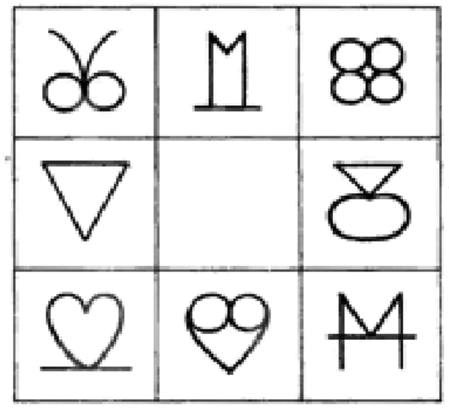
PATRIOTISM IS NOT DEAD

submitted by Graham Jones, Cross Hall High School, Ormskirk, Lancs.

Using graph paper with scales 0 to 21 on the x-axis and 0 to 35 on the y-axis, join the following points:—

(3,3) (5,3) (5,2) (6,2) (6,3) (7,3) (7,4) (11,4)
(11,5) (16,5) (16,6) (17,6) (17,5) (18,5) (18,9) (19,9)
(19,14) (18,14) (18,13) (16,13) (16,14) (15,14) (15,16) (14,16)
(14,17) (15,17) (15,19) (12,19) (12,21) (11,21) (11,25) (7,25)
(7,27) (9,27) (9,28) (10,28) (10,31) (11,31) (11,32) (5,32)
(5,34) (7,34) (7,35) (3,35) (3,32) (1,32) (1,31) (2,31)
(2,29) (1,29) (1,28) (2,28) (2,25) (4,25) (4,23) (3,23)
(3,21) (4,21) (4,20) (5,20) (5,21) (6,21) (6,18) (7,18)
(7,17) (6,17) (6,16) (7,16) (7,14) (5,14) (5,15) (4,15)
(4,14) (3,14) (3,13) (4,13) (4,10) (1,10) (1,9) (3,9)
(3,8) (8,8) (8,7) (7,7) (7,6) (6,6) (6,5) (5,5)
(5,6) (4,6) (4,4) (3,4) (3,3)

(15,9) (6,8) (8,25) are important points. What do they represent?



REFLECTIONS ON AN OLD PROBLEM

This is an old problem really, but with a magic twist.

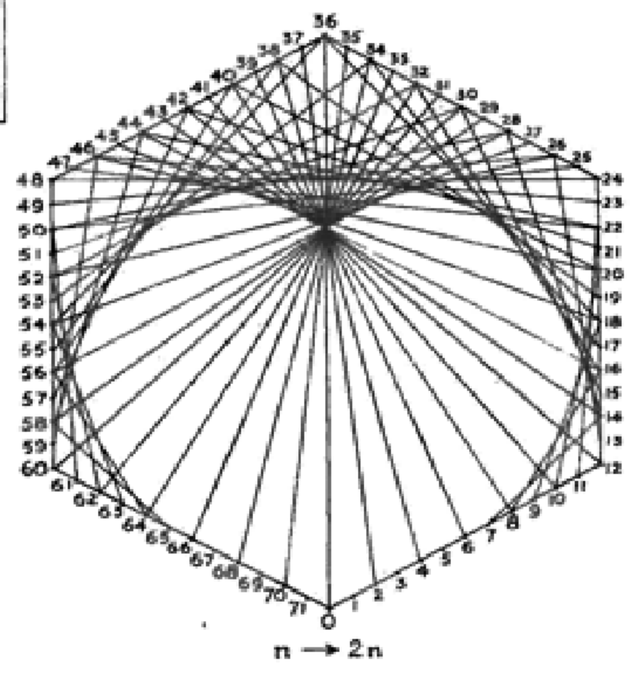
What is missing? E.G.

POLYSTITCH

Mark the sides of a regular hexagon with equal divisions as shown and label them 0 to 71.

Using the mapping $n \rightarrow 2n$, stitch 7 to 14, 8 to 16, 9 to 18, etc.

After stitching 35 to 70, continue with 36 to 0, 37 to 2, 38 to 4 until the pattern is complete with 58 to 65. D.I.B.



MATHEMATICAL PIE

No. 90 *Editorial Address :* West View, Fiveways, Nr. Warwick SUMMER, 1980

PERFECT NUMBERS

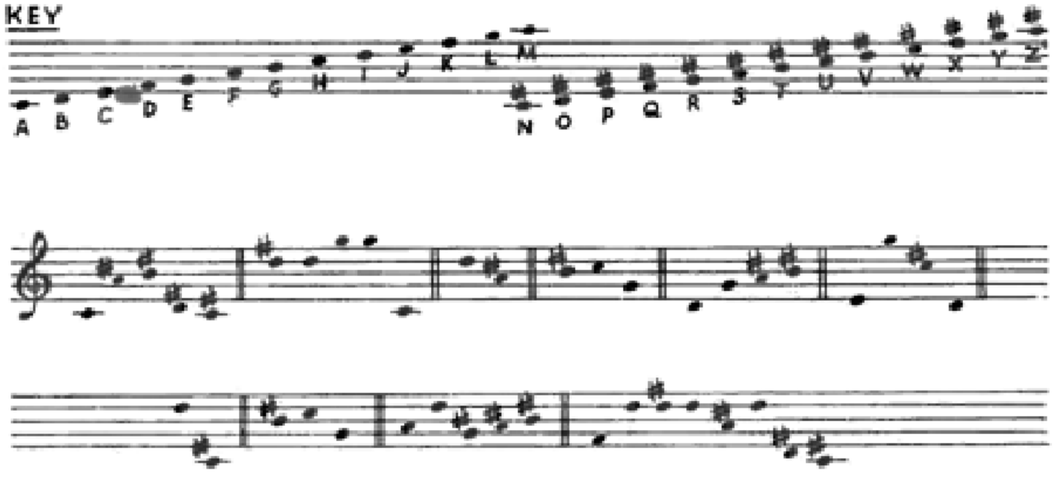
A perfect number is one such that the sum of its factors, excluding the number itself, is equal to the number. The first two perfect numbers are shown in the diagram. It would appear that they are plentiful but this is not so. The next perfect number is 496.


"I am perfect"

Like so many aspects of number theory, perfect numbers have been associated with magic. The creation took six days and there are 28 days in a lunar month. B.A.

VILLAIN'S ANTHEM

Mark Bisset, a pupil at Arden School, Solihull sent a set of co-ordinates to add to the "Pied piper" (multicoloured plot, issue No. 88) to draw a rat, a boy, a castle and complete real Hamelin picture. Unfortunately, we have not been able to use these, but we are pleased to know that our articles spark off ideas. We are pleased to print the musical code and message from Mark below.



DOZEN it mean that?

Can you make TEN squared equal to one DOZEN? If each of the letters N, E, T, Z, O and D stands for a single digit, find their values to make

TEN multiplied by TEN = DOZEN.

E.G.

THE EARLY EIGHTIES

As we move into the nineteen eighties, we look at the digits 1, 9, 8 & 0. Using these digits in this order and any conventional signs, can you represent the numbers 1, 2, 3 etc? R.H.C.

TWO DIFFERENCES

Take any three consecutive numbers and square them, $a^2 = 3^2 = 9$, $b^2 = 4^2 = 16$ and $c^2 = 5^2 = 25$ for example.

Work out the difference between $(b^2 - a^2)$ and $(c^2 - b^2)$.

Now consider another set of three consecutive numbers and carry out the same operations. Try again.

Can you verify that your result will always be the same? R.H.C.

GROW UP

When asked his age, the teacher replied that when it was divided by 2, 3, 4 or 6, there was always one left over but when divided by 7 there was no remainder. How old was he? R.H.C.

CRAZY SHORT CUT

Mr. T. Noble of Normanton on Soar writes:– to find the cube root of 135, move the last digit to the front and add the decimal point. Ans. 5.13.

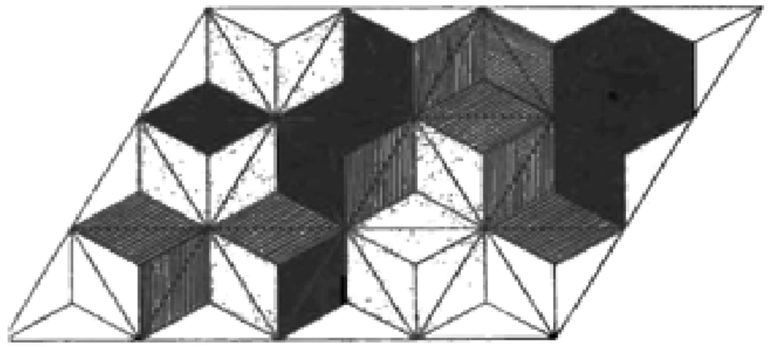
THE LOST £1

(a version by Alyson Hulme, City School, Lincoln)

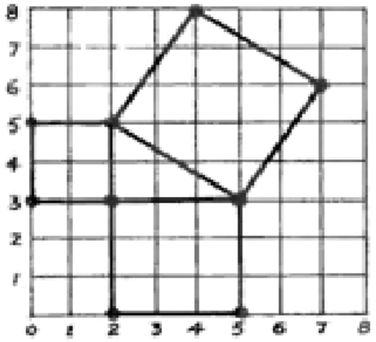
Three men bought a television set for £45, which meant that they each paid £15. The salesman took the £45 to the manager whilst the men loaded the set into their car. The manager told the salesman to return £5 discount as they had paid cash and gave him five £1 notes.

As the salesman was walking back to the three men he decided to "get in on the deal" and took £2 and gave the men £1 each, so the men had really paid £14 each. £14 x 3 = £42, add £2 that the salesman took for himself, equals £44. Where is the other £1?

Triangles puzzle



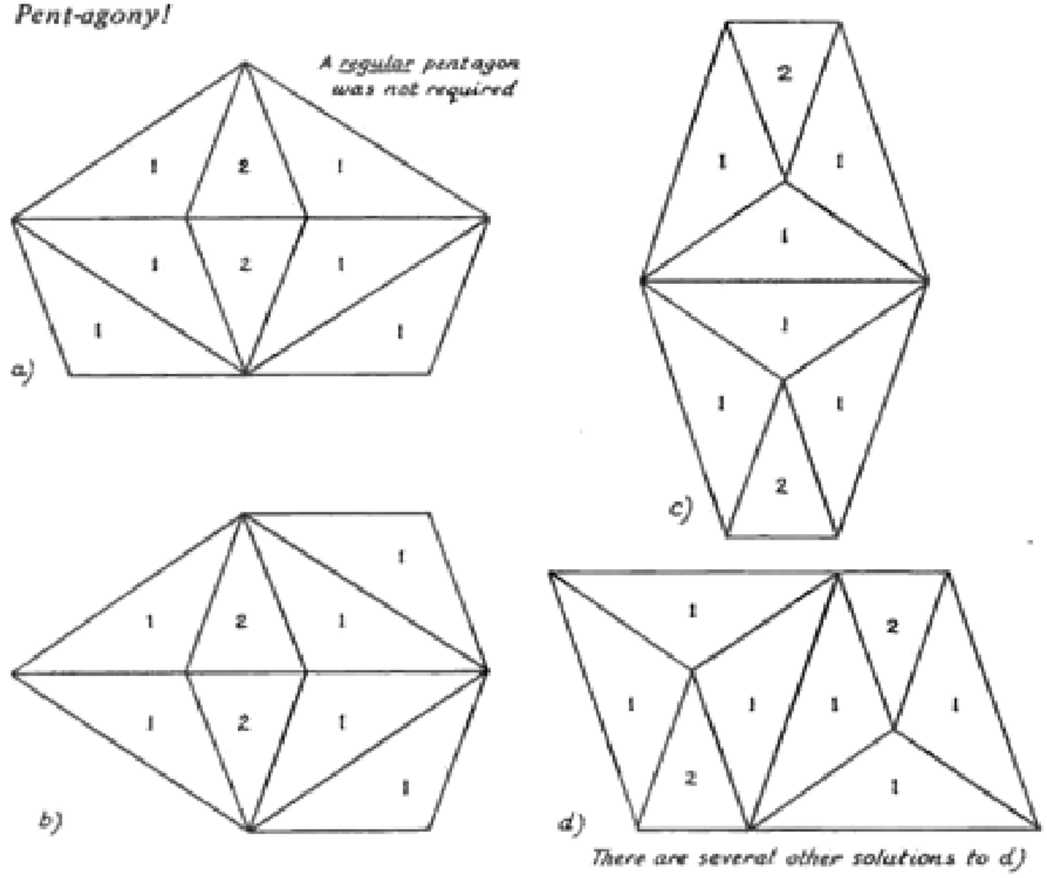
Pictocode No. 4



Sold The man made a profit of £5 when he bought back the bicycle.

A logical Solution The word was LOGIC.

Pent-agony!



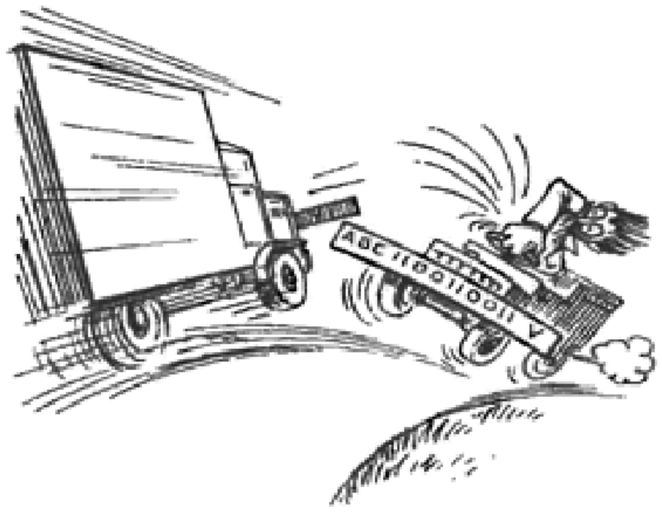
Squaring the circle This gives a value of 3 for π.

A golfer's warning The figure 4 was omitted but it could have been in any position. The sum of the digits of the original number must be divisible by 9 without remainder. B.A.

REFUGEES FROM A NUMBER BASE

submitted by C. B. Atkin, Retford.

Recently many bewildered refugees have been arriving here from Iooi, because of their overcrowding, sometimes as many as 100 persons to one house, even though most of them are millionaires. These people are normal in every way except that they count in binary. They have been amazed by our number system and how it affects (or does not affect) our lives. They are used to wide roads to accommodate the long number plates on their cars, short streets and very wide gateposts for their house numbers and long telephone numbers.

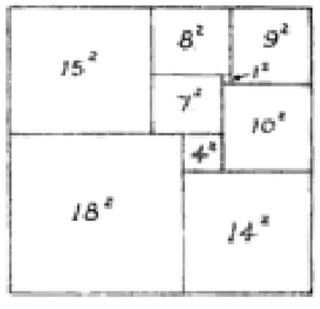


On the face of it, we have a better system. When the children started school, they found a very different story. They already knew their number bonds up to 10, i.e. 0+0, 0+1, 1+0 and 1+1. They already knew their tables, 0x0, 1x0, 0x1 and 1x1. They could work out all short division in their heads. They could count up to 100 very quickly.

When they started to learn our system, they were amazed at the amount of work involved, 20 addition bonds and 100 responses in multiplication. It seems that the alternatives are a lot of easy work or rather less much harder work.

SOLUTIONS TO PROBLEMS IN ISSUE No. 89

Sum Squares



Power to the Romans Cross-figure

M	C̄	C	L	X
M	C	L	X	X
D	C	X	V	I
L	X	X	I	I
X	X	V	I	I

Problem Unfortunately, the penultimate number should have been 87·416 to give the answer 1.

Triple check? 5 people play 10 games and 100 people play 4 950 games.

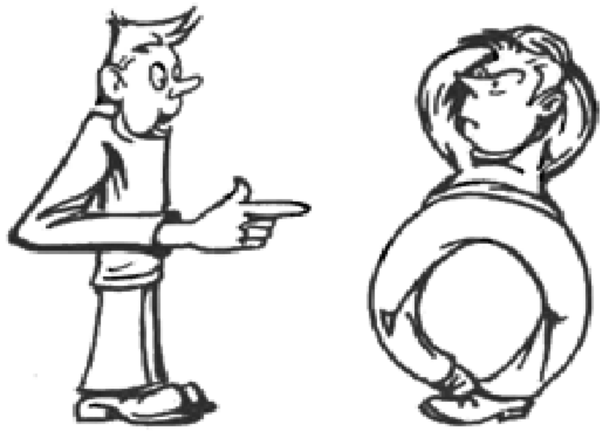
Square it 31 squares, 17 unit side, 8 two unit side, 5 three unit side and 1 five unit side.

HOW LUCKY CAN YOU BE?

Charlie Cook had to simplify the fraction $\frac{2\,666}{6\,665}$ so he crossed out the three sixes in the numerator and the denominator to get $\frac{2}{5}$, which is correct! R.H.C.

BACK TO FRONT

Whilst driving to work one day, I looked into the driving mirror to see the car behind. When I read the number plate of the car following I realised that although my mirror was reversing the three registration letters, they still read in the same order. What were they? R.H.C.



"My double? – nonsense! You don't look at all like me."

TRANSLATIONS

When mathematical symbols are translated into words, the meaning sometimes leads to a conflict of concepts.

Can you suggest other illustrations? B.A.

LADIES IN MATHEMATICS 2
MARIA GAETANA AGNESI

Maria Gaetana Agnesi was an outstandingly clever Italian lady. She was born in Milan in 1718 and at an early age had mastered Latin, Greek, Hebrew, French, German and Spanish. At 19, she turned her interest towards mathematics and was taught by her father and the Olivetan Father Rampinelli. We are told she was a sleep walker; she would occasionally go to her desk and work out mathematical problems while fast asleep then be amazed to find them there the next morning.

In 1748 she produced her most famous work — "Analytical Institutions" – which was an essay, in four parts, on the most up to date mathematical ideas of her day. This was thought to be so important that it was later translated into French and English.

In 1750 she was nominated as professor of mathematics at the university of Bologna, but she never actually taught there, preferring to spend more and more time on religious work and less time on mathematics.

After her father died, in 1752, she devoted herself completely to religious and charitable work, leaving behind her interest in mathematics forever. A.M.A.

MODMAGIC

In Fig. i the mod 4 numbers have been arranged so that each row, column and diagonal includes the same number only once. The sum of the numbers in each row, column or diagonal is 2 (in mod 4); and the sum of any 2 X 2 square within the figure gives the same result.

1	0	2	3
2	3	1	0
3	2	0	1
0	1	3	2

Fig. i

A Mod 4 Clock

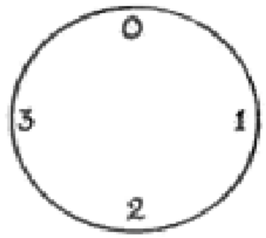


Fig. ii

If denary equivalents are substituted for the mod 4 numbers, with the condition that each denary number is used only once, a Magic Square can be compiled very simply. Taking the set of integers from 1 to 16, the sum of all numbers in the square is 136: thus, the sum of each required sub-set (i.e. row, column, diagonal or 2 X 2 square) is 136 ÷ 4 = 34.

Mod 4 Numbers	Denary Numbers
0	4, 8, 12, 16
1	1, 5, 9, 13
2	2, 6, 10, 14
3	3, 7, 11, 15

Referring to Fig. i, the first four consecutive denary equivalents can be entered. Although there are four possible starting points for "1" only one number must be placed in each row, column and diagonal (Fig. iii).

	4		
		1	
3			
			2

Fig. iii

	4	14	
	15	1	
3			
			2

Fig. iv

As the sum of the numbers in the top middle 2 X 2 square is 34, the two missing numbers (which are 2 and 3 in mod 4) can be only 14 and 15, respectively. With the help of the table, the rest of the magic square can be completed quite easily: for example, the two missing numbers in the top row have a sum of 16, giving a choice of either "9 and 7" or "5 and 11".

9	4	14	7
6	15	1	12
3	10	8	13
16	5	11	2

Fig. v

15	10	20	13
12	21	7	18
9	16	14	19
22	11	17	8

Fig. vi

To compile a magic square which has a sum of (say) 58, subtract 34 from 58 and divide the answer by 4:

$$\frac{58-34}{4} = \frac{24}{4} = 6.$$

Now add 6 to each number in Fig. v to give the new magic square Fig. vi.

This procedure has to be modified if the division by 4 does not produce a whole number. To compile a magic square which has a sum of (say) 61:

15*	11	21	14
13	22	8	18*
10	16*	15	20
23	12	17*	9

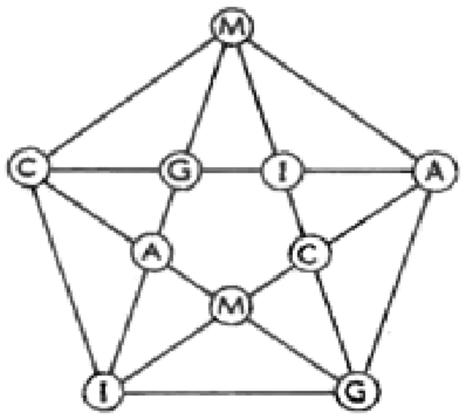
Fig. vii

$61 - 34 = 27$
$27 = 1 \times 6 + 3 \times 7.$

Hence, 6 must be added to one number in each row, column and diagonal* and 7 must be added to each of the remaining (three) numbers (Fig. vii). This is not strictly a magic square as a number (15) has been entered more than once.

D.I.B.

THE PENTAGRAM



The regular five-pointed star, called a pentagram, has been associated with magic for many years. Drawn on the floor, it is supposed to give protection to people standing in it.

The diagram shows a pentagon drawn round the outside of the pentagram. By following the lines of the diagram, the word "MAGIC" can be spelled (sorry) out in two paths.

Can you rearrange the letters so that several different paths spell magic? What is the best score? E.G.