1. Prove or disprove each of the following statements. For each statement, also prove or disprove its converse. (These are all in the context of Statement Calculus, not Predicate Calculus.) Assume Γ is a (possibly infinite) set of formulas.

   (a) If A is satisfiable, then A is a tautology.

   (b) If A is consistent, then $\neg A$ is a contradiction. (Be careful: what's the definition of a contradiction?)

   (c) If Γ is not satisfiable, then it contains a formula that's not satisfiable.

   (d) If Γ is not satisfiable, then it contains an inconsistent finite subset.

   (e) If Γ is not consistent, then it contains an unsatisfiable finite subset.

   (f) Let $\Delta = \{\neg A \mid A \in \Gamma\}$. If Γ is not satisfiable, then Δ is satisfiable.

   (g) Let $\Delta = \{\neg A \mid A \in \Gamma\}$. If Γ is not consistent, then Δ is consistent.

   (h) If $\Gamma \models A$, then $\Gamma \cup \{\neg A\}$ is inconsistent.

   (i) If $\Gamma \models A$, then for some finite subset $\Delta \subset \Gamma$, $\Delta \vdash A$.

2. Prove, without using the Compactness Theorem, that:

   If $\Gamma \vdash A$, then for some finite subset $\Delta \subset \Gamma$, $\Delta \models A$.