COUNTING IN DOZENS

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

Our common number system is decimal - based on ten. 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.

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	3Ɛ2	Two ft. eight in.	2.8'
19Ɛ	1000	Eleven ft. seven in.	Ɛ.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 *2Ɛ*, 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 X, and the successive remainders are the desired decimal number.

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

Numerical Progression

1	One		
10	Do	.1	Edo
100	Gro	.01	Egro
1,000	Mo	.001	Emo
10,000	Do-mo	.000,1	Edo-mo
100,000	Gro-mo	.000,01	Egro-mo
1,000,000	Bi-mo	.000,001	Ebi-mo
1,000,000,000	Tri-mo	and so on.	

Multiplication Table

1	2	3	4	5	6	7	8	9	X	Ɛ
2	4	6	8	X	10	12	14	16	18	1X
3	6	9	10	13	16	19	20	23	26	29
4	8	10	14	18	20	24	28	30	34	38
5	X	13	18	21	26	2Ɛ	34	39	42	47
6	10	16	20	26	30	36	40	46	50	56
7	12	19	24	2Ɛ	36	41	48	53	5X	65
8	14	20	28	34	40	48	54	60	68	74
9	16	23	30	39	46	53	60	69	75	83
X	18	26	34	42	50	5X	68	76	84	92
Ɛ	1X	29	38	47	56	65	74	83	92	X1

The Duodecimal Bulletin

Whole Number 1X

Volume Ɛ, No. 1
May - 1955

THE DUODECIMAL SOCIETY OF AMERICA

20 Carlton Place ~ ~ ~ ~ ~ Staten Island 4, N. Y.

is a voluntary nonprofit organization 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.

Full membership with voting privileges requires the passing of elementary tests in the performance of twelve-base arithmetic. The lessons and examinations are free to those whose entrance applications are accepted. Remittance of $6, covering initiation fee ($3) and one year's dues ($3), must accompany applications.

The Duodecimal Bulletin is the official publication of the Duodecimal Society of America, Inc., 20 Carlton Place, Staten Island 4, New York. F. Emerson Andrews, Chairman of the Board of Directors. Kingsland Camp, President. Ralph H. Beard, Editor.

Separate subscriptions $2.00 a year, 50¢ a copy.

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The Duodecimal Bulletin

All figures in italics are duodecimal.

THE DO-RE-MI SYSTEM OF DOZENAL NOMENCLATURE
(A Trip into the Land of Ever-Ever)
by Henry Clarence Churchman

The duodecimal system of numbers is based upon the assumption there are a dozen parts to every unit. The decimal system conceives every unit to be divisible into ten parts. The decimal system is now in common use. Decimal measurements reach their ultimate goal in the use of the metric system of values.

The monetary system of the United States of America is based on the metric system of values. It could be readily converted into duodecimal values.

The measurement of solids and liquids, as well as distances, both in the United States and in the British Commonwealth, in general follow a dozenal system. The foot unit, for instance, contains a dozen inches and is divisible into either two, three, four, six, or a dozen whole parts. Ten, on the other hand, is divisible into either two, five, or ten whole parts; any other division results in fractions. The dozenal system of numbers is, then, actually more practical in certain pursuits, such as carpentry, wholesale distribution, etc.

However, neither the decimal nor the duodecimal system can wholly supplant the other. As with languages, a knowledge of two systems is more useful than the introverting effect of one alone. And the study of another system actually helps one to understand better his own.

In this article I ask all exponents of the duodecimal system to take an Alice in Wonderland excursion with me into a land where the numerical progression contains slightly different names based upon the do-re-mi musical scale. It is only a pleasure trip, of course, from which we will return. But it may give us a new slant at our own dozenal system, perhaps tend to cause us to be more continental, even more universal, by picking up the worldwide musical scale nomenclature as a temporary substitute for our Anglo-Saxon derivatives. In a word, do-re-mi is momentarily established in place of do-gro-mo, so that "do" remains "do", but "gro" becomes "re", and "mo" becomes "mi".

This exercise is just for fun. If we must learn a new nomenclature for the nonce, it may give us more sympathy and understanding of the problems of our newly found friends of the duodecimal system who, themselves, are learning numerical progression nomenclature for the first time. But the do-re-mi nomenclature might gain for us a burst of sympathy in the romance language areas, so steeped in music, where the metric system is presently common.

A Simple Approach to Doremial Dozenal Nomenclature

Everyone with the slightest knowledge of music is familiar with the do-re-mi scale. Music knows no language barriers. If we consider for a moment that "do" could represent for us a dozen units of measurement, that "re" might represent a dozen-dozen objects, and "mi" a dozen-dozen-dozen things, then we should have the implements of nomenclature to speak with facility about all values now described by "tens" and "hundreds" and "thousands". And from there, millions, billions, trillions offer no difficulty.

Speaking decimally, every "do" would represent 12 objects, every "re" would represent 144 things, and every "mi" would indicate 1728 articles. From this it might be noted that one "mi" comprises more than one and seven-tenths times the number of articles contained in one "thousand". So if we were to register automobiles by license plates using the dozenal system, the display of three digits, still speaking decimally, might comprise as high as 999 vehicles; but three digits of the dozenal system could encompass as many as 1727 automobiles. This indicates, where space is valuable, the dozenal system is superior to the decimal system. More shocking, within the grasp of six digits decimally we may register 999,999 vehicles, but we may list as high as 2,985,983 within the space of only six digits of the dozenal system.

Again speaking decimally, the ten parts may be described in units as anything from cipher through nine. But when the tenth part is added to nine, we are ready to begin a new series called "tens". One "ten" is indicated as 10. Two "tens" are indicated as 20. And nine "tens" are indicated as 90. If we add nine "units" to nine "tens" we have 99, which we call ninety-nine.

Let us for a moment try to analyze the description "ninety-nine". It contains three syllables. If we think of the middle syllable "ty" as an abbreviation of "ten", as indeed it is, we are merely saying "nine tens and nine".

Now speaking dozenally, it is generally agreed that the dozen parts of a unit column may be described as cipher, one, two, three, four, five, six, seven, eight, nine, dek, and el. Dek is merely taken from the Greek "deka", meaning ten. El is no more than the first two letters of the English word "eleven". But when the dozenth part is added to "el" , we begin a new series called "do". One "do" is indicated as *10*. Two "do" are indicated as *20*. Nine "do" are indicated as *90*, and "el" "do" are indicated by the initial letter of "el", preceding a cipher, thus *£0*, pronounced as are the English words "ell" "doe". If we add "el" units to "el do", we have *££*, which we call "el do el".

Let us now try to analyze the description "el do el", as we have just done with "ninety-nine". It contains three syllables. If we think of the middle syllable "do" as an abbreviation of "dozen", as in truth it is, we are merely saying, decimally, "eleven dozen and eleven". Again speaking decimally, this number is the decimal sum of 143. Yet, to indicate that sum it was necessary, in the dozenal system, to utilize only two digit spaces, shown *££*, which we call "el do el". Then, too, there is an economy of half as many syllables when we say "el do el" to indicate the sum of "one hundred forty-three."

While we are glancing at "unit" and "do" columns, let us note how easy it is to count from 13 to 24 when we change momentarily from the decimal to the duodecimal system. In the decimal system, we say thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty, twenty one, twenty two, twenty three, and twenty four. Duodecimally, we say do one, do two, do three, do four, do five, do six, do seven, do eight, do nine, do dek, do el, and two do. None of the duodecimal descriptions contains more than two syllables. Yet they plainly say "a dozen and one", which equals 13, a dozen and two, which equals 14, etc.

The Three Digit Column (Hundreds)

So much for "units" and "tens", or units and dozens. Anything from one hundred to anything short of one thousand requires, decimally, three digits to express such value. In the do-re-mi nomenclature of the dozenal system, we make no reference to "hundreds", but the third column of digits, appearing to the left of the "unit" and "do" columns, might be called the "re" column, keeping in mind the do-re-mi musical scale as we move upward.

Thus, speaking decimally, 100 represents ten tens or one hundred, but, speaking dozenally in the do-re-mi nomenclature, *100* represents a dozen dozen or one "re". Or, again speaking decimally, 111 represents one hundred, one ten, and one unit. But speaking in do-re-mi dozenal language *111* represents one "re", one "do", and one "unit", and is pronounced simply "re do one". It equals the quantity of one gross, one dozen, and one unit. The do-re-mi nomenclature simplifies its pronunciation to three syllables---"re do one", whereas the decimal description requires six syllables.

Again, speaking decimally, 222 represents two hundreds, two tens, and two units, and is pronounced "two hundred twenty two". But speaking dozenally in the do-re-mi scheme of nomenclature, *222* represents two gross, two dozen, and two units, and is pronounced "two re, two do two". Decimally, six syllables are utilized. Dozenally, five syllables suffice.

The Four Digit Column (Thousands)

So much for units, tens, and hundreds, the latter occupying three digits or places.

Anything from one thousand to anything short of ten thousand requires, decimally, four digits to express such value. In the do-re-mi dozenal system of nomenclature, we make no reference to "thousands", but the fourth column of digits, appearing to the left of the "re" column, might be called the "mi" column, keeping in mind again the do-re-mi musical scale as we ascend in values.

Thus, speaking decimally, 1000 represents ten hundreds or one thousand, but, speaking dozenally with the do-re-mi complexion, *1000* represents one dozen gross or one "mi". In dozenal language, *1000* is one "mi". In decimal language, 1000 is one "thousand".

Again, speaking decimally, 1111 represents one thousand, one hundred, one ten, and one unit. But speaking dozenally in the do-re-mi nomenclature, *1111* represents one "mi", one "re", one "do" , and one "unit", and is pronounced (coming down the musical scale) "mi re do one". It equals the quantity of one dozen gross, one gross, one dozen, and one unit. The do-re-mi nomenclature simplifies its pronunciation to four syllables. Decimally, it requires at least eight syllables.

Back speaking decimally, 2222 represents two thousands, two hundreds, two tens, and two units, and is pronounced "two thousand, two hundred twenty-two." But speaking dozenally in the do-re-mi nomenclature, 2222 represents two dozen gross, two gross, two dozen, and two units, and is pronounced "two mi, two re, two do two." Decimally, nine syllables are used. Dozenally, seven syllables are needed.

The Five, Six, and Seven Digit Columns and Over

Above "mi", it would seem to be unnecessary to extend the musical scale. Thus, *11,111* in the do-re-mi dozenal system of nomenclature may be described as "do one mi, re do one."

And *111,111* in do-re-mi nomenclature is simply described as "re do one mi, re do one."

When we get to *1,111,111* and above in this delightful nomenclature of the musical instrument, we avoid the decimal system of millions, billions, and trillions. The seven digits above are described in do-re-mi terms as one "bi-mi, re do one mi, re do one". And *1,111,111,111* is then quite properly described as one "tri-mi, re do one bi-mi, re do one mi, re do one".

Now to transport the do-re-mi nomenclature to the sublime or to the ridiculous, according to one's present taste, one mi re do one ella-mi, re do one deka-mi, re do one nona-mi, re do one octa-mi, re do one septa-mi, re do one hexa-mi, re do one penta-mi, re do one cuatra-mi, re do one tri-mi, re do one bi-mi, re do one mi, re do one stars in the heavens may be indicated in doremial dozenal numerals as *1,111,111,111,111,111,111,111,111,111,111,111,111 111* stars, or three dozen and one places left of the point.

In the doremial nomenclature, *1,000,000,000,000,000,000,000, 000,000,000,000,000* (comprising three dozen and one places left of the point) is called, dozenally speaking, one "mi ella-mi", and is equal to the decimal sum of 1,728 raised to the dozenth

power. And one mi ella-mi, mi ella-mi, mi ella mi (nine dozen and one places left of the point) is equal to the decimal sum of 1,728 raised to the three dozenth power.

Please, if you have floated this far, feel free to use the doremial dozenal nomenclature, or to leave it alone. I have found it much easier to describe one mi ella-mi in the doremial manner than to speak of "one cipher, cipher, cipher, continue until you have three dozen ciphers." Or to picture "re do one mi, re do one" as (try saying it, using the musical scale pronunciation as if dropping a note on each syllable) *111,111*. It is true that to say "one, one, one, one, one, one" requires one less syllable than to say Ray Doe Won Me, Ray Doe Won!

ANOTHER ARITHMOCRYPT
by Mary Lloyd

Which looks easy, but isn't as easy as it looks. This one can be solved entirely by inferences, without resorting to the lengthy and exhaustive elimination process.

```
                I S S
        _____________
M O U N T ) B R I S T L E
            M O U N T
            I N F M L L
            I O B T L N
              I M O R N E
              I O B T L N
                T U M N O
```

Just for the birds, why don't you try constructing one of these duodecimal arithmocrypts. You'll learn a lot about the peculiar advantages of the twelve-base, and you'll get the dust off your number logic, - which you probably have not used for some time.

THE ANNUAL MEETING

This year several of the Directors arrived in New York well in advance of the date of the Annual Meeting and a leisurely series of luncheons and informal sessions with others of the Board facilitated deliberate consideration and discussion of our problems.

President Beard convened the Annual Meeting at 2030 EST., on January 20th, in the Roof Terrace of the Gramercy Park Hotel in New York City, and opened the session with a review of the salient features of the year's activities.

There has been a noticeable increase in the requests for duodecimal literature, especially from teachers colleges. We have filled 16 bulk requests from such institutions and the summer sessions of regional meetings of mathematics teachers. Factors contributing to the increased demand are the listing of our literature in the Elementary Teachers Guide to Free Curriculum Materials, and in the circulars of the U. S. Office of Education.

We exchange publications with about a dozen scientific and mathematical societies around the world. The U. S. Office of Information is of aid in this respect, referring occasional requests to us. We have had such requests from Japan, Formosa, Hawaii and the Philippines.

There has been but one issue of The Duodecimal Bulletin this year, and there was an issue of Dozenal Doings in November.

Our general publicity has been rather meager but not sterile. In the Mathematics Teacher for October, William L. Schaaf published a list of about 30 duodecimal references in a section of bibliography devoted to Scales of Notation. We have a satisfactory paper on the Duodecimal System in the new edition of the Encyclopedia Americana. Mr. Andrews has written an article for the Methodists' teen-age magazine, Twelve-Fifteen, which includes favorable reference to our Society and to duodecimals. This magazine has a circulation of *60,000*, and it is planned to use Mr. Andrews' article in four other similar publications. Mr. Edward Pharo, Jr., delivered an informal talk on duodecimals to the Princeton congress of the Esperanto League for North America in July.

Our membership stands at 76, and includes a promising group of young folk from Glen Rock, N. J., - one of whom, Jay M. Anderson, is now Chairman of our Membership Committee.

The report of Treasurer Humphrey followed, reflecting the very satisfactory state of our finances, with this year's operations in black ink. Our total revenues were $1057, expenses $736, and an increase in our reserves of $321. These figures include contributions of $823, and Mr. Humphrey expressed the gratitude of the Society to these generous members who carry so large a part of the burden of our operations.

Chairman Stevens of the Nominating Committee was unable to attend the meeting and his report was delivered by the Secretary. It recommended that the Directors of the Class of 1955, Kingsland Camp, Paul E. Friedemann, and H. C. Robert, Jr., be renominated as the Class of 1958 with the addition of Lewis Carl Seelbach, and that the new Nominating Committee be Leopold Schorsch, Chairman, P. J. Celani, and Richard B. Parker. There being no other nominations before the meeting, these nominees were duly elected. The thanks of the Society are extended to the retiring Nominating Committee for its good services.

In reporting the actions of the Board of Directors, Secretary Beard announced the election of Kingsland Camp as President, and that the other officers would continue in their present assignments. Mr. George Terry has asked to be relieved of the editorship of the Duodecimal Bulletin, and Mr. Beard will serve as Editor in his stead. Mr. Camp was presented to the meeting, and warmly acclaimed.

The Board discussed the desirability of holding the Annual Meeting at some time other than January of each year, as provided by our constitution. It was generally agreed that it would be wise to relax the rigidity of this provision, and an amendment of the consitution is to be submitted providing that the Annual Meeting shall be held before May 1st of each year. Other meetings may be held in centers of duodecimal interest where it was thought that further development might be anticipated.

We plan to solicit greater co-operation from the colleges and universities, - especially from their departments of physics and engineering, - in the selection and definition of desirable units of measurement for the Do-Metric System. Plans for the printing of the Society's folder in Esperanto and in Interlingua are well progressed. It is intended to prepare this year for a more intensive international program for 1956.

In this connection, Mr. Beard introduced Dr. Alexander Gode, Director of the Interlingua Office of Science Service, and instructor of the newly scheduled class in Interlingua of New York University's Department of General Education. Dr. Gode then addressed the meeting on the application of Interlingua to duodecimals. The text of his talk appears elsewhere in this issue.

The general discussion of Interlingua which followed this talk, was interrupted by Mr. Beard's proposal that the formal section of the meeting be closed, as there was no further business to consider, and that these discussions be continued informally with serving of the refreshments. The meeting was accordingly adjourned at 2230 EST.

A MESSAGE FROM PRESIDENT CAMP

The thought of my much more deserving predecessors, and the volume of work they have done, makes me hesitate to recommend actions and outline policies immediately after taking office.

But our interest in orderly principles for arithmetic, weights and measures, and time, obliges us to use an opportunity we now have to make our weight felt, however slight we may suppose it to be. We recently approved the World Calendar and notified the World Calendar Association of our endorsement. The subject is now on the agenda of the Economic and Social Council of the United Nations; our own government consented to have it discussed, but is indifferent whether it is approved or not. Undoubtedly this indifference results from strenuous opposition by a loud-voiced and highly organized but very small minority who insist that the "unbroken succession of seven-day weeks" is vital to their own very ancient religion.

In fact, however, neither this nor any other feature of the present calendar or of any calendar that can be proposed, is satisfactory to everybody on religious grounds, and scholars have demonstrated that the "unbroken succession" just mentioned was unheard of before *700* B.C. The manner of reckoning time has been changed before and may perfectly legitimately be changed again.

The new calendar, whether decreed for 1956 or for 1961 (both years will begin on Sundays as will every year by the the World Calendar) will be as easy to slip into as is daylight-saving time, and will forever after greatly simplify planning, schedules, comparisons, the reckoning of dates, and the measurement of time.

All the governments must submit their views in this year 1955. If you have convictions on this subject, we urge you as an individual to write your senators and representatives, expressing your views on the proposed calendar change.

INTERLINGUA AND THE DUODECIMAL NOMENCLATURE
by Alexander Gode

The importance of Interlingua in the solution of terminological problems -- duodecimal and otherwise -- results paradoxically from the fact that Interlingua has no life of its own but reflects merely what the major languages of the Western world have in common.

A neologism in Interlingua is of necessity born in the spirit of the entire Occident, never in the spirit of just one of its languages. And conversely, a neologism formed in Interlingua is never an exclusive peculiarity of Interlingua but can immediately be adapted to any of the occidental languages.

If the languages of the Western world did not have as much in common as they do, there would be no Interlingua, for one of the fundamental principles underlying this auxiliary language is precisely that no arbitrarily constructed auxiliary language can possibly attain practical usefulness beyond a limited circle of initiates.

The shared identities in the Occidental languages are dramatically apparent in the language of science and technology with its tremendous neologistic activity. One example will serve to suggest thousands of a similar kind. A medical man wishing to designate a type of anemia occasioned by blood dilution refers to it as "hydremia," suggesting water and blood. When the need for a special name for this condition first arose, a German might have called it "Wasserblütigkeit," an Englishman "watered blood," a Frenchman "sang à excès d'eau," etc. By coining such a term out of the resources of his native language, the first student of this condition would have solved his terminological problem for himself and his equilingual colleagues, but for medical men speaking another language he would have posed a translation problem as bothersome as his own original problem of naming the new entity. Instead of using a nationally limited term, the first namer of this special anemia chose a term of immediate adaptability in all occidental languages. To claim that the new coinage was Greek is philologically correct but factually quite beside the point. What matters is that a German choosing the term "Hydrämie" in lieu of "Wasserblütigkeit" would have coined a word comprehensible to all his German colleagues and in addition to all his colleagues throughout the Western world: to the French in the adapted form of "hydrémie," to the English as "hydremia," etc. And actually, by looking at the word as it stands now, we cannot tell whether it was first made by a Frenchman, a German, a Spaniard, an Italian, or a speaker of any of the other Occidental languages.

Our scientists on the whole do not speak Greek or Latin. But by coining their neologisms as though they did, they profit by and strengthen the elements which their native language shares with its neighbors. These elements are pan-Occidental. And since from them Interlingua has been built, it may be claimed that most scientific and technological neologisms are drawn not from national languages but from the Interlingua of the Occident.

The lesson to be derived from these observations is simple. Anyone confronted with the task of devising terminological neologisms for a discipline of international importance or of more than national aspirations should draw his material -- in the sense outlined above -- from Interlingua.

* * *

It might be argued that the approach outlined above, while sound and healthy in the sciences, is not applicable to the specific problems of a duodecimal nomenclature for the simple reason that no such nomenclature exists in any of the Occidental languages and hence not in Interlingua either. This objection stands if one conceives of duodecimalism as a revolution which attempts to do away with the old and introduce something radically new. I do not share this conception. I consider duodecimalism an evolution from decimalism and furthermore an evolution promoted by trends of a venerable past.

In tackling the problems of duodecimal nomenclature in Interlingua I thus take it for granted that the following two methodological rules will be considered acceptable: (1) Duodecimal usage must not depart from current terminological usage except where the latter is decimally determined and (2) duodecimal usage must exploit and evolve every possible duodecimal aspect of our current tradition.

It seems to me that the recommendations of the Duodecimal Society as they now stand violate rule (1) in only one important area. The numerical procession from mo to bi-mo, tri-mo, etc., and especially the duodecimal fractions with their prefix e- must be condemned as arbitrary and psychologically unsupported and unnecessary. The monotony of these forms makes for confusion instead of clarity despite the schematic pattern they were made to follow. That they cannot even be called an unavoidable evil will be demonstrated below.

As for rule (2) with its insistence that none of the traces of duodecimalism in the traditional number system must go unexploited, I wish to submit the following pair of observations. Both strike me as fundamentally important.

I. While the traditional number system is of course clearly decimal, this is apparent in oral counting only from thirteen (three plus ten) on. Whatever the etymology of the words eleven and twelve, they are no compounds to the unsophisticated ear. The fact that many centuries of usage succeeded in remolding these forms originally built as one plus ten and two plus ten into -- psychologically speaking -- underived base words would seem to attest to a powerful duodecimal propensity in the popular unconscious. This does not hold true in all languages. But it is very striking in English, German, Dutch, Swedish, Danish, Norwegian. In the Slavic languages the words for eleven and twelve show clearly the element one and two. This latter situation is also characteristic of Latin, but the modern Romance languages which are short-term descendants of Latin demonstrate again the powerful effect of the duodecimal propensities of the common people. French *onze* and *douze* are base words to the unprejudiced mind and have nothing to do with *un* and *deux*. The Spanish and Portuguese forms reflect a similar trend while Italian and Rumanian are more conservative. -- The conclusion to be derived from the foregoing is obviously that the whole set of numerals up to twelve should be preserved in the duodecimal system in all those languages in which the modern names of these numerals include no compounds with ten.

In English this would mean that we be allowed to count duodecimally up to twelve or dozen. These two terms would be synonymous and of course the duodecimal names for *20, 30, 40,* etc., could continue to be derived from 'dozen' rather than from 'twelve'. If such a reform should prove acceptable, it might carry with it the minor improvement that the symbol for eleven be explained as chosen semi-arbitrarily on the basis of the fact that 'L' (el) is the eleventh letter of the classical Roman alphabet rather than as suggesting the English word 'eleven' which after all has no interest for people who do not speak English.

II. In choosing terms for duodecimal *100, 1,000, 1,000,000,* etc., there seems to be more in the traditional system that can be kept than meets the eye at first blush. Words like milliard, million, billion, trillion, etc., are based on *mille* and pose no independent problem. In discussing the names of the higher numerals we need pay attention only to the Latin forms represented by *cent-* and *mill-* with their Teutonic correspondences represented by English hundred and thousand and possibly the Greek types *hekaton* and *kilo*. Now it must be noted that in all these forms there is nothing to indicate a dependence on the base ten. As a matter of fact, not even the ultimate etymologies of them can be unequivocally related to a word signifying ten. There is considerable evidence to suggest that their origins are multiple. Their initial signification may have been 'many' or they may have been derivatives from bases other than ten. In passing I may here refer to the possibility that the extraordinary age of some Biblical characters is only seemingly so: it may well be that the term hundred in the passages in question stands for a term which did not really signify ten times ten.

Particular interest attaches in this connection to the article *Grosshundert* (i.e. *great hundred*) in Kluge's *Etymological Dictionary of German*. The following is a free translation of this article. "Great hundred means 120 pieces as there is also a great thousand which means 1200 pieces. There seems to be little doubt that the Indo-Europeans knew a decimal hundred, but in addition all the Teutonic tribes were also conversant with a duodecimal hundred. Ulfilas saw fit in 1. Cor xv:6 to explain his use of the word 'hund' by the note 'taihuntewi' (ten times ten) lest some listeners might misconstrue the term duodecimally. The Old Norse 'tolfroett hundrad' stands for 12 times ten, 'tiroett hundrad' for 10 times ten. In England (especially Worcester, Norfolk, Somerset) we find expressions long or great hundred which have corresponding terms also in Gaelic. In the *Lex Salica* there is a noun 'tualepti' which would mean 'twelveness' and stands for 120. In the legal codes of the Ripuarians and Longobardi twelve is the base of all fines. In German commercial usage the term great hundred has survived especially along the coast where it is used for peat, boards, fish, fruit, and eggs. It is not always specifically expressed. A manual of arithmetic published in 1532 still used the term hundred unmodified for 120 in referring to codfish. The same holds true for a publication of 1656. In 1658 we find hundred explained as six score or 120 pieces in reference to boards. In 1668 we have great thousand used for boards and lemons. The eighteenth-century lexicographer Adelung listed the term great hundred as belonging to the language of everyday life. From a publication of 1654 we quote the definition that "a great hundred is 6 score in referring to boards, walnuts, codfish, cheese, etc."

The duodecimal theoretician may be interested in these references because they show how the practical requirements of commerce impose a duodecimal principle upon the primitive "hand-given" decimal system. In the present context the occurence of a modified hundred and hence a modified thousand with the value of ten times twelve or ten times ten times twelve suggests the historical and psychological justification of using a duodecimal hundred, thousand, million, etc., expressed by a simple modifier like 'long' or 'great.' This modifier would appear in international usage as the type *gran-*. It would be used in a given context only once, and if in continued calculation the use of the duodecimal system may be assumed to have replaced decimal habits in the minds of the participants, special mention of *gran-* or *long* may be dispensed with altogether. (I have been struck by the fact that the publications of the Duodecimal Society use the term percent and do not replace it by pergro. This procedure is fully justified on the basis of the approach here advocated.)

The ideas presented above in critical terms permit the smooth derivation of a complete duodecimal system of numerals in Interlingua from the present decimal system. The only additional feature is the use of the full word for twelve in compound numerals in lieu of the English-*do-*, that is, in positions corresponding duodecimally to the decimal-*ty* in English (*-anta*) in Interlingua.

A. Cardinal Duodecimal Numerals in Interlingua.

1 un (one)
2 duo (two)
3 tres (three)
4 quatro (four)
5 cinque (five)
6 sex (six)
7 septe (seven)
8 octo (eight)
9 nove (nine)
𝒳 dece (ten)
Ɛ unze (eleven)
10 doze (twelve, dozen)

Note: *unze* and *doze* betray their decimal origin as little as eleven and twelve. The decimal forms for the same values are *dece-un* and *dece-duo*.

11 doze-un (do-one)
12 doze-duo (do-two)
13 doze-tres (do-three)
14 doze-quatro (do-four)
15 doze-cinque (do-five)
16 doze-sex (do-six)
17 doze-septe (do-seven)
18 doze-octo (do-eight)
19 doze-nove (do-nine)
1𝒳 doze-dece (do-ten)
1Ɛ doze-unze (do-eleven)
20 duodoze (twodo)
21 duodoze-un (twodo-one)
etc.
30 tresdoze (threedo)
31 tresdoze-un (threedo-one)
etc.
40 quatrodoze (fourdo)
50 cinquedoze (fivedo)
60 sexdoze (sixdo)
70 septedoze (sevendo)
80 octodoze (eightdo)
90 novedoze (ninedo)
𝒳0 decedoze (tendo)
Ɛ0 unzedoze (elevendo)
Ɛ1 unzedoze-un (elevendo-one)
etc.
ƐƐ unzedoze-unze (elevendo-eleven)
100 grancento (long hundred)

Note: The term *grosso* for English 'gross' is likewise available in Interlingua. Its use does not, however, justify also the form *megagrosso* for *granmille* after the proposed English 'megro'.

200 duo grancentos (two long hundred)

Note: *cento* and other powers of the base are always treated as nouns and are subject to pluralization.

201 duo grancentos un (two long hundred one)
20Ɛ duo grancentos unze (two long hundred eleven)
210 duo grancentos doze (two long hundred do)
211 duo grancentos doze-un (two long hundred do-one)
21Ɛ duo grancentos doze-unze (two long hundred do-eleven)
220 duo grancentos duodoze (two long hundred twodo)
22Ɛ duo grancentos duodoze-unze (two long hundred twodo-eleven)
230 duo grancentos tresdoze (two long hundred threedo)
240 duo grancentos quatrodoze (two long hundred fourdo)
etc.
300 tres grancentos (three long hundred)
400 quatro grancentos (four long hundred)
900 nove grancentos (nine long hundred)
X00 dece grancentos (ten long hundred)
Ɛ00 unze grancentos (eleven long hundred)
ƐƐ0 unze grancentos unzedoze (eleven long hundred elevendo)
ƐƐX unze grancentos unzedoze-dece (eleven long hundred elevendo-ten)
ƐƐƐ unze grancentos unzedoze-unze (eleven long hundred elevendo-eleven)
1000 granmille (long thousand)
1001 granmille un (long thousand one)
100Ɛ granmille unze (long thousand eleven)
1010 granmille doze (long thousand do)
1100 granmille cento (long thousand hundred)
1110 granmille cento doze (long thousand hundred do)
1111 Granmille cento doze-un (long thousand hundred do-one)
ƐƐƐƐ unze granmilles unze centos unzedoze-unze (eleven long thousand eleven hundred elevendo-eleven)
10000 doze granmilles (twelve long thousand, dozen long thousand)
100000 grancento milles (long hundred thousand)
200000 duo grancentos milles (two long hundred thousand)

Note: In lengthy numbers international usage sets off groups of three basic numerals by a period, not by a comma as in English.

X00.000 dece grancentos milles (ten long hundred thousand)
ƐƐƐ.ƐƐƐ unze grancentos unzedoze-unze milles unzedoze-unze (eleven long hundred elevendo-eleven thousand eleven hundred elevendo-eleven)
1.000.000 granmillion (long million)
1.111.111 granmillion cento doze-un milles cento doze-un (long million hundred do-one thousand hundred do-one)
Ɛ.ƐƐƐ.ƐƐƐ unze granmilliones unze centos unzendoze-unze milles unze centos unzedoze-unze (eleven long million eleven hundred elevendo-eleven thousand eleven hundred elevendo-eleven)

Note: The above examples suffice to illustrate the system. In the continuation of it, the user must bear in mind that the Interlingua pattern follows British, French, German, etc., usage and has accordingly for a thousand millions the term milliardo. The term

billion stands for a thousand milliards. After that the forms in *-ard* and *-on* alternate. The following list sets the pattern in comparison with the American system.

1.000.000	million (Am. million)
1.000.000.000	milliardo (Am. billion)
1.000.000.000.000	billion (Am. trillion)
1.000.000.000.000.000	billiardo (Am. quadrillion)
1.000.000.000.000.000.000	trillion (Am. quintillion)
1.000.000.000.000.000.000.000	trilliardo (Am. sextillion)
etc.	

B. Ordinal Duodecimal Numerals in Interlingua.

Note: In Interlingua as in English the ordinals are adjectives. Again as in English they can be used as nouns and are then capable of pluralization. In contrast to English usage, Interlingua ordinals in the noun form have a final *-o*, in rare cases -- when the ordinal noun refers to a female human -- also a final *-a*. The basic ordinals are either special forms or carry the suffix *-ime*. All ordinals corresponding to cardinals ending in zero use the suffix *-esime*, except *10* which also uses *-ime*.

1me prime (first)
2nde secunde (second)
3tie tertie (third)
4te quarte (fourth)
5te quinte (fifth)
6te sexte (sixth)
7me septime (seventh)
8ve octave (eighth)
9ne none (ninth)
Xme decime (tenth)
Ɛme unzime (eleventh)
10me dozime (twelfth, dozenth)
100me grancentesime (long hundredth)
101me grancento prime (long hundred first)
etc.

C. Fractions in Interlingua.

Fractions are expressed by ordinals, as in English. This may be done by using the ordinals in their adjectival form plus the word parte, 'part.' It may also be done by using the noun form of the ordinal. For half, Interlingua, like English, has a special word. It is *medie* with the corresponding noun *medietate*.

Examples: *1/5* un quinte parte (a fifth part); *11/17* doze-un doze-septimos (do-one do-sevenths); *1/357* un tres grancentos cinquedoze-septimo (one three long hundred five-do seventh); *X/ƐƐƐ* dece unze centos unzedoze-unzimos (ten eleven hundred elevendo-elevenths); etc.

D. Duodecimal Fractions in Interlingua.

Note: Following international usage Interlingua, in contrast to English, has a decimal comma, not a decimal point. Hence it also uses a duodecimal comma. The numerals after the comma are read off in succession in keeping with traditional usage. Example: *XƐ,ƐX3Ɛ65* reads decedoze-unze comma unze dece tres unze sex cinque.

E. Adverbial Duodecimal Numerals in Interlingua.
Adverbial duodecimal numerals in Interlingua follow the same principle as decimal adverbial numerals in Interlingua and in English. They are the ordinal adjectives in adverbial forms: primemente (firstly), dozimemente (twelfthly, dozenthly), etc. Where English uses the shorter adverbial form without *-ly*, Interlingua uses no *-mente* but the ending *-o*.

F. Collective Duodecimal Numerals in Interlingua.
Collectives, whether decimal or duodecimal, are formed in Interlingua by means of the suffix *-ena:* un decena (some ten, a group of ten), un dozena (some twelve, one dozen), grancentena (some long hundred), etc.

ARE WE READY?

The Duodecimal Society has accepted responsibility for research and education on the twelve-base.

The Duodecimal Society is the one means to free the coming generations from the ancient slavery to the ten-base.

The Duodecimal Society offers the only effective check to the further encroachments of the French Decimetric System.

The Duodecimal Society has the responsibility of developing the Arithmetic and the Metric System of tomorrow.

Are these statements correct?

Do we realize this?

Do we accept this responsibility?

THE TWELVE WINDS AND THEIR PORTALS
An Excerpt From The Book of Enoch

As translated from an ancient Ethiopic text by R.C. Charles, Canon of Westminster, Fellow of Merton College, Fellow of the British Academy.
Submitted by Kenneth C. McCulloch

LXXVII 1. And at the ends of the earth I saw twelve portals open to all the quarters of the heavens, from which the winds go forth and blow over the earth. 2. Three of these are open on the face (i.e. the east) of the heavens, and three in the west, and three on the right (i.e. the south) of the heavens, and three on the left (i.e. the north). 3. And the three first are those of the east, and three are of the north, and three (after those on the left) of the south, and three of the west.
4. Through four of these come winds of blessing and prosperity, and from those eight come hurtful winds; when they are sent they bring destruction on all the earth and on the waters upon it, and on all who dwell thereon, and on everything which is in the water and on the land.

5. And the first wind from those portals, called the east wind, comes forth through the first portal which is in the east, inclining towards the south; from it comes forth desolation, drought, heat and destruction. 6. And from the second portal in the middle comes what is fitting, and from it there comes rain and fruitfulness and prosperity and dew; and through the third portal which lies towards the north comes cold and drought.

7. And after these come forth the south winds through these portals; through the first portal of them inclining to the east comes forth a hot wind. 8. And through the middle portal next to it there come forth fragrant smells, and dew and rain, and prosperity and health. 9. And through the third portal lying to the west come forth dew and rain, locusts and desolation.

10. And after these the north winds; from the seventh portal in the east come dew and rain, locusts and desolation. 11. And from the middle portal come in a direct direction health and rain and dew and prosperity; and through the third portal in the west come cloud and hoar-frost, and snow and rain, and dew and locusts.

12. And after these (four) are the west winds; from the first portal adjoining the north come forth dew and hoar-frost, and cold and snow and frost. 13. And from the middle portal come forth dew and rain, and prosperity and blessing; and through the last portal which adjoins the south come forth drought and desolation, and burning and destruction. 14. And the twelve portals of the four quarters of the heaven are therewith completed, and all their laws and all their plagues and all their benefactions have I shown to thee, my son Methusaleh.

AN OLD UNIQUE ISSUE OF U. S. POSTAGE STAMPS
by Lewis Carl Seelbach

For the information of philatelists, the U. S. Post Office has recently published the book, "Postage Stamps of the United States, 1847 - 1953." It is profusely illustrated and may be secured from the Superintendent of Documents, Washington 25, D. C., for 65¢.

A very beautiful issue of newspaper and periodical stamps of January 7th, 1875, is illustrated and described on pages 19 to 21. It has a special interest for us because the denominations of the issue are so clearly based on the dozen. The denominations of the issue are as follows:

Denomination	Dozens of ¢	Denomination	Dozens of $
$ .01	*.1*	$	
.02	*.2*		
.03	*.3*		
.04	*.4*		
.06	*.6*		
.08	*.8*	3.00	*.3*
.09	*.9*	6.00	*.6*
.10	*.X*	9.00	*.9*
.12	*1.*	12.00	*1.*
.24	*2.*	24.00	*2*
.36	*3*	36.00	*3*
.48	*4*	48.00	*4*
.60	*5*	60.00	*5*
.72	*6*		
.84	*7*		
.96	*8*		
1.92	*14*		

STUDENT MEMBERSHIP

Two new grades of membership in the Society have been established:- Student Aspirants, and Student Members. How this change came about makes an interesting story.

In April, 1953, Richard B. Parker, a high school student from Glen Rock, N. J., applied for membership in the Society. By the end of the year, he completed his lessons and tests, and was advanced from Aspirant to Member. He had interested others in his school in duodecimals, and in January, 1954, Jay M. Anderson applied for membership. Their enthusiasm and interest resulted in three more applications from their schoolmates within the year.

Jay had meanwhile done a lot of work on the conversion of standards and constants into duodecimals, - especially in the field of chemistry, - and had submitted several very creditable papers for the Bulletin. In November, he was appointed Chairman of the Membership Committee.

Since then, every month or so, two or three of the Glen Rock group use their allowances to make a Saturday trip to our Staten Island headquarters. We have had many enjoyable and profitable klatches.

In line with his work with the Membership Committee, Jay Anderson has suggested that the initial charges of the Initiation Fee and a year's dues were too great an obstacle for the personal finances of high school students, and special terms should be established to meet their needs. The Executive Committee of the Board has considered the problem, and has temporarily approved two new grades of membership, pending official adoption of the necessary constitutional amendment at the next Annual Meeting. The new grades are Student Aspirants and Student Members. For them, initiation fees are waived and the annual dues are reduced to $2 until they become of age. Then the regular dues of $3 a year become applicable.

These teen-agers become Student Aspirants on joining the Society and are conducted through their lessons and tests by the Membership Committee. Upon successful completion of this work, they become Student Members, with full membership privileges.

Since the approval of these grades, Jay Anderson reports receipt of membership applications from four Student Aspirants, and the formation of the Ridgewood High School Duodecimal Mathematics Society. We wish to express to all concerned our congratulations on these constructive developments. We have great respect and admiration for the teaching staff of the Ridgewood High School which has cultivated the initiative and eager enterprise of these young students.

MATHEMATICAL RECREATIONS

Donald M. Brown, Editor

In a recent letter, David Rohy, Santa Barbara, Calif., informed us that his 9th grade algebra class was having trouble with the solution of a problem we published in the August 1950 issue of the Duodecimal Bulletin.

This problem was suggested by Battell Loomis. It concerns the resection of a square into parts which may be rearranged into a rectangle. In its most familiar form, the puzzle proposes cutting an 8 x 8 square into four parts which resemble into a 5 x 11 rectangle. The area in one case is 54, and in the other 55. How is the difference in area to be explained?

Stated in general terms, this is the problem: Given an a x b rectangle cut into 4 sections, A, B, C, and D, as shown. Reassemble them as shown below. Determine integers a, b, and y, such that the shaded excess area is a given integer.

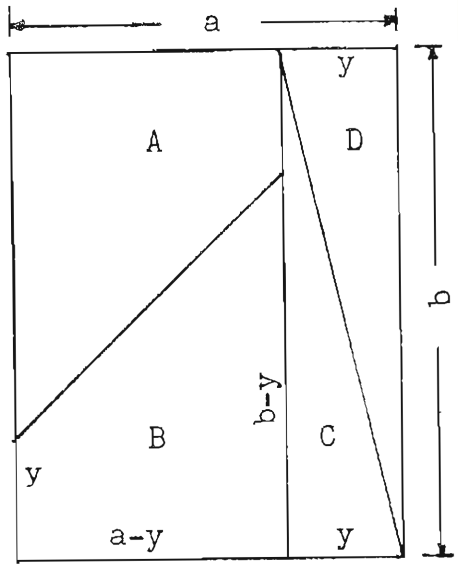

Figure 3

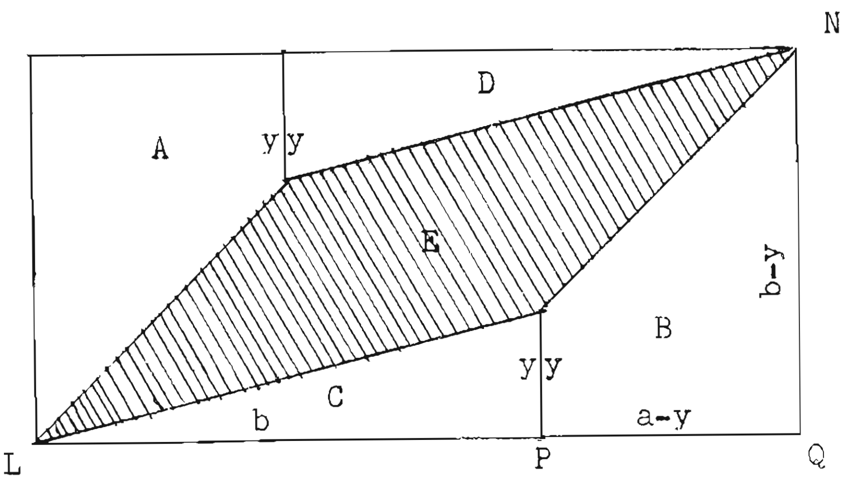

Figure 4

Solution to Problems I and II on page 43 of the Duodecimal Bulletin, Vol. 6, No. 2, August 1950.

The simplest solution can be obtained by considering problem II and Figures 3 and 4. These figures are reproduced here because of errors in the given figures.

Let z be the difference of areas between Figures 3 and 4 so that

1 $$z = (b+a-y)(b-y)-ab = b^2-(a+2b)y + y^2$$

or

2 $$z + ay = (b^2-2by)+y^2 = (b-y)^2.$$

Since b is larger than y, one has

3 $$b-y = \sqrt{z + ay}$$

It is to be remembered that a, b, y, and z are all to be positive integers. Also from 3, z + ay must be the square of a positive integer. Solutions to problem II may now be obtained by the following procedure:

A. Let z be any integer,

B. select any integer, t, not less than z + 1

C. compute $t^2 - z$,

and D. factor this into any 2 factors p & q, where p is larger than q, so that

E. $pq = t^2 - z$. Then a solution to problem II is

F. $a = p$

$y = q$

$b = y + t$

For example,

A. $z = 3$

B. $t = 4$

C. $t^2 - z = 11$

D. $11 = 11 \cdot 1$

E. $p = 11,\ q = 1$

F. $a = p = 11,\ y = q = 1,\ b = y + t = 5.$

As another example, let

A. $z = 1$

B. $t = 5$

C. $t^2 - z = 20$

D. $20 = 8 \cdot 3$

E. $p = 8,\ q = 3$

F. $a = p = 8,\ y = q = 3,\ b = y+t = 8$

This is the example shown in Figure 1 of the bulletin. As a third example let

A. $z = 2$ D. $7 = 7 \cdot 1$

B. $t = 3$ E. $p = 7,\ q = 1$

C. $t^2 - z = 7$ F. $a = p = 7,\ y = q = 1,\ b = y+t = 4$

which is the example given at the bottom of page 43 of the bulletin.

To solve problem I, one need only take $z = 0$. For example let

A. $z = 0$ D. $9 = 9 \cdot 1$

B. $t = 3$ E. $p = 9,\ q = 1$

C. $t^2 - z = 9$ F. $a = p = 9,\ y = q = 1,\ b = y+t = 4$

which is the example given with the statement of problem I in the bulletin.

Note that if $z = 0$ equation 3 becomes

4 $$b - y = \sqrt{ay}$$

and y may contain some squared factors so that

5 $$a = r^2 e$$
$$\text{and } y = s^2 f$$

in which e and f contain no squared factors. Then equation 5 becomes

6 $$b - s^2 f = rs\sqrt{ef}$$

It follows that $\sqrt{ef}$ must be an integer. Since neither one contain any squared factors a little reflection will show that

7 $$e = f$$

Also, since a is larger than y, r is greater than s, so that 5 yields

8 $$a = r^2 e$$
$$y = s^2 e \qquad r \text{ larger than } s$$
$$\text{and } b = s(s+r)e$$

Substituting 8 in 1 one finds that this equation is satisfied for the numbers of the form given in 8. For example, let

$$s = 2$$
$$r = 3$$
$$e = 1$$

then

$$a = 3^2 \cdot 1 = 9$$
$$y = 2^2 \cdot 1 = 4$$
$$b = 2(2+3)1 = X$$

There are at least two other approaches to the problem which may be of interest to a high school algebra class.

Whenever $z = 0$, which is problem I, the area E in Figure 4 becomes 0 and the two line segments LM and MN must fall along the same line. In other words

9 $$LM + MN = LN.$$

Using the Pythagorean theorem this becomes

X $$\sqrt{b^2+y^2} + \sqrt{(a+y)^2+(b-2y)^2} = \sqrt{(b+a-y)^2+(b-y)^2}$$

Squaring both sides and simplifying, this reduces to

Ɛ $$ab - 2y^2 = \sqrt{b^2+y^2}\ \sqrt{(a-y)^2+(b-2y)^2}$$

Again squaring both sides of Ɛ and simplifying this reduces to

10 $$b^4-(2a+4b)\ b^2 y + (a^2+4ab+6b^2)y^2-(2a+4b)\ y^3 + y^4 = 0$$

or

11 $$[b^2 - (a + 2b)y + y^2]^2 = 0$$

Taking the square root of both sides one gets

12 $$b^2 - (a+2b)\ y + y^2 = 0$$

or

13 $$b^2 - 2by + y^2 - ay = 0$$

or

14 $$(b-y)^2 = ay$$

so that

15 $$b-y = \sqrt{ay}$$

This is precisely equation 3 when $z = 0$.

A third method of arriving at this same equation is by noting that when E is 0 lines LM, MN, and LN must have the same slope, or in Figure 4, triangles NQL and MPL must be similar so that

16 $$y/b = \frac{b-y}{b+a-y}$$

Clearing of fractions this reduces to

17 $$y(b+a-y) = b(b-y)$$

or

18 $$b^2 - (a+2b)y + y^2 = 0$$

which is precisely equation 12.

Suppose that one has been given in advance values for a, y, and b. Referring to 8 note that

19 $$b/y = \frac{s+r}{s} = 1 + r/s$$

and

1X $$a/y = r^2/s^2.$$

Using either of these relationships one can obtain r/s and hence values for r and s. To illustrate consider the example given under problem I in the bulletin.

$$a = 9$$
$$y = 1$$
$$b = 4$$

From 19

$$b/y = 1 + r/s = 1 + 3 = 4$$
$$a/y = r^2/s^2 = 9$$

Either equation gives $r/s = 3$, so that one can take $r = 3$, $s = 1$. Note that 19 applies only to problem I. If one attempts to apply it to problem II (that is when z is not 0) one cannot obtain values for r and s. For example, if we consider the problem in the bulletin

$$a = 8$$
$$y = 3$$
$$b = 8$$
$$(z = 1)$$

trying to apply 19 yields

$$b/y = r/s + 1 = 8/3$$

or

$$r/s = 5/3$$

but $$a/y = r^2/s^2 = 8/3$$

or $$r/s = \sqrt{8/3}$$

Since the two values of r/s are not the same, equations 19 do not apply in this case.

Referring again to equation 8 it should be noted that the effect of the factor e for a given r and s is to give a similar figure but of different size. It should also be noted that in following step D of the procedure for obtaining solutions for problem II, frequently more than one set of values for p and q can be obtained. For instance in the example at the foot of page 19, step D could have been written either as $20 = 20\cdot 1 = 10\cdot 2 = 8\cdot 3 = 6\cdot 4$. which would yield four different sets of values for a, y, and b in step F.

It might also be noted referring to figure 4, that not only a-y and b-y must be greater than 0 but also b-2y must be positive. By selecting a value for y, followed by a value of a greater than y and a value of b greater than 2y, a solution to problem II may be obtained in which z is not given in advance but is obtained from equation 1. For example, let

$$y = 2$$
$$a = 3$$
$$b = 5$$

then $$z = 5^2 - 11\cdot 2 + 2^2 = 3$$

YOUR INVITATION

Our plans for 1956 involve a greater attention to the expansion of the influence of our Society among peoples of other tongues. It is probable that we shall have to issue basic duodecimal literature in Interlingua, or Esperanto, or both.

Esperanto offers the advantages of a wide world interest and acquaintance, a background of many years of experience, and a considerable literature. However, it is not immediately comprehensible to the uninitiated. Interlingua is a relatively recent development, but is is readily comprehensible to the educated person without previous acquaintance. Perhaps we will need to use both.

We are not quite happy about the equivalents proposed for duodecimal terms for translation into either of these interlanguages. Your interest in this phase of our work is tremendously important to us. And, whether you are a member, a friend, or a critic of the Society, we would like to have your comments on the relative terminology. Please write us your views.

TIME AND ANGLE CONVERSION TABLES

by Jay M. Anderson

In the duodecimal system, fractionals of the circle are used as the notation of both time and angle. This eliminates the confusion that exists between minutes and seconds of time and minutes and seconds of arc. It also avoids the necessity for changing from one to the other, which is constantly met in navigation and astronomy.

Tables for conversion from the decimal notation of these measures to the duodecimal, and the reverse, may be found in George S. Terry's "Duodecimal Arithmetic," but since this work is often not readily available, the following tables are presented.

Table of Duodecimal Time and Angle Measure

Name	Designation	Time	Angle or Arc
Day or Circle	*1.0*^{d} or *1.0*^{c}	24 hours	360 degrees
Dour	*.1*	2 hours	30 degrees
Temin	*.01*	10 minutes	2.5 degrees
Minette	*.001*	50 seconds	12.5 minutes
Grovic	*.000 1*	4.17 seconds	1.04 minute
Dovic	*.000 01*	.347 second	5.21 seconds
Vic	*.000 001*	.029 second	.434 second

Clock time is to be changed to the 24-hour notation before conversion; i.e., 10:30 P.M. is 22.30. The tables are to be entered from the left.

Examples: (1) Convert 328° 27' 28" to duodecimals.

300° = *.X*
20° = *.08*
8° = *.032 497*
20' = *.001 725*
7' = *.000 688*
20" = *.000 03X*
8" = *.000 016*
Total *.XƐ4 720*^{c}

(2) Convert 12½ minutes of 5 P.M. to duodecimals.
(12½ minutes of 5 P.M. is 16:47:30)

10 hours = *.5*
6 hours = *.3*
40 minutes = *.04*
7 minutes = *.008 497*
30 seconds = *.000 725*
Total = *.849 000*^{d}

CONVERSION OF TIME TO DUODECIMALS					
Hours	Circle	Minutes	Circle	Seconds	Circle
1	.06	1	.001 24X	1	.000 02Ɛ
2	.1	2	.002 497	2	.000 059
3	.16	3	.003 725	3	.000 088
4	.2	4	.004 972	4	.000 0Ɛ6
5	.26	5	.006	5	.000 125
6	.3	6	.007 24X	6	.000 153
7	.36	7	.008 497	7	.000 182
8	.4	8	.009 725	8	.000 1Ɛ0
9	.46	9	.00X 972	9	.000 21Ɛ
10	.5	10	.01	10	.000 24X
20	.X	20	.02	20	.000 497
30	1.3	30	.03	30	.000 725
40	1.8	40	.04	40	.000 972
50	2.1	50	.05	50	.001

CONVERSION OF ANGLE TO DUODECIMALS					
Degrees	Circle	Minutes	Circle	Seconds	Circle
1	.004 972	1	.000 0Ɛ6	1	.000 002
2	.009 724	2	.000 1Ɛ0	2	.000 005
3	.0Ɛ2 497	3	.000 2X7	3	.000 007
4	.017 249	4	.000 3X1	4	.000 009
5	.02	5	.000 497	5	.000 010
6	.024 972	6	.000 591	6	.000 012
7	.029 724	7	.000 688	7	.000 014
8	.032 497	8	.000 782	8	.000 016
9	.037 249	9	.000 878	9	.000 019
10	.04	10	.000 972	10	.000 01Ɛ
20	.08	20	.001 725	20	.000 03X
30	.1	30	.002 497	30	.000 059
40	.14	40	.003 24X	40	.000 078
50	.18	50	.004	50	.000 097
60	.2				
70	.24				
80	.28				
90	.3				
100	.34				
200	.68				
300	.X				

1 Second of Arc = *.000 002 379 38Ɛ*
1 Second of Time = *.000 02X 687 81Ɛ*
1 Vic = .028 935 18 Second of Time
1 Vic = .434 027 Second of Arc
The frequency of the Vic = 34.56 per Second

CONVERSION OF DUODECIMALS TO TIME AND ANGLE

Circle	Hours	Degrees	Circ.	Time Hour	Time Min	Angle Deg	Angle Min	Circ.	Time Min.	Time Sec.	Angle Min.	Angle Sec.
.1	2	30	.01		10	2	30	.001		50		12.5
.2	4	60	.02		20	5		.002	1	40		25
.3	6	90	.03		30	7	30	.003	2	30		37.5
.4	8	120	.04		40	10		.004	3	20		50
.5	10	150	.05		50	12	30	.005	4	10	1	2.5
.6	12	180	.06	1		15		.006	5		1	15
.7	14	210	.07	1	10	17	30	.007	5	50	1	27.5
.8	16	240	.08	1	20	20		.008	6	40	1	40
.9	18	270	.09	1	30	22	30	.009	7	30	1	52.5
.X	20	300	.0X	1	40	25		.00X	8	20	2	5
.Ɛ	22	330	.0Ɛ	1	50	27	30	.00Ɛ	9	10	2	17.5

Circle	Time Seconds	Angle Seconds	Circle	Time Seconds	Angle Seconds	Circle	Time Seconds	Angle Seconds
.000 1	4.167	1.042	.000 01	.347	.087	.000 001	.029	.007
.000 2	8.333	2.083	.000 02	.694	.174	.000 002	.058	.014
.000 3	12.5	3.125	.000 03	1.042	.260	.000 003	.087	.022
.000 4	16.667	4.167	.000 04	1.389	.347	.000 004	.116	.029
.000 5	20.833	5.208	.000 05	1.737	.434	.000 005	.145	.036
.000 6	25.	6.25	.000 06	2.083	.521	.000 006	.174	.043
.000 7	29.167	7.292	.000 07	2.431	.608	.000 007	.203	.051
.000 8	33.333	8.333	.000 08	2.778	.694	.000 008	.231	.058
.000 9	37.5	9.375	.000 09	3.125	.781	.000 009	.260	.065
.000 X	41.667	10.167	.000 0X	3.472	.868	.000 00X	.289	.072
.000 Ɛ	45.833	11.458	.000 0Ɛ	3.819	.955	.000 00Ɛ	.318	.080

INCENTIVES AND OBJECTIVES

There are probably as many different reasons for becoming a member of the Duodecimal Society as there are members. But a few motives are true for all of us. We think the use of duodecimals offers advantages not otherwise available. We want to help make them known, and make them accessible. We seek to explore them more fully, and to learn more about them.

But the differences in our motivations are as important as the common similarities. They are more dynamic for each of us because they are personal.

We all have an acceptance of the idea of a gradual evolution. We feel confident that there is progress toward the better, - the more convenient, - the more practical. Below the surface of our minds, it is this justification that crystalizes our interest in the twelve-base. Duodecimal are better, - and their ultimate adoption is inevitable.

Of course it will take a long time. And time is one of the things we cannot control. But, to some extent, we can control *rate*, and we can control *interval*. The efficiency and the intensity of the force applied affects both.

So the clarity of our planning is important. Within the Society's means, we seek the widest possible distribution of our educational literature. We wish to assure the continuing work of the Society as a center of reference and information. We seek to be ready with the tool that is needed for the next step in the job.

Each of us naturally weighs the effects of the use of duodecimals in our own job or profession. We think of their application to our hobbies and avocations. Sometimes we become curious as to cause and effect of a particular factor, and we investigate what work has been done in this direction. Many fields have had no special cultivation, and we may find an unusual satisfaction in putting our own aptitudes to work. What greater reward can we ask, than to find significance in what we have done?

Even doodling can be of surprising gratification. It is easy to smile about it. But it is possible that what seemed playful embroidery may develop an amazing relevance. Giving the hands something duodecimal to do may let vague and fugitive ideas strengthen into impressive concepts. All of this depends on our personal involvement. In a sense, we each confer on ourselves a different grade of membership by the nature and depth of our personal interest.