MUCH RHYME, LITTLE REASON

When Newton sat under a tree,
He was happy as happy could be
He thought it was rippin'
When hit by a pippin —
It caused the invention of "g".

Galileo and some of his mates
— Citizens of Italian states —
Threw down from the tower
Of Piza, a shower
Of various masses (or weights).

Archimedes reputedly ran,
On inventing the "Eureka" can,
(When through water displacement
He flooded the basement)
— Through the streets in the nude
—silly man!

When Pythagoras started to muse
On the square of the hypotenuse
His heart sank to his boots
At the thought of square roots
And "root two" really gave him
the blues.

E.G.

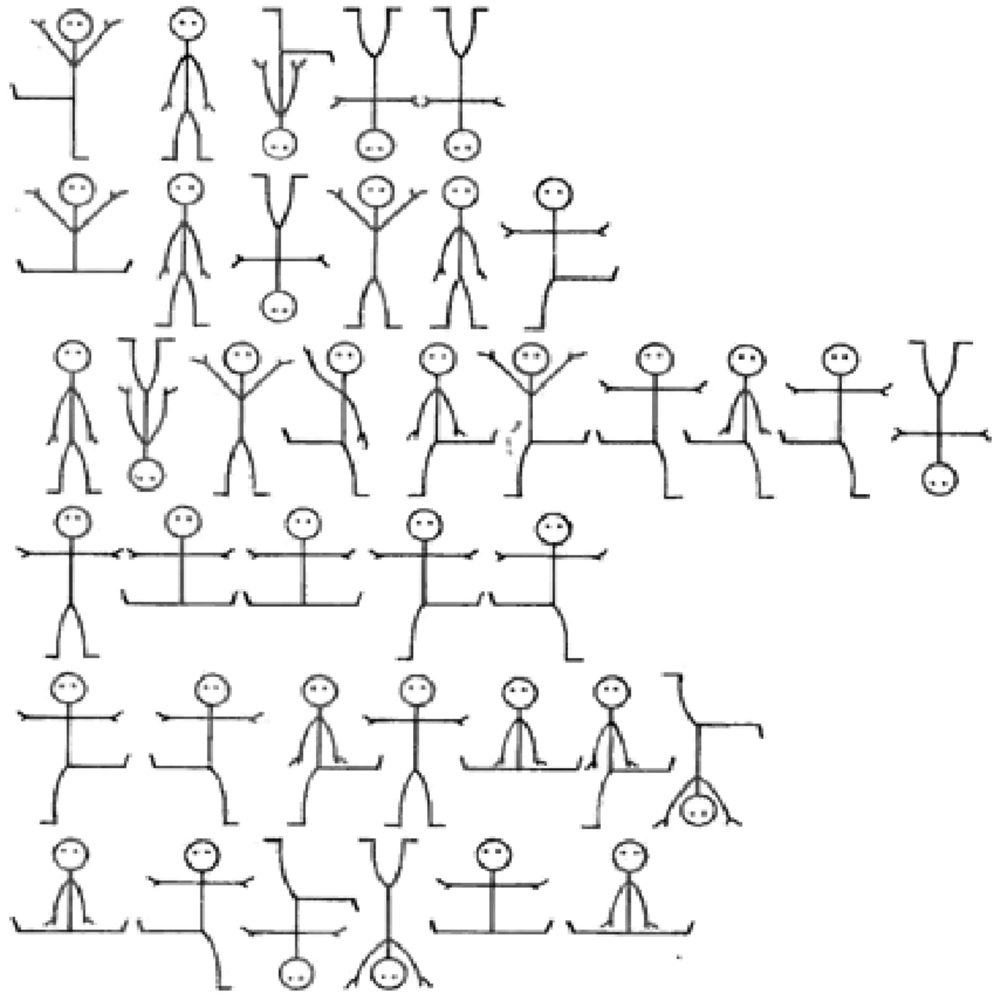
MATHEMATICAL PIE

No. 91 | *Editorial Address :* West View, Fiveways, Nr. Warwick | AUTUMN, 1980

CODES

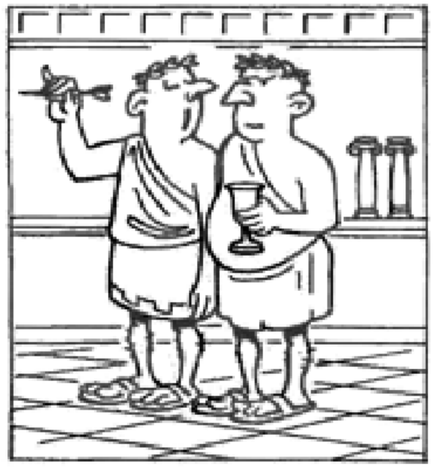
Each of the symbols below represents a different letter. The names of six well-known mathematicians are given.

Can you solve the code and find the names? A.M.A.



MORE STRANGE FIGURES

"Somehow you look much older than I."



"That leaves double XIV."

"Don't call me Ivy."

SPELL IT OUT

Translate

$$\frac{C}{TTTTTTTTT}$$

R.H.C.

MAKE IT UNIQUE

Write down 3 digits, reverse the digits and subtract the smaller number from the larger, reverse the answer and add the new number to the answer.

What is the answer?

What additional condition is required for the answer to be unique?

R.H.C.

A GOLDEN OPPORTUNITY TO SHINE

Find all the solutions of the equation

x x = x $\qquad X^{\sqrt[X]{X}} = X^X$ R.H.C.

ODD BALL

Submitted by Richard Ewin, Arden School, Knowle.

Eight balls look alike but one is heavier than the rest, but not much heavier. Using a pair of balance scales only twice, how can one tell which is the odd ball?

INSOMNIA CURE

Farmer Giles had 1,000 sheep in a field, some were rams and the rest ewes which produced either one or two lambs. Most of the ewes produced one lamb and exactly one half of the remainder had two. How many lambs were born?

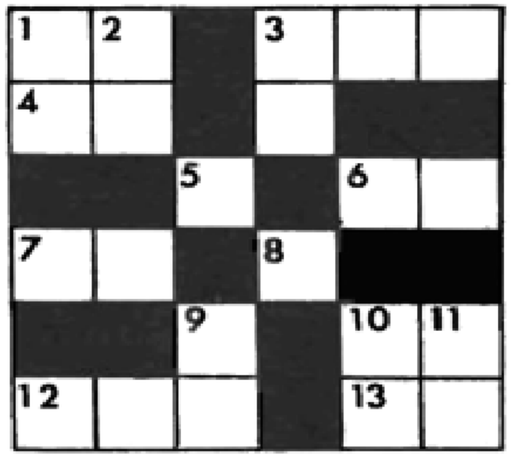
Would the answer be different if most of the ewes did not produce one lamb? R.H.C.

SILVER SCREEN CROSS-FIGURE

Across
1. Unlucky for some
3. Squadron number
4. Days around the world
5. Ingrid Bergman stayed at this inn
6. Total brides and brothers
7. A dirty one
8. How many mules for Sister Sarah?
10. A good summer
12. A lot of dalmations
13. Half of 10 down reversed

Down
1. One less than a famous number of steps
2. Address in Rillington Place
3. Class of '56 seemed rather backward?
9. Four more than the magnificent ones
10. A famous number of thieves
11. There's a catch in this one

A.M.A.



SOLUTIONS TO PROBLEMS IN ISSUE No. 90

DOZEN it mean that? 176 x 176 = 30976.

Grow up The teacher was 49.

The lost £1 The £3 returned to the men should have been added to the cost not the £2 the salesman kept.

The pentagram Reverse the order of the letters of MAGIC in the centre.

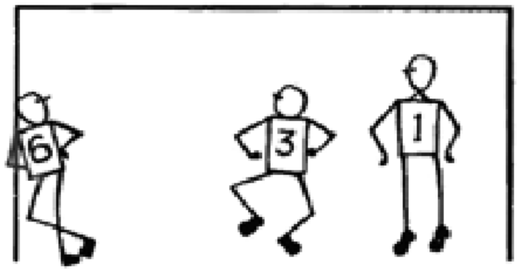
Patriotism is not dead A map of the British Isles.

Reflections on an old problem The magic square has the numbers reflected in a vertical axis, so the missing symbol is 5 reflected in the same way. B.A.

SCORE LINE

Choose the following players of your local soccer team, goalkeeper, left back, left half back.

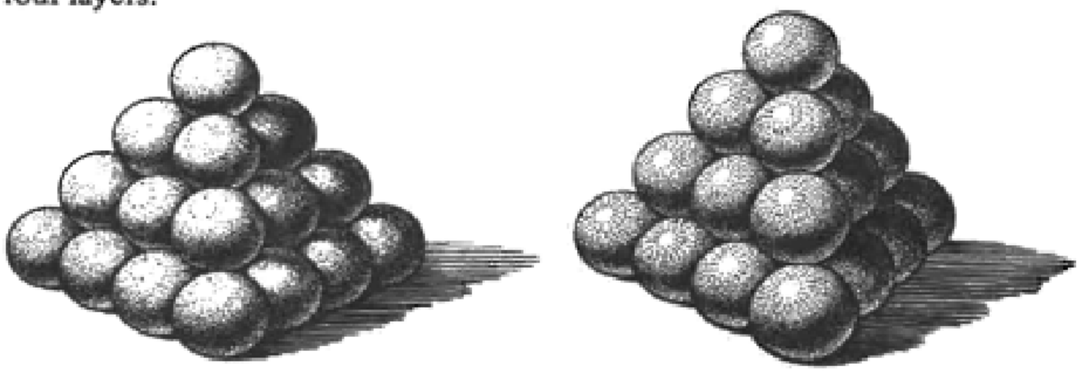
Put the following questions to them (Girls ask your boy friend for advice if necessary).



a. Can you arrange yourselves so that you are divisible by 4?
b. So that you are divisible by 8?
c. So that you are divisible by 23?
d. So as to express 63?
e. So as to express ½?
f. So as to express 2?
g. So as to express the largest possible number? R.H.C.

STOCK PILING

Spheres can be stacked in a variety of ways. The two diagrams show how they can be arranged in either triangular or square layers. Find, in each case, the number of balls in each layer and the totals for two, three and four layers.



Can you generalise the result for n layers for each formation? B.A.

HAPPY BIRTHDAY

A colleague of mine is retired and recently celebrated his birthday. When asked how old he was, he replied, my age is

(a) the sum of consecutive natural numbers starting with 1,
(b) the sum of the squares of consecutive natural numbers starting with 1,
(c) the sum of two consecutive cubes,
(d) such that the candles on my birthday cake can be arranged in a triangular pattern and also in a hexagonal pattern.

How old is my colleague? C.V.G.

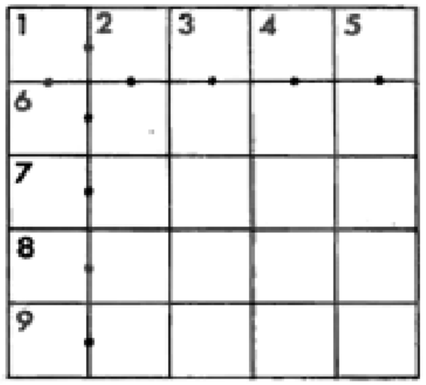
MNEMONIC FOR REMEMBERING THE TRIGONOMETRICAL RATIOS

A GEOMETRICAL CONSTRUCTION

On the three sides of any triangle, construct equilateral triangles outside the original triangle. Find the centres of these three triangles and join them to form another triangle. What can you say about the triangle?

Can you verify the result that you have discovered? R.H.C.

FOUR FIGURE TABLES CROSS-FIGURE



Clues Across

1. $\log_{10} 10{\cdot}5$
6. 76° in radians
7. $\sqrt{2}$
8. $\tan 65^\circ$
9. $\log_{10} 157{\cdot}5$

Clues Down

1. $\log \tan 85^\circ 35'$
2. $\tan 18^\circ 50'$
3. $\log_e 9{\cdot}161$
4. $\sqrt{2{\cdot}75}$
5. $\log_{10} 335{\cdot}2$

All the decimal points have been entered for you. A.M.A.

LADIES IN MATHEMATICS 3
MARY SOMERVILLE

This remarkable lady, daughter of Vice Admiral Sir William George Fairfax, was born in 1780 at the Manse of Jedburgh. She was interested in nature as a child, and learnt a great deal on her long rambles. Her education continued at a fashionable boarding school at Musselburgh where she proved to be an able mathematician. She learnt Latin in order to read Newton's **Principia**, and also excelled in music, painting and needlework.

Because of her pleasant manner and small, delicate appearance she became known as "the rose of Jedburgh". She was a lover of learning and continued to study science throughout her long life.

Her first marriage to Samuel Greig ended after only three years when he died in 1807, and in 1812 she married her cousin William Somerville.

Her circle of scientific friends and acquaintances included Laplace and Poisson, both of whom thought highly of her. Laplace commented that she was the only woman who understood his work; Poisson remarked that there were less than twenty people in France who could understand what she had written.

Her works were many and varied: in 1826 "The Magnetic Properties of the Violet Rays of the Solar Spectrum", in 1834 "The Connection of the Physical Sciences", in 1848 "Physical Geography", and "Molecular and Microscopic Science" in 1869. Her most famous work was a translation of Laplace's "Le Mécanique Céleste", published in 1831.

Age did not subdue her eagerness to learn, and when she died in Naples aged 92, her mind was as sprightly as it had always been. The great width, as well as depth of her scientific understanding, combined with the ability to write, made her one of the most remarkable ladies of her time. A.M.A.

SHORT CUTS, OR HOW TO GET A-CROSS A SQUARE?

The outline shown in fig. 1 is called a Greek Cross. It is well known that if the cross is cut along the lines shown (which join the midpoints of certain edges), the four pieces can be re-arranged to form a square. Make a copy from card or squared paper and see.

Fig. 2 shows another way of cutting up a Greek Cross. This time the pieces can be arranged to form two squares.

Now, we have turned one cross into one square and one cross into two squares. Try two crosses into one square. Make two copies of fig. 3 and cut them both as shown. Again, as in fig. 1 and fig. 2, two straight cuts are used for each cross.

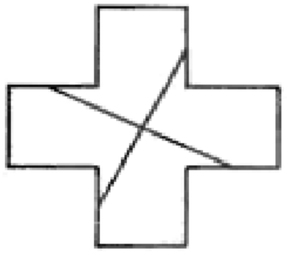


fig. 1

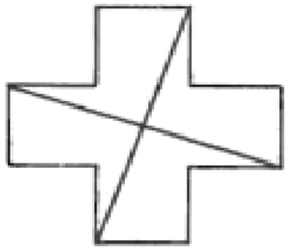


fig. 2

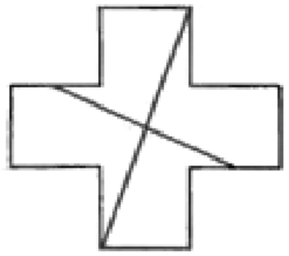


fig. 3

Those of you who know the theorem of Pythagoras could try to work out the lengths of the various cuts, taking one edge of a cross to be one unit. You should notice a connection with the edges of the final squares. You may also have noticed that swastika- like pattern of cuts have appeared within your completed squares for fig. 1 and fig. 3. (The swastika, by the way, quite apart from any recent usage, was a religious symbol in India thousands of years ago and is still used today).

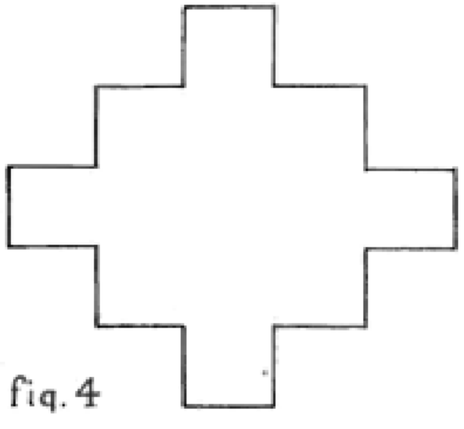


fig. 4

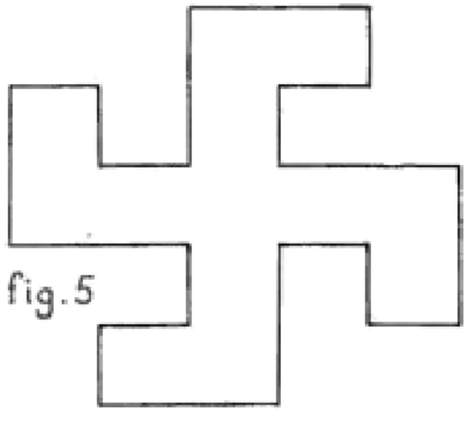


fig. 5

Finally, a super cross and a swastika. This time, it is left to you to find two straight cuts for each example so that the four resulting pieces of each shape can be arranged into a square. It may help to observe that thirteen "unit" squares are involved in each case. E.G.

TRIANGLES PUZZLE

A. E. ORFORD, writing from Felixtowe, has written bringing to our notice a Major P. A. MacMahon who devised puzzles based on triangles the same as those described in issue No. 89. Mr. Orford "feels strongly that E.G. should have given credit to Major MacMahon".

Sorry, Mr. Orford, but E.G. couldn't, since this is the first he has heard of that gentleman! Regular readers of "Pie" may remember a "Squares Puzzles" in issue No. 69, back in 1973: only recently E.G. independently realised that a problem involving 3 colours on a 4-edged regular polygon might profitably be converted to a problem of 4 colours on a 3-edged one.

We are pleased to receive information and comments on our articles: Mr. Orford points out that the 24 triangles can be used to form a regular hexagon with coloured edges matching. If you still have your triangles, try it. E.G.

FOR CALCULATOR OWNERS

Try this. Feed in ·999. Now press x= as often as you can. How often can you do this before zero appears? The answer will be different for different calculators. Now try ·111, ·222, etc. A.M.A.

FOLLOW THIS UP!

What are the next three words in this sequence?

One thousand two hundred and five, twenty eight, eleven, six, ? ? ? E.G.

A POWERFUL SEQUENCE!

Which four-figure number completes the sequence?

2052 2139 2828 4719 ? ? ? ? ? D.I.B.

FOLLOWING LETTERS

G K M Q ?

A E I O ?

I J K L ?

G I M O ?

Find the letters to replace the question marks in each sequence and they will add up to a word. D.I.B.

MORE CRAZY NUMBERS

Don't you square up to me, man!

What a prime little number!