DOZENAL SOCIETY OF AMERICA
c/o Math Department
Nassau Community College
Garden City, LI, NY 11530

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THE DUODECIMAL BULLETIN 53;

DSA MEMBERS HONORED.....See page 19;

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THE DOZENAL SOCIETY OF AMERICA

(Formerly: The Duodecimal Society of America)

is a voluntary, nonprofit, educational corporation, organized for the conduct of research and education of the public in the use of base twelve in numeration, mathematics, weights and measures, and other branches of pure and applied science.

Membership dues are $12.00 (US) for one calendar year. Student membership is $3.00 per year, and a Life membership is $144.00 (US).

The Duodecimal Bulletin is an official publication of the DOZENAL SOCIETY OF AMERICA, Inc., c/o Math Department, Nassau Community College, Garden City, LI, NY 11530.

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The DSA does NOT endorse any particular symbols for the digits ten and eleven. For uniformity in publications we use the asterisk (*) for ten and the octothorpe (#) for eleven. Years ago, as you can see from our seal, we used χ and ℰ. Both * and χ are pronounced "dek". The symbols # and ℰ are pronounced "el".

When it is not clear from the context whether a numeral is a decimal or a dozenal, we use a period as a unit point for base ten and the semi-colon, or Humphrey point, as a unit point for base twelve.
Thus ½ = 0.5 = 0;6.

THE DUODECIMAL BULLETIN

Whole Number Five Dozen Three

Volume 2#; Number 1;

Winter 1196;

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Patricia McCormick Zirkel, *Editor*
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6 Brancatelli Court
West Islip, New York 11795

DOZENAL SOCIETY OF AMERICA

MINUTES OF THE ANNUAL MEETING - 1195;

Saturday, October 12, 1985
Nassau Community College
Garden City, NY 11530

Administrative Tower, Twelfth Floor

I. BUSINESS MEETING

(1) The meeting was called to order at 10:20 by Alice Berridge after the members and guests had an opportunity to become acquainted over coffee and donuts.

(2) The following people were present:

Members:
Walter Berkmann
Alice Berridge
Anthony Catania
Victor Gany
Dudley George
John Impagliazzo
Kennett Love
James Malone
Fred Newhall
Angelo Scordato
Gene Zirkel
Patricia Zirkel

Guest:
Mary Newhall

Moved by Gene Zirkel that the minutes of the last meeting as published in the Bulletin be accepted. Seconded by Anthony Catania.

(3) President's Report: Prof. Gene Zirkel
This meeting was the 35;th Annual Meeting, and next year will be a milestone, the 36;th Annual Meeting.

Our mailing list has grown to just over 1 gross, and we

1985 ANNUAL MEETING, Continued

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have had 6 dozen requests for the Excursion in the past year.

Special thanks were extended to Alice Berridge and Tony Catania for their work on the Annual Meeting; and to Pat Zirkel and Fred Newhall for their continued assistance throughout the year.

The DSA Archives are to be moved within Nassau Community College from Building M to Building V, top floor, sometime around January 1. (This move has since been postponed. -Ed) John Impagliazzo suggested that an inventory be taken to determine which Bulletins need reprinting and to estimate the value of our capital equipment. Fred Newhall volunteered to take the inventory.

Dr. Paul Rapoport of Canada has designed a Dozenal Digital Clock and can build one for our use for $100. Walter Berkmann moved we buy; Jim Malone seconded the motion. Voted Unanimously. It was suggested that the clock be rotated among the members for publicity purposes.

We have received from Arthur Whillock in England a number of copies of the booklet TGM by Tom Pendlebury, an Honorary Member of the DSA. A few last minute errors will be covered by an errata sheet to be distributed later. Copies of TGM are available to Society Members. Write to us if you should want one.

In this regard a reviewer is needed so that TGM may be adequately covered in our Bulletin. Another book, The Seven Day Circle by Eviatar Zerubavel, which concerns time cycles in everyday life, should also be reviewed.

Anyone interested in reviewing one of these for the Bulletin, or in being a reviewer in general, should contact the editor.

The Colson News, a bulletin from England concerning J. Halcro Johnston's idea of negative digits, will

Continued...

accept an article from the DSA in exchange for one of their articles being printed in our Bulletin. There is need for someone to write said article.

A question arose concerning postage costs. Dr. Igor Valevsky requested literature for a meeting in Brazil at which he intended to make a presentation. The material was needed quickly, and the resultant postage cost the DSA $50. The members agreed, however, that in spite of this high cost, the educational purposes of our society warrant such an expense.

A question as to whether our Annual Meeting should continue to be held during National Metric Week arose, since some members have previous commitments. After some disucssion Alice Berridge moved that the next Annual Meeting be held on the 10th and 11th October 1986; Pat Zirkel seconded. All were in favor. A suggestion was made that we continue to publicize our meeting as coinciding with National Metric Week.

Gene ended by noting that contributions to the DSA are tax deductible.

(4) Treasurer's Report: Prof. James Malone
Liquid assets from 10/13/84 to 10/12/85 were $3,021.71 with expenses of $2,688.91. Revenue from investments will total approximately $1500.00, as expected. A full treasurer's report was submitted.

Approximately $300 (US) was disbursed to the DSGB to pay for their Journal and copies of TGM. The DSA will continue to support the DSGB in this manner.

The question of the value of our capital and equipment, including our stock of previous Bulletins, was again raised in light of a suggestion that our archives be insured. It was pointed out that there are two archival collections: an assemblage of our limited edition books is in the possession of the Nassau Community College Library, and is available for interlibrary loan and scholarly research. This collection is in fact

owned by the College. The second archival collection includes books, papers and back issues of our Bulletin. This is the collection which will be inventoried by Fred Newhall.

Suggestions were made concerning either microfilming or xeroxing and binding some of the rare material in this (second) collection, and John Impagliazzo volunteered to ascertain the cost of xeroxing and binding out-of-print issues of our Bulletin. The issue of xeroxing archival material was referred to the Financial Committee.

James Malone suggested that some of our rare material should be kept in a fireproof file. The cost of such a file is to be ascertained pursuant to final word on the value of our collection, to be determined after the aforementioned inventory.

Continued...

During a recent trip to England, Dudley George received copies of Tom Pendlebury's TGM: A Coherent Dozenal Metrology from Arthur Whillock of the DSGB. Here Dudley passes the booklets along to Gene Zirkel for distribution to DSA members.

Concerning the financial report which had been distributed, a suggestion was made that the maturity date of the Society's Certificate of Deposit and the date of the end of our fiscal year should coincide so that interest on the CD may be conveniently reported. John Impagliazzo moved that the DSA fiscal year end on September 30. This was seconded by Gene Zirkel and passed.

Also moved by John Impagliazzo that the financial report be accepted (with correction to the date of same). Seconded by Pat Zirkel and passed.

(5) Editor's Report: Patricia Zirkel
Although membership is up and readership is up, the cost of publishing the Bulletin remains the same.

Articles are now reviewed by two persons each, and the reviewing staff is 4 members, but more reviewers are needed. Thanks were extended to our current reviewers: Tony Catania, Kay McKiernan, Fred Newhall and Gene Zirkel.

We have a backlog of articles to be printed, so there is time to return some for revision, and some may be rejected -- all in the interests of improving the quality of the publication.

The Financial Committee approved the rates for ads at $37.50 for a full page, $19.75 for a half page and $10.50 for a quarter page (non-profit rates). Ads should be in good taste and consistent with the aims of the Society.

Circulation is 144 plus requests for 72 additional per year.

A question was raised concerning the format of the front cover of the Bulletin. After discussion it was decided that continuity of design at this point outweighs other aesthetic considerations, and the Bulletin cover format will remain unchanged.

(6) Annual Meeting Committee: Anthony Catania
(The organizers of the 1985 Annual Meeting -- Alice Berridge and Tony Catania -- were congratulated on the success of their efforts.)

An announcement was made to the effect that the afternoon's presentations were to be videotaped toward the eventual end of their use as educational resources.

Suggestions as to further videotaping were solicited.

(See pages 1* to 1# herein, concerning the afternoon's events.)

Continued on page 16; . . .

On Friday 11 October 1985, DSA members and guests preceded the Annual Meeting with an evening of entertainment. Participants attended the play "Two by Two", a tale of Noah's Ark with music by Richard Rogers; and then gathered at the home of Tony and Annette Catania for cocktails and conviviality. Shown at the party are Gene Zirkel, Tony, and Fred and Mary Newhall.

*

STRANGE BASES, PART III

Gene Zirkel
Nassau Community College
Garden City, LI, NY

In Parts I and II of this article we considered negative integers and the rational fractions as possible bases of a positional number system. Now, in this final part, we consider the irrational and imaginary numbers as candidates for a base.

3.1 Algebraic Irrational Numbers.

$\sqrt{2}$ can be used as a base. If we use the digits 0 and 1, then a number expressed in the usual binary notation as abc.de will become a0b0c.0d0e.

In general, the base $\sqrt{n}$ and the base n are related in this way. Thus $132_{seven} = 10302_{\sqrt{7}}$.

Algorithms could be devised such as: when adding, carry not to the first column to your left, but to the second column to the left, etc.

For example, in base seven we have 5 + 3 = 11, so when we add 15 + 13, we carry a 1 to the left:

$$\begin{array}{r} 15 \\ +13 \\ \hline 31 \end{array}$$ (or 10 + * = 1*;)

Similarly, in base radical seven we carry to the *second* column to the left:

$$\begin{array}{r} 50 \\ +30 \\ \hline 1010 \end{array}$$ (or $5\sqrt{7} + 3\sqrt{7} = 7\sqrt{7} + \sqrt{7}$)

It is easy to see that any number which is an integral root of an integer can be used as a base. If, for example, we try the cube root of 7, then

$abc.d_{seven} = a00b00c.00d$ in this new base

What about other algebraic numbers which are not the integral roots of some integer? Can they be used as a base? As an example, suppose we were to try $\sqrt{2}+1$. Since $\sqrt{2}+1 < 3$, we might try the digits 0, 1, and 2. Then

$$\begin{aligned} 1 &= 1 \\ 11 &= (\sqrt{2}+1) + 1 = \sqrt{2}+2 \\ 101 &= (\sqrt{2}+1)^2 + 0 + 1 = 4+2\sqrt{2} \end{aligned}$$

Can we express 3 in this base? Yes! 3 = 10.11 exactly. And that means that 4 = 11.11, and 5 = 12.11.

6 turns out to be equal to 21.01, hence 7 = 22.01. But, even if it turns out that all the integers can be expressed in such a base (a minimal requirement, to say the least), an important question remains. Are there simple algorithms available for arithmetic? For example, what rule will tell us that

10.11 + 11.11 = 22.01 (or 3 + 4 = 7)?

The algebaric numbers which are not the integral roots of an integer do not seem to be likely candidates for a base. (Learning a lesson from Part II, it should be clear that one could also use the integral roots of unit fractions by simply reversing the notation as we did there.)

3.2 Transcendental Bases.

What about the remainder of the real numbers, the transcendental numbers? For example, is pi (approximately 3;18) a useful base? In such a base 457 would equal

$$4(pi)^2 + 5(pi) + 7$$

Other than the digits we were using, no other integers could be expressed simply. Therefore, it appears that the only useful class of real numbers which can serve as bases are the integral roots of either the integers or of the unit fractions (which latter we have seen become the reverse of the former).

Continued...

3.3 Imaginary Bases.

And now we come to consider imaginary numbers as possible bases. The imaginary numbers are numbers of the form a + bi where b is not equal to zero and i is defined as the imaginary unit, $\sqrt{-1}$. (If b = 0 then these are simply the real numbers which we have discussed above. These real and imaginary numbers taken together are known as the complex numbers.)

Let us first review a few simple facts about the arithmetic of imaginary numbers. We recall that since $i = \sqrt{-1}$, it follows that

$$i^2 = -1$$
$$i^3 = -i, \text{ and}$$
$$i^4 = +1$$

Addition and subtraction of two imaginary numbers follow the simple (and obvious) rules illustrated below.

```
  3+4i          3+4i
+ 7+2i        -(7+2i)
 10+6i         -4+2i
```

Multiplication is performed as follows:

```
    3+4i
  x 7+2i
   6i+8i²
 19+24i
19+26i+8i² = 19 + 26i + 8(-1) = 11 + 26i
```

Division is performed by using the conjugate of the divisor, where the conjugate of a+bi is found by changing the sign of the imaginary term. Thus the conjugate of a+bi is a-bi. For example 3+4i and 3-4i are conjugates, as are -2-5i and -2 +5i.

Are your dues paid? Why not mail that check today?

To divide 11 + 2*i by 3+4i we write the fraction

$$\frac{11+2*i}{3+4i}$$

and then mutilply it by one in the form of

$$\frac{3-4i}{3-4i}.$$

$$\frac{11+2*i}{3+4i} \times \frac{3-4i}{3-4i} = \frac{33 + 86i - 44i - \#4i^2}{9 + 10i - 10i - 14i^2}$$

$$= \frac{33 + 42i - \#4(-1)}{9 - 14(-1)}$$

$$= \frac{127 + 42i}{21}$$

$$= 7 + 2i$$ (Which is the answer we would expect, considering the example above, illustrating multiplication.)

Now back to our question: Can imaginary numbers serve as bases?

If we try the number i itself, the answer is yes, since it is the integral root of an integer. An example of such a number would be:

$$1111 = 1(i)^3 + 1(i)^2 + 1(i) + 1$$
$$= -i + (-1) + i + 1$$
$$= 0!$$

The following numbers are also equal to zero:

$$101 = -1 + 0 + 1$$
$$1010 = -i + 0 + i + 0, \text{ and}$$
$$10.1 = i + 0 + 1/i = i + 0 + -i$$

The base 2i along with the digits 0, 1, 2, and 3 is known

Continued...

as the "quarter imaginary" number system. (See Seminumerical Algorithms by Donald E Knuth, Addison-Wesley Publishing Company, page 171.) The system is similar to the quarternary number system, and every complex number, either real or imaginary can be represented in this system. The first dozen integers are

1, 2, 3, 10300, 10301, 10302, 10303,
10200, 10201, 10202, 10203, and 10100.

They can be added by use of an algorithm similar to the one we used for negative integers, such as

```
   10301
 + 10301
[ -1    ]  <--carry
   10202   (or 5 + 5 = *)
```

The algorithm is similar to those we have seen before: If a sum exceeds 4, carry -1 TWO columns to the left. Notice that a leading -1 = 1' = 103. Thus multiplying (and adding) we have:

```
     121
   x  31
     121
[ 1'     ]   <-- carry from multiplying by 3
+  323
[ 1'     ]   <-- carry from adding
  1'2311 = 1 032 311
(or (-3+4i) x (1+6i) = -23 - 12i)
```

Another possible base is $\sqrt{2}i$ using the digits 0 and 1, but it requires an infinite, non-repeating expansion for the imaginary unit, i.

A further suggestion is (i-1) with the digits 0 and 1. (See Walter F Penney's article in the Journal of the Association for Computing Machinery, volume 12, 1965, pages 247-248.)

Remember - your gift to the DSA is tax deductible.

Note that all these numbers are the integral roots of integers:

$(2i)^4 = 14$
$(\sqrt{2}i)^4 = 4$, and
$(i-1)^8 = 14$

3.4 Conclusion.

In the above we have tried to broaden our vision by not limiting the base of a positional number system to the usual values of 2, 3, 4, ...

J. Halcro Johnston in his book, The Reverse Notation, tried to broaden our view by expanding the digits we could use to include the negative digits. Why stop now? How about other digits? Could we make use of fractional digits? Could every number be expressed dozenally with digits representing -6;6, -5;6, -4;6, -3;6, -2;6, -1;6, -0;6, 0;6, 1;6, 2;6, 3;6, 4;6, 5;6, and 6;6?

Maybe you would like to try an easier question first. Try base 3 using the four digits

a = 1/2
a' = -1/2
b = 3/2
b' = -3/2

We note that in this system:
aa = 0;6(3) + 0;6 = 2
aa' = 0;6(3) - 0;6 = 1, and
ab' = 0;6(3) - 1;6 = 0.

What about the mathematical constants, pi and e? They are universally accepted as numbers, and are used almost as digits now. Could they be included in a number system?

The most important idea that all this leads to is: WHAT QUESTIONS SHOULD WE BE ASKING OURSELVES? Let us not take

Continued on page 15;...

DUODECIMAL LOGARITHMS

Eugene Scifres
Denver, Colorado

A few days ago I thought of the Duodecimal Logarithms which I hand calculated over three dozen years ago. It was interesting to program the same thing on my new OTRONA Portable computer. In my original calculation I did all the work longhand using Taylor's Series to calculate the Logarithms. After expanding the Natural Logs of a few simple ratios between 1 and 2 to about a dozen fractional places, I then used this formula to get the Natural Logarithm of a dozen:

$$\ln 10 = 4*\ln(3/2) + 3*\ln(4/3)$$

Then I found the Modulus of Common Logarithms by dividing 1 by ln 10. Using this Modulus as a starting factor in the Taylor Series for Common Logarithms, it was quite easy to find the Common Logs of various fractions. By selecting various numbers, multiplying and dividing numbers, adding and subtracting Logarithms, and doing some interpolation when it seemed safe to do so, I constructed a four place table of Common Logs.

It was after this that I wrote to F. Emerson Andrews in care of Mechanics Illustrated which had published his article "Further Adventures in Counting" in Feb. 1944. Andy's reply to this letter told me that George Terry had a book, DUODECIMAL ARITHMETIC, which contained Trig functions, Logs, and other information. Also he told me of the soon-to-be-formed Duodecimal Society and invited me to join with them.

My present effort is somewhat different because my machine is better adapted to doing Decimal Arithmetic. Here is how it goes. I set up a loop that would find the Natural Log of each integer from One Gross to one Great Gross. From each of these I subtracted the Natural Log of One Gross. These numbers are the Natural Logs covering the range of Numbers 1 to a Dozen. I now scaled these by dividing by ln(Dozen) so the numbers now run from 0 to 1. However, they are still in Decimal.

Another little loop multiplies each of these fractions by a

DUODECIMAL LOGARITHMS, Continued

dozen and uses the integer portion to select a Dozenal Digit which is placed in a one character string. Then the integer is subtracted, the remaining fractional part is again multiplied by a dozen, the next digit saved, etc. until the desired number of Dozenal digits are obtained. The last one has a half added before the integer is converted so as to round to the nearest whole number. The successive one character strings are printed together to represent the Dozenal number because, of course, the computer doesn't recognize a

mixture of numerals and letters as a number. It took a couple of hours to program and test this calculation, and then it took only five minutes to run. And my manual effort many years ago required all my spare time for about three months!

In checking my results against the published table in The Manual of the Dozen System, I found a typographical error in the book. It gives Log 2.12 as 0.35E03, and it should be 0.36E03.

The December '85 issue of the Mathematics Teacher contained a question which might interest our readers:

"Do the values of six dozen dozen and a half dozen dozen differ?"

STRANGE BASES III, Continued from page 13;

too much for granted. If we did that we would still believe that the awkward dek was a reasonable base for counting and measuring. Having taken the first step, let us continue to try to find other possibilities. For more ideas read the references given above. For more questions, consider: must the set of digits be limited to a finite set? Should the number xyz be limited to only mean $xb^2 + yb + z$?

1985 ANNUAL MEETING, Continued from page 9:

(7) Financial Committee: Dr. Angelo Scordato - The Society's CD was transferred to Goldome for better monthly interest. Three names were added to the CD.

It was decided that copies of our Excursion continue to be distributed at no charge even for bulk requests. This is to be made known in the Bulletin.

Six Bulletins are out of print but would cost $400 per reprint. A proposal to reprint was tabled until an inventory is completed.

DSA Dues are: $1 gross for Life Membership, $1 dozen Regular and $3 for Student Membership (Same overseas, but all funds are US$.)

Patricia Zirkel suggested that should we have surplus funds we spend some money on public advertising. A suggestion was made as to buying a video camera of our own.

(8) Nominating Committee: Alice Berridge, Anthony Catania & Bob Foley

The Class of 1985 was nominated to continue as the Class of 1988: Carmine DeSanto, Dr. Anton Glaser, Dr. Angelo Scordato and Patricia McCormick Zirkel. These were elected unanimously.

The Nominating Committee for 1985-86 is:

Anthony Catania, Chair
Alice Berridge
Dr. Angelo Scordato

So elected.

The General Meeting was then adjourned, and a Board of of Directors meeting convened immediately.

The repeating decimal .333... in base ten arithmetic represents the fraction 1/3. What fraction does it represent in base twelve arithmetic?

1985 ANNUAL MEETING, Continued

II. BOARD OF DIRECTORS MEETING

12 October 1985

(1) Chairman of the Board, Dr. Angelo Scordato, called the meeting to order at 12:12 P.M. in the Administrative Tower of Nassau Community College, Garden City, New York. He thanked the many members who had helped to make the Society so successful this year.

(2) The slate of officers submitted for the coming year is as follows:

Chairman of the Board:	Dr. John Impagliazzo
President:	Gene Zirkel
Vice President:	Patricia Zirkel
Secretary:	Fred Newhall
Treasurer:	James Malone

There were no further nominations; moved that the nominations be closed; seconded and elected unanimously.

(3) The new Chairman of the Board, Dr. John Impagliazzo, thanked all those present for their continued interest in the Society.

Continued...

Outgoing Chairman Dr. Tony Scordato congratulates Dr. John Impagliazzo, Chairman of the Board for 1986.

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(4) Committees and appointments for the coming year are as follows:

Editor:	Patricia Zirkel
Annual Meeting Committee:	Anthony Catania (Chair for 1985-86) Alice Berridge Barbran Smith Mark Gwydir (Chair for 1986-87)
Finance Committee:	Dr. Angelo Scordato (Chair) Dudley George James Malone Patricia Zirkel Anthony Razziano
Parliamentarian:	Patricia Zirkel
Awards Committee:	Dr. Angelo Scordato (Chair) Patricia Zirkel Walter Berkmann

With no further business Gene Zirkel moved to adjourn the meeting, and Patricia Zirkel seconded. So carried. Meeting adjourned at 12:20 P.M.

Respectfully submitted,

Fred Newhall, Secretary

REVIEWER WANTED...

We would appreciate it if one of our readers would write a review of Tom Pendlebury's *TGM: A Coherent Dozenal Metrology based on Time, Gravity and Mass* for publication in this *Bulletin*.

III. LUNCHEON *(SEE COVER)*

At a luncheon which followed immediately, two members of the Society were named as Fellows:

James Malone: for his years of dedicated and responsible service as Society Treasurer.

Patricia Zirkel: for the successful re-issuing of the Duodecimal Bulletin and continued service as Editor.

- FN

Continued...

Shown at lunch during the DSA Annual Meeting on 12 October 1985 are (clockwise from lower left): Tony Catania, James Malone, John Berkmann and Mary Newhall (both partially hidden), Fred Newhall, Dudley George, John Impagliazzo, Pat Zirkel, Kennett Love, Alice Berridge, Vic Gany (partially hidden), and Gene Zirkel (back to camera).

IV AFTERNOON PRESENTATIONS

Lounge, North Hall

The afternoon's events convened at 2:30 P.M. in an area reserved for videotaping.

(1) James Malone
"Eggsactly a Dozen"

Participants reviewed a videotape of Professor Malone's presentation, which had been filmed previously. (Comments were favorable, and the tape should soon be ready for loan to high schools, etc., for educational purposes.) See Bulletin 42; for a transcript of this introduction to dozenal counting.

(2) Fred Newhall
"The Accuracy Scale"

Fred Newhall is an engineer who has had a continuing interest in accuracy of measurement. His presentation made creative use of a large-scale ruler as a graphic aid.

Two members were awarded the honor of being named as Fellows of the Dozenal Society of America during the 1986 Annual Meeting. Patricia Zirkel (left) was cited for her service as Editor, and James Malone (center) for his tenure as DSA Treasurer. Both are here congratulated by Board Chairman Dr. John Impagliazzo.

(3) Walter Berkmann
"A Dozenal Abacus/Calculator"

Walter is a civil engineer and machinist who has personal experience in the use of both the Chinese abacus and the related Japanese Soraban. A soraban may function as a dozenal abacus.

(4) Dudley George
"Dozenals in Measurement"

Dudley has been an active dozenalist for over forty years. His presentation concerned the measurement of land parcels.

(5) Gene Zirkel
"Symbol Summation"

Gene's brief presentation summarized the various symbols which have been used to denote "dek" and "el" over the years.

Symbols and Pronunciation				Origin
t	"tee"	e	"ee"	Hall
↊	"ten"	↋	"elf"	Pittman
χ	"dek"	ℰ	"el"	Dwiggins
*	"dek"	#	"el"	Bell Labs

Presentations 2 through 5 were videotaped and may provide the basis for future educational videotapes which could then be loaned by the Society to interested educational organizations and institutions.

The afternoon's presentations were adjourned at 5 P.M.

Continued...

An extra benefit of your DSA membership is the DSGB's *Dozenal Journal*. This is distributed *FREE* to our membership as available.

V. EVENING BANQUET

Following the DSA Annual Meeting, members and guests gathered for the Annual Banquet on Saturday evening 12 October 1985.

Here Gene Zirkel, DSA President, accepts Dr. John Impagliazzo's dues and welcomes him as a new Life Member of the Society.

John Impagliazzo plays while Annamaria Impagliazzo, Alice Berridge and Gene Zirkel (?) sing along.

A SIMPLER NOTATION

Many of us convert to base twelve by succesively dividing by twelve and retaining the remainders after each division. Thus to convert decimal 2056 into dozenals we divide again and again. We often write these division with the quotient *under* the dividend:

```
12 )2056          remainder
 12 )171              4
  12 )14              3
   12 )1              2
      0               1
```

Now, to obtain the result we read the remainders from *bottom to top* and so

$$2056_{ten} = 1234_{twelve}$$

Director Fred Newhall suggests the following improvement in how we write this. He reasons that, first, we are accustomed to writing the quotient of a division *over* the dividend, not under it. (To accomplish this, we simply skip a line before we write down the divisor and the dividend. This we now do without thinking.) Second, we are not accustomed to read the answer from bottom to top.

So Fred suggests that we leave some room for the quotients *over* the dividends, and then write our quotients in the way in which we are accustomed to do. Thus the conversion above would be written:

```
                  remainders
      0               1
  12 )1               2
 12 )14               3
12 )171               4
12 )2056
```

And now we easily read the result, 1234_{twelve}, in the more usual top to bottom fashion.

DOZENAL JOTTINGS

...from members and friends...News of Dozens and Dozenalists....

IGOR VALEVSKY of Brazil sent us a letter to pass along to his old friend, recently re-instated member number 37; TOM O'NEILL (see "Jottings", Bulletin number 51;). We were glad to do so. Igor recently spoke at an Esperanto (universal language) conference in Brazil, and much interest in dozenals was expressed by those who attended his conference. He sent us the names of three persons who can use our Dozenal literature in Esperanto. (Past DSA members had this literature printed some years ago.) In this regard, we also heard from ROAN ORLOFF STONE of the *Bahaa Esperanto-Ligo* in Gallup, NM, thanking us for our material, and outlining the uses he will have for it...New member number 294; JERRY BROST of Gainsville, FL has been in touch with Board Member ROBERT MC PHERSON of the same city. Jerry is also preparing an article for our Bulletin...PAUL RAPOPORT of Ontario, CAN, working on a dozenal clock, has recently received some support and suggestions from our BILL SCHUMACHER of NJ...GENE ZIRKEL'S back is fine now. This is due in part to an excellent book, *The Bad Back Book*, by actor Jerry Wayne. Director TONY GLASER sent it to Gene from PA. Inside the book is former DSA President TOM LINTON'S name. Tom had originally sent the book to Tony from CA. Who wants it next??...Director TONY SCORDATO recently heard from SKIP SCIFRES in Denver, who outlined the capabilities of various computers and peripherals which he uses at home and at work. Skip also

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ATTENTION TEACHERS,

SPEAKERS,

DOZENALISTS!

Bulk requests for our pamphlet "An Excursion in Numbers" by F. Emerson Andrews are now available at no charge.

mentioned his business: building special memory and communication boards to enable the interfacing of dis-similar machines or the performance of unique tasks...TOM PENDLEBURY of Norfolk, ENG, wrote to say that he felt very proud to be made an honorary member of the DSA. He said that like others, he "secretly began to invent dozenal (as a boy) with its many accessories. A glimpse into a wonderful new world. But to reveal such 'eccentric' thoughts to the world around? They would have thought me mad." Later in life he came to the DSGB through the influence of the late HALCRO JOHNSTON'S work, *The Reverse Notation*....We have recently lost contact with two members: JOE CAPPE 151; of Toronto, Ontario, CAN and JOSEPH P. CELKO 18#; of Atlanta, GA. Does anyone know of their present addresses?...DSGB member ARTHUR WHILLOCK writes: "Your Bulletin number 52 received. Good of Glaser to put the record straight about Stevin and Charles XII." He also says that he recently discussed with DUDLEY GEORGE the differences between the DSA and the DSGB: "Your side tends to the academic and interest in mathematical exercises, wheras we are concerned with the

Continued...

The following are available from the Society

1. Our brochure (free)
2. "An Excursion in Numbers" by F. Emerson Andrews. Reprinted from the *Atlantic Monthly*, Oct. 1934. (Free.)
3. *Manual of the Dozen System* by George S. Terry ($1;00)
4. *New Numbers* by F. Emerson Andrews ($10;00)
5. *Douze: Notre Dix Futur* by Jean Essig, in French ($10;00)
6. Dozenal Slide rule, designed by Tom Linton ($3;00)
7. Back issues of the *Duodecimal Bulletin* (as available) 1944 to present ($4;00 each)

DOZENAL JOTTINGS, Continued

practical and social aspects, having been pushed to it by the metric busybodies. Your turn will come if you are not careful."...

Welcome to new members:

296; Prof. **ANTHONY RAZZIANO** of Nassau Community College, LI, NY...

297; **EDMUND BERRIDGE** (LI), husband of member **ALICE BERRIDGE**...

298; **ANN BERRIDGE**, a student member from LI, and her brother,

299; **DAVID BERRIDGE**, also a student; together with their friend,

29*; **GARY MC MANUS**, like Ann and David, a student from LI.

Welcome to all!

End

READ TGM!

Dudley George brought the first few dozen copies of Tom Pendlebury's comprehensive new book, *TGM: A Coherent Dozenal Metrology based on Time, Gravity and Mass*, back from England. They arrived just in time for the Annual Meeting and were quickly snatched up by those present. We still have a few left, and are expecting more from Great Britain shortly. Members of the Society may receive a *FREE* copy while they last, so *write for yours today*. First come, first served.

RECENT LIBRARY ACQUISITIONS

Among the recent acquisitions to our Dozenal Collection housed in the Nassau Community College Library were:

The Twecimal System by Alfred Norland
Problems of Number and Measure by Robert M. Pierce
DUODECIMAL ARITHMETIC, A Comparison by George S. Terry, Longmans, Green & Co.
Duodecimal Arithmetic by George S. Terry, Longmans, Green & Co.
Realm of Numbers by Honorary member Isaac Asimov, Houghton Mifflin Co.
Mathematics & Philanthropy by Warren Weaver of the Sloan Foundation (giving reasons why foundations should support research in mathematics)
The Mathematics Teacher December 1950 containing "Fractionals and the Unit Point" by Ralph Beard, page 419 and listing "An Excursion in Numbers" under Aids to Teaching, page 449
The Mathematics Teacher December 1944 containing "The Duodecimal System" by W.C. Janes, pages 365-367

In one pamphlet we discovered a letter dated November 6, 1944 from former president Kingsland Camp, member number dek, to founders Beard and Terry, mentioning among other things the problem of symbols and the fact that the next member would be member number twelve.

ANOTHER SUCCESSFUL ANNUAL MEETING!

One dozen and seven people attended, including one by phone from California. 13; members were present, including 9 members of the Board of Directors, plus four guests. (In fact, we started with 12; members and 5 guests, and one of the guests joined the Society.)

We also added two Life Members and two Fellows to our rolls during the meeting.

COUNTING IN DOZENS

1	2	3	4	5	6	7	8	9	*	#	10
one	two	three	four	five	six	seven	eight	nine	dek	el	do

Our common number system is decimal—based on 10. The dozen system uses twelve as the base, which is written *10*, and is called *do*, for dozen. The quantity *one gross* is written *100*, and is called *gro*. *1000* is called *mo*, representing the meg-gross, or great-gross.

In our customary counting, the places in our numbers represent successive powers of ten; that is, in 365, the 5 applies to units, the 6 applies to tens, and the 3 applies to tens-of-tens, or hundreds. Place value is even more important in dozenal counting. For example, *265* represents *5* units, *6* dozen, and *2* dozen-dozen, or gross. This number would be called *2 gro 6 do 5*, and by a coincidence, represents the same quantity normally expressed as 365.

We use a semicolon as a unit point, thus two and one-half is written 2;6.

Place value is the whole key to dozenal arithmetic. Observe the following additions, remembering that we add up to a dozen before carrying one.

94	*136*	Five ft. nine in.	*5;9′*
31	*694*	Three ft. two in.	*3;2′*
96	*3#2*	Two ft. eight in.	*2;8′*
19#	*1000*	Eleven ft. seven in.	*#;7′*

You will not have to learn the dozenal multiplication tables since you already know the 12-times table. Mentally convert the quantities into dozens, and set them down. For example, 7 times 9 is 63, *which is* 5 dozen and 3; so set down *53*. Using this *"which is"* step, you will be able to multiply and divide dozenal numbers without referring to the dozenal multiplication table.

Conversion of small quantities is obvious. By simple inspection, if you are 35 years old, dozenally you are only *2#*, which is two dozen and eleven. For larger numbers, keep dividing by 12, and the successive remainders are the desired dozenal numbers.

12) 365
12) 30 + 5
12) 2 + 6
0 + 2 Answer: *265*

Dozenal numbers may be converted to decimal numbers by setting down the units figure, adding to it 12 times the second figure, plus 12^2 (or 144) times the third figure, plus 12^3 (or 1728) times the fourth figure, and so on as far as needed. Or, to use a method corresponding to the illustration, keep dividing by *, and the successive remainders are the desired decimal number.

Fractions may be similarly converted by using successive multiplications, instead of divisions, by 12 or *.

For more detailed information see *Manual of the Dozen System* ($1;00).

DETACH HERE -- OR PHOTOCOPY

We extend an invitation to membership in our society.
Dues are only $12 (US) per calendar year; the only requirement is a constructive interest.

Application for Admission to the Dozenal Society of America

Name _____ (LAST) (FIRST) (MIDDLE)

Mailing Address (for DSA items) _____

_____ (See below for alternate address)

Telephone: Home _____ Business _____

Date & Place of Birth _____

College _____ Degrees _____

Business or Profession _____

Employer (Optional) _____

Annual Dues ..... $12.00 (US)

Student (Enter data below) ..... $3.00 (US)

Life ..... $144.00 (US)

School _____

Address _____

Year & Math Class _____

Instructor _____ Dept. _____

Other Society Memberships _____

_____

Alternate Address (indicate whether home, office, school, other)

_____

_____

_____

Signed _____ Date _____

My interest in duodecimals arose from _____

_____

_____

Use space below to indicate special duodecimal interests, comments, and other suggestions, or attach a separate sheet:

Mail to: Dozenal Society of America
c/o Math Department
Nassau Community College
Garden City, LI, NY 11530