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| ***Techniques for Documenting with Proof or Supporting Evidence, and Related Strategies for Problem Solving***  **By David Alderoty © 2016**  **Chapter 7) Technique-7, Using Deductive Reasoning, to Support The Statements in your Document, and for Problem Solving**  [**This e-book presents 28 techniques for supporting the validity of the statements you write**](http://www.TechForText.com/DP/List)**.**  **Left click on the above for a list of the techniques**  **This chapter contains a little over 2,540 words**  **If you want to go to chapter 6, left click on the following link:**  [**www.TechForText.com/DP/chapter-6**](http://www.TechForText.com/DP/chapter-6)  **To contact the author use David@TechForText.com**  [**or left click for a website communication form**](http://www.david100.com/Mail)  **Table of Contents, and an Outline of this Chapter**  The following is a hyperlink table of contents, as well as an outline of this chapter. If you left click on a blue underlined heading, the corresponding topic or subtopic will appear on your computer screen. Alternatively, you can scroll down to access the material listed in the table of contents, because this chapter is on one long webpage.  [Topic 1.) Technique 7) Deductive Reasoning to Support the Statements in your Document 4](#_Toc464552937)  [**Subtopic, Deductive Reasoning, Based on Assumptions that are Probably Correct, Possibly Correct, and Fictional Assumptions** 5](#_Toc464552938)  [**Subtopic, a Simplified Example of Deductive Reasoning, Based on Assumptions** 7](#_Toc464552939)  [**Subtopic, Deductive Reasoning, and Truth-Value** 8](#_Toc464552940)  [**Deductive Reasoning can be Thought of as a Chain of Premises Leading to a Conclusion, Without any Extraneous Chain Links** 9](#_Toc464552941)  [Topic 2.) Deductive Reasoning Can Be Very Complexed 10](#_Toc464552942)  [**Subtopic, Deductive Reasoning, and a Sequence of Premises, Displayed on Paper, or on a Computer Screen** 11](#_Toc464552943)  [**Subtopic, An Example of Deductive Reasoning Involving Basic Algebra, Which Is More Complex Than the Previous Examples** 12](#_Toc464552944)  [Topic 3.) Concluding Concepts Focused on the Limitations and Alternatives to Deductive Reasoning, And Additional Information from Web-Based Sources 13](#_Toc464552945)  [**Web-Based ARTICLES that Relate Directly, or Indirectly, to Technique 7** 16](#_Toc464552946)  [**Web-Based VIDEOS that Relate Directly or Indirectly to Technique 7** 18](#_Toc464552947)  **This E-Book Provides Additional and Supporting Information from other Authors, with Web Links**  This e-book contains links to web-based articles and videos from other authors, for **additional, alternative, and supporting information.** The links are the blue underlined words, presented throughout this e-book. However, some of these links are to access different sections of this e-book, or material on my own websites.  Quotes and paraphrases in this e-book have hyperlinks to access the original source. The quotes are presented in brown text, which is the same color of these words. (The precise text color is RGB Decimal 165, 42, 42, or Hex #a52a2a)  Some of the web links in this e-book will probably fail eventually, because websites may be removed from the web, or placed on a new URL. If a link fails, use the blue underlined words as a search phrase, with [www.Google.com](http://www.google.com/) If the link is for a video, use [www.google.com/videohp](http://www.google.com/videohp) The search will usually bring up the original website, or one or more good alternatives. |

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| ***For those who prefer listening, as an alternative to reading, this book is recorded in an audio format.***  [***For an audio narration of this chapter, left click on these words (requires 18 minutes, and 40 seconds)***](P1.mp3)***.*** |

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| **Topic 1.)** **Technique 7) Deductive Reasoning** **to Support the Statements in your Document**  |||  When you write about the mathematics, or any subject based on symbolic logic, deductive reasoning is useful for **proving** the validity of the statements in your document. Deductive reasoning involves **a series of statements or premises that leads to a conclusion.** For example, if A=C, and B=C, then the conclusion is A=B. This is because of the premise “things which equal the same thing also equal one another.” [See Euclid's Elements Book I, Common Notions](http://aleph0.clarku.edu/~djoyce/elements/bookI/cn.html).  Deductive reasoning often involves proving the validity of a [**theorem**](http://www.dictionary.com/browse/theorem), **equation**, **mathematical relationship**, or a **statement**. **This is done, with a logical sequence of premises, which may consist of one or more of the following:** [**postulates**](http://www.dictionary.com/browse/postulate?s=t),[**axioms**](http://www.dictionary.com/browse/axiom?s=t)**, definitions, assumptions, and previously proven theorems.**  **With deductive reasoning the premises must be true, to obtain a logical proof, and a correct conclusion.** This type of reasoning is useful when you are writing about mathematics, or any subject that is based on pure logic. This is because with **mathematics and pure logic, the premises**, are postulates, axioms, and theorems that are definitely true.  **In real life situations, in science, engineering, and with most writing projects, we usually cannot be absolutely-certain that our premises are true, or perfectly correct.** This can limit the utility of deductive reasoning.  **Subtopic, Deductive Reasoning, Based on Assumptions that are Probably Correct, Possibly Correct, and Fictional Assumptions**  |||  However, if we use assumptions as premises, we can widen the utility of deductive reasoning. **Specifically**, assumptions are statements that are assumed true, or postulated to be true. With this simple idea, we can use premises that are probably true, or even possibly true, which are the type of premises we encounter in everyday life, and in most writing projects. We can even use premises that are fictional in nature, if we are writing fiction, with a scenario that takes place, in a logical sequence. In general, this modified form of deductive reasoning can be useful when writing documents with a series of logically related assumptions, or occurrences that leads to a conclusion, an outcome, or final-result. This includes any document that contains an argument that can be structured in a deductive reasoning format.  It is important to keep in mind that deductive reasoning, results in a proof and related conclusion that is true beyond any doubt. This is assuming that the premises are true, and the sequence of reasoning is carried out correctly. However, the modified version of deductive reasoning, based on assumptions that are probably true, or possibly true, yields a conclusion that is probably true, or possibly true. This certainly cannot be called a proof, but it could be called supporting evidence. Often, conclusions that are probably true or possibly true can be confirmed or refuted by experimentation.  **Subtopic, Devising Multiple Deductive Reasoning Statements or Arguments, for the same Problem, Using Two or More Sets of Assumptions that are Probably Correct, or Possibly Correct**  |||  A useful problem-solving strategy can be carried out with deductive reasoning and assumptions that are probably correct, or possibly correct. With this type of deductive reasoning, you can derive a number of conclusions about a problem, by using two or more sets of assumptions. Each set of assumptions would result in a deductive reasoning statement or argument, with a conclusion that is probably correct, or possibly correct. If you use many sets of assumptions for a specific problem, you will obtain many possible solutions. With this strategy, the conclusions or solutions must be evaluated experimentally, or by real-life applications, to determine if they are correct or useful.  **Subtopic, a Simplified Example of Deductive Reasoning, Based on Assumptions**  |||  At the **SIMPLEST LEVEL**, deductive reasoning can start with a **general statement** that is presumed to be **true**, such as ***all New York City******police officers are required to carry a gun***. This is followed by one or more **assumptions** (or **premises)** such as ***John is a New York City police officer***. This leads to a **conclusion*,*** which is ***John is required to carry a gun.***  The above example started with a **general statement** (all New York City police officers are required to carry a gun). The above sequence of deductive reasoning can be reorganized into an argument that starts with a **claim,** as follows:  ***John is required to carry a gun, because he is a New York City police officer, and in New York City, all police officers are required to carry a gun.***  The above sequence of deductive reasoning is obviously in the sentence format, which is probably best for most writing projects. This is especially the case when the deductive reasoning is relatively simple. However, when explaining concepts and deductive reasoning it may be better to present the material and a list format, as follows:  **The claim is: John is required to carry a gun**  **Premise-1 John is a New York City police officer,**  **Premise-2 In New York City, all police officers are required to carry a gun.**  **The conclusion is John is required to carry a gun. The conclusion proves the claim.**  **Subtopic, Deductive Reasoning, and Truth-Value**  |||  The truth-value of the proof and related conclusion obtained with deductive reasoning is determined by the truth-value of the premises. If all of the premises are true, the conclusion will be true. However, if one of the premises is false the conclusion is false.  Sometimes, when a series of premises are incorrectly arranged or used in deductive reasoning, you may end up with the correct conclusion, by chance, even if one or more of the premises are incorrect. Of course, such results are erroneous, and it has no meaning or utility.  **Deductive Reasoning can be Thought of as a Chain of Premises Leading to a Conclusion, Without any Extraneous Chain Links**  |||  A properly configured deductive reasoning statement or argument does **not** contain any unnecessary premises. All of the premises are in a sequence that leads to a conclusion. If one of the premises is removed from the sequence, the conclusion will not be obtained, and the related proof will fail.  Deductive reasoning can be thought of as a chain of premises, supporting a **weight, called the conclusion**. If one link in the chain is broken, the weight is no longer supported, and it falls to the ground. Deductive reasoning can also be thought of as an electronic circuit, involving a series of components wired in sequence, such as a set of Christmas tree lights. If one of the lights is removed or damaged, the circuit is broken, and none of the lights will function.  **The above is very different from inductive reasoning, and the way people frequently reason in everyday life.** Specifically, human reasoning often, (but certainly **not** always) involves a set of components comprised of observations, assumptions, and/or arguments that all point to the same conclusion. If one of the components is proven false, or removed from the set, the conclusion might be adequately supported by the remaining components. This type of reasoning is similar to a series of chains holding up a weight called the conclusion. If one of the chains is broken, the weight might be supported by the remaining chains. If too many of the chains of broken, the intact chains might also break, and the weight will no longer be supported. This type of reasoning can also be thought of as a series of electronic components wired in **parallel**, such as lights in a home. If one of the lights is damaged or removed, the remaining lights still function.  **The ideas presented in the above paragraph represent an effective and valid way of reasoning.** **However, it is important to understand that it is not deductive reasoning.** |

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| **Topic 2.) Deductive Reasoning Can Be Very Complexed**  |||  Keep in mind that the examples of deductive reasoning presented in topic 1 are very simple, but they serve as good illustrations of the basic concept. Most people probably could easily carry out this simplified version of deductive reasoning in their mind in a few seconds. However, deductive reasoning can be very **complexed**. It can involve a general statement, followed by many premises that lead to a conclusion. The proofs toward in some mathematics classes, is a good example of relatively complexed deductive reasoning. However, if you examine the mathematical literature, you can find proofs based on deductive reasoning that are many pages in length. See [List of long mathematical proofs](http://www.scientificlib.com/en/Mathematics/LX/ListLongMathematicalProofs.html), also see [Prize awarded for largest mathematical proof (15,000 pages)](https://www.newscientist.com/article/dn20893-prize-awarded-for-largest-mathematical-proof/)  Excessively long examples of deductive reasoning, such as 15,000 pages, may have questionable validity, and utility. This is because it is generally **not** feasible for other scholars to check the validity of excessively long sequences of deductive reasoning. Perhaps with some exceptions, it is generally **not** possible to check a complex sequence of deductive reasoning with computers.  **Subtopic, Deductive Reasoning, and a Sequence of Premises, Displayed on Paper, or on a Computer Screen**  |||  It is usually necessary to carry out deductive reasoning on paper or on a computer screen, if it involves more than 3 premises. This can involve a general statement, or claim, on top of a list. After the general statement, one or more premises are listed. On the bottom of the list, there is a conclusion. This format can be seen in the example presented in the next subtopic. However, any format that can display the sequence of logical reasoning can be used, which is from the general statement, to one or more premises, followed by a conclusion. This can obviously be achieved with the conventional sentence structure.  **Subtopic, An Example of Deductive Reasoning Involving Basic Algebra, Which Is More Complex Than the Previous Examples**  |||  In this subtopic, there is an example of deductive reasoning that involves a simple algebraic equation, and two axioms, which are described below:  To understand the following **axioms**, it is necessary to keep in mind that the left and right side of an equation are equal to each other.  **Axiom 1)** **When equal quantities are added or subtracted from equal quantities, the results are equal**. This means if you add or subtract the same number from the left and right side of an equation, the left and right side of the equation will remain equal to each other. **Note for axiom 1)** I combine two of the axioms into one, for the sake of simplicity. This involved **equal quantities added to equal quantities,** combined with **equal quantities subtracted from equal quantities.**  **Axiom 2), *When equal quantities are divided by equal quantities, the results are equal.***  This means if you divide the left and right side of an equation by the same number, the equality between the left and right side will be maintained.  The example of deductive reasoning involving the above axioms is presented below.  The statement in red type will be proved with the following sequence of deductive reasoning.  http://www.techfortext.com/TD/index_files/image003.png  http://www.techfortext.com/TD/index_files/image004.png  Most proofs in mathematics are more complicated, and much longer than the above example. They may be comprised of at least several premises, consisting of axioms, definitions, and theorems. |

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| **Topic 3.)** **Concluding Concepts Focused on the Limitations and Alternatives to Deductive Reasoning, And Additional Information from Web-Based Sources**  |||  Deductive reasoning has its limitations, and it should **not** be thought of as the optimum reasoning strategy in all situations. In mathematics, and subjects based on symbolic logic, deductive reasoning usually is the optimum strategy for proving concepts, and solving problems. This is because mathematics and symbolic logic are based on **predictable static conceptual frameworks, created by human beings**. With these static frameworks, it is feasible to derive and discover axioms and theorems that are true beyond any doubt, which are the type of premises needed for good deductive reasoning.  In real-life situations, as well as in the social, psychological, physical, and biological sciences, there are highly complex dynamic systems. Most of these systems are constantly changing, and they contain many unknown components and dynamics. As a result, it is usually difficult, or impossible to derive or discover the perfectly true and accurate premises required for good deductive reasoning.  However, there reasoning strategies that work well for the real world, and the real universe, such as the following:   * **Inductive Reasoning:** This is the type of reasoning used by juries, judges, and scientists. It generally involves evidence usually obtained from observations, including scientific evaluations and measurements, which are used to derive a hypothesis. In science, usually the hypothesis can be evaluated experimentally to determine if it is correct. * **Reasoning based on common sense:** This type of reasoning seems very simple, and somewhat inaccurate. However, it works very well, and often provides the optimum solution in a few seconds without much effort. It often works where other reasoning strategies fail. It is sometimes difficult to understand precisely how it works, and to date efforts to create computers with common sense as failed. * **Reasoning based on educated common sense, WITHIN A SPECIFIC DISCIPLINE OR SPECIALIZED FIELD**: This is similar to the above, except it is based on specialized knowledge. * **Reasoning based on cause-and-effect:** This involves studying a relevant series of potential or actual actions, and reactions, to determine how a problem developed, or how a goal can be obtained. * **Reasoning with schematic diagrams, or flowcharts:** This involves studying with diagrams the flow of particles, fluids, energy, data, people, automobiles, or other real or hypothetical entities, through pathways and components, to solve a problem or obtained a goal. * **Experimentation:** This involves testing or experimenting to determine the validity of a hypothesis, or to determine if an invention or other entity functions as intended. It can also involve an evaluation to determine what happens under specific set of artificially created conditions.   **Web-Based ARTICLES that Relate Directly, or Indirectly, to Technique 7**  |||  [The Hundred Greatest Theorems](http://pirate.shu.edu/~kahlnath/Top100.html)  [Proofs in Mathematics](file:///C:\CopStoneWork\WorkON\Proofs%20in%20Mathematics)  [Difference Between Axioms and Postulates](http://www.differencebetween.com/difference-between-axioms-and-vs-postulates/)  [What's the difference between axioms and postulates?](https://www.quora.com/Whats-the-difference-between-axioms-and-postulates)  [Proofs in Mathematics](http://www.cut-the-knot.org/proofs) <http://www.cut-the-knot.org/proofs>  [Computer generated math proof is too large for humans to check](http://phys.org/news/2014-02-math-proof-large-humans.html)  [Proofs and Logic](http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/15251-f10/Site/Materials/Lectures/Lecture10/lecture10.pdf)  [PROOFS IN MATHEMATICS](http://www.teachlearnweb.com/study-material/ssc/class-9/math/proofs-in-mathematics/reasoning-in-mathematics/2-1070)  [What is Mathematics - an Overview Liaqat Ali Khan](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKEwiW8d7cjovNAhWKcT4KHXfnBVUQFggoMAI&url=https%3A%2F%2Fwww.researchgate.net%2Fpublication%2F276417407_What_is_Mathematics_-_an_Overview&usg=AFQjCNGcfNjHWkic0KrKnLekxKo3Jamesg&sig2=hjhjvIbtSnfr1x8HpGnWHw)  [Probabilistically Checkable Proofs](https://www.cs.jhu.edu/~scheideler/courses/600.471_S05/lecture_8.pdf)  [Inductive Reasoning vs. Inductive Reasoning](http://www.livescience.com/21569-deduction-vs-induction.html)  [A blog dedicated to mathematical philosophy](http://m-phi.blogspot.com/2011/09/on-largest-mathematical-proof-aka.html).  [Azimuth: Insanely Long Proofs](https://johncarlosbaez.wordpress.com/2012/10/19/insanely-long-proofs/)  [Inductive and Inductive: *Internet Encyclopedia of Philosophy*](http://www.iep.utm.edu/ded-ind/)  [DEDUCTIVE REASONING P. N. Johnson-Laird Department of Psychology, Princeton University, Princeton, New Jersey 08544](http://matt.colorado.edu/teaching/highcog/fall8/j99.pdf)  [Non-Deductive Methods in Mathematics](http://plato.stanford.edu/entries/mathematics-nondeductive/)  [Deductive Reasoning, Description, Discussion](http://changingminds.org/disciplines/argument/types_reasoning/deduction.htm)  [Deductive Reasoning, Psychology Glossary](http://www.alleydog.com/glossary/definition.php?term=Deductive%20Reasoning)  [Inductive vs. Deductive Writing](https://kuwcnews.wordpress.com/2015/02/25/inductive-vs-deductive-writing/)  [Deductive Essay](http://essayinfo.com/essays/deductive_essay.php)  [Inductive vs. deductive reports](http://owll.massey.ac.nz/assignment-types/inductive-vs-deductive-reports.php)  [The Toxic and Mythical Combination of a Deductive Writing Logic for Inductive Qualitative Research, Sarah J. Tracy](http://www.sarahjtracy.com/wp-content/uploads/2013/07/Tracy-Toxic-and-Mythical.pdf)  [Deductive, Inductive, and Quasi-Inductive Writing Styles in Persian and English: Evidence from Media Discourse, Khatib Mohammad, Mahmood Reza Moradian](http://cscanada.net/index.php/sll/article/view/j.sll.1923156320110201.014)  [Deduction (logic and rhetoric)](http://grammar.about.com/od/d/g/deductionterm.htm)  **Web-Based VIDEOS that Relate Directly or Indirectly to Technique 7**  |||  [Difference between inductive and inductive reasoning](https://www.youtube.com/watch?v=GEId0GonOZM)  [Conditional statements and inductive reasoning](https://www.youtube.com/watch?v=Q5gk9ljVuTE)  [Lisa VanDamme - Inductive and Deductive Writing](https://www.youtube.com/watch?v=PFUJ20tHTNE)  [Deductive Reasoning: Examples & Definition](http://study.com/academy/lesson/deductive-reasoning-examples-definition-quiz.html)  [Academic research and writing – Chapter 9 Structuring technique – Unit 2 Deductive reasoning, Prof. Dr. Christian Decker](https://www.youtube.com/watch?v=iGeTLK9u1NI)  [Aristotelian Syllogism](https://www.youtube.com/watch?v=vJH9KtvxenE)  [How to Argue - Philosophical Reasoning: Crash Course Philosophy #2](https://www.youtube.com/watch?v=NKEhdsnKKHs)  [YouTube search page: How to argue - philosophical reasoning crash course philosophy](https://www.youtube.com/results?search_query=how+to+argue+-+philosophical+reasoning+crash+course+philosophy)  **If you want to go to chapter 8 of this e-book, left click on the following link:**  [**www.TechForText.com/DP/chapter-8**](http://www.TechForText.com/DP/chapter-8) |