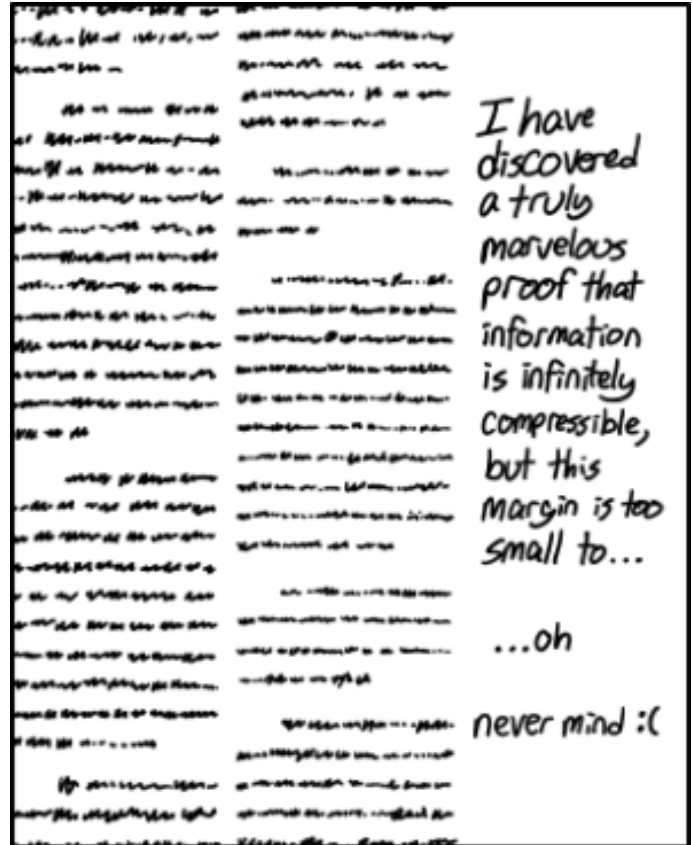
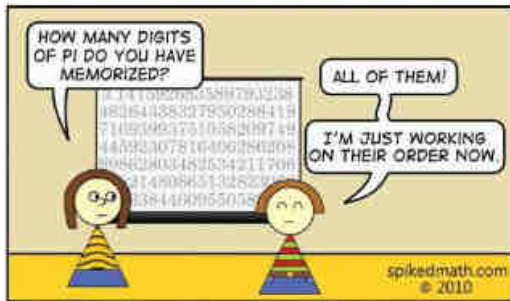
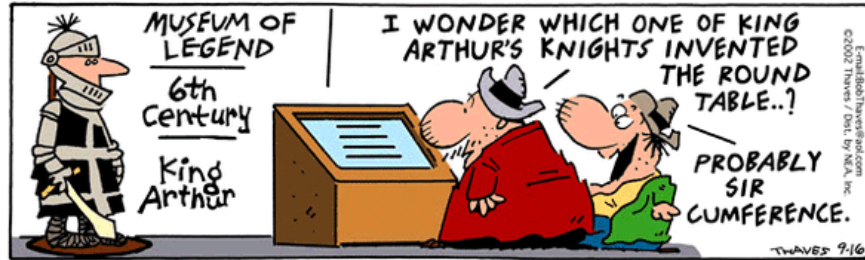
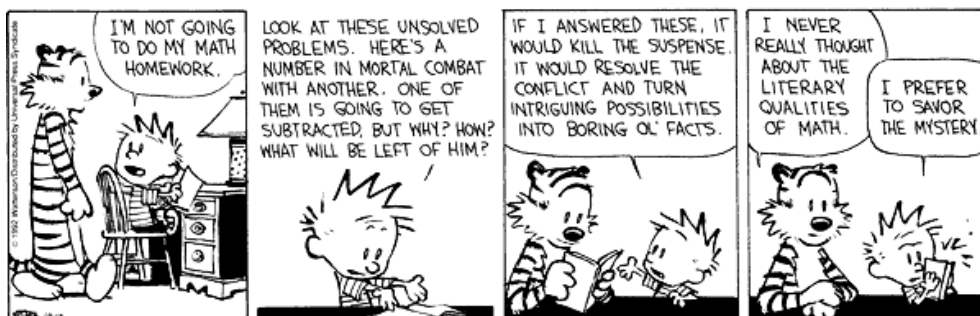


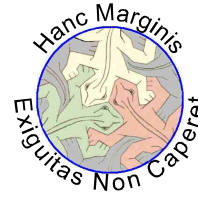
$$x^3 - 6'138x^2 + 12'557'564x - 8'563'189'272 = 0$$



It's called **reading**.
It's how people install new software into their brains.



1	1	M	(1803) Guglielmo Libri Carucci dalla Sommaja	RM132
			(1878) Agner Krarup Erlang	
	2	T	(1894) Satyendranath Bose	RM168
			(1912) Boris Gnedenko	
			(1822) Rudolf Julius Emmanuel Clausius	
			(1905) Lev Genrichovich Shnirelman	
			(1938) Anatoly Samoilenko	
3	W	(1917) Yuri Alexeievich Mitropolsky		
4	T	(1643) Isaac Newton	RM071	
5	F	(1723) Nicole-Reine Étable de Labrière Lepaute		
		(1838) Marie Ennemond Camille Jordan		
		(1871) Federigo Enriques	RM084	
		(1871) Gino Fano		
6	S	(1807) Jozeph Mitza Petzval		
		(1841) Rudolf Sturm		
7	S	(1871) Felix Edouard Justin Émile Borel		
		(1907) Raymond Edward Alan Christopher Paley		
2	8	M	(1888) Richard Courant	RM156
			(1924) Paul Moritz Cohn	
			(1942) Stephen William Hawking	
	9	T	(1864) Vladimir Adreievich Steklov	
			(1915) Mollie Orshansky	
	10	W	(1875) Issai Schur	
			(1905) Ruth Moufang	
	11	T	(1545) Guidobaldo del Monte	RM120
			(1707) Vincenzo Riccati	
			(1734) Achille Pierre Dionis du Sejour	
	12	F	(1906) Kurt August Hirsch	
			(1915) Herbert Ellis Robbins	RM156
	13	S	(1864) Wilhelm Karl Werner Otto Fritz Franz Wien	
			(1876) Luther Pfahler Eisenhart	
(1876) Erhard Schmidt				
(1902) Karl Menger				
14	S	(1902) Alfred Tarski	RM096	
3	15	M	(1704) Johann Castillon	
			(1717) Mattew Stewart	
			(1850) Sofia Vasilievna Kovalevskaya	RM144
	16	T	(1801) Thomas Klausen	
			(1647) Catherina Elisabetha Koopman Hevelius	
	17	W	(1847) Nikolay Egorovich Zukowsky	
			(1858) Gabriel Koenigs	
(1856) Luigi Bianchi				
18	T	(1880) Paul Ehrenfest	RM204	
		(1813) Rudolf Friedrich Alfred Clebsch		
19	F	(1879) Guido Fubini		
		(1908) Aleksandr Gennadievich Kurosh		
		(1775) André Marie Ampère		
20	S	(1895) Gabor Szegő		
		(1904) Renato Caccioppoli	RM072	
		(1846) Pieter Hendrik Schoute		
21	S	(1915) Yuri Vladimirovich Linnik		
		(1592) Pierre Gassendi		
4	22	M	(1886) John William Navin Sullivan	
			(1908) Lev Davidovich Landau	RM063
			(1840) Ernst Abbe	
	23	T	(1862) David Hilbert	RM060
			(1891) Abram Samoilovitch Besicovitch	
	24	W	(1902) Oskar Morgenstern	
			(1914) Vladimir Petrovich Potapov	
			(1627) Robert Boyle	
	25	T	(1736) Joseph-Louis Lagrange	RM048
			(1843) Karl Hermann Amandus Schwarz	
			(1799) Benoît Paul Émile Clapeyron	
	26	F	(1862) Eliakim Hastings Moore	
			(1832) Charles Lutwidge Dodgson	RM108
27	S	(1701) Charles Marie de La Condamine		
		(1888) Louis Joel Mordell		
		(1892) Carlo Emilio Bonferroni		
5	29	M	(1817) William Ferrel	
			(1888) Sidney Chapman	
	30	T	(1619) Michelangelo Ricci	RM216
			(1715) Giovanni Francesco Fagnano dei Toschi	
31	W	(1841) Samuel Loyd	RM192	
		(1896) Sofia Alexandrovna Janowskaja		
		(1945) Persi Warren Diaconis	RM180	



Putnam 2003, A1

Let n be a fixed positive integer. How many ways are there to write n as a sum of positive integers, $n = a_1 + a_2 + \dots + a_k$, with k an arbitrary positive integer and $a_1 \leq a_2 \leq \dots \leq a_k \leq a_1 + 1$? For example, for $n=4$ there are four ways: 4; 2+2; 2+1+1, 1+1+1+1.

Invited to the Great Ball of Scientists...

... Ampere was following the current.

How do mathematicians do it?

Möbius always did it on the same side.

If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties.

Francis Bacon

"For a complete logical argument", Arthur began with admirable solemnity, "we need two prim Misses –"
"Of course!" she interrupted. "I remember that word now. And they produce –"
"A Delusion," said Arthur.

"Ye-es?" she said dubiously. "I don't seem to remember that so well. But what is the whole argument called?"
"A Sillygism."

"Ah, yes! I remember now. But I don't need a Sillygism to prove that mathematical axiom you mentioned"
"Nor to prove that 'all angles are equal', I suppose?"
"Why, of course not! One takes such a simple truth as that for granted!"

Charles Lutwidge Dodgson

Mathematics may be likened to a large rock whose interior composition we wish to examine. The older mathematicians appear as persevering stone cutters slowly attempting to demolish the rock from the outside with hammer and chisel. The later mathematicians resemble expert miners who seek vulnerable veins, drill into these strategic places, and then blast the rock apart with well placed internal charges.

Howard W. Eves

The infinite! No other question has ever moved so profoundly the spirit of man.

David Hilbert

The union of the mathematician with the poet, fervor with measure, passion with correctness, this surely is the ideal.

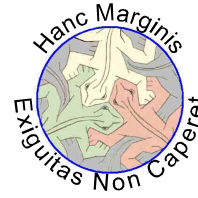
William James

The average human has one breast and one testicle.

Des McHale

One merit of mathematics few will deny: it says more in fewer words than any other science. The formula, $e^{i\pi} = -1$ expressed a world of thought, of truth, of poetry, and of the religious spirit "God eternally geometrizes."

David Eugene Smith



1	T	(1900) John Charles Burkill		
2	F	(1522) Lodovico Ferrari (1893) Cornelius Lanczos (1897) Gertrude Blanch		
3	S	(1893) Gaston Maurice Julia	RM073	
4	S	(1905) Eric Christopher Zeeman		
6	5	M	(1757) Jean Marie Constant Duhamel	
	6	T	(1465) Scipione del Ferro (1612) Antoine Arnauld (1695) Nicolaus (II) Bernoulli	RM064 RM093
	7	W	(1877) Godfried Harold Hardy (1883) Eric Temple Bell	RM049
	8	T	(1700) Daniel Bernoulli (1875) Francis Ysidro Edgeworth (1928) Ennio de Giorgi	RM093 RM133
	9	F	(1775) Farkas Wolfgang Bolyai (1907) Harold Scott Macdonald Coxeter	RM097
	10	S	(1747) Aida Yasuaki (1932) Vivienne Malone-Mayes	RM121
	11	S	(1657) Bernard Le Bovier de Fontenelle (1800) William Henry Fox Talbot (1839) Josiah Willard Gibbs (1915) Richard Wesley Hamming	RM205
7	12	M	(1914) Hanna Caemmerer Neumann (1921) Kathleen Rita McNulty Mauchly Antonelli	
	13	T	(1805) Johann Peter Gustav Lejeune Dirichlet	RM145
	14	W	(1468) Johann Werner (1849) Hermann Hankel (1877) Edmund Georg Hermann Landau (1896) Edward Artur Milne (1932) Maurice Audin	RM063 RM194
	15	T	(1564) Galileo Galilei (1850) Sophie Willock Bryant (1861) Alfred North Whitehead (1946) Douglas Hofstadter	RM085
	16	F	(1822) Francis Galton (1853) Gregorio Ricci-Curbastro (1903) Beniamino Segre	
	17	S	(1890) Sir Ronald Aylmer Fisher (1891) Adolf Abraham Halevi Fraenkel (1905) Rózsa Péter	
	18	S	(1404) Leon Battista Alberti (1919) Clifford Truesdell	RM157
8	19	M	(1473) Nicolaus Copernicus	RM181
	20	T	(1844) Ludwig Boltzmann	RM061
	21	W	(1591) Girard Desargues (1915) Evgeny Michailovich Lifshitz	
	22	T	(1857) Heinrich Rudolf Hertz (1903) Frank Plumpton Ramsey	RM217
	23	F	(1583) Jean-Baptiste Morin (1905) Derrick Henry Lehmer (1922) Anneli Cahn Lax (1951) Shigefumi Mori (1561) Henry Briggs	RM215 RM169
	24	S	(1871) Felix Bernstein	
	25	S	(1827) Henry Watson	
9	26	M	(1786) Dominique Francois Jean Arago	RM193
	27	T	(1881) Luitzen Egbertus Jan Brouwer	
	28	W	(1735) Alexandre Théophile Vandermonde	
	29		(1860) Herman Hollerith	RM109

Putnam 2003, A2

Let a_1, a_2, \dots, a_n and b_1, b_2, \dots, b_n be nonnegative real numbers. Show that:

$$(a_1 a_2 \dots a_n)^{\frac{1}{n}} + (b_1 b_2 \dots b_n)^{\frac{1}{n}} \leq [(a_1 + b_1) + (a_2 + b_2) + \dots + (a_n + b_n)]^{\frac{1}{n}}$$

Invited to the Great Ball of Scientists...

... Boyle said he was under pressure.

How do mathematicians do it?

Algebraists make it in a group.

The mathematical life of a mathematician is short. Work rarely improves after the age of twenty-five or thirty. If little has been accomplished by then, little will ever be accomplished.

Alfred W. Adler

If a lunatic scribbles a jumble of mathematical symbols it does not follow that the writing means anything merely because to the inexperienced eye it is indistinguishable from higher mathematics.

Eric Temple Bell

O Logic: born gatekeeper to the Temple of Science, victim of capricious destiny: doomed hitherto to be the drudge of pedants: come to the aid of thy master, Legislation.

Jeremy Bentham

Philosophy [nature] is written in that great book which ever is before our eyes – I mean the universe – but we cannot understand it if we do not first learn the language and grasp the symbols in which it is written. The book is written in mathematical language, and the symbols are triangles, circles and other geometrical figures, without whose help it is impossible to comprehend a single word of it; without which one wanders in vain through a dark labyrinth.

Galileo Galilei

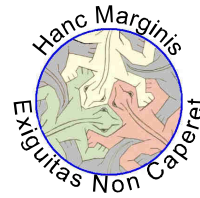
The fact is that there are few more "popular" subjects than mathematics. Most people have some appreciation of mathematics, just as most people can enjoy a pleasant tune; and there are probably more people really interested in mathematics than in music. Appearances may suggest the contrary, but there are easy explanations. Music can be used to stimulate mass emotion, while mathematics cannot; and musical incapacity is recognized (no doubt rightly) as mildly discreditable, whereas most people are so frightened of the name of mathematics that they are ready, quite unaffectedly, to exaggerate their own mathematical stupidity.

Godfried Harold Hardy

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.

Ernst Mach

1	T	(1611) John Pell (1879) Robert Daniel Carmichael		
2	F	(1836) Julius Weingarten		
3	S	(1838) George William Hill (1845) Georg Cantor (1916) Paul Richard Halmos	RM062	
4	S	(1822) Jules Antoine Lissajous		
10	5	M	(1512) Gerardus Mercator (1759) Benjamin Gompertz (1817) Angelo Genocchi (1885) Pauline Sperry (1915) Laurent Schwartz (1931) Vera Pless	RM194
6	T	(1866) Ettore Bortolotti		
7	W	(1792) William Herschel (1824) Delfino Codazzi (1922) Olga Alexandrovna Ladyzhenskaya	RM146	
8	T	(1851) George Chrystal		
9	F	(1818) Ferdinand Joachimsthal (1900) Howard Hathaway Aiken		
10	S	(1864) William Fogg Osgood (1872) Mary Ann Elizabeth Stephansen		
11	S	(1811) Urbain Jean Joseph Le Verrier (1853) Salvatore Pincherle (1870) Louis Bachelier	RM158	
11	12	M	(1685) George Berkeley (1824) Gustav Robert Kirchhoff (1859) Ernesto Cesaro	
13	T	(1861) Jules Joseph Drach (1957) Rudy D'Alembert		
14	W	(1864) Jozef Kurschak (1879) Albert Einstein (1904) Lyudmila Vsevolodovna Keldysh	RM074	
15	T	(1860) Walter Frank Raphael Weldon (1868) Grace Chisolm Young		
16	F	(1750) Caroline Herschel (1789) Georg Simon Ohm (1846) Magnus Gosta Mittag-Leffler	RM146	
17	S	(1876) Ernest Benjamin Esclangon (1897) Charles Fox		
18	S	(1640) Philippe de La Hire (1690) Christian Goldbach (1796) Jacob Steiner (1870) Agnes Sime Baxter	RM122	
12	19	M	(1862) Adolf Kneser (1910) Jacob Wolfowitz	
20	T	(1840) Franz Mertens (1884) Philip Franck (1938) Sergei Petrovich Novikov		
21	W	(1768) Jean Baptiste Joseph Fourier (1884) George David Birkhoff		
22	T	(1394) Ulugh Beg (1891) Lorna Mary Swain (1917) Irving Kaplansky (1944) Margaret Hilary Ashworth Millington	RM206	
23	F	(1754) Georg Freiherr von Vega (1882) Emmy Amalie Noether (1897) John Lighton Synge	RM050	
24	S	(1809) Joseph Liouville (1948) Sun-Yung (Alice) Chang (1966) Gigliola Staffilani	RM142	
25	S	(1538) Christopher Clausius		
13	26	M	(1848) Konstantin Andreev (1913) Paul Erdős	RM110
27	T	(1857) Karl Pearson		
28	W	(1749) Pierre-Simon de Laplace (1928) Alexander Grothendieck	RM086	
29	T	(1825) Francesco Faà Di Bruno (1873) Tullio Levi-Civita (1896) Wilhelm Ackermann	RM170 RM098	
30	F	(1892) Stefan Banach (1921) Alfréd Rényi	RM134	
31	S	(1596) René Descartes	RM218	



Putnam 2003, A3

Find minimum value of:

$$[\sin x + \cos x + \tan x + \cot x + \sec x + \operatorname{cosec} x]$$

for $x \in \mathbb{R}$.

Invited to the Great Ball of Scientists...

... Ohm offered resistance on principle.

How do mathematicians do it?

[Logicians do it] OR [NOT [Logicians do it]].

The first non-absolute number is the number of people for whom the table is reserved. This will vary during the course of the first three telephone calls to the restaurant, and then bear no apparent relation to the number of people who actually turn up, or to the number of people who subsequently join them after the show/match/party/gig, or to the number of people who leave when they see who else has turned up. The second non-absolute number is the given time of arrival, which is now known to be one of those most bizarre of the mathematical concepts, a reciprierversexclusion, a number whose existence can only be defined as being anything, other than itself. In other words, the given time of arrival is the one moment of time at which it is impossible that any member of the party will arrive. Reciprierversexclusions now play a vital part in many branches of math, including statistics and accountancy and also form the basic equations used to engineer the Somebody Else's Problem field. The third and most mysterious piece of non-absoluteness of all lies in the relationship between the number of items on the check, the cost of each item, the number of people at the table and what they are each prepared to pay for. (The number of people who actually brought any money is only a sub-phenomenon in this field.)

Douglas Adams

The Riemann Hypothesis is a mathematical statement that you can decompose the primes in music. That the primes have music in them is a poetic way of describing this mathematical theorem. However, it's highly post-modern music.

Michael Berry

These long chains of perfectly simple and easy reasonings by means of which geometers are accustomed to carry out their most difficult demonstrations had led me to fancy that everything that can fall under human knowledge forms a similar sequence; and that so long as we avoid accepting as true what is not so, and always preserve the right order of deduction of one thing from another, there can be nothing too remote to be reached in the end, or too well hidden to be discovered.

René Descartes

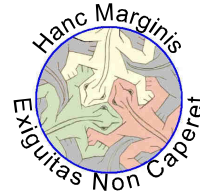
To be a scholar of mathematics you must be born with talent, insight, concentration, taste, luck, drive and the ability to visualize and guess.

Paul Richard Halmos

Mathematicians boast of their exacting achievements, but in reality they are absorbed in mental acrobatics and contribute nothing to society.

Sorai Ogyu

1	S	(1640) Georg Mohr (1776) Marie-Sophie Germain (1895) Alexander Craig Aitken	RM219
14	2	M	(1878) Edward Kasner (1934) Paul Joseph Cohen
	3	T	(1835) John Howard Van Amringe (1892) Hans Rademacher (1900) Albert Edward Ingham (1909) Stanislaw Marcin Ulam (1971) Alice Riddle
	4	W	(1809) Benjamin Peirce (1842) François Édouard Anatole Lucas (1949) Shing-Tung Yau
	5	T	(1588) Thomas Hobbes (1607) Honoré Fabri (1622) Vincenzo Viviani (1869) Sergei Alexeievich Chaplygin
	6	F	(1801) William Hallows Miller
	7	S	(1768) François-Joseph Français
	8	S	(1903) Marshall Harvey Stone
15	9	M	(1791) George Peacock (1816) Charles Eugene Delaunay (1894) Cypra Cecilia Krieger Dunaij (1919) John Presper Heckert
	10	T	(1857) Henry Ernest Dudeney
	11	W	(1953) Andrew John Wiles
	12	T	(1794) Germain Pierre Dandelin (1852) Carl Louis Ferdinand von Lindemann (1903) Jan Tinbergen
	13	F	(1728) Paolo Frisi (1813) Duncan Farquharson Gregory (1869) Ada Isabel Maddison (1879) Francesco Severi
	14	S	(1629) Christiaan Huygens
	15	S	(1452) Leonardo da Vinci (1548) Pietro Antonio Cataldi (1707) Leonhard Euler (1809) Herman Gunther Grassmann
16	16	M	(1682) John Hadley (1823) Ferdinand Gotthold Max Eisenstein
	17	T	(1798) Étienne Bobillier (1853) Arthur Moritz Schonflies (1863) Augustus Edward Hough Love
	18	W	(1791) Ottaviano Fabrizio Mossotti (1907) Lars Valerian Ahlfors (1918) Hsien Chung Wang (1949) Charles Louis Fefferman
	19	T	(1880) Evgeny Evgenievich Slutsky (1883) Richard von Mises (1901) Kiyoshi Oka (1905) Charles Ehresmann
	20	F	(1839) Francesco Siacchi
	21	S	(1652) Michel Rolle (1774) Jean Baptiste Biot (1875) Teiji Takagi
	22	S	(1811) Otto Ludwig Hesse (1887) Harald August Bohr (1935) Bhamu Srinivasan (1939) Sir Michael Francis Atiyah
17	23	M	(1858) Max Karl Ernst Ludwig Planck (1910) Sheila Scott Macintyre
	24	T	(1863) Giovanni Vailati (1899) Oscar Zariski
	25	W	(1849) Felix Christian Klein (1900) Wolfgang Pauli (1903) Andrei Nicolayevich Kolmogorov
	26	T	(1889) Ludwig Josef Johan Wittgenstein
	27	F	(1755) Marc-Antoine Parseval des Chenes (1932) Gian-Carlo Rota
	28	S	(1906) Kurt Gödel
	29	S	(1854) Jules Henri Poincaré
18	30	M	(1777) Johann Carl Friedrich Gauss (1916) Claude Elwood Shannon



Putnam 2003, A4

Suppose that a, b, c, A, B, C are real numbers, $a \neq 0, A \neq 0$, such that

$$|ax^2 + bx + c| \leq |Ax^2 + Bx + C|$$

for all real numbers x . Show that

$$|b^2 - 4ac| \leq |B^2 - 4AC|$$

Invited to the Great Ball of Scientists...

... Hilbert took care of guest accommodation in hotels.

How do mathematicians do it?

Group theorists do it with the Monster.

The story goes that when the French philosopher Denis Diderot paid a visit to the Russian Court, he conversed very freely and gave the younger members of the Court circle a good deal of lively atheism. There upon Diderot was informed that a learned mathematician was in possession of an algebraical demonstration of the existence of God, and would give it to him before all the Court, if he desired to hear it. Diderot consented. Then Euler advanced toward Diderot, and said gravely, and in a tone of perfect conviction: "Monsieur, $a + bn/n = x$, donc Dieu existe: répondez!" Diderot, to whom algebra was Hebrew, was embarrassed and disconcerted, while peals of laughter rose on all sides. He asked permission to return to France, which was granted.

Leonhard Euler

It is not knowledge, but the act of learning, not possession but the act of getting there, which grants the greatest enjoyment. When I have clarified and exhausted a subject, then I turn away from it, in order to go into darkness again; the never-satisfied man is so strange if he has completed a structure, then it is not in order to dwell in it peacefully, but in order to begin another. I imagine the world conqueror must feel thus, who, after one kingdom is scarcely conquered, stretches out his arms for others.

Johann Carl Friedrich Gauss

The concept of number is the obvious distinction between the beast and man. Thanks to number, the cry becomes a song, noise acquires rhythm, the spring is transformed into a dance, force becomes dynamic, and outlines figures.

Joseph Marie De Maistre

Later generations will regard Mengenlehre (set theory) as a disease from which one has recovered.

Jules Henri Poincaré

I am ill at these numbers.

William Shakespeare

For Bourbaki, Poincaré was the devil incarnate. For students of chaos and fractals, Poincaré is of course God on Earth.

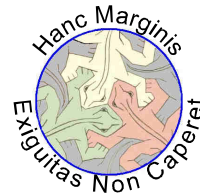
Marshall Harvey Stone

[Mathematics] is an independent world

Created out of pure intelligence.

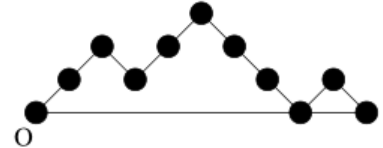
William Wordsworth

1	T	(1825) Johann Jacob Balmer (1908) Morris Kline (1977) Maryam Mirzakhani	RM122 RM189	
2	W	(1860) D'Arcy Wentworth Thompson (1905) Kazimierz Zarankiewicz	RM138	
3	T	(1842) Otto Stolz (1860) Vito Volterra (1892) George Paget Thomson	RM136 RM161	
4	F	(1845) William Kingdon Clifford		
5	S	(1833) Lazarus Emmanuel Fuchs (1883) Anna Johnson Pell Wheeler (1889) René Eugène Gateaux (1897) Francesco Giacomo Tricomi (1923) Cathleen Synge Morawetz	RM196	
6	S	(1872) Willem de Sitter (1906) André Weil	RM088	
19	7	M	(1854) Giuseppe Veronese (1881) Ebenezer Cunningham (1896) Pavel Sergeievich Alexandrov (1926) Alexis Claude Clairaut	RM220
8	T	(1859) Johan Ludwig William Valdemar Jensen (1905) Winifred Lydia Caunden Sargent		
9	W	(1746) Gaspard Monge (1876) Gilbert Ames Bliss (1965) Karen Ellen Smith	RM208	
10	T	(1788) Augustin Jean Fresnel (1847) William Karl Joseph Killing (1904) Edward James Mcshane (1958) Piotr Rezierovich Silverbrahms		
11	F	(1902) Edna Ernestine Kramer Lassar (1918) Richard Phillips Feynman	RM076	
12	S	(1820) Florence Nightingale (1845) Pierre René Jean Baptiste Henry Brocard (1902) Frank Yates	RM104	
13	S	(1750) Lorenzo Mascheroni (1899) Pelageia Yakovlevna Polubarinova Kochina		
20	14	M	(1832) Rudolf Otto Sigismund Lipschitz (1863) John Charles Fields	RM100
15	T	(1939) Brian Hartley (1964) Sijue Wu		
16	W	(1718) Maria Gaetana Agnesi (1821) Pafnuti Lvovi Chebyshev (1911) John (Jack) Todd	RM112 RM139	
17	T	(1940) Alan Kay		
18	F	(1850) Oliver Heaviside (1892) Bertrand Arthur William Russell	RM160 RM052	
19	S	(1865) Flora Philip (1919) Georgii Dimitrievich Suvorov		
20	S	(1861) Henry Seely White		
21	21	M	(1471) Albrecht Dürer (1792) Gustave Gaspard de Coriolis	RM124
22	T	(1865) Alfred Cardew Dixon		
23	W	(1914) Lipa Bers	RM148	
24	T	(1544) William Gilbert		
25	F	(1838) Karl Mikailovich Peterson		
26	S	(1667) Abraham de Moivre (1896) Yuri Dimitrievich Sokolov		
27	S	(1862) John Edward Campbell		
22	28	M	(1676) Jacopo Francesco Riccati (1710) Johann (II) Bernoulli	RM093
29	T	(1882) Harry Bateman		
30	W	(1814) Eugene Charles Catalan	RM184	
31	T	(1926) John Kemeny		



Putnam 2003, A5

A Dyck n -path is a lattice path of n upsteps $(1,1)$ and n downsteps $(1,-1)$ that starts at the origin O and never dips below the x -axis. A *return* is a maximal sequence of contiguous downsteps that terminates on the x -axis. For example, the Dyck 5-path illustrated has two returns, of length 3 and 1 respectively.



Show that there is a one-to-one correspondence between the Dyck n -paths with no return of even length and the Dyck $(n-1)$ -paths.

Invited to the Great Ball of Scientists...

... Riemann refused for fear of not integrating.

How do mathematicians do it?

Topologists do it openly.

Equations are the devil's sentences.

Stephen Colbert

Whoever ... proves his point and demonstrates the prime truth geometrically should be believed by all the world, for there we are captured.

Albrecht Dürer

The female mind is capable of understanding analytic geometry. Those people who have for years been insisting (in the face of all obvious evidence to the contrary) that the male and female are equally capable of rational thought may have something. The difficulty may just be that we have never yet discovered a way to communicate with the female mind. If it is done in the right way, you may be able to get something out of it.

Richard Phillips Feynman

Ordinary language is totally unsuited for expressing what physics really asserts, since the words of everyday life are not sufficiently abstract. Only mathematics and mathematical logic can say as little as the physicist means to say.

Bertrand Arthur William Russell

And the female brain,' said the holy man, 'is incapable of grasping the first principles of geometry. This unique science is founded in reason, in the use of equations, and in the application of clear principles with the help of logic and proportion. How can a girl who has been shut up in her father's harem learn algebraic formulas and geometric theorems? Never! Easier for a whale to make a pilgrimage to Mecca than for a woman to learn mathematics.

Malba Tahan

Do I contradict myself? Very well, then I contradict myself, I am large, I contain multitudes.

Walt Whitman



1	F	(1796) Sadi Leonard Nicolas Carnot (1851) Edward Bailey Elliott (1899) Edward Charles Titchmarsh	
2	S	(1895) Tibor Radó	
3	S	(1659) David Gregory (1954) Susan Landau	
23	4	M	(1809) John Henry Pratt (1966) Svetlana Yakovlevna Jitomirskaya RM197
	5	T	(1814) Pierre Laurent Wantzel RM065 (1819) John Couch Adams (1883) John Maynard Keynes
	6	W	(1436) Johann Müller Regiomontanus RM185 (1857) Aleksandr Michailovitch Lyapunov RM077 (1906) Max August Zorn
	7	T	(1863) Edward Burr Van Vleck
	8	F	(1625) Giovanni Domenico Cassini (1858) Charlotte Angas Scott (1860) Alicia Boole Stott (1896) Eleanor Pairman RM209 (1923) Gloria Olive (1924) Samuel Karlin
	9	S	(1885) John Edensor Littlewood RM049
	10	S	(940) Mohammad Abu'L Wafa Al-Buzjani (1887) Vladimir Ivanovich Smirnov RM101
24	11	M	(1881) Hilda Phoebe Hudson (1937) David Bryant Mumford
	12	T	(1888) Zygmunt Janyszewski (1937) Vladimir Igorevich Arnold RM221
	13	W	(1831) James Clerk Maxwell RM113 (1872) Jessie Chrystal Macmillan (1876) William Sealey Gosset (Student) (1928) John Forbes Nash RM149
	14	T	(1736) Charles Augustin de Coulomb (1856) Andrei Andreyevich Markov RM125 (1903) Alonzo Church
	15	F	(1640) Bernard Lamy (1894) Nikolai Gregorievich Chebotaryov
	16	S	(1915) John Wilder Tukey
	17	S	(1898) Maurits Cornelius Escher RM097
25	18	M	(1858) Andrew Russell Forsyth (1884) Charles Ernest Weatherburn (1884) Frieda Nugel (1913) Paul Teichmueller RM148 (1915) Alice Turner Schafer
	19	T	(1623) Blaise Pascal RM053 (1902) Wallace John Eckert
	20	W	(1873) Alfred Loewy (1917) Helena Rasiowa
	21	T	(1781) Simeon Denis Poisson (1828) Giuseppe Bruno (1870) Maria Skłodowska Curie RM182
	22	F	(1822) Mario Pieri (1864) Hermann Minkowsky (1910) Konrad Zuse (1932) Mary Wynne Warner
	23	S	(1912) Alan Mathison Turing RM089
	24	S	(1880) Oswald Veblen
26	25	M	(1908) William Van Orman Quine
	26	T	(1824) William Thomson, Lord Kelvin RM161 (1918) Yudell Leo Luke
	27	W	(1806) Augustus de Morgan
	28	T	(1875) Henri Léon Lebesgue RM173
	29	F	(1888) Aleksandr Aleksandrovich Friedmann RM101 (1979) Artur Avila Cordeiro de Melo RM189
	30	S	(1791) Felix Savart (1958) Abigail Thompson

Putnam 2003, A6

For a set S of nonnegative integers, let $r_s(n)$ denote the number of ordered pairs (s_1, s_2) such that $s_1 \in S, s_2 \in S, s_1 \neq s_2$ and $s_1 + s_2 = n$. Is it possible to partition the nonnegative integers into two sets A and B in such a way that $r_A(n) = r_B(n)$ for all n ?

Invited to the Great Ball of Scientists...

... Meucci would phone for confirmation.

How do mathematicians do it?

Analysts do it almost everywhere.

The creator of the universe works in mysterious ways. But he uses a base ten counting system and likes round numbers.

Scott Adams

No one really understood the music unless he is a scientist, his father declared; and not a scientist, oh no, only the real ones, the theorists, whose language is mathematics. She did not understand mathematics until he had explained her that it is the symbolic language of relationships. And the relationships, he told her, contain the essential meaning of life.

Pearl S. Buck

There is something somewhat priestly in the academic world, the idea that a scholar must not be distracted from the everyday tasks of everyday life. I once worked in long sessions. Now I can think of research as I prepare peanut butter rolls. Of course you cannot throw down ideas as you read Little Red Riding Hood to a two year old. On the other hand, when my husband finished university studies and started his first job, his speaker told him "Maybe you wonder how a professor can do research while teaching, receiving students, being part of committees, judging articles, writing letters of recommendation, interviewing prospective candidates. Well, I take long showers."

Susan Landau

The theory of numbers is particularly liable to the accusation that some of its problems are the wrong sort of questions to ask. I do not myself think the danger is serious; either a reasonable amount of concentration leads to new ideas or methods of obvious interest, or else one just leaves the problem alone. "Perfect numbers" certainly never did any good, but then they never did any particular harm.

John Edensor Littlewood

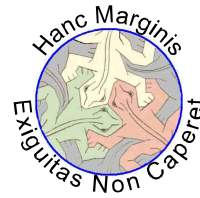
Let no one say that I have said nothing new... the arrangement of the subject is new. When we play tennis, we both play with the same ball, but one of us places it better.

Blaise Pascal

There are certainly people who regard $\sqrt{2}$ as something perfectly obvious but jib at $\sqrt{-1}$. This is because they think they can visualise the former as something in physical space but not the latter. Actually $\sqrt{-1}$ is a much simpler concept.

Edward Charles Titchmarsh

1	S	(1643) Gottfried Wilhelm von Leibniz (1788) Jean-Victor Poncelet (1906) Jean Alexandre Eugène Dieudonné	RM054
27	2	M	(1820) William John Rankine (1852) William Burnside (1925) Olga Arsen'evna Oleinik
3	T	(1807) Ernest Jean Philippe Fauque de Jonquiere (1897) Jesse Douglas	RM162
4	W	(1906) Daniel Edwin Rutherford (1917) Michail Samoilovich Livsic	
5	T	(1936) James Mirrlees	
6	F	(1849) Alfred Bray Kempe	
7	S	(1816) Johann Rudolf Wolf (1906) William Feller (1922) Vladimir Aleksandrovich Marchenko	
8	S	(1760) Christian Kramp (1904) Henri Paul Cartan	RM126
28	9	M	(1845) George Howard Darwin (1931) Valentina Mikhailovna Borok
10	T	(1856) Nikola Tesla (1862) Roger Cotes (1868) Oliver Dimon Kellogg	RM138 RM197 RM174
11	W	(1857) Sir Joseph Larmor (1888) Jacob David Tamarkin (1890) Giacomo Albanese	RM101
12	T	(1875) Ernest Sigismund Fischer (1895) Richard Buckminster Fuller (1935) Nicolas Bourbaki	RM066 RM126
13	F	(1527) John Dee (1741) Karl Friedrich Hindenburg	
14	S	(1671) Jacques D'Allonville (1793) George Green	RM078
15	S	(1865) Wilhelm Wirtinger (1898) Mary Taylor Slow (1906) Adolph Andrej Pavlovich Yushkevich	
29	16	M	(1678) Jakob Hermann (1903) Irmgard Flugge-Lotz
17	T	(1831) Victor Mayer Amédeé Mannheim (1837) Wilhelm Lexis (1944) Krystyna Maria Trybulec Kuperberg	
18	W	(1013) Hermann von Reichenau (1635) Robert Hooke (1853) Hendrik Antoon Lorentz	RM114 RM161
19	T	(1768) Francois Joseph Servois	
20	F	(1876) Otto Blumenthal (1947) Gerd Binnig	RM222
21	S	(1620) Jean Picard (1848) Emil Weyr (1849) Robert Simpson Woodward (1861) Herbert Ellsworth Slaughter	
22	S	(1784) Friedrich Wilhelm Bessel	RM198
30	23	M	(1775) Étienne-Louis Malus (1854) Ivan Slezynsky
24	T	(1851) Friedrich Hermann Schottky (1871) Paul Epstein (1923) Christine Mary Hamill	
25	W	(1808) Johann Benedict Listing	
26	T	(1903) Kurt Mahler	
27	F	(1667) Johann Bernoulli (1801) George Biddel Airy (1848) Lorand Baron von Eötvös (1867) Derrick Norman Lehmer (1871) Ernst Friedrich Ferdinand Zermelo	RM093 RM210 RM215 RM090
28	S	(1954) Gerd Faltings	RM222
29	S	(1898) Isidor Isaac Rabi	
31	30	M	(1889) Vladimir Kosma Zworkyn
31	T	(1704) Gabriel Cramer (1712) Johann Samuel Koenig (1926) Hilary Putnam	RM186



Putnam 2003, B1

Do there exist polynomials $a(x)$, $b(x)$, $c(y)$, $d(y)$ such that

$$1 + xy + x^2y^2 = a(x)c(y) + b(x)d(y)$$
holds identically?

Invited to the Great Ball of Scientists...

... Joule gave up for lack of energy.

How do mathematicians do it?

Statisticians probably don't do it.

The composer opens the cage door for arithmetic, the draftsman gives geometry its freedom.

Jean Cocteau

The solution of problems is one of the lowest forms of mathematical research, ... yet its educational value cannot be overestimated. It is the ladder by which the mind ascends into higher fields of original research and investigation. Many dormant minds have been aroused into activity through the mastery of a single problem.

Benjamin Franklin Finkel

Anyone who cannot cope with mathematics is not fully human. At best, he is a tolerable subhuman who has learned to wear his shoes, bathe, and not make messes in the house.

Robert A. Heinlein

Many statistics are clearly false. They can only slip because the magic of the numbers causes a suspension of common sense.

Darrell Huff

Spoken of the young Archimedes: ... [he] was as much enchanted by the rudiments of algebra as he would have been if I had given him an engine worked by steam, with a methylated spirit lamp to heat the boiler; more enchanted, perhaps for the engine would have got broken, and, remaining always itself, would in any case have lost its charm, while the rudiments of algebra continued to grow and blossom in his mind with an unflinching luxuriance. Every day he made the discovery of something which seemed to him exquisitely beautiful; the new toy was inexhaustible in its potentialities.

Aldous Huxley

The soul is the mirror of an indestructible universe.

Gottfried Wilhelm von Leibniz

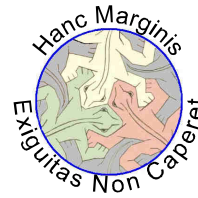
All mathematical laws which we find in Nature are always suspect to me, in spite of their beauty. They give me no pleasure. They are merely auxiliaries. At close range it is all not true.

Georg Christoph Lichtenberg

Invention is the mother of necessity.

Thorstein Veblen

1	W	(1861) Ivar Otto Bendixson (1881) Otto Toeplitz (1955) Bernadette Perrin-Riou	
2	T	(1856) Ferdinand Rudio (1902) Mina Spiegel Rees	
3	F	(1914) Mark Kac	RM115
4	S	(1805) Sir William Rowan Hamilton (1838) John Venn	RM079
5	S	(1802) Niels Henrik Abel (1941) Alexander Keewatin Dewdney	RM055
32	6	M	(1638) Nicolas Malebranche (1741) John Wilson
7	T	(1868) Ladislaus Josephowitsch Bortkiewitz	
8	W	(1902) Paul Adrien Maurice Dirac (1931) Sir Roger Penrose (1974) Manjul Bhargava	RM103 RM189
9	T	(1537) Francesco Barozzi (Franciscus Barocius) (1940) Linda Goldway Keen	RM223
10	F	(1602) Gilles Personne de Roberval (1926) Carol Ruth Karp	
11	S	(1730) Charles Bossut (1842) Enrico D'Ovidio	
12	S	(1882) Jules Antoine Richard (1887) Erwin Rudolf Josef Alexander Schrödinger	RM103
33	13	M	(1625) Erasmus Bartholin (1819) George Gabriel Stokes (1861) Cesare Burali-Forti
14	T	(1530) Giovanni Battista Benedetti (1842) Jean Gaston Darboux (1865) Guido Castelnuovo (1866) Charles Gustave Nicolas de La Vallée-Poussin	RM187
15	W	(1863) Aleksei Nikolaevich Krylov (1892) Louis Pierre Victor Duc de Broglie (1901) Piotr Sergeevich Novikov	RM175
16	T	(1773) Louis-Benjamin Francoeur (1821) Arthur Cayley	
17	F	(1601) Pierre de Fermat	RM091
18	S	(1685) Brook Taylor	
19	S	(1646) John Flamsteed (1739) Georg Simon Klügel	
34	20	M	(1710) Thomas Simpson (1863) Corrado Segre (1882) Wacław Sierpiński
21	T	(1789) Augustin-Louis Cauchy	RM127
22	W	(1647) Denis Papin	
23	T	(1683) Giovanni Poleni (1829) Moritz Benedikt Cantor (1842) Osborne Reynolds	
24	F	(1561) Bartholomeo Pitiscus (1942) Karen Keskulla Uhlenbeck	RM163
25	S	(1561) Philip Van Lansberge (1844) Thomas Muir	RM199
26	S	(1728) Johann Heinrich Lambert (1875) Giuseppe Vitali (1965) Marcus Peter Francis du Sautoy	
35	27	M	(1858) Giuseppe Peano
28	T	(1862) Roberto Marcolongo (1796) Irénée Jules Bienaymé	RM187
29	W	(1904) Leonard Roth	
30	T	(1703) Giovanni Ludovico Calandrini (1856) Carle David Tolmé Runge (1906) Olga Taussky-Todd	RM186 RM139
31	F	(1821) Hermann Ludwig Ferdinand von Helmholtz (1885) Herbert Westren Turnbull	RM211



Putnam 2003, B2

Let n be a positive integer. Starting with the sequence:

$1, \frac{1}{2}, \frac{1}{3}, \dots, \frac{1}{n}$ form a new sequence of $n-1$ entries

$$\frac{3}{4}, \frac{5}{12}, \dots, \frac{2n-1}{2n(n-1)}$$

by taking the average of two consecutive entries in the first sequence. Repeat the averaging of neighbours on the second sequence to obtain a third sequence of $n-2$ entries, and continue until the final sequence produced consists of a single number x_n .

Show that $x_n < 2/n$.

Invited to the Great Ball of Scientists...

... Faraday thought he would feel in a cage.

How do mathematicians do it?

Mathematical physicists have many theories how to do it, but when it comes to it there is always something not working.

The mathematicians have been very much absorbed with finding the general solution of algebraic equations, and several of them have tried to prove the impossibility of it. However, if I am not mistaken, they have not as yet succeeded. I therefore dare hope that the mathematicians will receive this memoir with good will, for its purpose is to fill this gap in the theory of algebraic equations.

Niels Henrik Abel

Geometry is to the plastic arts what grammar is to the art of the writer.

Guillaume Apollinaire

On earth there is nothing great but man; in man there is nothing great but mind.

Sir William Rowan Hamilton

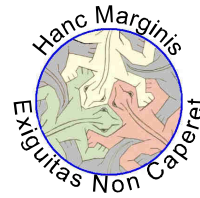
The discovery in 1846 of the planet Neptune was a dramatic and spectacular achievement of mathematical astronomy. The very existence of this new member of the solar system, and its exact location, were demonstrated with pencil and paper; there was left to observers only the routine task of pointing their telescopes at the spot the mathematicians had marked.

James R. Newman

The main duty of the historian of mathematics, as well as his fondest privilege, is to explain the humanity of mathematics, to illustrate its greatness, beauty and dignity, and to describe how the incessant efforts and accumulated genius of many generations have built up that magnificent monument, the object of our most legitimate pride as men, and of our wonder, humility and thankfulness, as individuals. The study of the history of mathematics will not make better mathematicians but gentler ones, it will enrich their minds, mellow their hearts, and bring out their finer qualities.

George Sarton

1	S	(1659) Joseph Saurin (1647) Giovanni Ceva (1835) William Stanley Jevons	RM203	
2	S	(1878) Mauriche René Frechet (1923) René Thom	RM080	
36	3	M	(1814) James Joseph Sylvester (1884) Solomon Lefschetz (1908) Lev Semenovich Pontryagin	RM104
4	T	(1809) Luigi Federico Menabrea	RM150	
5	W	(1667) Giovanni Girolamo Saccheri (1725) Jean-Étienne Montucla	RM128	
6	T	(1859) Boris Jakovlevich Bukreev (1863) Dimitri Aleksandrovich Grave		
7	F	(1707) George Louis Leclerc Comte de Buffon (1948) Cheryl Elisabeth Praeger (1955) Efim Zelmanov		
8	S	(1584) Gregorius Saint-Vincent (1588) Marin Mersenne	RM092	
9	S	(1860) Frank Morley (1914) Marjorie Lee Browne		
37	10	M	(1839) Charles Sanders Peirce	RM123
11	T	(1623) Stefano degli Angeli (1798) Franz Ernst Neumann (1877) Sir James Hopwood Jeans	RM224	
12	W	(1891) Antoine André Louis Reynaud (1900) Haskell Brooks Curry (1894) Dorothy Maud Wrinch	RM212	
13	T	(1873) Constantin Carathéodory (1885) Wilhelm Johann Eugen Blaschke		
14	F	(1858) Henry Burchard Fine (1891) Ivan Matveevich Vinogradov		
15	S	(973) Abu Arrayhan Muhammad Ibn Ahmad Al'Biruni (1886) Paul Pierre Levy	RM164	
16	S	(1494) Francisco Maurolico (1736) Johann Nikolaus Tetens		
38	17	M	(1743) Marie Jean Antoine Nicolas de Caritat de Condorcet (1826) Georg Friedrich Bernhard Riemann	RM176 RM068
18	T	(1752) Adrien-Marie Legendre	RM140	
19	W	(1749) Jean-Baptiste Delambre		
20	T	(1842) Alexander Wilhelm von Brill (1861) Frank Nelson Cole		
21	F	(1899) Juliusz Pawel Schauder (1917) Phyllis Nicolson		
22	S	(1765) Paolo Ruffini (1769) Louis Puissant (1803) Jaques Charles Francois Sturm	RM116	
23	S	(1768) William Wallace (1900) David Van Dantzig		
39	24	M	(1501) Girolamo Cardano (1625) Johan de Witt (1801) Michail Vasilevich Ostrogradski (1862) Winifred Edgerton Merrill (1945) Ian Nicholas Stewart	RM064 RM188 RM056
25	T	(1819) George Salmon (1888) Stefan Mazurkiewicz		
26	W	(1688) Willem Jakob 's Gravesande (1854) Percy Alexander Macmahon (1891) Hans Reichenbach		
27	T	(1855) Paul Émile Appell (1876) Earle Raymond Hedrick (1919) James Hardy Wilkinson		
28	F	(1698) Pierre Louis Moreau de Maupertuis (1761) Ferdinand François Desiré Budan de Boislaurent (1873) Julian Lowell Coolidge	RM152	
29	S	(1540) François Viète (1561) Adriaan Van Roomen (1812) Adolph Gopel	RM200 RM200	
30	S	(1775) Robert Adrain (1829) Joseph Wolstenholme (1883) Ernst Hellinger		



Putnam 2003, B3

Show that for each positive integer n ,

$$n! = \prod_{i=1}^n \text{lcm} \left\{ 1, 2, \dots, \left\lfloor \frac{n}{i} \right\rfloor \right\}$$

(here lcm denotes the least common multiple, and $\lfloor x \rfloor$ denotes the greatest integer $\leq x$).

Invited to the Great Ball of Scientists...

... Gödel said he would come if he could find a suit(able) set.

How do mathematicians do it?

Quantum physicists know when or where they do it, but not both.

Prime numbers are what is left when you have taken all the patterns away. I think prime numbers are like life. They are very logical but you could never work out the rules, even if you spent all your time thinking about them.

Mark Haddon

The real danger is not that computers will begin to think like men, but that men will begin to think like computers.

Sydney J. Harris

Nobody before the Pythagoreans had thought that mathematical relations held the secret of the universe. Twenty-five centuries later, Europe is still blessed and cursed with their heritage. To non-European civilizations, the idea that numbers are the key to both wisdom and power, seems never to have occurred.

Arthur Koestler

It is now (1956) quite legal for a Catholic woman to avoid pregnancy by a resort to mathematics, though she is still forbidden to resort to physics and chemistry.

H. L. Mencken

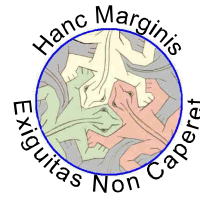
The world of ideas which it [mathematics] discloses or illuminates, the contemplation of divine beauty and order which it induces, the harmonious connection of its parts, the infinite hierarchy and absolute evidence of the truths with which it is concerned, these, and such like, are the surest grounds of the title of mathematics to human regard, and would remain unimpeached and unimpaired were the plan of the universe unrolled like a map at our feet, and the mind of man qualified to take in the whole scheme of creation at a glance.

James Joseph Sylvester

A man is like a fraction whose numerator is what he is and whose denominator is what he thinks of himself. The larger the denominator the smaller the fraction.

Lev Nikolgeevich Tolstoj

40	1	M	(1671) Luigi Guido Grandi (1898) Bela Kerekjarto' (1912) Kathleen Timpson Ollerenshaw	RM177
	2	T	(1825) John James Walker (1908) Arthur Erdélyi	
	3	W	(1944) Pierre René Deligne	
	4	T	(1759) Louis Francois Antoine Arbogast (1797) Jerome Savary	
	5	F	(1732) Nevil Maskelyne (1781) Bernhard Placidus Johann Nepomuk Bolzano (1861) Thomas Little Heath	RM117
	6	S	(1552) Matteo Ricci (1831) Julius Wilhelm Richard Dedekind (1908) Sergei Lvovich Sobolev	RM141 RM081
	7	S	(1885) Niels Bohr	RM063
41	8	M	(1908) Hans Arnold Heilbronn	
	9	T	(1581) Claude Gaspard Bachet de Meziriac (1704) Johann Andrea von Segner (1873) Karl Schwarzschild (1949) Fan Rong K Chung Graham	RM201 RM153 RM110
	10	W	(1861) Heinrich Friedrich Karl Ludwig Burkhardt	
	11	T	(1675) Samuel Clarke (1777) Barnabè Brisson (1881) Lewis Fry Richardson (1885) Alfred Haar (1910) Cahit Arf	
	12	F	(1860) Elmer Sperry	
	13	S	(1890) Georg Feigl (1893) Kurt Werner Friedrich Reidemeister (1932) John Griggs Thomson	
	14	S	(1687) Robert Simson (1801) Joseph Antoine Ferdinand Plateau (1868) Alessandro Padoa	
42	15	M	(1608) Evangelista Torricelli (1735) Jesse Ramsden (1776) Peter Barlow (1931) Eléna Wexler-Kreindler	RM165
	16	T	(1879) Philip Edward Bertrand Jourdain	
	17	W	(1759) Jacob (II) Bernoulli (1888) Paul Isaac Bernays	RM093
	18	T	(1741) John Wilson (1945) Margaret Dusa Waddington Mcduff	
	19	F	(1903) Jean Frédéric Auguste Delsarte (1910) Subrahmanyan Chandrasekhar	RM153
	20	S	(1632) Sir Christopher Wren (1863) William Henry Young (1865) Aleksandr Petrovich Kotelnikov	RM105
	21	S	(1677) Nicolaus (I) Bernoulli (1823) Enrico Betti (1855) Giovan Battista Guccia (1893) William Leonard Ferrar (1914) Martin Gardner	RM093 RM150 RM129 RM137
43	22	M	(1587) Joachim Jungius (1895) Rolf Herman Nevanlinna (1907) Sarvadaman Chowla	
	23	T	(1865) Piers Bohl	
	24	W	(1804) Wilhelm Eduard Weber (1873) Edmund Taylor Whittaker	
	25	T	(1811) Évariste Galois	RM069
	26	F	(1849) Ferdinand Georg Frobenius (1857) Charles Max Mason (1911) Shiing-Shen Chern	
	27	S	(1678) Pierre Remond de Montmort (1856) Ernest William Hobson	
	28	S	(1804) Pierre François Verhulst	
44	29	M	(1925) Klaus Roth	
	30	T	(1906) Andrej Nikolaevich Tichonov (1946) William Paul Thurston	
	31	W	(1711) Laura Maria Caterina Bassi (1815) Karl Theodor Wilhelm Weierstrass (1935) Ronald Lewis Graham	RM189 RM057 RM110



Putnam 2003, B4

Let

$$f(z) = az^2 + bz^3 + cz^2 + dz + e$$

$$= a(z-r_1)(z-r_2)(z-r_3)(z-r_4)$$

where a, b, c, d, e are integers, $a \neq 0$. Show that if r_1+r_2 is a rational number and $r_1+r_2 \neq r_3+r_4$, then r_1r_2 is a rational number.

Invited to the Great Ball of Scientists...

... Galois said he did not have time.

How do mathematicians do it?

Markov did it in chains.

I must study politics and war that my sons may have liberty to study mathematics and philosophy. My sons ought to study mathematics and philosophy, geography, natural history, naval architecture, navigation, commerce, and agriculture, in order to give their children a right to study painting, poetry, music, architecture, statuary, tapestry, and porcelain.

John Adams

For God is like a skilful Geometrician.

Sir Thomas Browne

[Epitaph] Here lies Diophantus, the wonder behold. Through art algebraic, the stone tells how old: 'God gave him his boyhood one-sixth of his life, One twelfth more as youth while whiskers grew rife; And then yet one-seventh ere marriage begun; In five years there came a bouncing new son. Alas, the dear child of master and sage After attaining half the measure of his father's life chill fate took him. After consoling his fate by the science of numbers for four years, he ended his life.

Diophantus

I have often pondered over the roles of knowledge or experience, on the one hand, and imagination or intuition, on the other, in the process of discovery. I believe that there is a certain fundamental conflict between the two, and knowledge, by advocating caution, tends to inhibit the flight of imagination. Therefore, a certain naiveté, unburdened by conventional wisdom, can sometimes be a positive asset.

Harish-Chandra

It is now proved beyond doubt that smoking is one of the leading causes of statistics.

Fletcher Knebel

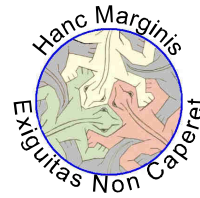
Think of Adam and Eve as a kind of imaginary number, like the square root of minus one; you will never see any concrete evidence of its existence, but if you include it in your equations you will be able to calculate a whole amount of things that you could not even conceive in your absence.

Philip Pullman

In each statistic, the inaccuracy of the numbers is compensated by the accuracy of decimals.

Alfred Sauvy

1	T	(1535) Giambattista della Porta	RM226
2	F	(1815) George Boole (1826) Henry John Stephen Smith	RM094
3	S	(1867) Martin Wilhelm Kutta (1878) Arthur Byron Coble (1896) Raymond Louis Wilder (1906) Carl Benjamin Boyer	
4	S	(1744) Johann (III) Bernoulli (1865) Pierre Simon Girard	RM093
45	5	M	(1848) James Whitbread Lee Glaisher (1930) John Frank Adams
6	T	(1906) Emma Markovna Trotskaia Lehmer	RM215
7	W	(1660) Thomas Fantet de Lagny (1799) Karl Heinrich Graffe (1567) Clara Immerwahr (1898) Raphael Salem	RM182
8	T	(1656) Edmond Halley (1781) Giovanni Antonio Amedeo Plana (1846) Eugenio Bertini (1848) Fredrich Ludwig Gottlob Frege (1854) Johannes Robert Rydberg (1869) Felix Hausdorff	RM190 RM154
9	F	(1847) Carlo Alberto Castigliano (1885) Theodor Franz Eduard Kaluza (1885) Hermann Klaus Hugo Weyl (1906) Jaroslav Borisovich Lopatynsky (1913) Hedwig Eva Maria Kiesler (Hedy Lamarr) (1922) Imre Lakatos	RM178 RM202
10	S	(1829) Helwin Bruno Christoffel	
11	S	(1904) John Henry Constantine Whitehead	
46	12	M	(1825) Michail Egorovich Vashchenko-Zakharchenko (1842) John William Strutt Lord Rayleigh (1927) Yutaka Taniyama
13	T	(1876) Ernest Julius Wilkzynsky (1878) Max Wilhelm Dehn	
14	W	(1845) Ulisse Dini (1919) Paulette Libermann (1975) Martin Hairer	RM189
15	T	(1688) Louis Bertrand Castel (1793) Michel Chasles (1794) Franz Adolph Taurinus	
16	F	(1835) Eugenio Beltrami	RM150
17	S	(1597) Henry Gellibrand (1717) Jean-Baptiste Le Rond D'Alembert (1790) August Ferdinand Möbius	RM166 RM118
18	S	(1872) Giovanni Enrico Eugenio Vacca (1927) Jon Leslie Britton	
47	19	M	(1894) Heinz Hopf (1900) Michail Alekseevich Lavrentev (1901) Nina Karlovna Bari
20	T	(1889) Edwin Powell Hubble (1924) Benoît Mandelbrot (1963) William Timothy Gowers	RM214
21	W	(1867) Dimitri Sintsov	
22	T	(1803) Giusto Bellavitis (1840) Émile Michel Hyacinthe Lemoine	
23	F	(1616) John Wallis (1820) Issac Todhunter (1917) Elizabeth Leonard Scott	RM070 RM106
24	S	(1549) Duncan Maclaren Young Sommerville (1909) Gerhard Gentzen	
25	S	(1841) Fredrich Wilhelm Karl Ernst Schröder (1873) Claude Louis Mathieu (1943) Evelyn Merle Roden Nelson	
48	26	M	(1894) Norbert Wiener (1946) Enrico Bombieri
27	T	(1867) Arthur Lee Dixon	
28	W	(1898) John Wishart	
29	T	(1803) Christian Andreas Doppler (1849) Sir Horace Lamb (1879) Nikolay Mitrofanovich Krylov	
30	F	(1549) Sir Henry Savile (1969) Matilde Marcolli	RM142



Putnam 2003, B5

Let A , B and C be equidistant points on the circumference of a circle of unit radius centered at O , and let P be any point in the circle's interior. Let a , b , c be the distance from P to A , B , C , respectively. Show that there is a triangle with side lengths a , b , c , and that the area of this triangle depends only on the distance from P to O .

Invited to the Great Ball of Scientists...

... Schrödinger said he would come and stay home.

How do mathematicians do it?

Cosmologists do it in the first three minutes.

If I am given a formula and I am ignorant of its meaning, it cannot teach me anything, but if I already know it what does the formula teach me?

Augustine of Hippo

In scientific thought we adopt the simplest theory which will explain all the facts under consideration and enable us to predict new facts of the same kind. The catch in this criterion lies in the word "simplest." It is really an aesthetic canon such as we find implicit in our criticisms of poetry or painting. The layman finds such a law as $dx/dt = K(d^2x/dy^2)$ much less simple than "it oozes," of which it is the mathematical statement. The physicist reverses this judgment, and his statement is certainly the more fruitful of the two, so far as prediction is concerned. It is, however, a statement about something very unfamiliar to the plainman, namely, the rate of change of a rate of change.

John Burdon Sanderson Haldane

If they would, for Example, praise the Beauty of a Woman, or any other Animal, they describe it by Rhombs, Circles, Parallelograms, Ellipses, and other geometrical terms...

Jonathan Swift

Logic is the hygiene the mathematician practices to keep his ideas healthy and strong.

Hermann Klaus Hugo Weyl

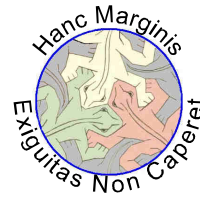
We mathematicians who operate with nothing more expensive than paper and possibly printers' ink are quite reconciled to the fact that, if we are working in an active field, our discoveries will commence to be obsolete at the moment that they are written down or even at the moment they are conceived. We know that for a long time everything we do will be nothing more than the jumping off point for those who have the advantage of already being aware of our ultimate results. This is the meaning of the famous apothegm of Newton, when he said, "If I have seen further than other men, it is because I have stood on the shoulders of giants".

Norbert Wiener

Mathematics was born and nurtured in a cultural environment. Without the perspective which the cultural background affords, a proper appreciation of the content and state of present-day mathematics is hardly possible.

Raymond Louis Wilder

1	S	(1792) Nikolay Yvanovich Lobachevsky (1847) Christine Ladd-Franklin	RM083
2	S	(1831) Paul David Gustav du Bois-Reymond (1869) Dimitri Fedorovich Egorov (1901) George Frederick James Temple	RM214
49	3	M	(1903) Sidney Goldstein (1924) John Backus
4	T	(1795) Thomas Carlyle	
5	W	(1868) Arnold Johannes Wilhelm Sommerfeld (1901) Werner Karl Heisenberg (1907) Giuseppe Occhialini	RM155 RM122
6	T	(1682) Giulio Carlo Fagnano dei Toschi	
7	F	(1823) Leopold Kronecker (1830) Antonio Luigi Gaudenzio Giuseppe Cremona (1924) Mary Ellen Rudin	RM150
8	S	(1508) Regnier Gemma Frisius (1865) Jaques Salomon Hadamard (1919) Julia Bowman Robinson	RM227
9	S	(1883) Nikolai Nikolaievich Luzin (1906) Grace Brewster Murray Hopper (1917) Sergei Vasilovich Fomin	RM214
50	10	M	(1804) Karl Gustav Jacob Jacobi (1815) Augusta Ada King Countess Of Lovelace
11	T	(1882) Max Born	RM059 RM155
12	W	(1832) Peter Ludwig Mejdell Sylov (1913) Emma Castelnuovo	RM191
13	T	(1724) Franz Ulrich Theodosius Aepinus (1887) George Pólya	RM131
14	F	(1546) Tycho Brahe	
15	S	(1802) János Bolyai (1923) Freeman John Dyson	RM083
16	S	(1804) Wiktor Yakovievich Bunyakowsky	
51	17	M	(1706) Gabrielle Émilie Le Tonnelier de Breteuil du Châtelet (1835) Felice Casorati (1842) Marius Sophus Lie (1900) Dame Mary Lucy Cartwright
18	T	(1856) Joseph John Thomson (1917) Roger Lyndon (1942) Lenore Blum	RM161
19	W	(1783) Charles Julien Brianchon (1854) Marcel Louis Brillouin (1887) Charles Galton Darwin	RM138
20	T	(1494) Oronce Fine (1648) Tommaso Ceva (1875) Francesco Paolo Cantelli	RM203
21	F	(1878) Jan Łukasiewicz (1921) Edith Hirsch Luchins (1932) John Robert Ringrose	
22	S	(1824) Francesco Brioschi (1859) Otto Ludwig Hölder (1877) Tommaso Boggio (1887) Srinivasa Aiyangar Ramanujan	RM150
23	S	(1872) Georgii Yurii Pfeiffer	
52	24	M	(1822) Charles Hermite (1868) Emmanuel Lasker
25	T	(1642) Isaac Newton (1900) Antoni Zygmund	RM095 RM167 RM071
26	W	(1780) Mary Fairfax Greig Somerville (1791) Charles Babbage (1937) John Horton Conway	RM059 RM119
27	T	(1571) Johannes Kepler (1654) Jacob (Jacques) Bernoulli	RM093
28	F	(1808) Louis Victoire Athanase Dupré (1882) Arthur Stanley Eddington (1903) John von Neumann	RM179 RM107
29	S	(1856) Thomas Jan Stieltjes	
30	S	(1897) Stanislaw Saks	
31	M	(1872) Volodymyr Levitsky (1896) Carl Ludwig Siegel (1945) Leonard Adleman (1952) Vaughan Frederick Randall Jones	RM143



Putnam 2003, B6

Let $f(x)$ be a continuous real-valued function defined on the interval $[0,1]$. Show that

$$\int_0^1 \int_0^1 |f(x)+f(y)| dx dy \geq \int_0^1 |f(x)| dx$$

Invited to the Great Ball of Scientists...

... Avogadro was not contacted: no one could remember his number.

How do mathematicians do it?

The True Mathematician does not do it: he leaves it as a simple exercise to the reader.

It is utterly implausible that a mathematical formula should make the future known to us, and those who think it can would once have believed in witchcraft.

Jacob Bernoulli

I believe there are 15 747 724 136 275 002 577 605 653 961 181 555 468 044 717 914 527 116 709 366 231 425 076 185 631 031 296 protons in the universe and the same number of electrons. [(136 × 2²⁵⁶) Terner lecture 1938]

Arthur Stanley Eddington

A topologist is one who doesn't know the difference between a doughnut and a coffee cup.

John Kelley

How can you shorten the subject? That stern struggle with the multiplication table, for many people not yet ended in victory, how can you make it less? Square root, as obdurate as a hardwood stump in a pasture nothing but years of effort can extract it. You can't hurry the process. Or pass from arithmetic to algebra; you can't shoulder your way past quadratic equations or ripple through the binomial theorem. Instead, the other way; your feet are impeded in the tangled growth, your pace slackens, you sink and fall somewhere near the binomial theorem with the calculus in sight on the horizon. So died, for each of us, still bravely fighting, our mathematical training; except for a set of people called "mathematicians" – born so, like crooks.

Stephen Leacock

The latest authors, like the most ancient, strove to subordinate the phenomena of nature to the laws of mathematics.

Isaac Newton

Chance favours only the prepared mind.

Louis Pasteur

It is a pleasant surprise to him (the pure mathematician) and an added problem if he finds that the arts can use his calculations, or that the senses can verify them, much as if a composer found that sailors could heave better when singing his songs.

George Santayana