



# Law of Detachment and Deductive Reasoning in Geometry

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## Learning Objectives

- Distinguish between inductive and deductive reasoning
- Identify the hypothesis and conclusion of a conditional statement
- Apply the Law of Detachment to determine validity of an argument
- Form valid conclusions from given premises using deductive reasoning

Read each problem carefully and apply the Law of Detachment or identify the type of reasoning used to determine the correct conclusion.

**1. Identify whether the following reasoning is inductive or deductive: 'Every quiz this month has been on a Friday. Therefore, next week's quiz will be on Friday.'**

Answer: \_\_\_\_\_

**2. Identify whether the following reasoning is inductive or deductive: 'All right angles measure 90 degrees. Angle A is a right angle. Therefore, angle A measures 90 degrees.'**

Answer: \_\_\_\_\_

**3. Identify the hypothesis and conclusion of the conditional statement: 'If two angles are vertical, then they are congruent.'**

Answer: \_\_\_\_\_

**4. Apply the Law of Detachment. Given: 'If a polygon is a triangle, then it has three sides.' Figure ABC is a triangle. What conclusion follows?**

Answer: \_\_\_\_\_

**5. Apply the Law of Detachment. Given: 'If an angle measures 90 degrees, then it is a right angle.' Angle X measures 90 degrees. What conclusion follows?**

Answer: \_\_\_\_\_

**6. Determine whether the argument is valid by the Law of Detachment: 'If it rains, then the field is wet. The field is wet. Therefore, it rained.'**

Answer: \_\_\_\_\_

**7. Determine whether the argument is valid by the Law of Detachment: 'If two lines are perpendicular, then they form right angles. Lines m and n are perpendicular. Therefore, lines m and n form right angles.'**

Answer: \_\_\_\_\_

**8. Use the Law of Detachment to write a valid conclusion. Given: 'If a number is divisible by 4, then it is even.' The number 16 is divisible by 4.**

Answer: \_\_\_\_\_



**9. Determine whether the conclusion is valid: 'If an angle is acute, then it measures less than 90 degrees. Angle B measures 45 degrees. Therefore, angle B is acute.'**

Answer: \_\_\_\_\_

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**10. Use the Law of Detachment to write a valid conclusion. Given: 'If a triangle has three congruent sides, then it is equilateral.' Triangle PQR has three congruent sides.**

Answer: \_\_\_\_\_





This worksheet covers the difference between inductive reasoning (conjecture based on patterns) and deductive reasoning (theorem based on facts), identifying conditionals, and applying the Law of Detachment to validate arguments in geometry.

## Solutions

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1. Identify whether the following reasoning is inductive or deductive: 'Every quiz this month has been on a Friday. Therefore, next week's quiz will be on Friday.'

- The conclusion is drawn from observing a repeated pattern of quizzes occurring on Fridays.
- Since the conclusion is a conjecture based on a pattern rather than a proven fact, this is inductive reasoning.

**Answer:** Inductive Reasoning

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2. Identify whether the following reasoning is inductive or deductive: 'All right angles measure 90 degrees. Angle A is a right angle. Therefore, angle A measures 90 degrees.'

- The argument starts with a known fact about right angles.
- Since the conclusion follows logically from accepted facts and definitions, the reasoning is deductive.

**Answer:** Deductive Reasoning

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3. Identify the hypothesis and conclusion of the conditional statement: 'If two angles are vertical, then they are congruent.'

- In a conditional 'If  $p$ , then  $q$ ,' the hypothesis is the part following 'if.'
- The conclusion is the part following 'then.'
- So the hypothesis is 'two angles are vertical' and the conclusion is 'they are congruent.'

**Answer:** Hypothesis: two angles are vertical; Conclusion: they are congruent

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4. Apply the Law of Detachment. Given: 'If a polygon is a triangle, then it has three sides.' Figure ABC is a triangle. What conclusion follows?

- The Law of Detachment states that if 'If  $p$ , then  $q$ ' is true and  $p$  is true, then  $q$  must be true.
- Here  $p$  is 'a polygon is a triangle' and  $q$  is 'it has three sides.'
- Since ABC is a triangle,  $p$  is true, so we conclude that ABC has three sides.

**Answer:** Figure ABC has three sides.

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5. Apply the Law of Detachment. Given: 'If an angle measures 90 degrees, then it is a right angle.' Angle X measures 90 degrees. What conclusion follows?

- Identify the hypothesis: 'an angle measures 90 degrees.'
- Identify the conclusion: 'it is a right angle.'
- Since angle X measures 90 degrees, the hypothesis is satisfied, so by the Law of Detachment, angle X is a right angle.

**Answer:** Angle X is a right angle.

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6. Determine whether the argument is valid by the Law of Detachment: 'If it rains, then the field is wet. The field is wet. Therefore, it rained.'

- The Law of Detachment requires the hypothesis to be true, not the conclusion.
- Here, the conclusion 'the field is wet' is given, not the hypothesis 'it rains.'
- The field could be wet for other reasons, so the argument is invalid.

**Answer:** Invalid

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7. Determine whether the argument is valid by the Law of Detachment: 'If two lines are perpendicular, then they form right angles. Lines  $m$  and  $n$  are perpendicular. Therefore, lines  $m$  and  $n$  form right angles.'

→ The conditional 'If  $p$ , then  $q$ ' is given as true.

→ The hypothesis  $p$ , 'lines  $m$  and  $n$  are perpendicular,' is also stated to be true.

→ By the Law of Detachment, the conclusion  $q$ , 'they form right angles,' must be true, so the argument is valid.

**Answer:** Valid

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8. Use the Law of Detachment to write a valid conclusion. Given: 'If a number is divisible by 4, then it is even.' The number 16 is divisible by 4.

→ The hypothesis is 'a number is divisible by 4,' and the conclusion is 'it is even.'

→ Since 16 satisfies the hypothesis, the Law of Detachment lets us conclude that 16 is even.

**Answer:** 16 is even.

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9. Determine whether the conclusion is valid: 'If an angle is acute, then it measures less than 90 degrees. Angle B measures 45 degrees. Therefore, angle B is acute.'

→ The Law of Detachment requires that the hypothesis 'an angle is acute' be stated as true.

→ Here the given information matches the conclusion, not the hypothesis.

→ Although the statement may be true by definition, it is not a valid application of the Law of Detachment.

**Answer:** Invalid by Law of Detachment

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10. Use the Law of Detachment to write a valid conclusion. Given: 'If a triangle has three congruent sides, then it is equilateral.' Triangle PQR has three congruent sides.

→ Identify the hypothesis: 'a triangle has three congruent sides.'

→ Identify the conclusion: 'it is equilateral.'

→ Since triangle PQR satisfies the hypothesis, by the Law of Detachment, triangle PQR is equilateral.

**Answer:** Triangle PQR is equilateral.

