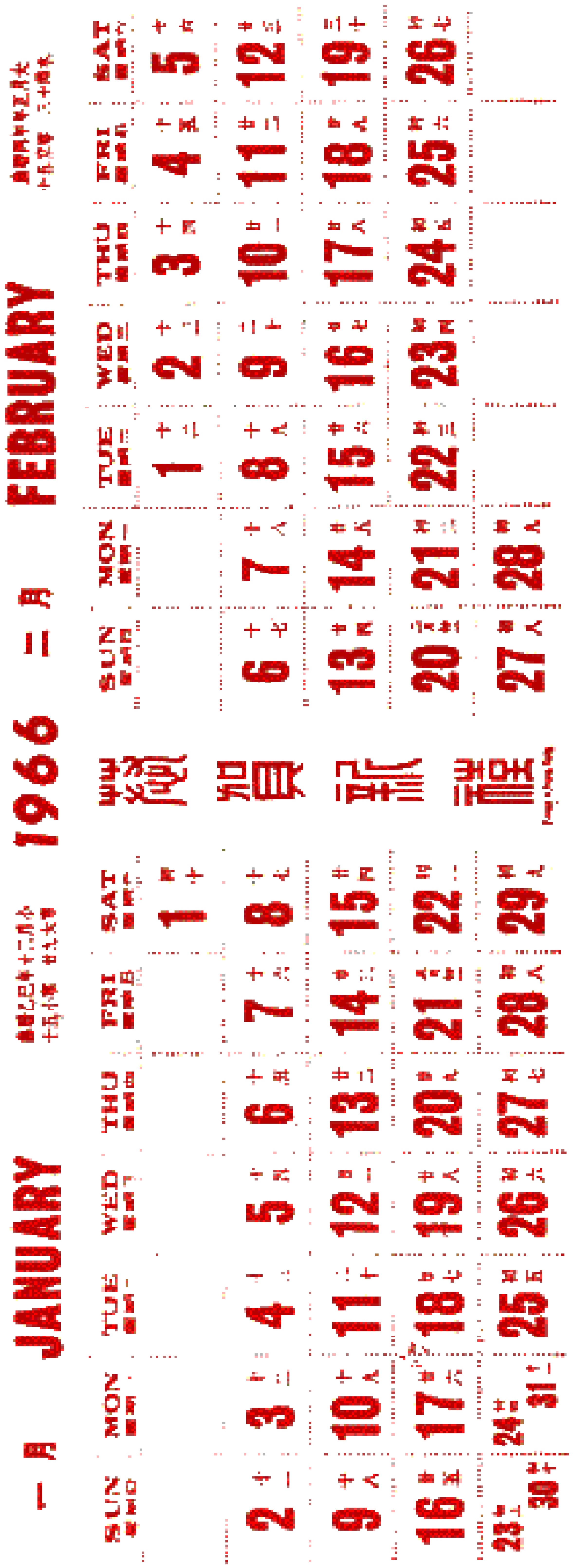


CHINESE CALENDAR

The history of the calendar is the story of a struggle to combine lunar months of 29½ days with years of nearly 365¼ days. In the West we long ago gave up the attempt to relate the months to the phases of the moon. Our Gregorian Calendar measures the year. The extra days in leap years ensure that the calendar is never more than half a day out.

The best compromise was the calendar formerly used in the Near East. Months of 29 days alternating with months of 30 days took care of the moon, but 12 such months are 9¼ days short of a year. To make this up, every third or fourth year had 13 months. There was no regular system of deciding when this extra month should come. The high priest, and later the bishop, in each town would inspect the crops. If he thought the harvest would be late he would order that the year should have an extra month. Perhaps the N.F.U. would like to introduce this system in England.

After the Arab conquests, Mohammed ordered that every year should have twelve months. This means that the Mohammedan "New Year" wanders round the true year and falls in the same season about every forty years.

The Chinese gave up the struggle even earlier. The Chinese "year" consists of twelve lunar months, six of 29 days and six of 30 days. The leaf from a Chinese Calendar shows that China celebrated New Year on January 21st, 1966.

The calendar shows the dates in Chinese numerals. Perhaps you can identify them. The Chinese have numerals from 1 to 9 and symbols for "tens," "hundreds," "thousands." If we wrote 365 as 3h6t5 (just as we might write 3yd.2ft.4in.) we would be using a system like the Chinese. There is just one complication; instead of 2t and 3t there are special combinations for twenty and thirty.

C.V.G.

40041 52970 02878 30766 70944 47456 01345 56417

mathematical pie

No. 49 *Editorial Address:* 100, Burman Rd., Shirley, Solihull, Warwicks, England OCTOBER, 1966

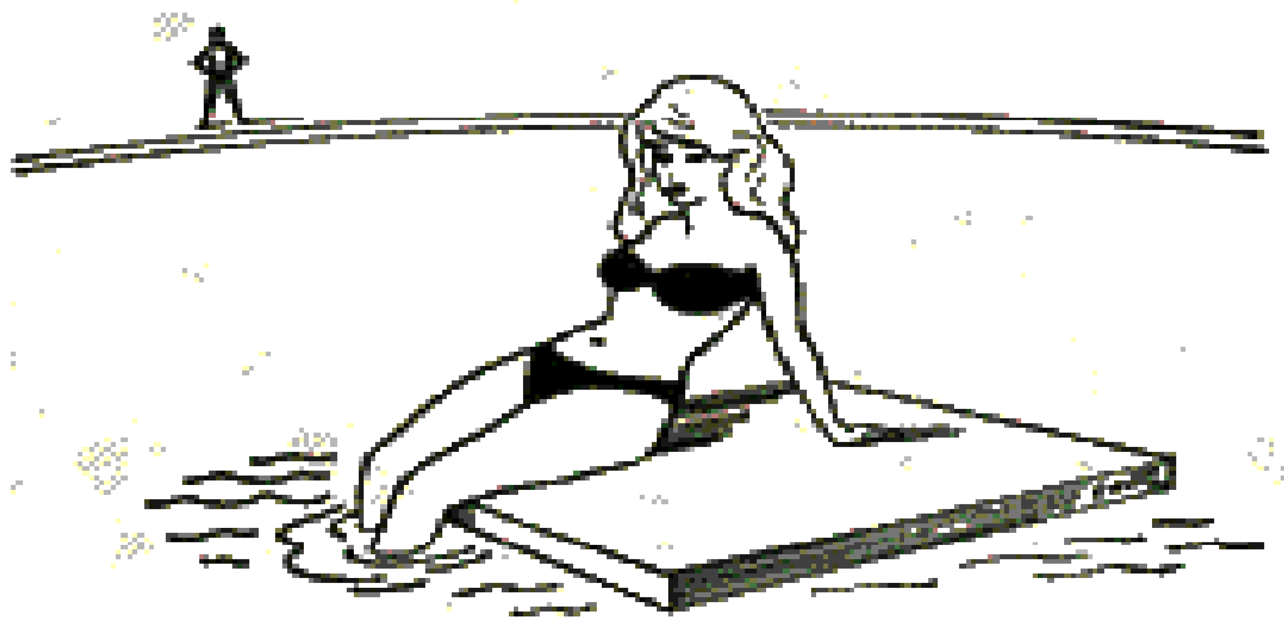
CHASE ME CHARLIE

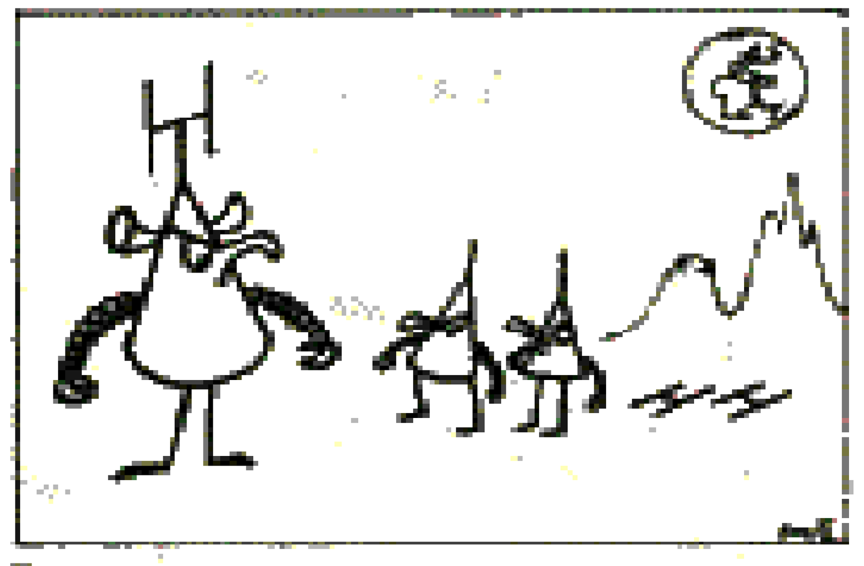
Cutie was sunning herself on a raft at the centre of a large swimming pool when to her annoyance she saw an ex-boy friend waiting at the edge of the pool with the obvious intention of pressing his unwelcome attention on her when she came to the shore. She knew that he could run four times as fast as she could swim but once on land, she could easily outdistance him.

It was beginning to get late and she was hungry as well as annoyed so she devised a plan for outwitting him. What was her best strategy for reaching a point on the land before he could get there?

Assume the pool is circular.

R.M.S.





"Dropping your aitches again, children!"

WHEN WRITING NUMBERS

When writing numbers in the binary system, the various columns correspond to powers base two.

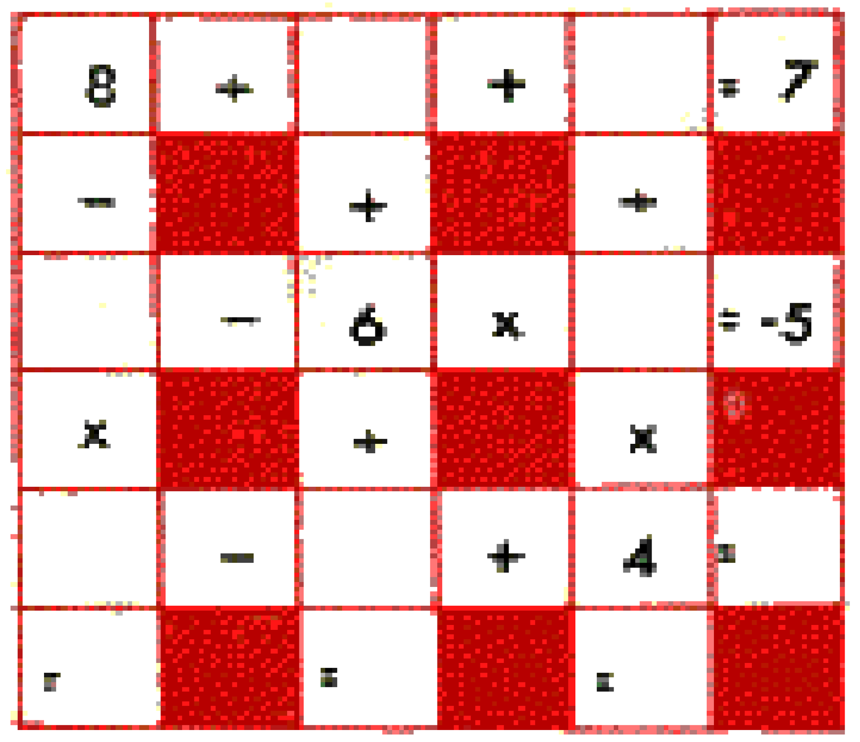
i.e.,	16	8	4	2	1	in the denary notation
					1	means one
				1	0	means two
				1	1	means three, etc.

Hence any number may be expressed in terms of the symbols 0 and 1. Twenty-five is 11001.

Suppose the columns referred to the powers of minus two. Can we express any number by the symbols 0 and 1 when the headings of the columns are 16 −8 4 −2 1?

R.H.C.

18443 96582 51375 43885 69094 11303 15095 26179



WITHOUT A WORD

Each empty square requires one figure so that the working from top to bottom and from left to right is correct. BODMAS applies.

D.I.B.

BAND CONSTRUCTION

In my pocket I carry around what used to be a combined ruler and protractor made of white plastic. It is an accurate rectangle 6 in. by 2 in., but the constant rubbing in my pocket has obliterated all the markings from it. Recently, I used it to bisect a straight line 3.7 in. long and also an angle of about 57°. In my usual forgetful way I had left my compasses at home. How did I do the two constructions?

A parallel strip without markings is called a band. R.M.S.

HOW ODD

Make a table of the values of a^n for $a = 1, 2, 3, \ldots$ working on upwards. For each base inspect the last digit of each power and see what you notice in each case. For example, if we begin with base 4, $4^1 = 4$, $4^2 = 16$, $4^3 = 64$, $4^4 = 256$, $4^5 = 1024$, etc.

Here you notice that only two digits 4, 6 turn up as the last digit. Which kind of number do you have to have to be sure that 9 digits can turn up at the end. Can you explain why this is so? R.H.C.

INITIAL ALGEBRA 1

Some shopkeepers use 'private marks' by which the price of an article is stated by letters representing numbers. Usually these letters form a code word if arranged in the order that corresponds to 1, 2, 3, etc. Can you find the code word used in the shop where the following was seen? The trade prices are likely to be between 15 and 25 per cent. of the retail price.

BRUSHES

	B quality		A quality	
	Trade	retail	Trade	retail
1 in.	O/T	3s. 3d.	R/E	3s. 9d.
2 in.	N/A	5s. 6d.	N/T	5s. 10d.
3 in.	A/HH	8s. 9d.	S/L	9s. 6d.
4 in.	HE/R	12s. 6d.	HH/A	14s. 6d.
6 in.	HA/A	20s. 6d.	HT/A	22s. 6d.

Submitted by Mr. G. Edgcombe, Plymstock Comprehensive School.

FRUITY REMARK

What happens when you count apples in two's? R.H.C.

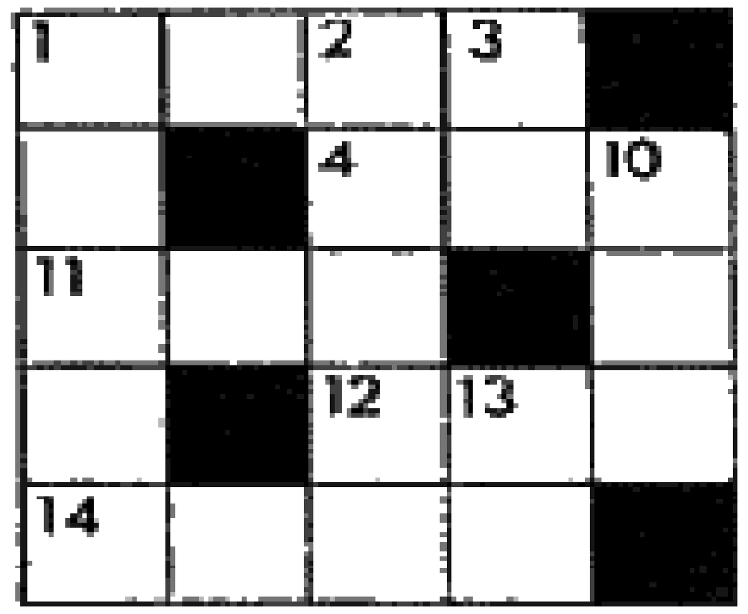
THE LATEST JAZZ GROUP?

Logarithm. (Say it slowly). R.H.C.

37800 29741 20766 51479 39425 90298 96959 46995

JUNIOR CROSS FIGURE No. 41

All the clues and answers are in the scale of five.



Across

1. 234 × 12
4. 212 — 210 ÷ 24
11. $4^3 + 3^3 + 2^3 - 1^3$
12. 2.021 — 1.442
14. $3^{10} - 3^4 - 3^3 - 3^1 - 3^0$

Down

1. 243 × 102
2. 111 reversed + 1
3. $\sqrt{2124}$
10. 43
13. $4^2 + 4^1 - 4^0$

B.A.

SOLUTIONS TO PROBLEMS IN ISSUE No. 48

PRESIDENTIAL PROBLEM

LYNDON	570140
B	6
JOHNSON	3420840

MODERN CROSS FIGURE

Clues Across: (1) 123; (5) 1618; (8) 322; (10) 36; (11) 27; (12) 600; (13) 1875 (15) 896.
Clues Down: (2) 212; (3) 56; (4) 1321; (6) 130; (7) 8600; (9) 278; (12) 659; (14) 78.

SOLUTIONS TO PROBLEMS IN ISSUE No. 49

CHASE ME CHARLIE

She must first swim so that the raft is always between her and the boy, gradually increasing her distance from the raft until she is $\frac{1}{4}$ radius from the centre. At this distance from the raft he can move round the edge of the pool with the same angular speed that she can swim, so she can gain no more in this way. She must now turn and dash straight for the shore. She has $\frac{3}{4}$ radius to travel while he has π radii to cover at four times the speed. As $\frac{3}{4}$ is less than $\frac{\pi}{4}$, she will arrive there first and make her escape.

WHEN WRITING NUMBERS

It is possible to write numbers in this way. For example, three is 111 in the scale of − 2, *i.e.*, 4 − 2 + 1, and seven is 11011, *i.e.*, 16 − 8 − 2 − 1.

BAND CONSTRUCTION

The solutions will be given in the next issue.

INITIAL ALGEBRA I

The code word was HORN?ASTLE, probably HORNCASTLE.

FRUITY REMARK

When apples are counted in two's do they become pears? (pairs!).

ABCD IS A SQUARE

One cut only is necessary, but the folding is left to you.

EIGHT EIGHT'S

888 + 8(8 + 8) − 8 − 8 = 1,000.

BACKWARDS

There are six years between 1st January 3 B.C. and 1st January 4 A.D.

SMALLEST NUMBER

The smallest number is 59.

WITHOUT A WORD

8 + 2 + 3 = 7, 7 − 6 × 2 = −5, 1 − 2 + 4 = 3.

B.A.

09183 90367 36722 20888 32151 37556 00372 79839

ANY SCALENE TRIANGLE

In any scalene triangle, draw a line perpendicular to the longest side to divide the triangle into two equal areas. Explain your construction.

Book token for best solutions received by 30th November.

NOT A HUNDRED PER CENT FIT

" 25% of patients can be cured completely, and 90% can be sufficiently relieved of their symptoms to make life tolerable."

So said a doctor speaking on television about migraine.

It would be interesting to know what happens to all the others ! S.T.P.

QUOTE

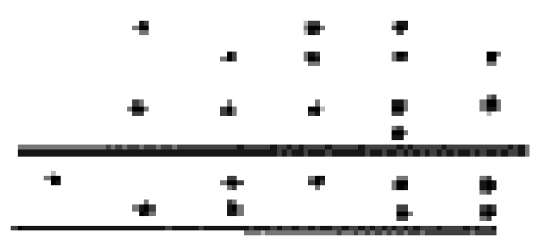
Ah ! why, ye Gods, should two and two make four ?

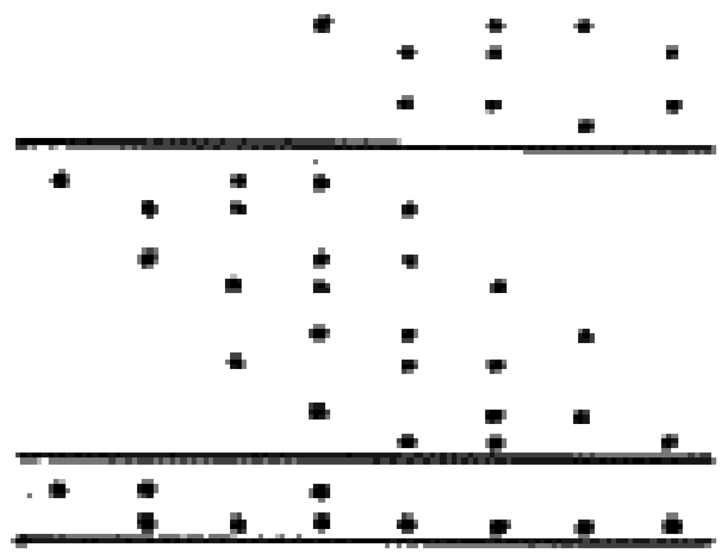
ALEXANDER POPE

LETTERS TO THE EDITOR from GENERAL TAIKOFF

Dear Comrade,

Everyone knows of the brilliant achievement of Colonel Blastov in successfully landing his space craft on the chief planet of Alpha Centauri. Unfortunately some damage was sustained and a return journey is not possible. Suitable conjunctions for the despatch of a recovery expedition will not occur for another 37 years. In the meantime, Blastov is transmitting observations of considerable interest. The dominant creatures, who call themselves Yaffels, are not men but equal men in intelligence, although they are 3,000 years behind us in technology. They have a highly developed language and have considerable skill in arithmetic. To represent numbers, they use the three symbols ·, .., and : which they make by striking their beaks on tablets of wax or clay. They have never developed an algebra because they have no alphabet. In writing, they represent the 25 sounds used in their language by the numbers from –12 to +12. Blastov has sent the following examples of computation :—





which appear to be an addition and a long multiplication in Yaffel notation. Unfortunately, because of interference, the remainder of the transmission explaining this notation was not received and it is impossible to ask for a repetition as Blastov's receiver is not functioning. Perhaps one of your readers could interpret the notation and provide me with addition and multiplication tables in Yaffel notation. Honorary membership of the Order of the Red Rocket* will be conferred on the solver.

Yours co-fraternally,

A. TAIKOFF, General.

**and also a book token for the best effort.*—ED., Mathematical Pie.

ABCD IS A SQUARE

ABCD is a square cloth that has to be cut into 16 squares of equal size. What is the least number of cuts that are necessary to do this ?

What is the least number of cuts necessary to produce 64 equal squares ? Folding of the cloth is permitted. J.F.H.

Do you ever say things like " Two minuses make a plus " when it is obvious that –2 –2 = –4 ? Or do you think that eight 8's always make 64 ? If so, try filling in the necessary mathematical symbols in this skeleton equation to show that eight 8's can make 1,000.

$$8 \quad 8 \quad 8 \quad 8 \quad 8 \quad 8 \quad 8 \quad 8 \quad = \quad 1{,}000$$

(And be careful that you say precisely what you mean next time !). S.T.P.

If * represents one of the signs + or — and †† represents the other, decide which is which if $a*(b\dagger\dagger c) = (a*b)\dagger\dagger(a*c)$ but $a\dagger\dagger(b*c) \neq (a\dagger\dagger b)*(s\dagger\dagger c)$. C.V.G.

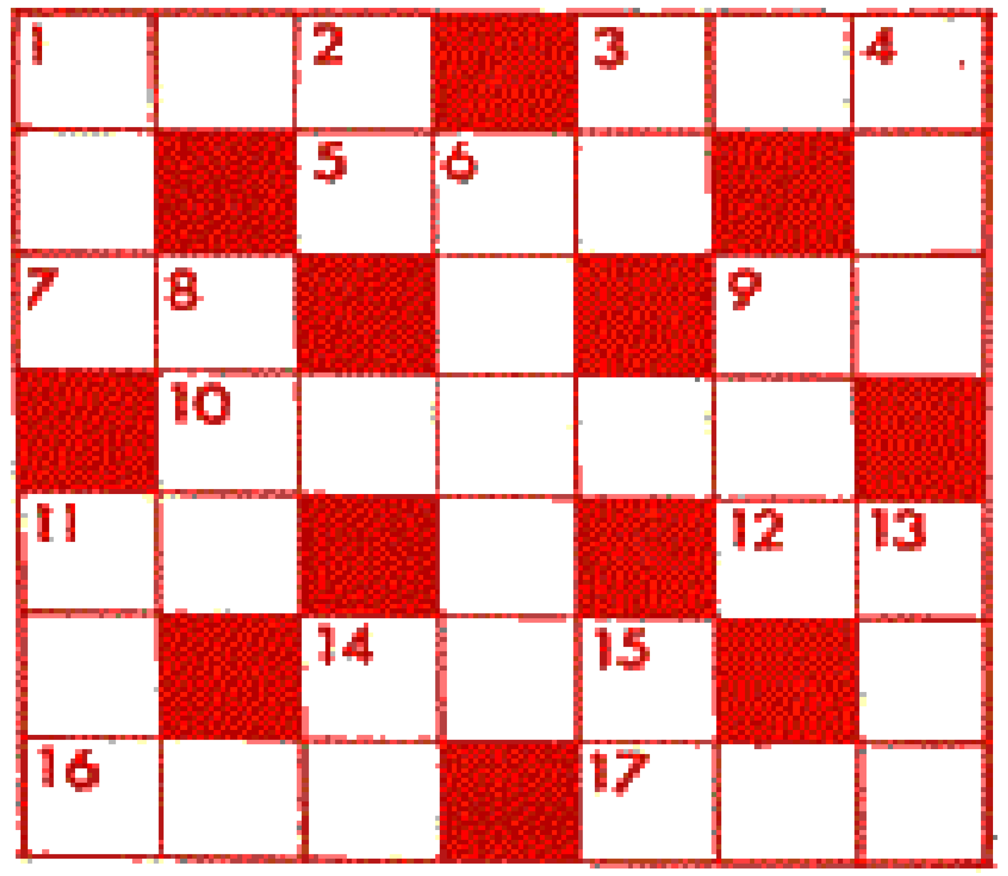
BACKWARDS COUNTERS

We are used to seeing numbers arranged like 4, 3, 2, 1, 0, –1, –2, –3 and make such a scale when we draw a graph. What happens when we go backwards in time from 4 A.D. to 3 B.C. ? How many years were there between 1st January 3 B.C. and 1st January 4 A.D. ? J.F.H.

What is the smallest number which leaves
a remainder of 1 when divided by 2
" " " 2 " " 3
" " " 3 " " 4
" " " 4 " " 5
and " " " 5 " " 6 ? S.T.P.

SENIOR CROSS FIGURE No. 46

Submitted by Mr. T. Noble, Baguley, Manchester.

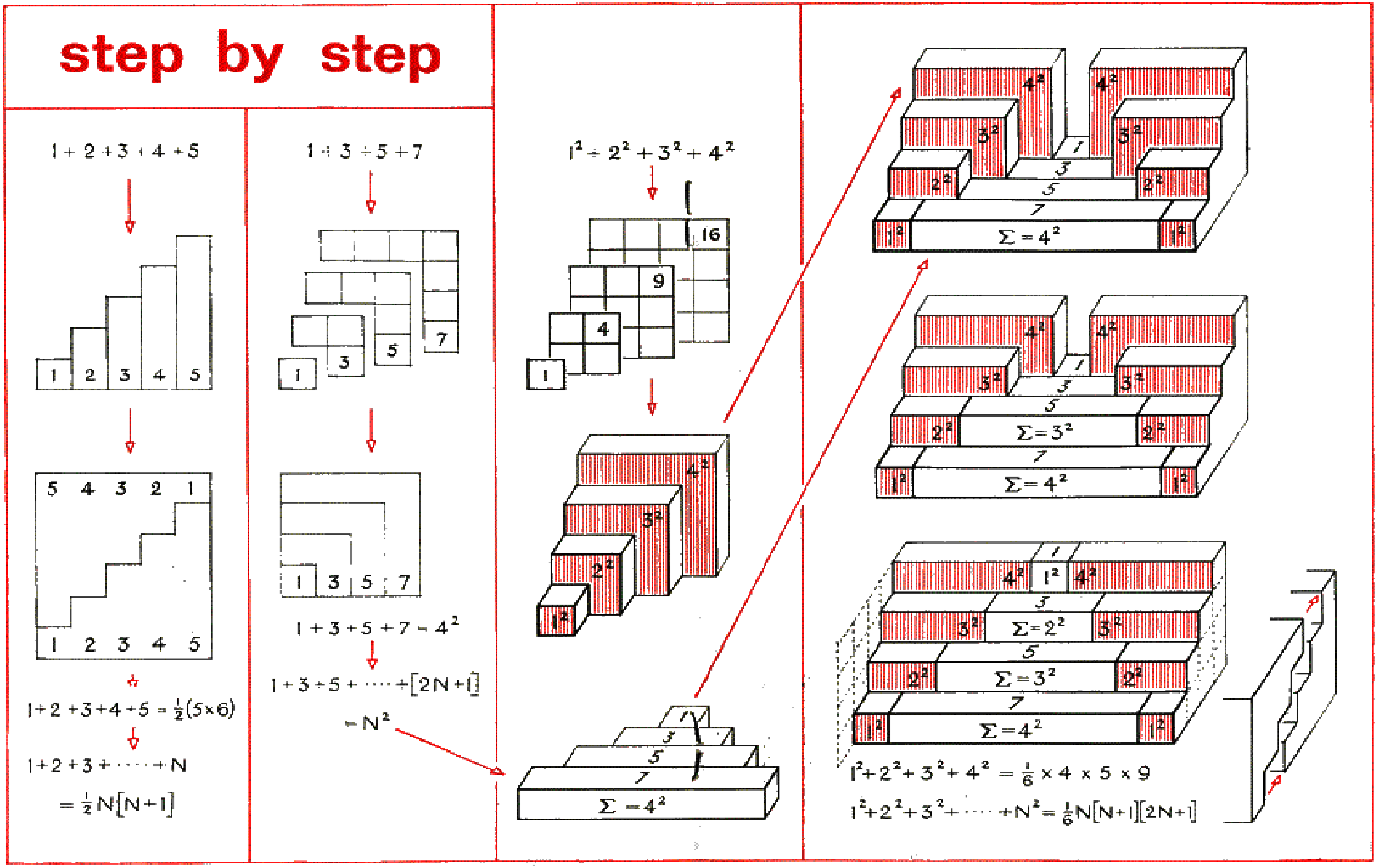


CLUES DOWN :

1. A square reversed.
2. A square.
3. A cube reversed.
4. A square.
6. A cube squared.
8. A square.
9. Another square.
11. The square of ' 9 across.'
13. ' 1 down reversed.'
14. A root of ' 6 down.'
15. The square root of ' 2 down cubed.'

CLUES ACROSS :

1. A square.
3. The square of ' 3 down reversed.'
5. A cube reversed.
7. A square.
9. The square root reversed of ' 4 down reversed.'
10. A square cubed.
11. A square reversed.
12. Twice the square root of ' 7 across.'
14. A square squared.
16. A cube.
17. A square.



Algebraic methods for finding the sum of sequences of numbers are well known. A geometrical representation of the sum of a sequence is often more striking. The results of the illustrations in the left-hand half of the diagram above are used in the right-hand example.

In the right hand diagrams, the space between the two blocks made up of square faced-units is filled with groups of blocks made up of rectangular units which are an odd number of units long and one unit wide. The sum of the odd numbers is equal to the square of the number of terms taken. Hence the complete blocks consist of three parts each made up of the sum of the squares of the natural numbers. Two of these units combine to make a rectangular block whose dimensions are N, N+1, 2N+1, so that the sum of the squares of the natural numbers is one-sixth of the product of these dimensions.

B.A.

69222 10327 48892 18654 36480 22967 80705 76561

51446 32046 92790 68212 07388 37781 42335 62823