LESSON MAKER PRO

Test the Claim

Use algebra and counterexamples to check logical statements.

HIGH SCHOOL · G.RL.1

G.RL.1 "Use appropriate tools and logic, including algebraic methods, to evaluate mathematical arguments. Use undefined terms, definitions, postulates, and theorems in logical arguments/proofs..."

NAME _____ DATE _____

CHECK BOTH DIRECTIONS

A conditional says, "If P, then Q." Solve or simplify P to check whether Q must follow. The converse switches P and Q, so check it separately. To disprove either statement, find one value that makes its "if" part true and its "then" part false.

WORKED EXAMPLE

If $7x - 13 = 50$, then $x = 9$. Is the statement true? Is its converse true?

1. Add 13 to both sides: $7x = 63$.
2. Divide by 7: $x = 9$. The original statement is true.
3. Check the converse: when $x = 9$, $7(9) - 13 = 50$.

Answer: Both the statement and its converse are true.

PRACTICE 6 problems

1 If $3x + 4 = 19$, then $x = 5$. Is the statement true?

ANSWER _____

2 If $4x - 6 = 18$, then $x = 3$. Is the statement true? If not, give a counterexample.

ANSWER _____

3 If $x = 8$, then $6x + 1 = 49$. Is the statement true?

ANSWER _____

4 Write the contrapositive of this statement: If $3x < 0$, then $x < 0$.

ANSWER _____

5 If $x < 4$, then $x < 10$. Is the converse true? If not, give a counterexample.

ANSWER _____

6 If $x < -3$, then $-4x > 12$. Is the statement true? Explain using algebra.

ANSWER _____

APPLY IT Show your work

1 Concert tickets cost $12 each, plus one $8 fee per order. A post claims, “If an order totals $56, it contains 3 tickets.” Is the claim valid? If not, give a ticket count that disproves it.

WORK SPACE

ANSWER _____

2 A streaming plan costs $14 per month, plus a one-time $6 fee. A classmate claims, “If the total for x months is more than $48, then x > 3.” Is the claim true? Is its converse true? Show how you know.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For real numbers x, consider: “If 3x + 8 > 20, then x > 1.” Is the statement true? Is its converse true? Use algebra to justify each conclusion or give a counterexample.

WORK SPACE AND ANSWER

ANSWER KEY

Test the Claim

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	If 3x + 4 = 19, then x = 5. Is the statement true?	**True.**
2	If 4x - 6 = 18, then x = 3. Is the statement true? If not, give a counterexample.	**False. When x = 6, 4x - 6 = 18, but x is not 3.**
3	If x = 8, then 6x + 1 = 49. Is the statement true?	**True.**
4	Write the contrapositive of this statement: If 3x < 0, then x < 0.	**If x >= 0, then 3x >= 0.**
5	If x < 4, then x < 10. Is the converse true? If not, give a counterexample.	**No. The converse says, "If x < 10, then x < 4." When x = 6, its first part is true and its second part is false.**
6	If x < -3, then -4x > 12. Is the statement true? Explain using algebra.	**True. Multiplying x < -3 by -4 reverses the inequality and gives -4x > 12.**

PART 2 · APPLY IT

1. **No. An order of 4 tickets totals $56, not 3 tickets.** Solve 12x + 8 = 56 to get x = 4. This makes the claim's first part true and its second part false.
2. **The claim and its converse are both true.** Solving 14x + 6 > 48 gives x > 3, so the claim is true. Starting with x > 3 and multiplying by 14, then adding 6, gives 14x + 6 > 48, so the converse is also true.

CHALLENGE

The statement is true: 3x + 8 > 20 gives x > 4, which guarantees x > 1. The converse is false. When x = 3, x > 1, but 3x + 8 = 17, which is not greater than 20.

Accept any valid counterexample in problems 2 and 5 and the challenge. In problem 4, accept an equivalent contrapositive with both inequalities negated.