

SWBAT: Practice the application of several logic laws in the form of Logic Proofs.

PRACTICE WITH LOGIC PROOFS

SWBAT: Practice the application of several logic laws in the form of Logic Proofs.

SWBAT: Use the De Morgan's Law and the Laws of Simplification, Conjunction, and Disjunctive Addition.

Given: $p \rightarrow (q \vee t)$

p

$\sim q$

Prove: t

QUIZ #2

Statements	Reasons
1. $p \rightarrow (q \vee t)$	1. Given
2. p	2. Given
3. $q \vee t$	3. Law of Detachment (1,2)
4. $\sim q$	4. Given
5. t	5. Law of Disjunctive Inference (3,4)

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1. Premises:
$$\begin{cases} \sim A \rightarrow (C \wedge D) \\ A \rightarrow B \\ \sim B \end{cases}$$

Prove: C.

Statements	Reasons
1. $A \rightarrow B$	1. Given
2. $\sim B$	2. Given
3. $\sim A$	3. Law of Modus Tollens (1,2)
4. $\sim A \rightarrow (C \wedge D)$	4. Given
5. $C \wedge D$	5. Law of Detachment (4,3)
6. C	6. Law of Simplification (5)

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$$\begin{cases} P \wedge Q \\ P \rightarrow \sim(Q \wedge R) \\ S \rightarrow R \end{cases}$$

2. **Example.** Premises:

Prove: $\sim S$.

<u>Statements</u>	<u>Reason</u>
1. $P \wedge Q$	1. Given
2. P	2. Law of Simplification (1)
3. $P \rightarrow \sim(Q \wedge R)$	3. Given
4. $\sim(Q \wedge R)$	4. Law of Detachment (3, 2)
5. $\sim Q \vee \sim R$	5. De Morgan's Law (4)
6. Q	6. Simplification (1)
7. $\sim R$	7. Law of Disjunctive Inference (5, 6)
8. $S \rightarrow R$	8. Given
9. $\sim S$	9. Law of Modus Tollens (8, 7)

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3. **Example.** Premises:
$$\begin{cases} \sim (A \vee B) \rightarrow C \\ \sim A \\ \sim C \end{cases}$$

Prove: B.

Statements	Reasons
1. $\sim(A \vee B) \rightarrow C$	1. Given
2. $\sim C$	2. Given
3. $A \vee B$	3. Law of Modus Tollens (1,2)
4. $\sim A$	4. Given
5. B	5. Law of Disjunctive Inference (3,4)

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4. Either Carmelo was in the game or the Knicks won the game.

If Carmelo was in the game and LeBron was in the game, then D-Wade was *not* in the game.

If the Knicks won the game, then D-Wade was in the game.

If D-Wade was in the game, then Carmelo was in the game.

D-Wade was in the game.

The Heat won the game and LeBron was in the game.

Let H represent: The Heat won the game

Let K represent: The Knicks won the game

Let C represent: Carmelo was in the game

Let L represent: Lebron was in the game

Let D represent: D-Wade was in the game

Prove: Carmelo was in the game

GIVEN:

$C \vee K$

$(C \wedge L) \rightarrow \sim D$

$K \rightarrow D$

$D \rightarrow C$

D

$H \wedge L$

PROVE:

C

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	<u>Statements</u>	<u>Reasons</u>
1.	$K \longrightarrow D$	1. Given
2.	$D \longrightarrow C$	2. Given
3.	$K \longrightarrow C$	3. Chain Rule (1,2)
4.	$(C \wedge L) \longrightarrow \sim D$	4. Given
5.	D	5. Given
6.	$\sim (C \wedge L)$	6. Law of Modus Tollens (4,5)
7.	$\sim C \vee \sim L$	7. De Morgan's Law (6)
8.	$H \wedge L$	8. Given
9.	L	9. Simplification (8)
10.	$\sim C$	10. Law of Disjunctive Inference (7,9)
11.	$\sim K$	11. Law of Modus Tollens (3,10)
12.	$C \vee K$	12. Given
13.	C	13. Law of Disjunctive Inference (11,12)

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5. Prove $[(t \rightarrow w) \wedge \sim w] \rightarrow \sim t$ by setting up a truth table.

t	w	$\sim t$	$\sim w$	$t \rightarrow w$	$(t \rightarrow w) \wedge \sim w$	$(t \rightarrow w) \wedge \sim w \rightarrow \sim t$
T	T	F	F	T	F	T
T	F	F	T	F	F	T
F	T	T	F	T	F	T
F	F	T	T	T	T	T

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6. Set up a truth table to prove the chain rule is valid. (LEVEL C – Problem)

$$[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$$

p	q	r	$p \rightarrow q$	$q \rightarrow r$	$(p \rightarrow q) \wedge (q \rightarrow r)$	$p \rightarrow r$	See above
T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	T
T	F	T	F	T	F	T	T
T	F	F	F	T	F	F	T
F	T	T	T	T	T	T	T
F	T	F	T	F	F	T	T
F	F	T	T	T	T	T	T
F	F	F	T	T	T	T	T