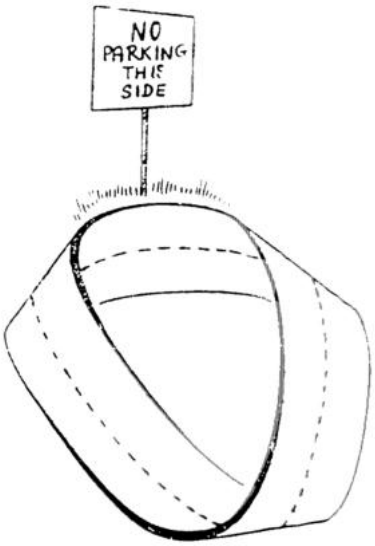
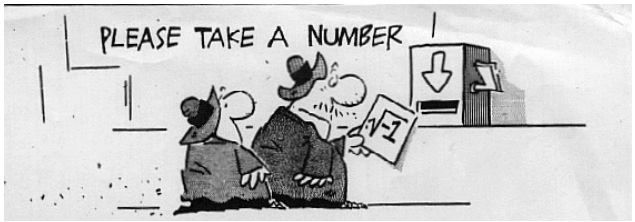
$$x^4-8176x^3+25065656x^2-34150792256x+17446960811280=0$$

"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!"



— James R. Martino



January

1	**1**	M	(1803) Guglielmo LIBRI Carucci dalla Somaja (1878) Agner Krarup ERLANG (1894) Satyendranath BOSE (1912) Boris GNEDENKO
	2	M	(1822) Rudolf Julius Emmanuel CLAUSIUS (1905) Lev Genrichovich SHNIRELMAN (1938) Anatoly SAMOILENKO
	3	G	(1917) Yuri Alexeievich MITROPOLSHY
	4	V	(1643) Isaac NEWTON
	5	S	(1838) Marie Ennemond Camille JORDAN (1871) Federigo ENRIQUES (1871) Gino FANO
	6	D	(1807) Jozeph Mitza PETZVAL (1841) Rudolf STURM
2	**7**	M	(1871) Felix Edouard Justin Emile BOREL (1907) Raymond Edward Alan Christopher PALEY
	8	T	(1888) Richard COURANT (1924) Paul Moritz COHN (1942) Stephen William HAWKING
	9	W	(1864) Vladimir Adreievich STELKOV
	10	T	(1875) Issai SCHUR (1905) Ruth MOUFANG
	11	F	(1545) Guidobaldo DEL MONTE (1707) Vincenzo RICCATI (1734) Achille Pierre Dionis DU SEJOUR
	12	S	(1906) Kurt August HIRSCH
	13	S	(1864) Wilhelm Karl Werner Otto Fritz Franz WIEN (1876) Luther Pfahler EISENHART (1876) Erhard SCHMIDT
3	**14**	M	(1902) Alfred TARSKI
	15	T	(1704) Johann CASTILLON (1717) Mattew STEWART (1850) Sofia Vasilievna KOVALEVSKAJA
	16	W	(1801) Thomas KLAUSEN
	17	T	(1847) Nikolay Egorovich ZUKOWSKY (1858) Gabriel KOENIGS
	18	F	(1856) Luigi BIANCHI (1880) Paul EHRENFEST
	19	S	(1813) Rudolf Friedrich Alfred CLEBSCH (1879) Guido FUBINI (1908) Aleksandr Gennadievich KUROS
	20	S	(1775) Andre` Marie AMPERE (1895) Gabor SZEGO (1904) Renato CACCIOPPOLI
4	**21**	M	(1846) Pieter Hendrik SCHOUTE (1915) Yuri Vladimirovich LINNIK
	22	T	(1592) Pierre GASSENDI (1908) Lev Davidovich LANDAU
	23	W	(1840) Ernst ABBE (1862) David HILBERT
	24	T	(1891) Abram Samoilovitch BESICOVITCH (1914) Vladimir Petrovich POTAPOV
	25	F	(1627) Robert BOYLE (1736) Joseph-Louis LAGRANGE (1843) Karl Herman Amandus SCHWARTZ
	26	S	(1799) Benoit Paul Emile CLAPEYRON
	27	S	(1832) Charles Lutwidge DOGSON
5	**28**	M	(1701) Charles Marie de LA CONDAMINE (1892) Carlo Emilio BONFERRONI
	29	T	(1817) William FERREL (1888) Sidney CHAPMAN
	30	W	(1619) Michelangelo RICCI
	31	T	(1715) Giovanni Francesco FAGNANO dei Toschi (1841) Samuel LOYD (1896) Sofia Alexandrovna JANOWSKAJA

18º USAMO (1989) - 5

Let $\boldsymbol{u}$ and $\boldsymbol{v}$ real numbers such that:

$$\sum_{i=1}^{8} u^i + 10 * u^9 =$$

$$= \sum_{i=1}^{10} v^i + 10 * v^{11} = 8$$

Determine -with proof- which of the two numbers -$\boldsymbol{u}$ or $\boldsymbol{v}$- is larger

There are only two types of people in the world: those that don't do math and those that take care of them.

A mathematician confided
That a Moebius strip is one-sided
You' get quite a laugh
If you cut it in half,
For it stay in one piece when divided.

A mathematician's reputation rests on the number of bad proofs he has given.

Abram BESICOVICH

If you are afraid of something, measure it, and you will realize it is a mere triple

Renato CACCIOPPOLI

Someone told me that each equation I included in a book would halve the sales.

Stephen HAWKING

God not only plays dice. He also sometimes throws the dice were they cannot be seen.

Stephen HAWKING

"When I use a word," Humpty Dumpty said, in a rather scornful tone, "it means just what I choose it to mean, neither more or less". "The question is," said Alice, "wether you can make words mean so many different things"."The question is," said Humpty Dumpty, "wich is to be master; that's all".

Charles DOGSON

When we ask advice, we are usually looking for an accomplice.

Joseph-Louis LAGRANGE

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

Isaac NEWTON

February

5	**1**	F	(1900) John Charles BURKILL
	2	S	(1522) Lodovico FERRARI
	3	S	(1893) Gaston Maurice JULIA
6	**4**	M	(1905) Eric Cristopher ZEEMAN
	5	T	(1757) Jean Marie Constant DUHAMEL
	6	W	(1612) Antoine ARNAULD (1695) Nicolaus (II) BERNOULLI
	7	T	(1877) Godfried Harold HARDY (1883) Eric Temple BELL
	8	F	(1700) Daniel BERNOULLI (1875) Francis Ysidro EDGEWORTH
	9	S	(1775) Farkas Wolfgang BOLYAI (1907) Harod Scott MacDonald COXETER
	10	S	(1747) Aida YASUAKI
7	**11**	M	(1800) William Henry Fox TALBOT (1839) Josiah Willard GIBBS (1915) Richard Wesley HAMMING
	12	T	(1914) Hanna CAEMMERER NEUMANN
	13	W	(1805) Johann Peter Gustav Lejeune DIRICHLET
	14	T	(1468) Johann WERNER (1849) Hermann HANKEL (1896) Edward Artur MILNE
	15	F	(1564) Galileo GALILEI (1861) Alfred North WHITEHEAD
	16	S	(1822) Francis GALTON (1853) Georgorio RICCI-CURBASTRO (1903) Beniamino SEGRE
	17	S	(1890) Sir Ronald Aymler FISHER (1891) Adolf Abraham Halevi FRAENKEL
8	**18**	M	(1404) Leon Battista ALBERTI
	19	T	(1473) Nicolaus COPERNICUS
	20	W	(1844) Ludwig BOLTZMANN
	21	T	(1591) Girard DESARGUES (1915) Evgenni Michailovitch LIFSHITZ
	22	F	(1903) Frank Plumpton RAMSEY
	23	S	(1583) Jean-Baptiste MORIN (1951) Shigefumi MORI
	24	S	(1871) Felix BERNSTEIN
9	**25**	M	(1827) Henry WATSON
	26	T	(1786) Dominique Francois Jean ARAGO
	27	W	(1881) Luitzen Egbertus Jan BROUWER
	28	T	(1735) Alexandre Theophile VANDERMONDE
			(1860) Herman HOLLERITH

19º USAMO (1990) - 4

Find -with proof- the number of positive integers whose base-***n*** representation consists of distinct digits with the property that -except for the leftmost digit- every digit differ by ±1 from some digit further to the left (Your answer should be an explicit function of ***n*** in the simplest form).

Philosophy is a game with objectives and no rules.
Mathematics is a game with rules and no objectives

Consider the pitiful plight
Of a runner who wasn't too bright
But he sprinted so fast,
That he vanished at last
By red-shifting himself out of sight

Common sense is not really so common.

Antoine ARNAUD

It would be better for the true physics if there were no mathematicians on hearth.

Daniel BERNOULLI

A mathematician can will recognize Cauchy, Gauss, Jacobi, or Helmohltz after reading a few pages, just as musician recognize, from the first few bars, Mozart, Beethoven or Schubert.

Ludwig BOLTZMANN

Whenever you can, count.

Francis GALTON

One of the principle objects of research in my department of knowledge is to find the point of view from which the subject appears in the greatest simplicity.

Willard GIBBS

I am interested in mathematics only as a creative art.

Godfried HARDY

March

9	**1**	F	(1611) John PELL
	2	S	(1836) Julius WEINGARTEN
	3	S	(1838) George William HILL (1845) Georg CANTOR
10	**4**	M	(1822) Jules Antoine LISSAJUS
	5	T	(1512) Gerardus MERCATOR (1759) Benjamin GOMPERTZ (1817) Angelo GENOCCHI
	6	W	(1866) Ettore BORTOLOTTI
	7	T	(1792) William HERSCHEL (1824) Delfino CODAZZI
	8	F	(1851) George CHRYSTAL
	9	S	(1818) Ferdinand JOACHIMSTHAL (1900) Howard Hathaway AIKEN
	10	S	(1864) William Fogg OSGOOD
11	**11**	M	(1811) Urbain Jean Joseph LE VERRIER (1853) Salvatore PINCHERLE
	12	T	(1685) George BERKELEY (1824) Gustav Robert KIRKHHOFF (1859) Ernesto CESARO
	13	W	(1861) Jules Joseph DRACH (1957) Rudy D`ALEMBERT
	14	T	(1864) Jozef KURSCHAK (1879) Albert EINSTEIN
	15	F	(1860) Walter Frank Raphael WELDON (1868) Grace CHISOLM YOUNG
	16	S	(1750) Caroline HERSCHEL (1789) Georg Simon OHM (1846) Magnus Gosta MITTAG-LEFFLER
	17	S	(1876) Ernest Benjamin ESCLANGON (1897) Charles FOX
12	**18**	M	(1640) Philippe de LA HIRE (1690) Christian GOLDBACH (1796) Jacob STEINER
	19	T	(1862) Adolf KNESER (1910) Jacob WOLFOWITZ
	20	W	(1840) Franz MERTENS (1884) Philip FRANCK (1938) Sergi Petrovich NOVIKOV
	21	T	(1768) Jean Baptiste Joseph FOURIER (1884) George David BIRKHOFF
	22	F	(1917) Irving KAPLANSKY
	23	S	(1754) Georg Freiherr von VEGA (1882) Emmy Amalie NOETHER (1897) John Lighton SYNGE
	24	S	(1809) Joseph LIOUVILLE (1948) Sun-Yung (Alice) CHANG
13	**25**	M	(1538) Christopher CLAUSIUS
	26	T	(1848) Konstantin ADREEV (1913) Paul ERDOS
	27	W	(1857) Karl PEARSON
	28	T	(1749) Pierre Simon de LAPLACE
	29	F	(1825) Francesco FAA` DI BRUNO (1873) Tullio LEVI-CIVITA (1896) Wilhelm ACKERMAN
	30	S	(1892) Stefan BANACH
	31	S	(1596) Rene` DESCARTES

18º USAMO (1990) - 5

An acute-angle triangle ***ABC*** is given in the plane. The circle with diameter ***AB*** intersects altitude ***CC`*** and its extension at points ***M*** and ***N*** -and and the circle with diameter ***AC*** intersects altitude ***BB`*** and its extension at points ***P*** and ***Q***. Prove that ***M***, ***N***, ***P*** and ***Q*** lie on a common circle.

Algebraic symbols are used when you do not know what you are talking about.

A Calculus student upset as could be
That his antiderivative just didn't agree
With the answer in the book
Even after a second look
Indeed it was off, but by a constant C

Don't worry about people stealing your ideas. If your ideas are any good, you'll have to ram them down people's throats.

Howard AIKEN

A mathematician is a person who can find analogies between theorems; a better mathematician is one who can see analogies between proofs and the best mathematician can notice analogies between theories. One can imagine that the ultimate mathematician is one who can see analogies between analogies.

Stefan BANACH

The essence of mathematics lies in its freedom.

Georg CANTOR

Perfect numbers like perfect men are very rare.

Rene` DESCARTES

It is not enough to have a good mind. The main thing is to use it well.

Rene` DESCARTES

I don't berlieve in mathematics.

Albert EINSTEIN

The search for truth is more precious than its possession.

Albert EINSTEIN

A mathematician is a machine for turning coffe into theorems.

Paul ERDÖS

April

14	**1**	M	(1640) Georg MOHR (1776) Marie-Sophie GERMAIN (1895) Alexander Craig AITKEN
	2	T	(1934) Paul Joseph COHEN
	3	W	(1835) John Howard Van AMRINGE (1892) Hans RADEMACHER (1900) Albert Edward INGHAM (1909) Stanislaw Marcin ULAM (1971) Alice RIDDLE
	4	T	(1809) Benjamin PEIRCE (1842) Francois Edouard Anatole LUCAS (1949) Shing-Tung YAU
	5	F	(1588) Thomas HOBBES (1607) Honore` FABRI (1622) Vincenzo VIVIANI (1869) Sergi Alexeievich CHAPLYGIN
	6	S	
	7	S	(1768) Francais Joseph FRANCAIS
15	**8**	M	(1903) Marshall Harvey STONE
	9	T	(1791) George PEACOCK (1816) Charles Eugene DELAUNAY (1919) John Presper HECKERT
	10	W	(1857) Henry Ernest DUDENEY
	11	T	(1953) Andrew John WILES
	12	F	(1794) Germinal Pierre DANDELIN (1852) Carl Louis Ferdinand Von LINDEMANN (1903) Jan TINBERGEN
	13	S	(1728) Paolo FRISI (1813) Duncan Farquharson GREGORY (1879) Francesco SEVERI
	14	S	(1629) Christiaan HUYGENS
16	**15**	M	(1452) Leonardo da VINCI (1548) Pietro Antonio CATALDI (1707) Leonhard EULER (1809) Herman Gunther GRASSMANN
	16	T	(1682) John HADLEY (1823) Ferdinand Gotthold Max EISENSTEIN
	17	W	(1798) Etienne BOBILLIER (1853) Arthur Moritz SCHONFLIES
	18	T	(1907) Lars Valerian AHLFORS (1918) Hsien Chung WANG (1949) Charles Luois FEFFERMAN
	19	F	(1880) Evgeny Evgenievich SLUTSKY (1883) Richard VIN MISES (1901) Kiyoshi OKA (1905) Charles EHRESMANN
	20	S	(1839) Francesco SIACCI
	21	S	(1652) Michel ROLLE (1774) Jean Baptiste BIOT (1875) Teiji TAKAGI
17	**22**	M	(1811) Otto Ludwig HESSE (1887) Harald August BOHR
	23	T	(1858) Max Karl Ernst Ludwig PLANCK
	24	W	(1863) Giovanni VAILATI
	25	T	(1849) Felix Christian KLEIN (1900) Wolfgang PAULI (1903) Andrei Nicolayevich KOLMOGOROV
	26	F	(1889) Ludwig Josef Johan WITTENGSTEIN
	27	S	(1755) Marc-Antoine PARSEVAL des Chenes
	28	S	(1906) Kurt GODEL
18	**29**	M	(1854) Jules Henri POINCARE`
	30	T	(1777) Johann Carl Friedrich GAUSS (1916) Claude Elwood SHANNON

20° USAMO (1991) - 2

For any nonempty set S of numbers, let $\sigma(S)$ and $\pi(S)$ denote the sum and product (respectively) of the elements of S. Prove that:

$$\sum \frac{\sigma(S)}{\pi(S)} = \left(n^2+2n\right)-(n+1)\sum_{i=1}^{n}\frac{1}{i}$$

Where "Σ" denotes a sum involving all nonempty subsets S of $\{1,2,3,\ldots,n\}$

The law of the excluded middle either rules or does not rule, O.K.?

If you integrate zee squared dee zee
From one to the cube root of three
Multiplied by cosine
Of three pi over nine
You get natural log of the cube root of e

Point set topology is a disease from which the uman race will soon recover.

Henri POINCARE`

The notion of a set is too vague for the continuum hypothesis to have a positive or negative answer.

Paul COHEN

[upon losing the use of his right eye]
Now I will have less distraction

Leonhard EULER

The total number of Dirichlet's publications is not large: jewels are not weighed on a grocery store.

Carl Friedrich GAUSS

I don't believe in natural science

Kurt GODEL

There is more in Mersenne than in all the universities together

Thomas HOBBES

Everyone knows what a curve is, until he has studied enough mathematics to become confused through the countless number of possible exceptions.

Felix KLEIN

The facrt that the author thinks slowly is not serious, but the fact that it publishes faster than he thinks is inexcusable

Wolfgang PAULI

May

18	**1**	W	(1825) Johann Jacob BALMER
	2	T	(1860) D`Arcy Wentworth THOMPSON (1905) Kazimierz ZARANKIEWITZ
	3	F	(1842) Otto STOLZ (1860) Vito VOLTERRA
	4	S	(1845) William Kingdon CLIFFORD
	5	S	(1833) Lazarus Emmanuel FUCHS (1897) Francesco Giacomo TRICOMI
19	**6**	M	(1872) Willem DE SITTER (1906) Andre` VEIL
	7	T	(1926) Alexis Claude CLAIRAUT (1854) Giuseppe VERONESE (1881) Ebenezer CUNNINGHAM (1896) Pavel Sergieievich ALEXANDROV
	8	W	(1859) JOhan Ludwig William Valdemar JENSEN
	9	T	(1746) Gaspard MONGE (1876) Gilbert Ames BLISS
	10	F	(1788) Augustin Jean FRESNEL (1847) William Karl Joseph KILLING (1958) Piotr Rizierovich SILVERBRAHMS
	11	S	(1918) Richard Phillips FEYNMAN
	12	S	(1845) Pierre Rene`Jean Baptiste Henry BROCARD (1902) Frank YATES
20	**13**	M	(1750) Lorenzo MASCHERONI
	14	T	(1832) Rudolf Otto Sigismund LIPSCHITZ (1863) John Charles FIELDS
	15	W	(1939) Brian HARTLEY
	16	T	(1718) Maria Gaetana AGNESI (1821) Pafnuti Lvovi CHEBYSHEV
	17	F	
	18	S	(1850) Oliver HEAVISIDE (1892) Bertrand Arthur William RUSSELL
	19	S	(1919) Georgii Dimitirievich SUVOROV
21	**20**	M	(1861) Henry Seely WHITE
	21	T	(1471) Albrecht DURER (1792) Gustave Gaspard de CORIOLIS
	22	W	(1865) Alfred Cardew DIXON
	23	T	(1914) Lipa BERS
	24	F	
	25	S	(1838) Karl Mikailovich PETERSON
	26	S	(1667) Abraham DE MOIVRE (1896) Yuri Dimitrievich SOKOLOV
22	**27**	M	(1862) John Edward CAMPBELL
	28	T	(1676) Jacopo Francesco RICCATI (1710) Johann (II) BERNOULLI
	29	W	(1882) Harry BATEMAN
	30	T	(1814) Eugene Charles CATALAN
	31	F	(1926) John KEMENY

20º USAMO (1991) - 3

Show that, for any fixed integer $n \geq 1$, the sequence

$$2,\ 2^2,\ 2^{2^2},\ \ldots\ a_k = 2^{a_{k-1}} \pmod{n}$$

is eventually constant.

Engineers think that equations approximate the real world.
Physicists think that the real world approximates equations.
Mathematicians are unable to make the connection ...

A mathematician named Klein
Thought the Mobius band was divine
Said he, "If you glue
The edges of two
You get a weird bottle like mine"

A quantity wich is increased or decreased by an infinitely small quantity is neither increased or decreased.

Johann BERNOULLI

To isolate mathematics from the practical demands of the sciences is to invite the sterility of a cow shut away from the bulls.

Lipa BERS

Where did we get Schrodinger's equation from? It's not possible to derive it from anything you know. It came out of the mind of Schrodinger.

Richard FEYNMAN

Nature is not embarassed by difficulties of analysis.

Augustin FRESNEL

This series is divergent therefore we may be able to do something with it.

Oliver HEAVISIDE

The whole problem with the world is that fools and fanatics are always so certain of themselves, but wiser people so full of doubts.

Bertrand RUSSELL

June

22	**1**	S	(1796) Sadi Leonard Nicolas CARNOT (1851) Edward Bailey ELLIOTT (1899) Edward Charles TITCHMARSH
	2	S	(1895) Tibor RADO`
23	**3**	M	(1659) David GREGORY
	4	T	(1809) John Henry PRATT
	5	W	(1814) Pierre LAurent WANTZEL (1819) John Couch ADAMS
	6	T	(1436) Johann Muller REGIOMONTANUS (1857) Aleksandr Michailovitch LYAPUNOV (1906) Max ZORN
	7	F	(1863) Edward Burr VAN VLECK
	8	S	(1625) Giovanni Domenico CASSINI (1858) Charlotte Angas SCOTT (1860) Alicia Boole STOTT
	9	S	(1885) John Edensor LITTLEWOOD
24	**10**	M	(940) Mohammad ABU`L WAFA Al-Buzjani (1887) Vladimir Ivanovich SMIRNOV
	11	T	(1937) David Bryant MUMFORD
	12	W	(1888) Zygmunt JANYSZEWSKI
	13	T	(1831) James Clerk MAXWELL (1876) William Sealey GOSSET (Student) (1928) John Forbes NASH
	14	F	(1736) Charles Augustin de COULOMB (1856) Andrei Andreyevich MARKOV (1903) Alonzo CHURCH
	15	S	(1640) Bernard LAMY (1894) Nikolai Gregorievich CHEBOTARYOV
	16	S	(1915) John Wilder TUKEY
25	**17**	M	(1898) Maurits Cornelius ESCHER
	18	T	(1858) Andrew Russell FORSYTH (1884) Charles Ernest WEATHERBURN
	19	W	(1623) Blaise PASCAL (1902) Wallace John ECKERT
	20	T	(1873) Alfred LOEWY
	21	F	(1781) Simeon Denis POISSON (1828) Giuseppe BRUNO
	22	S	(1860) Mario PIERI (1864) Hermann MINKOWSKY (1910) Konrad ZUSE
	23	S	(1912) Alan Mathison TURING
26	**24**	M	(1880) Oswald VEBLEN
	25	T	(1908) William Van Orman QUINE
	26	W	(1824) William THOMPSON, Lord Kelvin (1918) Yudell Leo LUKE
	27	T	(1806) Augustus DE MORGAN
	28	F	(1875) Henri Leon LEBESGUE
	29	S	(1888) Aleksandr Aleksandrovich FRIEDMANN
	30	S	(1791) Felix SAVART

20° USAMO (1991) - 4

Let m and n positive integers, and let

$$a = \frac{m^{m+1} + n^{n+1}}{m^m + n^n}$$

Prove that

$$a^m + a^n \geq m^m + n^n.$$

Theorem: All positive integers are interesting.
Proof: Assume the contrary. Then there is a lowest non-interesting positive integer. But, hey, that's pretty interesting! A contradiction.
QED

A challenge for many long ages
Had baffled the savants and sages.
Yet at last came the light:
Seems old Fermat was right:
To the margin add 200 pages

In my opinion, a mathematician, in so far as he is a mathematician, need not preoccupy himself with philosophy... An opinion, moreover, wich has been expressed by many philosophers...

Henri LEBESGUE

Try a hard problem. You may not solve it, but you will prove something else.

John E. LITTLEWOOD

The numbers may be said to rule the whole world of quantity, and the four rules of arithmetic may be regarded as the complete equipment of the mathematician.

James Clerk MAXWELL

The mathematical education of Albert Einstein was not very solid, wich I am in good position to evaluate since he obtained it from me in Zurich some time ago.

Hermann MINKOWSKY

July

27	**1**	M	(1643) Gottfried Wilhelm von LEIBNITZ (1788) Jean Victor PONCELET
	2	T	(1820) William John Racquorn RANKINE (1852) William BURNSIDE
	3	W	(1807) Ernest Jean Philippe Fauque de JONQUIERE (1897) Jesse DOUGLAS
	4	T	(1906) Daniel Edwin RUTHERFORD (1917) Michail Samuilovich LIVSIC
	5	F	
	6	S	(1849) Alfred Bray KEMPE
	7	S	(1816) Johann Rudolf WOLF (1906) William FELLER (1922) Vladimir Aleksandrovich MARCHENKO
28	**8**	M	(1760) Christian KRAMP
	9	T	(1845) George Howard DARWIN
	10	W	(1862) Roger COTES (1868) Oliver Dimon KELLOGG
	11	T	(1857) Sir Joseph LARMOR (1890) Giacomo ALBANESE
	12	F	(1875) Ernest Sigismund FISCHER (1895) Richard BUCKMINSTER FULLER
	13	S	(1527) John DEE (1741) Karl Friedrich HINDENBURG
	14	S	
29	**15**	M	(1865) Wilhelm WIRTINGER (1906) Adolph Andrej Pavlovich YUSHKEVICH
	16	T	(1678) Jakob HERMANN (1903) Irmgard FLUGGE-LOTZ
	17	W	(1831) Victor Mayer Amedee` MANNHEIM (1837) Wilhelm LEXIS
	18	T	(1013) Hermann von REICHENAU (1635) Robert HOOKE (1853) Hendrich Antoon LORENTZ
	19	F	(1768) Francois Joseph SERVOIS
	20	S	
	21	S	(1620) Jean PICARD (1848) Emil WEYR (1849) Robert Simpson WOODWARD
30	**22**	M	(1784) Friedrich Wilhelm BESSEL
	23	T	(1775) Etienne Louis MALUS (1854) Ivan SLEZYNSKY
	24	W	(1851) Friedrich Herman SCHOTTKY (1871) Paul EPSTEIN (1923) Christine Mary HAMILL
	25	T	(1808) Johann Benedict LISTING
	26	F	(1903) Kurt MAHLER
	27	S	(1667) Johann BERNOULLI (1801) George Biddel AIRY (1848) Lorand Baron von EOTVOS (1871) Ernst Friedrich Ferdinand ZERMELO
	28	S	(1954) Gerd FALTINGS
31	**29**	M	
	30	T	
	31	W	(1704) Gabriel CRAMER (1712) Johann Samuel KOENIG

21° USAMO (1992) - 1

Find, as function of n, the sum of the digits of:

$$9 * 99 * 9999 * \cdots * \left(10^{2n} - 1\right)$$

where each factor has twice as many digitsas the previous one.

You know how dumb the average guy is? Well, by definition, half of them are even dumber than that.

Points
Have no part or joints
How then can they combine
To form a line?

Probability is a mathematical discipline whose aims are akin to those, for example, of geometry of analytical mechanics. In each field we must carefully distinguish three aspects of the theory:
(a) the formal logical content
(b) the intuitive background
(c) the applications.
The character, and the charm, of the whole structure cannot be appreciated without considering all three aspects in their proper relation.

William FELLER

When working on a problem, I never think about beauty; I think only of how to solve the problem. But when I have finished, if the solution is not beautyful, I know that is wrong.

Richard BUCKMINSTER FULLER

The art of discovering the causes of phenomena, or true hypothesis, is like the art of decyphering, in which an ingenious conjecture greatly shortens the road.

Gottfried LEIBNITZ

[The infinitesimals] neither have nor can have theory; in practise it is a dangerous instrument in the hand of beginners. Anticipating the judgement of posterity, I would predict that this method will be accused one day, and rightly, of having retarded the progress of the mathematical sciences.

François SERVOIS

August

31	**1**	T	(1861) Ivar Otto BENDIXSON (1881) Otto TOEPLITZ
	2	F	(1856) Ferdinand RUDIO (1902) Mina Spiegel REES
	3	S	(1914) Mark KAC
	4	S	(1805) Sir William Rowan HAMILTON (1838) John VENN
32	**5**	M	(1802) Niels Henrik ABEL
	6	T	(1638) Nicolas MALEBRANCHE (1741) John WILSON
	7	W	(1868) Ladislaus Josephowitsch BORTKIEWITZ
	8	T	(1902) Paul Adrien Maurice DIRAC
	9	F	(1537) Francesco BAROZZI (Franciscus Barocius)
	10	S	(1602) Gilles Personne de ROBERVAL
	11	S	(1730) Charles BOSSUT (1842) Enrico D`OVIDIO
33	**12**	M	(1882) Jules Antoine RICHARD (1887) Erwin Rudolf Josef Alexander SCHRODINGER
	13	T	(1625) Erasmus BARTHOLIN (1819) George Gabriel STOKES (1861) Cesare BURALI-FORTI
	14	W	(1530) Giovanni Battista BENEDETTI (1842) Jean Gaston DARBOUX (1865) Guido CASTELNUOVO (1866) Charles Gustave Nicolas de la VALLEE` POUSSIN
	15	T	(1863) Aleksei Nikolaevich KRYLOV (1892) Louis Pierre Victor duc de BROGLIE (1901) Petr Sergeevich NOVIKOV
	16	F	(12773) Louis Beniamin FRANCOEUR (1821) Arthur CAYLEY
	17	S	(1601) Pierre de FERMAT
	18	S	(1685) Brook TAYLOR
34	**19**	M	(1646) John FLAMSTEED (1739) Georg Simon KLUGEL
	20	T	(1710) Thomas SIMPSON (1863) Corrado SEGRE (1882) Waclav SIERPINSKI
	21	W	(1789) Augustin Louis CAUCHY
	22	T	(1647) Denis PAPIN
	23	F	(1683) Giovanni POLENI (1829) Moritz Benedikt CANTOR
	24	S	(1561) Bartholomeo PITISCUS (1942) Karen Keskulla UHLENBECK
	25	S	(1561) Philip van LANSBERGE (1844) Thomas MUIR
35	**26**	M	(1728) Johann Heinrich LAMBERT (1875) Giuseppe VITALI
	27	T	(1858) Giuseppe PEANO
	28	W	(1796) Irenee Jules BIENAYME`
	29	T	(1904) Leonard ROTH
	30	F	(1856) Carle David Tolme` RUNGE (1906) Olga TAUSSKY-TODD
	31	S	(1821) Hermann Ludwig Ferdinand von HELMHOLTZ

21° USAMO (1992) - 3

For a nonempty set S of integers let $\sigma(S)$ the sum of the elements of S. Suppose that $A=\{a_1,a_2,\cdots,a_{10}\}$ is a set of positie integers with $a_1<a_2<\cdots<a_{11}$ and that, for each positive integer $n\le 1500$, there is a subset S of A for which $\sigma(S)=n$. What is the smallest possible value of a_{10}?

Did you know that 87.166253% of all statistics claim a precision of results that is not justified by the method employed?

Pi goes on and on and on...
And e is just as cursed.
I wonder: Which is larger
When they digits are reversed?

If you disregard the very simplest cases, there is in all the mathemathics not a single infinite series whose sum has been rigorously determined. In other words, the most important part of mathematics stand without a foundation.

Niels ABEL

As for everything else, so for mathematical theory: beauty can be perceived but not explained.

Arthur CAYLEY

I consider that I understand an equation when I can predict the properties of its solutions, without actually solving it.

Paul DIRAC

And perhaps, posterity will thank me for having shown that the ancients did not known everything.

Pierre FERMAT

Who would not rather have the fame of Archimedes than that of his conqueror Marcellus?

William HAMILTON

September

35	**1**	S	(1659) Joseph SAURIN (1835) William Stankey JEVONS
36	**2**	M	(1878) Mauriche Rene` FRECHET (1923) Rene` THOM
	3	T	(1814) James Joseph SYLVESTER (1884) Solomon LEFSCHETZ (1908) Lev Semenovich PONTRYAGIN
	4	W	(1809) Luigi Federico MENABREA
	5	T	(1667) Giovanni Girolamo SACCHERI (1725) Jean Etienne MONTUCLA
	6	F	(1859) Boris Jakovlevich BUKREEV (1863) Dimitri Aleksandrovich GRAVE
	7	S	(1707) George Louis Leclerc comte de BUFFON (1955) Efim ZELMANOV
	8	S	(1584) Gregorius SAINT-VINCENT (1588) Marin MERSENNE
37	**9**	M	(1860) Frank MORLEY
	10	T	(1839) Charles Sanders PEIRCE
	11	W	(1623) Stefano degli ANGELI (1877) sir James Hopwood JEANS
	12	T	(1891) Antoine Andre` Louis REYNAUD (1900) Haskell Brooks CURRY
	13	F	(1873) Constantin CARATHEODORY (1885) Wilhelm Johann Eugen BLASCHKE
	14	S	(1858) Henry Burchard FINE (1891) Ivan Matveevich VINOGRADOV
	15	S	(973) Abu Arrayhan Muhammad ibn Ahmad AL`BIRUNI (1886) Paul Pierre LEVY
38	**16**	M	(1494) Francisco MAUROLICO (1736) Johann Nikolaus TETENS
	17	T	(1743) Marie Jean Antoine Nicolas de Caritat de CONDORCET (1826) Georg Friedrich Bernhard RIEMANN
	18	W	(1752) Adrien Marie LEGENDRE
	19	T	(1749) Jean Baptiste DELAMBRE
	20	F	(1842) Alexander Wilhelm von BRILL (1861) Frank Nelson COLE
	21	S	(1899) Juliusz Pawel SCHAUDER
	22	S	(1765) Paolo RUFFINI (1769) Louis PUISSANT (1803) Jaques Charles Francois STURM
39	**23**	M	(1768) William WALLACE (1900) David van DANTZIG
	24	T	(1501) Girolamo CARDANO (1625) Johan DE WITT (1801) Michail Vasilevich OSTROGRADSKI
	25	W	(1819) George SALMON (1888) Stefan MAZURKIEWICZ
	26	T	(1688) Willem Jakob `s GRAVESANDE (1854) Percy Alexander MACMAHON (1891) Hans REICHENBACH
	27	F	(1855) Paul Emile APPEL (1876) Earle Raymond HEDRICK (1919) James Hardy WILKINSON
	28	S	(1698) Pierre Louis Moreau de MAUPERTUIS (1761) Ferdinand Francois Desire` Budan de BOISLAURENT (1873) Julian Lowell COOLIDGE
	29	S	(1561) Adriaan van ROOMEN (1812) Adolph GOPEL
40	**30**	M	(1775) Robert ADRAIN (1829) Joseph WOLSTENHOLME (1883) Ernst HELLINGER

21° USAMO (1992) - 4

Chords $\overline{AA'}, \overline{BB'}, \overline{CC'}$ meet at an interior point ***P*** but are not contained in a plane. The sphere through A, B, C, P is tangent to the sphere through A', B', C', P. Prove that $\overline{AA'} = \overline{BB'} = \overline{CC'}$

Studies have shown that the leading cause of death is life.

In Arctic and Tropical Climes,
The Integers, additions and times,
Taken (mod p) will yeld,
A full finite field,
As p ranges over the primes.

The unproved postulates with which we start are purely arbitrary. They must be consistent, but they had better lead to something interesting.

Julian COOLIDGE

We may as well cut out the group theory. That is a subject that will never be of any use in science.

James JEANS

It is clear that Economics, if it is to be a science at all, must be a mathematical science.

William JEVONS

If it's just turning the crank is algebra, but if it's got an idea in it, it's topology.

Solomon LEFSCHETZ

The pragmatist knows that doubt is an art wich has to be acquired with difficulty.

Charles PEIRCE

The early study of Euclid make me a hater of geometry.

James SYLVESTER

I believe that proving is not a natural activity for mathematicians.

Rene` THOM

Algebra is rich in structure but weak in meaning.

Rene` THOM

October

40	**1**	T	(1671) Luigi Guido GRANDI (1898) Bela KEREKJARTO`
	2	W	(1825) John James WALKER (1908) Arthur ERDELYI
	3	T	(1944) Pierre Rene` DELIGNE
	4	F	(1759) Louis Francois Antoine ARBOGAST (1797) Jerome SAVARY
	5	S	(1732) Nevil MASKELYNE (1781) Bernhard Placidus Johann Nepomuk BOLZANO (1861) Thomas Little HEATH
	6	S	(1552) Matteo RICCI (1831) Julius Wilhelm Richard DEDEKIND (1908) Sergei Lvovich SOBOLEV
41	**7**	M	(1885) Niels BOHR
	8	T	(1908) Hans Arnold HEILBRONN
	9	W	(1581) Claude Gaspard BACHET de Meziriac (1704) Johann Andrea von SEGNER (1873) Karl SCHWARTZSCHILD
	10	T	(1861) Heinrich Friedrich Karl Ludwig BURKHARDT
	11	F	(1675) Samuel CLARKE (1777) Barnabe` BRISSON (1885) Alfred HAAR (1910) Cahit ARF
	12	S	(1860) Elmer SPERRY
	13	S	(1890) Georg FEIGL (1893) Kurt Werner Friedrich REIDEMEISTER (1932) John Griggs THOMSON
42	**14**	M	(1687) Robert SIMSON (1801) Joseph Antoine Ferdinand PLATEAU (1868) Alessandro PADOA
	15	T	(1608) Evangelista TORRICELLI (1735) Jesse RAMSDEN (1776) Peter BARLOW
	16	W	(1879) Philip Edward Bertrand JOURDAIN
	17	T	(1759) Jacob (II) BERNOULLI (1888) Paul Isaac BERNAYS
	18	F	(1741) John WILSON
	19	S	(1903) Jean Frederic Auguste DELSARTE (1910) Subrahmanyan CHANDRASEKHAR
	20	S	(1632) Sir Cristopher WREN (1863) William Henry YOUNG (1865) Aleksandr Petrovich KOTELNIKOV
43	**21**	M	(1677) Nicolaus (I) BERNOULLI (1823) Enrico BETTI (1855) Giovan Battista GUCCIA (1893) William LEonard FERRAR
	22	T	(1587) Joachim JUNGIUS (1895) Rolf Herman NEVANLINNA (1907) Sarvadaman CHOWLA
	23	W	(1865) Piers BOHL
	24	T	(1804) Wilhelm Eduard WEBER (1873) Edmund Taylor WITTAKER
	25	F	(1811) Evariste GALOIS
	26	S	(1849) Ferdinand Georg FROBENIUS (1857) Charles Max MASON (1911) Shiing-Shen CHERN
	27	S	(1678) Pierre Remond de MONTMORT (1856) Ernest William HOBSON
44	**28**	M	(1804) Pierre Francois VERHULST
	29	T	(1925) Klaus ROTH
	30	W	(1906) Andrej Nikolaevich TIKHONOV
	31	T	(1815) Karl Theodor Wilhelm WEIERSTRASS

22° USAMO (1993) - 1

For each integer $n \geq 2$ determine (with proof) which of the two positive real numbers ***a*** and ***b*** satisfying

$$\begin{cases} a^n = a+1 \\ b^{2n} = b+3a \end{cases}$$

is larger.

A mathematician is a person who says that, when 3 people are supposed to be in a room but 5 came out, 2 have to go in so the room gets empty...

A graduate student at Trinity
Computed the square of infinity
But it gave him the fidgets
To put down the digits
So he dropped math and took up divinity

An expert is a man who has made all the mistakes which can be made in a very narrow field.

Niels BOHR

How wonderful that we have met with a paradox. Now we have some hope of making progress.

Niels BOHR

As professor in the Polytechnic School in Zürich I found myself for the first time obliged to lecture upon the elements of the differential calculus and felt more keenly than ever before the lack of a really scientific foundation for arithmetic.

Richar DEDEKIND

Unfortunately what is little recognized is that the most worthwhile scientific books are those in which the author clearly indicates what he does not know; for an author most hurts his readers by concealing difficulties.

Evariste GALOIS

Newton is, of course, the greatest of all Cambridge professors; he also happens to be the greatest disaster that every befell not merely Cambridge, but British mathematical science as a whole.

Leonard ROTH

It is true that a mathematician that is not also something of a poet will never be a perfect mathematician.

Karl WEIERSTRASS

November

44	**1**	F	(1535) Giambattista DELLA PORTA
	2	S	(1815) George BOOLE
	3	S	(1867) Martin Wilhelm KUTTA (1878) Arthur Byron COBLE
45	**4**	M	(1744) Johann (III) BERNOULLI (1865) Pierre Simon GIRARD
	5	T	(1848) James Whitbread Lee GLAISHER (1930) John Frank ADAMS
	6	W	(1781) Giovanni Antonio Amedeo PLANA
	7	T	(1660) Thomas Fantet DE LAGNY (1799) Karl Heinrich GRAFFE (1898) Raphael SALEM
	8	F	(1656) Edmond HALLEY (1846) Eugenio BERTINI (1848) Fredrich Ludwig Gottlob FREGE (1854) Johannes Robert RYDBERG (1869) Felix HAUSDORFF
	9	S	(1847) Carlo Alberto CASTIGLIANO (1885) Theodor Franz Eduard KALUZA (1885) Hermann Klaus Hugo WEYL (1906) Jaroslav Borisovich LOPATYNSKY (1922) Imre LAKATOS
	10	S	(1829) Helwin Bruno CHRISTOFFEL
46	**11**	M	(1904) John Henry Constantine WHITEHEAD
	12	T	(1825) Michail Egorovich VASHCHENKO-ZAKHARCHENKO (1842) John William STRUTT Lord RAYLEIGH (1927) Yutaka TANIYAMA
	13	W	(1876) Ernest Julius WILKZYNSKY (1878) Max Wilhelm DEHN
	14	T	(1845) Ulisse DINI
	15	F	(1688) Louis Bertrand CASTEL (1793) Michel CHASLES (1794) Franz Adolph TAURINUS
	16	S	(1835) Eugenio BELTRAMI
	17	S	(1597) Henry GELLIBRAND (1717) Jean Le Rond D`ALEMBERT (1790) August Ferdinand MOBIUS
47	**18**	M	(1872) Giovanni Enrico Eugenio VACCA (1927) Jon Leslie BRITTON
	19	T	(1894) Heinz HOPF (1900) Michail Alekseevich LAVRENTEV (1901) Nina Karlovna BARI
	20	W	(1889) Edwin Powell HUBBLE (1924) Benoit MANDELBROT
	21	T	(1867) Dimitri SINTSOV
	22	F	(1803) Giusto BELLAVITIS (1840) Emile Michel Hyacinte LEMOINE
	23	S	(1616) John WALLIS (1820) Issac TODHUNTER
	24	S	(1549) Duncan MacLaren Young SOMERVILLE (1909) Gerhard GENTZEN
48	**25**	M	(1873) Claude Louis MATHIEU (1841) Fredrich Wilhelm Karl Ernst SCHRODER
	26	T	(1894) Norbert WIENER (1946) Enrico BOMBIERI
	27	W	(1867) Arthur Lee DIXON
	28	T	(1898) John WISHART
	29	F	(1803) Christian Andreas DOPPLER (1849) Horace LAMB (1879) Nikolay Mitrofanovich KRYLOV
	30	S	(1549) Sir Henry SAVILE

22° USAMO (1993) - 2

Let ***ABCD*** be a convex quadrilateral such that diagonals ***AC*** and ***BD*** intersect at right angles, and let ***E*** be their intersection. Prove thatthe reflections of ***E*** across ***AB***, ***BC***, ***CD***, ***DA*** are concyclic.

"To speak algebrically, Mr. M is execrable, but Mr. G. is (x+1)ecrable"

Edgar Allan POE

A conjecture both deep and profound
Is wether the circle is round.
In a paper of Erdös written in Kurdish
A counterexample is found.

Algebra is generous; she often gives more than is asked for.

Jean d'ALEMBERT

Mathematics is the only instructional material that can be presented in an entirely undogmatic way.

Max DEHN

A scientist can hardly meet with anything more undesirable than to have the foundations give way just as the work is finished. I was put in this position by a letter from Mr. Bertrand Russell when the work was nearly through the press.

Gottlob FREGE

The history of astronomy is the history of receding horizons.

Edwin HUBBLE

That sometimes clear and something vague stuff which is mathematics...

Imre LAKATOS

Being a language, mathematics may be used not only to inform but also, among other things, to seduce.

Benoit MANDELBROT

My work has always tried to unite the true with the beautiful and when I had to choose one or the other, I usually choose the beautiful.

Hermann WEYL

A professor is one who can speak on any subject. For precisely fifty minutes.

Norbert WIENER

December

48	**1**	D	(1792) Nikolay Yvanovich LOBACHEVSKY
49	**2**	M	(1831) Paul David Gustav DU BOIS-RAYMOND (1901) George Frederick James TEMPLE
	3	T	(1903) Sidney GOLDSTEIN (1924) John BACKUS
	4	W	(1795) Thomas CARLYLE
	5	T	(1868) Arnold Johannes Wilhelm SOMMERFELD (1901) Werner Karl HEISENBERG
	6	F	(1682) Giulio Carlo FAGNANO dei Toschi
	7	S	(1647) Giovanni CEVA (1823) Leopold KRONECKER (1830) Antonio Luigi Gaudenzio Giuseppe CREMONA
	8	S	(1508) Regnier GEMMA FRISIUS (1865) Jaques Salomon HADAMARD (1919) Julia Bowman ROBINSON
50	**9**	M	(1883) Nikolai Nikolaievich LUZIN (1906) Grace Brewster MURRAY HOPPER (1917) Sergei Vasilovich FOMIN
	10	T	(1804) Karl Gustav Jacob JACOBI (1815) Augusta Ada KING Countess of LOVELACE
	11	W	(1882) Max BORN
	12	T	(1832) Peter Ludwig Mejdell SYLOW
	13	F	(1724) Franz Ulrich Theodosius AEPINUS (1887) George POLYA
	14	S	(1546) Tycho BRAHE
	15	S	(1802) Janos BOLYAI
51	**16**	M	(1804) Wiktor Yakovievich BUNYAKOWSKY
	17	T	(1706) Gabrielle Emile Le Tonnelier de Breteuil du CHATELET (1835) Felice CASORATI (1842) Marius Sophus LIE (1900) Dame Mary Lucy CARTWRIGHT
	18	W	(1917) Roger LYNDON
	19	T	(1783) Charles Julien BRIANCHON (1854) Marcel Louis BRILLOUIN
	20	F	(1494) Oronce FINE (1648) Tommaso CEVA (1875) Francesco Paolo CANTELLI
	21	S	(1878) Jan LUKASIEVIKZ (1932) John Robert RINGROSE
	22	S	(1824) Francesco BRIOSCHI (1859) Otto Ludwig HOLDER (1877) Tommaso BOGGIO (1887) Srinivasa Aiyangar RAMANUJAN
52	**23**	M	(1872) Georgii Yurii PFEIFFER
	24	T	(1822) Charles HERMITE (1868) Emmanuel LASKER
	25	W	(1642) Isaac NEWTON (1900) Antoni ZYGMUND
	26	T	(1780) Mary Fairfax Greig SOMERVILLE (1791) Charles BABBAGE
	27	F	(1571) Johannes KEPLER (1654) Jacob (Jacques) BERNOULLI
	28	S	(1808) Athanase Louis Victoire DUPRE` (1882) Arthur Stanley EDDINGTON (1903) John von NEUMANN
	29	S	(1856) Thomas Jan STIELTJES
1	**30**	M	(1897) Stanislaw SAKS
	31	T	(1872) Volodymyr LEVIYTSKY (1896) Carl Ludwig SIEGEL (1952) Vaughan Frederick Randall JONES

22° USAMO (1993) - 4

Let a and b be odd positive integers. Define the sequence (f_n) by putting $f_1 = a$, $f_2 = b$ and by letting f_n for $n \geq 3$ be the greatest odd divisor of $f_{n-1} + f_{n-2}$. Show that f_n is constant for n sufficiently large and determine the eventual value as a function of a and b.

Q: What's an Abelian group under addition, is closed, associative, distributive, and bears a curse?

A: The ring of the Nibelung.

Q: Why did the mathematician name his dog "Cauchy"?

A: Because he left a residue at every pole.

The Moebius strip is a pain
When you cut it again and again
But if you should wedge
A large disk 'round the edge
Then you just get a projective plane.

Errors using inadequate data are much less than those using no data at all.

Charles BABBAGE

We have found a strange footprint on the shores of the unknown. We have devised profound theories, one after another, to account for its origins. At last, we have succeeded in reconstructing the creature that made the footprint. And lo! It is our own.

Arthur EDDINGTON

The shortest path between two truths in the real domain passes through the complex domain.

Jaques HADAMARD

An expert is someone who knows some of the worst mistakes that can be made in his subject, and how to avoid them.

Werner HEISENBERG

Abel has left mathematician enough to keep them busy for 500 years.

Charles HERMITE

Mathematics consists of proving the most obvious thing in the least obvious manner.

George POLYA