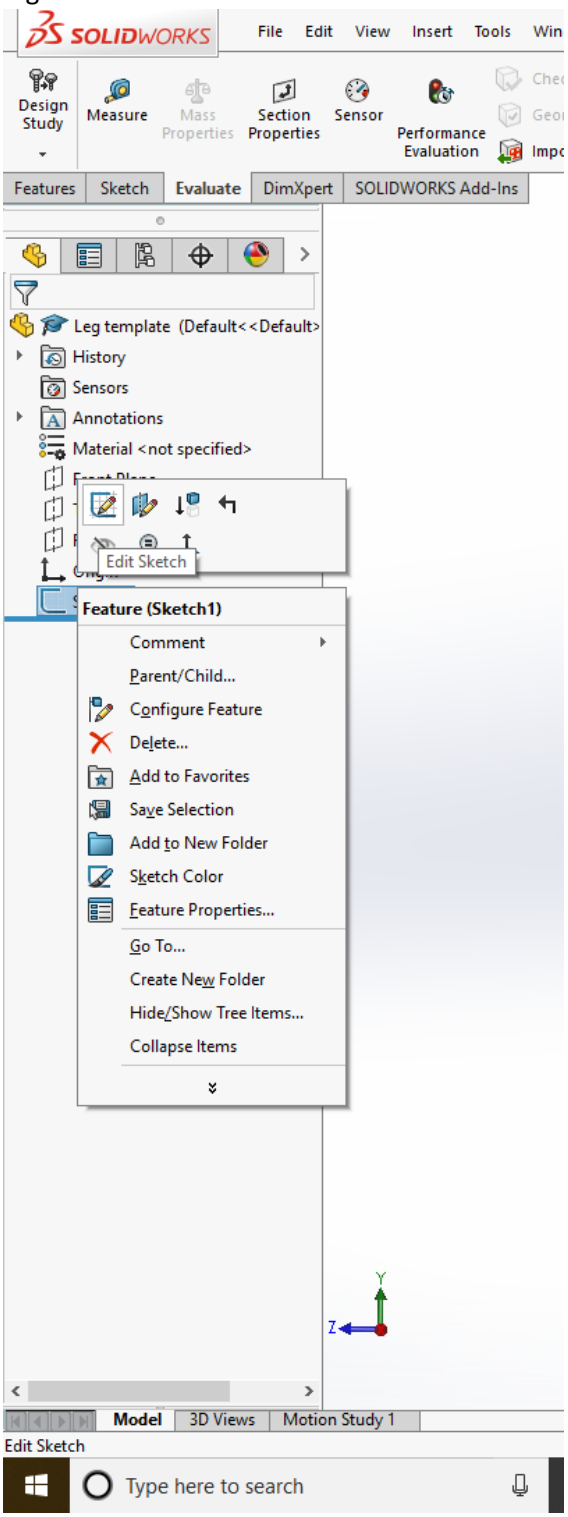
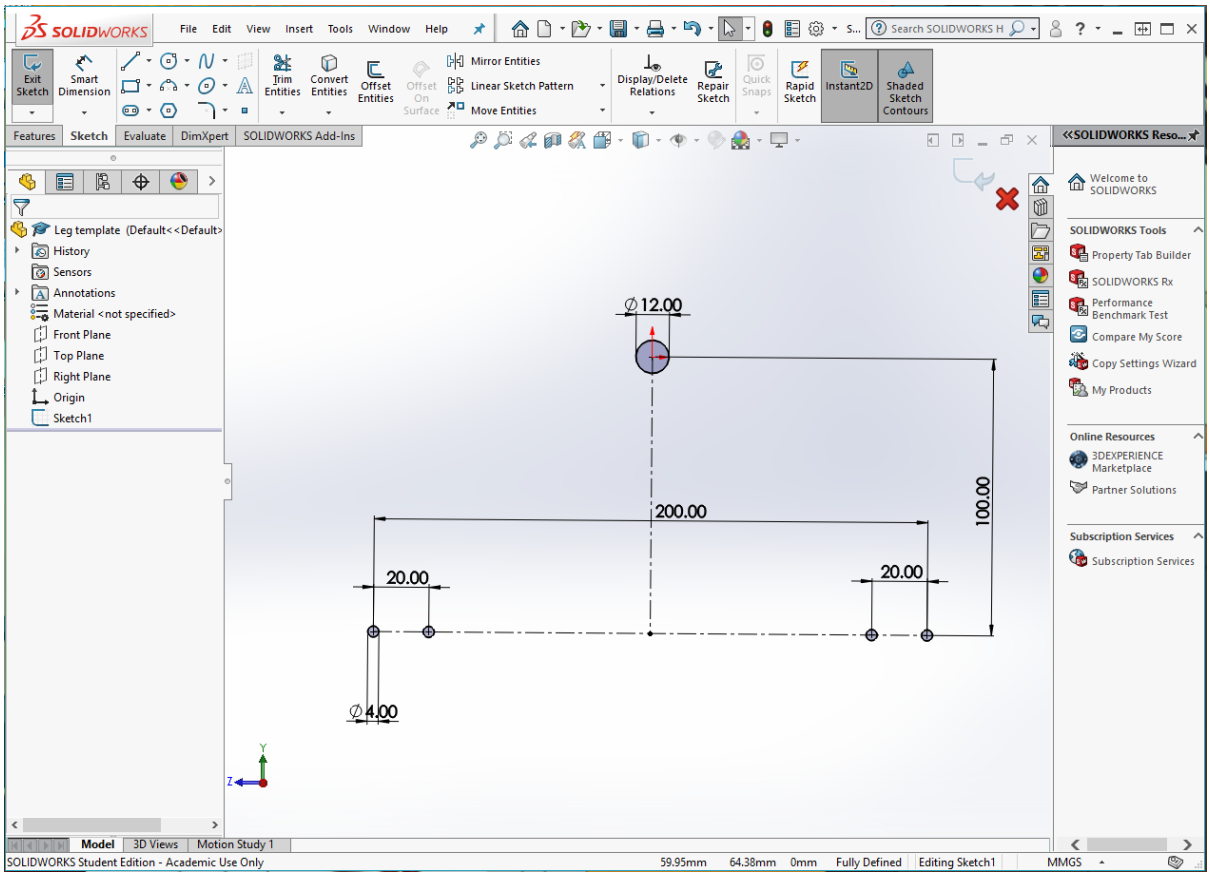
1) Open “Leg Template.sldprt” in SolidWorks.

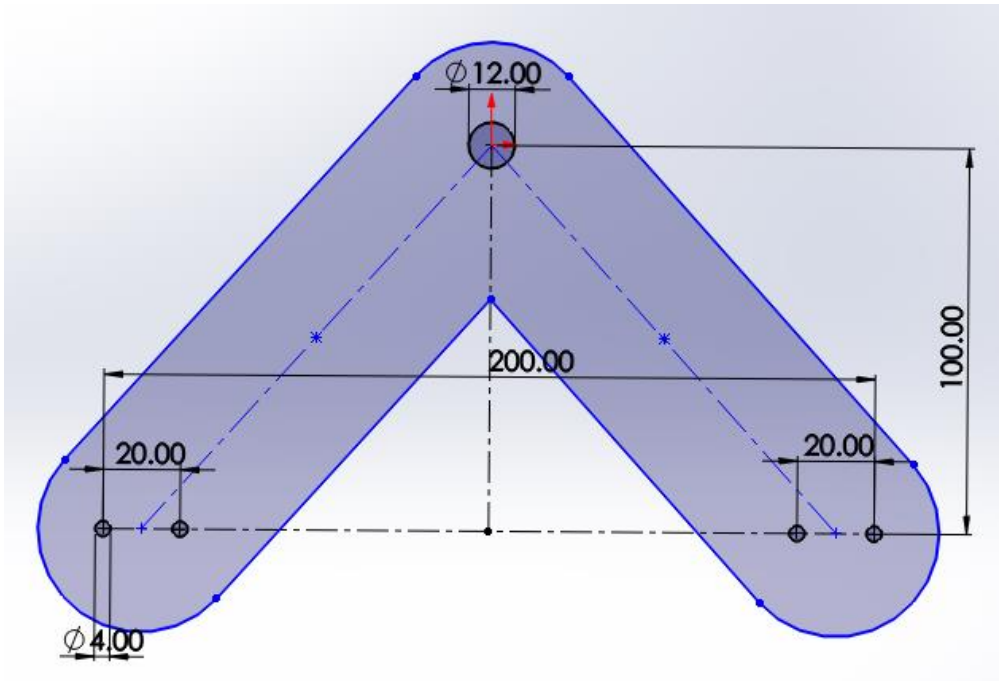
2) Right click on “Sketch 1” and select “Edit Sketch”.



3) The currently included geometry should not be edited as these holes are dependent on other parts of the rover.

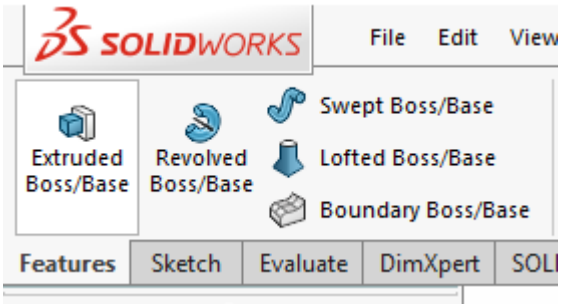


4) Begin drawing in your own leg design, using the “Sketch” tools in the upper toolbar. Any shape is fine, as long as it encloses all of the holes. When the shape is closed, it will be filled with light blue shading. Ask for help if you get stuck at this stage.

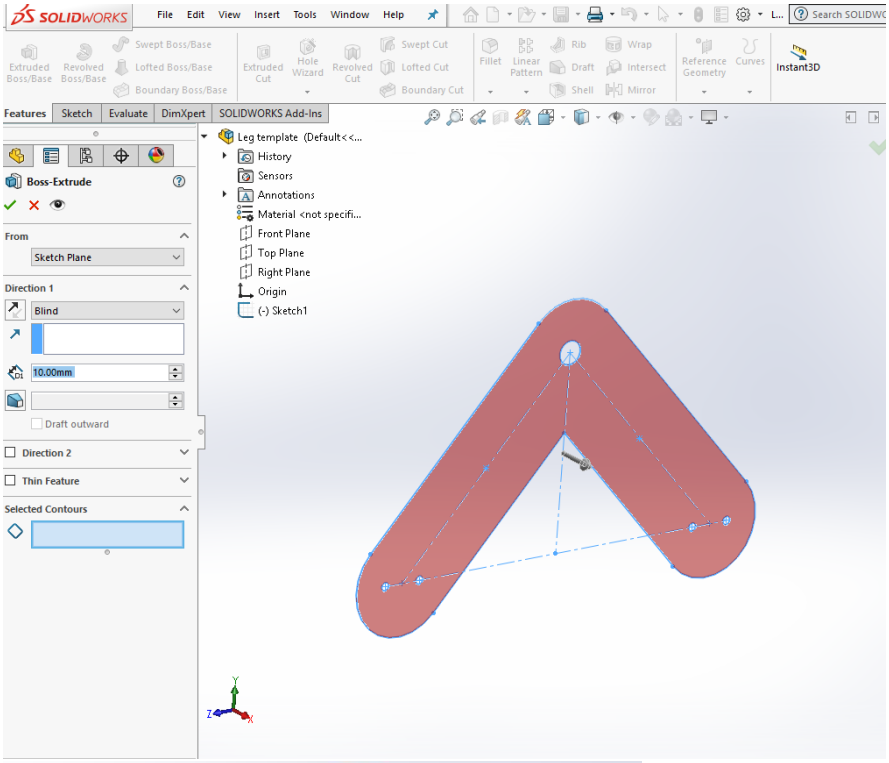


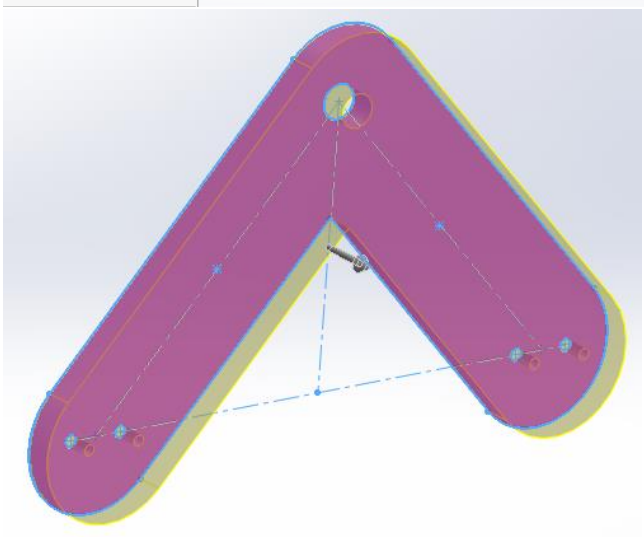
5) Click “Exit Sketch” in the top left.

6) Click on “Sketch 1” in the left toolbar (your sketch should be highlighted in blue). Then click the “Features” tab in the top toolbar, then “Extruded Boss/Base”.

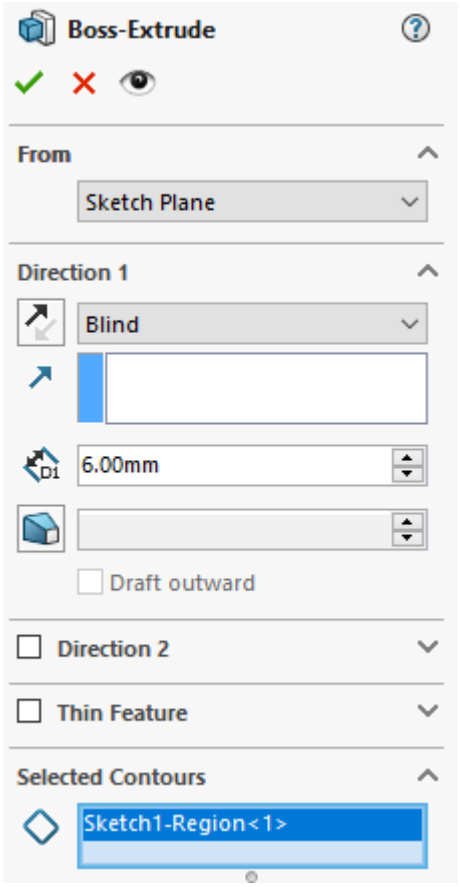


7) Move your mouse over the sketch until the main section appears in red – this is the region that will be extruded. Click on this to make it preview the 3D result.

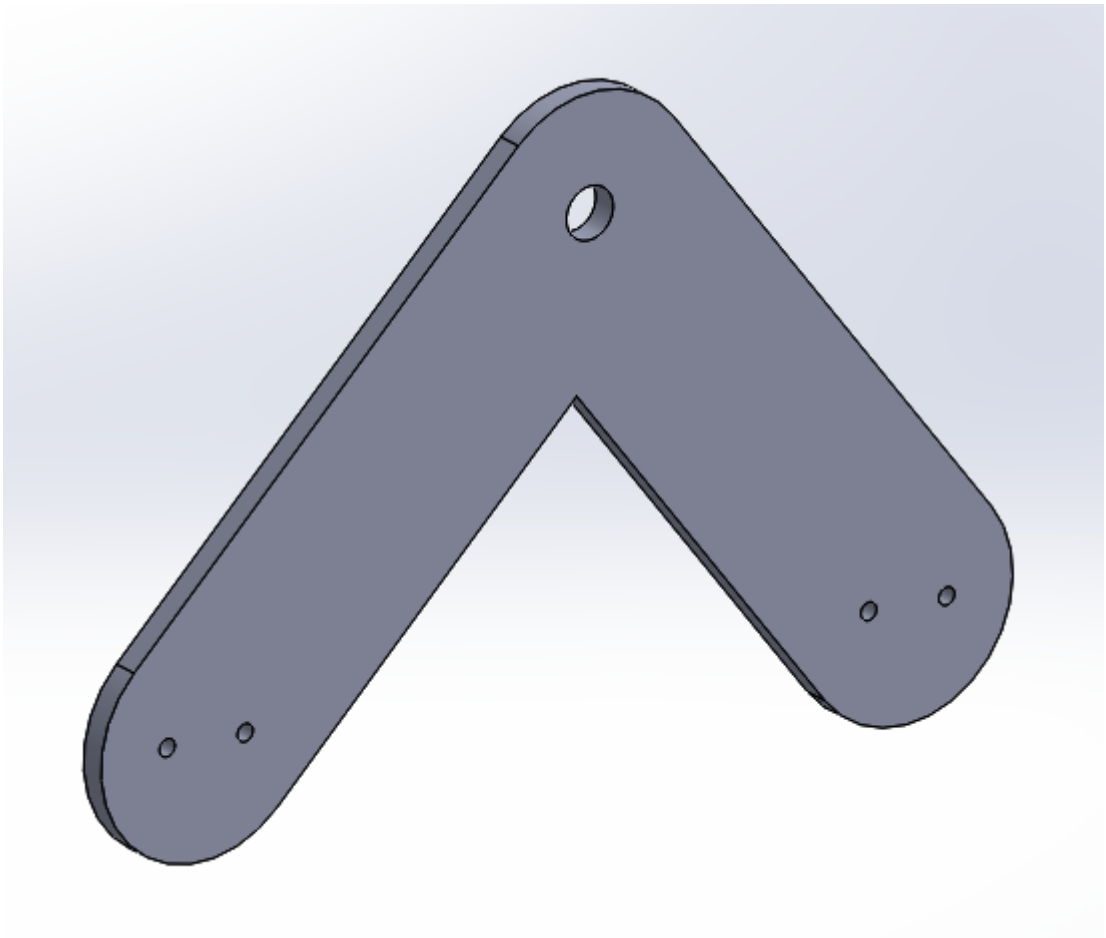




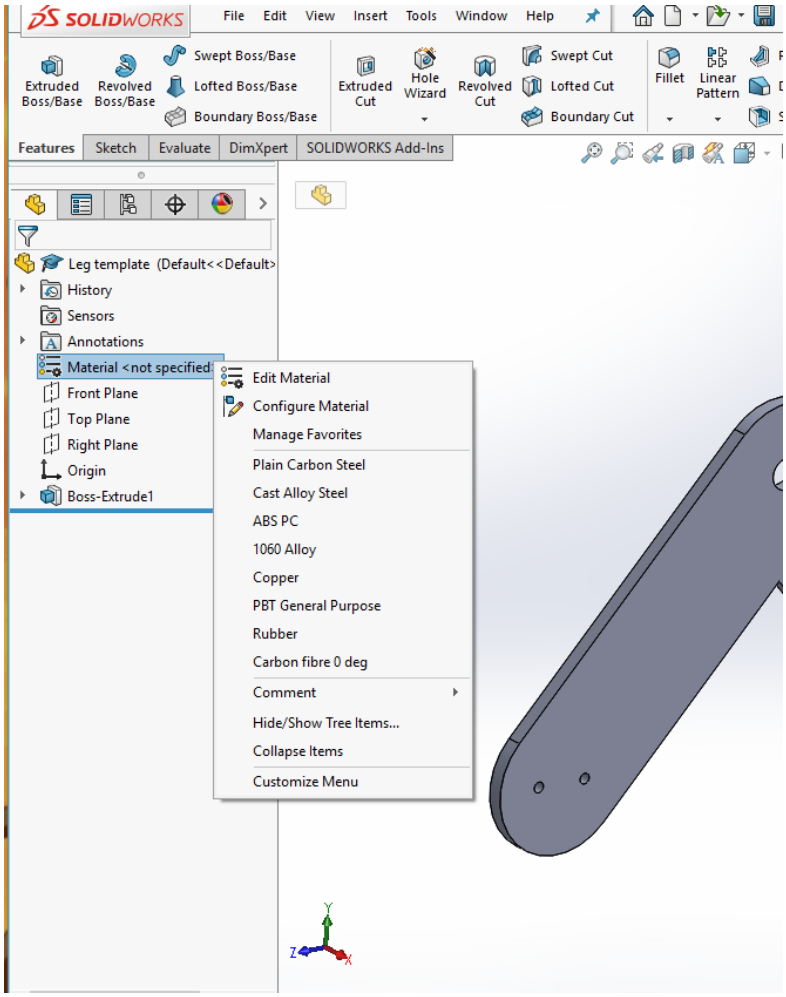
8) In the left toolbar, there is a field labelled D1. By changing the value in here, you can adjust the thickness of your part. 6mm is a standard thickness for aluminium.



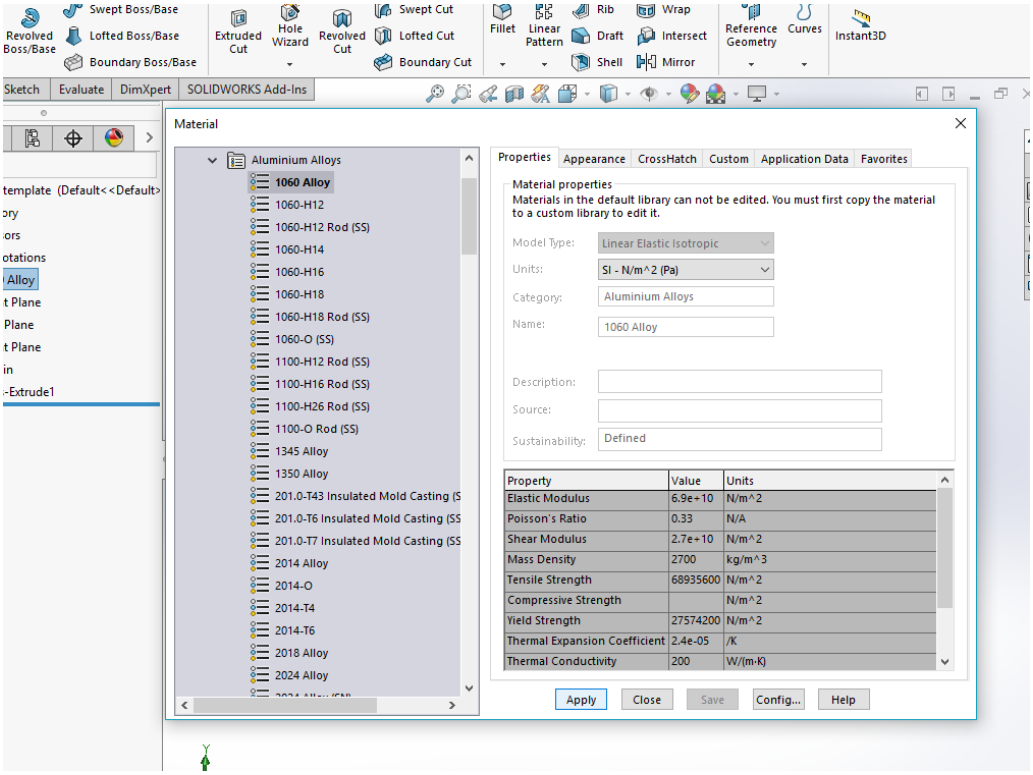
9) When you're happy with the settings, click on the green tick to extrude the part. It will now appear in 3D.



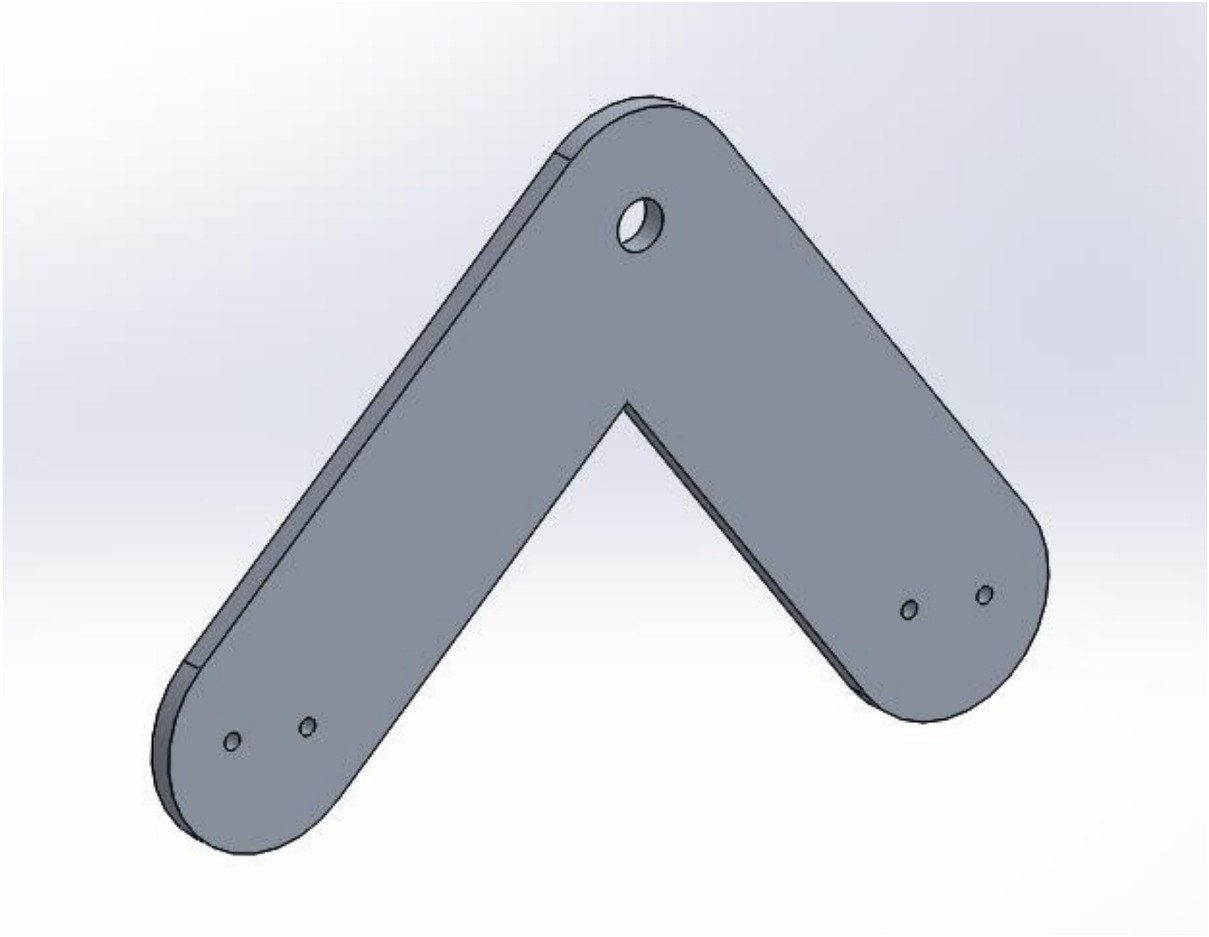
10) We are now going to choose a material for the leg. In the left toolbar, right click on “Material”, then select “Edit material”.



11) In the popup window, you can choose from a large range of built-in materials. Choose one that you are interested in (ideally something sensible like aluminium or steel) then click “Apply”, followed by “Close”.

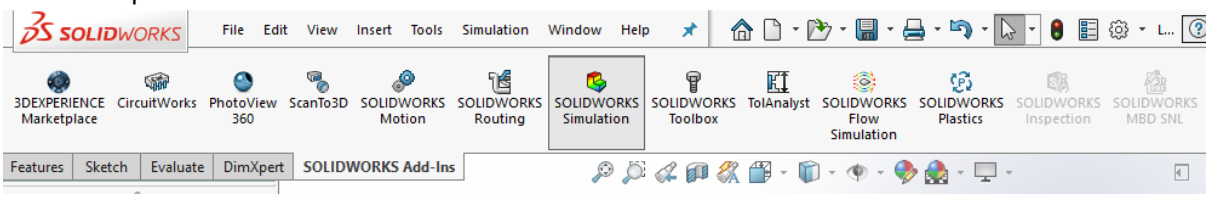


12) Depending on the material you chose, the leg will probably have changed colour.

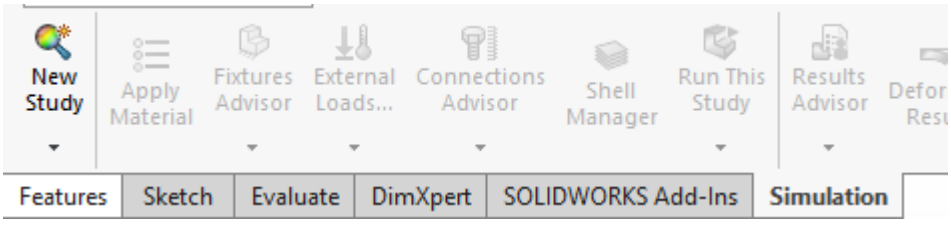


Reminder Remember to save your file regularly!

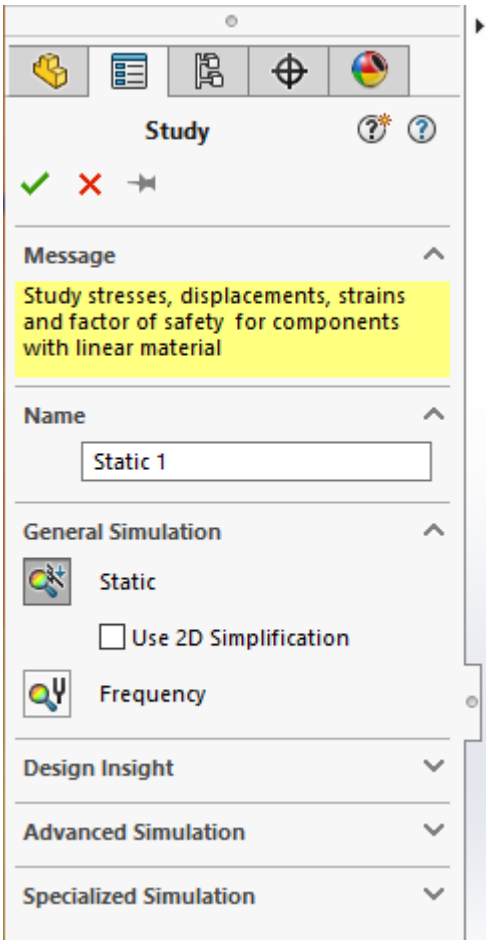
13) In the top toolbar, click on the “SOLIDWORKS Add-Ins” tab, then click the “SOLIDWORKS Simulation” button. A new tab called “Simulation” should appear. This may take a minute to load so be patient.



14) In the “Simulation” tab, click “New Study”.

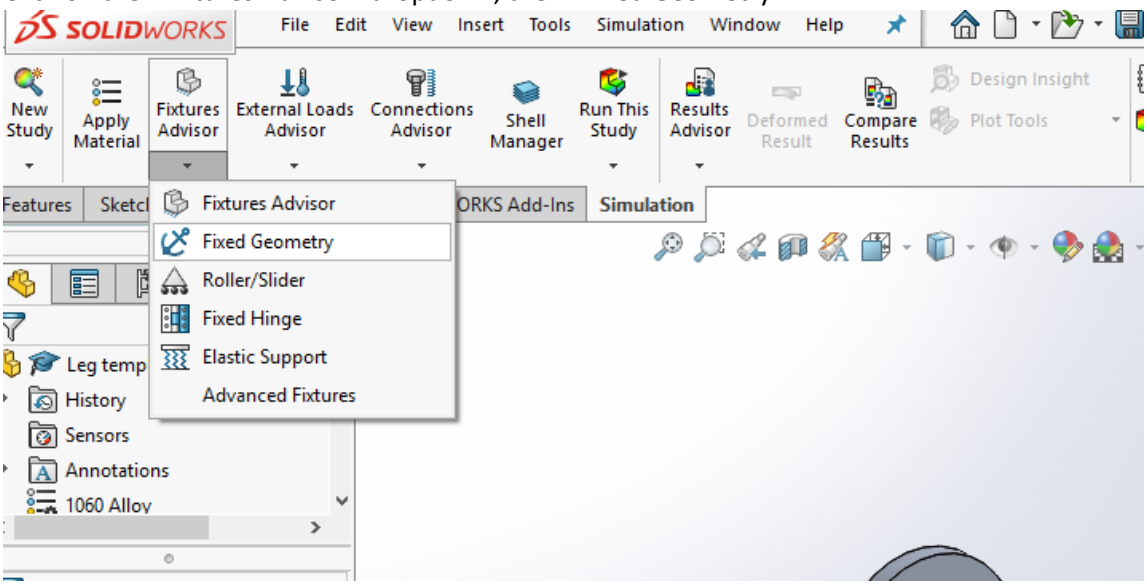


15) In the menu that appears on the left, select “Static” and click the green tick. Additional options will now appear in the top toolbar.

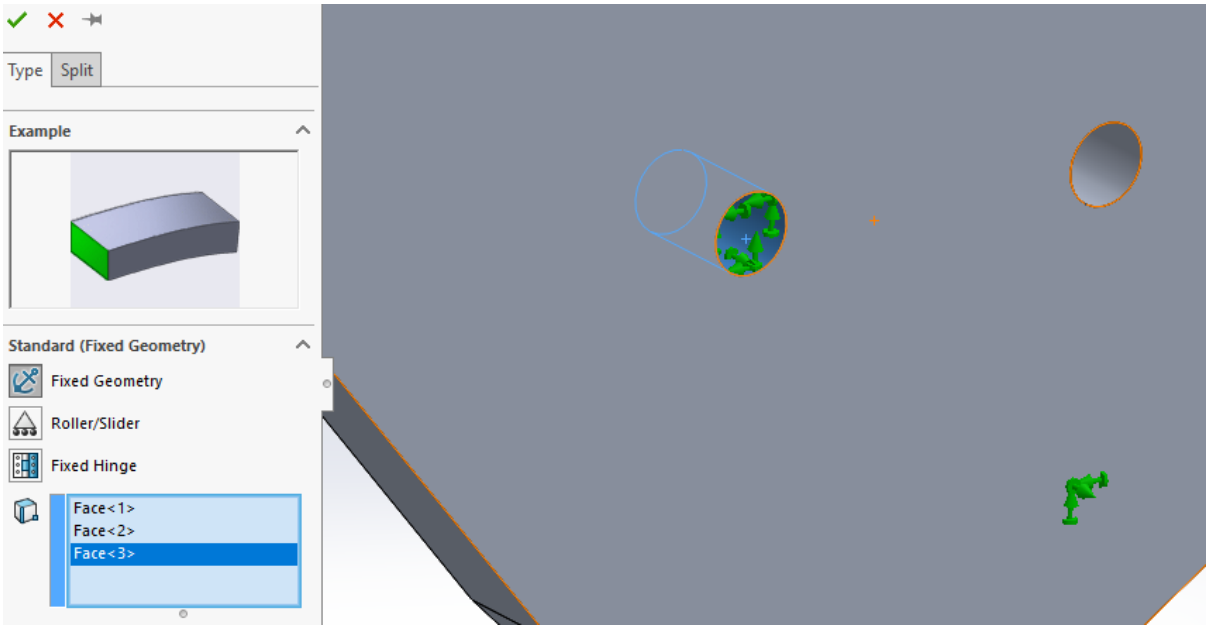


There are lots of different simulations that we could run. However, the simplest is to model the weight of the rover being transmitted to the leg through the upper hole. As such, we will be setting the lower holes with fixed geometry and applying a force to the top hole.

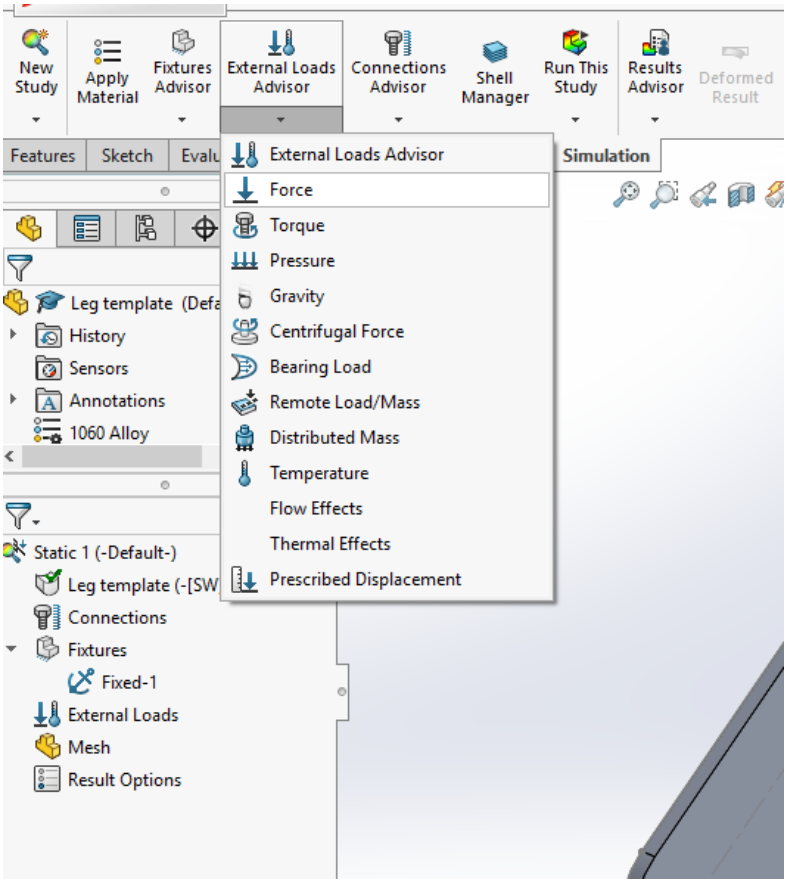
16) Click on the “Fixtures Advisor” dropdown, then “Fixed Geometry”.



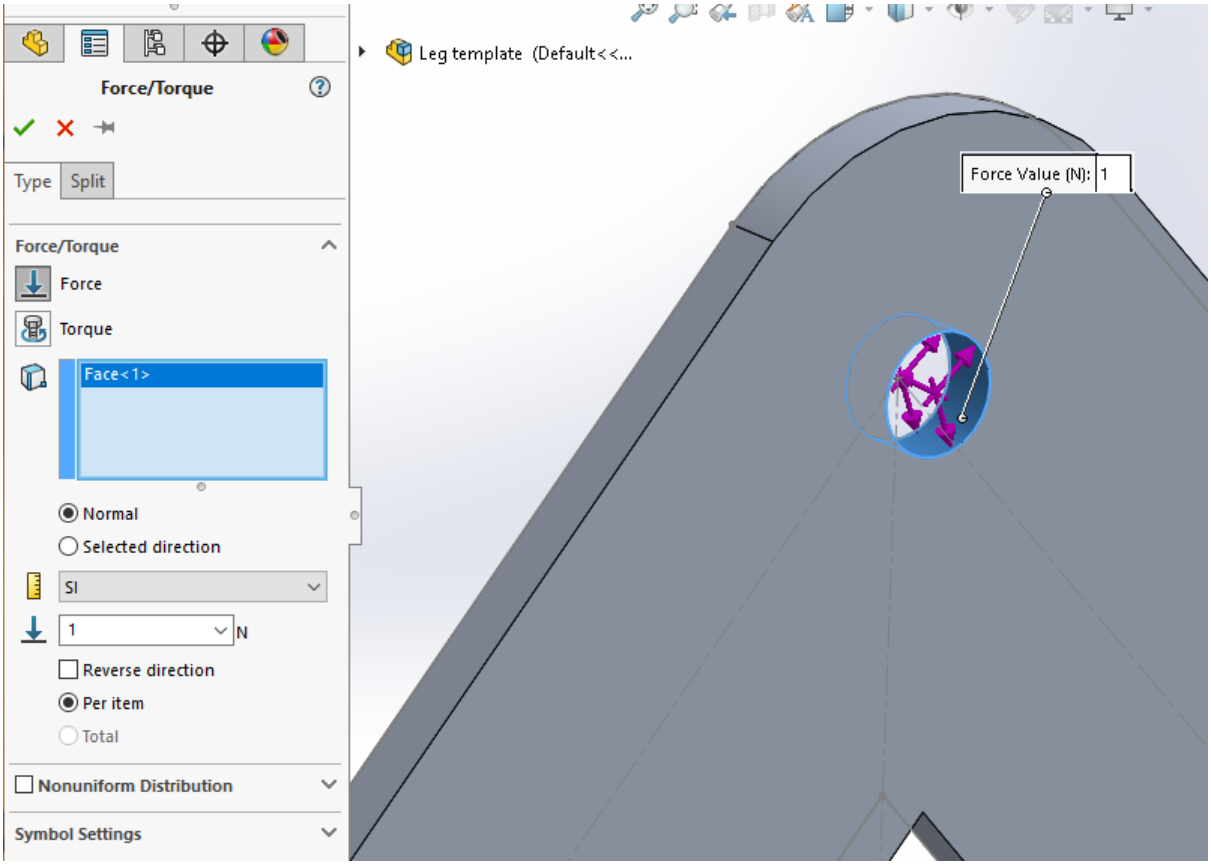
17) Click inside each of the lower holes, such that Faces 1-4 are listed in the box on the left. You may need to zoom in by scrolling. If you make a mistake, right click on the incorrect face and select “Delete”. When all four lower holes are selected, click on the green tick.



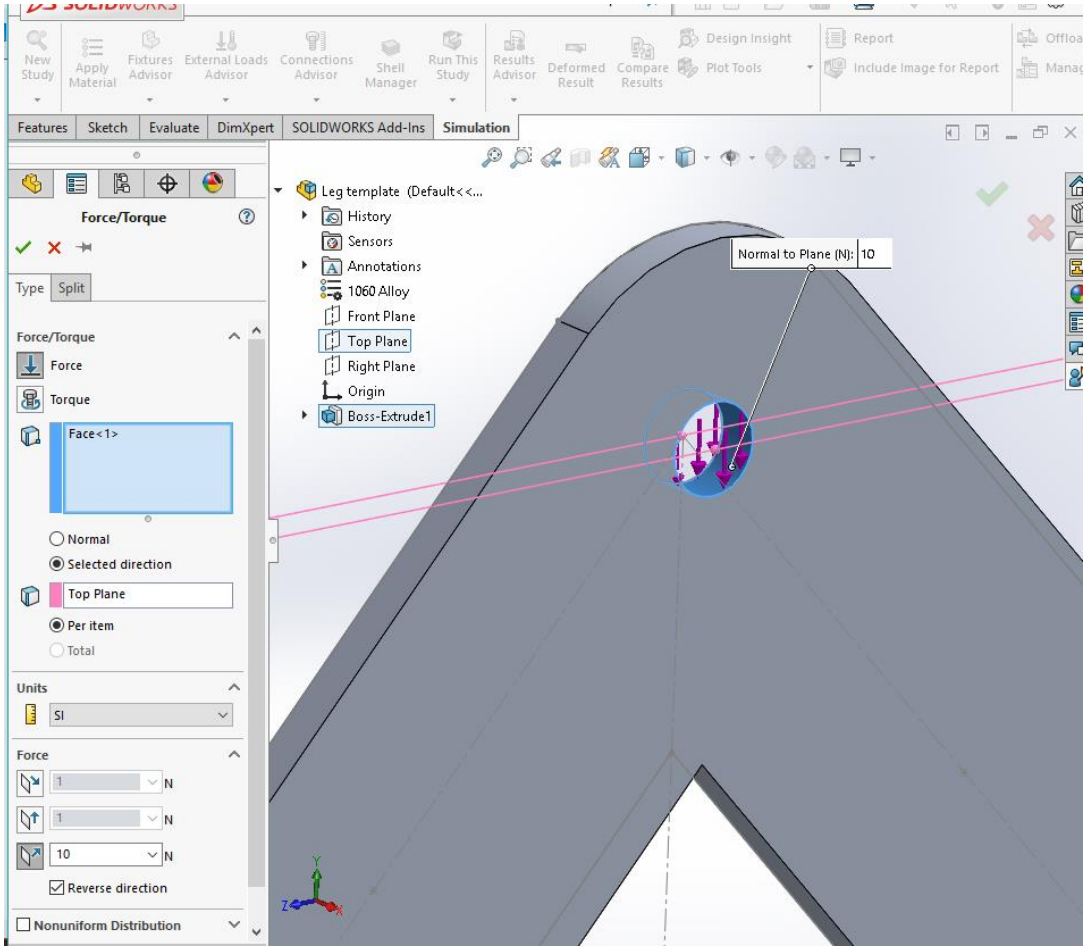
18) Next, we'll apply the weight of the rover. Click on "External Loads Advisor" in the top toolbar, followed by "Force".



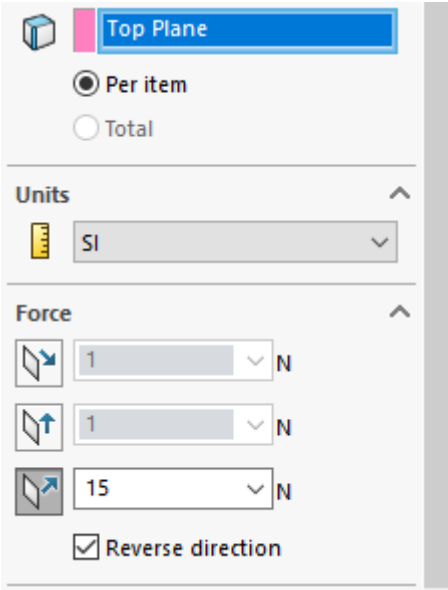
19) This time, select the inside surface of the top hole.



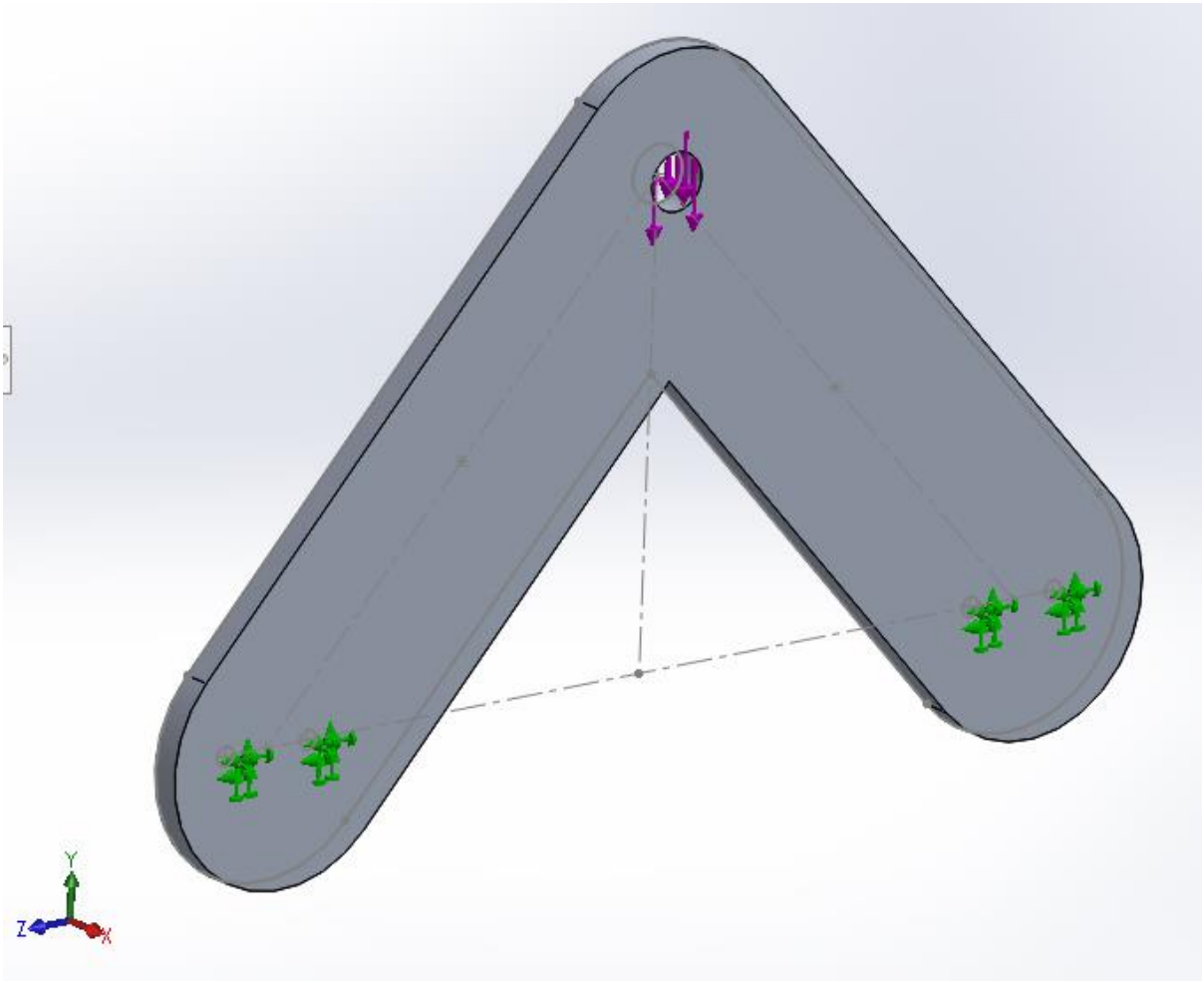
20) Click on the “Selected direction” option, then select the “Top Plane” as the direction by expanding the part tree.



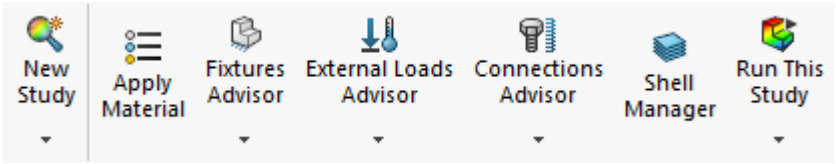
21) Change the force to 15N acting downwards by clicking the “Normal to Plane” button in the left menu, editing the number in the field and ticking the “Reverse direction” box. Then click the green tick to confirm these settings.



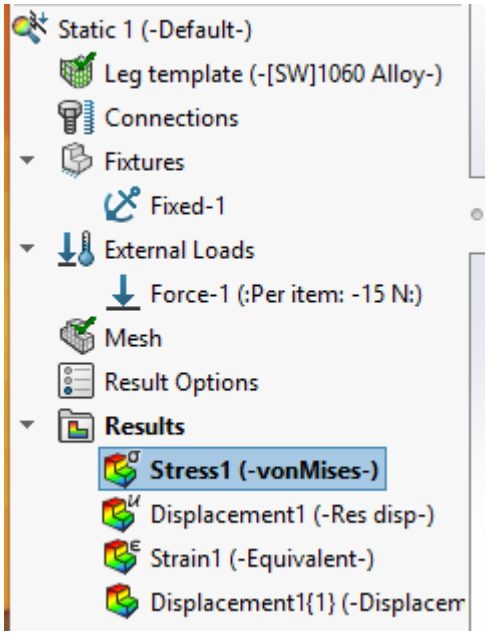
22) Your model should now look something like this:



23) Click “Run This Study” in the top toolbar. The model will now be automatically meshed and some default results will be generated.



24) Look at each of the sets of results by double-clicking the relevant name in the left menu.



Congratulations! You have now designed and run FEA on your own rover leg design! Feel free to go back and edit different parts of your model to see what changes. I hope this gave you an interesting introduction to how you can use FE in design. ☺