LESSON MAKER PRO

Logic in Action

Translate statements and test when they are true.

HIGH SCHOOL · FM.LR.A.2

FM.LR.A.2 "Represent logic operations such as and, or, not, nor, and x or (exclusive or) in words, with symbols, and in truth tables."

NAME _____ DATE _____

THE BIG IDEA

For statements p and q, $p \wedge q$ is true only when both are true, while $p \vee q$ is true when at least one is true. The symbol $\neg$ means NOT: $\neg p$ reverses p, and $\neg(p \vee q)$, called NOR, is true only when both statements are false. The symbol $\oplus$ means exclusive OR, or XOR: $p \oplus q$ is true when exactly one statement is true.

WORKED EXAMPLE

Let p be F and q be F. Find $\neg(p \vee q)$.

1. Evaluate the expression inside the parentheses: $p \vee q$ is F.
2. Apply NOT to that result: $\neg F$ is T.

Answer: T

PRACTICE 6 problems

1 Let m mean a movie is on and f mean a friend is free. Write "The movie is on and a friend is free" using symbols.

ANSWER _____

2 Let p be F and q be T. Find $p \oplus q$.

ANSWER _____

3 Let p be T and q be T. Find $p \vee q$.

ANSWER _____

4 Let p be T. Find $\neg p$.

ANSWER _____

5 Let p be T and q be F. Find $p \wedge q$.

ANSWER _____

6 In the truth table, what value replaces the ?

NOR TRUTH TABLE

p	q	$\neg(p \vee q)$
T	T	F
T	F	F
F	T	?
F	F	T

ANSWER _____

APPLY IT Show your work

1 A concert livestream unlocks if you have a paid pass or a promo code, including when you have both. Let p mean you have a paid pass and q mean you have a promo code. Write the unlock rule in symbols. Does the livestream unlock if p is F and q is T?

WORK SPACE

ANSWER _____

2 An esports event lets you enter exactly one division: solo or team. Let s mean you enter solo and t mean you enter team. Write the entry rule in symbols. If you enter both, do you meet the rule?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Complete both result columns in the truth table. Do $(p \wedge \neg q) \vee (\neg p \wedge q)$ and $p \oplus q$ match in every row? Explain using the table.

COMPARE TWO EXPRESSIONS

p	q	$(p \wedge \neg q) \vee (\neg p \wedge q)$	$p \oplus q$
T	T	?	?
T	F	?	?
F	T	?	?
F	F	?	?

WORK SPACE AND ANSWER

Logic in Action

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Let m mean a movie is on and f mean a friend is free. Write "The movie is on and a friend is free" using symbols.	**m ∧ f**
2	Let p be F and q be T. Find p ⊕ q.	**T**
3	Let p be T and q be T. Find p ∨ q.	**T**
4	Let p be T. Find ¬p.	**F**
5	Let p be T and q be F. Find p ∧ q.	**F**
6	In the truth table, what value replaces the ?	**F**

PART 2 · APPLY IT

1. **p ∨ q; yes, it unlocks.** The rule is OR because either option is enough. F ∨ T is T.
2. **s ⊕ t; no, you do not meet the rule.** Exactly one calls for XOR. When both statements are T, s ⊕ t is F.

CHALLENGE

For the rows T,T; T,F; F,T; F,F, both result columns are F, T, T, F. Yes, they match in every row: both are true exactly when one of p and q is true.

Accept equivalent wording for the word-problem conclusions and challenge explanation. In the challenge, check that both result columns have the same values in the same row order.