LESSON MAKER PRO

Logic Reality Check

Test claims, test arguments, and find the exception.

HIGH SCHOOL · MA.912.LT.4.10

MA.912.LT.4.10 "Judge the validity of arguments and give counterexamples to disprove statements."

NAME _____ DATE _____

TEST THE LOGIC

An argument is valid when the premises cannot be true while the conclusion is false. To disprove a statement that says something is always true, find one counterexample that makes the statement fail.

WORKED EXAMPLE

Is this statement true? Every integer greater than 8 is even.

1. Test the integer 9.
2. 9 is greater than 8.
3. 9 is odd, not even.

Answer: False. A counterexample is 9.

PRACTICE 6 problems

1 Judge this argument: If an integer is divisible by 4, then it is even. 18 is even. Therefore, 18 is divisible by 4.

ANSWER _____

2 Is this statement true? For every integer x, if x^2 is even, then x is even.

ANSWER _____

3 Judge this argument: For any real x, if $x > 5$, then $x^2 > 25$. 3^2 is not greater than 25. Therefore, 3 is not greater than 5.

ANSWER _____

4 Is this statement true? All prime numbers are odd. If it is false, give a counterexample.

ANSWER _____

5 Judge this argument: If a student joins the debate club, then the student attends the first meeting. Maya attended the first meeting. Therefore, Maya joined the debate club.

ANSWER _____

6 Is this statement true? For every integer x, if x is odd, then x^2 is odd.

ANSWER _____

APPLY IT Show your work

1 An esports tournament uses this rule: If a team wins every match, then it earns a playoff spot. Team Nova earned a playoff spot. A commentator concludes that Team Nova won every match. Is the commentator's argument valid? Give a counterexample if it is invalid.

WORK SPACE

ANSWER _____

2 A career teacher says, "If a student uploads a portfolio by the deadline, then the student receives feedback." Eli did not receive feedback. The teacher concludes that Eli did not upload a portfolio by the deadline. Is this argument valid?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student claims, "For every integer x, if x^2 is divisible by 12, then x is divisible by 12." Is the claim true? Explain your reasoning with a counterexample if needed.

WORK SPACE AND ANSWER

ANSWER KEY

Logic Reality Check

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Judge this argument: If an integer is divisible by 4, then it is even. 18 is even. Therefore, 18 is divisible by 4.	**Invalid. 18 is even but is not divisible by 4.**
2	Is this statement true? For every integer x, if x^2 is even, then x is even.	**True.**
3	Judge this argument: For any real x, if $x > 5$, then $x^2 > 25$. 3^2 is not greater than 25. Therefore, 3 is not greater than 5.	**Valid.**
4	Is this statement true? All prime numbers are odd. If it is false, give a counterexample.	**False. A counterexample is 2.**
5	Judge this argument: If a student joins the debate club, then the student attends the first meeting. Maya attended the first meeting. Therefore, Maya joined the debate club.	**Invalid. Maya could have attended the meeting as a guest without joining the club.**
6	Is this statement true? For every integer x, if x is odd, then x^2 is odd.	**True.**

PART 2 · APPLY IT

1. **Invalid.** Team Nova could have lost one match and still earned a playoff spot. The rule says winning every match is enough to earn a spot, but it does not say it is the only way. A team could earn a spot with a loss.
2. **Valid.** This uses the contrapositive form. If uploading leads to feedback, then no feedback means the portfolio was not uploaded by the deadline.

CHALLENGE

False. Let $x = 6$. Then $6^2 = 36$, and 36 is divisible by 12, but 6 is not divisible by 12.

Accept any valid counterexample that makes the premises true and conclusion false, or that makes a universal statement fail. For true statements and valid arguments, accept a correct statement that no counterexample exists.