# 5.4.x. Exercise questions

1.  Use derivations to check each of the claims below; if a derivation indicates that a claim fails, present a counterexample that divides an open gap. Since **d** is a claim of tautologousness, it is established by a derivation that begins with only a goal and no initial premises.

    **a.**  A → B ⇔ ¬ A ∨ B

    **b.**  (A ∧ B) → C ⇔ A → C

    **c.**  (A → B) ∧ (B → C) ⇔ A → C

    **d.**  ⇒ ((A → B) → A) → A

2.  Construct derivations for each of the following. These exercises are designed to make attachment rules often useful. The derivations can be constructed for the English sentences in **e-g** without first analyzing them since you generally need to recognize only the main connective and the immediate connectives in order to know what rules apply; however, the abbreviated notation provided by an analysis may be more convenient.

    **a.**  (A ∧ B) → C, (C ∨ D) → E, A, B ⇒ E

    **b.**  (A ∨ ¬ B) → C ⇒ ¬ C → B

    **c.**  ¬ (A ∧ B), B ∨ C, D → ¬ C ⇒ A → ¬ D

    **d.**  C → ¬ (A ∨ B), E ∨ ¬ (D ∧ ¬ C), D ⇒ A → E

    **e.**  *Tom will go through Chicago and visit Sue*
    *Tom won't go through both Chicago and Indianapolis*
    *Tom won't visit Ursula without going through Indianapolis*
    *Tom will visit Sue but not Ursula*

    **f.**  *Either we spend a bundle on television or we won't have wide public exposure*
    *If we spend a bundle on television, we'll go into debt*
    *Either we have wide public exposure or our contributions will dry up*
    *We'll go into debt if our contributions dry up and we don't have large reserves*
    *We won't have large reserves*
    *We'll go into debt*

    **g.**  *If Adams supports the plan, it will go though provided Brown doesn't oppose it*
    *Brown won't oppose the plan if either Collins or Davis supports it*
    *The plan will go through if both Adams and Davis support it*