

(13)

Surface 3 (See Opposite)

Each 'handle' adds 2 vertices in the subdivision  $\therefore V = 2 + 2n$

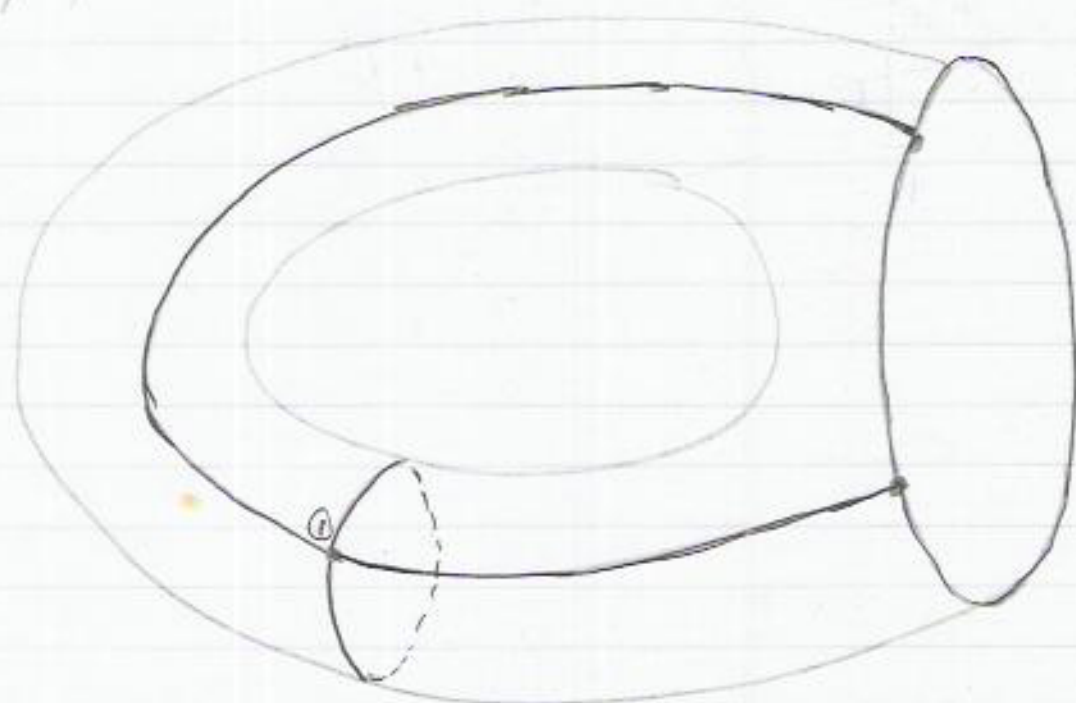
Each 'handle' adds 3 edges in the subdivision  $\therefore E = 3 + 3n$

Each 'handle' leaves the no. of faces unchanged:  $F = 1$

$$\chi = F - E + V$$

$$= 1 - (3 + 3n) + (2 + 2n) = 1 - (1 + n) = -n.$$

3)i)



Rule 2 was not satisfied: three edges met at a point which was not a vertex shown ①. Therefore vertex ① is added. ✓ 3/3

ii) Rule 2 is not satisfied. At points ② and ③ shown, edges cross at points which are not vertices. (Also Rule 1)

Rule 4 is not satisfied. After cutting the surface will not form a topological disc. To rectify this an edge needs to be added, shown ④, between two vertices which need to be added, A and B.