



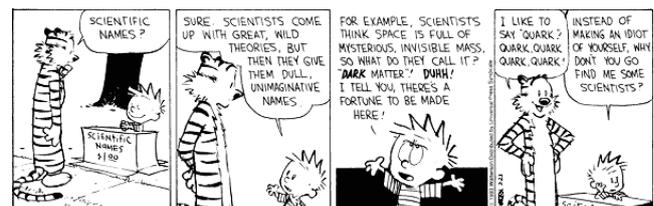
$$x^4 - 8204x^3 + 25237646x^2 - 34502914684x + 17687247380985 = 0$$



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DILBERT By SCOTT ADAMS



THE AUTHOR LIST: GIVING CREDIT WHERE CREDIT IS DUE

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- The first author**
Senior grad student on the project. Made the figures.
- The third author**
First year student who actually did the experiments, performed the analysis and wrote the whole paper. Thinks being third author is "fair".
- The second-to-last author**
Ambitious assistant professor or post-doc who instigated the paper.
- The second author**
Grad student in the lab that has nothing to do with this project, but was included because he/she hung around the group meetings (usually for the food).
- The middle authors**
Author names nobody really reads. Reserved for undergrads and technical staff.
- The last author**
The head honcho. Hasn't even read the paper but, hey, he got the funding, and his famous name will get the paper accepted.

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- the colon**
Can't decide what to title your thesis? Use a colon!
- a preposition**
A good preposition tells your readers "hey, this is not just a futile exercise"
- "Witty catchphrase"**
Length-enhanced superlative verbage with prolixity
- in/of/for**
Obscure topic few people care about.
- witty catchphrase**
Makes people think you're hip and culturally relevant. Only marginally related to the actual thesis? No problem.
- the boring stuff**
Nothing says "academic rigor" like a long string of dry scientific-sounding terminology and fancy buzzwords.
- obscure topic few people care about**
Sad, but true.



Rudi Mathematici

January

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

USAMO 1999 – Pr. 1

Some checkers placed on an $n \times n$ checkerboard satisfy the following conditions:

- every square that does not contain a checker shares a side with one that does;
- given any pair of squares that contain checkers, there is a sequence of squares containing checkers, starting and ending with the given squares, such that every two consecutive squares of the sequence share a side.

Prove that at least $(n^2 - 2)/3$ checkers have been placed on the board.

Mathematics Terms

CLEARLY: I don't want to write down all the "in-between" steps.

TRIVIAL: If I have to show you how to do this, you're in the wrong class.

Calculus!

They chose an ϵ that was so small that ϵ^2 was negative.

"The future science of government should be called 'la cybernetique'."

Andrè Marie AMPERE

[Asked for a testimony to the fact that Emmy Noether was a great woman mathematician, he said:] *"I can testify that she is a great mathematician, but that she is a woman, I cannot swear."*

Edmund LANDAU

"Physics is becoming too difficult for the physicists."

David HILBERT

"Father of Chemistry and Uncle of the Earl of Cork."

Robert BOYLE [On his tombstone]

"What I tell you three times is true."

Charles Lutwidge DOGSON

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

Renato CACCIOPPOLI



Rudi Mathematici

February

	1	S	(1900) John Charles BURKILL
6	2	M	(1522) Lodovico FERRARI
	3	T	(1893) Gaston Maurice JULIA
	4	W	(1905) Eric Christopher ZEEMAN
	5	T	(1757) Jean Marie Constant DUHAMEL
	6	F	(1612) Antoine ARNAULD (1695) Nicolaus (II) BERNOULLI
	7	S	(1877) Godfried Harold HARDY (1883) Eric Temple BELL
	8	S	(1700) Daniel BERNOULLI (1875) Francis Ysidro EDGEWORTH
	7	9	M
10		T	(1747) Aida YASUAKI
11		W	(1800) William Henry Fox TALBOT (1839) Josiah Willard GIBBS (1915) Richard Wesley HAMMING
12		T	(1914) Hanna CAEMMERER NEUMANN
13		F	(1805) Johann Peter Gustav Lejeune DIRICHLET
14		S	(1468) Johann WERNER (1849) Hermann HANKEL (1896) Edward Artur MILNE
15		S	(1564) Galileo GALILEI (1861) Alfred North WHITEHEAD (1946) Douglas HOFSTADTER
8		16	M
	17	T	(1890) Sir Ronald Aymler FISHER (1891) Adolf Abraham Halevi FRAENKEL
	18	W	(1404) Leon Battista ALBERTI
	19	T	(1473) Nicolaus COPERNICUS
	20	F	(1844) Ludwig BOLTZMANN
	21	S	(1591) Girard DESARGUES (1915) Evgenni Michailovitch LIFSHTZ
	22	S	(1903) Frank Plumpton RAMSEY
	9	23	M
24		T	(1871) Felix BERNSTEIN
25		W	(1827) Henry WATSON
26		T	(1786) Dominique Francois Jean ARAGO
27		F	(1881) Luitzen Egbertus Jan BROUWER
28		S	(1735) Alexandre Theophile VANDERMONDE (1860) Herman HOLLERITH

USAMO 1999 – Pr. 2

Let $ABCD$ be a cyclic quadrilateral. Prove that

$$|AB - CD| + |AD - BC| \geq 2|AC - BD|.$$

Mathematic Terms

OBVIOUSLY: I hope you weren't sleeping when we discussed this earlier, because I refuse to repeat it.

RECALL: I shouldn't have to tell you this, but for those of you who erase your memory tapes after every test...

Mathematical Psychology

Zenophobia: the irrational fear of convergent sequences.

"Common sense is not really so common."

Antoine ARNAULD

"Technical skill is mastery of complexity while creativity is mastery of simplicity."

Eric Christopher ZEEMAN

"Reductio ad absurdum, which Euclid loved so much, is one of a mathematician's finest weapons. It is a far finer gambit than any chess play: a chess player may offer the sacrifice of a pawn or even a piece, but a mathematician offers the game."

Godfried HARDY

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

Daniel BERNOULLI

"Epur si muove!"

Galileo GALILEI

"Connaitre, decouvrir, communiquer... telle est la destinee d'un savant."

Dominique ARAGO

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

Ludwig BOLTZMANN

"Whenever you can, count."

Francis GALTON



	1	S	(1611) John PELL
10	2	M	(1836) Julius WEINGARTEN
	3	T	(1838) George William HILL (1845) Georg CANTOR
	4	W	(1822) Jules Antoine LISSAJUS
	5	T	(1512) Gerardus MERCATOR (1759) Benjamin GOMPERTZ (1817) Angelo GENOCCHI
	6	F	(1866) Ettore BORTOLOTTI
	7	S	(1792) William HERSCHEL (1824) Delfino CODAZZI
	8	S	(1851) George CHRYSTAL
	11	9	M
10		T	(1864) William Fogg OSGOOD
11		W	(1811) Urbain Jean Joseph LE VERRIER (1853) Salvatore PINCHERLE
12		T	(1685) George BERKELEY (1824) Gustav Robert KIRKHOFF (1859) Ernesto CESARO
13		F	(1861) Jules Joseph DRACH (1957) Rudy D'ALEMBERT
14		S	(1864) Jozef KURSCHAK (1879) Albert EINSTEIN
15		S	(1860) Walter Frank Raphael WELDON (1868) Grace CHISOLM YOUNG
12		16	M
	17	T	(1876) Ernest Benjamin ESCLANGON (1897) Charles FOX
	18	W	(1640) Philippe de LA HIRE (1690) Christian GOLDBACH (1796) Jacob STEINER
	19	T	(1862) Adolf KNESER (1910) Jacob WOLFOVITZ
	20	F	(1840) Franz MERTENS (1884) Philip FRANCK (1938) Sergi Petrovich NOVIKOV
	21	S	(1768) Jean Baptiste Joseph FOURIER (1884) George David BIRKHOFF
	22	S	(1917) Irving KAPLANSKY
	13	23	M
24		T	(1809) Joseph LIOUVILLE (1948) Sun-Yung (Alice) CHANG
25		W	(1538) Christopher CLAUDIUS
26		T	(1848) Konstantin ADREEV (1913) Paul ERDOS
27		F	(1857) Karl PEARSON
28		S	(1749) Pierre Simon de LAPLACE
29		S	(1825) Francesco FAÀ DI BRUNO (1873) Tullio LEVI-CIVITA (1896) Wilhelm ACKERMAN
14		30	M
	31	T	(1596) René DESCARTES

USAMO 1999 – Pr. 3

Let $p > 2$ be a prime and let a, b, c, d be integers not divisible by p , such that

$$\left\{ \frac{ra}{p} \right\} + \left\{ \frac{rb}{p} \right\} + \left\{ \frac{rc}{p} \right\} + \left\{ \frac{rd}{p} \right\} = 2$$

for any integer r not divisible by p . Prove that at least two of the numbers $a+b$, $a+c$, $a+d$, $b+c$, $b+d$, $c+d$

are divisible by p .

(Note: $\{x\} = x - \lfloor x \rfloor$ denotes the fractional part of x .)

Mathematic Terms

WLOG (*Without Loss Of Generality*): I'm not about to do all the possible cases, so I'll do one and let you figure out the rest.

IT CAN EASILY BE SHOWN: Even you, in your finite wisdom, should be able to prove this without me holding your hand.

The Four Operations

Ambition, distraction, uglification and derision. (L. Carroll)

"Common sense is nothing more than a deposit of prejudices laid down in the mind before you reach eighteen."

Albert EINSTEIN

"We [he and Halmos] share a philosophy about linear algebra: we think basis-free, we write basis-free, but when the chips are down we close the office door and compute with matrices like fury."

Irving KAPLANSKY

"A Mathematician is a machine for turning coffee into theorems."

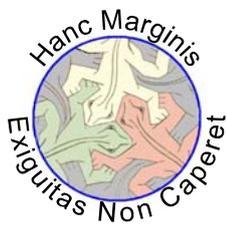
Paul ERDOS

"Perfect numbers (like perfect men) are very rare."

René DESCARTES

"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



15	1	W	(1640) Georg MOHR (1776) Marie-Sophie GERMAIN (1895) Alexander Craig AITKEN
	2	T	(1934) Paul Joseph COHEN
	3	F	(1835) John Howard Van AMRINGE (1892) Hans RADEMACHER (1900) Albert Edward INGHAM (1909) Stanislaw Marcin ULAM (1971) Alice RIDDLE
	4	S	(1809) Benjamin PEIRCE (1842) Francois Edouard Anatole LUCAS (1949) Shing-Tung YAU
	5	S	(1588) Thomas HOBBS (1607) Honorè FABRI (1622) Vincenzo VIVIANI (1869) Sergi Alexeievich CHAPLYGIN
16	6	M	(1801) William Hallows MILLER
	7	T	(1768) Francois Joseph FRANCAIS
	8	W	(1903) Marshall Harvey STONE
	9	T	(1791) George PEACOCK (1816) Charles Eugene DELAUNAY (1919) John Presper HECKERT
	10	F	(1857) Henry Ernest DUDENEY
	11	S	(1953) Andrew John WILES
	12	S	(1794) Germinal Pierre DANDELIN (1852) Carl Louis Ferdinand Von LINDEMANN (1903) Jan TINBERGEN
	13	M	(1728) Paolo FRISI (1813) Duncan Farquharson GREGORY (1879) Francesco SEVERI
	14	T	(1629) Christiaan HUYGENS
	15	W	(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	F	(1798) Etienne BOBILLIER (1853) Arthur Moritz SCHONFLIES
18	S	(1907) Lars Valerian AHLFORS (1918) Hsien Chung WANG (1949) Charles Luois FEFFERMAN	
19	S	(1880) Evgeny Evgenievich SLUTSKY (1883) Richard VIN MISES (1901) Kiyoshi OKA (1905) Charles EHRESMANN	
17	20	M	(1839) Francesco SIACCI
	21	T	(1652) Michel ROLLE (1774) Jean Baptiste BIOT (1875) Teiji TAKAGI
	22	W	(1811) Otto Ludwig HESSE (1887) Harald August BOHR
	23	T	(1858) Max Karl Ernst Ludwig PLANCK
	24	F	(1863) Giovanni VAILATI
	25	S	(1849) Felix Christian KLEIN (1900) Wolfgang PAULI (1903) Andrei Nicolayevich KOLMOGOROV
	26	S	(1889) Ludwig Josef Johan WITTENGSTEIN
	27	M	(1755) Marc-Antoine PARSEVAL des Chenes
18	28	T	(1906) Kurt GODEL
	29	W	(1854) Jules Henri POINCARÉ
	30	T	(1777) Johann Carl Friedrich GAUSS (1916) Claude Elwood SHANNON

USAMO 1999 – Pr. 4

Let a_1, a_2, \dots, a_n ($n > 3$) be real numbers such that:

$$a_1 + a_2 + \dots + a_n \geq n$$

And

$$a_1^2 + a_2^2 + \dots + a_n^2 \geq n^2.$$

Prove that $\max(a_1, a_2, \dots, a_n) \geq 2$.

Mathematic Terms

CHECK (or *CHECK FOR YOURSELF*): This is the boring part of the proof, so you can do it on your own time.

SKETCH OF A PROOF: I couldn't verify all the details, so I'll break it down into the parts I couldn't prove.

Formally Correct

Q: What's the difference between the radius and the diameter of a circle?

A: The radius.

"Knowing what is big and what is small is more important than being able to solve partial differential equations"

Stanislaw Marcin ULAM

"You treat world history as a mathematician does mathematics, in which nothing but laws and formulae exist, no reality, no good and evil, no time, no yesterday, no tomorrow, nothing but an eternal shallow, mathematical present."

Otto Ludwig HESSE

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

Wolfgang PAULI

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

Felix KLEIN



	1	F	(1825) Johann Jacob BALMER	
	2	S	(1860) D'Arcy Wentworth THOMPSON (1905) Kazimierz ZARANKIEWITZ	
	3	S	(1842) Otto STOLZ (1860) Vito VOLTERRA	
19	4	M	(1845) William Kingdon CLIFFORD	
	5	T	(1833) Lazarus Emmanuel FUCHS (1897) Francesco Giacomo TRICOMI	
	6	W	(1872) Willem DE SITTER (1906) Andrè VEIL	
	7	T	(1926) Alexis Claude CLAIRAUT (1854) Giuseppe VERONESE (1881) Ebenezer CUNNINGHAM (1896) Pavel Sergieievich ALEXANDROV	
	8	F	(1859) Johan Ludwig William Valdemar JENSEN	
	9	S	(1746) Gaspard MONGE (1876) Gilbert Ames BLISS	
	10	S	(1788) Augustin Jean FRESNEL (1847) William Karl Joseph KILLING (1958) Piotr Rezierovic SILVERBRAHMS	
	20	11	M	(1918) Richard Phillips FEYNMAN
		12	T	(1845) Pierre RenéJean Baptiste Henry BROCARD (1902) Frank YATES
		13	W	(1750) Lorenzo MASCHERONI
14		T	(1832) Rudolf Otto Sigismund LIPSCHITZ (1863) John Charles FIELDS	
15		F	(1939) Brian HARTLEY	
16		S	(1718) Maria Gaetana AGNESI (1821) Pafnuti Lvovi CHEBYSHEV	
17		S	(1940) Alan KAY	
21		18	M	(1850) Oliver HEAVISIDE (1892) Bertrand Arthur William RUSSELL
	19	T	(1919) Georgii Dimitrievich SUVOROV	
	20	W	(1861) Henry Seely WHITE	
	21	T	(1471) Albrecht DURER (1792) Gustave Gaspard de CORIOLIS	
	22	F	(1865) Alfred Cardew DIXON	
	23	S	(1914) Lipa BERS	
	24	S	(1544) William GILBERT	
	22	25	M	(1838) Karl Mikailovich PETERSON
26		T	(1667) Abraham DE MOIVRE (1896) Yuri Dimitrievich SOKOLOV	
27		W	(1862) John Edward CAMPBELL	
28		T	(1676) Jacopo Francesco RICCATI (1710) Johann (II) BERNOULLI	
29		F	(1882) Harry BATEMAN	
30		S	(1814) Eugene Charles CATALAN	
31		S	(1926) John KEMENY	

USAMO, 1999 – Pr. 5

The Y2K Game is played on a 1×2000 grid as follows. Two players in turn write either an S or an O in an empty square. The first player who produces three consecutive boxes that spell SOS wins. If all boxes are filled without producing SOS then the game is a draw.

Prove that the second player has a winning strategy.

Mathematic Terms

HINT: The hardest of several possible ways to do a proof.

BRUTE FORCE: Four special cases, three counting arguments, two long inductions, "and a partridge in a pair tree."

Back to Reality

Q: What is the physicist's definition of a vector space?

A: A set V satisfying the axiom that for any x in V , x has a little arrow drawn over it.

"Nature is not embarrassed by difficulties of analysis."

Augustin Jean FRESNEL

"To those who do not know mathematics it is difficult to get across a real feeling as to the deepest beauty of nature [...] If you want to appreciate nature, it is necessary to understand the language that she speaks in."

Richard Phillips FEYNMAN

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

Pafnuti Lvovi CHEBYSHEV

"Mathematics is very much like poetry. What makes a great poem is that there is a great amount of thought expressed in very few words. In this sense, formulas like $e^{\pi}+1=0$ are poems."

Lipa BERS

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

Oliver HEAVISIDE

"Men who are unhappy, like men who sleep badly, are always proud of the fact."

Bertrand RUSSELL

"A quantity that is increased or decreased by an infinitely small quantity is neither increased nor decreased."

Johann BERNOULLI



23	1	M	(1796) Sadi Leonard Nicolas CARNOT (1851) Edward Bailey ELLIOTT (1899) Edward Charles TITCHMARSH
	2	T	(1895) Tibor RADÓ
	3	W	(1659) David GREGORY
	4	T	(1809) John Henry PRATT
	5	F	(1814) Pierre LAurent WANTZEL (1819) John Couch ADAMS
	6	S	(1436) Johann Muller REGIOMONTANUS (1857) Aleksandr Michailovitch LYAPUNOV (1906) Max ZORN
	7	S	(1863) Edward Burr VAN VLECK
24	8	M	(1625) Giovanni Domenico CASSINI (1858) Charlotte Angas SCOTT (1860) Alicia Boole STOTT
	9	T	(1885) John Edensor LITTLEWOOD
	10	W	(940) Mohammad ABUL WAFI Al-Buzjani (1887) Vladimir Ivanovich SMIRNOV
	11	T	(1937) David Bryant MUMFORD
	12	F	(1888) Zygmunt JANYSZEWSKI
	13	S	(1831) James Clerk MAXWELL (1876) William Sealey GOSSET (Student) (1928) John Forbes NASH
	14	S	(1736) Charles Augustin de COULOMB (1856) Andrei Andreyevich MARKOV (1903) Alonzo CHURCH
25	15	M	(1640) Bernard LAMY (1894) Nikolai Gregorievich CHEBOTARYOV
	16	T	(1915) John Wilder TUKEY
	17	W	(1898) Maurits Cornelius ESCHER
	18	T	(1858) Andrew Russell FORSYTH (1884) Charles Ernest WEATHERBURN
	19	F	(1623) Blaise PASCAL (1902) Wallace John ECKERT
	20	S	(1873) Alfred LOEWY
	21	S	(1781) Simeon Denis POISSON (1828) Giuseppe BRUNO
26	22	M	(1823) Mario PIERI (1864) Hermann MINKOWSKY (1910) Konrad ZUSE
	23	T	(1912) Alan Mathison TURING
	24	W	(1880) Oswald VEBLEN
	25	T	(1908) William Van Orman QUINE
	26	F	(1824) William THOMPSON, Lord Kelvin (1918) Yudell Leo LUKE
	27	S	(1806) Augustus DE MORGAN
	28	S	(1875) Henri Leon LEBESGUE
27	29	M	(1888) Aleksandr Aleksandrovich FRIEDMANN
	30	T	(1791) Felix SAVART

USAMO 1999 – Pr. 6

Let $ABCD$ be an isosceles trapezoid with $AB \parallel CD$. The inscribed circle \mathcal{O} of triangle BCD meets CD at E . Let F be a point on the (internal) angle bisector of $\hat{D}AC$ such that $EF \perp CD$. Let the circumscribed circle of triangle ACF meet line CD at C and G . Prove that the triangle AFG is isosceles.

Mathematic Terms

SOFT PROOF: One third less filling (of the page) than your regular proof, but it requires two extra years of course work just to understand the terms.

ELEGANT PROOF: Requires no previous knowledge of the subject matter and is less than ten lines long.

Topology

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

"It can be of no practical use to know that π is irrational, but if we can know, it surely would be intolerable not to know."

Edward Charles TITCHMARSH

"What I give form to in daylight is only one per cent of what I have seen in darkness."

Maurits Cornelius ESCHER

"The more I see of men, the better I like my dog."

Blaise PASCAL

"Science is a differential equation. Religion is a boundary condition."

Alan Mathison TURING

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

Henri LEBESGUE

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

"Mathematics is a dangerous profession; an appreciable proportion of us goes mad."

John LITTLEWOOD

"The mathematical education of the young physicist [A. Einstein] was not very solid, which I am in good position to evaluate since he obtained it from me in Zurich some time ago."

Hermann MINKOWSKI



1	W	(1643) Gottfried Wilhelm von LEIBNIZ (1788) Jean Victor PONCELET		
	2	T	(1820) William John Racquorn RANKINE (1852) William BURNSIDE	
	3	F	(1807) Ernest Jean Philippe Fauque de JONQUIERE (1897) Jesse DOUGLAS	
	4	S	(1906) Daniel Edwin RUTHERFORD (1917) Michail Samuilovich LIVSIC	
	5	S	(1936) James MIRRLEES	
28	6	M	(1849) Alfred Bray KEMPE	
	7	T	(1816) Johann Rudolf WOLF (1906) William FELLER (1922) Vladimir Aleksandrovich MARCHENKO	
	8	W	(1760) Christian KRAMP	
	9	T	(1845) George Howard DARWIN	
	10	F	(1862) Roger COTES (1868) Oliver Dimon KELLOGG	
	11	S	(1857) Sir Joseph LARMOR (1890) Giacomo ALBANESE	
	12	S	(1875) Ernest Sigismund FISCHER (1895) Richard BUCKMINSTER FULLER	
	29	13	M	(1527) John DEE (1741) Karl Friedrich HINDENBURG
		14	T	(1671) Jacques D'ALLONVILLE (1793) George GREEN
		15	W	(1865) Wilhelm WIRTINGER (1906) Adolph Andrej Pavlovich YUSHKEVICH
16		T	(1678) Jakob HERMANN (1903) Irmgard FLUGGE-LOTZ	
17		F	(1831) Victor Mayer Amedeè MANNHEIM (1837) Wilhelm LEXIS	
18		S	(1013) Hermann von REICHENAU (1635) Robert HOOKE (1853) Hendrich Antoon LORENTZ	
19		S	(1768) Francois Joseph SERVOIS	
30		20	M	(1876) Otto BLUMENTHAL (1947) Gerd BINNIG
		21	T	(1620) Jean PICARD (1848) Emil WEYR (1849) Robert Simpson WOODWARD
	22	W	(1784) Friedrich Wilhelm BESSEL	
	23	T	(1775) Etienne Louis MALUS (1854) Ivan SLEZYNSKY	
	24	F	(1851) Friedrich Herman SCHOTTKY (1871) Paul EPSTEIN (1923) Christine Mary HAMILL	
	25	S	(1808) Johann Benedict LISTING	
	26	S	(1903) Kurt MAHLER	
	31	27	M	(1667) Johann BERNOULLI (1801) George Biddel AIRY (1848) Lorand Baron von EOTVOS (1871) Ernst Friedrich Ferdinand ZERMELO
28		T	(1954) Gerd FALTINGS	
29		W	(1898) Isidor Isaac RABI	
30		T	(1889) Vladimir Kosma ZWORYKN	
31		F	(1704) Gabriel CRAMER (1712) Johann Samuel KOENIG	

USAMO 2000, Pr. 1

Call a real-value function f *very convex* if:

$$\frac{f(x) + f(y)}{2} \geq f\left(\frac{x+y}{2}\right) + |x+y|$$

holds for all real numbers x and y .

Prove that no *very convex* function exists.

Mathematics Terms

SIMILARLY: At least one line of the proof of this case is the same as before.

CANONICAL FORM: 4 out of 5 mathematicians surveyed recommended this as the final form for their students who choose to finish.

Algebra

In modern mathematics, algebra has become so important that numbers will soon only have symbolic meaning.

"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 beautiful, I know that it is wrong."

Richard Buckminster FULLER

"There is (gentle reader) nothing (the works of God only set apart) which so much beautifies and adorns the soul and mind of man as does knowledge of the good arts and sciences. ... Many ... arts there are which beautify the mind of man; but of all none do more garnish and beautify it than those arts which are called mathematical, unto the knowledge of which no man can attain, without perfect knowledge and instruction of the principles, grounds, and Elements of Geometry."

John DEE

"CEIHOSSOTTUU"

Anagram to establish priority in the discovery of elasticity: *"Ut tensio, sic vis"*.

Robert HOOKE

"Miracles are not to be multiplied beyond necessity."

"Taking mathematics from the beginning of the word to the time of Newton, what he has done is much the better half."

Gottfried LEIBNIZ

"[The infinitesimals] neither have nor can have theory: in practise it is a dangerous instrument in the hands of beginners [...] anticipating, for my part, 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."

Francois SERVOIS



32	1	S	(1861) Ivar Otto BENDIXSON (1881) Otto TOEPLITZ
	2	S	(1856) Ferdinand RUDIO (1902) Mina Spiegel REES
	3	M	(1914) Mark KAC
	4	T	(1805) Sir William Rowan HAMILTON (1838) John VENN
	5	W	(1802) Niels Henrik ABEL
	6	T	(1638) Nicolas MALEBRANCHE (1741) John WILSON
	7	F	(1868) Ladislaus Josephowitsch BORTKIEWITZ
	8	S	(1902) Paul Adrien Maurice DIRAC
	9	S	(1537) Francesco BAROZZI (Franciscus Barocius)
33	10	M	(1602) Gilles Personne de ROBERVAL
	11	T	(1730) Charles BOSSUT (1842) Enrico D'OVIDIO
	12	W	(1882) Jules Antoine RICHARD (1887) Erwin Rudolf Josef Alexander SCHRODINGER
	13	T	(1625) Erasmus BARTHOLIN (1819) George Gabriel STOKES (1861) Cesare BURALI-FORTI
	14	F	(1530) Giovanni Battista BENEDETTI (1842) Jean Gaston DARBOUX (1865) Guido CASTELNUOVO (1866) Charles Gustave Nicolas de la VALLEÈ POUSSIN
	15	S	(1863) Aleksei Nikolaevich KRYLOV (1892) Louis Pierre Victor duc de BROGLIE (1901) Petr Sergeevich NOVIKOV
	16	S	(12773) Louis Beniamin FRANCOEUR (1821) Arthur CAYLEY
	34	17	M
18		T	(1685) Brook TAYLOR
19		W	(1646) John FLAMSTEED (1739) Georg Simon KLUGEL
20		T	(1710) Thomas SIMPSON (1863) Corrado SEGRE (1882) Waclaw SIERPINSKI
21		F	(1789) Augustin Louis CAUCHY
22		S	(1647) Denis PAPIN
23		S	(1683) Giovanni POLENI (1829) Moritz Benedikt CANTOR
35		24	M
	25	T	(1561) Philip van LANSBERGE (1844) Thomas MUIR
	26	W	(1728) Johann Heinrich LAMBERT (1875) Giuseppe VITALI
	27	T	(1858) Giuseppe PEANO
	28	F	(1796) Irenee Jules BIENAYMÈ
	29	S	(1904) Leonard ROTH
	30	S	(1856) Carle David Tolmè RUNGE (1906) Olga TAUSSKY-TODD
	36	31	M

USAMO 2000, Pr. 2

Let S be the set of all triangles ABC for which:

$$5\left(\frac{1}{AP} + \frac{1}{BQ} + \frac{1}{CR}\right) - \frac{3}{\min\{AP, BQ, CR\}} = \frac{6}{r}$$

Where r is the inradius and P, Q, R are the points of tangency of the incircle with sides AB, BC, CA respectively.

Prove that all triangles in S are isosceles and similar to one another.

Mathematic Terms

TFAE (*The Following Are Equivalent*): If I say this it means that, and if I say that it means the other thing, and if I say the other thing...

BY A PREVIOUS THEOREM: I don't remember how it goes (come to think of it I'm not really sure we did this at all), but if I stated it right (or at all), then the rest of this follows.

Prime Numbers

It was mentioned on CNN that the new prime number discovered recently is four times bigger than the previous record.

"This result is too beautiful to be false; it is more important to have beauty in one's equations than to have them fit experiment."

Paul Adrien Maurice DIRAC

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

Pierre de FERMAT

"Cubum autem in duos cubos, aut quadrato quadratum in duos quadrato quadratos, et generaliter nullam in infinitum ultra quadratum potestatem in duos ejusdem nominis fas est dividere: cujus rei demonstrationem mirabilem sane detexi. Hanc marginis exiguitas non caperet."

Pierre de FERMAT

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

Arthur CAYLEY

"There are surely worse things than being wrong, and being dull and pedantic are surely among them."

Mark KAC

"Whoever [in the pursuit of science] seeks after immediate practical utility may rest assured that he seeks in vain."

Hermann von HELMHOLTZ



Rudi Mathematici

September

	1	T	(1659) Joseph SAURIN (1835) William Stankey JEVONS	
	2	W	(1878) Mauriche René FRECHET (1923) René THOM	
	3	T	(1814) James Joseph SYLVESTER (1884) Solomon LEFSCHETZ (1908) Lev Semenovich PONTRYAGIN	
	4	F	(1809) Luigi Federico MENABREA	
	5	S	(1667) Giovanni Girolamo SACCHERI (1725) Jean Etienne MONTUCLA	
	6	S	(1859) Boris Jakovlevich BUKREEV (1863) Dimitri Aleksandrovich GRAVE	
37	7	M	(1707) George Louis Leclerc comte de BUFFON (1955) Efim ZELMANOV	
	8	T	(1584) Gregorius SAINT-VINCENT (1588) Marin MERSENNE	
	9	W	(1860) Frank MORLEY	
	10	T	(1839) Charles Sanders PEIRCE	
	11	F	(1623) Stefano degli ANGELI (1877) sir James Hopwood JEANS	
	12	S	(1891) Antoine André Louis REYNAUD (1900) Haskell Brooks CURRY	
38	13	S	(1873) Constantin CARATHEODORY (1885) Wilhelm Johann Eugen BLASCHKE	
	14	M	(1858) Henry Burchard FINE (1891) Ivan Matveevich VINOGRADOV	
	15	T	(973) Abu Arrayhan Muhammad ibn Ahmad AL'BIRUNI (1886) Paul Pierre LEVY	
	16	W	(1494) Francisco MAUROLICO (1736) Johann Nikolaus TETENS	
	17	T	(1743) Marie Jean Antoine Nicolas de Caritat de CONDORCET (1826) Georg Friedrich Bernhard RIEMANN	
	18	F	(1752) Adrien Marie LEGENDRE	
	19	S	(1749) Jean Baptiste DELAMBRE	
	20	S	(1842) Alexander Wilhelm von BRILL (1861) Frank Nelson COLE	
	39	21	M	(1899) Juliusz Pawel SCHAUDER
		22	T	(1765) Paolo RUFFINI (1769) Louis PUISSANT (1803) Jaques Charles Francois STURM
23		W	(1768) William WALLACE (1900) David van DANTZIG	
24		T	(1501) Girolamo CARDANO (1625) Johan DE WITT (1801) Michail Vasilevich OSTROGRADSKI	
25		F	(1819) George SALMON (1888) Stefan MAZURKIEWICZ	
26		S	(1688) Willem Jakob's GRAVESANDE (1854) Percy Alexander MACMAHON (1891) Hans REICHENBACH	
27		S	(1855) Paul Emile APPEL (1876) Earle Raymond HEDRICK (1919) James Hardy WILKINSON	
40		28	M	(1698) Pierre Louis Moreau de MAUPERTUIS (1761) Ferdinand Francois Desirè Budan de BOISLAURENT (1873) Julian Lowell COOLIDGE
	29	T	(1561) Adriaan van ROOMEN (1812) Adolph GOPEL	
	30	W	(1775) Robert ADRAIN (1829) Joseph WOLSTENHOLME	
			(1883) Ernst HELLINGER	

USAMO 2000 – Pr. 3

A game of solitaire is played with R red cards, W white cards, and B blue cards. A player plays all the cards one at a time. With each play he accumulates a penalty. If he plays a blue card, then he is charged a penalty which is the number of white cards still in his hand. If he plays a white card, then he is charged a penalty which is twice the number of red cards still in his hand. If he plays a red card, then he is charged a penalty which is three times the number of blue cards still in his hand.

Find, as a function of R , W and B , the minimal total penalty a player can amass and all the ways in which this minimum can be achieved.

Mathematic Terms

TWO LINE PROOF: I'll leave out everything but the conclusion, you can't question 'em if you can't see 'em.

BRIEFLY: I'm running out of time, so I'll just write and talk faster.

Pi

I've memorized 100,000 digits of pi. They're all 3. Of course I haven't memorized exactly where they occur.

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

René THOM

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

Solomon LEFSCHETZ

"This branch of mathematics [Probability] is the only one, I believe, in which good writers frequently get results which are entirely erroneous."

Charles Sanders PEIRCE

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

sir James Hopwood JEANS

"If error is corrected whenever it is recognised, the path of error is the path of truth."

Hans REICHENBACH

"The early study of Euclid made me a hater of geometry."

James SYLVESTER

"If only I had the theorems! Then I should find the proofs easily enough..."

Bernhard RIEMANN



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

USAMO 2000 – Pr. 4

Find the smallest positive integer n such that if n squares of a 1000×1000 chessboard are coloured, then there will exist three coloured squares whose centres form a right triangle with sides parallel to the edges of the board.

Mathematic Terms

LET'S TALK THROUGH IT: I don't want to write it on the board lest I make a mistake.

PROCEED FORMALLY: Manipulate symbols by the rules without any hint of their true meaning (popular in pure math courses).

Ancient Mathematics

The Romans didn't find algebra very challenging, because X was always 10.

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

"Anyone who is not shocked by quantum theory has not understood it."

"Prediction is very difficult, especially about the future."

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

Niels BOHR

" $2^{30}(2^{31}-1)$ is the greatest perfect number that will ever be discovered, for, as they are merely curious without being useful, it is not likely that any person will attempt to find a number beyond it."

Peter BARLOW

"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

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

Karl Theodor Wilhelm WEIERSTRASS



Rudi Mathematici

November

	1	S	(1535) Giambattista DELLA PORTA	
45	2	M	(1815) George BOOLE	
	3	T	(1867) Martin Wilhelm KUTTA (1878) Arthur Byron COBLE	
	4	W	(1744) Johann (III) BERNOULLI (1865) Pierre Simon GIRARD	
	5	T	(1848) James Whitbread Lee GLAISHER (1930) John Frank ADAMS	
	6	F	(1781) Giovanni Antonio Amedeo PLANA	
	7	S	(1660) Thomas Fantet DE LAGNY (1799) Karl Heinrich GRAFFE (1898) Raphael SALEM	
	8	S	(1656) Edmond HALLEY (1846) Eugenio BERTINI (1848) Fredrich Ludwig Gottlob FREGE (1854) Johannes Robert RYDBERG (1869) Felix HAUSDORFF	
	46	9	M	(1847) Carlo Alberto CASTIGLIANO (1885) Theodor Franz Eduard KALUZA (1885) Hermann Klaus Hugo WEYL (1906) Jaroslav Borisovich LOPATYNSKY (1922) Imre LAKATOS
10		T	(1829) Helwin Bruno CHRISTOFFEL	
11		W	(1904) John Henry Constantine WHITEHEAD	
12		T	(1825) Michail Egorovich VASHCHENKO-ZAKHARCHENKO (1842) John William STRUTT Lord RAYLEIGH (1927) Yutaka TANIYAMA	
13		F	(1876) Ernest Julius WILKZYNSKY (1878) Max Wilhelm DEHN	
14		S	(1845) Ulisse DINI	
15		S	(1688) Louis Bertrand CASTEL (1793) Michel CHASLES (1794) Franz Adolph TAURINUS	
47		16	M	(1835) Eugenio BELTRAMI
		17	T	(1597) Henry GELLIBRAND (1717) Jean Le Rond D'ALEMBERT (1790) August Ferdinand MOBIUS
		18	W	(1872) Giovanni Enrico Eugenio VACCA (1927) Jon Leslie BRITTON
		19	T	(1894) Heinz HOPF (1900) Michail Alekseevich LAVRENTEV (1901) Nina Karlovna BARI
		20	F	(1889) Edwin Powell HUBBLE (1924) Benoit MANDELBROT
		21	S	(1867) Dimitri SINTSOV
		22	S	(1803) Giusto BELLAVITIS (1840) Emile Michel Hyacinte LEMOINE
		48	23	M
	24		T	(1549) Duncan MacLaren Young SOMERVILLE (1909) Gerhard GENTZEN
	25		W	(1873) Claude Louis MATHIEU (1841) Fredrich Wilhelm Karl Ernst SCHRODER
26	T		(1894) Norbert WIENER (1946) Enrico BOMBIERI	
27	F		(1867) Arthur Lee DIXON	
28	S		(1898) John WISHART	
29	S		(1803) Christian Andreas DOPPLER (1849) Horace LAMB (1879) Nikolay Mitrofanovich KRYLOV	
49	30		M	(1549) Sir Henry SAVILE

USAMO 2000, Pr. 5

Let $A_1A_2A_3$ be a triangle and let ω_1 be a circle in its plane passing through A_1 and A_2 . Suppose there exist circles $\omega_2, \omega_3, \dots, \omega_7$ such that for $k = 2, 3, \dots, 7$, ω_k is externally tangent to ω_{k-1} and passes through A_k and A_{k+1} , where $A_{n+3} = A_n \forall n \geq 1$.

Prove that $\omega_7 = \omega_1$.

Mathematic Terms

QUANTIFY: I can't find anything wrong with your proof except that it won't work if x is a moon of Jupiter (Popular in applied math courses).

PROOF OMITTED: Trust me, It's true.

Set Theory

Theorem: Consider the set of all sets that have never been considered.

Hey! They're all gone!! Oh, well, never mind...

"Of the many forms of false culture, a premature converse with abstractions is perhaps the most likely to prove fatal to the growth of a masculine vigour of intellect."

George BOOLE

"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."

Fredrich Ludwig Gottlob FREGE

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

Hermann Klaus Hugo WEYL

"The British Mathematical Colloquium consists of three days of mathematics with no dogs and no wives."

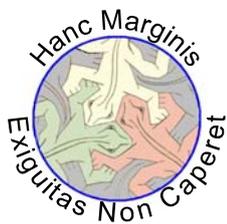
John Henry Constantine WHITEHEAD

"The modern physicist is a quantum theorist on Monday, Wednesday, and Friday and a student of gravitational relativity theory on Tuesday, Thursday, and Saturday. On Sunday he is neither, but is praying to his God that someone, preferably himself, will find the reconciliation between the two views."

Benoit MANDELBROT

"Algebra is generous: she often gives more than is asked for."

Jean D'ALEMBERT



Rudi Mathematici

December

	1	T	(1792) Nikolay Yvanovich LOBACHEVSKY
	2	W	(1831) Paul David Gustav DU BOIS-RAYMOND (1901) George Frederick James TEMPLE
	3	T	(1903) Sidney GOLDSTEIN (1924) John BACKUS
	4	F	(1795) Thomas CARLYLE
	5	S	(1868) Arnold Johannes Wilhelm SOMMERFELD (1901) Werner Karl HEISENBERG
	6	S	(1682) Giulio Carlo FAGNANO dei Toschi
50	7	M	(1647) Giovanni CEVA (1823) Leopold KRONECKER (1830) Antonio Luigi Gaudenzio Giuseppe CREMONA
	8	T	(1508) Regnier GEMMA FRISIUS (1865) Jaques Salomon HADAMARD (1919) Julia Bowman ROBINSON
	9	W	(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	F	(1882) Max BORN
	12	S	(1832) Peter Ludwig Mejdell SYLOW
	13	S	(1724) Franz Ulrich Theodosius AEPINUS (1887) George POLYA
51	14	M	(1546) Tycho BRAHE
	15	T	(1802) Janos BOLYAI
	16	W	(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	F	(1917) Roger LYNDON
	19	S	(1783) Charles Julien BRIANCHON (1854) Marcel Louis BRILLOUIN
	20	S	(1494) Oronce FINE (1648) Tommaso CEVA (1875) Francesco Paolo CANTELLI
52	21	M	(1878) Jan LUKASIEVIKZ (1932) John Robert RINGROSE
	22	T	(1824) Francesco BRIOSCHI (1859) Otto Ludwig HOLDER (1877) Tommaso BOGGIO (1887) Srinivasa Aiyangar RAMANUJAN
	23	W	(1872) Georgii Yurii PFEIFFER
	24	T	(1822) Charles HERMITE (1868) Emmanuel LASKER
	25	F	(1642) Isaac NEWTON (1900) Antoni ZYGMUND
	26	S	(1780) Mary Fairfax Greig SOMERVILLE (1791) Charles BABBAGE
	27	S	(1571) Johannes KEPLER (1654) Jacob (Jacques) BERNOULLI
1	28	M	(1808) Athanase Louis Victoire DUPRÉ (1882) Arthur Stanley EDDINGTON (1903) John von NEUMANN
	29	T	(1856) Thomas Jan STIELTJES
	30	W	(1897) Stanislaw SAKS
	31	T	(1872) Volodymyr LEVIYTSKY (1896) Carl Ludwig SIEGEL (1952) Vaughan Frederick Randall JONES

USAMO 200, Pr. 6

Let $a_1, b_1, a_2, b_2, \dots, a_n, b_n$ be nonnegative real numbers. Prove that

$$\sum_{i,j=1}^n \min\{a_i a_j, b_i b_j\} \leq \sum_{i,j=1}^n \min\{a_i b_j, a_j b_i\}$$

Mathematic Terms

Obvious: The instructor is sure it is in his notes somewhere.

Certainly: The instructor saw one of his instructors do it, but has completely forgotten how it was done.

Statistics

Q: Did you hear the one about the statistician?

A: Probably....

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

Jaques Salomon HADAMARD

"Now it is quite clear to me that there are no solid spheres in the heavens, and those that have been devised by authors to save the appearances, exist only in their imagination, for the purpose of permitting the mind to conceive the motion which the heavenly bodies trace in their courses."

Tycho BRAHE

"Mathematical discoveries, like springtime violets in the woods, have their season which no human can hasten or retard."

Janos BOLYAI

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

Arthur EDDINGTON

"The Analytical Engine weaves algebraic patterns, just as the Jacquard loom weaves flowers and leaves."

Augusta Ada KING Countess of LOVELACE

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

Werner Karl HEISENBERG