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Mathematical References in Literature

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MATHEMATICAL REFERENCES IN LITERATURE

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1. INTRODUCTION

Many years ago, my father, an ^{actuary} began collecting references to actuaries in literature. None of his material saw print until much later (E. A. Lew 1968); but well before this, from my college reading, I had begun to find things he had overlooked. (This disappointed me; one expects one's father to be omniscient.)

Then, a few years after my graduation, the eminent critic Clifton Fadiman published two anthologies, "Fantasia Mathematica" (1958) and "The Mathematical Magpie" (1962), containing short stories, poems, and other literary excerpts with mathematical references. These books re-

printed considerable science fiction. I had no complaint about that, since previously I had read most of his selections in that area; but I remarked that Fadiman too had overlooked well-known things, items that should not have escaped a literary personage. I began remembering more carefully what I would have chosen instead.

Fortunately, this secret contest with my father and Mr. Fadiman never caught the attention of a psychoanalyst. At some point I began recording my finds on index cards. In the 1970's I transferred my growing list to a computer file, standardized the references, and began inviting others' contributions. The core is still my own curiosity, but this bibliography now includes many suggestions, and its final part names all those who helped me. I thank them all here. Some are eminent scholars. Some are personal friends. One is my wife, who contributed her knowledge of science fiction - and her professional services as a librarian.

Despite this long quest, I cherish no thought that my list approaches completeness. It has gained breadth by swallowing several other lists, but still it reflects only my discoveries and those of finitely many other people, none of whom can possibly have read everything. Indeed, I shall be most grateful if those who study this accumulation, and who have further proposals, will write and tell me. But first they should consider the following paragraphs. To limit this bibliography, and avoid listing every old book that contains a mathematical term, I have adopted my own private, arbitrary, and doubtless wrongheaded criteria. Thus it may interest both casual readers and prospective

contributors to know just what I claim here to include, or not to include.

Many distinguished mathematicians have produced essays or books giving broad views of their subject, or fine examples of its discoveries, or popular introductions to its study. My office shelves hold numerous such works, and I would never claim to equal these - but my list does not include them. I do not disparage the writers; in their prose style, they need take second place to no other profession. But, in my bibliography, I have been collecting mostly reactions to mathematics by people other than its practitioners. Here I say "mostly" because now and then mathematicians make reference to their domain in some traditional literary form: novel, short story, poem. Of these, a few are too good to omit; so I list the professionals when they do non-professional things. Thus I admit Bertrand Russell's little fantasy "The Mathematician's Nightmare"; after all, its author only won the Nobel Prize in Literature.

Likewise, biographers have produced some fine lives of eminent mathematicians, but collecting these would dictate a quite different area for my search; so I omit them. Again, I make a small exception: I allow autobiographies. Even dedicated professionals may offer something beyond technical matters when describing their own lives. In particular, I admit Sofya Kovalevskaya's "A Russian Childhood", a small work whose narrative, at least in translation, recalls the great Russian novels of the 19th century.

When fans of popular music buy a respectable quantity of some classical recording, the music business calls this work a "crossover", and similarly when a popular recording achieves a more serious following. In something like this sense, I have been hunting "crossovers". However, my objective needs a few more qualifications.

In his two anthologies, Clifton Fadiman reprints considerable light verse on mathematical concepts. In my poetry section, I exclude these and collect

primarily works with more ambitious goals or better-known authors. Indeed, in the 19th century, the British journal "Punch" and its competitors published untold volumes of light verse. Thus, if one allowed this genre, then, conscientiously, one would need to search these old journals for versified British academic humor (or humour) on mathematical topics. Having collected this material, one would need also to decide how much was worth listing. (Once, years ago, I wrote a perfect Italian sonnet on the definition of continuity, but a journal editor declared it totally unfunny.) I prefer to avoid the light-verse category rather than contemplate such a bibliographic project. Any volunteers?

Through such considerations, I have preferred to set rules for inclusion (and subrules for exceptions) that serve my purpose, then to intrude fewer personal judgements of merit in adding things to the list. Thus, inclusion does not always mean quality. Most emphatically, this is not a "Recommended Reading" list. Some works here I would praise whether or not they had mathematical references; others may have little value except to illustrate a theme, and my parenthetical remarks on them may betray a lack of admiration. Still, I do not altogether reject subjectivity. From major literary figures I admit rather trivial items (though, in Dante and Shakespeare, even such brief remarks have some point.) On the other hand, scientific mumbo-jumbo is a standard element of science fiction. Hence generally I exclude such fiction when it has no further mathematical relevance, though I bend this rule slightly to include marginal items when a prior source has mentioned them. I try to incorporate my sources; the last section acknowledges them all.

The Table of Contents shows my subdivision of this list. Then a short initial section notes a few anthologies that contain many later items, items some of which are otherwise not too accessible. Later entries cite these books in giving published sources. However, I have usually tried to find earlier published versions. Thus entries for some works may mention an original date and a later reprinting,

or an early source and an anthology. Here "partly in Collection X" means that I have read a more complete version, while "excerpt in ..." means that I have not. I have lumped general non-fiction and short stories because some works straddle the boundary; otherwise, my categories should need no explanation.

As its title suggests, this list collects primarily mathematical references in printed material. However, two late sections gather a few songs and films. Despite video rentals, a longer list of relevant old films requires either lifelong dedication to the movies, a good bit of luck, or further help from others. For this project it was my luck that, some years ago at 2:00 a.m., a TV station in my area chose to broadcast the film "Are You With It?". Otherwise I might have known it only from my father's memories of the play. With luck, readers may have encountered other films suitable for my list.

Yes, but what does it all mean? I claim that the cited works dramatize some Western intellectual history. Ancient astronomers were mathematicians as well; a fable of Aesop concerns such a one in a field, so preoccupied watching the stars that he fell down a well. This fable remains the stereotype; different eras have added different things.

Some writers and artists of the Renaissance (e.g., Chaucer, Leonardo) knew far more mathematics than others. (Clearly, Latin and Greek were more prized attainments.) But, to such people, mathematics was not a totally separate universe; what they knew made appearances in their work. Then the intellectual triumphs of Newton persuaded artists of 18th-century Europe to value a rational, quantitative style even in their own productions. Newton himself came to symbolize this outlook. Certain writers even studied his works! And references to him show great respect, mingled occasionally with the impish humor that aims shafts at anyone on a pedestal.

Late in the 18th century, important European writers came to feel that rationalism left too little space for human emotions. Admittedly, not everything called rational makes sense or ever has; but, as a conscious estrangement, rather than mutual ignorance, the famous "two-cultures" split may be little older than Rousseau. To Blake, Newton the hero became Newton the villain; later this view, much sophisticated, reached the universities, where it prompted G. H. Hardy's 1930's remark on the word "intellectual": "There seems to be a new definition which certainly doesn't include Rutherford or Eddington or Dirac or Adrian or me." No doubt Blake's view helped animate the F. R. Leavis counterattack when C. P. Snow, in 1959, first deplored the separation of "the two cultures". Poetry, for Leavis, was the true source of "finer awareness"; to him, supposedly, the literature alone of a time and place could embody the important aspects of its culture.

My list documents this split, but also suggests that writers had begun bridging the gap by the time of the confrontation. By then, major 20th century authors, some with mathematical training, had made literary uses of mathematics going well beyond the tired stereotypes. This is both good and bad news. Mathematicians in modern novels now commit the same range of sins as do their innumerate neighbors. It seems the literary world has conceded that mathematicians are human.

Our society needs more young people studying mathematics, and this development may encourage them. Probably most young people have not yet had time to try all the interesting sins. Literature now assures them that they can pursue a mathematical career without foreclosing the opportunity. That is a change from the ancient astronomer in the well, and I call it an improvement. In any event, those reading my list may find that mathematical things have won literary attention from more writers than they might

have supposed, including figures of great eminence in the world's eyes.

A final footnote. My very quick historical sketch reflects a book by (naturally) a mathematician, namely, Alfred North Whitehead's "Science and the Modern World" (The Macmillan Company, 1925). My source for Hardy's remark is C. P. Snow's "The Two Cultures" (Cambridge University Press, 1959). F. R. Leavis published his response in "Two Cultures? The Significance of C. P. Snow" (Chatto and Windus, 1962); for his general views, see "New Bearings in English Poetry" (University of Michigan Press, 1960). This bibliography itself, under appropriate headings, gives detailed references for all other cited works.

2. COLLECTIONS

(DB) Joan Digby and Bob Brier (eds.) - "Permutations: Readings in Science and Literature", Quill (William Morrow), New York 1985

(F1) Clifton Fadiman (ed.) - "Fantasia Mathematica", Simon and Schuster, New York 1958

(F2) Clifton Fadiman (ed.) - "The Mathematical Magpie", Simon and Schuster, New York 1962

(M) Robert Edouard Moritz (ed.) - "Memorabilia Mathematica", Macmillan, New York 1914 (brief quotations about mathematics, some from literary sources)

(N) James R. Newman (ed.) - "The World of Mathematics", Simon and Schuster, New York 1956

(RW) Ernest Robson and Jet Wimp (eds.) - "Against Infinity", Primary Press, Parker Ford, PA 1979 (mathematical poetry)

3. NOVELS

Edwin A. Abbott - "Flatland" (1884), Barnes and Noble, New York 1963, partly in Collection N (Polygonal beings inhabit a planar world.)

Jeffrey Archer - "Not a Penny More, Not a Penny Less", Doubleday & Co., New York 1976 (A mathematician leads a team to dupe a financier who swindled them.)

Isaac Asimov - "The Foundation Trilogy", Doubleday & Co., New York 1951 (intermittent references to the basic premise: statistical equations for broad historical development)

Isaac Asimov - "Foundation's Edge", "Foundation and Earth", Doubleday & Co., New York 1982, 1986 (resp. fourth and fifth novels in the "Foundation" series)

Desmond Bagley - "The Spoilers", Doubleday & Co., New York 1970, Chaps. 2.4, 3.4, 5.1 (A professional gambler exploits probability paradoxes.)

Samuel Beckett - "Molloy" (1951), Grove Press, New York 1955, excerpt in Collection F2 (The narrator, with ever more compulsive requirements, distributes 16 sucking-stones among his four pockets.)

Saul Bellow - "The Adventures of Augie March" (1953), Viking Press, New York 1960, p. 188 (Augie's resourceful friend Manny Padilla is a demon equation-solver and future mathematical physicist.)

Hermann Broch - "The Unknown Quantity", Collins, London 1935, Howard Fertig, New York 1975 (A young physics Ph.D. in Germany ponders the meanings of mathematics and life.)

Dionys Burger - "Sphereland", Thomas Y. Crowell Co., New York 1965 (Flatland inhabitants discover curved space.)

James Branch Cabell - "Jurgen" (1919), Dover Publications, New York 1978, Chap. 32, partly in Collection FI (Jurgen's private session with Queen Dolores imparts mathematics by the sensuous approach.)

John Dickson Carr - "The Case of the Constant Suicides" (1941), Collier Books, New York 1977, Chap. 20 (Dr. Fell, though scorning geometry, uses it to explain a murder.)

John Dickson Carr - "Dark of the Moon", Harper & Row 19??, Berkley Medallion Books 1967, p. 61 (gripping about motion problems)

John Dickson Carr - "The Three Coffins", Gregg Press, Boston 1979, 1935 British title - "The Hollow Man", Chap. 3 (The first victim's secretary is a mathematics student.)

Lewis Carroll - "Alice's Adventures in Wonderland" (1865) and "Through the Looking Glass" (1872). For passages with mathematical significance, see "The Annotated Alice", introduction and notes by Martin Gardner, World Publishing Co., New York 1963.

Arthur C. Clarke and Gentry Lee - Rama II, Bantam Books, New York 1989, Chap. 55 (General O'Toole uses a prime-number curiosity to create a 50-digit identification number.)

James Gould Cozzens - "Guard of Honor" (1948), Harcourt Brace Jovanovich, New York 1964,

Part 2, Section 2 (A young mathematician, during WWII, breaks the U.S. Navy code in an idle hour.)

Daniel Defoe - "A Journal of the Plague Year" (1722: Weekly mortality figures for various London districts document the onward march of the bubonic plague.)

Daniel Defoe - "Robinson Crusoe" (1719-1720), 2/9 from start (The mechanical arts, like mathematics, require mainly perseverance and reason.)

Don DeLillo - "The Names", Alfred A. Knopf, New York 1982, Chap. 7 (esoteric nature of pure mathematics)

Don DeLillo - "Ratner's Star", Alfred A. Knopf, New York 1976 (A mathematical prodigy at a satirized scientific institute helps decode a mysterious message from outer space.)

William De Morgan - "Joseph Vance", Henry Holt, New York 1906, Chap. 9 (Joey sees that an equilateral triangle has equal angles.)

A. K. Dewdney - "The Planiverse: Computer Contact with a Two-Dimensional World", Poseidon Press, New York 1984 (Intelligent beings inhabit a scientifically consistent 2-dimensional universe.)

Norman Douglas - "South Wind" (1917), Modern Library, New York 1925, Dover Publications, New York 19??, Chap. 28 (A young professor is calculating how soon the volcanic eruption will bury the town.)

Arthur Conan Doyle - "The Valley of Fear" (1915), Chap. 1 (Holmes, to Watson, sketches the mathematical career of Prof. Moriarty.)

H. F. Ellis - "The Vexations of A. J. Wentworth, B. A.", Little, Brown, and Co., Boston 1950 (comic misadventures of an accident-prone mathematics master at an English prep school.)

Ford Madox Ford - "Parade's End" (1924-1928), Vintage Books, New York 1979 (The much-abused hero is a vastly knowledgeable statistician.)

C. S. Forester - "Randall and the River of Time", Little, Brown, and Co., Boston 1950, especially Chaps. 3-5, 13, 18, 19 (Naive mathematics student, veteran of WWI, accidentally discovers and kills the lover of his unappreciative wife.)

Johann Wolfgang von Goethe - "Wilhelm Meisters Wanderjahre" (1829), Chap. 10, English translation: "Wilhelm Meister's Travels" (Thomas Carlyle, translator), Houghton Mifflin, Boston 1889; excerpts in Collection M, pp. 36 & 121 (Children's participation in singing spurs their respect for numerical accuracy.)

Rebecca Goldstein - "The Mind-Body Problem", Random House, New York 1983 (The wife of a mathematical genius encounters the value system of his rarefied world.)

Hermann Hesse - "Das Glasperlenspiel" (1943), American title - "Magister Ludi" (The "glass bead game" of the German title has some unexplained resemblances to mathematics and music.)

Charles Howard Hinton - "An Episode of Flatland", Swann Sonnenschein & Co., London 1907, long excerpt in "Speculations on the Fourth Dimension", Dover Publications, New York 1980

James Joyce - "A Portrait of the Artist as a Young Man" (1916), Chap. 5 (The professor's lecture distinguishes ellipse and ellipsoid.)

James Joyce - "Ulysses" (1922), U.S. 1934 edition pp. 18, 662, 683 (brief joke on algebra, remark on age ratios, remark on large numbers)

Norton Juster - "The Phantom Tollbooth", Random House, New York 1961, partly in Collection F2 (The city of Digitopolis and its king, the Mathemagician, play large roles in the fantastic adventures of Milo.)

Rudyard Kipling - "Kim" (1901), Chap. 9 (Kim wins mathematics prize on completing secondary school.)

Arthur Koestler - "Darkness at Noon" (1941), Part 1, Section 14 (Politics spins open formulas in x , where x = the masses, but history finds the meaning of this x .)

D. H. Lawrence - "Sons and Lovers" (1913), Modern Library, New York 1929, Chap. 7 (Paul, convalescing, tries to teach Miriam algebra.)

Richard Llewellyn - "How Green Was My Valley", Macmillan, New York 1941, excerpt in Collection F1 (Mother asks why mathematical bathtubs have multiple outlets - and who owns the decimal point.)

William John Locke - "The Morals of Marcus Ordeyne", John Lane Co., New York 1906, pp. 244-245 (The protagonist teaches elementary mathematics, though thinking it useless and oppressive.)

Jack London - "Martin Eden" (1909: Martin works day and night to get an education, including algebra, trigonometry, and physics.)

Jack London - "The Sea Wolf" (1904), Chap. 10 (Wolf Larsen, in lonely mathematical study, has simplified the techniques of navigation.)

George Malcolm-Smith - "Slightly Perfect", Random House, New York 1941, basis for stage and film musical "Are You With It?" (A sobersided real

man inspired this fictional tale wherein a similarly-named actuary misplaces a decimal point - and leaves his job to join a carnival.)

Russell McCormach - "Night Thoughts of a Classical Physicist", Avon Books, New York 1982 (An elderly German physicist, during WWI, regrets the increasing mathematical abstractness of theoretical physics.)

Herman Melville - "The Confidence-Man: His Masquerade" (1856) Chap. 36 (trigonometric simile)

Nicholas Meyer - "The Seven Per Cent Solution", E. P. Dutton & Co., New York 1974 (Moriarty 's criminal eminence is just Holmes' cocaine induced paranoia.)

Robert Musil - "The Man Without Qualities" (1930-1943), Coward McCann, New York 1953, Chaps. 10, 11, 13, 17, 28 (The protagonist, like the author, leaves a promising mathematical career for some undefined broader goal .)

Vladimir Nabokov - "Invitation of a Small Guest" (1957), Atheneum, New York 1963, Chap. (brief satire on mathematical linguistics)

Joyce Carol Oates - "Wonderland", Vanguard Press, Inc., 1971, excerpt in American Mathematical Monthly 88 (1981) p. 604 (Character tells himself he can't understand calculus.)

Flann O'Brien - "The Dalkey Archive" (1964), Penguin Books, New York 1977 (atomic physics in Irish brogue)

Flann O'Brien - "The Third Policeman" (1967, written 1940), Plume Books, New York 1976, Chap. 6 (earlier and better version of preceding.)

Robert Pease - "The Associate Professor", Simon and Schuster, New York 1967 (A harried professor at a NYC college can no longer solve anything but the assigned problems .)

Thomas Pynchon - "The Crying of Lot 49", J. B. Lippincott, New York 1966, Chap. 5 (brief speculation: delirium tremens = dt's)

Thomas Pynchon - "Gravity's Rainbow", Viking Press, New York 1973, especially p. 55 (stochastic vs. deterministic view of life)

Thomas Pynchon - "Vineland", Little, Brown, and Co., Boston 1990, pp. 204-217 and 342 (A young group-theorist at a California college, a leader in a 1960's rebellion, meets a fate like that of Galois - another leader shoots him; the number 2. 71828 seems "real natural".)

Erik Rosenthal - "The Calculus of Murder", St. Martin's Press, New York 1986 (A young mathematician and part-time detective solves a differential equation to explain the timing of a murder.)

Erik Rosenthal - "Advanced Calculus of Murder", St. Martin's Press, New York 1989 (The 15-year-old theft of an unpublished theorem motivates a murder at an Oxford operator-theory conference.)

Dorothy Sayers - "The Documents in the Case" (1930), Avon Books, New York 1971, p. 58 (Mathematicians, through habitual abstraction, gain a cheerful detachment from the world's vicissitudes.)

Lynne Sharon Schwartz - "Rough Strife", Harper & Row, New York 1980, especially pp. 50, 77, 89, 148 (Mathematician and art historian negotiate troubled marriage.)

George Bernard Shaw - "An Unsocial Socialist" (1884), W. W. Norton, New York 1972, Chap. 6 (Mathematics needs postulates; life offers few.)

Charles Sheffield - "The McAndrew Chronicles", Tom Doherty Associates, New York 1983 (The mathematics of black holes provides the rationale for a space drive.)

Nevil Shute - "No Highway", William Morrow, New York 1948 (Wherein separating nascent important research from mere eccentric elaboration means literally life or death.) See Amer. Math. Monthly 86 (1979) p. 305

James Park Sloan - "The Case History of Comrade V.", Houghton Mifflin, Boston 1972 (A patient in an East-European mental hospital is either a schizophrenic or a politically imprisoned mathematician.)

Tobias Smollett - "Peregrine Pickle" (1751), Everyman's Library, London 1939, Chapters 24, 35, 83 (Geometric arguments prove youth's folly; a treatise on the cycloid comforts a storm-tossed traveler; fortunetelling, not De Moivre's actuarial science, fetches the multitude.)

Alexander Solzhenitsyn - "The First Circle", Harper & Row, New York 1968 (A Stalinist work camp for "unreliable" scientists houses the protagonist, a mathematician, together with other technical specialists.)

John Steinbeck - "The Moon Is Down", Viking Press, New York 1942, Chap. 2 ("He was an arithmetician rather than a mathematician.")

Laurence Sterne - "Tristram Shandy" (1759-1767), Chap. 3, partly in Collection N, p. 734 (geometrical studies of Uncle Toby.)

Rex Stout - "And Be a Villain", Viking Press, New York 1948 (A mathematician, one of the murder suspects, discusses the investigation in probabilistic terms.)

Rex Stout - "Death of a Doxy", Viking Press, New York 1966 (The culprit, a mathematics teacher, takes the pseudonym Thales.)

Jan Struther - "Mrs. Miniver" (1940), Harcourt Brace, New York 1966, excerpt in Collection F2 (geometry problem as psychological metaphor.)

Jonathan Swift - "Gulliver's Travels" (1726), Part 2, partly in American Mathematical Monthly 92 (1985) p. 326 (education in Brobdingnag); Part 3, partly in Collection N (scientific excesses of Laputa; Grand Academy of Lagado.)

Anthony Trollope - "The Last Chronicle of Barset" (1867), Oxford Univ. Press, London 1946, Chap. 63 (Unlettered Jane, aged 16, has read only Latin, Greek, Euclid's "Elements", and Wood's "Algebra".)

John Updike - "Roger's Version", Alfred A. Knopf, New York 1986 (Young computer scientist tutors youngster in mathematics, urges modern cosmological argument from design to prove God's existence.)

S. S. Van Dine - "The Bishop Murder Case", Charles Scribner's Sons, New York 1930 (Homicidal reenactments of nursery rhymes stalk a New York enclave of mathematicians and chess enthusiasts.)

Jules Verne - "From the Earth to the Moon" (1865) and "A Trip around It" (1870), Book 1, Chaps. 2, 4, 7, 8, and Book 2, Chaps. 4, 8 (geometric communication with extraterrestrials, mathematical considerations for the trip, orbital recalculations en route.)

Jules Verne - "Journey to the Center of the Earth" (1864), Chaps. 2 & 3 (transposition cipher.)

Jules Verne - "The Mysterious Island" (1870), Part 1, Chap. 14 (Geometry and simple apparatus fix the castaways' latitude and longitude.)

Sylvia Townsend Warner - "Mr. Fortune's Maggot", Viking Press, New York 1927 (about 1/3 from end), partly in Collection N. (A "simple" tropical islander can't understand mathematical abstractions.)

H. G. Wells - "Joan and Peter", Macmillan, New York 1918, Chap. 7.3, partly in Collection FI (The usual teaching of elementary arithmetic confuses any students but the mathematically self-sufficient.)

H. G. Wells - "The Undying Fire", Macmillan, New York 1919, Chap. 1.3 (By Satan's reckoning, Job's descendants, through geometric increase, are now the whole human race.)

Thornton Wilder - "The Eighth Day", Harper & Row, New York 1967, Part 2 (Ashley, in New Orleans, uses his mathematical gift in gambling.)

4. PLAYS

W. H. Auden - "For the Time Being", The Summons, III (1944), in Marvin Halverson - "Religious Drama I", Meridian Books, Inc., New York 1957 ("The Kingdom of Infinite Number")

Thomas Dekker - "The Honest Whore", Part 2 (1605), Act 1, Scene 3, excerpt in Collection FI (moralized circles and squares)

Bob Elliott and Ray Goulding - Unpublished skit (Belligerent intruder on Bob-and-Ray broadcast states everything in probabilities.)

Christopher Fry - "The Lady's Not for Burning", Oxford Univ. Press, New York 1950, Act 2, p .50 (Mathematical relations obsessed Jenet's dead father, an alchemist.)

W. S . Gilbert and Arthur Sullivan - "The Pirates of Penzance" (1879), Act 1 ("many cheerful facts about the square of the hypotenuse".)

Norman MacOwan - "The Infinite Shoeblack", London 1929, New York 1930 (A poor and moralistic actuarial student meets a sexually adventurous young woman.) See "The New York Times Theater

Reviews 1920-1970", The New York Times & Arno Press, New York 1971, Vol. 2, 5 May 1929; Vol. 3, 18 Feb. 1930.

Sam Perrin and George Balzer (book), Harry Revel (music), Arnold B. Horwitt (lyrics) - "Are You With It?", musical comedy based on George Malcolm-Smith's novel "Slightly Perfect", New York premiere 10 Nov. 1945. (Having misplaced a decimal point, an actuary leaves his job and joins a carnival.) See George Jean Nathan - "The Theatre Book of the Year 1945-1946", Alfred A . Knopf, New York 1946 . See also "The New York Times Theater Reviews 1929-1970", The New York Times & Arno Press, New York 1971, Vol . 5, 12 Nov . 1945 .

Elmer Rice - "The Adding Machine" (1923), Scenes 2-4, in "Three Plays", Hill & Wang, New York 1965 (Repetitive arithmetic symbolizes the dehumanization of an urban clerical worker yclept Mr. Zero.)

William Shakespeare - "Henry V" (c. 1598-1599), Act 1, prologue (metaphorical use of positional notation.)

William Shakespeare - "The Taming of the Shrew" (c . 1594), Act 1, Scene 1 & Act 2, Scene 1, partly in Collection M, p . 190 (mere mention.)

William Shakespeare - "The Winter's Tale" (c. 1611), Act 1, Scene 2 (brief joke on positional notation.)

George Bernard Shaw - "Back to Methusaleh" (1922), Part 5 (In 31920 A.D., mathematical contemplation is the main activity of adult humans.)

George Bernard Shaw - "Major Barbara" (1905), Act 3 (Mathematics not being his field, Prof Cusins must ask whether $3/5$ exceeds $1/2$.)

George Bernard Shaw - "Mrs. Warren's Profession" (1898), especially Act 1 (Mrs. Warren's daughter is a Cambridge mathematics student.)

Tom Stoppard - "Rosencrantz and Guildenstern Are Dead", Grove Press, New York 1967, Act 1 (The title characters try to explain Guildenstern's having thrown 90 consecutive heads.)

John Webster - "The Duchess of Malfi" (c.1613), Act 1, Scene 1 & Act 2, Scene 2, partly in Collection Fl (geometrical images in lewd jokes.)

5. GENERAL NONFICTION AND SHORT STORIES

Goodman Ace - "Like Is a Many-Splendored Thing", in Martin Levin (ed.) - "The Saturday Review Sampler of Wit and Wisdom", Simon and Schuster, New York 1966 (Poor, lonely parallel lines, doomed never to meet!)

Samuel Hopkins Adams - "The One Best Bet", in "Average Jones", Bobbs-Merrill 1911, Arno Press, New York 1976 (A deduction from similar triangles prevents the assassination of a governor.)

Joseph Addison - "The Vision of Mirzah" (1 Sept. 1711), in "Collected Essays" (the stochastic process of life.)

W. H. Auden - "Squares and Oblongs", in W. H. Auden, Karl Shapiro, Rudolf Arnheim, and Donald A. Stauffer - "Poets at Work", Harcourt, Brace, and Co., New York 1948 (Pure mathematicians, unlike modern poets, meet no public attacks on their alleged incomprehensibility.)

St. Augustine - "Sermon 41", Art. 23, excerpt in Collection M, p.379 (religious numerology.)

Nigel Balchin - "God and the Machine", in "Last Recollections of My Uncle Charles", Rinehart

& Co., New York 1951, also in Collection Fl. (A checkers-playing computer disillusions its creator by cheating.)

Hilaire Belloc - "First and Last", Methuen & Co., London 1911, specifically "On Cheeses" (nested brackets as a literary device), "The Old Gentleman's Opinions" (puzzled silence over noneuclidean concepts.)

Ambrose Bierce - "The Devil's Dictionary" (1906), Dover Publications, New York 1958, specifically entries for "hash", "logic".

Jorge Luis Borges - "Labyrinths", New Directions, New York 1962, especially "The Garden of Forking Paths" (time as infinite branching), "The Lottery in Babylon" (life as an infinite lottery), "The Library of Babel" (the set of all alphabetic n-tuples), "Death and the Compass" (mathematical patterns in a detective tale), "Partial Magic in the Quixote" (self-reference in great literary works.)

Edmund Burke - "A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful" (1757), Part 3, Section 2, partly in Collection M, p. 66 (Geometric proportion, by this reasoning, is not a cause of beauty.)

Jeffrey Burke - "All You Need to Know", Harpers, Vol. 257, No. 1543 (Dec. 1978) p. 93 (If beauty = truth, then "mathematics" proves that truth = beauty.)

E. M. Butler - "Ritual Magic", Noonday Press, New York 1959, pp. 67 & 77 (Genuine lore of black magic: the principal angels, by the book "Lemegeton", have vast numbers of attendants; the demon Asmodeus grants, among other things, skill in arithmetic and geometry.)

Lewis Carroll - Miscellaneous prose, especially "The Purse of Fortunatus", in "Sylvie and Bruno",

also in Collection F2 (Moebius strip); "Eternity: a Nightmare", in "Sylvie and Bruno Concluded", Chap. 16, also in Collection F1 (algebraic geometry: an infinite task); "Knot IX: a Serpent with Corners", in "A Tangled Tale", also in Collection N (hydrostatic paradoxes); "What the Tortoise Said to Achilles", in Collection N (a logical infinite regress.)

Leslie Charteris - "The Percentage Player", in "The Saint to the Rescue", Manor Books, New York 1968 (The Saint foils a mathematically adept gambler.)

Geoffrey Chaucer - "A Treatise on the Astro-labe" (c. 1390: a manual for his son using concepts of astronomy, geometry, and proportion.)

John Cheever - "The Geometry of Love", in "The World of Apples", Alfred A. Knopf, New York 1973 (Lines and angles represent human relationships.)

G. K. Chesterton - "George Bernard Shaw", Hill and Wang 1956, Chap. 5, "The Critic" (Poetry dismays logicians because it uses words differently.)

Winston S. Churchill - "If Lee Had Not Won the Battle of Gettysburg", Scribner's Magazine, Dec. 1930, pp. 587-597, also in J. C. Squire (ed.) - "If It Had Happened Otherwise", 1931 (Growing militarism yields agreement by miraculous transmutation, as an increasing function reaches negative values through infinity; e.g., $f(t) = -1/t$.)

Robert M. Coates - "The Law" (1947), in Collections F2 and N (Congress repairs the Law of Averages when it fails.)

Dante Alighieri - "Vita Nuova" (1292-1300), Chaps. 12 & 29; English translation: Mark Musa - "Dante's Vita Nuova", Indiana Univ. Press, Bloomington, IN, 1973 (The center of a circle is Love's

image for himself; properties of the number 9 link it mystically with Beatrice.)

Arthur Conan Doyle - "The Complete Sherlock Holmes", specifically "The Adventure of the Dancing Men" (1904: substitution cipher), "The Final Problem" (1894: first appearance of Prof. Moriarty), "The Musgrave Ritual" (1894: trigonometric note.)

Corey Ford - "The Wonderful World of Figures", in "Corey Ford's Guide to Thinking", Doubleday and Co., New York 1961, also in Collection F2.

Benjamin Franklin - "On the Usefulness of Mathematics", excerpts in Collection M.

W. S. Gilbert - "An Elixir of Love", The Graphic, Dec. 1869, also in Peter Haining (ed.) - "The Lost Stories of W. S. Gilbert", Robson Books, London 1982 (This tale, the original form of "The Sorcerer", contains a curate who proves human equality by algebra.)

Johann Wolfgang von Goethe - "Maximen und Reflexionen", Nos. 1277 & 1280, in American Mathematical Monthly 92 (1985) p. 130 (mathematicians' intolerance of the qualitative.)

Oliver Goldsmith - "An Enquiry into the Present State of Polite Learning in Europe", J. Dodsley, London 1774; Garland Publishing, New York 1970, Chap. 13 (The meanest intellects, given but the will, might understand mathematics.)

Robert Graves - "The Abominable Mr. Gunn", in "Collected Short Stories", Penguin Books, Harmondsworth, England, 1968, also in Collection F2 (A sarcastic teacher suppresses a mathematically quick student.)

J. B. S. Haldane - "On Being the Right Size", in "Possible Worlds", Harper & Brothers, New York 1928, also in Collection N (An animal's size determines its shape.)

O. Henry - "The Handbook of Hymen" (1906), partly in Collection N, p. 1487 (A woman's two suitors offer her poetry and "statistics".)

Charles Howard Hinton - "Speculations on the Fourth Dimension", Dover Publications, New York 1980, specifically "A Plane World" (1884 anticipation of Burger's "Sphereland"), "An Unfinished Communication" (1885 tale of 2-dimensional time.)

Richard Hughes - "The Vanishing Man", in "A Moment of Time", Harold Ober Associates, 1926, also in Collection F2 (Returning from a fourth dimension is harder than walking into it.)

Aldous Huxley - "Young Archimedes", in "Young Archimedes" (collection), Harper & Brothers, 1924, also in Collections F1 and N (Selfish adults exploit a young prodigy.)

Kurd Lasswitz - "The Universal Library" (1901), in Collection F1 (Every sequence of alpha-numerics is a book in this library.)

Stephen Leacock - "Caroline's Christmas", in "Nonsense Novels", Dodd, Mead, and Co., New York 1959 (running joke: "The Good Book" = Euclid's "Elements".)

Stephen Leacock - "Common Sense and the Universe", in Collection N (Modern science narrowly survives Leacock's explanations.)

Stephen Leacock - "Literary Lapses", John Lane Co., New York 1920, specifically "A, B, and C: the Human Element in Mathematics", also in Collection F2 (the private lives of those familiar characters in algebra problems); "Aristocratic Education" (geometry amended by the House of Lords); "Boarding-House Geometry" (Euclidean axioms for lodgers); "How to Avoid Getting Married" (the importance of one's fiancée's knowledge of quadratic equations.)

Stephen Leacock - "Mathematics for Golfers", in Collections F2 & N (The average golfer's excuses for a bad game permit a good one about once in 29 million years.)

Eliphas Levi - "The History of Magic" (Arthur Edward Waite, translator), William Rider & Son, London 1922, especially Introduction and Book I (mathematical mysticism.)

Jack London - "The Siege of the Lancashire Queen", in "Tales of the Fish Patrol" (Capturing some poachers becomes a geometry problem.)

Russell Maloney - "Inflexible Logic" (1940), in Collections F1 and N (Six typewriting monkeys produce error-free world literature.)

W. Somerset Maugham - "A Writer's Notebook", Doubleday & Co., Garden City, N. Y. 1949, p. 265 (Do theorems have real content?)

W. Somerset Maugham - "The Portrait of a Gentleman" (1923-1929), in "Collected Short Stories", Penguin Books, New York 1977 (A poker-players' manual in a second-hand shop conveys well the personality of its author, an actuary.)

H. L. Mencken - "The Educational Process", in "Heathen Days", Alfred A. Knopf, Inc., New York 1943 (recollections of past algebra-teachers.)

H. L. Mencken - "A Mencken Chrestomathy", Alfred A. Knopf, New York 1956; specifically "The Scientist" (1919), p. 12; "The Metaphysician" (1940's), pp. 13-14; "Caveat Against Science" (1927), pp. 330-333; "The Eternal Conundrum" (1931), pp. 333-337.

Edward Page Mitchell - "The Tachypomp" (1873), in Collection F1 (Our hero, to win his sweetheart's hand, must invent a device reaching arbitrarily high speeds.)

David Osselton - "Monkeys and Shakespeare: A Dissent", Harpers, Feb. 1985, p. 22, from "Making a Monkey of Shakespeare", New Scientist, 1 Nov. 1984 (Random typing takes far too long to produce Shakespeare.)

Samuel Pepys - "Diary", entry for 4 July 1662 (Pepys starts learning "mathematics" - his first attempt being the multiplication table.) See American Mathematical Monthly 91 (1984) p. 52.

Plato - "Timaeus", partly in Collection DB, pp. 211-216 (geometry and mysticism.)

Edgar Allan Poe - "Essays and Reviews", The Library of America, New York 1984, especially "A Few Words on Secret Writing" (1841: cryptography essay), "Maelzel's Chess Player" (1836: impeachment of reputed chess automaton, using deduced properties of artificial intelligence.)

Edgar Allan Poe - "Poetry and Tales", The Library of America, New York 1984, especially "Eureka" (1848: metaphysics of the universe, making appeals to algebra, geometry, physics), "The Gold Bug" (1843: substitution cipher), "The Murders in the Rue Morgue" (1841: praise of that highest "analysis" combining logical with psychological acumen), "The Purloined Letter" (1845: algebra vs poetry), "The Thousand-and-Second Tale of Scheherazade" (1845: mathematically fluent birds and bees.)

John Reese - "The Symbolic Logic of Murder" (1960), in Collection F2 (Boolean algebra gets its man.)

Bertrand Russell - "The Collected Stories of Bertrand Russell", Simon and Schuster, New York 1972, specifically "The Perplexities of John Forstice" (A symposium of great men, including a mathematician, state their philosophies of life.), "The Mathematician's Nightmare" (1955), also in Collection F2 (The various integers have different shapes, colors, and personalities.)

Bruno Schulz - "The Comet", Part 2, in "The Street of Crocodiles", Penguin Books, New York 1977, 1934 Polish title - "Cinnamon Shops" (A comet, with mathematical certainty, nears a collision with the earth.)

Richard Steele - "Sir Roger and Sir Andrew" (19 Sept. 1711), in "Collected Essays" (All major human enterprises demand accurate numbers.) Rex Stout - "The Zero Clue", in "Three Men Out", Viking Press, New York 1954 (Nero Wolfe interprets a mathematical clue.)

Lytton Strachey - "Hume", in "Portraits in Miniature", Harcourt, Brace, and Co., New York 1931 (The pure mathematician, among all creatures, represents the ultimate in detachment.)

J. L. Synge - "O'Brien's Table", in "Science: Sense and Nonsense", Jonathan Cape, Ltd., 1951, also in Collection F2 (What, legally, is a surface?)

Henry David Thoreau - "A Week on the Concord and Merrimac Rivers" (1849), excerpt in Collection M, p. 189 (the poetry of mathematics.)

James Thurber - "Many Moons", Harcourt, Brace, and Co., New York 1943 (The King's three advisors include the Royal Mathematician.)

Mark Twain - "Life on the Mississippi" (1883), Chap. 17, partly in Collection F2 (facetious extrapolation of the river's future length.)

William Hazlett Upson - "A. Botts and the Moebius Strip" (1945), in "The Best of Botts", McKay & Co., New York 1961, also in Collection F1 (Painting just the "outside" of a Moebius belt keeps an officious lieutenant out of Botts's hair.)

William Hazlett Upson - "Paul Bunyan versus the Conveyer Belt" (1949), in Collection F2 (The Moebius strip rolls again!)

Voltaire - "Philosophical Dictionary" (1764), specifically "Atoms" (questionable utility of mathematical abstractions), "Nature" (Nature is not a mathematician but obeys mathematical laws.)

Ben Ames Williams - "Coconuts" (1926), in collection F2 (The well-known problem of the monkey and the coconuts diverts a commercial architect from his financial self-interest.)

Angus Wilson - Early parody of Virginia Woolf, in "Diversity and Depth in Fiction: Selected Critical Writings", Secker and Warburg, London? 1983, also in John Bayley - "Life-enhancing world views", Times Literary Supplement, 16 Sept. 1983, p. 978 (Square root of pi troubles reverie of Mrs. Green.)

William Wordsworth - 1802 Preface to William Wordsworth and Samuel Taylor Coleridge - "Lyrical Ballads", Barnes and Noble, New York 1963 (Mathematicians and scientists, like poets, ultimately seek pleasure in their creations.)

6. REMARKS ON OTHERS' VIEWS OF MATHEMATICS

John Carey - "John Donne: Life, Mind, and Art", Oxford Univ. Press, New York 1981, Chap. 4 (Donne knew little mathematics, but his metaphors use what he knew.)

Carl H. Grabo - "Newton among Poets: Shelley's Use of Science in Prometheus Unbound", Cooper Sq. 1968.

Diane Johnson - "Dashiell Hammett", Random House, New York 1983, especially pp. 18, 169, excerpts in American Mathematical Monthly 92 (1985) p. 444 (Hammett's interest in mathematics.)

D. O. Koehler - "Mathematics and Literature", Mathematics Magazine 55 (1982) pp. 81-95 (more extended comments on fewer works, including particularly the novels of Thomas Pynchon.)

Thomas Babington Macaulay - "Lord Bacon", Edinburgh Review, July 1837, also in "Critical and Historical Essays", excerpts in Collection M (Bacon's ignorance of mathematics.)

David Eugene Smith - "Thomas Jefferson and Mathematics", Scripta Mathematica 1 (1932) pp. ??, excerpts in American Mathematical Monthly 91 (1984) pp. 56, 72.

G. Otto Trevelyan - "The Life and Letters of Lord Macaulay", Harper and Brothers, New York 1875, Vol. 1, p. 91, excerpt in American Mathematical Monthly 89 (1982) p. 312 (Macaulay's youthful loathing for mathematics.)

Garry Wills - "Inventing America: Jefferson's Declaration of Independence", Doubleday & Co., Garden City, NY 1978, Part 2 (Newtonian mathematics and science inspired Jefferson's era.)

7. SCIENCE FICTION SHORT STORIES

Note: Science fiction routinely involves some technical vocabulary; the following stories attempt a bit more.

Isaac Asimov - "The Feeling of Power" (1957), in Collection F2 (A computerized world rediscovers hand arithmetic.)

Isaac Asimov - "Living Space", in "Earth Is Room Enough", Doubleday & Co., New York 1957 (Alternatives to our time-line provide homes for the expanding population.)

Isaac Asimov - "The Missing Item", in George Scithers (ed.) - "Isaac Asimov's Masters of Science Fiction", Davis Publications, New York 1978 (An accurate computation explodes a religious cult.)

James Blish - "FYI" (1961), in Collection F2 (Only transfinite arithmetic can save us if anyone should start a major war.)

James Blish - "The Glitch", in Philip Strick (ed.) - *Antigrav: Cosmic Comedies by S. F. Masters*, Taplinger Publishing Co., New York 1976 (The ultimate computer develops the ultimate bug.)

Ben Bova - "A Slight Miscalculation", in Isaac Asimov and J. O. Jeppson (eds.) - "Laughing Space", Houghton Mifflin, Boston 1982 (A mathematical earthquake prediction contains just one small error.)

Miles J. Breuer, M.D. - "The Appendix and the Spectacles", in Collection F2 (An appendectomy without an incision, through a 4th dimension, leaves an old pair of spectacles inside the patient.)

Miles J. Breuer, M.D. - "The Captured Cross-Section" (1929), in Collection F1 (A 4th-dimensional being abducts the hero's fiancée.)

Miles J. Breuer, M.D. - "The Gostak and the Doshes", in Groff Conklin (ed.) - "Great Science Fiction by Scientists", Collier-Macmillan, New York 1962 (Patter about 4-dimensional rotations "explains" a trip to an alternate world.)

Arthur C. Clarke - "The Nine Billion Names of God" (1953), in Collection F2 (The Universe will end when all God's names are printed out.)

Arthur C. Clarke - "The Pacifist" (1956), in Collection F2 (A perverse computer rejects all military problems.)

Arthur C. Clarke - "Superiority" (1951), in Collection F1 (Wherein the more advanced weapons lose an interstellar war.)

Mark Clifton - "Star Bright" (1952), in Collection F2 (Precocious grasp of mathematics shows a toddler's evolution beyond homo sapiens.)

A. J. Deutsch - "A Subway Named Moebius" (1950), in Collection F1 (Disappearing trains plague the Boston subway network when a new route gives it "infinite connectivity".)

Bruce Elliott - "The Last Magician" (1952), in Collection F1 (An emulator of Houdini traps himself in a Klein bottle.)

George Gamow - "The Heart on the Other Side", in Isaac Asimov and J. O. Jeppson (eds.) - "Laughing Space", Houghton Mifflin, Boston 1982 (Making right shoes only, a mathematician undertakes to invert half, and inverts himself too.)

Martin Gardner - "The Island of Five Colors" (1952), in Collection F1 (Each of five tribes has a common boundary with all others.)

Martin Gardner - "No-Sided Professor" (1946), in Collection F1 (If we have one-sided surfaces, then why not ... ?)

Randall Garrett - "On the Martian Problem", in George Scithers (ed.) - "Isaac Asimov's Masters of Science Fiction", Davis Publications, New York 1978 (Modifying relativity rationalizes time-travel.)

Tom Godwin - "The Cold Equations", in Robert Silverberg (ed.) - "The Science Fiction Hall of Fame", Vol. 1, Doubleday & Co., New York 1970 (Celestial mechanics requires a rescue ship, carrying urgently needed antitoxin, to jettison a stowaway.)

J. B. S. Haldane - "The Gold-Makers" (1932), in Groff Conklin (ed.) - "Great Science Fiction by Scientists", Collier-Macmillan, New York 1962 (International financiers destroy a mathematician whose work yields a cheap gold-extraction process.)

Donald Hall - "The Wonderful Dog Suit", in Judith Merrill (ed.) - "10th Annual Edition, the Year's Best SF", Delacorte Press, New York 1965 (A dog disguise lets a gifted child escape responsibilities.)

Robert A. Heinlein - "And He Built a Crooked House" (1940), in Collection F1 (An earthquake near a modern house collapses the eight cubical rooms into a hypercube.)

Raymond F. Jones - "The Person from Porlock", in Groff Conklin (ed.) - "A Treasury of Science Fiction", Crown Publishers, New York 1958 (Continual blocks to his research, including a subtly false proof of its impracticability, drive an engineer almost to breakdown.)

Norman Kagan - "The Mathenauts", in Judith Merrill (ed.) - "10th Annual Edition, the Year's Best SF", Delacorte Press, New York 1965 (Only mathematicians have the mental flexibility to pilot faster-than-light craft.)

C. M. Kornbluth - "Gomez", in Anthony Boucher (ed.) - "A Treasury of Great Science Fiction", Vol. 1, Doubleday & Co., New York 1959 (Puerto Rican prodigy discovers, and suppresses, a unified field theory.)

Henry Kuttner and Catherine L. Moore (pen name Lewis Padgett) - "Mimsy Were the Borogoves", in "The Best of Henry Kuttner", Nelson Doubleday, Inc., Garden City, NY, 1975 (Toys from the future educate two children into 4-dimensional awareness.)

Stanislaw Lem - "The Cyberiad", Avon Books, New York 1976, especially "How the World Was Saved" (literalness of computers), "Trurl's Machine" (the world's dumbest computer), "The First Sally (A) or Trurl's Electronic Bard" (mathematical poetry), "The Second Sally or the Offer of King Krool" ("simulation" of big game hunting), "The Third Sally or the Dragons of Probability" (the quantum theory of dragons.)

Stanislaw Lem - "The Star Diaries", Avon Books, New York 1977, especially "The Seventh Voyage" (Our hero traverses a region where the universe has time loops.)

H. Nearing, Jr. - "The Hermeneutical Doughnut" (1954), in Collection F2 (A toroidal pocket in space elucidates a passage from Ezekiel.)

H. Nearing, Jr. - "The Hyperspherical Basketball", Fantasy and Science Fiction, Dec. 1951 (A 4-dimensional ball wins an administration-faculty basketball game.)

H. Nearing, Jr. - "The Mathematical Voodoo" (1951), in Collection F1 (A dunce blossoms as a mathematician when the professor lectures to a voodoo doll.)

H. Nearing, Jr. - "The Poetry Machine", Fantasy and Science Fiction, Fall 1950 (A poetry-writing computer develops the artistic temperament.)

Larry Niven - "Convergent Series" (title story), in "Convergent Series" (collection), Ballantine Books, New York 1979 (An infinite geometric sequence foils a particularly nasty devil.)

M. C. Pease - "Devious Weapon", Astounding Science Fiction, Apr. 1949 (Self-reference paradox defeats sophisticated military computer.)

Green Peyton (pen name of G. Peyton Wertenbaker) - "The Ship That Turned Aside", in Groff Conklin (ed.) - "The Classic Book of Science Fiction", Bonanza Books, New York 1982 (A side-slip in a 4th dimension brings an ocean liner to an uninhabited land.)

Arthur Porges - "The Devil and Simon Flagg" (1954), in Collection F1 (Even the Devil can't prove Fermat's Last Theorem.)

Arthur Porges - "Problem Child", in Judith Merrill (ed.) - "10th Anniversary Edition, the Year's Best SF", Delacorte Press, New York 1965 (A seemingly retarded child is a mathematical prodigy.)

Kim Stanley Robinson - "The Blind Geometer", Isaac Asimov's Science Fiction Magazine, Aug. 1987 (A blind mathematician defeats conspirators who think his unpublished ideas have military applications.)

Hilbert Schenck - "The Geometry of Narrative", Analog Science Fiction/Science Fact, Aug. 1983 (The characters in this story analyze its structure by geometric analogies.)

Donald Wandrei - "The Monster from Nowhere" (1935), in Groff Conklin (ed.) - "The Best of Science Fiction", Crown Publishers, New York 1946 (The only survivor of an Andean expedition brings back a captive 4-dimensional predator to New Jersey.)

Stanley G. Weinbaum - "The Brink of Infinity", in "A Martian Odyssey and Other Classics of Science Fiction", Lancer Books, New York 1962 (Trapped by a lunatic, a mathematician must solve a mathematical riddle in ten questions.)

8. POEMS

Note: Systematically including mathematical light verse would be too large an enterprise.

Anonymous - "Marmaduke Multiply's Merry Method of Making Minor Mathematicians", Munroe and Francis, Boston 1841, Dover Publications, New York 1971 (Historical interest may warrant including this illustrated children's classic, whose rhymed couplets present the multiplication table.)

Robert Bridges - "The Testament of Beauty", Oxford Univ. Press, New York 1929, Book 4, lines 665 & 852 (Science, thru' infinitesimals, spanneth immensities; Pythagoras, behind all things, saw Mathematick.)

Samuel Butler - "Hudibras" (1663), Part 1, Canto 1, partly in Collection F1 (Hudibras's irritating talents include mathematical skill.)

Lewis Carroll - "The Humorous Verse of Lewis Carroll", Dover Publications, New York 1960, especially "Four Riddles" from "Phantasmagoria" (Yet what are all such gaieties to me . . .), "The Beaver's Lesson" from "The Hunting of the Snark" (versified

arithmetic), "The Mad Gardener's Song" from "Sylvie and Bruno" ("double rule of three".)

Geoffrey Chaucer - "The Canterbury Tales" (c. 1387-1400), Prologue to the Parson's Tale (trigonometric note); the Franklin's Tale (The magic of algebra removes all rocks from the Brittany coast.)

Marion Cohen - "The Weirdest Is the Sphere", Seven Woods Press, New York 1979.

Marion Cohen - published poems in various magazines: "The Infinite Loop", "The One-Dimensional Man", "Space Is Relative", "Ram Dass Poem", "Fifth Grade Science Class", "House Poem", "Changing the Topology of the House", "The Way It Is Once and for All", "Some Simple Questions", "The Middle" (San Fernando Poetry Journal, Northridge, CA); "Waiting for the Franklin Institute", "The Mathematician and the Common Cold" (South Street Star, Philadelphia?); "The Two-Dimensional Man", "The Horror of Odd and Even" (Space and Time, New York, NY); "They Put Cantor Away" (Reflect, Norfolk, VA and Tempest, Miami, FL); "What Makes Things Tick" (Sojourner, Cambridge, MA.)

Samuel Taylor Coleridge - "A Mathematical Problem", in "The Complete Poetical Works of Samuel Taylor Coleridge", Vol. 1, Oxford Univ. Press, London 1912, partly in Collection M, p. 213 (versified construction of an equilateral triangle.)

J. V. Cunningham - "Meditation on Statistical Method", in Mark Strand (ed.) - "Contemporary American Poets", New American Library, New York 1969 (Some important things just don't "average out".)

Dante Alighieri - "Il Convivio" (The Banquet, 1304-1307), Tractate 2.14 (Jupiter); English translation: William Walrond Jackson - "Dante's Convivio", Oxford, Clarendon Press 1909 (The circle cannot be squared because its boundary is curved.)

Dante Alighieri - "Paradiso" (1321), Cantos 15 & 33, the latter partly in Collection M (The Primal Intellect generates all knowledge, as unity generates all numbers; our relation to God surpasses human comprehension - like circle-squaring.)

John Donne - "The Complete English Poems", Penguin Books, New York 1971, specifically "Lovers' Infiniteness", "The Primrose" (numerology of love), "Elegy upon the untimely death of the Incomparable Prince Henry" (geometrical metaphors), "Obsequies to the Lord Harrington" (geometry), "Of the Progress of the Soul" (geometry.)

William Empson - "Collected Poems", Harcourt, Brace, and Co., New York 1956, especially "The World's End", "High Dive", "Letter I", "Letter V". (Appended notes explain quite non-trivial mathematical references.)

John Gower - "Confessio Amantis" (1386-1393), Book 7, lines 145-202, partly in Collection M, p. 293 (Aristotle's subdivision of mathematics.)

A. E. Housman - "When First My Way to Fair I Took", in "Collected Poems of A. E. Housman", Henry Holt and Co., 1940, partly in Collection F1 (Time, in adding wealth, inevitably subtracts youth.)

Robinson Jeffers - "The Beginning and the End and Other Poems", Random House, New York 1963, specifically "The Great Wound" (the paradoxical power of modeling), "The Silent Shepherds" (the ultimate inadequacy of modeling.)

Robinson Jeffers - "The Double Axe and Other Poems", Liveright, New York 1977, specifically "The Inhumanist", Parts 9 and 36 (Mathematics itself is a profound metaphor.)

Vachel Lindsay - "Poems about the Moon, I: Euclid", from "The Congo and Other Poems", Macmillan, New York 1914, cited part in Collection

F1 (A diagram of a circle is just a picture of the moon.)

Andrew Marvell - "The Definition of Love", partly in Collection F1 (geometrical metaphors.)

Edna St. Vincent Millay - "Euclid Alone Has Looked on Beauty Bare", from "The Harp-Weaver" (1923), also in Collection F1.

Katharine O'Brien - "Three Haiku: What Is Mathematics", American Mathematical Monthly 88 (1981) p. 626; "Bilateral Convolution", American Mathematical Monthly 93 (1986) p. 399.

David Petteys - "Spaces (for Samuel Beckett)", in Collection DB, p. 190 (The center of an unbounded universe may even be your heap of manuscripts.)

Hyam Plutzik - "An Equation", in George P. Elliott (ed.) - "15 Modern American Poets", Holt, Rinehart, and Winston, New York 1956 (The beauty of a mathematical curve inhabits a realm beyond human suffering.)

Alexander Pope - "The Dunciad" (1728, 1743), Book 2, line 285, Book 4, lines 31-34, partly in Collections F2 and M (The reign of Dulness suppresses all human arts but mad mathematics.)

Kenneth Rexroth - "The Collected Longer Poems of Kenneth Rexroth", New Directions, New York 1968, specifically "The Phoenix and the Tortoise", Part 4; "The Dragon and the Unicorn", Part 1; "The Heart's Garden, the Garden's Heart", Part 2.

Kenneth Rexroth - "The Collected Shorter Poems of Kenneth Rexroth", New Directions, New York 1966, especially "An Equation for Marie", "Fundamental Disagreement with Two Contemporaries" (mathematical jargon in dispute with surrealists), "Inversely, as the Square of Their Distance Apart" (gravitation as symbol for love), "OTTFSS-SENTE" (rhapsody on the word "dozen"),

"Phronesis, III", "The Place", "Theory of Numbers", "A Lemma by Constance Reid" (A prose passage from an early Reid book is an unrhymed poem in Rexroth's rearrangement.)

Muriel Rukeyser - "The Dam", in "The Collected Poems of Muriel Rukeyser", McGraw Hill, New York 1978, pp. 95-98 (The mathematical beauty of the result outweighs the corruption of the builders.)

Carl Sandburg - "The Complete Poems of Carl Sandburg", Revised and Expanded Edition, Harcourt Brace Jovanovich, New York 1970, specifically "Tentative (First Model) Definitions of Poetry" (metaphors from mathematics), "The People, Yes", Part 36 (thoughts about zero), "Arithmetic" (also in Collection FI), "Number Man" (homage to Bach), "Atlas, How Have You Been?" (musings about the world's shape.)

Wallace Stevens - "The Collected Poems of Wallace Stevens", Alfred A. Knopf, New York 1961, specifically "The Motive for Metaphor" (x = the exciting unknown), "Six Significant Landscapes" (moralized geometry.)

John Updike - "Midpoint and Other Poems", Alfred A. Knopf, New York 1969 (The long autobiographical title poem includes some scattered mathematical symbolism.)

William Wordsworth - "The Prelude" (1830), Book 2, lines 203-205 (mere mention), Book 5, lines 65-114 (poetry vs. geometry), Book 6, lines 115-167 (charms of geometry), excerpts in Collections F2 and M.

9. REAL MATHEMATICIANS IN LITERARY WORKS

Note: A few mathematicians, such as Newton, have achieved symbolic status in Western literature.

John Barth - "The Sot-Weed Factor", Part 1, Chap. 3, Grosset and Dunlap, New York 1960 (A long reminiscence by Burlingame describes his Cambridge friendship with Newton.)

William Blake - "Collected Poems", specifically "You don't believe ...", "Mock on, mock on ...", (both 1790's), also in Collection DB, pp. 181-182 (Newton and others symbolize the 18th-century rationalism that Blake attacks here.)

George Gordon, Lord Byron - "Don Juan" (1819-1824), Canto 10, partly in Collection N, p. 1094 (Adam, Newton, and their respective apples.)

Karel Capek - "The Death of Archimedes", in "Apocryphal Stories", Penguin Books, Harmondsworth, England 1975, also in Collection FI ("Don't spoil my diagram!" he told the soldier.)

John Dos Passos - "U.S.A.", Vol. 1, "The 42nd Parallel" (1930), Modern Library, New York 1937, specifically "Proteus" (short life of Steinmetz, whose mathematics tamed alternating current.)

Friedrich Durrenmatt - "The Physicists", Grove Press, New York 1964 (Two spies, claiming to be Newton and Einstein, penetrate an exclusive mental institution housing a brilliant modern physicist.)

John Gay - "Three Hours after Marriage", London 1717 (caricature of Newton). See Jacob Bronowski - "The Ascent of Man", Little, Brown, and Co., Boston 1973, p. 236.

Arthur Koestler - "Pythagoras and the Psychoanalyst", in Collection FI (How Pythagoras mastered his psychological problems - and discovered no theorems.)

Charles Lamb - "From the Latin of Vincent Bourne", in Collection DB, pp. 183-184 (The lessons of Newton's first schoolmistress were the foundation for his algebraic work.)

Walter Savage Landor - "Barrow and Newton", in "Imaginary Conversations", Vol. 4, J. M. Dent & Co., London 1891 (Barrow and Newton are made to discuss Bacon's "Essays".)

Alexander Pope - "Epitaph on Newton", in Collection N, p. 1094

Alfred Renyi - "Dialogues on Mathematics", Holden-Day, San Francisco 1967 (Classical dialogues with Socrates, Archimedes, and Galileo expound the nature of mathematics.)

Muriel Rukeyser - "Gibbs", in "The Collected Poems of Muriel Rukeyser", McGraw Hill, New York 1978, pp. 187-190 (Here Gibbs exemplifies the detached quest for mathematical understanding.)

Friedrich von Schiller - "Archimedes und der Schuler", excerpt in Collection M, p. 137.

J. L. Synge - "Euclid and the Bright Boy" in "Science: Sense and Nonsense", Jonathan Cape, Ltd., 1951, also in Collection F2 (criticism of the definition of a point.)

James Thomson - "To the Memory of Sir Isaac Newton", in Collection DB, pp. 175 - 180.

Hugh Whitmore - "Breaking the Code", Fireside Theatre, Garden City, NY 1987 (Broadway play about career and homosexuality of Alan Turing.)

William Wordsworth - "The Complete Poetical Works of Wordsworth", Houghton Mifflin, Boston 1932, specifically "The Prelude" (1850), Book 3, lines 60-63 (Newton), "The Excursion" (1814), Book 8, lines 220-230, excerpt in Collection M, p.137 (Archimedes).

William Butler Yeats - "Among School Children", in "Collected Poems", Macmillan, New York

1956 (The poem cites "golden-thighed" Pythagoras - probably evoking reincarnation or cyclical history.)

10. AUTOBIOGRAPHICAL MEMOIRS

Note: Biographies of mathematicians might make a long list, so this section collects only relevant autobiographies - of mathematicians and others.

Henry Adams - "The Education of Henry Adams", Massachusetts Historical Society, Boston 1918 (The author's confessed ignorance of mathematics spawns a grand historical theory in mathematical jargon.)

Winston S. Churchill - "My Early Life", Charles Scribner's Sons, New York 1930, Chap. 3, partly in Collection F2 (The author desperately crams enough mathematics to enter Sandhurst.)

Philip J. Davis - "The Thread: A Mathematical Yarn", Birkhauser, Boston 1983 (The author, during his travels, unearths the origins of Chebyshev's first name.)

G. H. Hardy - "A Mathematician's Apology", Cambridge Univ. Press, London 1940, also in Collection N.

Pamela Hansford Johnson - "Important to Me", Charles Scribner's Sons, New York 1974, Chap. 12 (Neither a good grammar school nor a patient spouse can dent the author's incomprehension of trigonometry.)

Sofya Kovalevskaya - "A Russian Childhood" (1889), Springer-Verlag, New York 1979 (the author's first fifteen years.)

Bertrand Russell - "My Mental Development", in Collection N.

Edward O. Thorp - "Beat the Dealer", Vintage Books, New York 1966 (The author's strategy for blackjack makes him persona non grata in Las Vegas.)

S. M. Ulam - "Adventures of a Mathematician", Charles Scribner's Sons, New York 1976.

Norbert Wiener - "Ex-Prodigy", M.I.T. Press, Cambridge, MA, 1964 (the author's first 26 years.)

Norbert Wiener - "I Am a Mathematician", M.I.T. Press, Cambridge, MA, 1964 (the author's professional career.)

11. FILMS

Louis de Rochemont and Alfred Werker - "Walk East on Beacon", 1952 (Russian agent pursues military secrets of refugee mathematician.) See "The New York Times Film Reviews 1949-1958", The New York Times & Arno Press, New York 1970, 29 May 1952.

Jack Hively - "Are You With It?", 1948, film version of listed stage musical, same title, by Perrin, Balzer, Revel, and Horwitt (Donald O'Connor, as a mortified actuary expiating a misplaced decimal point in a carnival job, displays numerical talent mostly through his dancing.) See "The New York Times Film Reviews 1913-1968", The New York Times & Arno Press, New York 1970, Vol. 3, 15 Apr. 1948.

Sam Peckinpah - "Straw Dogs", 1971 (Effete mathematician kills six louts, acquires Peckinpah's dubious wisdom concerning true manhood. A professor of English is the protagonist in the original novel: Gordon M. Williams - "The Siege of Trencher's Farm", William Morrow, 1969.) See "The New York Times Film Reviews 1971-1972", The New York Times & Arno Press, New York 1973, 20 Jan. 1972.

Alain Resnais - "Last Year at Marienbad", 1962 (Repetitive games of Nim symbolize the constraints of reality.) See "The New York Times Film Reviews 1913-1968", The New York Times & Arno Press, New York 1970, Vol. 5, 8 Mar. 1962.

Claudia Weill - "It's My Turn", 1980 (University of Chicago group-theorist Jill Clayburgh permutes a retired baseball superstar into her love life.) See "The New York Times Film Reviews 1979-1980" The New York Times & Arno Press, New York 1982, 24 Oct. 1980; see TIME, 27 Oct. 1980, p. 24; see Newsweek, 3 Nov. 1980, pp. 90-92.

William Wellman - "Magic Town", 1947 (A pollster discovers a small town whose opinions perfectly represent the whole U.S.) See "The New York Times Film Reviews 1913-1968", The New York Times & Arno Press, New York 1970, Vol. 3, 8 Oct. 1947.

Krzysztof Zanussi - "The Constant Factor", 1980 (Interests in mathematics and mountaineering reflect the protagonist's incorruptibility - which brings him only trouble in a corrupt society.) See "The New York Times Film Reviews 1979-1980", The New York Times & Arno Press, New York 1981, 9 Oct. 1980.

Krzysztof Zanussi - "Illumination", 1973 (Mathematical physics disappoints a student pursuing "unequivocal things".) See "The New York Times Film Reviews 1973-1974", The New York Times & Arno Press, New York 1975, 1 Oct. 1973.

Krzysztof Zanussi - "The Imperative", 1982 (Protagonist is tormented mathematician.) See The New York Times, 13 Mar. 1983, p. H21.

? - "The Average Giraffe" (A cartoon short kids statistical averages.)

12. SONGS

Anonymous - "Litoria! Litoria!", in Charles O'Brien Kennedy (ed.) - "A Treasury of American Ballads", The McBride Co., New York 1954 (A 19th-century Yale student song mentions the sophomores' ceremonial burying of their Euclid texts.)

Saul Chaplin (music) and Johnny Mercer (words) - "The Square of the Hypotenuse", Commander Publications, 1958, in Collection F2 (a song from the Danny Kaye film "Merry Andrew".)

Joseph Charles Holbrooke (music) and Sidney H. Sime (words) - "The Ta Ta", 1962, in Collection F2.

Tom Lehrer - "Too Many Songs by Tom Lehrer with Not Enough Pictures by Ronald Searle", Pantheon, New York 1981, specifically "Lobachevsky" (no resemblance to the real mathematician Lobachevsky) and "New Math" (a maximally confusing lesson in elementary subtraction.)

13. SOURCES

American Mathematical Monthly - "Miscellanea"

Thomas G. Bergin - private communication

Ralph P. Boas - private communication

Marion Cohen - Review of Collection RW, American Mathematical Monthly 89 (1982) pp. 138-139, and subsequent private communication

Philip J. Davis - private communication

Clifton Fadiman - Collections F1 and F2

Owen Gingerich - private communication

Edna Grossman - private communication

J. L. Haynes - private communication

Richard J. Herman - private communication

D. O. Koehler - "Mathematics and Literature", Mathematics Magazine 55 (1982) pp. 81-95

George M. Koppelman - private communications

Edward A. Lew - "The Actuary in Fiction", The Actuary 2, No. 3 (March 1968) pp. 1 & 7

Susan Lew - private communications

Mathematical Gazette - "Gleanings Far and Near"

Robert Edouard Moritz - Collection M

James R. Newman - Collection N

Donald A. Quarles, Jr. - private communication

James M. Rawley - "Rawley Views", LIMENS 2, No. 7 (July 1981) p. 6 Theodore J. Rivlin - private communication

John B. Rockwell - private communications

Joseph D. Rutledge - private communication

Tony Simon - private communication

W. R. Utz - Letter, Mathematics Magazine 55 (1982) pp. 249-250, and subsequent private communications