

The Interpolation of Psi, Unit 1 - Michael Gregory, M231 (Farnham)

Once upon a time during Simpson's rule, Psi Hermite returned to his normal form after a black period. He lived with Gamma and Grandfather Tape in affine house called "Limagon" in Royal Road. Housekeeping operations gave Gamma the jitters, buckets and garbage were points to be rejected, but she would coset without limit her Poly, a parrot from the Kronecker Delta.

Psi recalled Carroll's words: "...the different branches of Arithmetic -Ambition, Distraction, Uglification and Derision", while eating his supper assembled from Napier's bones. He rejected an evening listening to Kreider playing Mendelson, and the Forsythe saga. There was no reply when the operator tried to get Wron Skian's number. Wron had a job debugging in the neighbourhood. Then Psi remembered arranging to meet Chris Toffel, whose true identity he questioned, but Chris was not in a conversational mode and only muttered: "Going trouble-shooting on the range."

"Forgetful functor", was Psi's comment.

So he decided to try 'Cayley - an Informal Evening of Singing and Dancing', a free function advertised in his local; errors from lapses in memory being common he had recorded the data on a paper tape. It was time to pick himself up by the bootstraps; so Psi put a sinh on his shoes and a patch on his union suit, and wearing a cocked hat he was ready to go.

GOTO 12 for the next installment.

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Math-Quotes No. 1 - Ron Davidson, M201, MDT241 (Southampton)

"He who distinctly and severally knows addition and the rest of the twenty logistics, and the eight determinations including measurement by shadow, is a Mathematician."

Brahma-Sphuta-Sidd'Hanta (born AD 598)

Note: By the twenty logistics Brahmagupta was referring to addition, subtraction, multiplication, division, square, square root, cube, cube root, six rules of reduction of fractions, rule of three terms (direct and inverse, whatever they are!!), of five terms, seven terms, nine terms, eleven terms and barter are Twenty arithmetical operations. Mixture, progression, plane figure, excavation, stack, saw, mound and shadow are eight determinations.

Brahmagupta's work contains some interesting and amusing work; the problems he solves are quite entertaining. For instance:

- Q.1: A person gives away a hundred and eight cows in three days; how many does he bestow in a year and a month?
- Q.2: A stack of bricks is seen, containing five layers, having two bricks at the top, and increasing by three in each layer. Tell the whole number of bricks.

Should anyone be able to work out the above little problems, then they can rest assured that, as far as Brahmagupta is concerned, they are indeed Mathematicians!! (Answers, according to Brahmagupta: 14040 cows and 40 bricks.)

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Odd note to fill a line - : 'Problem Corner No.1 0' overleaf should read 'No.1 1 ' (Now you see why pages aren't numbered!) [They are now - mostly (EK)]

PROBLEM CORNER No. 101. Dental Cavity - Tony Brooks, M231, A303 (Portsmouth)

This problem was originally posed by Mr. E. Rosentiel of King's College Hospital Dental School, London. Figure 1 (see attached sheet of diagrams) shows a filling aCcdbA for a dental cavity AECDfB, constructed as follows: BD and AC are concentric circular arcs with centre O. Radius of BD > radius of AC. AB is parallel to CD. The distance of AB from O is such that the filling will, upon counter-clockwise rotation, just clear its point d at B when a point ab has come up against A. In this position it is now just possible to remove the filling by a translation past B. We therefore have a filling that can be removed from a cavity although its largest horizontal diameter EF is larger than the aperture of the cavity, AB.

Problem: What is the maximum possible value of the ratio $R = EF/AB$?

I think this is an interesting problem for two reasons:

- 1) It arose in practical dental research and is not a pure academic exercise.
- 2) No more than A-level trig and calculus are required for its solution. Despite this, the problem is far from easy. It requires a great deal of thought to take the correct steps to the solution. The average person follows many dead ends.

2. Ladder against Outhouse - Alan Nicol, M251, MST282 (Southampton)

A ladder 30' long is placed against a wall so that it just touches an outhouse which is 10' high and 10' wide (see fig. 2 on sheet of diagrams). How far is the foot of the ladder from the bottom of the wall?

There are, of course, two possible answers. Several quartic equations are possible. Is there a simpler method, other than scale drawing?

3. Ladder against Box - (purloined from Stan Rosson at Keele 1973)

This is essentially the same as problem 2. Question: what is the height of the ladder from the ground? This time, the ladder just touches a 6' box, (fig. 3)

4. Variations on (3) (Stan Rosson commented that he had no solution 'after several years')

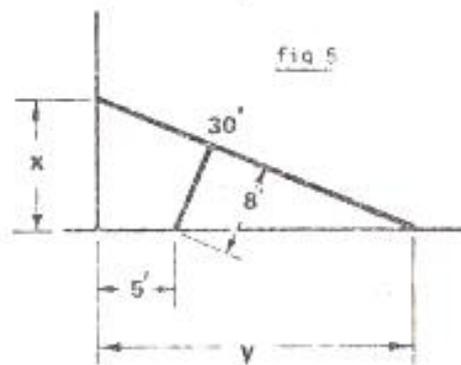
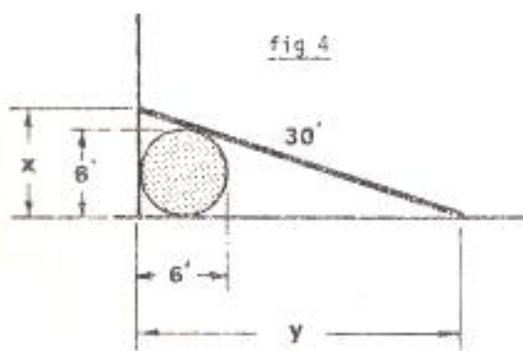
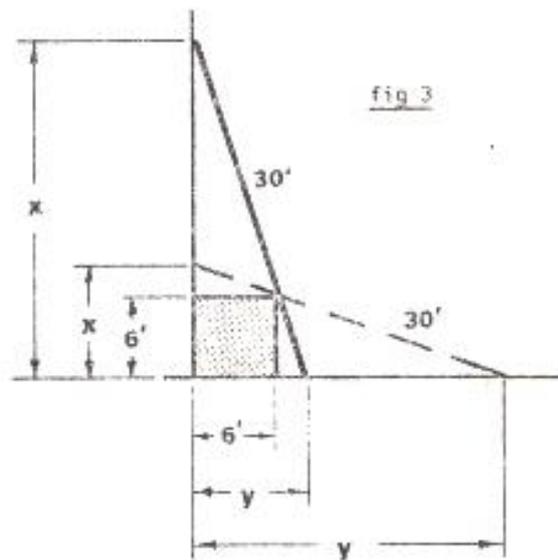
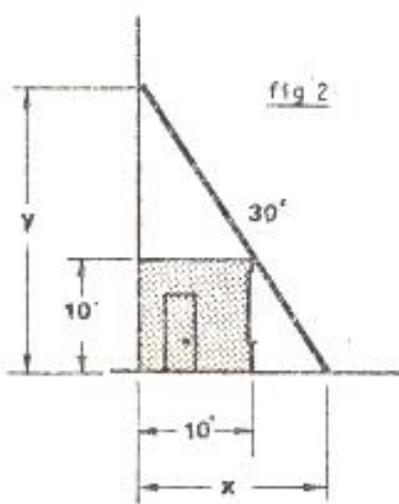
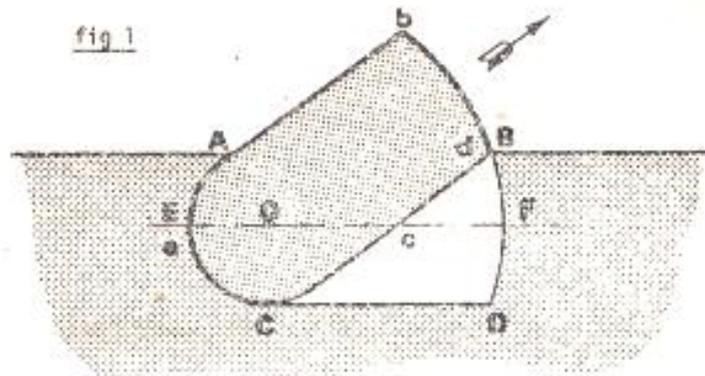
- a) There is an 8' strut at right angles to the ladder, with the base of the strut 5' from the projection of the ladder to the ground. Find the height of the ladder against the wall, (Fig.5).
- b) The ladder leans against a cylinder with diameter 6'. Find the height of the ladder against the wall, (fig.4).

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Acknowledgements: Grateful thanks to Mr. Lawrence Seaton, Course Tutor for Scientific Illustration at Southampton College of Art, for his drawings of the required drawings in this issue; more thanks to Mr. A.W.W. Hammond, Group Tutor (Origination) in the Department of Printing at ScoA, for advice and technical assistance in reproduction of the diagrams.

Anyone submitting any item for publication which involves diagrams, please supply the diagrams on a separate sheet of plain, white, unruled paper, using black ink or black biro, if possible.

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LETTERS - ON THE ABSENCE OF NORTHERN MOUTHS

John Brown - M231, M251, MDT 241 Burnley

As far as OU Maths is concerned, this is a very isolated part of the country, and last year I was only in contact with one other student on the same course. This year the OU has closed down my centre at Nelson and the one at Blackburn, and combined them in a new centre at Accrington which is halfway between the two old ones.

I started on M100 in Coventry and there were so many students that M100 was split into two groups. However, when I moved to Burnley I was very surprised how few there were.

I would have liked the OU to send out the course material for this year earlier than they did; they have known since the middle of last year the courses I am doing this year, irrespective of results, and I would like to have a few units in hand for any domestic difficulties (e.g. decorating, wife not well, etc.) arising this year.

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Annette Walsh - M231, M321, ST285, Darwen, Lancs

We are rather 'thin' in Lancashire, particularly for those doing 3rd level courses. My initial reaction on reading the first unit of all three of my courses is that I shall need all the help I can get, and am sure that MOUTHS will prove invaluable to me. Many thanks to the M321 Stop Press Organiser for bringing you to my attention.

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MORE LETTERS

(Dr.) Margaret Corbett - MDT241 (London)

The 'Dr.' Is the academically non-respectable type, due to a degree in medicine in 1953. I have been so bucked up by finding that I could pass OU maths courses that I have recently started practising again, after 15 years in which I did no clinical work at all.

My new work has had an unfortunate sequel in terms of OU maths courses, because I have to read up some of the advances in medicine made while I was not attending. I had intended doing M202, and was very much looking forward to what was clearly going to be a severe struggle. But now feel there isn't time to fit in a year for this, which would be frivolous since I don't need another full-credit at second level. I bought the set books in 1972, and am wondering if I can persuade someone somebody who is doing (or did last year) M202 to sell me a set of units and supplementaries in a condition reasonably free from annotations, when he or she is finished with them. I would be happy to agree such a purchase with somebody now, for this time next year or later, if necessary.

I found the bit by Bob Margolis on Hoops absolutely riveting. It makes me feel mad not to be doing M202 this year!

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Datta Gumaste - M231, MDT241 (Barnehurst)

Susan Major and others in similar circumstances (ref M500/9) may like to know that I found M202 most fascinating, exciting and beautiful. And it is not all that difficult.

Too much is said about M202 abstractions. The fact that something is abstract does not entail that it is difficult. All one needs to follow M202 is a little patience to look at the unfamiliar, to watch it carefully, to handle it gently, and soon the unfamiliar begins to tell its story. The course is extremely well-written with plenty of help.

As I see it, M202 is essentially concerned with how mathematicians go about playing the game of ideas which are simple, primitive and beautiful, and in doing so, how they manage to produce and prove lovely results, and to solve interesting problems.

Now what can be more concrete than this? So let us not be put off by the so-called abstractive. After all, music is highly abstract, but most of us seem to enjoy it. M202 is not very different from music. Indeed, I would argue that it is the music of morphisms!

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Eddie Kent - M231, MST282, SDT286 (Farnham)

For Bob Escolme (and anyone else who is interested) "Minds, Machines and Gödel" by J.R. Lucas, in Philosophy, vol. 36, 1961 is worth a glance. It is reprinted in "Minds and Machines" ed. A.R. Anderson, Prentice-Hall, 1964

If anyone wants read Gödel it is:

"Über Formal Unentscheidbare Sätze der Principia Mathematica und verwandter Systeme", pt. 1, Monatshefte für Mathematik und Physik, vol. XXXVIII 1931, pp173-189. I'm sure your local library would be delighted to get you a copy.

Still on the Gödel subject, I rather like Hilbert's 10th problem. In his own words:

"Given a Diophantine equation with any number of unknown quantities and with rational integral numerical coefficients: to devise a process according to which it can be determined by a finite number of operations whether the equation is solvable in rational integers,"

Of course, Gödel's main work was on the consistency of axiomatic systems, based on Hilbert's second problem, which is completely solved.

(A Diophantine is one that uses only integers. Fermat's Last Theorem of blessed memory is one.)

See: "Hilbert's Tenth Problem is Unsolvable", Martin Davis, American Mathematical Monthly, vol. 80 no. 3, pp 233-269 March 1973.

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SOLUTION TO CROSSNUMBER 2 (M500/10) - M.Gregory, E.Kent, M.Stubbs (and probably others yet to come - typing early on 19.2.74)

Rows across: 452248/881910/491492/102649/325472/324386

A(1) to A(36) are: 3,10,102,191,80,133,22,491,47,419,86,294,72,236,14,211,100,25

643,88,492,48,484,40,452,8,90,280,58,254,32,248,26,709,43,649

PROBLEM CORNER No.10 SOLUTION

Square root of Wonderful: $(22887)^2 = 523814769$ (A.Walsh, E.Kent, L.Barlow, M.Stubbs, M.Gregory, A.Froshaug...)

Roland Warburton - M251 (Watford)

An excellent little publication. Keep it up. I am a teacher of Maths and Computer Science. Hobby Photography. Age 'past caring'! Interested in all problems, hints, etc. and back numbers of maths mags or computer mags.

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David Francis - M231, M251, MDT241 (Llanelli)

I have organised a local self-help group for the past two years, and this year there is a regular meeting at my home every Tuesday evening. I welcome the opportunity to help in any way possible.

I am 64 years of age and was, until my retirement, Head of the Mathematics Department at a Comprehensive School. I took my degree of BSc with honours in Pure Mathematics in 1930, and am now doing another mathematics degree just for the fun of it. I shall be pleased to be of assistance to anyone (on past mathematics courses and MST281 as well as current courses.)

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Hugh McIntyre - M202 etc. (Port Glasgow)

With regard to the MOUTHS list: is it clear that the pen can, on occasion, be mightier than the phone? I for one am willing to correspond interminably on any mathematical topic under the sun, providing only that my correspondent knows just a little less than about the topic. The impossibility of ever establishing this shouldn't put anyone off.

M202 goes well, the second time round. Incidentally, students of that course should check Unit 2 and the supplementary material for TV2 when they will note that (Unit 2 p.22) the Unit calls the Cartesian Product, Z - whereas the TV commentary (and the programme) calls the domain of the function h , Z . This is most confusing until noticed. Last year I missed it.

In M500/9 Richard Ahrens asked if the phrase: "Let V be a vector space" always presages a discussion applying to all vector spaces. There are two ways to look at this (at least): First, as meaning "From the set of mathematical structures choose a vector space and call it V ", and second, as meaning: from the set of vector spaces choose one and call it V ". Looking at it superficially, the Axiom of Specification (Halmos, p.4) would force the first interpretation, though until now I must admit I've used the second. I come down on the side of it applying to all vector spaces.

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Raymonde Knowles - M231 (Royston)

I am at home during the day looking after a small baby, so anyone is quite welcome to ring me. However, at 25 $\frac{1}{2}$ p for 3 minutes and the difficulty of holding a mathematical discussion lasting less than 2 hours I would expect them, at the very least, to have shares in the GPO.

Re "Anon 2nd Level" (M500/10) - one important consideration has been omitted. The prior knowledge required for A100, D100, S100 could fairly be described as 'general', the sort of thing that most intelligent people acquire 'in passing' so to speak. This cannot be said for M100. This is not an argument for altering the credit ratings of the courses, but rather for providing a pre-M100 course for those feeling that they require it.

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Ed: We'll frighten M100 to death if we go on too much! I'm one of the surviving 19% with no previous mathematical background - nearly a drop-out at M100/2 and M100/13, but miraculously still at it 3 years later. Question: do any of the 19% get Distinctions at 2nd level? I do not!

Henry Jones - M100 (Knighton)

Richard Ahrens' contribution (M500/9) reinforced the faint suspicion I gained on reading M100/1 & 3, that compilers of the complex mathematical symbolism and processes favoured today have not eliminated all traces of past inadequacies of expression. His typical example has been such a bugbear as to create in me a preference for expressions specifying intervals of values in which limits of continuity and discontinuity are plainly set out. It is satisfying to invent one's own symbols, but mine still have imperfections.

My own pet doodle is to provide our lonely decimal point with a companion. In a system of notation employing the notion of position, identification of the basic unit digit is necessary. Except by inference, the insertion of a point between it and the succeeding digit does not wholly meet this requirement, and tends therefore to give rise to a vexing awkwardness in mathematical processes.

I suggest that it is correct, symbolically, to use two points, one to the right of the basic unit digit as at present, and another to the left. Thus, instead of writing 123.45, write 12.3.45. This does remove a difficulty (only a personal one, perhaps) associated with common logarithms, exponents and rounding off. The 'point' may possibly be appreciated a little by giving place numbers to the digits:

	+ + + +	- - - -	
Place	4 3 2 1 0 1 2 3 4		
Logarithm	1 2.3.4	=	2.0913
Logarithm	1 2 3.4	=	2.0913

In 'common' logarithms such as 3.0790, the second decimal point may perhaps be inferred because only the digits to the right of the existing point conform to basic rules. The two points system does look odd, but I suppose one could get accustomed to it.

In a more serious and controversial vein, why is it that authors of mathematical treatises continue to describe $\log_e x$ as the (i.e. the sole) natural logarithm, when there is an infinity of natural logarithmic expressions? Basing my arguments on a thesis developed some 27 years ago in the hope, some day, of taking my degree, I'd love to take issue on it regardless of the status of my opponent. Its fundamental theorem is:

$$x \cdot \frac{df(x)}{dx} = f(x) \cdot \frac{lf(x)}{lx} = \frac{le^{f(x)}}{lx}$$

where, using Leibniz notation, $\frac{lf(x)}{lx}$ is an expression which I call

'the logarithmic derivative of $f(x)$ at x ' and which is related to the Newtonian differentials by $\theta_x = \delta x/x$ and $\theta f(x) = \delta f(x)/f(x)$, θ_x and $\theta f(x)$ being my logarithmic differentials. My logarithmic derivative has all the properties of logarithms, complements the Newtonian derivative, has applications in most laws of physics, gives rise to several beautiful theorems, and simplifies many existing theorems in the integral calculus and in the theory of complex numbers. To my astonishment, it even simplifies 'error' theory, which is new to me.

Free copies of my thesis are available to anyone interested. I'm hopeful that someone will clear up one problem I have in defining the domain of x and $f(x)$ relative to $lf(x)/lx$. So far, I exclude $f(x) = 0$ and $x=0$, but recent experience of M100 suggests that I may be too conservative.

Incidentally, the l 's in $lf(x)/lx$ are meant to be the lower case letter l , not the number 1.

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There is no hoop with ten elements. Part 1 - R. Ahrens

Preliminary observations and terminology.

1. Hoops are never associative unless trivial (1 element).
This is SAQ1.
However we can write $x \circ y \circ x$ without brackets because
 $x \circ (y \circ x) = (x \circ y) \circ (x \circ x) = (x \circ y) \circ x$.
2. Every element of a hoop is a one-element subhoop so we will call a subhoop proper if it has more than one element (i.e. ≥ 3 elements - see Margolis) but is not the whole hoop.
3. If S is a subhoop of a hoop H then $o(S) \leq \frac{1}{3} o(H)$ (Margolis). This means that if it had 10 elements a proper subhoop of H would have order 3.
4. R. Margolis has observed that "multiplication" by an element is an automorphism of the hoop. Some notation will be useful later.

If $a \in H$ define $R_a : H \rightarrow H$ and $L_a : H \rightarrow H$

$$\text{by } R_a(x) = x \circ a \quad L_a(x) = a \circ x$$

That is R_a multiplies by a on the right and L_a multiplies by a on the left.

From 1 above we can say that these 2 automorphisms commute because

$$R_a(L_a(x)) = (a \circ x) \circ a$$

while

$$L_a(R_a(x)) = a \circ (x \circ a)$$

The inverse functions R_a^{-1} , L_a^{-1} are also automorphisms of course although we may not be able to describe them in terms of multiplications by an element.

R_a^{-1} and L_a^{-1} will also commute with each other and with R_a and L_a .

If these last remarks are not obvious remember that we are looking at some elements in a group - the automorphism group of H.

5. The intersection of 2 subhoops is a subhoop (SAQ 2).

Theorem 1. (Alex Wilkie)

If H is a hoop (finite) and S is a subhoop of order 3 then $O(H)$ is a multiple of 3.

Proof: (We imitate Lagrange's theorem and show that the right cosets of S are either disjoint or coincide. So that these cosets partition H into isomorphic subhoops of 3 elements each (see Margolis on cosets). We have not been able to extend Lagrange's theorem to arbitrary subhoops because Alex's proof of theorem 1. depends on knowing that there is only one hoop of 3 elements and in this hoop the product of 2 distinct elements is the third one.)

Let $S = \{s_1, s_2, s_3\}$ and consider 2 cosets

$S_x = \{s_1x, s_2x, s_3x\}$ and $S_y = \{s_1y, s_2y, s_3y\}$, $x \neq y$

(I have grown tired of the circle)

Suppose that S_x and S_y are not disjoint i.e. they have at least one common element. We must show that in this case they are identical. It will be enough to show that they have a second element in common because $o(S_x) \cap (S_y) \neq 2$ (see 5 above) - it must therefore be 3.

It does no harm to suppose $s_1x = s_2y$ — — (a)

$$\therefore s_3(s_1x) = s_3(s_2y)$$

$$(s_1s_2)(s_1x) = (s_3s_2)(s_3y)$$

$$s_1(s_2x) = s_1(s_3y)$$

$$s_2x = s_3y$$

$s_3 = s_1s_2$ used on left

side distributive law

on right

We have succeeded.

Each element of H certainly belongs to some coset ($y = s_1t$ for some $t \in H$ so $y \in St$ – we need H to be finite here so that

$$L_{S_1} \text{ one-to-one} \Rightarrow L_{S_1} \text{ is onto } H).$$

Hence H is partitioned and $o(H)$ is a multiple of 3.

Cor: Observation 3 and Theorem 1 imply that a hoop of order 10 has no proper subhoops.

Show that a hoop of order 6 has no proper subhoops. (SAQ 3)

In part 2 we will show how to get hoops from certain abelian groups and how to get abelian groups from some hoops.

LATIN SQUARES - Roger Claxton, M202 (Sevenoaks)

Martin Gardner's "New mathematical diversions from Scientific American" has a chapter about Latin Squares in it, which the hoops dialogue reminded me about. Apparently Euler asserted that there were no [Graeco-]Latin Squares of certain orders (including 10). This was disproved in 1959 by E.T. Parker, R.C. Bose and S.S. Shrilcharde and improved computing methods have led to several hundreds of order 10 squares being discovered. There is a good (American) bibliography in the book for those interested.

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MISPRINT OF THE MONTH

Nominations for this new award must be original discoveries, not already notified in official Stop Presses.

From Anon 2nd level (can Anons quote student number please???)

"Please read this before reading any other MDT241 material.

Mathematical methods required for the course are for the most part presented in the units, and we are assuming that you will be familiar with the following topics...

...If you feel need to brush up any of these, take an early look at Appendix 1, Review of Basic Mathematics, in the set book: 'General Statistics' by Haber and Runyon, where none of these topics are covered." (Ref: Guide to the Course, Statistics, pp.6,7)

How is that for vital information?

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[This page was originally printed upside-down, with the end cropped]

METRIC TIME AS IT AFFECTS THE OPEN UNIVERSITY - Marion Stubbs

As doubtless you will have read in the National Press, from midnight on April 6th 1974, the whole of Great Britain (excluding the Isle of Man and the Channel Islands) will be converting to Metric Time.

From that date there will be ten seconds to the minute, 10 minutes to the hour, 10 hours to the day, and so on, based on the unit day, where 1 (S.I.) day = 1 (Imperial) day, as follows:

10 millidays	= 1 centiday
10 centidays	= 1 deciday
10 deciday	= 1 day
10 days	= 1 decaday
10 decadays	= 1 hectoday
10 hectodays	= 1 kiloday

The fortnight and the weekend will be withdrawn by stages.

Since one week represents only 0.7 decadays, students who elect to study one OU unit per decaday (i.e. $4 \frac{1}{6}$ or 5 decadays of study per decaday, for the average student) rather than $1 \frac{3}{7}$ units per decaday will possibly find that they are unable to complete sufficient assignments for continuous assessment before the 1974 prescribed examination dates. It has been assumed that a few students will not wish to spend 6 kilodays (approx. 16.438 Imperial years) in obtaining a General Degree, so after considerable discussion, following guidelines laid down by Committee No. 574, Committee No. 549 at Walton Hall advises these students to conform to the national legislation, but, for the future, to apply to take 2.74 full credits per kiloday, thus completing their requirements in 2.19 kilodays (6 Imperial years) as before.

In order to assist students as much as possible, three courses are currently in urgent production, rated at 0.74, 0.74 and 0.52 Credits respectively. These are A4041 - The Influence of Celtic Mythology on 17th Century English Literature, D3068 - A History of the 1974 General Election and E4074 - Juvenile Delinquency in the Home. It is expected that these will be of considerable interest to the majority of students. In addition, during the conversion period, continuing students will be permitted to take 1974 examinations at the end of 0.365 kilodays or 1 kiloday, according to choice, and you will be asked to make your selection on form CEF/2, which will be issued with the Conditional Registration Form shortly.

Tutorials, when supplied at all, will last for one deciday; Summer Schools, where provided, will be extended to one decaday. The schedule of radio and TV programmes is being revised, and will be sent to you as soon as possible, when paper supplies permit.

Meanwhile, please note that full details of broadcasting schedules are printed in 'Playboy' and 'Good Housekeeping', and latest information is issued once each 0.7 decaday on Radio Open Forum.

Should you feel that personal difficulties are likely to arise despite these arrangements, please contact your Counsellor and show him this report.

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EDITORIAL

Hi. folks!

ITEMS FOR NO. 12 NEEDED NOW OR ASAP, PLEASE.

Enquiries for the sample still come in daily. We now have 175 paid-up subscribers, and about 200 more who have had the sample but not yet sent in the form. Please keep spreading the word, in particular [to councellors ?...]

PURE MECHANICS - from 'Anon 2nd Level' of No. 10 (M500 not Tedharold)

Flee - all is discovered!

Fellow MST282 students will know that the course text book 'Mechanics' is co-authored by one of the Maths Faculty. If they look at problem 4 on p.43 they will see that it is about ship A picking up ship B on its radar at a distance of 75km. Now I have played with many radars over a period of 20 years at sea, and I know that this could not be done. My parrot, who is good at sums, tells me this is something to do with the curvature of the earth, and it would be possible theoretically if you put your radar on top of a mast 1500 ft high. Shiver my timbers, that would be an odd ship.

What then is the dread secret behind the problem? Obviously there is an active coven of the Flat Earth Society operating at Walton Hall.

Flee - all is discovered!

Dorothy Craggs - M231, M321, A304

Many thanks for newsletters 9 and 10 - I'm hoping to get to work on my tutor (M231) and counsellor this weekend. I feel that M500 should provide very welcome contact with fellow students - for the last three years we've had a small but active self-help group at the Birkenhead centre, but now everyone else seems to have defected to either science or technology, so I'm feeling rather lonely.

Ref M202, I'm hoping that we will be given the opportunity of carrying our studies, particularly of the Algebra part of the course, somewhat further in later years. I could imagine that, if M500 can attract a reasonably large membership, our opinions might be of some value to the course planners.

CORRECTIONS TO M500/10 - Richard Ahrens

Erratum in Bob Margolis's article: it was not Alex Graham but Alec Wilkie who has proved the theorems about subhoops of order 3. Alec Wilkie is a research assistant at the Maths Faculty. I gave Bob the christian name and he mistakenly added the wrong surname. I hope we can avoid another affair of the Rolle's Theorem type. Alec Wilkie has proved several clever things about hoops.

Chris Rowley - a course assistant in the Faculty - also deserves some credit for supplying the essential bit of group theory in the first proof of the non-existence of a hoop of order 10.

GENERAL NOTE - this will not be printed again in 1974, but \forall M500

Opinions expressed in the M500 Newsletter are those of the authors, and do not necessarily represent the views of the editor or of the organisations (including the Open University) by which the authors are employed or to which they belong as members.