In Exercises 1–10, determine whether the graphs G_1 and G_2 are isomorphic. If the graphs are isomorphic, find functions f and g for Definition 6.6.1; otherwise, give an invariant that the graphs do not share.

3.

G_1 $\qquad$ G_2

6.

G_1 $\qquad$ G_2
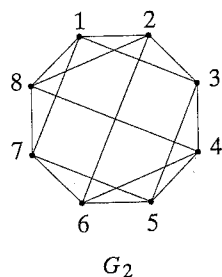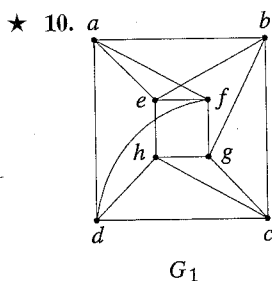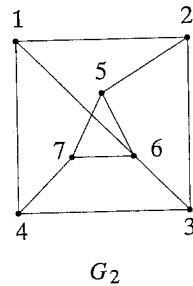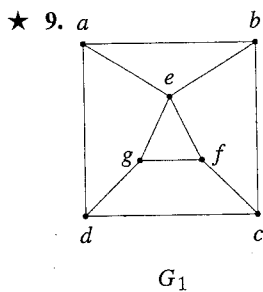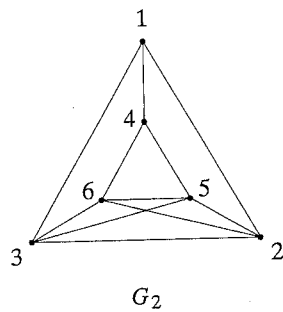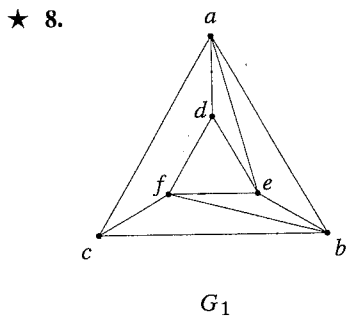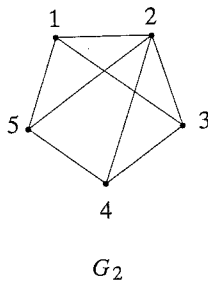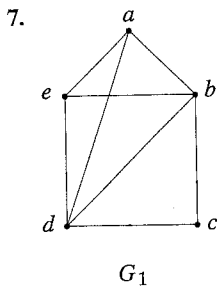
In Exercises 12–16, show that the property given is an invariant.

12. Has a simple cycle of length k

13. Has n vertices of degree k

14. Is connected

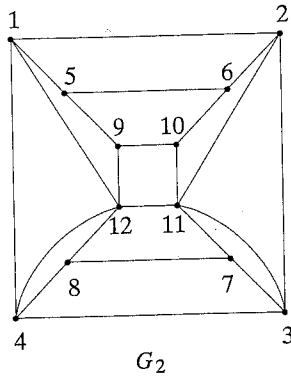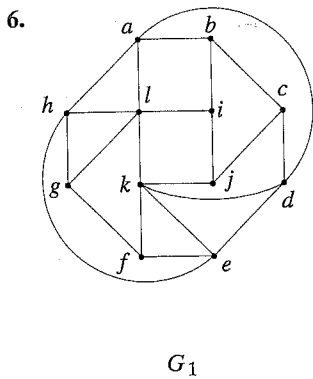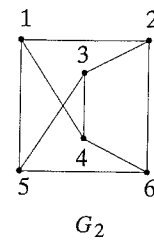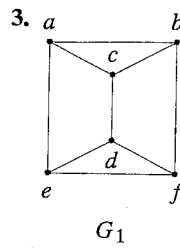**15.** Has n simple cycles of length k

16. Has an edge (v, w), where $\delta(v) = i$ and $\delta(w) = j$

7.

G_1 $\qquad$ G_2

For #7-9, find an invariant that is different for the two graphs. Write a sentence or set of sentences explaining how you know (using an invariant) that the two graphs are not isomorphic.

For #10 find an isomorphism between the two graphs. Write the isomorphism (tell what vertex goes to what), and then write the adjacency matrix for both graphs, with the vertices in the same order that your isomorphism tells you to use, to prove that the graphs are isomorphic.

★ 8.

G_1 $\qquad$ G_2

★ 9.

G_1 $\qquad$ G_2

★ 10.

G_1 $\qquad$ G_2