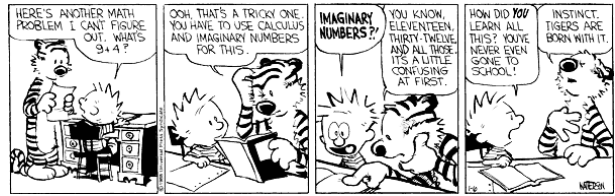
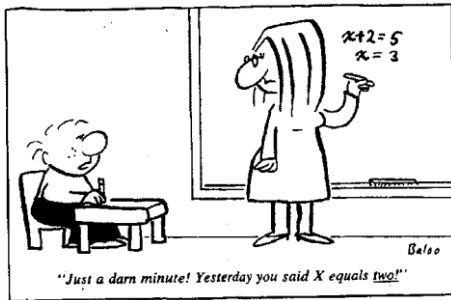


$$x^3 - 6'159x^2 + 12'643'643x - 8'651'393'325 = 0$$



Frank and Ernest



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E-mail: randyg@norwich.net



"Why is it important for today's kids to learn algebra? Because I had to learn this junk in school and now it's your turn, that's why!"

Frank and Ernest



"The trouble with Mobius is he thinks there's only one side to every question."



1	W	(1803) Guglielmo Libri Carucci dalla Sommaja	RM132	
		(1878) Agner Krarup Erlang		
		(1894) Satyendranath Bose	RM168	
		(1912) Boris Gnedenko		
2	T	(1822) Rudolf Julius Emmanuel Clausius	RM240	
		(1905) Lev Genrichovich Shnirelman		
		(1938) Anatoly Samoilenko		
3	F	(1777) Louis Poinso		
		(1917) Yuri Alexeievich Mitropolsky		
4	S	(1643) Isaac Newton	RM071	
		(1723) Nicole-Reine Étable de Labrière Lepaute	RM288	
5	S	(1838) Marie Ennemond Camille Jordan	RM276	
		(1871) Federigo Enriques	RM084	
		(1871) Gino Fano		
2	6	M	(1807) Jozeph Mitza Petzval	RM300
			(1841) Rudolf Sturm	
	7	T	(1871) Felix Edouard Justin Émile Borel	
			(1907) Raymond Edward Alan Christopher Paley	
	8	W	(1925) Walter Noll	
			(1888) Richard Courant	RM156
			(1924) Paul Moritz Cohn	
	9	T	(1942) Stephen William Hawking	
			(1864) Vladimir Adreievich Steklou	
			(1882) Pavel Aleksandrovitch Florenskij	RM252
	10	F	(1915) Mollie Orshansky	
			(1875) Issai Schur	
11	S	(1905) Ruth Moufang		
		(1545) Guidobaldo del Monte	RM120	
12	S	(1707) Vincenzo Riccati		
		(1734) Achille Pierre Dionis du Séjour		
		(1853) Gregorio Ricci-Curbastro		
3	13	M	(1906) Kurt August Hirsch	
			(1915) Herbert Ellis Robbins	RM156
			(1864) Wilhelm Karl Werner Otto Fritz Franz Wien	
			(1876) Luther Pfahler Eisenhart	
	14	T	(1876) Erhard Schmidt	
			(1902) Karl Menger	
	15	W	(1901) Alfred Tarski	RM096
			(1704) Johann Castillon	
	16	T	(1717) Mattew Stewart	
			(1850) Sofia Vasilievna Kovalevskaya	RM144
			(1801) Thomas Klausen	
17	F	(1647) Catherina Elisabetha Koopman Hevelius	RM264	
		(1847) Nikolay Egorovich Zukowsky		
18	S	(1858) Gabriel Koenigs		
		(1856) Luigi Bianchi		
19	S	(1880) Paul Ehrenfest	RM204	
		(1813) Rudolf Friedrich Alfred Clebsch		
		(1879) Guido Fubini		
4	20	M	(1908) Aleksandr Gennadievich Kurosh	
			(1775) André Marie Ampère	
			(1895) Gabor Szegő	
	21	T	(1904) Renato Caccioppoli	RM072
			(1846) Pieter Hendrik Schoute	
	22	W	(1882) Pavel Aleksandrovitch Florenskij	RM252
			(1915) Yuri Vladimirovich Linnik	
			(1561) Francis Bacon	
	23	T	(1592) Pierre Gassendi	
			(1886) John William Navin Sullivan	
(1908) Lev Davidovich Landau			RM228	
24	F	(1840) Ernst Abbe		
		(1862) David Hilbert	RM060	
25	S	(1891) Abram Samoilovitch Besicovitch		
		(1902) Oskar Morgenstern		
		(1914) Vladimir Petrovich Potapov		
26	S	(1627) Robert Boyle		
		(1736) Joseph-Louis Lagrange	RM048	
		(1843) Karl Hermann Amandus Schwarz		
5	27	M	(1799) Benoît Paul Émile Clapeyron	
			(1849) Francesco Flores D'Arcais	
	28	T	(1862) Eliakim Hastings Moore	
			(1832) Charles Lutwidge Dodgson	RM108
			(1611) Johannes Hevelius	RM264
29	W	(1701) Charles Marie de La Condamine		
		(1888) Louis Joel Mordell		
30	T	(1892) Carlo Emilio Bonferroni		
		(1817) William Ferrel		
31	F	(1888) Sidney Chapman		
		(1619) Michelangelo Ricci	RM216	
		(1715) Giovanni Francesco Fagnano dei Toschi		
		(1841) Samuel Loyd	RM192	
		(1896) Sofia Alexandrovna Janowskaja		



Putnam 2010, A1

Given a positive integer n , what is the largest k such that the numbers $1, 2, \dots, n$ can be put into k boxes so that the sum of the numbers in each box is the same? [When $n = 8$, the example $\{1, 2, 3, 6\}, \{4, 8\}, \{5, 7\}$ shows that the largest k is at least 3.]?

Gauss Facts (Heath & Dolphin)

Gauss can trisect an angle with a straightedge and compass.

Gauss can get to the other side of a Möbius strip.

Mathematical Nursery Rhymes (Graham)

Fiddle de dum, fiddle de dee
A ring round the Moon is π times D
But if a hole you want repaired
You use the formula πr^2 .

Another diversity of Methods is according to the subject or matter which is handled; for there is a great difference in delivery of the Mathematics, which are the most abstracted of knowledges, and Policy, which is the most immersed..., yet we see how that opinion, besides the weakness of it, hath been of ill desert towards learning, as that which taketh the way to reduce learning to certain empty and barren generalities; being but the very husks and shells of sciences, all the kernel being forced out and expelled with the torture and press of the method.

Francis Bacon

It was then that I saw the Pendulum. The sphere, mobile at the end of a long thread fixed to the vault of the choir, described its wide oscillations with isochronous majesty. I knew - but anyone should have felt in the enchantment of that placid breathing - that the period was regulated by the ratio between the square root of the length of the thread and that number π which, irrational to sublunary minds, by divine reason necessarily links the circumference to the diameter of all possible circles - so that the time of that wandering of the sphere from one pole to the other was the effect of an arcane conspiracy between the most timeless of measures, the unity of the point of suspension, the duality of an abstract dimension, the ternary nature of π , the secret tetragon of the root, the perfection of the circle.

Umberto Eco

Those who act with approximation also get used to speaking with approximation, and coarse, imprecise and slovenly speaking involves thought in this indeterminacy [...] Thought is a gift from God and requires that you take care of yourself. Being precise and clear in one's thoughts is the pledge of spiritual freedom.

Pavel Aleksandrovitch Florenskij

Infinity is nowhere in reality, no matter how much we draw on experience, observation, and knowledge. Can thoughts about things be so different from things? Can thought processes be so dissimilar from how objects proceed? In short, can thought be so far removed from reality?

David Hilbert



1	S	(1900) John Charles Burkill		
2	S	(1522) Lodovico Ferrari (1893) Cornelius Lanczos (1897) Gertrude Blanch	RM229	
6	3	M	(1893) Gaston Maurice Julia	RM073
	4	T	(1905) Eric Christopher Zeeman	RM241
	5	W	(1757) Jean Marie Constant Duhamel	
	6	T	(1465) Scipione del Ferro (1612) Antoine Arnauld (1695) Nicolaus (II) Bernoulli	RM064 RM093
	7	F	(1877) Godfried Harold Hardy (1883) Eric Temple Bell	RM049
	8	S	(1700) Daniel Bernoulli (1875) Francis Ysidro Edgeworth (1928) Ennio de Giorgi	RM093 RM133
	9	S	(1775) Farkas Wolfgang Bolyai (1907) Harold Scott Macdonald Coxeter	RM097
7	10	M	(1747) Aida Yasuaki (1932) Vivienne Malone-Mayes	RM121
	11	T	(1657) Bernard Le Bovier de Fontenelle (1800) William Henry Fox Talbot (1839) Josiah Willard Gibbs (1915) Richard Wesley Hamming	RM205
	12	W	(1914) Hanna Caemmerer Neumann (1921) Kathleen Rita McNulty Mauchly Antonelli	
	13	T	(1805) Johann Peter Gustav Lejeune Dirichlet	RM145
	14	F	(1468) Johann Werner (1849) Hermann Hankel (1877) Edmund Georg Hermann Landau (1896) Edward Artur Milne (1932) Maurice Audin	RM253 RM063 RM194
	15	S	(1564) Galileo Galilei (1850) Sophie Willock Bryant (1861) Alfred North Whitehead (1946) Douglas Hofstadter	RM085 RM301
	16	S	(1822) Francis Galton (1903) Beniamino Segre	
8	17	M	(1890) Sir Ronald Aylmer Fisher (1891) Adolf Abraham Halevi Fraenkel (1905) Rózsa Péter	
	18	T	(1404) Leon Battista Alberti (1919) Clifford Ambrose Truesdell III	RM157
	19	W	(1473) Nicolaus Copernicus	RM181
	20	T	(1844) Ludwig Boltzmann	RM061
	21	F	(1591) Girard Desargues (1915) Evgeny Michailovich Lifshitz	
	22	S	(1857) Heinrich Rudolf Hertz (1903) Frank Plumpton Ramsey	RM217
	23	S	(1561) Henry Briggs (1583) Jean-Baptiste Morin (1730) Giulio Giuseppe Mozzi del Garbo (1905) Derrick Henry Lehmer (1922) Anneli Cahn Lax (1951) Shigefumi Mori	RM169 RM277 RM215 RM289
9	24	M	(1871) Felix Bernstein	
	25	T	(1827) Henry Watson	
	26	W	(1786) Dominique Francois Jean Arago	RM193
	27	T	(1881) Luitzen Egbertus Jan Brouwer	
	28	F	(1735) Alexandre Théophile Vandermonde	RM265
	29		(1860) Herman Hollerith	RM109

Putnam 2010, A2

Find all differentiable functions $f: \mathbb{R} \rightarrow \mathbb{R}$ such that

$$f'(x) = \frac{f(x+n) - f(x)}{n}$$

for all real numbers x and all positive integers n .

Gauss Facts (Heath & Dolphin)

“Uncountably Infinite” was a phrase coined to explain the intelligence of Gauss.

There are no Fermat Primes greater than 65,537 because Gauss saw that Fermat was on to something, and well... he put an end to that.

Mathematical Nursery Rhymes (Graham)

Rock-a-bye baby in the tree top
As a compound pendulum, you are a flop.
Your center of percussion is safe and low,
As one may see when wind doth blow.
Your frequency of vibration is quite small,
Frankly, I don't think you'll fall at all.

Although the idea behind it is childishly simple, the method of analytic geometry is so powerful that ordinary seventeen-year-olds can use it to prove results that would have defeated the greatest Greek geometers – Euclid, Archimedes, and Apollonius.

Eric Temple Bell

I believe that mathematical reality lies outside us, that our function is to discover or observe it, and that the theorems which we prove, and which we describe grandiloquently as our “creations”, are simply the notes of our observations.

Godfried Harold Hardy

There is a constant demand for graduate students in “numerical” subjects such as mathematics, physics, and engineering. Some employers need specialized knowledge, but most are not interested in the higher levels of mathematical knowledge their future employees have achieved, in Galois theory, or in particle physics. What they want is the competence and confidence at lower levels, such as those of the first year of university, indicated by knowledge of the higher levels.

T.W. Körner

Our minds are finite, and yet even in these circumstances of finitude we are surrounded by possibilities that are infinite, and the purpose of life is to grasp as much as we can out of that infinitude.

Alfred North Whitehead

1	S	(1611) John Pell (1879) Robert Daniel Carmichael	
2	S	(1836) Julius Weingarten	
10	3	M	(1838) George William Hill (1845) Georg Cantor (1916) Paul Richard Halmos RM062
4	T	(1822) Jules Antoine Lissajous	
5	W	(1512) Gerardus Mercator (1759) Benjamin Gompertz (1817) Angelo Genocchi (1885) Pauline Sperry (1915) Laurent Schwartz (1931) Vera Pless RM230	
6	T	(1866) Ettore Bortolotti	
7	F	(1792) William Herschel (1824) Delfino Codazzi (1922) Olga Alexandrovna Ladyzhenskaya RM146	
8	S	(1851) George Chrystal	
9	S	(1818) Ferdinand Joachimsthal (1900) Howard Hathaway Aiken RM302	
11	10	M	(1864) William Fogg Osgood (1872) Mary Ann Elizabeth Stephansen
11	T	(1811) Urbain Jean Joseph Le Verrier (1853) Salvatore Pincherle (1870) Louis Bachelier RM158	
12	W	(1685) George Berkeley (1824) Gustav Robert Kirchhoff (1859) Ernesto Cesaro	
13	T	(1861) Jules Joseph Drach (1957) Rudy D'Alembert RM278	
14	F	(1864) Jozef Kurschak (1879) Albert Einstein (1882) Waclav Sierpiński (1904) Lyudmila Vsevolodovna Keldysh RM074 RM271 RM266	
15	S	(1860) Walter Frank Raphael Weldon (1868) Grace Chisolm Young	
16	S	(1750) Caroline Herschel (1789) Georg Simon Ohm (1846) Magnus Gosta Mittag-Leffler RM146	
12	17	M	(1876) Ernest Benjamin Esclangon (1897) Charles Fox (1915) Wolfgang (Vincent) Döblin (Doblin) RM254
18	T	(1640) Philippe de La Hire (1690) Christian Goldbach (1796) Jacob Steiner (1870) Agnes Sime Baxter RM122	
19	W	(1862) Adolf Kneser (1910) Jacob Wolfowitz	
20	T	(1840) Franz Mertens (1884) Philip Franck (1938) Sergei Petrovich Novikov	
21	F	(1768) Jean Baptiste Joseph Fourier (1884) George David Birkhoff RM242	
22	S	(1394) Ulugh Beg (1891) Lorna Mary Swain (1917) Irving Kaplansky (1944) Margaret Hilary Ashworth Millington RM206	
23	S	(1749) Pierre-Simon de Laplace (1754) Georg Freiherr von Vega (1882) Emmy Amalie Noether (1897) John Lighton Synge RM050	
13	24	M	(1809) Joseph Liouville (1948) Sun-Yung (Alice) Chang (1966) Gigliola Staffilani RM142
25	T	(1538) Christopher Clausius RM290	
26	W	(1848) Konstantin Andreev (1913) Paul Erdős RM110	
27	T	(1857) Karl Pearson	
28	F	(1928) Alexander Grothendieck RM086	
29	S	(1825) Francesco Faà Di Bruno (1873) Tullio Levi-Civita (1896) Wilhelm Ackermann RM170 RM098	
30	S	(1892) Stefan Banach (1921) Alfréd Rényi RM134	
14	31	M	(1596) René Descartes RM218



Putnam 2010, A3

Suppose that the function $h: \mathbb{R}^2 \rightarrow \mathbb{R}$ has continuous partial derivatives and satisfies the equation

$$h(x, y) = a \frac{\partial h}{\partial x}(x, y) + b \frac{\partial h}{\partial y}(x, y)$$

for some constants a, b . Prove that if there is a constant M such that $|h(x, y)| \leq M$ for all $(x, y) \in \mathbb{R}^2$, then h is identically zero.

Gauss Facts (Heath & Dolphin)

For Gauss, arithmetic is consistent AND complete. It only takes Gauss 4 minutes to sing "Aleph-Null Bottles of Beer on the Wall".

Mathematical Nursery Rhymes (Graham)

Ride a fast plane
And don't spare the cash,
To see the math wizard do sums in a flash.
Roots on his fingers
And power on his toes –
He carry log tables
Whenever he goes.

AlGoreItmo, n. – A mathematical operation that continues to occur until it converges to the desired result. Use: Regional, especially in Florida.

Unknown

All modern high mathematics is based on a calculus of operations, on laws of thought.

Mary Everest Boole

From this it is clear why Arithmetic and Geometry are far more certain than other disciplines; for they alone deal with an object pure and simple enough to accept nothing that experience has made uncertain, and they alone, in general, consist of a series of consequences rationally deducible. Arithmetic and Geometry are therefore the easiest and clearest of all, so that it seems impossible that man could err in them, except through inadvertence. [...] Those who seek the right path to truth should not concern themselves with any object of which they cannot have a certainty equal to the demonstrations of Arithmetic and Geometry.

René Descartes

A mathematician is a person for whom mathematics is a soap opera. [...] The "characters" in the soap opera of mathematics are not people but, precisely, mathematical objects: numbers, geometric figures, groups, topological spaces, and so on. The facts and relationships at the center of attention are not births, deaths, marriages, romantic relationships, and business dealings, but mathematical facts and relationships between mathematical objects. What is the relationship between objects X and Y ? Do all objects of type X have the property P ? How many objects of type Z exist?

Keith Devlin

We come now to the question: what is a priori certain or necessary, respectively in geometry (doctrine of space) or its foundations? Formerly we thought everything; nowadays we think nothing. Already the distance-concept is logically arbitrary; there need be no things that correspond to it, even approximately.

Albert Einstein

1	T	(1640) Georg Mohr (1776) Marie-Sophie Germain (1895) Alexander Craig Aitken	RM219		
2	W	(1878) Edward Kasner (1934) Paul Joseph Cohen (1984) Alessio Figalli	RM243		
3	T	(1835) John Howard Van Amringe (1892) Hans Rademacher (1900) Albert Edward Ingham (1971) Alice Riddle			
4	F	(1809) Benjamin Peirce (1842) François Édouard Anatole Lucas (1949) Shing-Tung Yau (1588) Thomas Hobbes	RM123 RM279		
5	S	(1588) Thomas Hobbes (1607) Honoré Fabri (1622) Vincenzo Viviani (1869) Sergei Alexeievich Chaplygin			
6	S	(1801) William Hallowes Miller			
15	7	M	(1768) François-Joseph Français		
	8	T	(1903) Marshall Harvey Stone		
	9	W	(1791) George Peacock (1816) Charles Eugene Delaunay (1865) Karl August Rudolph Steinmetz (1894) Cypra Cecilia Krieger Dunaij (1919) John Presper Heckert	RM291	
10	T	(1857) Henry Ernest Dudeney	RM183		
11	F	(1953) Andrew John Wiles	RM207		
12	S	(1794) Germain Pierre Dandelin (1852) Carl Louis Ferdinand von Lindemann (1903) Jan Tinbergen	RM267		
13	S	(1728) Paolo Frisi (1813) Duncan Farquharson Gregory (1869) Ada Isabel Maddison (1879) Francesco Severi (1909) Stanislaw Marcin Ulam	RM171		
16	14	M	(1629) Christiaan Huygens	RM135	
	15	T	(1452) Leonardo da Vinci (1548) Pietro Antonio Cataldi (1707) Leonhard Euler (1809) Herman Gunther Grassmann	RM051	
	16	W	(1682) John Hadley (1823) Ferdinand Gotthold Max Eisenstein		
	17	T	(1798) Étienne Bobillier (1853) Arthur Moritz Schonflies (1863) Augustus Edward Hough Love		
	18	F	(1791) Ottaviano Fabrizio Mossotti (1907) Lars Valerian Ahlfors (1918) Hsien Chung Wang (1949) Charles Louis Fefferman	RM150	
	19	S	(1880) Evgeny Evgenievich Slutsky (1883) Richard von Mises (1901) Kiyoshi Oka (1905) Charles Ehresmann		
	20	S	(1839) Francesco Siacchi (1955) Pietro Greco	RM311	
	17	21	M	(1652) Michel Rolle (1774) Jean Baptiste Biot (1875) Teiji Takagi	RM231
		22	T	(1811) Otto Ludwig Hesse (1887) Harald August Bohr (1935) Bhamas Srinivasan (1939) Sir Michael Francis Atiyah	RM063
		23	W	(1858) Max Karl Ernst Ludwig Planck (1910) Sheila Scott Macintyre	RM303
24		T	(1863) Giovanni Vailati (1899) Oscar Zariski	RM099	
25		F	(1849) Felix Christian Klein (1900) Wolfgang Pauli (1903) Andrei Nicolayevich Kolmogorov	RM255 RM159	
26		S	(1889) Ludwig Josef Johan Wittgenstein		
27		S	(1755) Marc-Antoine Parseval des Chenes (1932) Gian-Carlo Rota	RM195	
18	28	M	(1906) Kurt Gödel	RM087	
	29	T	(1854) Jules Henri Poincaré	RM075	
	30	W	(1777) Johann Carl Friedrich Gauss (1916) Claude Elwood Shannon	RM147 RM111	



Putnam 2010, A4

Prove that for each positive integer n , the number $10^{10^{10}n} - 10^{10^n} - 10^n - 1$ is not prime.

Gauss Facts (Heath & Dolphin)

When Gauss tells you that he's lying, he's telling the truth. Gauss once played himself in a zero-sum game and won \$50.

Mathematical Nursery Rhymes (Graham)

Little Bo-Beep has lost her sheep,
Totalling 10100.
She counted by twos, meaning fewer to lose,
But we trust that all the twenty get caught.

After practical skills had developed sufficiently to adequately meet material needs, one of the sciences not devoted to utilitarian purposes [mathematics] could arise in Egypt, since the priestly caste had the necessary leisure for disinterested research.

Aristotle

A great part of its [higher arithmetic] theories derives an additional charm from the peculiarity that important propositions, with the impress of simplicity on them, are often easily discovered by induction, and yet are of so profound a character that we cannot find the demonstrations till after many vain attempts; and even then, when we do succeed, it is often by some tedious and artificial process, while the simple methods may long remain concealed.

Johann Carl Friedrich Gauss

Either mathematics is incomplete in this sense, that its self-evident axioms can never be comprehended in a finite rule, i.e. that the human mind (even within the domain of pure mathematics) infinitely surpasses the powers of any finite machine, or there exist absolutely insoluble Diophantine problems [...] (where it is not excluded that both terms of the disjunction are true).

Kurt Godel

At first one might well believe that the proposition $7 + 5 = 12$ is a simple analytic proposition deducible according to the principle of contradiction from the concept of the sum of seven and five. But if one considers the matter more closely, one sees that the concept of the sum of seven and five contains nothing more than the union of two numbers into one. The concept of "twelve" is in no way already implied in the pure concept of that addition.

Immanuel Kant

Inequality is the cause of all local movements.

Leonardo Da Vinci

Absolute space, that is to say, the mark to which it would be necessary to refer the earth to know whether it really moves, has no objective existence.... The two propositions: "The earth turns round" and "it is more convenient to suppose the earth turns round" have the same meaning: there is nothing more in the one than in the other.

Jules Henri Poincaré

1	T	(1825) Johann Jacob Balmer (1908) Morris Kline (1926) Peter Lax (1977) Maryam Mirzakhani	RM122 RM289 RM189	
2	F	(1860) D'Arcy Wentworth Thompson (1905) Kazimierz Zarankiewicz	RM138	
3	S	(1842) Otto Stolz (1860) Vito Volterra (1892) George Paget Thomson	RM136 RM161	
4	S	(1845) William Kingdon Clifford		
19	5	M	(1833) Lazarus Emmanuel Fuchs (1883) Anna Johnson Pell Wheeler (1889) René Eugène Gateaux (1897) Francesco Giacomo Tricomi (1923) Cathleen Synge Morawetz (1963) Maurizio Codogno	RM196 RM256
6	T	(1872) Willem de Sitter (1906) André Weil	RM088	
7	W	(1854) Giuseppe Veronese (1881) Ebenezer Cunningham (1896) Pavel Sergieievich Alexandrov (1926) Alexis Claude Clairaut	RM220	
8	T	(1859) Johan Ludwig William Valdemar Jensen (1905) Winifred Lydia Caunden Sargent		
9	F	(1746) Gaspard Monge (1876) Gilbert Ames Bliss (1965) Karen Ellen Smith	RM208	
10	S	(1788) Augustin Jean Fresnel (1847) William Karl Joseph Killing (1904) Edward James Mcshane (1958) Piotr Rezierovich Silverbrahms	RM304	
11	S	(1902) Edna Ernestine Kramer Lassar (1918) Richard Phillips Feynman	RM076	
20	12	M	(1820) Florence Nightingale (1845) Pierre René Jean Baptiste Henry Brocard (1902) Frank Yates	RM104
13	T	(1750) Lorenzo Mascheroni (1899) Pelageia Yakovlevna Polubarinova Kochina		
14	W	(1832) Rudolf Otto Sigismund Lipschitz (1863) John Charles Fields	RM100	
15	T	(1939) Brian Hartley (1964) Sijue Wu		
16	F	(1718) Maria Gaetana Agnesi (1821) Pafnuti Lvovi Chebyshev (1911) John (Jack) Todd	RM112 RM139	
17	S	(1940) Alan Kay		
18	S	(1850) Oliver Heaviside (1892) Bertrand Arthur William Russell	RM160 RM052	
21	19	M	(1865) Flora Philip (1919) Georgii Dimitirievich Suvorov	
20	T	(1861) Henry Seely White		
21	W	(1471) Albrecht Dürer (1792) Gustave Gaspard de Coriolis	RM124	
22	T	(1865) Alfred Cardew Dixon		
23	F	(1914) Lipa Bers	RM148	
24	S	(1544) William Gilbert		
25	S	(1838) Karl Mikailovich Peterson (1979) Elena Tosato (1989) Maria Colombo	RM268 RM307	
22	26	M	(1667) Abraham de Moivre (1896) Yuri Dimitrievich Sokolov	RM280
27	T	(1862) John Edward Campbell		
28	W	(1676) Jacopo Francesco Riccati (1710) Johann (II) Bernoulli	RM232 RM093	
29	T	(1882) Harry Bateman		
30	F	(1814) Eugene Charles Catalan	RM184	
31	S	(1912) Wu Chien Shiung (Madame Wu) (1926) John Kemeny	RM292	



Putnam 2010, A5

Let G be a group, with operation $*$. Suppose that
 (i) G is a subset of \mathbb{R}^3 (but $*$ need not be related to addition of vectors);
 (ii) For each $a, b \in G$, either $a \times b = a * b$ or $a \times b = 0$ (or both), where \times is the usual cross product in \mathbb{R}^3 .
 Prove that $a \times b = 0$ for all $a, b \in G$.

Gauss Facts (Heath & Dolphin)

For Gauss, point nine repeating equals whatever he wants it to equal.
 Gauss did not prove theorems, he simply stared at them until they yielded their solutions.

Mathematical Nursery Rhymes (Graham)

A diller, a dollar,
 A witless trig scholar,
 On a ladder against a wall.
 If length over height
 Gives an angle too slight,
 The cosecant may provide his downfall.

You can only find truth in logic if you have already found it without it.

Gilbert Keith Chesterton

A mathematician may have to choose between half-right methods that allow his thinking to develop, and rigorous methods that hold it back. Neither path is without risk, but it is worth taking.

Giorgio De Santillana

It is a huge mistake to formulate theories when you do not have sufficient data.

Sir Arthur Conan Doyle

In practice, [cook Ernestina] kept their attention constant as consultants of the quality of the mixed fried food, playing with the combination of the mathematician Celestino Sbrogliacci applied to the table service: each new course following the first two had to consist of a number of pieces that was the sum of the two numbers that preceded it.

To simplify for those not accustomed to numerical combinations: a turkey steak plus an amaretto plus two cauliflowers, plus three lamb chops, plus five veal chops, plus eight pieces of brains, plus thirteen mushrooms, plus twenty-one pieces of sausage...

Bruno Gambarotta

The great tragedy of science – the slaying of a beautiful hypothesis by an ugly fact.

Thomas Henry Huxley

Calculus required continuity, and continuity was supposed to require the infinitely little; but nobody could discover what the infinitely little might be.

Bertrand Arthur William Russell



1	S	(1796) Sadi Leonard Nicolas Carnot (1851) Edward Bailey Elliott (1899) Edward Charles Titchmarsh			
23	2	M	(1895) Tibor Radó		
	3	T	(1659) David Gregory (1954) Susan Landau		
	4	W	(1809) John Henry Pratt (1966) Svetlana Yakovlevna Jitomirskaya	RM197	
	5	T	(1814) Pierre Laurent Wantzel (1819) John Couch Adams (1883) John Maynard Keynes (1941) Nikolai Vladimirovic Krylov	RM065 RM281 RM269 RM286	
	6	F	(1436) Johann Müller Regiomontanus (1857) Aleksandr Michailovitch Lyapunov (1906) Max August Zorn	RM185 RM077	
	7	S	(1863) Edward Burr Van Vleck		
	8	S	(1625) Giovanni Domenico Cassini (1858) Charlotte Angas Scott (1860) Alicia Boole Stott (1896) Eleanor Pairman (1923) Gloria Olive (1924) Samuel Karlin	RM245 RM209	
	24	9	M	(1885) John Edensor Littlewood	RM049
		10	T	(940) Mohammad Abu'L Wafa Al-Buzjani (1887) Vladimir Ivanovich Smirnov	RM257 RM101
		11	W	(1881) Hilda Phoebe Hudson (1937) David Bryant Mumford	
		12	T	(1888) Zygmunt Janyszewski (1937) Vladimir Igorevich Arnold	RM221
		13	F	(1831) James Clerk Maxwell (1872) Jessie Chrystal Macmillan (1876) William Sealey Gosset (Student) (1928) John Forbes Nash	RM113 RM149
		14	S	(1736) Charles Augustin de Coulomb (1856) Andrei Andreyevich Markov (1903) Alonzo Church	RM125 RM233
		15	S	(1640) Bernard Lamy (1894) Nikolai Gregorievich Chebotaryov	
		25	16	M	(1915) John Wilder Tukey
17			T	(1898) Maurits Cornelius Escher	RM097
18			W	(1858) Andrew Russell Forsyth (1884) Charles Ernest Weatherburn (1884) Frieda Nudel (1913) Paul Teichmüller (1915) Alice Turner Schafer	RM148
19	T		(1623) Blaise Pascal (1902) Wallace John Eckert	RM053	
20	F		(1873) Alfred Loewy (1917) Helena Rasiowa		
21	S		(1781) Simeon Denis Poisson (1828) Giuseppe Bruno (1870) Clara Immerwahr	RM293 RM182	
22	S		(1822) Mario Pieri (1864) Hermann Minkowsky (1910) Konrad Zuse (1932) Mary Wynne Warner		
26	23		M	(1912) Alan Mathison Turing	RM089
	24		T	(1880) Oswald Veblen	
	25		W	(1908) William Van Orman Quine	
	26	T	(1824) William Thomson, Lord Kelvin (1918) Yudell Leo Luke	RM161	
	27	F	(1806) Augustus de Morgan		
	28	S	(1875) Henri Léon Lebesgue	RM173	
	29	S	(1888) Aleksandr Aleksandrovich Friedmann (1979) Artur Avila Cordeiro de Melo	RM101 RM189	
	27	30	M	(1791) Felix Savart (1958) Abigail Thompson	

Putnam 2010, A6

Let $f: [0, \infty) \rightarrow \mathbb{R}$ be a strictly decreasing continuous function such that $\lim_{x \rightarrow \infty} f(x) = 0$. Prove that $\int_0^{\infty} \frac{f(x) - f(x+1)}{f(x)} dx$ diverges.

Gauss Facts (Heath & Dolphin)

Occam's Razor – The principle stating that the explanation of any phenomenon is equal to the explanation that came out of Gauss' mouth.

Mathematical Nursery Rhymes (Graham)

Where are going to, my pretty maid?
I'm going a-milking, sir, she said.
How many gallons to drink when you're done?
Divide cubic inches by 231.

It is situations like these [of Diophantus] that make us realize how profoundly unnatural mathematical thinking is. Even a concept as basic as negative numbers took centuries to become clear in the minds of mathematicians, with many intermediate stages of understanding.

John Derbyshire

Or it may cause you suddenly to reconsider the projective plane: it isn't a kind of space after all. It is a structure, a system of relations, which we could, if we chose, embody in space – but it is no more native to space than is the transmigrating soul to a particular creature's body.

Robert & Ellen Kaplan

Mathematics is often mistakenly referred to as the science of common sense. In reality, it can transcend common sense and go beyond both imagination and intuition. It has become a very strange and perhaps frightening subject from an ordinary point of view, but anyone who manages to enter it will find a fairy land: strange, but with a sense of its own, even if it is not the ordinary one.

E. Kasner, J.R. Newman

I must also note a personal feeling of mine: there is not a single conceivable reason to believe that [the Riemann Hypothesis] must be true. On the other hand, life would be more comfortable if there were solid reasons to believe that the hypothesis is false.

John Edensor Littlewood

Reason is the slow and tortuous method by which these who do not know the truth discover it. The heart has its own reason which reason does not know.

Blaise Pascal

I will be sufficiently rewarded if when telling it to others you will not claim the discovery as your own, but will say it was mine.

Thales

	1	T	(1643) Gottfried Wilhelm von Leibniz (1788) Jean-Victor Poncelet (1906) Jean Alexandre Eugène Dieudonné	RM054 RM246
	2	W	(1820) William John Rankine (1852) William Burnside (1925) Olga Arsen'evna Oleinik	
	3	T	(1807) Ernest Jean Philippe Fauque de Jonquières (1897) Jesse Douglas	RM162
	4	F	(1906) Daniel Edwin Rutherford (1917) Michail Samoilovich Livsic (1960) Roberto Natalini	RM311
	5	S	(1936) James Mirrlees	
	6	S	(1849) Alfred Bray Kempe	
28	7	M	(1816) Johann Rudolf Wolf (1906) William Feller (1922) Vladimir Aleksandrovich Marchenko	
	8	T	(1760) Christian Kramp (1904) Henri Paul Cartan	RM126
	9	W	(1845) George Howard Darwin (1931) Valentina Mikhailovna Borok	RM138 RM197
	10	T	(1856) Nikola Tesla (1862) Roger Cotes (1868) Oliver Dimon Kellogg	RM174
	11	F	(1857) Sir Joseph Larmor (1888) Jacob David Tamarkin (1890) Giacomo Albanese	RM101
	12	S	(1875) Ernest Sigismund Fischer (1895) Richard Buckminster Fuller (1935) Nicolas Bourbaki	RM066 RM126
	13	S	(1527) John Dee (1741) Karl Friedrich Hindenburg	RM234
29	14	M	(1671) Jacques D'Allonville (1793) George Green	RM078
	15	T	(1865) Wilhelm Wirtinger (1898) Mary Taylor Slow (1906) Adolph Andrej Pavlovich Yushkevich	
	16	W	(1678) Jakob Hermann (1903) Irmgard Flugge-Lotz	
	17	T	(1831) Victor Mayer Amédeé Mannheim (1837) Wilhelm Lexis (1944) Krystyna Maria Trybulec Kuperberg	
	18	F	(1013) Hermann von Reichenau (1635) Robert Hooke (1853) Hendrik Antoon Lorentz	RM282 RM114 RM161
	19	S	(1768) Francois Joseph Servois	
	20	S	(1876) Otto Blumenthal (1947) Gerd Binnig	RM258 RM222
30	21	M	(1620) Jean Picard (1848) Emil Weyr (1849) Robert Simpson Woodward (1861) Herbert Ellsworth Slaughter	
	22	T	(1784) Friedrich Wilhelm Bessel	RM198
	23	W	(1775) Étienne-Louis Malus (1854) Ivan Slezynsky (1992) Cristiana De Filippis	RM307
	24	T	(1851) Friedrich Hermann Schottky (1871) Paul Epstein (1923) Christine Mary Hamill	
	25	F	(1808) Johann Benedict Listing	
	26	S	(1903) Kurt Mahler	
	27	S	(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
31	28	M	(1954) Gerd Faltings	RM222
	29	T	(1898) Isidor Isaac Rabi (1984) Samuele Mongodi	RM294 RM307
	30	W	(1889) Vladimir Kosma Zworjyn	
	31	T	(1704) Gabriel Cramer (1712) Johann Samuel Koenig (1926) Hilary Putnam	RM186



Putnam 2010, B1

Is there an infinite sequence of real numbers a_1, a_2, a_3, \dots such that

$$a_1^m + a_2^m + a_3^m + \dots = m$$

for every positive integer m ?

Gauss Facts (Heath & Dolphin)

Gauss drinks his beer from a Klein bottle.
For Gauss, there are no indefinite integrals.

Mathematical Nursery Rhymes (Graham)

Sing a song of sixpence –
A mathman full of rye,
Four times twenty square feet,
Multiplied by π
Gives the total ground he covers
While weaving an ellipse;
His path would have no area
If he had no nips.

*You never change things by fighting the existing reality.
To change something, build a new model that makes the existing model obsolete.*

Richard Buckminster Fuller

It is indubitable that a 50-year-old mathematician knows the mathematics he learned at 20 or 30, but has only notions, often rather vague, of the mathematics of his epoch, i.e. the period of time when he is 50.

Jean Alexandre Eugène Dieudonné

What is it about mathematics that compels so many men and women to work at it with the fervor of the incessantly dedicated artist, and yet keeps it outside the experience of the rest of intellectual society?

Jerry P. King

Math is a weave of many threads: the formal and the intuitive, the simple and the profound, the momentary and the eternal. Love the thread you love. But never mistake it for the tapestry.

Ben Orlin

Of course, Kandinsky's triangle is very different from Euclid's, but it is still mathematics.

Federico Peiretti

*"Euclid, my dear, why, what is it?" said Mr. Tulliver.
"Oh, I don't know: they are definitions and axioms and triangles and things. It's a book I have to learn – it's meaningless."*

George Sand

What we now want is closer contact and better understanding between individuals and communities all over the earth, and the elimination of egoism and pride which is always prone to plunge the world into primeval barbarism and strife... Peace can only come as a natural consequence of universal enlightenment...

Nikola Tesla

	1	F	(1861) Ivar Otto Bendixson (1881) Otto Toeplitz (1955) Bernadette Perrin-Riou	
	2	S	(1856) Ferdinand Rudio (1902) Mina Spiegel Rees	
	3	S	(1914) Mark Kac	RM115
32	4	M	(1805) Sir William Rowan Hamilton (1838) John Venn	RM079
	5	T	(1802) Niels Henrik Abel (1941) Alexander Keewatin Dewdney	RM055
	6	W	(1638) Nicolas Malebranche (1741) John Wilson	RM283
	7	T	(1868) Ladislaus Josephowitsch Bortkiewitz	
	8	F	(1902) Paul Adrien Maurice Dirac (1931) Sir Roger Penrose (1974) Manjul Bhargava	RM103 RM189
	9	S	(1537) Francesco Barozzi (Franciscus Barocius) (1940) Linda Goldway Keen	RM223
	10	S	(1602) Gilles Personne de Roberval (1901) Franco Dino Rasetti (1917) Nikolai Sergeevitch Krylov (1926) Carol Ruth Karp	RM235 RM286
33	11	M	(1730) Charles Bossut (1842) Enrico D'Ovidio	RM259
	12	T	(1882) Jules Antoine Richard (1887) Erwin Rudolf Josef Alexander Schrödinger	RM103
	13	W	(1625) Erasmus Bartholin (1819) George Gabriel Stokes (1861) Cesare Burali-Forti	RM187
	14	T	(1530) Giovanni Battista Benedetti (1842) Jean Gaston Darboux (1865) Guido Castelnuovo (1866) Charles Gustave Nicolas de La Vallée-Poussin	
	15	F	(1863) Aleksei Nikolaevich Krylov (1892) Louis Pierre Victor Duc de Broglie (1901) Piotr Sergeevich Novikov	RM286 RM175
	16	S	(1773) Louis-Benjamin Francoeur (1821) Arthur Cayley	
	17	S	(1601) Pierre de Fermat	RM091
34	18	M	(1685) Brook Taylor	
	19	T	(1646) John Flamsteed (1739) Georg Simon Klügel	
	20	W	(1710) Thomas Simpson (1863) Corrado Segre	RM247
	21	T	(1789) Augustin-Louis Cauchy	RM127
	22	F	(1647) Denis Papin	
	23	S	(1683) Giovanni Poleni (1829) Moritz Benedikt Cantor (1842) Osborne Reynolds	
	24	S	(1561) Bartholomeo Pitiscus (1942) Karen Keskulla Uhlenbeck	RM163
35	25	M	(1561) Philip Van Lansberge (1844) Thomas Muir	RM199
	26	T	(1728) Johann Heinrich Lambert (1875) Giuseppe Vitali (1965) Marcus Peter Francis du Sautoy	
	27	W	(1858) Giuseppe Peano	RM067
	28	T	(1796) Irénée Jules Bienaymé (1862) Roberto Marcolongo	RM187
	29	F	(1904) Leonard Roth	
	30	S	(1703) Giovanni Ludovico Calandrini (1856) Carle David Tolmé Runge (1906) Olga Taussky-Todd	RM186 RM139
	31	S	(1821) Hermann Ludwig Ferdinand von Helmholtz (1885) Herbert Westren Turnbull	RM211



Putnam 2010, B2

Given that $A, B,$ and C are noncollinear points in the plane with integer coordinates such that the distances $AB, AC,$ and BC are integers, what is the smallest possible value of AB ?

Gauss Facts (Heath & Dolphin)

Gauss once started falling asleep in his complex analysis class. The result... Singularities.

Mathematical Nursery Rhymes (Graham)

Hey diddle, diddle,
The cat and the fiddle,
The cow jumped into the blue;
Her leap into action
Took plenty of traction
The product of Force times mew.

Until now the theory of infinite series in general has been very badly grounded. One applies all the operations to infinite series as if they were finite; but is that permissible? I think not. Where is it demonstrated that one obtains the differential of an infinite series by taking the differential of each term? Nothing is easier than to give instances where this is not so.

Niels Henrik Abel

The renewal of mathematics in the 17th century is linked to the rebirth of experimental sciences. In this perspective, the teacher should point out how the fundamental concepts of modern mathematics, that of function in particular, are suggested by observational sciences and, later specified by mathematics, have in turn exerted a beneficial influence on the development of this.

Guido Castelnuovo

The mathematician plays a game in which he himself invents the rules while the physicist plays a game in which the rules are provided by nature, but as time goes on it becomes increasingly evident that the rules which the mathematician finds interesting are the same as those which nature has chosen.

Paul Adrien Maurice Dirac

They said that numbers rule the world. Maybe. But I am sure that numbers show us whether it is governed well or badly.

Wolfgang Goethe

Asking what the "probability" of an event is seems to be a more "modern", "scientist" way of facing the world. But it hides nothing other than the banal question "What will happen?" The choice to introduce probability makes the question even more difficult to treat rigorously.

Furio Honsell

36	1	M	(1647) Giovanni Ceva (1659) Joseph Saurin (1835) William Stanley Jevons	RM203
	2	T	(1878) Mauriche René Frechet (1923) René Thom	RM080
	3	W	(1814) James Joseph Sylvester (1884) Solomon Lefschetz (1908) Lev Semenovich Pontryagin	RM104
	4	T	(1809) Luigi Federico Menabrea	RM150
	5	F	(1667) Giovanni Girolamo Saccheri (1725) Jean-Étienne Montucla	RM128
	6	S	(1859) Boris Jakovlevich Bukreev (1863) Dimitri Aleksandrovich Grave	
	7	S	(1707) George Louis Leclerc Comte de Buffon (1948) Cheryl Elisabeth Praeger (1955) Efim Zelmanov	
37	8	M	(1584) Gregorius Saint-Vincent (1588) Marin Mersenne	RM092
	9	T	(1860) Frank Morley (1914) Marjorie Lee Browne	
	10	W	(1839) Charles Sanders Peirce	RM123
	11	T	(1623) Stefano degli Angeli (1798) Franz Ernst Neumann (1877) Sir James Hopwood Jeans	RM224
	12	F	(1891) Antoine André Louis Reynaud (1894) Dorothy Maud Wrinch (1900) Haskell Brooks Curry	RM260 RM212
	13	S	(1873) Constantin Carathéodory (1885) Wilhelm Johann Eugen Blaschke	
	14	S	(1858) Henry Burchard Fine (1891) Ivan Matveevich Vinogradov	
38	15	M	(973) Abu Arrayhan Muhammad Ibn Ahmad Al'Biruni (1886) Paul Pierre Levy	RM164
	16	T	(1494) Francisco Maurolico (1736) Johann Nikolaus Tetens	RM296
	17	W	(1743) Marie Jean Antoine Nicolas de Caritat de Condorcet (1826) Georg Friedrich Bernhard Riemann	RM176 RM068
	18	T	(1752) Adrien-Marie Legendre	RM140
	19	F	(1749) Jean-Baptiste Delambre	
	20	S	(1842) Alexander Wilhelm von Brill (1861) Frank Nelson Cole	
	21	S	(1899) Juliusz Pawel Schauder (1917) Phyllis Nicolson	
39	22	M	(1765) Paolo Ruffini (1769) Louis Puissant (1803) Jaques Charles Francois Sturm	RM116
	23	T	(1768) William Wallace (1900) David Van Dantzig	
	24	W	(1501) Girolamo Cardano (1625) Johan de Witt (1801) Michail Vasilevich Ostrogradski (1862) Winifred Edgerton Merrill (1945) Ian Nicholas Stewart	RM064 RM188 RM056 RM236
	25	T	(1819) George Salmon (1888) Stefan Mazurkiewicz	
	26	F	(1688) Willem Jakob 's Gravesande (1854) Percy Alexander Macmahon (1891) Hans Reichenbach	
	27	S	(1855) Paul Émile Appell (1876) Earle Raymond Hedrick (1919) James Hardy Wilkinson	
	28	S	(1698) Pierre Louis Moreau de Maupertuis (1761) Ferdinand François Desiré Budan de Boislaurent (1873) Julian Lowell Coolidge	RM152
40	29	M	(1540) François Viète (1561) Adriaan Van Roomen (1812) Adolph Gopel	RM200 RM200
	30	T	(1775) Robert Adrain (1829) Joseph Wolstenholme (1883) Ernst Hellinger (1891) Otto Yuljevich Schmidt	RM248



Putnam 2010, B3

There are 2010 boxes labeled $B_1, B_2, \dots, B_{2010}$, and 2010n balls have been distributed among them, for some positive integer n . You may redistribute the balls by a sequence of moves, each of which consists of choosing an i and moving *exactly* i balls from box B_i into any one other box. For which values of n is it possible to reach the distribution with exactly n balls in each box, regardless of the initial distribution of balls?

Gauss Facts (Heath & Dolphin)

Imaginary numbers are simply those that Gauss has not deemed worthy of existence.
The shortest distance between two points is Gauss.

Mathematical Nursery Rhymes (Graham)

Little Jack Horner sat in a corner
Trying to evaluate π .
He disdained rule of thumb,
Found an infinite sum,
And exclaimed "It's REAL, nary an i ".

There is probably no other science which presents so different an aspect to its practitioners and to its non-practitioners as mathematics. To the latter it is ancient, venerable, and complete; a body of dry, irrefutable, unambiguous reasoning. To the mathematician, on the other hand, the science is still in the full bloom of its vigorous youth.

C.H. Chapman

When mathematical ideas first appear, no one really understands them well, which is natural since they are new. And no one wants to struggle to sort out all the logical minutiae and make sense of these ideas until they are convinced that it is all worth it.

Jack Cohen, Terry Pratchett, Ian Stewart

Teach to the problem, not to the text.

E. Kim Nebeuts

This trend [emphasizing applied mathematics over pure mathematics] will make the queen of the sciences into the quean of the sciences.

Leonard Magruder Passano

All human events are based on probabilities, and the same is true everywhere.

Charles Sanders Peirce

The mathematics taught in secondary schools is very little compared to how much of it does not enter there, nor can enter there, but it is far from being a trifle in the general framework of culture.

Gaetano Scorza

To see why math is fun, you have to find the right perspective. You have to stop being intimidated by symbols and jargon, and focus on the ideas; you have to think of math as a friend, not an enemy. I'm not saying that math is always joyful fun; but you should be able to enjoy it, no matter what level you operate at.

Ian Nicholas Stewart

1	W	(1671) Luigi Guido Grandi (1898) Bela Kerekjarto' (1912) Kathleen Timpson Ollerenshaw	RM177
2	T	(1825) John James Walker (1908) Arthur Erdélyi	
3	F	(1944) Pierre René Deligne	
4	S	(1759) Louis Francois Antoine Arbogast (1797) Jerome Savary	
5	S	(1732) Nevil Maskelyne (1781) Bernhard Placidus Johann Nepomuk Bolzano (1861) Thomas Little Heath	RM117
41	6	M	(1552) Matteo Ricci RM141 (1831) Julius Wilhelm Richard Dedekind RM081 (1908) Sergei Lvovich Sobolev
7	T	(1885) Niels Bohr	RM063
8	W	(1908) Hans Arnold Heilbronn	
9	T	(1581) Claude Gaspard Bachet de Meziriac RM201 (1704) Johann Andrea von Segner (1854) Mihajlo Idvorski Pupin RM297 (1873) Karl Schwarzschild RM153 (1949) Fan Rong K Chung Graham RM110	
10	F	(1731) Henry Cavendish RM273 (1861) Heinrich Friedrich Karl Ludwig Burkhardt	
11	S	(1675) Samuel Clarke (1777) Barnabè Brisson (1881) Lewis Fry Richardson (1885) Alfred Haar (1910) Cahit Arf	RM261
12	S	(1860) Elmer Sperry	
42	13	M	(1890) Georg Feigl (1893) Kurt Werner Friedrich Reidemeister (1932) John Griggs Thomson
14	T	(1687) Robert Simson (1801) Joseph Antoine Ferdinand Plateau (1868) Alessandro Padoa	
15	W	(1608) Evangelista Torricelli RM165 (1735) Jesse Ramsden (1776) Peter Barlow (1931) Eléna Wexler-Kreindler	
16	T	(1879) Philip Edward Bertrand Jourdain	
17	F	(1759) Jacob (II) Bernoulli RM093 (1888) Paul Isaac Bernays	
18	S	(1945) Margaret Dusa Waddington Mcduff	RM249
19	S	(1903) Jean Frédéric Auguste Delsarte (1910) Subrahmanyam Chandrasekhar	RM153
43	20	M	(1632) Sir Christopher Wren RM105 (1863) William Henry Young (1865) Aleksandr Petrovich Kotelnikov
21	T	(1677) Nicolaus (I) Bernoulli RM093 (1823) Enrico Betti RM150 (1855) Giovan Battista Guccia RM129 (1893) William Leonard Ferrar (1914) Martin Gardner	RM137
22	W	(1587) Joachim Jungius RM285 (1895) Rolf Herman Nevanlinna (1907) Sarvadaman Chowla	
23	T	(1865) Piers Bohl (1960) Rossella Panarese	RM311
24	F	(1804) Wilhelm Eduard Weber (1873) Edmund Taylor Whittaker	
25	S	(1811) Évariste Galois	RM069
26	S	(1849) Ferdinand Georg Frobenius (1857) Charles Max Mason (1911) Shiing-Shen Chern	
44	27	M	(1678) Pierre Remond de Montmort (1856) Ernest William Hobson
28	T	(1804) Pierre François Verhulst	
29	W	(1925) Klaus Roth	
30	T	(1906) Andrej Nikolaevich Tichonov (1946) William Paul Thurston	RM237
31	F	(1711) Laura Maria Caterina Bassi RM189 (1815) Karl Theodor Wilhelm Weierstrass RM057 (1935) Ronald Lewis Graham RM110	



Putnam 2010, B4

Find all pairs of polynomials $p(x)$ and $q(x)$ with real coefficients for which

$$p(x)q(x+1) - p(x+1)q(x) = 1.$$

Gauss Facts (Heath & Dolphin)

Once, while playing chess, Gauss solved the Knights Problem in six moves.

Mathematical Nursery Rhymes (Graham)

RUB-A-DUB-DUB

Three men in a tub

Useful volume a tub must be

Weight of tub plus the fellows

(If you disregard billows)

Over specific weight of the sea.

The black holes of nature are the most perfect macroscopic objects there are in the universe: the only elements in their construction are our concepts of space and time.

Subrahmanyam Chandrasekhar

...Organization is of the utmost importance for military affairs, as it is ... for other disciplines where the gathering process of practical knowledge exceeds the strength of any individual. In mathematics, however, organizing talent plays a most subordinate role. Here weight is carried only by the individual. The slightest idea of a Riemann or a Weierstrass is worth more than all organisational endeavours. To be sure, such endeavours have pushed to take centre stage in recent years, but they are exclusively pursued by people who have nothing, or nothing more, to offer in scientific matters. There is no royal road to mathematics.

Georg Frobenius

The trouble with integers is that we have examined only the very small ones. Maybe all the exciting stuff happens at really big numbers, ones we can't even begin to think about in any very definite way. Our brains have evolved to get us out of the rain, find where the berries are, and keep us from getting killed. Our brains did not evolve to help us grasp really large numbers or to look at things in a hundred thousand dimensions.

Ronald Lewis Graham

Man transcends other creatures because he is endowed with a spiritual soul within himself, and the ability to observe the principles of things without.

Matteo Ricci

We have made many glass vessels... with tubes two cubits long. These were filled with mercury, the open end was closed with the finger, and the tubes were then inverted in a vessel where there was mercury.

Evangelista Torricelli

The more I meditate on the principles of the theory of functions – and I do this unremittingly – the stronger becomes my conviction that the foundations upon which these must be built are the truths of Algebra...

Karl Theodor Wilhelm Weierstrass

1	S	(1535) Giambattista della Porta	RM226	
2	S	(1815) George Boole (1826) Henry John Stephen Smith	RM094	
45	3	M	(1867) Martin Wilhelm Kutta (1878) Arthur Byron Coble (1896) Raymond Louis Wilder (1906) Carl Benjamin Boyer	
4	T	(1744) Johann (III) Bernoulli (1865) Pierre Simon Girard	RM093	
5	W	(1848) James Whitbread Lee Glaisher (1930) John Frank Adams		
6	T	(1906) Emma Markovna Trotskaia Lehmer	RM215	
7	F	(1660) Thomas Fantet de Lagny (1799) Karl Heinrich Graffe (1867) Maria Skłodowska Curie (1878) Lise Meitner (1898) Raphael Salem	RM182 RM238	
8	S	(1656) Edmond Halley (1781) Giovanni Antonio Amedeo Plana (1846) Eugenio Bertini (1848) Friedrich Ludwig Gottlob Frege (1854) Johannes Robert Rydberg (1869) Felix Hausdorff	RM190 RM154 RM274 RM178	
9	S	(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	RM202 RM082 RM144	
46	10	M	(1829) Helwin Bruno Christoffel	
11	T	(1904) John Henry Constantine Whitehead		
12	W	(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	F	(1845) Ulisse Dini (1919) Paulette Libermann (1975) Martin Hairer	RM189	
15	S	(1688) Louis Bertrand Castel (1793) Michel Chasles (1794) Franz Adolph Taurinus		
16	S	(1835) Eugenio Beltrami	RM262	
47	17	M	(1597) Henry Gellibrand (1717) Jean-Baptiste Le Rond D'Alembert (1790) August Ferdinand Möbius (1902) Eugene Wigner	RM166 RM118 RM298
18	T	(1872) Giovanni Enrico Eugenio Vacca (1927) Jon Leslie Britton		
19	W	(1894) Heinz Hopf (1900) Michail Alekseevich Lavrentev (1901) Nina Karlovna Bari	RM214	
20	T	(1889) Edwin Powell Hubble (1924) Benoît Mandelbrot (1963) William Timothy Gowers		
21	F	(1867) Dimitri Sintsov		
22	S	(1803) Giusto Bellavitis (1840) Émile Michel Hyacinthe Lemoine	RM310	
23	S	(1616) John Wallis (1820) Issac Todhunter (1917) Elizabeth Leonard Scott	RM070 RM106	
48	24	M	(1549) Duncan Maclaren Young Sommerville (1909) Gerhard Gentzen	
25	T	(1841) Fredrich Wilhelm Karl Ernst Schröder (1873) Claude Louis Mathieu (1943) Evelyn Merle Roden Nelson		
26	W	(1894) Norbert Wiener (1946) Enrico Bombieri	RM172	
27	T	(1867) Arthur Lee Dixon		
28	F	(1898) John Wishart		
29	S	(1803) Christian Andreas Doppler (1849) Sir Horace Lamb (1879) Nikolay Mitrofanovich Krylov	RM250 RM286	
30	S	(1549) Sir Henry Savile (1969) Matilde Marcolli	RM142	



Putnam 2010, B5

Is there a strictly increasing function $f: \mathbb{R} \rightarrow \mathbb{R}$ such that $f'(x) = f(f(x))$ for all x ?

Gauss Facts (Heath & Dolphin)

Gauss is neither a Frequentist nor a Bayesian. For Gauss, the probability is always 1. Fermat once made Gauss angry. The result... Fermat's Last Theorem.

Mathematical Nursery Rhymes (Graham)

Jack be nimble, Jack be quick,
Jack jump over the candlestick.
But figure out β and also time T
"a" due to gravity, velocity V ,
And don't forget $y=VT\sin\beta$
Minus $\frac{1}{2} aT^2$, or you'll regret later.
Figure trajectory right to the inch
Or it may be a "sinige" instead of a cinch!

Pure mathematics is a collection of hypothetical, deductive theories, each consisting of a precise system of primitive, undefined concepts or symbols, and of primitive, unproved non-contradictory assumptions (usually called axioms), together with the consequences logically deducible from them by rigidly deductive processes without any appeal to intuition.

George Hamlin Fitch

Example of a math recommendation letter:

Dear Director,
I am writing this letter to introduce you to John Smith, who has applied for a position in your department. I begin immediately to tell you that I am not able to recommend him enough. In fact, I don't have any of my students to compare him to, and I am sure you will be surprised by his mathematical knowledge. His thesis is the kind of work you don't expect to see nowadays; it shows in a very clear way what his abilities are. Finally let me tell you that you will be lucky if you can make him work for you.
In faith,

A. D. Visor (Prof.)

The predominant use of the letter x to represent an unknown value came about in an interesting way. While printing La géométrie... the printer faced a dilemma. As he was printing the text, he ran out of the last letters of the alphabet. He asked Descartes if it mattered whether x, y, or z was used in each of the book's many equations. Descartes replied that it made no difference which of the three letters was used to indicate an unknown quantity. The printer chose x for most of the unknowns, because the letters y and z are used in the French language more often than x.

Art Johnson

"Do we know what sequence of numbers this is? All right, let's see, we can work it out in our heads... fifty-nine, sixty-one, sixty-seven... seventy-one... Aren't they all prime numbers?" A buzz of excitement spread through the control room. Ellie's face flashed a flicker of intense emotion, but it was quickly replaced by a sober expression, a fear of being overwhelmed, a fear of appearing foolish, unscientific.

Carl Sagan

49	1	M	(1792) Nikolay Yvanovich Lobachevsky (1847) Christine Ladd-Franklin	RM083	
	2	T	(1831) Paul David Gustav du Bois-Reymond (1901) George Frederick James Temple		
	3	W	(1903) Sidney Goldstein (1924) John Backus		
	4	T	(1795) Thomas Carlyle		
	5	F	(1868) Arnold Johannes Wilhelm Sommerfeld (1901) Werner Karl Heisenberg (1907) Giuseppe Occhialini	RM275 RM155 RM122	
	6	S	(1682) Giulio Carlo Fagnano dei Toschi		
	7	S	(1823) Leopold Kronecker (1830) Antonio Luigi Gaudenzio Giuseppe Cremona (1924) Mary Ellen Rudin	RM239 RM150	
50	8	M	(1508) Regnier Gemma Frisius (1865) Jaques Salomon Hadamard (1919) Julia Bowman Robinson	RM263 RM227	
	9	T	(1883) Nikolai Nikolaievich Luzin (1906) Grace Brewster Murray Hopper (1917) Sergei Vasilovich Fomin	RM214	
	10	W	(1804) Karl Gustav Jacob Jacobi (1815) Augusta Ada King Countess Of Lovelace	RM251 RM059	
	11	T	(1882) Max Born	RM155	
	12	F	(1832) Peter Ludwig Mejdell Sylow (1913) Emma Castelnuovo	RM191	
	13	S	(1724) Franz Ulrich Theodosius Aepinus (1887) George Pólya	RM131	
	14	S	(1546) Tycho Brahe		
	51	15	M	(1802) János Bolyai (1923) Freeman John Dyson	RM083
		16	T	(1804) Wiktor Yakovievich Bunyakowsky	
		17	W	(1706) Gabrielle Émilie Le Tonnelier de Breteuil du Châtelet (1835) Felice Casorati (1842) Marius Sophus Lie (1900) Dame Mary Lucy Cartwright	RM299
		18	T	(1856) Joseph John Thomson (1917) Roger Lyndon (1942) Lenore Blum	RM161
		19	F	(1783) Charles Julien Brianchon (1854) Marcel Louis Brillouin (1887) Charles Galton Darwin	RM138
		20	S	(1494) Oronce Fine (1648) Tommaso Ceva (1737) Tommaso Valperga di Caluso (1875) Francesco Paolo Cantelli	RM203 RM287
		21	S	(1878) Jan Łukasiewicz (1921) Edith Hirsch Luchins (1932) John Robert Ringrose	
52		22	M	(1824) Francesco Brioschi (1859) Otto Ludwig Hölder (1869) Dimitri Fedorovich Egorov (1877) Tommaso Boggio (1887) Srinivasa Aiyangar Ramanujan	RM150 RM214
		23	T	(1872) Georgii Yurii Pfeiffer	
		24	W	(1822) Charles Hermite (1868) Emmanuel Lasker	RM095 RM167
		25	T	(1642) Isaac Newton (1900) Antoni Zygmund	RM071
	26	F	(1780) Mary Fairfax Greig Somerville (1791) Charles Babbage (1937) John Horton Conway	RM059 RM119	
	27	S	(1571) Johannes Kepler (1654) Jacob (Jacques) Bernoulli	RM093	
	28	S	(1808) Louis Victoire Athanase Dupré (1882) Arthur Stanley Eddington (1903) John von Neumann	RM179 RM107	
	53	29	M	(1856) Thomas Jan Stieltjes	
		30	T	(1897) Stanislaw Saks	
		31	W	(1872) Volodymyr Levitsky (1896) Carl Ludwig Siegel (1945) Leonard Adleman (1952) Vaughan Frederick Randall Jones	RM143



Putnam 2010, B6

Let A be an $n \times n$ matrix of real numbers for some $n \geq 1$. For each positive integer k , let $A^{[k]}$ be the matrix obtained by raising each entry to the k^{th} power. Show that if $A^k = A^{[k]}$ for $k = 1, 2, \dots, n+1$, then $A^k = A^{[k]}$ for all $k \geq 1$.

Gauss Facts (Heath & Dolphin)

In Gauss' mind, there is no such branch of mathematics as "Number Theory". This is because he knows it as "Number Facts".

Mathematical Nursery Rhymes (Graham)

Little Miss Muffet
Sat on a tuffet
Counting her surds, and say,
Along came a binar
And counted beside her,
Which frightened Miss Muffet away.

The difficulty involved in the proper and adequate means of describing changes in continuous deformable bodies is the method of differential equations. ... They express mathematically the physical concept of contiguous action.

Max Born

Mathematicians want to believe in the unity, universality, certainty, and objectivity of their discipline, just as Americans want to believe in the Constitution and Free Enterprise, or other nations in their Gracious Queen and their Glorious Revolution.

Reuben Hersh

Man muss immer generalisieren: We must always generalize.

Karl Gustav Jacob Jacobi

What is the purpose of demonstrations? What a question, they are needed because if there were no demonstrations there would be no theorems. Mathematicians would limit themselves to proclaiming statements: «2+2=4», «the square built on the hypotenuse is equal to the sum of the squares built on the legs», «the continuum has cardinality \aleph_1 », «continuous functions are differentiable», « $x^n + y^n = z^n$ has no solutions for $n > 2$ », competing to see who shouts the loudest to sell them, genuine or flawed, like at the market.

Gabriele Lolli

Are not gross bodies and light convertible into one another; and may not bodies receive much of their activity from the particles of light which enter into their composition? The changing of bodies into light, and light into bodies, is very conformable to the course of Nature, which seems delighted with transmutations.

Isaac Newton

Refined mathematics, presented in a refined form, seems to be something purely deductive, made up only of demonstration. Yet mathematics, in its making, resembles all other human knowledge in its making. You have to guess the theorem before you can prove it; you have to have an idea of the proof before you can develop its details. You have to combine observation and follow analogies; you have to try and try again.

George Polya