

Name: _____

1. [**3 parts, 1 point each**] Write the negation of the following sentences.

(a) The weather is hot and dry.

(b) Carl is short or strong.

(c) Either it will rain or it will snow, but not both.

2. Two parts.

(a) [**3 points**] Write a truth table for the following wff:

$$(A \leftrightarrow B) \wedge (B \vee C) \wedge (A \rightarrow C) \rightarrow C$$

(b) [**1 point**] Is the wff a tautology? Briefly explain why or why not.

Derivation Rule	Name/Abbreviation for Rule
$P \vee Q \iff Q \vee P$ $P \wedge Q \iff Q \wedge P$	Commutative—comm
$(P \vee Q) \vee R \iff P \vee (Q \vee R)$ $(P \wedge Q) \wedge R \iff P \wedge (Q \wedge R)$	Associative—ass
$(P \vee Q)' \iff P' \wedge Q'$ $(P \wedge Q)' \iff P' \vee Q'$	De Morgan's laws—De Morgan
$P \rightarrow Q \iff P' \vee Q$	Implication—imp
$P \iff (P')'$	Double negation—dn
$P \leftrightarrow Q \iff (P \rightarrow Q) \wedge (Q \rightarrow P)$	Defn of Equivalence—equ
$\left. \begin{array}{l} P \\ P \rightarrow Q \end{array} \right\} \implies Q$	Modus ponens—mp
$\left. \begin{array}{l} P \rightarrow Q \\ Q' \end{array} \right\} \implies P'$	Modus tollens—mt
$\left. \begin{array}{l} P \\ Q \end{array} \right\} \implies P \wedge Q$	Conjunction—con
$P \wedge Q \implies \left\{ \begin{array}{l} P \\ Q \end{array} \right.$	Simplification—sim
$P \implies P \vee Q$	Addition—add

3. [3 points] Using the given derivation rules, give a proof sequence to show the following wff is a tautology.

$$A' \wedge (A \vee B) \rightarrow B$$