

Mastercam 2019

METRIC – TRAINING TUTORIAL SERIES



Demo Software Download Instructions Included

SOLIDS

Mastercam® 2019

SOLIDS METRIC TRAINING TUTORIAL

Mastercam 2019 Solids Tutorial Metric

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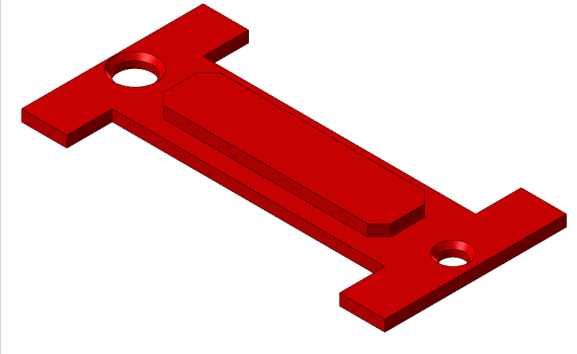
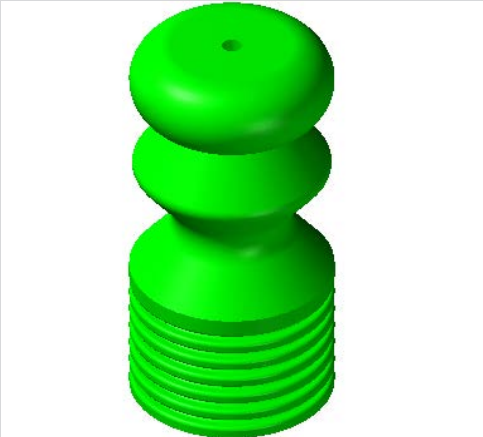

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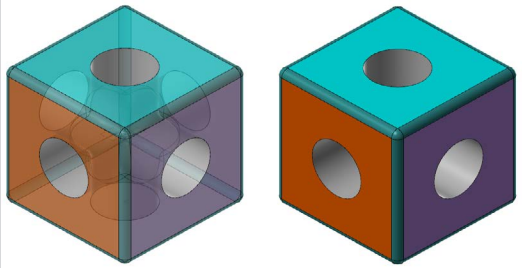
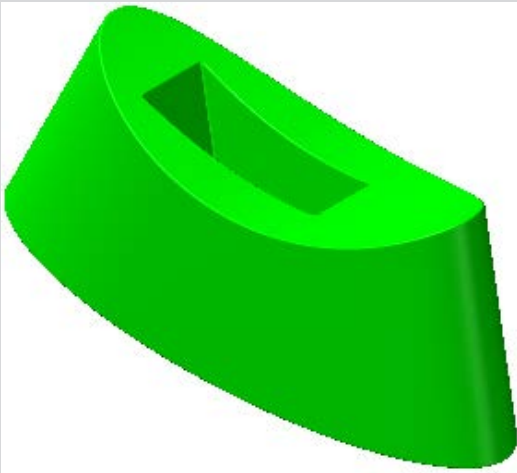
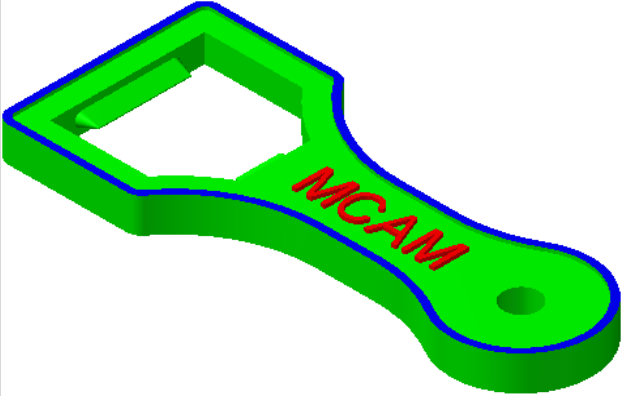
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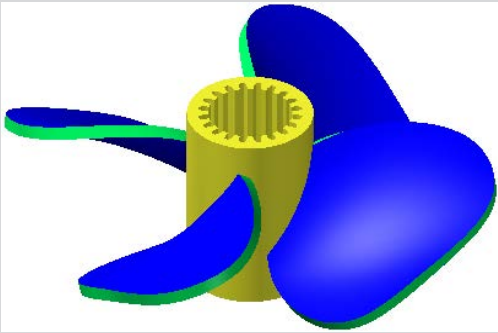

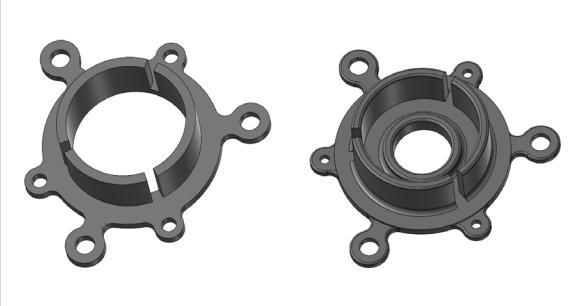
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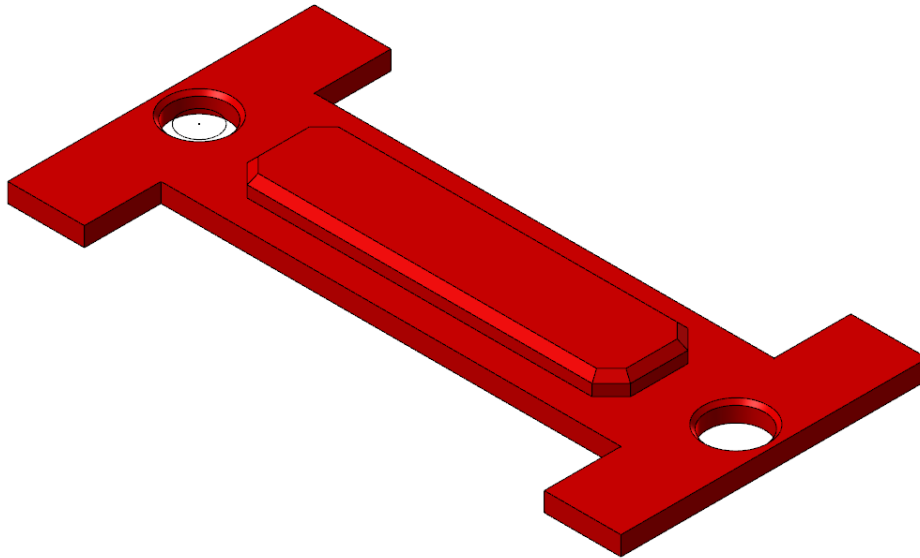
Solids Projects

Tutorial	Geometry Functions
<p>#1</p> 	<p>Create Rectangle. Chamfer Outside Profile. Solid Extrude Create Body. Solid Extrude Add Boss. Solid Hole. Constant Radius Fillet. One Distance Chamfer</p>
<p>#2</p> 	<p>Create Geometry in Front Plane. Create Rectangle. Create Parallel Lines. Create Tangent Arcs. Create Lines. Translate Geometry. Create Fillets. Solid Revolve Create Body. Solid Extrude Cut Body</p>
<p>#3</p> 	<p>Create Rectangle. Create Geometry in Front Plane. Create Fillets. Create Circle Center Point. Create Rectangular Array. Solid Extrude Create Body. Solid Extrude Add Bosses. Constant Fillet Radius. Solid Sweep Cut Body. Make Changes to The Solid. Solid Shell.</p>

Tutorial	Geometry Functions
<p>#4</p> 	<p>Create Circles Primitive Solid Block Constant Fillet Radius Set Solid Feature Color Solid Extrude Boolean Add Boolean Remove</p>
<p>#5</p> 	<p>Create Ellipses. Create Rectangles. Create an Arc in Front Plane. Create Lines. Create Solid Body Using Loft. Solid Loft Cut. Solid Extrude Cut. Move Solid to Another Level. Fillet All Edges. Set Feature Color.</p>
<p>#6</p> 	<p>Top Construction Plane. Create Circle Center Point. Create Rectangle. Create Horizontal and Parallel Lines. Create Arc Tangent. Create Arc Endpoints. Create Fillet. Transform Mirror The Geometry. Transform Offset. Trim Geometry. Create Rectangular Shapes. Create Letters. Transform Dynamic. Solid Extrude Create Body. Solid Extrude Add Bosses. Solid Extrude Add Bosses with Draft Angle. Solid Extrude Cut Body. Remove Solid History.</p>

Tutorial	Geometry Functions
<p>#7</p> 	<p>Create Rectangle. Create Circle Center Point. Create Arc Polar. Transform Rotate. Create Line Parallel. Create Points. Create a Spline. Create Net Surface. Create Ruled Surface. Solids from Surfaces. Solid Extrude. Solid Circular Pattern. Create Curves On All Edges</p>
<p>#8</p> 	<p>Open File From Previously Saved File. Create Rectangle. Extrude Solid Body. Boolean Remove. Trim Solid by Plane. Transform Dynamic.</p>
<p>#9</p> 	<p>Open an existing file. Model Prep Remove All Solid History Operations. Model Prep Split Solid Face - Projection option. Model Prep Pull-Push. Model Prep Move. Model Prep Split Solid Face - Flowline option.</p>

Tutorial 1



OVERVIEW OF STEPS TAKEN TO CREATE THE PART GEOMETRY:

From Drawing to CAD Model:

- ◆ The student should examine the drawing on the following page to understand what part is being created in the tutorial.
- ◆ From the drawing we can decide how to create the geometry in Mastercam.

Create the wireframe that will be used to create the solid:

- ◆ The student will create flat geometry in the Top plane.
- ◆ Geometry with a Z-Depth of 0 will be created and used to extrude the solid later on.
- ◆ 2D Geometry commands such as Rectangle, Chamfer, Trim, and Divide will be used.

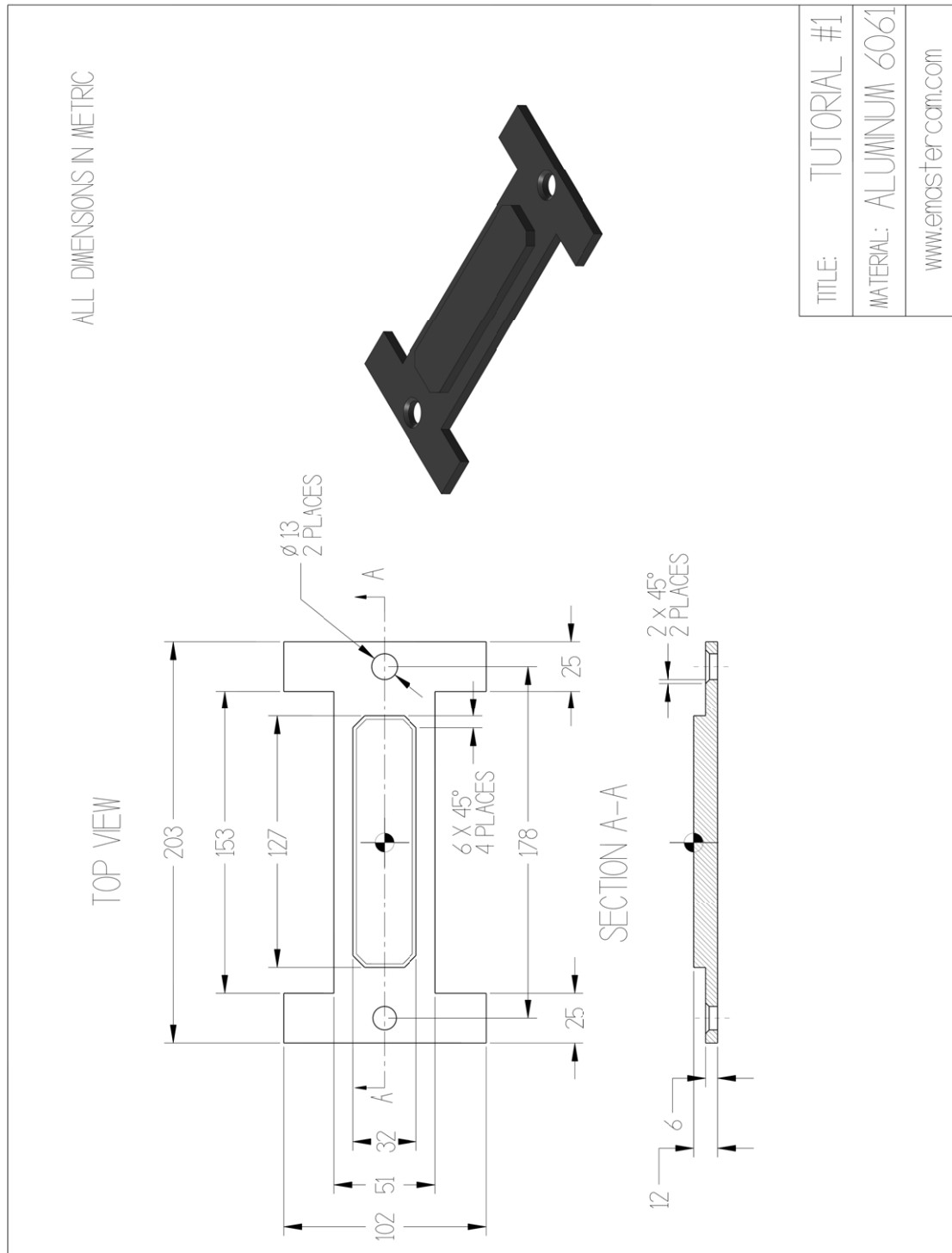
Create the solid model:

- ◆ The student will create a new level to separate the wireframe from the solid model so that the file can be better organised.
- ◆ The Extrude command will be used to create the main solid body of the part and the boss.
- ◆ The Hole command will be used to cut the holes through the part.
- ◆ The Extrude command will be used to add the boss at the top of the main solid.
- ◆ The top of the boss will be chamfered using One Distance Chamfer command.



This tutorial takes approximately one hour to complete.

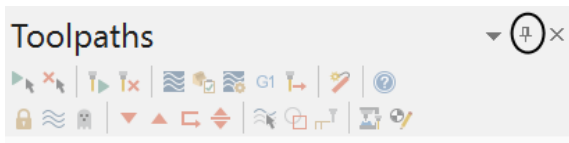
TUTORIAL #1 DRAWING



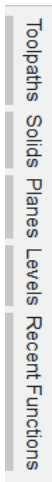
STEP 1: SETTING UP THE GRAPHICAL USER INTERFACE

Please refer to the Getting Started section for more info on how to set up the graphical user interface. In this step, you will learn how to hide the manager panels to gain more space in the graphics window.

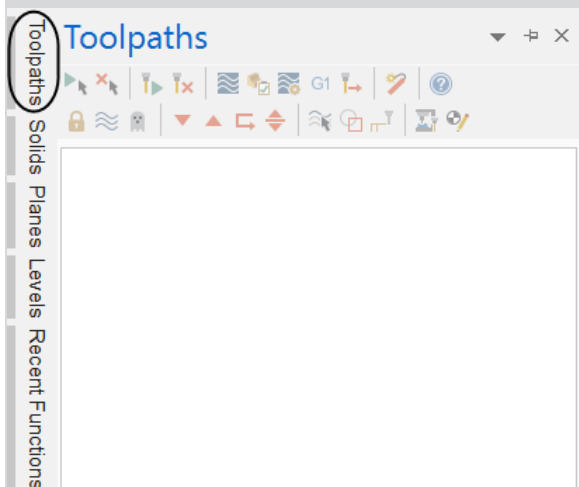
- ◆ Use **Auto Hide** icon to hide all **Manager** panels.



- ◆ The panels will be hidden to the left of the graphics window as shown.



Note: To un-hide them temporarily, you can click on one of the Managers to open it as shown.

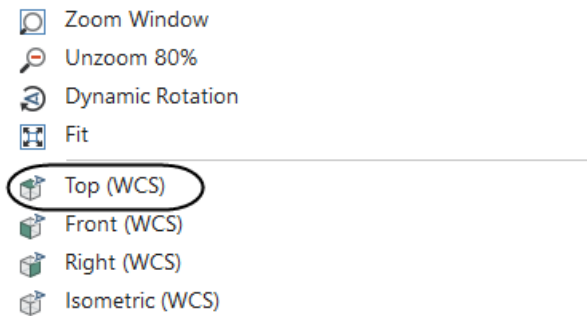


While creating the geometry, keep the Manager panels hidden. This ensures more space in the graphics window for the geometry.

STEP 2: SET THE CONSTRUCTION PLANE AND CHANGE WIREFRAME COLOR

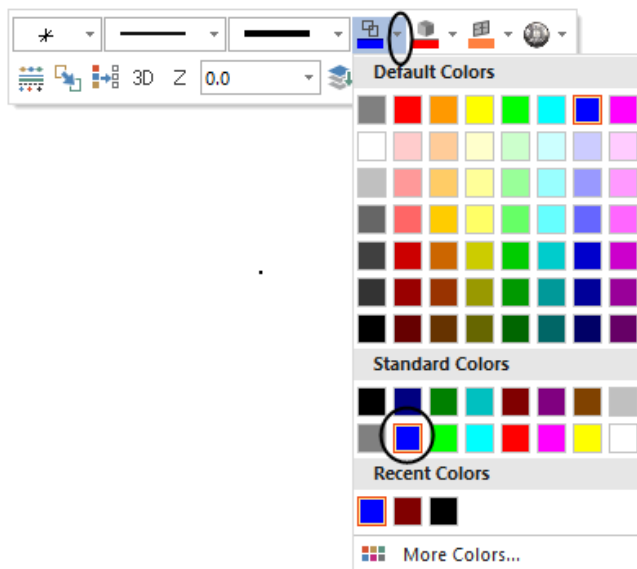
In this step you will learn how to set the Construction Plane to create the flat geometry. By setting the Graphic View to Top the Construction Plane will be automatically set to Top too.

- ◆ Right mouse click in the graphics window and select the Top (WCS) icon as shown.



Note: You may skip this step if the wireframe color is already set to Blue #9.

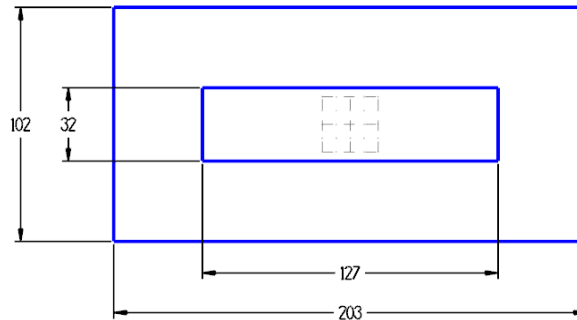
- ◆ Right mouse click in the graphics window and from the **Mini Toolbar**, left click on the arrow next to the **Wireframe Color** icon and select the color **Blue #9** as shown.



STEP 3: CREATE RECTANGLES GIVEN THE SIZE AND ANCHOR POINT

In this step you will learn how to create two rectangles given the width, height, and anchor point.

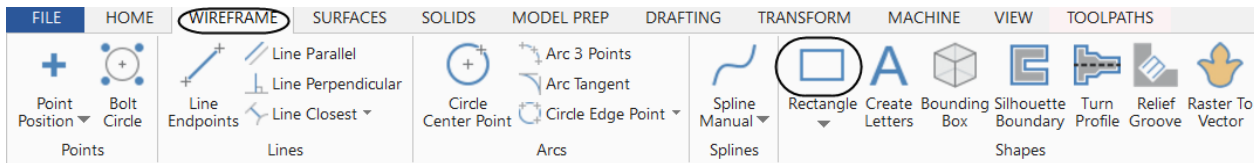
Step Preview:



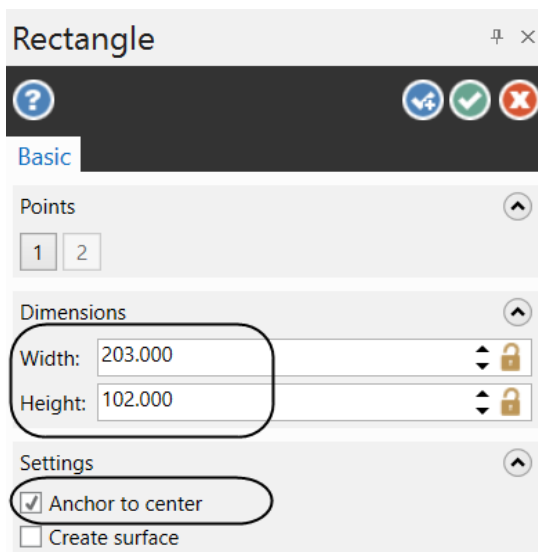
3.1 Create the 203mm X 102mm Rectangle

WIREFRAME

- ◆ From the **Shapes** group, select **Rectangle**.



- ◆ In the **Rectangle** panel, enter the **Width** and **Height** and enable **Anchor to center** as shown.

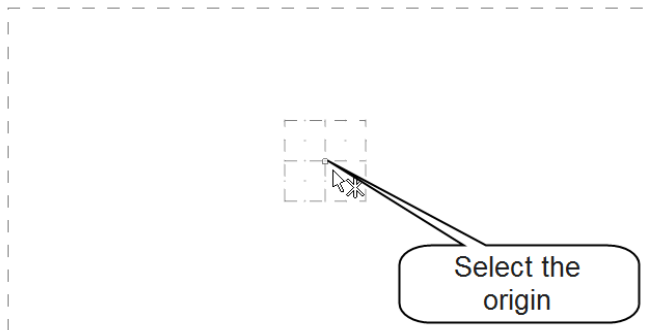


Anchor to center sets the base point of the rectangle to its center and draws the rectangle outward from the center.

Create surface creates a surface inside of the rectangle. Surface creation and Surface toolpath are covered in Mill Advanced.

A **surface** can be described as the skin on the top of a 3D wireframe. If the Create surface option is on, in addition to the four lines of the rectangle, you will also see extra lines which represent the surface display while it is not shaded.

- ◆ Press **Enter** after typing the values to see a preview of the rectangle.
- ◆ [Select position of base point]: Select the Origin as shown.





- ◆ Make sure that when selecting the origin, the visual cue of the cursor changes as shown.



- ◆ Select the **OK and Create New Operation** button to stay in the same command.



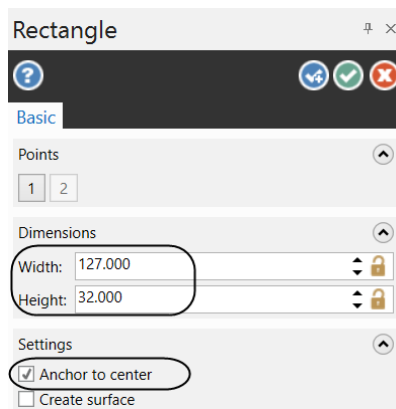
- ◆ To fit the drawing to the screen, press **Alt + F1**.

*Note: While creating geometry for this tutorial, if you make a mistake, you can undo the last step using the **Undo** icon.  You can undo as many steps as needed. If you delete or undo a step by mistake, just use the **Redo** icon.  To delete unwanted geometry, select the geometry first and then press **Delete** from the keyboard. To zoom or un-zoom, move the cursor in the center of the geometry and scroll up or down the mouse wheel.*

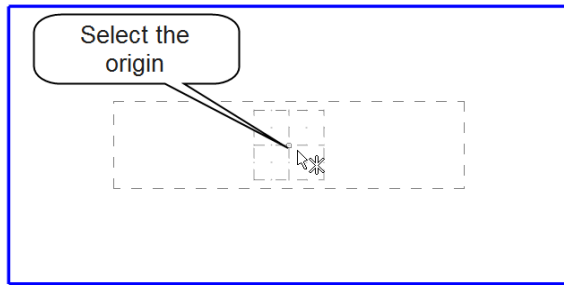
- ◆ To zoom in and out, hover the cursor approximately above the center of the part and scroll the mouse wheel up and down.

3.2 Create the 127mm X 32mm Rectangle

- ◆ Enter the **Width**, the **Height** and leave **Anchor to center** enabled as shown.
- ◆ Make sure that the **Create surface** button is not selected.



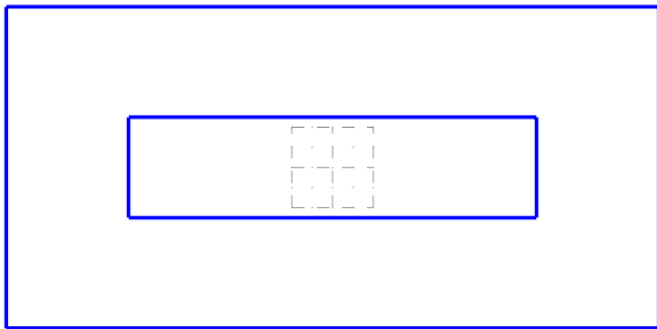
- ◆ [Select position of base point]: Select the **Origin** as shown.



- ◆ Select the **OK** button to exit the same command.



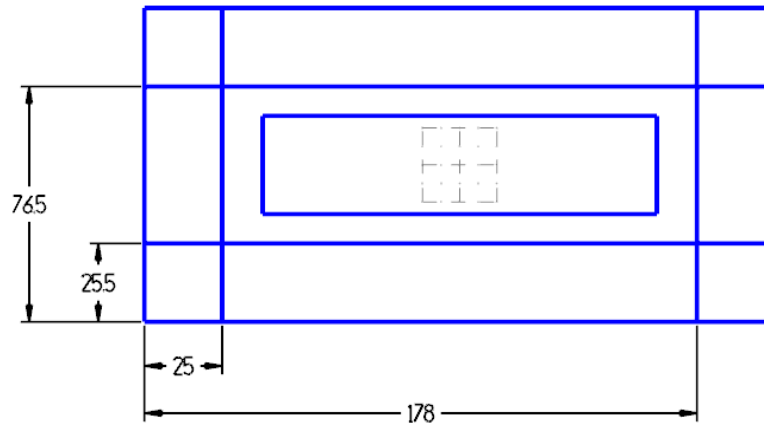
- ◆ The drawing should look as shown below.



STEP 4: CREATE THE PARALLEL LINES

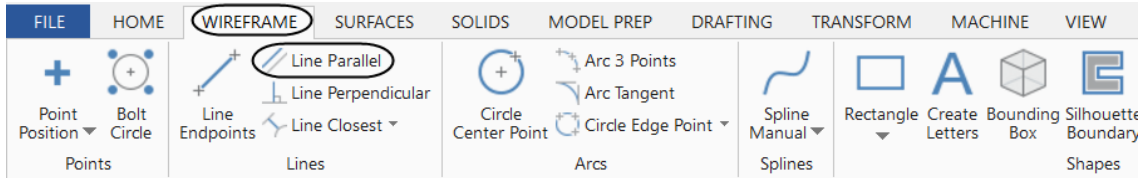
In this step you will learn how to create parallel lines to existing lines given the distance between the lines. We are creating the lines to use them as part of the geometry as well as construction lines.

Step Preview:

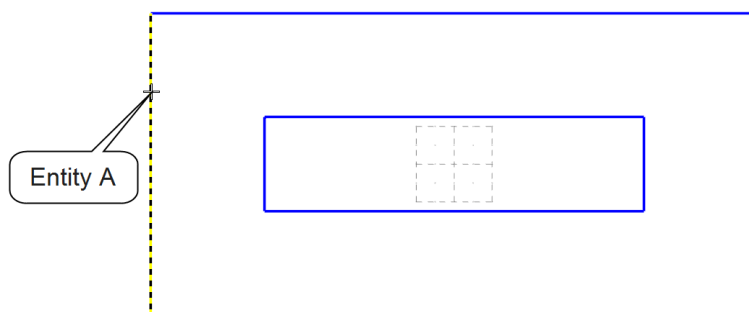


WIREFRAME

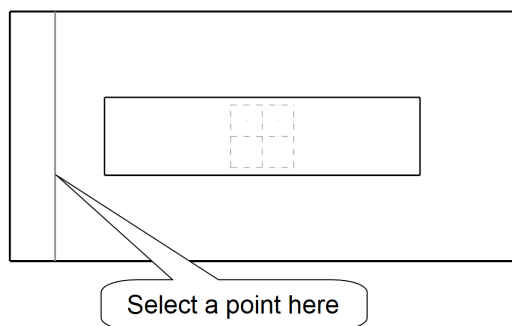
- ◆ From the **Lines** group, select **Line Parallel** as shown.



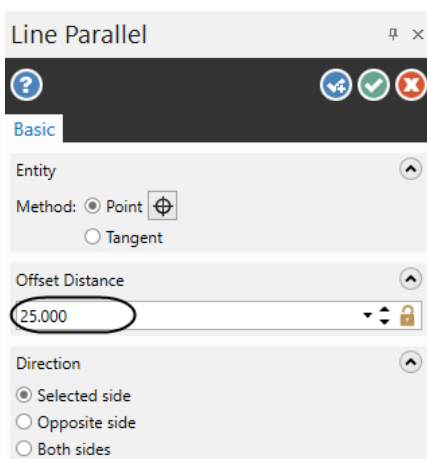
- ◆ [Select a line]: Select Entity A as shown.



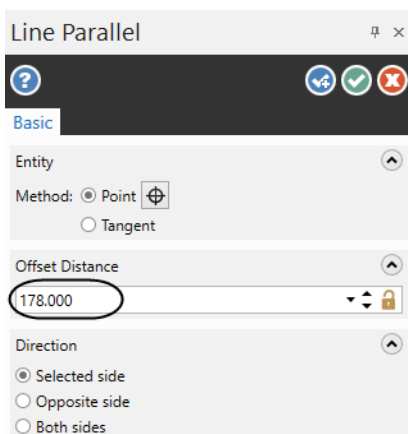
- ◆ [Select the point to place a parallel line through]: Select a point to the right of the selected line.



- ◆ In the **Line Parallel** panel, enter an **Offset Distance** of **25mm** as shown.



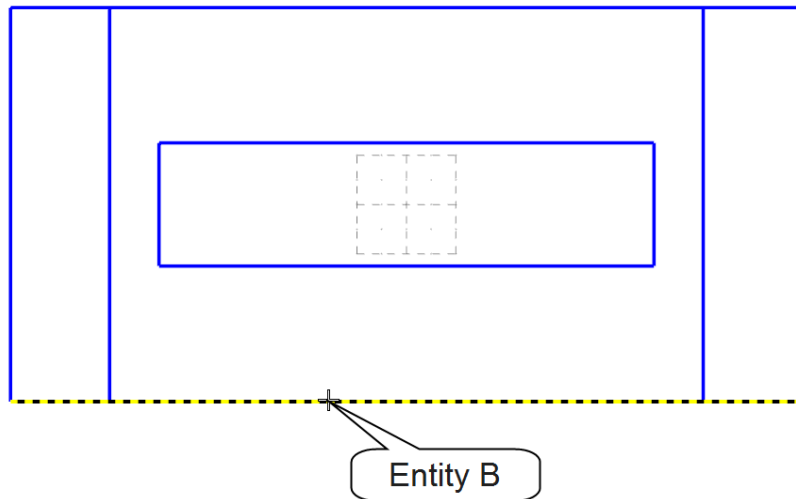
- ◆ Select the **OK and Create New Operation** button to stay within the command.
- ◆ [Select a line]: Select Entity A again.
- ◆ [Select the point to place a parallel line through]: Select a point to the right of the selected line.
- ◆ In the **Line Parallel** panel, enter an **Offset Distance** of **178mm** as shown.



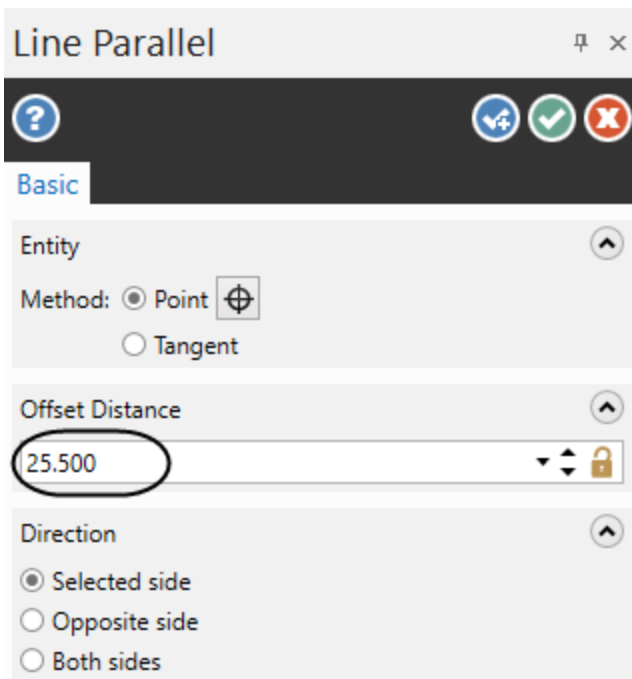
- ◆ Select the **OK and Create New Operation** button to stay within the command.



- ◆ [Select a line]: Select Entity B as shown.



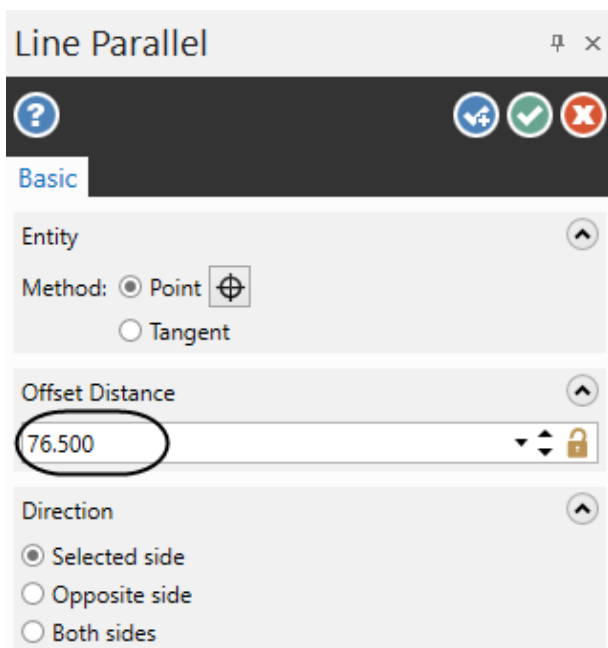
- ◆ [Select the point to place a parallel line through]: Select a point above the selected line.
- ◆ In the **Line Parallel** panel, enter an **Offset Distance** of **25.5mm** as shown.



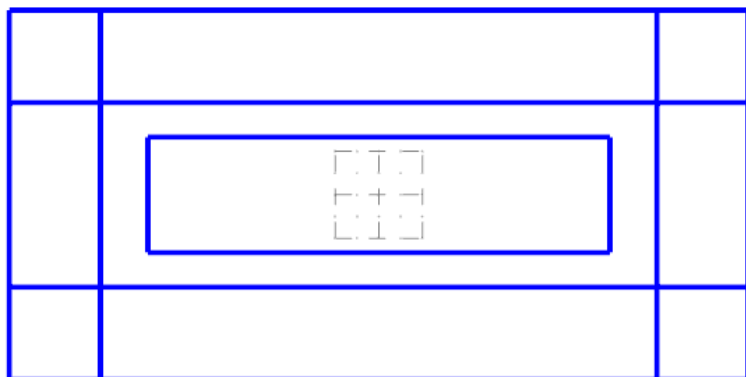
- ◆ Select the **OK and Create New Operation** button to stay within the command.



- ◆ [Select a line]: Select Entity B again.
- ◆ [Select the point to place a parallel line through]: Select a point above the selected line.
- ◆ In the **Line Parallel** panel, enter an **Offset Distance** of **76.5mm** as shown.



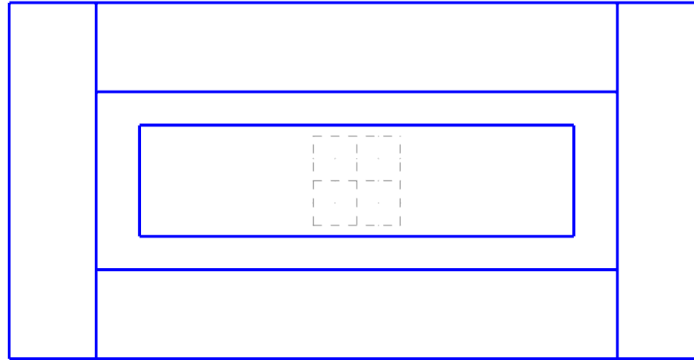
- ◆ Select the **OK** button to exit the command.
- ◆ The geometry should look as shown.



STEP 5: TRIM THE GEOMETRY

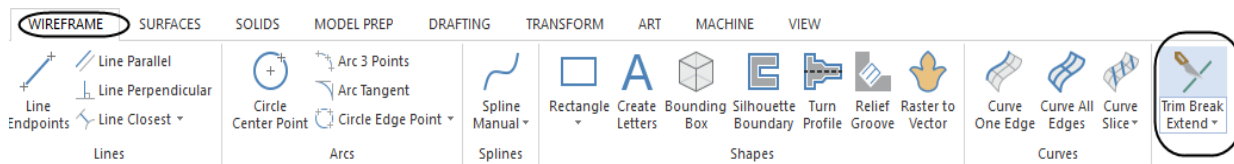
To Trim 1 entity, select the entity you wish to trim, then select the entity you wish to trim to.

Step Preview:

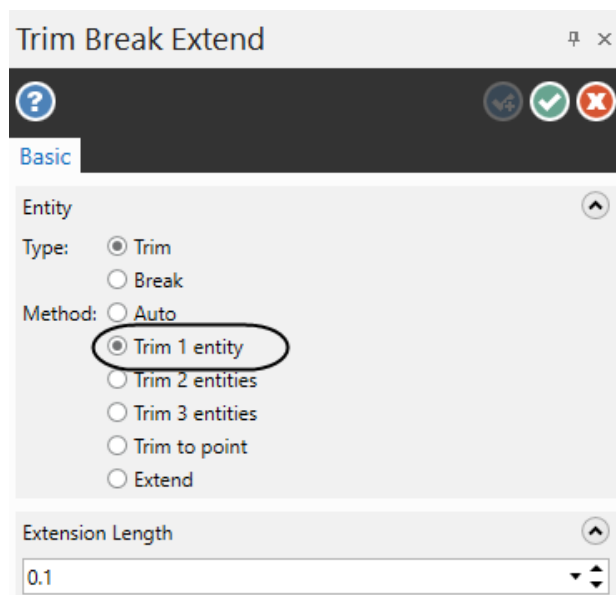


WIREFRAME

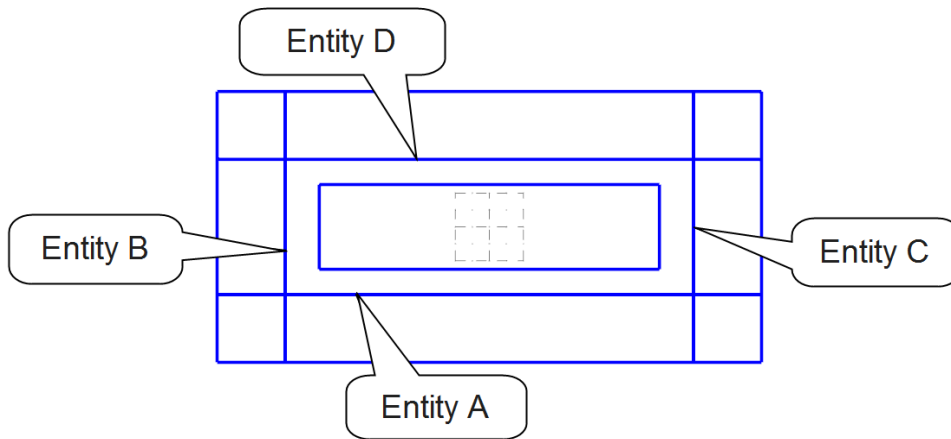
- ◆ From the **Modify** group, select the **Trim Break Extend** icon as shown.




- ◆ In the **Trim Break Extend** panel, enable the **Trim 1 entity** as shown.

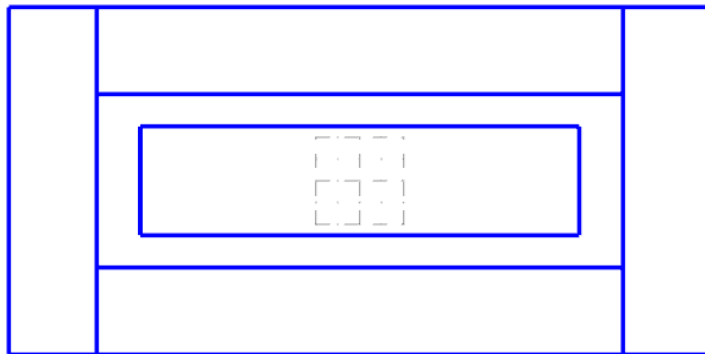


- ◆ [Select the entity to trim/extend]: Select Entity A as shown.
- ◆ [Select the entity to trim/extend to]: Select Entity B as shown.
- ◆ [Select the entity to trim/extend]: Select Entity A as shown.
- ◆ [Select the entity to trim/extend to]: Select Entity C as shown.



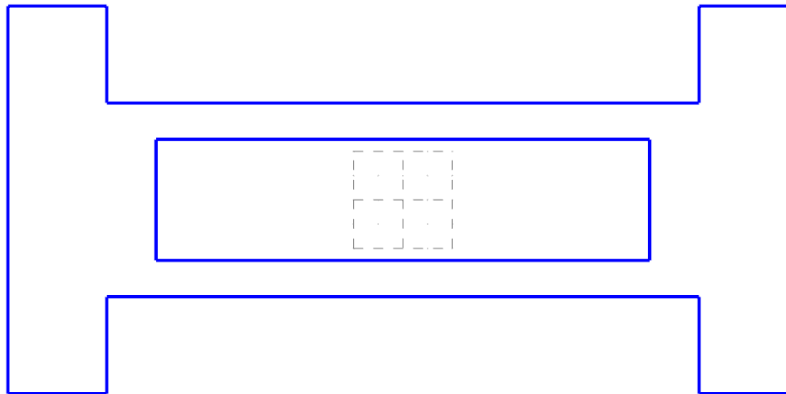
- ◆ [Select the entity to trim/extend]: Select Entity D as shown.
- ◆ [Select the entity to trim to]: Select Entity B as shown.
- ◆ [Select the entity to trim/extend]: Select Entity D as shown.
- ◆ [Select the entity to trim to]: Select Entity C as shown.

- ◆ Select the **OK** icon to exit the command. 
- ◆ The drawing will appear as shown.

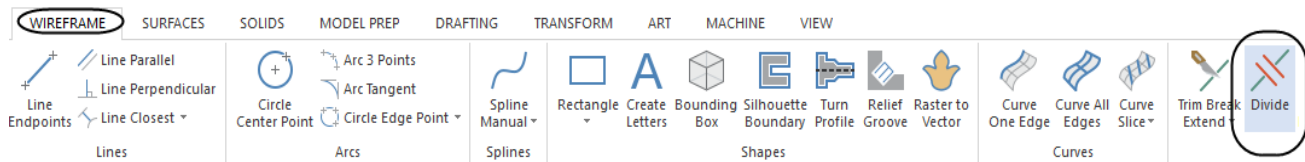


STEP 6: REMOVE THE LEFTOVER LINES USING DIVIDE COMMAND

Step Preview:



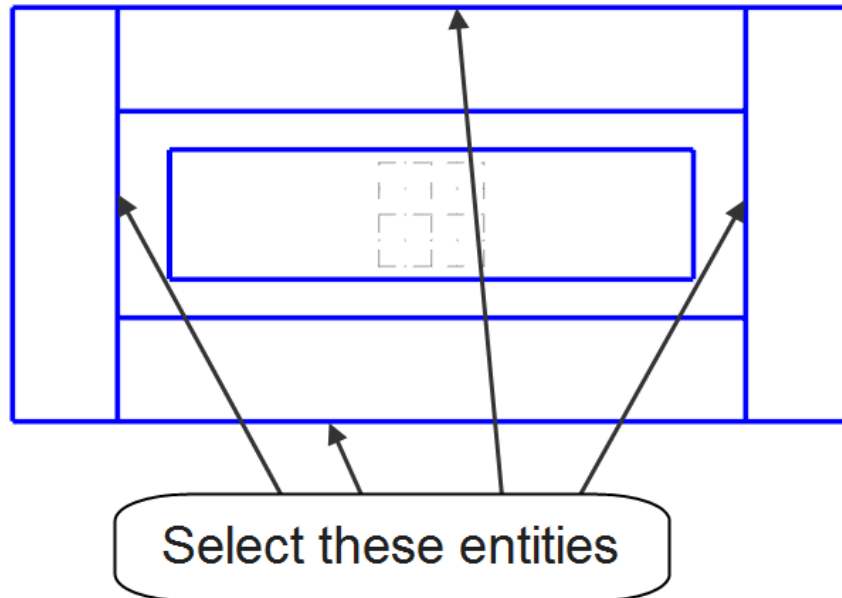
- ◆ From the **Modify** group, select the **Divide** icon as shown.



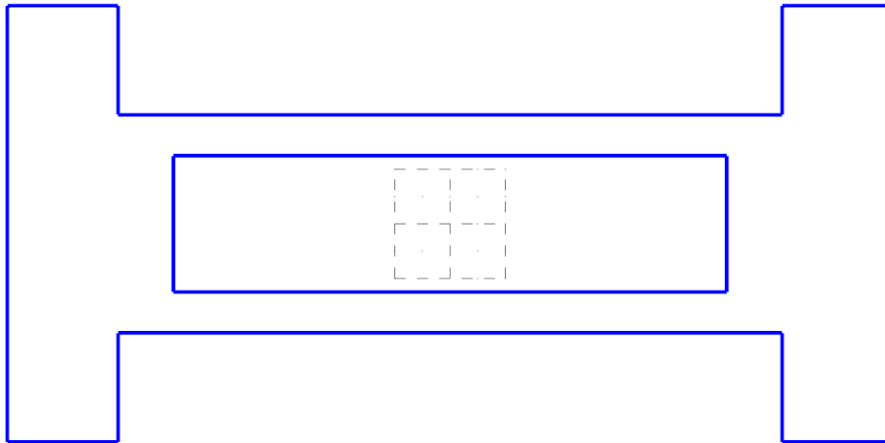
- ◆ In the **Divide** panel, make sure that **Trim** is enabled as shown.



- ◆ Select the lines as shown.



- ◆ The geometry will appear as shown.



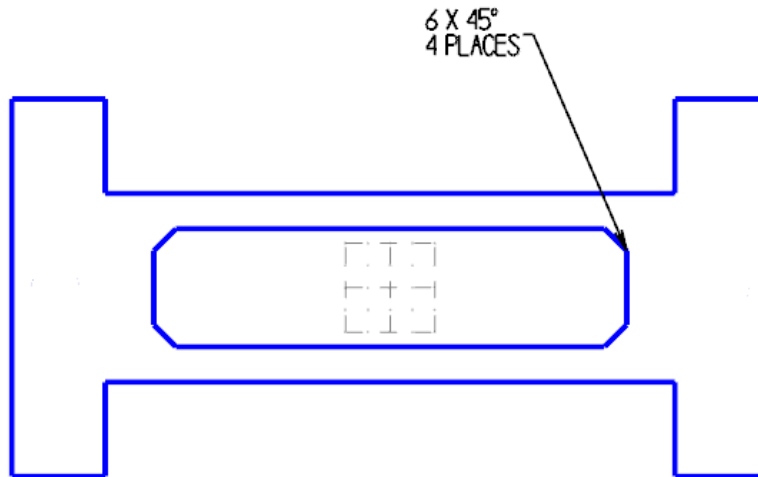
- ◆ Select the **OK** button to finish the command.



STEP 7: CHAMFER THE INSIDE RECTANGLE

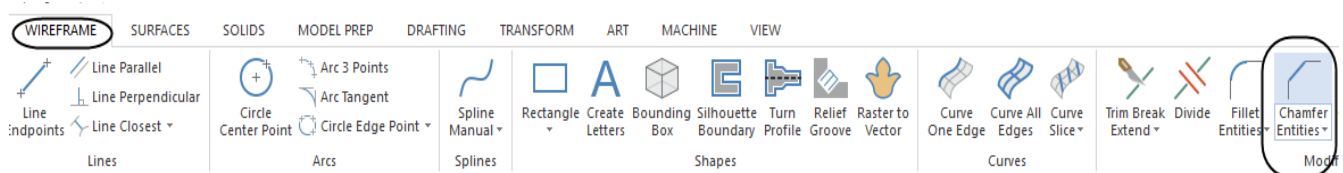
In this step we will use the Chamfer Entities command to apply chamfers to the corners of the outside profile.

Step Preview:

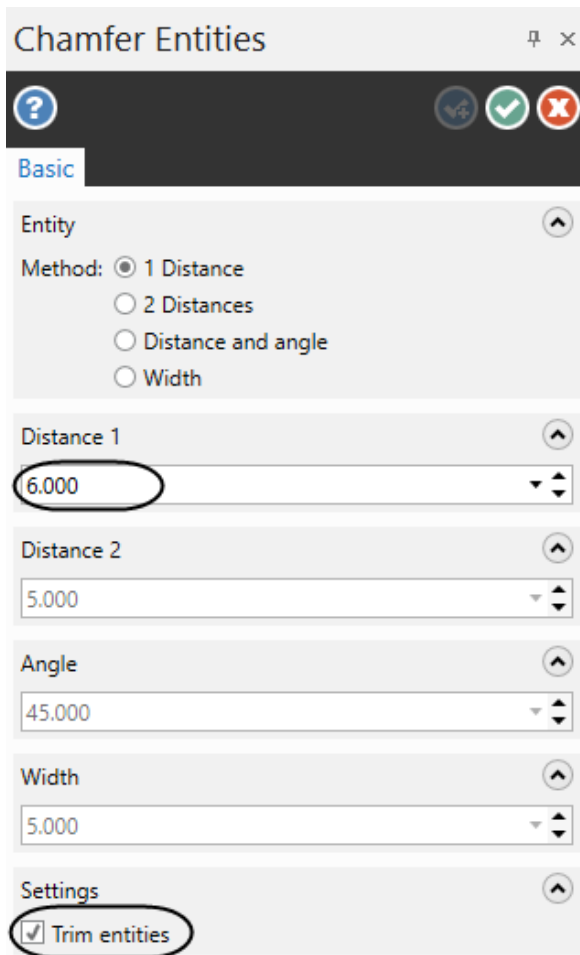


WIREFRAME

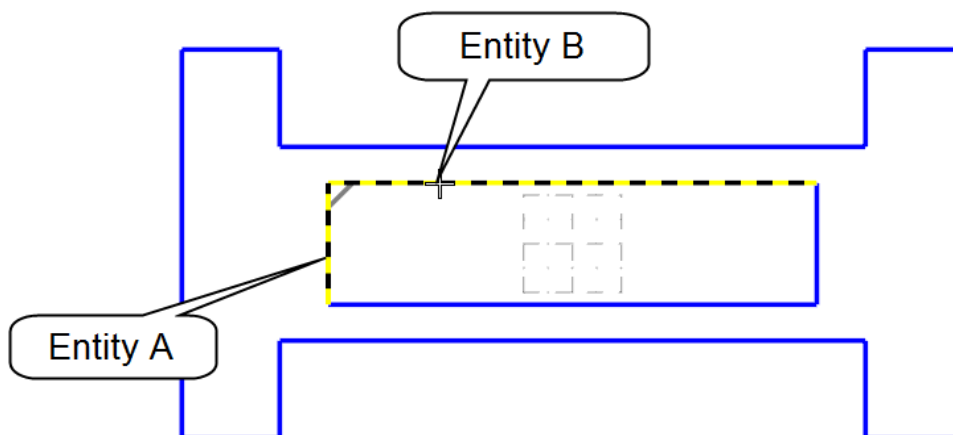
◆ From the **Modify** group, select **Chamfer Entities**.



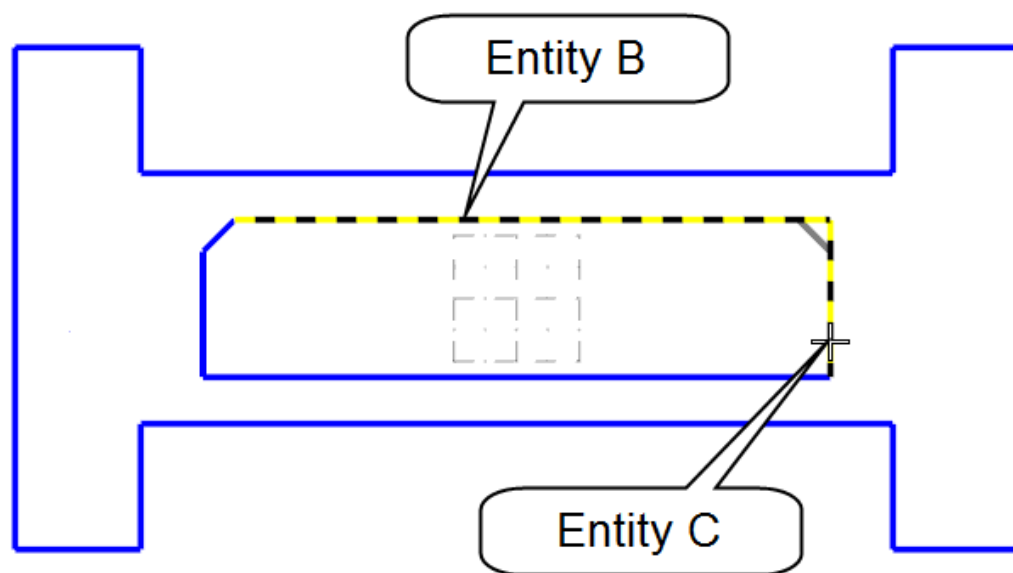
- ◆ Select **1 Distance** and enable **Trim entities** in the panel as shown.
- ◆ Enter a distance of **6.0** as shown.



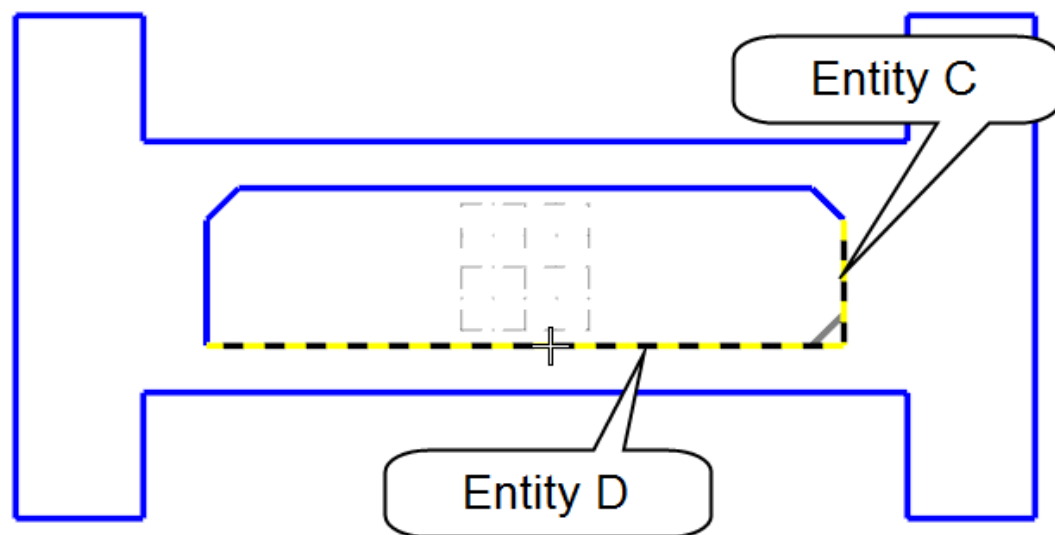
- ◆ [Select line or arc]: Select Entity A as shown.
- ◆ [Select line or arc]: Select Entity B as shown.



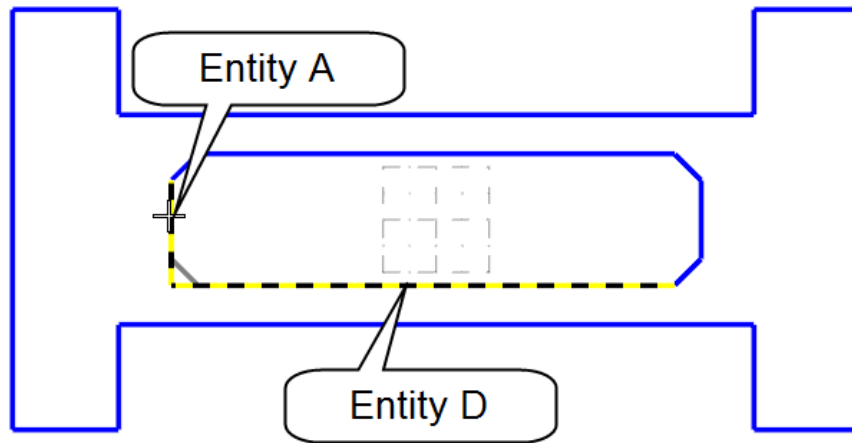
- ◆ [Select line or arc]: Select Entity B as shown.
- ◆ [Select line or arc]: Select Entity C as shown.



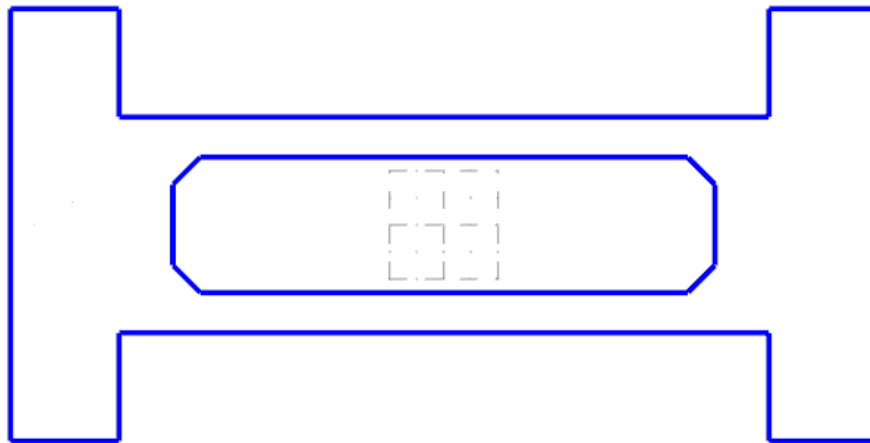
- ◆ [Select line or arc]: Select Entity C as shown.
- ◆ [Select line or arc]: Select Entity D as shown.



- ◆ [Select line or arc]: Select Entity D as shown.
- ◆ [Select line or arc]: Select Entity A as shown.



- ◆ Select the **OK** button to exit the command.
- ◆ The geometry should look as shown.



STEP 8: SAVE THE FILE

FILE

- ◆ **Save As.**
- ◆ Click on the **Browse** icon as shown.
- ◆ Find a location on the computer to save your file.
- ◆ File name: "Wireframe 1".

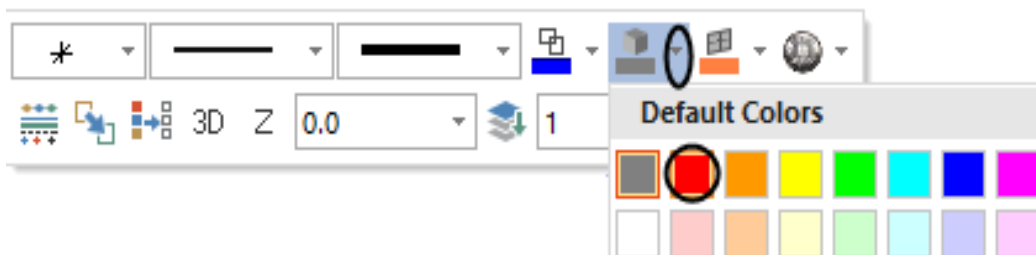


SOLID CREATION

A **Solid** is a geometric entity that occupies a region of space and consists of one or more faces, which define the closed boundary of the solid. A solid operation requires closed boundary geometry.

STEP 9: CHANGE THE SOLID COLOR TO RED

- ◆ Right mouse click in the graphics window and from the Mini Toolbar, left click on the arrow next to the **Solid Color** icon and select the color red as shown.

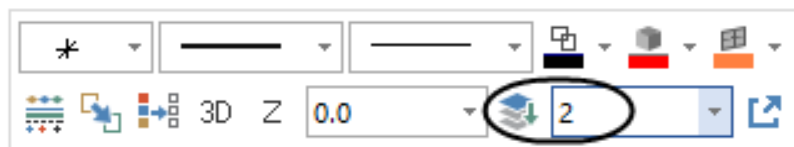


STEP 10: CHANGE THE MAIN LEVEL TO 2

Levels are a primary organizational tool in Mastercam. A Mastercam file can contain separate levels for wireframe, surfaces, drafting entities, solids, and toolpaths. By organizing your files into levels, you can easily control which areas of the drawing are visible at any time and which parts are selectable. By doing so, you will not inadvertently make changes to areas of the drawing you do not want to change.

In this step we will change the **Main Level to 2** to create the solid on **Level 2**.

- ◆ Right mouse click in the graphics area and in the **Mini Toolbar**, change the **Level** number to **2** as shown.



- ◆ Press the **Enter** key on your keyboard.

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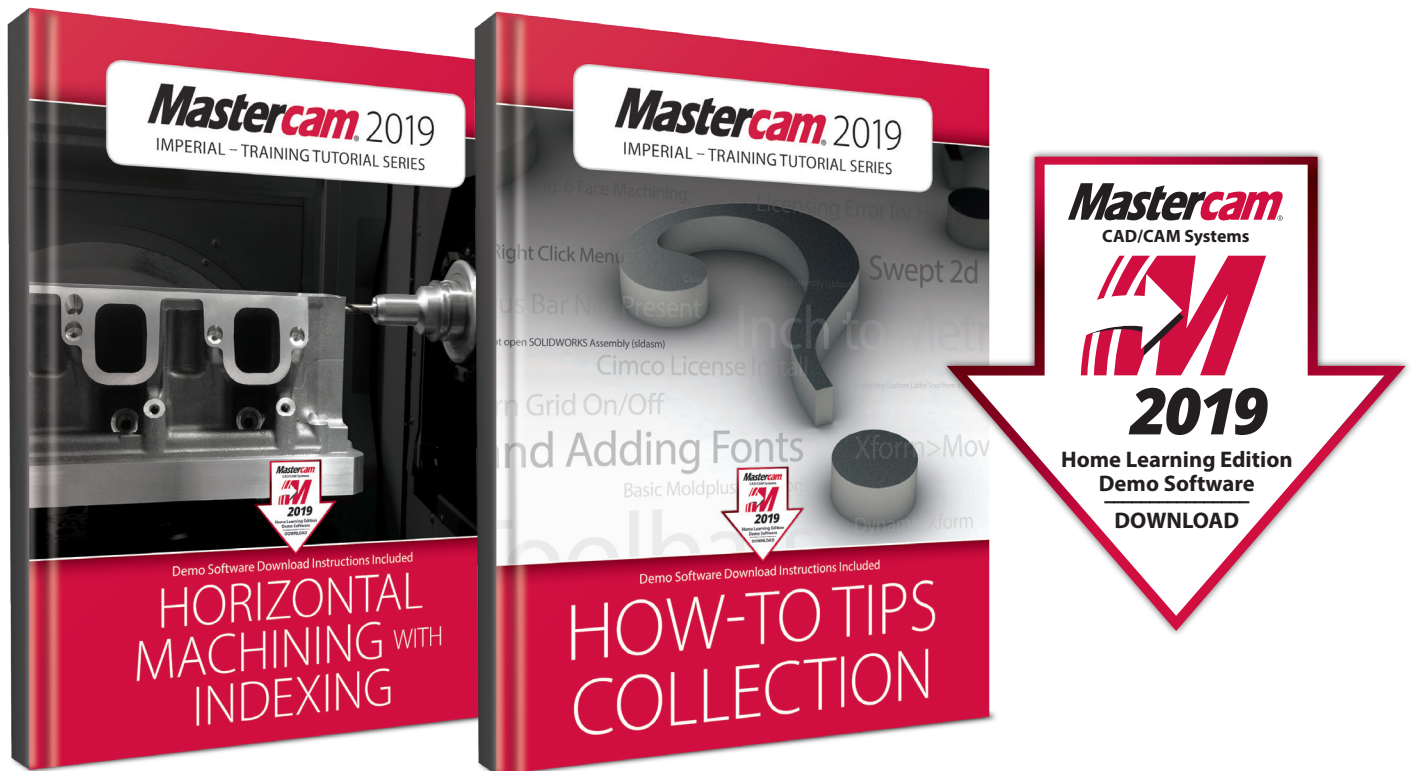
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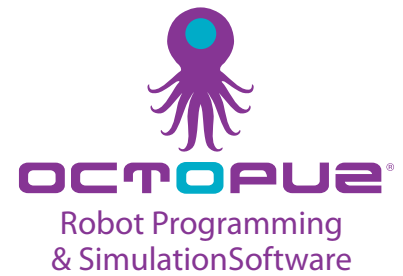
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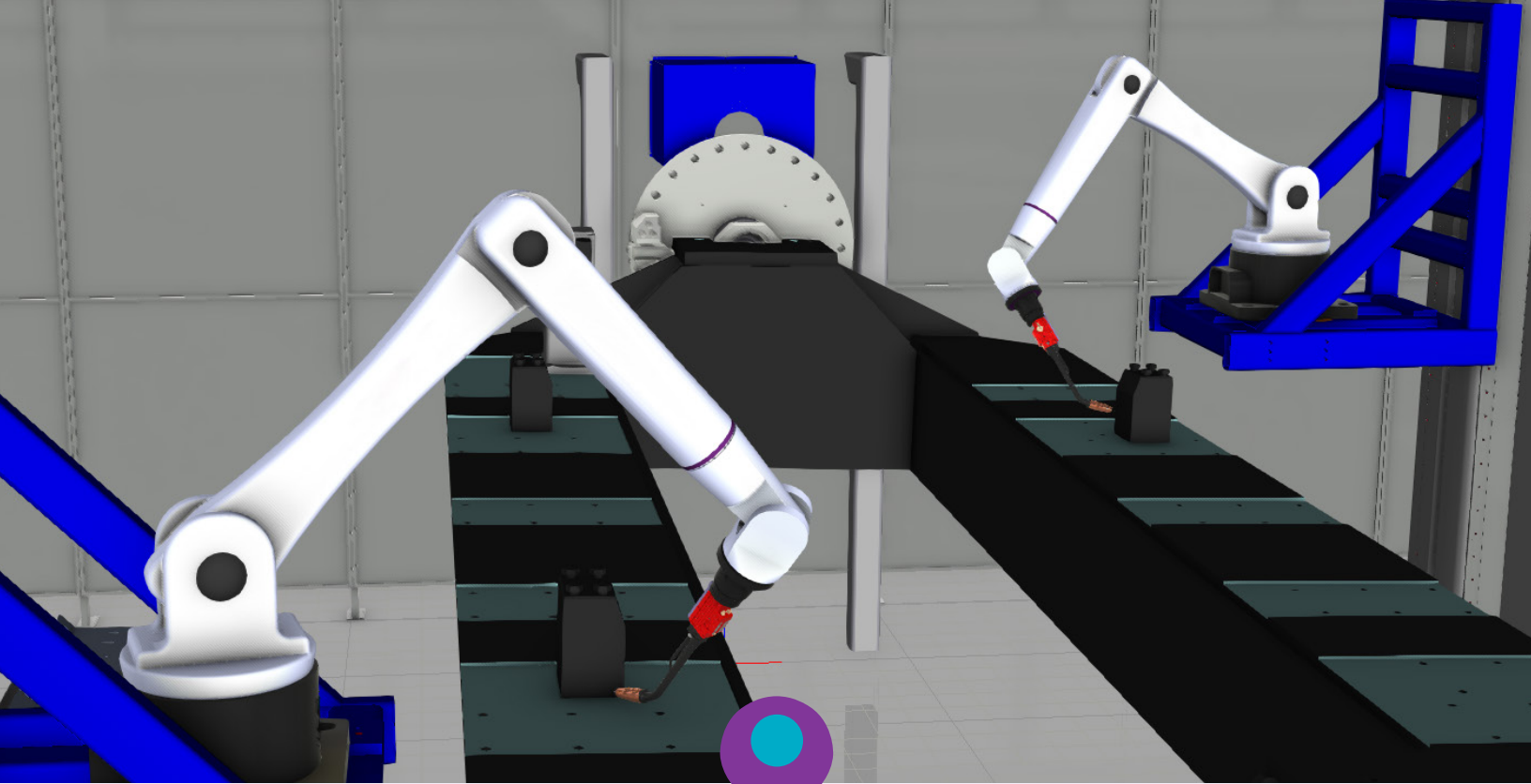
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