MORE RHYME, EVEN LESS REASON – 2

Said Kepler: "Here from my own lips
Are my best astronomical tips
The sun is the focus
And each planets locus
Is obviously an ellipse".

At a poker game, Pascal said "Son,
You have had a phenomenal run –
So there's no need to shout
Now your luck's evened out –
I think that's sixty francs that I've won."

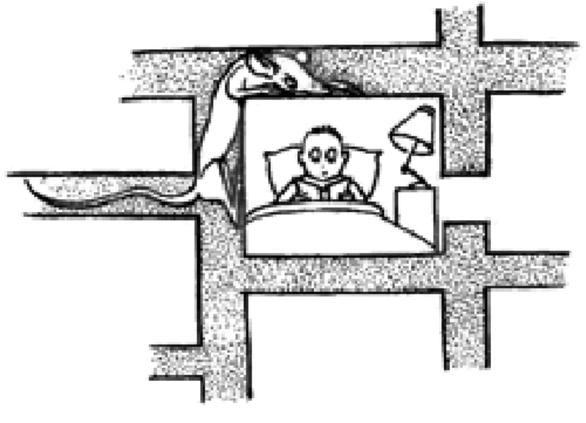
E.G.

REVELATIONS AT MIDNIGHT

Infinity's taken by everyone
As a figure-of-eight written sideways on,
But all of a sudden I now apprehend
That eight is infinity standing on end.

MOUSE & MAN

A relativistic grook on co-existance
A human being sharing with a mouse
Each thinks himself the master of the house
In fact, of course, each occupier's place is
The other's insulating interspaces.



MATHEMATICAL PIE

No. 94 — *Editorial Address :* West View, Fiveways, Nr. Warwick — AUTUMN, 1981

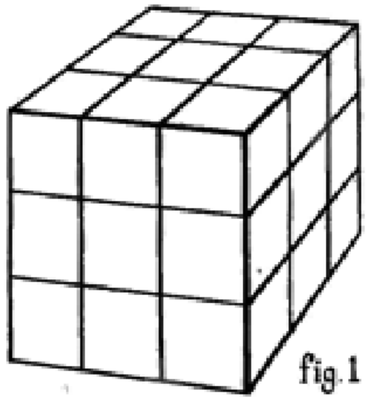
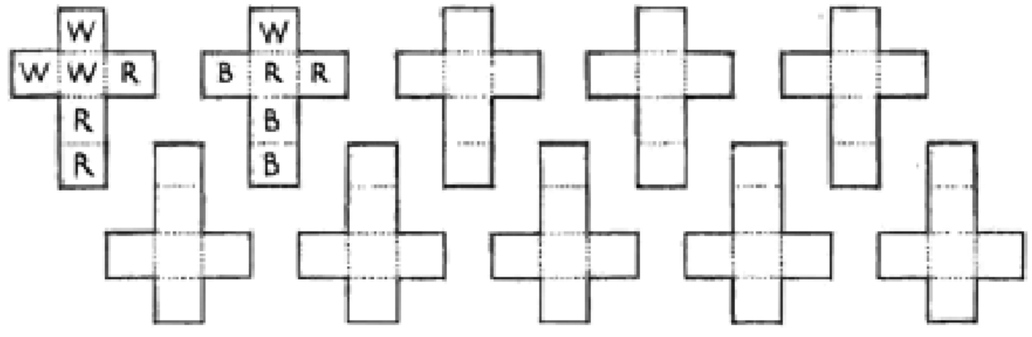


fig. 1

PATRIOTIC CUBES

A cube of white material is painted red and then is cut into equal pieces as shown in fig. 1.
What is the least number of cuts that will enable this to be done?
How many small cubes will be produced?
How many red faces will there be?
How many white faces?

By using some blue paint, it would be possible to paint some faces of the small cubes so that all of the cubes can be arranged to form a red cube, or a blue cube, or a white cube. Can you complete the ten "nets" below to show ten different designs of colouring? How many of each design will be needed?



E.G.

IN THE BALANCE

A grocer has a faulty balance which only gives 990 grams when it is registering 1 kilogram. How much extra profit has he made in selling a sack of sugar for £25?

R.H.C.

FOR MATURE MATHEMATICIANS

A question on an O level paper mentioned a triangle of sides 4 cm, 5 cm and 6 cm. Some of the candidates who could not answer the question that was set, calculated the angles of the triangle. Of course, they did not score any marks for this but it did help to pass the time. Those who did the calculations correctly found that one angle was exactly double one of the other angles.

There is a simple formula connecting the sides of a triangle ABC if aingle A is twice angle B. Can you find the formula?

C.V.G.

HARD GRAFT

If 20 men dig 20 holes in 20 hours, how many hours will it take 50 men to dig 50 holes? Assume each of the men work at the same rate and each hole is the same size.

C.B.A.

CHRISTMAS PRESENTS

12, 22, 30, 36, 40, 42, 42, 40, 36, 30, 22, 12. Do you recognise this sequence of numbers?

Hint: you may not wish to receive these Christmas presents!

A.M.A.

UNUSUAL SQUARES

$13^2 = 169$, $x^2 = 196$, what is x?

Now try these $157^2 = 24649$, $y^2 = 24964$, find y and
$z^2 = 833569$, $?^2 = !!$, find z and ?

R.H.C.

LEFT OVERS

Can you find a number which when divided by 8 has a remainder of 7, when divided by 7 has a remainder of 6 and when divided by 6 has a remainder of 5?

C.B.A.

SOLUTIONS TO PROBLEMS IN ISSUE No. 93

A calculator problem For a pawn, the largest sum is 24, covering 9, 8 and 7. For a bishop 25, a rook 45, the queen 45, the king 45 and the knight 40.

Hop it! The toad never reaches the pond but the frog will.

It's a fact When C = 48, s = 44. When $s = 1\frac{2}{3}$, $t = 44\frac{1}{3}$ and $C = 29\frac{1}{3}$.

Charlie Cook strikes again 42 = 21 x 2 and 24 = 12 x 2, so that each product is 21 x 2 x 12.

A double deal in boats The man loses £5 because his loss is 20% of a larger sum than his gain is 20% of.

Inflation again In 1840, a sovereign would buy stamps for 240 letters. £1 today would buy 7 first class mail stamps but a sovereign is worth about £60, so that it would buy 428 first class mail stamps.

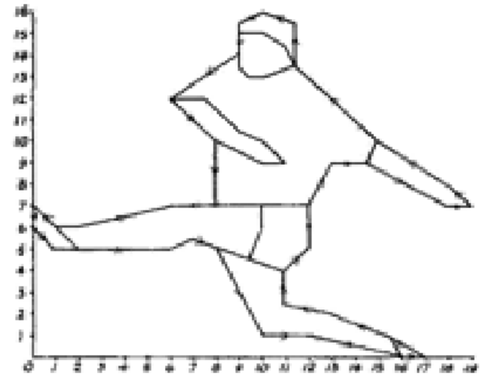
Weight in order A is the heaviest, then D and C and B is the lightest.

Flight path The distances between the aircraft are 3½, 2½ and 1½ km.

Junior cross-figure No. 70

1	6	9	■	2	3
8	4	■	7	4	7
■	5	1	2	■	5
1	■	5	6	7	■
1	2	0	■	1	5
1	3	■	5	4	6

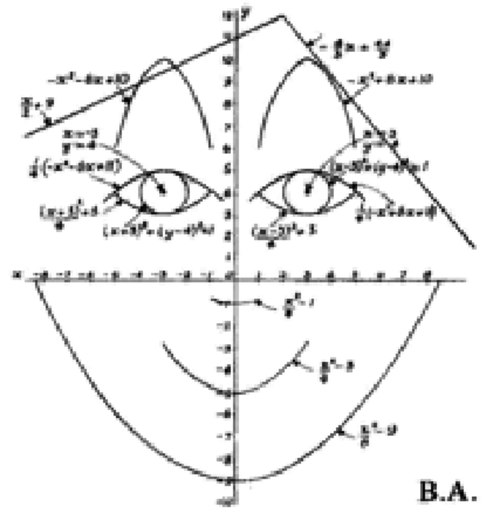
Score line



Cutie Pie and the cycle tour Cutie Pie travelled 15 km in 3 hours at an average speed of 5 km per hour.

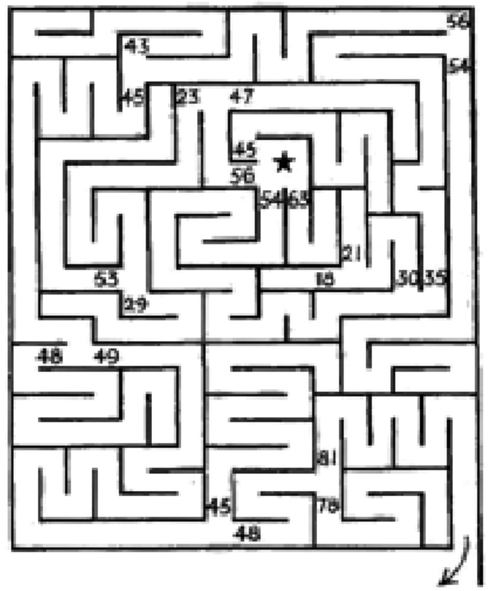
Whose shadow? There are three squares and a right-angled triangle, shades of Pythagoras. The area is 56 square units.

Another clever plot



B.A.

AMAZINGLY PRODUCTIVE?



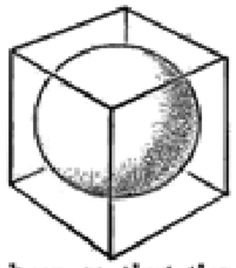
Quick recall of your "times tables" is often useful. In this puzzle, it can help you to "escape" from the maze.

Begin at the star and to decide which path to take, answer these:—

First choice: nine sixes.
2nd choice: seven fives.
3rd choice: eight sevens.
4th choice: five nines.
5th choice: seven sevens.
6th choice: six eights.
7th choice: nine nines.

E.G.

MORE OR LESS — A SPACE PROBLEM



If a sphere is inscribed in cube such that the diameter of the sphere equals the length of the side of the cube. What percentage of the space in the cube is taken up by the sphere?

If two cones are fitted into a sphere so that the height of each cone, the radius of each cone and the radius of the sphere are all equal, do you think that the cones will take up more or less than half the volume of the sphere?

C.B.A.

LADIES IN MATHEMATICS 5
SOPHIE GERMAIN 1776–1831

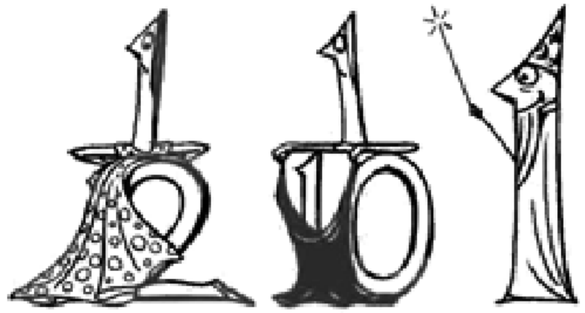
Sophie Germain was a French scientist and mathematician known as "the Hypatia of the nineteenth century", see issue No. 89, because her work was original. She taught herself calculus from books and then took correspondence courses from the Ecole Polytechnique in Paris.

In 1808, in Paris, an Italian called Chladni was experimenting with elastic membranes. The theory behind the work had been worked out for one dimension, and Sophie began solving the problem for two dimensions. When the Academie des Sciences offered a prize for the solution, Sophie sent in her work in 1811 and again in 1813 and 1816. She finally won the prize although the judges were not convinced of the correctness of her solution.

She corresponded with Gauss using the pen-name M.Le Blanc. He thought so highly of her that he recommended her for an honary doctorate degree from the University of Gottingen. Unfortunately, she died before she could receive it.

A.M.A.

MAKING FRACTIONS FIT



It was party time in fraction land and all the young fractions were getting ready for the biggest ball of the year.

"It's no good," said a half, "I'll never get into my new gown — my bottom is twice as big as my top. I feel like an hour glass with all the sand in the bottom!".

"What about me?" retorted a tenth "I'm worse!".

"I'm alright" said seven eighths haughtily, and they both glared at her.

Just then the One-derful wizard of One passed by and heard the girls talking. "I can help you" he cried and before anyone could say Common Denominator he had changed himself into five-fifths and made the surprised half into five tenths.

"Now you can be .5, and you can be .1 — now you both fit into your dresses".

Just then, the wizard's friend, Zero rolled by, and before anyone could say thank you, they had multiplied themselves together and rolled off.

A.M.A.

DECIMODS

Did you know that every recurring decimal that has a "cycle" of digits is symmetrical? Of course I don't mean palindromic, as you would soon see if you worked out one seventh (0.142857). Perhaps you can't see the symmetry — but try this:

Draw some circles (perhaps radii of about 5 cm would be best) and use your protractor to mark ten equally spaced points on each circumference. Label the points in order round the circle 0, 1, 2, 3 up to 9, (just as we do for modular arithmetics). Look at the decimal for one seventh again, starting at 1 draw lines from 1 to 4, from 4 to 2, and so on until the decimal begins to repeat from 7 back to 1. Can you see the symmetry now?

Try working out the decimals for two sevenths, three sevenths and so on (you don't really need to draw these on a circle, do you?!) Then try one eleventh two elevenths, etc. — all of these could go on your second circle. The real challenge — try as many other "prime number" divisions as you can and draw each one on a circle.

The symmetry is the same type in every case — the symmetry line runs between 0 and 9 and 4 and 5. Changing numbers by the mapping $x \to 9 - x$ would not change any of the patterns. This idea shows up in each decimal: 0.142857 splits into two halves 1, 4, 2, and 8, 5, 7. The second half of the digits which are "nine minus and the first half". Next time you work out a decimal it could take only half the time!

E.G.

TWENTY-ONE – 2

In issue No. 92, we described a game where two players took turns to choose from a set of nine cards Ace, King, 9, 8, 6, 5, 4, 3 and tried to make a total of 21 using any (or all) of their chosen subset. If you haven't played the game, try it with a friend a few times before you read on.

You may not have realised that you have been playing a game which is very similar to "noughts and crosses". The connection can be seen more clearly if we arrange the numbers 3 to 11 in a magic square with its totals 21 (see fig. 1). Choosing a card is like writing an X or an O in the squares. Noughts and crosses, if played logically by both players, should end in a draw. This card has an extra winning combination, instead of "three in a line", of 11 + 10. This gives the first player the chance of playing logically to "force" a win.

4	11	6
9	7	5
8	3	10

fig. 1

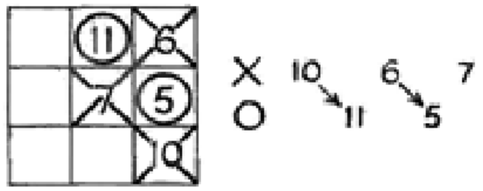


fig. 2

The second figure shows how "X", by choosing 10 first, forces "O" to take 11, then by choosing 6 forces "O" to have 5. After "X" takes 7, "O" cannot prevent "X" from completing a diagonal line to finish with either 6+7+8 = 21 or 10+7+4. If you use the "magic square" like a noughts and crosses grid, you should be able to work out some other ways of forcing a win if you have first choice. If you are playing against someone who does not know the magic square secret, you may still be able to win when you have second choice. Good luck!

E.G.

HIDDEN WORDS – 2

Can you find, hidden in the block on the right, the numbers one to twelve inclusive, twenty, fifty and hundred?

C.B.A.

T	W	O	Y	T	F	I	F
H	U	N	D	R	E	D	O
R	A	E	L	E	V	E	N
E	Y	B	F	O	U	R	T
E	T	S	I	X	M	T	W
Q	N	E	V	O	E	A	E
U	E	V	E	N	A	L	L
I	W	E	I	G	H	T	V
T	T	N	O	B	N	E	E

A GEOMETRICAL CONSTRUCTION

Draw any triangle and make the following constructions on the same diagram. A suitable size for the triangle is one with sides 13, 12 and 10 units, each one cm or half an inch.

Construct the bisectors of the three angles. They should be concurrent, i.e. the third should pass through the point of intersection of the first two. Let the point where they meet be I.

Construct the three perpendicular bisectors of the three sides. These, too, should be concurrent. Let the point of intersection be O.

Join each vertex of the triangle to the mid-point of the opposite side. These three lines are called medians and should be concurrent. Let the point of intersection of these lines be G.

What do you notice about the three points I, O and G?

B.A.

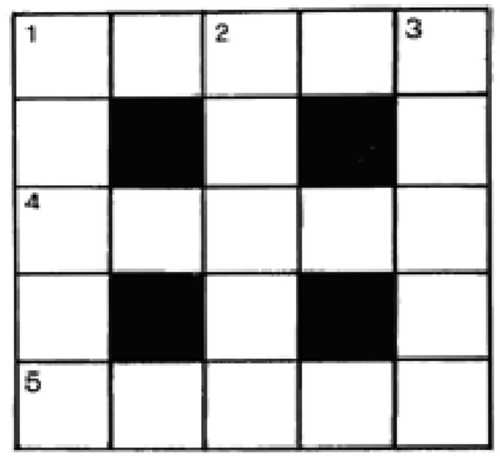
INVERTED CALCULATOR CROSS FIGURE WORDS

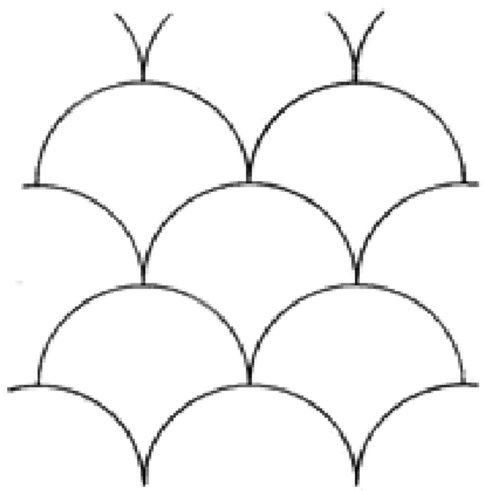
Clues Across
1. 50,000 + 3,000 + 700 + 4
4. 75,000 – 1493
5. 6,415 x 3 x 3

Clues Down
1. 9,619 x 3 x 2
2. 10,501 x 7
3. 10,741 x 5

Having worked out the clues on a calculator, turn the calculator upside down to read the word which will fit the cross figure.

C.B.A.





A FISHY PROBLEM

The scales pattern on the left is made up of semicircles of diameter 2 cm. What is the area of each scale?

C.V.G.