

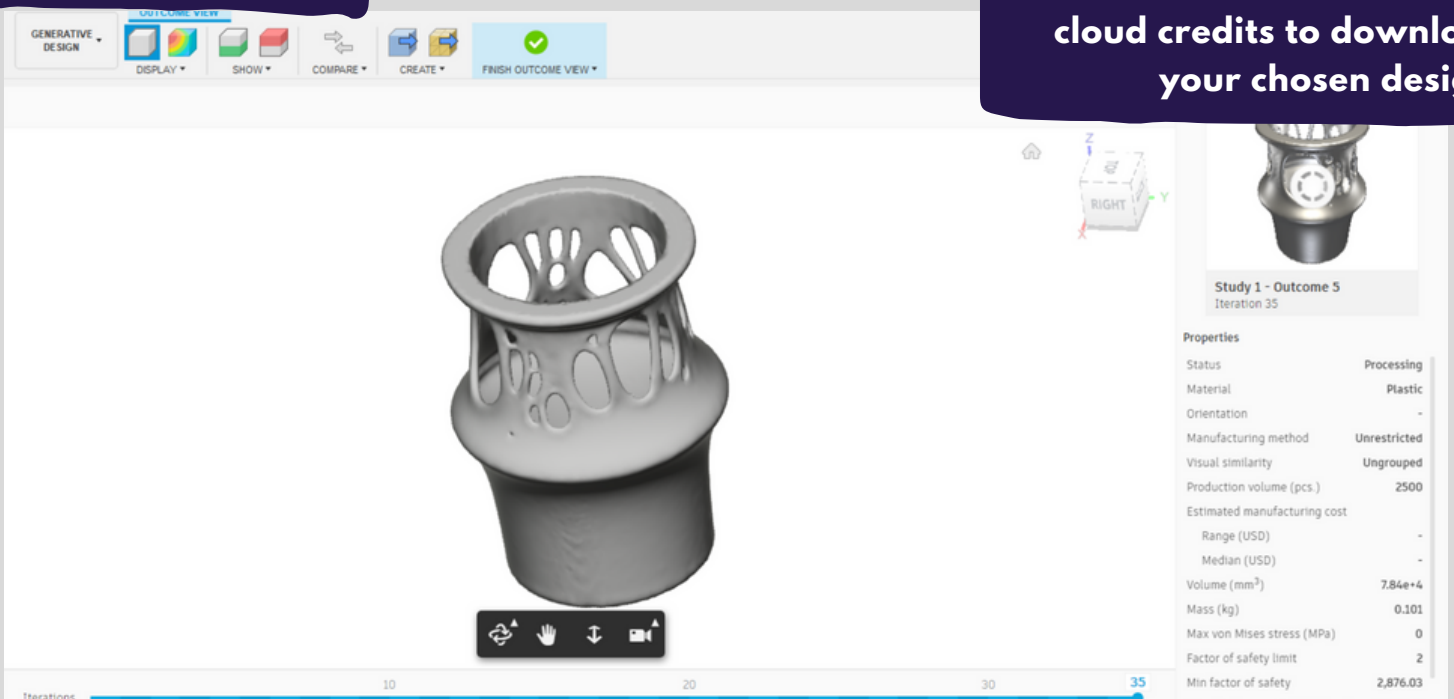
WHAT IS GENERATIVE DESIGN?

Technical Pointers

Cloud credits are a resource in Fusion 360 that can be used to process certain jobs. A hobbyist license starts with 300.

Generative design generate several models based off your design constraints and conditions. Basically once you've told the AI your constraints and design criteria it gives you several models that could all solve that design problem. The final product made by the process is editable and printable.

The Generative design process will set you back 25 cloud credits. It will cost 100 cloud credits to download your chosen design.

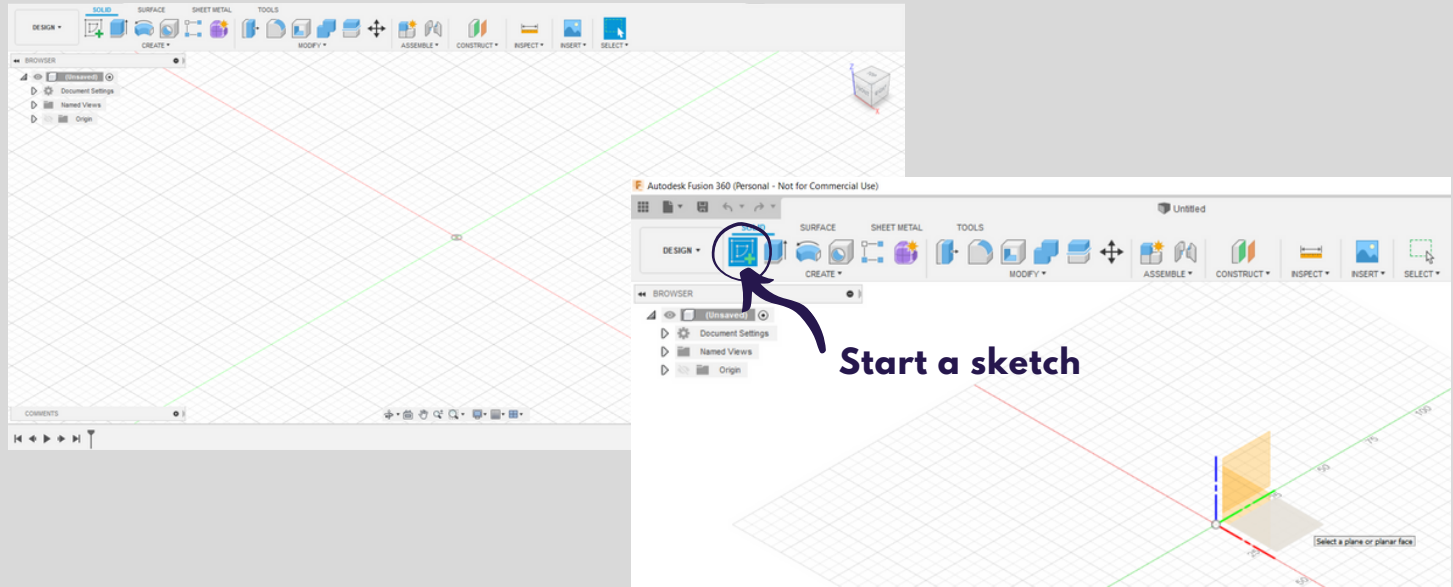


As Kevin Kenndy puts it:

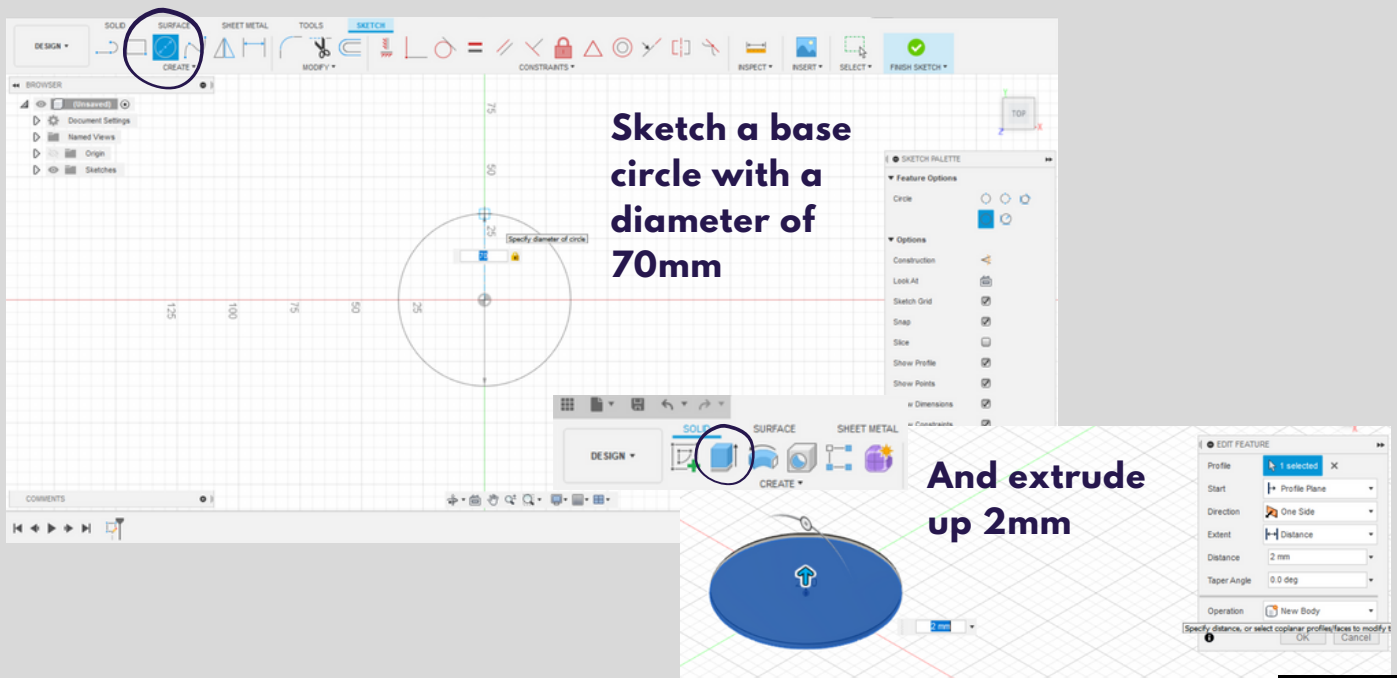
“You can think of generative design as a game of connect the dots. You need to define where the dots are placed and the computer will output as many solutions as possible based on the defined requirements. The computer, however, will not be able to change the placements of the dots.”

From Generative Design - Designing a STRONGER Chair in Fusion 360

CREATE A BASIC SHAPE

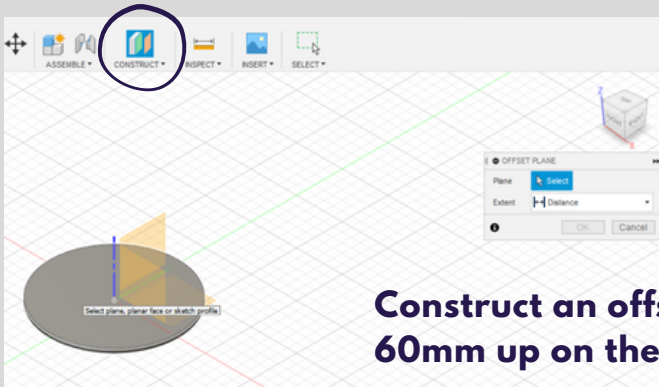


To start, sketch the absolute basics of the design you want – think about what the key components of your design are. For this pencil holder I'm considering the base and top edge essential to define a basic shape. There will also need to be an edge to hold of the pencils in.

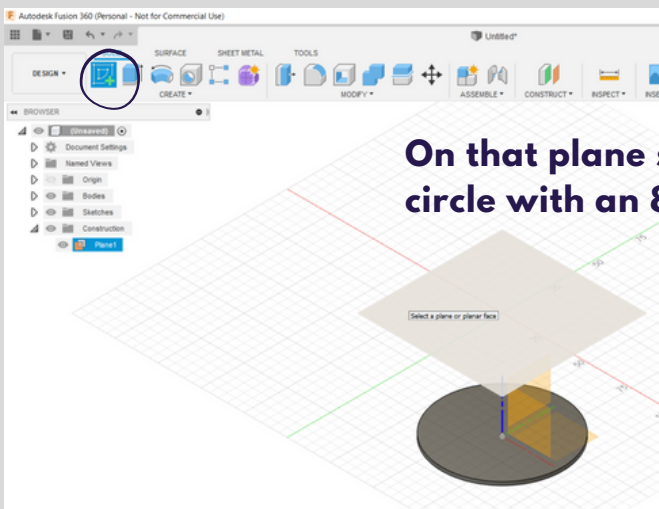
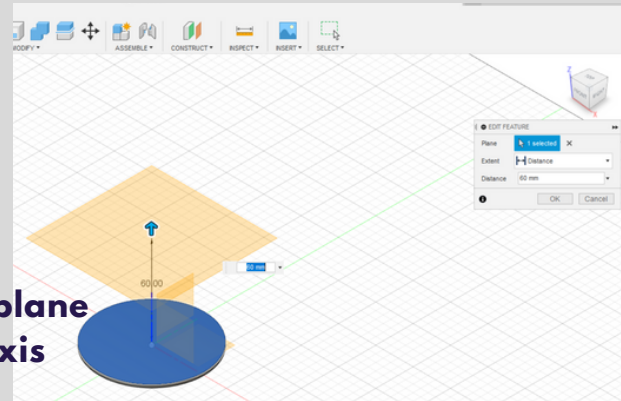




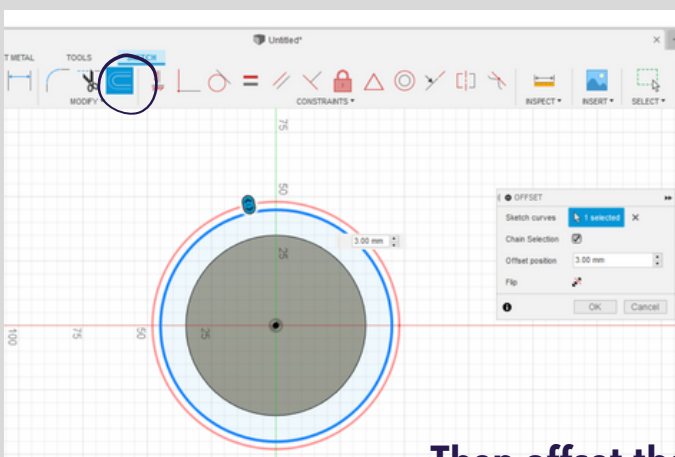
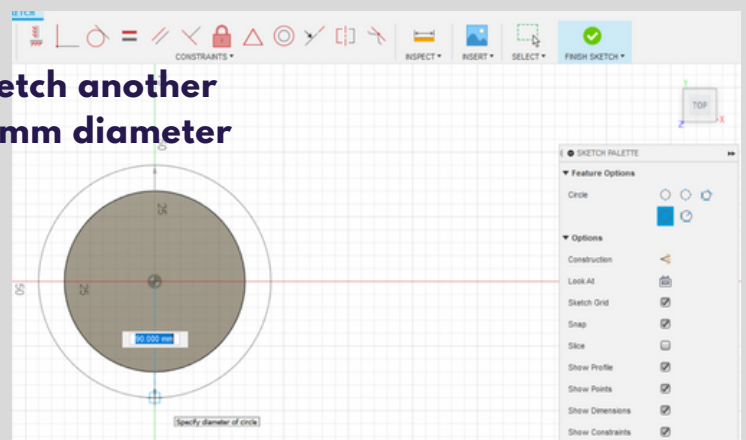
MAKE A RING



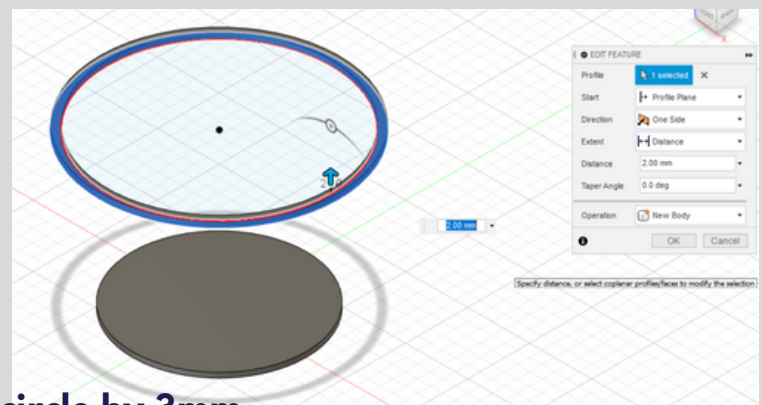
**Construct an offset plane
60mm up on the z axis**



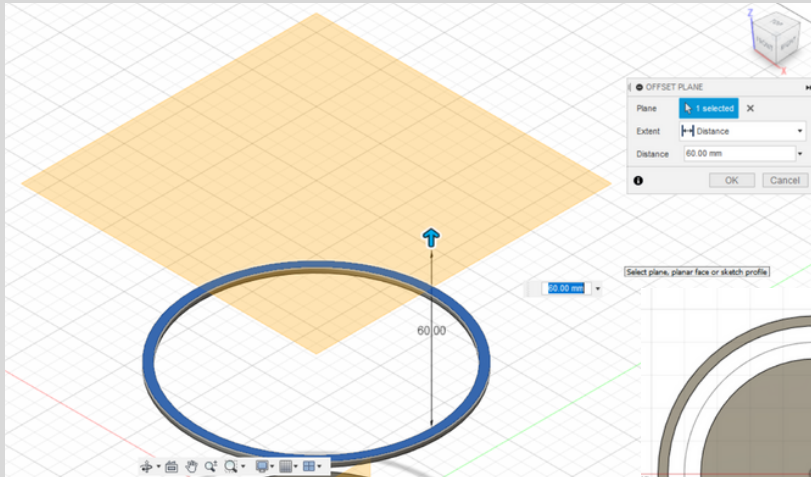
**On that plane sketch another
circle with an 80mm diameter**



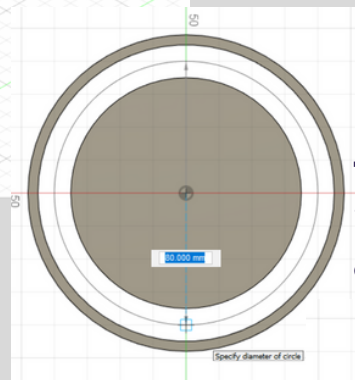
**Then offset the circle by 3mm
and extrude this ring up 3mm**



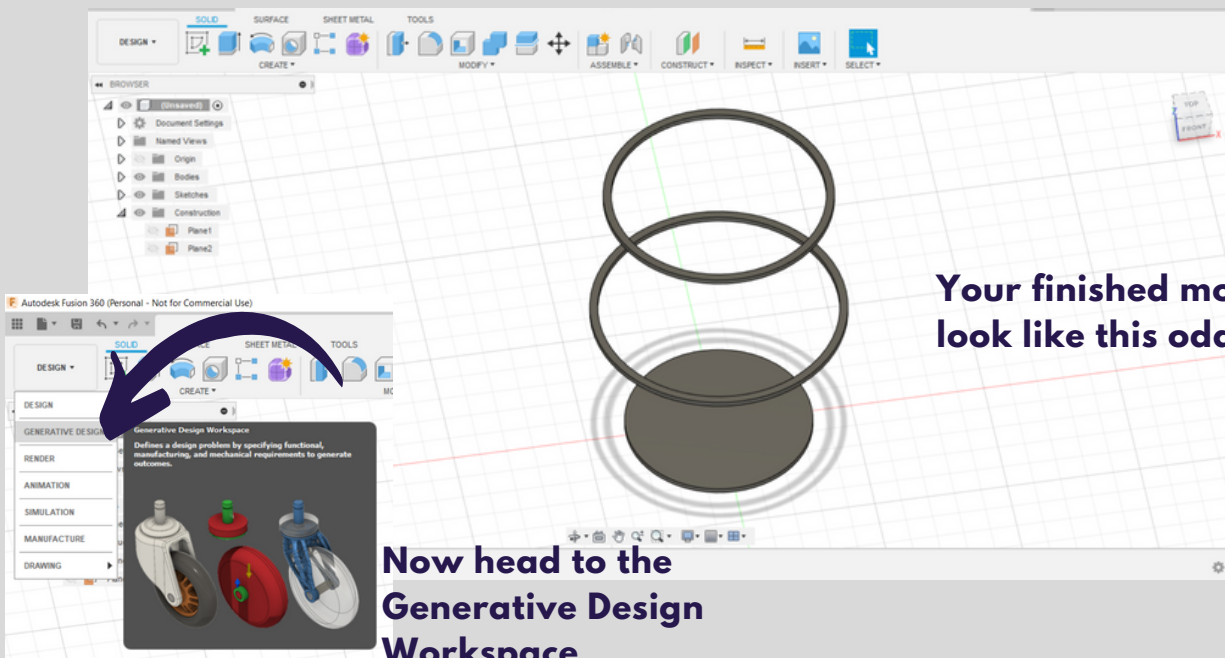
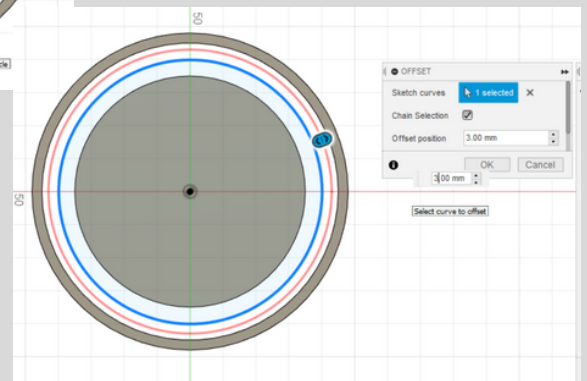
MAKE A SECOND RING



Next repeat the process for a second ring. Construct an offset plane 60mm up from the first ring on the z axis



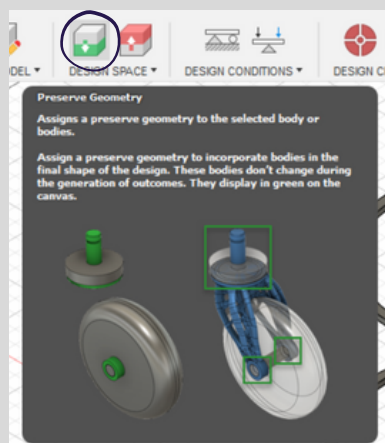
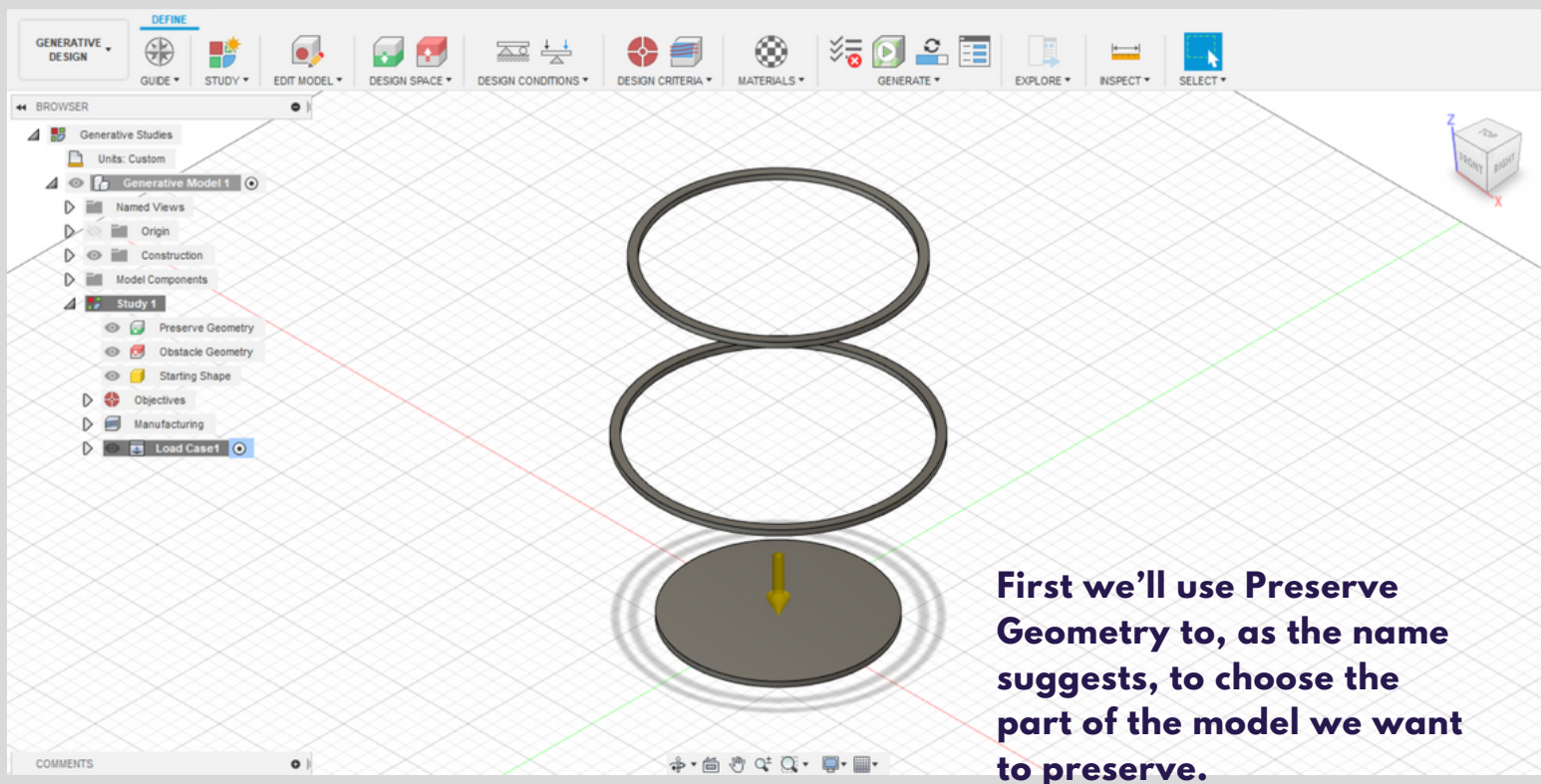
Then sketch a circle 70 mm in diameter and offset that circle by 3mm



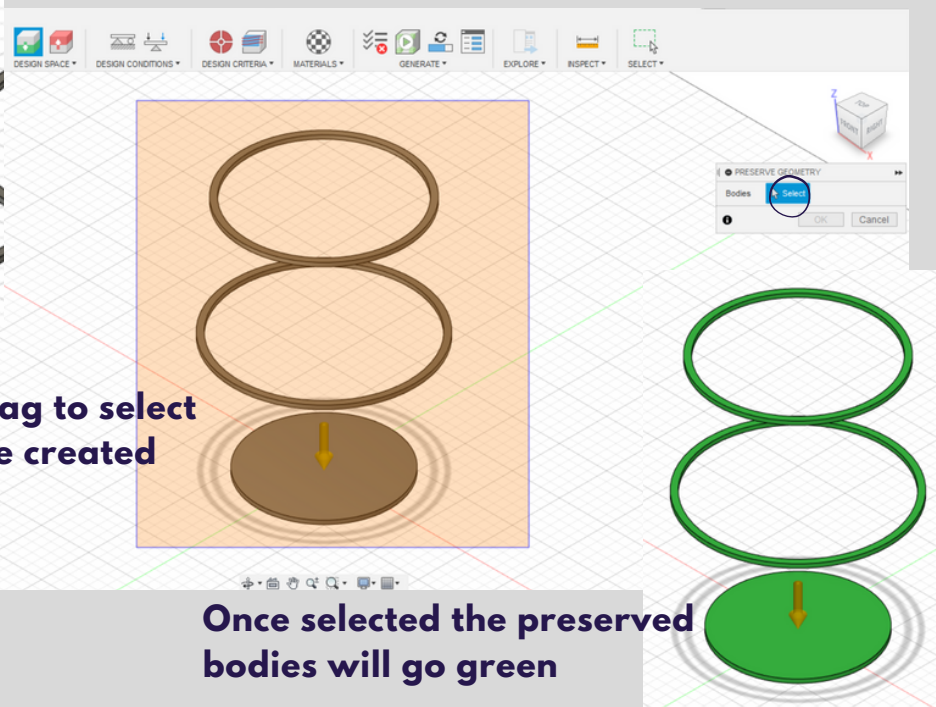
Your finished model should look like this odd thing

Now head to the
Generative Design
Workspace

PRESERVE GEOMETRY



Just click and drag to select all the bodies we created



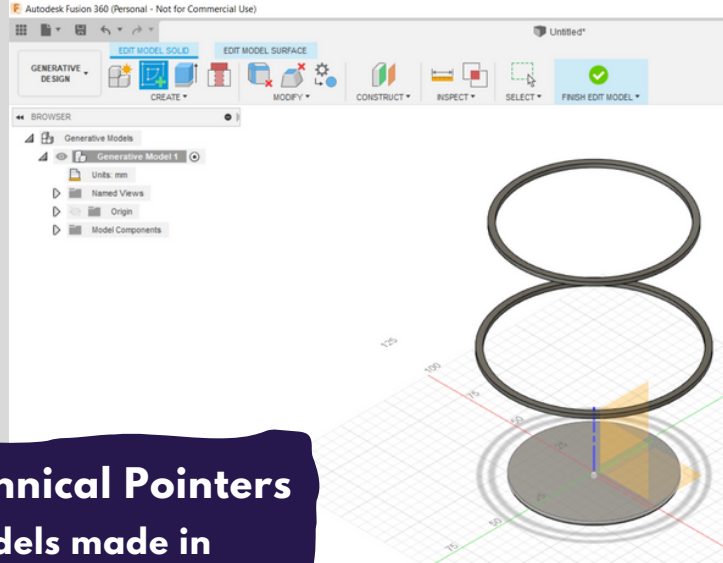
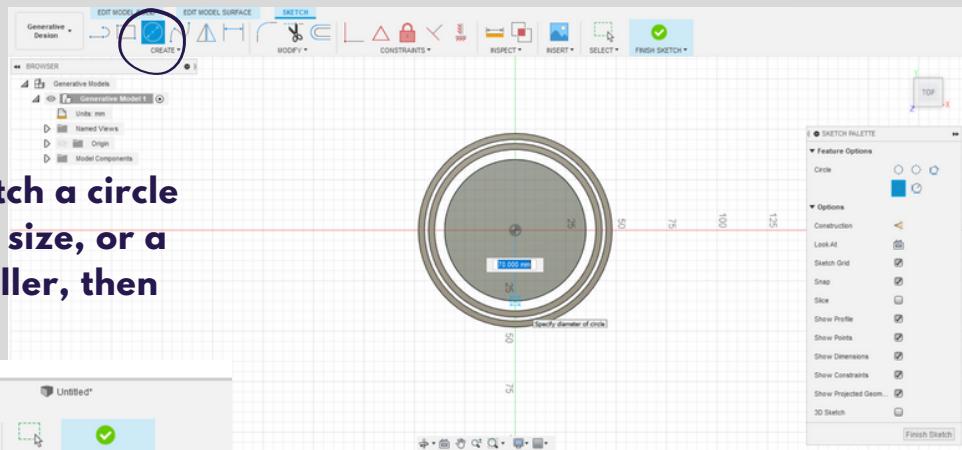
CREATE OBSTACLE GEOMETRY



First enter the
edit model menu

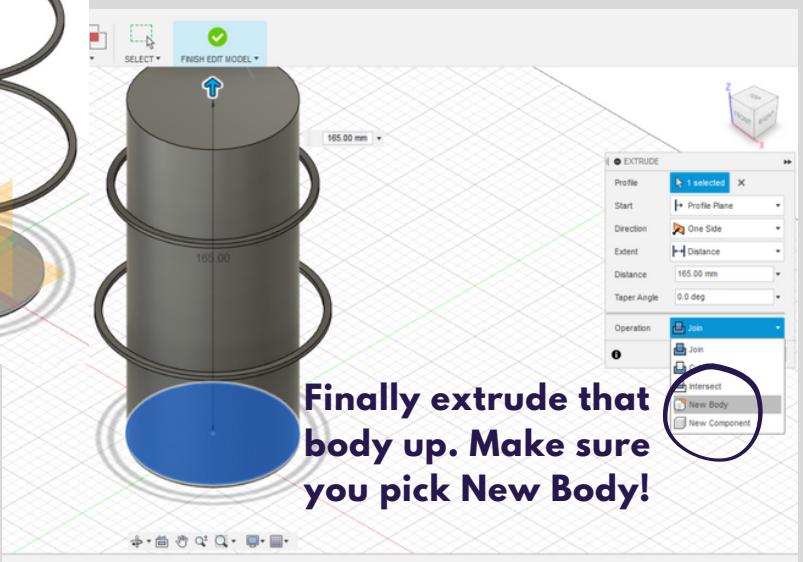
Now we're going to create geometry to
tell the program where to not generate
geometry. For this pencil holder we
need the center of the holder to remain
empty so we can fill it with pencils.

Then sketch a circle
the same size, or a
little smaller, then
our base

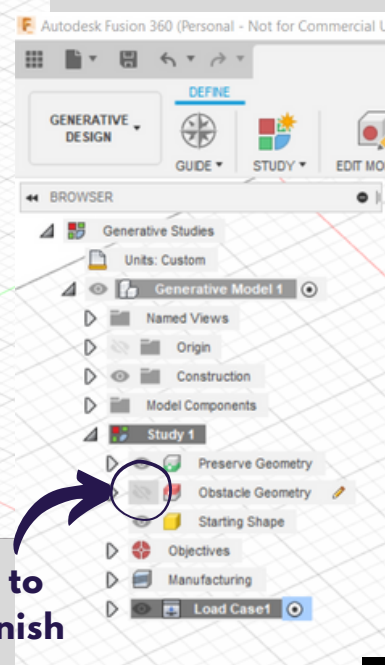
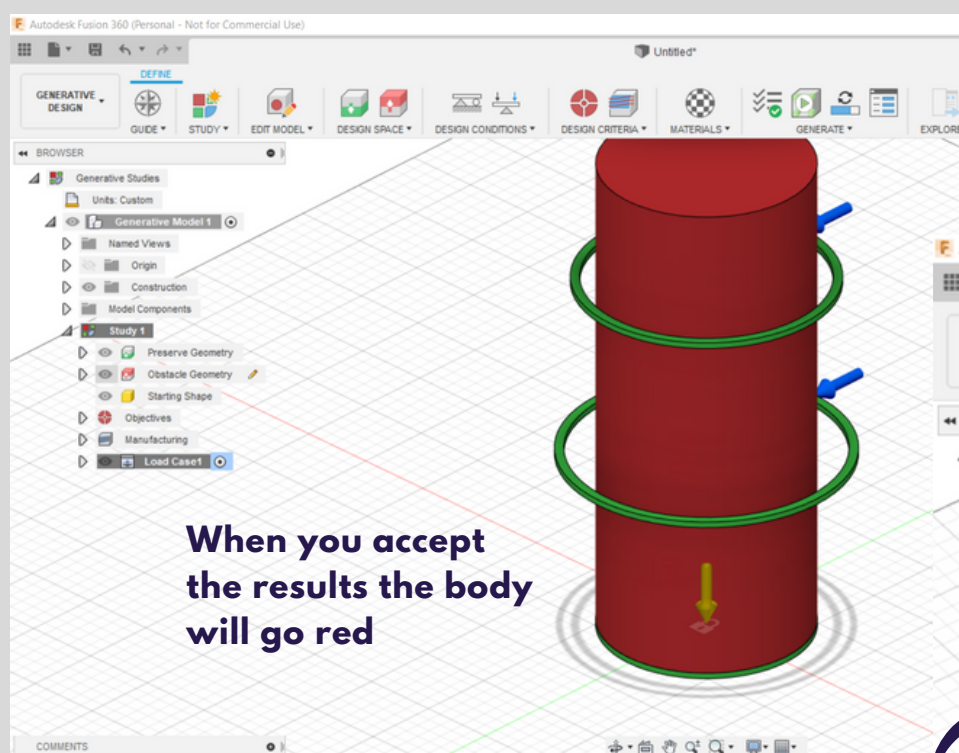
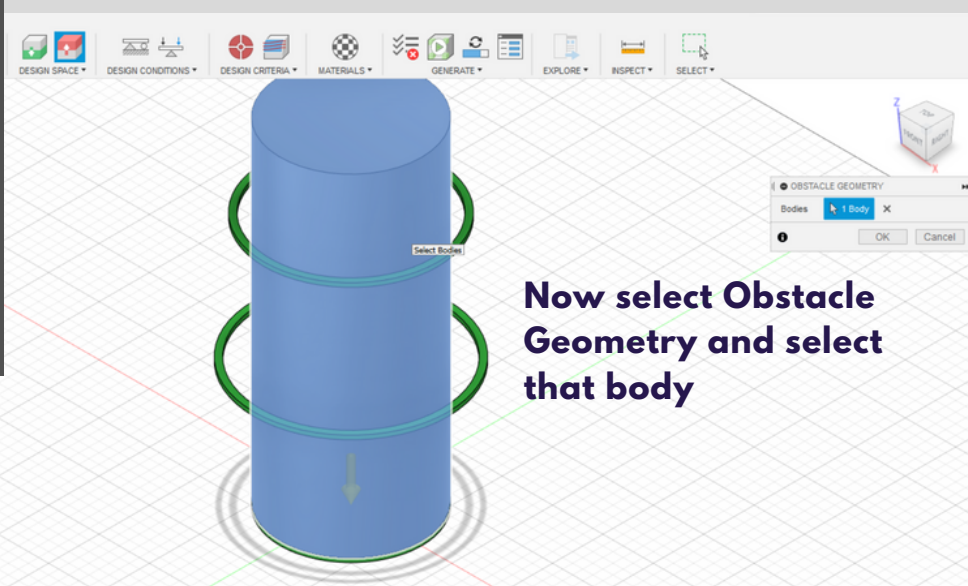
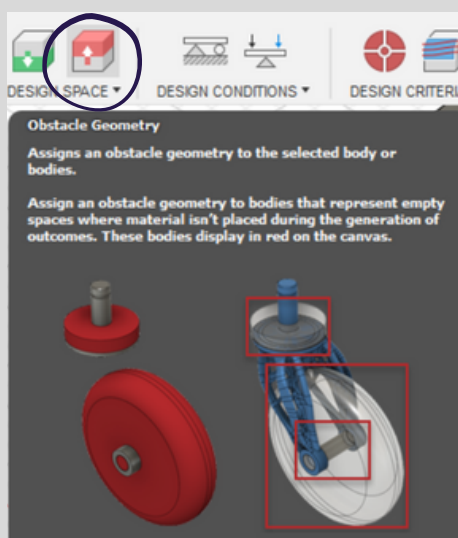


Technical Pointers
Models made in
the generative
design workspace
will not appear in
other workspaces

Finally extrude that
body up. Make sure
you pick New Body!

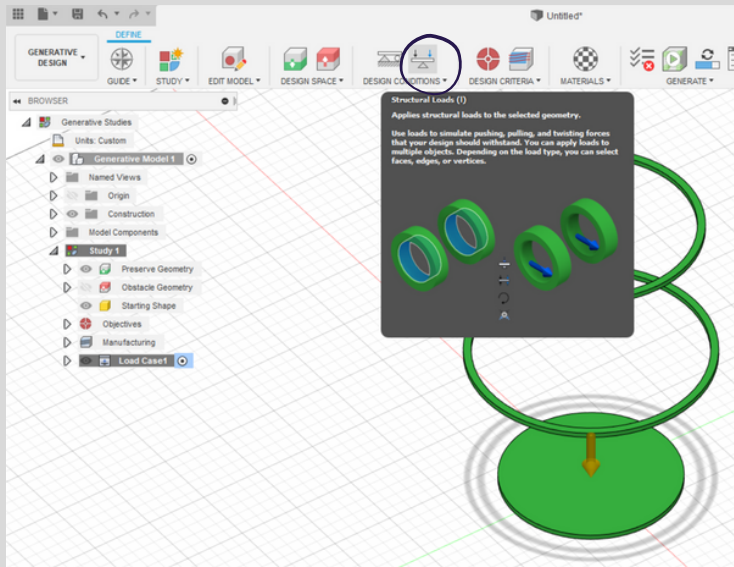


OBSTACLE GEOMETRY

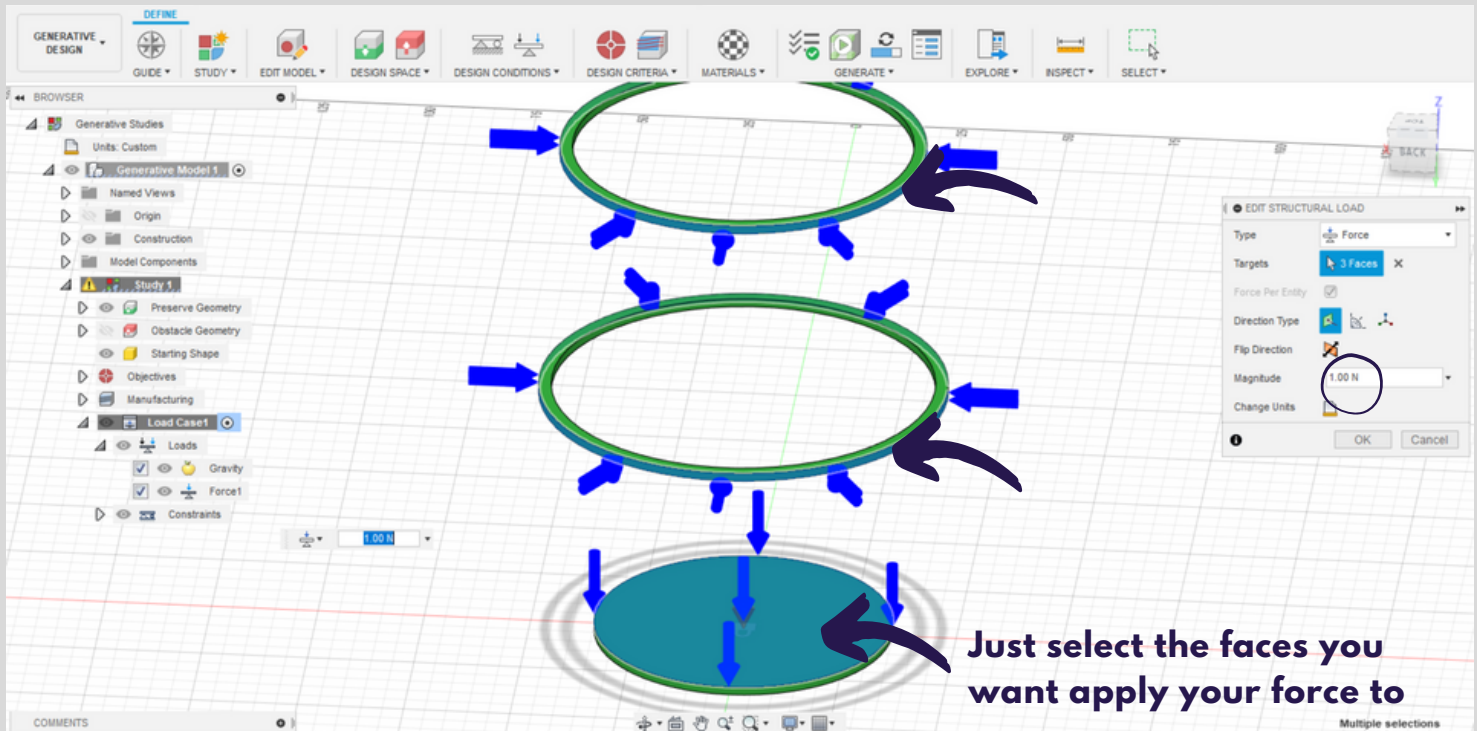


Now hide the body to make it easier to finish editing the model

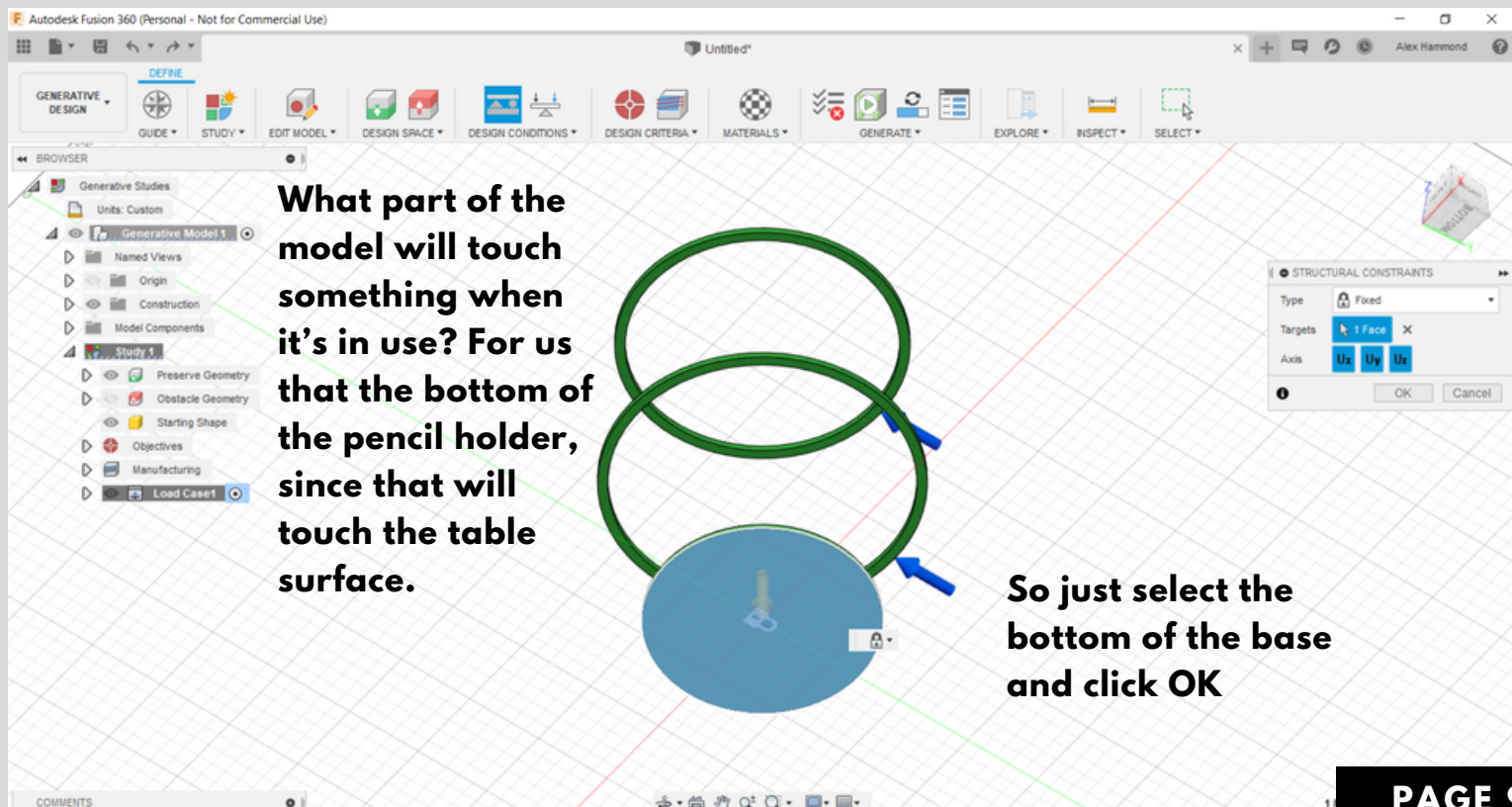
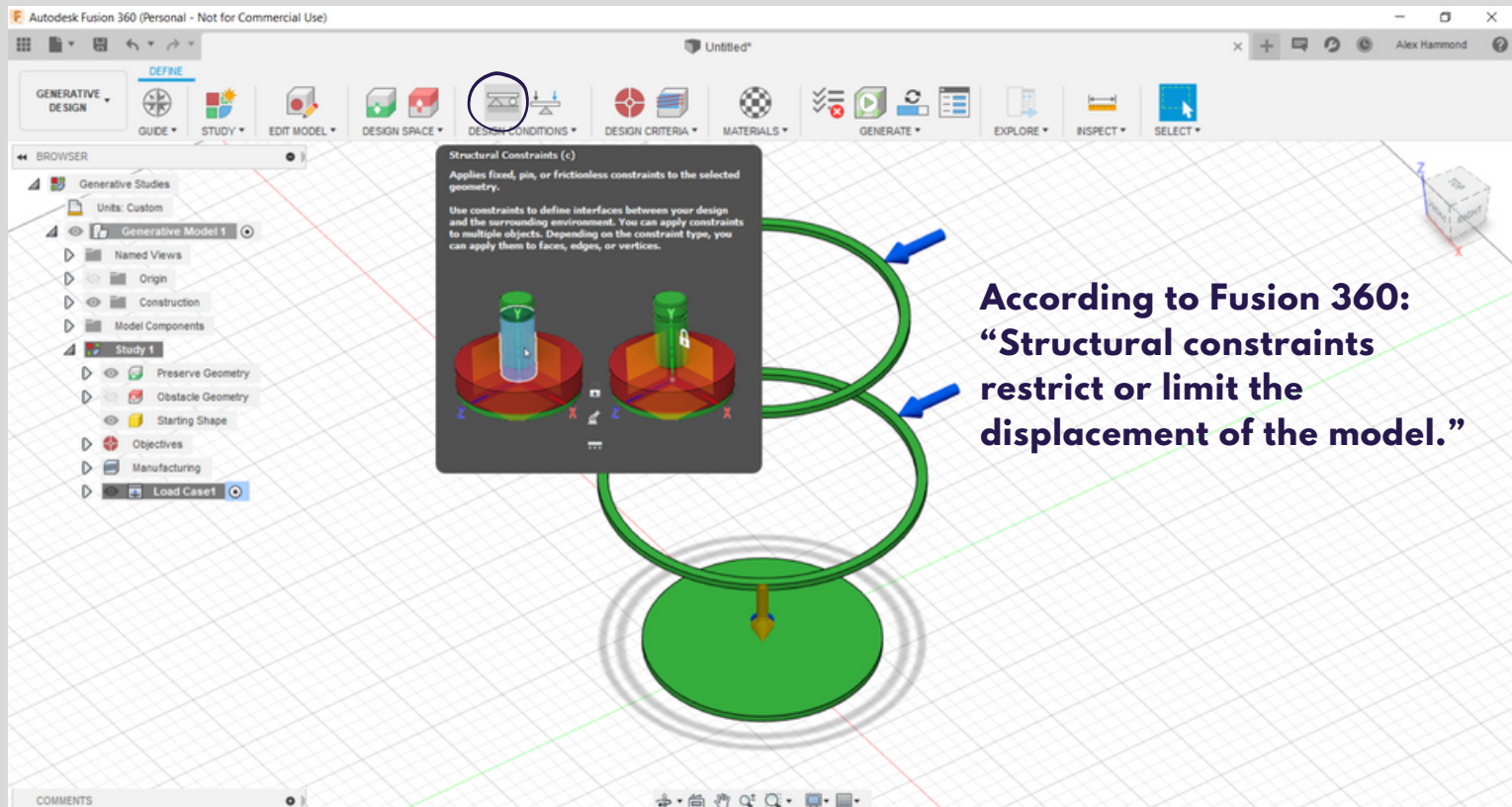
STRUCTURAL LOADS



Next we'll apply some Structural Loads to our model. To do this we'll need to think about how much force is being applied to the model. Since this is a pencil holder I'm going to put a rather small force of 1N on the outer rims and bottom of the holder in case the holder got dropped.

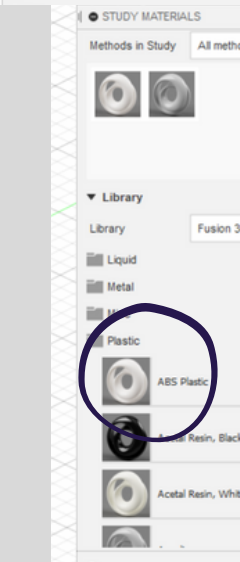
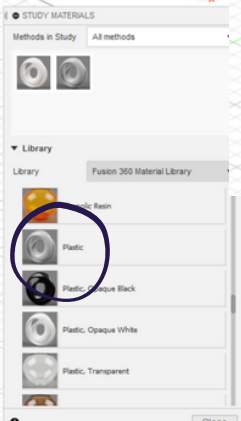
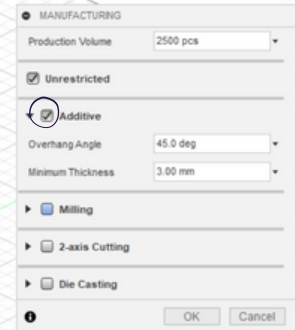


STRUCTURAL CONSTRAINTS



**MANUFACTURING
AND MATERIALS**

CITY OF
CANADA BAY
LIBRARIES
THE LEARNING
SPACE

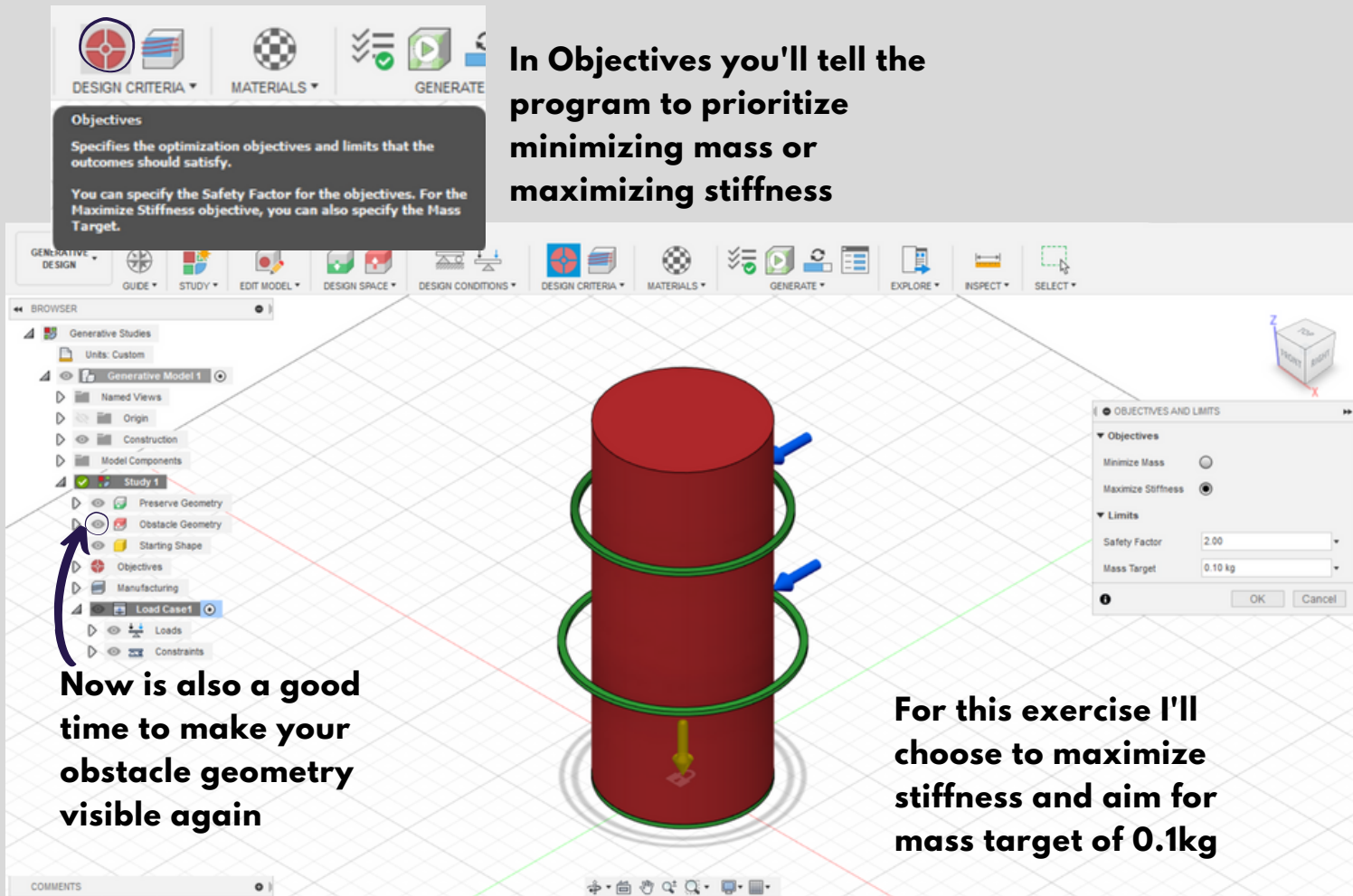


Technical Pointers
To find ABS you'll
need to change
the library to
Fusion 360
Material Library.

In the Materials tool you can choose which materials you'll make this model out of. We'll choose ABS plastic and plastic. Feel free to keep or remove the generic metal material.

OBJECTIVES AND LIMITS

In Objectives you'll tell the program to prioritize minimizing mass or maximizing stiffness



Objectives
Specifies the optimization objectives and limits that the outcomes should satisfy.

You can specify the Safety Factor for the objectives. For the Maximize Stiffness objective, you can also specify the Mass Target.

OBJECTIVES AND LIMITS

Objectives

- Minimize Mass
- Maximize Stiffness

Limits

- Safety Factor: 2.00
- Mass Target: 0.10 kg

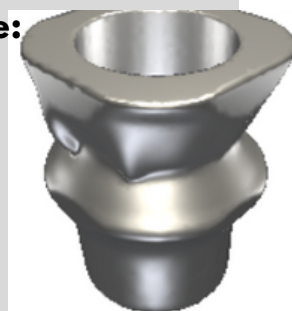
Now is also a good time to make your obstacle geometry visible again

For this exercise I'll choose to maximize stiffness and aim for mass target of 0.1kg

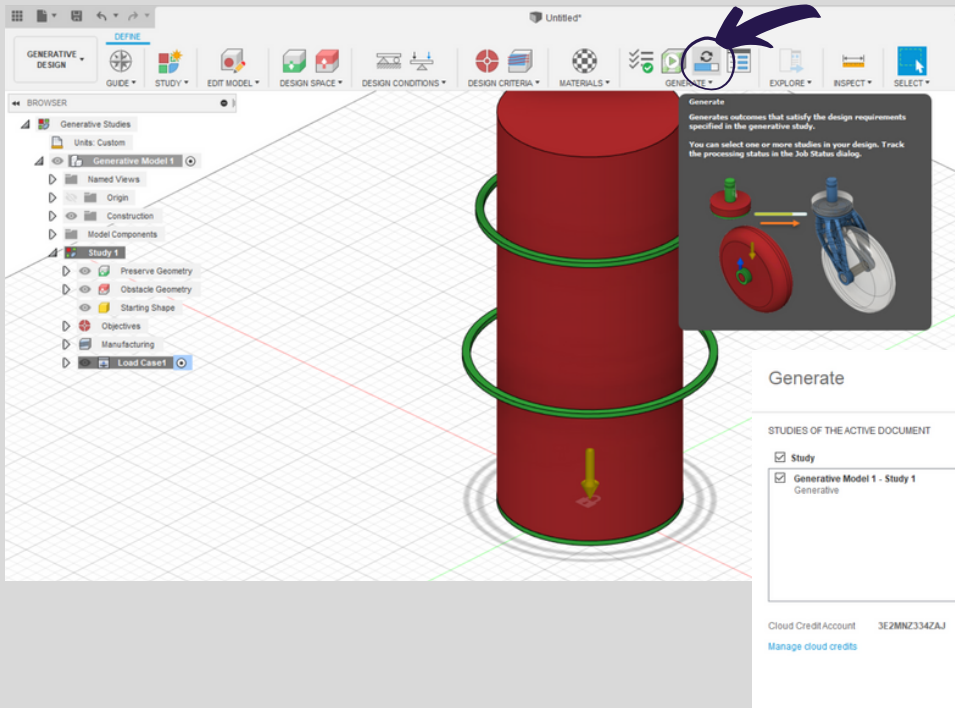
When you minimize mass you are much more likely to come out with results like these:



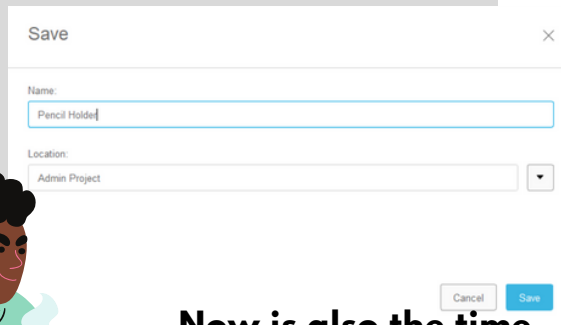
When you maximize stiffness you are much more likely to come out with results like these:



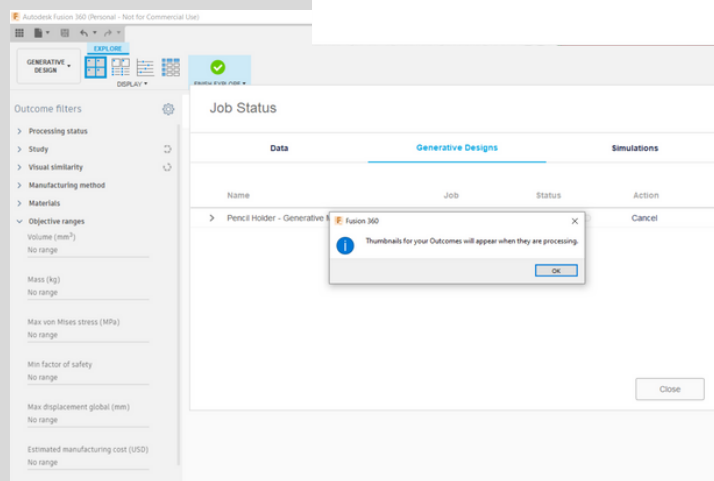
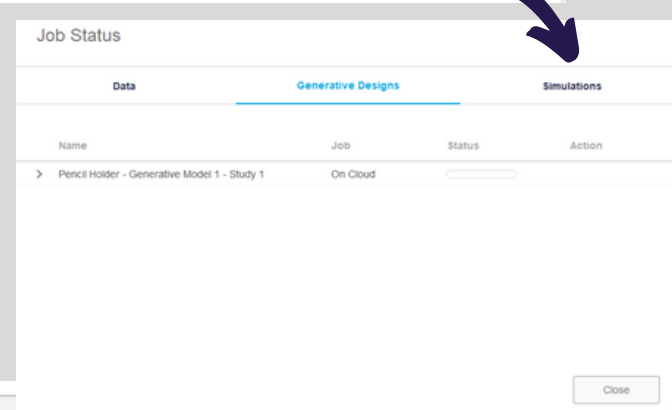
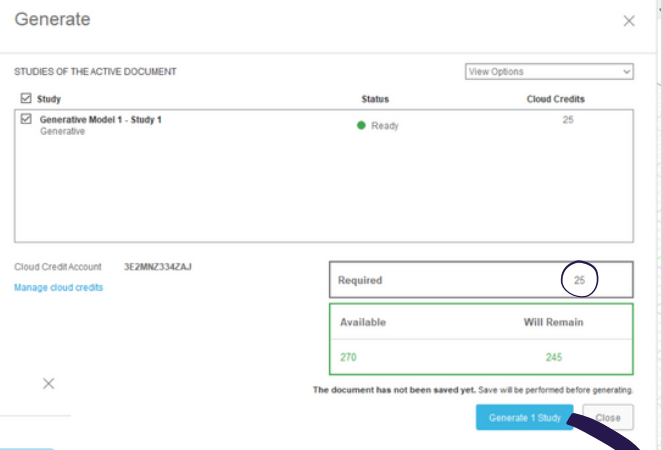
GENERATE - TIME FOR A CUPPA



Now it's time to hit the generate button and find another activity because this process will take some time.



Now is also the time you'll be asked to save if you haven't already!



GENERATE AND EXPORT

EXPLORE

GENERATIVE DESIGN | DISPLAY | FINISH EXPLORE

Outcome filters

- Processing status
- Study
- Visual similarity
- Manufacturing method
- Materials
- Objective ranges

Volume (mm³)
7.84e+4 | 1.475e+5

Mass (kg)
0.101 | 0.19

Max von Mises stress (MPa)
Nominal

Min factor of safety
1,889.63 | 5,681.78

Max displacement global (mm)
5.609e-5 | 0.01

Estimated manufacturing cost (USD)
52 | 116

Sort by: Processing status

Converged

Study 1 - Outcome 1 Converged

Study 1 - Outcome 2 Converged

Study 1 - Outcome 3 Converged

Study 1 - Outcome 4 Converged

Study 1 - Outcome 5 Converged

Study 1 - Outcome 6 Converged

Study 1 - Outcome 7 Converged

Study 1 - Outcome 8 Converged

The gallery will look like this when it's finished.

While a model is being generated you can preview it.

OUTCOME VIEW

GENERATIVE DESIGN | DISPLAY | SHOW | COMPARE | CREATE | FINISH OUTCOME VIEW

You are viewing the Design Preview

When you open a design you'll get a preview

Study 1 - Outcome 5 Iteration 35 (final)

Properties

Status	Converged
Material	Plastic
Orientation	-
Manufacturing method	Unrestricted
Visual similarity	Unique
Production volume (pcs.)	2500
Estimated manufacturing cost	
Range (USD)	52 - 96
Median (USD)	81
Volume (mm ³)	7.84e+4
Mass (kg)	0.101
Max von Mises stress (MPa)	0
Factor of safety limit	2
Min factor of safety	2,876.03
Max displacement global (mm)	2.023e-4

Create a design from this outcome

☒ Show cloud credit costs and balances

Process this outcome and open it in a separate tab as a design. This process may take a few minutes. When it's ready, click the green status button in the upper-left corner to open the design.

Cloud Credit Account: 3E2MNZ334ZAJ
[Manage cloud credits](#)

Required	100
Available	Will Remain
245	145

Create design | Cancel

If you like what you see press Design from Outcome button.

Design from Outcome

Creates a 3D design which you can edit, from the current outcome's iteration.

To track the job status, view the color buttons in the top left corner of the view. When the design is ready, open it on another tab and edit using T-Spline tools.