LESSON MAKER PRO

Logic Matchup

Compare truth values to test each pair.

HIGH SCHOOL · MA.912.LT.4.5

MA.912.LT.4.5 "Determine whether two propositions are logically equivalent."

NAME _____ DATE _____

THE BIG IDEA

In this worksheet, ^ means and, v means or, and ~ means not. Two propositions are logically equivalent if they have the same truth value for every possible combination of truth values. Make a truth table and compare the final columns.

WORKED EXAMPLE

Determine whether m -> (n v k) and ~m v n v k are logically equivalent.

1. Use rows TTT, TTF, TFT, TFF, FTT, FTF, FFT, FFF for m, n, k.
2. For m -> (n v k), the final column is T, T, T, F, T, T, T, T.
3. For ~m v n v k, the final column is T, T, T, F, T, T, T, T.
4. The final columns match in every row.

Answer: Yes, m -> (n v k) and ~m v n v k are logically equivalent.

PRACTICE 6 problems

1 Determine whether p -> q and ~q -> ~p are logically equivalent.

ANSWER _____

2 Determine whether p v q and p ^ q are logically equivalent.

ANSWER _____

3 Determine whether ~(r v s) and ~r ^ ~s are logically equivalent.

ANSWER _____

4 Determine whether r -> s and r ^ s are logically equivalent.

ANSWER _____

5 Determine whether ~(t -> u) and t ^ ~u are logically equivalent.

ANSWER _____

6 Determine whether (a ^ b) v (a ^ ~b) and a are logically equivalent.

ANSWER _____

APPLY IT Show your work

1 Let p mean you attend every robotics club meeting, and let q mean you may compete at the regional event. Compare these statements: A, If you attend every robotics club meeting, then you may compete at the regional event. B, Either you do not attend every robotics club meeting, or you may compete at the regional event. Are A and B logically equivalent?

WORK SPACE

ANSWER _____

2 Let p mean you post your art portfolio by the deadline, and let q mean your work is shown in the school gallery. Compare these statements: A, If you post your portfolio by the deadline, then your work is shown in the gallery. B, If your work is shown in the gallery, then you posted your portfolio by the deadline. Are A and B logically equivalent?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Use a truth table or logic laws. Are (p -> q) ^ (p -> r) and p -> (q ^ r) logically equivalent? Explain why in one or two sentences.

WORK SPACE AND ANSWER

ANSWER KEY # Logic Matchup

HIGH SCHOOL · MA.912.LT.4.5

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Determine whether p -> q and ~q -> ~p are logically equivalent.	**Yes, they are logically equivalent.**
2	Determine whether p v q and p ^ q are logically equivalent.	**No, they are not logically equivalent.**
3	Determine whether ~(r v s) and ~r ^ ~s are logically equivalent.	**Yes, they are logically equivalent.**
4	Determine whether r -> s and r ^ s are logically equivalent.	**No, they are not logically equivalent.**
5	Determine whether ~(t -> u) and t ^ ~u are logically equivalent.	**Yes, they are logically equivalent.**
6	Determine whether (a ^ b) v (a ^ ~b) and a are logically equivalent.	**Yes, they are logically equivalent.**

PART 2 · APPLY IT

1. **Yes, A and B are logically equivalent.** A has the form p -> q. B has the form ~p v q, which has the same truth table as p -> q.
2. **No, A and B are not logically equivalent.** A is p -> q, while B is q -> p. When p is false and q is true, A is true but B is false.

CHALLENGE

Yes, they are logically equivalent. Both expressions are false only when p is true and at least one of q or r is false.

Accept a correct truth table, a valid logical identity, or a counterexample row for a pair that is not equivalent. Treat v as inclusive or.