NAME _____ DATE _____

Study Guide

Student Edition
Pages 85–91

Deductive Reasoning

Two important laws used frequently in deductive reasoning are the **Law of Detachment** and the **Law of Syllogism**. In both cases you reach conclusions based on if-then statements.

Law of Detachment	Law of Syllogism
If $p \rightarrow q$ is a true conditional and p is true, then q is true.	If $p \rightarrow q$ and $q \rightarrow r$ are true conditionals, then $p \rightarrow r$ is also true.

Example: Determine if statement (3) follows from statements (1) and (2) by the Law of Detachment or the Law of Syllogism. If it does, state which law was used.

(1) If you break an item in a store, you must pay for it.
(2) Jill broke a vase in Potter's Gift Shop.
(3) Jill must pay for the vase.

Yes, statement (3) follows from statements (1) and (2) by the Law of Detachment.

Determine if a valid conclusion can be reached from the two true statements using the Law of Detachment or the Law of Syllogism. If a valid conclusion is possible, state it and the law that is used. If a valid conclusion does not follow, write no conclusion.

1. (1) If a number is a whole number, then it is an integer.
(2) If a number is an integer, then it is a rational number.

2. (1) If a dog eats Dogfood Delights, the dog is happy.
(2) Fido is a happy dog.

3. (1) If people live in Manhattan, then they live in New York.
(2) If people live in New York, then they live in the United States.

4. (1) Angles that are complementary have measures with a sum of 90.
(2) $\angle A$ and $\angle B$ are complementary.

5. (1) All fish can swim.
(2) Fonzo can swim.

6. Look for a Pattern Find the next number in the list 83, 77, 71, 65, 59 and make a conjecture about the pattern.

NAME _____ DATE _____

Practice

Student Edition
Pages 85–91

Deductive Reasoning

Determine if a valid conclusion can be reached from the two true statements using the Law of Detachment or the Law of Syllogism. If a valid conclusion is possible, state it and the law that is used. If a valid conclusion does not follow, write no conclusion.

1. If Jim is a Texan, then he is an American.
   Jim is a Texan.

2. If Spot is a dog, then he has four legs.
   Spot has four legs.

3. If Rachel lives in Tampa, then Rachel lives in Florida.
   If Rachel lives in Florida, then Rachel lives in the United States.

4. If October 12 is a Monday, then October 13 is a Tuesday.
   October 12 is a Monday.

5. If Henry studies his algebra, then he passes the test.
   If Henry passes the test, then he will get a good grade.

Determine if statement (3) follows from statements (1) and (2) by the Law of Detachment or the Law of Syllogism. If it does, state which law was used. If it does not, write invalid.

6. (1) If the measure of an angle is greater than 90, then it is obtuse.
   (2) $m\angle T$ is greater than 90.
   (3) $\angle T$ is obtuse.

7. (1) If Pedro is taking history, then he will study about World War II.
   (2) Pedro will study about World War II.
   (3) Pedro is taking history.

8. (1) If Julie works after school, then she works in a department store.
   (2) Julie works after school.
   (3) Julie works in a department store.

9. (1) If William is reading, then he is reading a magazine.
   (2) If William is reading a magazine, then he is reading a magazine about computers.
   (3) If William is reading, then he is reading a magazine about computers.

10. **Look for a Pattern** Tanya likes to burn candles. She has found that, once a candle has burned, she can melt 3 candle stubs, add a new wick, and have one more candle to burn. How many total candles can she burn from a box of 15 candles?

Sequencing Worksheet **Name:**_____

**REMEMBER: A contrapositive of a conditional is the same as the conditional itself!

EXERCISES: Each of the following exercises consists of a "theorem" and a proof in which one or more of the statements has been omitted. By studying the relationships of the statements given, write the missing statements.

1. **Theorem :**

   If you could count to one million without stopping, it would take you more than a week to do it

   Proof:
   - If you could count to one million without stopping, it would take you at least one million seconds
   - If something takes at least one million seconds, it takes more than sixteen thousand minutes
   - If something takes more than sixteen thousand minutes, it takes more than two hundred hours.
   - _____
     (write in statement)
   - If something takes more than eight days, it would take you more than a week to do it

2. **Theorem:**

   If the electricity was off during the night, you will be late to school.

   Proof:
   - If the electricity was off during the night, your clock will be slow.
   - If your clock is slow, you won't realize what time it is.
   - _____
     (write in statement)

3. **Theorem:**
   - If there is a total eclipse of the sun, the temperature can be determined without a thermometer.

   Proof:
   - _____
     (write in statement)
   - If the sky becomes dark, the crickets think that it is night.
   - _____
     (write in statement)
   - If crickets start chirping, it is possible to estimate the temperature by counting the number of chirps per minute.
   - If the temperature is estimated by counting cricket chirps, it can be determined without a thermometer.

4. **What theorem is proved by the following statements?**

   Theorem:

   _____
   (write in statement)

   Proof:
   - If the moon were made of green cheese, mice would make eager astronauts.
   - If mice were eager astronauts, sooner or later NASA would send some on a lunar mission.
   - If mice were sent on a lunar mission, the eyes of the entire world would be watching them on TV.
   - If the eyes of the entire world watched some mice on TV, it would be one giant peep for mousekind.

5. **What is wrong with the following proof:**

   Theorem:

   If all three sides of a triangle are equal, then each of its angles has a measure of $60°$

   Proof:
   - If all three sides of a triangle are equal, then the triangle is equilateral.
   - If a triangle is equiangular, then it is also equilateral.
   - If a triangle is equiangular, then each of its angles has a measure of $60°$

   _____

6. **The following logic was written by Lewis Carroll. Carroll deliberately made the proof difficult to follow by not stating his sentences in "If-Then" form and by not stating them in logical order. Make the proof more understandable by rewriting it, doing both of these things.**
   Theorem:
   Babies cannot manage crocodiles.
   Proof:
   - Babies are illogical.
   - Nobody is despised who can manage a crocodile
   - Illogical persons are despised.

   _____

   _____

   _____

7. **The following proof looks incorrect but is actually valid. Show why there is nothing wrong with it by replacing one of the statements with one that is logically equivalent.**
   Proof:
   - If the opposite sides of a quadrilateral are equal, then they are parallel
   - If a quadrilateral is not a parallelogram, then its opposite sides are not parallel.
   - If a quadrilateral is a parallelogram, then its diagonals bisect each other.

   _____

   What theorem is being proved?

   _____

8. **Reorganize the proof below so that it is easier to follow:**
   Theorem: If there is no Great Pumpkin, Snoopy won't have pie for dinner.
   - _____ If Lucy plays a trick on Charlie Brown, he will be upset.
   - _____ If Linus is mistaken, Lucy is pleased.
   - _____ If Lucy becomes rambunctious, she plays a trick on Charlie Brown.
   - _____ If Linus is not mistaken, there is a Great Pumpkin
   - _____ If Charlie Brown doesn't feed Snoopy, Snoopy won't have pie for dinner.
   - _____ If Lucy is pleased, she becomes rambunctious.
   - _____ Charlie Brown forgets to feed Snoopy if he is upset

9. **Rearrange the following statements in logical order. What theorem do they prove?**
   Theorem:

   _____

   Proof:
   - _____ If I have trouble with a proof it is not easy.
   - _____ If I study a proof without getting dizzy, it is one I understand.
   - _____ If a proof is not arranged in a logical order, I can't understand it
   - _____ A proof is giving me trouble if I get dizzy while studying it.

10. **Rewrite the following proof so that it is easier to follow. What theorem does it prove?**
    Theorem:

    _____

    - If a rabbit's name is Harvey, he is invisible.
    - A rabbit will not be taken seriously if he is thought to be imaginary.
    - If a rabbit is over six feet tall, his name is Harvey.
    - If only a rabbit's best friends can see him, everyone else will think he is imaginary.
    - If a rabbit is invisible, then only his best friends can see him.

    _____

    _____

    _____

    _____

    _____