



## Lesson Plan

# House and Holmes: A Guide to Deductive and Inductive Reasoning

### SUMMARY:

Maybe you've seen Dr. House in action – figuring things out from what seem like totally unrelated clues. Like Sherlock Holmes before him, House is a master of induction. In this lesson, students will keep up with the doctor (and a lawyer, too) as they learn how to spot – and analyze – both inductive and deductive arguments. Students will then get a chance to show off their deductive skills by solving a logic puzzle and test their inductive abilities by solving a 5-minute mystery.

### OBJECTIVES:

In this lesson students will learn to:

- Distinguish between deductive and inductive arguments.
- Construct and analyze deductive arguments.
- Produce and evaluate inductive arguments.

### KEY TERMS:

- **Argument:** a conclusion together with the premises that support it
- **Premise:** a reason offered as support for another claim
- **Conclusion:** the claim being supported by a premise or premises
- **Valid:** an argument whose premises genuinely support its conclusion
- **Unsound:** an argument that has at least one false premise
- **Deductive:** an argument whose premises make its conclusion certain
- **Inductive:** an argument whose premises make its conclusion likely

### BACKGROUND:

Logic has been a formal academic discipline for almost 2,500 years. The 4<sup>th</sup> century B.C.E. Greek philosopher Aristotle first systematized formal logic, and university logic courses teach Aristotelian logic to this day. For much of western history, logic was one of the main branches of schooling (the classical curriculum consisted of grammar, logic and rhetoric). With the growth of more specialized disciplines and wider curricula in the 20<sup>th</sup> century, formal logic got lost in the shuffle. In its place, philosophers began formulating courses in what we now call critical thinking, or informal logic. Formal rules and the reduction of sentences to things like

$$\forall x \exists y [Ax \supset [(Qx \vee Rx) \cdot Sy]]$$

are reserved for formal logic courses at the university level. Critical thinking deals with ordinary language arguments, offering us tools for assessing those arguments without the need to learn complicated sets of rules for turning sentences into math-like entities.

That said, one still needs to know some basic technical vocabulary.

**Premise:** a reason offered as support for another claim

**Conclusion:** the claim being supported by a premise or premises

**Argument:** a conclusion together with the premises that support it

So, to take the oldest example in all of logic, one that Aristotle used in teaching logic at his Academy (the lines are numbered to make it convenient to refer to them):

1. All men are mortal.
2. Socrates was a man.
3. Therefore Socrates is mortal.

The three lines taken together constitute an argument. Line 3 is the conclusion. Lines 1 and 2 are premises. Now, there are a few important things to remember about arguments. One is that arguments can be either really short (like the one about Socrates) or they can be really long (most op-eds are extended arguments; lots of books are really long extended arguments). But really long arguments will usually be broken down into series of shorter ones. We're going to learn how to analyze relatively short arguments in this first section of the lesson, but you'll use exactly the same procedures to analyze the longer ones later on.

#### **MATERIALS:**

1. "A Few Good Men," Courtroom Scene  
<http://www.broadcaster.com/clip/13666>
2. Teacher Handout #1, "Teacher's Guide to the Courtroom Scene"  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/teacher.handout.1.guide.to.courtroom.scene.pdf>
3. "House, M.D." Clinic Scenes  
<http://youtube.com/watch?v=MCPkoqGyVpl&mode=related&search=>
4. Teacher Handout #2, "Teacher's Guide to the Clinic Scenes from House, M.D."  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/teacher.handout.2.guide.to.clinic.scene.pdf>
5. Student Handout #1, "Neighborhood Watch"  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/student.handout.1.neighborhood.watch.pdf>
6. Teacher Handout #3, "Teacher's Guide to the Neighborhood Watch Exercise"  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/teacher.handout.3.neighborhood.watch.pdf>
7. Student Handout #2, Salon 5-Minute Mystery, "Where There's a Will"  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/student.handout.2.wheres.a.will.pdf>

8. Student Handout #3, Salon 5-Minute Mystery, “The Menagerie Murder”  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/student.handout.3.menagerie.murder.pdf>
9. Student Handout #4, Salon 5-Minute Mystery, “The Fragment of Serpentine Marble”  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/student.handout.4.fragment.serpentine.marble.pdf>
10. Teacher Handout #4, Solution to 5-Minute Mysteries  
<http://factchecked.org/Downloads/LessonPlans/DeductionInduction/teacher.handout.4.mystery.solutions.pdf>

### **INSTRUCTIONS:**

Make enough copies of all the student handouts for each group, if you wish to divide the class into small groups, or, alternatively, for each student.

### **EXERCISES:**

#### **Exercise #1 – Deduction and induction**

*To the teacher: Discerning the structure of an argument is only the first step in assessing arguments. Students must also learn to critically evaluate arguments. That means asking whether the premises really do support the conclusions. It also means asking whether or not the premises themselves are true. It's the first part that is the hardest thing for most students. We are all accustomed (to varying degrees) to questioning the truth of someone's claims. What we do not often ask is whether someone's conclusion really does follow from his/her premises.*

Mastering the art of picking out premises and conclusions is the first step toward good analytical thinking, but we must also think about whether the premises really do support their conclusions. Making that sort of determination requires that we think a little bit about the different kinds of arguments. There are several ways of categorizing arguments, but for our purposes, we can distinguish all arguments into one of two types: deductive and inductive.

**Deductive argument:** an argument whose premises make its conclusion certain

**Inductive argument:** an argument whose premises make its conclusion likely

(Note: Some dictionaries – and even some older logic texts – define deductive arguments as arguments that reason from the general to the specific and inductive arguments as those that reason from the specific to the general. That particular usage of the terms is obsolete.)

The difference between deductive and inductive arguments is easiest to see by way of examples.

Smith owns only blue pants and brown pants. Smith is wearing a pair of his pants today. So Smith is wearing either blue or brown pants today.

This is an instance of a deductive argument. We can tell that the argument is deductive because the two premises (that is, the first two sentences) guarantee the truth of the conclusion. If the two premises really are true, then there is no possible way that the conclusion could be false. Here's another example:

The soccer game is on either Thursday or Friday. I just found out that the game is not on Thursday, so the game must be on Friday.

Again, this is a deductive argument, for the truth of the premises guarantees the truth of the conclusion. Contrast those examples with this one:

January has always been cold here in Siberia. Today is January 14, so it is going to be another cold day in Siberia.

This argument is inductive. The premises makes the conclusion likely, but they do not guarantee that the conclusion is true. To put the point another way, it is possible that the premises of this argument could be true and the conclusion could still be false. One can, for example, imagine a freak warm day in Siberia on January 14. But one cannot imagine that Smith owns only brown pants and blue pants, that he is wearing his own pants and that his pants are not brown or blue. To make the conclusion about the color of Smith's pants false, one has to make one of the premises false. But one can make the cold day in Siberia claim false while keeping the premises true. Here is one more:

The local branch of Wachovia Bank was robbed yesterday. Jenny needed money to pay off her gambling debts. She just bought a gun two days ago, and I saw her hanging around the local Wachovia Bank yesterday morning. Today the bookie's goons stopped looking for Jenny. So Jenny robbed Wachovia Bank yesterday.

This is the sort of inductive argument that should be familiar to anyone who has ever watched an episode of "Law & Order." Again, though, as anyone who has seen "Law & Order" can attest, these sorts of inductive arguments can be (and frequently are) wrong. Even if all the premises are true, it is still possible that the conclusion is false.

**Exercise:** Show students the clinic scene from "House, M.D." and the courtroom scene from "A Few Good Men." Divide the class into groups of 3 to 4 students each. Assign each group to work on one scene or the other. Ask students to:

1. Pick out the premises and the conclusions of each argument. Remember to check for premise indicators (since, because, for, given that) and for conclusion indicators (therefore, consequently, so, thus). Keep in mind the three-year-old method: Read each statement and then ask "why?" Statements that answer why questions are premises. Statements that are supported by other statements are conclusions. Finally, remember that sometimes premises and conclusions can be implied. In other words, sometimes the speaker/writer will assume that the reader can fill in the missing piece(s) of the argument.

2. Determine whether the argument is deductive or inductive. Remember that deductive arguments make their conclusions certain while inductive arguments make their conclusions likely.
3. Construct the argument. Pull out the premises and show how they demonstrate their conclusions.

### **Exercise #2 – Deduction**

*To the teacher: Deductive arguments are relatively rare in normal conversation, but the skills one acquires in mastering deductive arguments transfer to many other sorts of activities. In particular, deductive arguments are particularly useful for teaching about the relationship between premises and conclusions – a crucial step in distinguishing between good and bad arguments.*

Pass out student handout #1, “Neighborhood Watch.” Divide the class into groups of 3 to 4 students, if you haven’t already. Ask each group to fill in the grid.

1. Begin by writing down what you know. Many of the rules will allow you to fill boxes in directly.
2. Write down any other rules that do not allow you to fill in a box directly. (Example: A rule that said that Maple Street is next to Oak Street would not allow you to fill in a box right away, but it would be helpful later on. You might symbolize the rule by writing down M next to O somewhere on the sheet.)
3. Make deductions. Once you have all the information from the rules, you can deduce everything else. You will not have to guess; there is more than enough information in the rules to allow you to fill in every box on the grid.
4. Hint: If you’re stuck, start out by looking at street names and colors of houses. You can fill all of those in right off the bat.

### **Exercise #3 – Induction**

*To the teacher: Inductive arguments are by far the most common types of arguments. Reasoning from the best available evidence to the most likely conclusion is something that we do countless times throughout the day. But because the process is so routine, students often do not think quite so carefully about the relationship between the evidence and their conclusions. This exercise will give students the opportunity to sift through a great deal of information to pick out the most important facts.*

Divide the class into groups of 3 to 4 students each. Then give each student in each group a copy of a 5-minute mystery. Ask each group to work together to determine the solution to the problem. Tell students to:

1. Ask yourself some basic questions: What are you being asked to solve? What information would you need to determine the answer to that question?
2. Go back through the story and see what sorts of facts you can find.
3. Now ask yourself how those facts might be related to the question you are being asked to answer.
4. Construct an argument that gets you from the facts to the solution.

### **CORRELATION TO NATIONAL STANDARDS (summary)**

For a more detailed version of these standards, please see <http://factchecked.org/Downloads/LessonPlans/DeductionInduction/deductive.inductive.national.standards.pdf>

### ***National Social Studies Standards***

**X. Civic Ideals and Practices** Social studies programs should include experiences that provide for the study of the ideals, principles, and practices of citizenship in a democratic republic.

### ***Essential Skills for Social Studies***

#### **Acquiring Information**

##### *A. Reading Skills*

1. Comprehension
2. Vocabulary

##### *B. Study Skills*

1. Find Information
2. Arrange Information in Usable Forms

##### *C. Reference & Information-Search Skills*

2. Special References

##### *D. Technical Skills Unique to Electronic Devices*

1. Computer

#### **Organizing and Using Information**

##### *A. Thinking Skills*

1. Classify Information
2. Interpret Information
3. Analyze Information
4. Summarize Information
5. Synthesize Information
6. Evaluate Information

##### *B. Decision-Making Skills*

##### *C. Metacognitive Skills*

#### **Interpersonal Relationships & Social Participation**

##### *A. Personal Skills*

##### *C. Social and Political Participation Skills*

### ***Democratic Beliefs and Values***

#### **B. Freedoms of the Individual**

#### **C. Responsibilities of the Individual**

### ***National Mathematics Standards***

#### **Process Standards**

##### *Reasoning and Proof Standard*

### ***National Educational Technology Standards***

#### **Profiles for Technology Literate Students**

##### *Performance Indicators*

2. Make informed choices among technology systems, resources, and services.

7. Routinely and efficiently use online information resources to meet needs for collaboration, research, publication, communication, and productivity.
8. Select and apply technology tools for research, information analysis, problem solving, and decision making in content learning.

### ***Information Literacy Standards***

#### **Information Literacy**

*Standard 1* accesses information efficiently and effectively.

*Standard 2* evaluates information critically and competently.

*Standard 3* uses information accurately and creatively.

#### **Social Responsibility**

*Standard 7* recognizes the importance of information to a democratic society.

*Standard 8* practices ethical behavior in regard to information and information technology.

*Standard 9* participates effectively in groups to pursue and generate information.

### ***English Language Arts Standards***

**Standard 1** Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary work.

**Standard 3** Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

**Standard 5** Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

**Standard 6** Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.

**Standard 7** Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

**Standard 8** Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

**Standard 12** Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

### **ABOUT THE AUTHOR**

*Joe Miller received his Ph.D. in philosophy from the University of Virginia. He is a staff writer at FactCheck.org, a project of the University of Pennsylvania's Annenberg Public Policy Center. Prior to joining FactCheck, he served as an assistant professor of philosophy at West Point and at the University of North Carolina at Pembroke, where he taught logic, critical thinking, ethics and political theory. The winner of an Outstanding Teacher award at UNC-Pembroke and an Outstanding Graduate Teaching Assistant award at the University of Virginia, Joe has more than 10 years of experience developing curriculum. He is a member of the American Philosophical Association and the Association for Political Theory.*