

Question 9

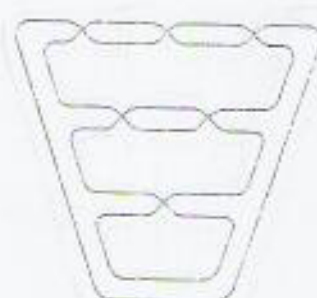
Redraw each of the following surfaces in a simpler form, labelling clearly any cutting and glueing operations. Hence determine χ (the Euler characteristic) and β (the number of boundary components) for each surface, and write down whether or not each is orientable.

(i) (thin paper)



[5]

(ii) (thin paper)



[5]

Question 10

This question concerns those closed surfaces which have been subdivided into F 9-sided polygons, with k faces meeting at each vertex. The number of edges and vertices of this subdivision are E and V respectively.

[1]

(i) Write down an equation connecting k , F , and V for such a surface.

We shall now let the Euler characteristic χ be negative, and write $\chi = -n$, where $n > 0$.

(ii) Show that $F = \frac{2kn}{7k - 18}$.

[2]

(iii) Write down the corresponding expression for k in terms of F and n .

[1]

(iv) Hence find all possible regular subdivisions of this type when

(a) $n = 1$,

(b) $n = 2$,

(c) $n = 3$,

(d) $n = 4$.

[7]