

Proof (Truth)

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A proof is sufficient evidence or argument for the truth of a proposition. The concept arises in a variety of areas, with both the nature of the evidence or justification and the criteria for sufficiency being area-dependent. In the area of oral and written communication such as conversation, dialog, rhetoric, etc., a proof is a persuasive perlocutionary speech act, which demonstrates the truth of a proposition. In any area of mathematics defined by its assumptions or axioms, a proof is an argument establishing a theorem of that area via accepted rules of inference starting from those axioms and other previously established theorems. The subject of logic, in particular proof theory, formalizes and studies the notion of formal proof. In the areas of epistemology and theology, the notion of justification plays approximately the role of proof, while in jurisprudence the corresponding term is evidence, with burden of proof as a concept common to both philosophy and law.

In most areas, evidence is drawn from experience of the world around us, with science obtaining its evidence from nature, law obtaining its evidence from witnesses and forensic investigation, and so on. A notable exception is mathematics, whose evidence is drawn from a mathematical world begun with postulates and further developed and enriched by theorems proved earlier.

As with evidence itself, the criteria for sufficiency of evidence are also strongly area-dependent, usually with no absolute threshold of sufficiency at which evidence becomes proof. The same evidence that may convince one jury may not persuade another. Formal proof provides the main exception, where the criteria for proofhood are ironclad and it is impermissible to defend any step in the reasoning as "obvious"; for a well-formed formula to qualify as part of a formal proof, it must be the result of applying a rule of the deductive apparatus of some formal system to the previous well-formed formulae in the proof sequence.

Proofs have been presented since antiquity. Aristotle used the observation that patterns of nature never display the machine-like uniformity of determinism as proof that chance is an inherent part of nature. On the other hand, Thomas Aquinas used the observation of the existence of rich patterns in nature as proof that nature is not ruled by chance. Augustine of Hippo provides a good case study in early uses of informal proofs in theology. He argued that given the assumption that Christ had risen, there is resurrection of the dead and he provided further arguments to prove that the death of Jesus was for the salvation of man.

Proofs need not be verbal. Before Galileo, people took the apparent motion of the Sun across the sky as proof that the Sun went round the Earth. Suitably incriminating evidence left at the scene of a crime may serve as proof of the identity of the perpetrator. Conversely, a verbal entity need not assert a proposition to constitute a proof of that proposition. For example, a signature constitutes direct proof of authorship; less directly, handwriting analysis may be submitted as proof of authorship of a document. Privileged information in a document can serve as proof that the document's author had access to that information; such access might in turn establish the location

of the author at certain time, which might then provide the author with an alibi.

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