ENTRY MATH CITATIONS

[ENTRY MATH CITATIONS] Collected by Oliver Knill: 2000-2002

solution

[solution] Every problem in the calculus of variations has a solution, provided the word solution is suitably understood. – David Hilbert

enhusiast

[enhusiast] The real mathematician is an enthusiast per se. Without enthusiasm no mathematics. – Novalis

royal

[royal] There is no royal road to geometry. – Euclid

computer

[computer] One may be a mathematician of the first rank without being able to compute. It is possible to be a great computer without having the slightest idea of mathematics – Novalis

analysis

[analysis] Geometry may sometimes appear to take the lead over analysis, but in fact precedes it only as a servant goes before his master to clear the path and light him on the way. – James Joseph Sylvester

freedom

[freedom] The essence of mathematics lies in its freedom. – Georg Cantor

fantasy

[fantasy] Fantasy, energy, self-confidence and self-criticism are the characteristic endowments of the mathematician. – Sophus Lie

magacian

[magacian] Pure mathematics is the magician's real wand. – Novalis

axiomatics

[axiomatics] When a mathematician has no more ideas, he pursues axiomatics. – Felix Klein

turbulence

[turbulence] The paper "On the nature of turbulence" with F. Takens was eventually published in a scientific journal. (Actually, I was an editor of the journal, and I accepted the paper by myself for publication. This is not a recommended procedure in general, but I felt that it was justified in this particular case). – D. Ruelle, in Chance and Chaos

hairy-ball

[hairy-ball] A good topological theorem to mention any time is the theorem which, in essence, states that however you try to comb the hair on a hairy ball, you can never do it smoothly - the so-called 'hairy-ball' theorem. You can make snide comments about the grooming of the hosts' dog or cat in the meantime as you pick hairs off your trouser leg. – R. Ainsley in Bluff your way in Maths, 1988

large

[large] LARGE NUMBERS: (10^n means that 10 is raised to the n'th power)

10^4	One "myriad". The largest numbers, the Greeks were considering.
10^5	The largest number considered by the Romans.
10^{10}	The age of our universe in years.
10^{22}	Distance to our neighbor galaxy Andromeda in meters.
10^{23}	Number of atoms in two gram Carbon (Avogadro).
10^{26}	Size of universe in meters.
10^{41}	Mass of our home galaxy "milky way" in kg.
10^{51}	Archimedes's estimate of number of sand grains in universe.
10^{52}	Mass of our universe in kg.
10^{80}	The number of atoms in our universe.
10^{100}	One "googol". (Name coined by 9 year old nephew of E. Kasner).
10^{153}	Number mentioned in a myth about Buddha.
10^{155}	Size of ninth Fermat number (factored in 1990).
$10^{(10^6)}$	Size of large prime number (Mersenne number, Nov 1996).
$10^{(10^7)}$	Years, ape needs to write "hound of Baskerville" (random typing).
$10^{(10^(33))}$	Inverse is chance that a can of beer tips by quantum fluctuation.
$10^{(10^(42))}$	Inverse is probability that a mouse survives on sun for a week.
$10^{(10^{51))}}$	Inverse is chance to find yourself on Mars (quantum fluctuations)
$10^{(10^{100)}}$	One "Gogoolplex", Decimal expansion can not exist in universe.

– from R.E. Crandall, Scient. Amer., Feb. 1997

analytic

[analytic] The statement sometimes made, that there exist only analytic functions in nature, is in my opinion absurd. – F. Klein, Lectures on Mathematics, 1893

violence

[violence] The introduction of numbers as coordinates ... is an act of violence... – H. Weyl, Philosophy of Mathematics and Natural Science 1949

beauty

[beauty] Mathematics possesses not only truth but supreme beauty - a beauty cold and austere, like that of a sculpture – Bertrand Russell

geometry

[geometry] Geometry is magic that works... – R. Thom. Stability Structurelle et Morphogenese, 1972

Zermelo

[Zermelo] Ernst Zermelo, who created a system of axioms for set theory, was a Privatdozent at Goettingen when Herr Geheimrat Felix Klein held sway over the fabled mathematics department. As Pauli told it, "Zermelo taught a course on mathematical logic and stunned his students by posing the following question: All mathematicians in Goettingen belong to one of two classes. In the first class belong those mathematicians who do what Felix Klein likes, but what they dislike. In the second class are those mathematicians who do what Felix Klein likes, but what they dislike. To what class does Felix Klein belong?" Jordan, having listened intently, broke into roaring laughter. Pauli paused, took a sip of wine and said disapprovingly, "Herr Jordan, you have laughed too soon". He continued: "None of the awed students could solve this blasphemous problem. Zermelo then crowed in his high-pitched voice, 'But, meine Herren, it's very simple. Felix Klein isn't a mathematician.'" Jordan laughed again. Pauli drained his wine glass approvingly and concluded with "Zermelo was not offered a professorship at Goettingen". – E.L. Schucking, in 'Jordan, Pauli,Politics, Brecht and a variable gravitational constant' Physics Today, Oct. 1999

Conway

[Conway] In the beginning, everything was void, and J.H.W.H.Conway began to create numbers. Conway said, "Let there be two rules which bring forth all numbers large and small. This shall be the first rule: Every number corresponds to two sets of previously created numbers, such that no member of the left set is greater than or equal to any member of the right set. And the second rule shall be this: One number is less than or equal to another number if and only if no member of the first number's left set is greater than or equal to the second number, and no member of the second number 's right set is less than or equal to the first number." And Conway examined these two rules he had made, and behold! they were very good. And the first number was created from the void left set and the void right set. Conway called this number "zero", and said that it shall be a sign to separate positive numbers from negative numbers. Conway proved that zero was less than or equal to zero, and he saw that it was good. And the evening and the morning were the day of zero. On the next day, two more numbers were created, one with zero as its left set and one with zero as its right set. And Conway called the former number "one", and the latter he called "minus one". And he proved that minus one is less than but not equal to zero and zero is less than but not equal to one. And the evening... – D. Knuth, Surreal numbers, 1979

obvious

[obvious] Mathematics consists essentially of :
a) proving the obvious
b) proving the not so obvious
c) proving the obviously untrue

For example, it took mathematicians until the 1800'ies to prove that 1+1=2 and not before the late 1970 were they confident of proving that any map requires no more than four colors to make it look nice, a fact known by cartographers for centuries. There are many not-so-obvious things which can be proved true too. Like the fact that for any group of 23 people, there is an even chance two or more of them share birthdays. (With groups of twins this becomes almost certain. Not quite certain as you will of course point out: they might all have been born either side of midnight). Mathematicians are also fond of proving things which are obviously false, like all straight lines being curved, and an engaged telephone being just as likely to be free if you ring again immediately after, as if you wait twenty minutes. – R. Ainsley in Bluff your way in Maths, 1988

infimum

[infimum] There exists a subset of the real line such that the infimum of the set is greater then the supremum of the set. – Gary L. Wise and Eric B. Hall, Counter examples in probability and real analysis, 1993, First Example in book

transcendental

[transcendental] Transcendental number : A number which is not the root of any polynomial equation, like pi and e, and which can only be understood after several hours meditation in the lotus position. – R. Ainsley in Bluff your way in Maths, 1988

illiteracy

[illiteracy] There are great advantages to being a mathematician: a) you do not have to be able to spell b) you do not have to be able to add up The illiteracy of mathematicians is taken for granted. There still persists a myth that mathematics somehow involves numbers. Many fondly believe that university students spend their time long dividing by 173 and learning their 39 times table; in fact, the reverse is true. Mathematicians are renowned for their inability to add up or take away, in much the same way as geographers are always getting lost, and economists are always borrowing money off you. – R. Ainsley in Bluff your way in Maths, 1988

prime

[prime] In this note we would like to offer an elementary 'topological' proof of the infinitude of the prime numbers. We introduce a topology into the space of integers S, by using the arithmetic progressions (from -infinity to +infinity) as a basis. It is not difficult to verify that this actually yields a topological space. In fact, under this topology, S may be shown to be normal and hence metrisable. Each arithmetic progression is closed as well as open, since its complement is the union of the other arithmetic progressions (having the same difference). As a result, the union of any finite number of arithmetic progressions is closed. Consider now the set A which is the union of A(p), where A(p) consists of primes greater or equal to p. The only numbers not belonging to A are -1 and 1, and since the set -1,1 is clearly not an open set, A cannot be closed. Hence A is not a finite union of closed sets, which proves that there is an infinity of primes. – H. Fuerstenberg, On the infinitude of primes, American Mathematical Montly, 62, 1955, p. 353

barber

[barber] The barber in a certain town shaves all the people who don't shave themselves. Who shaves the barber? This is meant to be a clever little paradox with no solution but you can annoy the asker intensely by saying it's easy and that the barber is a women. You can then ask the following (a version of Russell's Paradox, - point this out too): in a library there are some books for the catalogue section which is a list of all books which don't list themselves. Shold he or she include this book in its own list? If so, then it becomes a book which lists itself, so it shouldn't be in the list of books which don't and vice versa. This should keep the most determined assailant at bay while you attack the wine. – R. Ainsley in Bluff your way in Maths, 1988

Hadamard

[Hadamard] Hadamard, trying to find a job in a US university, came to a small university and was received by the chairman of the department of mathematics. He explained who he was and gave his curriculum vitae. The chairman said: 'our means are very limited and I can not promise that we shal take you'. Then Hadamard noticed that among the portraits on he wall was his own. 'That's me!' he said. 'Well, come again in a week, we shal think about this'. On his next visit, the answer was negative and his portrait had been removed. – Vladimir Mazya and Tatyana Shaposhnikova, in Jacques Hadamard, a universal Mathematician, AMS History of Mathematics Volume 14

Cantor

[Cantor] The appropriate object is known as the Cantor set, because it was discovered by Henry Smith in 1875. (The founder of set theory, Georg Cantor, used Smith's invention in 1883. Let's fact it, 'Smith set' isn't very impressive, is it?) – Ian Stewart, in Does God Play Dice, 1989 p. 121

jouissance

[jouissance] ... Thus the erectile organ comes to symbolize the place of jouissance, not in itself, or even in the form of an image, but as a part lacking in the desired image: that is why it is equivalent to the $(-1)^(1/2)$ of the signification produced above, of the Jouissance that it restores by the coefficient of its statement to the function of lack of signifier (-1).
– Lacan, Ecrits, Paris 1966 (cited in 'Fashionable nonsense' by Alan Sokal and Jean Bricmont)

Mandelbrot

[Mandelbrot] Mandelbrot made quite good computer pictures, which seemed to show a number of isolated "islands" (in the Mandelbrot set M). Therefore, he conjectured that the set M has many distinct connected components. (The editors of the journal thought that his islands were specks of dirt, and carefully removed them from the pictures). – John Milnor, in Dynamics in one complex variable, 1991

sin

[sin] sin, cos, tan, cot, sec, cosec - Formulae derived from the sides of triangles but which crop up in completely unexpected places. Sins are extremely common, but rarely do you encounter secs in mathematics. – R. Ainsley in Bluff your way in Maths, 1988

Moser

[Moser] This reminds me of the Hilbert story, which I learned from my teacher Franz Rellich in Goettingen: When Hilbert - who was old and retired - was asked at a party by the newly appointed Nazi-minister of education: "Herr Geheimrat, how is mathematics in Goettingen, now that it has been freed of the Jewish influences" he replied: "Mathematics in Goettingen? That does not EXIST anymore". – Jurgen Moser, in Dynamical Systems-Past and Present, Doc. Math. J. DMV I p. 381-402, 1998

wine

[wine] There are two glasses of wine, one white and one red. A teaspoonful of wine is taken from the red and mixed in with the white. Then a teaspoonful of this mixture is taken and mixed in with the red. Which is bigger, the amount of red in the white or the amount of white in the red? The answer is that the're both the same, because there's the same volume in each glass, so whatever quantity of red is in the white must be equal to the quantity of white in the red. However in practice it is impossible to do this because the white always runs out first at parties and the red always gets spilt on someone's white trousers. – R. Ainsley in Bluff your way in Maths, 1988

Monty-Hall

[Monty-Hall] "Suppose you're on a game show and you are given a choice of three doors. Behind one door is a car and behind the others are goats. You pick a door-say No. 1 - and the host, who knows what's behind the doors, opens another door-say, No. 3-which has a goat. (In all games, the host opens a door to reveal a goat). He then says to you, "Do you want to pick door No. 2?" (In all games he always offers an option to switch). Is it to your advantage to switch your choice?" – The three doors problem, also known as Monty-Hall Problem

sex

[sex] Pure mathematician - Anyone who prefers set theory to sex. – R. Ainsley in Bluff your way in Maths, 1988

mad

[mad] There was a mad scientist (a mad ...social... scientist) who kidnaped three colleagues, an engineer, a physicist, and a mathematician, and locked each of them in separate cells with plenty of canned food and water but no can opener. A month later, returning, the mad scientist went to the engineer's cell and found it long empty. The engineer had constructed a can opener from pocket trash, used aluminum shavings and dried sugar to make an explosive, and escaped. The physicist had worked out the angle necessary to knock the lids off the tin cans by throwing them against the wall. She was developing a good pitching arm and a new quantum theory. The mathematician had stacked the unopened cans into a surprising solution to the kissing problem; his dessicated corpse was propped calmly against a wall, and this was inscribed on the floor in blood:
Theorem: If I can't open these cans, I'll die. Proof: assume the opposite...

induction

[induction] Proof by induction - A very important and powerful mathematical tool, because it works by assuming something is true and then goes on to prove that therefore it is true. Not surprisingly, you can prove almost everything by induction. So long as the proof includes the following phrases:
a) Assume true for n; then also true for n+1 because.. (followed by some plausible but messy working out in which n, n+1 appear prominently).
b) But is true for n=0 (a little more messy working out with lots of zeros sprayed at random through the proof).
c) So is true for all n. Q.E.D.
– R. Ainsley in Bluff your way in Maths, 1988

horse

[horse] LEMMA: All horses are the same color. Proof (by induction): Case n=1: In a set with only one horse, it is obvious that all horses in that set are the same color. Case n=k: Suppose you have a set of k+1 horses. Pull one of these horses out of the set, so that you have k horses. Suppose that all of these horses are the same color. Now put back the horse that you took out, and pull out a different one. Suppose that all of the k horses now in the set are the same color. Then the set of k+1 horses are all the same color. We have k true =¿ k+1 true; therefore all horses are the same color.
THEOREM: All horses have an infinite number of legs. Proof (by intimidation): Everyone would agree that all horses have an even number of legs. It is also well-known that horses have fore-legs in front and two legs in back. But $4 + 2 = 6$ legs is certainly an odd number of legs for a horse to have! Now the only number that is both even and odd is infinity; therefore all horses have an infinite number of legs. However, suppose that there is a horse somewhere that does not have an infinite number of legs. Well, that would be a horse of a different color; and by the Lemma, it doesn't exist. QED

dean

[dean] Dean, to the physics department. "Why do I always have to give you guys so much money, for laboratories and expensive equipment and stuff. Why couldn't you be like the maths department - all they need is money for pencils, paper and waste-paper baskets. Or even better, like the philosophy department. All they need are pencils and paper."

astronomer

[astronomer] An astronomer, a physicist and a mathematician were holidaying in Scotland. Glancing from a train window, they observed a black sheep in the middle of a field. "How interesting," observed the astronomer, "all Scottish sheep are black!" To which the physicist responded, "No, no! Some Scottish sheep are black!" The mathematician gazed heavenward in supplication, and then intoned, "In Scotland there exists at least one field, containing at least one sheep, at least one side of which is black." – J. Steward in 'Concepts of Modern Mathematics'

coffee

[coffee] An engineer, a chemist and a mathematician are staying in three adjoining cabins at an old motel. First the engineer's coffee maker catches fire. He smells the smoke, wakes up, unplugs the coffee maker, throws it out the window, and goes back to sleep. Later that night the chemist smells smoke too. He wakes up and sees that a cigarette butt has set the trash can on fire. He says to himself, "Hmm. How does one put out a fire? One can reduce the temperature of the fuel below the flash point, isolate the burning material from oxygen, or both. This could be accomplished by applying water." So he picks up the trash can, puts it in the shower stall, turns on the water, and, when the fire is out, goes back to sleep. The mathematician, of course, has been watching all this out the window. So later, when he finds that his pipe ashes have set the bed-sheet on fire, he is not in the least taken aback. He says: "Aha! A solution exists!" and goes back to sleep.

logs

[logs] Taking logs - Broadly speaking, any equation which looks difficult will look much easier when logs are taken on both sides. Taking logs on one side only is tempting for many equations, but may be noticed. – R. Ainsley in Bluff your way in Maths, 1988

cat

[cat] Theorem: A cat has nine tails. Proof: No cat has eight tails. A cat has one tail more than no cat. Therefore, a cat has nine tails.

chocolate

[chocolate] Prime number - A number with no divisors. Boxes of chocolates always contain a prime number so that, whatever the number of people present, somebody has to have that one left over. – R. Ainsley in Bluff your way in Maths, 1988

aleph

[aleph] Aleph-null bottles of beer on the wall, Aleph-null bottles of beer, You take one down, and pass it around, Aleph-null bottles of beer on the wall.

qed

[qed] At the end of a proof you write Q.E.D, which stands not for Quod Erat Demonstrandum as the books would have you believe, but for Quite Easily Done. – R. Ainsley in Bluff your way in Maths, 1988

1+1

[1+1] $1+1 = 3$, for large values of 1

painting

[painting] Group theory - An exceedingly beautiful branch of pure mathematics used for showing in how many ways blocks of wood can be painted. – R. Ainsley in Bluff your way in Maths, 1988

engeneer

[engeneer]

Mathematician:	3 is prime,5 is prime,7 is prime, by induction - every odd integer higher than 2 is prime.
Physicist:	3 is prime, 5 is prime, 7 is prime, 9 is an experimental error, 11 is prime,...
Engineer:	3 is prime, 5 is prime, 7 is prime, 9 is prime, 11 is prime,...
Programmer:	3's prime, 5's prime, 7's prime, 7's prime, 7's prime,...
Salesperson:	3 is prime, 5 is prime, 7 is prime, 9 – we'll do for you the best we can,...
Software seller:	3 is prime, 5 is prime, 7 is prime, 9 will be prime in the next release,...
Biologist:	3 is prime, 5 is prime, 7 is prime, 9 – results have not arrived yet,...
Advertiser:	3 is prime, 5 is prime, 7 is prime, 11 is prime,...
Lawyer:	3 is prime, 5 is prime, 7 is prime, 9 – there is not enough evidence to prove that it is not prime,...
Accountant:	3 is prime, 5 is prime, 7 is prime, 9 is prime, deducing 10 percent tax and 5 percent other obligations.
Statistician:	Let's try several randomly chosen numbers: 17 is prime, 23 is prime, 11 is prime...
Psychologist:	3 is prime, 5 is prime, 7 is prime, 9 is prime but tries to suppress it,...

pi

[pi] PI= 3.14159265358979323846264338327950288419716939937510582097494459230781640628

e

[e] Euler E= 2.71828182845904523536028747135266249775724709369995957496696762772407663035

cancel

[cancel] THEOREM: The limit as n goes to infinity of sin x/n is 6. PROOF: cancel the n in the numerator and denominator.

coffee

[coffee] A mathematician is a device for turning coffee into theorems. – P. Erdos

stupider

[stupider] Finally I am becoming stupider no more. – Epitaph, P. Erdos wrote for himself

Erdoes

[Erdoes]

epsilon	child
bosses	women
slaves	men
captured	married
liberated	divorced
recaptured	remarried
trivial beings	nonmathematicians
noise	music
poison	alcohol
preaching	giving a lecture
supreme fascist	god
died	stopped doing mathematics
preach	lecture
Joedom	UDSSR
Samland	USA

on the long wave length communists on the short wave length fashists – from the vocabulary of P. Erdos 'the man who loved only numbers'

Chebyshev

[Chebyshev] Chebyshev said it, and I say it again There is always a prime between n and 2n – P. Erdos

Outrage

[Outrage] Outrage, disgust, the characterization of group theory as a plague or as a dragon to be slain - this is not an atypical physist's reaction in the 1930s-50s to the use of group theory in physics. – S. Sternberg

digits

[digits] Anyone who considers arithmetical methods of producing random digits is, of course, in a state of sin. – J. von Neumann

poet

[poet] The mathematician's patterns, like the painter's or the poet's must be beautiful; the ideas, like the colors or the words, must fit together in a harmonious way. Beauty is the first test: there is no permanent place in the world for ugly mathematics... It may be very hard to define mathematical beauty, but that is just as true of beauty of any kind - we may not know quite what we mean by a beautiful poem, but that does not prevent us from recognizing one when we read it. – G.H. Hardy

melancholy

[melancholy] It is a melancholy experience for a professional mathematician to find himself writing about mathematics. – G.H. Hardy

Hilbert

[Hilbert] There is a much quoted story about David Hilbert, who one day noticed that a certain student had stopped attending class. When told that the student had decided to drop mathematics to become a poet, Hilbert replied, "Good- he did not have enough imagination to become a mathematician". – R. Osserman

refreree

[refreree] Referee's report: This paper contains much that is new and much that is true. Unfortunately, that which is true is not new and that which is new is not true. – H. Eves 'Return to Mathematical Circles', 1988.

weapons

[weapons] Structures are the weapons of the mathematician. – N. Bourbaki

undogmatic

[undogmatic] Mathematics is the only instructional material that can be presented in an entirely undogmatic way. – M. Dehn

solve

[solve] Each problem that I solved became a rule which served afterwards to solve other problems – R. Decartes

tool

[tool] For a physicist mathematics is not just a tool by means of which phenomena can be calculated, it is the main source of concepts and principles by means of which new theories can be created. – F. Dyson

sheet

[sheet] If the entire Mandelbrot set were placed on an ordinary sheet of paper, the tiny sections of boundary we examine would not fill the width of a hydrogen atom. Physicists think about such tiny objects; only mathematicians have microscopes fine enough to actually observe them. – J. Eving

recommendation

[recommendation] Sample letter of recommendation:
Dear Search Committee Chair, I am writing this letter for Mr. Still Student who has applied for a position in your department. I should start by saying that I cannot recommend him too highly. In fact, there is no other student with whom I can adequately compare him, and I am sure that the amount of mathematics he knows will surprise you. His dissertation is the sort of work you don't expect to see these days. It definitely demonstrates his complete capabilities. In closing, let me say that you will be fortunate if you can get him to work for you. Sincerely, A. D. Advisor (Prof.) – from MAA Focus Newsletter

cube

[cube] To divide a cube into two other cubes, a fourth power or in general any power whatever into two powers of the same denomination above the second is impossible, and I have assuredly found an admirable proof of this, but the margin is too narrow to contain it. – P. de Fermat

reality

[reality] Mathematics is not only real, but it is the only reality. That is that entire universe is made of matter, obviously. And matter is made of particles. It's made of electrons and neutrons and protons. So the entire universe is made out of particles. Now what are the particles made out of? They're not made out of anything. The only thing you can say about the reality of an electron is to cite its mathematical properties. So there's a sense in which matter has completely dissolved and what is left is just a mathematical structure. – M. Gardner

arithmetic

[arithmetic] God does arithmetic. – K.F. Gauss

hypothesis

[hypothesis] Don't just read it; fight it! Ask your own questions, look for your own examples, discover your own proofs. Is the hypothesis necessary? Is the converse true? What happens in the classical special case? What about the degenerate cases? Where does the proof use the hypothesis? – P.R. Halmos

dice

[dice] God not only plays dice. He also sometimes throws the dice where they cannot be seen. – S.W. Hawking

wissen

[wissen] 'Wir muessen wissen. Wir werden wissen.' (We have to know. We will know.) – D. Hilbert (engraved in tombstone)

physics

[physics] Physics is much too hard for physicists. – D. Hilbert

Hofstadter

[Hofstadter] Hofstadter's Law: It always takes longer than you expect, even when you take into account Hofstadter's Law. – D.R. Hofstadter, Goedel-Escher-Bach

experience

[experience] The science of mathematics presents the most brilliant example of how pure reason may successfully enlarge its domain without the aid of experience. – E. Kant

doughnut

[doughnut] A topologist is one who doesn't know the difference between a doughnut and a coffee cup. – J. Kelley

Kovalevsky

[Kovalevsky] Say what you know, do what you must, come what may. – S. Kovalevsky

god

[god] God made the integers, all else is the work of man. – L. Kronecker

abstract

[abstract] There is no branch of mathematics, however abstract, which may not some day be applied to phenomena of the real world. – N. Lobatchevsky

medicine

[medicine] Medicine makes people ill, mathematics make them sad and theology makes them sinful. – M. Luther

intelligence

[intelligence] The mathematician who pursues his studies without clear views of this matter, must often have the uncomfortable feeling that his paper and pencil surpass him in intelligence. – E. Mach

flesh

[flesh] I tell them that if they will occupy themselves with the study of mathematics they will find in it the best remedy against the lusts of the flesh. – T. Mann

philosophers

[philosophers] Today, it is not only that our kings do not know mathematics, but our philosophers do not know mathematics and - to go a step further - our mathematicians do not know mathematics. – J.R. Oppenheimer

obvious

[obvious] Mathematics consists of proving the most obvious thing in the least obvious way. – G. Polya

whispers

[whispers] However successful the theory of a four dimensional world may be, it is difficult to ignore a voice inside us which whispers: "At the back of your mind, you know a fourth dimension is all nonsense". I fancy that voice must have had a busy time in the past history of physics. What nonsense to say that this solid table on which I am writing is a collection of electrons moving with prodigious speed in empty spaces, which relative to electronic dimensions are as wide as the spaces between the planets in the solar system! What nonsense to say that the thin air is trying to cursh my body with a load of 14 lbs. to the square inch! What nonsense that the star cluster which I see through the telescope, obviously there NOW, is a glimpse into a past age 50'000 years ago! Let us not be beguiled by this voice. It is discredited... – Sir Arthur Eddington

decimal

[decimal] The first million decimal places of pi are comprised of:

99959	0's
99758	1's
100026	2's
100229	3's
100230	4's
100359	5's
99548	6's
99800	7's
99985	8's
100106	9's

–David Blatner, the joy of pi

historians

[historians] Math historians often state that the Egyptians thought pi = 256/81. In fact, there is no direct evidence that the Egyptians conceived of a constant number pi, much less tried to calculate it. Rather, they were simply interested in finding the relationship between the circle and the square, probably to accomplish the task of precisely measuring land and buildings. –David Blatner, the joy of pi

pi

[pi]

2000 BC	Babilonians use pi=25/8, Egyptians use pi=256/81
1100 BC	Chinese use pi=3
200 AC	Ptolemy uses pi=377/120
450	Tsu Ch'ung-chih uses pi=255/113
530	Aryabhata uses pi=62832/20000
650	Brahmagupta uses pi=sqrt(10)
1593	Romanus finds pi to 15 decimal places
1596	Van Ceulen calculates pi to 32 places
1699	Sharp calculates pi to 72 places
1719	Tantet de Lagny calculates pi to 127 places
1794	Vega calculates pi to 140 decimal places
1855	Richter calculates pi to 500 decimal places
1873	Shanks finds 527 decimal places
1947	Ferguson calculates 808 places
1949	ENIAC computer finds 2037 places
1955	NORC computer computes 3089 places
1959	IBM 704 computer finds 16167 places
1961	Shanks-Wrench (IBM7090) find 100200 places
1966	IBM 7030 computes 250000 places
1967	CDC6600 computes 500000 places
1973	Guilloud-Bouyer (CDC7600) find 1 Mio places
1983	Tamura-Kanada (HITACM-280H) compute 16 Mio places
1988	Kanada (HITAC M-280H) computes 16 Mio digits
1989	Chudnovsky finds 1000 Mio digits
1995	Kanada computes pi to 6000 Mio digits
1996	Chudnovsky computes pi to 8000 Mio digits
1997	Kanada determines pi to 51000 Mio digits

–David Blatner, the joy of pi

FBI

[FBI] The following is a transcript of an interchange between defence attorney Robert Blasier and FBI Special Agent Roger Martz on July 26, 1995, in the courtroom of the O.J. Simpson trial:
Q: Can you calculate the area of a circle with a five-millimeter diameter? A: I mean I could. I don't...math I don't ... I don't know right now what it is. Q: Well, what is the formula for the area of a circle? A: Pi R Squared Q: What is pi? A: Boy, you ar really testing me. 2.12... 2.17... Judge Ito: How about 3.1214? Q: Isn't pi kind of essential to being a scientist knowing what it is? A: I haven't used pi since I guess I was in high school. Q: Let's try 3.12. A: Is that what it is? There is an easier way to do... Q: Let's try 3.14. And what is the radius? A: It would be half the diameter: 2.5 Q: 2.5 squared, right? A: Right. Q: Your honor, may we borrow a calculator? [pause] Q: Can you use a calculator? A: Yes, I think. Q: Tell me what pi times 2.5 squared is. A: 19 Q: Do you want to write down 19? Square millimeters, right? The area. What is one tenth of that? A: 1.9 Q: You miscalculated by a factor of two, the size, the minimum size of a swatch you needed to detect EDTA didn't you? A: I don't know that I did or not. I calculated a little differently. I didn't use this. Q: Well, does the area change by the different method of calculation? A: Well, this is all estimations based on my eyeball. I didn't use any scientific math to determine it. –David Blatner, the joy of pi

beauty

[beauty] To those who do not know Mathematics it is difficult to get across a real feeling as to the beauty, the deepest beauty of nature. ... If you want to learn about nature, to appreciate nature, it is necessary to understand the language that she speaks in. – Richard Feynman in "The Character of Physical Law"

Bacon

[Bacon] All science requires Mathematics. The knowledge of mathematical things is almost innate in us... This is the easiest of sciences, a fact which is obvious in that no one?s brain rejects it; for laymen and people who are utterly illiterate know how to count and reckon. – Roger Bacon

deductions

[deductions] 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... It's essential not to discuss whether the proposition is really true, and not to mention what the anything is of which it is supposed to be true... 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. – Bertrand Russell

ambitious

[ambitious] The more ambitious plan may have more chances of success – G. Polya, How To Solve It

fourteen

[fourteen] THEOREM: Every natural number can be completely and unambiguously identified in fourteen words or less. PROOF: 1. Suppose there is some natural number which cannot be unambiguously described in fourteen words or less. 2. Then there must be a smallest such number. Let's call it n. 3. But now n is "the smallest natural number that cannot be unambiguously described in fourteen words or less". 4. This is a complete and unambiguous description of n in fourteen words, contradicting the fact that n was supposed not to have such a description! 5. Since the assumption (step 1) of the existence of a natural number that cannot be unambiguously described in fourteen words or less led to a contradiction, it must be an incorrect assumption. 6.Therefore, all natural numbers can be unambiguously described in fourteen words or less!

1=2

[1=2] THEOREM: 1=2 PROOF:
1. Let $a = b$.
2. Then $a^2 = ab$,
3. $a^2 + a^2 = a^2 + ab$,
4. $2a^2 = a^2 + ab$,
5. $2a^2 - 2ab = a^2 + ab - 2ab$,
6. and $2a^2 - 2ab = a^2 - ab$
7. Writing this as $2(a^2 - ab) = 1(a^2 - ab)$,
8. and cancelling the $(a^2 - ab)$ from both sides gives $1 = 2$.

primes

[primes] II III V VII XI XIII XVII XIX XXIII XXIX ...

Queen

[Queen] ”Can you do addition?” the White Queen asked. ”What’s one and one and one and one and one and one and one and one and one and one?” ”I don’t know,” said Alice, ”I lost count.”. – Lewis Carrol alias Charles Lutwidge Dodgson, Alice’s Adventures in Wonderland

subtraction

[subtraction] ”She can’t do Subtraction”, said the White Queen. ”Can you do Division? Divide a loaf by a knife – what’s the answer to that?” ”I suppose –” Alice was beginning, but the Red Queen answerd for her. ”Bread and butter, of course ...” – Lewis Carrol alias Charles Lutwidge Dodgson, Alice’s Adventures in Wonderland

subtraction

Theorem: the square root x of 2 is irrational. Proof: x=n/m with $gcd(n,m) = 1$ implies $2 = n^2/m^2$ which is $2m^2 = n^2$ so that n must be even and n^2 a multiple of 4. Therefore m is even. This contradicts gcd(n,m)=1.

blackboard

[blackboard] It is still an unending source of surprise for me to see how a few scribbles on a blackboard or on a sheet of paper could change the course of human affairs. – Stanislaw Ulam.

ephermeral

[ephermeral] Of all escapes from reality, mathematics is the most successful ever. It is a fantasy that becomes all the more addictive because it works back to improve the same reality we are trying to evade. All other escapes- sex, drugs, hobbies, whatever - are ephemeral by comparison. The mathematician’s feeling of triumph, as he forces the world to obey the laws his imagimation has created, feeds on its own success. The world is premanently changed by the workings of his mind, and the certainty that his creations will endure renews his confidence as no other pursuit. – Gian-Carlo Rota

joke

[joke] A good mathematical joke is better, and better mathematics than a dozen mediocre papers.
– John Edensor Littlewood

Leibniz

[Leibniz] $pi/4 = 1 - 1/3 + 1/5 - 1/7 + 1/9 ....$
– Wilhelm von Leibniz

war

[war] It has been said that the First World War was the chemists' war because mustard gas and chlorine were empolyed for the first time, and that the Second World War was the physicists war, because the atom bomb was detonated. Similarly, it has been argued that the Third World War would be the mathematicians' war, because mathematics will have control over the next great weapon of war - information. – Simon Singh, in 'The code book'

clearly

[clearly] Never speak more clearly than you think. – Jeremy Bernstein

Piaget

[Piaget] What, in effect are the conditions for the construction of formal thought? The child must not only apply operations to objects - in other words, mentally execute possible actions on them - he must also 'reflect' those operations in the absence of the objects which are replaced by pure propositions. Thus 'reflection' is thought raised to the second power. Concrete thinking is the representation of a possible action, and formal thinking is the representation of a representation of possible action... It is not surprising, therefore, that the system of concrete operations must be completed during the last years of childhood before it can be 'reflected' by formal operations. In terms of their function, formal operations do not differ from concrete operations except that they are applied to hypotheses or propositions whose logic is an abstract translation of the system of 'inference' that governs concrete operations. – Jean Piaget

Mersenne

[Mersenne] An integer $2^n - 1$ is called a Mersenne number. If it is prime, it is called a Mersenne prime. In that case, n must be prime. Known examples are n = 2, 3, 5, 7, 13, 17, 19, 31, 61, 89, 107, 127, 521, 607, 1279, 2203, 2281, 3217, 4253, 4423, 9689, 9941, 11213, 19937, 21701, 23209, 44497, 86243, 110503, 132049, 216091, 756839, 859433, 1257787, 1398269, 2976221, 3021377. It is not known whether there are infinitely many Mersenne primes.

Mersenne

A positive integer n is called a perfect number if it is equal to the sum of all of its positive divisors, excluding n itself. Examples are 6=1+2+3, 28=1+2+4+7+14. An integer k is an even perfect number if and only if it has the form $2^(n-1)(2^n - 1)$ and $2^n - 1$ is prime. In that case $2^n - 1$ is called a Mersenne prime and n must be prime. It is unknown whether there exists an odd perfect number.

Wilson

[Wilson] WILSON'S THEOREM: p prime if and only if $(p-1)! == -1 \pmod{p}$ PROOF. $1, 2, ..., p-1$ are roots of $x^(p-1) == 0 \pmod{p}$. A congruence has not more roots then its degree, hence $x^(p-1) - 1 ==$ $(x-1)(x-2)...(x-(p-1))$ mod p. For x=0, this gives $-1 == (-1)^(p-1)(p-1)! == (p-1)!$ which is also true for p=2.
– from P. Ribenboim, 'The new book of prime number records'

twin

[twin] There is keen competition to produce the largest pair of twin primes. On October 9, 1995, Dubner discovered the largest known pair of twin primes $p, p+2$, where $p = 570918348 * 10^{5120} - 1$. It took only one day with 2 crunchers. The expected time would be 150 times longer! What luck! – from P. Ribenboim, 'The new book of prime number records'

lion

[lion] How to catch a lion:

- THE HILBERT METHOD. Place a locked cage in the desert. Set up the following axiomatic system. (i) The set of lions is non-empty
  (ii) If there is a lion in the desert, then there is a lion in the cage.
  Theorem. There is a lion in the cage
- THE PEANO METHOD. There is a space-filling curve passing through every point of the desert. Such a curve may be traversed in as short a time as we please. Armed with a spear, traverse the curve faster than the lion can move his own length.
- THE TOPOLOGICAL METHOD. The lion has a least the connectivity of a torus. Transport the desert into 4-space. It can now be deformed in such a way as to knot the lion. He is now helples.
- THE SURGERGY METHOD. The lion is an orientable 3-manifold with boundary and so may be rendered contractible by surgery.
- THE UNIVERSAL COVERING METHOD. Cover the lion by his simply-connected covering space. Since this has no holes, he is trapped.
- THE GAME THEORY METHOD. The lion is a big game, hence certainly a game. There exists an optimal strategy. Follow it.
- THE SCHROEDINGER METHOD. At any instant there is a non-zero probability that the lion is in the cage. Wait.
- THE ERASTOSHENIAN METHOD. Enumerate all objects in the desert: examine them one by one; discard all those that are not lions. A refinement will capture only prime lions.
- THE PROJECTIVE GEOMETRY METHOD. The desert is a plane. Project this to a line, then project the line to a point inside the cage. The lion goes to the same point.
- THE INVERSION METHOD. Take a cylindrical cage. First case: the lion is in the cage: Trivial. Second case: the lion is outside the cage. Go inside the cage. Invert at the boundary of the cage. The lion is caught. Caution: Don't stand in the middle of the cage during the inversion!

Euler

[Euler] Euler's formula: A connected plane graph with n vertices, e edges and f faces satisfies n - e + f = 2 Proof. Let T be the edge set of a spanning tree for G. It is a subset of the set E of edges. A spanning tree is a minimal subgraph that connects all the vertices of G. It contains so no cycle. The dual graph G* of G has a vertex in the interior of each face. Two vertices of G* are connected by an edge if the correponding faces have a common boundary edge. G* can have double edges even if the original graph was simple. Consider the collection T* of edges E* in G* that correspond to edges in the complement of T in E. The edges of T* connect all the faces because T does not have a cycle. Also T* does not contain a cycle, since otherwise, it would seperate some vertices of G contradicting that T was a spanning subgraph and edges of T and T* don't intersect. Thus T* is a spanning tree for G*. Clearly e(T)+e(T*)=2. For every tree, the number of vertices is one larger than the number of vertices. Applied to the tree T, this yields n = e(T)+1, while for the tree T* it yields f=e(T*)+1. Adding both equations gives n+f=(e(T)+1)+(e(T*)+1)=e+2. – from M.Aigner, G. Ziegler "Proofs from THE BOOK"

irrational

[irrational] Theorem: e = sum(k) 1/k! is irrational. Proof. e=a/b with integers a,b would imply N = n! (e - sum(k¡n+1) 1/k!) is an integer for n¿b because n! e and n!/k! were both integers. However, $0 < N = \sum_{k>n} n!/k! = 1/(n+1) + 1/(n+1)(n+2) + ... < 1/(n+1) + 1/(n+1)^2 + ... = 1/n$ (second sum is a geometric series) for every n is not possible.
– from M.Aigner, G. Ziegler "Proofs from THE BOOK"

Wiener

[Wiener] After a few years at MIT, the Mathematician Norbert Wiener moved to a larger house. His wife, knowing his nature, figured that he would forget his new address and be unable to find his way home after work. So she wrote the address of the new home on a piece of paper that she made him put in his shirt pocket. At lunchtime that day, the professor had an inspiring idea. He pulled the paper out of his pocket and used it to scribble down some calculations. Finding a flaw, he threw the paper away in disgust. At the end of the day he realized he had thrown away his address, he now had no idea where he lived. Putting his mind to work, he came up with a plan. He would go to his old house and await rescue. His wife would surely realize that he was lost and go to his old house to pick him up. Unfortunately, when he arrived at his old house, there was no sign of his wife, only a small girl standing in front of the house. "Excuse me, little girl" he said "but do you happen to know where the people who used to live here moved to?" "It's okay, Daddy," said the little girl, "Mommy sent me to get you". Moral 1. Don't be surprised if the professor doesn't know your name by the end of the semester. Moral 2. Be glad your parents aren't mathematicians. if your parents are mathematicians, introduce yourself and get them to help you through the course. - From the introduction of "How to ace calculus" by C. Adams, A. Thompson and J. Hass

funeral

[funeral] David Hilbert was one of the great European mathematicians at the turn of the century. One of his students purchased an early automobile and died in one of the first car accidents. Hilbert was asked to speak at the funeral. "Young Klaus" he said, "was one of my finest students. He had an unusual gift for doing mathematics. He was insterested in a great variety of problems, such as..." There was a short pause, follwed by "Consider the set of differentiable functions on the unit interval and take their closure in the ..." Moral 1. Sit near the door. Moral 2. Some mathematicians can be a little out of touch with reality. If your professor falls in this category, look at the bright side. You will have lots of funny stories by the end of the semester. - From the introduction of "How to ace calculus" by C. Adams, A. Thompson and J. Hass

rabbit

[rabbit] In a forest a fox bumps into a little rabbit, and says, "Hi, junior, what are you up to?" "I'm writing a dissertation on how rabbits eat foxes," said the rabbit. "Come now, friend rabbit, you know that's impossible!" "Well, follow me and I'll show you." They both go into the rabbit's dwelling and after a while the rabbit emerges with a satisfied expression on his face. Along comes a wolf. "Hello, what are we doing these days?" "I'm writing the second chapter of my thesis, on how rabbits devour wolves." "Are you crazy? Where is your academic honesty?" "Come with me and I'll show you." ...... As before, the rabbit comes out with a satisfied look on his face and this time he has a diploma in his paw. The camera pans back and into the rabbit's cave and, as everybody should have guessed by now, we see an enormous mean-looking lion sitting next to the bloody and furry remains of the wolf and the fox. The moral of this story is: It's not the contents of your thesis that are important – it's your PhD advisor that counts. - Unknown Usenet Source

poet

[poet] It is true that a mathematician who is not also something of a poet will never be a perfect mathematician. - K. Weierstrass, Quoted in D MacHale, Comic Sections (Dublin 1993)

equilateral

[equilateral] THEOREM: All triangles are equilateral. PROOF: 1) Given an arbitrary triangle ABC. Construct the middle orthogonal on AB in D and cut it with the line dividing the angle at C. Call the intersection E. Form the normal from E to AC in F and from E to BC in G. Draw the lines AE und BE. C * / / *F *G / E* / — / — / —D A*———*————*B

2. The angles ECF and ECG are gleich. The angles EFC and EGC are both right angles. Because the triangles ECF and ECG have also EC common, they must be congruent. Therefore CF=CG and EF=EG.

3. The sides DA and DB are equal. The angle EDA and EDB are both right angles. Because the triangles EDA and EDB have also ED in common, they have to be congruent and EA=EB.

4. The angle EGB and EFA are both right angle. Also, EF=EG and EA=EB. Therefore both triangles EGB and EFA are congruent. Therefore FA=GB.

5. Since CF=CG and FA=GB, addition of the sides gives also CA=CB.

6. Having proved that two arbitrary sides are equal, all are equal.

widow

[widow] I married a widow, who had an adult stepdaughter. My father, a widow and who often visited us, fell in love with my stepdaughter and married her. So, my father became my son-in-law and my stepdaughter became my stepmother. But my wife became the mother-in-law of her father-in-law. My stepmother, stepdaughter of my wife had a son and I therefore a brother, because he is the son of my father and my stepmother. But since he was in the same time the son of our stepdaughter, my wife became his grandmother and I became the grandfather of my stepbrother. My wife gave me also a son. My stepmother, the stepsister of my son, is in the same time his grandmother, because he is the son of her stepson and my father is the brother-in-law of my child, because his sister is his wife. My wife, who is the mother of my stepmother, is therefore my grandmother. My son, who is the child of my grandmother, is the grandchild of my father. But I'm the husband of my wife and in the same time the grandson of my wife. This means: I'm my own grandfather.

dots

[dots] I never could make out what those damned dots meant. – Lord Randolph Churchill (1849-1895) Brittish conservative politician, referring to decimal points.

ladder

[ladder] The mathematician has reached the highest rung on the ladder of human thought. – Havelock Ellis

ignorant

[ignorant] Let no one ignorant of mathematics enter here. – Plato, Inscription written over the entrance to the academy

god

[god] I knew a mathematician, who said 'I do not know as much as God. But I know as much as God knew at my age'. – Milton Shulman, Candian writer

english

[english] English professor: In English, a double negative makes a positive. In other languages such as Russian, a double negative is still a negative. There are, however, no languages in which a double positive makes a negative. Student in back of class: "Yea, right"

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