

Logic Checkpoint

Use truth tables to test statements.

HIGH SCHOOL • MA.912.LT.4.2

MA.912.LT.4.2 "Determine truth values of simple and compound statements using truth tables."

NAME _____

DATE _____

TRUTH TABLE RULES

A simple statement has one truth value, T or F. In a truth table, list the possible T and F combinations, then use the rule for each connector. An "and" statement is T only when both parts are T, an "or" statement is T when at least one part is T, and $p \rightarrow q$ is F only when p is T and q is F.

WORKED EXAMPLE

Let p be "10 is divisible by 2" and q be "7 is less than 4." Use a truth table to find the truth value of p or q.

- p is T, and q is F.
- Make the truth table:
- $p \mid q \mid p \text{ or } q$ TT | TTF | TFT | TFF | F
- Use the row $p = T$ and $q = F$. The result is T.

Answer: T

PRACTICE 6 problems

1 State the truth value: 13 is an odd number.

ANSWER _____

2 State the truth value: not (6 is less than 1).

ANSWER _____

3 Let $p = T$ and $q = F$. Find the truth value of p and q.

ANSWER _____

4 Let $p = F$ and $q = F$. Find the truth value of p or q.

ANSWER _____

5 Let $p = T$ and $q = F$. Find the truth value of $p \rightarrow q$.

ANSWER _____

6 Complete the truth table for $p \leftrightarrow q$. $p \mid q \mid p \leftrightarrow q$ TT | _ TF | _ FT | _ FF | _

ANSWER _____

APPLY IT Show your work

1

A student media club can livestream its esports match when the studio is open and the internet connection is working. Today, the studio is open, but the internet connection is not working. Let p mean "the studio is open" and q mean "the internet connection is working." What is the truth value of p and q ?

WORK SPACE

ANSWER _____

2

At a school game, a digital ticket is accepted if and only if its QR code is valid. Sam's ticket was not accepted, and its QR code was not valid. Let p mean "the ticket is accepted" and q mean "the QR code is valid." What is the truth value of $p \leftrightarrow q$?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Build a truth table for $(p \text{ and } q) \rightarrow (\text{not } p \text{ or } q)$. Is this compound statement always true, always false, or sometimes true?

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	State the truth value: 13 is an odd number.	T
2	State the truth value: not (6 is less than 1).	T
3	Let $p = T$ and $q = F$. Find the truth value of p and q .	F
4	Let $p = F$ and $q = F$. Find the truth value of p or q .	F
5	Let $p = T$ and $q = F$. Find the truth value of $p \rightarrow q$.	F
6	Complete the truth table for $p \leftrightarrow q$. $p \mid q \mid p \leftrightarrow q$ $T \mid T \mid \underline{\quad}$ $T \mid F \mid \underline{\quad}$ $F \mid T \mid \underline{\quad}$ $F \mid F \mid \underline{\quad}$	$p \mid q \mid p \leftrightarrow q$ $T \mid T \mid T$ $T \mid F \mid F$ $F \mid T \mid F$ $F \mid F \mid T$

PART 2 • APPLY IT

1. **F** $p = T$ and $q = F$. A conjunction with one false part is F.
2. **T** $p = F$ and $q = F$. A biconditional is T when both statements have the same truth value.

CHALLENGE

**$p \mid q \mid (p \text{ and } q) \rightarrow (\text{not } p \text{ or } q)$ $T \mid T \mid T$
 $T \mid F \mid F$
 $F \mid T \mid T$
 $F \mid F \mid T$** The statement is always true.

Accept T/F or the words true/false. For truth tables, accept rows in any order if the truth value for each p and q combination is correct.