LESSON MAKER PRO

Logic Link Lab

Use statements and set relationships to prove what follows.

HIGH SCHOOL · MA.912.LT.4.9

MA.912.LT.4.9 "Construct logical arguments using laws of detachment, syllogism, tautology, contradiction and Euler Diagrams."

NAME _____ DATE _____

BUILD A VALID ARGUMENT

Use detachment when p -> q is true and p is true, so q must be true. Use syllogism when p -> q and q -> r are true, so p -> r is true. A tautology is always true, a contradiction is always false, and an Euler diagram shows which groups fit inside or do not overlap other groups.

WORKED EXAMPLE

If a library book is overdue, then it has a late notice. This book is overdue. What conclusion follows?

1. Let p = "the book is overdue" and q = "the book has a late notice."
2. The first statement says p -> q.
3. The second statement says p is true.
4. By detachment, q is true.

Answer: The book has a late notice.

PRACTICE 6 problems

1 If an integer is divisible by 4, then it is even. 28 is divisible by 4. What conclusion follows by detachment?

ANSWER _____

2 If a file is saved, then it can be shared. If a file can be shared, then classmates can view it. What conclusion follows by syllogism?

ANSWER _____

3 Classify the statement p or not p as a tautology, contradiction, or neither.

ANSWER _____

4 Classify the statement p and not p as a tautology, contradiction, or neither.

ANSWER _____

5 All photographers are artists. No artists are astronauts. Describe the correct Euler diagram.

ANSWER _____

6 If a number is a multiple of 6, then it is even. 14 is even. Therefore, 14 is a multiple of 6. Is this argument valid?

ANSWER _____

APPLY IT Show your work

1 Nia is applying for a student tech crew. If a student completes the equipment quiz, then the student gets a checkout pass. If a student gets a checkout pass, then the student may borrow a camera for the school event. Nia completes the equipment quiz. What conclusion can you prove? Name the laws you use.

WORK SPACE

ANSWER _____

2 At club sign-up, all esports team members are gaming club members. No gaming club members are chess club members. Malik is an esports team member. State two facts about Malik that must be true, and describe the Euler diagram.

WORK SPACE

ANSWER _____

CHALLENGE One step up

At a campus coding event, if a student registers, then the student receives a badge. If a student receives a badge, then the student may enter the coding lab. Ava registers. Use syllogism and detachment to write a valid conclusion. Then classify the statement "Ava may enter the coding lab and Ava may not enter the coding lab" as a tautology, contradiction, or neither. Explain your reasoning.

WORK SPACE AND ANSWER

Logic Link Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	If an integer is divisible by 4, then it is even. 28 is divisible by 4. What conclusion follows by detachment?	**28 is even.**
2	If a file is saved, then it can be shared. If a file can be shared, then classmates can view it. What conclusion follows by syllogism?	**If a file is saved, then classmates can view it.**
3	Classify the statement p or not p as a tautology, contradiction, or neither.	**tautology**
4	Classify the statement p and not p as a tautology, contradiction, or neither.	**contradiction**
5	All photographers are artists. No artists are astronauts. Describe the correct Euler diagram.	**The photographers circle is entirely inside the artists circle, and the astronauts circle does not overlap the artists circle.**
6	If a number is a multiple of 6, then it is even. 14 is even. Therefore, 14 is a multiple of 6. Is this argument valid?	**Invalid, it affirms the consequent.**

PART 2 · APPLY IT

1. **Nia may borrow a camera for the school event.** Use syllogism, then detachment. Use syllogism to connect completing the quiz to being allowed to borrow a camera. Then use detachment because Nia completed the quiz.
2. **Malik is a gaming club member, and Malik is not a chess club member.** The esports circle is inside the gaming club circle, and the chess club circle does not overlap the gaming club circle. Since Malik is in esports, he is in the gaming club. Because the gaming club and chess club do not overlap, Malik cannot be in the chess club.

CHALLENGE

Ava may enter the coding lab. The final statement is a contradiction because it has the form r and not r.

Accept equivalent wording for valid conclusions and Euler diagram descriptions. For the challenge, accept an explanation that identifies the final statement as a contradiction because both a statement and its negation cannot be true together.