

First one can notice that the complete planar graph with the biggest number of vertices is K_4 . Indeed, a planar graph must satisfy the following property : if $v \leq 3$, then $e \leq 3v - 6$. So for a general graph K_n , we must have :

$$n \frac{(n-1)}{2} \leq 3n - 6$$

which implies that $n < 5$. On the other hand, if $n = 3$, it is clear that P is not a 3-dimensional polytope. So if the graph of a 3-dimensional polytope is complete, then this graph must have 4 vertices. It implies that P is a tetrahedron.