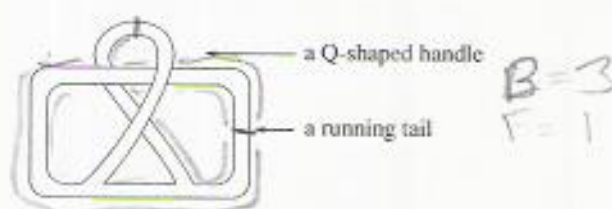


Question 6 - 10 marks

Before attempting this question, you might like to look at the first Exercise Booklet for the Geometric Topology half of the course, where the terms 'sketch' and 'simpler' are defined.

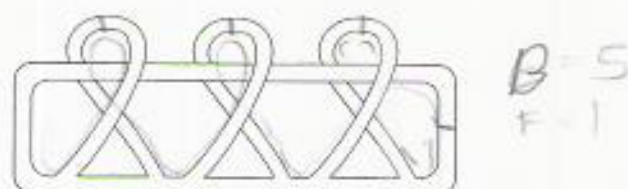
Sketch simpler versions of the following surfaces. In each case explain, preferably with a sketch, how you arrived at the simplifications. All the surfaces are made of thin paper. (The names we have given the surfaces are for the purposes of this question only.)

- (i) A surface with a 'running tail' and 1 'Q-shaped handle'.



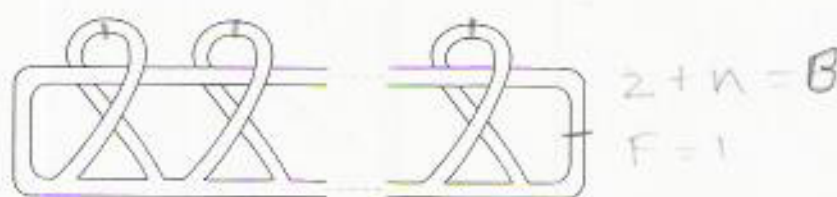
[2]

- (ii) A surface with a running tail and 3 Q-shaped handles.



[4]

- (iii) A surface with a running tail and n Q-shaped handles.



[4]

Question 7 - 15 marks

For each of the surfaces in Question 6 above, add any vertices or edges you feel are necessary to obtain a subdivision. Clearly label each vertex and edge that you add. For your subdivision, write down:

- V , the number of vertices;
- E , the number of edges;
- F , the number of faces;
- χ , the Euler characteristic;
- β , the number of boundary curves.

[15]