

## 1: 'A mathematician's apology' | [www.enganchecubano.com](http://www.enganchecubano.com)

*A Mathematician's Apology is a essay by British mathematician G. H. Hardy. [www.enganchecubano.com](http://www.enganchecubano.com) concerns the aesthetics of mathematics with some personal content, and gives the layman an insight into the mind of a working mathematician.*

Hardy This is an old book. In the wider world G. Hardy - is famous largely due to the above film for his fascinating collaboration with the Indian mathematician Srinivasa Ramanujan. If his patterns are more permanent than theirs, it is because they are made with ideas. Beauty is the first test: He states and proves two theorems as examples, carefully chosen to be accessible to non-mathematicians: He points to the sense of unshakeable truth and permanence in both of these results "two thousand years have not written a wrinkle on either of them" and their far-reaching significance within mathematics: The permanence is what distinguishes maths among other fields, and their fundamental nature is what distinguishes these two results among others within maths. More generally, Hardy tries to define what makes a result significant. The ideas within a result and its proof should be useful in many different constructs of mathematics and the "relations revealed by the proof" should connect many mathematical ideas. He beautifully describes how maths appears to be made of different "strata", with basic ideas eg the whole numbers sitting on top of more involved ones eg the irrational numbers. A result is deep if it cuts right through to the lower strata. The beauty of a result is intimately linked with its significance. In both of his examples, as Hardy puts it, "There is a very high degree of unexpectedness, combined with inevitability and economy. The arguments take so odd and surprising a form; the weapons used so childishly simple when compared with the far-reaching results; but there is no escape from the conclusions. There are no complications of detail [ A mathematical proof should resemble a simple and clear-cut constellation, not a scattered cluster in the Milky Way. Hardy believes that those aspects of maths that serve as tools for engineers and other applied scientists are precisely the boring ones. Real maths, according to Hardy, is "almost wholly useless". He makes some surprising points, for example that maths is in "more direct contact with reality" than physics, and that "pure mathematics is on the whole distinctly more useful than applied". Hardy counts its originators as "real" mathematicians and claims that these areas of theoretical physics are almost as useless as number theory. New technologies use both quantum mechanics eg the internet and relativity eg GPS. Even the number theoretical result on the infinitude of primes could be argued, admittedly with a considerable stretch, to find applications in cryptography, which makes use of very large primes. But Hardy himself admits that time may change his assertions. Yet, this subjective view of mathematics is probably shared by a good part of pure mathematicians, which is what makes the essay interesting: But not without humility: I have just one chance of escaping a verdict of complete triviality, that I may be judged to have created something worth creating. There are several editions of this book. The cover above is from the following:

## 2: A Mathematician's Apology - Wikipedia

*1 1 It is a melancholy experience for a professional mathematician to find himself writing about mathematics. The function of a mathematician is to do something, to prove new theorems, to add.*

Aesthetics, the study of what is inherently important and valuable, is for Hardy the fundamental power of mathematics, not an incidental result of correct thought. Aesthetics, while not unique to mathematics, is arguably more single-mindedly applied in mathematics than in any other human activity, including art of all kinds. Hardy, like many poets and artists as well as other mathematicians, is hesitant about his exposition of the aesthetics of mathematics. It seems to him vaguely disloyal and a possible waste of time. And he has a point: Mathematicians could care less about their reputations outside of mathematics. Hardy is acutely aware that an aesthetic, that is, a specific criterion or set of criteria, is that which is valuable for itself, and for no other reason. The aesthetic aims at nothing practical, nothing beyond itself. It is an argument from first principles that cannot be gainsaid by any other argument. It proves itself by its own assertion and by its own internal logic. Paradoxically, this is what makes an aesthetic so powerful: It is the scale of its own value. Its attraction is precisely its special kind of absoluteness. Aesthetics therefore is a dangerous business. It holds itself apart from criticism of any kind from those outside the circle which embraces it. It is an elitist activity. Its justification is merely the complete indifference about whether others subscribe to its views or not. It does not even claim any right to exist, for that would imply a purpose beyond itself. The assertion may have implications. Indeed this assertion has vast implications for the practice of mathematics. But that is the extent of its mathematical significance. It is a start in expressing the relevant aesthetic, but it is not intended to make the world better, or more intelligent, or more interested in mathematics. Does that make all aesthetics equal? But such intrinsic value is not arbitrary. The aesthetics adhered to by the professions - law, medicine, science - for example are distinctly different and incommensurate; but they are not arbitrary. Rather they are arrived at through social processes and accepted for what they are - the way we do things. Nonetheless a distinction can be made between fundamental criteria of action I hesitate to call them aesthetics at this point which are hidden, implicit, and unexpressed, from those that are made explicit, revealed, and given for consideration to others without the threat of compulsion. It is only the latter that are aesthetics. The former we can categorise as mere prejudice or, at best, unconsidered preferences. An aesthetic then must be articulated and expressed to be considered as such. When it is, it develops an uncanny power. The greater the precision of the articulation, the greater its attractiveness. This latter aesthetic has become accepted throughout Western Europe and North America as it has become expressed. An aesthetic is likely to attract those with a talent to employ it creatively. Hardy identifies curiosity, professional pride and ambition for reputation within the profession as general aesthetic aspects, applicable to many others than mathematicians. The game in question is never described except to the extent that it involves the identification of patterns across otherwise discrete fields of human knowledge - mathematics, history, politics, painting, poetry, physics, etc. A mathematical aesthetic expanded universally in other words. Pattern-seeing rather than pattern-making is the essential mathematical skill. The difference is crucial, and what makes mathematics an empirical science. Numbers are there to be explored and interrogated. These patterns are as real, perhaps even more real, than the patterns proposed by, say, physicists. But these are mere hypotheses in comparison with the factual solidity of the number 2, or the logical necessity of more than one cardinal order of infinity. There are ugly and beautiful patterns in mathematics. One might suppose that this distinction is also arbitrary. But as Hardy explains, it is not arbitrary at all, nor is it vague even if its details are obvious only within the profession. It has a seductive elegance that does not so much force as it does invite acceptance. Without these characteristics, theorems, however ingenious, remain curiosities of interest only to puzzlers and hobbyists. On the other hand, too much generality and a theorem becomes abstractly insipid. Depth is even more subtle and has to do with the virtuosity involved in solving a problem that has just the right degree of generality and difficulty - again using innovative or unexpected Hardy makes several mentions of how the aesthetic becomes obsolete and how it might be modified. Only by having the personal courage to move against this established norm did the situation improve. Without the

mathematical talent sufficient to participate in the community that shares the aesthetic, it is perhaps impossible to appreciate the power of the aesthetic Hardy outlines. But it is, I think, sufficient to establish the almost miraculous way in which a professional discipline can create and sustain criteria of value that are not only independent of economic or commercial imperatives, but markedly antithetical to them. One might say that mathematics is serious business indeed. Aesthetics and Fake News An aesthetic has no intentional meaning beyond itself but it does have an incidental effect in the sense that it eliminates any consideration of truth. Since an aesthetic is its own truth, it cannot be compared or verified by reference to any other truth. This might appear as an aesthetic defect until it is realized that an aesthetic has a great epistemological consequence. It eliminates what has come to be known as fake news. It is fake because it is irrelevant in a given aesthetic. It exists when there is an ulterior motive that remains unexpressed, a purpose - political, economic, or otherwise pragmatic - which is beyond the simple factual assertion. It takes some practice to know whether one is dealing with an aesthetic or some other instrumental or intermediate criterion of value. Often we hide our aesthetic under layers of rationalization so that we may not be aware ourselves what our aesthetic is. When a politician claims that a news story is fake, it is because he has some underlying interest he wants to promote, some hidden aesthetic, possibly Power, possibly wealth, possibly reputation. When a physicist or a social scientist makes a claim about reality, he or she is also making claim that is fake.

## 3: A Mathematician's Apology Essays and Criticism - [www.enganchecubano.com](http://www.enganchecubano.com)

*Non-mathematicians usually know him for A Mathematician's Apology, his essay from on the aesthetics of mathematics. The apology is often considered one of the best insights into the mind of a working mathematician written for the layman.*

David Auerbach on literature, tech, film, etc. It is worth reading especially by anyone who is not a member of those clubs. It is the memoir of a person who has spent so much time discovering theorems of numbers, formulae, and equations that they have come to seem far more real than the discovery of a new species of plant or a new planet, which after all is just one more instance of a form that was already known. I am not exaggerating on the Platonist front. Hardy states it plainly: This view has been held, in one form or another, by many philosophers of high reputation from Plato onwards, and I shall use the language which is natural to a man who holds it. A reader who does not the philosophy can alter the language: This is the key point, never to be forgotten. Hardy witnessed connection to this reality in an even stronger form in his friend Ramanujan, the great mystic mathematician, who had sent him a sample his unpolished but noetically brilliant work. Hardy rated Ramanujan as the most talented mathematician he had ever known. His very opening suggests he has only come down from the mountain because his powers have faded and failed him: It is a melancholy experience for a professional mathematician to find himself writing about mathematics. The function of a mathematician is to do something, to prove new theorems, to add to mathematics, and not to talk about what he or other mathematicians have done. Statesmen despise publicists, painters despise art-critics, and physiologists, physicists, or mathematicians have usually similar feelings: Exposition, criticism, appreciation, is work for second-rate minds. Yet in the human world, mathematics seems a talent of marginal utility at least to Hardy, and he defends his mortal life by saying only that he did mathematics because he was good at it. Judged by all practical standards, the value of my mathematical life is nil; and outside mathematics it is trivial anyhow. I have just one chance of escaping a verdict of complete triviality, that I may be judged to have created something worth creating. And that I have created is undeniable: It is a tiny minority who can do something really well, and the number of men who can do two things well is negligible. If a man has any genuine talent he should be ready to make almost any sacrifice in order to cultivate it to the full. But in terms of the greater pageant of time, the mathematician has the greatest chance at immortality. As for language and literature, they are merely human creations and even more evanescent. If intellectual curiosity, professional pride, and ambition are the dominant incentives to research, then assuredly no one has a fairer chance of satisfying them than a mathematician. His subject is the most curious of all—there is none in which truth plays such odd pranks. It has the most elaborate and the most fascinating technique, and gives unrivalled openings for the display of sheer professional skill. Finally, as history proves abundantly, mathematical achievement, whatever its intrinsic worth, is the most enduring of all. Archimedes will be remembered when Aeschylus is forgotten, because languages die and mathematical ideas do not. A mathematician, like a painter or a poet, is a maker of patterns. If his patterns are more permanent than theirs, it is because they are made with ideas. Could lines be better, and could ideas be at once more trite and more false? The poverty of the ideas seems hardly to affect the beauty of the verbal pattern. A mathematician, on the other hand, has no material to work with but ideas, and so his patterns are likely to last longer, since ideas wear less with time than words. Any connection to the everyday nominal world is something that endangers the solid rock of eternal truths which Descartes described as the sole object of posthumous contemplation. Our memories do not exist after death, for Descartes, so the only things our souls can contemplate are a priori truths: All such claim, if interpreted literally, are strictly nonsense. It cannot be possible to prove mathematically that there will be an eclipse to-morrow, because eclipses, and other physical phenomena, do not form part of the abstract world of mathematics. We can describe, sometimes fairly accurately, sometimes very roughly, the relations which hold between some of its constituents, and compare them with the exact relations holding between constituents of some system of pure geometry. The geometer offers to the physicist a whole set of maps from which to choose. One map, perhaps, will fit the facts better than others, and then the geometry which provides

that particular map will be the geometry most important for applied mathematics. I may add that even a pure mathematician may find his appreciation of this geometry quickened, since there is no mathematician so pure that he feels no interest at all in the physical world; but, in so far as he succumbs to this temptations, he will be abandoning his purely mathematical position. And so applied mathematics is inferior to pure mathematics because it is hamstrung by contingent particulars. Airborne truth is brought down to earth by the accumulated weight of midges and gnats: One rather curious conclusion emerges, that pure mathematics is one the whole distinctly more useful than applied. A pure mathematician seems to have the advantage on the practical as well as on the aesthetic side. For what is useful above all is technique, and mathematical technique is taught mainly through pure mathematics. I hope that I need not say that I am trying to decry mathematical physics, a splendid subject with tremendous problems where the finest imaginations have run riot. But is not the position of an ordinary applied mathematician in some ways a little pathetic? If he wants to be useful, he must work in a humdrum way, and he cannot give full play to his fancy even when he wishes to rise to the heights. This is not a new attitude; the Pythagorean cult is only one of the oldest known manifestations of this tendency. And it exists today in hardly a different form: To hear Hardy tell it, the real divide is not between the humanities and the sciences but between the theoreticians and the engineers, idea and praxis, rationalists and empiricists, philosophers and storytellers, gnostics and skeptics. It is more a continuum than it is a dichotomy, but each pole is a strong attractor and tends to draw in those who already lean toward it. Hardy refers to the anodyne of escape provided by theory, but not only can it also be a dereliction of human duty, but it is also ultimately an unreliable respite for mere particulars such as ourselves: There is one purpose at any rate which the real mathematics may serve in war. When the world is mad, a mathematician may find in mathematics an incomparable anodyne. Mathematics is not a contemplative but a creative subject; no one can draw much consolation from it when he has lost the power or the desire to create; and that is apt to happen to a mathematician rather soon.

## 4: A Mathematician's Apology | Introduction & Overview

*A mathematician's apology is an attempt to justify, and explain, pure mathematics. On Wikipedia it's described as an essay on the aesthetics of mathematics and that's certainly partly true. On Wikipedia it's described as an essay on the aesthetics of mathematics and that's certainly partly true.*

Overview[ edit ] G. Wilson, Srinivasa Ramanujan centre , G. Hardy extreme right , and other scientists at Trinity College at the University of Cambridge, ca. Hardy was born on 7 February , in Cranleigh , Surrey, England, into a teaching family. Both parents were mathematically inclined. When just two years old, he wrote numbers up to millions, and when taken to church he amused himself by factorising the numbers of the hymns. In he entered Trinity College, Cambridge. While at university, Hardy joined the Cambridge Apostles , an elite, intellectual secret society. In he passed part II of the Tripos and was awarded a fellowship. In he earned his M. From onward he held the position of a lecturer where teaching six hours per week left him time for research. Hardy spent the academic year " at Princeton in an academic exchange with Oswald Veblen , who spent the year at Oxford. In prime number theory, they proved results and some notable conditional results. This was a major factor in the development of number theory as a system of conjectures ; examples are the first and second Hardy"Littlewood conjectures. In a lecture, the Danish mathematician Harald Bohr reported a colleague as saying, "Nowadays, there are only three really great English mathematicians: Hardy, Littlewood, and Hardy"Littlewood. He played cricket with the geneticist Reginald Punnett who introduced the problem to him, and Hardy thus became the somewhat unwitting founder of a branch of applied mathematics. He made several statements similar to that in his Apology: I have never done anything "useful". No discovery of mine has made, or is likely to make, directly or indirectly, for good or ill, the least difference to the amenity of the world. Though Hardy wanted his maths to be "pure" and devoid of any application, much of his work has found applications in other branches of science. Hardy regards as "pure" the kinds of mathematics that are independent of the physical world, but also considers some "applied" mathematicians, such as the physicists Maxwell and Einstein , to be among the "real" mathematicians, whose work "has permanent aesthetic value" and "is eternal because the best of it may, like the best literature, continue to cause intense emotional satisfaction to thousands of people after thousands of years. Moore , Bertrand Russell and J. He was an avid cricket fan. Apart from close friendships, he had a few platonic relationships with young men who shared his sensibilities, and often his love of cricket. Hardy was extremely shy as a child, and was socially awkward, cold and eccentric throughout his life. During his school years he was top of his class in most subjects, and won many prizes and awards but hated having to receive them in front of the entire school. He was uncomfortable being introduced to new people, and could not bear to look at his own reflection in a mirror. It is said that, when staying in hotels, he would cover all the mirrors with towels. By definition, there are plenty of others to do that. If his patterns are more permanent than theirs, it is because they are made with ideas. I do not know an instance of a major mathematical advance initiated by a man past fifty. Hardy once told Bertrand Russell "If I could prove by logic that you would die in five minutes, I should be sorry you were going to die, but my sorrow would be very much mitigated by pleasure in the proof".

## 5: A Mathematician's Apology by Serra Carmines on Prezi

*This book is a deeply moving account about the worth, and indeed the nobility, of a life spent pursuing "useless" mathematical beauty. A thread of despair alloys the work, as the author -- a brilliant pure mathematician -- had lost his deep creative mathematical abilities at the time of writing.*

Robotics Animated films The diversity of fields that employ mathematicians is reflected in Mathematical Moments and Mathematics and Statistics Awareness Month themes. Mathematicians make it possible to send secure emails and buy things online. Mathematicians are essential to analyze data and design accurate models in fields as diverse as biology and finance. Mathematicians enabled researchers to complete The Human Genome Project quickly. And because of the prevalence of the computer at work and at play, mathematicians will continue to touch everyone in modern society. Professions in mathematics top the CareerCast. There are over 35, individual members of the four leading professional mathematical sciences societies in the U. Most would call themselves mathematicians; many received their doctoral degrees outside the U. There are at least 10, more members of the societies who are graduate students or in other categories, and there are also mathematicians who are not members of any of these societies. Although they have advanced degrees in mathematics, many of those employed in academia might call themselves professors instead of mathematicians, and similarly, those in industry and government may not have "mathematician" in their job title. These people are doing mathematics and are indeed mathematicians. Furthermore, the number of mathematicians is increasing. The number of new Ph. Mathematicians are people of all ages and from all over the world who enjoy the challenge of a problem, who see the beauty in a pattern, a shape, a proof, a concept. Some of the best young mathematicians compete in math olympiads, state and national science fairs, or the fun Who Wants to Be a Mathematician game. Some high school mathematicians go to summer Math Camps to learn more and work with teams on projects; undergraduates participate in Summer Research Experiences. Many carry on their research and teach at colleges and universities, while others apply their skills in all kinds of professions. Keith Devlin poses this idea in his book, *The Math Instinct*: In any case, those who are not "mathematicians" can appreciate the subject by reading about mathematicians, breakthroughs in mathematics, and current applications at *Math in the Media*. Resources on the *Mathematics Profession*: Mathematicians advocate for the importance of mathematics as they present the latest advances in mathematics research to Congressional representatives who vote to fund the National Science Foundation and other governmental agencies.

## 6: AMS :: What Do Mathematicians Do

*This 'Apology', written in , offers a brilliant and engaging account of mathematics as very much more than a science; when it was first published, Graham Greene hailed it alongside Henry James's notebooks as 'the best account of what it was like to be a creative artist'.*

## 7: A Mathematician's Apology - G. H. Hardy - Google Books

*A Mathematician's Apology Quotes (showing of 54) "A mathematician, like a painter or poet, is a maker of patterns. If his patterns are more permanent than theirs, it is because they are made with ideas."*

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## 9: Godfrey Harold Hardy: A Mathematician's Apology - waggish

## MATHEMATICIANS APOLOGY pdf

*Bernard Russo (UCI) A MATHEMATICIAN'S APOLOGY G. H. Hardy 3 / 8 3 The standard apology I do what I do because it is the one and only thing that I can do well.*

*History, memory, and the law Race for the eighth The Battle at the Moons of Hell (Helforts War #1 ) Nonpolluting coatings and coating processes B.S. Plake, Doesnt Everybody Know That 70 Is Passing? Henry the Green Engine (6 (Railway series) Defiant queen onine Paniolo House Stories Methods of Study and Memory Development Little men, little women, little food Methods of behavior analysis in neuroscience All my puny sorrows The viking, Guy, Legend of the Moxahals Methods of slaughtering animals Green corrosion inhibitors theory and practice American criminal courts Ice creams for Rosie Love and the Marquis Beeckman in historical perspective: the rise of molecularism Morituri Te Salutant The stories of Fannie Hurst Quasihomogeneous distributions Great books and liberal arts Otto Bird Savings insurance Family Circle Favorite Recipes Cookbook Sibelius, Symphony no. 5 Mao Tse-tung, the lacquered image Russian short stories from pushkin to buida Volume II: flow number and flow time. Hajo Holborn; Inter Nationes prize, 1969. Enjoying the funeral: Konstantine Karyotakis Ram jet mefi manual At a General Assembly of the governor and Company of the state of Connecticut Collected Papers on General Telecommunications Theory The wit and wisdom of Hollywood The development of modern sociology, its nature and growth in the United States Varma kalai in tamil On solving the large sparse generalized eigenvalue problem The Firefly Forensics Doublepack: Includes 2 paperback books The man and the spirit of the age.*