VM 250 Computational Lab Sessions
Lab 1

Introduction and Primary Sketching Skills

Prepared by TA Group

Overview

Overview

- Sketching skills (Labs 1 and 2)
  - ➢ Ball bearing
- Virtual manufacture (Labs 3)
  - ➢ Shaft
- Mold design for soft robotics (Lab 4)
- FEM simulation (Lab 5)
- Advanced sketching skills (Lab 6)
  - ➢Spur and helical gear

✓Mold design for soft robotics (Lab 4)

Sketching Skills for drawing a bearing

- **2D Sketch**
  - Smart Dimension
  - Trim
  - Geometric relationship
  - Constraints

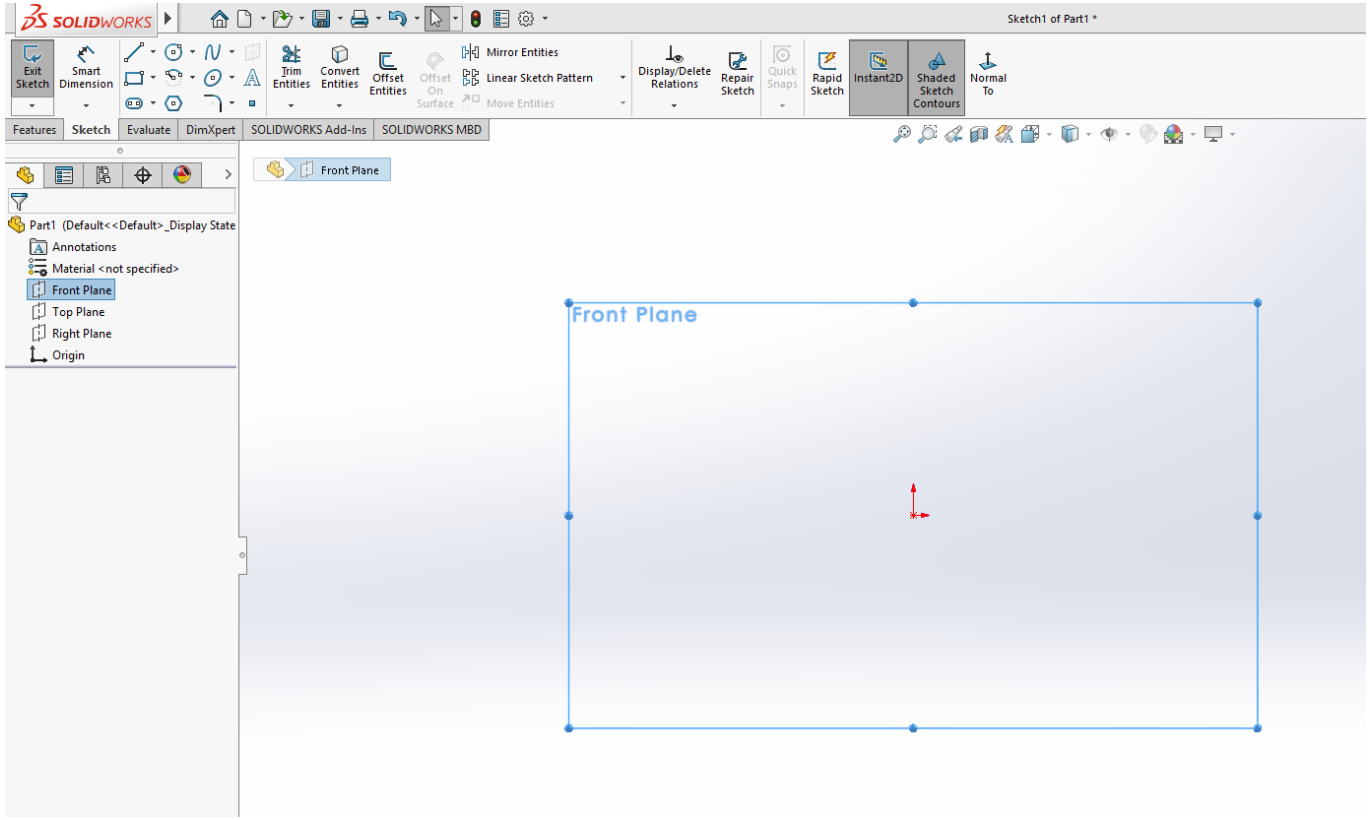
Sketching Skills for drawing a bearing

- **3D Features**
  - Outer, inner ring and ball
    - Revolve
    - Fillet
  - Cage for the ball
    - Extrusion, revolved cut
    - Temporary axis, circular pattern, shell
  - Assembly
  - mate

2D Sketch

2D Sketch

- Sketcher environment

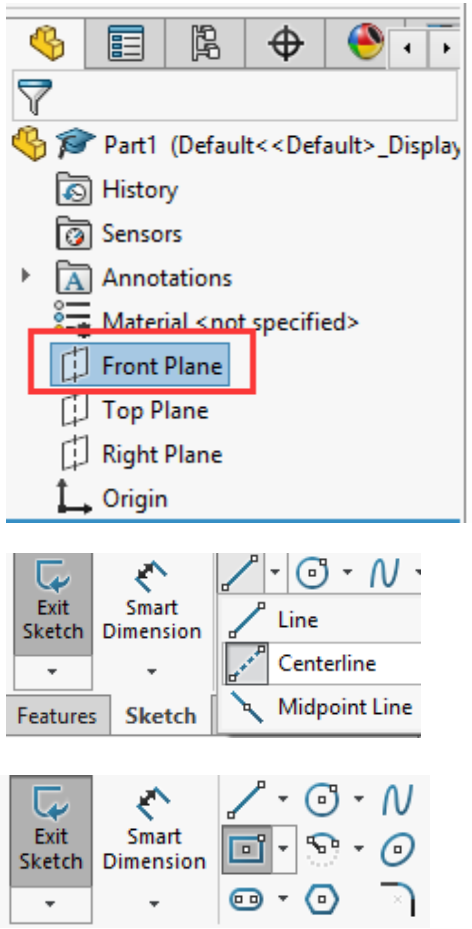


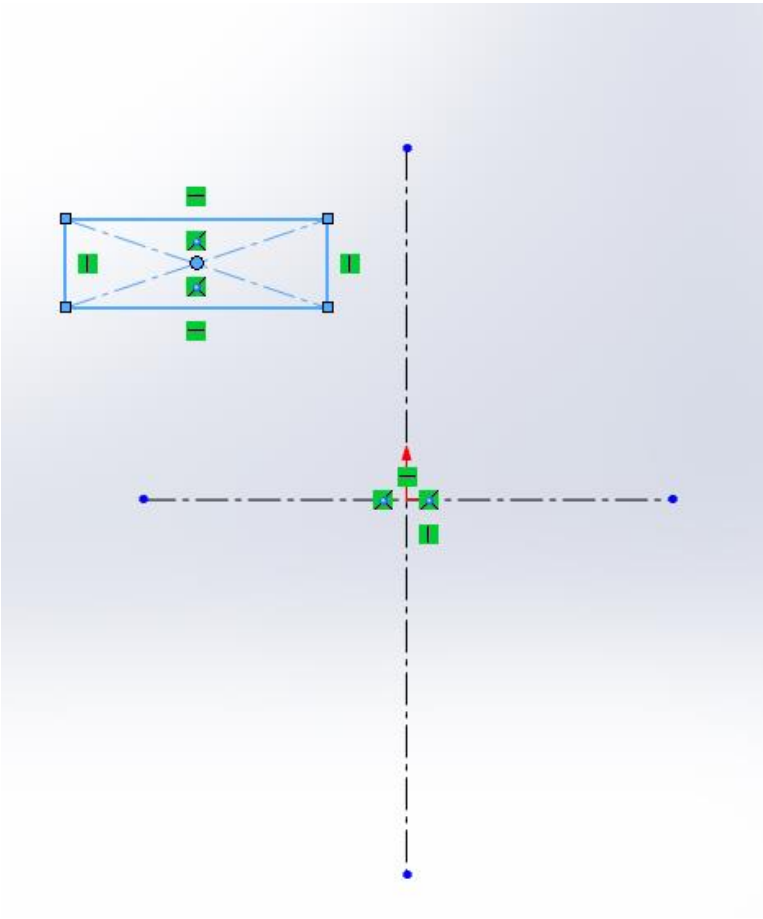
- Click Sketch on the top left corner.
- Select the reference plane that you want to create your sketch on. Click OK to make your selection.

2D Sketch for outer ring

- Start with creating a rectangle in SolidWorks

1. Select the reference plane on which you want to create your sketch.
2. Create a center line first.
3. Choose rectangular button and input parameters for it .

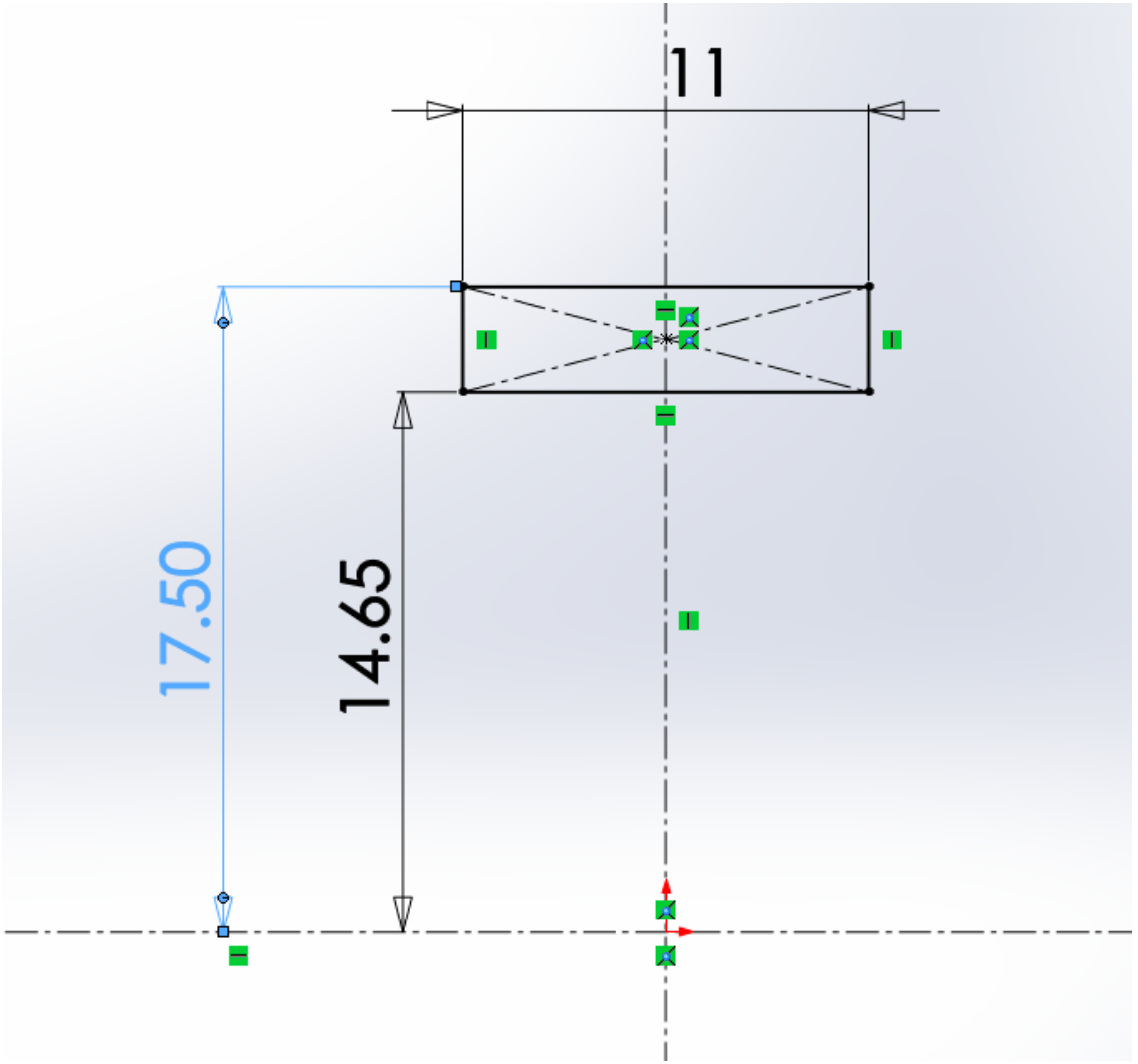


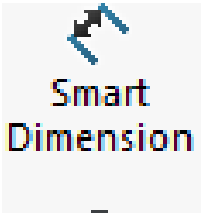


The result after these procedures

2D Sketch for outer ring

- Use a smart dimension to make it fully constrained.





- How to use smart dimension?
  - Select the reference center line and the line you want to input the dimension.
  - Input parameter as shown on the left for dimension.

Introduction of

- Under constrained
- Constrained
- Over Constrained

Constraints

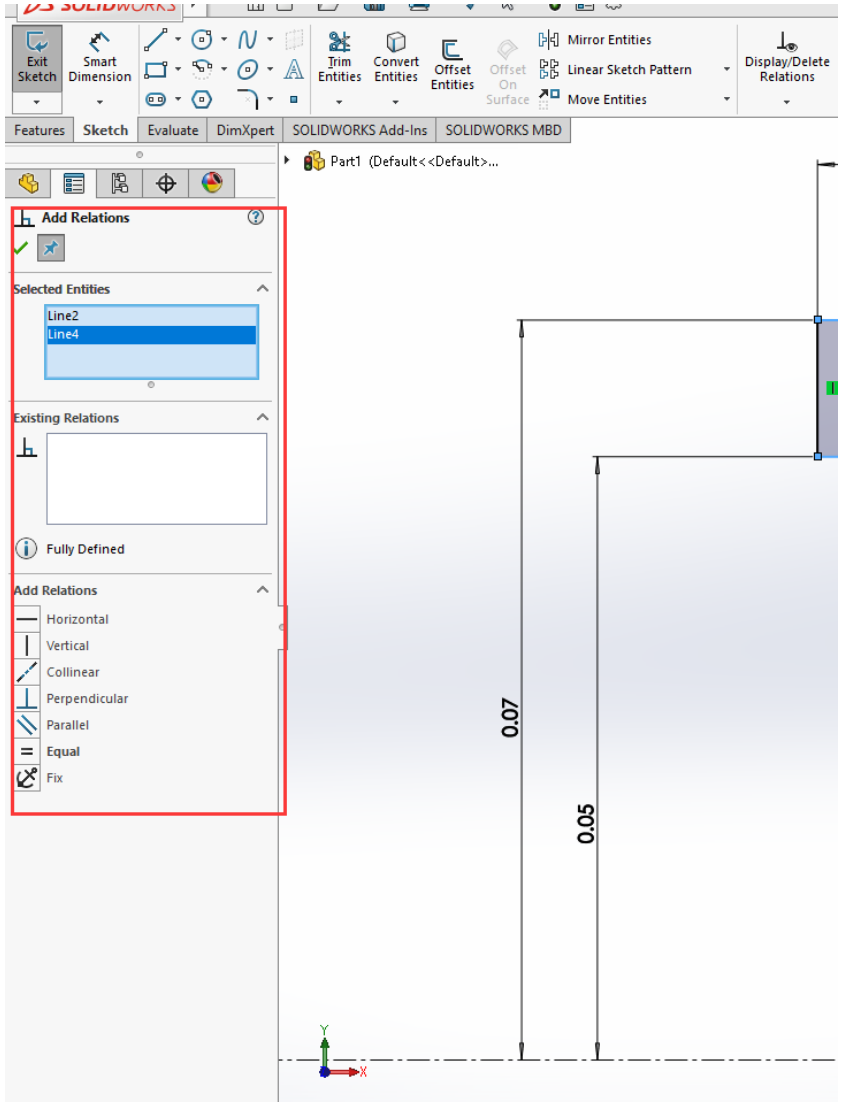
Geometric relationships between entities

- Geometrical constraint

  A relationship that forces a limitation between one or more geometric elements.

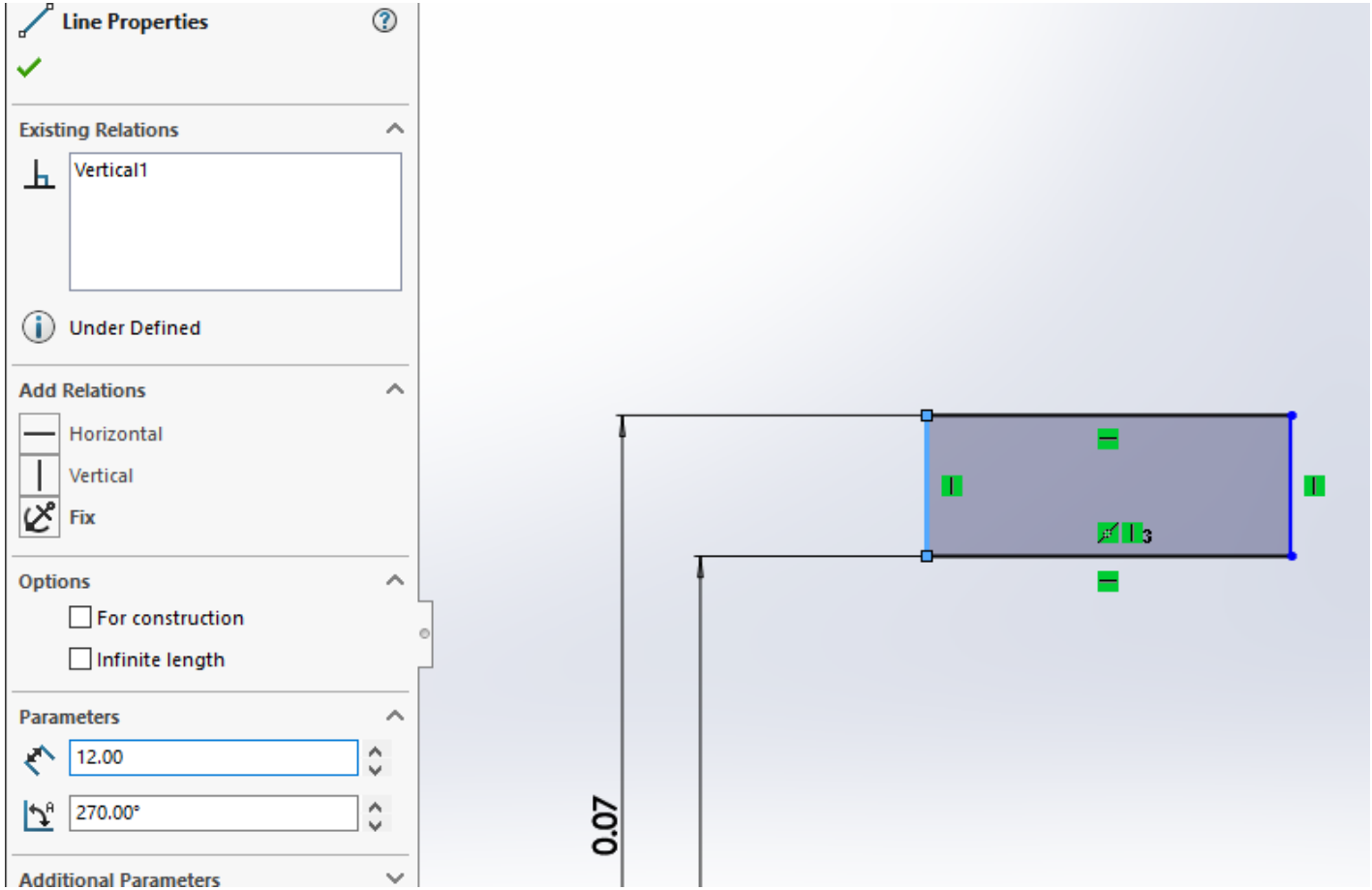
- Dimensional constraint (Smart dimension)

  A constraint whose value determines geometric object measurements.



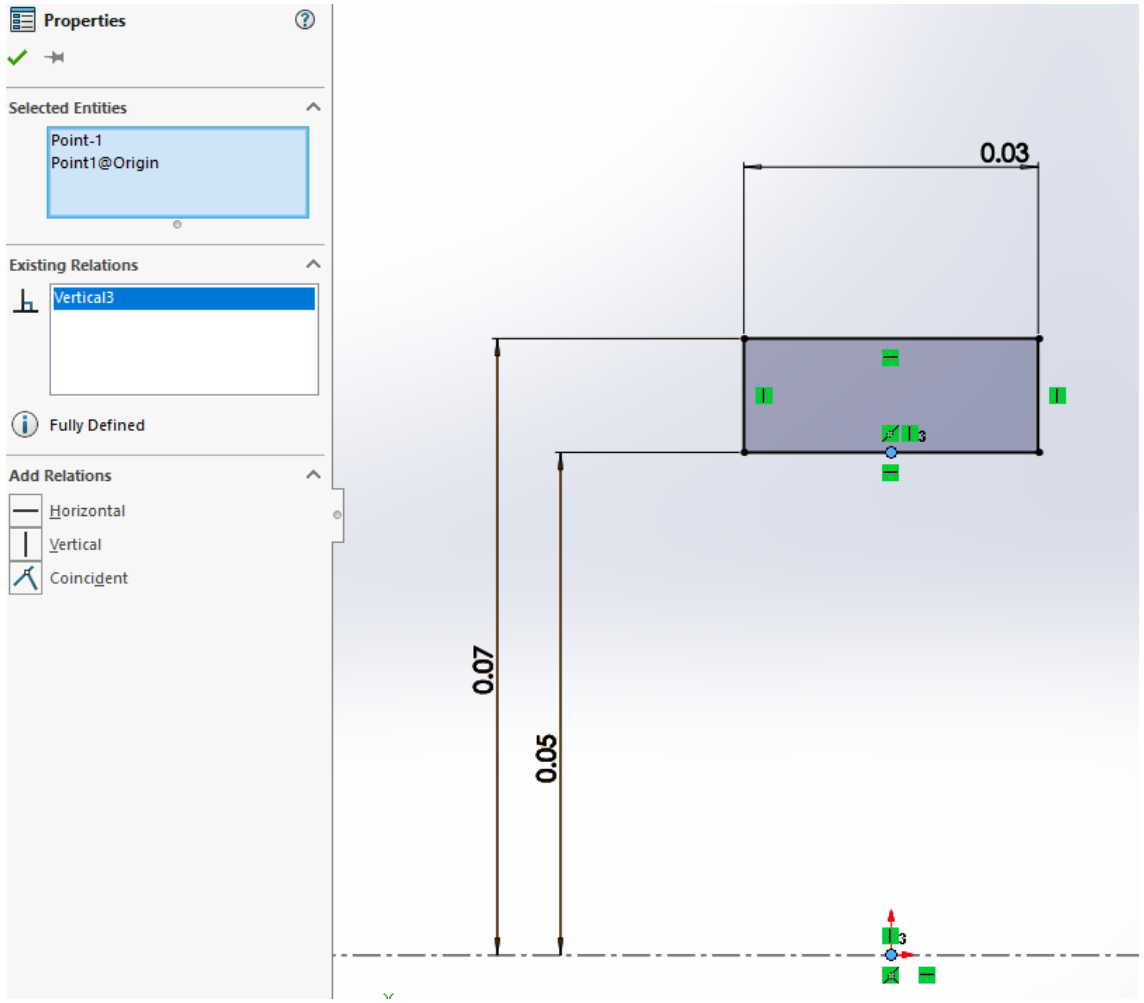
Under Constrained

- There is not enough constraints to fully define the geometry, so some dimensions are automatically added (in blue), which may not be desired.



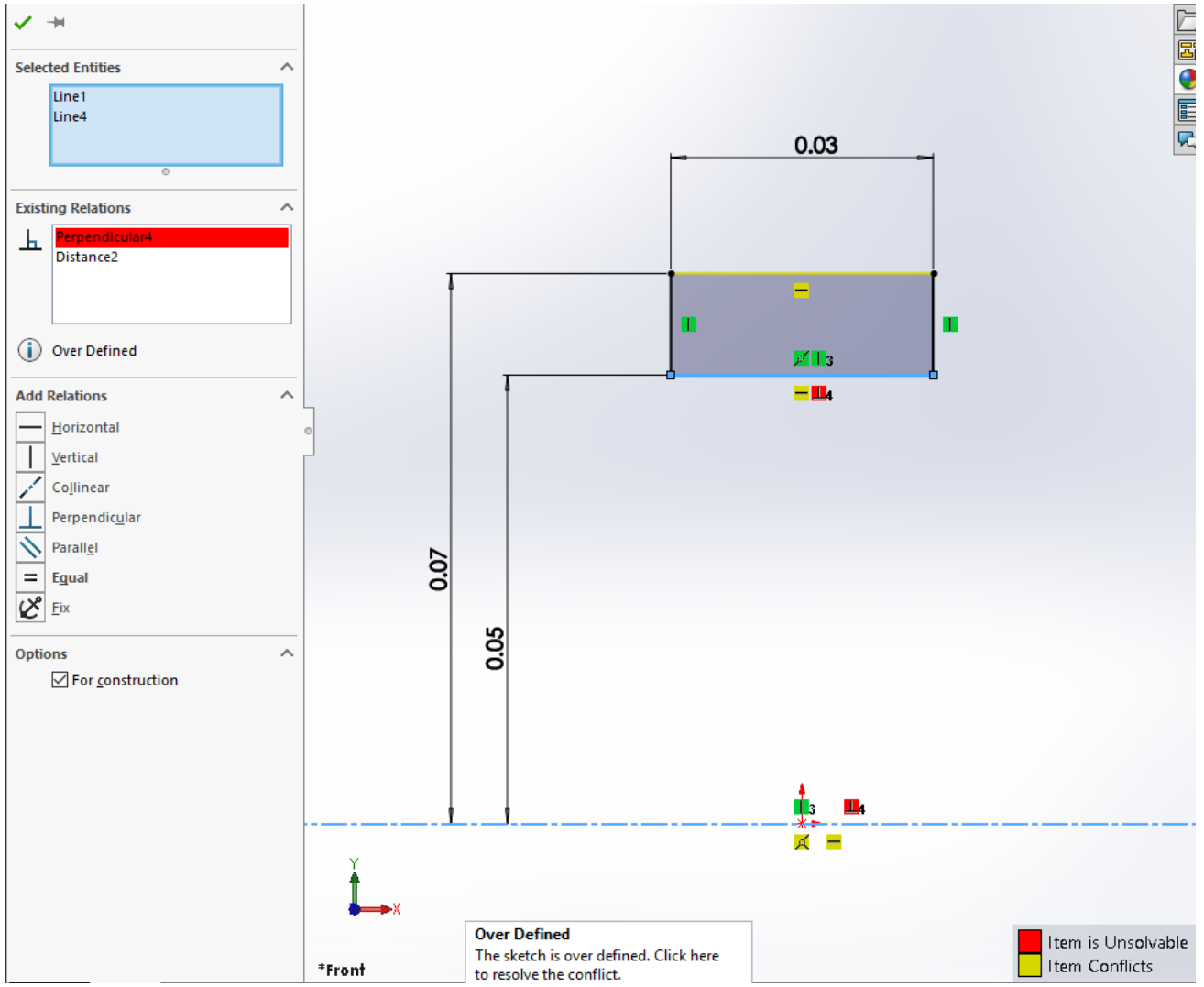
Fully Constrained

- There are just enough constraints to fully define the geometry.
- Make sure your sketch is always fully constrained！



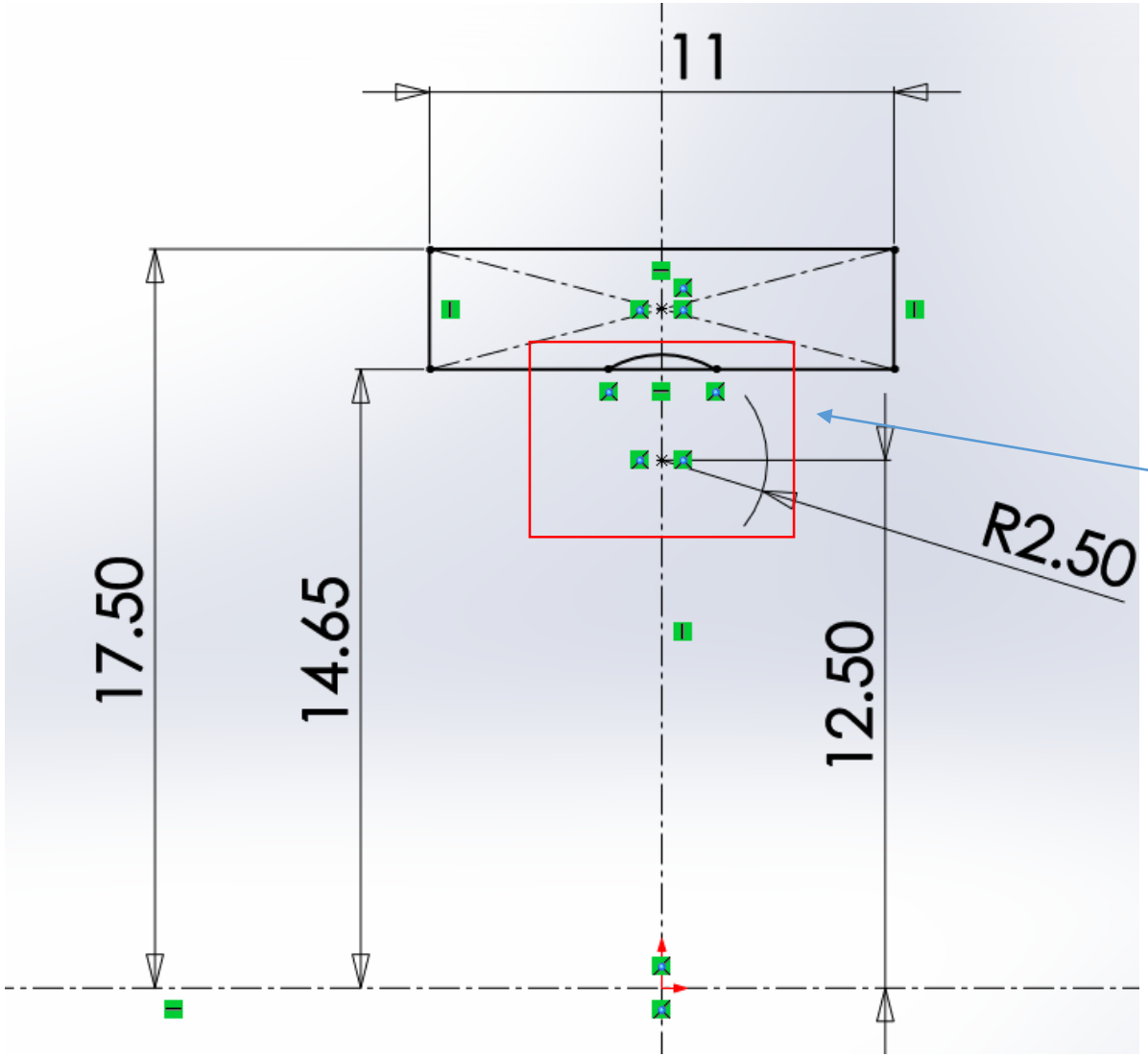
Over Constrained

- The geometry will turn yellow with red constraints or dimensions and a message saying that “the sketch is over-defined.”



2D Sketch for outer ring

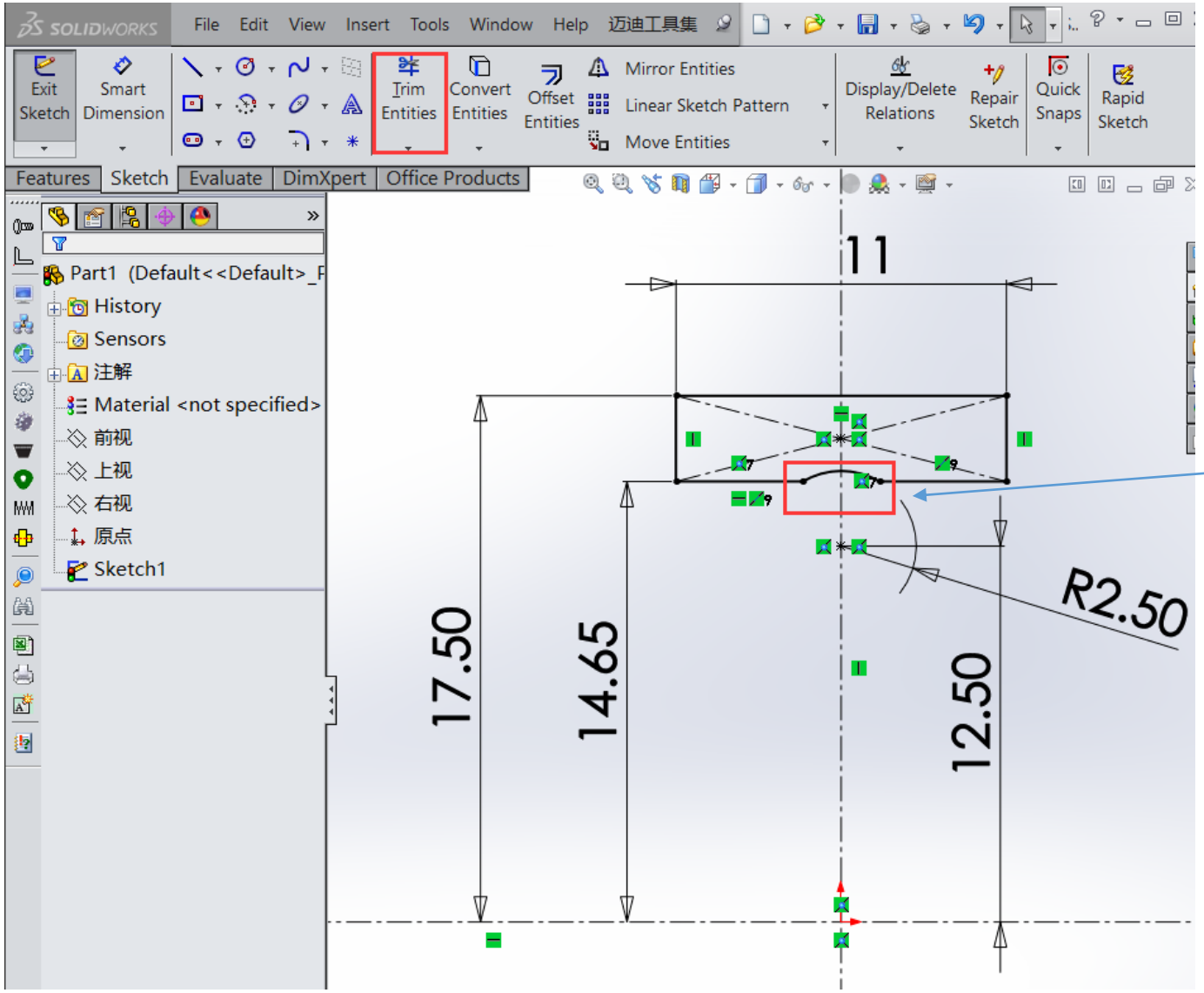
- Adding an arc



- Select a center-pointed type for an arc and add a dimension for it as shown in the red retangle.

2D Sketch for outer ring

- Trim

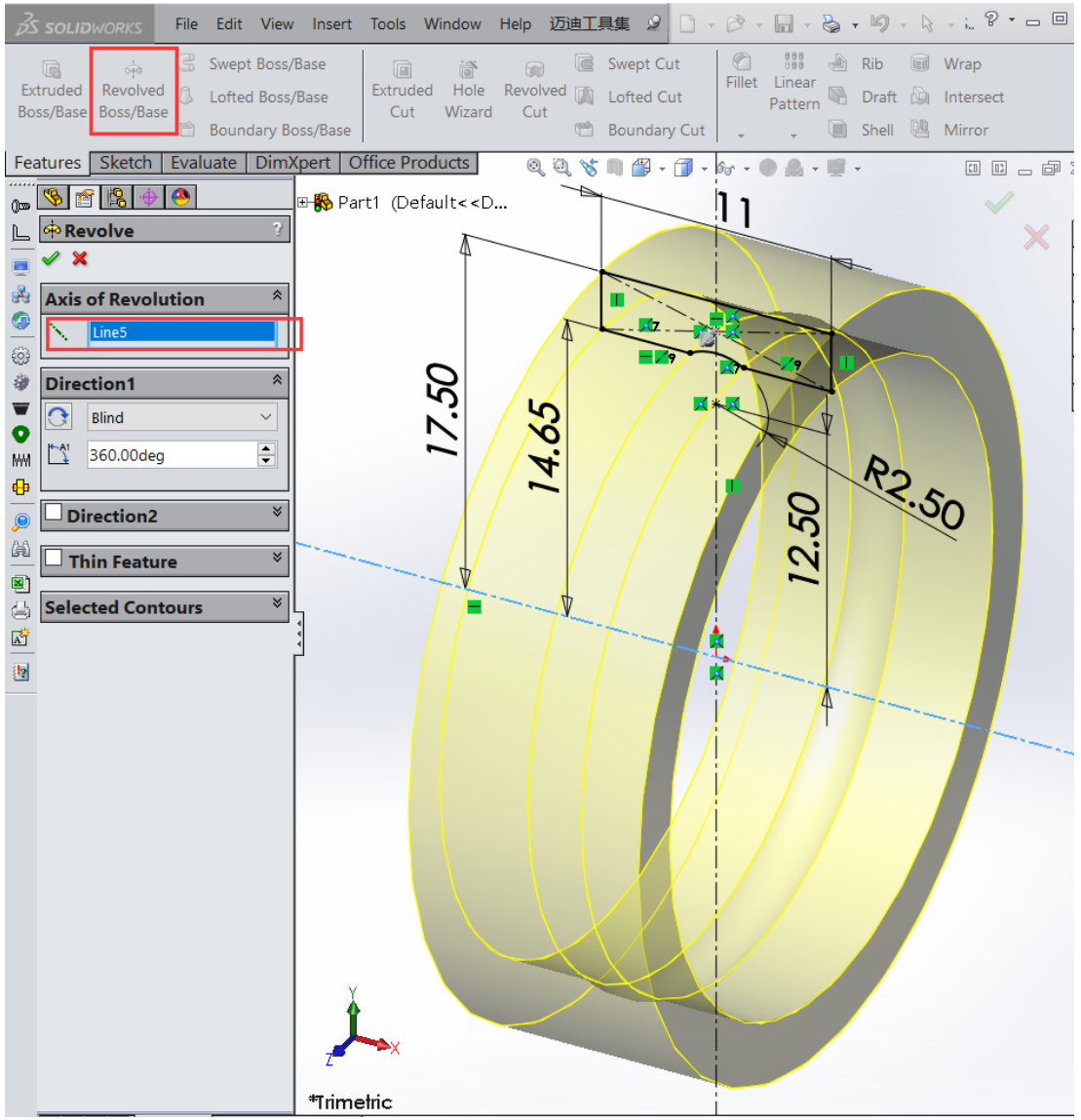


- Select an option "Trim to closest" to trim the line as shown in the red rectangle.

3D sketch

3D sketch for outer ring

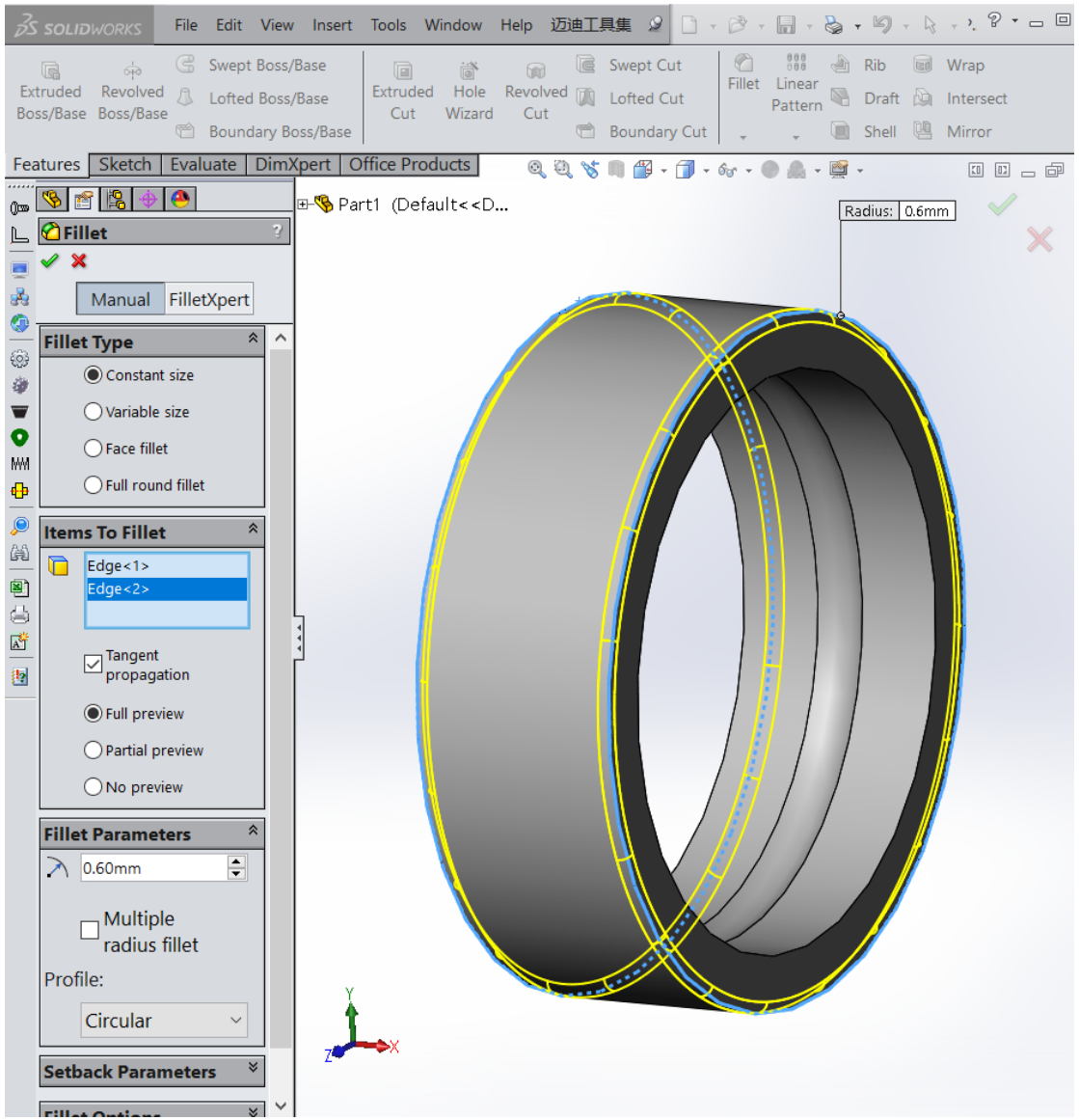
- Revolve



- Click the revolve feature button.
- Select the pre-made center line as the axis of revolution.
- Preview the result.
- Click green tick button.

3D sketch for outer ring

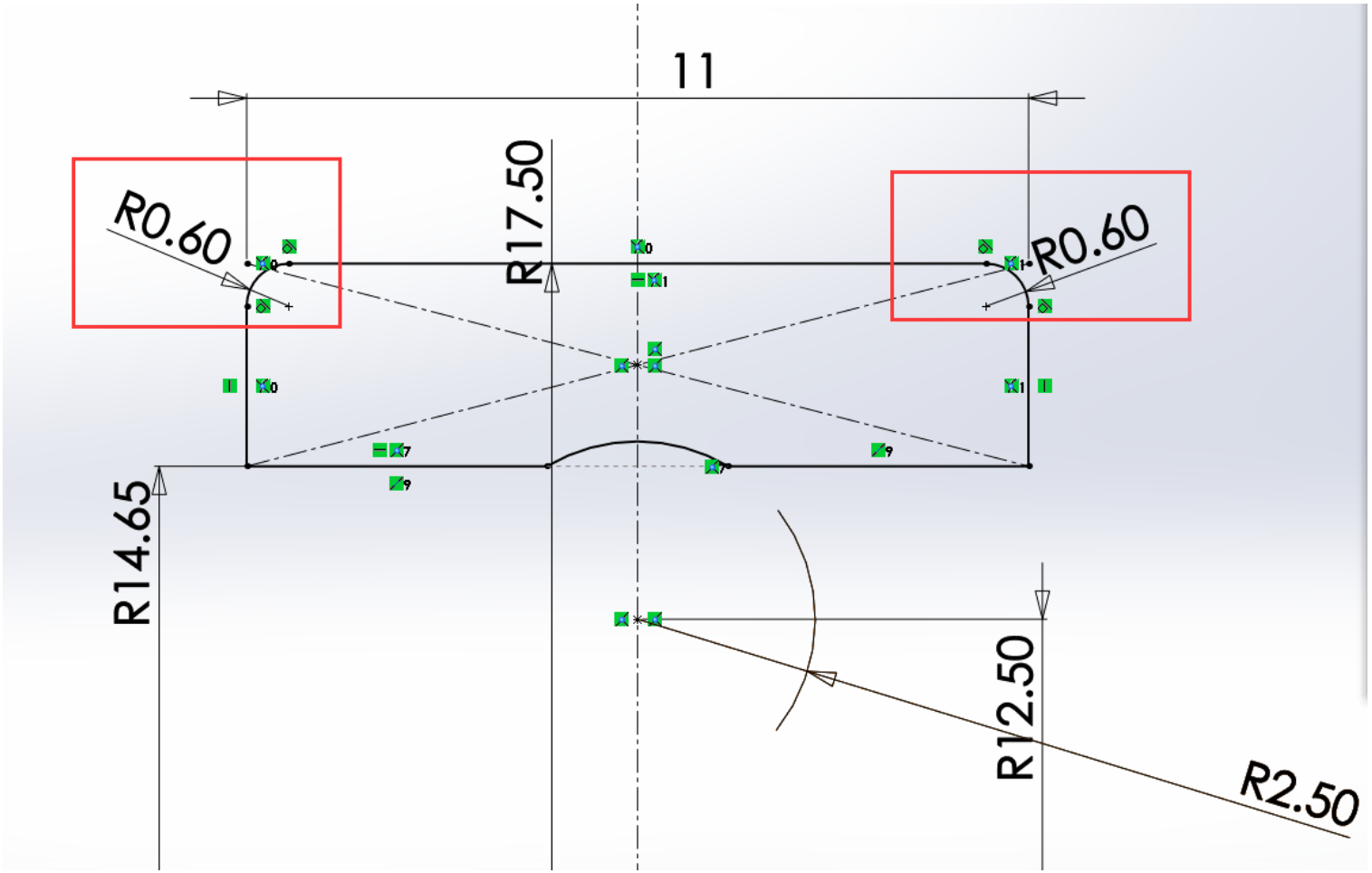
- Fillet

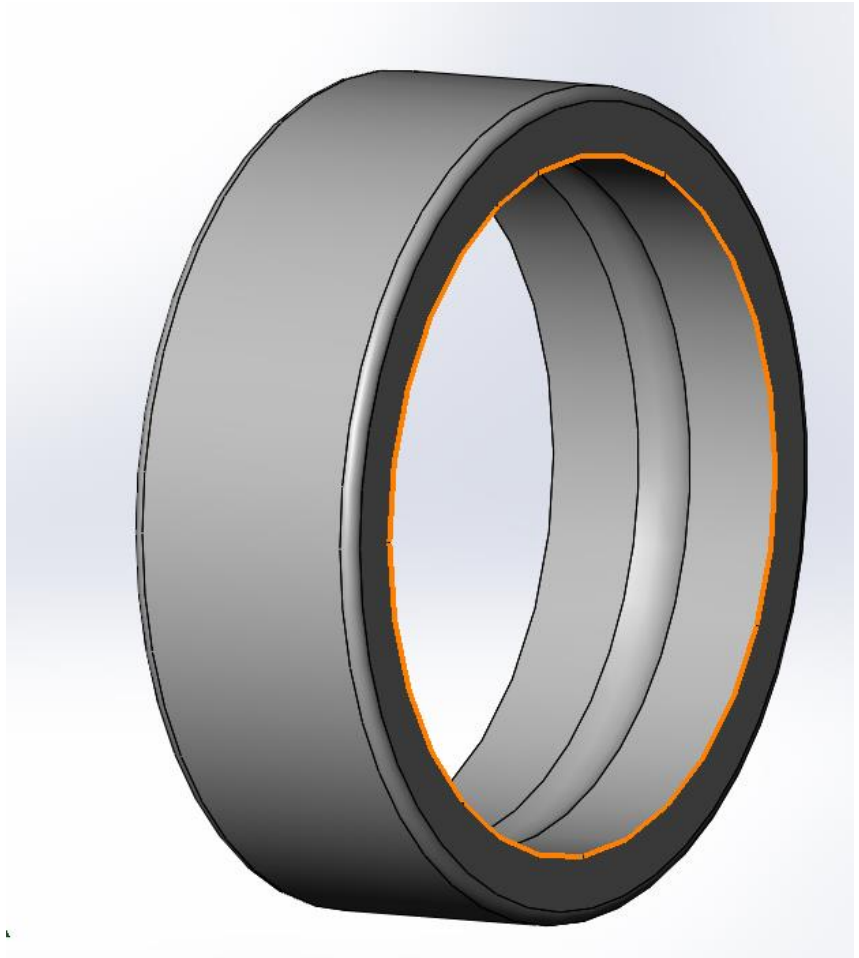


- Choose the edges to fillet.
- Fillet parameter is .60mm.
- SolidWorks enables preview the fillet.
- Save the file of the out ring and open a new part file.

3D Sketch for outer ring

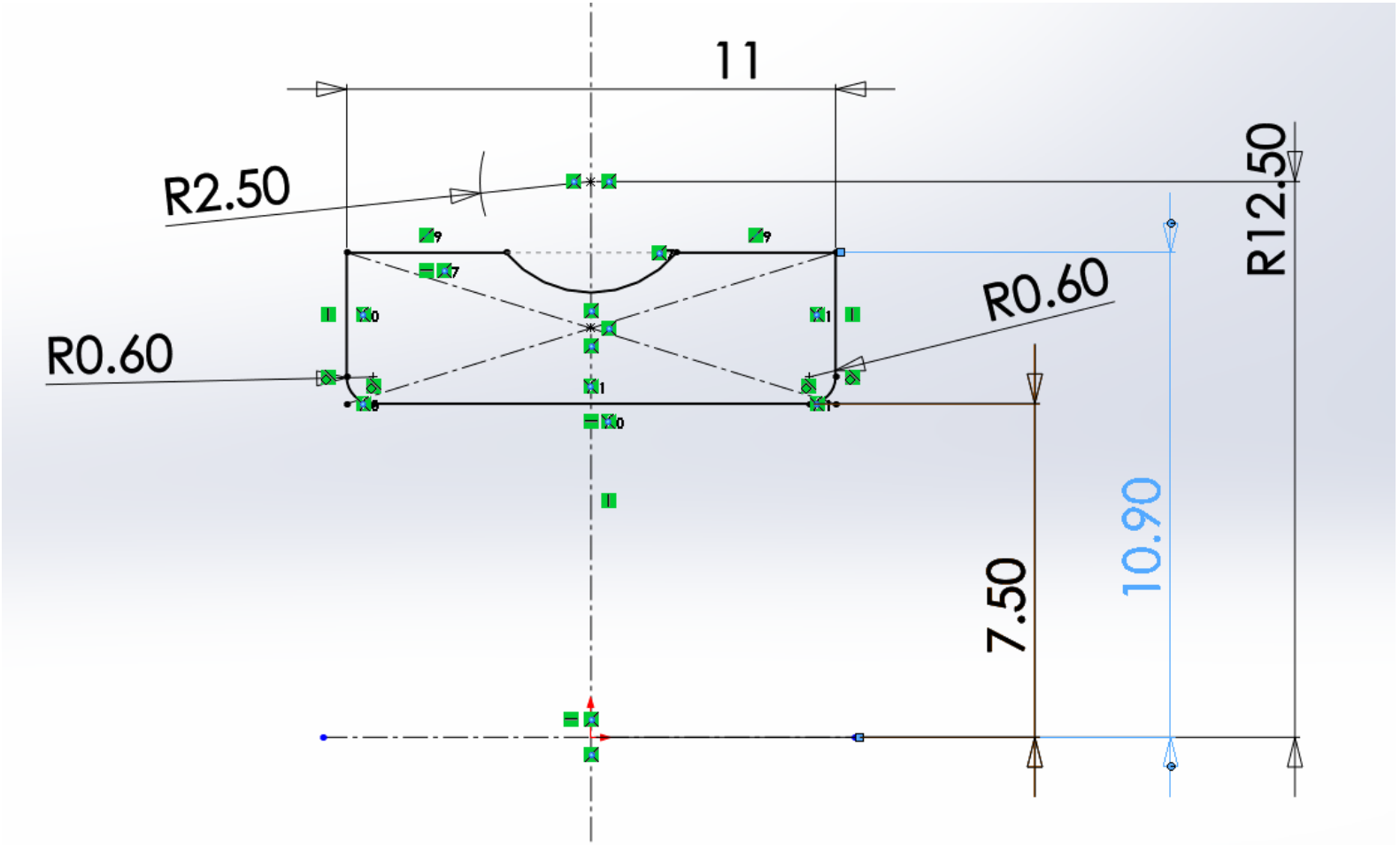
- Add fillet on the 2D sketch before adding revolution.

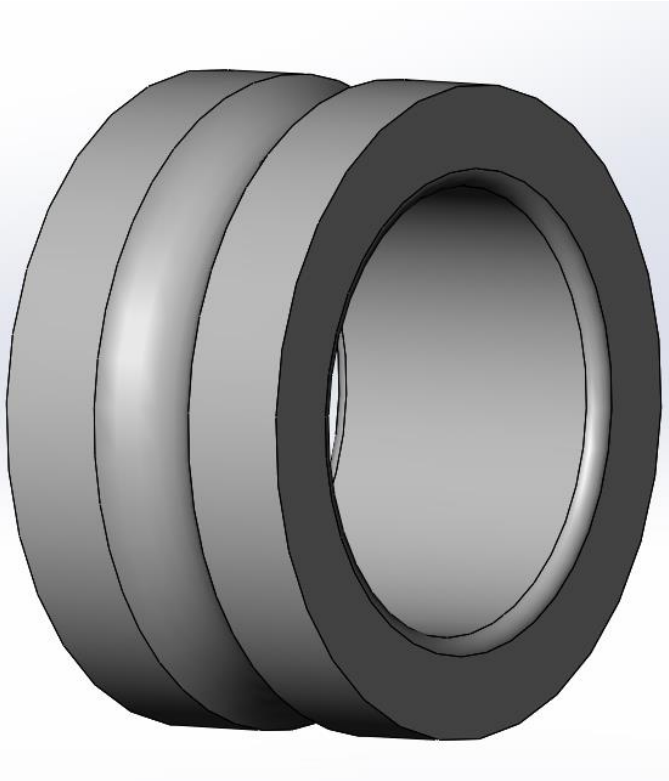




3D Sketch for inner ring

- The same method for sketching an inner ring

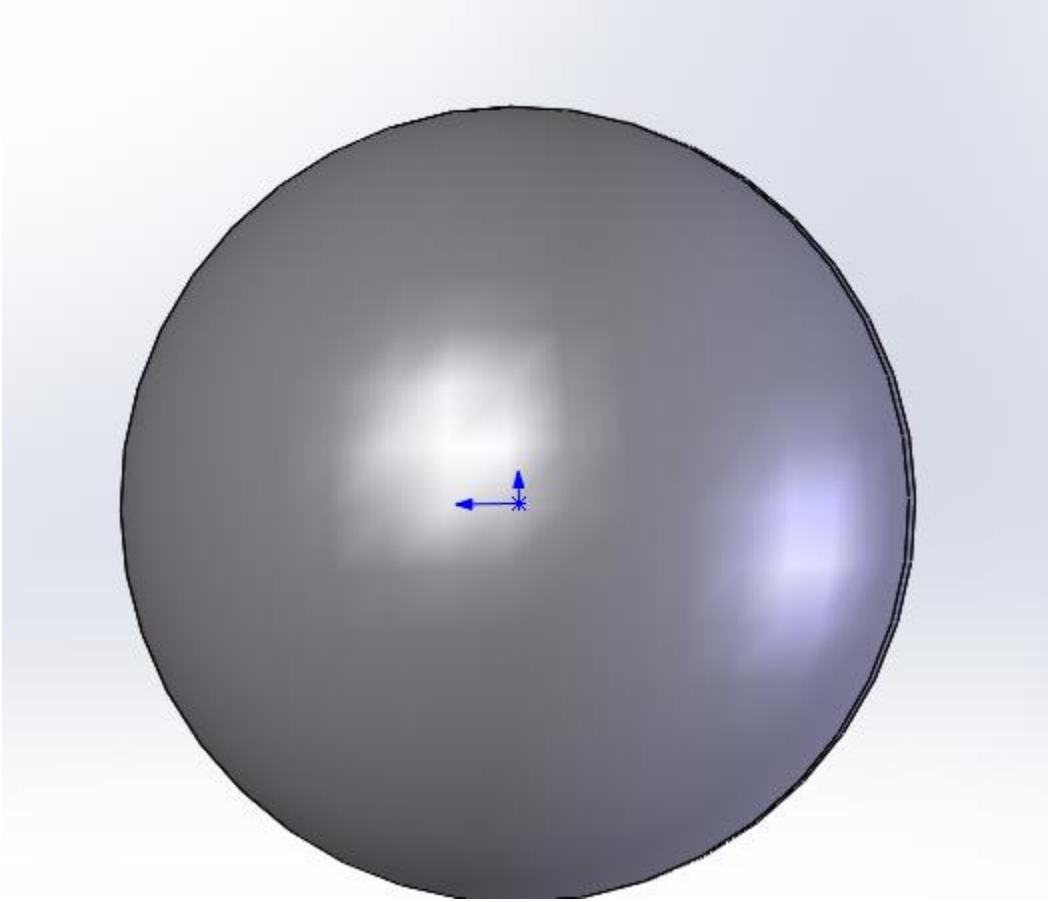




The sketch for the inner ring

Self practice - 3D Sketch of a \ball

- Find a way to draw a ball.



R=2.5mm

Lab assignment #1

Assignment #1 - 3D Sketch

- Draw this part in SolidWorks with the skills you learned. Show the model to TA before you leave.