Welcome to Code Crunch!

C12 | Crunch 3D: CAD & Modeling

[Tues 4-5 PM] Weekly | Spring 2025

Attendance

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

CODECRUNCH.CS.FIU



Unit #1

Topic: Introduction & Sketching
C12 | Crunch 3D: CAD & Modeling

What we offer at C12 Crunch 3D: CAD & Modeling

- This **6-week** course introduces the basics of **On-Shape**, a **3D CAD** software used in engineering, product design, and manufacturing.

- We will **guide** you through the **essential skills** needed to bring your ideas to life, including **sketching, 3D modeling,** and **assemblies**.

- By the **end** of this course, you will not only have a **finished project** to showcase but also a **solid understanding** of On-Shape.

- Whether you dream of **creating** your own 3D models, **breaking** into the **3D design industry**, or **simply exploring** your creativity, this course will give you the foundation you need to get started!

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.

Let’s Get Started!



onshape®

OnShape Overview

- OnShape is a 3D CAD modeling software that is **free**!
- OnShape is accessible through a **web browser** as well as a **mobile app**.
- With OnShape you can **share and collaborate** on 3D models live (you can edit the same file at the same time!).
- OnShape allows for **3D modeling, assemblies, simulations**, and **engineering drawings**.

Creating an Account

1. Search “Sign up for OnShape” or click https://www.onshape.com/en/sign-up

2. Fill out the information (any name, any last name, any email!)

3. For use, select either Education or Fun

4. Continue with the steps to fill out your account information

5. You now have access to OnShape!

What is sketching?

- **Sketching** is a 2D drawing feature which allows you make the base for your 3D design.
- **Sketch entities** are the lines or curves drawn in a sketch.
- **Dimensions** are the lengths you give to sketch entities created in the sketch.
- **Constraints** are limitations created by the dimension given to different sketch entities.
- **Relations** are relationships between sketch entities (tangent, parallel, etc.).

Time for...

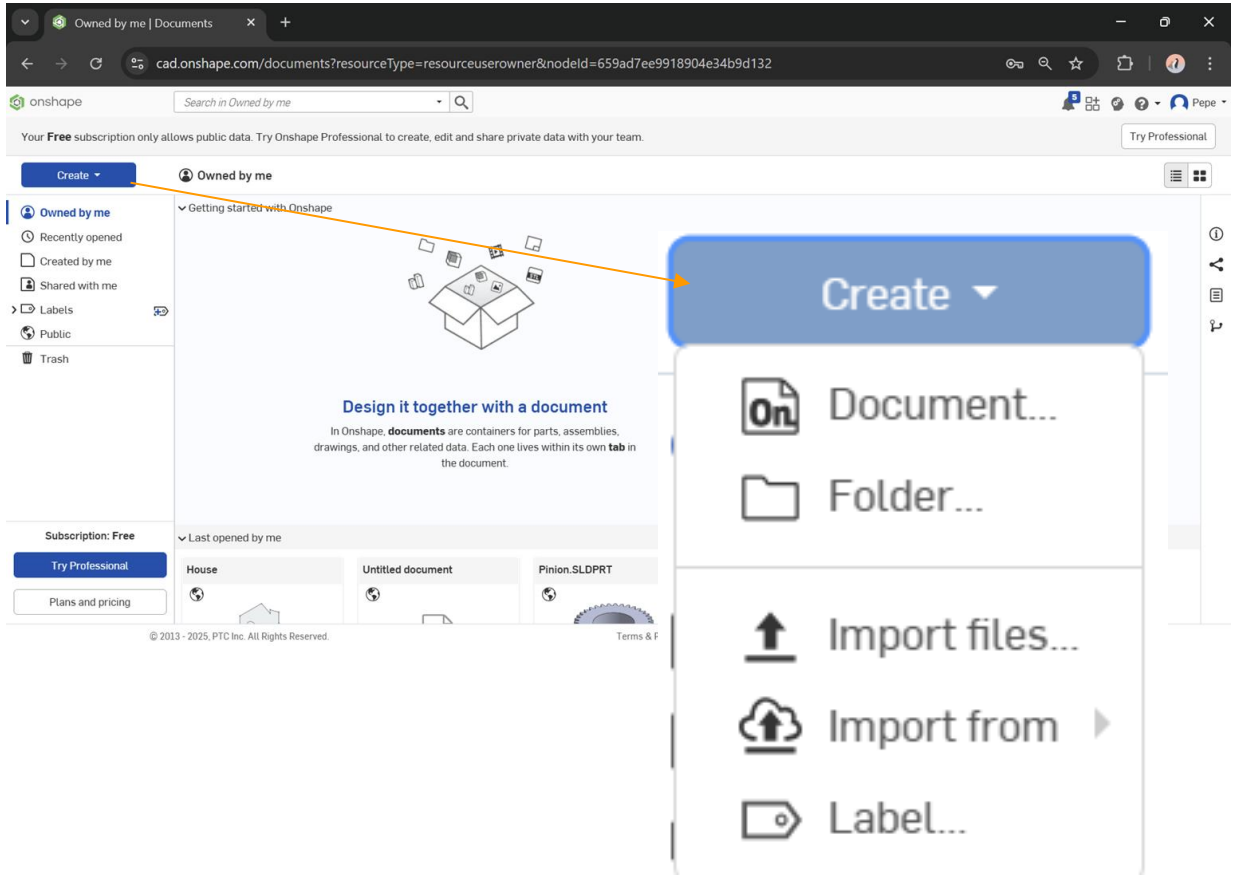


Sketching!

Starting a New Document

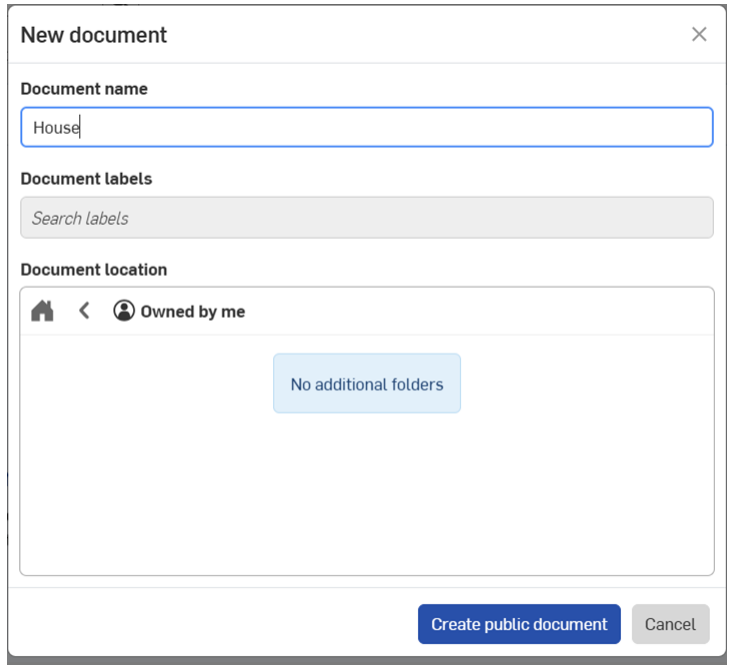
Before we start the sketch, we need to create a document.

In the main menu, click on **“Create”** at the top left corner of the page. Then, click on **“Document…”**.



Starting a New Document

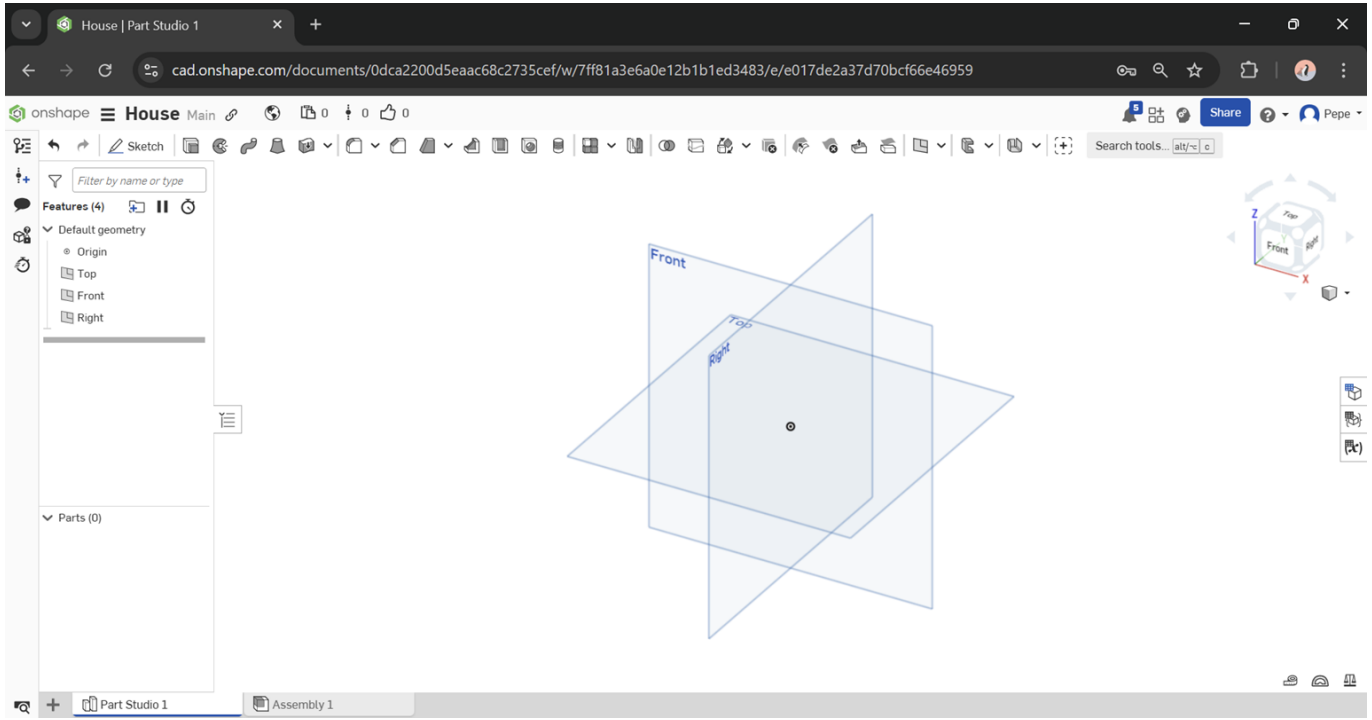
After that, choose a **name** for the document at the top, and finish by clicking **“Create public document”**.



Document Layout

This is what the document is going to look like.

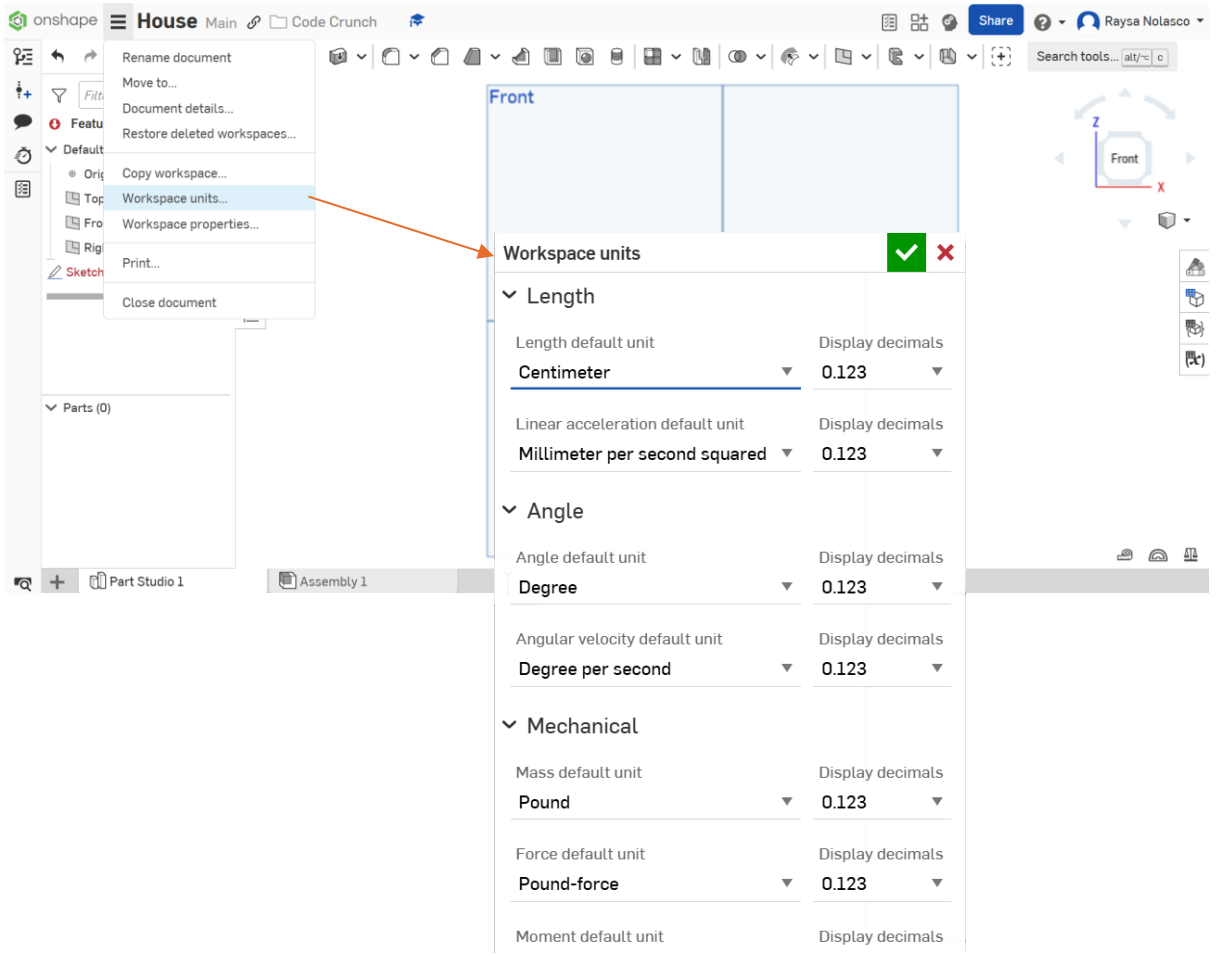
There are the **3 planes** (front, right, and top) in the middle. Additionally, there is a **cube** at the top corner to change the **perspective**.



Units

At the **top left corner** (three lines), there is an option to change the **units** for the document. Click “**Workspace units…**”.

For this sketch, **centimeter (cm)** was selected for the **length** and **degree** was selected for the **angle**.

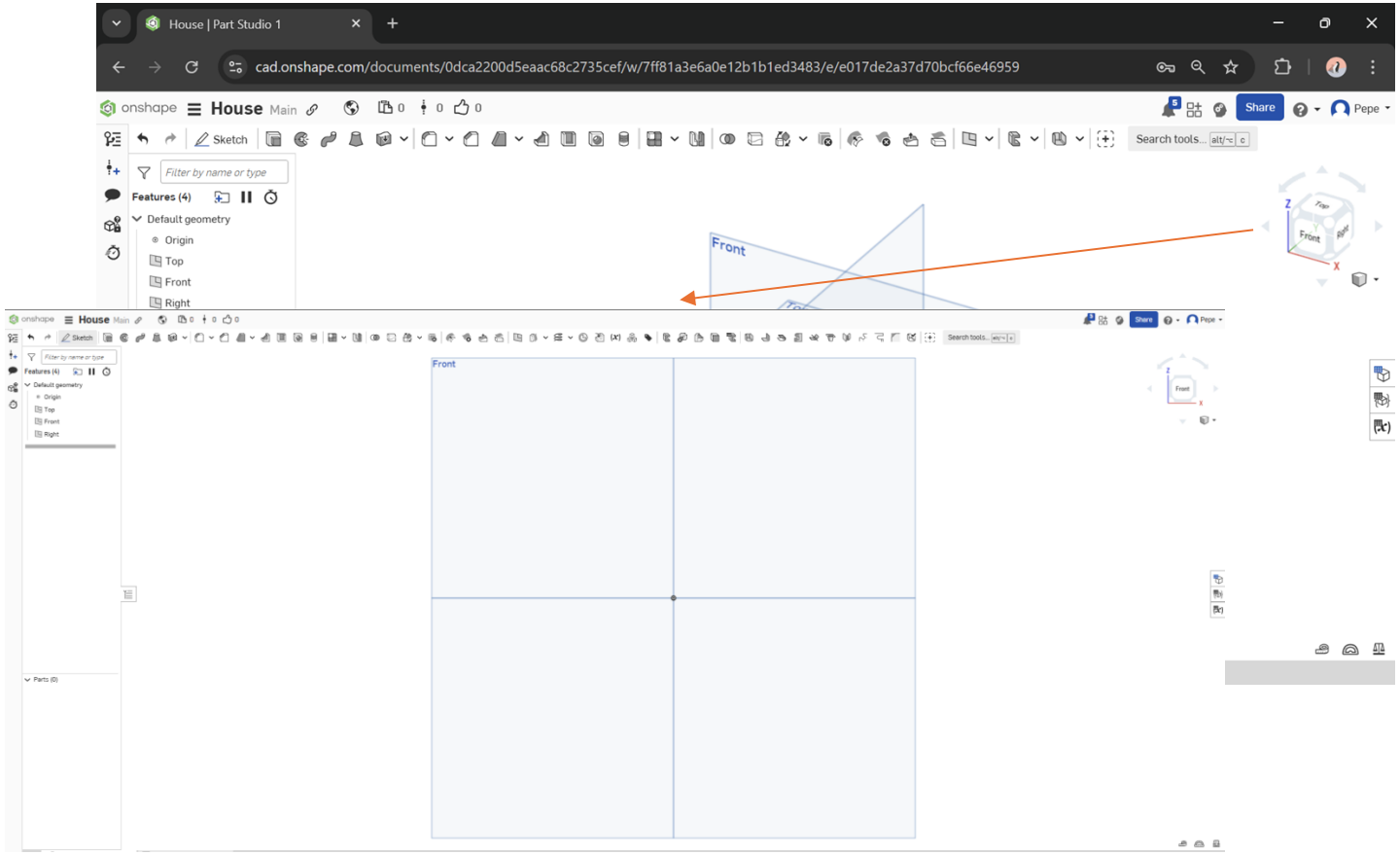


Perspective

Changing the view perspective of the document could increase the **understanding** of the drawn sketch.

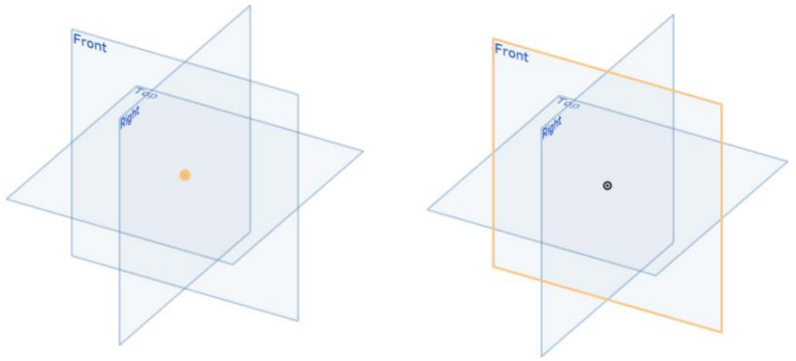
To change the **perspective**, you select the different **faces** in the **cube**.

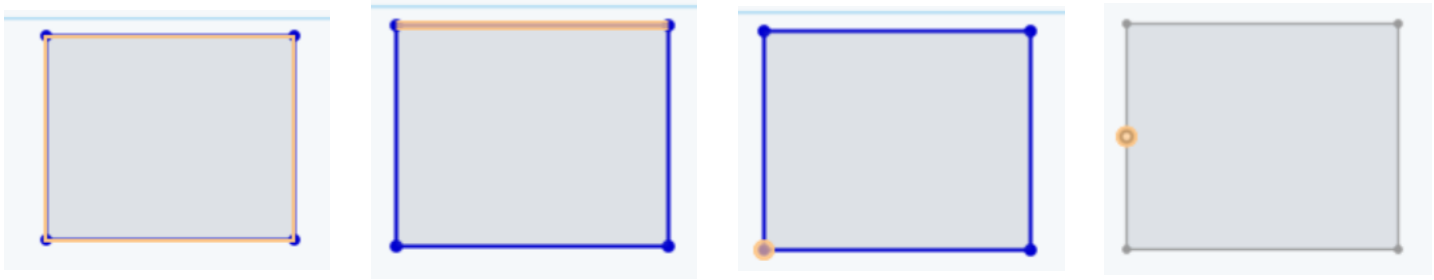
For this document, the **front face** was selected.

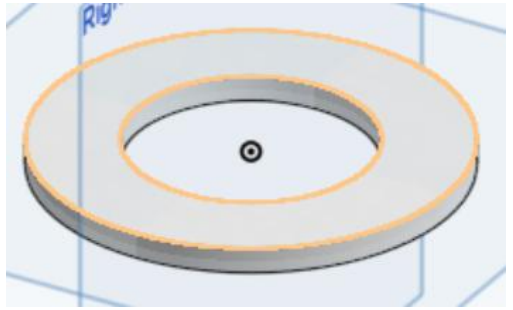


Selecting

When **hovering** over points (origin, midpoints, endpoints, etc.), lines, planes, sketch entities, or components of a 3D model, they will turn **yellow**. This indicates what you are **clicking/selecting**.



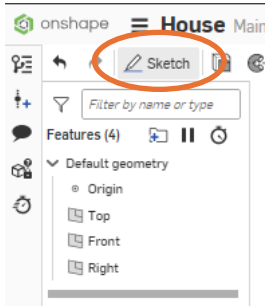


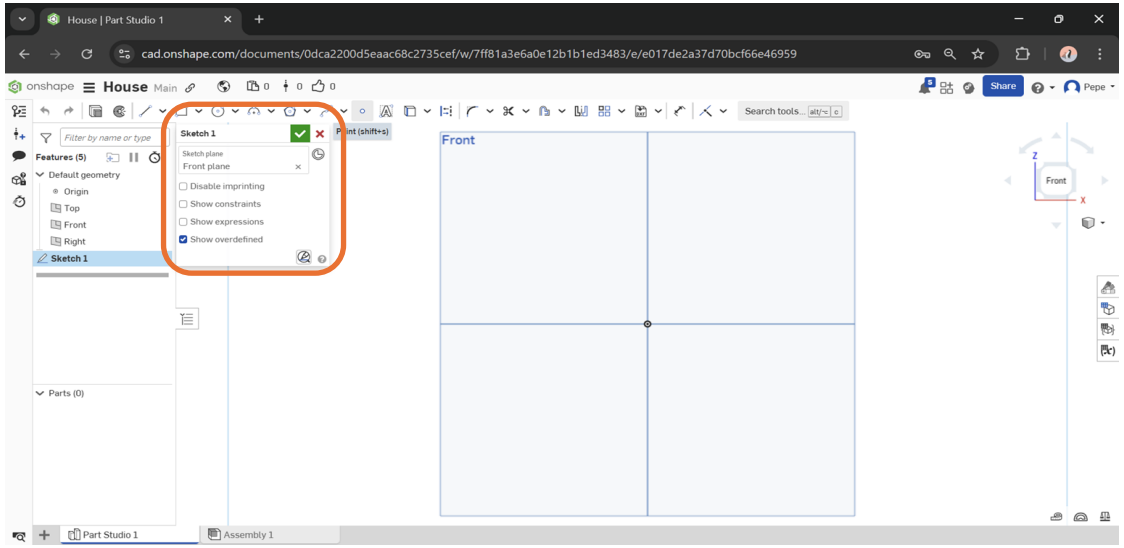


For sketching, this assists in **aligning** sketch entities.

Creating a Sketch

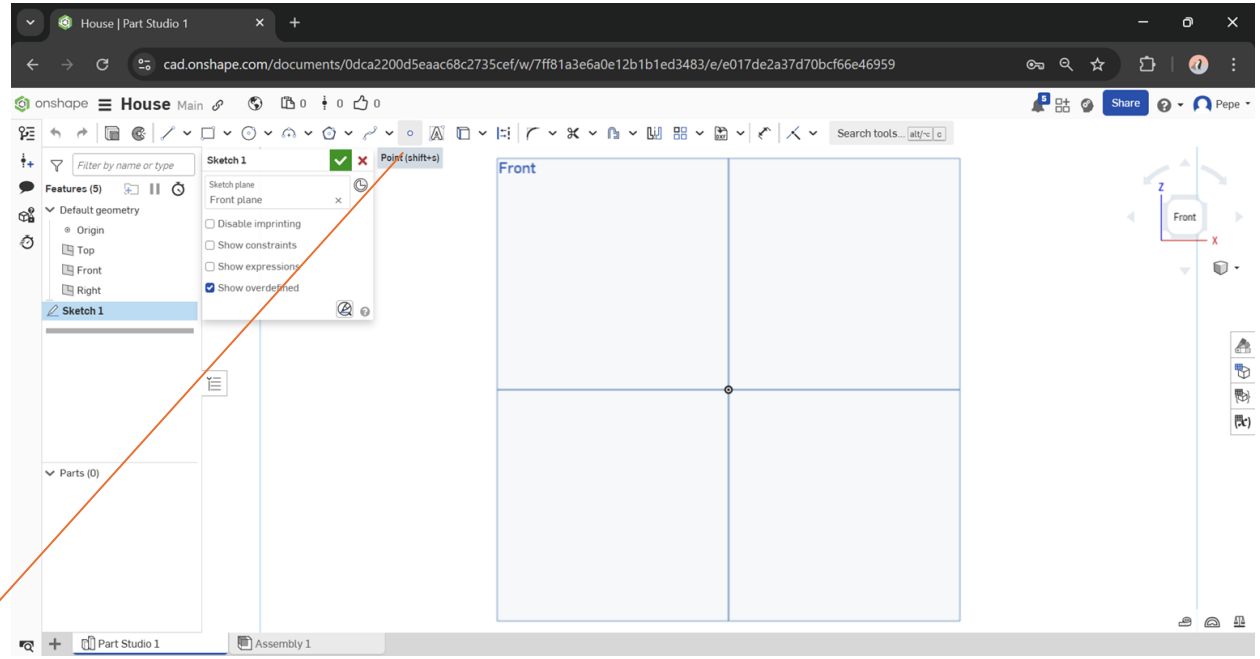
To begin sketching, click **"Sketch"** button on the **top right corner** of the page. After clicking that button, you will see a **menu** at the top indicating you are in the sketch.





Sketching: Tools

At the top of the page, the different **tools** for sketching are displayed on the **ribbon**.



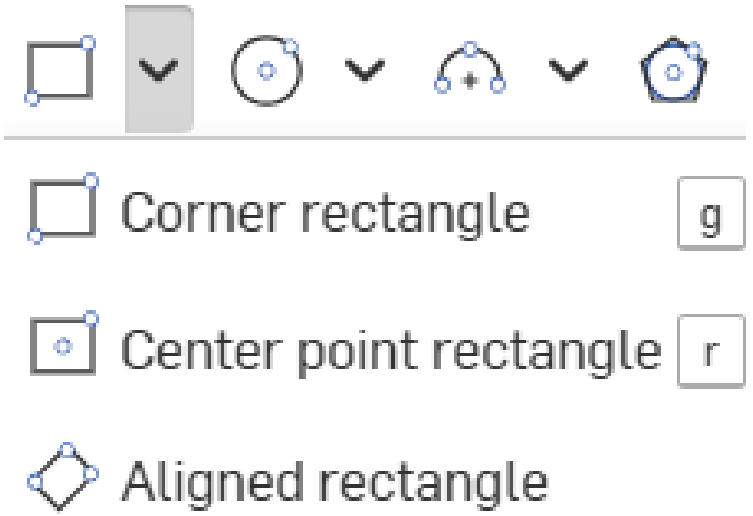
Some tool options include:

- Drawing a line, rectangle, or circle
- Creating a pattern
- Mirroring sketch entities
- Deleting lines
- Adding dimensions to sketch entities



Sketching: Sub Tools

The tools that have a **drop-down arrow** next to them, have **“Sub tools”**. These are **variations** of the same tool that, depending on the drawing/preferences, can be more useful.

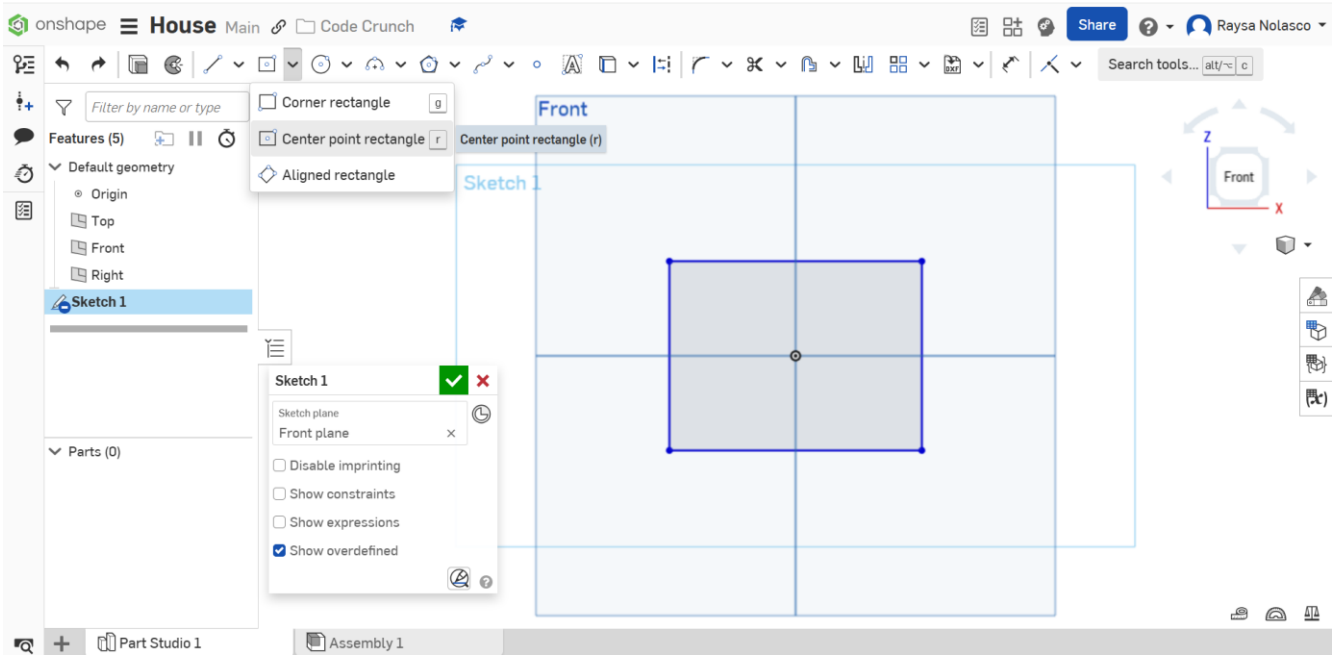


Sketching: Drawing a Figure

To start the house:

1. Select the **center point rectangle**
2. Place the **first point** at the **center** of the plane
3. **Click and drag** to create the rectangle

Note: the size is not important because the dimensions can be change later.



Sketching: Dimensions

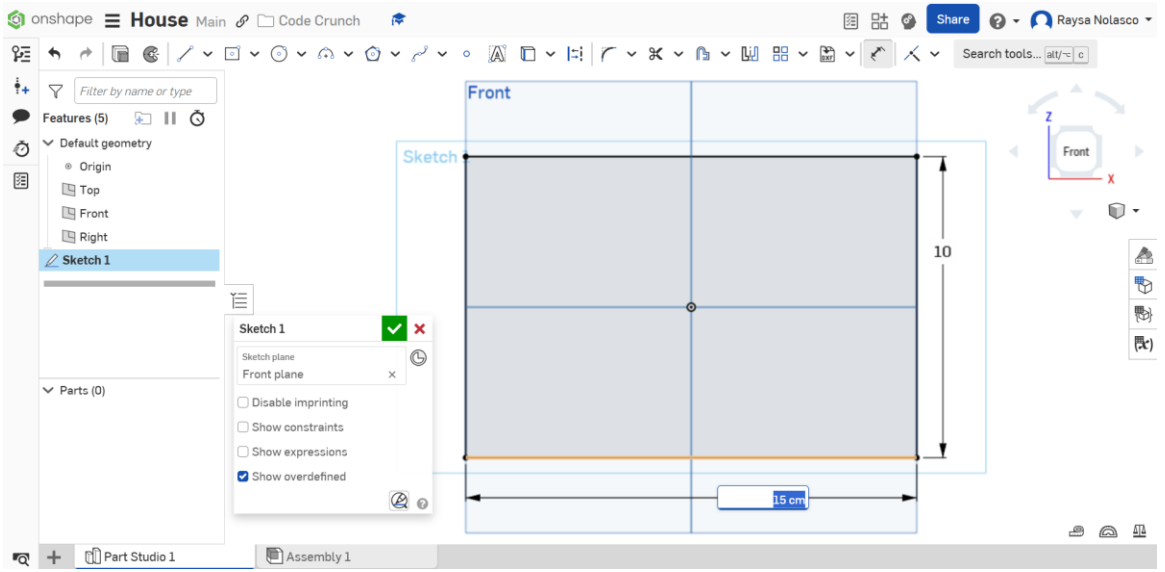


After placing a sketch entity, use the **dimension** tool to give specific measurements.

Click in the **line/diameter** and then type the **value** of the **length/diameter** you want the object to have.

The **rectangle** we just made will have a **width** of 15 cm and **height** of 10 cm.

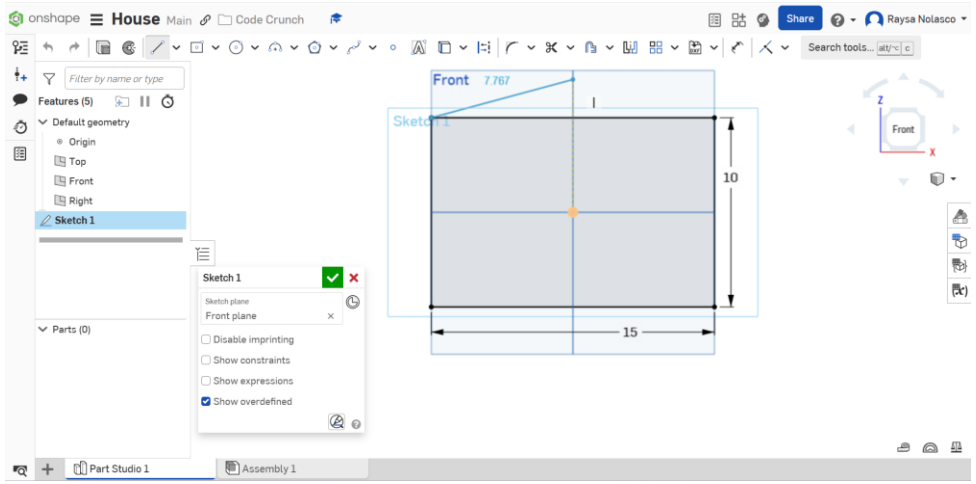
When a **dimension** is added to a sketch entity, the line(s) will change from **blue** to **black**.

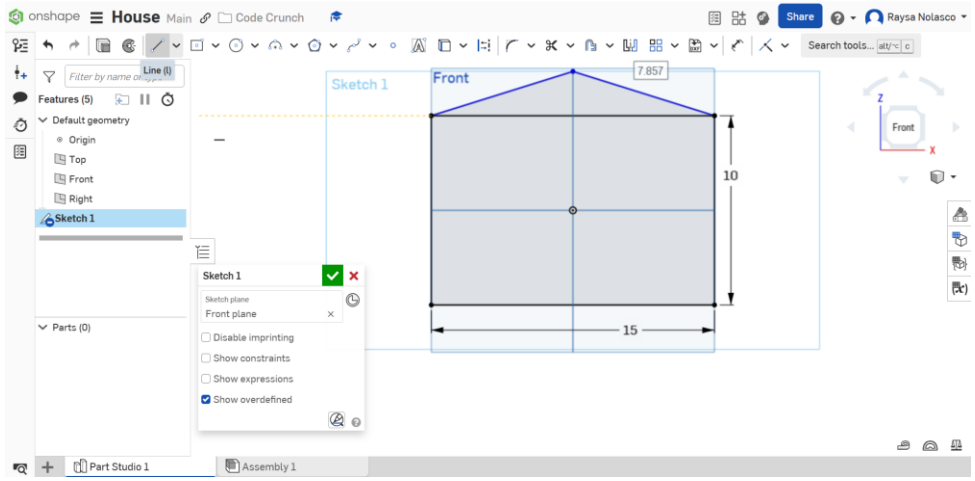


Sketching: More Figures

After the rectangle, we are going to add different details to the house.

First, we are going to add the **roof**. We can do this by adding **lines**. When passing by the center of the plane, the **center line** turns yellow. We will **select** this center line to make sure the roof is perfectly **aligned** with the center of the house.



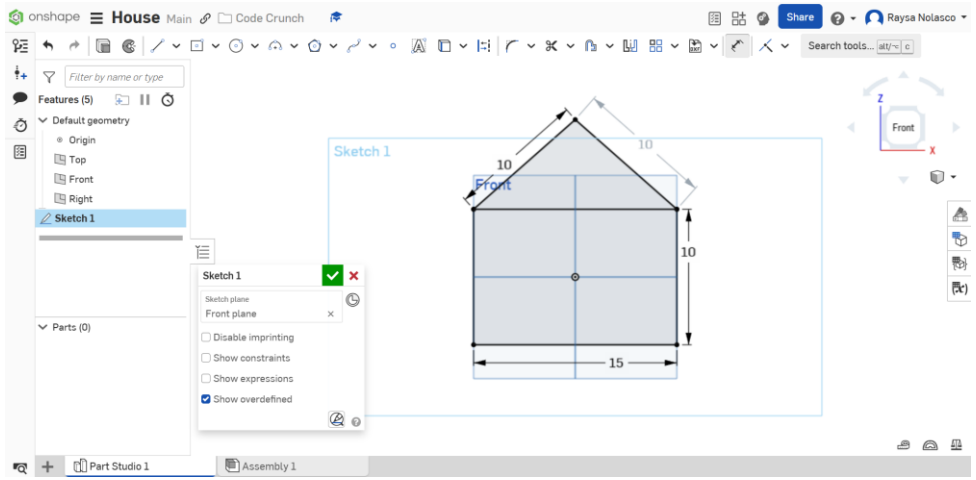


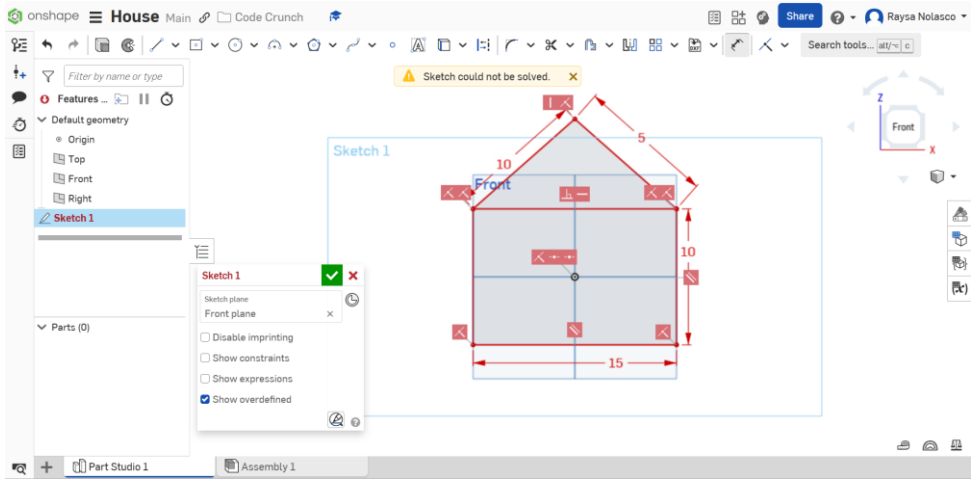
Sketching: Constraints

The software will **not** allow you to add a dimension to a sketch entity that **contradicts** the already **defined** dimensions. This is what is called a **constraint**.

A **grey line** demonstrates a “**driven**” dimension which means a dimension derived from other constraints.

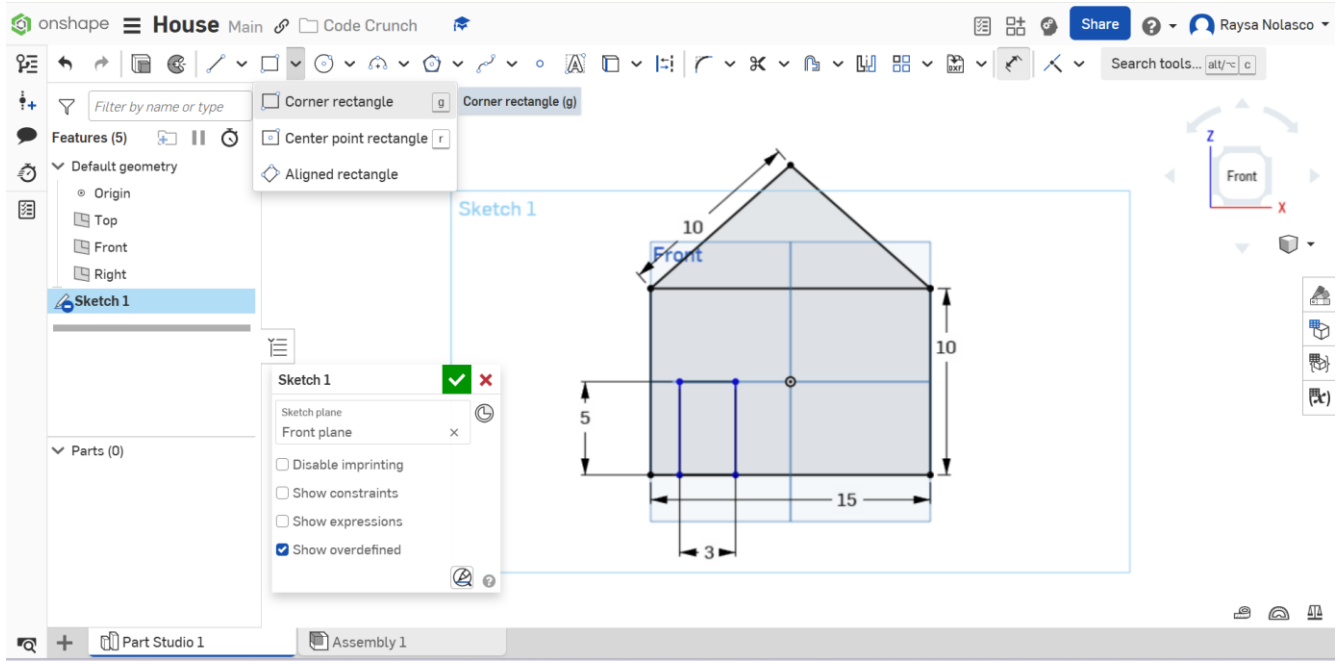
The constraints depend on the shape of the entity (2 define size for a square, 2 for a triangle, etc.). If you try to add a dimension and get an error, **just click undo.**





Sketching: More Figures Pt. 2

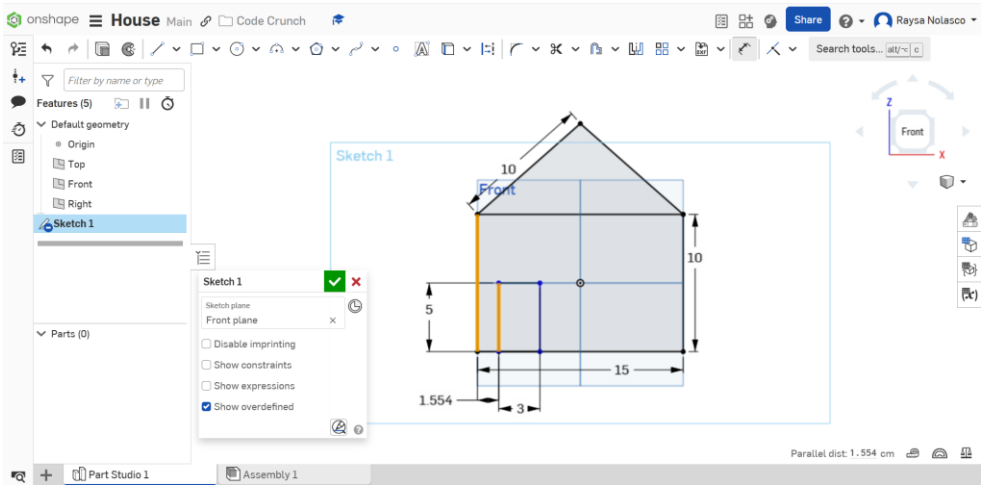
Continuing with the house, we are going to another rectangle (using **corner rectangle tool**) for door.

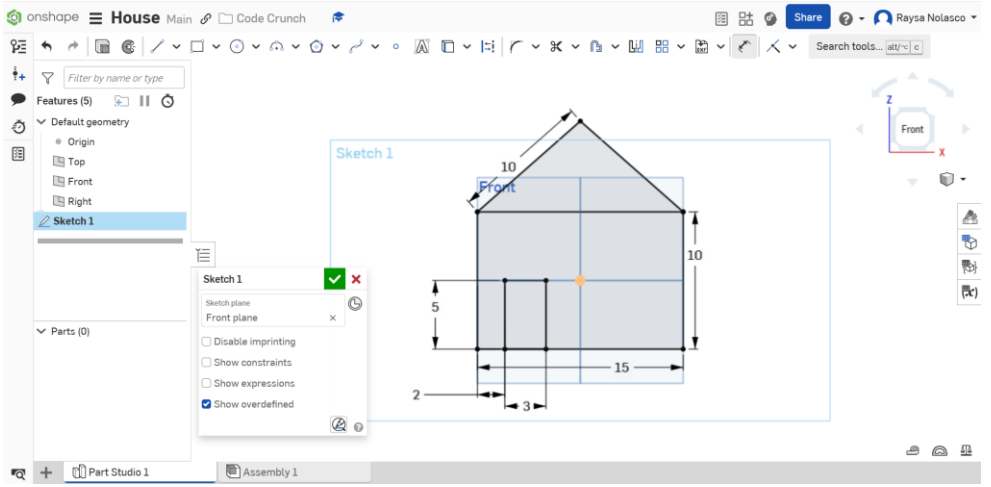


Sketching: Dimensions Pt. 2

Dimensions can be added **between** sketch entities.

To do so, **select** the **two** desired sketch entities, and then type the value for the dimension.





Sketching: Patterns

To make a **replica**(s) of a **sketch entity** without manually creating multiple of them, you have the option of creating a **pattern**.

A **pattern** allows you to select the **sketch entity** that is desired to be **repeated** and then choose the **number of copies** wanted and the **spacing** between them.

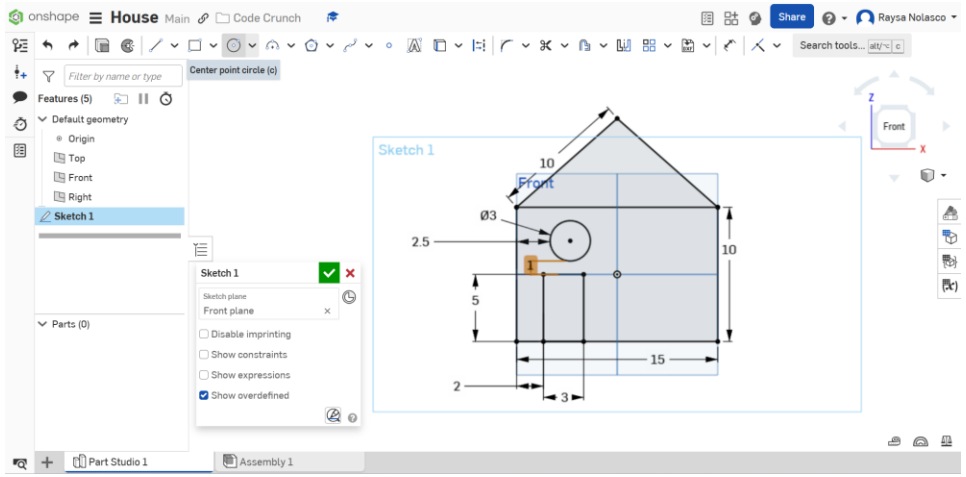
Note: When making a pattern, you may need to select the **green check** to finish a sketch for the changes to make effect. You can still open the sketch and **edit** these patterns afterwards.

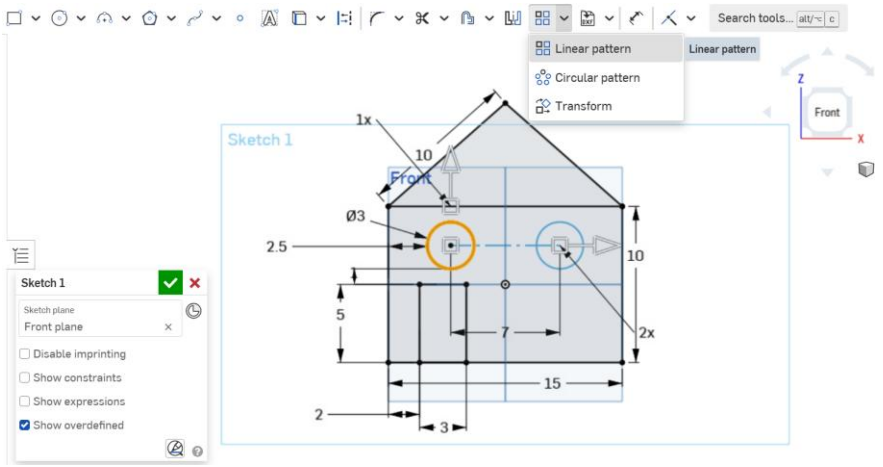
Sketching: Linear Pattern

A **linear pattern** allows you to create **replicas** of a sketch entity in a **line**.

To use: click **“linear pattern”**, **select** the **entity** you wish to repeat, and specify **how many** copies and the **distance between** them.

For the house, we will use the linear pattern tool to duplicate a window.





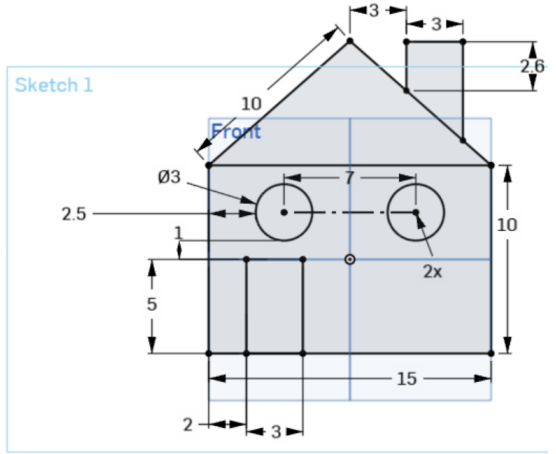
Sketching: Trim

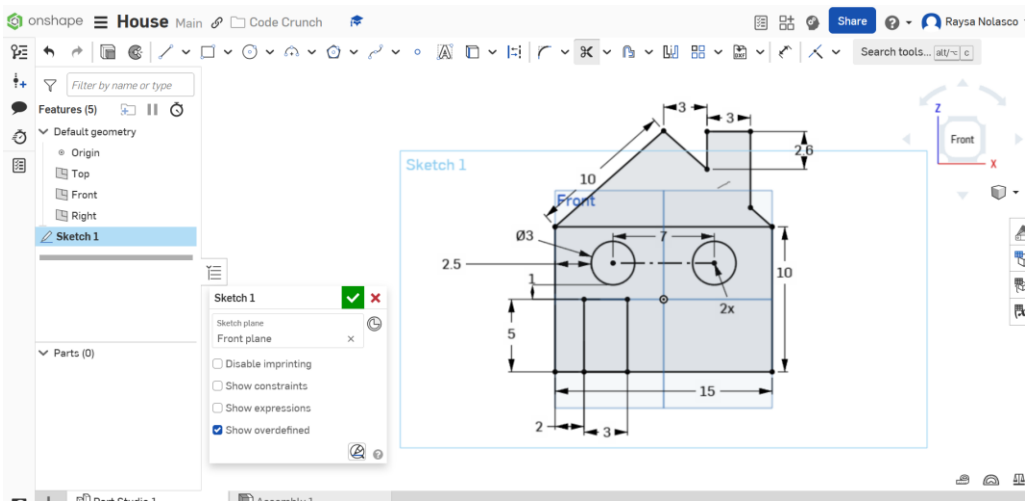


To **delete** lines/curves between two points, use the **trim** tool.

Click **"trim"**, then **click and drag** your cursor **through** the **lines/curves** you wish to **delete**.

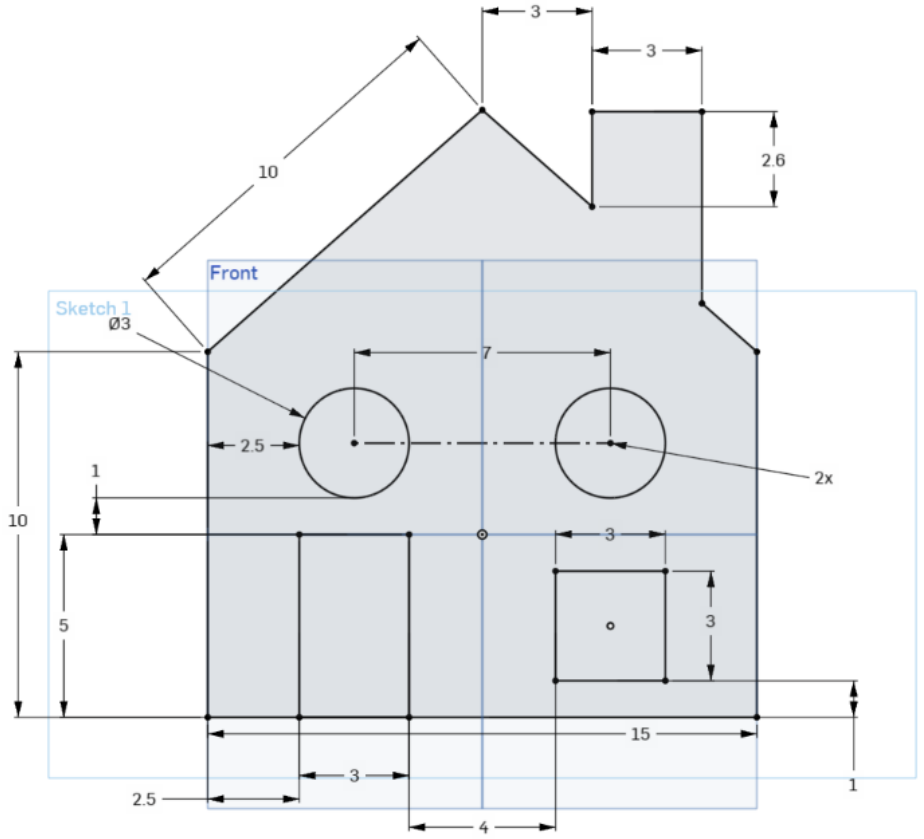
For the house, the trim was used to **remove** the line separating the roof and chimney.





Fully defined Sketch

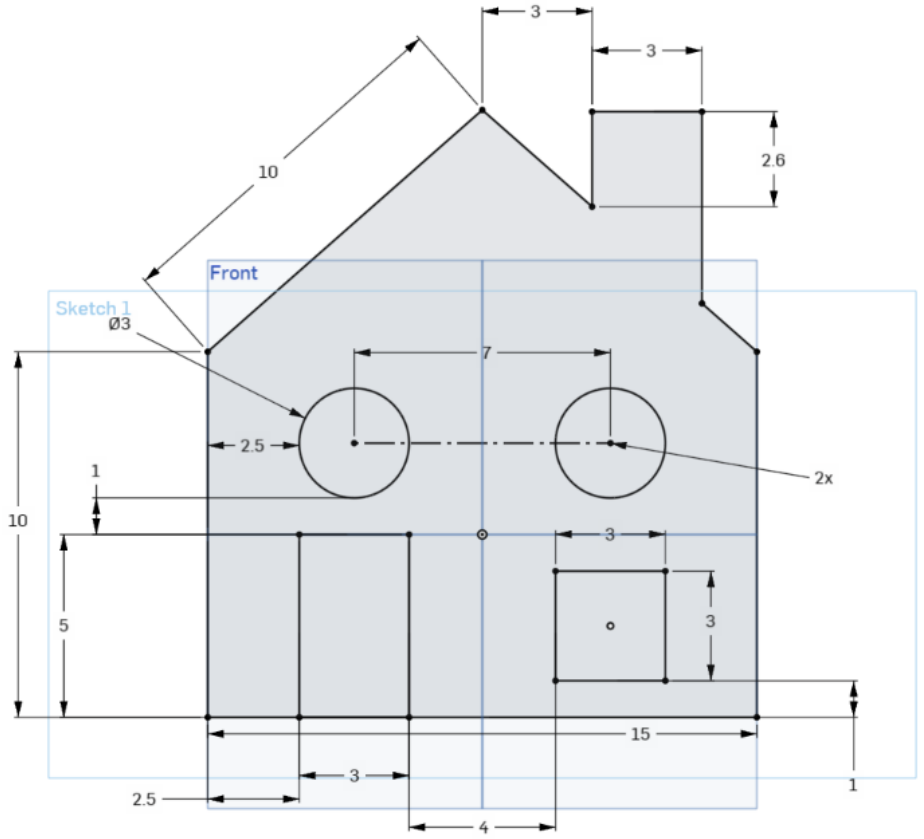
A **fully defined sketch** is when **all** the **sketch entities** are given dimensions and relationships. In a fully defined sketch, all the **lines/curves** will be **black** like the image on the right.



Practice Time: House

Sketches do **not** have a set of **rules** of how it should be done. Therefore, it depends on the user's knowledge/ **preferences**.

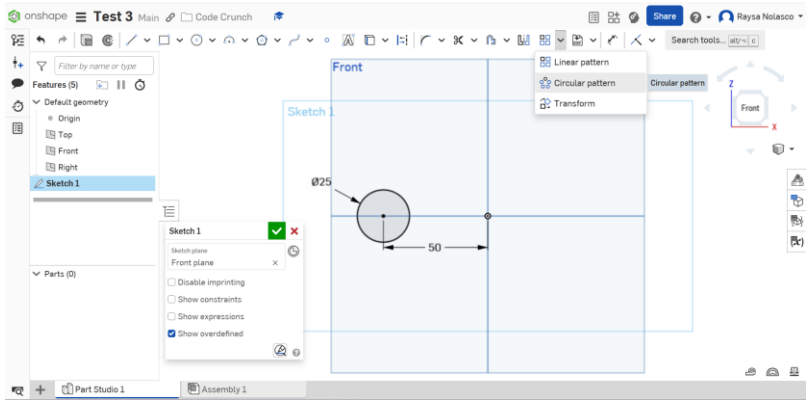
To **practice** your skills, try adding the different lines, squares, circles, and dimensions to the house that are missing.

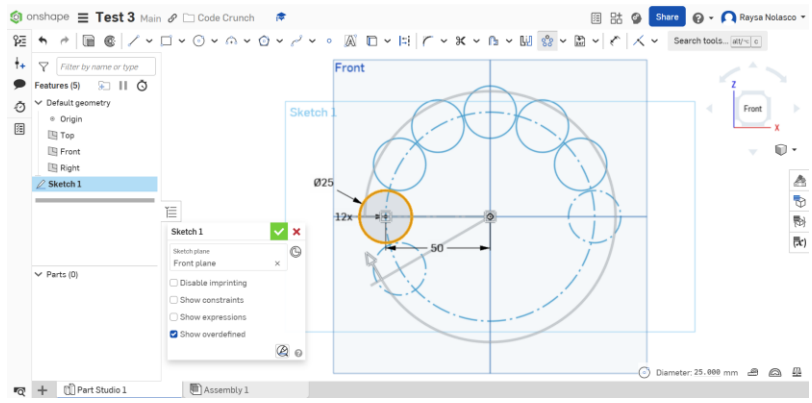


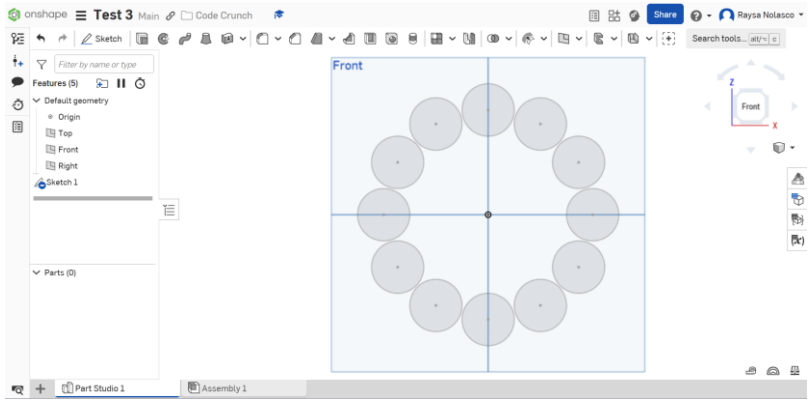
Sketching: Circular Pattern

A **circular pattern** allows you to create **replicas** of a sketch entity in a **circle**.

To use: click **“circular pattern”**, **select** the **entity** you wish to repeat, and specify **how many** copies. It will **automatically space** them out **evenly** in a circle. You can change how many degrees you would like the pattern to span out to.

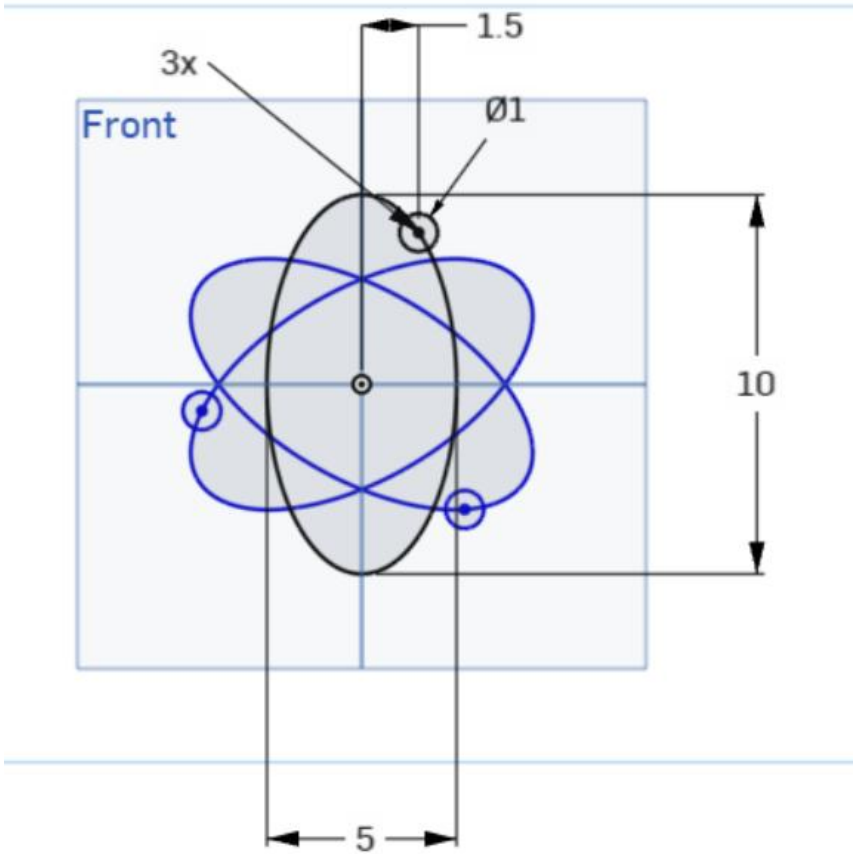






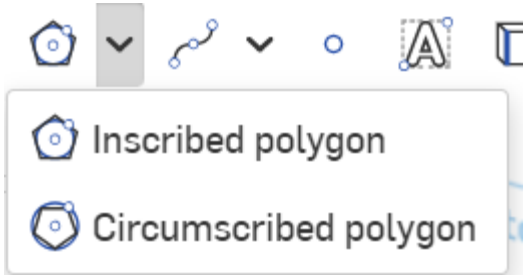
Practice Time: Atom

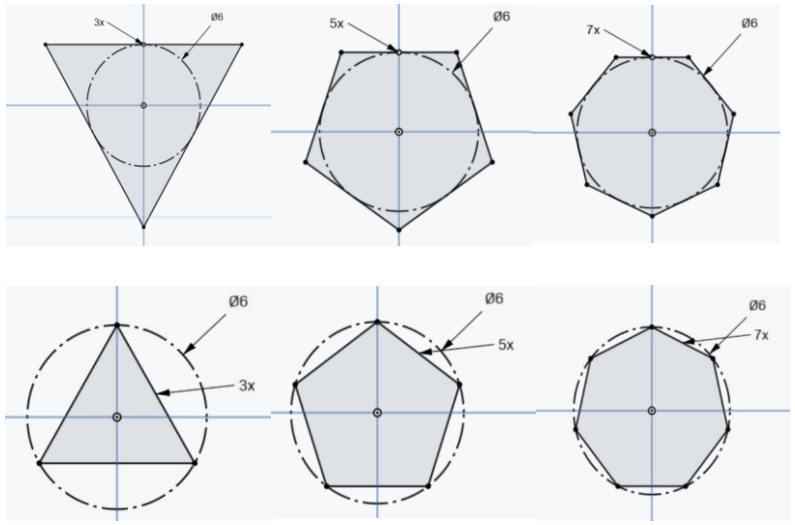
To **practice** your skills, try making the sketch of an **atom** like the one on the right and use **circular pattern**.



Sketching: Polygon

Instead of creating a polygon with the use of multiple lines, OnShape has a **polygon** tool that allows you to create a polygon by selecting the **number of sides** desired and **how big** the inner/outer circle of the polygon is.



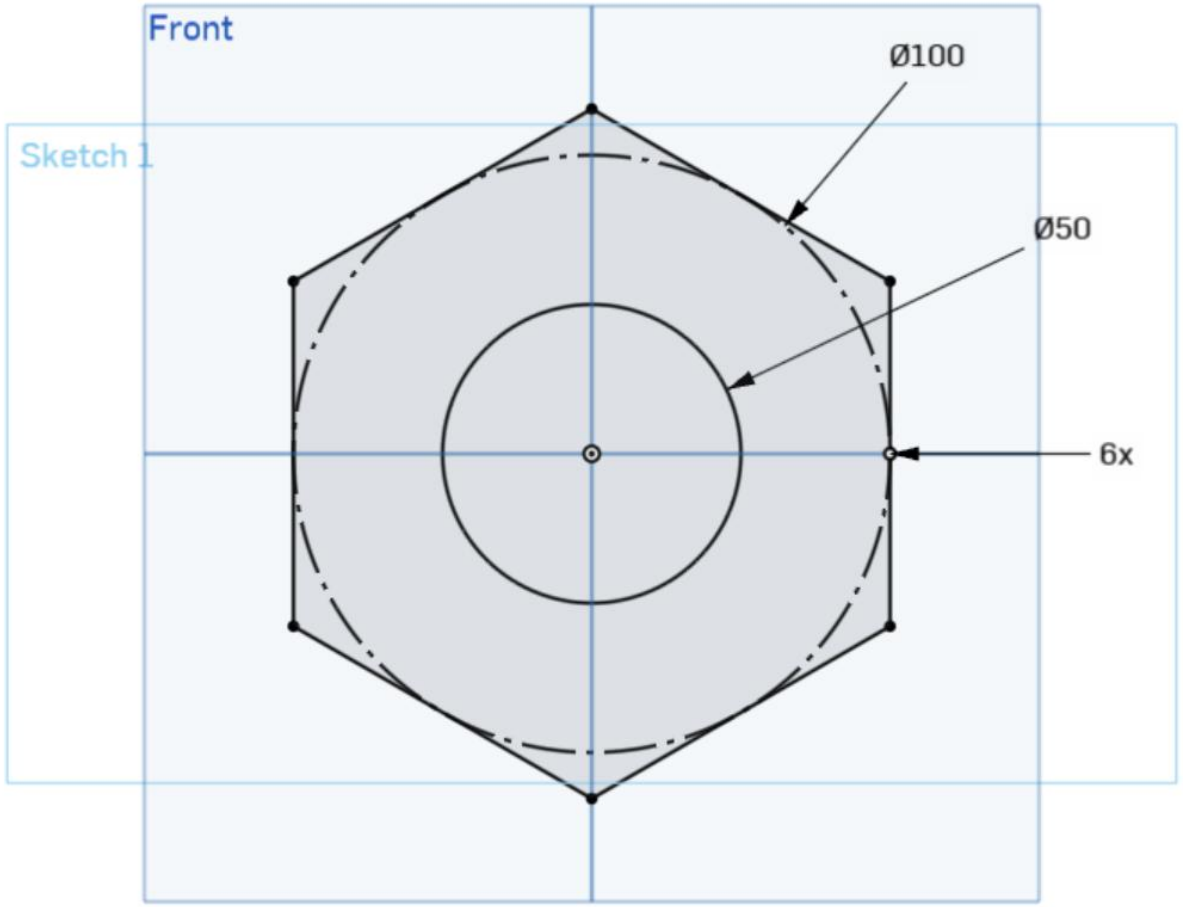


Inscribed Polygon: has a circle in the **inside** to adjust the size of the polygon.

Circumscribed Polygon: has a circle on the **outside** to adjust the size of the polygon.

Practice Time: Nut

To **practice** your skills, try making the sketch of a **nut** like the one on the right and use **polygon**.



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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