Name: _____

Please show all work.

1. (a) If P, Q, R are propositions, use a truth table to prove that
   $(P \vee Q) \wedge R \Leftrightarrow (P \wedge R) \vee (Q \wedge R)$

   (b) If X, Y, Z are sets, prove that $(X \cup Y) \cap Z = (X \cap Z) \cup (Y \cap Z)$

2. Using formal language and appropriate quantifiers, translate into symbolic form the following sentences. Determine whether they are equivalent and explain why or why not.

   • Some integers are not even and not odd.

   • Some integers are not even and some integers are not odd.

3. For each statement below determine whether it is true. If so, prove it. If not, exhibit a concrete counterexample and explain why it is indeed a counterexample.

   (a) If a, b, c are integers and a divides bc, then a divides b or a divides c

   (b) If S and T are sets, $S \cup T = T \Leftrightarrow S \subseteq T$

1	2	3	total (30)