Welcome to Code Crunch!

C12 | Crunch 3D: CAD & Modeling

[Tues 4-5PM] Weekly | Spring 2025

Attendance

Earn a Certificate of Completion by attending at least 70% of the workshops

CODECRUNCH.CS.FIU



Unit #3

Topic: 3D Part Modeling Continued

C12 | Crunch 3D: CAD & Modeling

Key Dates and Structure
C12 - Crunch 3D: CAD & Modeling

- **Week 1: Introduction to OnShape, Sketching Fundamentals, & 2D Constraints**

  Learning what On-Shape is and how to properly sketch on OnShape.

- **Week 2: 3D Part Modeling**

  Learning how to use extrude, remove, fillet, chamfer, revolve, shell, and loft functions for 3D models.

- **Week 3: 3D Part Modeling Continued**

  Learning how to use draft, mirror, and sweep functions for 3D models.

- **Week 4: Assemblies & Mating Constraints**

  Learning how to create assemblies through mates and constraints.

- **Week 5: Final Project - Real-World Design Challenge**

  Applying all concepts to design a functional product.

- **Week 6: Final Project Showcase**

  Presenting your final project, sharing your experience, and receiving feedback.

3D Modeling Definitions

- **Draft** is a feature that increases/decreases the size of an extrusion based on a chosen angle.
- **Mirror** is used to reflect a sketch entity across a line/axis or a 3D model across a plane. It is useful for creating symmetric parts.
- **Sweep** allows a profile to be swept through a path to form a 3D model or surface.
    - **Path** is a line/curve. It could be comprised of multiple sketch entities, be an entire sketch, or even be the edge of a 3D model.

Session Overview

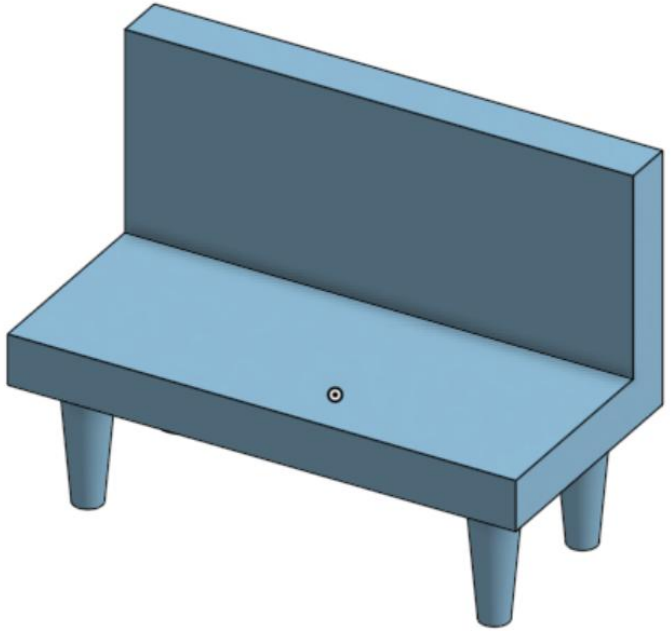
In this session we will be creating a bench and a bolt to practice the 3D modeling tools of extrude, draft, mirror, sweep, and remove. For both, we start off with a 2D sketch.

Bench:
To create a rectangular bench, we will be using extrude, draft, mirror, and sweep.

Bolt:
To create a bolt and nut, we will be using extrude, helix, sweep, draft, and remove.

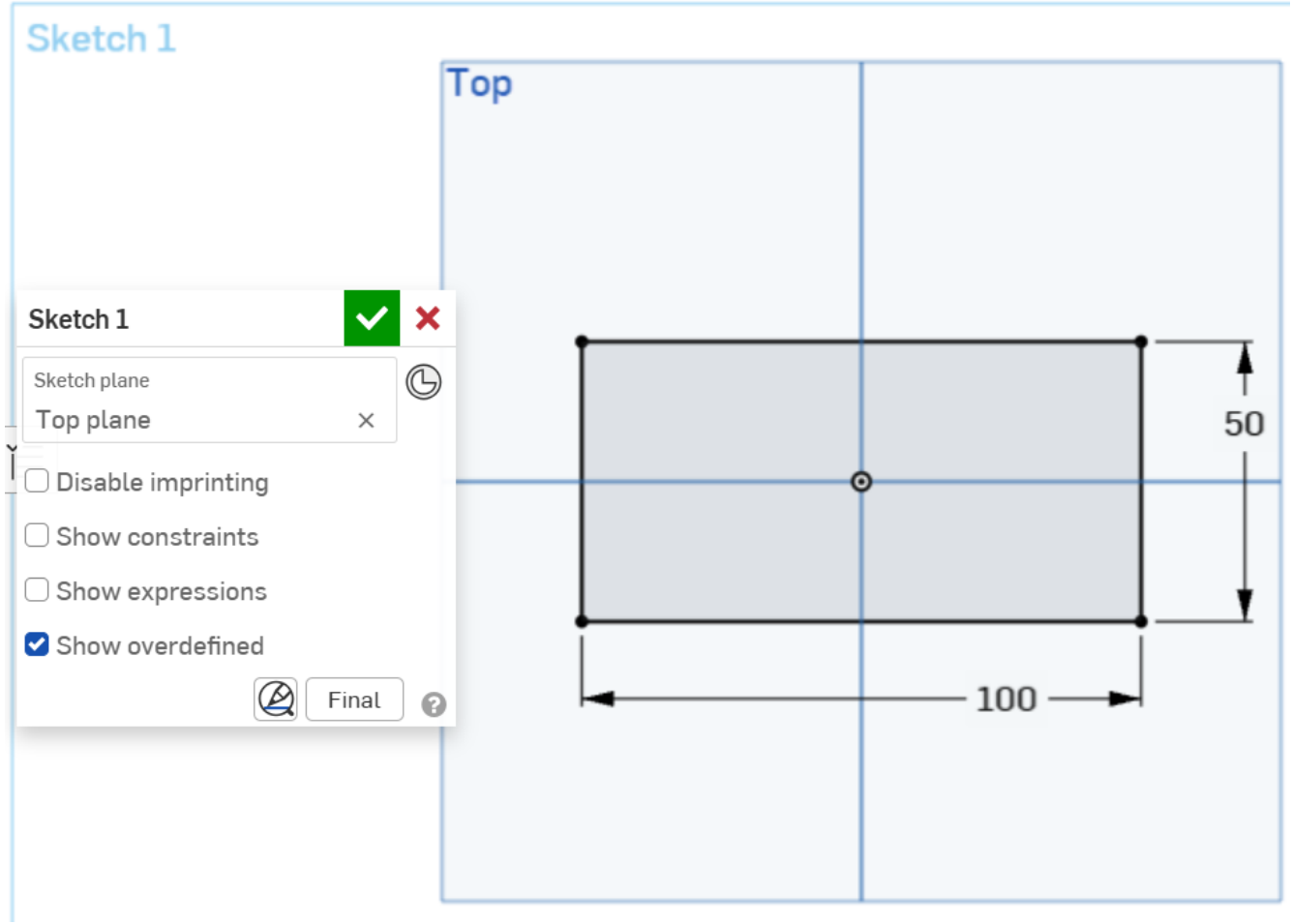
Time for the…

Bench!



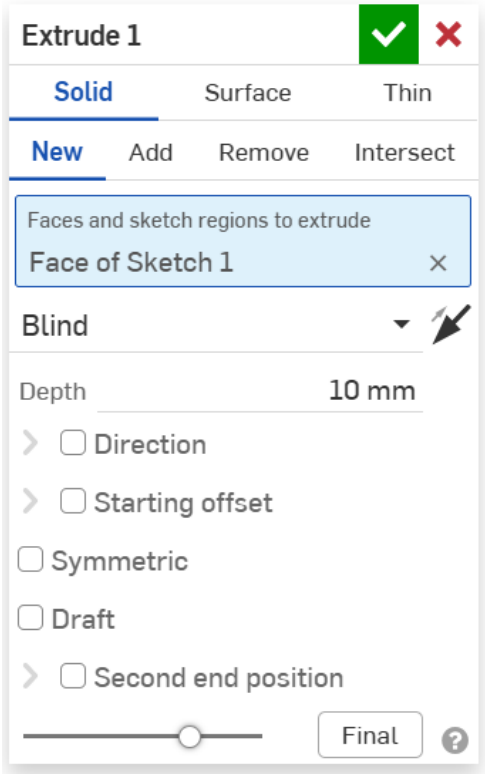
Bench: Sketch 1

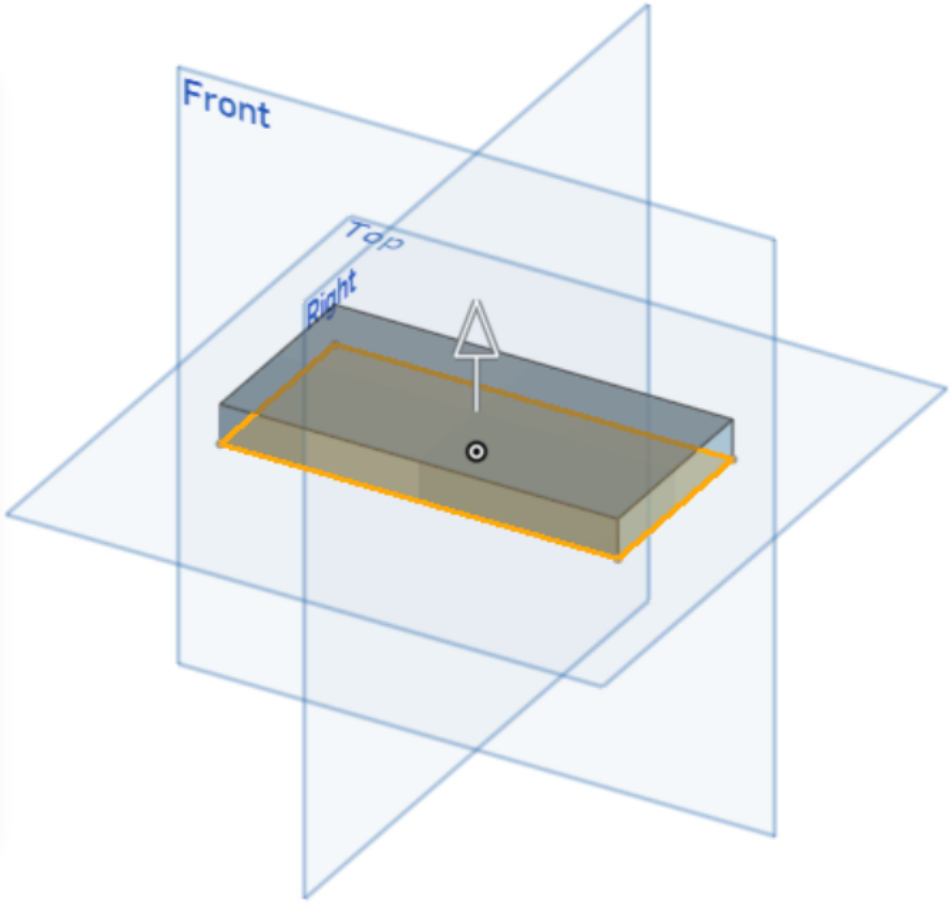
To make the **seat** for the bench, create a **sketch** on the **top plane** with a **center point rectangle** of **length** 100 mm and **width** of 50 mm.



Bench: Extrude

Extrude sketch 1 with a **depth** of 10 mm, and you have the **seat**.



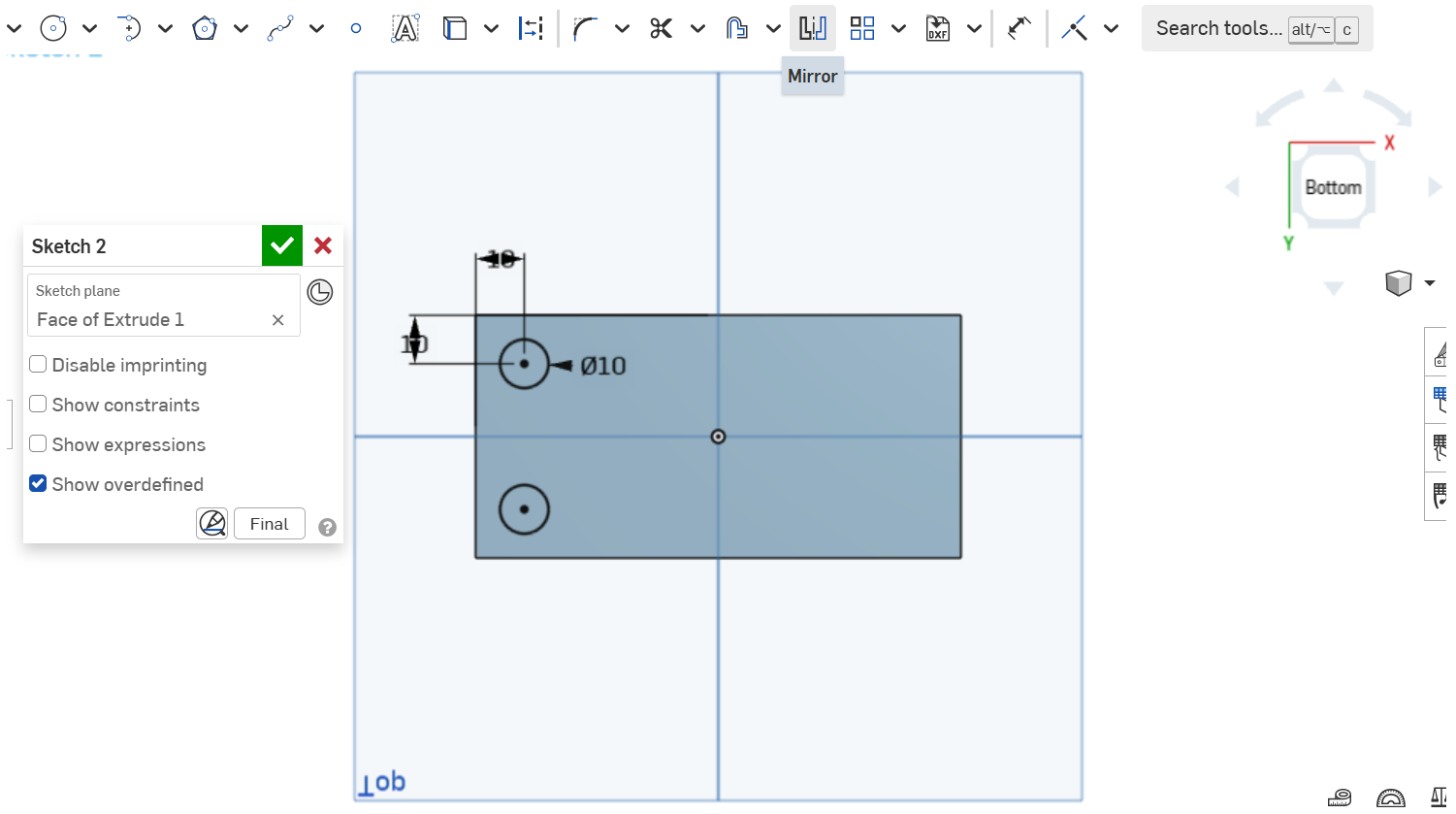


Bench: Sketch 2

To create the **legs** of the bench, we will create a **sketch** on the **bottom of the seat**.

Create a **center point circle** with a **diameter** of 10 mm and position its center 10 mm from the edges of the bench.

Mirror this circle across the horizontal axis.



Note: **Mirror** is used to reflect sketch entities across a line/axis. In this case, select **mirror**, then the **mirror line** is the horizontal axis, and the **circle** is the **entity to be mirrored**.

Extrude Draft

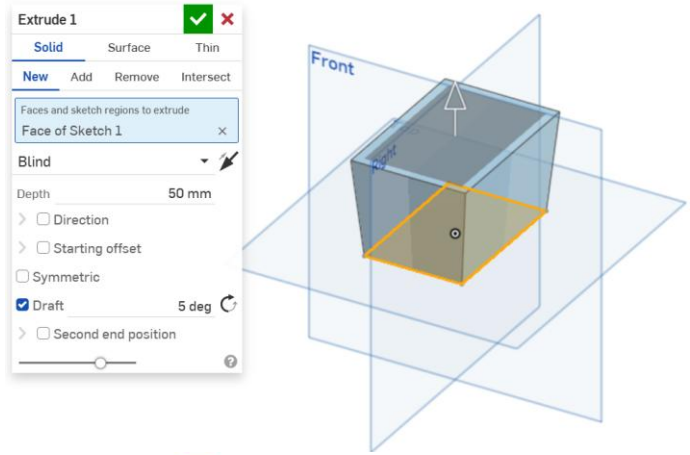
We know that **extrude** is used to convert a profile into a 3D model.

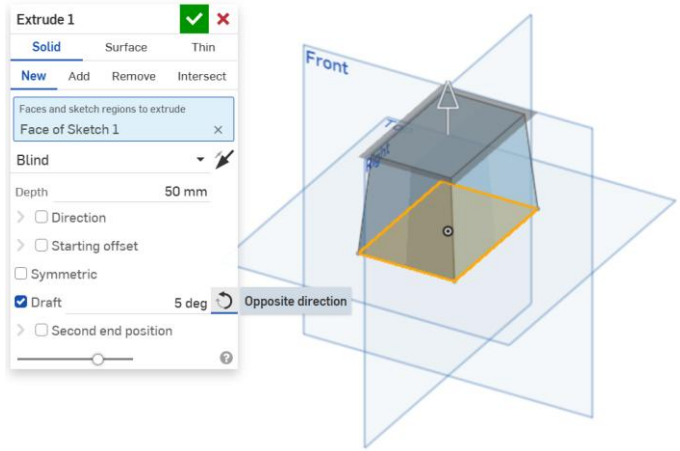
Draft extrudes a profile while increasing/decreasing its size based on a chosen angle.

To use **draft**:

1. Click **extrude**, the **entity** to extrude, and type the **depth** for the extrusion. Then check "**draft**".
2. Next to **draft**, type the value of the desired **angle** and select the **direction** of the angle (clockwise or counterclockwise).

Note: The **default direction** is set to increase the size of the profile. By clicking "**opposite direction**," the direction will then be flipped to decrease the size of the profile.

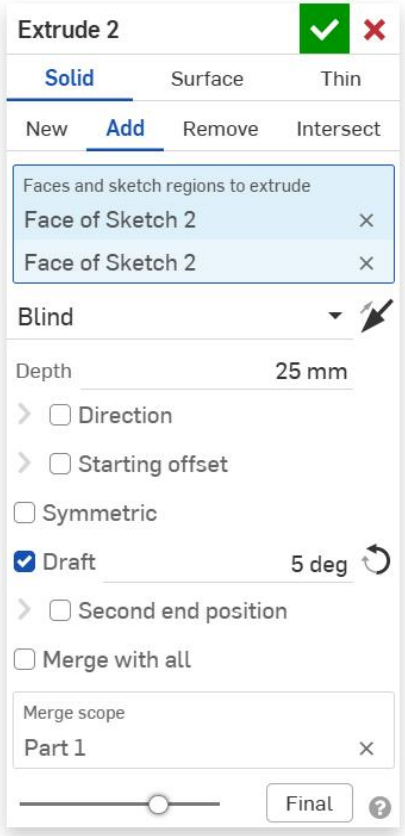


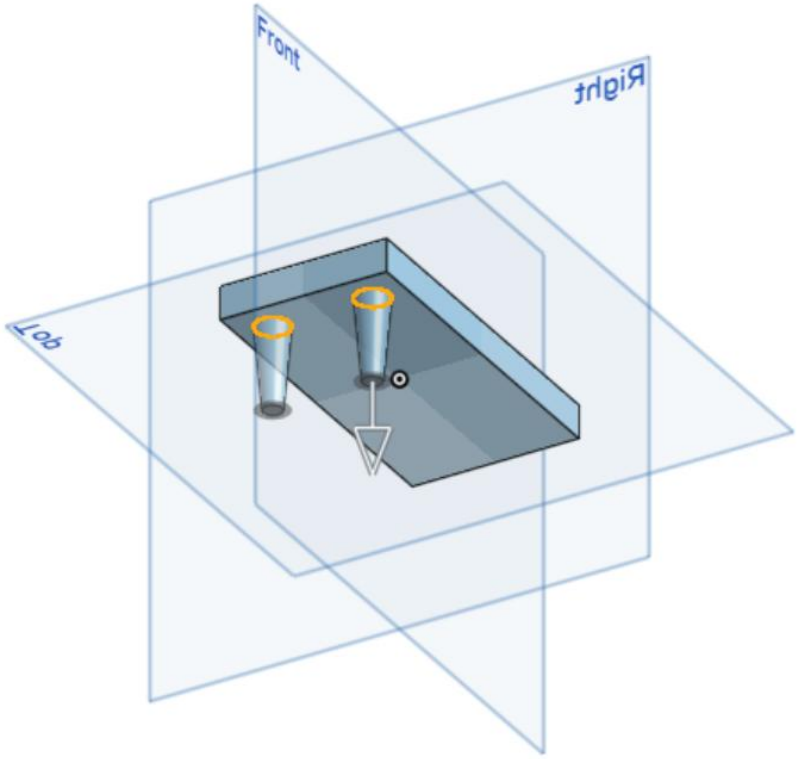


Bench: Draft

The legs will be made into a 3D part by using **draft**.

1. Select the **2 circles** on the bottom of the seat and click **extrude**.
2. Set the **depth** of the extrusion to 25 mm.
3. Select **draft**.
4. Type 5 deg as the **angle** and make the direction **counterclockwise** (decreasing the circles in size).
5. Click the green check to complete 2 legs.



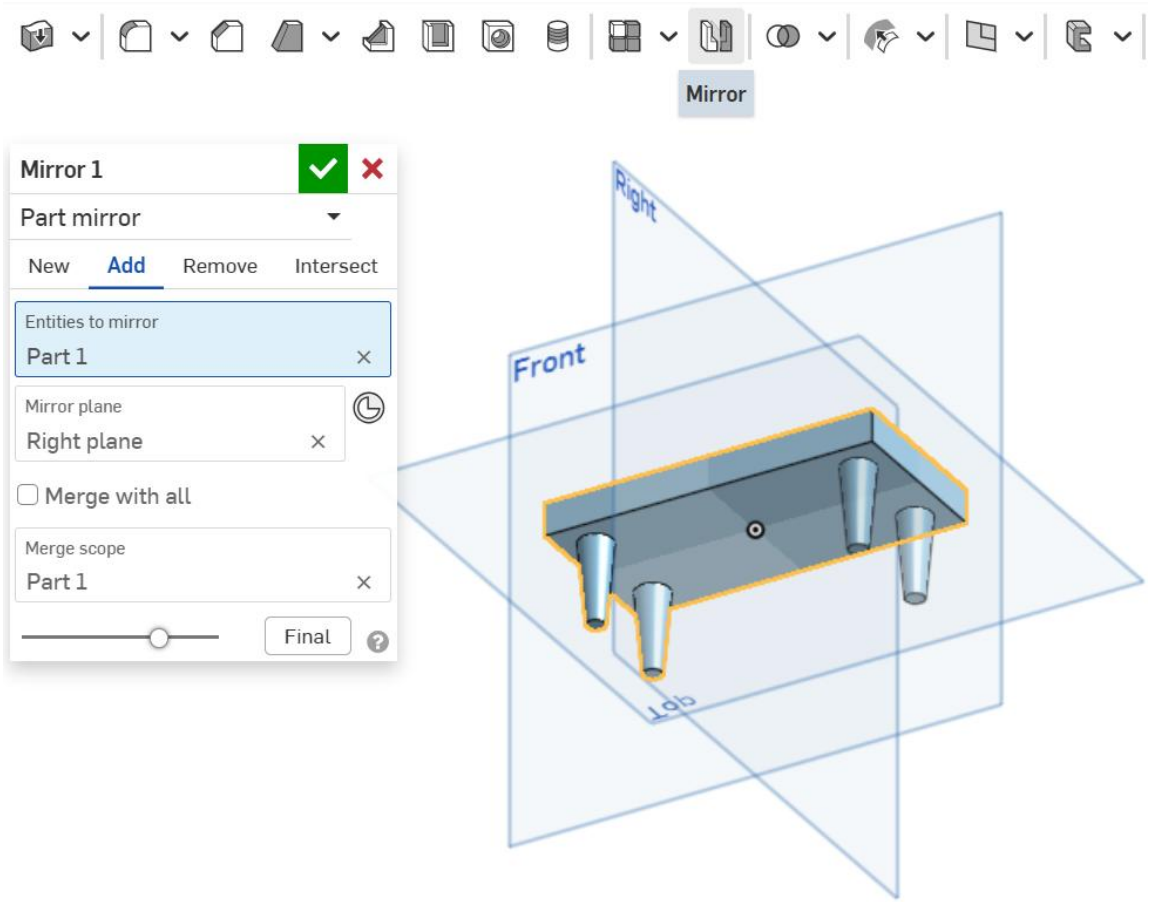


Bench: Mirror

Mirror can also be used to reflect a **3D model** across a **plane**.

To create the other 2 legs of the bench, we will be **mirroring** the **2 created legs** across the **right plane**.

1. Select **mirror**.
2. Select the **3D part** as the **entity to mirror**.
3. Select the **right plane** as the **mirror plane**.
4. Click the green check mark to complete the legs for the bench.

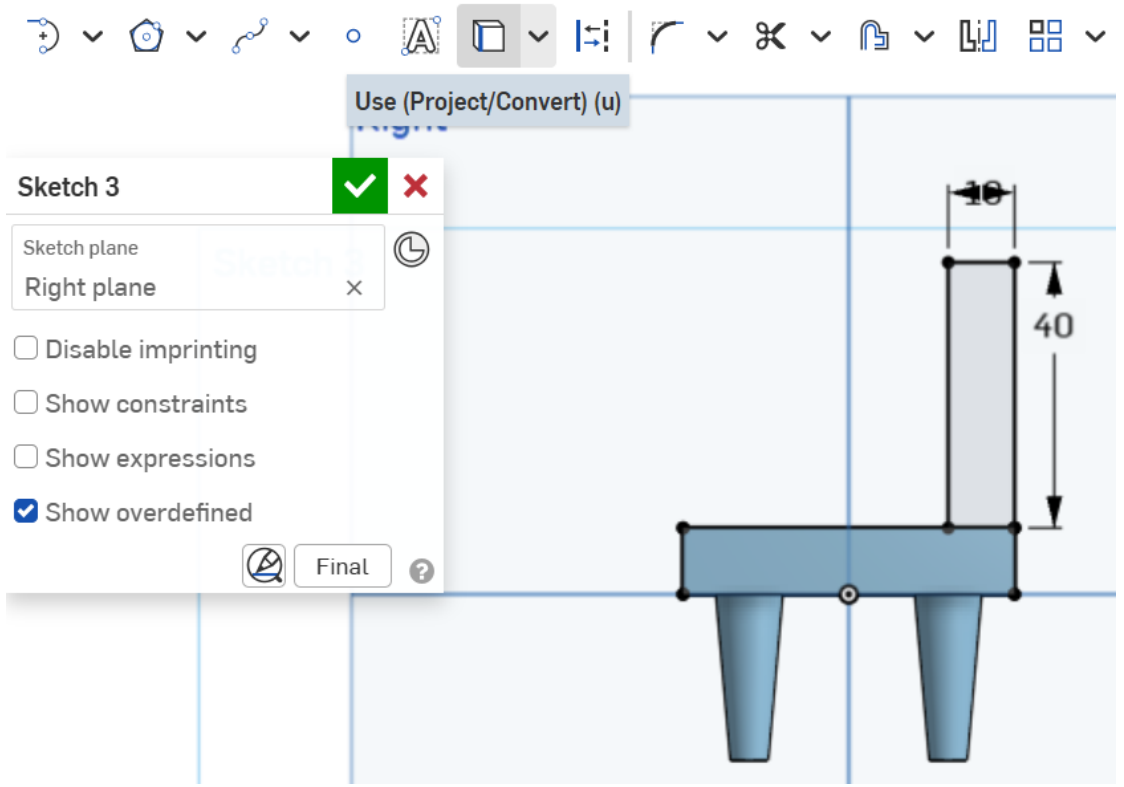


Bench: Sketch 3

To create the backrest for the bench, the **sweep** feature will be used. The **sweep** feature allows a **profile** to be swept through a **path** to form a 3D model or surface.

To create the **profile**:

1. Make a **sketch** on the **right plane**.
2. Click **use** and select the **seat**. This allows the **seat** to show up as a **sketch entity** in the **new sketch**.
3. Use **corner rectangle** to make a rectangle from the **top right corner** of the seat.
4. For the rectangle, set the **width** to 10 mm and **height** to 40 mm.
5. Click the green check to complete the sketch.



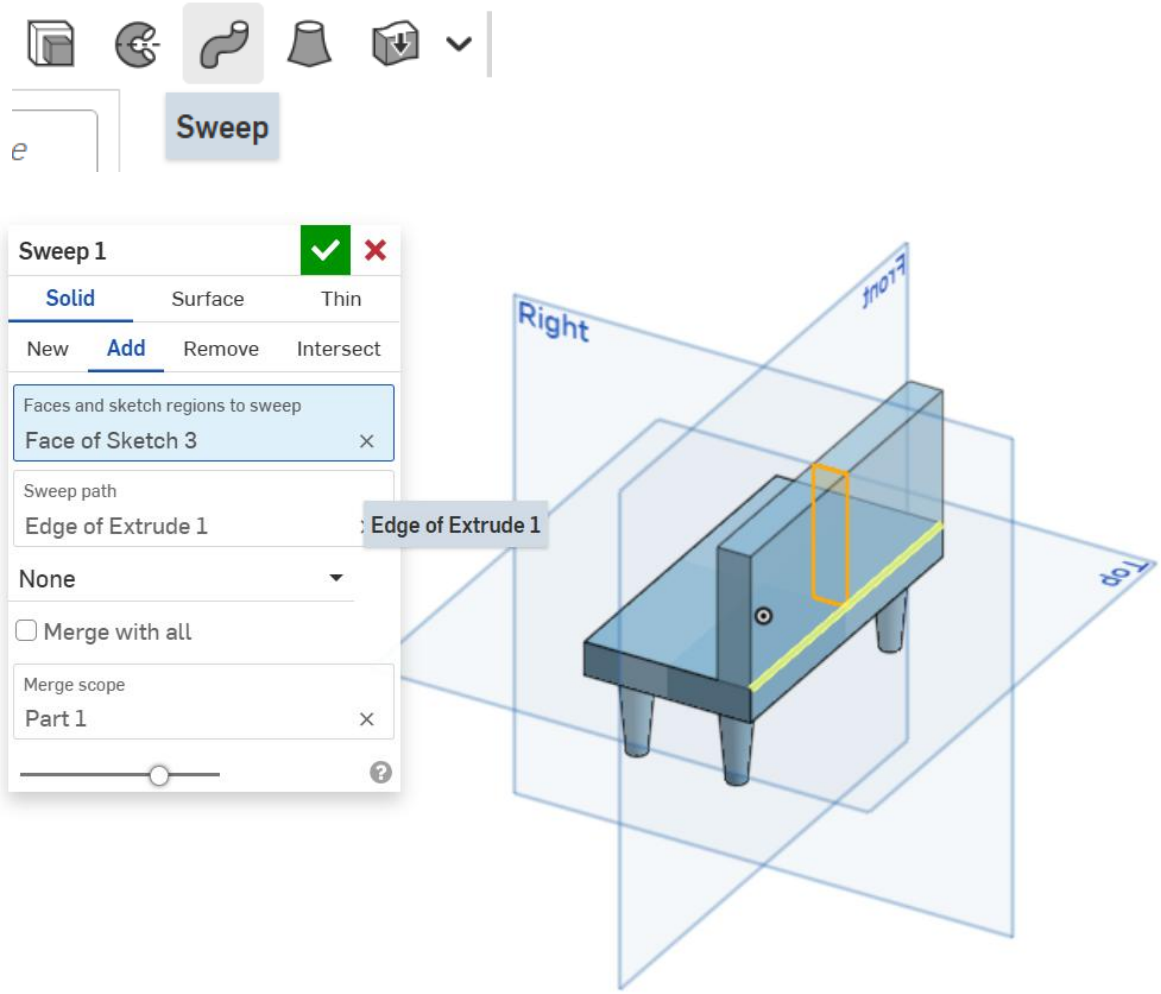
Bench: Sweep

We can now select **sweep**.

The **profile** (face & sketch regions to sweep) is the rectangle that was just created.

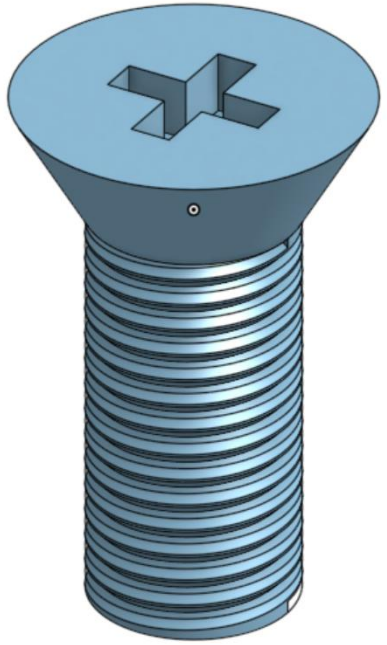
The **sweep path** for the sweep is the back edge of the seat.

Click the green check mark to complete the bench!



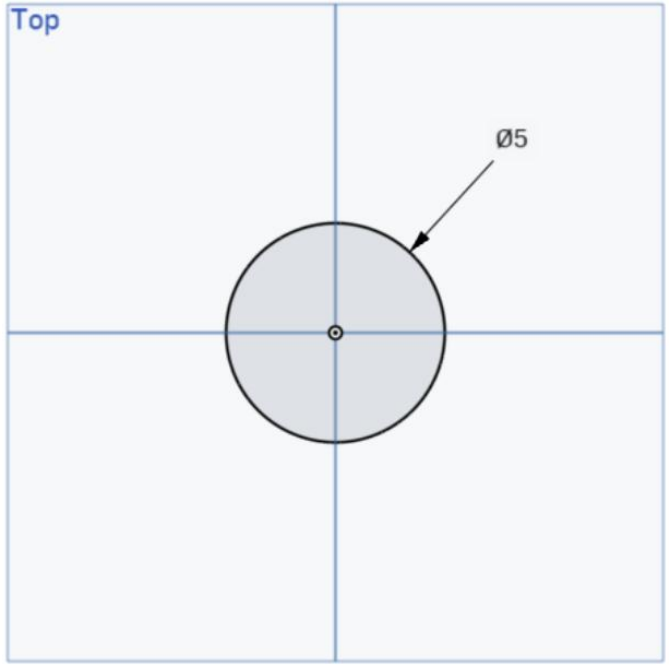
Time for the…

Bolt!



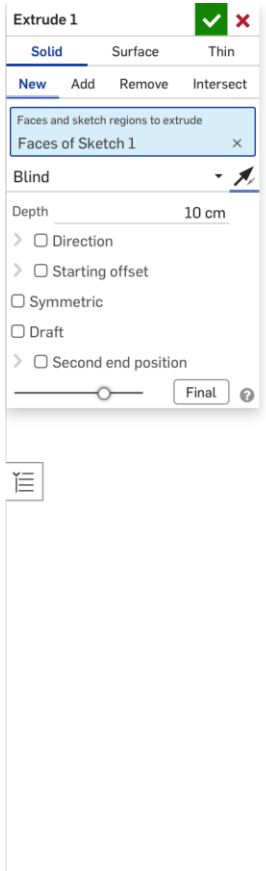
Bolt: Sketch

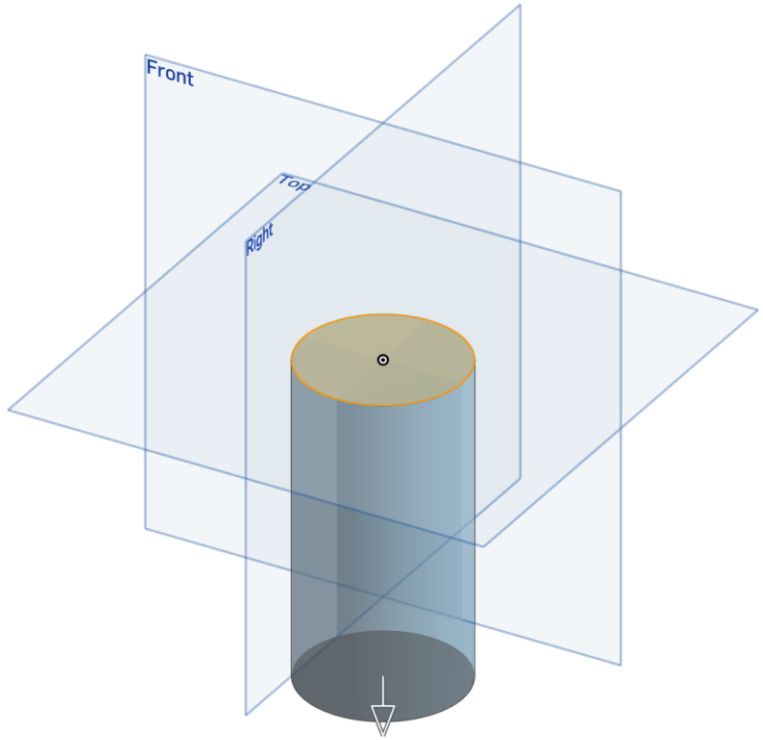
To start with the **bolt**, we are going to draw a **center point circle** with a 5 cm diameter in the **top plane**.



Bolt: Extrude Base

Do an **extrude base** with a **depth** of 10 cm on the **opposite direction** (going down). The direction can be change clicking the **arrow on top where the depth is changed**. Click the check mark to finish the extrusion.





Bolt: Sweep – Helix Path

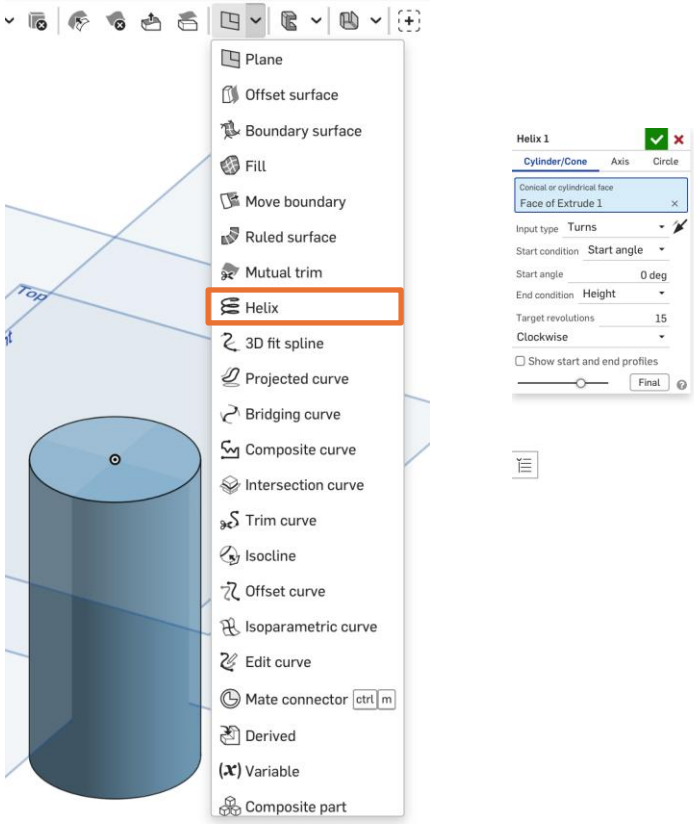
Remember: The **path** required for the **sweep** feature is a line/curve.

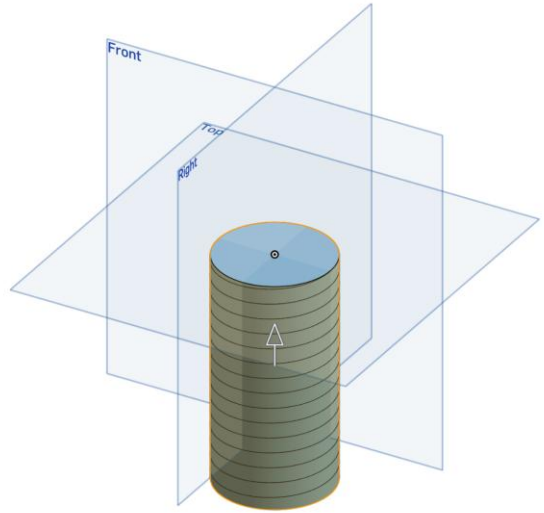
In this case, the **path** will be a **helix**.

A **helix** is spiral that can be drawn on the surface of cylinder or cones.

To make a **helix**: On the tool bar at the top, click the **arrow next to the plane** and click the **helix** feature. Then select the cylinder.

For the bolt, we are going to use a **helix** with 15 **target revolutions.**

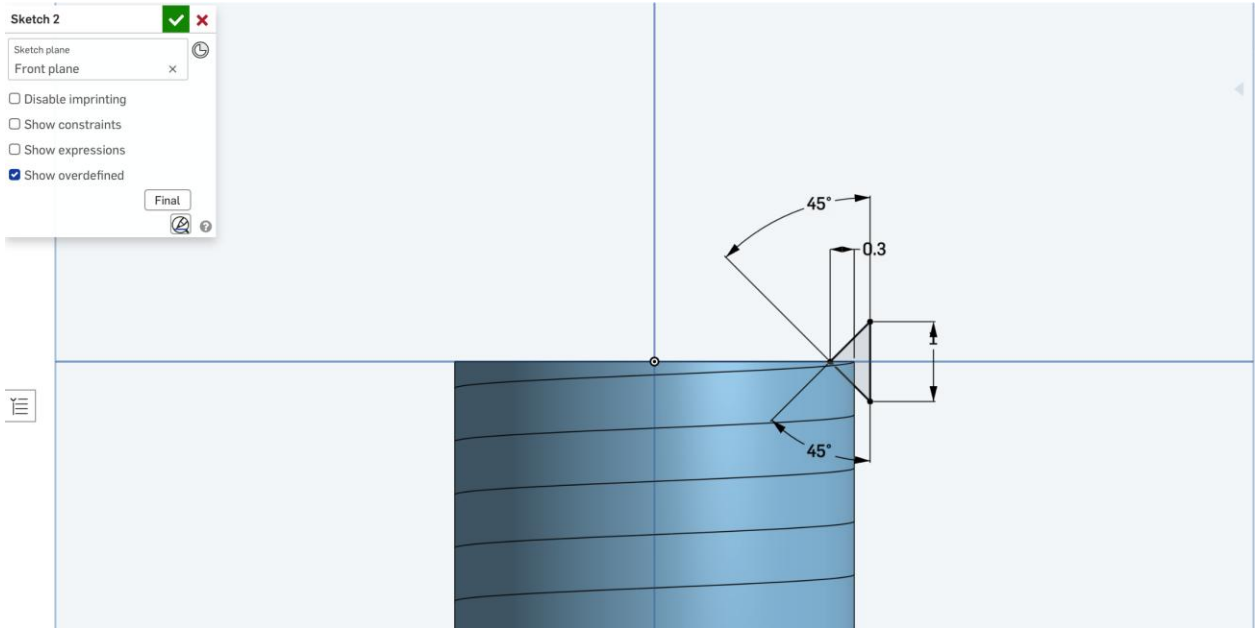




Bolt: Sweep – Sketch Profile

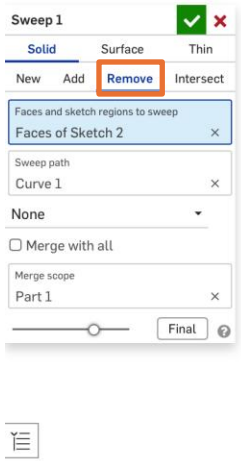
To create the **profile** for the **sweep,** we will do a **sketch** on the **front plane**.

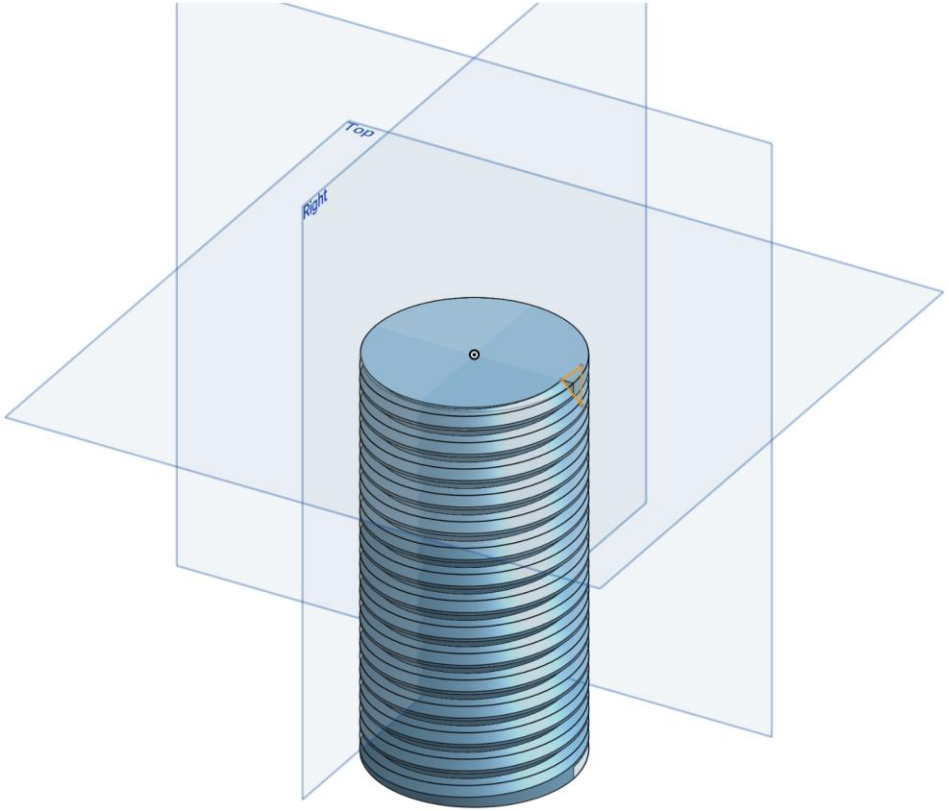
1. Draw a sketch where the "top“ of the triangle is **aligned with the center.**
   - Note: “top” is used to refer to the left tip of the triangle in the image.
2. Make the 2 diagonal sides **have an angle of 45 degrees** with the vertical side.
3. Give the vertical side a length of 1 cm.
4. Make the "top" be 0.3 cm from the side of the cylinder.
5. Hit the check mark to complete the sketch.



Bolt: Sweep

Now that the **profile** and **path** for the **sweep** feature are created, the **sweep** feature can be used to make the **threads** for the bolt.



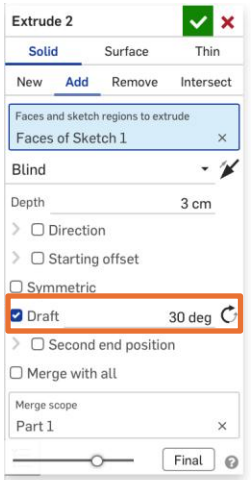


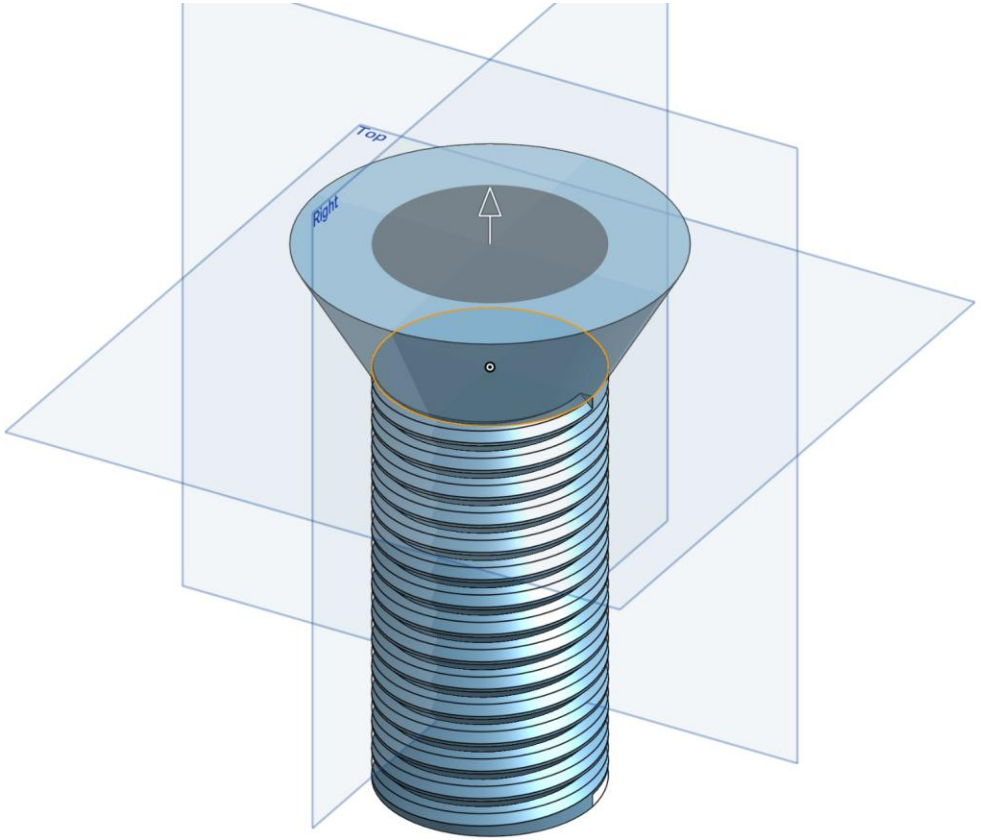
In this case, we are going to **remove** the area created by the sweep. Click the check mark to complete the sweep.

Bolt: Extrude Boss with Draft

To create the top of the bolt, we can use **draft** through the **extrude** feature.

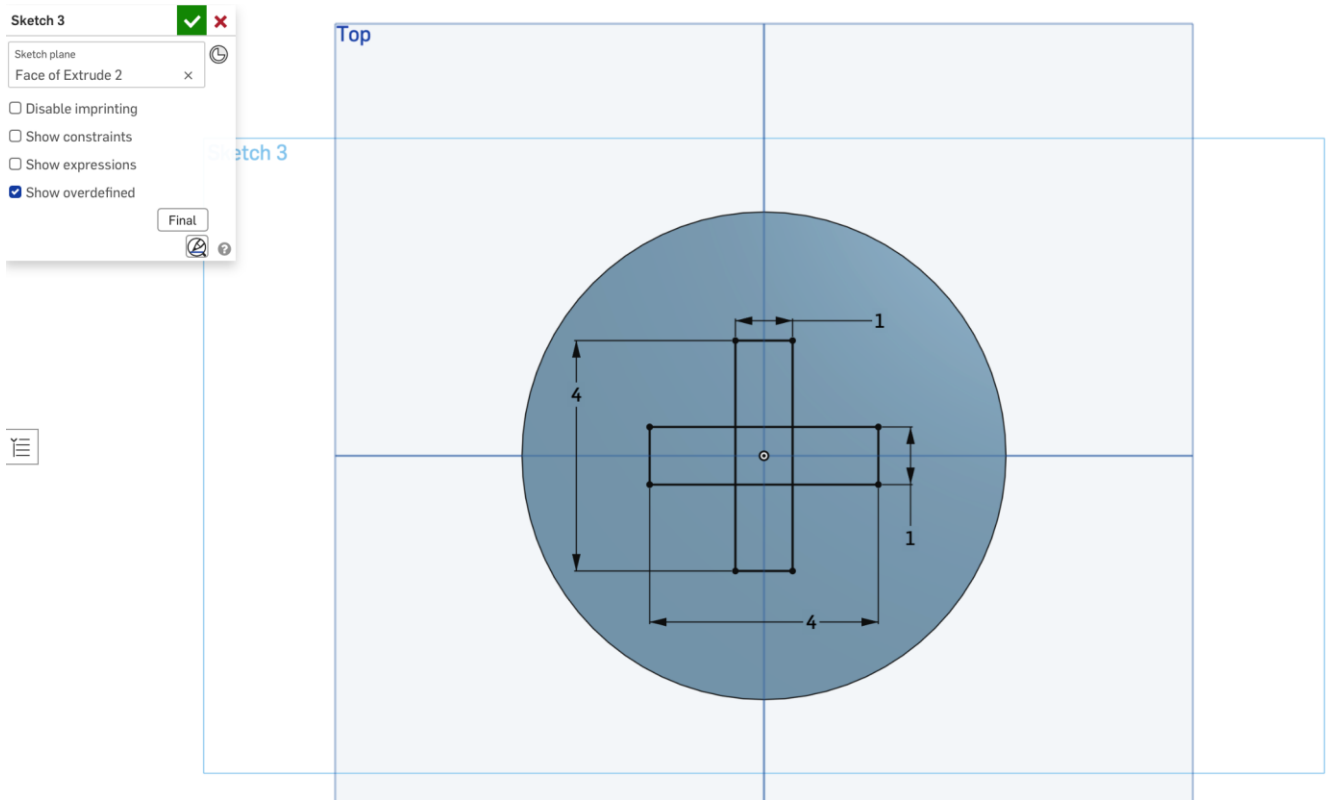
Do an **extrude boss** using **sketch 1** with a **depth** of 3 cm. Check the **box next to draft** and give it a **draft angle** of 30 degrees. Click the green check mark to complete the extrude.





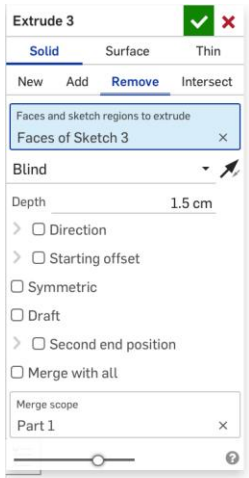
Bolt: Sketch

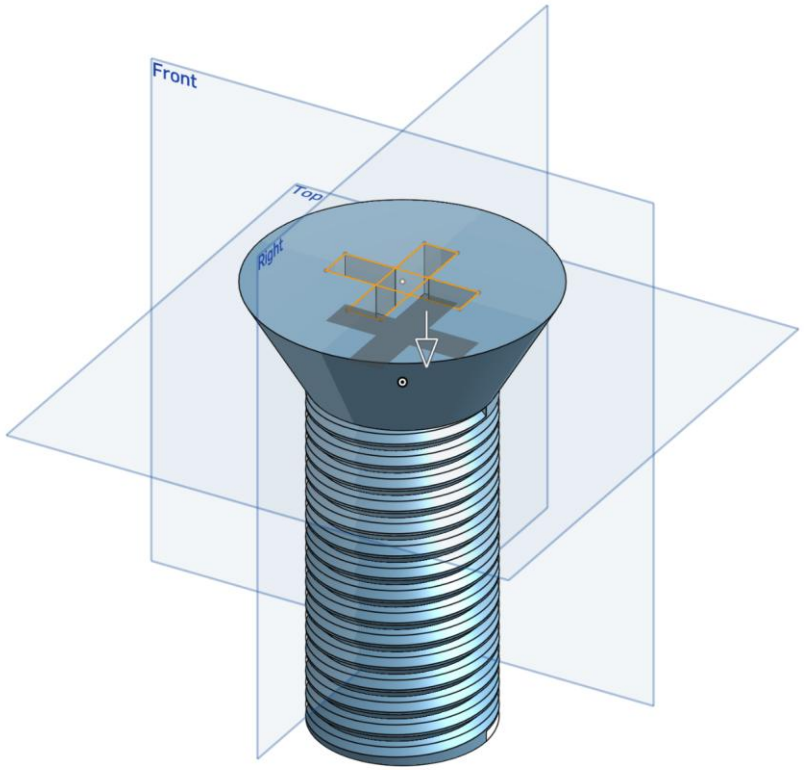
Select the **top of the bolt** to do a **sketch**. Draw 2 **center point rectangles**, one with a width of 1 cm and height of 4 cm, and the other one the other way around to make a cross.



Bolt: Remove

Do an **extrude**, having **remove** selected, on **sketch 4** with a **depth** of 1.5 cm. Click the green checkmark to complete the bolt!





Q&A Session

Attendance

Join us for the upcoming weekly sessions this Spring 2025!
(Jan 6 - Apr 4, 2025)

Monday: C5 1PM
Tuesdays: C7 1PM / **C11** 3PM
Wednesdays: C5 12:30 PM / **C9** 1:30 PM (Varies)
C1 2:30PM / **C2** 3:30PM / **C13** 5:30PM
Thursdays: C6 1PM / **C8** 3PM
Friday: C9 2PM (Varies) / **C10** 3PM/ **C11** 4PM

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