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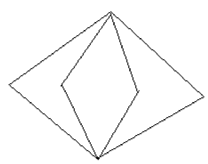
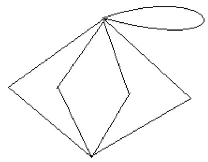
Exercise 6.14: For a 1D complex in 3D space we have that β_1 is the number of tunnels (see page 225). Furthermore, from graph theory we also know that for a connected graph G= [V, E], the cardinality of the cycle base of G is equal to $\alpha_1 - \alpha_0 + 1$.

Case (1): The set is homotopic to the 1D geometric (or Euclidean) complex shown in the following figure:



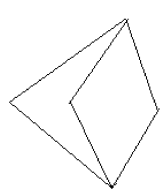
In this case we have $8 - 6 + 1 = 3$ tunnels.

Case (2): The set is homotopic to the 1D geometric (or Euclidean) complex shown in the following figure:



In this case we have $9 - 6 + 1 = 4$ tunnels.

Case (3): The set is homotopic to the 1D geometric (or Euclidean) complex shown in the following figure:



In this case we have $6 - 5 + 1 = 2$ tunnels.