

# AIM Stepped Shaft in Axial Tension - Geometry

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## Problem Specification

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## Geometry

This problem could be simulated in either 2D or 3D by employing the proper geometric assumptions and boundary conditions. Since AIM provides a 3D capability, there are several simplifications that must be made to the geometry. When the shape is drawn, we want to create a quarter symmetric model of the geometry so that proper supports can be added to the model that do not over constrain the model. By creating these one dimensional supports, we allow the body to be subjected to the forces of the problem while preventing any rigid body translation and/or rotation of the body in space.

### Draw Geometry

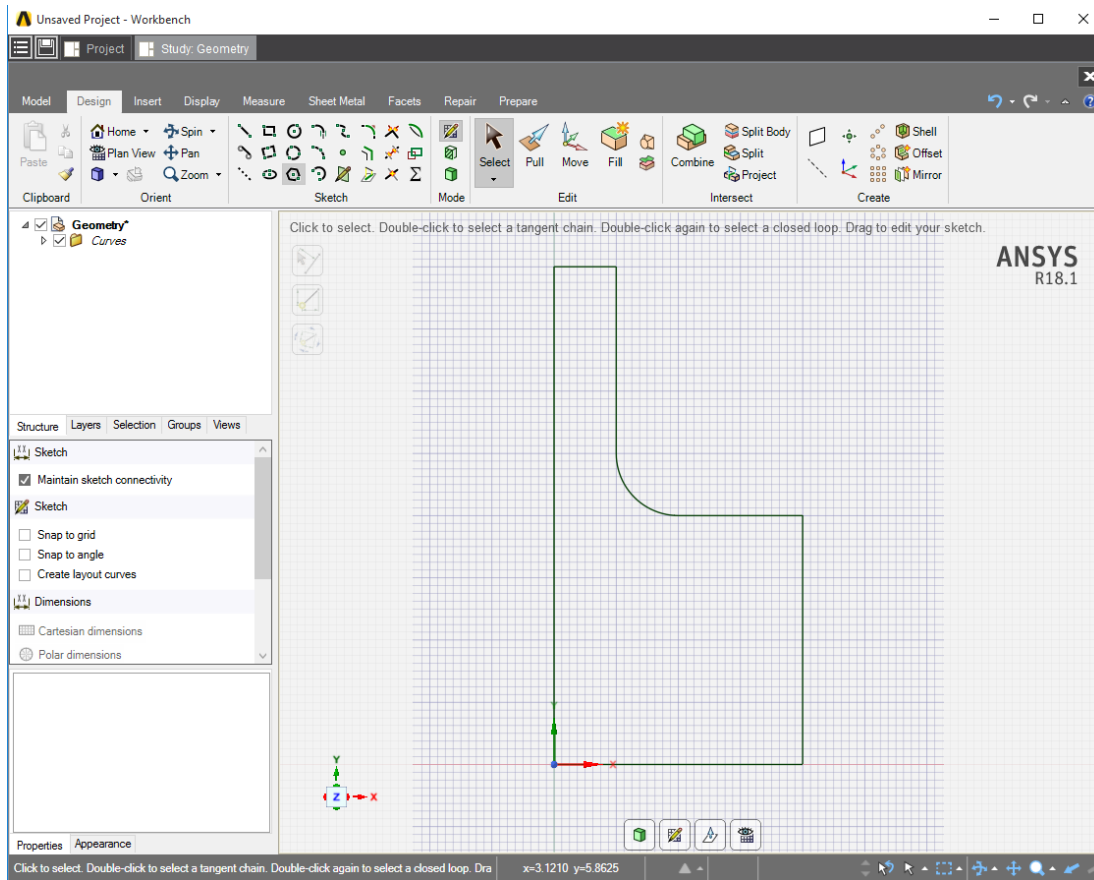
Click the **Z-axis** on the compass in the bottom left corner of the screen to look at only the XY-plane. Right click in the empty white space and choose **Select New Sketch Plane** so that the plane we are sketching on will be on the XY-plane, then click on the grid that appears. Next, select the **Line** tool and, beginning at the origin, make a 8-inch line going in the positive Y direction. Then, starting at the top of the newly-created line, create another line in the positive X direction for 1 inch. You can enter the dimensions directly by pressing the spacebar and typing the numbers.

Make another line on the positive **X-axis**, starting from the origin, for 4 inches, and then another 4 inches in the positive Y direction from the right end of the previous line.

In order to get a fillet edge where these two lines intersect, first we need to intersect them. Create lines starting from the open points of the sketch and allow them to intersect; the lengths the lines are arbitrary as long as they cross.

Next, trim the extra lines using the **Trim Away** tool.

Lastly, use the **Create Rounded Corner** tool to make a fillet edge between the new corner. Click the vertical line and hover the mouse of the horizontal line then press 1 to create the radius of 1 inch. The Model Editor will display 2.0 in while in sketch mode but when 3D will truly be 1.0 in. The problem specified its radius to be 1 inch. The **Create Rounded Corner** tool is selected in the **Sketch** section of the toolbar in the picture below.



In order to convert this sketch into the stepped shaft that is required, it must be rotated around the Y axis. Since the sketch is now complete, **select the Pull tool in the Edit section of the toolbar**. Utilize the **Revolve** feature by **picking the Y axis to rotate about**. **Rotate the view slightly to see the yellow, curved arrow**, then **drag with your mouse to pull the sketch around the Y axis**. **Press the spacebar and enter "90deg"** to achieve the precise rotation needed. It should look like the object in the picture below.

**Click in a blank spot of the model window, or press the Esc key on your keyboard, to complete the Pull operation.**

### Go to Step 3: Mesh

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