

### 3.4.x. Exercise questions

1. The following arguments are not formally valid. In each case, use a derivation to show this and present a counterexample that the derivation leads you to.
  - a.  $\neg B / \neg (A \wedge \neg B)$
  - b.  $\neg (A \wedge B) / \neg A \wedge \neg B$
  - c.  $\neg (A \wedge B), \neg (B \wedge C) / \neg (A \wedge C)$
2. Use derivations to check the following claims of entailment. If the claim fails, present a counterexample that the derivation leads you to.
  - a.  $\neg (A \wedge \neg B) \Rightarrow B$
  - b.  $\neg (A \wedge B) \Rightarrow \neg (B \wedge A)$
  - c.  $\neg (A \wedge \neg B) \Rightarrow \neg (B \wedge \neg A)$
  - d.  $\neg (A \wedge B), \neg (B \wedge C), B \Rightarrow \neg A \wedge \neg C$
  - e.  $\neg (A \wedge \neg (B \wedge \neg (C \wedge \neg D))) \Rightarrow \neg (A \wedge \neg (B \wedge D))$