

Lesson 21

Laws of Detachment and Syllogism

Deductive 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, the bakery is making
fresh bread.*

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

Therefore, Marla needs to breathe.

Example 1 Using Deductive Reasoning

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

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

SOLUTION

Therefore, Jeffery won his opening match in the last tournament.

Example 1 Using Deductive Reasoning

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

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

SOLUTION

Therefore, Melissa was wearing a hat at the ball.

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, Marc will go to work today.

In the statements above, p represents the phrase “*it is Monday,*” and q represents the phrase “*Marc will go to work.*”

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

Therefore, I will wear my warm jacket today.

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.

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

SOLUTION

Therefore, angle D cannot be obtuse.

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.

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

SOLUTION

Therefore, 104 can be divided by 2.

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

If there is a power outage, then the ice cream will eventually melt.

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

“Annika jumps higher than 5 feet 3 inches in this event” is p . “She will win first place” is q . “She will receive a medal” is r . Using the Law of Syllogism, write “if p , then r .”

If Annika jumps higher than 5 feet 3 inches in this event, then she will receive a medal.

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

If Maria wants to see a movie, then she buys popcorn.

The Law of Syllogism is used. The first statement is of the form “If p , then q .” The second statement is of the form “If q , then r .” The conclusion follows, “If p , then r .”

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.

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

SOLUTION

Therefore, today I will bring an umbrella to school.

The Law of Detachment is used. The first statement is of the form “If p , then q .” The second statement is of the form “ p is true,” which leads to the conclusion, “then q .”

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.

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

SOLUTION

Recall that conditional statements are not always in ‘if-then’ form, but they can be rewritten that way. In ‘if-then’ form, the given statements read as follows:

If something is a bibble, then it is also a bobble. If something is a bobble, then it plays bubbles.

If something is a bibble, then it plays bubbles.

The Law of Syllogism is used. The first statement is of the form “If p , then q .” The second statement is of the form “If q , then r .” The conclusion follows, “If p , then r .”

You Try!!!!

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

All the girls on the swim team are left-handed. Lorissa is on the swim team.

When it is below 32°F for at least a week, the pond freezes. It has been below 32°F for a week.

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.

When employees work more than 40 hours in a week, they get paid overtime. Dominiqua worked 43 hours this week.

You Try!!!!

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.

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.

You Try!!!!

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.

Which law was used to reach the conclusion in problem g?

You Try!!!!

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.

If a gumble is hungry, it craves gloop. If a gumble craves gloop, he must hunt for gloop.

If a vehicle is a unicycle, then it has only one wheel. This vehicle is a unicycle.

Assignment

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Lesson Practice (Ask Mr. Heintz)

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Practice 1–30 (Do the starred ones first)