TERRAPIN WORKS

Introduction to CAD: Fusion 360

Students please sign in for the TW Workshop!

https://go.umd.edu/TWSP25

Before we get started….

- If you haven't already, **DOWNLOAD AUTODESK FUSION 360 TO YOUR COMPUTER!!!**
  - Visit: https://www.autodesk.com/campaigns/education/fusion-360
- Let us know if you need help!

Let's Start!

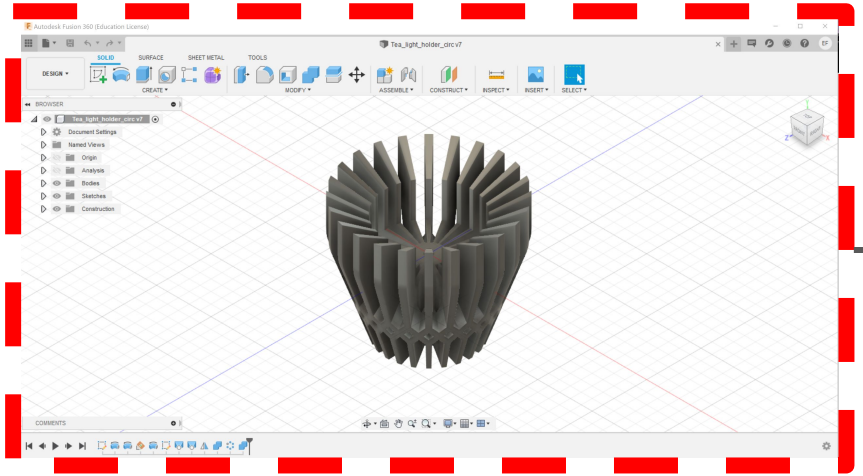
AUTODESK® FUSION 360™

Today we'll be going over…

- Introduction and Utility
- Tour of Fusion 360
- Making Sketches
- Turning Sketches into 3D models
- Mini-Project: Making a Planter

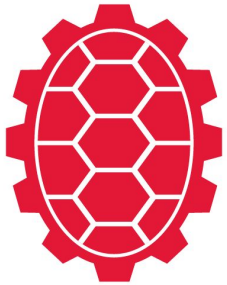
What is CAD? What is AutoDesk?

- CAD = Computer assisted design
- A software for designing 3D models, parts, products, etc.



What is Fusion 360? Why Fusion 360?

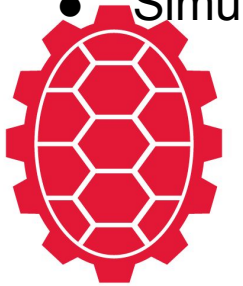
- Specific CAD software by Autodesk
- Powerful software with less steep learning curve
- Note: this lecture is aimed at new Fusion 360 users, but anyone is welcome to review the fundamentals



AUTODESK® FUSION 360™

Other Fusion 360 Applications

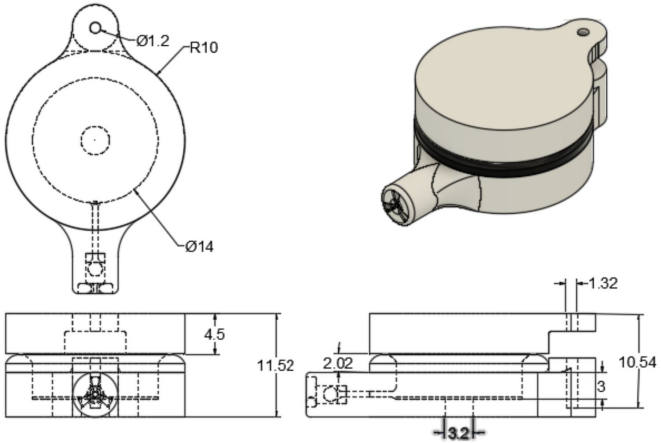
- CAM (Computer Aided Manufacturing) - software that directs the actual manufacturing of said part(s) by communicating with a numerically controlled (NC) manufacturing machine
- CAE (Computer Aided Engineering) - simulates the effects of various aspects of the 3D design of a particular structure or product using simulated loads and constraints
- PCB (Printed Circuit Board) Printing - allows designers and engineers to develop different parts of the circuit in parallel for electronic design
- Rendering
- Simulation

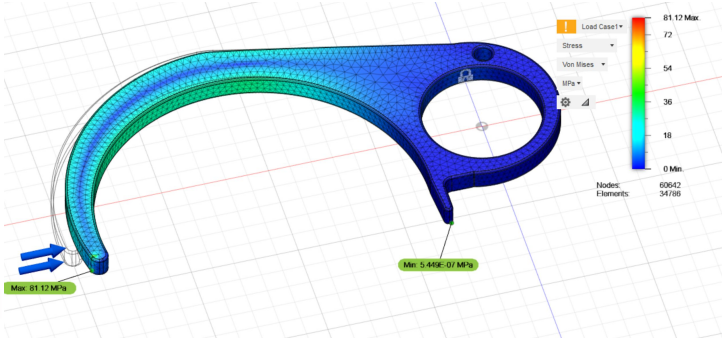


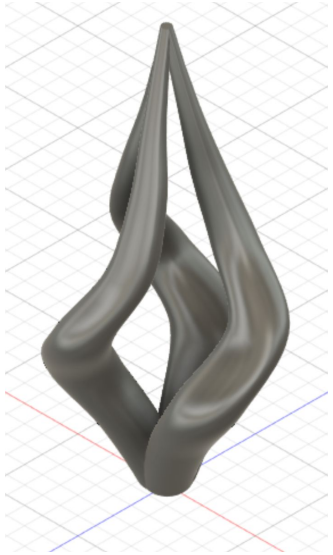
AUTODESK® FUSION 360™

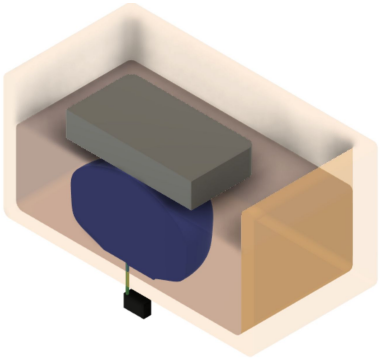
Uses for Fusion 360

- Precise designs for engineering or science
- Art and schematic models
- Simulations
- Electronics design

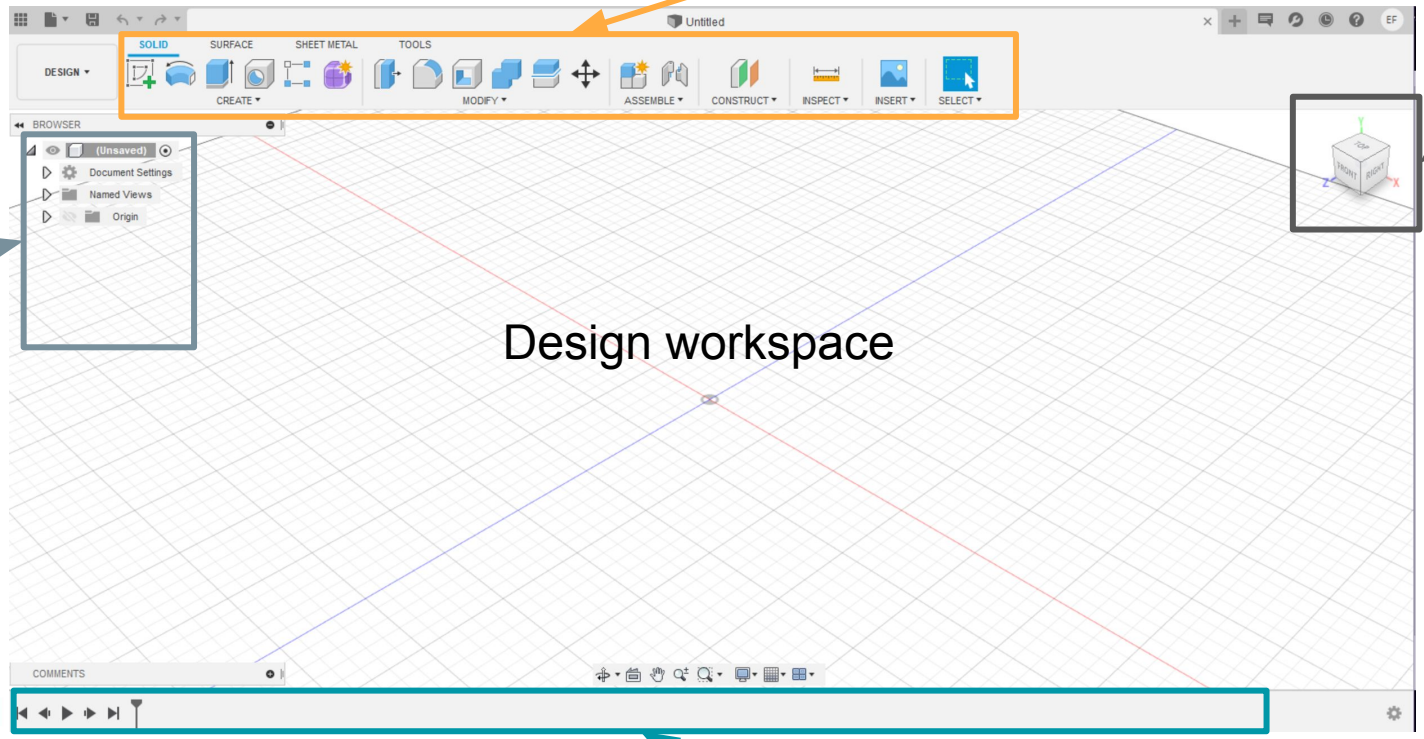




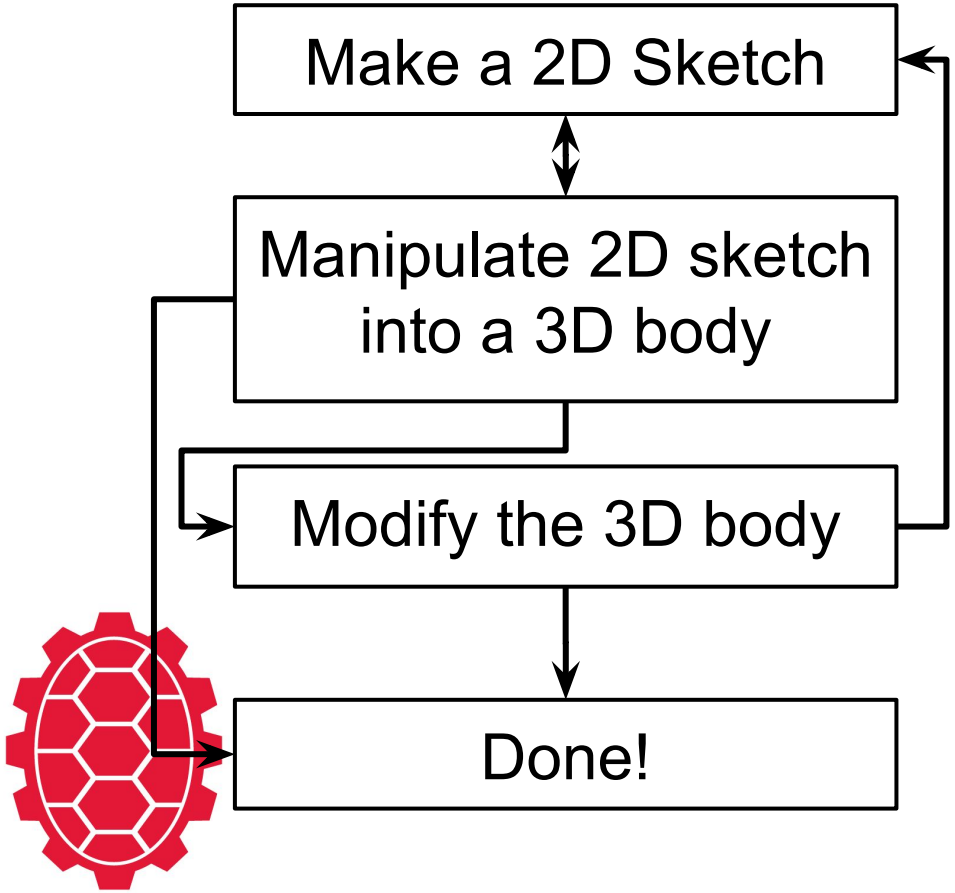


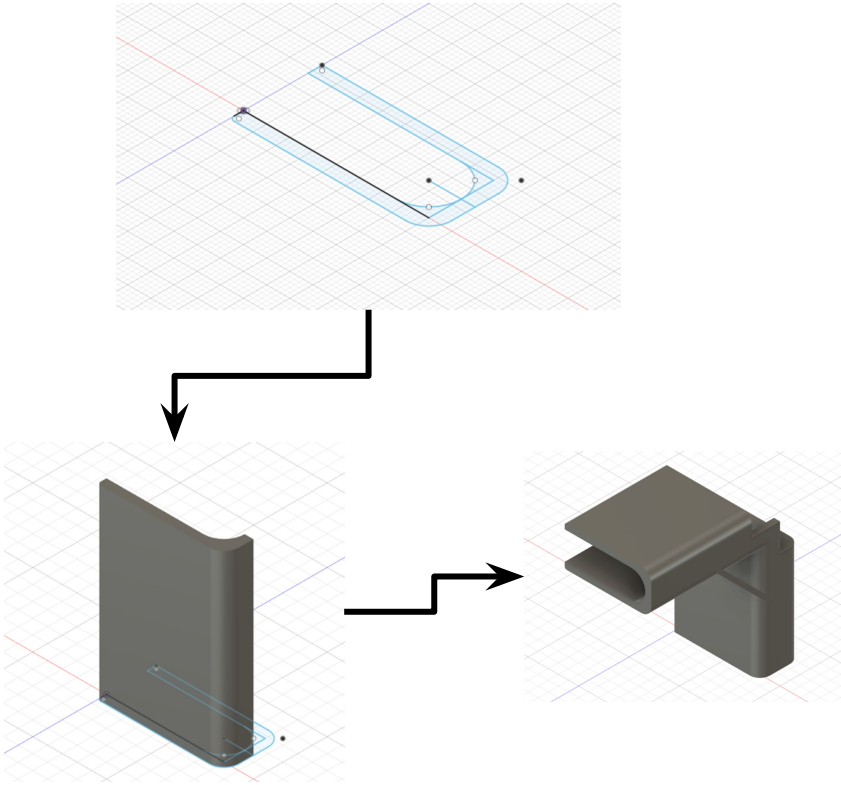


Tour of Fusion 360



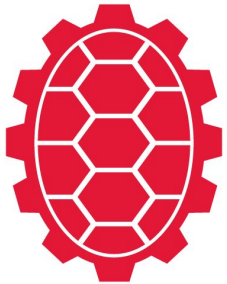
Process of 3D Design in Fusion 360





Introduction to Sketching

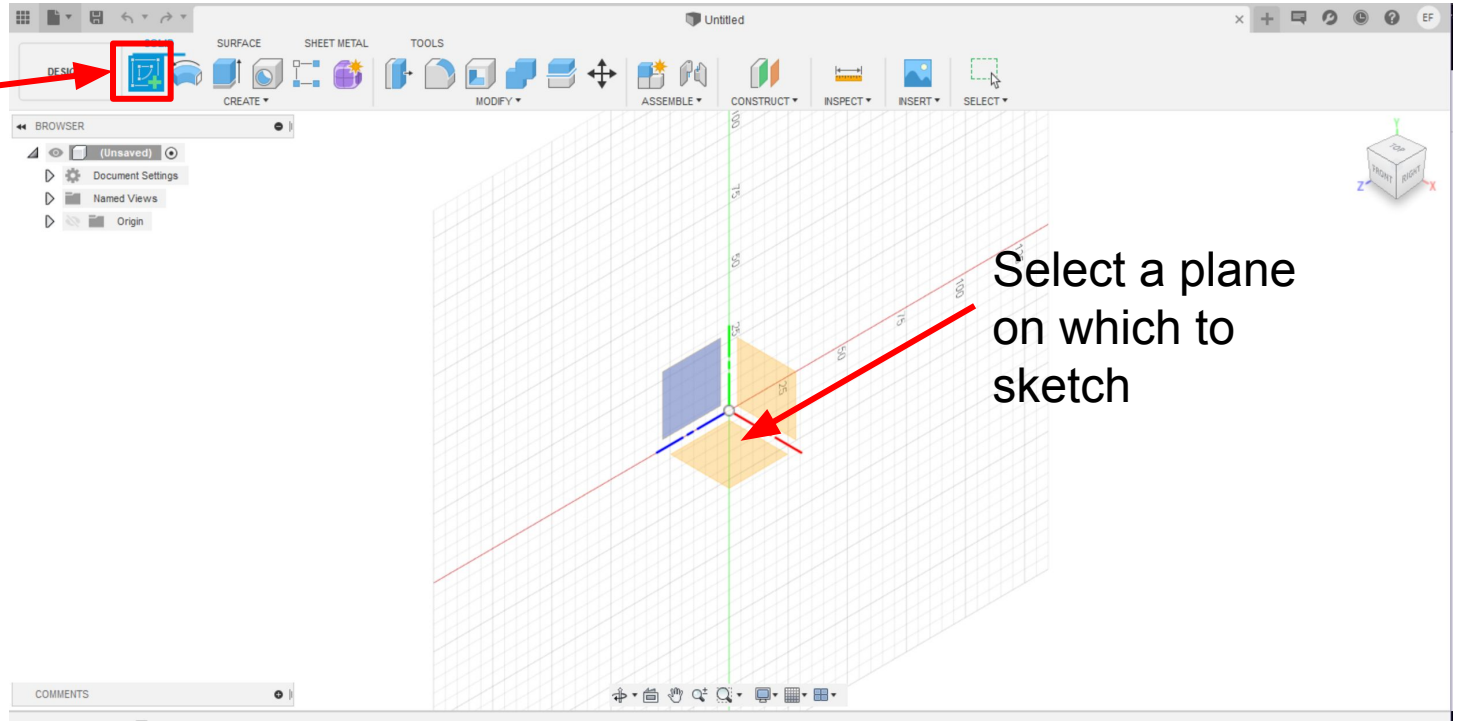
- Sketches are necessary to build 3D solid bodies
- Most commands that turn a sketch into a solid require a closed profile
- We'll cover:
  - How to open a sketch
  - Some fundamental sketch tools
  - Differences between paths and profiles



Introduction to Sketching

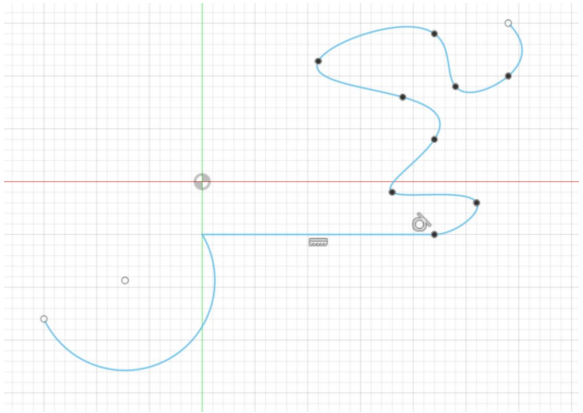
To start a sketch:

Click on the sketch icon

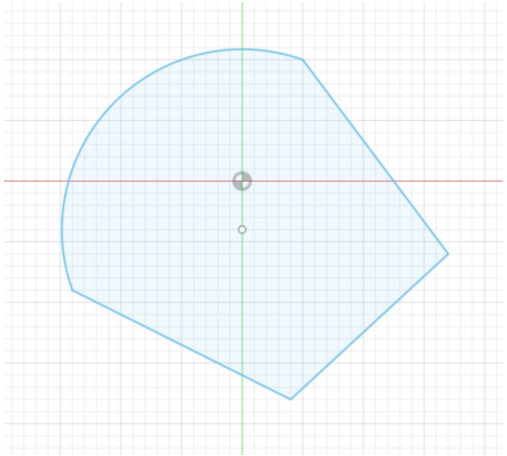


Paths and Profiles

- A path describes a line or curve that does not enclose an area
- A profile encloses an area to create a closed shape



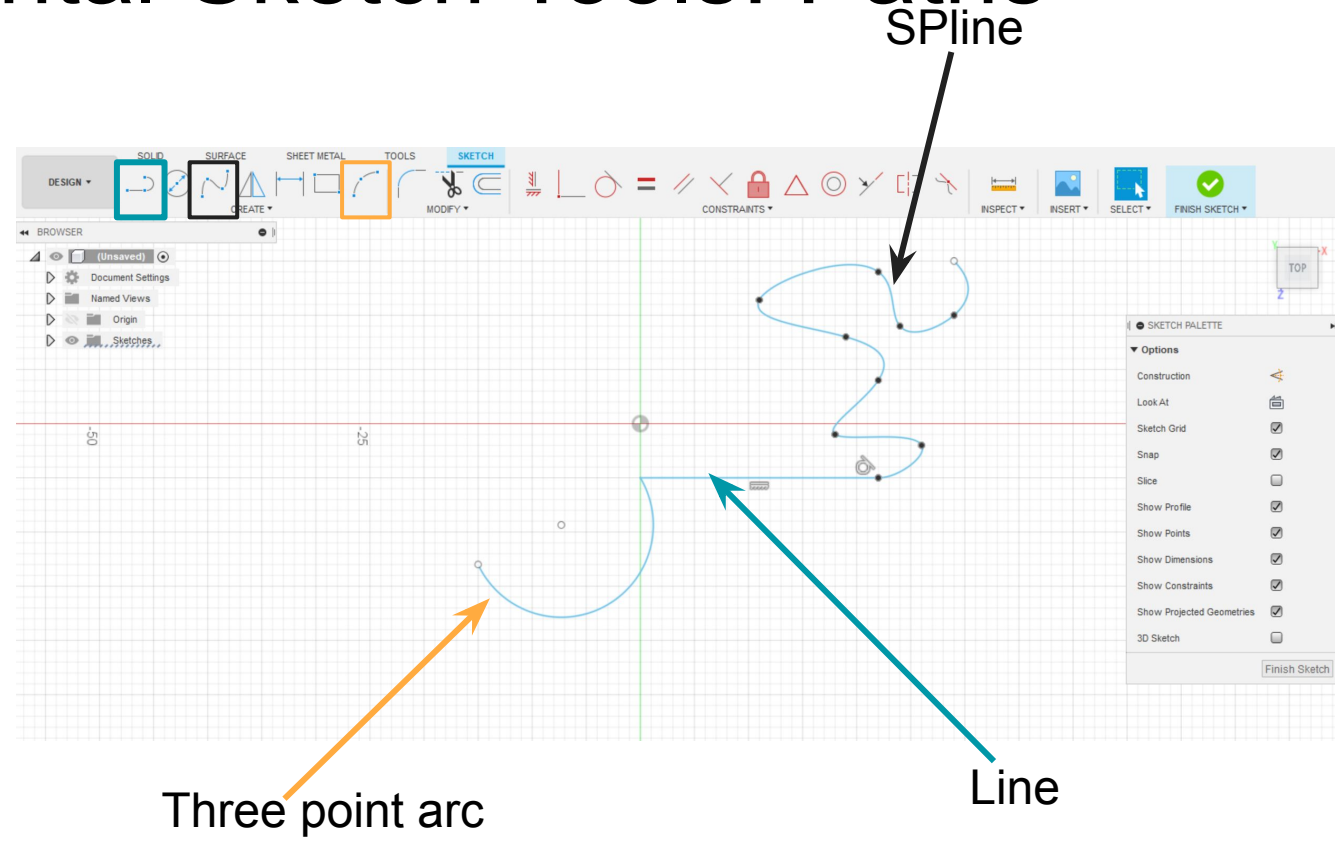
Path



Profile

Fundamental Sketch Tools: Paths

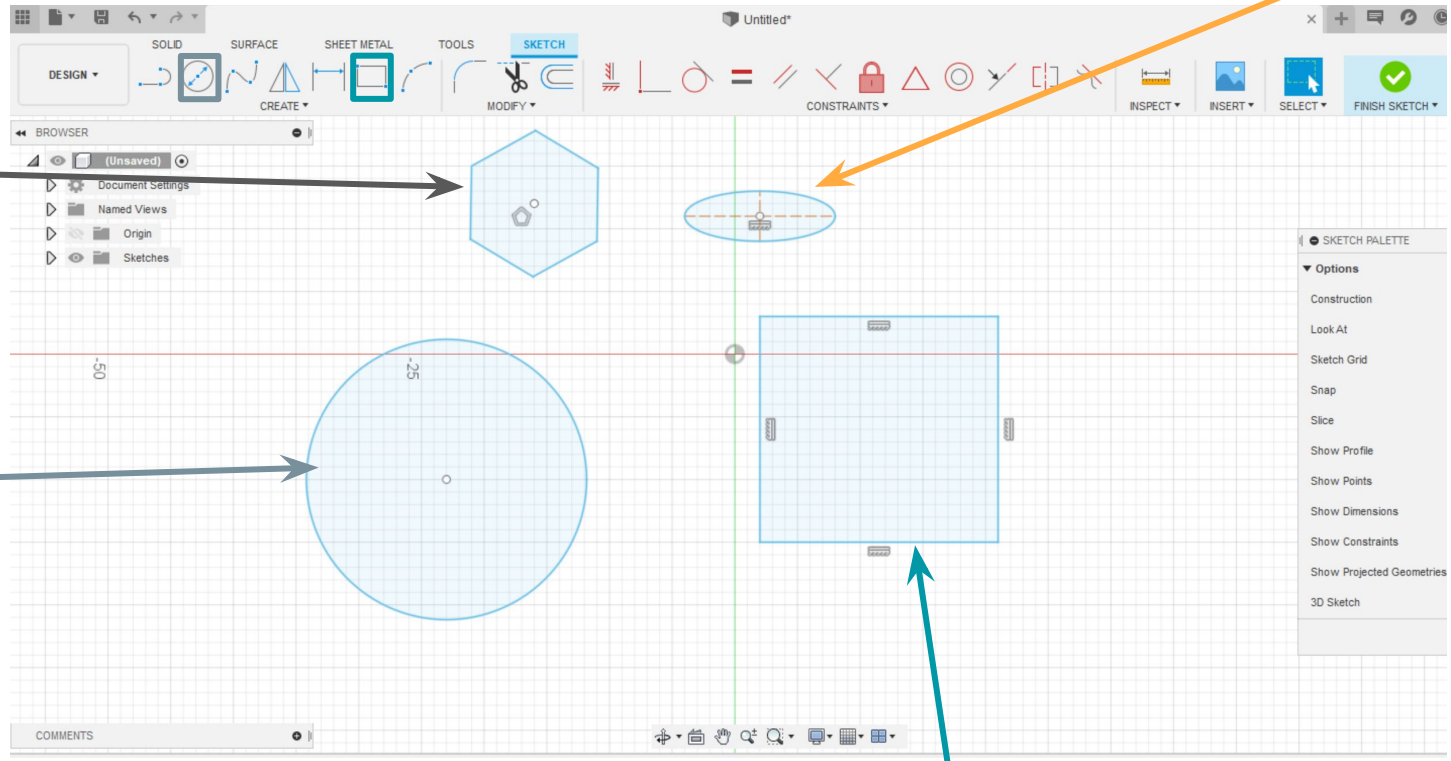
- Tools for making lines and curves
- Produce paths unless connected to enclose an area



Fundamental Sketch Tools: Shapes

Ellipse

Polygon



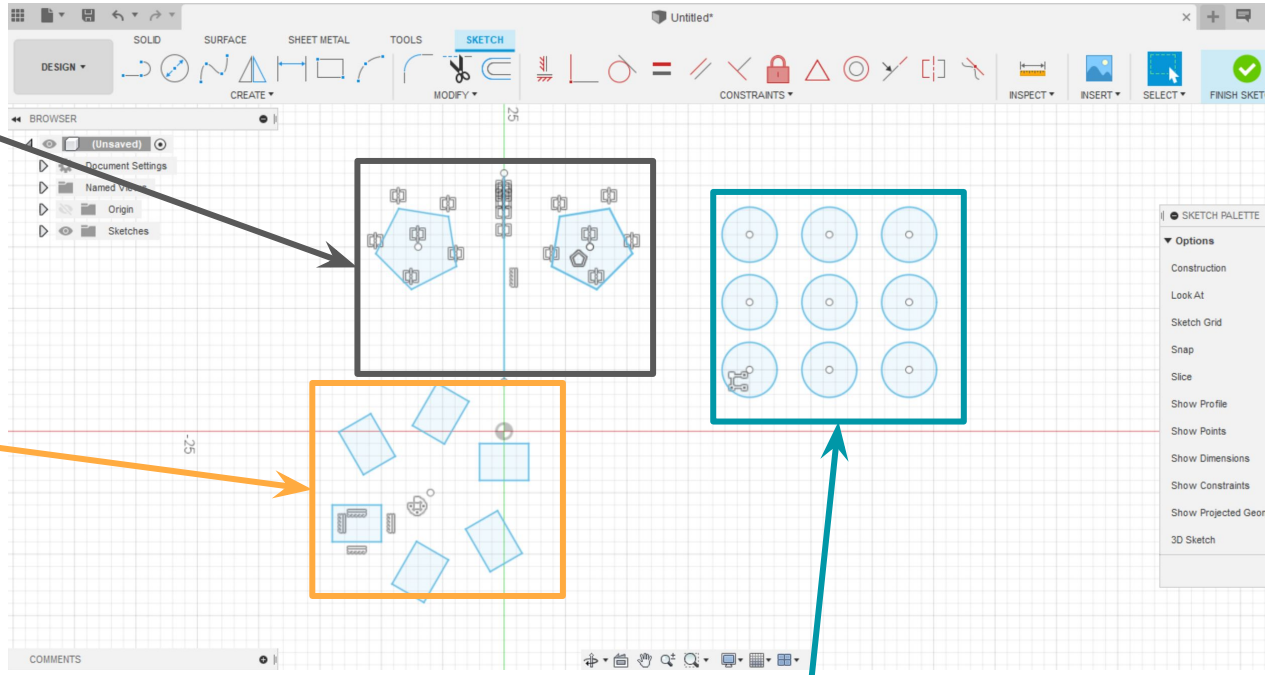
Center point circle

Two point rectangle

Fundamental Sketch Tools: Patterns

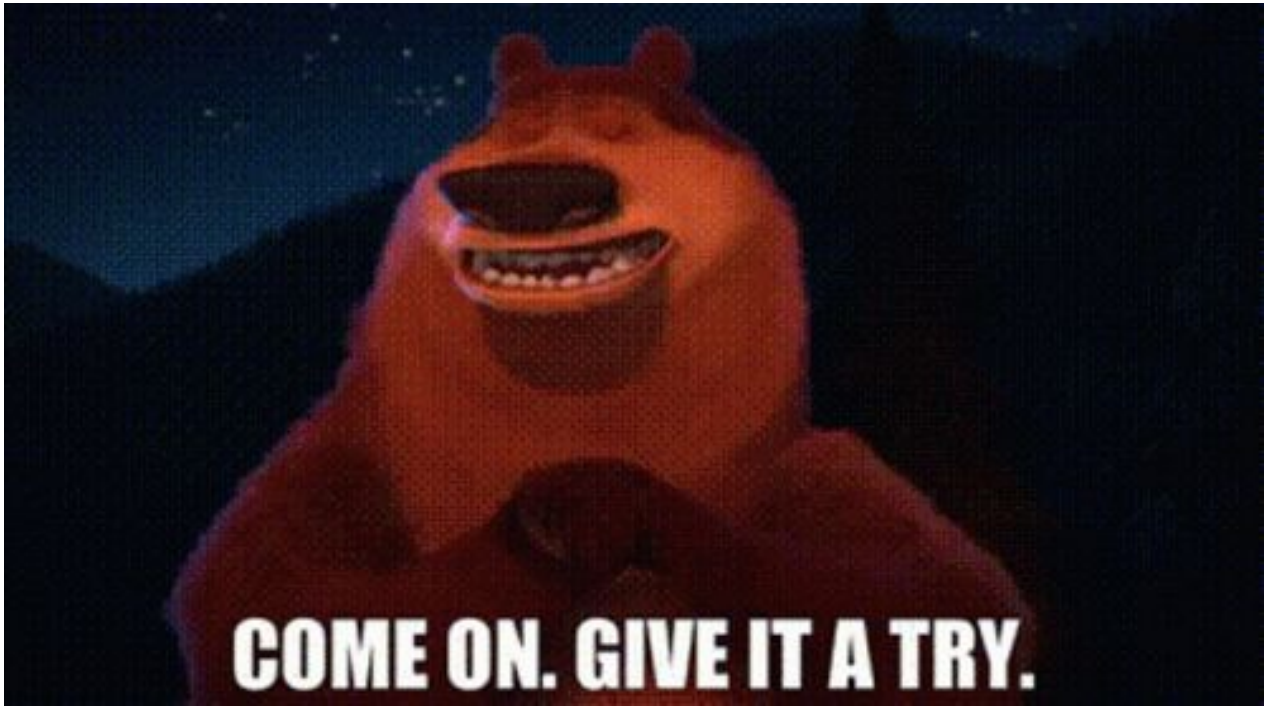
Mirror: specify mirror line

Circular pattern: specify center point



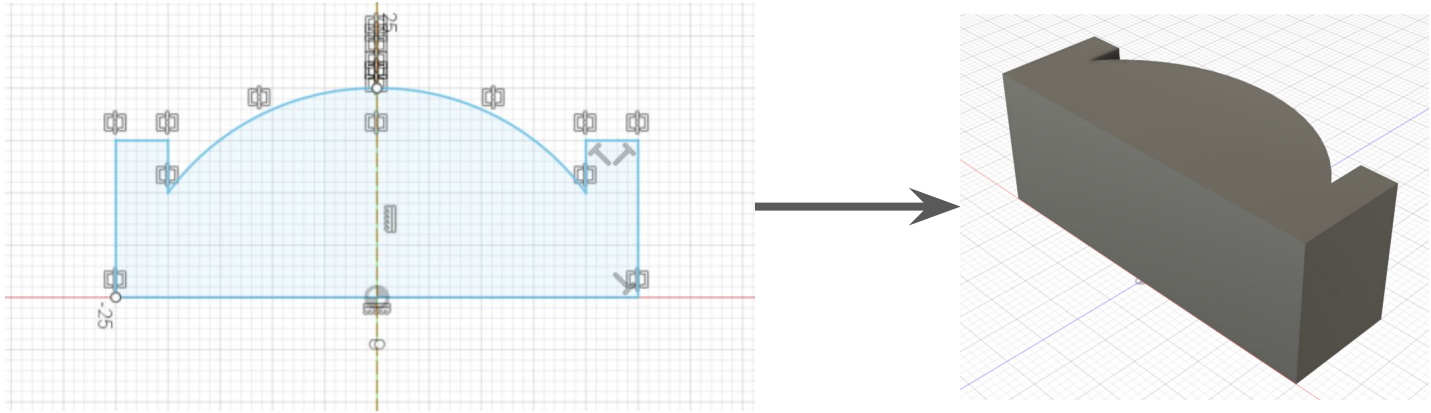
Rectangular pattern: specify axes of patterning

Let’s Practice!

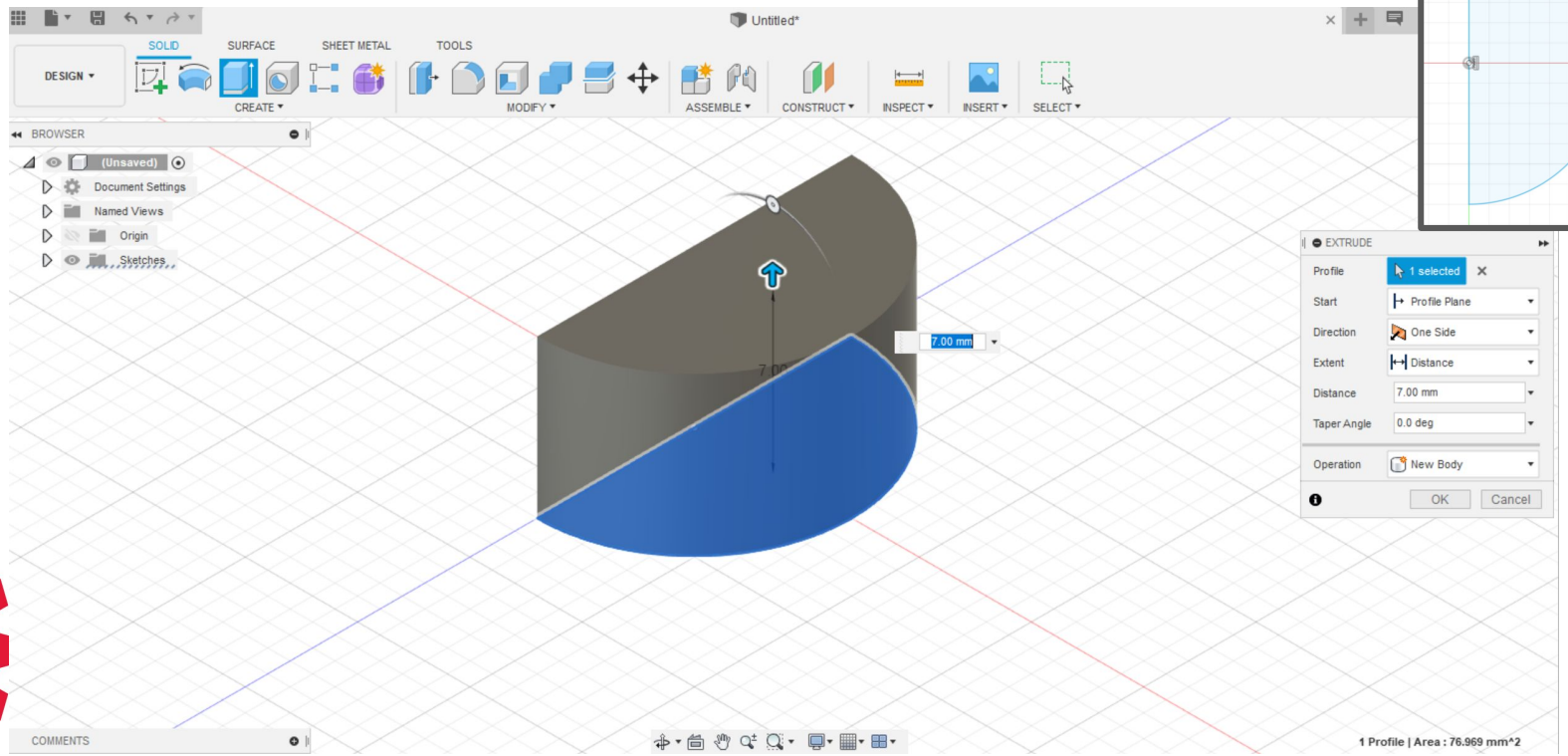


Fundamentals of Modeling

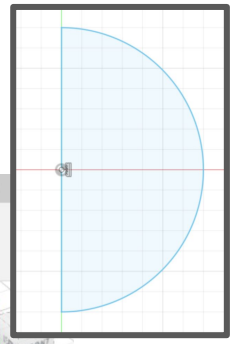
- Turn a sketch into a 3D body
- Can then manipulate that 3D solid body
- We'll cover:
  - Some of the most common tools to turn a sketch into a solid
  - Some of the most common tools to edit solid bodies

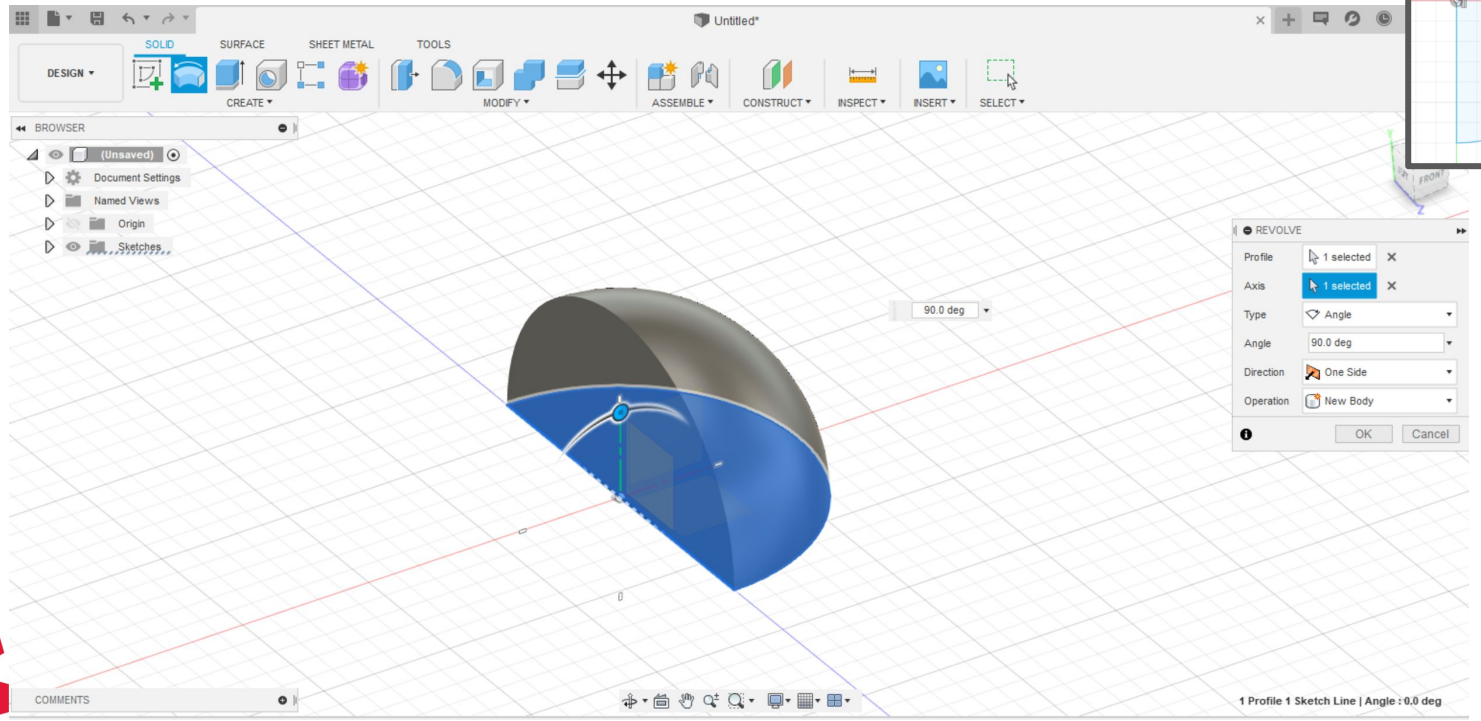


Extrusion


Untitled*
DESIGN
SOLID
SURFACE
SHEET METAL
TOOLS
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
BROWSER
(Unsaved)
Document Settings
Named Views
Origin
Sketches
7.00 mm
EXTRUDE
Profile
1 selected
Start
Profile Plane
Direction
One Side
Extent
Distance
Distance
7.00 mm
Taper Angle
0.0 deg
Operation
New Body
OK
Cancel
COMMENTS
1 Profile | Area : 76.969 mm^2

Revolve

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DESIGN
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90.0 deg
REVOLVE
Profile
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Axis
1 selected
Type
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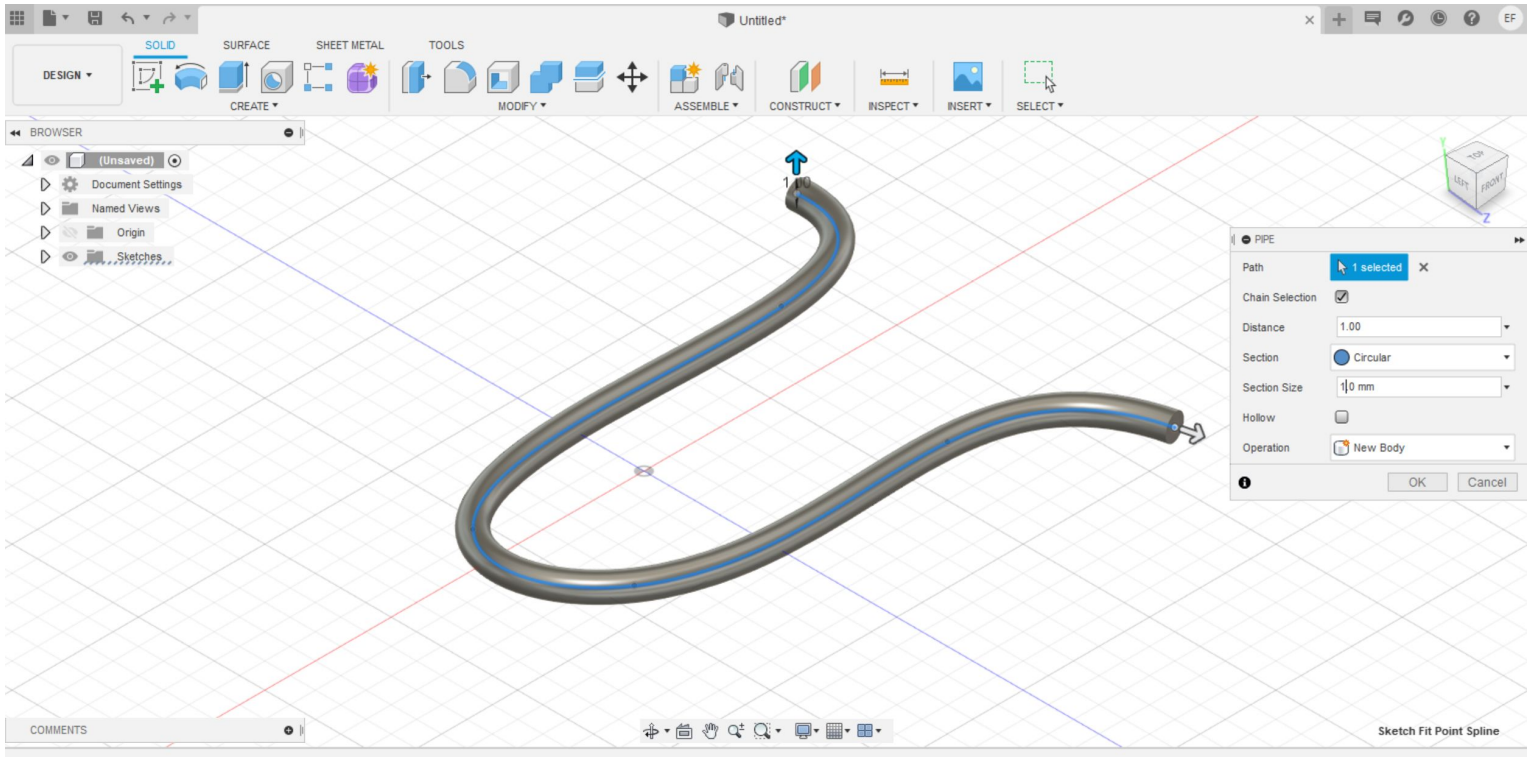
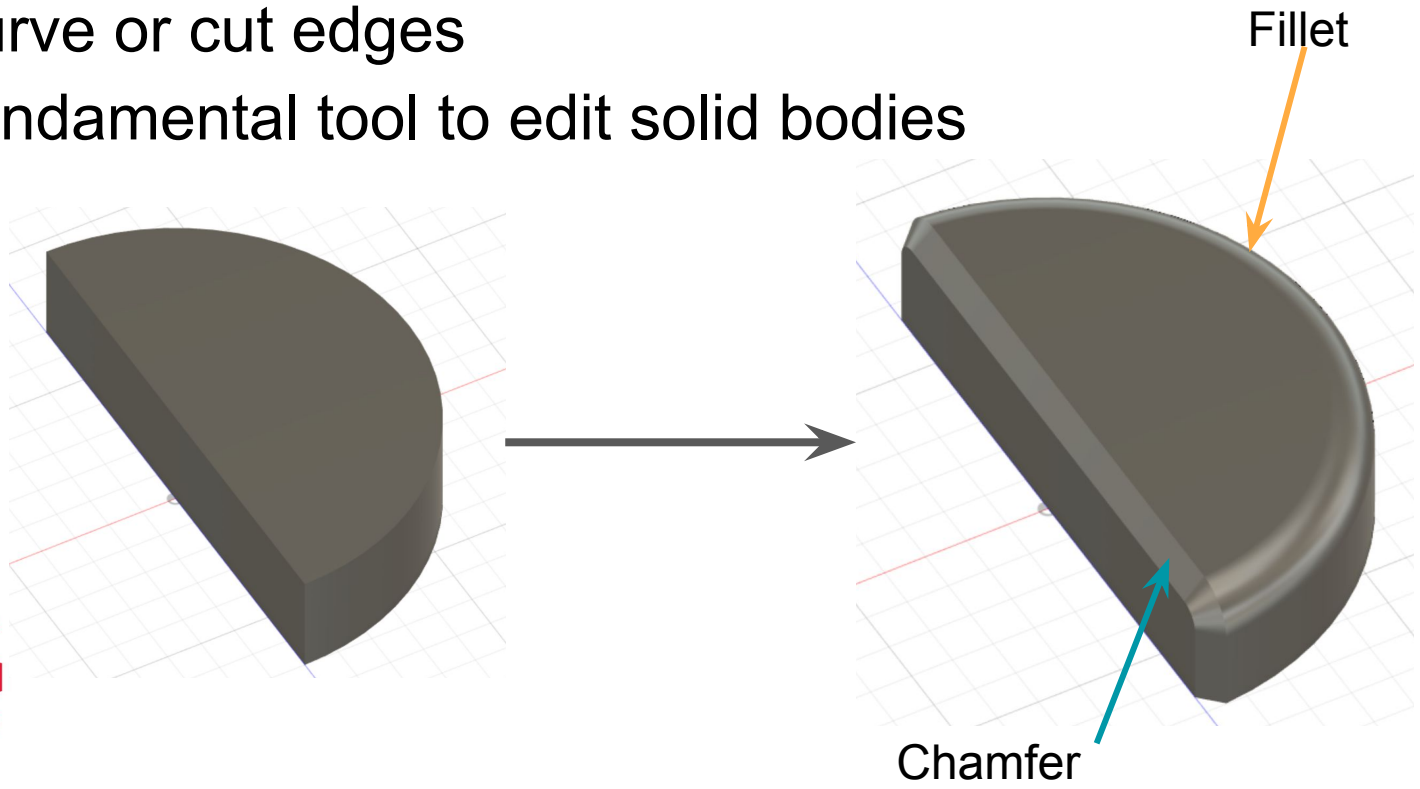
Direction
One Side
Operation
New Body
OK
Cancel
COMMENTS
1 Profile 1 Sketch Line | Angle : 0.0 deg

Pipe and Sweep



Fillets and Chamfers

- Curve or cut edges
- Fundamental tool to edit solid bodies



Demo Activity

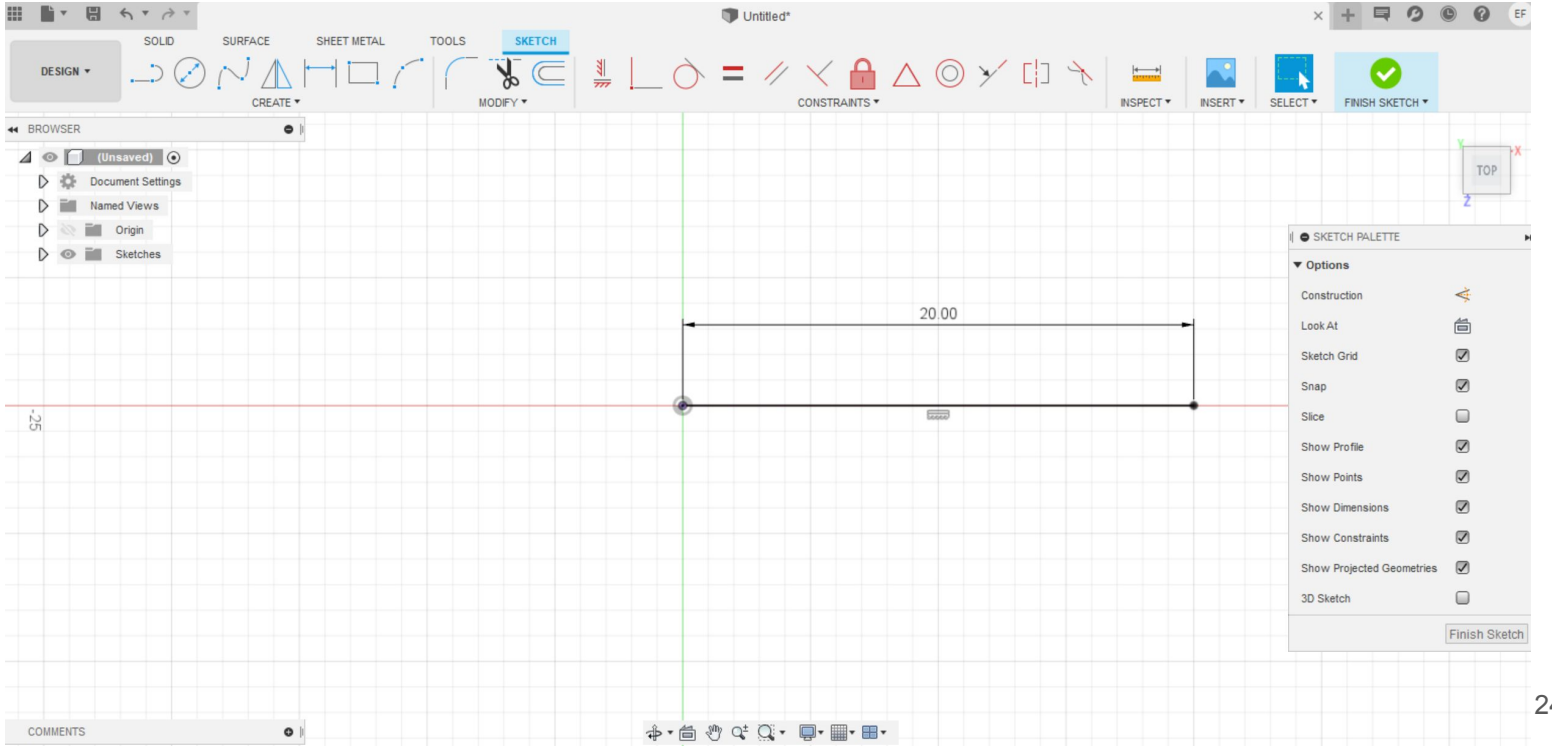
Mini-Project: 3D Printable Planter

- Apply the tools we just reviewed to make a succulent-sized 3D printable planter

Design this planter →

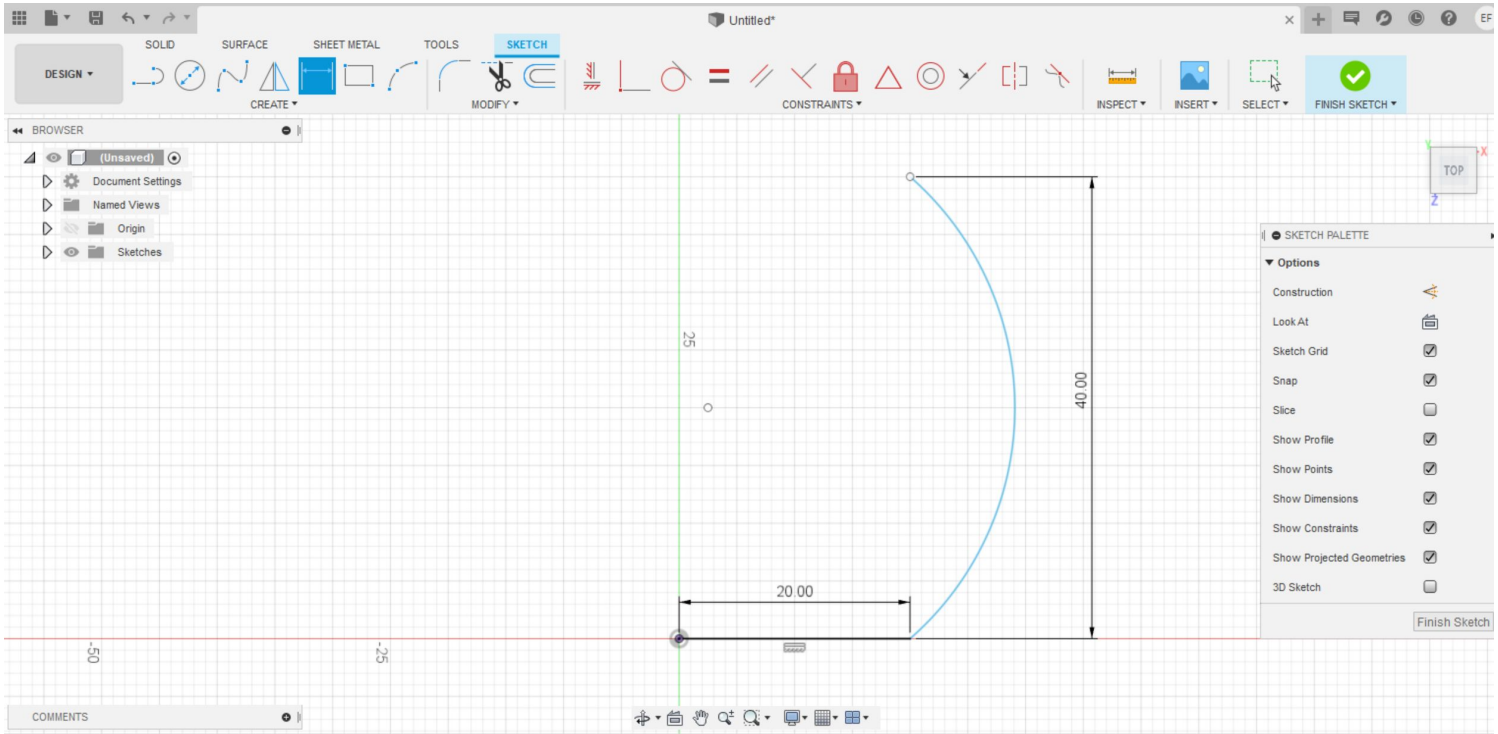
Sketching

Open a sketch and start with a line 20 mm long



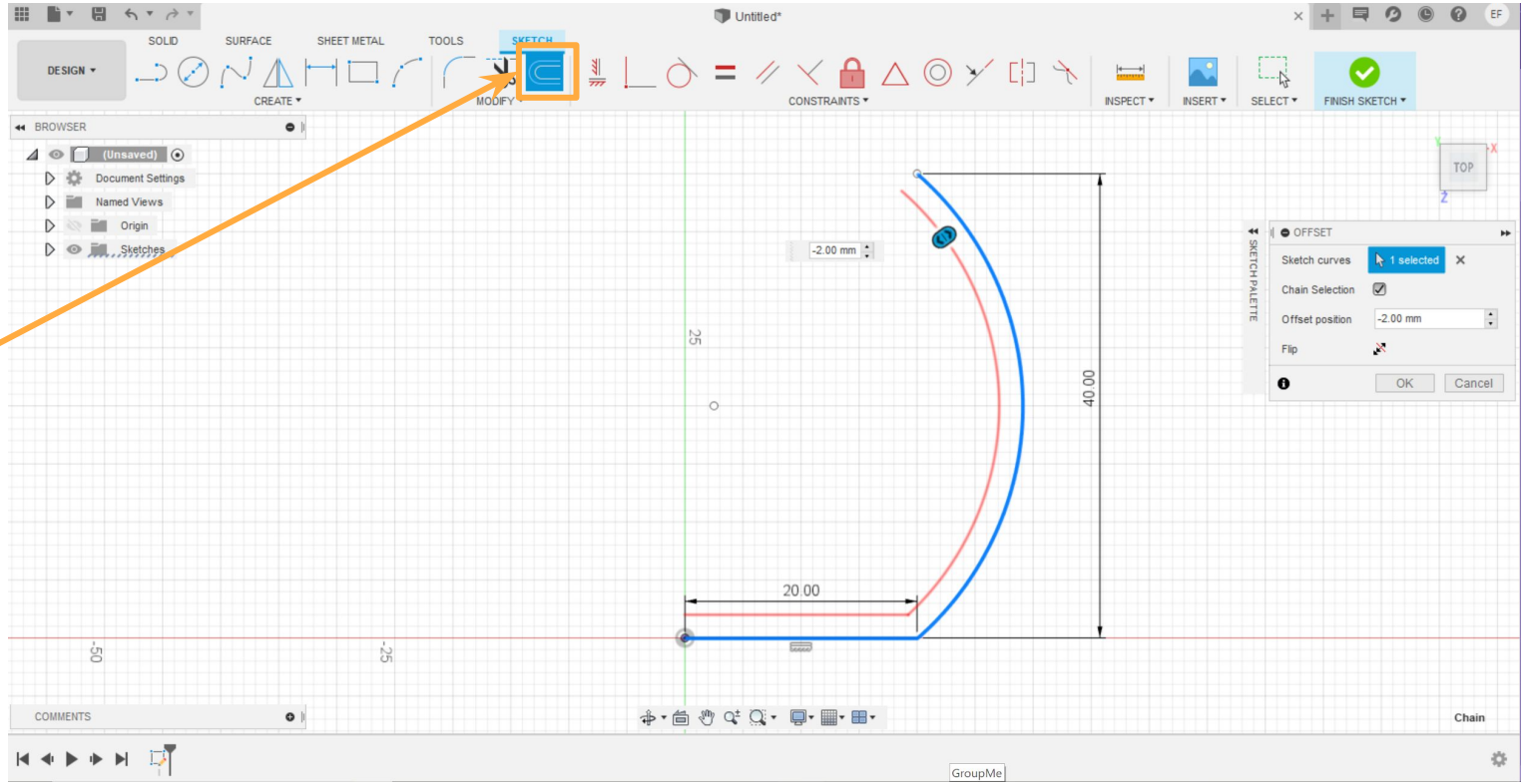
Step #1: Sketching

Add a three point arc 40 mm in the y direction



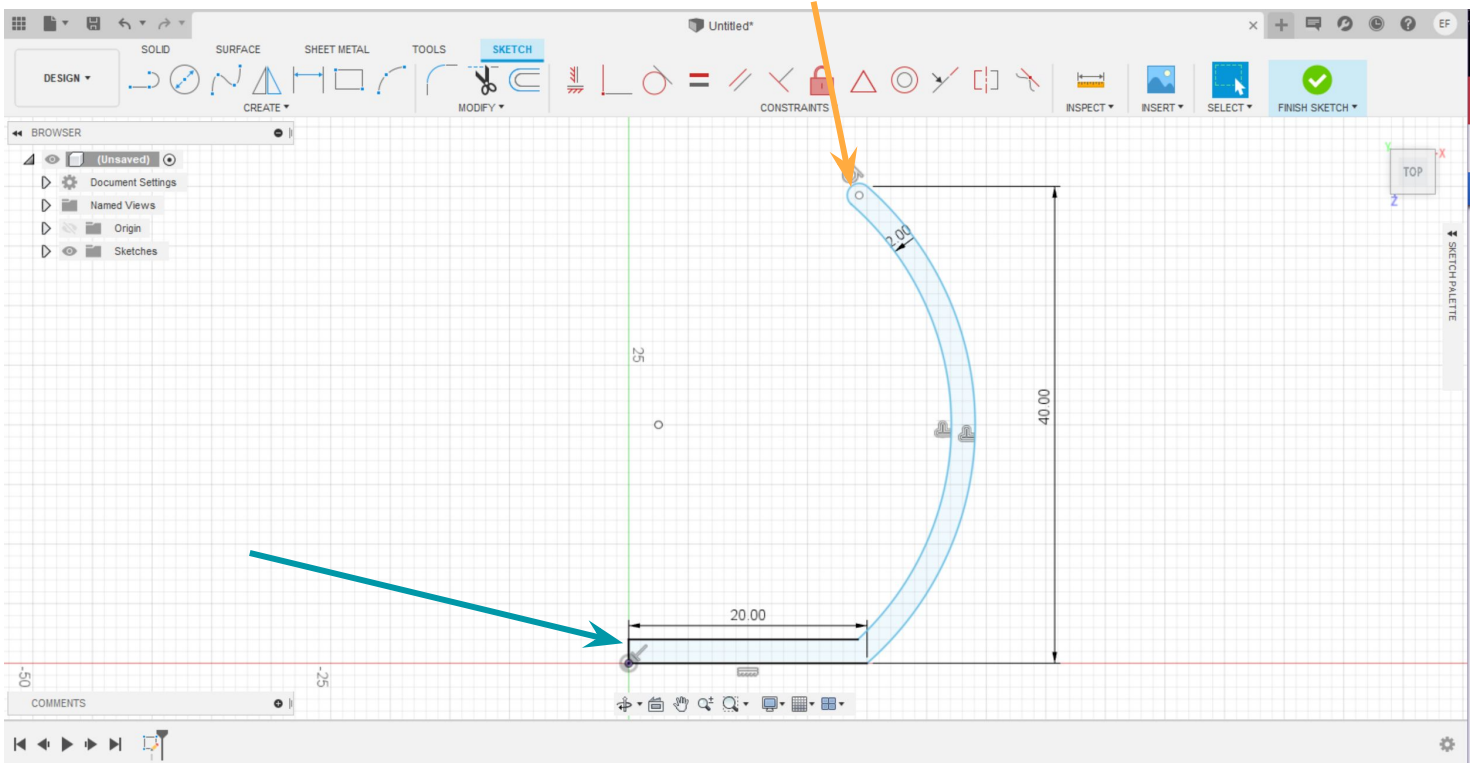
Step #1: Sketching

Use the offset tool to make the inner surface of the planter



Step #1: Sketching

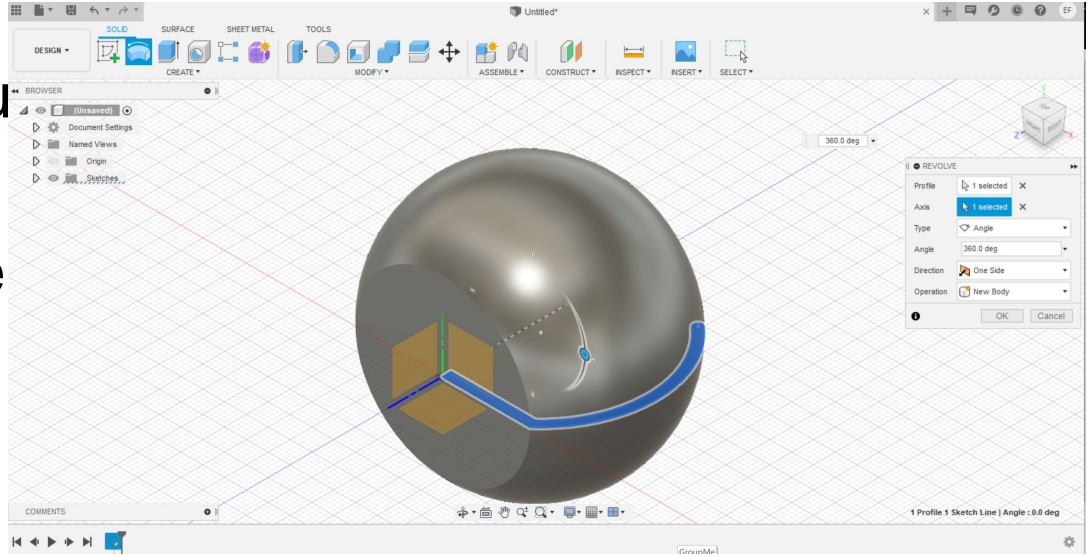
Use the arc and line tool to make a closed profile



Step #2: Revolve

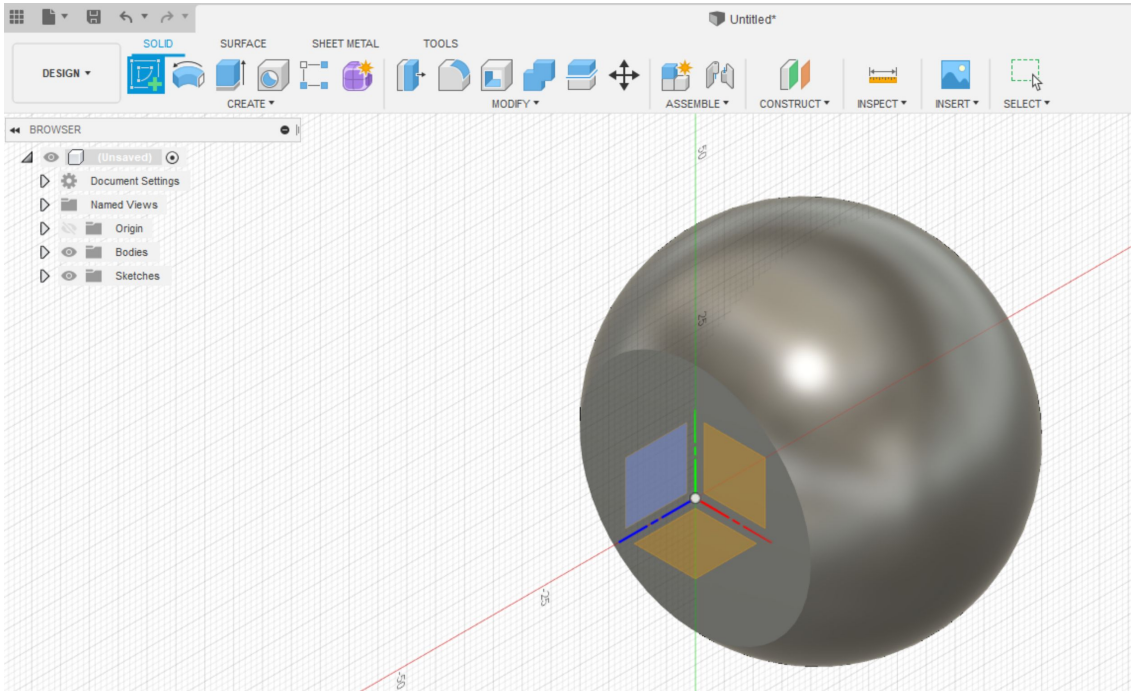
Use the revolve command

- Select the profile you just made
- Use the line near the origin as the axis of revolution



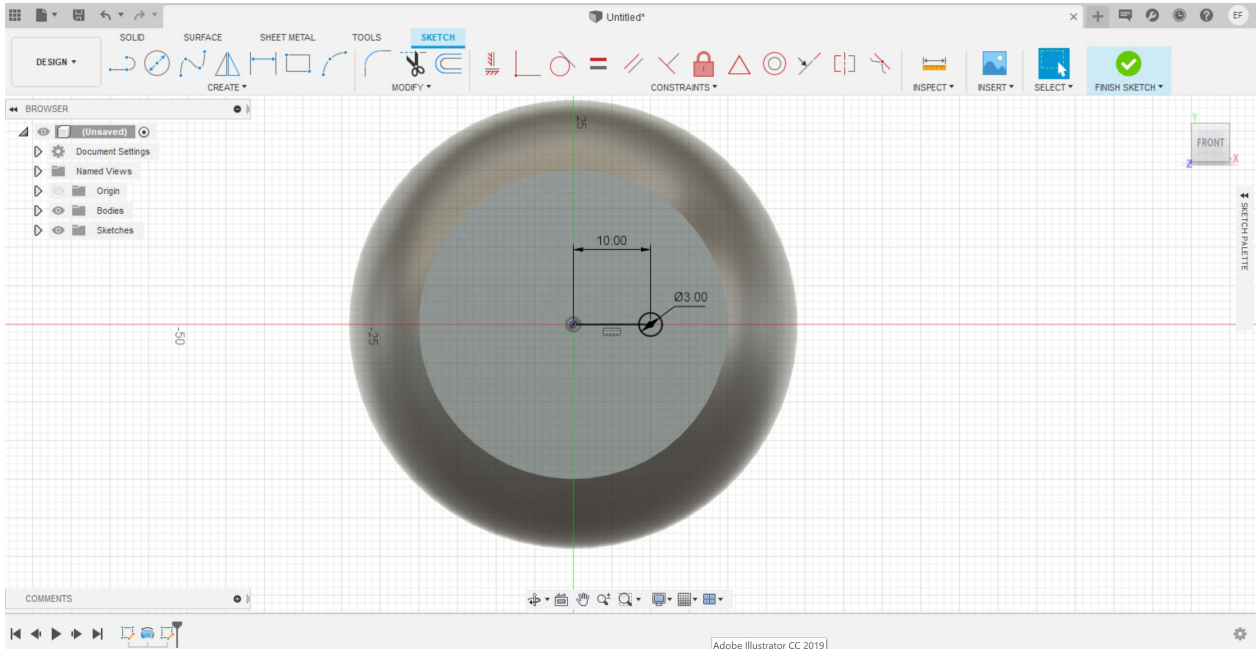
Step #3: Drainage Holes Sketch

Open a sketch and select the bottom of the planter as the sketch plane



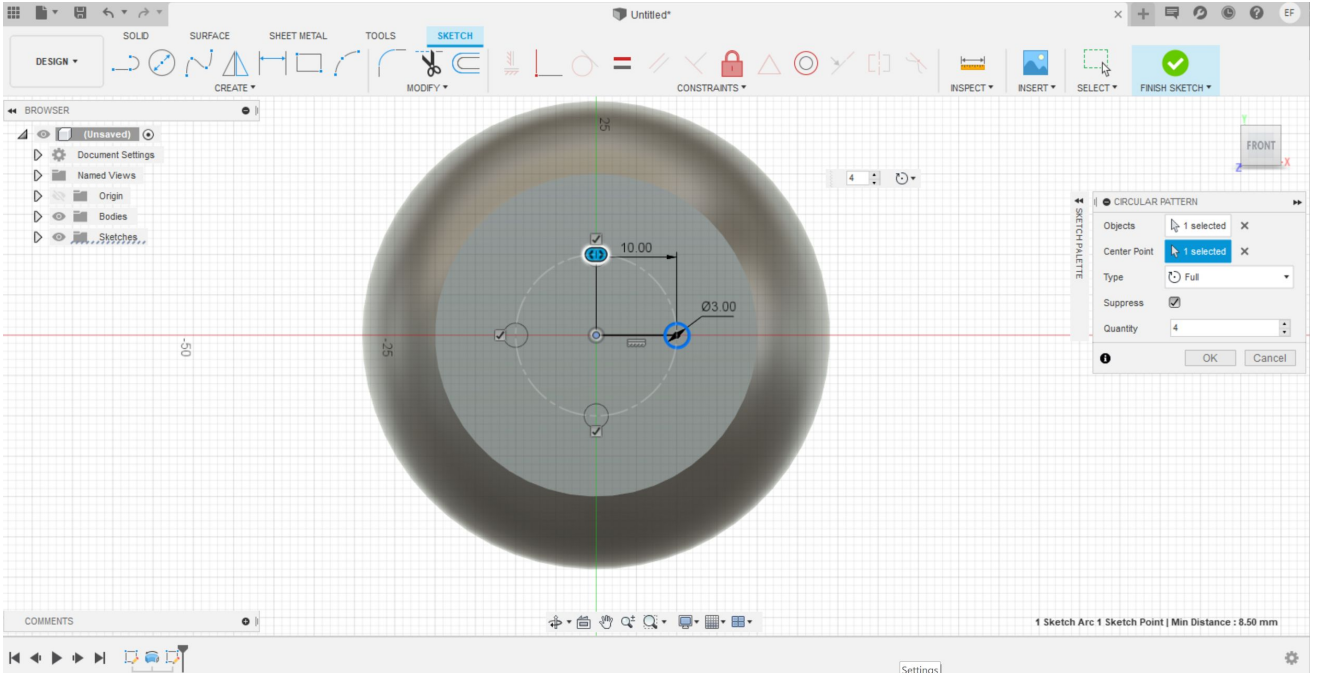
Step #3: Drainage Holes Sketch

Draw a 10 mm line from the center of the planter, then use the end of the planter to make a 3 mm circle



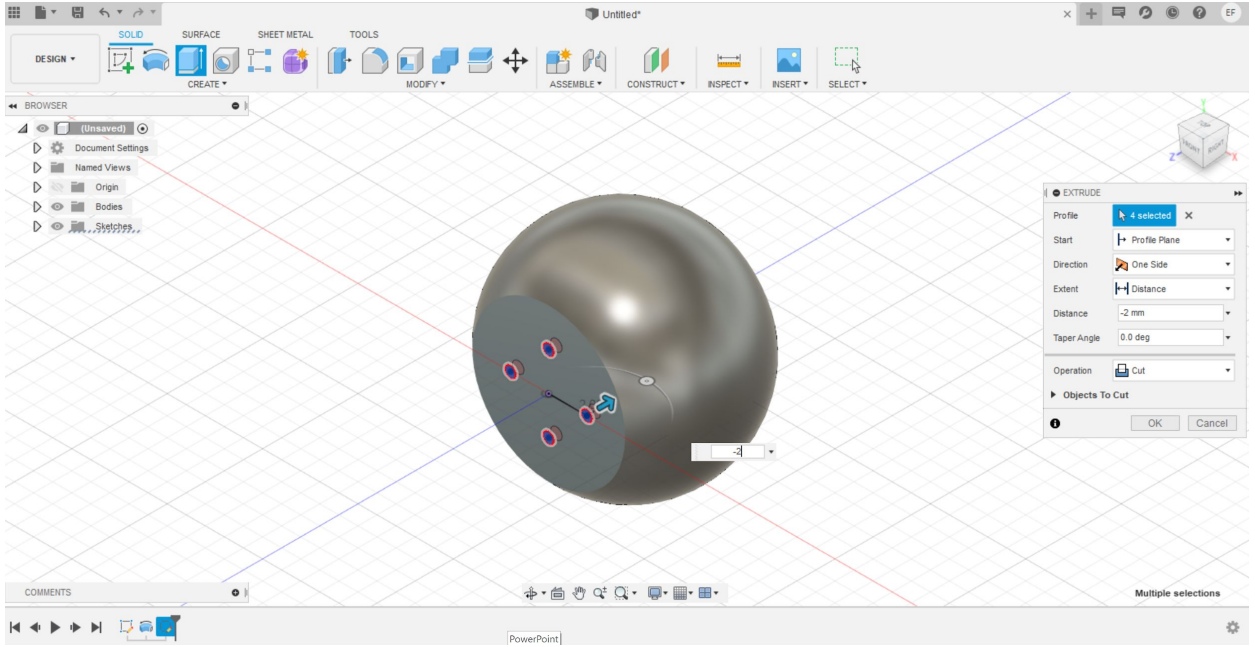
Step #3: Drainage Holes Sketch

Use the circular pattern to make 4 circles equidistant from the planter center



Step #4: Drainage Holes Extrusion

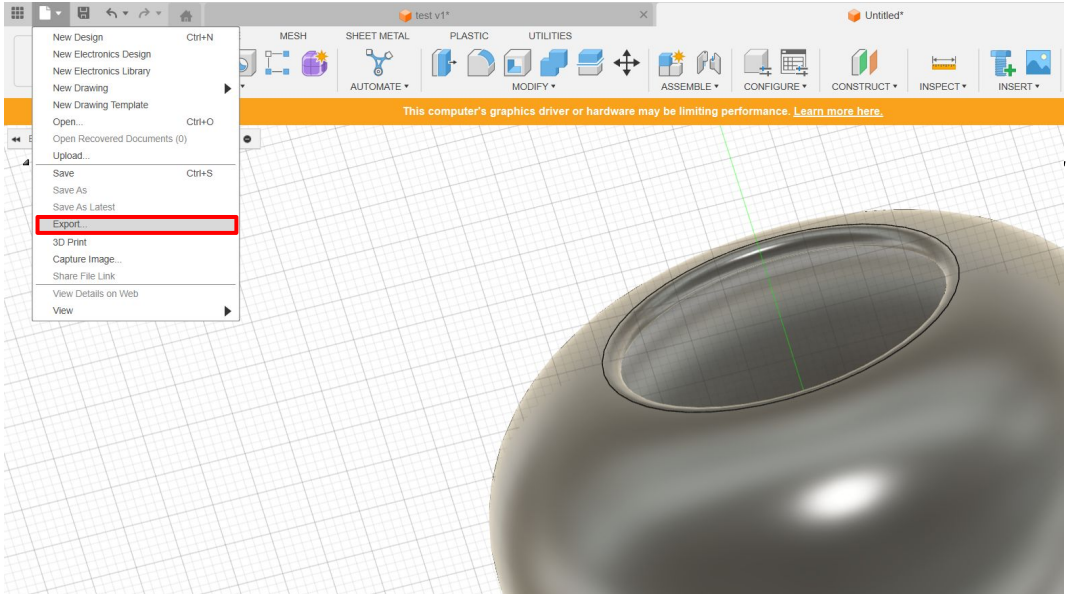
Finish the sketch and use the extrusion tool to cut four holes in the bottom of the planter



Step #5: Export as an .stl file

In the file menu select export, and in type select .stl, which is the simplest format for a 3D printer to read.

*Note: you must save your file first to do this



Let’s submit an order!

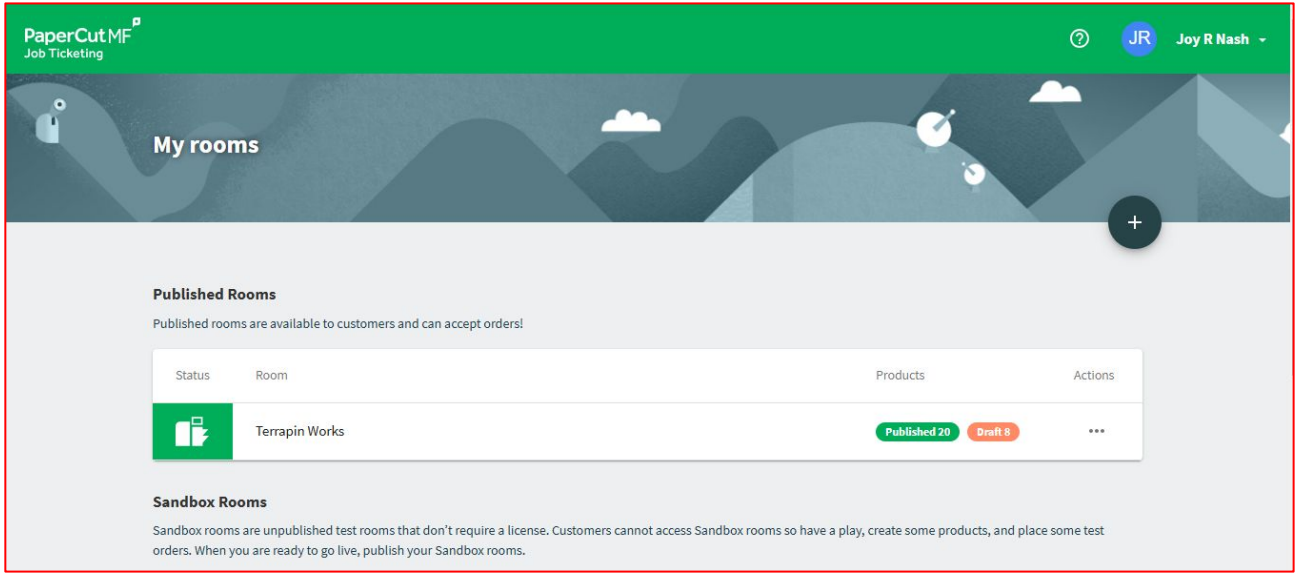
- Congratulations on making a 3D printable planter!

Next Steps

- Please visit: https://maker.umd.edu/job-ticketing/operator/rooms
- **LOGIN USING YOUR UMD CANVAS INFO!**

How to Submit an Order [Cont.]

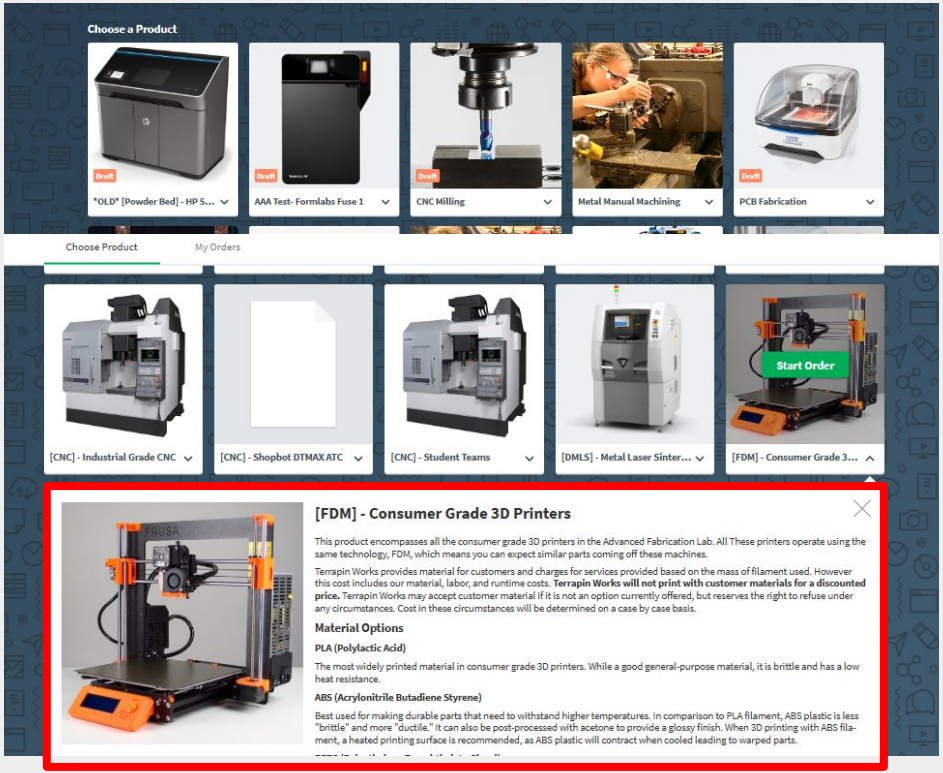
- You should see this page. Click the **Terrapin Works Room**



How to Submit an Order [Cont.]

Select a printer you'd like to submit an order on.

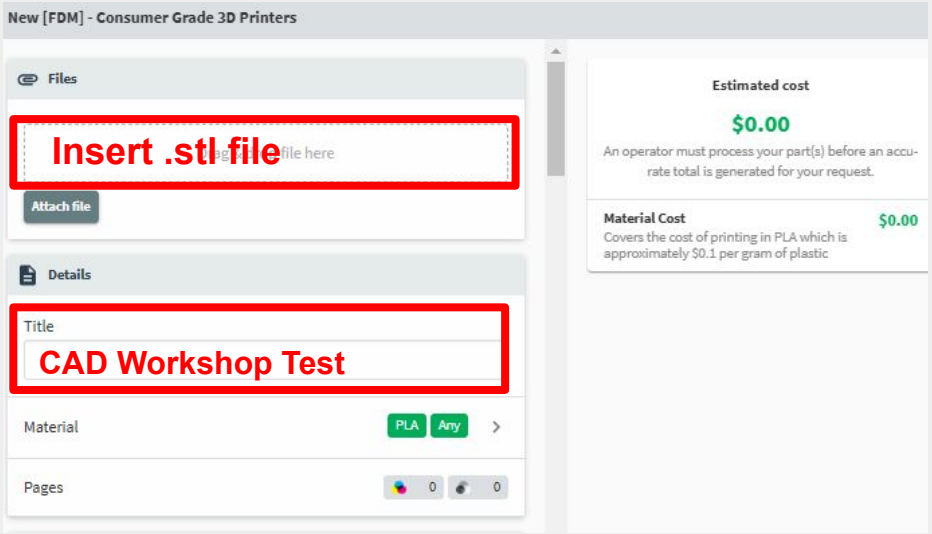
(For this workshop, use **the Consumer Grade 3D Printers**)



How to Submit an Order [Cont.]

After selecting **Start Order**, upload your **.stl file** and fill out your print specifications as best you can.

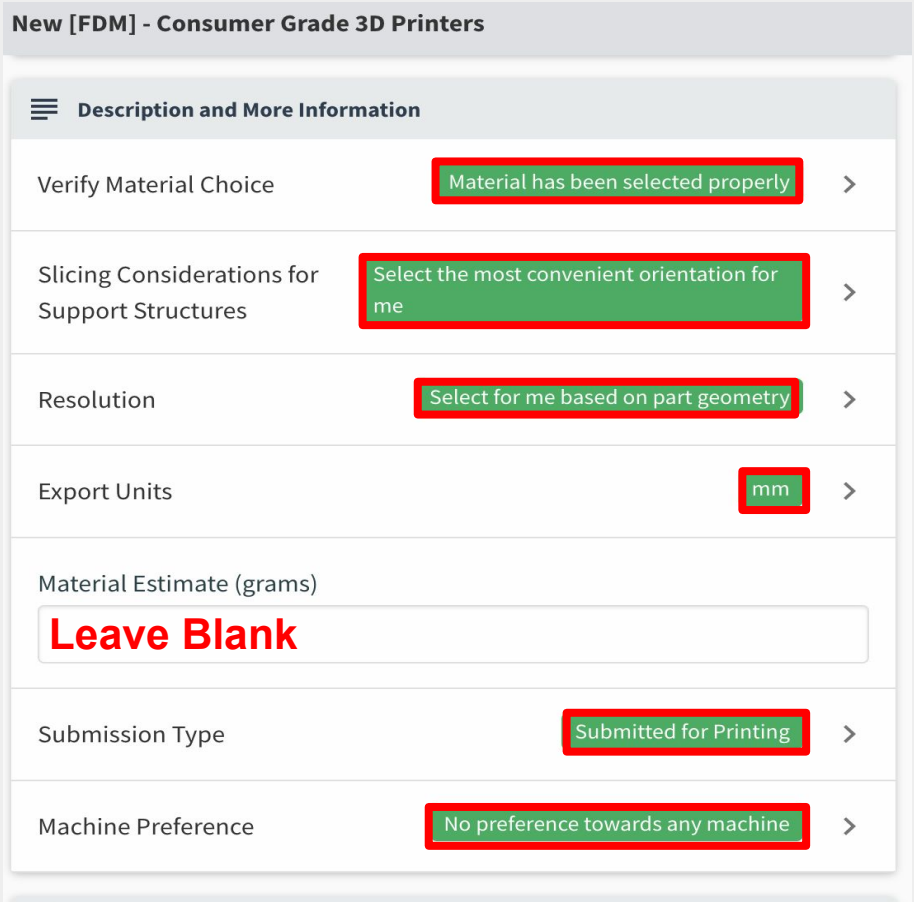
Title you order in the section **“CAD Workshop TEST”**



How to Submit an Order [Cont.]

Description & More Info Section:

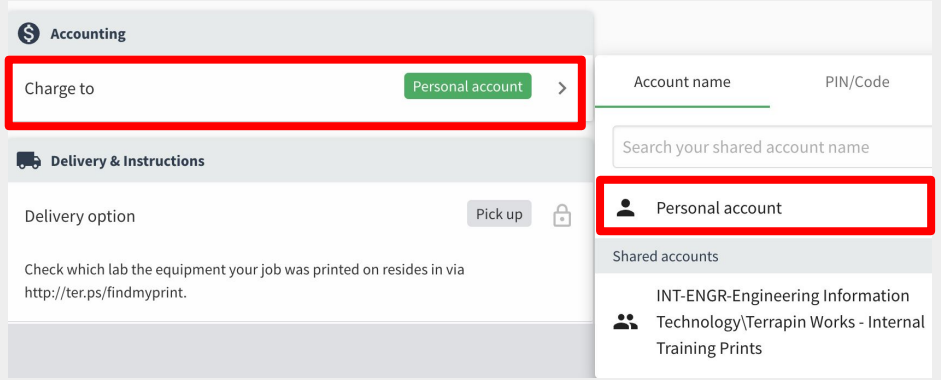
- **Verify Material Choice** – Ensure material has been selected properly
- **Slicing Considerations for Support Structure** – Select the most convenient orientation
- **Resolution** – Select based on part geometry
- **Export Units** – mm
- **Material Estimates (grams)** – Leave blank
- **Submission Type** – Submit for printing
- **Machine Preferences** – Prusa MK3s



How to Submit an Order [Cont.]

“Accounting” Section

If you want to submit future engineering projects for printing, you already have an account on file!

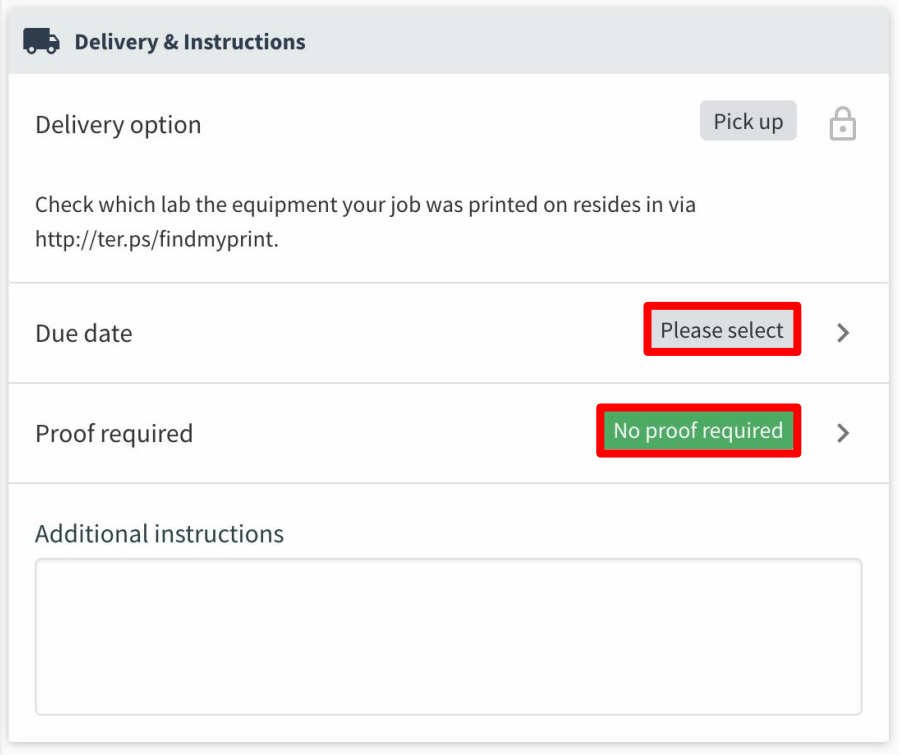


Charge to a personal account.

How to Submit an Order [Cont.]

Final Steps:

- **Due Date** – Pick any date in late November 2024
- **Proof Required** – No proof required

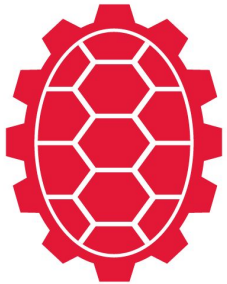


All done! Submit your order :)

Get your free planter today!

- Title you order in the **Details** section “**CAD Workshop TEST**” so that you can get your order for **FREE**!!!

Once you've submitted your order, show me your email confirmation to receive your free pre-printed planter!



Reference Materials

- Congratulations on making a 3D printable planter!
- If you want to review this material, visit https://dozuki.umd.edu/c/Introduction_to_Autodesk_Fusion
- If you want to review this material or want additional CAD challenges, visit https://ter.ps/360intoproj
- Questions?