12/4/71 (A) New Books Section

(1) Year book of the Royal Society of London, 1968 — Nothing interesting.

Mathematics of Computation, January, 1970.

14/4/71

(B) above: (1) A conjecture of Paul Erdös concerning Gaussian Primes: *, p. 221

Abstract: Erdös has conjectured that you can stroll from the origin of the complex plane to infinity using Gaussian primes (?) as stepping stones and be required only to take steps of finite length. This paper establishes that steps of length 4 would be required to make the journey.

It is well-known that if P_n be the nth prime, then the values of $\{P_n - P_{n-1}\}$ are without bound. That is, $\limsup \{P_n - P_{n-1}\} = \infty$. Put in every day language this says that there exist arbitrarily large intervals which have no primes. This in some sense says that if you used the primes as stepping stones and attempted to walk from 2 out the real line, you would from time to time be called on take longer and longer steps.

Erdös' conjecture is that you can use the Gaussian primes as stepping stones, start in the vicinity of the origin and stroll out to infinity never being required to take a step of length more than M. ie there is an M and a sequence of Gaussian primes $\{r_j\}_1^\infty$, such that $|r_1| < M$, $|r_j - r_{j-1}| < M$ and $\lim |r_j| = \infty$.

It is shown in the paper that if the conjecture be true, then $M \geq 4$.

[* by Jordan & Babung: Washington State Univ & U.S. Naval Research Laboratory]

(2) Mathematics of Computation, April, 1970

p. 423: On Amicable & sociable numbers by Henri Cohen

Abstract:- An exhaustive search has yielded 236 amicable pairs of which the lesser number is smaller than 10^8, 57 pairs being new.

It has also yielded 9 new sociable groups of order 10 or less, of which the lesser number is smaller than $6 \cdot 10^7$: the 9 sociable groups are all of order 4.

The sequence of iterates of the fn $s(n) = \sigma(n) - n$ starting with 276

$$7 \cdot 10^2 + 6 \cdot 10 + 4$$
$$4 \cdot 10^2 + 6 \cdot 10 + 7$$
$$3 \cdot 10^2 - 3$$

$$c \times 10^2 + d \times 10 + e$$
$$e \times 10^2 + d \times 10 + c$$
$$(c-e)10^2 - (c-e) = (c-e)99$$

824
428
396
693
1089

835
538
297

has also been extended to 119 terms.

[work supported in part by the Comité de Génie Biologique et Médical de la D.G.R.S.T (Convention n° 6801307

Conjecture 1 – There exists an infinity of amicable pairs

conjecture 2 – There exists an infinity of sociable groups of order 4.

Eleven references given on amicable & sociable numbers.

p. 431 : Amicable numbers and their distribution by P. Bratley, F. Lunnon and J. McKay

Reference to above paper of Cohen. Using the data of this paper a conjecture is made about the distribution of amicable pairs. A result on "Crowds" (sociable numbers of order 3) is also given. – Also gives a figure

p. 433 – Integer sequences having prescribed quadratic character by D.H. Lehmer, Emma Lehmer & Daniel Shanks. – Difficult paper.

p. 453 – on generating infinitely many solutions of the diophantine equation $A^6 + B^6 + C^6 = D^6 + E^6 + F^6$ by Simcha Brudno.

work presents the first known method for generating new solutions of the above eqn in a recursive way from a given solution – Rather complicated, but interesting.

p. 490 – Review of article by L.M. Chawla & S.A. Shad on a trio-set of partition functions and their tables (J. Natur. Sci. & Math. V, 9, 1969, pp. 87-96)

Ramanujan's partition fns

p. 493 – Review of E.J. Lee's article on the Discovery of amicable numbers – A 28 page history together with a computer-listed table of 977 pairs then known, Oak Ridge Nat. Lab, Oak Ridge, Tenn, June 4, 1969, deposited in UMT (Unpublished Mathematical Tables) file – Perhaps parts of this will appear in J. Recr. Math.

p. 495 – Review of D.H. Lehmer's Tables of Ramanujan Function $\tau(n)$, 1963 ms of 164 pages of Computer printout deposited in the UMT file

$\tau(n)$ defined by $\sum_{n=0}^{\infty} \tau(n) x^n = x \left\{ \prod_{n=1}^{\infty} (1-x^n) \right\}^{24}$ and begins with

Consider the number 73,939,133. By successively dropping the rightmost digit, the resulting numbers are also primes. Such numbers are called primes primes. A table of ~~all~~ all primes primes $< 73,939,133$ is supplied by Walstrom & Berg in Math. Mag. 42 (1969), 232

Math. Letters

R) Also found a reference to an article by A. P. Stakt ~~in which he calls~~ (Fibonacci Quarterly, 6 (1968) No. 2, 139-161 — This must be the journal mentioned in the beautiful book on Excursions into number theory) in which he calls an integer n defective if a complete residue system mod n is not contained in the Fibonacci sequence. He then discusses necessary and sufficient conditions for an integer n to be non-defective

---

Verify prime primality of 73,939,133.

7 is prime, 73 prime, 739 is prime as can be easily verified. Refer to table of ~~739~~ primes up to a million made by Lehmer.

169 The number must start with 1, 3, 5 or 7 in the first digit or with

11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, or 97.

$\tau(1) = 1$, $\tau(2) = -24$, $\tau(3) = 252$, -- obtained by a recurrence formula

p. on computer – Refs. to earlier work (Ramanujan, Watson, Lehmer, etc etc)

p. 496 – Review of Number theory and Analysis – A collection of papers in honour of Edmund Landau (1877–1938) Edited by P. Turan

pp. 497–500 – Heaps of names of Computers.

(3). Educational Studies in Mathematics* – Vol 3, No. 1, Sept. 1970,

p. 111 to p. 127 } Article by J. N. Kapur on Combinatorial Analysis & School Mathematics

Talks of his being "Convener of the Mathematics Study Groups of the Govt. of India", Morris Kline of the Courant Inst. asking him "I hope you are not going in for 'modern mathematics'. Please don't!" and his replying "We are definitely 'modernising' our curriculum, but we are not going all out for Baby Bourbaki. We are trying to find a proper balance between abstractions and applications" – Obviously Kapur has collected a lot of material from others.

[* I can devote myself to this kind of trivial work. Shall I?]

16/4/71 New Books Section

(1) Mathematics for the modern mind by W. R. Fuchs (Macmillan Co. N.Y) with foreword by H. Bondi (translated ~~by~~ from the German)

– Some quite elementary book with nice ~~colle~~ coloured illustrations

(R) Abstract methods in partial differential equations by Robert W. Carroll, Prof (Univ of Illinois) (Harper & Row, Publishers, N.Y, Evanston & London)

Chap 1 – functional analysis & distributions

" 2 – Elliptic Theory

" 3 – Evolution equations I

" 4 – " II (weak problems)

" 5 – " III (Strong problems)

" 6 – Global analysis – ~~Deals~~ mentions Atiyah – Singer Index Theorem & gives references to the same with 2 appendices.

– Quite an abstract & forbidding book.

– Find in the reference a reference to van der Waarden's algebra both Vols I & II (3')
being published by Ungar, N.Y, 1949 & 1950.

✓ (18) The modern researcher by Barzun & Graff (Harcourt Brace & World, Inc.)
Revised for 1970 – the classical manual on all aspects of research & writing

Some extracts from (5) – Mathemagic:

Magic squares – In India, even at the present time magic squares are worn engraven on stone or metal as talismans.

(i) Simplest 3-square

8	1	6
3	5	7
4	9	2

(ii) Magic square on hypotenuse of a right angle

(ii) Magic square on hypotenuse = sum of magic squares on the other two sides ie
rows & Columns & diagonals of each one adds up to 174
& no two numbers are duplicated

the sum of all the numbers in the three square, squared, plus the sum of all the numbers in the four square squared, equals the sum of all the numbers in the five square squared [ie $(174)^2(3^2) + (174)^2 * 4^2 = (174)^2 5^2$ obvious]

(iii) The magic A & B

24	3	18
9	15	27
12	27	6

32	4	24
12	20	28
16	36	8

40	5	30
15	25	35
20	45	10

C

The square of any cell of C = sum of squares of corresponding cells of A & B, for eg. $40^2 = 24^2 + 32^2$

Likewise the square of the sum of any two or more cells or any diagonal or horizontal row or any i^{th} column in C is equal to the sum of the square of the sum of the corresponding two or more cells, rows, columns or diagonals of A & B

Also note that the square of the total of all the cells in C equals the square of the total of all the cells in A + sq. of the total of all cells in B

16/7/71 – Referred to Math. Reviews of 1970 for some Referees to be suggested for (1) a Andhra Ph.D. on arithmetic fns.

Found in the issue of Dec 70, p. 1302 a reference to prime pairs

Scripta Mathematica - Vol. 28, No. 1, May 1967

p. 5 - L'induction Incomplète dans la Théorie des nombres by W. Sierpinski

(1) Are all numbers of the infinite sequence

$$2+1,\ 2^2+1,\ 2^{2^2}+1,\ 2^{2^{2^2}}+1,\ 2^{2^{2^{2^2}}}+1,\ \ldots$$

prime?

This is true for the first four, but the fifth = F_{16} (having 19729 digits) is proved not prime. Selfridge showed in 1953, using the electronic machine SWAC, that this number is composite being divisible by $2^{18} \cdot 3150 + 1$.

The smallest Fermat number which we do not know whether it is prime or not is F_{17} (having 39457 digits). J. Selfridge and A. Hurwitz are of the opinion that, to decide whether F_{17} is prime or not, the machine would have to work for 128 weeks.

Re. $n^{n^n}+1$, we note $16^{16^{16}}+1 = F_{66}$ and we do not know whether it is prime or not.

(2) Goldbach's hypothesis - It has been verified ~~for~~ every ~~number pair~~ (nombres pairs) even number >6 and <1000000 is the sum of two distinct primes.

Although Goldbach's hypothesis is not proved to be true, we can make some deductions assuming it to be true:-

(i) Every odd integer can be represented an an infinite number of ways as $p+q-r$, where p, q, r are odd primes - van d. Corput.

(ii) Every odd number >7 is the sum of three odd primes - ~~Kiuro~~

(iii) Every ~~odd number~~ integer >5 is the sum of three odd primes.

(3) Gilbreath's hypothesis (verified for the 63418 first of primes) is

| 2 | 3 | 5 | 7 | - | - | 11 | | |

3 books of Lewis Carroll, 2 of Dudeney, ~~one by Martin~~ 3 by Martin Gardner (2 ~~are~~ edited by him being Puzzles of Sam Loyd),

– Foreword by Bernard M. L. Ernst, President of the Society of American Magicians (!)

Contents - Mathemagic – Number symphonies – Easy way to multiply – Arithmetricklish – Sleight of mind – Magic squares – Appendigits (!)

(magic triangle, square on typ, tower, gridiron, explosion, square of squares, honeycomb, web, wheel, quintuplets, block of the Three Acrobats)

– ~~In the~~ At the end of the foreword it is said " This book has been approved by the Committee on Ethics and Standards of the Society of American Magicians as not detrimental to the professional magicians of America)

✓ – A collection of heaps of simple interesting things – good for use if I write a book on Math. Recreations in Kannada at any time – Problems on magic squares specially interesting

(6) Matrix methods – An introduction by Richard Bronson (Academic Press, 1969)

Contents – Matrices – Determinants – The inverse – Simultaneous linear equations – Eigen-values & eigen vectors – Matrix calculus – Linear differential Equations – Jordan canonical forms – Special matrices

Answers & hints to selected problems

– Appears to be ~~a~~ a good introduction to the subject – Also the problems appear useful for exam work

(7) An introduction to Abstract Algebra by Dennis. B. Ames – International Textbook Co. Scranton, Pennsylvania

Intro says: Groups, rings, modules, fields & Galois theory, together with some extensions, such as homology theory, make up what is usually called abstract algebra.

Chaps: Introduction – Groups – Vector spaces & linear transformations – Structure of groups – Rings – Factorisation & ideals – Modules – Algebras – Field theory and Galois theory – Homological algebra – Elementary structure theory of Rings.

Reviews: (a) Book on "Principles of Hindu Reckoning" – Wisconsin Univ Press, 1963
– Review by B. A. Rosenfeld.

(b) "Mathematical Magic" by W. Simon – mention is made of the fact

For newsletter || that if 12,345,679 is multiplied by 72, the resulting product is
888,888,888.

(c) Also book of Polyominoes reviewed shortly

Vol. 28. No. 2 – June 1968. Book Reviews

(a) Review of revised edition of Fock's book by Banesh Hoffmann.

Fock's basic views reemphasised in the book viz "Special relativity is indeed a theory of relativity because it involves a flat space-time and thus allows a maximal group of motions into itself. General relativity, on the contrary, has, except in special cases not realised in nature, no Lie group of motions. It is therefore not a theory of relativity at all but one absoluteness. That general relativity involves invariance under general coordinate transformations is entirely irrelevant; special relativity can be expressed in general coordinates too. The principle of general covariance has no physical significance, though, for Einstein, it has crucial heuristic importance. Therefore Prof. Fock refuses to call general relativity by its usual name but refers to it consistently as Einstein's theory of gravitation. While many of these ideas have been known for a ~~long~~ some time, no one has presented them so cogently and with such depth & forthrightness as Prof. Fock.

(b) "Pythagorean triangles" by Sierpinski – translated by Ambikeshwar Sharma.
– reviewed by Ivan Niven.

Reminds me of a theorem of Brahmagupta – Lookup || Reviewer mentions the result theorem of Kummer viz that every convex quadrilateral with rational sides and diagonals is divided by its diagonals into four triangles with rational sides

(c) "Packing & Covering" by C. A. Rogers – Cambridge Tracts in Maths & Math. Phys 1964.
– Review by E. N. Gilbert

(d) "Mahavira's Ganita-Sara-Sangraha" in Hindi by L. C. Jain – Translated from the English of Rangacharya of Madras (1912) – Review by
N. Manicka Idaikkadar.

(e) Review of Jacobson's Vol. 3 on Theory of Fields & Galois Theory, 1964
by D. C. B. Marsh – Very favourable review.

Axiomatic theories (Rings, integral domains, fields, Boolean algebra, Algebra of propositions) — Geometry & topology — Natural numbers, integers & rational nos — Real & complex nos — Infinite sets

? | Elementary treatment — I wonder how people can write so many peculiar types of books involving only selected material

(2) finite mathematics: a liberal arts approach by Irving Allen Dodes (Mc-Graw Hill)

Chaps — Introduction to O.R — Mathematics of gambling — An introduction to matrices — Intn to the theory of games — Theory of games, mixed strategy — The slide rule — Intn to Mathematical tables — Applications of logarithms — The mathematics of management — Introduction to computing

— Again a funny collection of items of practical interest — Business Mathematics?

(3) Abelian varieties by David Mumford — T.I.F.R Series edited by M. S. Narasimhan (1970) No. 4

(4) The Great Art of the Rules of Algebra by Girolamo Cardano. (M.I.T. Press, 1968)

Some 40 Chapters ~~with~~ dealing with all sorts of rules (for eg. Ch. 38 deals with "On the Rule (Double) by which Parts Drop Out by Multiplication"

✓ | p.7 — mentions Leonardo of Pisa & says he is better known today as Leonardo Fibonacci

— ~~Looks an absurd absurd book~~; ~~but~~ has a foreword by Oystein ore. This is the treatise of the old book of Cardano (of the time of renaissance) called Ars Magna (which, as Ore points out, along ~~with~~ the other two masterpieces of the renaissance due to Copernicus and Versalius form a great group three treatises of the time published simultaneously).

— mostly of historical interest — Ore gives an account ~~in~~ of the Cardano — Tartaglia controversy.

(5) Math E Magic by Royal Vale Heath (Dover publications, 1955)

Puzzles, games with number

— Yet another book on recreations

— At the end of the book is given a list of Dover books ~~on~~ of Math and word puzzles, logic, curiosities of words — This list includes

(f) "Abelian categories" – Intn to the theory of functors by P. Freyd, Harper & Row N.Y.
– Review by P. Hilton of Cornell

(g) "Homographies, quaternions & reflections" by Patrick Du Val – Clarendon Press 1964 – Favourable review by Coxeter.

(h) "Puzzles and paradoxes" by T.H. O'Beirne – N.Y. Oxford Univ. Press, 1965
– Solutions form an integral part of the book.

(i) "Symplectic Geometry" by C.L. Siegel – Ref. to review in Math. Rev. Vol 4, pp. 242–43

(j) "Recreational mathematics" A guide to the literature by W.L. Schaaf, 3rd Edn, 1963
Washington 6, D.C. National Council of Teachers of mathematics – with a supplement. (first appeared in 1954 & shows how after even 10 years it is still useful)

(k) "C.F. Gauss. Prince of Mathematicians" by W.L. Schaaf, 1964.
– Gives a fascinating biography of Gauss. &c

(l) "Vedic mathematics" – quotes some stupid remarks of the author – ⊗

Vol. 28. No. 3 – June 1968.

2 (19/4/71) New Books Section.

(1) Elementary Diff. Eqns by Kells – 6th Edition – good text book.
(International Student Edn – McGraw Hill

(2) The soln of Eqns in integers by A.O. Gelfond.

p. 52 – Fermat's conjecture that
$$x^n + y^n = z^n$$
has no +ve integral solns for integral $n \geq 3$ (Kummer's introduction of theory of ideals etc. in trying to prove Fermat's conjecture. This conjecture has been proved for many n, in particular any n divisible by a prime less than 100.
[mention of $6 = 2 \cdot 3 = (1+i\sqrt{5})(1-i\sqrt{5})$

p. 54 – Prove the theorem that
$$x^4 + y^4 = z^4$$
has no integral solns for x, y and z, $xyz \neq 0$.

Mentions solns of $x^2 - Ay^2 = 1$ on p. 19, but no reference to Indian work. – Quite an interesting & elementary book.

(3) Puzzle Math – A book of brain twisters by Gamow & Martin Stern
– London, MacMillan & Co. Ltd, 1960

For newsletter

– Book dedicated to Theodore von Kármán who likes puzzles

Prologue – Hence we decided to put the puzzles together in a little book, presenting

(o) Generalized Chiral symmetry groups & the classification of hadrons by F. Gursey

(very interesting paper) by F. Gursey.

(b) Non linear Lagrangians and relativistic SU(6) by D. Wellesley.

(q) Current divergences in the $SU_3 \times SU_3$ algebra by B. Renner

(r) Electromagnetic mass differences, Equal-time commutators and Oscillatory spectral functions by J. Sucher

(s) Sum rules & Covariance by J. Mondray.

(t) $K_{\ell 3}$ form factors, current algebra & double integral representations by J. Mondray

(u) The $A_1 \rho\pi$ system by F. Csikor

(v) Equal time behaviour of current commutators in perturbation theory by F. Kaschluhn, E. Wieczorek & W. Zoeller

(w) Review of current algebra results in the weak decays of the metastable hadrons by Z. Kunszt & T. Nagy

✓ (x) Problems of the theory of weak interactions by F. E. Low

- It is not a theorem that no conventional theory of weak interactions exists.

(y) A model of maximal CP violation by S. Okubo.

(z) Field operator for an interacting unstable elementary system by J. Lukierski

---

e Exactly (a) to (z) – up to date papers – I wish I could understand all this

14/7/71 – New Books Section

(1) Mathematics: Creation and study of forms by Evans (Addison-Wesley 1970. Chaps – Patterns in content & method – Prime decomposition – Congruences – A concrete view of groups – Abstract groups theory –

each puzzle in the form of a short story. The puzzle part of each story is printed in ordinary type, while the part containing the answer is printed in italics. Readers who want to try their skill at solving the puzzles must stop reading when the italics begin.

Good luck!

M. Stern
G. Gamow

– A long list of largely worded problems with solutions equally long. Does not appear to be useful for Math. Newsletter – Last problem is one in which Stern, Gamow & Harman are involved – one of the shortest of the problems is chosen below:

The bumblebee

"Do you know any more train problems?" asked the railroad engineer, after a short silence.

"Yes, I know one more, but it is very simple. Two trains start simultaneously toward each other from two stations A and B, one hundred miles apart, both travelling at the speed of 50 m.p.h. A bumblebee starts at the same time from station A toward B flying along the road track at the speed of 70 m.p.h. When it encounters the train advancing from B, it gets scared, turns back and flies towards A. And so it flies to & fro between two advancing trains until the trains finally meet. When it sees the two trains oncrushing from both sides, the bumblebee is so scared that it drops dead. Question: What is the total distance flown by the bumblebee.

Soln: "Well, let us see" said Mr. Johnson. "It does not seem to be very difficult. If both trains are advancing at 50 m.p.h from two stations located one hundred miles apart, they must meet in the middle one hour after starting. Since the bumblebee was travelling at 70 m.p.h, then it must have flown just 70 miles. isn't it?

"Good for you!" explained the doctor "But the fact that you got the solution so easily shows that you are not a mathematician. A really good mathematician would think about it in terms of an infinite series representing the sum of intervals necessary to cover each swing of the bumblebee. It becomes a rather horrible mathematical exercise since the algebraic expressions for these time intervals are rather complicated. I heard that when this problem was given once to the late Doctor John von Neumann, who was one of the greatest mathematicians of this century, he thought just for a fraction of a second, and gave the correct answer of 70 miles

"Oh!" said the man who gave him this problem. "So you got the simple-minded solution; I thought you would sum the infinite series in your head"

"But, I did sum the ∞-series" said John von Neumann, who was able to carry out complicated calculations in his head at a speed which was second only to that of electronic computing machines, towards the development of which he made major contributions.

Contents :- (a) Analyticity, Regge poles and conspiracy by A. O. Barut.

- Implications of the O(4,2) model of strong interactions for Regge pole and high energy phenomenology.
- Linear Regge trajectories, secondary trajectories, form factors and their relation to high-energy hadron scattering are consequences of the O(4,2) model of strong interactions. The O(4), O(2,1) and the two distinct SL(2,C) classifications of trajectories used at present as well as the exchange degenerate trajectories, are all given by the sub-algebras of the O(4,2)

(b) Analyticity, factorisation and Lorentz symmetry by Vecchia & Drago
The properties of the scattering amplitude near t=0 have been studied on the basis of the above three factors.

(c) Regge families and Lorentz symmetry by G. L. Tindle
(Refers to a thesis "Daughters, Conspiracies & Lorentz symmetry" in a Berkeley preprint)

(d) Π-IV resonance widths in the broken SL(2,C) model by
K. Szegö & K. Tóth

(e) The multiperipheral model by F. E. Low.

(f) The Veneziano form by C. Grebel

(g) Unitarity & non-Regge singularities by Barzetto & Paccanoni

(h) Multi-Reggion behaviour of production amplitudes by J. T. Drummond
(uses Feynman graphs)

(i) Finite energy sum rules for meson meson-scattering by G. Costa and C. A. Savoy.

(j) On the decuplet superconvergence relations for meson-baryon scattering by J. Kwiecinski

(k) S-matrix theory for pion-pion scattering by P. R. Graves-Morris

(l) Unitarity structure of scattering amplitudes by C. Cronström

(m) $\pi^{\pm}$-p elastic scattering on polarised protons at large momentum transfers by G. Comforto.

(n) Introduction to Chiral symmetry & non-linear Lagrangians (Chiral symmetry currents & current algebras) by M. Nauenberg.

(4) Mathematics and logic – Retrospect and prospects by Marc Kac and Stanislaw M. Ulam.

– Frederick A. Praeger, Publishers, N.Y, Weidenfeld, London (1968)

(A Britannica perspective prepared to commemorate the 200th anniversary of the Encyclopaedia Britannica)

Contents – Introduction

Chap. 1 – Examples, p. 3

Chap 2 – Themes, Trends & Syntheses, p. 168

Chap. 3 – Relations to other disciplines, p. 145

Chap. 4 – Summary and outlook., p. 161

Quite a simple and easily understandable book, without use of any complicated techniques. Covers a large ground, sometimes in a popular way – Is good for selecting a topic for a popular lecture – In Ch. 3, authors appear to share the opinions of Morris Kline rather than that of P. R. Halmos. Also a quotation from E. P. Wigner on p. 150 – on the whole a very interesting book and a very beautiful & informative book.

(To be borrowed next week).

(5) Complex functions by R. L. Goodstein (A first course in Complex variables) – A good textbook (Mc Graw Hill, 1965).

(Univ. of Leicester)

(6) Vector Analysis by L. Marder (George Allen & Unwin Ltd) – Quite a good text book

(7) Modern Applied Algebra by Garrett Birkhoff & Thomas C. Bartee – Mc Graw Hill 1970.

Chap 1 – Sets & functions
" 2 – Binary relations & Graphs
" 3 – Finite state machines (
" 4 – Programming languages
" 5 – Boolean algebras
" 6 – Optimisation & Computer design

Chap 7 – Monoids & groups
" 8 – Binary group Codes
" 9 – Lattices
" 10 – Rings and Ideals
" 11 – Polynomial rings & Polynomial Codes
" 12 – Finite fields

Chap. 13 – Recurrent sequences
" 14 – Computability

Colossal amount of information about all sorts of topics – Shows how rapid & varied are the developments. – In Chap. 12 dealing with Galois fields, mentions in §§12.7 ff. the "Bose – Chaudhuri – Hocquenghem Code"

(8')

(h) A.M. Nathan (?) – [J. Opt. Soc. Amer 48, 285 (1958)]

(i) S. Pancharatnam [5 references all in Proc. Ind. Acad. Sci 1955-57

(j) G.N. Ramachandran & S. Ramaseshan – J. Opt. Soc. Amer. 42, 49 (1952)

– 'Crystal Optics' – A section in S. Flügge ed. Encyc of Physics, Vol 25/1 (Springer, Berlin 1961)

---

(5) Proc. Symposium on hadron spectroscopy – Keszthely, Hungary, 6-11 Sept, 1968 – Akadémiai Kiadó, Budapest, 1969.

Foreword by G. Marx :- on Hadron spectroscopy is very interesting

" In the jungle of particles & resonances the great break-through started with the discovery of the Eightfold way. The zoological systematisation of hadrons was made possible with the help of the compact groups SU(3) & SU(6). The first success made the theoreticians conceited. We started thinking in terms of quarks, and in our mind, we followed the classical trail of atomic physics; we wanted to understand the hadrons as molecule-like composite systems. But the hopes turned out to be premature. The hadronic jungle is more entangled.

Real progress was made possible only by more sophisticated methods, which grew out of the compact description. The union of the SU(6) with the Lorentz group led us to non-compact algebras. The interplay of the analytic Regge description and the Lorentz symmetry resulted in a conspiracy of poles; thus we arrived also from another direction at the infinite reps of non-compact algebras. Trying to build up a relativistic quark theory, expressing the higher symmetries in terms of local currents we got a coupled system of current commutators. This current algebraic approach enabled us to understand quite a number of relations among the different measurable properties of hadronic matter. Thus, we have learned that it is not possible to understand a single resonance or a single decay mode in itself, but only the complex system of all the hadronic energy levels, the correlated transitions among them, offers us an insight into the fundamental nature of hadronic matter

Hence a symposium on hadron spectroscopy — —

(8) Functions of a complex variable by Carrier, Krook & Pearson – McGraw Hill, 1966
– A good reference text book.

(9) Mathematical Theory of Control – Edited by A.V. Balakrishnan and Lucien. W. Neustadt
– Proc. of a Conference held in Univ. of Southern California, Los Angeles, Jan 30 – Feb 1 1967
– Academic Press, 1967. – Heap of papers.

Mathematical Gazette, Feb. 1970.

p. 31 – Lamé ovals – $(x/a)^n + (y/b)^n = 1$ – used by modern designers & architects
– Last remark about a particular oval on which every point except the four on the axes being transcendental! (uses in Peterborough Plaza)

Ibid – May, 1970.

p. 174 – Review of the book "Mathematics & Logic" by Kac & Ulam. by R. L. Goodstein – A very favourable review.

p. 202 – Review of Geometry of Quantum spaces by V. S. Varadarajan (by P. Wintenitz)

Ibid – October, 1970

(21/4/71) New Books Section

(1) Again read parts of book by Kac & Ulam on Mathematics & Logic.

(2) An introduction to quantum physics by Garrison Sposito.
(John Wiley & Sons, 1970).
– Appears to be a good text – took / to consult when I shall sit down to write a book on quantum mechanics for Indian Universities (God knows when!)

?!

other books

(1) (3) Lasers and Light – Readings from Scientific American with an introduction by Arthur L. Schawlow (Stanford University)
– 11 articles making up the September, 1968 Issue of Sc. Amer.
– 10 other previously published articles on various aspects of laser
– 12 relating to other aspects of modern optics of special interest.

2. For the Raman Issue of the CSIR, why not write a sort of review type of article re. lasers and the Raman Effect?
G. A. Giordmaine (Sc. Amer. 1967) on
No. 26 – the article by ~~Schawlow deals this topic~~
"Interaction of light with light" ~~treats this~~ – deals with this topic.

Chap 2 - Modern description of polarised light (p. 15) using the Poincaré sphere, the Stokes vector, the Jones vector and the quantum mechanical description.

(Ref. to a paper by Pancharatnam, also to G.N. Ramachandran & Ramaseshan

p. 19 - reference to above & also to S. Chandrasekhar in connection with the Stokes vector. This vector consists of a set of four quantities (called the Stokes parameters) that describe the intensity and polarisation of a beam of light. The four parameters have the dimensions of a time-averaged intensity. The vector is a mathematical one, though consists of four physical real parameters, existing in a 4-dimnl math. space & not in a 3-dimnl physical space. It can be written as the column vector

$$\begin{pmatrix} I \\ M \\ C \\ S \end{pmatrix} \quad \text{or} \quad \{I\ M\ C\ S\}$$ to save space

{ } reminding that it is a column-vector

I called the intensity, M, C, S are the "horizontal preference", "plus $\pm 45°$ preference", and "right-circular preference" respectively

p. 29 - Quantum mechanical description — Ref. to Born (Optik, Springer, Berlin, 1933)

— Relation to thermodynamics & entropy

— " between polarised light & general relativity discussed by Marriot [J. phys. radium 21, 805 (1960)

In the bibliography one finds

(a) S. Bhagavantam - Polarisation of Raman lines in liquids [Ind. J. Phys 7, 79 (1932)]

(b) M. Born - Optik & Theory of optical activity [Proc. Roy. Soc. A, 150, 84 (1935)]

(c) S. Chandrasekhar - Radiative transfer (Book) [Clarendon, Oxford, 1950, p. 393

- optical rotatory power of quartz etc [Proc. Ind. Acad. Sci. 35, 103 (1952)]

with Elbert - Illumination & polarisation of the twilit sky on Rayleigh scattering [Trans. Am. Phil. Soc. 44, Pt. 6, 88 (1954)]

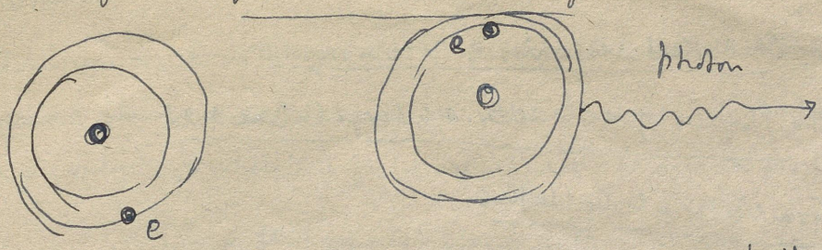
(d) K. S. Chandrasekharan [Proc. Ind. Acad. Sci. A, 44, 387 (1956)]

(e) K. Chowdhuri [Ind. J. Phys, 18, 74 (1944)]

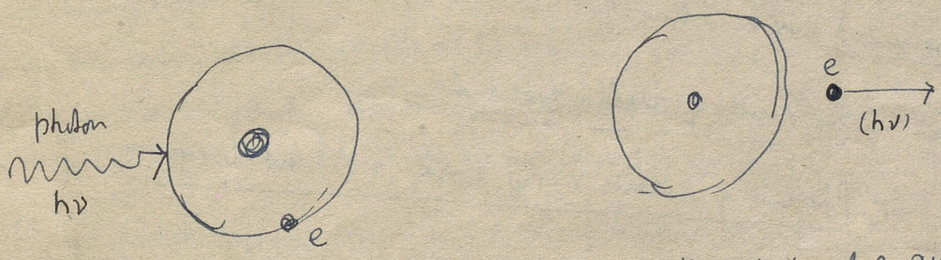
(f) S. C. Ganguly & N. K. Chaudhury [Phys. Rev. 95, 1148 (1954)]

(g) P. Hariharan [J. Sci. Instr. 37, 278 (1959)]

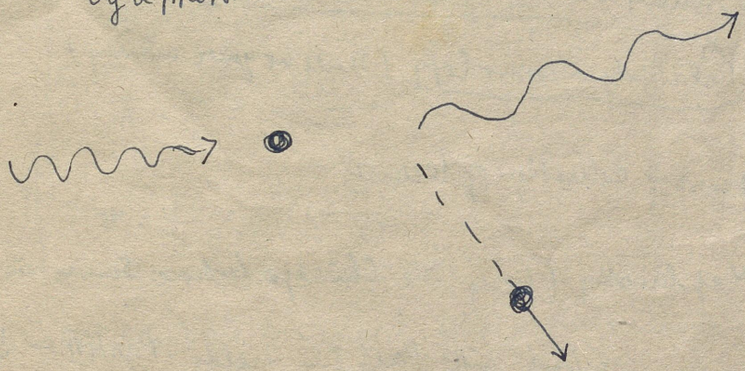
– Read in full the first article by Feinberg (Sc. Amr. Sept. 1968) on Light.



(i) Light is emitted when an electron drops from a higher energy state to a lower state in an atom or molecule.



(ii) Photoelectric effect – An electron is knocked out of an atom or a molecule by a photon. It was Einstein used this to establish quantum nature of light



(iii) Compton effect – explained how X-rays passing through matter may increase in wave length. An X-ray photon that strikes an electron is deflected and loses energy; the wave length shift and scattering angle are related by the dependence of wave length on energy.

Other remarks in the paper :-

(a) The simplest charged particle to consider is the electron, which does not have any known structure. An electron at rest can be taken as a point charge, and its fundamental interaction with light is the emission and absorption of photons, one at a time from this point --- In the fundamental interaction process the number of photons changes, while the number of electrons remain the same. There is no conservation law for photons as there is for charged particles.

(b) Photons obey Bose Statistics while electrons obey Fermi-Statistics based on Pauli's Exclusion Principle viz. which forbids the existence of more than one electron with any given value of momentum and A.M at any given time. For photons, on the other hand, not only is it allowed, but also there is a

- Collection of lectures by 9 people (including C.C. Lin, Misner, & Sachs)

Contents. D. Lynden Bell – Statistical mechanics of stellar systems

G. B. Field – The Physics of interstellar & intergalactic media

C. W. Misner – Gravitational Collapse.

A. F. Moffet – Extragalactic radio astronomy

Vol II – Contents announced are as follows:-

J. Greenstein – Extremes of stellar evolution

K. Greisen – Physics of cosmic x-ray, $\bar{\gamma}$-ray, and particle sources

D. Layzer – Cosmogenic processes

C.C. Lin & F.H.S. Shu – Density wave theory of spiral structure

R. Sachs & T. Ehlers – Relativity & cosmology (Shall be quite interesting)

– Whole thing is a very interesting collection of lectures

(3) Fields and Rings by Irving Kaplansky (Very the Chicago Lecture Series in Mathematics) – Quite an advanced book with Part I – Fields, Part II – Rings and Part III – Homological dimension.

(with examples scattered here and there. For eg. Exercises on p. 53 may be useful for setting qns on Galois theory)

(4) Polarised light – Production & use by William A. Shurcliff – Harvard Univ. Press, Cambridge, Mass, 1966.

– Describes different types of polarisers & the rules governing the Combination of polarisers & retarded plates – Chap. 8 is devoted to Mueller Calculus & Jones Calculus mainly in terms of matrices. – Appendix 2. is devoted to standard Mueller & Jones matrices.

p. 2 :- Physicists & Chemists find that polarised light has uses far beyond those of unpolarised light. Biologists, astronomers, and engineers find that polarised light solves many problems that are otherwise insoluble. If light is man's most useful tool, polarised light is the quintessence of utility.

tendency for photons to be produced in this way – in large numbers of the same momentum. Of all the stable elementary particles (leaving aside the gravitons), photons alone can occur in combinations necessary classical fields that have well defined ~~values~~ values over large regions. It is therefore not surprising that electromagnetism is the only case where the field aspects were recognised first.

This is the property, incidentally, that is exploited in the laser. What the laser does is the produce vast number of particles of exactly the same energy and wavelength. With no other particle except the photon is such a ~~feat~~ feat possible. The laser beam's remarkable macroscopic properties arise from the fact that its constituent photons are precisely identical. Whether the laser could have been invented without quantum mechanics is an interesting question!

(c) Light differs from other forms of matter primarily in that photons have ~~no~~ zero rest mass.

	General Case	Photon.
$p =$	$\frac{\sqrt{E^2 - m^2c^4}}{c}$	$= \frac{E}{c}$
$\lambda = \frac{h}{p} =$	$\frac{hc}{\sqrt{\quad}}$	$= \frac{hc}{E}$
$v = \frac{pc^2}{E} =$	$c\sqrt{1 - \frac{m^2c^4}{E^2}}$	$= c$

The adjoining table shows how the momentum, wave length and velocity are given for the general case and for the photon.

(d) Using Ampère's assumption that photons interact only with charges, and applying the principles of special relativity and quantum mechanics, a mathematical theory known as quantum electrodynamics has been developed that provides detailed and accurate predictions for the entire range of phenomena involving light and electrons. Some of these predictions (for eg. the response of hydrogen atoms to microwaves) have been verified to one part in a billion. Indeed of all the theories physicists have constructed, the quantum electrodynamics of electrons is rivalled only by the gravitational theory of planetary motion in its agreement with observation. We can agree with Dirac that this theory "explains all of Chemistry and most of physics".

New Books Section.

(3) The Planet Jupiter by Bertrand M. Peek (Faber & Faber, London) 1958)

Preface :- At the present time there is any amount of scope for the amateur who is prepared to observe Jupiter systematically, and the need for co-operation from the southern hemisphere is as great as it has ever been; if therefore, the perusal of these pages should result in the addition of even one more devotee to the ranks of the really

$1296 = 16 \times 81 = 4 \times 4 \times 9 \times 9$

$= 1 \cdot 16 \cdot 81 = 2 \cdot 8 \cdot 81 = 16 \cdot 9 \cdot 9 = 3 \cdot 16 \cdot 27 = 4 \cdot 4 \cdot 81 =$

$= 1 \cdot 36 \cdot 36 = 2 \cdot 72 \cdot 18 = 1 \cdot 72 \cdot 18$

(6) The technique of clear writing by Robert Gunning – McGraw Hill, 1968

(7) Applied Matrix and tensor analysis by John A. Eisele and Robert M. Mason – Wiley-Interscience, 1970

"we know that intellectual food is sometimes more easily digested if not taken in the most condensed form" (F. Cajori – History of mathematical notations)

Part III – Applications to Relativity & quantum mechanics; mention of Pauli's spin matrices & spinors and Dirac's relativistic wave equation

on p. 311 · Ex. 10. – Alladi Ramakrishnan has said "Everything seems to flow from the fraility of the Pauli matrices" write a brief essay tracing the development of this theme in his writings

– Anyway send the fools my reprints

12/7/71 – New Books Section

(1) Physics of nuclei and particles by Pierre Marmier & Eric Sheldon – Vol II

Academic Press, 1970

Vol I deals with fundamental aspects of nuclear & particle physics; in Vol II we aim to explore the prevalent descriptive methods used in these fields, stressing throughout the phenomenological & model-based aspects. (Vol II deals mostly with topics of nuclear physics) – on the inside flap of the cover one finds that this is going to be a three-volume treatise.

only rudimentary knowledge of mathematics, special relativity, quantum theory and atomic physics – such as that earned in an undergraduate modern physics course – is assumed

(2) Astrophysics & General Relativity – 1968 Brandeis Inst. Summer Inst. in Th. Physics – Gordon & Breach, 1969

Vol I

ardent students of the planet, then at least they will not have been written in vain

Topics in recreational mathematics by J. H. Caldwell (Cambridge University Press, 1966)

(1) Surface polyhedra
(2) The Fibonacci sequence
(3) Nested polygons.
(4) Distribution of prime numbers
(5) Inversion in elementary geometry
(6) Some ruled surfaces.
(7) Random walks
(8) The four-colour problem
(9) Dissection problems in two and three dimensions.
(10) Newton's Puzzle of plane algebraic curves.
(11) The plane symmetry groups.
(12) The real number system
(13) A theorem of Combinatorial topology.
(14) The number π
(15) Rotors and curves of constant breadth.

— Quite an impressive list of topics — To be borrowed for topics of newsletter

23/4/71 (1) Saw a book on "An analytical calculus" vols I to IV by E. A. Maxwell — Cambridge University Press — Very fine text book full of examples.

(2) Ingenious mathematical problems & methods by L. A. Graham (Dover book)

Gives a series of books (nearly 40 in number) all priced about $1.00 or 1.50 or 1.75 published by Dovers.

There are 100 problems with solns, but the problems as well as the solutions are too lengthy. We might choose

NO. 69 — The Census taker.

Little Euclid, who had grown up to be a census taker, came to the home of Pythagoras Jones. After Jones had given the requested information about himself, Euclid asked "Who else lives here"

Jones answered "Three others, but none is at home"

Euclid replies "Then perhaps you can give me their names and ages"

After giving the names in order of seniority, Jones, with a twinkle in his eye, says "The product of their ages is 1296, and the sum of their ages is the number of this house"

Euclid ponders for a moment, then asks "Are any of their ages the

and $10^2 > M/M_\odot > 1$ for the gnomd galaxies – Also classified according to 'bolometric(?) luminosity L. – Very interesting paper.

(4) Introduction to Mathematics by F.M. Hudson & D.W. Adlong – Addison Wesley, 1970

Chaps – Introduction – Sets (Venn diagrams) – Systems of numeration & Hindu-Arabic System, p. 44, probably originated in 3rd century B.C, ref. to King Asoka [250 B.C] & stone columns of his time; the Italian mathematician Fibonacci (1170–1250) was the first European to write an extensive discussion on the H-A. numerals; he was one of the foremost mathematicians of his time (Is this the same as the man of the Fibonacci sequence??) – Geometry – Probability & Statistics – Interest & annuities – Computers & computer programming – Quite an interesting elementary book.

$a/c = 3, \; b/c = 4$

$$\begin{array}{r} 27 \\ 64 \\ \hline 91 \end{array} \qquad \begin{aligned} a &= 27^3 = 91 \cdot 3 \\ b &= 36^4 = 91 \cdot 4 \end{aligned}$$

$$a^3 + b^3 = 91^3 \cdot 3^3 + 91^3 + 4^3$$
$$= 91^3 (3^4 + 4^3) = 91^4$$

(5) The Mathematical Sciences by – A Collection of Essays edited by the National Research Council (M.I.T. Press) of the National Academy of Sciences U.S.A. (1969)

Contents – The applicability of mathematics by Ulam – Complex analysis by Lipman Bers – The social sciences call on Mathematics by J. G. Kemeney – Topology of molecules by Joshua Lederberg – Non-Euclidean Geometry by H.S.M. Coxeter – Statistical Inference by J. Kiefer – Functional Analysis by J.T. Schwartz – Vector spaces and their applications – Mathematics in the Physical Sciences (Sc. American article), also biographical note) – Analytic fns & elementary particles by A.S. Wightman (talks of piecewise analytic fns; I seem to have read this collection of essays earlier) – Numerical analysis by P.J. Davis – Solving a quadratic eqn on a computer by G.E. Forsythe – The algebraization of mathematics by Samuel Eilenberg – The role of Maths in Economics by L.R. Klein – The evolution of differential topology by A.M. Gleason – Mathematical linguistics by Z. Harris – Combinatorial Analysis by Gian-Carlo Rota – Point-set topology by R.H. Bing – Mathematics & the Biomedical Sciences by Hirsh Cohen – Probability by Mark Kac – The continuum hypothesis by R.M. Smullyan – Prospects of computer science by J.T. Schwartz.

– A very interesting, elementary exposition of the several topics

same as yours?". Jones answers "no", whereupon Euclid leaves satisfied.

What is the house number?

Solution (by J. R. Hugh Dempster of Princeton N.J)

"The soln, of course, consists in finding, from the various sets of three integers ~~whose~~ (it should be with only two digits, not assuming centenarians & above) whose product is 1296, two different sets (it should be, at least two) that add up to the same number. I was lucky to get 81, 8, 2 and 72, 18, 1 which gave the answer 91."

---

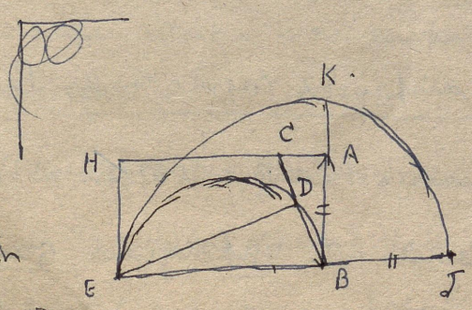
out of the 100, Nos 76 to 100 are called quickies, and an approximate time for solution of each of these is given as 5 minutes.

No. 78 – Dr Ernest Rabinowicz M.O.T. invites you to find quickly any two different integers, the sum of whose cubes is the fourth power of an integer. And after finding one pair of numbers that fill the bill, tell how you can find all such cases.

Soln: The short cut here is to divide both sides of the eqn $a^3 + b^3 = c^4$ by c^3 which gives $(a/c)^3 + (b/c)^3 = c$. If a/c and b/c are set equal to any two different figures other than 1, the numbers required are quickly found and are different integers. For eg. if a/c and b/c are 2 and 3 resp'ly, $c = 2^3 + 3^3 = 35$ and the required numbers are 70, 105

$$\left[70^3 + 105^3 = 35^3(2^3 + 3^3) = 35^4 \right]$$

No. 82. A. W. Everest, General Electric Co. Pittsfield, Mass. invites you to cut a sheet of typewriter paper into three pieces which can be rearranged into a square; prove your answer.



Too complicated and quite rubbish

There is really no point in including such a rotten problem

[P.T.O

Sommerfeld was Wentzel's teacher at Munich – Pauli-Wentzel team – the W-K-B method due to Wentzel. – For over twenty years at the University of Chicago he has taught superbly, inspired students, and contributed immeasurably to the quality & style of physics at that University – A man of scientific & moral integrity

Papers by Kemmer (Univ. of Edinburgh) and one by J. Schwinger on the charged scalar mesotron field (This paper was written early in 1941, but remained unfinished & unpublished. It is offered now, still incomplete and lacking references, in homage to Wentzel – ~~Marris a reference to Bhabha's paper in Rhys. Rev~~), one by S. Chandrasekhar on a topic relating to general relativity (no mention of Wentzel's name, but ref. to work done at Univ. of Chicago) – paper by Jauch & Piron on quantum logic –

(2) Non-linear differential equations (Ref. only) by Davies & James)
Addison – Wesley Pub. Co 1966 (Addison – Wesley Series)

(3) Advances in Astronomy and Astrophysics (Academic Pres, 1970 – Series Publication No.7 – Edited by Zdeněk Kopal, Dept. of Astronomy, Univ. of Manchester. – Article by Naresh Chandra & S.K. Joshi (Delhi Dept. of Physics, Univ. of Roorkee) and articles by R.A. Lyttleton (Cambridge) & Zwicky (Mt. Wilson & Palomar observatories –

✓ Lyttleton's article on "The structure of the terrestrial planets dealing with the Earth, Venus, Mars, Moon & Mercury & comparison of terrestrial planets – Very interesting introduction in which he remarks how little geophysicists know about the interior of the earth – widely agreed that the four great outer planets (Jupiter, Saturn, Uranus, Neptune) must be composed mainly of the lightest gases, hydrogen & helium & may possess small rocky cores of masses comparable with those of the terrestrial planets.

✓ Zwicky's article on Compact and dispersed cosmic matter Part II (Part I appeared in Vol. 5 of the Series & Part III will appear in Vol 8) is also of great interest – Classifies galaxies into Supergiant, Giant, Normal, Dwarf, Pygmy and Gnome galaxies (according to 'indicative' mass, $M/M_\odot > 10^{10}$, $10^{10} > M/M_\odot > 10^8$, $10^8 > \ldots > 10^6$, 10^6 to 10^4, 10^4 to 10^2

No. 92 - What is the quickest way to prove that the median to the hypotenuse of a right-angled Δ^{le} is equal to half the hypotenuse?

Soln: Draw a $\odot$ having the hypotenuse as diameter, then the $\perp$ drawn from the vertex must fall on the $\odot$. The median is the radius of the $\odot$ & hence $\frac{1}{2}$ diameter.

No. 98 - To find three consecutive integers such that; when all possible simple fractions are formed therefrom, the sum of the six different fractions will be an integer

Soln: Intuitively: 1, 2, 3

$\therefore \frac{1}{2} + \frac{1}{3} + \frac{2}{3} + \frac{2}{1} + \frac{3}{2} + \frac{3}{1} = 8.$

good question

To show that this is the only sequence, let $x-1$, x, $x+1$ be the consecutive integers, the sum of fractions formed $= \frac{6x^2}{x^2-1}$, and since x^2 and x^2-1 are relatively prime, (x^2-1) must be a divisor of 6, which is possible only if $x = 2$

Rouse Ball's recreations & essays revised by Coxeter:

(1) $8712 = 4 \times 2178$; $9801 = 9 \times 1089$

(2) $312 \times 221 = 68952$; $213 \times 122 = 25986$

(3) 698896 is a perfect square equal to its own reversal.

(4) The digits of F_{73} are so numerous that, if it were printed in full with the type and number of pages used in this book (420 pp); many more volumes would be required than are contained in all the public libraries of the world.

(26/4/71) New Books Section

(1) The exact sciences in antiquity by O. Neugebauer (Brown Univ. Press Providence, Rhode Island)

Much or proper attention is not paid to contributions of Hindu astronomers and mathematics.

p. 174 - A characterisation of Hindu astronomical and mathematical literature by al-Biruni as "a mixture of pearl shells and sour dates, or of pearls and dung, or of costly crystals and common pebbles"

There is a chapter on Egyptian Mathematics & Astronomy, but no special chapter devoted to Hindu mathematics & Astronomy.

population was put to death. The heads of the slain were severed from their bodies and piled in heaps, those of the men being separate from those of the women and children. --- These strange warriors, seemingly from another world, did inspire a stupefying kind of fear in all who encountered them. - - - -

- - - - They are inhuman and beastly, rather monsters than men, thirsting for and drinking blood, tearing and devouring the flesh of dogs and men, dressed in ox hides, short and stout, thickset, strong, invincible, indefatigable, their backs unprotected, their breasts covered with armour; drinking with delight the pure blood of their flocks, with big strong horses, which eat branches and even trees. They are without human laws, know no comforts, are more ferocious than lions or bears; they are able to swim or manage a boat, so that they can cross the largest and swiftest rivers without let or hindrance, ~~to~~ drinking muddy water when blood fails them ... They are wonderful archers, ~~s~~ are neither age, nor sex, nor condition. They know no other language but their own, which no one else knows; for until now there has been no access to them ... They wander about with their flocks and their wives, who are taught to fight like men. And so they come with the swiftness of ~~lightning~~ lightning to the confines of Christendom, ravaging and slaughtering, striking everyone with terror and incomparable horror. It was for this that the Saracens sought to ally themselves with the Christians hoping to be able to resist these monsters with their combined forces.

2|7|71 Looked at Issues of the Camb. Phil. Soc from 1970 backwards to 1965.

(1) In the Issue for 1966, Vol. 62, p. 87 found an article on "A spatially homogeneous gravitational field" by V. Joseph (Univ. of Ceylon, Colombo) with ref. to Petrov's work (but not to Petrov's book)

9|7|71 New Books Section

(1) Quanta – Essays in Theoretical Physics dedicated to Gregor Wentzel
Edited by P. G. O. Freund, C. J. Goebel & Y. Nambu

Preface: Prof. Wentzel has decided to retire from the Univ. of Chicago at the end of this academic year (1969) – A great teacher.

Introduction – Wentzel a great teacher, scientist and friend. – Intro by Bargmann & Goldberger.

– A funny looking picture of Wentzel with a cigar in his mouth
(Born on 17|2|1898)

(2) Geometry of Quantum theory Vol 2 by V. S. Varadarajan. – Van Nostrand

((Jeffrey Mathis, Univ of California, Los Angeles)

The last chapter dealing with relativistic free particles contains a lot of ununderstandable rubbish, including Clifford algebras – no reference to Corson's book or even to poor Harishchandra!

(3) Some recent advances in the basic sciences (Edited by A. Gelbart, Vol 2, 1965–66)

(Copyright, 1969 by Yeshiva University) [Belfer Graduate School] N.Y

(a) p. 41 – Approximate higher symmetries of strong interactions by Feza Gursey (Yale Univ)

– talks of SU(6), SU(2), SU(3) etc.

(b) ✓ p. 41 – Muonium by Vernon W. Hughes. (Yale University)

Muonium is an atom consisting of a +ve muon and an electron. I would like to review the work that has been done on muonium. The work started about ten years ago when parity non-conservation was discovered and it is still very active.

Muonium is of great interest in several subfields of physics. First it is the simplest system involving the muon and the electron, and hence is the best one for studying with precision the interaction of these two elementary particles. The muon is a particularly mysterious particle because it appears to behave in all respects like a heavy electron and hence there appears to be no interaction which could account for the large mass value of the muon mass relative to the electron mass. It thus occupies an anomalous role in the spectrum of the elementary particles. We have been able to study the electromagnetic interaction of the electron and the muon through a precise measurement of the hyperfine structure interval in the ground state of muonium. Secondly, muonium is a light isotope of hydrogen in which the +ve muon replaces the proton. Hence muonium has a rich chemistry and its interactions with other atoms and molecules have been studied. Thirdly, muonium provides a useful system for studying certain aspects of the weak interaction of the muon and the electron, in particular a possible weak interaction coupling muonium to antimuonium, which is the atom consisting of a negative muon and a positron.

Properties of the muon: Its mass is well known and is about 207 times the electron mass. The charge of the +ve muon is the same as the positron charge. The spin is 1/2 and the magnetic moment is somewhat more than 3 times the proton magnetic

making war on anybody – and senseless aggression against against people violates a Muslims religious belief ... I refused to take part in the war at that time [in 1942] against Japan and Germany, or help America to fight those wars. I considered myself a righteous Muslim, and I teach peace... If it is fighting for truth and ~~righteousness~~ righteousness – yes, we go along with that – But if it is fighting for territorial gain or to master or rule people in their own spheres, no. We think it is an injustice."

This extract is from Gene Marine (with Peter Collins and Robert Avakian) Called "Muhammad Ali")

30/6/71 Manchester Literary & Philosophical Society – Memoirs & Proceedings Vol. 112, 1969-70

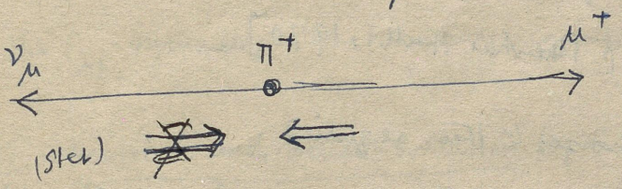
p. 5 – The last barbarian invaders: the impact of the Mongol Conquests upon the East & West by J. A. Boyle. (Genghis Khan the greatest of the Mongols)

|| Some of the extracts resemble recent Pakistani atrocities in Bangla Desh

(a) upon the peoples of Islam the initial invasions had the paralysing effect of some great natural disaster – – – In particular, the great and systematic massacres which characterised the conquest of North Eastern Persia, which are described in detail by the Persian historian Juwaini (1226 - 1283) – After the capture of a city the population was slaughtered en masse, to each Mongol soldier being allotted the execution of several hundred persons. The total figures are incredibly high. According to ~~Ibn al~~ Ibn al-Athir 90,000 people were killed at Merw. According to Juwaini, a Muslim deivine "together with some other persons passed thirteen days and nights in counting the people slain within the town. Taking into account only those that were plain to see, and leaving aside those that had been killed in holes and cavities and in the villages and deserts, they arrived at a figure of one million, and three hundred thousand – – – At Nishapur where a son-in-law of Genghis Khan had been killed in the fighting, it was ordered "That the town should be laid waste in such a manner that the site could be ploughed upon, and that in the execution of vengeance not even cats or dogs should be left alive" Apart from 400 craftsmen reserved for transportation to Mongolia as slaves, the whole

magnetic moment $\left[\frac{\mu_\mu}{\mu_p} = 3.18338 \pm 0.0004\right]$. The gyromagnetic ratio g_μ is greater than 2 by the anomalous magnetic moment factor $\left[g_\mu = 2\left(1.001162 \pm 0.000005\right)\right]$, and the excellent agreement between the experimental and theoretical values of the anomalous magnetic moment factor provides the most critical proof that the muon is a heavy Dirac particle with the usual coupling to the electromagnetic field. The mean life time of the muon is 2.2 μsec.

$$\pi^+ \longrightarrow \mu^+ + \nu_\mu$$



must be(?) → (Single line arrow)

$$\mu^+ \longrightarrow e^+ + \nu_e + \bar{\nu}_\mu$$

$$I_{e^+}(\theta) \propto 1 + A\cos\theta.$$

The tool for studying muonium is provided by parity non-conservation in the weak interactions involved in the production and decay of the muon (as in the figure above). The positive pi meson decays into a positive muon and a muon-type neutrino. In the rest frame of the pion, the muon spin angular momentum indicated by the double arrow, is in the direction opposite to its linear momentum, indicated by the single line arrow. This correlation of spin direction and velocity direction is a consequence of parity non-conservation and provides us with polarised muons. The +ve muon decays into a positron and two neutrinos with a continuous positron energy spectrum extending up to 52 MeV. The angular distribution of the positrons with respect to the muon spin direction $I_{e^+}(\theta)$ is asymmetric due to parity non-conservation. The quantity θ is the angle between the muon spin direction and the direction of emission of the positron, and A is approximately 1/3, so positrons are emitted preferentially along the muon spin direction. This characteristic of the muon decay provides the means for detecting the muon spin direction.

Other headings: – Formation – Hyperfine structure interval (explt details) –

Muonium interactions with atoms and molecules

Conclusion – As to future work on muonium, let me just remark that all our work has been done with only 10^{10} muonium atoms; work on the hydrogen atom on the other hand has available hydrogen atom beam intensities of 10^{14} atoms/sec. Research on muonium ~~atoms~~ is now severely limited by the number of muonium

manner the types of observations including Dicke's idea of oblateness of the Sun, and an account of how these observations can be made by making some assumptions) – Excitation & ionisation by electron impact by Bely & Regemorter – ✓ the nuclei of galaxies by Burbridge.

(8) Introduction to Nuclear Theory by Mac Carthy (John Wiley & Sons, 1968)

(9) A mixed bag – A contemporary collection for understanding and response edited by (Alan) Casty [Beacon Hill, 1970]

– All sorts of collections & responses to them required.

p. 74 – A piece "Muhammad Ali" – The negro Cassius Clay who became a Muslim, a great boxer (He recently lost to somebody else)

p. 77: And there can be little doubt that the Muslims get as much out of Ali as he ever got out of them. For one thing, they get money; for another, they get a forum that they could never buy. Probably it is trust rather than understanding that binds Ali to them

" followers of Allah" he has said " are the sweetest people in the world. They don't carry knives. They don't have weapons. They pray. The women wear dresses that come all the way to the knees and don't commit adultery. All they want to do is live in peace with the world. They don't hate anybody. They don't want to stir up any kind of trouble. All the meetings are held in secret, without any fuss or hate-mongering

" Muslims are righteous people" Eligah Muhammad said recently (in a lengthy interview with CBS and ABC reporters, only a small part of which was broadcast on ABC) " They don't believe in

* E. T. Bell became Prof in Calif. Inst. of Technology in 1926, a post (born 1883) he held until his death in 1960. He was author of numerous books on mathematics & surprisingly of highly competent science-fiction stories, published under a pseudonym.

atoms available or by muon beam intensity. When higher intensity accelerators – the so-called meson factories (!) – get built, great improvements and extensions of studies of muonium will be possible [muonium discovered by using synchrocyclotron]

(c) p. 91 – Space inversion, time reversal and particle-antiparticle conjugation by T. D. Lee (Dept of Physics, Columbia Univ, N.Y).

P & T in classical mechanics – Non conservation of parity – Question of time reversal invariance – CPT-invariance and the relations between particles and antiparticles – The C_{st}-symmetry – What is charge conjugation? – 24 references.

(d) p. 105 – Neutrinos and stellar evolution by E. E. Salpeter (Cornell Univ, Ithaca, N.Y)

Stellar ~~evol~~ evolution review – Hydrogen burning – Neutrino pair production – Highly evolved stars – 7 references.

(e) Appendix I, p. 229 – Award Dinner programs – Looking past the galaxies for the big flash by Phillip Morrison (M.I.T)

(f) Appendix II – giving details about the earlier Yeshiva Univ. Conferences.

(4) Mathematics – Edited by S. Rapport & Helen Wright (Foreword by ~~Prof.~~ R. Hollis. R. Cooley of N.Y. Univ) – N.Y. Univ. Press, 1963.

– A good popular book about mathematicians & other articles by several mathematicians

– In the story about Gauss (written by Bell)*, the teacher one Büttner is described as a virile brute running the school. The formula in A.P. given to the class is mentioned as

$$81297 + 81495 + 81693 + \cdots + 100899$$ (Common difference = 198 & no. of terms = 100)

(He was then a boy of ten)

p. 46 – Article on Evariste Galois by G. Sarton

(5) The Enjoyment of mathematics by Rademacher & ~~Forsplatz~~ Toeplitz (?) [Princeton Univ. Press]

28/4/71 – Some more notes from (4) above.

p. 21 – From the point of view of mathematics, Newton must be regarded as having wasted the last thirty years of his life in occupations unworthy of his supreme talents – – – Locke and other friends of Newton felt that it was outrageous that

operators – Analytic perturbation theory – asymptotic perturbation theory – Perturbation theory for semi-groups of operators – Perturbation of Continuous spectra and unitary equivalence

– Highly advanced treatise – useful in Quantum Theory.

(7) Annual review of Astronomy & Astrophysics (1970) – Annual Reviews Inc. 4139 El Camino Way, Palo Alto, California, U.S.A.

(Published by George Banta Co. Inc)

Preface: Such topics as Fourier Astronomical spectroscopy, Pulsars, Optical properties of X-ray sources, Neutron stars, Internal rotation of the Sun and Radio Recombination lines have developed within the past 5 or 10 years and are being reviewed in this series for the first time. ... – It is regrettable that funds for astronomy are being sharply reduced just at the time when the potential for exciting astronomical discovery has become virtually unlimited ... After this volume had gone to press, we learned with deep sorrow of the death of Prof. Sydney Chapman, who made monumental contributions to astrophysics & geophysics.

Contents: origin of solar magnetic fields by E.N. Parker – The theory of stellar winds and related flows by Holzer & Axford – Auroral Physics by S. Chapman – Atmospheres of very late-type stars by M.S. Vardya (or is it Vaidya?) of the T.I.F.R – Information-processing systems in radio astronomy & astronomy by B.G. Clark – optical observations

[* Jealousy of other people about Gauss & making fun of his work.]

of Extrasolar X-ray sources by Heltzer & Mook – The cosmic abundance of helium by Danziger – Neutron stars by Cameron – Astronomical Fourier Spectroscopy by Pierre Connes – Radio frequency Recombination Lines by Dupree & Goldberg – Pulsars by A. Hewish – Internal rotation of the sun by R.H. Dicke (At the end of the article is given a ~~dear~~ clear

the most eminent scientist and mathematician of his age should be dependent on the meagre salary of a College Professor and fellow. By their efforts, Newton was appointed warden of the mint in 1695, an appointment worth £ 500/- a year, but making so few demands of his time so as to allow him to retain his Cambridge professorship. In 1697 he was appointed Master of the Mint, a post worth two or three times as much as that of Warden.

It is impossible to avoid a feeling of regret that Newton (1642-1727) should have allowed himself to be persuaded to degrade his unrivalled talents by accepting a well-paid government ~~job~~ post that robbed the world of his genius for a quarter of a century [Statement rather unfair, for Newton lives up to 85 years & the last quarter meant from the period when he was 60 up to his death] - incidentally 1642 is the year of Galileo's death

[D'Alembert, a student of the Bernoullis, was an illegitimate child abandoned by his mother in infancy]

[The most remarkable man of the times of the French revolution was Leonhard Euler, born in Basle in 1707. He was a student of Jean Bernoulli (brother of Jacques Bernoulli) and later joined him in St. Petersburg, where they had been invited by Catherine I. He lost the use of an eye as an young man, and in Russia became totally blind. But his prodigious output continued, an output encyclopaedic in ~~natur~~ scope]

[Other giants of the period: Lagrange, Laplace, Legendre, Monge and Poncelet, the last two being founders of modern descriptive & projective geometry respectively]

[Lagrange, wearying of mathematics in his middle age considered the subject was exhausted, that "it was finished or at least passing into a period of decadence." In fact, he was right, for it would have been so if new ideas from Gauss, Abel, Galois, Cauchy & others had not been injected into mathematics]

- Read the life of Gauss by E. T. Bell in full* (Remarkable in breadth of his interests)

p. 45 - Abel's first important paper on the quintic equation was ignored by contemporary mathematicians - Gauss is said to have ~~tore~~ tossed it aside in disgust. Abel was, however, able to obtain a fellowship for foreign study (Abel born in Norway). In France, he offered his great paper on the integrals of algebraic functions to the French Academy. Cauchy, another great mathematician of the period, who was asked to judge its merits, forgot to do so. The paper was

2) Essentials of Algebra by Bardell & Shutzbart (Addison-Wesley, 1969)

- Choosing some topics & making up a book — Quite elementary

Chaps :- System of integers — Integers contd — Polynomials & factoring — Rational numbers & fractions — Linear eqns & systems of L. Eqns — Exponents & radicals — Quadratic eqns — Graphical repn & fns — Inequalities — Systems of eqns involving quadratics — Exponential & logarithmic functions — Progressions, the Binomial formula

(3) algebra and its applications (A problem solving approach by Clifford W. Sloyer [Addison-Wesley, 1970]

Preface :- Book not intended to provide a substitute for a good course in Modern Algebra.

Parts — Math. Induction — Summation of series (A.P, G.P) — Algebra of Quadratics — Concepts of number theory — Combinatorial algebra — Inequalities — Algebra of optimisation (algebra of game theory & idea of dynamic programming & linear programming)

— odd collection of elementary & a few unusual topics for algebra

Answers to selected exercises

(4) Arithmetic : A College approach by Sunko & Eulenberg (John Wesley, 1966)

Chaps :- Sets & set language — Sets of natural numbers — set of rational numbers — meaning & use of decimal fractions — Ratio, proportion and percentage — arithmetic of measurement — Irrational numbers — Set of real numbers — Generalisation of arithmetic processes.

— Again an elementary book of an odd type

(5)

(5) Numerical methods for partial diff. eqns by William F. Ames — Paperback edn Thomas Nelson & Sons Ltd., 36, Park St, London W1

— An advanced type of book

(6) Perturbation theory for linear operators by T. Kato (Grundlehren Series, Vol 132) (Calif, Berkeley) — Springer-Verlag 1966

Chaps — Operator theory in finite dimensional vector space — Perturbation theory in a finite-dimnl space — Intn to theory of operators in Banach spaces — Stability theorems — Operators in Hilbert spaces (includg Schrödinger & Dirac operators) — Sesquilinear forms in Hilbert spaces and associated

ignored. Abel returned home without funds, and ~~scratched~~ managed to sustain a poverty-stricken existence by tutoring. He had contracted tuberculosis and died of the disease in his twenty-sixth year. With classic irony, word came of his appointment as Prof. of Maths. at the Univ: of Berlin two days after his death.

pp. 46-63 – The beautiful biography of Galois by George Sarton.

pp. 113–126 – Read in full extracts of Hardy's "A mathematician's apology".

Fermat's two-square theorem mentioned in

The primes can be arranged in two classes, the primes

$$5, 13, 17, 29, 37, 41, -$$

which leave remainder 1 when divided by 4, and the primes

$$3, 7, 11, 19, 23, 31, -$$

which leave remainder 3. All the primes of the first class and none of the second, can be expressed as the sum of two integral squares

$$5 = 1^2 + 2^2,\ 13 = 2^2 + 3^2,\ 17 = 1^2 + 4^2,\ 29 = 2^2 + 5^2$$

but 3, 7, 11, and 19 are not expressible in this way (reader may check by trial)

This theorem of Fermat is justly ranked one of the finest of arithmetic. Unfortunately there is no simple proof.

30/4/71 The Mathematics of Education – Vol 5. No. 1, March, 1971

(Indian journal published in Bihar!)

Section B, pp. 1–7 – Growth of Mathematics in India by Dr S. C. Chatterji, Bhola Bhavan, Kalimpong (W. B).

– Some cursory remarks – also suggesting that Bhaskara knew the differential calculus.

Scripta Mathematica – Vol 28, February 1970 – No. 4

(Published by Belfer Graduate School of Science, Yeshiva University, N.Y.

p. 297 – A polynomial identity which implies the Rogers–Ramanujan identities by G. E. Andrews – Also gives latest references to work on these identities done since 1930.

p. 313 – Lists of ten or more primes in A.P. by Edgar Karst

Quite a confusing paper with the author introducing notions of trivial, exceptional, complete, and incomplete sequences – under the last type

28/6/71

New Books Section

(1) Dawn of Science in India by O.P. Jaggi (with Foreword by Kothari) – Atma Ram & Sons, Delhi-6 – 1969

(Something about ancient Indian Science)

(2) Elements of number theory by Anthony J. Pettofrezzo & Donald R. Byrkit (Prentice-Hall, New Jersey)

Idea is to present to the reader at an introductory level selected topics of number theory.

Chap 1 – Preliminary considerations (Defines the system I, +, ×, <) of integers as ordered integral domain [with any ⊕ & ⊗ an integral domain.

Chap 2 – Divisibility properties of integers – contains ref. to perfect nos. Mersenne nos. & Euler's φ-fn [φ(n) = no. of +ve integers < n & prime to n – also totient of n]

Some theorems: (i) Every even perfect number ends in 6 or 8

(ii) A prime number cannot be perfect number.

[Does not (ii) follow from (i) ?]

Chap. 3 – Theory of congruences (includes the Chinese remainder theorem viz.

If $(m_i, m_j) = 1$ for $1 \le i < j \le n$, then the system of linear congruences

$$x = a_1 \pmod{m_1}$$
$$x = a_2 \pmod{m_2}$$
$$\cdots$$
$$x = a_n \pmod{m_n}$$

has a unique solution modulo m where $m = \prod_{i=1}^{n} m_i$

Chap 4 – Continued fractions – (more than what is usually dealt with in books of this type)

Answers to selected exercises (≃ 400)

List of prime numbers ≤ 10,000 (Says in introduction that this list was prepared by one Donald W. Dumas using computing facilities at Southern Connecticut State College – why this unnecessary effort when Lehmer's tables of primes up to a million have been tabulated.?)

[Set of even nos. not an integral domain because of absence of 1, although 0 ⊕ & ⊗ exist]

Ex 3-§ 1.1.

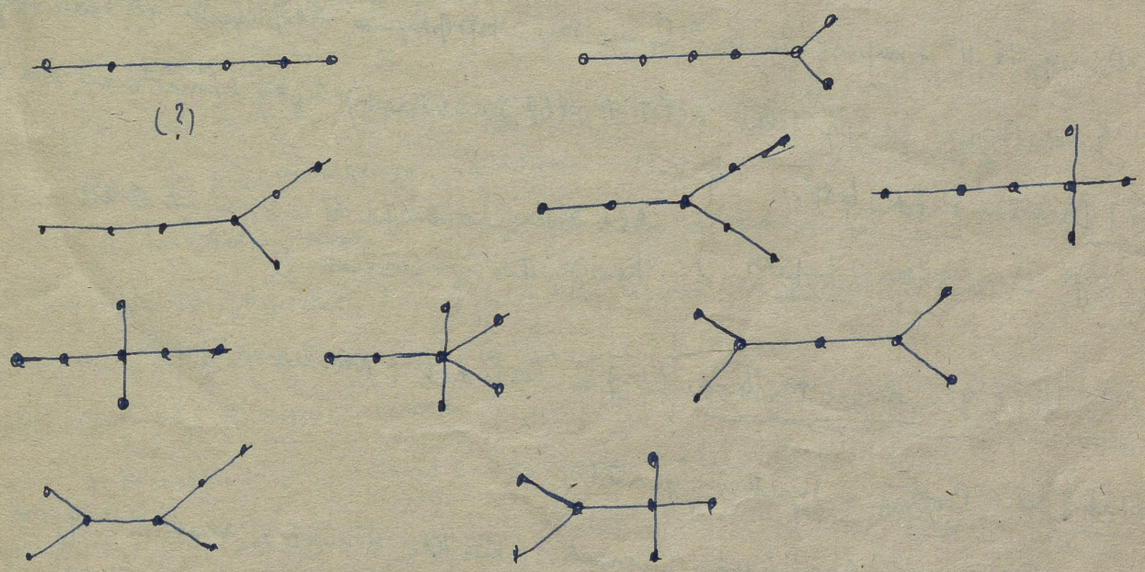
[Some kind of book – why not write such elementary books choosing special topics]

mentions the sequence

23143, 53173, ··· 353473 ($n = 12$, $d = 30030$) & mentions that A. M. Vaidya (Ahmedabad, India) ["On primes in A.P" Math. Mag. 40 (1967), 29-30 did not know it — 16 references in all.

p. 327] — Article on Trees by F. Harary and B. Manvel.

Giving definition of a tree as used in graph theory — Number of definitions unified by diagrams — mentions among the pervasive use of trees in electric net work theory and in organic Chemistry — figures of the 11 trees with seven points shown by Fig:



A graph G consists of a finite non-empty set V of p points together with a prescribed set K of q unordered pairs of distinct points of V. Each pair of points u and v in K is a line $x = uv$ of G, and x is said to join u & v which are adjacent points. If u & v be are points of G but $x = uv$ is not a line of G, then we denote by $G + x$ the graph obtained from G by adding the new line x. The union of two graphs $G = G_1 \cup G_2$ has $V = V_1 \cup V_2$ and $X = X_1 \cup X_2$ [X not defined, but I suppose it stands for the sets of points x]. The complete graph K_p on p points has every pair of points adjacent, and K_1 is called the trivial graph

A walk in a graph G is an alternating sequence of points and lines $v_1 x_1 v_2 x_2 v_3 \cdots v_n$, beginning & ending with points such that each line joins the points immediately following and preceding it. ~~A walk~~ A walk is a path if all points are distinct. A cycle is a walk with at least three distinct points and of the form $v_1 x_1 v_2 x_2 \cdots v_1$ with $v_i \neq v_j$ if $i \neq j$ [join as $v_1 \neq v_j$. Printing error]. A graph with no cycles is called acyclic.

A graph G is connected if every pair of points are (is) joined by a path. Connectedness is an equivalence relation on the points of a graph, and the

(5) Special theory of relativity by C.W. Kilmister (Prof. of Maths, King's College London) 120'

(Selected Readings in Physics) Pergamon Press (1st Edn 1970)

Part I - Introduction: 1632 - 1905 - Einsteins Contribution - Elementary consequences of the L.T - Applns in Quantum Theory

Part II - 10 extracts from fundamental papers of Michelson, Larmor, Lorentz, Poincaré, Einstein, Marjorie Wilson & H.A. Wilson, Zeeman, Dirac, C.D. Anderson and E.P. Wigner

(6) Proc. of the 11th Symposium on "Cosmic rays, Astrophysics, Geophysics and Elementary Particle Physics" Univ of Delhi, Oct 7-11, 1969 published by Deptt of Atomic Energy, G.O.I.

Vol I - Invited talks; Vol II - Contributed papers } All Indian participants - I had not at all heard of this Symposium!

(7) A history of geometrical methods by J.L. Coolidge (New Dover Edition

Chap I - Book I - Synthetic geometry

Chap I - Beginnings of Geometry (mentions Geometry of ancient kingdoms, Cells of bees, Spider's webs) - Babylonian Geometry - Egyptian Geometry - Indian Geometry (Sulvasutras, Pythagorean theorem, Aryabhatta, Brahmagupta, Bhaskara)

- Chinese and Japanese.

Chap II - Greek Mathematics

Chap III - Later Elementary Geometry - etc etc

Book II - Algebraic Geometry

Book III - Diff. Geometry

Quite a nice advanced type of book

(8) Grundlehren Series Bd. 149 (1969) - Capacity functionals by L. Sario & K. Oikawa - Quite Modern

(9) Lecture notes in Maths - Series: Math. Inst. Univ Bonn. No. 111

K.H. Mayer - Relationen zwischen Charakteristischen Zahlen

Springer-Verlag - Quite modern

equivalence classes under this relation are called connected components or simply the components of G. A tree is a connected acyclic graph. — Proof the equivalence of a number of definitions of a tree.

p. 347 — On some unitary divisor functions by R. Nageswara Rao

pp. 353 – 378 — Heaps of reviews

(i) Review of Sierpinski's book (Sharma's translation) by Chowla — Very favourable review mentioning ~~number~~ four out of the 100 problems at the end — Specially p_{100}^2 ! — Does the sequence of 9 digits 123456789 directly following one another occur at least once in the decimal expansion of π ?

(ii) Russian book on "Doctrine of number in the medieval Near and Middle East by Matvievskaya, Tashkent. — Review by B. Rosenfeld.
or The arithmetical treatise by Abû'l-Wafâ discovered by the author in Tashkent the manuscript of which he considers as unique apparently coincides with a manuscript of the library Raza in Rampur (India)

(iii) Review of "A source book in Mathematics" by Edited by D. J. Struick by J. V. Grabiner who calls it an immensely valuable book.

(iv) Graph Theory and Th. Physics — Edited by F. Harary — Lectures for NATO study institute — Lots of applns.

Science — 29/1/71 (Vol 171, No. 3969)

p. 339 — Arguments concerning relativity and cosmology by O. Klein

(i) Intro — Refers to de Vaucouleurs article in Science [1967, 1203 (1970) — How did I miss this

(ii) Role of the equivalence principle.
(iii) Cosmological and ordinary solutions.
(iv) A model of the Metagalaxy.
(v) Conjectures re. evolution of the Metagalaxy.
(vi) So-called fireball radiation
(vii) Summary (12 references)

p. 362 — Accelerator at Batavia by the NAL (National Accelerator Laboratory) (in Illinois) ! The next step in high energy physics — machines to produce protons of up to 500 GeV — accelerator design & construction — Accelerators to examine what ? — Experimental facilities & programs (Article by Allen H. Hammond) — Very impressive project — Meson, neutrino and proton Laboratories — To find magnetic monopoles, the intermediate boson (ie a short lived particle playing the same role in weak interactions, as does the photon in e.m. interactions & π-meson in strong interactions)

Bavandar
the Malayalee

References to be taken from Madachy

(1) 78049756 = $\Delta_{?} + \Delta_{?} = \Delta_{7804} + \Delta_{9756}$

(2) Printers error : $3^4 . 425 = 34425$ (?) ✓

4 8tex 425 × 81

425
3400
34425

$\frac{1}{2} \times 7804 \times 7805$

7805 × 3902

15610
0000
70245
23415
30455110

9757 × 4878

78056
68299
78056
39028
47594546
30455110
78049656 ✓

4
6
7
3
3

$31^2 \times 325$

1021 × 325

5105
2042
3063
331825

← P.7.0

quarks, structure of electron (existence of e and μ suggesting a lepton spectrum) (ie Coulomb force is also a composite force)

p. 367 – Review of book ("Heredity in mental disorders") "Genetic Theory and abnormal behaviour" by David Rosenthal, McGraw Hill, 1970 is interesting in view of Arun's behaviour.

p. 397 – A report about "Magneto-glow: A new geophysical resource".

Evidence has been found that the earth is immersed in a large volume of glowing helium ions → magnetoglow.

Science – 8/8/1971

✓ p. 23 – Science: Endless horizons or Golden Age? by B. Glass

Science ✓ 15/1/71

(3/5/71) New Books Section

(1) Algorithms, graphs & computers by R. Bellmann, K.L. Cooke and Jo Ann. Lockett (Academic Press, Vol 62 in the Series "Mathematics in Science & Engineering" edited by R. Bellmann

Preface – The development of the electronic computer has profoundly and irreversibly changed the scientific world.* In so doing, it has simultaneously created numerous opportunities for the application of mathematical ideas and methods to the solution of traditional scientific problems and made possible the exploration of research areas in mathematics and the sciences either previously unattainable or undreamt of. We are, in consequence, living in one of the great times of intellectual history. – – – – The principal medium we have chosen to achieve our goals is the mathematical puzzle. — Systematically applied only the two basic theories of dynamic programming and graph theory.

Large number of references to books on Mathematical recreations. Quite an elementary & funny sort of book

* Note – Martin Gardner in his 1961 Edn of Sc. Amer. Puzzles (Intro) talks of the increasing demand for mathematicians to meet the incredible needs of the new triple age of the atom, spaceship and the computer

—

In the above book of Gardner: Chapter 3 is entitled "Henry Ernest Dudeney, England's greatest puzzlist. – Dudeney's Canterbury Puzzles" etc

$$(\vec{a}\times\vec{x})\cdot(\vec{a}\times\vec{x}) + (\vec{a}\times\vec{x})\cdot\vec{x} + (\vec{a}\times\vec{x})\cdot m\vec{a} = 0 \qquad (22')$$

$(\vec{a}\times\vec{x})\cdot\vec{a} = 0$ & $(a\times\vec{x})\cdot\vec{x} = 0$ & hence $(\vec{a}\times\vec{x})\cdot m\vec{a} =$

$[(\vec{a}\times\vec{x})]^2 = 0$ ie $\vec{a}\times\vec{x} = 0$ & $\vec{x} = -m\vec{a}$. Soln is straight

Many other worked examples throughout the book - maybe useful for examination work

(3) A modern approach to Algebra & Trigonometry by Bettinger, Hutcheson and England – International Book Co. 1966

Contents – Set theory (briefly introduction) – Real-number system – Relations & functions – The trig. fns – Trig. fns of sums & differences – Trig. fns of angles – Theory of equations [p. 240. Horner's method two worked examples viz: one +ve root of $x^3 - 27x^2 + 13x - 64$ correct to 3D, Ans 26.602; second one finding a +ve root of $4x^4 + 13x^3 - 15x^2 - 19x - 28$; correct to 2D $P(1) < 0$, $P(2) > 0$, Ans 1.75] – Inequalities – Sequences & sets – Matrices and linear transformations – Permutations, combinations & probability – Soln of partial Δ^{ls}. Use of special modern symbols – Lots of examples – Quite elementary book.

(4) Fundamental Principles of modern theoretical Physics by P. H. Furth (Pergamon Press, 1970 (1st Edn)

Part I – Quantum theory – Fundamental Principles of classical Physics (Hamiltonian theory) Short history of development of quantum theory – Principles of Schrodingers wave mechanics – Eigen fns & eigen values of wave eqn – Applns of quant. mech to simple problems of atomic physics – Non-stationary phenomena – Operator and matrix mechanics – Many particle problem [Problems & exercises at end each Chapter]

Part II – Relativity theory – classical principle of relativity – Special theory of relativity – Connection between special theory of relativity & quantum mechanics – Elements of general theory of relativity

Part III – Statistical Mechanics – Basic principles – Some applications

Appendix – Soln to problems

useful for exams – good book for use in writing a book on quant. mech.

(2) Mathematics - A modern Introduction by Keedy & Bittinger (Addison-Wesley, 1970)

Preface - Designed for a course in basic mathematics at a low level of sophistication. - Does not emphasise proof notion of proof, contains numerous exercises of appropriate difficulty - number of exercises of the puzzle type, besides mathematical recreations included. - [looks quite a trivial sort of book - I wonder how such books can get published in U.S.!]

Chap 1 - Math. reasoning
2 - Numeration
3 - Natural numbers & whole nos
4 - Mathematical systems
5 - Sets, sentences & logic
6 - No. system of ordinary arithmetic
7 - System of integers
8 - Rational nos. & real numbers
9 - Geometry & Trigonometry
10 - Probability

---

(3) Complex numbers in geometry by I.M. Yaglom (U.S.S.R)
translated by E.J.F. Primrose (Academic Press, 1968)

Book intended for pupils in the top classes in high schools and for students in math. depts of Universities & Teachers' Colleges. - Practical reading of the book containing sections marked with single asterisk (*) & double asterisk (**) are more advanced

The main line of exposition is contained in Sections 1-4, 7, 9, 13 and 15 (not denoted by asterisks).

Mathematical Reviews - January, 1971 - p. 2 (Review No. 9)

Volodarskii. I - on Mahavira carya's treatise "A short course in Mathematics" (Russian) - Reviewer [I.N Vesol Veselovskii (Moscow)] remarks:

The paper gives an account of the content of Mahavira's Short course in Mathematics. As the author knows Sanskrit sufficiently (he translated Pāṭiganita), the reviewer would have been even happier to see a translation of the text. That would save the reader from studying the commentaries which are not absolutely reliable. The author does not have the correct time and

and so on alternately, a condition being that no cigar shall touch another. Which player should succeed in placing the last cigar, supposing that each will play in the best possible manner?

The supply of cigars is supposed to be inexhaustible, and the cigars are supposed to be uniform in size and shape.

Ans:— The second player need only add his cigar on that point (& in the same relative orientation) which is symmetrical to the position of the first cigar w.r.t to the centre of the table (A & B symmetrical w.r.t C if C be midpoint of AB). It would ~~thus seem that~~ seem then that the second player must win since he has only to keep pairing his plays with those of the first player. But there is a circumstance easily overlooked. The cigar as described can be made to stand upright on its flat end. The first player wins by placing his first cigar upright on the only unique point of the table — the centre of symmetry itself!

---

(2) Statics and Dynamics by Goodman & Warner (Wadsworth Publishing Co., Inc Belmont, California)

A huge book meant supposed for Engineers

pp. 1 – 367 — First part — Statics
pp 1 – 619 — Second " — Dynamics

Statics — Chaps — Vector algebra & allied geometric concepts — Principles of Statics — Analysis of statically determinate states of equilibrium
— Equilibrium under disturbed forces (Section on Hydrostatics & aerostatics)
— Frictional effects in Statics. — Centre of mass.

P. Some worked examples pp. 49-50 (1) Solve the vector vector equation $\vec{A} \times \vec{x} = \vec{B}$. We must have

$x \cdot A = 0$ [Also $A \cdot B = 0$, $B \times A$ not necessarily 0

Soln: Taking cross product of each side of given eqn with A

$$(A \times x) \times A = (B \times A) \text{ or } (A \cdot A)x - (x \cdot A)A = B \times A$$

using $x \cdot A = 0$, we have $x = \dfrac{\vec{B} \times \vec{A}}{A^2}$, a particular soln

general soln is $\vec{x} = \dfrac{\vec{B} \times \vec{A}}{A^2} + m\vec{A}$.

(2) Given the vector $\vec{a}$, and the scalar m, solve the equation

$$(\vec{a} \times \vec{x}) + \vec{x} + m\vec{a} = 0.$$

Taking scalar product of each side with $(\vec{a} \times \vec{x})$, we have.

place of Mahavira's birth (about 9th century A.D); he appears to have confused him with Mahavira the founder of Jainism (about 600 B.C). Annotations of the manuscripts are in the Kannara language which, according to the author, "was widespread in the South of India in the Middle Ages", but, as the reviewer remarks, is now one of the official languages of India (State of Mysore) with about 18 million speakers.

p. 3 (Review No. 11d) – The book on Indian "vāsikas" (Composite proportions) (Russian)

by al-Biruni Abūl-Rayhan Muhammad ibn Ahmad – Translated from the Arabic into Russian by B.A. Rozenfel'd

p. 3 (Review No. 11e) – Notes on ~~the~~ The book on "Indian" Rasikas" (Russian) by B.A. Rozenfel'd.

Review by E.S. Kennedy (Beirut)

Composite proportions are expressions of the form $a_1 : a_2 = (a_3 : a_4)(a_5 : a_6) \cdots (a_{n-1} : a_n)$ n even ≤ 14. The case $n = 6$ was of great interest and utility in medieval times, since Menelaos' theorem was expressed in this form, and this theorem was in turn applied to the solution of configurations on the sphere – All results derived without the aid of a calculus of symbols which reduces them to trivialities

Science – 15|1|71 – nothing special

Ibid – 22|1|71 – "

Ibid – 5|2|71 – p. 439 – The history and stability of atmospheric Oxygen.

p. 461 – Comment entitled "Star bright, Street Light, which will they see tonight?"

p. 464 – List of National Medal of Science Winners (1970)

(1) R.D. Brauer – Harvard – Theory of modular representations
(2) R.H. Dicke – Princeton – Cosmology & nature of gravitation
(3) Barbara McClintock – Carnegie Inst – inherited characters in plants
(4) G.E. Mueller – General Dynamics Corp – design of Apollo System
(5) A.B. Sabin – Weizmann Inst, Israel (?) – viruses & viral diseases
(6) J.C. Slater – Florida Univ – basic theory of atoms, molecules & solid state
(7) J.A. Wheeler – Princeton – Contributions to understanding of the nuclei of atoms
(8) S. Winstein (deceased) – Univ of California – organic chemical reactions

5|5|71 Science – 12|2|71

(1) p. 527 – Editorial – Nobody dies of overpopulation by Garrett Hardin

Ans: The problem is to find two squares that differ by 512 – & half a thousand footsoldiers & a full dozzaine more of my knights. ie to solve

$$x^2 - y^2 = 512$$

Solns are $129^2 - 127^2 = 66^2 - 62^2 = 36^2 - 28^2 = 24^2 - 8^2 = 512$

using the fact that "after slaying half the foe with only a loss of only a few score of their men, the only soln is given by

$$36^2 - 28^2 = 1296 - 784 = 512.$$

(18) Partitions: For eg. all possible partitions of 4 are

4
3 1
2 2
2 1 1
1 1 1

How many possible partitions are there of an integer n? What is the formula for the number of partitions of an integer into r parts. Answers to these questions have as yet not been supplied by mathematical theory.

(19) How many triangles? If every vertex of a regular octagon is connected with every other, how many triangles will be formed?

Ans:- Quite complicated. By grouping into four classes, according as the number of vertices involved is three, two, one or none, getting the answer

$$= 56 + 280 + 280 + 16 = 632.$$

(20) one pile – Two players draw alternately from a pile, the object being to gain the last counter. Suppose limits of drawing are 1 and 3 (min & max no. of pebbles or counters that can be drawn at a time). ~~Then if a player~~ the series of winning combinations, each of which is a number to be left in the pile for the opponent to draw from, is simply the multiples of 4. In general if a and m are respectively the least & most that may be drawn at a time, then a "winning combination" w is given by $w = (a+m)n$ (n any integer)

(21) Dudeney's cigar puzzle – A puzzle to be solved by "common sense" without any use knowledge of formal mathematics. A "gem" of this type is the cigar puzzle. I cannot resist narrating that I first became acquainted with this gem while reading in bed, and that like an illustrious precursor I startled the household by jumping out of bed, dancing about and crying "Eureka! Eureka!" The puzzle is:-

Two men are seated at a square-topped table. one places an ordinary cigar (flat at one end, pointed at the other) on the table, then the other one does the same

(Univ of California, Santa Barbara)

I was in Calcutta when the cyclone struck East Bengal in November, 1970. Early dispatches spoke of 15,000 dead, but the estimates rapidly escalated to 2,000,000 and then dropped back to 500,000. A nice round number: it will do as well as any, for we will never know. The nameless ones who died, "unimportant" people far beyond the fringes of the social power structure, left no traces of their existence. Pakistani parents repaired the population loss in just 40 days, and the world turned its attention to other matters.

What killed those unfortunate people? The Cyclone, newspapers said. But one can just as logically say that overpopulation killed them. The Gangetic delta is barely above sea level. Every year several thousand people are killed in quite ordinary storms. If Pakistan were not overcrowded, no ~~same~~ sane man would bring his family to such a place. Ecologically speaking, a delta belongs to the river and the sea; man obtrudes there at his peril.

In the web of life every event has many antecedents. Only by an arbitrary decision can we designate a single antecedent as a "cause". Our choice is biased - biased to protect our egos against the onslaughts of unwelcome truths. As T.S. Eliot put it in Burnt Norton

> Go, go, go, said the bird: human kind
> Cannot bear very much reality.

— — — one thing is certain: we won't blame the deaths on overpopulation. No one ever dies of overpopulation. It is unthinkable.

p. 558 - Review of a book Paul Ehrenfest by M. J. Klein - Reviewed by J. L. Heilbron, (Calif, Berkeley) - Quite interesting - Ehrenfest a Jew who succeeded Lorentz at Leyden

(2) Research Studies (Washington State University) - Sept. 1970, 38, No. 3

p. 201 - The ending of the Anglo-Chinese opium trade; Economics vs Morality

- Examination of some of the factors which led to the legalised opium traffic between India and China in 1917. As a producer of opium, British India responded to the principle of supply and demand. Enormous profits motivated first the Company, later the Indian Govt. to establish an elaborate system of finance and regulation on the production and distribution of opium. Lucrative returns from the opium trade also compelled the British Government to coerce the hapless Chinese Govt. to accept the legalisation of a narcotic — China later producing at least three times the amount she imported — first crusade against opium trade started in England in the 1890's — Sir Richard Temple

(13) Two-digit numbers – what numbers plus their reversals sum to perfect squares

Ans: 29, 38, 47, 56 (?)

(14) Three-digit numbers (i) How many numbers are twice the numbers formed by reversing the order of their digits? Ans: none

(ii) What no. is 11 times the sum of its digits — Ans: 198.

(15) Transferring digits: The following puzzle due to Dudeney is given because the method of solution is useful for a whole class of digital problems.

If we multiply 571,428 by 5 and then divide by 4, we get 714,285 which is the same as the original number with the first digit transferred to the end.

Can you find a number that can be multiplied by 4 and divided by 5 in the same way – by transferring the first digit to the end.

Of course 714285 would serve if we were to transfer the last digit to the head, but the transfer required is the other way round.

Ans:- Req'd number is enormous, but it can be found by "brute force" (see 2 pages of work) and the smallest integer satisfying the condition is

2,173,913,043,078,260,869,565.

There are no. can be found with first digit as 4, 6 or 8.

(16) Square-triangular integers – Find the first four such numbers.

Ans: 36, 1225, 41,616 and 1,403,721

$36 = 8 \cdot 9/2 = 6^2$; $1225 = \frac{1}{2} 49 \cdot 50 = 35^2$; $41,616 = \frac{1}{2} \cdot 288 \cdot 289 = 204^2$

* This may happen to West Pakistan now!

$1,403,721 = \frac{1}{2} \cdot 1681 \cdot 1682 = 1189^2$.

[Long piece of work required to find integral solns of $\frac{1}{2} x(x+1) = y^2$.

(17) The battle of Hastings – ~~The Normans advanced from the~~ The Saxons formed their house carls and Knights into a solid square phalanx. The Normans advanced from the shore also in a solid square, but were possessed of "half a thousand more footmenne and full dowzaine more of Knights". Despite these great odds, the Saxons fought so valiantly that they slew half the foe, losing "only a few score" of their own men, and thus reduced the two armies to exactly the same numbers.

Find exactly the size of the two armies as they joined battle

defended the existing opium agreement between India and China. He said in the House of Commons "I would remind the House . . . that we are asked to sacrifice £ 5,500,000 opium revenue by adopting the motion . . . And for what? Practically for no moral advantage, for the vindication of no moral principle whatsoever" — After the famine of Bengal of 1873-74, there was a continuous conversion of poppy land to the cultivation of food crops — Appointment of a Royal Commission in 1893 or so, with the Maharaja of Bhartpur and the Dewan of Junagarh representing India (!) — Commission Report "We may fairly compare the effect of opium among the Chinese population to those of alcoholic liquors in the U.K" — The decade following the Royal Commission Report produced no change in official British policy. The government continued to ignore anti-opium publications by missionaries, diplomats, and travellers in China. Between 1895 and 1905, the British parliament debated the opium question only once — American ~~action~~ action in 1905 forbidding import of opium into Philippines & denunciation of the Royal Commission Report — Theodore Taylor's extensive quotations from the historic letter which Commissioner Lin Tse-hsu had addressed to Queen Victoria in 1839 — In 1906 the British attitude of being solicitous for the Indian Revenue, and doubtful as to the harmful consequences of the use of opium, underwent an abrupt change — Vigorous cultivation of poppy in China had resulted in an abundance of smoking opium; Indian opium had lost its importance to the Chinese consumers — In the second decade of the twentieth-century, the opium issue transcended Indo-British-Chinese relations; it became an international concern & — (Action by the Kuang-hsu Emperor by issuing two edicts on 20/9/1906 & 1/12/1906 re. Opium smoking) — Finally on 31/3/1917 in an article Headlined "End of opium traffic" the London Times announced that the export of Indian opium to China was now prohibited. Thus as so often happened in history, government decisions were influenced by economic realities than by moral furor *. The Indo-Chinese opium trade was established over the moral objection which spanned three Countries. It was terminated, ironically, by the same type of economic forces which led to its creation

[Strangely enough, there is not the name of a single Indian at that time protesting against this trade. We must have been utter slaves!]

p. 243 — Review article on "Christians and Jews and Two Thousand years" by Henry Grossmans. — Ref. to Prof. Friedrich Heer, Prof. of the History of Ideas at the Univ. of Vienna, a truly ~~of~~ amazing scholar. Since World War II (he was one of those who spent time in both German & Russian prison camps) he has published a series of inspiring books

Ibid — March 1968, 36. pp. 1

p. 61 — Commentary by Andrew Allentuck on "Game Theory and the Battle of the Atlantic" — Reference to Operation Research Section during World War II established

is finding the mean ∴ l. BG is the side of the equivalent square. (26')

Connect AG. on AC measure AH = GD. Through H draw a line ⊥l to CD to cut AG. Slide the △ whose ABG downward to the right until G lies on CD extended. Then transfer the smaller △ so that AH coincides with GD. The square thus formed is shown on the right

(9) The Amulet – Dissection of a pentagon into a square in only six pieces was for some time a baffling problem & Dudeney's soln ~~dose~~ of the same deserves to be known better than it is

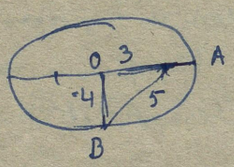
[Soln on pp. 167–68)

(10) How to draw an ellipse

Soln: Using defn of ellipse as locus of all points the sum of whose distances from two given points (foci) is constant.

If the pins are 6" apart & string = 10' long, ~~what will~~ find the lengths of the axes without use of formulae.

Ans: When the ~~string~~ pencil point is at the end of a minor axis, it is at the midpoint of the string. Hence $OB = \sqrt{5^2 - 3^2} = 4$.



[OA ? not given]

(11) Digital roots – Digital root of an integer is the single integer reached by continued summation of its digits: thus D.R of 917,534 → 29 → 11 → 2.

All arithmetic operations can be checked by digital roots. The root of the sum, difference, ~~and~~ product and quotient of two integers can be determined by performing the same operation on their roots – Digital roots are the basis of the well-known check of "casting out nines"

Ex: If the product of 673,106 and 4,783,205,468 is

3,219,60–,299,743,608

supplying the missing digit (–) without actual multiplication

Soln: The digital roots of the factors are 5 and 2 & hence of the product = 1.

The given digits of the product sum to 69, whose root is 6. To make the root 1, we will have to add 4. Hence missing digit is 4

24/6/71 Continuation of yesterday's work.

(12) Cryptic multiplication: Supply the missing digits in this multiplication problem.

```
  * * 7 *
    * 7 *
  -------
  * * * * *
  * * * 2 *
  8 * 5 * *
  ---------
  * * * * * *
```

Ans – 1475 × 677 = 10325 + 10325 + 8850 = 998575 (?)

in U.K. under the direction of Prof. P.M.S. Blackett — Assignment of P.M. Morse of M.I.T. for similar work in U.S about anti-submarine warfare operations research group (ASWORG) — mathematicians Morse, Steinhardt & J. von Neumann dealing with search & evasion procedures — use of Neumann's Theory of Games

The use of war games as a device of military evaluation seems to have its origin in ancient Hindu Civilisation in which the game of Chaturanga, similar in form to Chess, was used to represent the conditions of battle as they might have developed. The players usually accepted the outcome of the game as the equivalent of the war they might have fought — most interesting (But nobody no body in India knows this) — Ref. to [Vera Riley and John. P. Young's "Bibliography on war gaming" (Chevy Chase, Maryland : O.R. Office of John Hopkins University, April 1, 1957, p. 2)] — Ref. to Neumann & Morgenstern's book of 1944 — use of Computer-oriented equations used by Neumann — At that time no German mathematician had a grasp of game theory comparable to that of Neumann & his associates — Work of clearing U-boats using game theory results. — Final yet retrospective effects estimates of the value of game theory in the planning and conduct of the Battle of the Atlantic are sometimes curiously negative. Prof. P.M.S. Blackett said in a 1961 Encounter article later reprinted in Studies of War

" I think the influence of game theory has been almost wholly detrimental. I see no use in it of making practical predictions. If they had, such methods would have become accepted by investors & Card players. If such abstract theory cannot be applied in practice to such relatively simple activities, then it is clearly useless for the much more complicated problems of war. In fact, the theory of games is a branch of pure mathematics and almost wholly irrelevant to decision making"

[Ref. New York : Hill & Wang, 1962, p. 144]

7/5/71 Proc. Nat. Acad. Sci. U.S.A — Vol 68, No. 1, — Jan. 1971 — Nothing interesting

Ibid — Vol. 68, No. 2, Feb, 1971

pp. 399-401 — The characters of the symmetric group by F.D. Murnaghan.

(6202, Sycamore Road, Baltimore, Maryland 21212

Abstract - A short and simple derivation of the formula of Frobenius, which gives the dimensions of the irreducible representations of S_n, the symmetric group on any number, n, of symbols is given. These dimensions are the characters of the identity elements of the group ie of all the elements element all of whose cycles are unary. It is shown how a slight modification of Frobenius' formula yields, when

$$x+y = 44 \quad -- (1)$$

"Mary is twice as old as Ann was ---" Here is a reference to a past age of Ann. Let us represent this by $x-a$, then we are told that

$$y = 2(x-a) \quad -- (2)$$

"... as Ann was when Mary was ..." Here is a reference to a past age of Mary coincident with the time when Ann was $x-a$. At this time Mary's age was therefore $y-a$. Now what is said of this age? "When Mary was half as old as Ann will be ..." Represent the future age of Ann by $x+b$, we are told that

$$y-a = \frac{x+b}{2} \quad -- (3)$$

"... as Ann will be when Ann is three times as old as Mary was --" Here is a reference to another and distinct page of Mary. Let it be $y-c$. This clause states

$$x+b = 3(y-c) \quad -- (4)$$

"-- as Mary was when Mary was three times as old as Ann. At that time the age of Ann must have been $x-c$. Hence

$$y-c = 3(x-c) \quad -- (5)$$

These give five equations for 5 unknown quantities x, y, a, b, c.

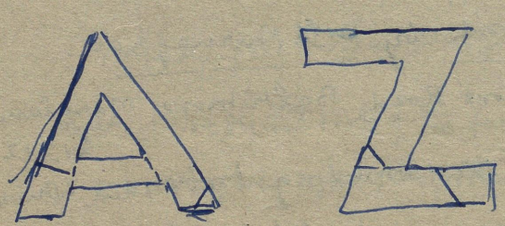
[Actual values of x & y not given]

(6) As old as ABC - Alice is as old as Betty and Christine together. Last year Betty was twice as old as Christine. Two years hence Alice will be twice as old as Christine. What are the ages of the three girls?

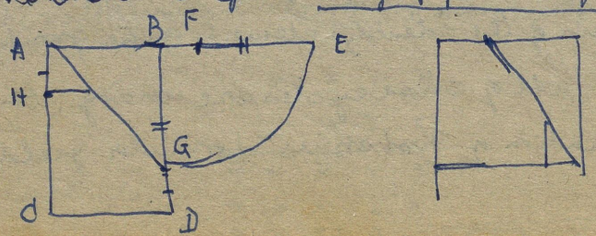
Trivial ans - $A = 8$, $B = 5$, $C = 3$

(7) From A to Z

To cut Z out of A. by cutting A into four parts to make a Z.



(8) Dissection of a Changing of a rectangle to a square



Produce AB to E such that BE = BD. Let F be middle of AE. Cut off FG = FE by drawing arc with F as centre as FE as radius. This

$n = 2p$ is even, the characters of an element of S_n all of whose cycles are binary and, when $n = 3p$ is a multiple of 3, the characters of an element of S_n all of whose cycles are ternary, and similarly for $n = kp$, - - - are of length k. It is noteworthy that the calculations become simpler, rather than more complicated, as k increases. Finally, this paper shows how to derive from Frobenius' formula the characters of an element of S_n which has at least one ~~unary~~ binary cycle and, from the present modification of Frobenius' formula, the characters of an element of S_n which has at least one cycle of length k, $k = 2, 3, \cdots n$.

X | Having read Murnaghan's Theory of Group representations in the earlier years, I now find the whole of this paper is absolutely Greek to me

Proceedings of the Royal Irish Academy

J. L. Synge (~~M. R. I. A.~~) M.R.I.A. School of Theoretical Physics, Dublin Institute for Advanced Studies

Vol. 65. A. 7 – April, 1967 – Spinors & rotations by D. J. Simms (Trinity College, Dublin) – Looks rather ~~a good~~ a simple interesting paper – Talks of Clifford algebras ~~and SU(2)~~ and

$$\begin{array}{ccc} & & \psi_0 \\ SU(2) & \longrightarrow & SO(V) \\ \downarrow & & \\ \text{onto } SU(2) & \longrightarrow & SO(V) \\ & & \psi \end{array}$$

Ref. to Chevalley's Theory of Lie groups.

Vol. 65. A. 1 – Multiplicities in weight diagrams by J. McConnell

The properties of weight diagrams of the B_2 Lie group are studied in detail, and the rules for finding multiplicities are derived. It is shown how they are related to Wigner's rules for multipliers in SU(3) weight diagrams.

Reference – Intro to the group theory of elementary particles by J. McConnell, 1965 – C. D. D. A. S – Series A. No. 16

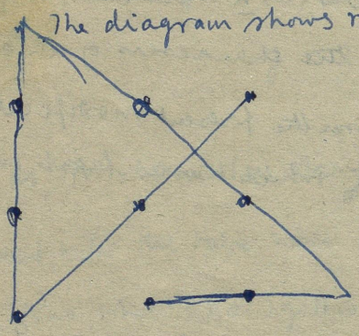
Also saw references to 2 papers of S. K. L nos. 2 and 5 in Vol 62.

Virginia Journal of Science – Fall 1970, Vol 21, No. 4

pp. 169-78 – Great discoveries of future science (Sidney S. Negus Memorial Lecture) by Robert M. Wood

(5) Extracts from the book on Mathematical Puzzles by Geoffrey Mott-Smith recorded on (21/6/71).

(1) The diagram shows nine dots in the form of a square. Draw 4 st: lines so as to cross out every dot. You must not cross any dot more than once, nor retrace any line, nor lift the pencil from the paper until all 9 dots are crossed



[Last cond^{n} states that we are dealing with finite segments only. Hence the solⁿ shown

(2) Easy magic square to be formed from 1 to 9

Ans: 4 9 2
3 5 7
8 1 6

(3) The Tennis tournament – If 78 players enter a tournament for a singles Championship, how many matches have to be played to determine the winner?

Ans: Perhaps one laboriously sets up the brackets foolishly. It is easily pointed out 77 of the entrants have to be eliminated, hence 77 matches are required!

(4) Bear facts – A bear left its den & went due South in a st: line for one mile. Then it made a 90° turn to the left and walked another mile in a st: line. Twice more it did 90°-turns to the left and walked a mile in a st: line, thus returning to its den. On reaching this starting point, the bear was facing due South.

What was the colour of the bear?

Ans:- The data lead to the conclusion that the bear's den must be on the North Pole, from which every direction is due South. Hence he is a polar bear ie its colour is white

(5) Loyd's famous puzzle

The combined ages of Mary and Ann are 44 years, and Mary is twice as old as Ann was when Mary was half as old as Ann will be when Ann is three times as old as Mary was when Mary was three times as old as Ann. Find the ages of these two friends.

Ans. Let x & y be ages of Ann & Mary

Universitas – Vol 13, 1970, No. 1.

✓ p. 25. Problems of the origin of stars by Prof. Hans Erlässer, Heidelberg

Science Progress pp. 279–81 – Two books on astrophysics reviewed by McCrea.

10/5/71 New Books Section. [Today Holiday Buddha Poornima – dist. 10 – 4 P.M. – all offices close in Dist]

(1) Relativity – Proc. Rel. Conf. in Midwest held at Cincinnati, Ohio, June 2–6, 1969 – Edited by Carmeli, Fickler & Louis Witten [Cincinnati, Dept of Phys] – Plenum Press, N.Y. 1970.

Preface: jointly sponsored by the Aerospace Research Laboratories & Univ. of Cincinnati – Because of extended interest of the Aerospace Research ~~Committee~~ Labs. in the theory of Relativity, such a national Conference held – first formal national conference specifically related to relativity in U.S. since the 1957 Conference on the Role of Gravitation in Physics held in Chapel Hill – The format consisted primarily of invited papers & extensive formal discussions (held over a ~~week~~) – Contributed papers were generally discouraged except as their subject matter fit into the discussions. At no time was a clock used to terminate an invited ~~discussion~~ talk; it was frequently necessary, however, to terminate the discussions after some hours because of the onset of weariness in mind and stomache – By general demand a special informal session was ~~held~~ organised and held to discuss "Superspace". Because of the ~~greate~~ great interest in Superspace generated at the Conference, the volume contains an extended introduction and discussion on the subject.

Contents (1) Soluble models of quantum gravitation by John R. Klauder

(2) The Quantisation Program of General Relativity by Arthur Komar

(3) Particles and Geometry by John A. Wheeler.

(4) The Sandwich Conjecture by Peter G. Bergmann.

(5) Classical and quantum mechanics of a closed Universe by Charles W. Misner.

(6) Post-Newtonian Methods and Conservation Laws by S. Chandrasekhar.

23/6/71 — New Books Sections

(1) Mathematics : Creation and study of form by J.P. Evans — Addison-Wesley, 1970 —
A one-semestre introductory course — Quite an interesting book, with a number of
exercises with suggestions for solving. (Also a few answers to selected questions)

Chaps: Patterns in content & method — Prime decomposition — Congruences — A concrete
view of groups — Abstract group theory — Axiomatic theories (inclusive Boolean algebra) —
rings & fields
Geometry & Topology — Natural numbers, integers and rational numbers — Real and
complex numbers — Infinite sets

[on p. 21 mentions "the most familiar system of representation of numbers is the decimal
one, for which we are indebted to the Hindus of the early centuries A.D

Ex. 3.9, p. 27 — Take any 3-digit number for which the first digit minus the
last is greater than 1. Reverse the digits. Subtract this
second number from the first to obtain a third number. Reverse
the digits in this third number and add the result to the third number
itself. What is the answer ? Ans 1089 always.

[Large no. of interesting examples like this in all the chapters, p. group = set + operation]
Explains in a simple way many abstract notions like Galois groups etc]

p. 100 — The general Galois theory continues to be of major importance today. The
amazing thing is that Galois had developed it before he was 21, and, in fact,
put his thoughts in written form the night before he was killed in a duel

(2) ~~Introduction to Mathematics by~~ Infinite abelian group theory by Phillip. A. Griffith
Univ. of Chicago Press (Chicago Lectures on Maths) — Reference Section — 1970
[Other Books already published :— Topics in Ring Theory, Fields & rings and Theory of
Sheaves.] — Quite an advanced type book.

(3) Progress in Mathematics Vol. 6 — Topology & Geometry — Series Publication
of Russian original called "Itogi Nauki" (Eng — Plenum Press N.Y, 1970
(A collection of articles on the subject by several writers
First article, p. 29. mentions theory of knots.

(4) The Calculus — A genetic approach by Otto Toeplitz — Phoenix Science Series.
Univ. of Chicago Press — Interesting book.

(7) Relativistic Boltzmann Theory and the Grad Method of Moments by James. L. Anderson.

(8) A lemma on the Einstein-Liouville Equations by Berezdivin & R. K. Sachs.

(9) Gravitational Radiation Experiments by J. Weber.

(10) General Relativity Expts. using low temperature techniques by x, y & z.

(11) Contributions to the History of Einstein's Geometry as a Branch of Physics by Eugene Gulk. ———

For newsletter?

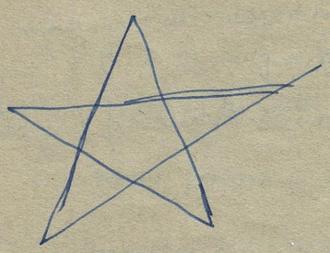
In the last article (11) of a historical nature on pp. 183-84, a reference is made to Einstein & Hilbert

Einstein & Hilbert - Apparently, Weyl, in the first text book of general relativity (first edition published in 1918) originated the story that the field eqns of general relativity have been established also by Hilbert simultaneously with and independently of Einstein. This remark was taken over by Pauli in his well known article on relativity, and later on by several other textbook writers. The remark of Weyl and Pauli does not correspond with the historical truth. In the first place, these two great experts did not look up carefully the references in Hilberts paper. Otherwise, they would have noticed that Hilbert quotes all of Einsteins communications of November, 1915, in the Proceedings of the Berlin Academy. In particular, he quotes the paper on p. 844 which contains the final form of the GR field equations.

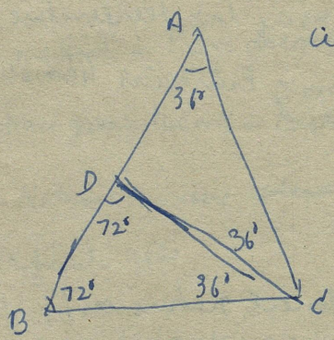
Einstein gave a talk in Göttingen. Hilbert, whose absent-mindedness was legendary, started to think about the problem on the basis of what Einstein said, who at the time did not yet have the correct form of his field equations. I heard from Ewald (Hilberts "Asst. for Physics" in 1915) that Hilbert, very likely in the fall of 1915, gave a talk in Göttingen presenting the correct equations without ~~mentioning~~ referring to Einstein. However, by that time, Einstein must have also had the correct ~~solution~~ equations, certainly before Hilbert did. Sommerfeld ~~had~~ heard about Hilberts talk at Göttingen and suggested that Hilbert wrote a letter apologising to Einstein, which Hilbert of course did. At any rate, he never claimed having been the indendependent discoverer of the field equations of GR.

There was another story according to which Eddington was asked: Was it true that only three people really understood relativity and Eddington supposedly asked "Who is the third?"

The Golden Ratio appears in the 5-pointed star of Mystic Pentagram of old. Each isoceles Δle forming a point of the star has 72° in the base angles and 36° at the apex



Pentagram



i.e. $\frac{AB}{BC} = \frac{BC}{BD}$

$\frac{AB}{AD} = \frac{AD}{BD}$ ($\because AD = BC$)

i.e. D divides AB in golden section

Also the ratio of the side of the isoceles Δle forming the point of the star, to its base, is ϕ.

In 1963 a group of enthusiasts, ~~began~~ founded the F-association of Fibonacci buffs solely devoted to Fn's. In first two years, journal published 600 pages carrying the results of investigation in this particular field. The F-association has adopted for its symbol a device of nested pentagrams.

There are those who feel that anything like a Fibonacci Association has hacked itself into too small a corner of the intellectual landscape. Nevertheless some nationally known mathematicians are counted among its members & have contributed to its journal. We repeat the often-stated principle that it is hazardous to pass judgment on what does or does not constitute valuable mathematics.

Besides, what if a study is not of earth-shaking importance? If it stimulates the imagination & whets the appetite for more, is not that enough? So we dare to hope that this book has done as much for you? Have we cast a little light on what was formerly dim, so that you now wish you knew more about some of these things

The path is endless, but many rewards are offered along the way. One could do worse than follow the gleam of numbers

---

(i) Martin Gardner gives unqualified approval of the book

(ii) Ref. to V. V. R. Satyanarayana (on Δr nos. — Math. Gaz. 45, 1961, p. 40) (p. 147)

- other references to physicists not understanding GR for eg. Lenard and Stark.

- Many other interesting references in this article by Guth - for eg. mention of a "Planck length" (10^{-33} cm) (subnuclear region where gravitation may play a part)

✓ - Paper on "Schwarzschild singularity" by N. Rosen is very interesting.

✓ - Theory of Superspace by A. E. Fischer, Princeton Univ (Dept of Maths, Univ. of Calif, Berkeley)

✓ - Space-time as a sheaf of geodesics in superspace by Bryce S. Witt (N. Carolina, Chapel Hill)

(4 empty sheets at end of the book).

(12/5/71) Book of Niels Bohr – His life and work as seen by his friends and

✓ Colleagues – Edited by North Holland, 1967.

Contributors by – Heisenberg, O. Klein, Casimir, Rosenfeld, Aage Bohr (?)
A. Pais, Kalckar, Möller, V. F. Weisskopf, Pedersen, Kamphaan, N. Phil,
Dirac, Courant, Koch, Scharff, Hans Bohr (Bohr's son)

- An open letter by Bohr to the United Nations – Personal glimpses and a number of pictures.

- Niels Bohr & Harald Bohr (younger brother of Niels) – Very interesting book specially Chapter on "The decisive years".

- Heisenberg's article is also full of personal references including Hardy, Harald Bohr, Besicovitch (Hardy & Harald being both passionate sportsmen), and some game they all played with Niels Bohr also.

- Bohr an inveterate pipe smoker, and he used countless matches to keep his pipe lit. He preferred to buy the biggest boxes of matches he could get.

- In the account by Pais is mentioned an incident involving Bohr & Einstein. Bohr being walking to the window, gazing out and repeating every now & then "Einstein, Einstein". At that moment the door opened softly & Einstein tiptoed in. He beckoned to me (Pais) with a finger on his lips to be very quiet, his mischievous smile on his face. He was to explain a few minutes later the reason for his behaviour. Einstein was not allowed by his doctor to buy any tobacco.

The sequence of numerators are the same as that of the denominators moved over one. The denominators are

$1, 1, 2, 3, 5, 8, 13, 21, 34, \ldots$ (F_n)

This famous sequence is named after Leonardo d Pisa a 13th century mathematician called Fibonacci. This sequence is found in nature as for eg. in the growth of branches of trees. (no. of branches after n years is F_n)

$$F_n = F_{n-1} + F_{n-2}$$

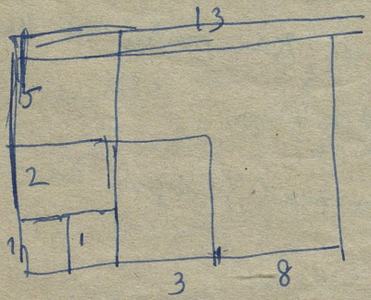
[telescoping: $F_1 = F_3 - F_2$ & ade]

Properties – (i) Sum of 1st n F_n's is $F_{n+2} - 1$

(ii) $F_{n+1}^2 = F_n F_{n+2} + (-1)^n$ [proof by induction]

(iii) Connection between binomial coefficients & F_n through the use of the Pascal triangle

(iv) Built-in geometric Fibonacci property

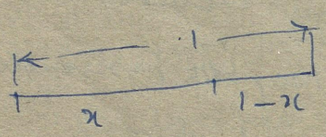


area of 8×13 rectangle
$= 1^2 + 1^2 + 2^2 + 3^2 + 5^2 + 8^2 = 8 \times 13$

ie $F_1^2 + F_2^2 + \ldots + F_n^2 = F_n F_{n+1}$

(v) Another geometric question related to value of continued fraction viz $x = 1 + \frac{1}{x}$ ie $x^2 - x - 1 = 0$

Question is: where is the point that divides a line into two segments such that the longer part is the mean ∵l between the whole line & the shorter part. If whole length $= 1$, then to find x such



that $\frac{1}{x} = \frac{x}{1-x}$ ie $x^2 - x - 1 = 0$, $x = \frac{-1 \pm \sqrt{5}}{2}$

Choosing +ve value $x = \frac{1+\sqrt{5}}{2} = 1.618\ldots$ (known as ϕ)

(It can be shown that of all possible continued fractions, the convergence of the ϕ-fraction is the slowest)

– Greeks called this division as a Golden section or the Golden ratio $\phi : 1$. Incidentally all psychologists tell us that this is supposed to be in some sense the most please shape for a rectangle (sides $\phi : 1$) It is approximately the shape chosen for picture postcards.

However, the doctor had not forbidden him to steal tobacco, and this was precisely what he set about to do now. Always on tiptoe he made a beeline bee-line for Bohr's tobacco hot which stood on the table at which I was sitting. Meanwhile, Bohr, unaware, was standing at the window muttering "Einstein --- Einstein --" It was at a loss what to do, especially because I had not at that moment the faintest idea what Einstein was up to.

Then Bohr, with a prin "Einstein" turned round. There they were face to face, as if Bohr had summoned him forth. It is an understatement to say that for a moment Bohr was speechless. I myself who had seen it coming, had distinctly felt uncanny for a moment, so I could well understand Bohr's own reaction.. A moment later the spell was broken when Einstein explained his mission, and soon we were all bursting into laughter.

14/5/71 American Journal of Physics - 39/1, Jan, 1971. (Pedagogical type, also small original & critical articles – not on the high research level like Phys. Rev. etc) – A journal devoted to the instructional and cultural aspects of Physical Science

on the inside front cover contains information to contributors.

pp. 1-2 – Statement of Editorial Policy – Also a mention of payment of an optional subscription charge of $40 per page – which when honoured, entitles them to 100 free reprints ($40 for page!)

pp. 3-8 – R. A. Millikan Lecture Award ~~for 1970~~ for 1970 to Franklin J. Miller.

p. 24 – Adiabatic invariance in simple harmonic motion by Leonard Parker – invariance established in an elementary but a new way. (old quant. mech)

pp. 27-33 – Science education; A case for Astronomy by Donald A. Wentzel

p. 41 – James Franck at Göttingen by O. Oldenberg (Recollections of Franck from 1922-1930 by his ↑ head assistant). – Mention of Born's name on p. 42 ('walking or biking home with Born) – Born's numerous students & collaborators, Heisenberg, Wigner, Weisskopf, Heitler, Hund, Pauli and many others spent many hours in discussion with Franck.

Franck's interest in politics & history – The "Franck Report" on predicting the effects of indiscriminate destruction is well-known.

p. 130 – (Chap on Continued fractions)

using $\arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + -$ & with $x=1$, one gets

Continued fraction for π viz

$$\pi = \cfrac{1}{1+\cfrac{1^2}{2+\cfrac{3^2}{2+\cfrac{5^2}{2+-}}}}$$

Remarkable that π (not a root of any eqn) should have a ~~simple~~ systematic expression in continued fractions. It is however not a simple continued fraction ie one where all the numerators are 1.

$e = 1 + \frac{1}{1!} + \frac{1}{2!} + -$ & in continued fractions

$$e = 2 + \cfrac{1}{1+\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{4+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{6+-}}}}}}}$$

ie a simple continued fraction.

Although far afield from number theory, this opens up an intriguing and very difficult question: Is e in some sense a "simpler" number than π? D. Shanks & J. W. Wrench Jr. tell us that the machine time required to compute the value of e to 100,000 decimal places was less than one-third of the time required for the corresponding calculation of the value of π. They then remark, in typical Shanksian style "one would hope for a theoretical approach . . . – a theory of the 'depth' of numbers – but no such theory now exists. One can guess that e is not as 'deep' as π, but try and prove it!"

Chap. 11 – Fibonacci numbers. – for the continued fraction (simplest)

$$1 + \cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+-}}}$$

Convergents are $\frac{1}{1}, \frac{2}{1}, \frac{3}{2}, \frac{5}{3}, \frac{8}{5}, \frac{13}{8}, \frac{21}{13}, \frac{34}{21}, -$

Soon after the Second World War Franck propounded to me the thesis that the military and industrial growth of China would ~~see~~ soon be felt as a serious threat by China. This pressure, combined with the aging of a revolutionary society would cause Russia to tone down its revolutionary fervor and come to terms with the Western powers. At present we see the wisdom of Franck's forecast

[Ref: Biographical memoirs of fellows of the Roy. Soc. 11, 53 (1965) by H. G. Kuhn]

p. 66 – Harmonic oscillator with cylindrical and spherical symmetry by Carlestone

– In the intn. talks of modern use of matrix technique for S.H.O & says that the 3-dimn S.H.O has SU(3) symmetry

p. 83 – An ~~ins~~ instructive example of the Bootstrap ~~hyp~~ hypothesis by W. J. Abbe

– Bootstrap concept in classical mechanics may be used for undergraduates & advanced high school students

– Reading of the article belies the author's hopes (!)

p. 94 – About magnetic monopoles.

p. 112 – A new introduction for the teaching of special relativity by D. N. Pinder (New Zealand)

p. 114 – on the relativistic nature of Newtonian mechanics by W. D. Halford.

Relativistic nature of the principles of energy and momentum & A.M. in Newtonian mechanics with, however, $t \equiv t'$.

p. 116 – on the neutrino theory of light by Martin Ruderfer.

Attempts to demonstrate: $\gamma = \nu + \bar{\nu}$ all abortive (Look up my own paper on this subject & Nagendranath's work)

pp. 117 – 119 – Comments & counter comments on "the nature of time"

p. 125 – Review of a book on ultrasonics.

Mid – 39/2 – February, 1971.

p. 144 – Small article on "Absorption coefficients for plane ripples on deep fluids" by Wallbridge

p. 157 – Variational calculation with harmonic-oscillator eigenfunctions

– Huge big abstract, not very clear.

N	Number of digits in N
6-millionth prime	9
F_7	39
F_8	78
Googol	100
1000!	2568
$* 2^{11213}-1$	3376
$\Theta_{17}(\text{Googol})^{101}$	10,000
F_{17}	40,000 (approx)
F_{36}	20 billion (")
Grogolplex	10^{100}
F_{1945}	10^{600} (approx)
Skewes' number	$10^{10,000,000,000,000,000,000,000,000,000,000,000,000}$ (approx)

Googol $= 10^{100}$

$*(M_{11213}$ largest prime known (1965)

Grogolplex $= 10^{\text{Googol}}$

Skewes' number $= e^{e^{e^{79}}} \simeq 10^{10^{10^{34}}}$.

How many terminal zeros does 1000! have? To find this we need know how many times the factor 10 appears. But 10 is not prime. However $10 = 5 \times 2$ and there are far more 2's in 1000! than 5's. Hence we need only ask how many 5's there are. This is given by

$$\left[\frac{1000}{5}\right] + \left[\frac{1000}{5^2}\right] + \left[\frac{1000}{5^3}\right] + \left[\frac{1000}{5^4}\right] + \left[\frac{1000}{5^5}\right]$$

$$= 200 + 40 + 8 + 1 + 0 = 249$$

i.e. 1000! has 249 terminal zeros $\left\{ [x] = \text{greatest integer not exceeding } x \right\}$

$\left\{$ The total no. of times any prime factor p appears in the complete factorisation of $n!$ is $\left[\frac{n}{p}\right] + \left[\frac{n}{p^2}\right] + \cdots$ till last is zero

---

p. 154 – A classical calculation of Raman line shapes by ~~by~~ – for a molecule which behaves like a damped harmonic oscillator – The Raman scattering phenomenon can be regarded classically as a case of forced oscillation, where the driving ~~field~~ force is the electric field of the exciting light.

[In the references there is no single Indian name (?)

p. 158 – Conformal flatness of the Schwarzschild interior solution by H. A. Buchdahl.

– Some uniqueness property of this solution is proved

p. 172 – Force on magnetic dipole by x & y – Deduction in an elementary way ~~by~~ without using "poles".

p. 222.

p. 215 – A note on the Partition Function for systems of independent particles by D. D. Ford – E-B & F-D & M-B statistics discussed with use of the partition function

p. 221 – Note by J. M. OOthukulam & M. K. Ramaswamy (?)

p. 222 – Classical Green's function of the S.H. oscillator by J. D. Patterson.

p. 223 – On the Lorentz transformation by Leonard Parker – useful for an introductory course on relativity

p. 231 – In Letters to Editor & A comment on "Does a photon have a rest mass?" by G. H. Keswani, 11-A, Koregaon Park, Poona-1, India (?) – Concludes by saying that a photon has really no mass of any physical description, and gives a poem created by him of 6 lines.

International Journal of non destructive testing – Vol. 1, No. 1, June 1969

– Do – Vol 2. No. 1 – June 1970

p. 31 – The physics & technology of surface elastic waves by Henry D. Smith

Vol 2. No. 2 – September 1970

p. 189 – Article by Hudson & K. N. Raju (both NASA Langley Centre, Virginia)

Vol 2. No. 3 – p. 261 – Evaluation of elastic constants from ultrasonic reflection measurements by Fred. R. Rollins

other known powers of 10 that give zero-bracketing. If there is one it is $> 10^{5000}$. Thus we have the curio

$$8,589,934,592 \times 116,415,321,826,934,814,453,125$$
$$= 1,000,000,000,000,000,000,000,000,000,000,000$$

---

p.90. $\frac{p^2}{q^2} = 2$ is never solvable in integers, but it is easy to find solns of $\frac{a^2+b^2}{c^2+d^2} = 2$. For eg. $\frac{2^2+4^2}{1^2+3^2} = 2$. If we demand that sum of squares be consecutive, we have the curio

$$\frac{3^2+4^2+5^2+6^2+7^2+8^2+9^2}{1^2+2^2+3^2+4^2+5^2+6^2+7^2} = 2.$$

p.92 - $5^3+6^3 = 341$ and $7^3 = 343$ (cf $x^3+y^3 = z^3$ not true by Fermat's theorem) a very near miss. If some one had deliberately set out to tease us, he could hardly have done a better job. Why does $x^n+y^n = z^n$ not true for $n > 2$?

Chap 8 - Primes as left over scrap. — Very interesting chapter giving advanced information & describing sieve method of H.S. Ulam giving 'lucky numbers', presenting the primes in a new light.

Chap. 9. Examples of Zerah Colburn, Zacharias Dase etc. and commentary about such prodigies & use of computers recently. - A most promising young mathematician known to the author having the ability to give write on the blackboard

$$e^{\pi\sqrt{163}} = 262,537,412,640,768,743,999,999,999,999,250,\ldots$$

not yet checked.

In 1853, ~~Shanks~~ one William Shanks published the value of π to 607 decimal places. Twenty years later he extended it to 707 decimal places, a great achievement indeed for those days. In 1949 events took an ironical turn. A (then) modern ~~computer~~ electronic computer, in three days, turned out 2000 decimal places of π. When checked Shanks's result was found to be in error after about the 500th decimal place - 20 years' work down the drain! — This record up to 2000 decimal places had been pushed by 1962 up to 100,000 decimal places & the table is one of random numbers.

p.281 - where stands non-destructive testing of concrete and whither?
by S.T. Li, V. Ramakrishnan & J.E. Russell (South Dakota School of mines & technology) - Number of references to Indian work and also work of the Cement Research Institute of India

Journal of Mathematical Physics - December 1970

p.3358 - Einstein tensor and 3-parameter groups of isometries with 2-dimensional orbits by Greenwe & Stachel
✓ || - contains References to Petrov's book

p.3428 - Group representations and geometry by G. de B. Robinson.

~~New Books~~
17/5/71 New Books Section

(1) Physics is Fun - An Introductory Course for secondary schools in four Volumes by J. Jardine (Heinemann Educational Books Ltd, London)
|- Elementary but quite interesting, specially Vol. 4.

(2) Proc. Int. Conf. on Transformation groups - New Orleans, 1967, Edited by Paul S. Mostert - Springer-Verlag, Heidelberg, N.Y

Introductory Remarks by Deane Montgomery :-
..... Mathematicians need to meet for this professional reason, and an added pleasure in meeting is that they understand each other better than they understand others and than others understand them. It may not be be true mathematics is as thick as blood but it is thicker than water.

In the first article is mentioned "the surgery problem and the fundamental results" by Browder.

Part I - Differentiable transformation groups - 10 articles
Part II - with 7 short notes & problems
Part II - Algebraic topological and other techniques - 7 articles with 7 short notes & problems
Part III - Compact (Non-Lie) transformation groups - 6 articles

p. 85. Gives $2^5 \cdot 9^2 = 2592$ as due to Joseph de Grazia (but this is given as Dudeney's printing error?)

p. 86. Illegal cancellations giving correct answers:

(i) $\frac{16}{64} = \frac{1}{4}$ – for such cases to be true it is necessary that

$$\frac{10x+y}{10y+z} = \frac{x}{z} \quad \text{ie} \quad 9xz = y(10x-z)$$

Now if 9 divides $(10x-z)$ we have, $10x - z \equiv 0 \pmod 9$ or $10x \equiv z \pmod 9$

but $10 \equiv 1 \pmod 9$ so that $10x \equiv x \pmod 9$ for all x ie $x = z$ are

have trivial cases like $\left\{\frac{44}{44} = \frac{4}{4} = 1\right\}$. If on the other hand 9 does not

divide $(10x-z)$, then 3 must be a factor of y. Our search is reduced, but it

still requires some trial to discover

$$\frac{26}{65}, \frac{19}{95}, \frac{49}{98}$$

are the only other solutions

It is more difficult to locate a cancellation like

$$\frac{143\not{8}5}{170\not{8}56} = \frac{1435}{17056}.$$

p. 88 – It has been proved that for two-digit numbers, the product of a number & its reverse (ie digits) can never be a perfect square except for $55 \times 55 = 55^2$ This is however not true for numbers of more than 2 digits, for eg

⊛ It is therefore imperative to stress the fact that the purported(?) uniqueness of the reshuffle-magnitude relation is entirely based on wishful thinking

$$169 \times 961 = 162409 = 403^2$$
$$(13^2 \times 31^2)$$

13×31

$$1089 \times 9801 = 10673289 = 3267^2$$

Note that all nos. on L.H.S are perfect squares. Hence the conjecture: Is this a necessary condition?

p. 89 – Zero-free factors of 10^n : upto $n = 7$, powers of 2 & 5 contain no zeros. but $5^8 = 390625$. Then 2^9 & 5^9 are zero-free. 10^{18} and 10^{33} are the only

with one short note and problems.

Part IV – Non-Compact transformation groups. – 5 particles with problems

(3) Advances in Astronomy & Astrophysics – Vol. 7, Edited by Z. Kopal – Academic Press, N.Y & London, 1970

The first article is by Naresh Chandra & S. K. Joshi (Deptt of Physics, Univ. of Roorkee, Roorkee, India)

An interesting article on the structure of the terrestrial planets by R. A. Lyttleton comprising Earth, Venus, Mars, Moon & Mercury.

✓✓ Last article by F. Zwicky* re. cosmic objects like compact galaxies and existence of large gravitational red shifts

[* § is Compact & dispersed cosmic matter. Part II – Mount Wilson & Palomar Observatories, Carnegie Inst. of Washington, California Inst. of Technology, Pasadena, California. – Part I appeared in Vol 5 – Part III will appear in Vol. 8]

– A Comprehensive article on this topic

p. 276 – suggesting that red shifts of quasars may in large part be due to the Einstein effect (gravitational effect)

p. 277 – Interesting remarks about redshift observations & conclusions derived by theoreticians ~~beings to about~~ concerning the evolution of the Universe being unfounded – criticises Hubble's assumptions (✱)

p. 279 – D. Theory – It is obvious that in connection with the observations now available and in progress on compact radio-emitting and radio-quiescent galaxies, many types of compact objects such as neutron stars, pygmy stars, compact gaseous galaxies, star-studded compact galaxies and neutron-studded compact galaxies as well as completely novel bodies such as cosmic balls of light, cosmic balls consisting essentially of neutrinos or other elementary particles remain to be studied

p. 278 – It must be stressed strongly that extremely compact galaxies and what others subsequently chose to call quasi-stellar objects are clearly the same objects.

✓ Similarly $Y = x^2 - 79x + 1601$, fails for the first time for $x = 80$ and many times thereafter - Indeed no polynomial can even produce primes for all x; proof on p. 37, quite elegant & interesting

p. 52. The famous "Monkey and Coconuts" problem, which has tantalised many a problem solver. We shall not only state it but will also solve it for you, although this seems almost like cheating

Five sailors plan to divide a pile of coconuts among themselves in the morning. During the night one of them wakes up and decides to take his share. After throwing a coconut to a monkey to make the division come out even, he takes one-fifth of the pile & goes back to sleep. The other four sailors do likewise, one after the other, each throwing a coconut to the monkey and taking one-fifth of the remaining pile. In the morning the five sailors throw a coconut to the monkey and divide the remaining coconuts into five equal piles. What is the smallest number of coconuts that could have been in the original pile.

Soln: If the original no. of coconuts be N, and the number each sailor receives in the final division is a, then

$$\frac{1}{5}\left(\frac{4}{5}\left(\frac{4}{5}\left(\frac{4}{5}\left(\frac{4}{5}\left(N-1\right)-1\right)-1\right)-1\right)-1\right)-1\right) = a$$

Removing the parentheses & regrouping (with care!) yields

$$\left(\frac{4}{5}\right)^5 N - \left[1 + \frac{4}{5} + \left(\frac{4}{5}\right)^2 + \left(\frac{4}{5}\right)^3 + \left(\frac{4}{5}\right)^4 + \left(\frac{4}{5}\right)^5\right] = 5a$$

which leads to $4^5(N+4) = 5^6(a+1)$.

Now regardless of the nature of $(a+1)$ the unique factorisation theorem tells us that all the prime factors of $5^6 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$ must also be contained in the L.H.S. Since none of them are in 4^5, 5^6 must divide $(N+4)$

ie $(N+4)$ is divisible by $5^6 = 15625$

ie $N \equiv -4 \pmod{15625}$

But we cannot start with -4 coconuts, and the very next integer in this residue class modulo 15625 is $-4 + 15625 = 15621$.

That is a lot of coconuts!

p. 82 - Gives a number of problems given in Sierpinski

Any attempts to use the apparent luminosities of galaxies as absolute distance indicators are on very shaky grounds unless criteria can be found to select objects at different distances that have the same intrinsic characteristics. In this connection, it should be mentioned that the only extragalactic objects known so far that possibly satisfy this requirement are the supernovae of Type I

(4) International Astronomical Symposium No. 28 — 5th Symposium on cosmical gas dynamics & aerodynamic phenomena in stellar atmospheres.
— Acad. Press, London & N.Y., 1967

In the list of participants is found the name of P. L. Bhatnagar (Conference held at the Centre international d'Astrophysique de l'observatoire de Nice, 2-14 Sept. 65.
— Another apparent Indian name is Uberoi (U.S.A). (?)

(5) Space and time by Richard Swinburne, Lecturer in Philosophy, Univ. of Hull,
— Macmillan, 1968.

— Interesting and of a purely philosophical nature — talks of the topology of time in Ch. 10.

(6) Scientific American — Resource Library - Vol. 2. Readings in the Physical Sciences & Technology — Offprints 247-290 —
(These readings are from Nos. 201-399 — Vol 1 is from 201-246 and Vol. 3 from 291-328) — W. H. Freeman & Co. San Fransisco

---

Journal of Mathematical Physics

October 1970. p. 3055 - Polynomial Algebras by I. V. V. Raghavacharyulu and Nalini. B. Menon
— The scoundrels give no reference whatever to my work.

November 1970. —

September 1970 —

August 1970 —

June 1970 — p. 1885 - A paper involving SU(2), SU(3) & SU(6) by M. Resnikoff.

May 1970 -

ord & partial diff eqns, integral eqns, Special functions, Monte Carlo method (37')
& Linear programming - Quite an imposing list of topics.

Chap. 13 - Difference Eqns - A humorous Swedish verse given

"My goodness, I'm feeling fine
said Granny, waving with her hand
Next birthday I'll be ninety nine
with just one year left to thousand"

Ex: (1) $y(x) = p\,y(x+1) + q\,y(x-1)$ with $p+q=1$ and $y(0)=1$, $y_N = 0$.
The characteristic eqn is $\lambda = p\lambda^3 + q$ with the roots 1 and q/p. If $p \neq q$, we find the soln $y(x) = \dfrac{p^{N-x} q^x - q^N}{p^N - q^N}$. If $p = q = 1/2$, we get $y = 1 - x/N$

(2) Mathematical puzzles for beginners & enthusiasts by Geoffrey Mott-Smith - Dover Publications, Inc, N.Y. 1954

- Yet another book (I think this is the fourth I have seen - why not try to write a book like this in English or Kannada?) - Quite elementary, but nevertheless interesting - Specially since solutions are given for each problem.

(3) Introduction to Mathematics by R.A. Good - Harcourt, Brace & World Inc. N.Y etc, 1966 (Book for reference only)

- Elementary book for first year college students.

(4) Excursions in number theory by C. Stanley Ogilvy & John Anderson (Oxford Univ. Press, 1966)

- Elementary, meant for general reader as well as for the more advanced mathematician - Quite a beautiful book.

Chaps! - The beginnings - Number patterns - Prime numbers as building bricks - Congruence arithmetic - Irrationals & iteration - Diophantine equations - Number curios - Prime numbers & left over scrap - Calculating prodigies and prodigious calculations - Continued fractions - Fibonacci numbers.

p. 36. A formula that produces a few primes is

$$Y = x^2 - x + 41$$

This turns out a Y that is prime if you put $x = 1$, or 2 or 3, all the way up to $x = 40$. But $x = 41$ yields the composite number $Y = 41^2$.

April, 1970 - p. 1210 - ~~Invariance~~ Invariant representations of all analytic Petrov type III solutions to the Einstein equations by Carl H. Brans - mentions a procedure involving the computer-aided analysis of the Einstein-Petrov eqns

(19/5/71) - Tabulation of Annamalai Marks dists.

(21/5/71) ———— ?

(24/5/71) - Solns from Uspensky, Mood & Graybill, Kendall & Stuart and Yule & Kendall for Annamalai Statistics paper.

Scientific Inference by Harold Jeffreys (C.U.P.)

(1) "Contrariwise" continued Tweedledee, "if it was so, it might be: and if it were so, it would be: but as it isn't, it ain't. That is logic."

Lewis Carroll
Through the Looking Glass

(Chap I - Logic & scientific inference)

Chap II - Probability

"Oh, it ain't gonna rain no mo' no mo',
It ain't rain no mo'!
How in the hell can the old folks tell?
I ain't gonna rain no'mo!

Messrs Layton & Johnstone

Chap III - Sampling

Little drops of water
Little grains of sand
Make the mighty ocean
And the glorious land

Julia Carney.

Ch. IV - Quantitative laws.

"Tis a lesson you should heed,
Try again;
If at first you don't succeed,
Try again;
Then your courage should appear
For if you will persevere

by 'magnons', 'plasmons', 'phonons' and 'polaritons' – on p. 247, the article by H. Z. Cummins on "Laser light scattering spectroscopy" sections are devoted to Brillouin scattering, Raman scattering and Rayleigh scattering. – on p. 323 mention is made of the Raman tensor – 3 huge papers on the quantum theory of the laser.

(4) ✓✓✓ Reread No(16) of Monday and found (a) the article "Problems of unifying Cosmology with microphysics" by Dmitri. D. Ivanenko (The Moscow State Univ) pp. 105–114 and discussions on the same quite interesting. In fact it is in line with my famous "3 year" CSIR project!!

(b) Article on possible internal subquantum motions of elementary particles by Jean-Pierre Vigier (Institut Henri Poincaré) also quite interesting as also discussion on it.

(c) Relativity theory and historicity of physical systems by Treder, p. 253

(d) General relativity as an open theory by Hermann Bondi, p. 265

(e) Non-quantal foundations of quantum mechanics by Alfred Landé, p. 297

(f) Is science human? by H. Bondi, p. 321.

18/6/71 (1) Looked at some general books.

(2). Science – 5/2/71

(3) Ibid – 26/2/71

p. 831 – Applications of physical sciences to archeology by F. H. Stross (Deptt of Anthropology, Univ. of California, Berkeley)

(4) Ibid – 5/3/71

21/6/71 New Books Section

(1) Introduction to numerical Analysis (2nd Edn) by Carl-Erik Fröberg

Addison-Wesley, 1970

From Preface: Numerical Analysis is a science – computation is an art.

Lots about matrices, their inversion etc – Difference Equations

You will conquer, never fear,
Try again
William Edward Hickson.

Ch V - Errors

A snapper-up of unconsidered trifles
Shakespeare, A Winter's Tale

Ch. VI - Physical magnitudes.

Multiplication is vexation;
Division's just as bad;
The Rule of Three perplexes me,
And Practice drives me mad.
Nursery Rhymes.

Ch. VII - Mensuration

"'Tis distance lends enchantment to the view"
Thomas Campbell, Pleasures of Hope

Ch. VIII - Newtonian Dynamics

Nature, and Nature's laws, lay hid in night:
God said, Let Newton be! and all was light.
Pope

Ch. IX - Light and Relativity

It did not last: the Devil, howling Ho!
Let Einstein be! restored the status quo
J. C. Squire

Ch X - Miscellaneous questions

"How is bread made?"

"I know that!" Alice cried eagerly. "You take some flour —"

"Where do you pick the flower?" the White Queen asked. "In a garden, or in the hedges?"

"Well, it isn't picked at all" Alice explained; "It is ground —"

"How many acres of ground?" said the White Queen. "You mustn't leave out so many things."
Lewis Carroll, Through the Looking Glass

✓||(20) Fundamentals of Geometry by Bruce E. Meserve and Joseph A. Izzo (Univ of Vermont) – Addison-Wesley, 1969

Chaps :– Introduction to Geometry – Intuitive intro to affine and other geometries – Deductive approach to geometry – Synthetic projective geometry – Analytic projective geometry – Affine geometry – Euclidean plane geometry – Appendices A to D

Primary aim of the book is to help the reader to discover (i) discover how Euclidean plane geometry is related to and often a special case of many other geometries;
(ii) obtain the concept of geometry as a logical system based upon postulates & undefined elements,
(iii) appreciate the historical evolution of our geometric concepts and their relation to the space in which we live

✓||– with exercises & answers

16/6/71 – New Books Section

(1) Quantum Theory of Matter – 2nd Edn by J. C. Slater (Reference only)
Int. Series in pure & appl. Physics (Edited by Leonard I. Schiff) – Mc Graw Hill, 1968

(2) The Scattering of light and other electromagnetic radiation by Milton Kerker (Dept of Chem) Academic Press, 1969.

– on p. 3. in the introduction mentions that the Raman effect (a quant. mech. phenomenon) is excluded from treatment in the Book – Some scatter only one reference to Raman's earlier work, and two to Ramanathan's – on p. 492, mentions the Laplace – Ramanathan equations (1927 – Ind. J. Phys. 1, 413)

|(3) Quantum Optics. – Proc. Int. Conf. School of Physics "Enrico Fermi" Course 42 – Edited by R. J. Glauber – Academic Press, 1969

– A huge book (perhaps biggest of the Fermi Courses) of nearly 760 pages with 31 contributors – Some papers specially devoted to quantum theory of the laser – Article on p. 397 by R. London on "Scattering of light by excitation in crystals" – goes deals mainly with Raman scattering (talks of this scattering by

Ch. XI – Other theories of scientific Knowledge

I have seen all the works that are done under the sun; and, behold, all is vanity and vexation of spirit. Eccles. 1.14

Addenda

After all, there is no harm in being sometimes wrong – especially if one is promptly found out.

J. M. Keynes, Essays in Biography.

New Books Section

(1) Unitary Symmetry & Elementary Particles by D. B. Lichtenberg

Chapters. Intn – Some properties of groups – Symmetry, group representations and particle multiplets – The symmetric group & identical particles – Lie groups & Lie Algebra – Multiplets – Young tableaux & unitary symmetry – Clebsch-Gordan coefficients – The eightfold way – Approximate SU(6) – The Quark model – Variants of the Quark model.

(2) Introduction to Abstract Algebra – Vol 2 – by F. M. Hall (C.U.P, 1969)

Chaps: Groups – Homomorphisms of groups – Rings – Fields – Integral domains – Invariant subgroups – Ideals – Extensions of structures – Vector spaces – Geometrical applications – Boolean Algebra – Further results.

– Quite an elementary book and a nice one (with exercises at end of each chapter. & also worked exercises

(3) Partial Diff. Eqns of elliptic type by Carlo Miranda (2nd Edn revised) Ergebnisse Series – Springer Verlag, 1970

(4) Partial Diff. Eqns by P. R. Garabedian. – John Wiley & Sons, 1964

(5) Rings & modules by P. Ribenboim – Interscience Publishers (John Wiley 1969 Dion)

Q. 3(b) Adjoint of $L = p_0(x) D^n + p_1 D^{n-1} + \cdots + p_n \to L u(x) = \sum p_{n-k}(x) u^k(x)$.

is $L^* v = (-1)^n \frac{d^n}{dx^n}(p_0 v) + (-1)^{n-1} \frac{d^{n-1}}{dx^{n-1}}(p_1 v) + \cdots + (-1)\frac{d}{dx}(p_{n-1} v) + (p_n v)$

for, $p_0 D^2 + p_1 Dy + p_2 y$

$$L^* v = (-1)^2 \frac{d^2}{dx^2}(p_0 v) - \frac{d}{dx}(p_1 v) + p_2 v$$

$$= \frac{d}{dx}\left(p_0 \frac{dv}{dx} + v \frac{dp_0}{dx}\right) - \left(p_1 \frac{dv}{dx} + v \frac{dp_1}{dx}\right) + p_2 v$$

$$= \frac{dp_0}{dx}\frac{dv}{dx} + p_0 \frac{d^2 v}{dx^2} + \frac{dv}{dx}\cdot\frac{dp_0}{dx} + v\frac{d^2 p_0}{dx^2} + p_2 v$$

$$- p_1 \frac{dv}{dx} - v \frac{dp_1}{dx}$$

So req'd adjoint eqn is $p_0 \frac{d^2 y}{dx^2} + \left(2\frac{dp_0}{dx} - p_1\right)\frac{dy}{dx} + v\left(\frac{d^2 p_0}{dx^2} - \frac{dp_1}{dx} + p_2\right) = 0.$

for cond^n for self-adjointness is

$$\frac{2a_0' - a_1}{a_1} = \frac{a_0'' - a_1' + a_2}{a_2} = 1$$

$2a_0' = 2a_1$, and $a_0'' - a_1' = 0$.

for equivalent self-adjointness of

$a_0 D^2 y + a_1 Dy + a_2 y = 0$

& $b_0 D^2 y + b_1 Dy + b_2 y = 0$

is $\frac{b_0}{a_0} = \frac{b_1}{2a_0' - a_1} = \frac{b_2}{a_0'' - a_1' + a_2}$.

So for second part of 3(b).

$$\frac{b_0}{x^2} = \frac{b_1}{4x + 2x} = \frac{b_2}{4 + 2 + 2}$$

$$\frac{b_0}{x^2} = \frac{b_1}{2x} = \frac{b_2}{2(1+3x)4}$$

ie eqn is $x^2 \frac{d^2 y}{dx^2} + 2x \frac{dy}{dx} + \frac{4}{2(1+3x)} y = 0$ //

26/5/71 – ~~Correction~~ Valuation of Annamalai Statistics answer scripts

28/5/71 – Solns for Andhra paper on Methods of Mathematical Physics

1(a)

2. Existence & uniqueness theorem for $\frac{dy}{dx} = f(x,y)$ — (1)

Statement. If (a) the function f is a (single-valued) continuous function of x and y in some domain D of the xy-plane, and

(b) the partial derivative $\frac{\partial f}{\partial y}$ is also a (single-valued) continuous function of x and y in D & let (x_0, y_0) be a point in D)

then there exists a unique soln ϕ of (1) defined on some interval $|x - x_0| \leq h$, where h is sufficiently small, which satisfies the condition

$$\phi(x_0) = y_0$$

1(d) Starting from $\phi(u,v) = 0$, (i)

$$\frac{\partial \phi}{\partial u}\left(\frac{\partial u}{\partial x} + p\frac{\partial u}{\partial z}\right) + \frac{\partial \phi}{\partial v}\left(\frac{\partial v}{\partial x} + p\frac{\partial v}{\partial z}\right) = 0$$

$$\frac{\partial \phi}{\partial u}\left(\frac{\partial u}{\partial y} + q\frac{\partial u}{\partial z}\right) + \frac{\partial \phi}{\partial v}\left(\frac{\partial v}{\partial y} + q\frac{\partial v}{\partial z}\right) = 0$$

Equating $\left(\frac{\partial \phi}{\partial u}\right) \Big/ \left(\frac{\partial \phi}{\partial v}\right)$ from the two eqns & on rearranging we get

$$Pp + Qq = R \quad — (ii)$$

where $P = \begin{vmatrix} \partial u/\partial y & \partial u/\partial z \\ \partial v/\partial y & \partial v/\partial z \end{vmatrix} = \begin{vmatrix} \partial u/\partial z & \partial u/\partial x \\ \partial v/\partial z & \partial v/\partial x \end{vmatrix} = \begin{vmatrix} \partial u/\partial x & \partial u/\partial y \\ \partial v/\partial x & \partial v/\partial y \end{vmatrix}$

or equivalently $P\frac{\partial u}{\partial x} + Q\frac{\partial u}{\partial y} + R\frac{\partial u}{\partial z} = 0$

$$P\frac{\partial v}{\partial x} + Q\frac{\partial v}{\partial y} + R\frac{\partial v}{\partial z} = 0$$

Hence when one has a diff. eqn of form (ii), we have a corresponding integral given by (i) provided u & v can be obtained.

Consider $u = a$, $v = b$ (a, b arbitrary constants). To form diff eqns corresponding to them, $\frac{\partial u}{\partial x}dx + \cdots + \frac{\partial u}{\partial z}dz = 0$

$$\frac{\partial v}{\partial x}dx + \cdots + \frac{\partial v}{\partial z}dz = 0$$

$e^x + (x-1)e^x$

$e^x + xe^x$ $\qquad 2e^x - 2e^{2x}$

$2e^x - 4e^{2x}$.

$z = \log \cos x$

$x = ay,\ z = bx$ i.e. $\phi\left(\frac{z}{y}, \frac{z}{x}\right) = 0$.

$\log z = \log x + \log a,\ \log z = \log y + \log b$

$\phi\left(\frac{\sin z}{\sin x}, \frac{\sin z}{\sin y}\right) = 0$.

$\uparrow\ d(\log \sin x) = d(\log \sin y) = d(\log z)$ i.e. $dx \cot x = dy \cot y = dz \cot z$

Ex under 1(a): $\frac{dx}{\tan x} = \frac{dy}{\tan y} = \frac{dz}{\tan z}$.

$D[e^x(x-1)]$

$= e^x + (x-1)e^x$

$= e^x \cdot x$

$e^x,\ e^x(x-1),\ e^x(2e^x - e^{2x})$

$e^x +$

$$\begin{vmatrix} e^x & e^x(x-1) & (2e^x - e^{2x}) \\ e^x & xe^x & 2e^x - 2e^{2x} \\ e^x & e^x(x+1) & 2e^x - 4e^{2x} \end{vmatrix}$$

$$= e^{3x} \begin{vmatrix} 1 & x-1 & 2-e^x \\ 1 & x & 2-2e^x \\ 1 & x+1 & 2-4e^x \end{vmatrix}$$

$$= e^{3x} \begin{vmatrix} 1 & x-1 & 2-e^x \\ 0 & 1 & -e^x \\ 0 & 2 & -2e^x \end{vmatrix} = e^{3x} \begin{vmatrix} 1 & -e^x \\ 2 & -2e^x \end{vmatrix} = e^{3x}\left[-2e^x + 2e^x = 0\right]$$

$$= \begin{vmatrix} 0 & e^x & -e^{2x} \\ 1 & xe^x & 2e^x - 2e^{2x} \\ 0 & -e^x & 2e^{2x} \end{vmatrix} = \begin{vmatrix} e^x & -e^{2x} \\ -e^x & 2e^{2x} \end{vmatrix} = 2e^{3x} + xe^{3x}$$

Hence the result

$$\therefore \quad \frac{dx}{\begin{vmatrix} & \\ & \end{vmatrix}} = \frac{dy}{\begin{vmatrix} & \\ & \end{vmatrix}} = \frac{dz}{\begin{vmatrix} & \\ & \end{vmatrix}}$$

$$\text{or} \quad \frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$$

These diff eqns have $u = a$, $v = b$ for integrals. Hence the rule:-

To obtain a soln of $Pp + Qq = R$ ——— (A)

integrate the subsidiary equations $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

& obtain two independent integrals of the latter; let these be $u = a$ & $v = b$

Then an integral of (A) is given by $\phi(u, v) = 0$ (ϕ arbitrary fn)

Ex. under 1(a) is worked Ex. 3 (vii) of Forsyth, p. 402 (1956 Edition)

Q. 3(a) Verify that $y_1 = e^x$, $y_2 = e^x(x-1)$, & $y_3 = 2e^x - e^{2x}$ are solns & then prove them independent by showing

$$\begin{vmatrix} \frac{d^2y_1}{dx^2} & \frac{d^2y_2}{dx^2} & \frac{d^2y_3}{dx^2} \\ \frac{dy_1}{dx} & \frac{dy_2}{dx} & \frac{dy_3}{dx} \\ y_1 & y_2 & y_3 \end{vmatrix} = 0$$

——— as shown

Q. 1(b) is worked Ex. 1, Forsyth, p. 625

Using Charpit's general method, forming the subsidiary eqns, we have (among others)

$$\frac{dp}{2y - 2p} = \frac{dq}{2x - 2q} = \frac{dx}{-2p + 2x} = \frac{dy}{-2q + 2y}$$

$$\left[f(x, y, z, p, q) = 0 \rightarrow \frac{dp}{\frac{\partial F}{\partial x} + p\frac{\partial F}{\partial z}} = \frac{dq}{\frac{\partial F}{\partial y} + q\frac{\partial F}{\partial z}} = \frac{dz}{-p\frac{\partial F}{\partial p} - q\frac{\partial F}{\partial q}} = \frac{dx}{-\partial F/\partial p} = \frac{dy}{-\partial F/\partial q} \right]$$

Hence $dp + dq = dx + dy$, so that $p - x + q - y = a$

Combining with original eqn, which may be written as $(p-x)^2 + (q-y)^2 = (x-y)^2$

we find $2(p - x) = a + \{2(x-y)^2 - a^2\}^{1/2}$

$2(q - y) = a - \{2(x-y)^2 - a^2\}^{1/2}$

(12) High-energy physics & nuclear structure edited by Samuel Devons (Ref. only) — Proc. 3rd. Int. Conf. held at (Columbia Univ N.Y) Sept. 8–12, 1969

Plenum Press, N.Y & Lond, 1970

✓ Heaps & heaps of participants — Colossal number of up to date contributions

Among participants found names of Telegdi, M.K. Sundaresan, F.C. Khanna, and D.C. Choudhury (all at American Universities)

(13) Mathematical & Theoretical Physics by Egil. A. Hylleraas (Vol I) — Wiley-Interscience, 1970) — Quite an elementary & standard type of textbook.

✓ (14) S-matrix theory of strong interactions by G.F. Chew (Univ. of California) — W.A. Benjamin Inc, N.Y, 1962 — Series of articles — Purely of a theoretical nature

✓ (15) Einstein's theory of relativity by Max Born — Revised Edition in collaboration with G. Leibfried & W. Biem — Dover Publns, N.Y, 1962 — Preface by Max Born — To look in carefully later on.

✓ (16) Physics, Logic and History — Edited by W. Yourgrau & A.D. Breck — Plenum Press, 1970 — Dedicated with respect & affection to the memory of George Gamow — 29 participants — All kinds of very interesting personal remarks & general types of essays with discussions, with articles by Gamow also (p. 203, the three Kinds of Physics), concluding with or Is Science human? by Bondi) — To be read carefully later

(17) Intn to Masers & Lasers by A.E. Siegman — Chapman & Hall, 1967

(18) Fluid Mechanics & statistical methods in Engineering (Univ. of ~~Penn~~ Pennsylvania Bicentennial Conference), Kennikat Press, Inc/ Port Washington, N.Y — Articles by H.L. Dryden; Kármán; Kaliński; Sherwood; S.S. Wells; Shewhart, L.E. Simon & Roscoe Pound — ~~Good articles on flu~~

(19) ordinary Diff. Eqns by E.L. Ince (Dover Publns), republished 1962 — Standard textbook. [See (39')]

Hence $dz = p\,dx + q\,dy$

gives $2\,dz = (2x+a)\,dx + (2y+a)\,dy + (dx-dy)\left\{2(x-y)^2 - a^2\right\}^{1/2}$

the integral of which is

$$2z - b = x^2 + ax + y^2 + ay + \frac{(x-y)}{2^{3/2}}\left\{2(x-y)^2 - a^2\right\}^{1/2}$$

$$- \frac{a^2}{2^{3/2}} \log\left\{2^{1/2}(x-y) + \left\{2(x-y)^2 - a^2\right\}^{1/2}\right.$$

This is the complete integral. General integral is deducible in the ordinary way. There is no singular integral

~~Q. 3 (b)~~

Q. 6 – Last part – Area of surface of revolution is

[from Calculus of Variations p. 37 by Elsgole (Int. Series of monographs of p. & a. maths 1961)]

$$S(y(x)) = 2\pi \int_{x_0}^{x_1} y\sqrt{1+y'^2}\,dx$$

The integrand depends only on y & y' and the Euler eqn has a first integral of the form $F - y'F_{y'} = C_1$

or in this particular case

$$y\sqrt{1+y'^2} - \frac{yy'^2}{\sqrt{1+y'^2}} = C_1$$

Introduce a parameter $y' = \sinh t$, then $y = C_1 \cosh t$ and

$$dx = \frac{dy}{y'} = \frac{C_1 \sinh t\,dt}{\sinh t} = C_1\,dt\,, \quad x = C_1 t + C_2$$

Hence the desired surface is obtained by revolving a curve with the parametric eqns $x = C_1 t + C_2$, $y = C_1 \cosh t$. Eliminating t

$$y = C_1 \cosh\frac{x - C_2}{C_1}$$

which is a family of Catenaries & surface generated is a catenoid. The constants C_1 & C_2 are to be determined from the condition that the curve giving the soln of the problem should pass through the given end points

31/5/71 Solutions to Andhra Q. paper on Fluid Mechanics

Q.6. (From Ramsey's Hydro~~dynamics~~ mechanics – Vol 2), p. 382

Eqns in absence of external forces (Steady motion in a tube of ⊙r cross section)

(p = pressure) $\frac{\partial p}{\partial r} = 0, \quad \frac{\partial p}{r\partial \theta} = 0$

(w = velocity) $\frac{\partial p}{\partial z} = \mu\left(\frac{\partial^2 w}{\partial r^2} + \frac{1}{r}\frac{\partial w}{\partial r}\right)$ — (1)

∴ p fn of z alone & equal to $-(p_1 - p_2)l$ (l = length of tube)

$$\frac{d}{dr}\left(r\frac{dw}{dr}\right) = -\frac{p_1 - p_2}{\mu l} r \quad \text{--- (2)}$$

$$r\frac{d^2w}{dr^2} + \frac{dw}{dr} = \frac{\partial p}{\partial z}\cdot\frac{r}{\mu} \quad (1)$$

Integrating $w = -\frac{(p_1 - p_2)}{4\mu l} + A\log r + B$ --(3)

p. 384. Steady flow between two ⊙r cylinders of radii a & b. In Ramsey it is taken that $w = W$ when $r = a$, & $w = 0$ when $r = b$. Here we can taken $w = 0$, when $r = a$ & when $r = b$ & taken $b = na$. & (3) gives

$$w = -\frac{p_1 - p_2}{4\mu l}\left\{r^2 - \frac{n^2a^2\log(r/a) - a^2\log(r/na)}{\log n}\right\}$$

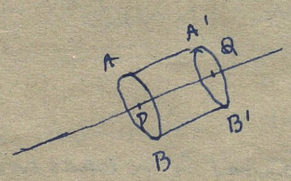
& Flux relative to fixed boundary

$$= \int_a^{na} w \cdot 2\pi r\,dr = \frac{\pi}{8\mu}\cdot\frac{p_1 - p_2}{l}\left\{n^4a^4 - a^4 - \frac{(n^2a^2 - a^2)^2}{\log n}\right\}$$

$P = \frac{p_1 - p_2}{l}$ = pressure gradient

$$= \frac{\pi}{8\mu} P\cdot a^4\left\{n^4 - 1 - \frac{(n^2-1)^2}{\log n}\right\}.$$

Q.1 (a) Worked out §1.51 in Ramsey:



Let PQ = δs of arc of the line of motion thro' P & AB a small area ⊥r to the curve & similarly A'B'

Let K = area of AB, ρ density & v velocity at P.

Then quantity of fluid which enters at AB during time δt

$= K\rho v\,\delta t$

& that which flows out at A'B' $= K\rho v\,\delta t + \frac{\partial}{\partial s}(K\rho v\,\delta t)\,\delta s$

Excess of former over latter of these two expns is the whole increase of the fluid in PQ during time δt, and is $= -\frac{\partial}{\partial s}(K\rho v)\,\delta t\,\delta s$.

; but mass of fluid at time $\underline{t}$ being $k\rho\delta s$, the increase in time δt is also expressed by $\frac{\partial}{\partial t}(k\rho\delta s)\delta t$ or $\frac{\partial}{\partial t}(k\rho)\delta s\,\delta t$

& therefore equating $\frac{\partial}{\partial t}(k\rho) + \frac{\partial}{\partial s}(k\rho v) = 0.$

Which is same as eqn in Q.1(a) with $k \to \omega$ & $v \to q$.

Q.1(b) is worked Ex (1), p.31 of Ramsey.

Q.2(a) BK work § 4.23 p.70 Ramsey.

2(b) " § 4.7, p.83, Ramsey

Q.3(a) " § 4.6, p.112, L.M.M (1955 Edn)

(b) Unworked second part of Ex. 10, p.116 of L.M.M

(In fact, whole of Q.3 is this Ex. 10)

Q.4 – Bookwork (L.M.M, ~~p.65~~ p.165 or Ramsey p.109)

Q.5. Ramsey pp. 370 & 375

Q.7. L.M.M, p. 569 & Ramsey, pp. 396 & 399

Q.8. — — —

2/6/71 – Valueing remaining answer scripts of Applied Fluid mechanics – Had met S.K.L. last night at home

---

Journals in Organic Chemistry in the Shelf

(1) Polymer Chemistry (Also Biopolymers) – 6 Journals

(2) Journal of Steroids

(3) J. Organometallic Chemistry

(4) J. Polyblends & Composites

(5) Tetrahedron – Int. Journal of Organic Chemistry – founded by Sir Robert Robinson.

In addition 40 General Chemistry journals (containing articles on organic Chemistry)

4/6/71 – New Books Section:

(1) Quantum Field Theory & Hydrodynamics – Edited by Acad. D. V. Skobel'tsyn – A special research report translated from Russian – Vol. 20 of Proc. of the P. N. Lebedev Phys. Institute, 1967

G. Polya; J. Popken; H. Rademacher; A. Rényi; I. J. Schoenberg; C. L. Siegel (Gottingen), Arnold Walfisz & Anna Walfisz.

p.220: In Mordell's paper there is a reference to the work of Bambah & Chowla in the beginning of the article itself [R & C: Proc. Nat. Inst. Sci 13, 2 (1947), 101-103]

Also a reference to P. H. Diananda (Proc. Japan. Acad 43, 1967, 417-19 & a further paper

(9) Boundary value problems in Physics & Engineering by F. Charlton (van Nostrand, (Burmingham)

Reinhold Co Ltd, London - Elementary book

Chaps:- Partial Diff. eqn techniques & formation of partial diff. eqns - Special techniques for solving simpler types of partial diff eqns (No. of solved Examples useful for exam work) - Theory & applns of orthogonal fns - Soln of Laplace's eqn - Complex variable applications - 2nd order partial diff. eqns - Integral transforms.

(10) Introduction to modern mathematics by Nathan J. Fine - Text originally written for social science & liberal arts students, useful at sixth-form level at grammar schools (?)

Chaps:- Logic - Set theory - Axiom systems (Boolean algebras also) - Real numbers - Linear algebra - Analytic geometry - Measure, area and integration - Limits, continuity & differentiation - Probability - Exercises with selected answers at the end

(11) Essays in Physics edited by Conn & Fowler - Academic Press, Vol 1. 1970.

Contributions: (a) Strong interactions of elementary particles by E. J. Eden (Cavendish Lab)

(b) Electronic phase transitions by David Adler

(c) Optical diffraction methods in crystal-structure determinations by H. Lipson.

(d) Meteorites by G. Turner.

Quite interesting for a preliminary reading

[Contd (42')]

(a) Method of Green's function in Quantum Field Theory and relativistic hydrodynamics

(b) Energy spectrum of a system of interacting relativistic particles.

(c) Spectral representation in Coordinate space

(d) Contemporary situation in the hydrodynamical theory of multiple production of particles by E. L. Feinberg.

(e) Hydrodynamical theory of multiple production taking viscosity into account.

(f) Theory of turbulent intermixing

(g) Width of high-intensity shock waves.

(h) Investigation of the stability of arbitrary one-dimensional hydrodynamical flow

(i) Refraction & reflection of shock waves from the interface between media having different densities

(2) Proof techniques in Graph Theory edited by Frank Harary – Proc of a conference Academic Press, 1969 – 25 contributions including two from Indian authors R. P. Gupta and V. S. R. Murty – Very interesting papers with peculiar names to eg

(a) The four-colour conjecture & other graphical diseases by F. Harary (an authority on graph theory)

Graph theory provides a fiendishly fertile field for famous fruitless follies. This fortuitous phenomenon enhances the intuitive and popular appeal of the subject. - - - - The word disease is quite appropriate for a puzzle which is easy to comprehend, apparently impossible for any one to solve, infectious, contagious, recurrent, malignant, painful, scarring and sometimes even hereditary!

(α) The four color disease (β) The Hamilton disease – A "game" which involves tracing a spanning cycle on the 1-skeleton of a dodecahedron. Graphs having a spanning cycle are called hamiltonian; eg. Every tournament (?) has a spanning directed path. (γ) The reconstructing disease (Kelly's conjecture; Kelly P.J. a student of Ulam) disease apparently originating in Warsaw; viz. Let G & H be graphs with $p \geq 3$ points u_i & v_i resply. If for each i, the two subgraphs $G - u_i$ and $H - v_i$ are isomorphic, then G & H are themselves isomorphic – Ph: Ulam's conjecture is true for trees

(b) The expanding unicurse by Blanche Descartes – Article merely consisting of a poem given as an after-dinner speech:

* Several techniques fail sometimes for small values of n. In particular they are of no help in proving the complete graph conjecture $\left[\gamma(K_n) = I(n) \text{ if } n \geq 3\right]$ if $n = 8, 9, 11, 13, 18, 20$ or 23. The first four cases were solved by ad hoc methods. We were thinking of using a computer on the last three when we heard from Jean Mayer, Professor of French Literature at Montpellier. ~~He had~~ During 1967 he had proved the conjecture for all $n \leq 23$. Thus the Heawood conjecture was finally confirmed.

Some citizens of Konigsberg
Were walking on the strand
Beside the river Pregel
With its seven bridges spanned

"O Euler, come and and walk with us"
Those burghers did beseech
"We will roam the seven bridges o'er
And pass but once by each"

"It can't be done" thus Euler cried
"Here comes the Q.E.D
Your islands are but vertices
And four have odd degree"

From Konigsberg to König's book
So runs the graphic tale
And still it grows more colorful
In Michigan and Yale.

(c) Remarks on Heawood's conjecture by Ringel & Youngs.*

(d) Indifference graphs by F. S. Roberts - The adjective motivated by the theory of preference and indifference in economics and psychology.

(e) pp. 189 – 329 is given a Key-word indexed bibliography on graph theory ~~by James~~ compiled by James Turner of Stanford Research Institute, Menlo Park, California. – a comprehensive up to date bibliography of the highest value for workers in the subject – In the introductory remarks "The virtual explosion of papers being written on the subject of graph theory and its applications has made it increasingly important to have up-dated bibliographies in the subject . . . . From February 1967 up to July 1968, a period of approximately one and a half years, more than 500 new papers have been uncovered" – also an appendix of 80 ~~Hebrew~~ words most commonly used in graph theory.

On back cover, advertisement of a book on "Graph Theory and Theoretical Physics" (~~AA~~ a NATO advanced study Institute Publn) edited by F. Harary (Academic Press, 1967) – Topics useful to theoretical physicists & electrical engineers & crystallography & organic chemistry – Some interesting

and Appendix B (both from Lewis Carrol) – Answers to problems –

Bibliography.

p. 238. Example of a valid argument with a false conclusion

Every man is immortal (*

Socrates is a man

Therefore Socrates is immortal (Note * is wrong)

Ex. of an invalid argument with a true conclusion

Every dog is mortal

Every animal is mortal

Therefore every dog is an animal

Lots of interesting things to read!

(6) The Theory of Numbers by Neal H. McCoy (Smith College) – Elementary book designed as a text for a one-semestre introductory course at undergraduate level:

Chapts :- Divisors and prime nos – Fundamental properties of Congruences – Polynomial Congruences and primitive roots – Quadratic residues (p. 89 – gives law of quadratic reciprocity due to Gauss: If p & q are distinct odd primes, then $(p/q)(q/p) = (-1)^{[(p-1)/2]\cdot[(q-1)/2]}$ – Continued fractions.

✓ || – Good as model for writing a text book

(7) Topology for Analysis by Albert Wilansky (Ginn & Co: A Xerox Co. College Div 1970)

(8) Number Theory and Analysis – A collection of papers in honor of Edmund Landau (1877–1938)

Edited by Paul Turán – Plenum Press N.Y – Web Deutscher Verlag der ~~Wiss~~ Wissenschaften. Berlin, 1969.

– with a portrait of Landau – Articles by Bombieri & Davenport; Bredihin, Linnik & ~~Tsu~~ Tschudakoff; J. G. van der Corput; H. Davenport and E. Landau; M. Deuring; P. Erdös, A. Sárközi & Szemeredi; H. Heilbronn; E. Hlawka; A. E. Ingham; V. Jarnik; S. Knapowski & P. Turán; J. Kubilius; J. E. Littlewood ~~(2 articles)~~; L. J. Mordell (2 articles); [See (44)'

headings are: Graph theory & Crystal physics; Graph theory applied to electrical network; Graphs & matrices.

(3) Differential systems, quantum systems and prediction by N. Wiener, Armand Siegel, Bayard Rankin & W. T. Martin [M.I.T. Press, 1966]

(a) Introduction (b) Brownian motion (c) Integration in differential space (d) Matrix factorisation & prediction (5) Differential-space theory of quantum systems (~~Neumann~~ Ref. to hidden variables & V. Neumann's theorem on same)

pp. 151-54 – An interesting historical analogy (Comparing old conflict between connection of statistical mechanics & Thermodynamics)

(4) A survey of binary systems by R. Hubert Bruck – Ergebnisse, New Series, Bd. 20, Springer-Verlag, 1966

(5) Topics in the theory of lifting by A. I. Tulcea & C. I. Tulsea – Ergebnisse Bd. 48 (Lifting is a mapping on algebra A into A ($\subset M^\infty$) if some axioms are satisfied) – Too very complicated notions.

(6) Commutation properties of Hilbert space operators & related topics by C. B. Putnam – Ergebnisse, Bd. 36. ~~Devoted~~

(a) Commutators of bounded operators (b) Commutators & spectral theory (c) Semi-normal operators (d) Commutation relations in quantum mechanics (e) Wave operators and unitary equivalence of self-adjoint operators (f) Laurent & Toeplitz operators, singular integral operators and Jacobi matrices ~~Ger~~ ~~Huge~~

Huge bibliography.

(7) Lecture notes in Mathematics – 144 – Seminar on differential equations and Dynamical systems – II – Springer Verlag, N.Y. 1970

(p. 22 – article by N. P. Bhatia)

A short article (last one) on the period of periodic solutions and charged particles in magnetic fields.

(8) Stochastic tools in Turbulence by J. L. Lumley – Vol. 12 of Applied Maths & Mechanics – Acad. Press, 1970.

(9) McGraw-Hill Encyclopaedia of Science & Technology – Vol 11 – Saw the

[* Gödel's incompleteness theorem - If the theory is valid, it is not complete] Correct

Decidable theories - axiomatisation of Predicate logic - Validity of the axiomatization - the Deduction theorem - the consistency theorem - the adequacy theorem & Compactness theorem - Predicate logic with Identity - The Löwenheim Skolem theorem - Categoricity - Gentzen's natural inference - Second formulation - the Adequacy theorem - the Herbrand Gentzen theorem - Craig's theorem - Diagonal arguments and the paradoxes - Gödel numbers (!) - Expressibility and Tarski Tarski's theorem - Gödel's incompleteness theorem - Decidability and Church's theorem - the unprovability of consistency - Bibliography - Index of names - Index of terms.

Quite an advanced & modern book with exercises interspersed:

Exx: p.29. (@) Any algebra of subsets of a set is a Boolean algebra.

p.51 Consistency theorem - A set of formulas is deductively consistent iff it has a model.

p.56 Adequacy theorem - If P is any set of formulas and q is in any formula then $P \vdash q$ iff $P \models q$

" Compactness theorem - A set P has a model iff every finite subset has a model.

p.73 - Adequacy theorem - For every sequent S, S is a theorem iff S is valid

p.77 - Craig's theorem: Let p & q be formulas such that $p \models q$. Then $p \vdash m$ and $m \models q$ for some formula m which contains only those relation symbols that occur in both p & q. [p.88 - Church's theorem - The set of all valid formulas of the predicate logic is not decidable] *

(5) A profile of mathematical Logic by Howard DeLong - Addison Wesley 1970 - also

Quite a different approach from that of (4), more historical, more elementary, ~~both~~ ~~second one~~ giving modern approaches as in (4)

Chaps: - Historical background of mathematical logic - Period of transition - Mathematical Logic - The metatheory of mathematical logic - Philosophical implications of mathematical logic - Epilog - Appendix A

[see (46)']

article on Raman Effect, found a lot of information about lasers & Raman effect - Also the remark on p. 356: " within a few months of Raman's & Krishnan's first announcement of their discovery, the Soviet physicists G. Landsberg and L. Mandelstam communicated their independent discovery of the existence of the effect in crystals. In Soviet literature the phenomenon is referred to as combination scattering and not Raman effect.

(10) Calculus & Linear Algebra - Vol I. by Kaplan & Lewis - John Wiley (Elementary book)

11/6/71 New Books Section

(1) Applied Diff. Eqns by Murray. R. Spiegel - 2nd Edn - Prentice Hall, 1967

(2) Mathematics applied to Physics with contributions from several people. - Springer-Verlag, & UNESCO, Paris, 1970 - Ten chapters written by people in 7 different countries - To be used by Univ. students and Professors of Physics for brushing up or adding to their Knowledge, modernising their teaching or assisting them in their research.

Foreword by Elie Roubine — Today Chemistry uses algebraic topology, coding techniques the Galois fields — Written by distinguished specialist - Thanks to Unesco Secretariat.

(a) Functions of complex variables by P. Sommer - Contains worked examples which maybe useful for examination work

(b) Theory of distributions by E. M. de Jager

(c) Exterior differential forms by G. A. Deschamps. - all kinds of useful things

(d) ordinary Diff. Eqns by A. N. Tikhonov & 2 others

(e) Partial Diff. Eqns by F. John - Specially interesting

(f) Integral Eqns also by F. John -

(g) Approximation numériques de la solution des problèmes d'équations aux dérivée partielles. by J. L. Lions.

(h) Optimisation by N. Moisseev et Tikhomirov

(i) Probability theory and its applications by D. J. A. Welsh

(j) Quantum mechanics by T. Yamanouchi - Mostly Graph theory, but quite elementary & interesting

14/6/71 New Books Section (48')

(1) Mathematics with understanding I by H. Fletcher & A. A. Howell (Commonwealth & International Library Series with Sir Robert Robinson O.M, F.R.S in the advisory Board – Math. Topics – General Editor C. Plumpton – Pergamon Press, 1970

– Elementary approach for primary schools using set theory – throughout set-theoretic language used – Some modern bunkum!

(2) A radical approach to Algebra by Mary Gray (The American Univ) – Addison-Wesley, 1970. – Chaps as follows:-

Rings & ideals – The classical radical (uses word "Hom" on p. 55) – Jacobian radical – other radical & radical properties – Generalisations to other systems – Lie and Jordan Algebras – Category theory – Radical subcategories – Applns to sheaf theory (?) to the study of rings – Selected Bibliography.

Mentions use of radical, a notion about which the book is organised – No prerequisites necessary to read Chaps 1–9. – Exercises (unworked) at end of each Chapter – Quite a nice book

(3) Basic mathematics for electronics – 3rd Edn – McGraw Hill – Quite an elementary book for schools & private study – only use of determinants, number systems & Boolean algebra used in 3rd Edn. [Boolean algebra in Chap. 37 is quite interesting as applied to electronics]

(4) Notes on Logic by Roger C. Lyndon – Prof. of Maths, Univ. of Michigan – Van Nostrand Math. Studies #6. (pp. 1–94) – Quite a small book, but very interesting and an up-to-date book – Chaps Topics (Not chapters) as follows:-

Preface – Intro – Program – Grammar – Terms – Formulae & sentences – Interpretation & Structure – Dependence & substitution – Semantic implication – Sentential logic – The algebra of propositions – Disjunctive form – Boolean algebra – Variants & semantic logic – Decidability & axiomatizability

[47']

(3) Mathematics for the physical Sciences by Laurent Schwartz — Hermann. Paris. (Gift of the French Govt to the Institute Library)

(a) Preliminary results in the integral calculus : Series & integrals (b) Elementary theory of distributions. (c) Convolution (d) Fourier Series (e) Fourier transform (f) Laplace transform (g) Wave & heat Conduction equations. (h) Gamma function (i) Bessel function.

— Very elementary with exercises at end of each chapter & this might be useful for examination work ✓

(4) Introduction to Abstract Algebra by C. R. J. Clapham (in the series Library of Mathematics edited by W. Ledermann — 22 books — London: Routledge & Kegal Paul Ltd, N.Y. Dover Publns, 1969) — A small book of 80 pages quite elementary dealing with (assuming knowledge of simple theory) integral domains (ordered & well-ordered), the integers, fields, rings, polynomials and Euclidean rings, Vector spaces, & field extensions (6 s. net — quite cheap).

✓ pp. 70 – 77 — Exercises on the several chapters. pp. 78 – 80 — Solutions to these || useful for exam. work

(5) New Math Puzzle Book by L. H. Longley-Cook — Van Nostrand Reinhold Co 1970.

Topics on Set theory, No. theory, Finite arithmetic, General number systems, Symmetry, Tessellation, Perspective, Topology and Probability — In all 10 chapters pp 1–164 — with exer solutions to the problems posed in each chapter — Good for Math. News Letter — Better than the other rotten book I borrowed the other day.

Chap. 2 — p. 25 — on binary & decimal systems.

Binary	Decimal
1	1
10	$1\times2+0=2$
11	$1\times2+1=3$
100	$1\times2\times2+0\times2+0=4$
101	$1\times2\times2+0\times2+1=5$
110	$1\times2\times2+1\times2+0=6$
111	$1\times2\times2+1\times2+1=7$

To convert a decimal number to the binary scale we divide successively

(49') — 2

~~100000~~

12845841 × 61
12845841
77075046
783596301

3721 × 3721
3721
7442
26047
10163
12845841 × 61
~~77075046~~

$61^5 \times 61$
61
366
3721

Sanaullah C/o Abdul Amir
Rly. Quarters
Yeswantpur

.7 . 14 x 41

59 x 25

1086
168
168
66 x 66

3.7.71
163 HRS
DELHI
BANGALORE

