

Onshape Parametric design: Lego-blocks

1. Define the dimensions of a Lego-block

There are two options to find your Lego-block dimensions.

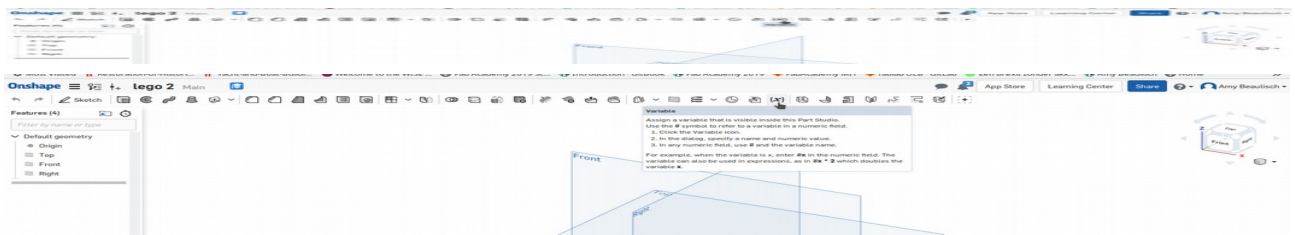
1. You take a Lego-block and measure it yourself
2. You use the online Lego-cheat sheet. And multiply the dimensions by 1.6mm. See table.

All measurements in Lego Units (1.6 mm)

Lego Unit	mm
0.75	1.2 mm
1.00	1.6 mm
1.5	2.4 mm
2.00	3.2 mm
3.00	4.8 mm
3.50	5.6 mm
4.07	7.52 mm
5.00	8 mm
6.00	9.6 mm

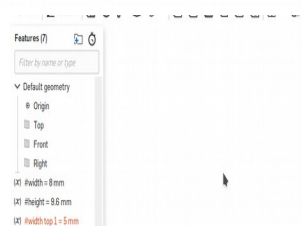
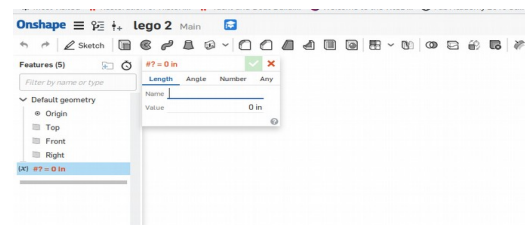
2. Define your parameters in Onshape

First of all, you need to know where the parameters are in Onshape. If you open a new document, you can find the variable symbol in your toolbar



When you click on this icon, a new window is being opened. For starters, we will define our basic dimensions.

- * width
- * length
- * height
- * diameter_{tap}
- * height_{tap}
- * shell



The values can be found on the cheat sheet or made up, but those are your dimensions.

Note: if the defined variable stays in red, the variable is not recognized. Don't use spaces, but use underscores instead.

Note: give meaningful names to your parameters.

3. Draw the sketch

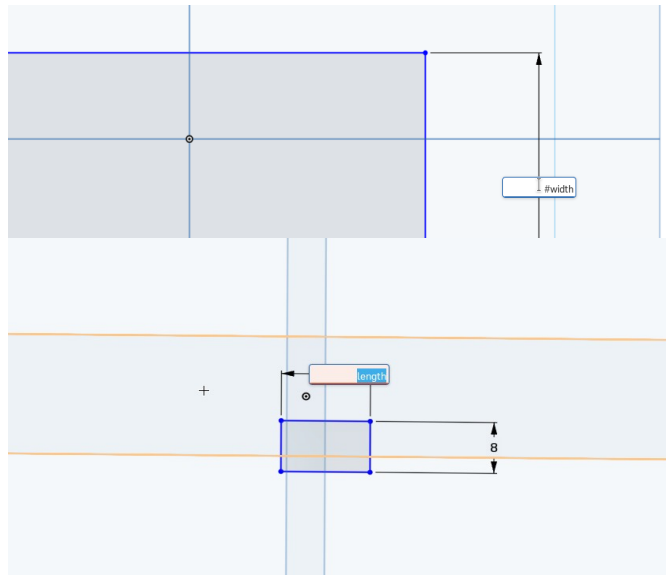
Step 1: Draw the sketch of the Lego-block.
Start with the base of the block, not the taps. If you want to give the sketch a dimension, use the variables that you set up before.

Note that each variable is being called upon by adding a # in front of it.

If the dimension stays in red, it has 3 possibility's

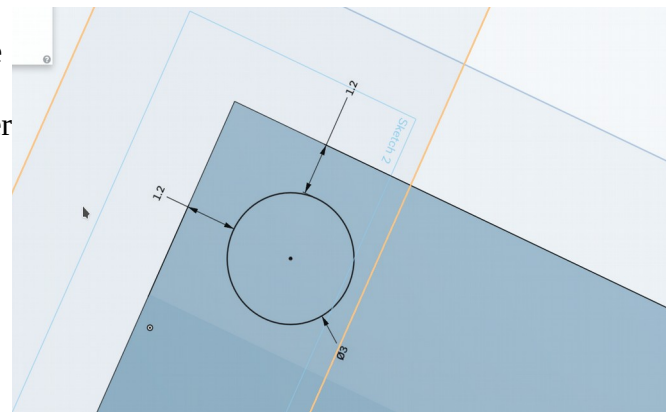
1. a typo
2. it doesn't exist
3. a missing #

After you have done this, extrude the block with the right pre-declared variable.



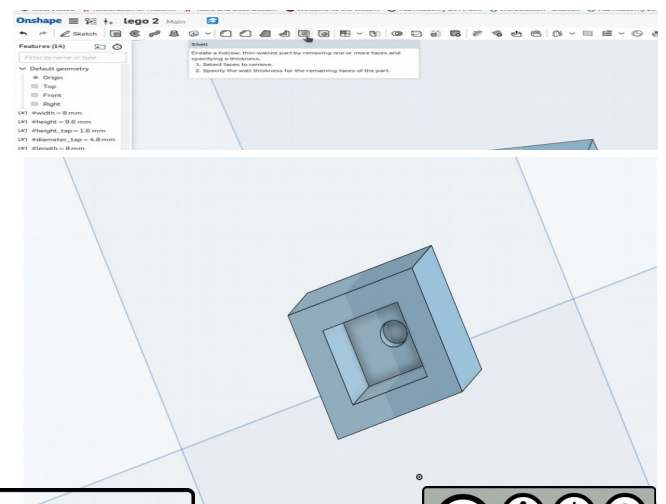
Step 2: Draw the tap

Create a new sketch and draw the circle. Use the pre-declared variables for the tap. You can connect the tap to the Lego block by using other non-pre-declared dimensions.



Step 3: Create the shell

As we all know, a Lego-block is empty inside. To create this, we won't use a boolean function but the shell function. Use the shell function and select the bottom of your part.



4. Pattern as you wish

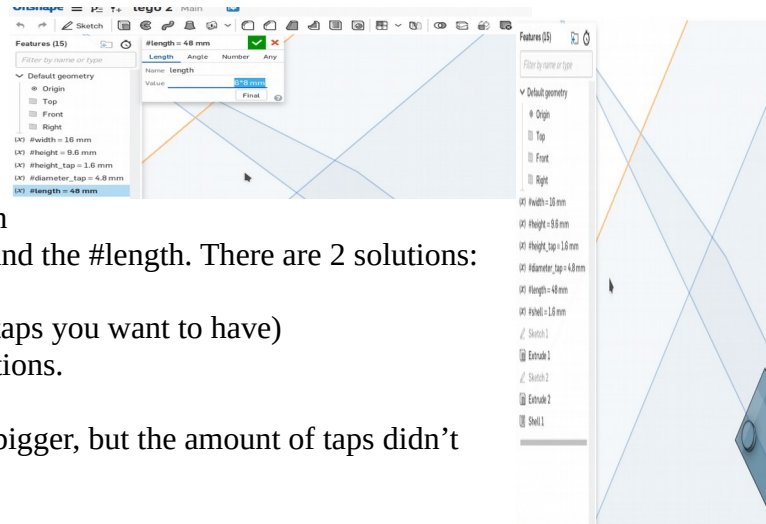
Step 4: Adjust the size of the Lego base
The one tap Lego-blocks are fun, but you can't really build things with it. So let us add some taps.

A thing to know, always use a multiple of 8 for the base (or 5 Lego Units). With that number you can change the #width and the #length. There are 2 solutions:

1. #width with a multiple of 8
2. #width $8*3$ (with x amount of taps you want to have)

For the length, we use the same calculations.

You can see now that our base became bigger, but the amount of taps didn't change. Let's adjust those.

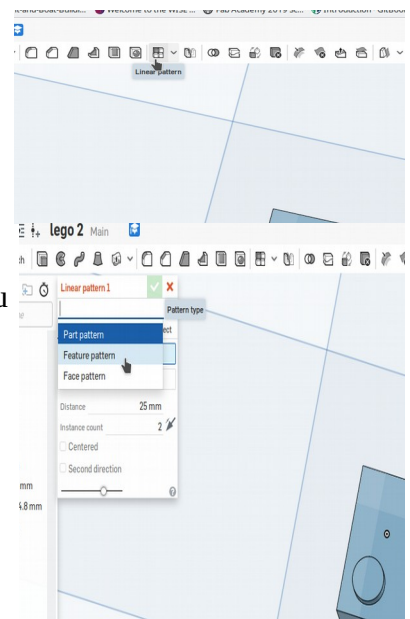


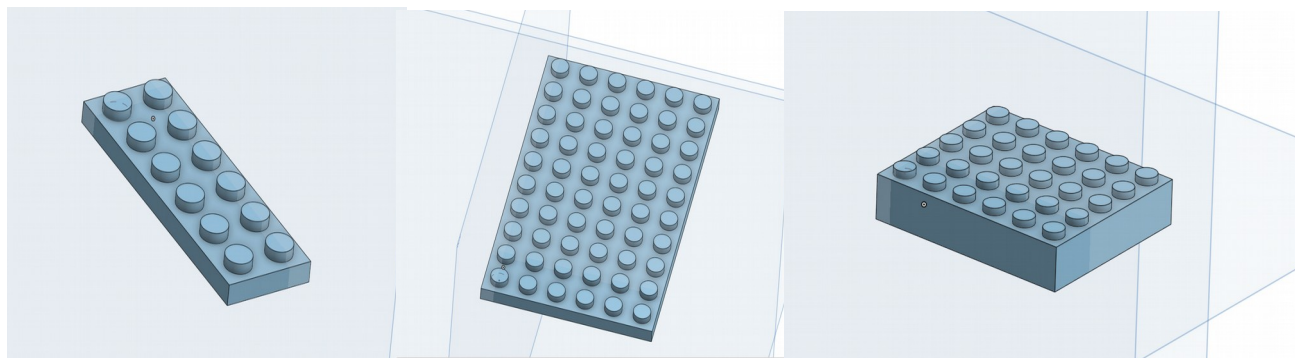
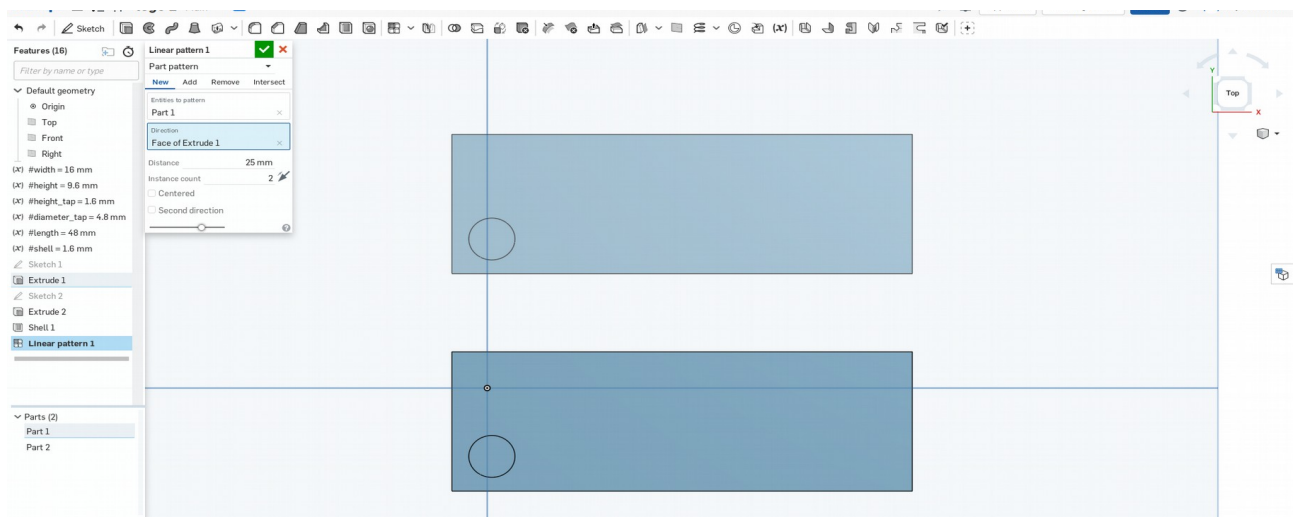
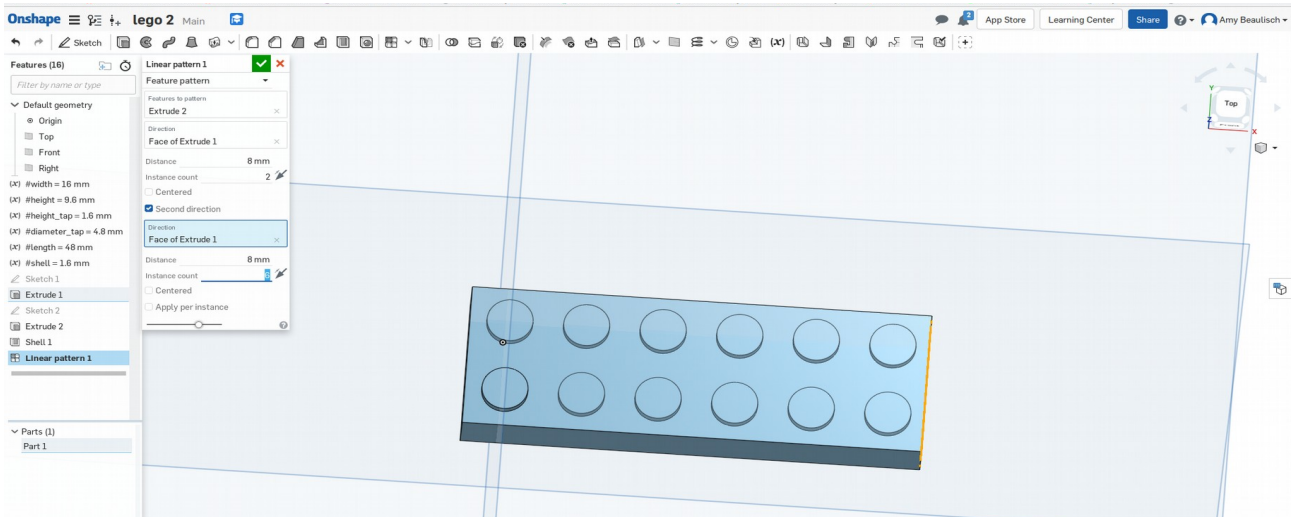
Step 5: Adjust the taps

Use the 'pattern' function from your toolbar. You can use the linear pattern function, but you have to adjust to 'feature pattern'. Otherwise you will keep copying the part in total and not just the taps.

As you can have multiple rows of taps on a Lego-block, use the second direction option when making the Lego-block. It will let you adjust all the taps at once.

Note: as you might have notice, the shell function only affected the first tap and the main body. Move the shell function down to let it affect all taps.





Note: if you go from the middle picture (10 x 6) to the last one (6x5) the pattern is still the same as in the middle picture, but not visible. You only have to change the with and length there (and height).

5. Interesting background info

1. <https://www.onshape.com/videos/patterns-in-onshape-04-20-17>