



## DEDUCTIONS

### Why

We want to make conclusions.

### Discussion

A *conclusion* is a statement that holds necessarily as a consequence of other statements. We have a list of quantified logical statements, and we call them *premisses*. We want to state which other statements hold necessarily if the premisses hold. A sequence of statements, each of which follows from the previous, ending with a *conclusion* is called a *proof* of the conclusion. The process is *deduction*. A *deduction* is a statement which follows necessarily from other premisses.

A *proposition* is another term for a statement. An unproven statement (or premiss) is also called a *principle*. We will often set apart propositions and principles from the text. We bold them and label them with Arabic numerals (see **Letters**) to enable us to reference them.

### Examples

Since principles have no proofs, they will look like

**Principle 1.** (*Here is where the statement would go*).

Since propositions have proofs, but are used like principles, they will appear stated first, and followed by their proof.

**Proposition 1.** (*Here is where the statement would go*).

*Proof.* (Here is the where the account would go). □

## Methods of Proof

We outline a few of the methods of proof used in this text.

### Forward Reasoning

If we have as premisses that a statement  $P$  implies a statement  $Q$ , and we have  $P$ , then we have  $Q$ . It is common that this reasoning is done in chains.  $P$  implies  $Q$ , and  $Q$  implies  $R$ . So if we have  $P$  then we have  $Q$  and if we have  $Q$  then we have  $R$ . So in other words, we can also deduce that  $P$  implies  $R$ .

### Contradiction

A contradiction occurs when we can deduce a statement and its opposite from the same premisses. If we can deduce a contradiction when we append to a list of premisses a given premiss we can conclude that the given premiss is false.

### Terms

To make propositions and principles easy to state, we will often introduce new terms. Doing so is a process of *definition*. These definitions are abbreviations for more complicated to explain objects or properties of objects. They are made to give us language and to save space. When we are defining a term, we will put it in italics.

