

Truth Tables Worksheet 2 Solutions

Question 1

Compare $A \Rightarrow \neg B$ with the statement that A and B cannot both be true.

A	$\neg A$	B	$\neg B$	$A \Rightarrow \neg B$	A and B cannot both be true
T	F	T	F	F	F
T	F	F	T	T	T
F	T	T	F	T	T
F	T	F	T	T	T

The two columns being compared are identical in every row, so the statements are equivalent.

Conclusion: Equivalent.

Question 2

Compare $\neg C \Rightarrow D$ with the statement that $\neg C$ and $\neg D$ cannot both be true.

C	$\neg C$	D	$\neg D$	$\neg C \Rightarrow D$	$\neg C$ and $\neg D$ cannot both be true
T	F	T	F	T	T
T	F	F	T	T	T
F	T	T	F	T	T
F	T	F	T	F	F

The two columns being compared are identical in every row, so the statements are equivalent.

Conclusion: Equivalent.

Question 3

Compare $E \Rightarrow F$ with the statement that E and F cannot both be true.

E	$\neg E$	F	$\neg F$	$E \Rightarrow F$	E and F cannot both be true
T	F	T	F	T	F
T	F	F	T	F	T
F	T	T	F	T	T
F	T	F	T	T	T

The two columns being compared differ in rows 1 and 2, so the statements are not equivalent.

Conclusion: Not equivalent.

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Question 4

Compare $\neg G \Rightarrow \neg H$ with the statement that $\neg G$ and H cannot both be true.

G	$\neg G$	H	$\neg H$	$\neg G \Rightarrow \neg H$	$\neg G$ and H cannot both be true
T	F	T	F	T	T
T	F	F	T	T	T
F	T	T	F	F	F
F	T	F	T	T	T

The two columns being compared are identical in every row, so the statements are equivalent.

Conclusion: Equivalent.

Question 5

Compare $I \Rightarrow \neg J$ with the statement that $\neg I$ and J cannot both be true.

I	$\neg I$	J	$\neg J$	$I \Rightarrow \neg J$	$\neg I$ and J cannot both be true
T	F	T	F	F	T
T	F	F	T	T	T
F	T	T	F	T	F
F	T	F	T	T	T

The two columns being compared differ in rows 1 and 3, so the statements are not equivalent.

Conclusion: Not equivalent.

Question 6

Compare $K \Rightarrow L$ and $\neg L \Rightarrow \neg K$.

K	$\neg K$	L	$\neg L$	$K \Rightarrow L$	$\neg L \Rightarrow \neg K$
T	F	T	F	T	T
T	F	F	T	F	F
F	T	T	F	T	T
F	T	F	T	T	T

The two columns being compared are identical in every row, so the statements are equivalent.

Conclusion: Equivalent.

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Question 7

Compare $\neg M \Rightarrow N$ and $N \Rightarrow \neg M$.

M	$\neg M$	N	$\neg N$	$\neg M \Rightarrow N$	$N \Rightarrow \neg M$
T	F	T	F	T	F
T	F	F	T	T	T
F	T	T	F	T	T
F	T	F	T	F	T

The two columns being compared differ in rows 1 and 4, so the statements are not equivalent.

Conclusion: Not equivalent.

Question 8

Compare $O \Rightarrow \neg P$ and $P \Rightarrow \neg O$.

O	$\neg O$	P	$\neg P$	$O \Rightarrow \neg P$	$P \Rightarrow \neg O$
T	F	T	F	F	F
T	F	F	T	T	T
F	T	T	F	T	T
F	T	F	T	T	T

The two columns being compared are identical in every row, so the statements are equivalent.

Conclusion: Equivalent.

Question 9

Compare $\neg Q \Rightarrow \neg R$ and $\neg R \Rightarrow \neg Q$.

Q	$\neg Q$	R	$\neg R$	$\neg Q \Rightarrow \neg R$	$\neg R \Rightarrow \neg Q$
T	F	T	F	T	T
T	F	F	T	T	F
F	T	T	F	F	T
F	T	F	T	T	T

The two columns being compared differ in rows 2 and 3, so the statements are not equivalent.

Conclusion: Not equivalent.

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Question 10

Compare $\neg S \Rightarrow T$ and $\neg T \Rightarrow S$.

S	$\neg S$	T	$\neg T$	$\neg S \Rightarrow T$	$\neg T \Rightarrow S$
T	F	T	F	T	T
T	F	F	T	T	T
F	T	T	F	T	T
F	T	F	T	F	F

The two columns being compared are identical in every row, so the statements are equivalent.

Conclusion: Equivalent.

Question 11

Compare $A \wedge B$ with the negation of $\neg A \vee \neg B$.

A	$\neg A$	B	$\neg B$	$A \wedge B$	$\neg A \vee \neg B$	$\neg(\neg A \vee \neg B)$
T	F	T	F	T	F	T
T	F	F	T	F	T	F
F	T	T	F	F	T	F
F	T	F	T	F	T	F

The first and final columns are identical in every row, so the original statements are negations of each other.

Conclusion: Negations.

Question 12

Compare $\neg C \wedge D$ with the negation of $C \vee \neg D$.

C	$\neg C$	D	$\neg D$	$\neg C \wedge D$	$C \vee \neg D$	$\neg(C \vee \neg D)$
T	F	T	F	F	T	F
T	F	F	T	F	T	F
F	T	T	F	T	F	T
F	T	F	T	F	T	F

The first and final columns are identical in every row, so the original statements are negations of each other.

Conclusion: Negations.

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Question 13

Compare $E \vee F$ with the negation of $\neg E \wedge \neg F$.

E	$\neg E$	F	$\neg F$	$E \vee F$	$\neg E \wedge \neg F$	$\neg(\neg E \wedge \neg F)$
T	F	T	F	T	F	T
T	F	F	T	T	F	T
F	T	T	F	T	F	T
F	T	F	T	F	T	F

The first and final columns are identical in every row, so the original statements are negations of each other.

Conclusion: Negations.

Question 14

Compare $\neg G \vee H$ with the negation of $G \wedge \neg H$.

G	$\neg G$	H	$\neg H$	$\neg G \vee H$	$G \wedge \neg H$	$\neg(G \wedge \neg H)$
T	F	T	F	T	F	T
T	F	F	T	F	T	F
F	T	T	F	T	F	T
F	T	F	T	T	F	T

The first and final columns are identical in every row, so the original statements are negations of each other.

Conclusion: Negations.

Question 15

Compare $I \wedge \neg J$ with the negation of $\neg I \vee J$.

I	$\neg I$	J	$\neg J$	$I \wedge \neg J$	$\neg I \vee J$	$\neg(\neg I \vee J)$
T	F	T	F	F	T	F
T	F	F	T	T	F	T
F	T	T	F	F	T	F
F	T	F	T	F	T	F

The first and final columns are identical in every row, so the original statements are negations of each other.

Conclusion: Negations.

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Question 16

Compare $K \wedge L$ with the negation of $\neg K \wedge \neg L$.

K	$\neg K$	L	$\neg L$	$K \wedge L$	$\neg K \wedge \neg L$	$\neg(\neg K \wedge \neg L)$
T	F	T	F	T	F	T
T	F	F	T	F	F	T
F	T	T	F	F	F	T
F	T	F	T	F	T	F

The first and final columns differ in rows 2 and 3, so the original statements are not negations of each other.

Conclusion: Not negations.

Question 17

Compare $\neg M \wedge N$ with the negation of $M \vee N$.

M	$\neg M$	N	$\neg N$	$\neg M \wedge N$	$M \vee N$	$\neg(M \vee N)$
T	F	T	F	F	T	F
T	F	F	T	F	T	F
F	T	T	F	T	T	F
F	T	F	T	F	F	T

The first and final columns differ in rows 3 and 4, so the original statements are not negations of each other.

Conclusion: Not negations.

Question 18

Compare $O \vee \neg P$ with the negation of $\neg O \vee P$.

O	$\neg O$	P	$\neg P$	$O \vee \neg P$	$\neg O \vee P$	$\neg(\neg O \vee P)$
T	F	T	F	T	T	F
T	F	F	T	T	F	T
F	T	T	F	F	T	F
F	T	F	T	T	T	F

The first and final columns differ in rows 1 and 4, so the original statements are not negations of each other.

Conclusion: Not negations.

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Question 19

Compare $\neg Q \vee \neg R$ with the negation of $Q \wedge \neg R$.

Q	$\neg Q$	R	$\neg R$	$\neg Q \vee \neg R$	$Q \wedge \neg R$	$\neg(Q \wedge \neg R)$
T	F	T	F	F	F	T
T	F	F	T	T	T	F
F	T	T	F	T	F	T
F	T	F	T	T	F	T

The first and final columns differ in rows 1 and 2, so the original statements are not negations of each other.

Conclusion: Not negations.

Question 20

Complete the tables and compare the first statement with the negation of the second statement.

Guessed every question	Did not guess any question	Survived the worksheet	Did not survive the worksheet	Guessed every question and did not survive the worksheet
T	T	T	F	F
T	T	F	T	T
T	F	T	F	F
T	F	F	T	T
F	T	T	F	F
F	T	F	T	F
F	F	T	F	F
F	F	F	T	F

Guessed every question	Did not guess any question	Survived the worksheet	Did not guess any question, or survived the worksheet	It is not the case that the previous statement is true
T	T	T	T	F
T	T	F	T	F
T	F	T	T	F
T	F	F	F	T
F	T	T	T	F
F	T	F	T	F
F	F	T	T	F
F	F	F	F	T

The first statement and the negation of the second statement differ in rows 2 and 8, so the statements are not negations of each other.

Conclusion: Not negations.

The correct negation is: You did not guess every question—perhaps only a few—or you survived the worksheet anyway! :)