



Introduction to CAD: Fusion 360



Students
please sign in
for the TW
Workshop!



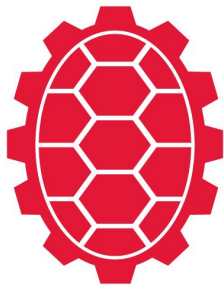
<https://go.umd.edu/TWSP25>

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!



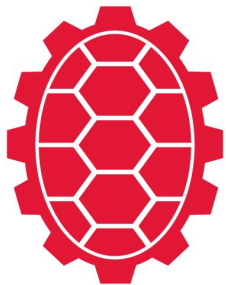
Let's Start!



AUTODESK[®] FUSION 360[™]

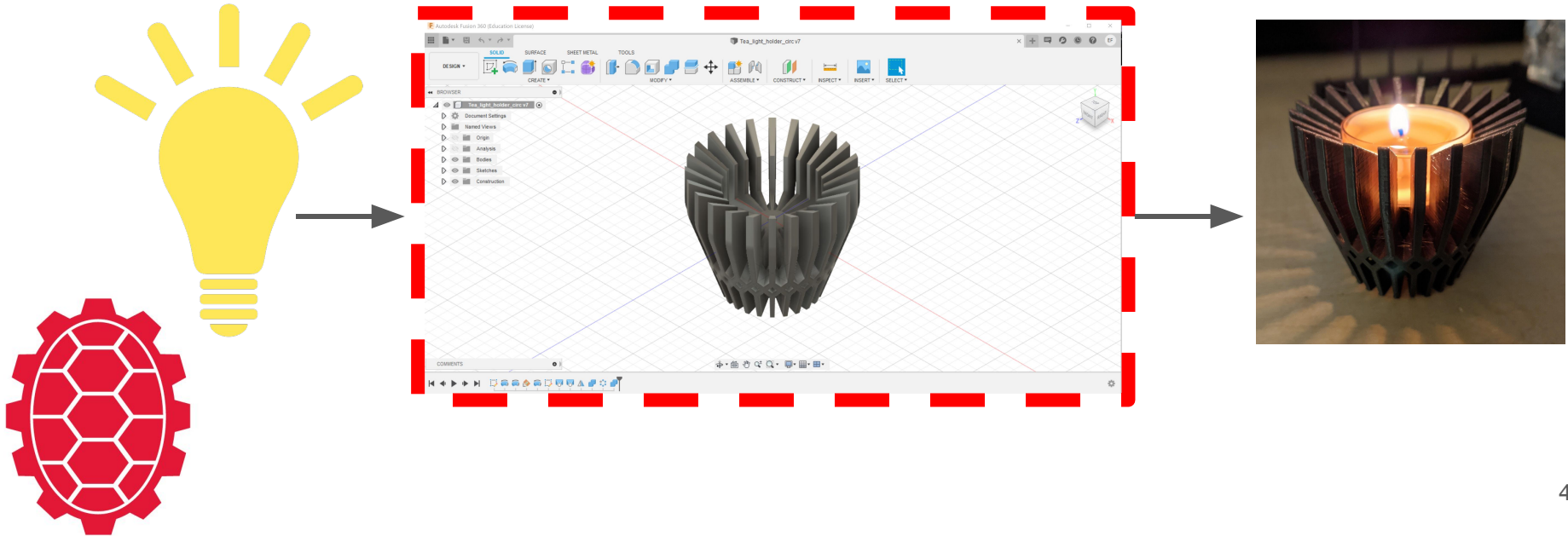
Today we'll be going over...

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



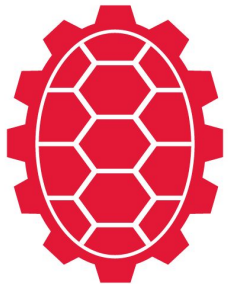
What is CAD? What is AutoDesk?

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



What is Fusion 360? Why Fusion 360?

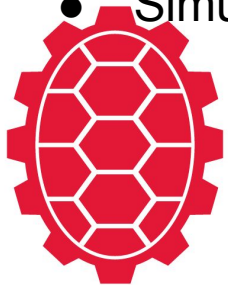
- Specific CAD software by Autodesk
- Powerful software with less steep learning curve
- Note: this lecture is aimed at new Fusion 360 users, but anyone is welcome to review the fundamentals



AUTODESK[®] FUSION 360[™]

Other Fusion 360 Applications

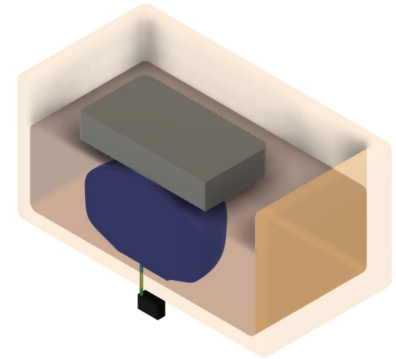
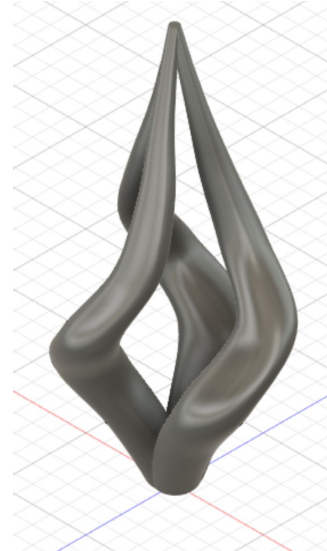
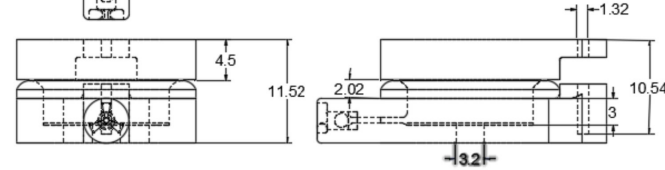
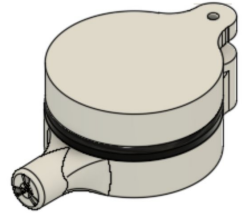
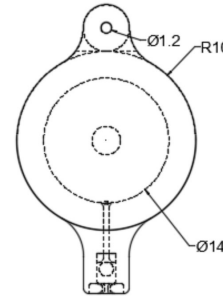
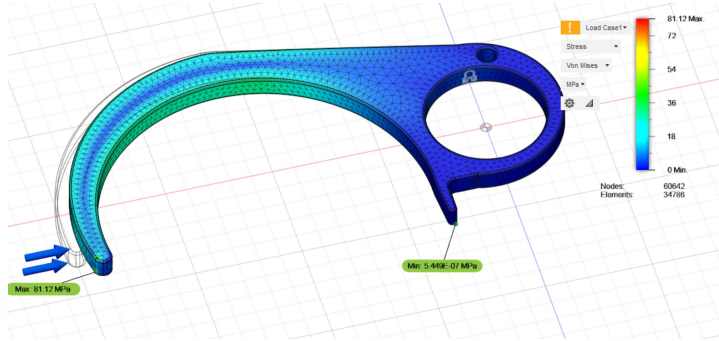
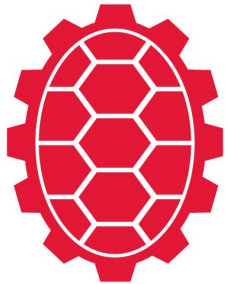
- CAM (Computer Aided Manufacturing) - software that directs the actual manufacturing of said part(s) by communicating with a numerically controlled (NC) manufacturing machine
- CAE (Computer Aided Engineering) - simulates the effects of various aspects of the 3D design of a particular structure or product 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



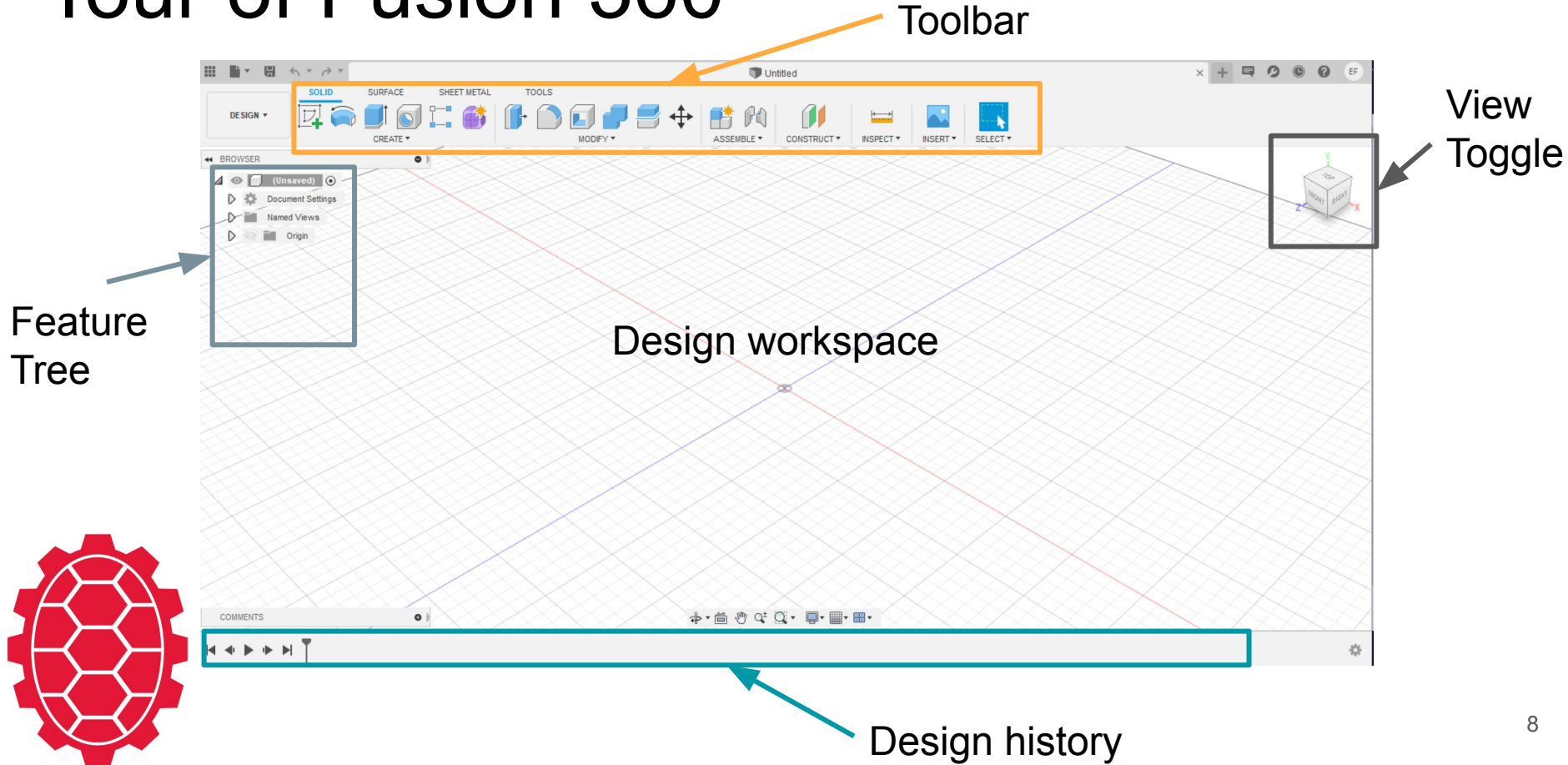
AUTODESK[®] FUSION 360[™]

Uses for Fusion 360

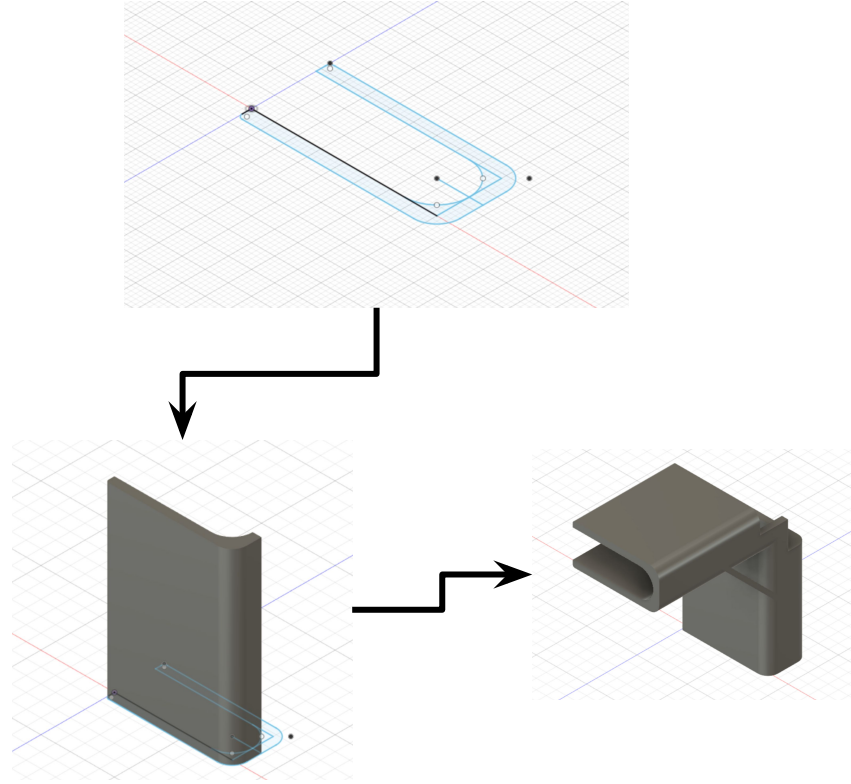
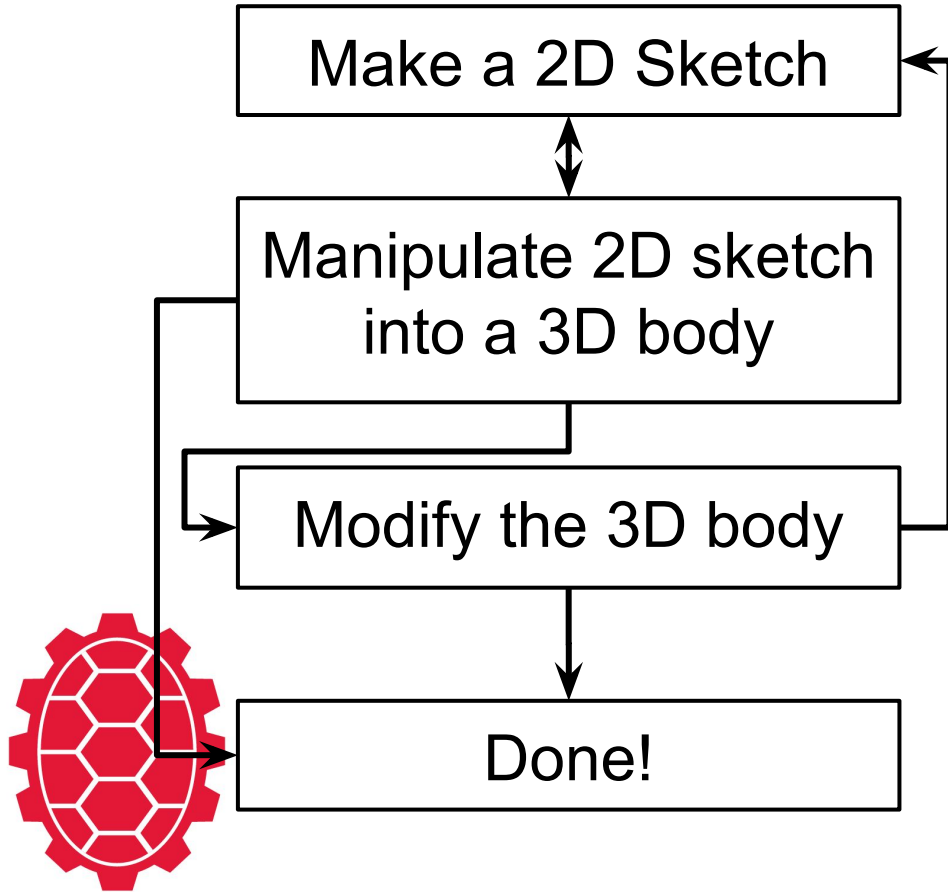
- Precise designs for engineering or science
- Art and schematic models
- Simulations
- Electronics design



Tour of Fusion 360

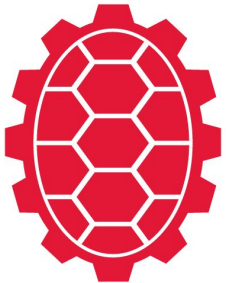


Process of 3D Design in Fusion 360



Introduction to Sketching

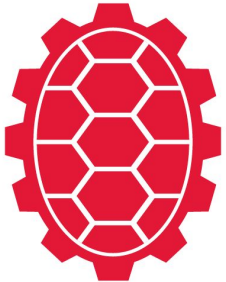
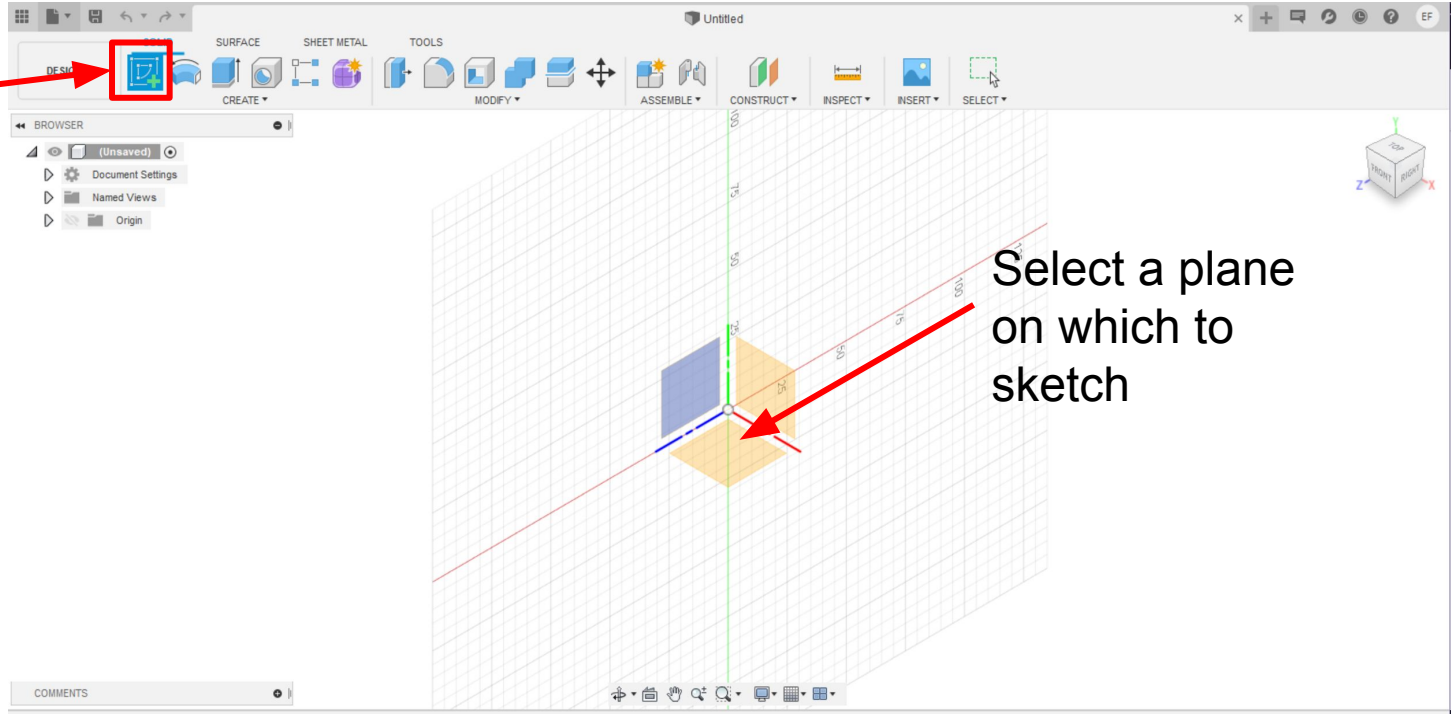
- Sketches are necessary to build 3D solid bodies
- Most commands that turn a sketch into a solid require a closed profile
- We'll cover:
 - How to open a sketch
 - Some fundamental sketch tools
 - Differences between paths and profiles



Introduction to Sketching

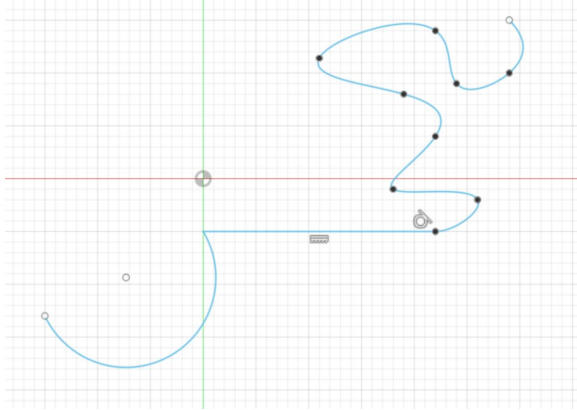
To start a sketch:

Click on the sketch icon

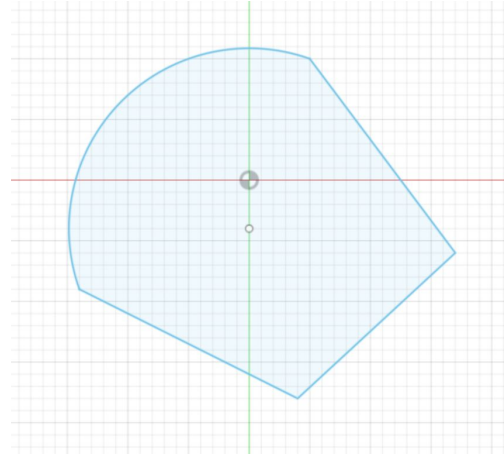


Paths and Profiles

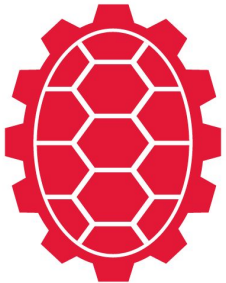
- A path describes a line or curve that does not enclose an area
- A profile encloses an area to create a closed shape



Path

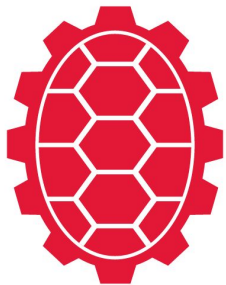
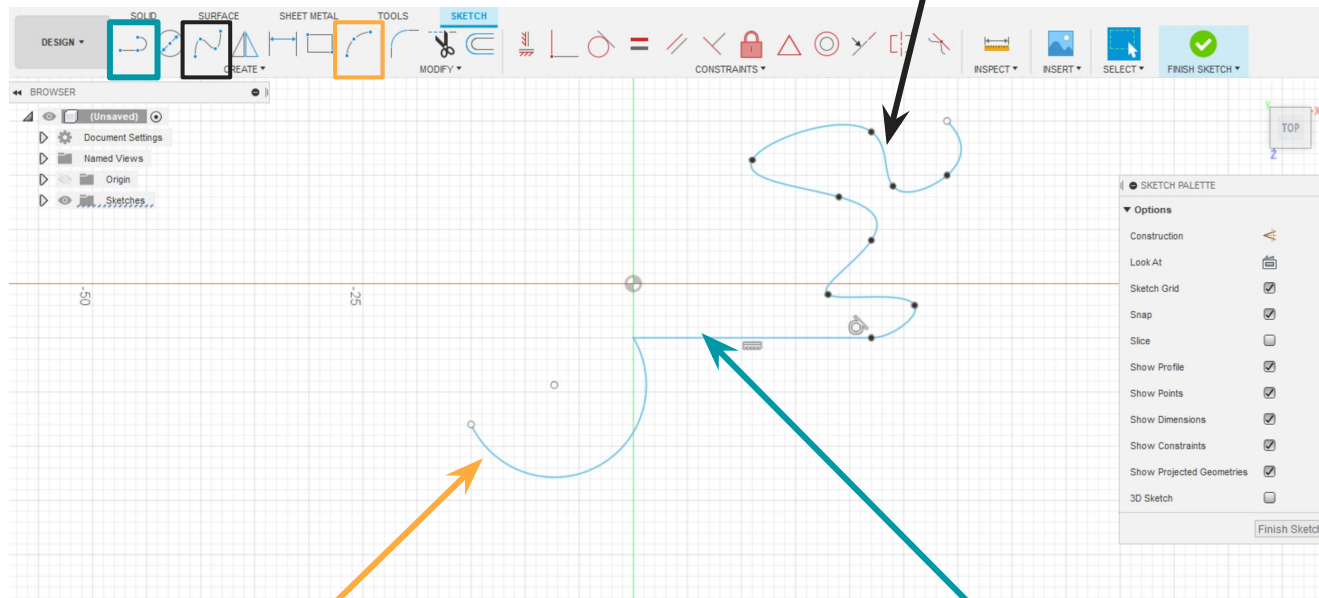


Profile



Fundamental Sketch Tools: Paths

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

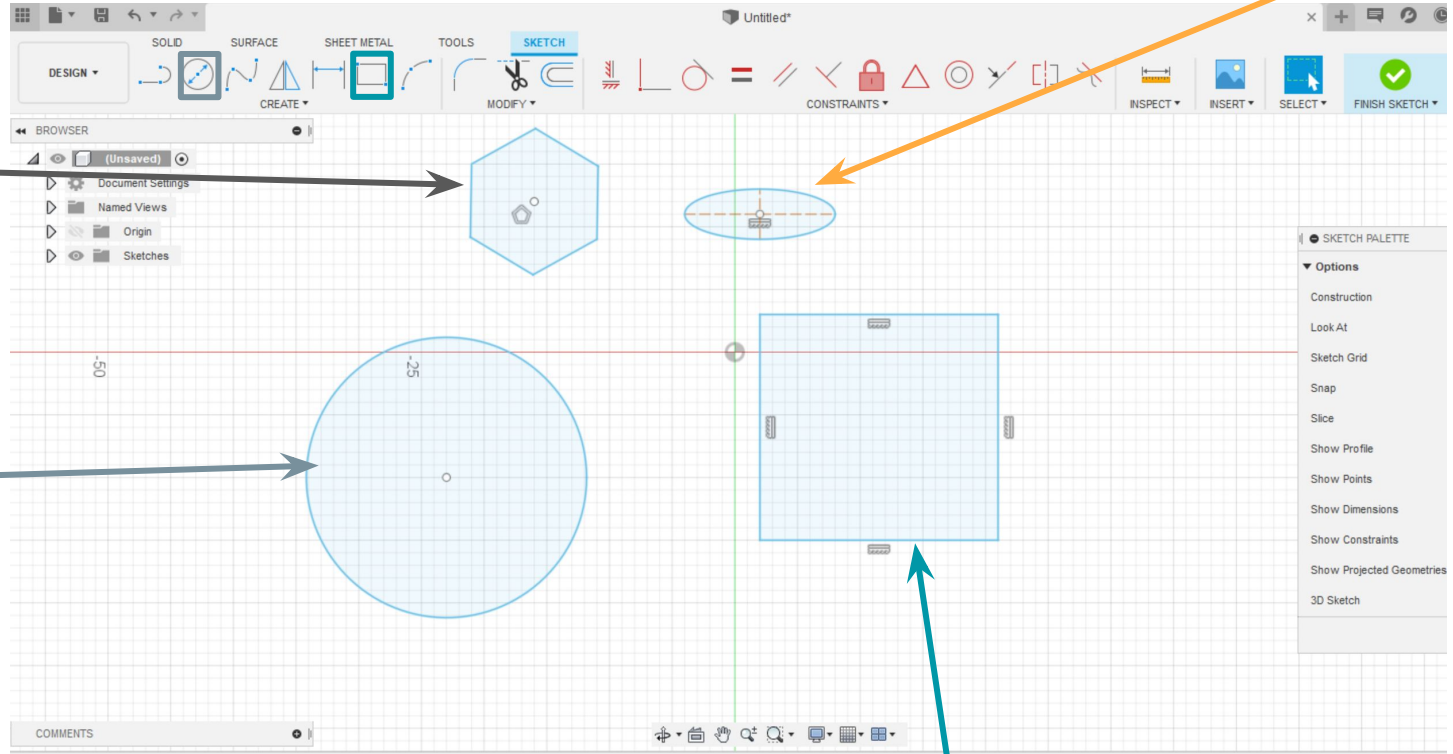
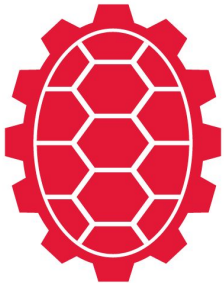


Fundamental Sketch Tools: Shapes

Ellipse

Polygon

Center point circle

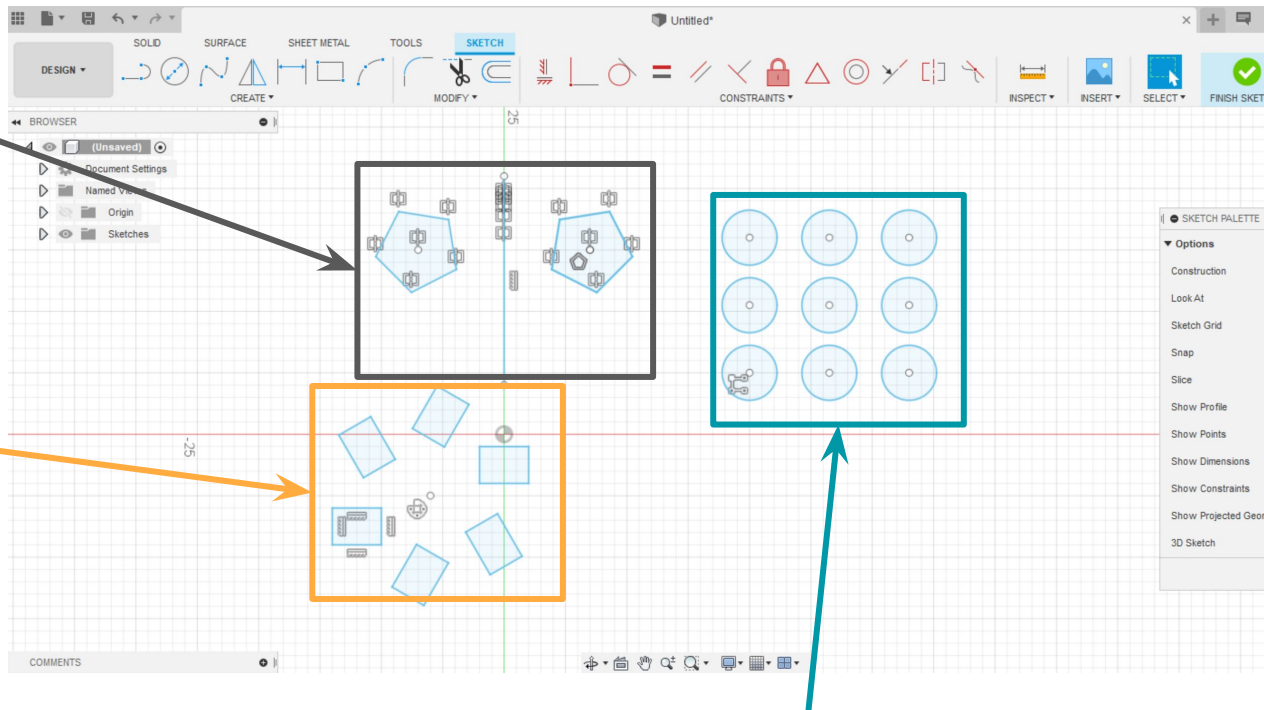
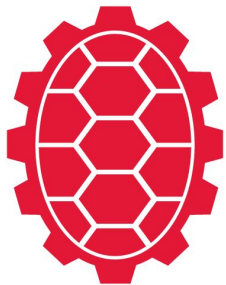


Two point rectangle

Fundamental Sketch Tools: Patterns

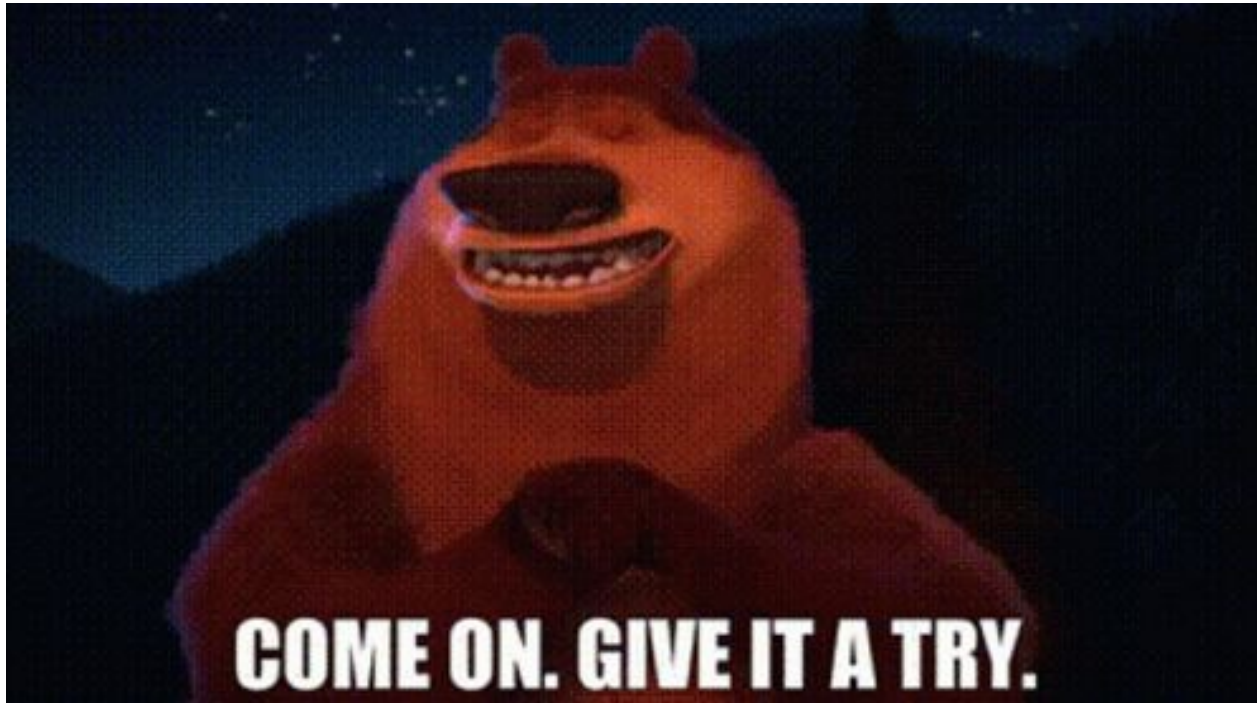
Mirror: specify mirror line

Circular pattern: specify center point



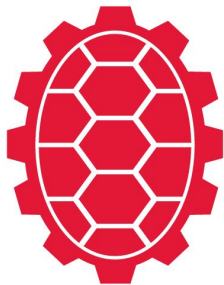
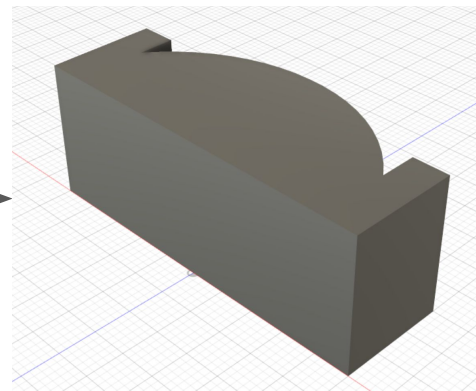
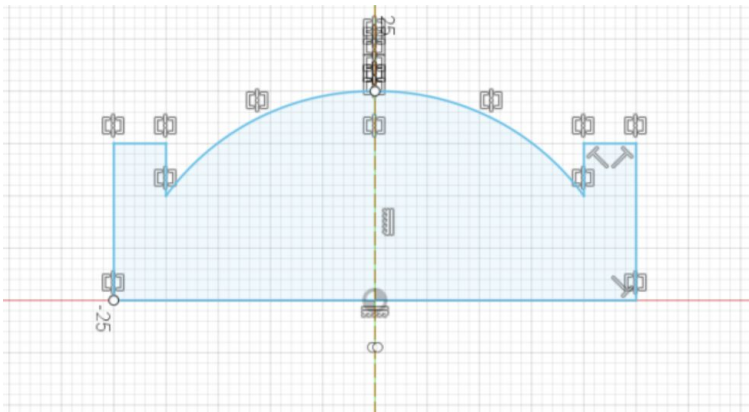
Rectangular pattern: specify axes of patterning

Let's Practice!

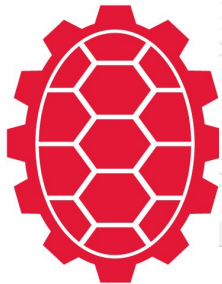
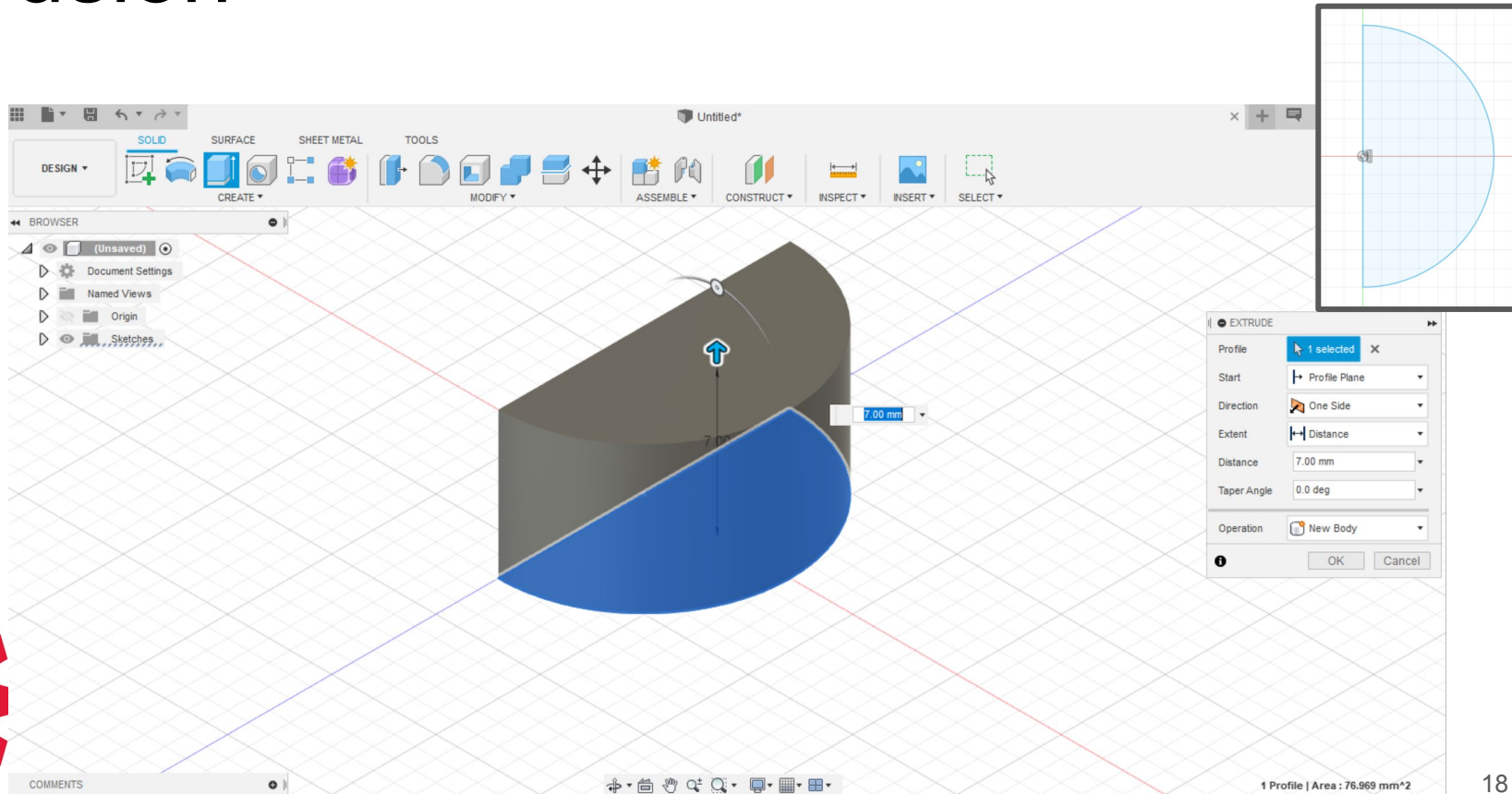


Fundamentals of Modeling

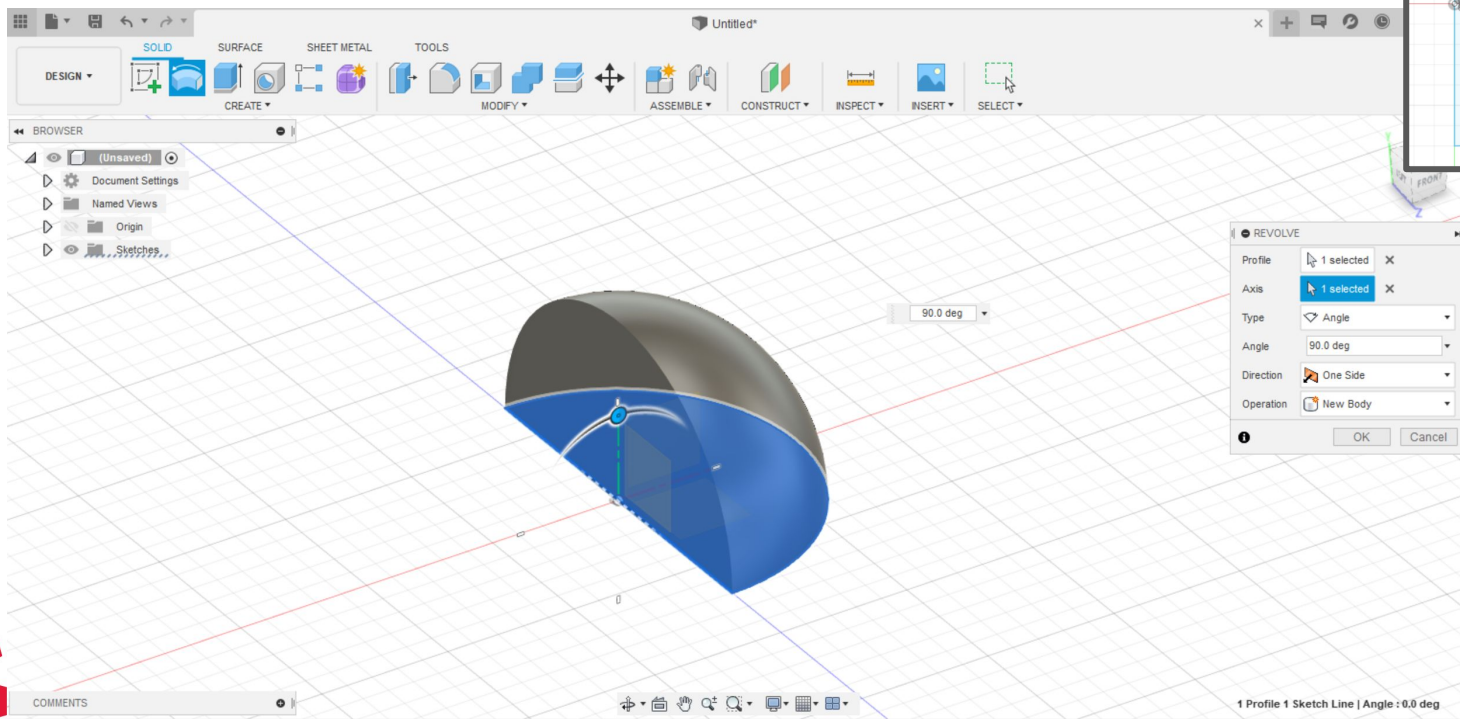
- Turn a sketch into a 3D body
- Can then manipulate that 3D solid body
- We'll cover:
 - Some of the most common tools to turn a sketch into a solid
 - Some of the most common tools to edit solid bodies



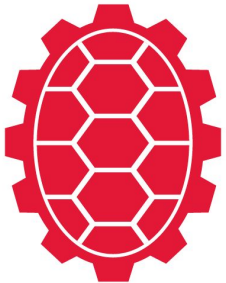
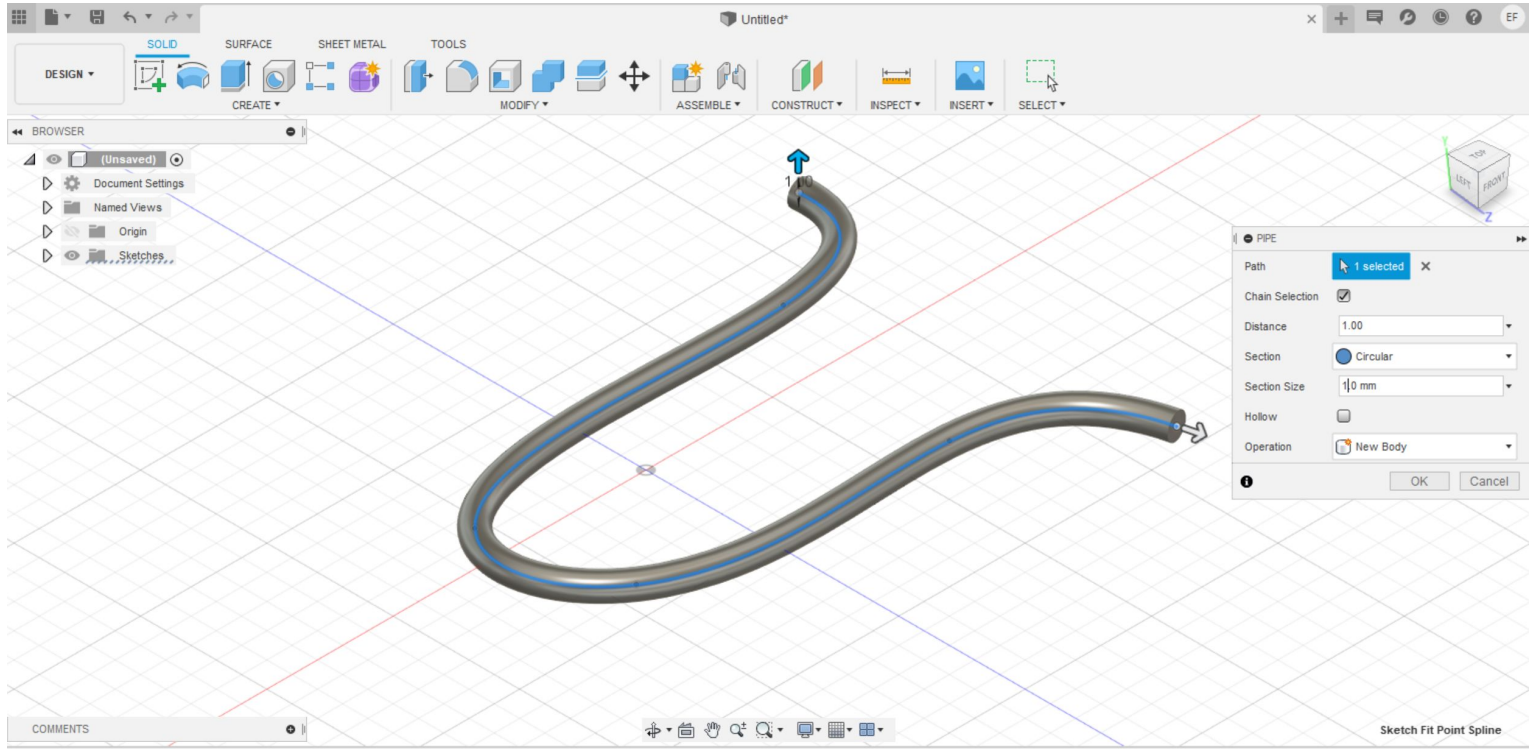
Extrusion



Revolve

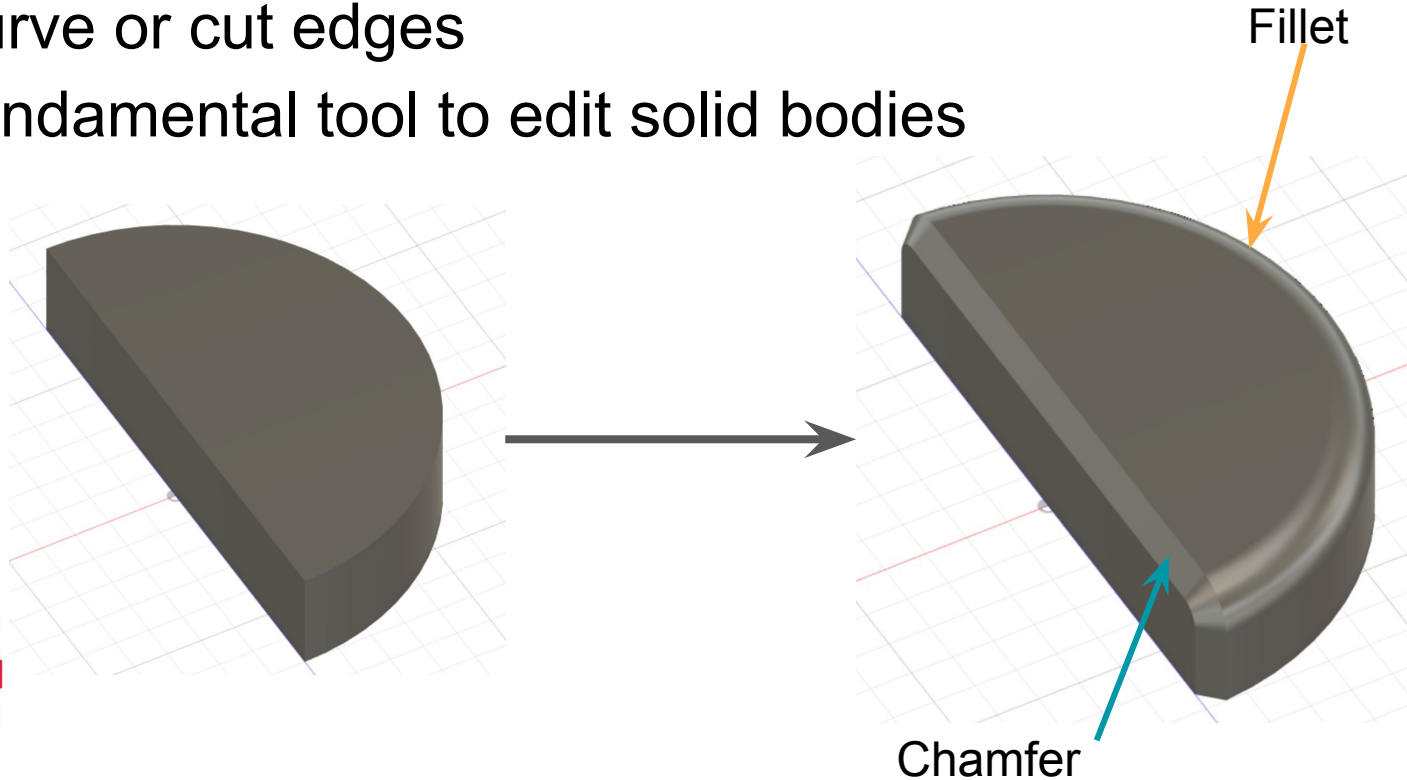


Pipe and Sweep



Fillets and Chamfers

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

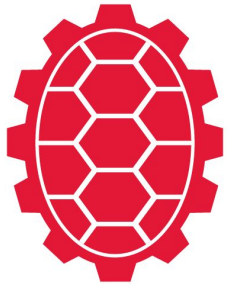


Demo Activity



Mini-Project: 3D Printable Planter

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

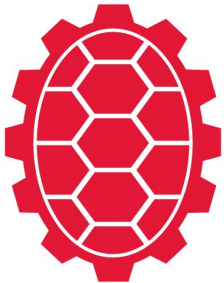
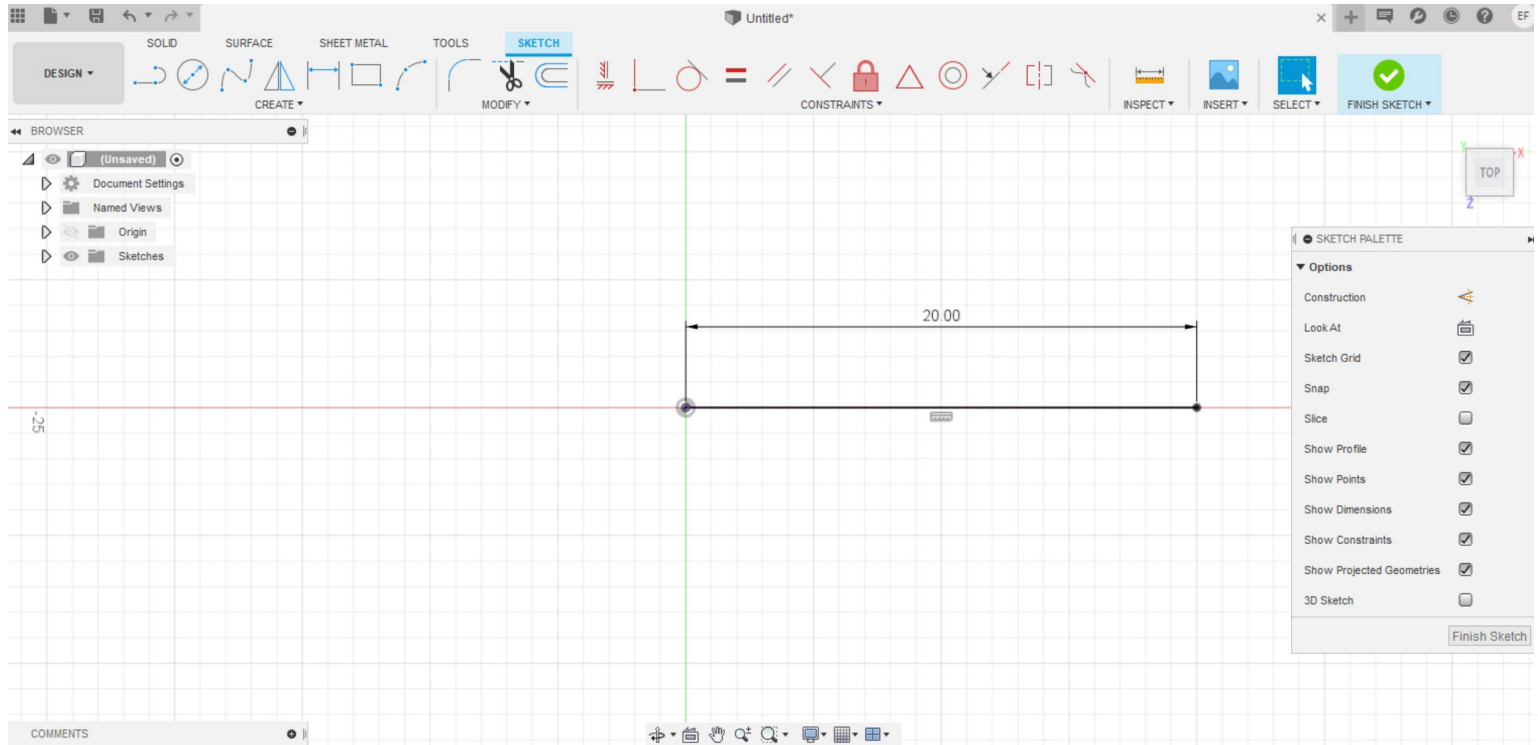


Design this planter →



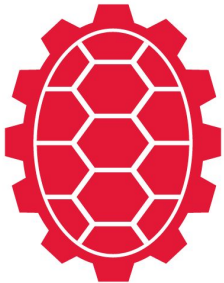
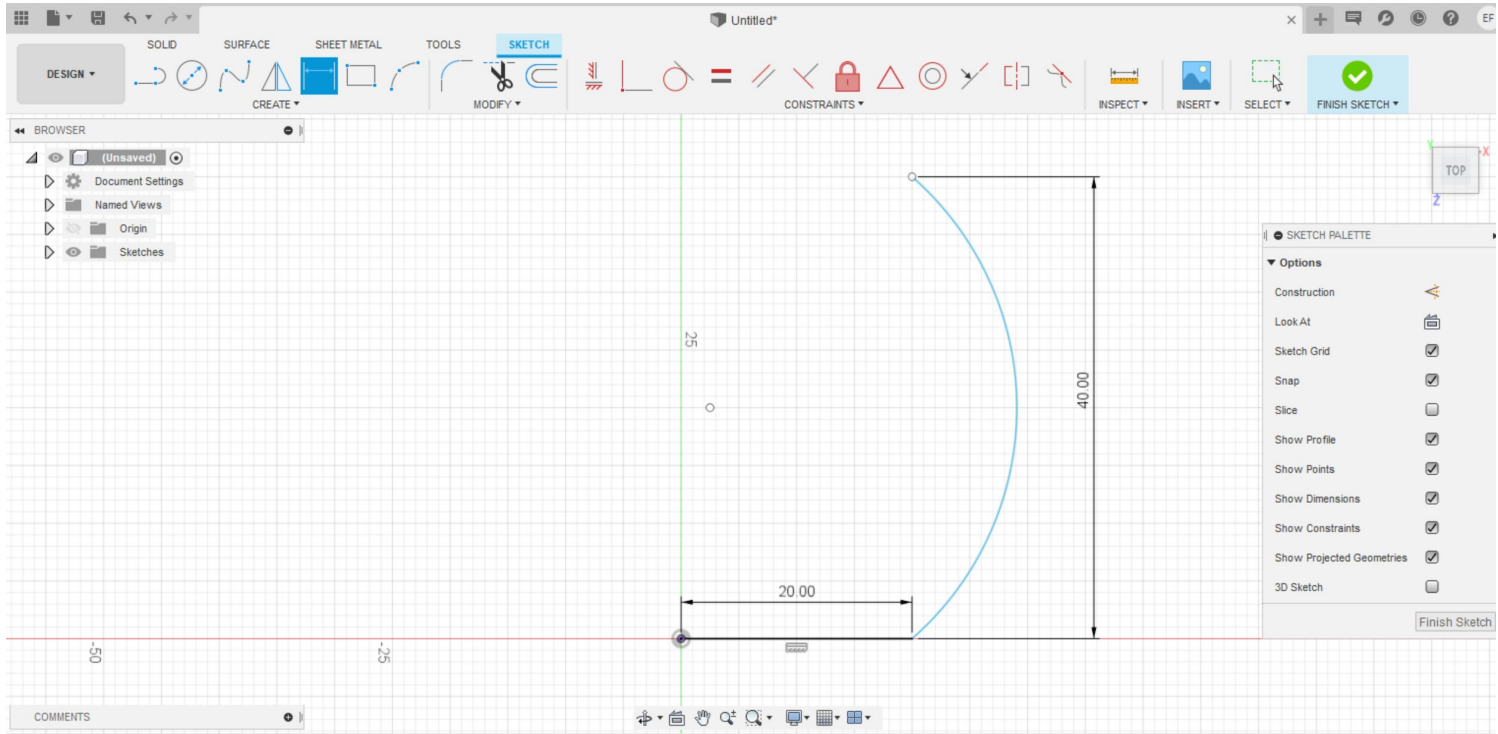
Sketching

Open a sketch and start with a line 20 mm long



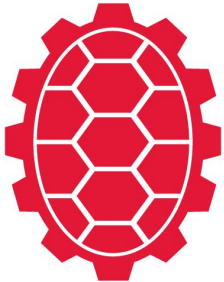
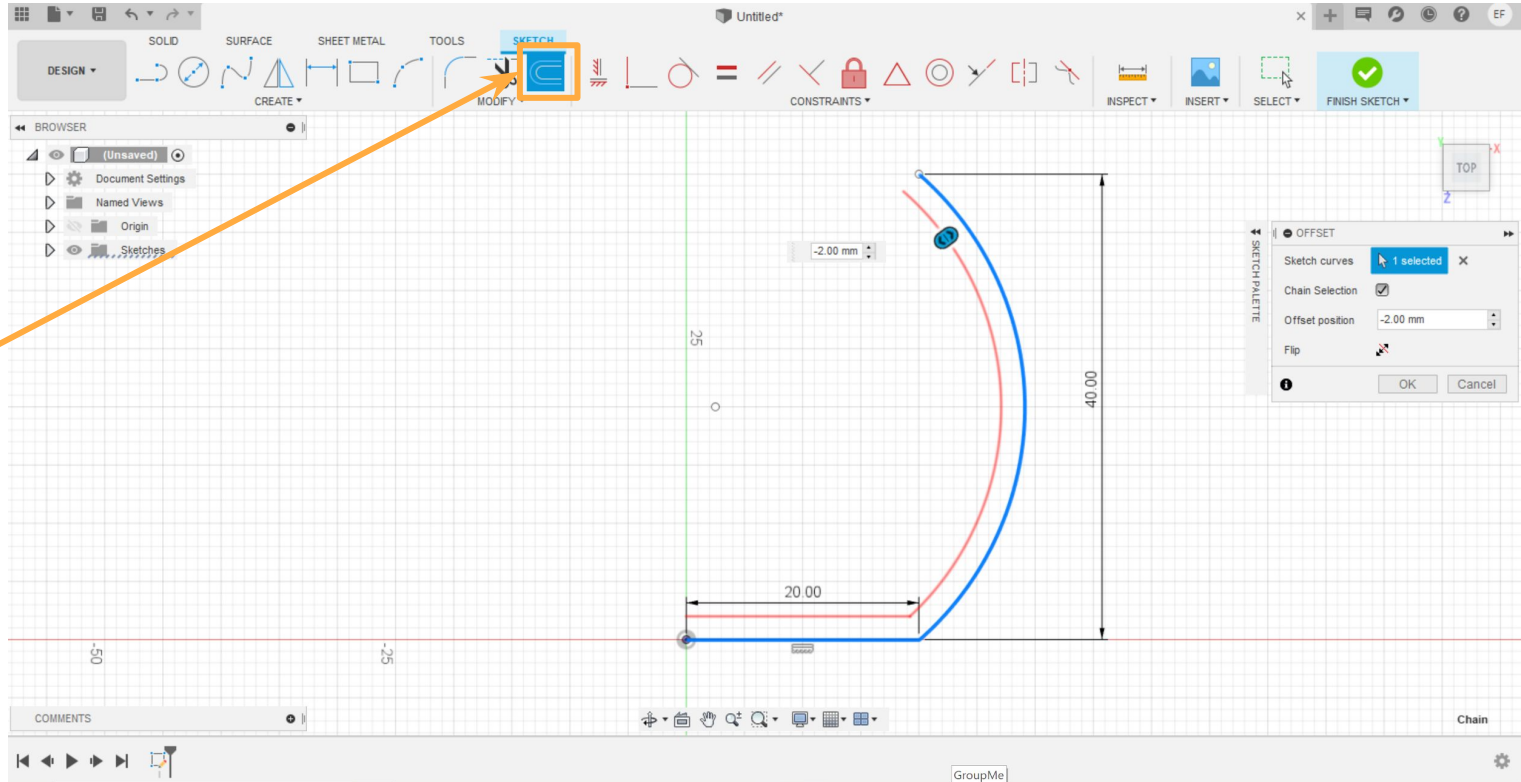
Step #1: Sketching

Add a three point arc 40 mm in the y direction



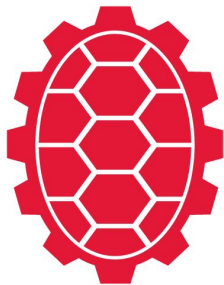
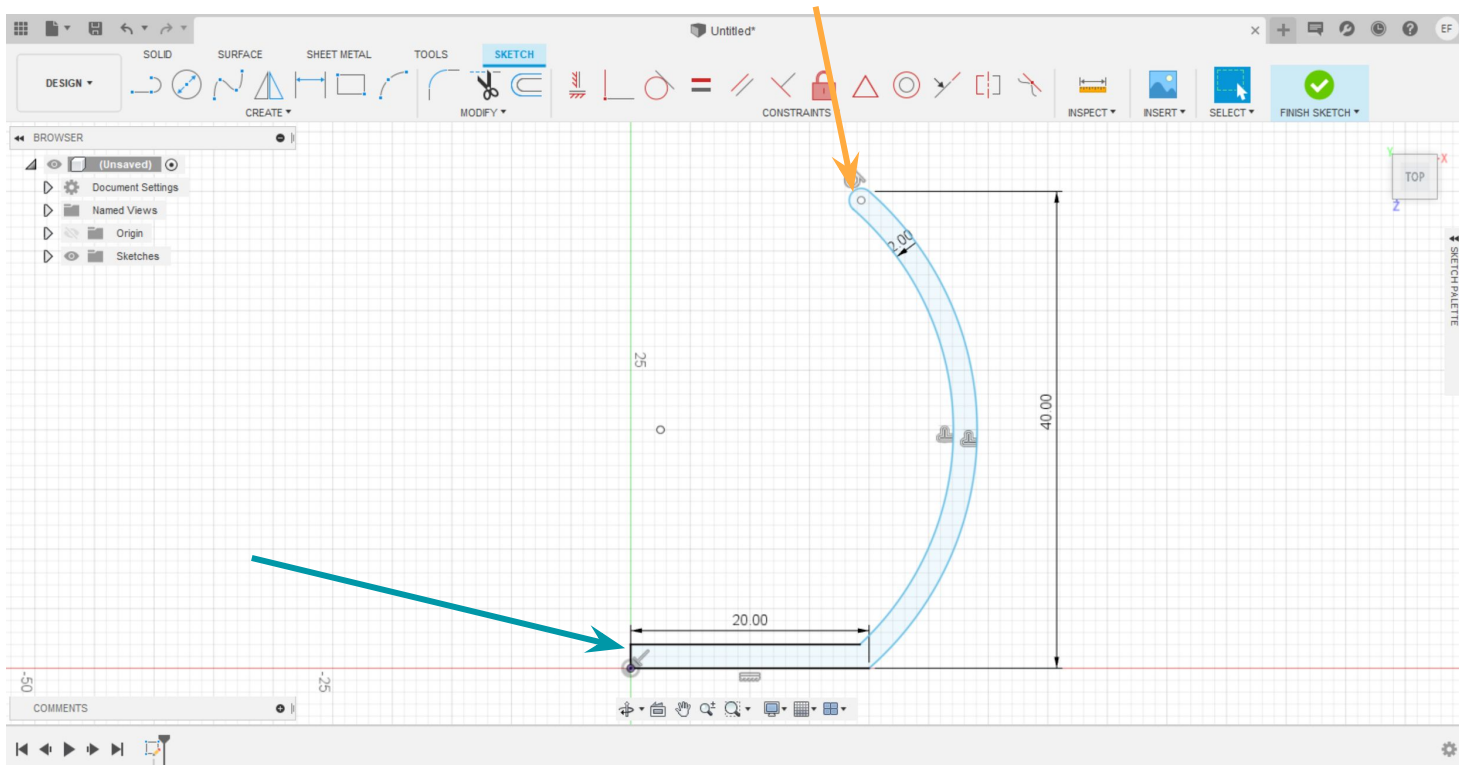
Step #1: Sketching

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



Step #1: Sketching

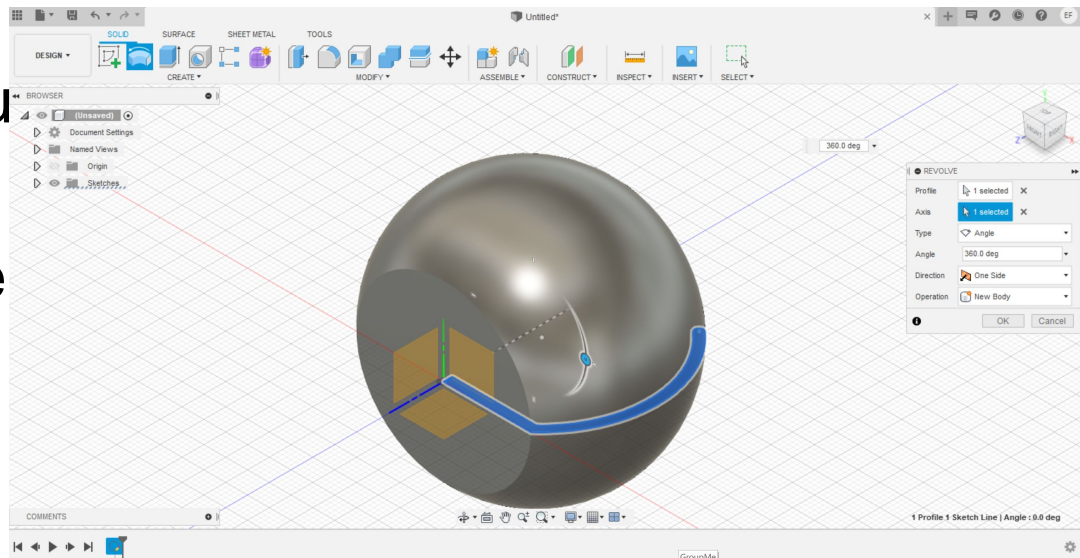
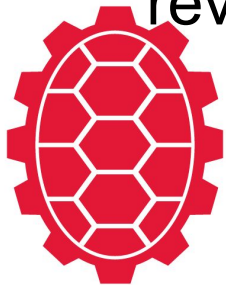
Use the **arc** and **line** tool to make a closed profile



Step #2: Revolve

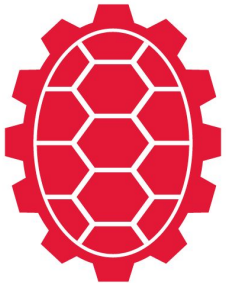
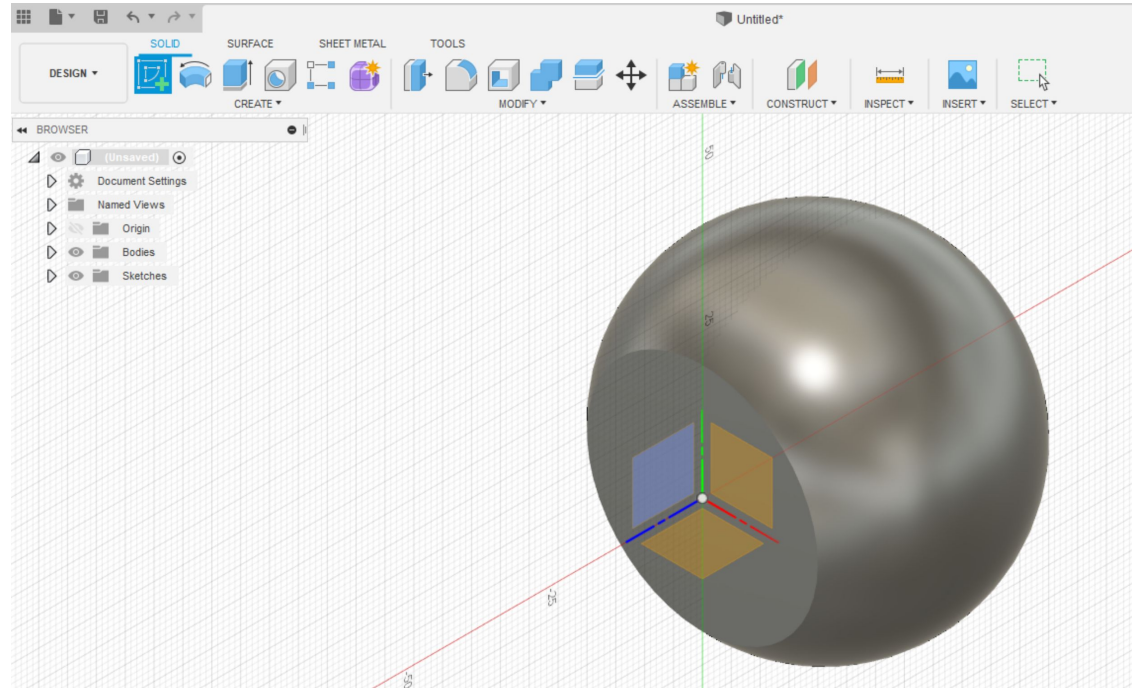
Use the revolve command

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



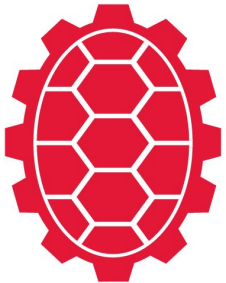
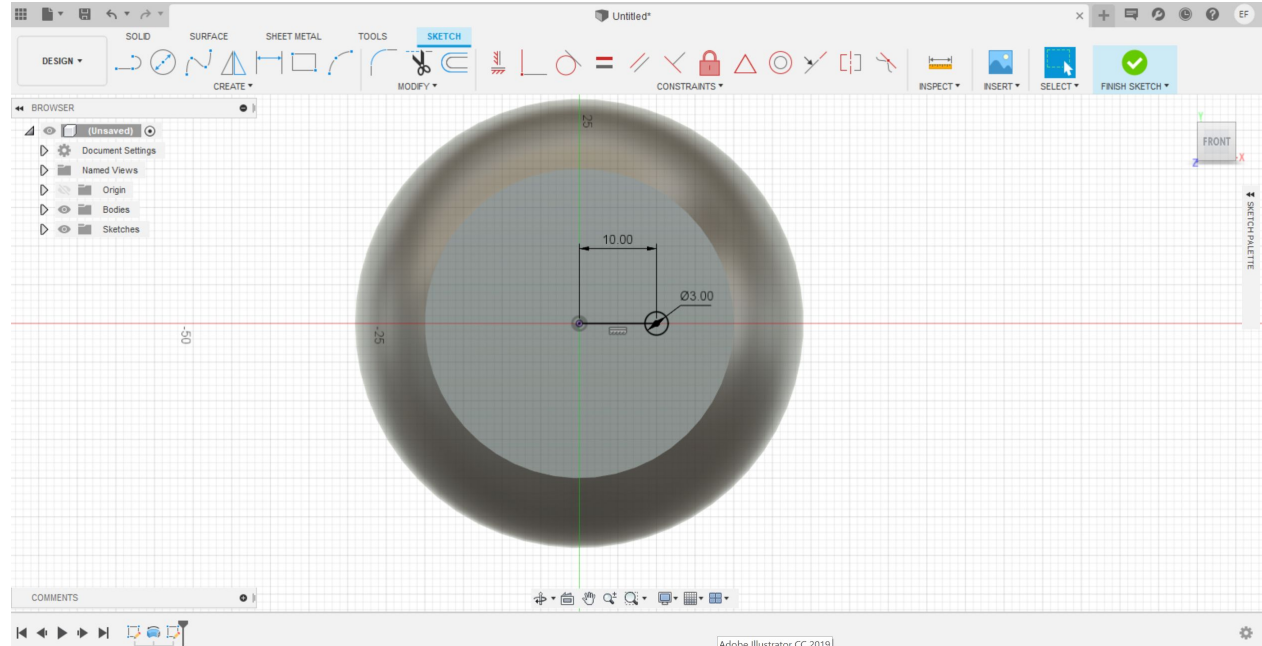
Step #3: Drainage Holes Sketch

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



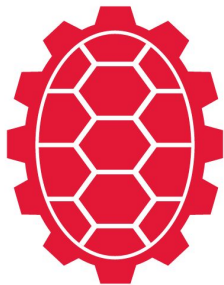
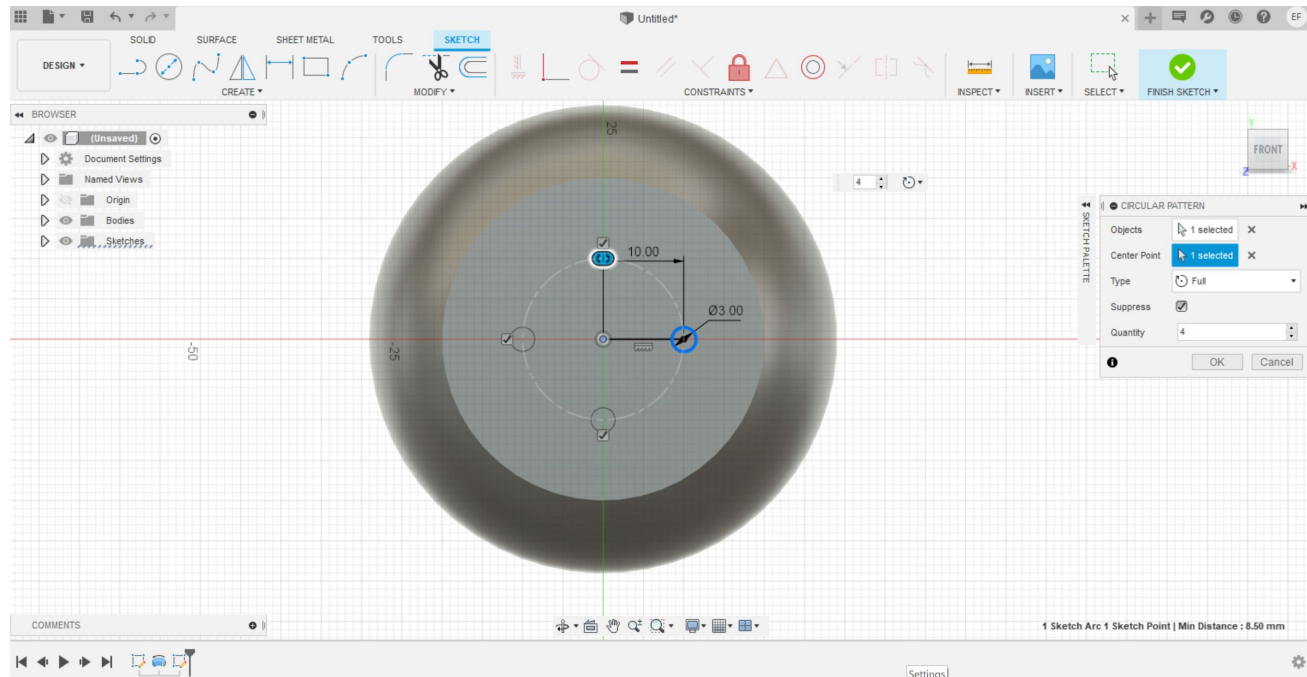
Step #3: Drainage Holes Sketch

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



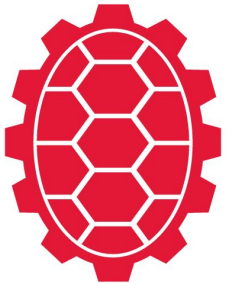
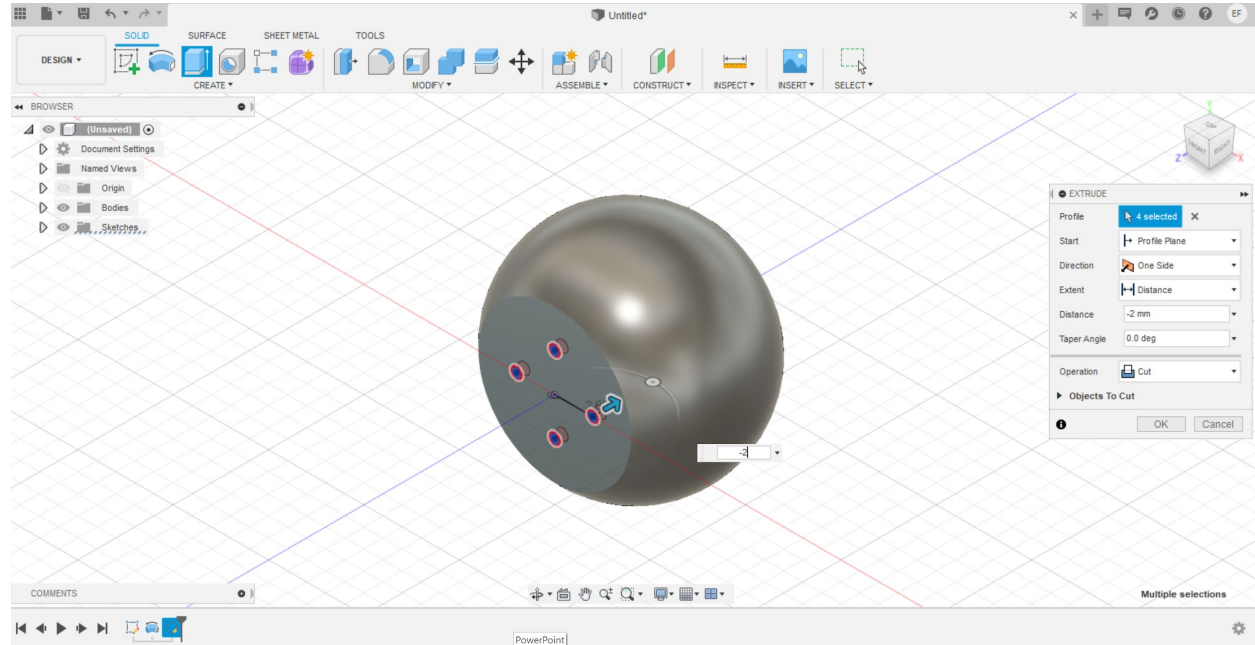
Step #3: Drainage Holes Sketch

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



Step #4: Drainage Holes Extrusion

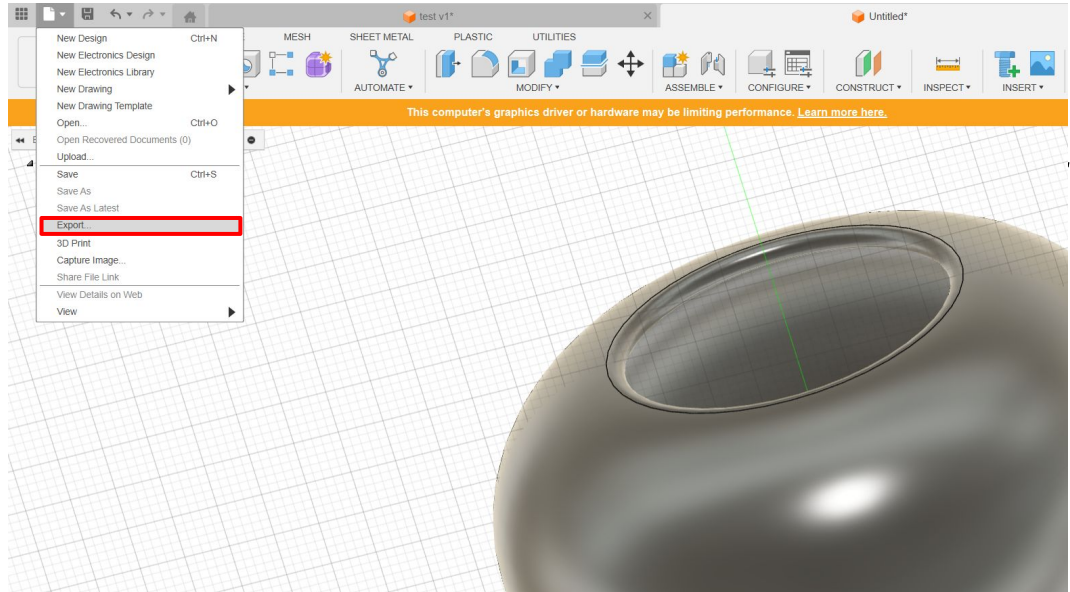
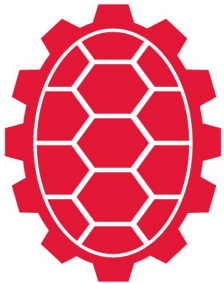
Finish the sketch and use the extrusion tool to cut four holes in the bottom of the planter



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

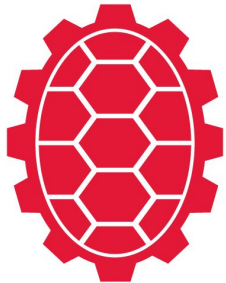


Let's submit an order!

- Congratulations on making a 3D printable planter!

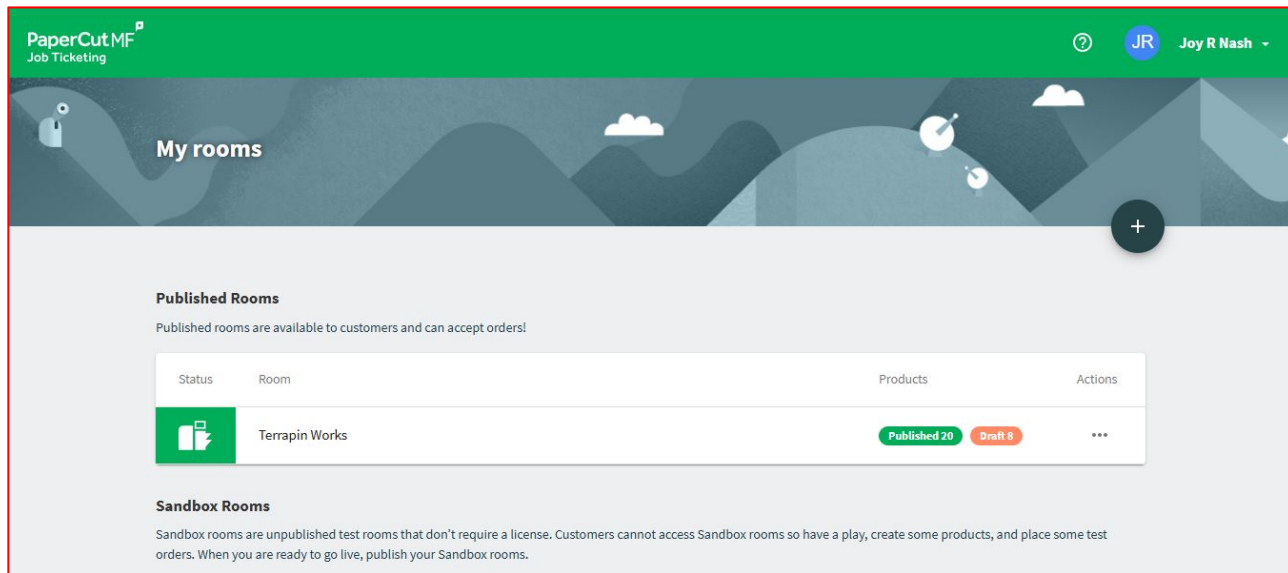
Next Steps

- 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**



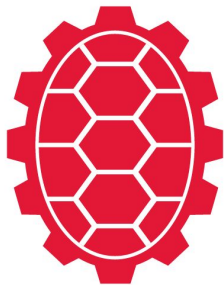
PaperCut MF
Job Ticketing

My rooms

Published Rooms
Published rooms are available to customers and can accept orders!

Status	Room	Products	Actions
	Terrapin Works	Published 20 Draft 8	...

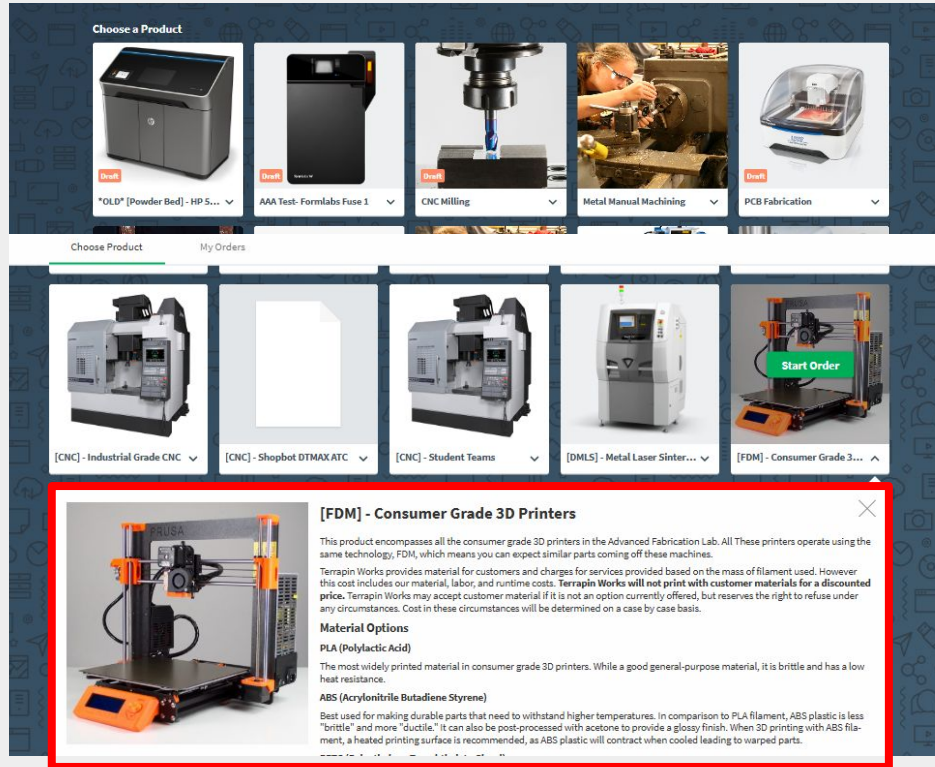
Sandbox Rooms
Sandbox rooms are unpublished test rooms that don't require a license. Customers cannot access Sandbox rooms so have a play, create some products, and place some test orders. When you are ready to go live, publish your Sandbox rooms.



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**)



Choose a Product

My Orders

Choose Product

My Orders

[FDM] - Consumer Grade 3D Printers

This product encompasses all the consumer grade 3D printers in the Advanced Fabrication Lab. All These printers operate using the same technology, FDM, which means you can expect similar parts coming off these machines.

Terrapin Works provides material for customers and charges for services provided based on the mass of filament used. However this cost includes our material, labor, and runtime costs. Terrapin Works will not print with customer materials for a discounted price. Terrapin Works may accept customer material if it is not an option currently offered, but reserves the right to refuse under any circumstances. Cost in these circumstances will be determined on a case by case basis.

Material Options

PLA (Polylactic Acid)

The most widely printed material in consumer grade 3D printers. While a good general-purpose material, it is brittle and has a low heat resistance.

ABS (Acrylonitrile Butadiene Styrene)

Best used for making durable parts that need to withstand higher temperatures. In comparison to PLA filament, ABS plastic is less "brittle" and more "ductile." It can also be post-processed with acetone to provide a glossy finish. When 3D printing with ABS filament, a heated printing surface is recommended, as ABS plastic will contract when cooled leading to warped parts.

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”

New [FDM] - Consumer Grade 3D Printers

Files

Insert .stl file

Attach file

Details

Title

CAD Workshop Test

Material

PLA Any >

Pages

0 0

Estimated cost

\$0.00

An operator must process your part(s) before an accurate total is generated for your request.

Material Cost

Covers the cost of printing in PLA which is approximately \$0.1 per gram of plastic

\$0.00

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

New [FDM] - Consumer Grade 3D Printers

Description and More Information

Verify Material Choice

Material has been selected properly



Slicing Considerations for Support Structures

Select the most convenient orientation for me



Resolution

Select for me based on part geometry



Export Units

mm



Material Estimate (grams)

Leave Blank

Submission Type

Submitted for Printing



Machine Preference

No preference towards any machine



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!


The screenshot shows the 'Accounting' section of a software interface. The 'Charge to' field is highlighted with a red box, and the 'Personal account' button is highlighted with a green box. To the right, a dropdown menu is open, showing 'Personal account' as the selected option, also highlighted with a red box. Below it, a list of 'Shared accounts' is visible, including 'INT-ENGR-Engineering Information Technology\Terrapin Works - Internal Training Prints'.

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

 **Delivery & Instructions**

Delivery option

Pick up 

Check which lab the equipment your job was printed on resides in via <http://ter.ps/findmyprint>.

Due date

Please select >

Proof required

No proof required >

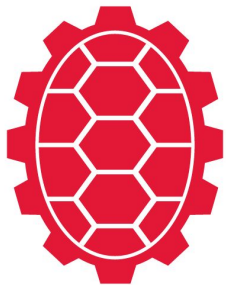
Additional instructions

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/360introproj>
- Questions?

