

# Geometry Lesson 21

Objective: TSW know and use the laws of detachment and syllogism.

Date: \_\_\_\_\_

Period: \_\_\_\_\_

\_\_\_\_\_ reasoning - the process of using logic to draw conclusions from given facts, definitions, and properties.

When two related statements are true, deductive reasoning can be used to make a conclusion. For example:

*The bakery makes fresh bread every morning. It is morning. Therefore, \_\_\_\_\_.*

## Example 1 Using Deductive Reasoning

Use deductive reasoning to form a "Therefore" concluding statement from the given statements.

a. *All human beings need to breathe. Marla is a human being.*

SOLUTION

b. *All the chess team members won their opening match in the last tournament. Jeffery is on the chess team.*

SOLUTION

c. *All the women in the royal family were wearing hats at the ball. Melissa is in the royal family.*

SOLUTION

**Law of Detachment - For two statements  $p$  and  $q$ , when "If  $p$ , then  $q$ " is a true statement and  $p$  is true, then  $q$  is true.**

The Law of Detachment is a form of deductive reasoning that can be used to draw valid concluding statements. When the given facts are true, then correct logic can lead to a valid conclusion. For example:

*If it is Monday, then Marc will go to work.*

*Today is Monday. Therefore, \_\_\_\_\_.*

In the statements above,  $p$  represents the phrase "it is Monday," and  $q$  represents the phrase "Marc will go to work."

### Caution

Be sure to draw conclusions based on the information given. Do not make assumptions that are not logically sound or which have not been stated in the question.

## Example 2 Using the Law of Detachment

For the following statements, use the Law of Detachment to write a valid concluding statement. Assume each conditional statement is true.

a. *When it is cold outside, I wear my warm jacket. It is cold outside today.*

SOLUTION

b. *If an angle is acute, then it cannot be obtuse. Angle D is acute.*

SOLUTION

c. *If a number is even, then it can be divided by 2. The number 104 is even.*

SOLUTION

Law of Syllogism - When "If  $p$ , then  $q$ " and "If  $q$ , then  $r$ " are true statements, then "If  $p$ , then  $r$ " is a true statement. The Law of Syllogism is another form of deductive reasoning. In this case, a third conditional statement is based on two conditional statements in which the conclusion of one is the hypothesis of the other.

This law poses that an intermediate truth is a valid progression from the original statement to a valid conclusion. For example:

*If there is a power outage, then the freezer does not work.*

AND

*If the freezer does not work, then the ice cream will eventually melt.*

THEN

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#### Example 3 Using the Law of Syllogism

Use the Law of Syllogism to write a third conditional statement based on the statements below.

*If Annika jumps higher than 5 feet 3 inches in this event, then she will win first place.*

*If Annika wins first place, then she will receive a medal.*

SOLUTION

#### Example 4 Using the Laws of Detachment and Syllogism

For each of the given statement sets, draw a valid conclusion. Identify which law is used to reach the conclusion. Assume each conditional statement is true.

a. *If Maria wants to see a movie, then she goes to the theater. If Maria goes to the theater, then she buys popcorn.*

SOLUTION

b. *If it is raining, then I will take an umbrella to school. Today, it is raining.*

SOLUTION

c. *All bibbles are bobbles. All bobbles play bubbles.*

SOLUTION

You Try!!!!

Use deductive reasoning to form a concluding statement from the given information.

- a. *All the girls on the swim team are left-handed. Lorissa is on the swim team.*
- b. *When it is below 32°F for at least a week, the pond freezes. It has been below 32°F for a week.*
- c. *When every answer on a math test is correct, a student will get a perfect score on the test. Michael got every answer correct on the last math test.*
- d. *When employees work more than 40 hours in a week, they get paid overtime. Dominiqua worked 43 hours this week.*
- e. Use the Law of Detachment to write a valid conclusion to the statements below.  
*If the gift I bought for my cousin is a toy truck, then it has four wheels.*  
*The gift I bought for my cousin is a toy truck.*
- f. Write a third conditional statement using the Law of Syllogism:  
*If Nafeesa enrolls in an elective, then she will enroll in Orchestra.*  
*If Nafeesa enrolls in Orchestra, then she will play the violin this semester.*
- g. What conclusion can be drawn from the following set of statements?  
*If I oversleep tomorrow morning, then I will miss my bus.*  
*If I miss my bus, then I will be late for my appointment.*
- h. Which law was used to reach the conclusion in problem g?

Use detachment or syllogism to draw a valid conclusion to the following statements. Identify which law was used in reaching the conclusion.

- i. *If a gumble is hungry, it craves gloop. If a gumble craves gloop, he must hunt for gloop.*
- j. *If a vehicle is a unicycle, then it has only one wheel. This vehicle is a unicycle.*