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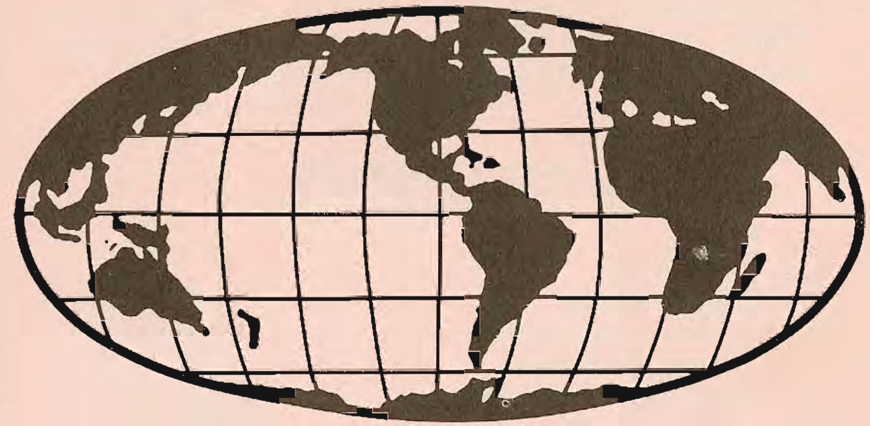

WHY WE NEED DOZENS . . . *See Page 18;*

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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).

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FUNDAMENTAL OPERATIONS IN THE DUODECIMAL SYSTEM - PART II

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Part I of Fundamental Operations appeared in Bulletin 5#, Fall 1988. The charts accompanying this section of the article have been supplied by Fred Newhall.

II. Subtraction in Base Twelve

Example 1: Subtract:

```
  463;
- 13T;
```

(Note: Charts use X rather than T for dec.)

Solution: Since T is greater than 3, we must borrow one group of 12 from the preceding (twelves) column. This yields a sum of 12+3=15 in decimal notation. Now subtracting 10 from 15 gives a difference of 5. Complete the problem in the standard manner. The 6 in the twelves column becomes a 5, 5-3=2 and 4-1=3.

```
Hence   463;
      - 13T;
        325;
```

Hence we have three groups of one hundred forty-four (twelve squared), two groups of twelve, and five units.

We can check our problem by addition:

```
  325;
+ 13T;
  463;
```

Note: (5+T) =(15) =(13;). Place the 3 in the units column and carry the 1 over to the twelves column. (1+2+3) =(6) =(6), which is less than the base. Hence we have no further carrying. (3+1) =(4) =(4), completing the problem.

Example 2: Subtract:

```
  1453;
-  245;
```

Solution: Since 5 is larger than 3, we must borrow one group of 12 from the preceding column. This yields a sum of 12+3=15 in base 10. Now subtract 5 from 15. The difference is 10(**T**). Completing the problem in the usual manner with no further borrowing required thereafter, the 5 in the second column becomes a 4, 4-4=0, 4-2=2, and bring down the 1 in the fourth (seventeen hundred twenty-eights) column.

```
Hence   1453;
      -  245;
        120T;
```

We have one group of seventeen hundred twenty-eight (twelve cubed), two groups of one hundred forty-four (twelve squared), no groups of twelve, and ten units.

To check by addition:

```
  120T;
+  245;
  1453;
```

III. Multiplication in Base Twelve

Multiplication is a bit more involved than addition and subtraction. We illustrate via the following examples:

Example 1: Multiply:

```
  124;
x   6
```

Solution: Multiply as one would in base 10, but use the **duodecimal** multiplication table. Multiplying (4x6) = (24) = (20;). We record the products in base 12. Record the 0 in the **units** column and carry the 2 over to the twelves column. [(2x6)+2] = (12+2) = (14) = (12;). Record the 2 and carry the 1 over to the 12^2 column. [(1x6)+1] = (6+1) = (7). Hence our problem is completed.

Continued . . .

We have
```
  124;
x   6
  720;
```

Thus 720; means seven groups of one hundred forty-four, two groups of twelve, and no units. To check this problem, one could convert each factor to base ten, multiply in base ten, and convert the base ten product into duodecimal notation.

Example 2: Multiply:
```
  6T3;
x  24;
```

Solution: (3x4) = (12) = (10;).
Record the 0. Carry the 1 to the preceding column.
(Tx4)+1] = (40+1) = (41) = (35;).
Record the 5 and carry over the 3 into the preceding column.
(6x4)+3] = (24+3) = (27) =(23;). Record the (23;). Let us examine what has so far been accomplished:

```
  6T3;
x  24;
 2350;   (our first partial product)
```

Next (2x3) = (6). Record the 6, since this is the same decimally and duodecimally.
(Tx2) = (20) = (18;). Record the 8 and carry the 1 into the preceding column.
(6x2)+1] = (12+1) = (13) = (11;). Record the (11;). We now have the following accomplished:

```
  6T3;
x  24;
 2350;  (first partial product)   + 1186; (second
                                   partial product)
```

We now add our partial products in Base 12:

```
   6T3;
x   24;
  2350;
+ 1186 ;
 13EE0;
```


Observe that after bringing down the 0, (5+6) = (E), less than the base 12. (3+8) = (E), (2+1) = (3), and finally bringing down the 1, our problem is complete. Note that no carrying is required.

IV. Division in Base Twelve

Division is the most involved operation encountered so far. It is instructive to illustrate via the following problems:

Example 1: Divide: 6)431;

Solution: Using the base 12 multiplication table, we list the multiples of the divisor, 6:

Decimals		Duodecimals
(6x1)	=(6)	=(6)
(6x2)	=(12)	=(10;)
(6x3)	=(18)	=(16;)
(6x4)	=(24)	=(20;)
(6x5)	=(30)	=(26;)
(6x6)	=(36)	=(30;)
(6x7)	=(42)	=(36;)
(6x8)	=(48)	=(40;)

Since (6x8) = (40;), which is less than (43;), (6) goes into (43;) eight times. We illustrate this below:

```
       8
6   )431;
```

Multiplying in base 12, (6x8) = (40;).
Subtracting, we have a remainder of 3, and bringing down the 1, we repeat the process. We see that (6x6) = (30;), which is less than (31;).

Continued . . .

Use the information above to complete the problem:

```
            86;   R. 1
   6      )431
           40
            31
            30
             1
```

Hence 431; divided by 6 equals 86; with a remainder of 1.

We can check the problem by observing that (Quotient x Divisor) + (Remainder) = (Dividend). As you can see below, (6x6) = (36;) = (30;), which is three groups of twelve. Bring down the 0 and carry the 3 over to the preceding column.
(8x6) = (48) = (40;). (40;) + (3) = (43;).
Also (430;) + 1 (the remainder) = (431;), the dividend.

```
       86
   x    6
      430;   + R 1 = 431;
```

Example: Divide: 7)235;

Solution: Using the base 12 multiplication table, list the multiples of the divisor 7.

Decimals		Duodecimals
(7x1)	=(7)	=(7)
(7x2)	=(14)	=(12;)
(7x3)	=(21)	=(19;)

Since (7x3) = (19;) which is less than (23;), (7) goes into (23;) three times. We illustrate below:

```
          3
      7 )235;
         190   (Supply a zero here, as in base ten
          65    division.)
```


Observe that 5-0=5. Since 9 is larger that 3, we must borrow one group of 12 from the preceding column. This yields a sum of 12+3=15 in base 10. Now subtract 9 from 15. The difference is 6. Working as usual, the 2 in the preceding (leftmost) column becomes a 1 and 1-1=0.

```
Hence     235;
        - 190;
           65;
```

DUO-DECIMAL SYSTEM MULTIPLICATION CHART

x	10	E	X	9	8	7	6	5	4	3	2	1		
1	10	E	X	9	8	7	6	5	4	3	2	1		
2	20	1X	18	16	14	12	10	X	8	6	4		1	1
3	30	29	26	23	20	19	16	13	10	9		4	2	2
4	40	38	34	30	28	24	20	18	14		9	6	3	3
5	50	47	42	39	34	2E	26	21		16	12	8	4	4
6	60	56	50	46	40	36	30		25	20	15	10	5	5
7	70	65	5X	53	48	41		36	30	24	18	12	6	6
8	80	74	68	60	54		49	42	35	28	21	14	7	7
9	90	83	76	69		64	56	48	40	32	24	16	8	8
X	X0	92	84		81	72	63	54	45	36	27	18	9	9
E	E0	X1		100	90	80	70	60	50	40	30	20	10	10
10	100		121	110	99	88	77	66	55	44	33	22	11	11
		144	132	120	105	96	84	72	60	48	36	24	12	12
		12	11	10	9	8	7	6	5	4	3	2	1	x

Squared numbers appear along this line

DECIMAL SYSTEM

Continued . . .

Now looking at our duodecimal multiplication table, (7) goes into (65;) exactly E times. Thus our problem is completed:

```
          3E;
(7)    )235;
        19 ;
         65;
         65;
          0
```

Check:
```
 3E;
x 7
235;
```

Observe that (Ex7) =(77) =(65;). Record the 5 and carry the 6 over to the preceding column.

[(3x7)+6] = (21+6) = (27) = (23;), which is two groups of twelve plus 3 units.]

It is interesting to note that in base 12, 7 is a factor of 235;. This is certainly not the case for 235 in base ten. We thus observe a difference in the duodecimal system.

V. Solving Equations in Base Twelve

Recall that an equation is a mathematical statement of equality between two expressions. In the decimal system, 2+5=7 and 3x7=21 are examples of equations. 2+8=11 is another example, although it is a false statement.

The following examples are equations (and true statements) in the duodecimal system:

E + T = 19; T - 9 = 1; 8 x E = 74; and 1T ÷ 2 = E.

One can solve equations in base 12 by a process similar to that in the decimal system. We will illustrate via the following examples:

Example 1: Solve for X: X + T = E

Solution: From our duodecimal addition table we desire the number that precedes E by T units. It is easily determined that X=1. Of course, one may subtract T units from both sides:

```
X + T = E
  - T  -T
X     = E - T
```

DUODECIMAL SYSTEM ADDITION CHART

+	10	E	X	9	8	7	6	5	4	3	2	1		
1	11	10	E	X	9	8	7	6	5	4	3	2		
2	12	11	10	E	X	9	8	7	6	5	4		2	1
3	13	12	11	10	E	X	9	8	7	6		4	3	2
4	14	13	12	11	10	E	X	9	8		6	5	4	3
5	15	14	13	12	11	10	E	X		8	7	6	5	4
6	16	15	14	13	12	11	10		10	9	8	7	6	5
7	17	16	15	14	13	12		12	11	10	9	8	7	6
8	18	17	16	15	14		14	13	12	11	10	9	8	7
9	19	18	17	16		16	15	14	13	12	11	10	9	8
X	1X	19	18		18	17	16	15	14	13	12	11	10	9
E	1E	1X		20	19	18	17	16	15	14	13	12	11	10
10	20		22	21	20	19	18	17	16	15	14	13	12	11
		24	23	22	21	20	19	18	17	16	15	14	13	12
		12	11	10	9	8	7	6	5	4	3	2	1	+

DECIMAL SYSTEM

Continued . . .

In base 10, (X) = (E-T) = (E) - (T) = (11) - **(10)** = (11-10) = (1), which is one unit either decimally or **duodecimally**. Thus X = 1.

Example 2: Solve for X: X - 145; = 789;

Solution: One can add 145; to both sides.

```
X - 145; = 789;
  + 145;  +145;
X        = 789; + 145;
```

Thus, add

```
 789;
+ 145;
```

Now (9+5) = (14) = (12;). Record the 2 in the unit column and carry the 1 over to the twelves column. (1+8+4) = (13) = (11;). Record the 1 in the twelves column and carry the one over to the one hundred forty-fours column. (1+7+1) = (9) = (9;), completing the problem. Hence X = 912;.

```
  789;
+ 145;
  912;
```

Example 3: Solve for X: 7X = 53;

Solution: It is easy to solve this problem using the multiplication table. Observe that 7 goes into 53; precisely 9 times. Hence X=9.

Example 4: Solve for X: $\frac{X}{6} = 8$

Solution: Multiply both sides by 6,

$6 \cdot \frac{X}{6} = 6(8)$ Thus: X=40;

(See the multiplication table.)

Example 5: Solve for X: 2X + 50; = 68;

Solution: First we subtract 50; from both sides:

```
2X + 50; = 68;
   - 50;  -50;
2X       = 18;
```

Now 2X =18;. Hence from the multiplication table we see that 2(T) = 18;. Hence X = T is our solution.

Example 6: Solve for X: X^2= T1

Solution: From our table for duodecimal multiplication we see that E x E = E^2 = T1. Hence our solution is that

X== ±E

Conclusion: The duodecimal system of numeration presents a very neat illustration of how to perform arithmetic and algebraic computations in other bases. In this paper the author has attempted to demonstrate these ideas. Other activities, such as decimal point computations, can be performed in much the same manner as in the decimal system. The use of another system of numeration serves to provide variety and promotes interest and appeal to mathematicians and dozenalists alike. The reader is invited to seek other activities in which duodecimals can be utilized.

End

NEXT ISSUE

The next issue of the *Bulletin* will be published in September.

The issue will include the Constitution and By-Laws of the DSA, as well as the schedule of the 1989 Annual Meeting.

10;0 = ONE DOZEN

*This article is reprinted with the permission of the Missouri Council of Teachers of Mathematics **BULLETIN**, where it originally appeared in Volume XIV, Number 3. Thanks to their Editor, Bob Buss, who solicited the article from the DSA, and to Gene Zirkel who assisted him.*

One of the [MCTM] **BULLETIN**'s reporters recently ran across an organization called the Dozenal Society of America, became excited by the goals of the organization and has become a tireless advocate of converting our present decimal system to the duodecimal system. We asked our reporter to share his findings and his views with our readers.

BULLETIN: Just what is the Dozenal Society?

Reporter: The Dozenal Society of America is a voluntary non-profit 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.

B: Why would anyone want to introduce a new number system?

R: Think for a second. There are twelve hours on a clock- twelve inches in a foot - twelve dozen in a gross - twelve items in a dozen - twelve months in a year - twelve ounces in a troy pound. We use these measures based on twelve in a number system based on ten.

Did you know that the word "grocer" comes from the same root as "gross" - a grocer is a man who deals by the gross. For ease in packaging and ease in computation, most commodities are sold by the dozen and gross instead of by tens and hundreds.

Mathematicians and philosophers have long been aware that ten is actually a poor base for a number system. Several others have been suggested, with considerable agreement that twelve, with its many factors, would be the most serviceable. Its actual use has been suggested at various times, notably by Herbert Spencer and Isaac Pitman--but the hand of tradition is heavy, and few persons, even among

professional mathematicians have actually tried out this superior system of counting by dozens.

B: Well maybe you have something. Tell us more about the Society itself.

R: An informal correspondence group began to call itself the Duodecimal Society of America. When this group grew too large for the round-robin correspondence and the importance of the investigations seemed to warrant more formal organization, one of the members suggested official incorporation and implemented his suggestion with a substantial endowment to help cover operating expenses.

Accordingly, the Duodecimal Society of America (DSA) was incorporated in the State of New York in 1944. In 1980 the name of the Society was changed to the Dozenal Society of America. A sister society, The Dozenal Society of Great Britain, was organized in 1958.

Dues are $12 a year and include a subscription to the Duodecimal Bulletin c/o Nassau Community College, Garden City, L.I., N.Y. 11530.

F. Emerson Andrews was president of the DSA from its founding in 1944 until 1950 when he became Chairman of the Board, a position he held until 1962. He authored "My Love Affair with Dozens" appearing in the spring 1972 Michigan Quarterly Review. He died in 1978 at the age of six dozen and four years.

B: What are the advantages of using a number system based upon the number twelve?

R: The duodecimal system offers a perfect third, 0;4, or four twelfths; a simple quarter, 0;3, or three twelfths, a multiplication table easier to learn; and vast economies in operations involving feet and inches, hours, months and the many other twelfths already present in our units of time and measure.

Continued . . .

B: You'd better tell us about the symbols you're using.

R: First we must invent the two additional symbols which the Hindus and Arabs forgot. At present ten and eleven are compound numbers; we must reduce them to a single symbol. For ten, we will use '*' and call it dek. For eleven, let us use '#', and call it el.

Thus:
0,1,2,3,4,5,6,7,8,9,*,#,10,11,12,13,14,15,16,17,18,19,1*, 1#,20...

The figure 10 now means not 'one ten and no units' but 'one dozen and no units.' To avoid confusion let us call it 'do,' which will remind us both of its ten-appearance and of its dozen units. In the new system 14 means 'one twelve plus 4 units' or the quantity we now express as 16. Similarly 86 means 'eight twelves, plus six units' our present 102.

Here is a line from our multiplication table:

6 X 1 = 6
6 X 2 = 10
6 X 3 = 16
6 X 4 = 20
6 X 5 = 26
6 X 6 = 30
6 X 7 = 36
6 X 8 = 40
6 X 9 = 46
6 X * = 50
6 X # = 56
6 X 10= 60

By the way, 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. Whatever symbols are used the numbers commonly called 'ten' and 'eleven' and 'twelve' are pronounced 'dek' 'el' and 'do' in the duodecimal system.

B: What about decimals?

R: Because of a simple confusion in names, many persons jump to the conclusion that it will be impossible to express fractional quantities by whole numbers after a point by any other than our present 'decimal' - founded on base-ten system. This is, of course, nonsense. 'Decimals' in the literal sense of tenths can be expressed only in the base-ten-system, but the same form of expressing fractions is available to any number system which includes a zero.

When it is not clear from the context whether a numeral is decimal or dozenal we use a period as a unit point for base ten and a semi-colon as a unit point for base twelve. Thus 1/2 = 0.5 = 0;6.

As a matter of blunt fact, the 10-system is a singularly poor one for the expression of decimal fractions.

It will be obvious that ;4 meaning four twelfths or one third, is an entirely adequate representation for a third, and a deal easier and more accurate than .33333333 plus.

Also ;3 for a quarter is better than our present .25. And ;6 (six twelfths) is as adequate for a half as .5 (five tenths). Let us examine the corresponding decimals and duodecimals for the low fractions:

Fraction	Decimal	Duodecimal
One	1.0	1;0
One half	.5	;6
One third	.33333...	;4
One fourth	.25	;3
One fifth	.2	;24972...
One sixth	.16666...	;2
One seventh	.14285...	;186*3...
One eighth	.125	;16
One ninth	.1111...	;14
One tenth	.1	;12497...
One eleventh	.09090...	;11111...
One twelfth	.08333...	;1

Continued . . .

A glance at this table reveals that the 10-system has 50 percent more (in this sample) endlessly repeating numbers which cannot be accurately expressed without fractions. Moreover, in the case of both one fourth and one eighth it requires an additional figure to express the same fraction.

B: And percentages?

R: What has been said of decimals can be repeated with still more pertinence for percentages. We have already spoken of the inexcusable shortsightedness of creating a whole with 100 parts. In the 12-system the whole has the same visual and computational advantages of being expressed as 100 per cent, but it has 144 parts. This means that pergrossages are not only more accurate (by nearly half) but because 144 is a splendidly factorable number (which one hundred is not), a percentage system based on 144 parts can express with complete accuracy a vastly greater number of much-used fractions than our present system.

B: What are some of the other beneficial results that would occur should we adopt the dozenal system?

R: The search for prime numbers is narrowed. All perfect squares in the 12 system must end in either 0,1,4 or 9.

Under the number system of 12, every dime is immediately worth 12 cents and every dollar twelve dimes - 144 cents. Would that not accomplish at one stroke the currency inflation we may have forced upon us by more dangerous methods - accomplish it without altering at all the relative possessions of people or the adequacy of the gold reserve.

B: Has anyone previously tried to introduce your system?

R: Twelve seems never to have been used as a number base by primitive people simply because no part of the body served very well for counting by twelves - it had no natural reason for springing up. By the time its mathematical advantages were recognized, men were so used to counting by tens that it was not introduced. Just once it came very near to being

tried. Charles XII of Sweden is reported to have been on the point of introducing the number system based on 12 when he died.

As early as 1585 Simon Stevin stated that the duodecimal base was superior to base ten.

B: But really, why should we change?

R: Why change? The same question was probably rife in Europe between the years 1000 and 1500, when the new Hindu-Arabic numerals were slowly making their inching progress and displacing the comfortable and familiar Roman numerals (Who needs a symbol for nothing?). We know that our present Arabic numerals were first introduced into Europe in 976, just a little more than a thousand years ago; number systems have changed repeatedly in history, and may change again.

The decimal base is unsatisFACTORy because it has NOT ENOUGH FACTORS. Let us consider just for a moment the highly improbable chance of the adoption of the duodecimal system. Colossal adjustments would be needed - but no greater than Turkey underwent when its new alphabet was adopted, no greater than the Western world underwent in the tenth and eleventh centuries in changing from Roman to Arabic numerals. The present generation would have a most awkward time, chiefly in unlearning the old multiplication tables; but children for all future generations would find mathemtics made vastly easier by the present sacrifice.

B: But should we change?

R: Should we change? Yes, but no change should be forced and we urge no mandated change. Base twelve numeration should be taught in the schools. Perhaps by the year 2000 (or maybe by 1200; which is 14; years later!) duodecimals may be the more popular base.

B: Thank you.

The MCTM Bulletin ended this article by inviting inquiries to the DSA.

End

THE COMMUNICATIONS EXPLOSION

Fred Newhall
Smithtown, NY

Fred Newhall is current President of the DSA. He spoke on "The Communications Explosion" at the 1988 DSA Annual Meeting.

We're living in the age of an ever expanding communications technology. We are increasingly being amazed by new developments in all fields of world information transfer.

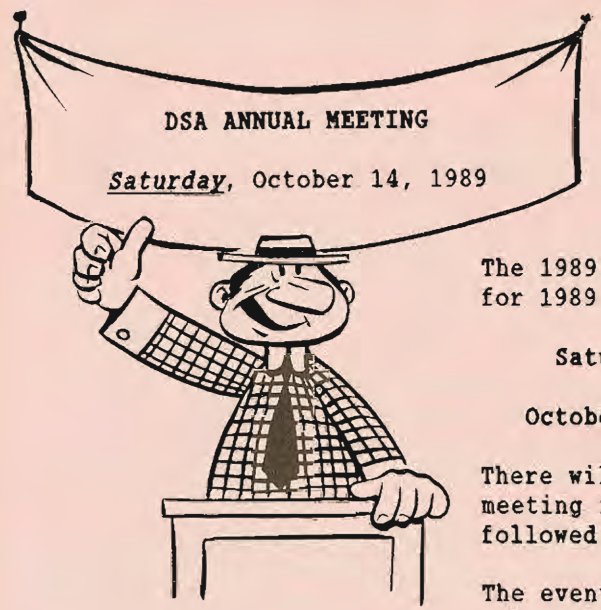
In my lifetime I remember when a "long distance" telephone call was limited to the nearest town 20 miles away. If over the crackle of background noise you shouted loud enough into the funnel of the mouthpiece, you might hear the faint answer in the earpiece. Any farther distance had to go Morse Code by Western Union telegraph. Now, through the design of induction coils, repeater stations, shielded cables, coax wires, microwave towers, and then statellites, we can speak to anywhere in the world almost as clearly as to someone in the same room. The boy telephone operators on roller skates were replaced by ladies at switchboards, then by dial phones, push-button phones, and electronic switching, so that now we have a choice of many types of multiple connections. Soon videophones will be economically feasible.

In Rochester we would go to a neighbor's home of an evening, put on our earphones and sit around the magic box whose tubes were lighted with a set a batteries underneath. Above the static, if the radio were tuned properly, we could make out the programs from KDKA Pittsburth, WEAF New York, or WGY Schenectady. The antenna was a 100-foot wire strung between two trees in the backyard. Later on I built a crystal set with a "cat's whisker" antenna; then came the Atwater Kent in the metal coffin with loudspeaker on top. It would heat up so much that the insulation would crack off the wires inside. Next came the Magnavox in the hand-crafted wooden cabinet with leather loudspeaker having "velvet tones." If you wanted to hear the higher frequencies, you could turn on the squeak of the mass-produced Emerson, Philco or Zenith. Our auto radio drew more amps than the headlights. Now our

transistorized combination radio tape recorder with dual hi-fi speakers has little effect on the car battery.

I remember the neighborhood West End Theatre whose "flickers" were really hard on the eyes because the electric generator was 25 cycle and the film speed was only 32 or so. A talented piano player, chewing gum to the rhythm of his music, eyes glued on the silent movie, played appropriate background music for two hours straight. With 50 cents or a dollar we could enjoy the downtown Palace to be entertained by two movies, vaudeville, and a Worlitzer organ recital in a luxurious setting during the depression. Charlie Chaplin's silents were replaced by the talkies, then Technicolor and musical extravaganzas.

Continued . . .



The 1989 DSA Annual Meeting for 1989 will be held on

Saturday ONLY

October 14, 1989.

There will be a business meeting in the morning, followed by a guest speaker.

The event will conclude with a late luncheon or early supper.

Full details will be provided in the September *Bulletin*.

COMMUNICATIONS EXPLOSION, Continued

But now even the Multiplex cinema has almost been rendered obsolete by TV. My first set was built from a kit with no cabinet. We enjoyed Uncle Miltie and Jack Benny and will always remember Orson Wells's invasion from outer space. Color TV again came in a big iron box. Adding an extra antenna brought in the educational channels. Now coaxial cable brings dozens of programs to choose from. Satellites bring us on-the-spot news from distant continents, and fiber optics provides static-free dependable reception.

Music enjoyment blossomed after World War I. My aunt had a magnificent mahogany Victrola with "His Master's Voice." She would wind it up, lift the hood, and carefully center the clay disk of Caruso, played with a cactus needle for soft tones. Remember the "Hit-of-the-Week" flexible

SQUARE ROOT OF TWO ??

Brian Dean, a new member from Kent, Ohio, in reference to "Mathematical Constants" by Mark Calandra [*Bulletin* number 52; Volume 2*, Number 3, Fall 1985, page #], says that the square root of 2 in base twelve should not be written 1;4#79170*07#76 as given there. This number is only accurate to 10; places. The correct number is actually 1;4#79170*07#85737704#.

COMMUNICATIONS EXPLOSION, Continued

records? Later came 33 and 45 RPM long-play records. You could load a jukebox for a whole evening's dance music. Then came tape recorders, 8-track hi-fi, and now digital recordings. Instruments are now electronic with synthetic compositions and out-of-this-world new sounds.

In the middle ages monks would copy *manu*-scripts by hand, one letter at a time. Gutenberg made mass printing possible. Most important is the duplication process, so that original works can not be lost forever. Remember when blueprints were blue, and when alcohol copies would fade out in sunlight? We used to crank out mimeograph copies of our Scout newspaper. Now my local Xerox store prints better-than-original copies collated while you wait at minimal cost.

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*, October 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)

Few people know of the latest communication breakthrough. Fiber Optics is the sending of information by light beam through hair-thin glass. A laser transmits a light beam into one end of a glass fiber, and miles distant it is transduced by LED into electronic signals again, all at frequencies higher than any metallic medium can transmit. It is static-proof, sun-spot proof, and is encouraged by the military who worry about our satellite communication being knocked out by "star wars" technology. Fiber optics now extends up and down the East Coast and West Coast, and recently a cable was laid under the Atlantic; next year the Pacific. Bravo!

In 1949 at Bell Laboratories we were building one of the first computers. Its relay racks from floor to high ceiling filled a huge room. Every time it was turned on, its vibrations would break wires loose, taking days to relocate and replace. But meanwhile they developed the first transistor in a 1 1/4-inch cylinder. Hot radio tubes were gradually replaced by cool transistors in "printed circuitry" until now a computer chip has to be examined under a microscope. An entire computer is on one almost invisible chip. Computers are networked by modem so that almost every business these days is computerized. If a first-grader hasn't learned how to operate his home computer, he's not with it!

The real achievement of computers is the forcing of people to think logically. No longer can people's minds be biased by tradition. New progressive ideas are grabbing hold in leaps and bounds. Our brains are being freed from the cobwebs of conservatism. I believe that the age of reason is progressing so fast that we can actually reconsider some of our most basic concepts of communication, such as language and number system.

Readin' and writin' are as primitive as when the Roman alphabet fell together 2000 years before the fall of Rome. We confuse our school children with illogical spelling and with inefficient writing. That is the greatest crime against our sons and daughters. World peace depends on

international understanding; the Sound Alphabet and Simplified English are the proven remedy awaiting acceptance.

'Rithmetic is also primitive. When people discover how convenient the Duo-Decimal base of numbers really is, they will begin to teach it in the early grades and on public television and adopt twelve-thinking to business and in the professions. If the speed of progress in communications continues to explode as it has up to now, it won't be long before everyone will accept as reality our dozenal system of mathematics.

End

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. Whatever symbols are used, the numbers commonly called "ten," "eleven" and "twelve" are pronounced "dek," "el" and "do" in the duodecimal system.

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 1/2 = 0.5 = 0;6.

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