MATHEMATICAL PROOFS pdf

1: Mathematical Proofs - Science NetLinks

In mathematics, a proof is an inferential argument for a mathematical www.enganchecubano.com the argument, other previously established statements, such as theorems, can be used.

Statistical proof The expression "statistical proof" may be used technically or colloquially in areas of pure mathematics , such as involving cryptography , chaotic series , and probabilistic or analytic number theory. See also " Statistical proof using data " section below. Computer-assisted proof Until the twentieth century it was assumed that any proof could, in principle, be checked by a competent mathematician to confirm its validity. Some mathematicians are concerned that the possibility of an error in a computer program or a run-time error in its calculations calls the validity of such computer-assisted proofs into question. In practice, the chances of an error invalidating a computer-assisted proof can be reduced by incorporating redundancy and self-checks into calculations, and by developing multiple independent approaches and programs. Errors can never be completely ruled out in case of verification of a proof by humans either, especially if the proof contains natural language and requires deep mathematical insight. Undecidable statements[edit] A statement that is neither provable nor disprovable from a set of axioms is called undecidable from those axioms. One example is the parallel postulate , which is neither provable nor refutable from the remaining axioms of Euclidean geometry. Mathematicians have shown there are many statements that are neither provable nor disprovable in Zermelo-Fraenkel set theory with the axiom of choice ZFC , the standard system of set theory in mathematics assuming that ZFC is consistent ; see list of statements undecidable in ZFC. Heuristic mathematics and experimental mathematics[edit] Main article: Experimental mathematics While early mathematicians such as Eudoxus of Cnidus did not use proofs, from Euclid to the foundational mathematics developments of the late 19th and 20th centuries, proofs were an essential part of mathematics. Early pioneers of these methods intended the work ultimately to be embedded in a classical proof-theorem framework, e. Visual proof[edit] Although not a formal proof, a visual demonstration of a mathematical theorem is sometimes called a " proof without words ". The left-hand picture below is an example of a historic visual proof of the Pythagorean theorem in the case of the 3,4,5 triangle. Animated visual proof for the Pythagorean theorem by rearrangement. A second animated proof of the Pythagorean theorem. Some illusory visual proofs, such as the missing square puzzle , can be constructed in a way which appear to prove a supposed mathematical fact but only do so under the presence of tiny errors for example, supposedly straight lines which actually bend slightly which are unnoticeable until the entire picture is closely examined, with lengths and angles precisely measured or calculated. Elementary proof An elementary proof is a proof which only uses basic techniques. More specifically, the term is used in number theory to refer to proofs that make no use of complex analysis. For some time it was thought that certain theorems, like the prime number theorem , could only be proved using "higher" mathematics. However, over time, many of these results have been reproved using only elementary techniques. Two-column proof[edit] A two-column proof published in A particular way of organising a proof using two parallel columns is often used in elementary geometry classes in the United States. In each line, the left-hand column contains a proposition, while the right-hand column contains a brief explanation of how the corresponding proposition in the left-hand column is either an axiom, a hypothesis, or can be logically derived from previous propositions. The left-hand column is typically headed "Statements" and the right-hand column is typically headed "Reasons". It is sometimes also used to mean a "statistical proof" below , especially when used to argue from data. Statistical proof using data[edit] Main article: Statistical proof "Statistical proof" from data refers to the application of statistics , data analysis , or Bayesian analysis to infer propositions regarding the probability of data. While using mathematical proof to establish theorems in statistics, it is usually not a mathematical proof in that the assumptions from which probability statements are derived require empirical evidence from outside mathematics to verify. In physics , in addition to statistical methods, "statistical proof" can refer to the specialized mathematical methods of physics applied to analyze data in a particle physics experiment or observational study in physical cosmology. Inductive logic proofs and Bayesian analysis[edit] Main articles: Inductive logic and Bayesian analysis

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Proofs using inductive logic , while considered mathematical in nature, seek to establish propositions with a degree of certainty, which acts in a similar manner to probability , and may be less than full certainty. Inductive logic should not be confused with mathematical induction. Proofs as mental objects[edit] Main articles: Psychologism and Language of thought Psychologism views mathematical proofs as psychological or mental objects. Mathematician philosophers , such as Leibniz , Frege , and Carnap have variously criticized this view and attempted to develop a semantics for what they considered to be the language of thought , whereby standards of mathematical proof might be applied to empirical science. Ending a proof[edit] Main article: Sometimes, the abbreviation "Q. This abbreviation stands for "Quod Erat Demonstrandum", which is Latin for "that which was to be demonstrated".

2: List of mathematical proofs - Wikipedia

A mathematical proof is a series of logical statements supported by theorems and definitions that prove the truth of another mathematical statement. Proofs are the only way to know that a statement is mathematically valid.

Quotes[edit] The great masters of modern analysis are Lagrange , Laplace , and Gauss , who were contemporaries. It is interesting to note the marked contrast in their styles. Lagrange is perfect both in form and matter, he is careful to explain his procedure, and though his arguments are general they are easy to follow. Laplace on the other hand explains nothing, is indifferent to style, and, if satisfied that his results are correct, is content to leave them either with no proof or with a faulty one. Gauss is as exact and elegant as Lagrange, but even more difficult to follow than Laplace, for he removes every trace of the analysis by which he reached his results, and studies to give a proof which while rigorous shall be as concise and synthetical as possible. Rouse Ball , History of Mathematics, London, , p. A horn of plenty had been spilled before them, and every physicist could find something to apply quantum mechanics to. They were pleased to think that this great mathematician had shown it was so. Yet the Von Neumann proof, if you actually come to grips with it, falls apart in your hands! There is nothing to it. If you look at the assumptions made, it does not hold up for a moment. You may quote me on that: The proof of Von Neumann is not merely false but foolish! John Stewart Bell , Omni, May , p. Indeed, between and Russell tried to forbid this, to say you cannot do mathematics if you can do that, and so he invented the theory of types. Of course, no sooner had he invented it than it turned up you could not do mathematics at all if you obeyed the theory of types. So then he had to put in an axiom of reducibility , which allows a certain amount of self-reference. And by this time everyone was pretty bored. Here he examined critically some of the customary conceptions and formulations in mathematics. He deplored the fact that mathematicians did not even seem to aim at the construction of a unified, well-founded system of mathematics, and therefore showed a lack of interest in foundations. He pointed out a certain looseness in the customary formulation of axioms, definitions, and proofs, even in the works of the more prominent mathematicians. Unfortunately, his admonitions go unheeded even today. Rudolf Carnap , "Intellectual Autobiography" pp. Reck, Steve Awodey Pythagoras did not possess a proof of the theorem which bears his name Thales was fully conversant with the theory of similar triangles. On the other hand, there is no doubt that Pythagoras fully appreciated the metaphysical implications. Tobias Dantzig , The Bequest of the Greeks Proof is the idol before whom the pure mathematician tortures himself. His motto, as he roamed about the world, a guest of other mathematicians. John Francis, Philosophy of Mathematics , p. It really is worth the trouble to invent a new symbol if we can thus remove not a few logical difficulties and ensure the rigour of the proofs. But many mathematicians seem to have so little feeling for logical purity and accuracy that they will use a word to mean three or four different things, sooner than make the frightful decision to invent a new word. Gottlob Frege as quoted by Dagobert D. The ideal of strictly scientific method in mathematics which I have tried to realise here, and which perhaps might be named after Euclid I should like to describe in the following way The novelty of this book does not lie in the content of the theorems but in the development of the proofs and the foundations on which they are based With this book I accomplish an object which I had in view in my Begriffsschrift of and which I announced in my Grundlagen der Arithmetik. I am here trying to prove the opinion on the concept of number that I expressed in the book last mentioned. Gottlob Frege , Grundgesetze der Arithmetik, Vol. Johnson , Manifest Rationality: A Pragmatic Theory of Argument p. Rebecca Goldstein , Incompleteness: It was possibly framed by Eudoxus. It states that "Analysis is the obtaining of the thing sought by assuming it and so reasoning up to an admitted truth: The theorem was known to be true, but for mathematicians, proofs are more than guarantees of truth: There were two reasons to want a new proof An elementary proofâ€"one that starts from first principles instead of relying on advanced techniquesâ€"would require many new ideas. Also published in The Best Writing on Mathematics p. The Pythagoreans discovered the existence of incommensurable lines, or of irrationals. This discovery of the incommensurable Thomas Little Heath , Achimedes When we are engaged in investigating the foundations of a science, we must set up a system of axioms which contains an exact and complete description of the relations subsisting between the elementary ideas of that science. The axioms so set up are at the same time the definitions of those elementary ideas; and no statement within the realm of the science Upon closer consideration the question arises: Whether, in any way, certain statements of single axioms depend upon one another, and whether the axioms may not therefore contain certain parts in common, which must be isolated if one wishes to arrive at a system of axioms that shall be altogether independent of one another. But above all, I wish to designate the following as the most important among numerous questions which can be asked with respect to the axioms: To prove that they are not contradictory, that is, that a finite number of logical steps based upon them can never lead to contradictory results. His modus operandi was to show up on the doorstep of a fellow mathematician, declare, "My brain is open," work with his host for a day or two, until he was bored or his host was run down, and then move on to another home. He did mathematics in more than 25 different countries, completing important proofs in remote places and sometimes publishing them in equally obscure journals. The difficulty in presenting a rigorous as well as clear statement of the theory of limits is inherent in the subject. If the reader has found some difficulty in grasping it he may be less discouraged when he is told that it eluded even Newton and Leibniz. Many contemporaries of Newton, among them Michel Rolle The book was undoubtedly profound but also unintelligible. He, too, formulated his own foundation This is not bad advice About a century and a half after the creation of calculus The Differential Calculus pp. Another feature of Alexandrian algebra is the absence of any explicit deductive structure. The various types of numbers Nor was there any axiomatic basis on which a deductive structure could be erected. The work of Heron , Nichomachus , and Diophantus , and of Archimedes as far as his arithmetic is concerned, reads like the procedural texts of the Egyptians and Babylonians The problems are inductive in spirit, in that they show methods for concrete problems that presumably apply to general classes whose extent is not specified. In view of the fact that as a consequence of the work of the classical Greeks , mathematical results were supposed to be derived deductively from an explicit axiomatic basis, the emergence of an independent arithmetic and algebra with no logical structure of its own raised what became one of the great problems of the history of mathematics. This approach to arithmetic and algebra is the clearest indication of the Egyptian and Babylonian influences Though the Alexandrian Greek algebraists did not seem to be concerned about this deficiency Gauss , Bolyai , Lobachevsky , and Riemann , that the impossibility of deducing the parallel axiom from the others was demonstrated. This outcome was of the greatest intellectual importance. Ernest Nagel , James R. There were also a few mathematicians there, cultivating the logical roots of the mathematical tree. Now, in many cases Proclus , "The Eudemian Summary," ca. Yehuda Rav, "Why do we prove theorems? A proof of a mathematical theorem is a sequence of steps which leads to the desired conclusion. The rules to be followed These rules can be used to disprove a putative proof by spotting logical errors; they cannot, however, be used to find the missing proof of a Heuristic arguments are a common occurrence in the practice of mathematics. The role of heuristic arguments has not been acknowledged in the philosophy of mathematics despite the crucial role they play in mathematical discovery. Our purpose is to bring out some of the features of mathematical thinking which are concealed beneath the apparent mechanics of proof. Gian-Carlo Rota , Indiscrete Thoughts p. The use of mathematical induction in demonstrations was, in the past, something of a mystery. There seemed no reasonable doubt that it was a valid method of proof, but no one quite knew why it was valid. Some believed it to be really a case of induction, in the sense in which that word is used in logic. We now know that all such views are mistaken, and that mathematical induction is a definition, not a principle. Bertrand Russell , Introduction to Mathematical Philosophy p. More than any other of his predecessors Plato appreciated the scientific possibilities of geometry By his teaching he laid the foundation of the science, insisting upon accurate definitions, and logical proof. His opposition to the materialists, who saw in geometry only what was immediately useful to the artisan and the mechanic, is made clear by Plutarch in his Life of Marcellus Mathematics, we must remember, were then only beginning to be seriously studied in England. I cannot find any historically gratifying basis for this generally accepted view Thales and Pythagoras took their start from Babylonian mathematics but gave it a very different An oral tradition makes it possible to indicate the line segments with the fingers; one can emphasize essentials and point out how the proof was found. All of this disappears in the written formulation

3: Geometry Proofs

Introduction to mathematical arguments (background handout for courses requiring proofs) by Michael Hutchings A mathematical proof is an argument which convinces other people that.

Proofs in Mathematics Proofs are to mathematics what spelling or even calligraphy is to poetry. Mathematical works do consist of proofs, just as poems do consist of characters. Pure mathematics consists entirely of such asseverations as that, if such and such a proposition is true of anything, then such and such another proposition is true of that thing If our hypothesis is about anything and not about some one or more particular things, then our deductions constitute mathematics. Thus mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true. Both opinions are enjoyable and thought provoking. To me, the former just plainly states that proving that is, deriving from one another propositions is the essence of mathematics. To a different extent and with various degrees of enjoyment or grief most of us have been exposed to mathematical theorems and their proofs. Even those who are revolted at the memory of overwhelmingly tedious math drills would not deny being occasionally stumped by attempts to establish abstract mathematical truths. But I hope, in time, more emphasis will be put on the abstract side of mathematics. Drills contain no knowledge. At best, after sweating on multiple variations of the same basic exercise, we may come up with some general notion of what the exercise is about. At worst, the sweat and effort will be just lost while the fear of math will gain a stronger foothold in our conscience. Non-professionals may enjoy and appreciate both music and other arts without being apt to write music or paint a picture. According to Kant , both feelings of sublime and beautiful arouse enjoyment which, in the case of sublime, are often mixed with horror. By this criterion, most of the people would classify mathematics as sublime much rather than beautiful. On the other hand, Kant also says that the sublime moves while the beautiful charms. I trust math would inspire neither of these in an average person. Rotundo, talking about experimental sciences, has the following to say about proofs: Evidence can support a hypothesis or a theory, but it cannot prove a theory to be true. It is always possible that in the future a new idea will provide a better explanation of the evidence. The proofs may only exist in formal systems as described by B. With these preliminaries I want to start a collection of mathematical proofs. The first is characterized by simplicity. A proof is defined as a derivation of one proposition from another. A single step derivation will suffice. If need be, axioms may be invented. A finest proof of this kind I discovered in a book by I. Most of the proofs I think of should be accessible to a middle grade school student. In the second group the proofs will be selected mainly for their charm. Simplicity being a source of beauty, selection of proofs into the second group is hard and, by necessety, subjective. The first of the collection is due to John Conway which I came across in a book by R. Many a mathematician would insist that math objects even the most abstract have existence of their own like physical objects. Mathematicians may only discover them and study their properties. Look into the proof. Think of those powers of the golden ratio. Has Conway invented them, or have they been filling the grid all along?

4: Mathematical proof - Simple English Wikipedia, the free encyclopedia

mathematical proof was presented by Euclid some years ago. We shall give his proof later. Another importance of a mathematical proof is the insight that it may o er. Being able to write down a valid proof may indicate that you have a thorough understanding of the problem. But there is more than this to it.

Who can tell me what a proof is? Any ideas of, what is a proof, anyway? But proofs exist beyond mathematics. Can anybody think of a higher level notion of what a proof is? It may have no logical deductions potentially. It may have no assumptions. Any thoughts about a proof? OK, well, I think generally, a proof is considered, across multiple fields, as a method for ascertaining the truth. And you described one method. Now, by ascertaining, I mean establishing truth, verifying truth. What are some examples of ways that we ascertain truth in society? Observations, like seeing that piece of chalk will fall to the ground. Observation, experiment and observation-- excellent. Well, we observe it. How is truth established? What are the ways? Then that helps you narrow down what is true. Truth is the opposite of falsehood. How do we establish falsehood? What are the ways in doing that? How you decide something is not true in every day-- yeah? So in fact, even a step more general, sampling. What about other ways? How are we going to decide if Roger Clemens is guilty of perjury for lying about steroids to Congress? How are we going to decide that? How is that truth going to be ascertained? Would it be by examining the evidence that we have? And who makes the conclusion there? Truth is established by juries or judges. OJ is guilty-- not of killing his wife, but of breaking into an apartment to steal back some of his merchandise. So judges and juries make decisions on truth. What are other truths-- bigger truths, even, than judges and juries, in society? Religion, the word of God-- broadly construed here, for religion. Now, that one is really hard to argue about because you believe it. So you rely on others to interpret it for you, often-- a priest, or a minister, a rabbi. Another one is the word of your boss. Whatever the boss says is right. Often in business, the customer is always right. Often in classes, the professor says it, it is true. Because the authority said it. That will not hold. And one of the nicest things about math that I like a lot is that the youngest student can stand up against the most oldest, most experienced professor, and win an argument on mathematics. I do get pleasure when a student comes up and proves me wrong. I feel a little embarrassed afterwards. OK, another one, which is related to the word of God sometimes, is inner conviction-- very popular in computer science, believe it or not, with the mantra, there are no bugs in my program. And someone stated it very clearly up there. Let me write it up here. In mathematics, we have a mathematical proof is a verification of a proposition by a chain of logical deductions from a set of axioms. A proposition is a statement that is either true or false. A simple example-- 2 plus 3 equals 5. For all n in the set of natural numbers, n squared plus n plus 41 is a prime number. This is-- the upside down A is the for all symbol. How many people have not seen that symbol before? A bunch of you. And that means for every possible choice of n-- and this is in the natural numbers, which is the set 0, 1, 2, 3, and so forth. Now, a prime number is a number that is not divisible by any other number besides itself and 1. So 1, 3, 5, 7 are prime. Now, this part here is called the predicate. And a predicate is a proposition whose truth depends on the value of a variable-- in this case, n. All right, this is referred to as the universe of discourse. This is called a quantifier. All right, now to see if this proposition is true, we need to make sure that this predicate is true for every natural number n. So for n equals 0, n squared plus n plus 41 is Yeah, nothing divides 41 but itself and 1. We get 4 plus 2 is 6 plus 41 is And I could keep on going here. I could go down to I get In fact, that is a prime. And I could just keep on going here. Go down to That is a prime. The first 40 values of n, the proposition is true. The predicate is true. Now, this is a great example because in a lot of fields-- physics, for example; statistics, often-- you checked 40 examples. So yeah, this must be true, right? It is not true. Can anybody give me an example of n for which n squared plus n plus 41 is not prime? So it is not prime. But 40 is the first break-point. So the first 40 examples work, and then it failed. So this proposition is false, even though it was looking pretty good. That is a proposition. Now, this proposition was conjectured to be true by Euler in It was unsolved for over 2 centuries. Mathematicians worked on it. It was finally disapproved by a very clever fellow named Noam Elkies years later after it was conjectured. He worked at that other school down the street. And he came up with this. So in fact, the correct proposition is there does exist a, b, c, d in the positive natural numbers such that a the fourth plus b to the fourth plus c to the fourth equals d to the fourth. I used a new quantifier here called there exists. So these are the positive natural numbers. It took a long time to figure out that actually, there was a solution here. Obviously, everything they tried until that time failed. Let me give you another one. This turns out to be false. But the shortest, smallest counter-example has over 1, digits. This one was easy. It only has six digits.

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5: CA Geometry: More proofs (video) | Khan Academy

Proofs in Mathematics Proofs are to mathematics what spelling (or even calligraphy) is to poetry. Mathematical works do consist of proofs, just as poems do consist of characters.

To explore the nature of logic, evidence, and proofs in the context of mathematics. Context In this lesson, students will explore the nature of mathematical proofs and mathematical inquiry. This lesson would be appropriate after students are familiar with the Pythagorean Theorem. The nature of logic and evidence are topics that should come up frequently in science, history, social studies, and mathematics. Piagetian research suggests that students can reason deductively from any assumptions once they reach the formal operational stage around age 12 and beyond. Other research suggests that the ability to construct proofs depends on the amount and organization of particular knowledge they have. Still other research suggests that students may need to understand the nature of proof and how it differs from everyday argumentation before they are able to construct proofs. A Shockwave and non-Shockwave version are available. Have students do the part of this activity that demonstrates the Pythagorean Puzzle. They will do the part of the activity called "Using the Pythagorean Theorem" later in the lesson. Then ask students to read the interview of Solving Fermat: Andrew Wiles on The Proof website. If available, view the NOVA program on which the site is based. When students have finished reading the selections, discuss the following questions: Because there are an infinite number of equations, and an infinite number of possible values for x, y, and z, the proof has to prove that no solutions exist within this infinity of infinities. Why did Wiles and Germain devote so much of their time to trying to solve this mathematical puzzle? Was there a practical application to solving the theorem? The discussion should emphasize the non-practical aspects of this particular endeavor. Both of these stories emphasize that both Wiles and Germain were motivated by the intellectual challenge of a purely abstract problem. Does Wiles believe that there is only one way to prove the theorem? How do non-mathematical proofs, such as in law or mystery novels, compare to mathematical proofs? Follow the discussion by having students use the webpage Proofs in Mathematics from the Interactive Mathematics Miscellany and Puzzles for guided, firsthand experience in solving mathematical proofs. Working in small groups, students should select and explore one of the problems on this page and share the "proof" with the class. Assessment Use the activities on the Using the Pythagorean Puzzle page to assess student understanding of the applications of Pythagorean Theorem.

6: 3 Ways to Do Math Proofs - wikiHow

Mathematical Proofs: A Transition to Advanced Mathematics, 2/e, prepares students for the more abstract mathematics courses that follow calculus. This text introduces students to proof techniques and writing proofs of their own.

7: High School Mathematics Extensions/Mathematical Proofs - Wikibooks, open books for an open world

Sometimes people read mathematical proofs and think they are reading a foreign language. This book describes the language used in a mathematical proof and also the different types of proofs used in math. This knowledge is essential to develop rigorous mathematics. As such, rigorous knowledge of math.

8: Mathematical Proofs: A Transition to Advanced Mathematics by Gary Chartrand

Proofs by contradiction can be somewhat more complicated than direct proofs, because the contradiction you will use to prove the result is not always apparent from the proof statement itself. Proof by Contradiction Walkthrough: Prove that âˆš2 is irrational.

9: Mathematical Proof - Wikibooks, open books for an open world

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In this tutorial I show how to do a proof by mathematical induction. Learn Math Tutorials Bookstore www.enganchecubano.com Donate www.enganchecubano.com

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Reel 413. Cook (part). New System or an Analysis of Ancient Mythology, Part 1 Little journeys to the homes of great teachers : Pythagoras Post-Modern Use of the Bible Poor bloody infantry Aromatic teas and herbal infusions Main idea and supporting details worksheet middle school Intensive Care Medicine in 10 Years (Update in Intensive Care Medicine) Britains buses in the seventies Carntyne local plan Bobby and J. Edgar Automatic rain operated wiper project With a Song in My Psyche Gods thousand ways What is modern science Differential equations and linear algebra gilbert strang Sean Manning Ishmael Reed David Ritz Ron Carlson Lynne Tillman Rebecca Brown General chemistry 4 edition Little Exercise for Young Theologians (Bible Christian Living) Focke Wulf Fw 190 in Action Aircraft No. Nineteen Responding to the continuing economic crisis adversely affecting American agricultural producers Urban Element Design Two pinches of snuff Fluid and Electrolyte Balance Adobe photoshop save as editable Automotive Safety, Anatomy, Injury, Testing, and Regulation Emerging Fields in Sol-Gel Science and Technology GRAND ENDEAV AMERN IND PHOTO Kompass Products Services Register The Present Situation Meeting the mountains Frommers Road Atlas Europe Back care on the job History of nursery rhymes Traveling on the Run The ABCs of Safe Healthy Child Care Staff attendance management system Examining the interface between commercial fishing and sportfishing: a property rights perspective Keith Barrington-Bernard correspondence and illustrative matter, 1760-1770 The tale of despereaux full book