Practice problems don’t turn in:

P1. [DPV] Problem 8.10 part (a) (Subgraph isomorphism)

P2. [DPV] Problem 8.4 part (c) (Clique-3)
Problem 1  [DPV] Problem 8.8 (Exact 4-SAT)

Solution:
Problem 2 [DPV] Problem 8.19 (Kite)

Solution:
Problem 3 4-COLORING

For integer $k > 0$, a $k$-coloring of an undirected graph $G = (V, E)$ is an assignment of a color $\sigma(v)$ to each vertex $v \in V$, where every color is from the set $\{1, 2, \ldots, k\}$ and for every edge $(v, w) \in E$, the endpoints $v$ and $w$ receive different colors (i.e., $\sigma(v) \neq \sigma(w)$).

Consider the $k$-COLORING problem defined for integer $k > 0$:
**Input:** An undirected graph $G = (V, E)$.
**Output:** A $k$-coloring $\sigma$ of $G$ if one exists, and NO if no $k$-coloring exists.

The 3-COLORING problem is NP-complete.

Prove that the 4-COLORING problem is NP-complete, using the fact that the 3-COLORING problem is NP-complete.

(Note, the input is a graph $G$ you cannot force a vertex to have a specific color.)

**Solution:**