MATCH YOUR WITS

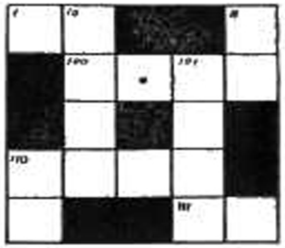
1. With six matches form 4 equilateral triangles, the sides of each being equal to the length of a match.

2. A man bought two horses for £80, and sold them for £80 each. The gain on one was 20% more than that on the other. What was the cost of each? R.H.C.

BINARY CROSS-FIGURE

Submitted by Mr. M. D. Meredith, Trinity School, North End, Croydon.

All numbers are expressed in the binary system.



ACROSS

1. H.C.F. of 110, 1111, and 10101.

100. One plus one half plus one quarter.

110. $110 \div 11$.

111. Rate per cent. per annum at which £10—1010s.—0d. earns 1/- simple interest in 1000 months.

DOWN

10. Double "1 across" doubled.

11. $\dfrac{a^{11}b^{110}}{a^{100}b^{101}}$ when $a = 1000$ and $b = 11000$.

101. Value of x if $\dfrac{x-10}{11} + \dfrac{x+100}{101} = 110$

110. Last and least.

SERIOUSLY SPEAKING

Find the next number in the series

61, 52, 36, 94, . . .

and explain the rule for calculating the terms.

SUM AND PRODUCT

Which is it easier to find the value of

$$1+2+3+4+5+6+7+8+9+0$$

or $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 0$? R.H.C.

SOLUTIONS TO PROBLEMS IN ISSUE No. 28

SENIOR CROSS FIGURE No. 28

CLUES ACROSS: (1) 41; (3) 132; (6) 48; (7) 345; (8) 123456; (11) 456; (12) 765; (14) 78; (16) 256; (17) 84.
CLUES DOWN: (1) 441; (2) 182; (3) 1345; (4) 34; (5) 256; (9) 3456; (12) 72; (13) 65; (15) 84.

CHARLIE COOK'S DINNER GOES UNCOOKED

Charlie brought 4 half-crowns, 2 florins, and 12 sixpences.

FALLACY No. 27

The solution ignores the fact that the level of the trench is not raised one foot.

JUNIOR CROSS FIGURE No. 26

CLUES ACROSS: (1) 12; (3) 40; (4) 34; (5) 682; (7) 53; (9) 34; (11) 210; (12) 85.
CLUES DOWN: (1) 108; (2) 145; (3) 460; (6) 231; (8) 375; (10) 408; (11) 23.

APOLOGIES

The editor apologises for errors in the Cross-figure clues in issue No. 28.

Senior Cross Figure: 1 down should have read $(a+b)^n$ and 4 down should have read diameter instead of radius.

Junior Cross Figure: 3 across was badly worded. It should have read ½ (2 down+5) — 10.

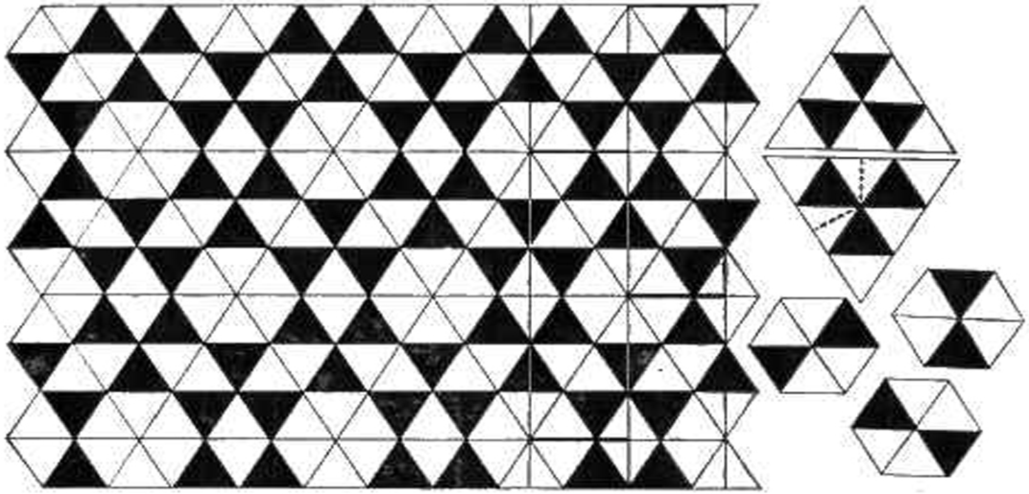
The picture of the Imperial yard was by courtesy of the *Radio Times Hulton Picture Library*. We apologise for having omitted this reference in the last issue. B.A.

18093 77344 40307 07469 21120 19130 20330 38019

MATHEMATICAL PIE

No. 29 — *Editorial Offices:* 97 Chequer Road, Doncaster — FEBRUARY 1960

PATCHWORK PATTERNS No. 2



This pattern of equilateral triangles in two colours was used for the floor of a Roman house in the first century. It is interesting to break the pattern down into repeats. It can be divided into parallelograms containing 12 light tiles and 6 dark tiles which can be fitted together without being turned, or into other shapes with more complicated outline, but all containing 18 tiles. It can be divided into triangles, containing 6 light tiles and 3 dark tiles, which have to be arranged in 2 different directions to make the pattern, or into hexagons, containing 4 light and 2 dark tiles, which are arranged in 3 different directions. These can be divided again into pentagons, or quadrilaterals or triangles, each covering 2 light and 1 dark tile, which arranged in 6 different directions fit together to form the pattern.

All repeating patterns can be divided into repeating rectangles. To do this, find 2 corresponding points of the pattern. If the line joining them is extended it will pass through more corresponding points equally spaced along the line, and there will be other lines parallel to this dividing the pattern into identical strips. These strips can then be divided into rectangles by drawing perpendicular lines. One way of dividing our pattern is shown by the lines on the right hand side. In this pattern the rectangles overlap like bricks in a wall. Designers would call it a half drop pattern.

C.V.G.

31501 97016 51511 68517 14376 57618 35155 65088

CUBIST ART

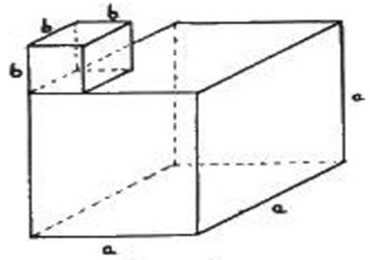


Figure 1

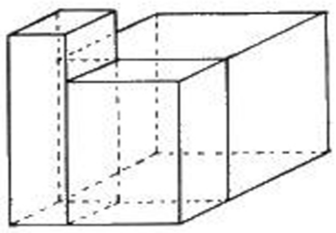


Figure 2

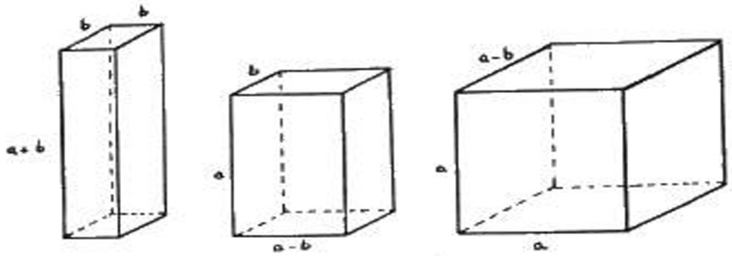


Figure 3

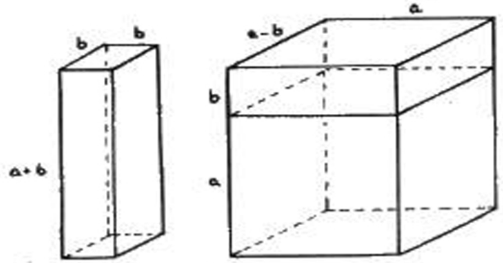


Figure 4

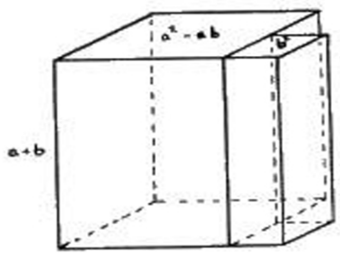


Figure 5

$$(a+b)^3 = (a+b)(a^2 - ab + b^2)$$

PIE and π (continued)

Following the note on π in Issue No. 26, we have received some interesting correspondence. Dr. Gosling, of Kingston, Ont., Canada, has sent information about his library of books on digital-computers—claimed to be the most complete in Canada, and M. Rigler, of Northbourne, Bournemouth, Hants., told us that he and other boys at his school have tried to use Klingenstierna's formula for π, but found the calculation hard going beyond the 15th decimal place !

We are full of admiration for youngsters with enterprise and cannot do better than quote Mr. Felton who wrote to us :—

> " M. Rigler should be encouraged—though perhaps not to carry on his calculations much further, or he and his friends will be busy for the next few centuries ! It must be appreciated that the amount of work necessary to work out a number like π to n decimals is roughly proportional to n^2 ; this means that to get to 10000 decimals would take about 500,000 times as long as getting to 15 decimals."

49099 89859 98238 73455 28331 63550 76479 18535

THE POWERS THAT BE

You can check that $2^4 = 4^2$.

I wonder if you can find another pair of numbers so that in a similar way $x^y = y^x$.

Apart from sheer guesses can you find any way of solving such a problem.

The Editor will award book tokens for any interesting solutions received before 1st June, 1960.

Suggested by Mr. J. W. Withrington, M.A., M.Sc., H.M.I.

PUZZLE CORNER

Contributed by Gillian Tyson, Port Erin, Isle of Man.

I have noticed a curious property of the squares of odd numbers which I hope you will find interesting enough to publish.

Square any odd number.

Divide the square by two.

Then the nearest integers above and below this answer, together with the odd number which we started, will be the lengths of the sides of a right-angled triangle.

Example : $15^2 = 225$
$225 \div 2 = 112\frac{1}{2}$
Nearest integers are 112 and 113
$112^2 + 15^2 = 113^2$

Can you explain why this method should be ?

STAMP COLLECTORS' CORNER No. 8

BLAISE PASCAL (1623–1662), was an exceptional boy. When he was 16 he discovered the theorem now known as Pascal's Theorem and wrote an " Essay on Conics " in which he deduced over 400 propositions in geometry as special cases of his theorem. At the age of 18 he invented and made the first calculating machine. Later he made important contributions to the theory of probability. At 31 he abandoned mathematics for theological and moral speculations.
C.V.G.

France 1944,
1·20 fr. + 1·80 fr. *black.*

WITHOUT COMMENT

Col. Withycombe and his family are the only people who live on the island, which is 269 feet above sea level and 44 acres in diameter."

Extract from the *Nottingham Guardian Journal,* Tuesday, November, 1954.
Contributed by Mr. F. Goodliffe, Mapperley, Nottingham.

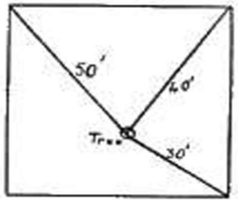
13883 03203 82490 37589 85243 74417 02913 27656

THE MATHEMATICIAN'S HUMOUR

Lord Kelvin (Professor William Thomson, 1824–1907), unable to meet his classes one day, posted the following notice on the door of his lecture room—" Professor Thomson will not meet his classes today."

The disappointed class decided to play a joke on the professor by erasing the "c". When the class assembled the next day in anticipation of the effect of their joke, they were astonished and chagrined to find that the Professor had outwitted them. He had erased the "l".

GEOMETRY IN A GARDEN



I own a square garden as shown in diagram, within the garden stands a tree 30′, 40′, and 50′ from three successive corners. How much land have I?

CARD TRICK

Two players in turn take a playing card from a pile and place the card on a tea tray. The one who first places a card so that it touches another card loses the game. How can the first player ensure that he wins?

Suggested by R. W. Payne, Mathematical School, Rochester.

MATHEMATICS OF A MILITARY MAN

" I'm very well acquainted, too, with matters mathematical,
I understand equations both simple and quadratical.
About Binomial Theorem I am teeming with a lot of news
With many cheerful facts about the square of the hypotenuse.

Major- General Stanley, Pirates of Penzance—By W. S. Gilbert.

MODERN GEOMETRY ?

When my sister discovered that she was taking the scholarship in February she developed an interest in geometrical instruments, this included the protractor.

After having had its functions explained to her in the simplest possible terms, she said, " Well, if a right angle is 90°, what's a left angle ? "

Sandra Shoham, 19, Asmara Road, London, N.W.2.

DO YOU KNOW ?

1. Which Mathematician was Master of the Mint ?
2. Who wrote " Angling may be said to be so like the Mathematics that it can never be fully learnt ? "
3. Which School had as its motto " Let none ignorant of Geometry enter my door ? "
4. What theorem in Geometry is known as " Pons asinorum ? "
5. What is the significance of the word " BODMAS " ?

57326 54893 82391 19325 97463 66730 58360 41428

Readers will be interested to know that Mr. Felton has found the cause of the disagreement between two formulae reported in our earlier note. He repeated the calculation and has provided us with the printed output charts from his Pegasus computer showing agreement between the Gauss and Klingenstierna formulae to about 10020 decimals. He also states :—

> " Since this work was completed, M. Genuys, of the IBM—France company, has quite independently carried out a calculation (using Machin's formula) to 10000 places. I am happy to say that the result agrees with the first 10000 places of mine."

J.F.H.

" DO-IT-YOURSELF " PIE

It can be proved that $\frac{\pi}{4} = 5 \text{ arc tan } \frac{1}{7} + 2 \text{ arc tan } \frac{3}{79}$ and that (for such values)

$$\text{arc tan } x = \frac{x}{1+x^2}\left\{1 + \frac{2}{3}\left(\frac{x^2}{1+x^2}\right) + \frac{2\cdot 4}{3\cdot 5}\left(\frac{x^2}{1+x^2}\right)^2 + \frac{2\cdot 4\cdot 6}{3\cdot 5\cdot 7}\left(\frac{x^2}{1+x^2}\right)^3 + \cdots\right\}$$

Evaluating $\frac{x^2}{1+x^2}$ for $x=\frac{1}{7}$, we have $\frac{2}{100}$ and for $x=\frac{3}{79}$, $\frac{144}{100000}$; the powers of 10 in the denominators cause the succeeding terms to become very small (the series is said to *converge* rapidly). Now try your luck !

J.F.H

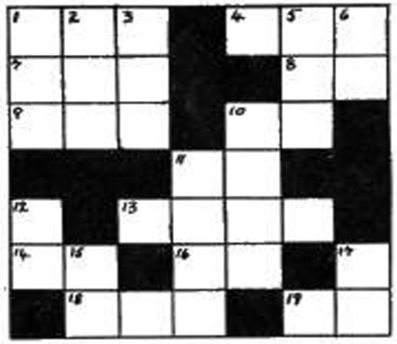
SENIOR CROSS-FIGURE No. 29

Submitted by Mr. F. G. Hewit, of Wrexham.

ABCDEFGH is a rectangular parallelepiped. All its edges and its diagonals are integers.

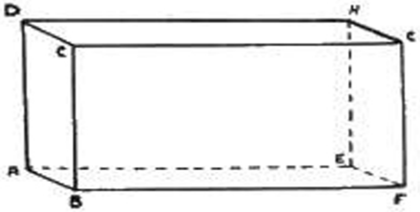
Across

1. BF^2
4. 11 down divided by 9.
7. BD^4
9. For fire, police, ambulance, phone - - -.
10. BD^2
11. BF
13. Number of square yards in 1 acre.
14. AD^2
16. AB^2 multiplied by 10.
18. DF multiplied by 33.
19. AB^4



Down

1. DF^2
2. The same as 18 across.
3. AB^2 multiplied by 51.
5. BD^3
6. AD^2 plus 1.
10. Number of lb. in one ton.
11. See 4 across.
12. AB^4
15. AD^3
17. AB multiplied by 7.



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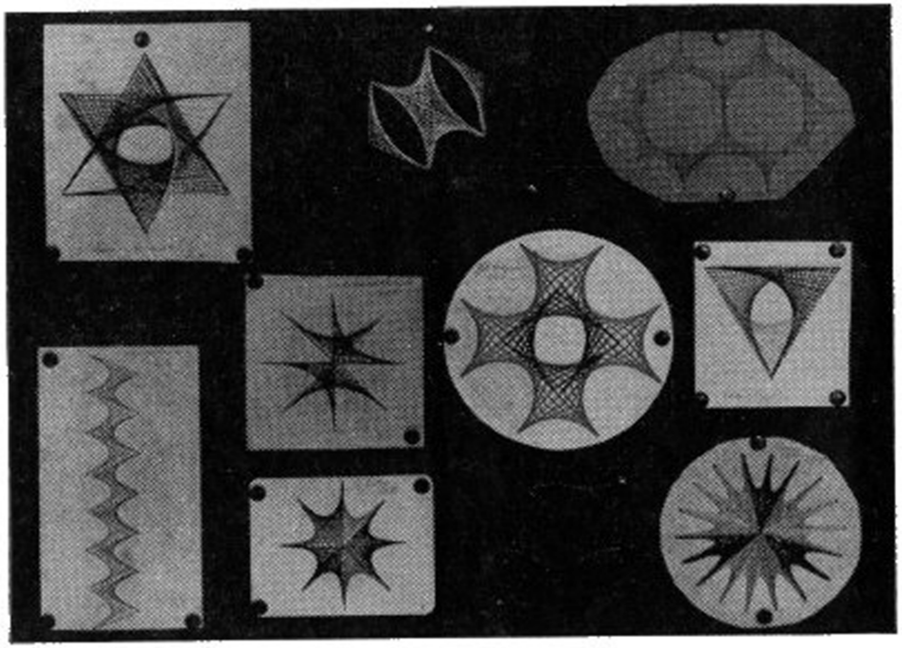

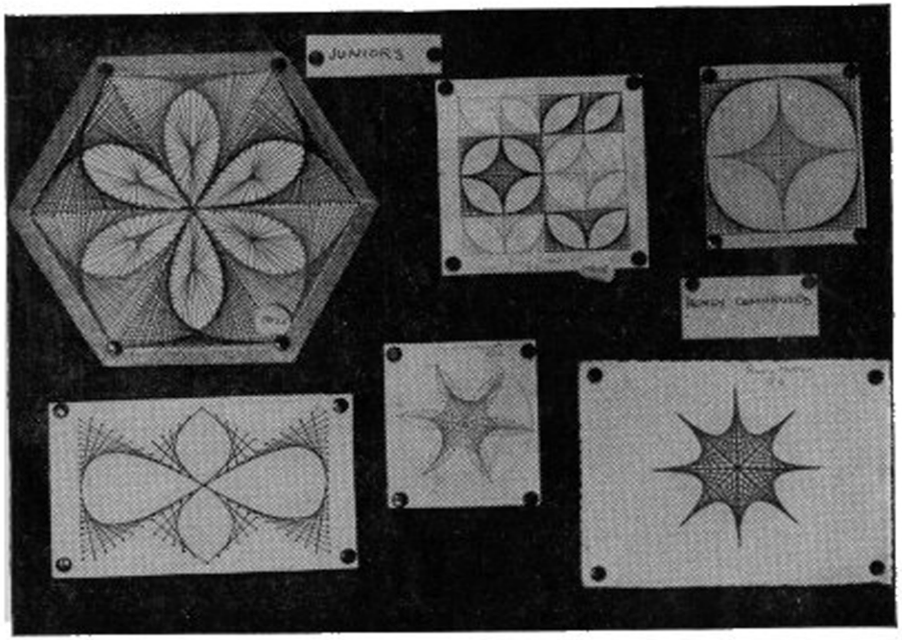

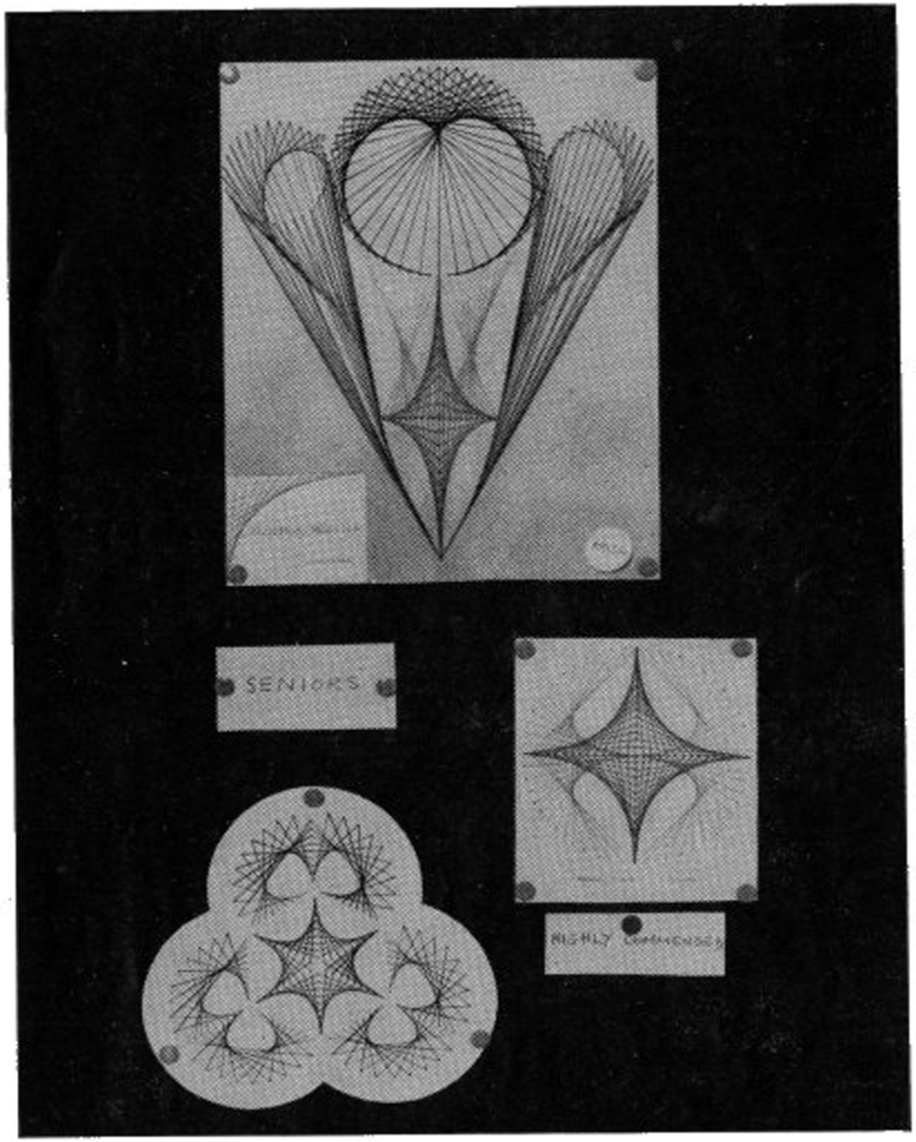

The photographs show the results of the work of the girls of Bournemouth School for Girls after the article on Mathematical Embroidery published in issue No. 25, October, 1958.