5"**.*

Use the following commands:

- **Wireframe/Circle Center Point.**
- **Transform/Translate.**
- The geometry should look as shown.



*Note: If you do not have the vertical line joining the two circles as shown, in the **Translate** panel ensure that **Join** is enabled as shown.*

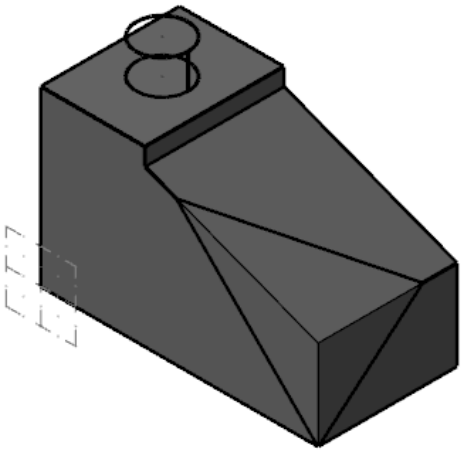


## CREATE DRAWING #1 SOLID

*1. Extrude The 2D Geometry In The Front Cplane*

Use the following command:

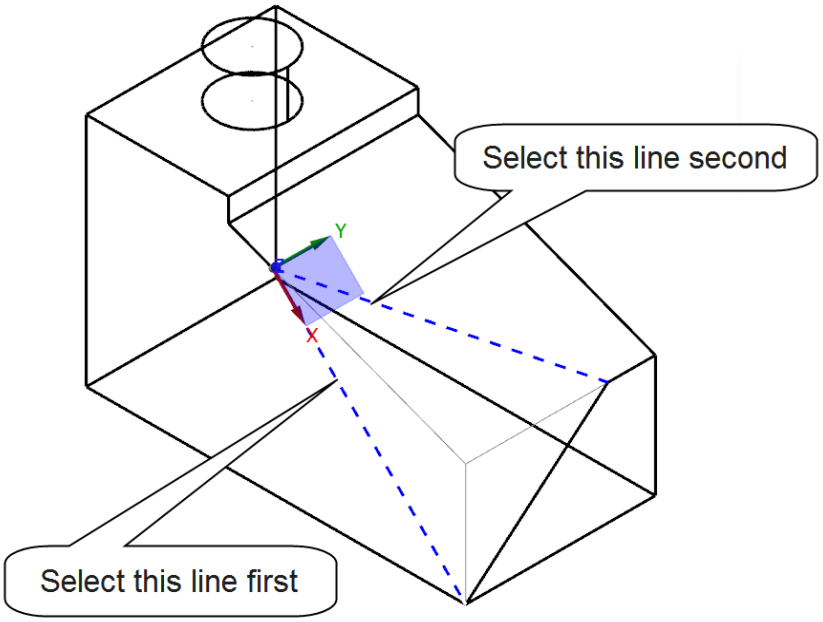
- **Solids/Extrude**.
- Make sure that the **Front** plane is selected as the **Cplane**.
- In the **Chaining** dialog box enable **C-plane**.
- Make sure the **Distance = 2.0**.
- **Reverse direction** if needed.



*2. Define A New Plane*

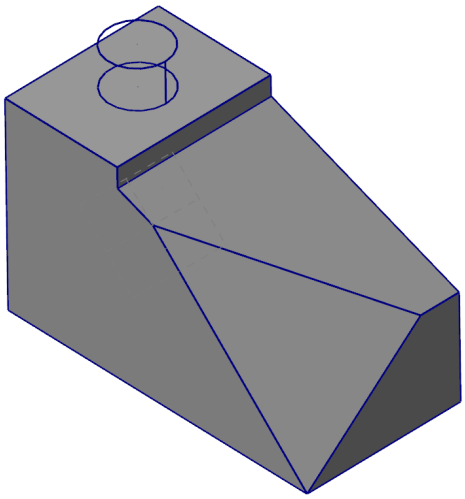
- From the **Planes Manager**, select **From geometry**.

- Select first the line that you want to be the **X Axis** and then the second line that will defined **Y Axis**.
- The **Z Axis** should point outwards, otherwise select the **Forward** button until all the axis are pointing as shown.




- Give a name to the new plane "**Plane - Solid Face**" and leave the origin at the intersection between the **X** and **Y axes**.

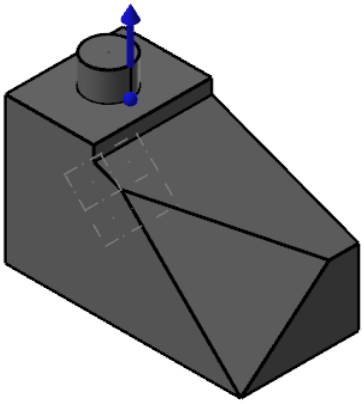
*3. Solid Trim By Plane*



Use the following command:

- **Solids/Trim by Plane**.
- Select the solid.
- In the **Plane** area, click on the **Named Plane** icon.
- Select the "**Plane - Solid Face**".
- Reverse the direction if needed as shown.

*4. Solid Extrude Add Boss*

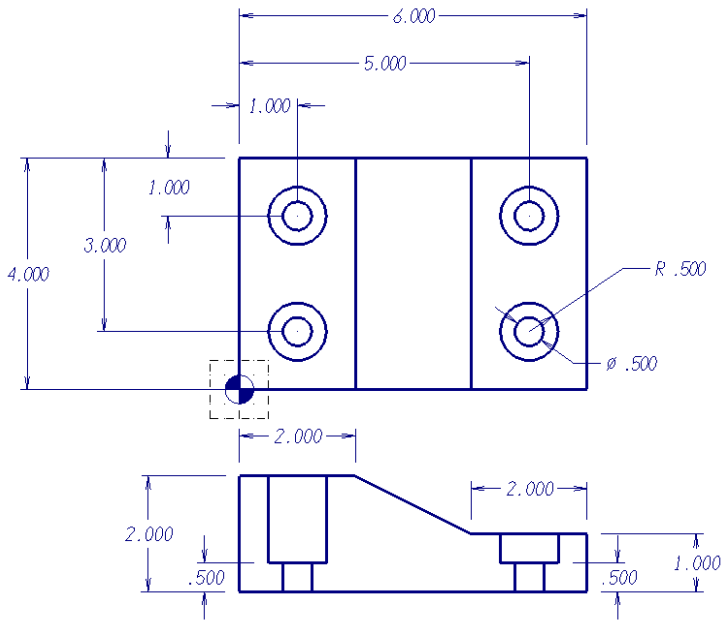


Use the following command:

- **Solids/Extrude - Add boss.**
- Select the bottom circle.
- Enable **Add boss**.
- Set the **Distance = 0.5**.
- Reverse the direction if needed.
- The geometry should look as shown.

## CREATE DRAWING #2 WIREFRAME

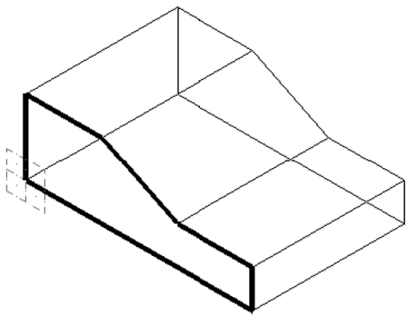
*Full sized drawings can be found at the back of the book*




*1. Create The 2D Geometry In The Front Cplane*

Use the following commands:

- **Wireframe/Rectangle.**
- **Wireframe/Line Parallel.**
- **Wireframe/Line Endpoints.**
- **Wireframe/Trim Break Extend - Trim 2 entities.**
- Delete the construction lines.
- The geometry should look as shown.



*2. Create The 3D Geometry Using Translate*

Use the following command:

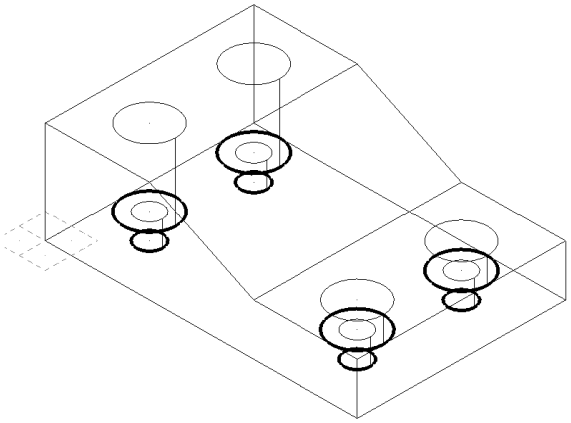
- **Transform/Translate**

*Note: To create the 3D geometry, in the Front Cplane, use Transform Translate with **Join** enabled and delta **Z = -4.0**.*

*3. Create The 2D Geometry In The Top Cplane*

Use the following commands:

- **Wireframe/Line Parallel.**
- **Wireframe/Circle Center Point.**
- Delete the construction lines.
- The geometry should look as shown.



*Note: Create the parallel lines to establish the centers of the circles. Change the Z depth to **0.5** and switch to 2D mode before you create the 1.0" diameter circles.*

*4. Create The Cylinders In The Top Cplane*

Use the following command:

- **Transform/Translate.**

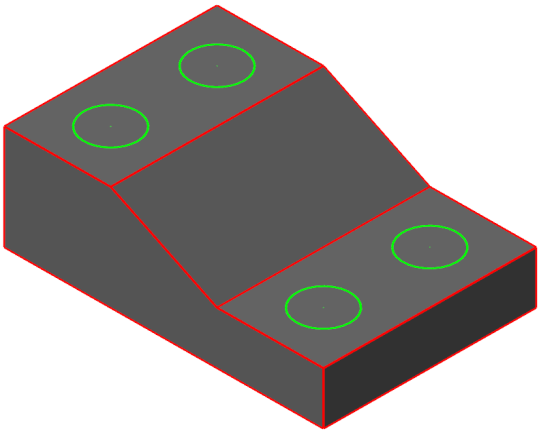
*Note: Make sure that the plane is set to the **Top Cplane** and for delta Z give the appropriate values based on the drawing dimensions.*

## CREATE DRAWING #2 SOLID

*1. Extrude Create Body*

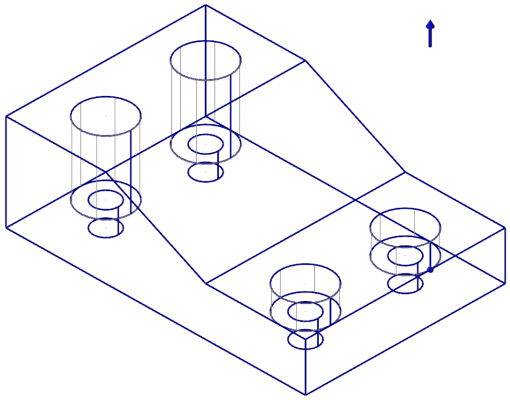
Use the following command:

- **Solids/Extrude.**
- Make sure that the **Front** plane is selected as the **Cplane**.
- In the **Chaining** dialog box enable **C-plane**.
- Make sure the **Distance = 4.0**.
- **Reverse direction** if needed.

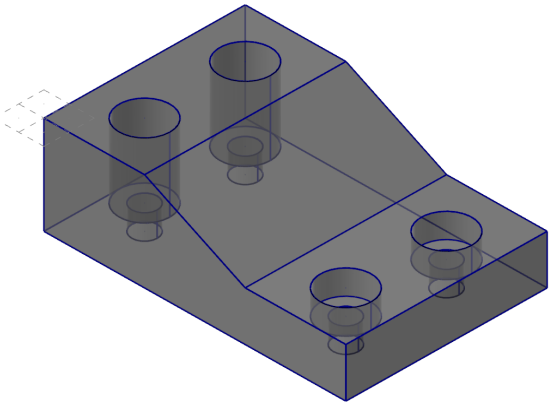


*2. Solid Extrude Cut The 1.0" Diameter Holes*

Use the following command:



- **Solids/Extrude - Cut body.**
- Unshade the solid and select all the 1" diameter circles **at the bottom**.
- Enable **Cut body**.
- Enable **Through all** as the Distance.
- Reverse direction if needed (you can click in the graphics window on the chain that was selected).
- **OK and Create New Operation**.

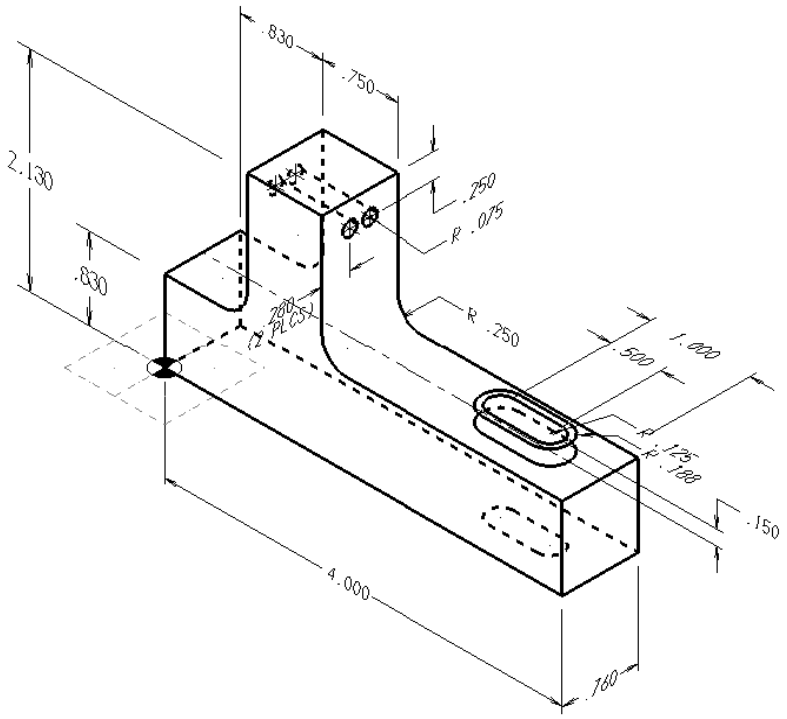


- Select the bottom circles in the same direction.
- Enable **Cut body**.
- Leave the **Distance** set **Through all**.
- Reverse direction if needed.
- Select the **OK** icon to exit the command.
- Select the **Translucency Toggle** icon.

- The geometry should look as shown.

## CREATE DRAWING #3 WIREFRAME

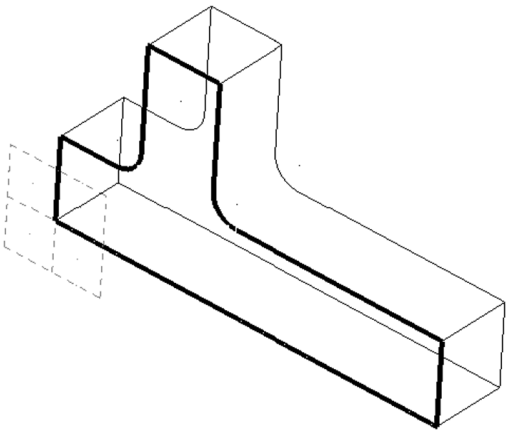
*Full sized drawings can be found at the back of the book*




*1. Create The 2D Geometry In The Front Cplane*

Use the following command:

- **Wireframe/Rectangle.**
- **Wireframe/Line Parallel.**
- **Wireframe/Trim Break Extend - Divide/delete.**
- **Wireframe/Fillet Entities**
- **Wireframe/Trim Break Extend - Trim 2 entities.**
- The geometry should look as shown.



*2. Create The 3D Geometry Using Translate*

Use the following command:

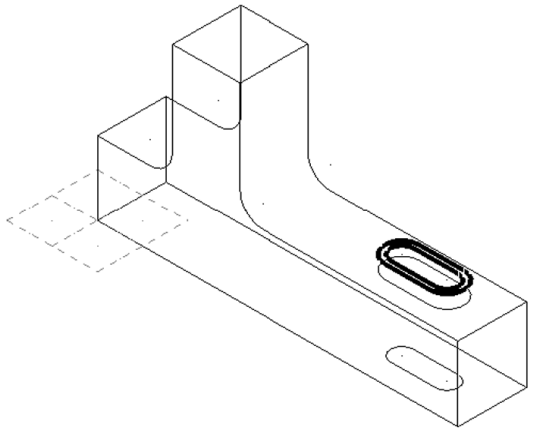
- **Transform/Translate.**

*Note: To create the **3D** geometry, use **Transform/Translate** in the **Front Cplane** with **Join** enabled and delta **Z = -0.76**.*

*3. Create The 2D Geometry In The Top Cplane*

Use the following command:

- **Wireframe/Line Parallel.**
- **Wireframe/Rectangular Shapes - Obround.**
- **Home/Delete Entities.**
- **Transform/Offset Chains.**
- **Transform/Translate**
- The geometry should look as shown.

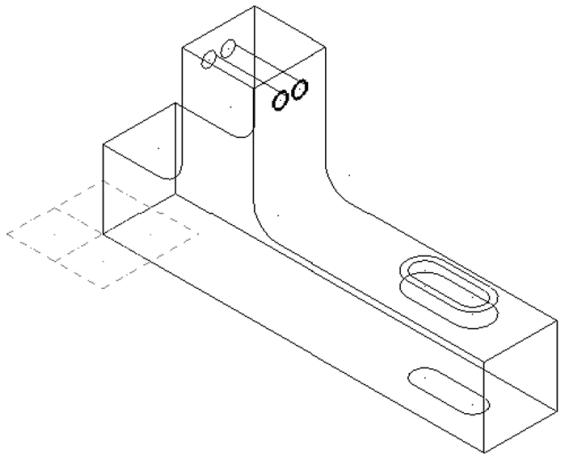


*Note: Create the parallel lines to establish the location of the lower left corner of the rectangle. Change the **Z depth** to **0.83" + 0.15"** before you create the obround. Use the **Transform/Offset Chain** to create the other obround. Use **Transform/Translate** to copy the other obrounds.*

*4. Create The 2D Geometry In The Right Cplane*

Use the following command:

- **Wireframe/Line Parallel.**
- **Wireframe/Circle Center Point.**
- **Transform/Translate**
- The geometry should look as shown.



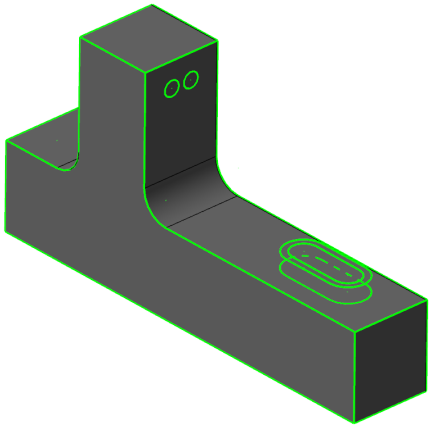
*Note: Change the plane and then change the Z-depth by selecting the endpoint of one of the lines from the face. Create the parallel lines for the center location of the circles and then create them. Use **Transform/Translate** to create the cylinders.*

## CREATE DRAWING #3 SOLID

*1. Extrude Create Body*

Use the following command:

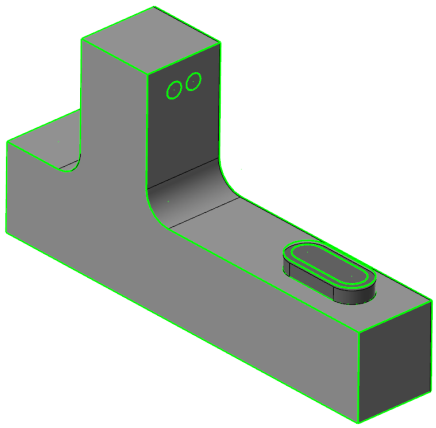
- **Solids/Extrude.**
- Select the **Front** as the **Cplane**.
- In the **Chaining** dialog box enable **C-plane**.
- Select the profile from the **Front** plane.
- Make sure the **Distance = 0.76**.
- **Reverse direction** if needed.
- **OK and Create New Operation.**



*2. Solid Extrude Add Boss*

Use the following command:

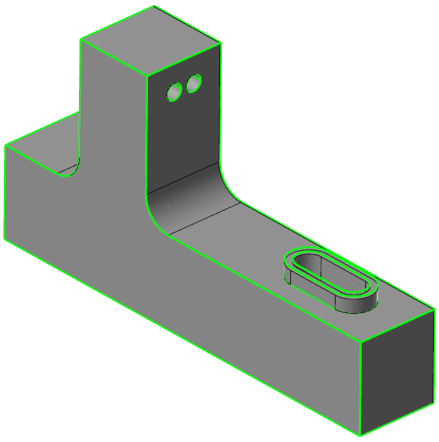
- **Solids/Extrude - Add boss.**
- Select the lower outer obround shape.
- Enable **Add boss**.
- Set the to **Distance = 0.15**.
- Reverse direction if needed.
- **OK and Create New Operation.**
- The geometry should look as shown.



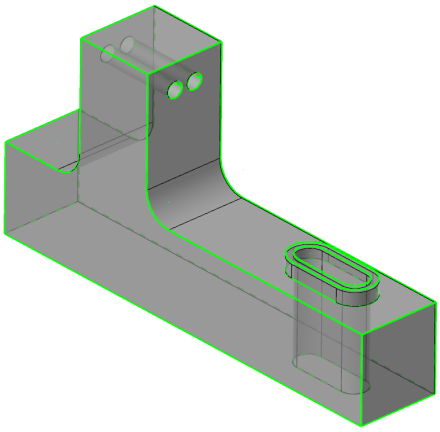
*3. Solid Extrude Cut Through The 0.15" Diameter Holes*

Use the following command:

- **Solids/Extrude - Cut body.**
- Select the **0.15"** diameter circles.
- Make sure that the **Right** plane is selected as the **Cplane**.
- Enable **Cut body**.
- Set the **Distance** to **Through all**.
- Reverse direction if needed (you can click in the graphics window on the chain that was selected).
- **OK and Create New Operation.**



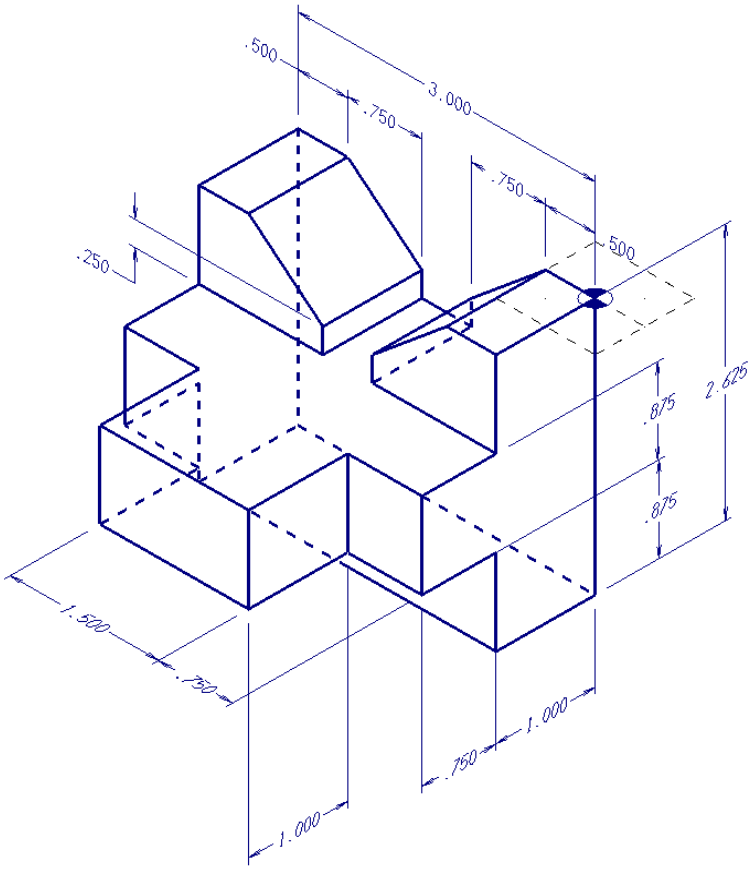
*4. Solid Extrude Cut The Obround Shape*



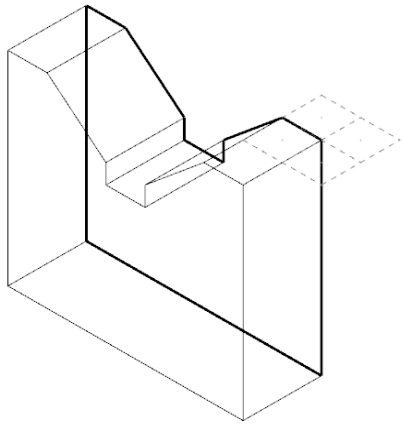
- Select the top inside obround shape.
- Leave the same settings.
- Reverse the direction if needed (you can click in the graphics window on the chain that was selected).
- Click on the **Translucency Toggle** icon.

## CREATE DRAWING #4 WIREFRAME

*Full sized drawings can be found at the back of the book*



*1. Create The 2D Geometry In The Front Cplane*



Use the following command:

- **Wireframe/Rectangle.**
- **Wireframe/Line Parallel.**
- **Wireframe/Line Endpoints.**
- **Wireframe/Trim Break Extend - Divide/delete.**
- **Wireframe/Trim Break Extend - Trim 3 entities.**
- The geometry should look as shown.

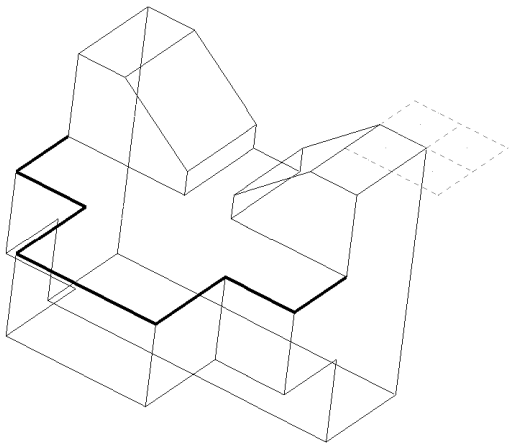
*2. Create The 3D Geometry Using Translate*

Use the following command:

- **Transform/Translate.**

*Note: To create the **3D** geometry, use **Transform/Translate** in the **Front Cplane** with **Join** enabled and delta **Z = 1.0**.*

*3. Create The 2D Geometry In The Top Cplane*



Use the following command:

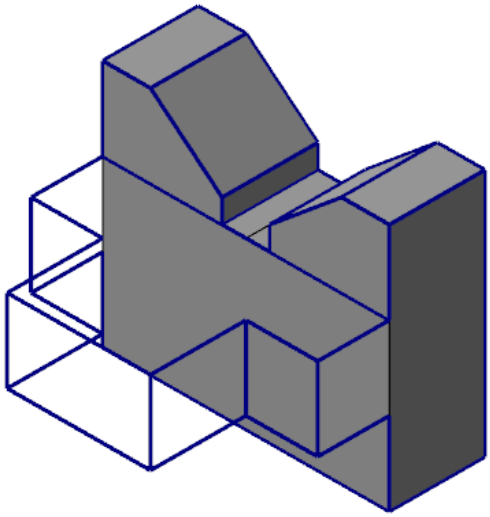
- **Wireframe/Line Endpoints.**
- **Wireframe/Line Parallel.**
- **Wireframe/Trim Break Extend - Divide.**
- **Wireframe/Trim Break Extend - Trim 2 entities.**
- **Transform/Translate**
- The geometry should look as shown.

***Note:** Change the **Cplane** to **Top** and change the **Z depth** to **-0.875**. Create a line horizontal and a line vertical and use them to create the rest of the parallel lines.*
*Use **Transform/Translate** with **Join** enabled and delta **Z = -0.875**. Clean up the geometry using trim.*

## CREATE DRAWING #4 SOLID

***Note:****Solids require closed chains. Use the* ***Join*** *command to join the lines if needed.*

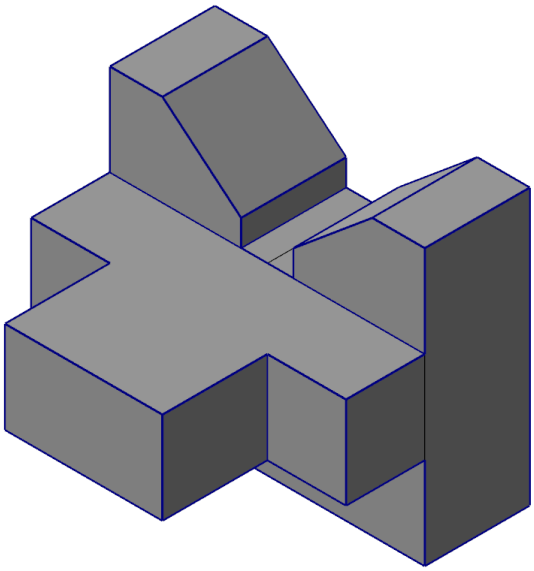
*1. Extrude Create Body*



Use the following command:

- **Solids/Extrude.**
- Select the **Front** as the **Cplane**.
- In the **Chaining** dialog box enable **C-plane**.
- Select the profile from the **Front** plane.
- Make sure the **Distance = 1.0**.
- **Reverse direction** if needed.
- **OK and Create New Operation.**

*2. Solid Extrude Add Boss*

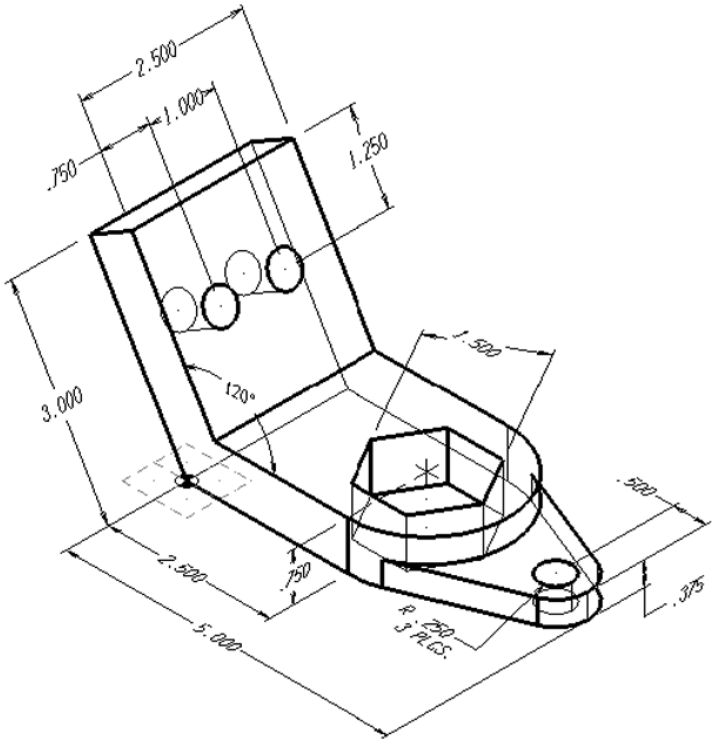


Use the following command:

- **Solids/Extrude - Add boss.**
- Select the **Top** plane as the **Cplane**.
- In the **Chaining** dialog box enable **C-plane**.
- Select the profile from the **Front** plane.
- Enable **Add boss**.
- Make sure the **Distance = 0.875**.
- **Reverse direction** if needed.

## CREATE DRAWING #5 WIREFRAME

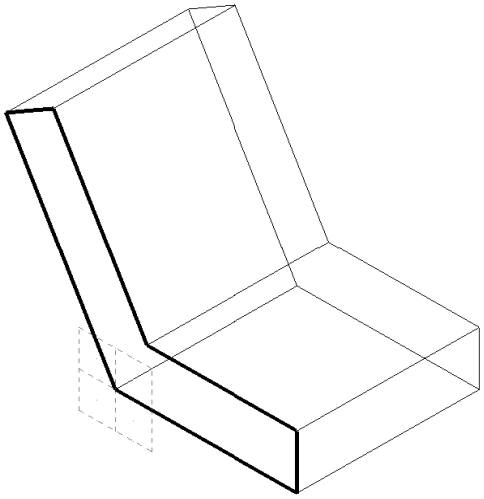
*Full sized drawings can be found at the back of the book*




*1. Create The 2D Geometry In The Front Cplane*

Use the following command:

- **Wireframe/Line Endpoints.**
- **Wireframe/Line Parallel.**
- **Wireframe/Trim Break Extend - Trim 2 entities.**
- The geometry should look as shown.



*2. Create The 3D Geometry Using Translate*

Use the following command:

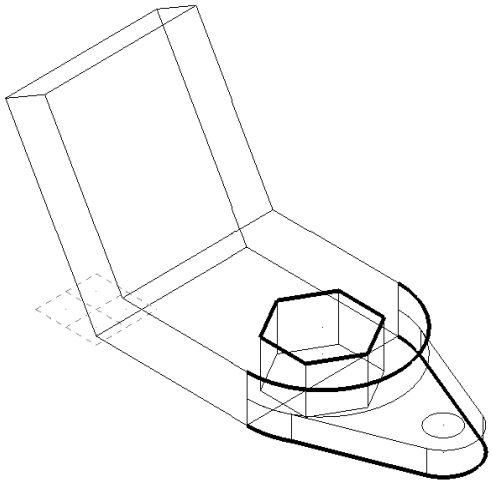
- **Transform/Translate.**

*Note: To create the **3D** geometry, use **Transform/Translate** in the **Front Cplane** with **Join** enabled and delta **Z = -2.5**.*

*3. Create The 2D Geometry In The Top Cplane*

Use the following command:

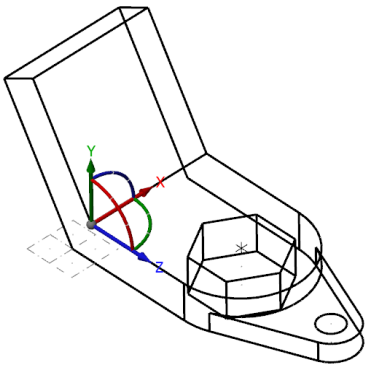
- **Wireframe/Arc Endpoints.**
- **Wireframe/Line Parallel.**
- **Wireframe/Trim Break Extend - Trim 1 entities.**
- **Wireframe/Circle Center Point.**
- **Delete entities.**
- **Wireframe/Line Endpoints - Tangent.**
- **Wireframe/Trim Break Extend - Divide.**
- **Wireframe/Trim Break Extend - Trim 2 entities.**
- **Transform/Translate**
- **Wireframe/Arc Endpoints.**
- **Transform/Translate.**
- **Wireframe/Polygon.**
- **Transform/Translate.**
- The geometry should look as shown.



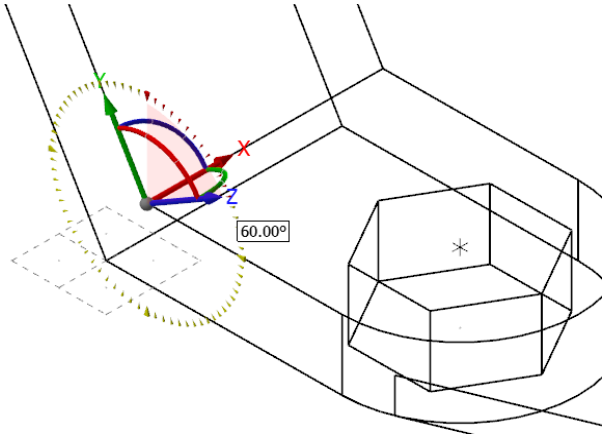
***Note:** Change the **Cplane** to **Top** and create the **2D** geometry at the appropriate depths as shown. Use **Transform/Translate** with **Join** and **delta Z** based on the drawing.*

*4. Define A New Plane*

- From the **Planes Manager**, click on the **Create new plane** icon and select **Dynamic**.
- Pick the new origin as shown.



- Pick the **Y axis** and rotate it as shown in the figure to the right.
- Give a name to the new plane and make sure **Set as Cplane** is enabled.
- Exit the **New Plane** dialog box.

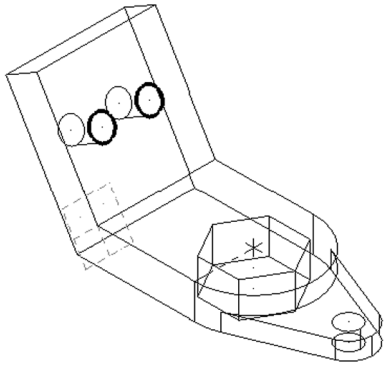



- Change the **Z depth** to **0.0**.

*5. Create The 2D Geometry In The New Cplane*

Use the following command:

- **Wireframe/Line Parallel.**
- **Wireframe/Circle Center Point.**
- The geometry should look as shown.

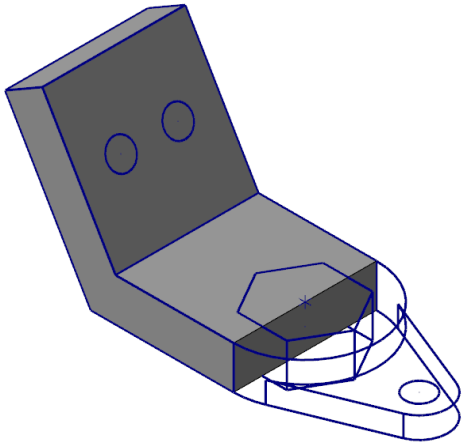


## CREATE DRAWING #5 SOLID

*1. Extrude Create Body*

Use the following command:

- **Solids/Extrude.**
- Select the **Front** as the **Cplane**.
- In the **Chaining** dialog box enable **C-plane**.
- Select the profile from the **Front** plane.
- Make sure the **Distance = 2.5**.
- **Reverse direction** if needed.
- Select the **OK** button.

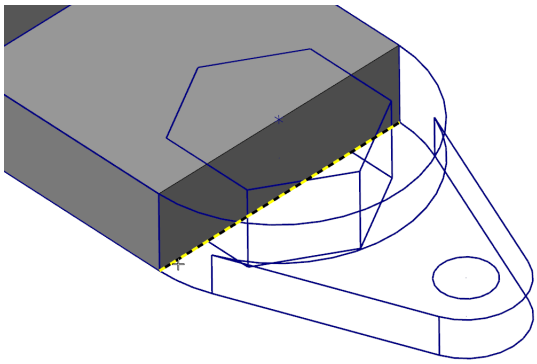


*2. Create A Line To Close The Profile*

***Note:*** *Solids require closed chains.*

Use the following command:

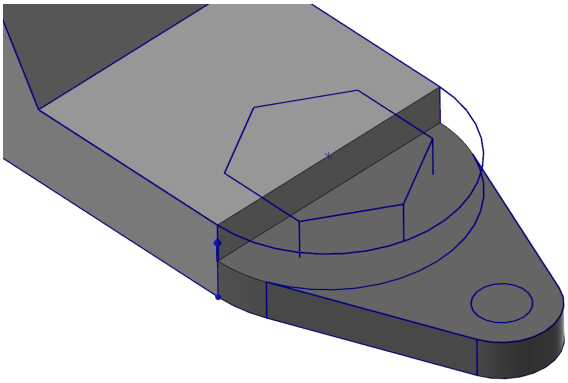
- **Wireframe/Line Endpoints.**



*3. Solid Extrude Add Boss*

Use the following command:

- **Solids/Extrude - Add boss.**
- Select the **Top** plane as the **Cplane**.
- In the **Chaining** dialog box enable **C-plane**.
- Select the profile from the **Top** plane.
- Enable **Add boss**.
- Make sure the **Distance = 0.375**.
- **Reverse direction** if needed.
- Select the **OK** button.



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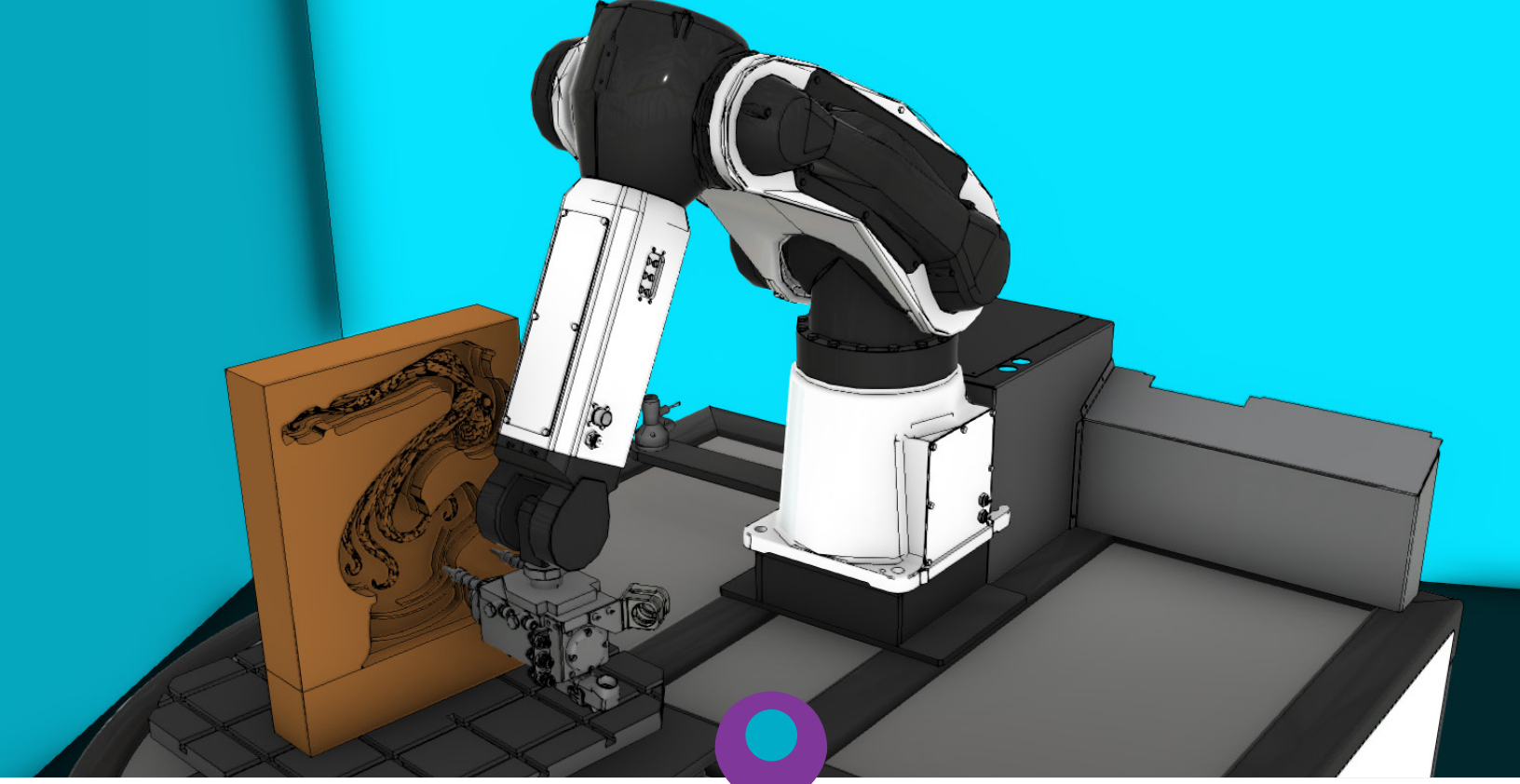

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