

Answer All Questions

1. For propositional expressions P, Q and R prove that:

- a) $(P \vee Q) \equiv (\neg P \rightarrow Q)$.
- b) $(P \rightarrow Q) \equiv (\neg Q \rightarrow \neg P)$.
- c) $\neg(P \vee Q) \equiv (\neg P \wedge \neg Q)$.
- d) $P \vee (Q \wedge R) \equiv (P \vee Q) \wedge (P \vee R)$
- e) The logical operator " \leftrightarrow " is read "if and only if." $P \leftrightarrow Q$ is defined as being equivalent to $(P \rightarrow Q) \wedge (Q \rightarrow P)$. Based on this definition, show that $P \leftrightarrow Q$ is logically equivalent to $(P \vee Q) \rightarrow (P \wedge Q)$ By using truth tables.
- f) Prove that implication is transitive in the propositional calculus, that is, that $((P \rightarrow Q) \wedge (Q \rightarrow R)) \rightarrow (P \rightarrow R)$.

2. Represent the following English sentences in predicate calculus:

- a) If it doesn't rain on Friday we will go to the park.
- b) Emma is a Doberman pinscher and a good dog
- c) All basketball players are tall.
- d) Nobody likes taxes.

3. Given the following

- i. if it is sunny and it is warm, then Samy is happy.
- ii. if there is blue sky then it is sunny.
- iii. there is blue sky.
- iv. it is warm.
- v. is Samy happy?

Use resolution to show Samy is happy

Good Luck