

Negate each statement.

- Marla served supper to Bill and Jean.
Marla did not serve supper to Bill or she did not serve supper to Jean.
- If John won the golf tournament, he became the national champion.
John won the golf tournament, but he did not become the national champion.
- Either Shawna or Shaneel cooked dinner.
Neither Shawna nor Shaneel cooked dinner.
- All birds have feathers, and all feathered things are birds.
Some birds have no feathers, or some feathered things are not birds.

Convert each statement into symbolic form.

- “If Benita made eggs, then she could have made pancakes” means the same as “Benita did not make pancakes, but she made eggs instead.”
 $(E \rightarrow P) \leftrightarrow (\sim P \wedge E)$
- “Shu or Jay did not win the spelling bee” means that “Shu and Jay won the spelling bee” is false.
 $(\sim S \vee \sim J) \leftrightarrow \sim (S \wedge J)$
- “Not pleasing self is to please Christ” is the same as “not pleasing Christ is to please self.”
 $(\sim S \rightarrow C) \leftrightarrow (\sim C \rightarrow S)$

Evaluate each statement as true or false.

- “If Benita made eggs, then she could have made pancakes” means the same as “Benita did not make pancakes, but she made eggs instead.”
False
- “Shu or Jay did not win the spelling bee” means that “Shu and Jay won the spelling bee” is false.
True
- “Not pleasing self is to please Christ” is the same as “not pleasing Christ is to please self.”
True

Give the reason for each step shown in the proof that $(A \rightarrow B) \leftrightarrow (\sim A \vee B)$.

- $(A \rightarrow B) \leftrightarrow (\sim B \rightarrow \sim A)$
contrapositive rule
- $(A \rightarrow B) \leftrightarrow \sim [\sim (\sim B \rightarrow \sim A)]$
double negation
- $(A \rightarrow B) \leftrightarrow \sim (\sim B \wedge A)$
negation of implication
- $(A \rightarrow B) \leftrightarrow (\sim \sim B \vee \sim A)$
negation of conjunction
- $(A \rightarrow B) \leftrightarrow (B \vee \sim A)$
double negation
- $(A \rightarrow B) \leftrightarrow (\sim A \vee B)$
commutative law of disjunction

Use a truth table to show that the statement is not an equivalence.

17. $(A \rightarrow B) \leftrightarrow (\sim A \rightarrow \sim B)$

$(A$	\rightarrow	$B)$	\leftrightarrow	$(\sim$	A	\rightarrow	\sim	$B)$
T	T	T	T	F	T	T	F	T
T	F	F	F	F	T	T	T	F
F	T	T	F	T	F	F	F	T
F	T	F	T	T	F	T	T	F

18. $\sim(A \rightarrow B) \leftrightarrow (\sim A \wedge B)$

\sim	$(A$	\rightarrow	$B)$	\leftrightarrow	$(\sim$	A	\wedge	$B)$
F	T	T	T	T	F	T	F	T
T	T	F	F	F	F	T	F	F
F	F	T	T	F	T	F	T	T
F	F	T	F	T	T	F	F	F

Construct the table.

19. Show the truth table for the Negation of Biconditional Rule.

\sim	$(P$	\leftrightarrow	$Q)$	\leftrightarrow	$[\sim$	$(P$	\rightarrow	$Q)$	\vee	\sim	$(Q$	\rightarrow	$P)]$
F	T	T	T	T	F	T	T	T	F	F	T	T	T
T	T	F	F	T	T	T	F	F	T	F	F	T	T
T	F	F	T	T	F	F	T	T	T	T	T	F	F
F	F	T	F	T	F	F	T	F	F	F	F	T	F

Answer the question.

20. Explain the significance of I John 5:12 to logic.

The verse is an equivalence: it explains both that Christ is the way of salvation and that there is no other way.