Name: _Solutions_____

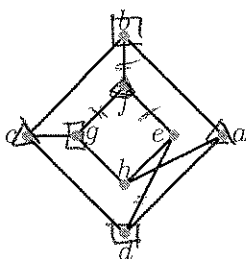**Directions:** Show all work. No credit for answers without work.

1. [**4 points**] A drawing of a connected planar graph has 200 edges and 60 regions (including the unbounded region). How many vertices are in the graph?

$$n - e + r = 2$$

$$n - 200 + 60 = 2$$

$$\boxed{n = 142}$$

2. Let G be the following graph:

(a) [**3 points**] Is G bipartite? Give a *short* proof.

No: cgfade is an odd cycle, and bipartite graphs do not have odd cycles.

(b) [**3 points**] Determine whether G is planar. If G is planar, give a planar drawing. If G is not planar, find a subgraph homeomorphic to K_5 or $K_{3,3}$.

No: G contains a subgraph homeomorphic to $K_{3,3}$.