1. False.

2. True.
   Every valid formula is satisfiable. Here is an example of a valid formula:

Consider the formula ($P \vee \neg P$). This formula is always true, regardless of the truth values assigned to P and $\neg P$. If we assign the value TRUE to P, then the formula becomes TRUE ∨ FALSE, which is true. If we assign the value FALSE to P, then the formula becomes FALSE ∨ TRUE, which is also true. Therefore, ($P \vee \neg P$) is a valid formula.

3. True.
   If a formula A is satisfiable, then it is possible to assign truth values to the variables in A in such a way that it is true. If we negate A to get $\neg A$, then it is not possible to assign truth values to the variables in $\neg A$ in such a way that it is true. Here is an example:

Consider the formula P. This formula is satisfiable because we can assign the value TRUE to P, which makes the formula TRUE. If we negate P to get $\neg P$, then we have the formula $\neg P$, which is unsatisfiable because it is not possible to assign a truth value to $\neg P$ in such a way that the formula is true.

4. True.
   If $A \vDash B$, then it is always the case that A implies B. If we add the formula C to both A and B, we still have the implication $A \wedge C \vDash B \wedge C$. Here is an example:

Consider the formulas $A = (P \wedge Q)$ and $B = (Q \wedge R)$. We can use the rule of conjunction (∧-intro) to derive the formula $A \wedge B = (P \wedge Q) \wedge (Q \wedge R)$. Using the rule of conjunction (∧-elim), we can also derive the formula $B \wedge C = (Q \wedge R) \wedge C$. Therefore, $A \wedge C \vDash B \wedge C$.

5. True.
   Explanation: An admissible inference rule is a rule of logic that is always valid and can be used to derive new formulas from existing ones. A formula is said to be derivable if it can be obtained by applying a sequence of admissible inference rules to a set of given formulas. Therefore, every admissible inference rule is derivable, because it can be used to derive new formulas from the given set.

Example: One common admissible inference rule is modus ponens, which states that if we have the formulas "P implies Q" and "P," we can conclude "Q." For example, if we have the formulas "P implies Q" and "P," we can use modus ponens to derive the formula "Q."

6. True.
   If C can be derived from A and B using a sound proof system, it must also be valid, and therefore satisfiable.

Example: Consider the proof system $\vdash$ and the formulas A = "P → Q" and B = "Q → R." If we assume that A and B are both true, then we can conclude that "P → R" is also true, because if P is true, then Q must be true (by A), and if Q is true, then R must be true (by B). Now, suppose we have a third formula C = "P → R." If we use the proof system to derive C from A and B, we can conclude that C is satisfiable because it can be derived from the satisfiable formulas A and B using a soundproof system.