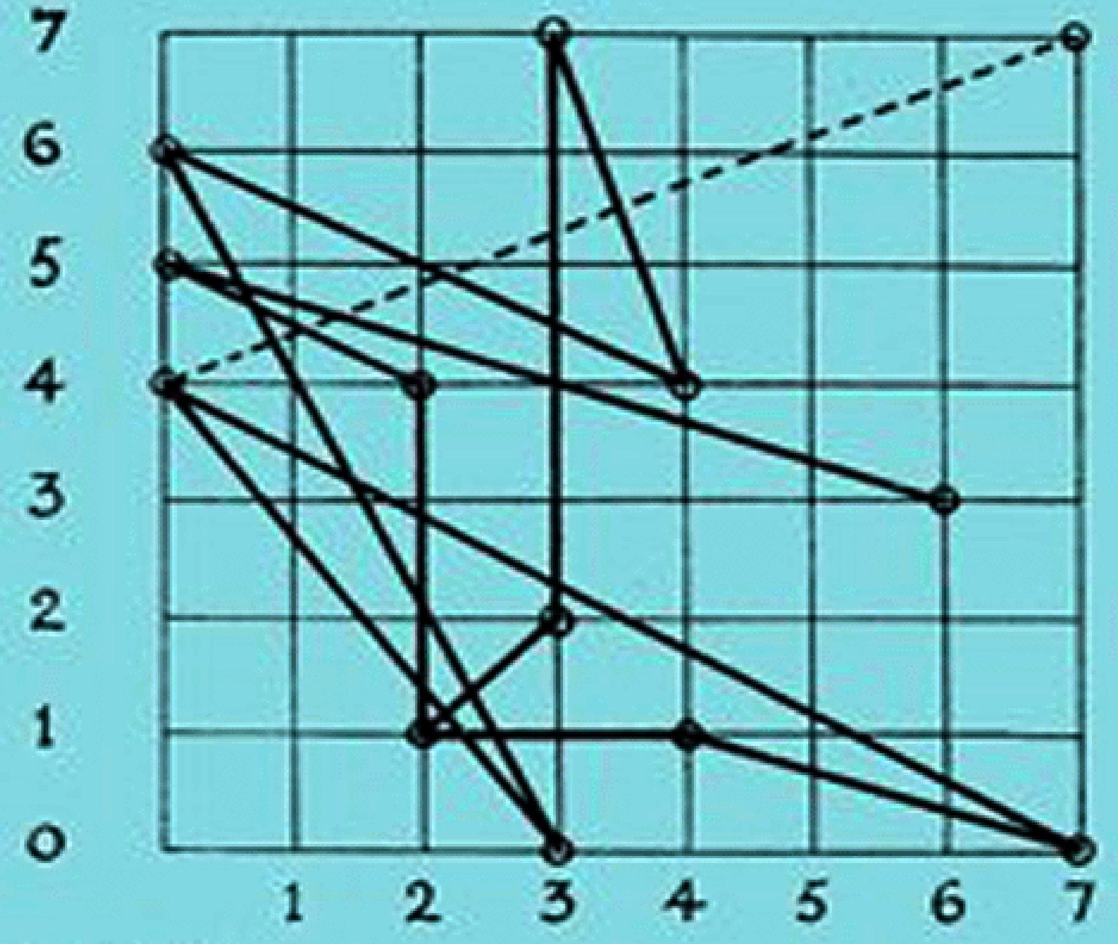
PICTOCODE No. 3

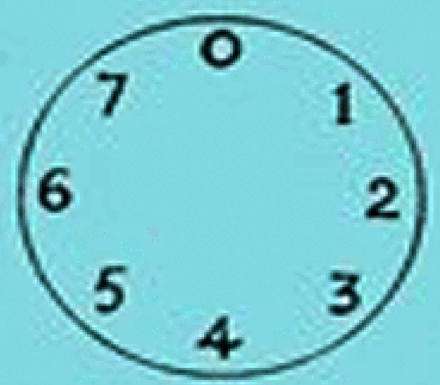


The pictocode is a coded figure. To "solve" it, first multiply each ordered pair by the decoding matrix $\begin{pmatrix}2 & 5\\ 1 & 3\end{pmatrix}$ in Modulo 8 arithmetic.

For example, starting with the point (6, 3):—

$$\begin{pmatrix}2 & 5\\ 1 & 3\end{pmatrix}\begin{pmatrix}6\\ 3\end{pmatrix} = \begin{pmatrix}2\times6 & + & 5\times3\\ 1\times6 & + & 3\times3\end{pmatrix}$$

$$= \begin{pmatrix}12 & + & 15\\ 6 & + & 9\end{pmatrix}$$



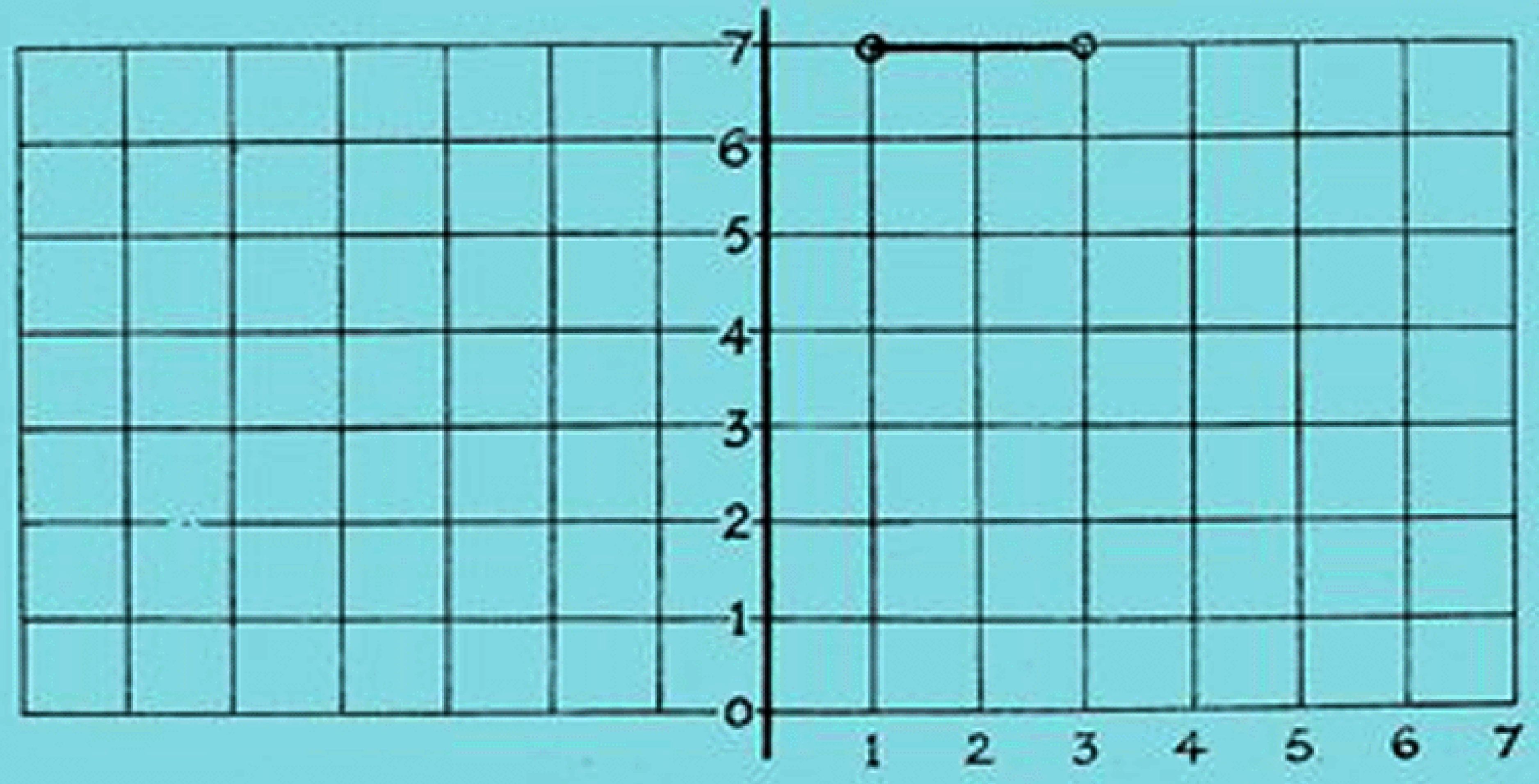
$$= \begin{pmatrix}27\\ 15\end{pmatrix} = \begin{pmatrix}3\\ 7\end{pmatrix} \text{ in modulo 8 arithmetic.}$$

In the same way, transform the next ordered pair:—

$$\begin{pmatrix}2 & 5\\ 1 & 3\end{pmatrix}\begin{pmatrix}0\\ 5\end{pmatrix} = \begin{pmatrix}1\\ 7\end{pmatrix} \text{ in modulo 8 arithmetic.}$$

Now plot all the transformations and join them in the order indicated by the set of straight lines connecting the points in the pictocode. Consider the two points joined by a dotted line as a separate set.

Finally, complete the transformed figure if the line joining (0, 0) and (0, 7) is its axis of reflective symmetry.



Reflection Transformation D.I.B.

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MATHEMATICAL PIE

No. 83 *Editorial Address:* West View, Fiveways, Nr. Warwick SPRING, 1978

FOR 8, 1, 12, 12, 15, 23, 5, 5, 14?

Most of you know about MAGIC SQUARES—square arrangements of numbers made up in such a way that the total in any row, any column or either diagonal is the same. The first square below is an almost-complete simple example, and it will not take you long to decide what the missing numbers are.

Just for a change, I've decided to try writing letters instead of the numbers, using the easy "code" 1=A, 2=B, 3=C, and so on. You will notice that in the second square I've filled in all of one diagonal again, so it's not hard. You might have to think a bit for the third one, though. What word can be spelled by the missing letters?

E.G.

i)

4		2
3	5	
	1	6

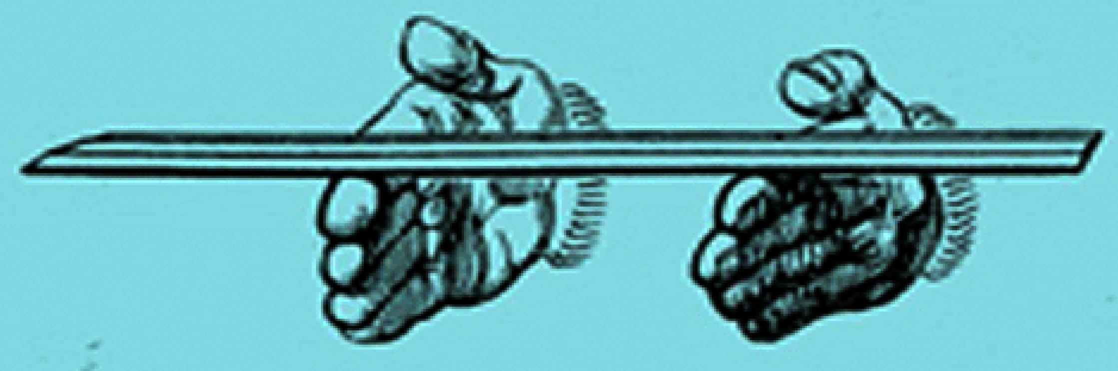
ii)

B		
O	H	
		N

iii)

O		K
E		
	Q	

FOR THE SIXTH FORMER



To find the centre of a stick place the edges of your palms underneath the stick so that the stick is horizontal. Slowly slide your hands together and when they finally come together that is the centre. Explain why this happens. R.H.C.

CORN BIN!

Fractions are a small part of Maths, but calculating is an additional factor. If it were not for decimals, you would not see the point.

The above were written by the editor's puncil (sic! or sick) E.G. Can you add to the contents of the Corn Bin? Book tokens for any suggestions that are used. Ed.

TOPS AND TAILS

A small holder kept hens and pigs. When asked how many of each he had, he replied, "I have 24 heads and 56 feet".

How many hens and how many pigs had he?

B.A.

TRANSLATION

I asked a class to find the sum of two numbers. One boy said 11 and a girl said 180. Both were wrong because they did not know what "sum" meant, although their computation was right. What were the numbers and what did each think "sum" meant?

B.A.

WINNING WAYS

I wish to donate four cups to two clubs. In how many ways can this be done if there is no restriction at all?

In how many ways can the cups be donated if both clubs must receive at least one cup?

B.A.

DIG FOR THE ANSWER

A boy was digging a hole. "How deep is the hole?", I asked. "Guess", he replied, "I am $1\frac{1}{2}$ metres tall".
"How much deeper are you going to dig?"
"Twice as deep as this—then my head will be three times as far below the ground as it is now above it".

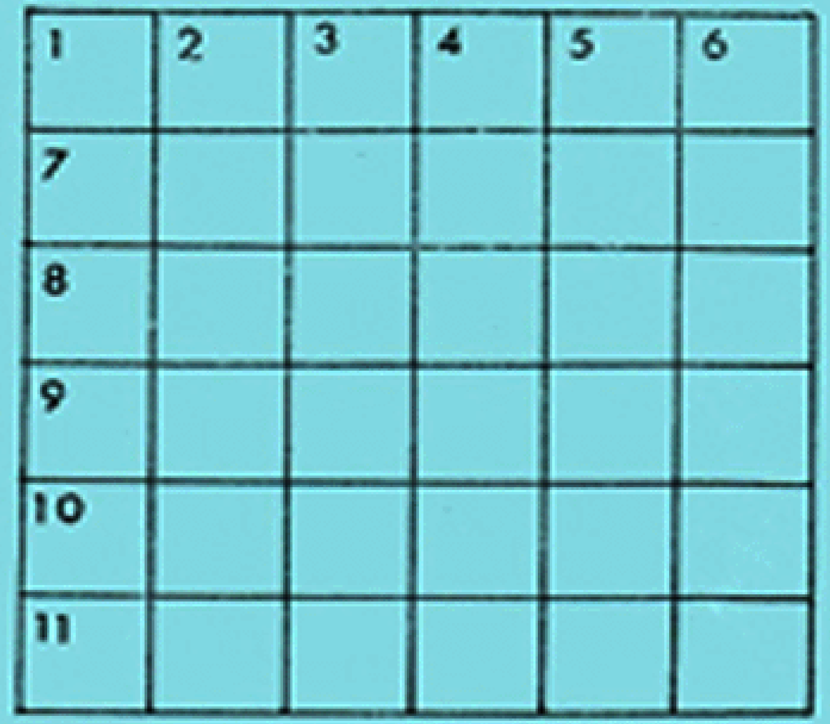
How deep was the final hole?

B.A.

JUNIOR CROSSWORD FIGURE No. LXVII

Across	Down
1. 1720	1. 1810
7. 820	2. 730
8. 325	3. 330
9. 132	4. 224
10. 123	5. 33
11. 37	6. 28

A.M.A.



SOLUTIONS TO PROBLEMS IN ISSUE No. 82

MERGER
The sensible drawing was a clown.

SQUARES
$36+9+1+1$

A CLEVER PLOT
"The graph gives a picture of Paddington the bear".

CARTAKER AND CARETAKER
The car took 10 minutes less each way.
The pick up was at 7.50 a.m.

FAIR'S FAIR
A cuts. B amends the cut or leaves it. C amends the cut or leaves it. The last person to cut takes the piece and then the other two proceed as before.

PUNNY ANAGRAMS
Polygon, vertices, axis and minimum.

This year $19+7-7=1$, $19+7-7=2$.

TRANSFORMATIONS

	I	Z	S	W
I	I	Z	S	W
Z	Z	Z	Z	Z
S	S	Z	S	I
W	W	Z	I	W

TRANSFORMATION
DRINK DRANK CRANK CLANK CLANS CLASS CLASH CRASH

JUNIOR CROSS FIGURE No. 66
ACROSS: 2, 16; 5, 496481; 8, 12; 9, 70; 10, 87; 11, 19; 12, 124416; 15, 87.
DOWN: 1, 44; 2, 162; 3, 64; 4, 910; 6, 9172; 7, 8791; 10, 810; 11, 147; 13, 48; 14, 60.

B.A.

CAR NUMBERS

Submitted by K. Atkin, Esq., Eaton Hall College of Education, Retford.

A popular game in the past was to look for car numbers in sequence, e.g. HAL 1, DVO 2, RNN 3 etc. It often took weeks to find the next number as the registration numbers did not begin at 1 for each letter combination every year.

Recently I tested an amended form of this game which uses a similar method to that described in "This year" in issue No. 82. Take the digits on the number plate of a car and, by inserting any accepted mathematical symbols at appropriate places, try to arrange the values in ascending order and continue the sequence as soon as possible, using the digits in the car number as you see them. If you are quick, the same number plate may be used for many successive numbers. The registration plate 'NVO 221 L' could give the following:

$2\div2\times1=1$, $2\div2+1=2$, $2\times2-1=3$,

$2\times2\times1=4$, $2\times2+1=5$, $2\,(2+1)=6$.

Note that in computing, 2^3 is written as $2\wedge3$, so that the same number plate could be used to give

$2\wedge(2+1)=8$ and $22\wedge1=22$.

Remember that $22^0=22\wedge0=1$ and $\sqrt{9}=9^{\frac{1}{2}}=9\wedge(1/2)=3$.

On a journey of 250 miles on the motorway it is quite easy to start at 1 and go beyond 100, and even on a 60-mile journey on A class roads to start at 1 and reach 30.

Try the game to see how far you can get on various journeys or in a given time at different points on your local roads.

TRY THIS FOR SIZE

$$\frac{22+22}{1+2+1}= \qquad \frac{333+333}{1+2+3+2+1}= \qquad \frac{4444+4444}{1+2+3+4+3+2+1}=$$

Now carry on and you have one minute to finish. R.H.C.

RE-ARRANGEMENTS

Use three 2's in three different ways so that the second way is twice the first and half the third.

Use three 2's and three 0's to make 1978.

Use four 2's, two 3's and one 0 to make 1978. R.H.C.

THREESOMES

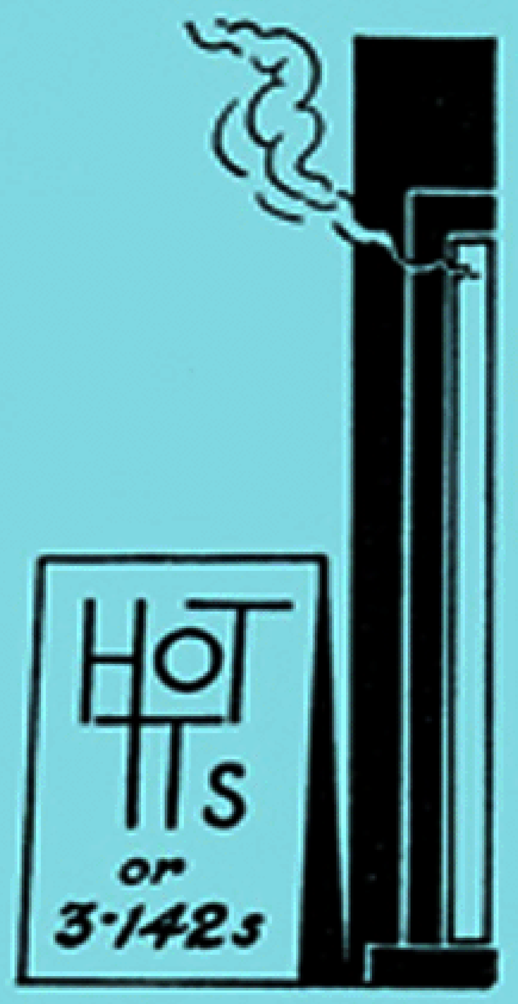
Using the same digit three times over, make expressions to give the answer 24. $22+2=24$ and $8+8+8=24$. What about the other seven digits? Remember that 4!, which is read as factorial 4, means $4\times3\times2\times1=24$. R.H.C.

1978

Using the figures 1 9 7 8 and mathematical symbols make up statements equal to 1, 2 etc.

BUSINESS SIGNS

Mark Ashton of Liverpool suggested the sign shown. It has been tidied up by "Shuttl" and a book token has been sent to Mark. We would be happy to receive more suggestions for "Shuttl" to work on. Ed.



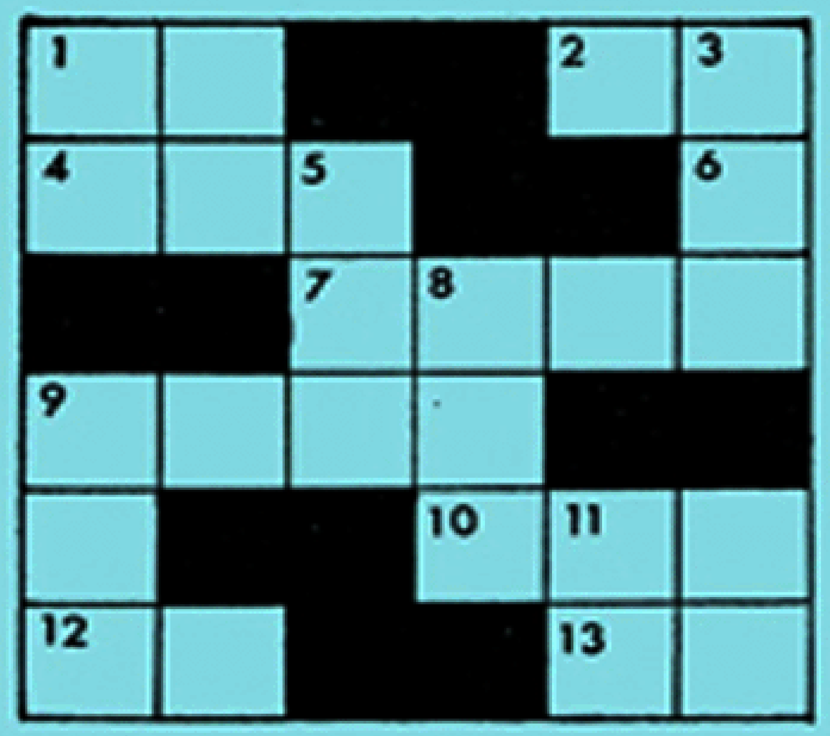
OLD MEASURE CROSS FIGURE

Clues Across

1. Noggins in three pints.
2. Trusses in one load.
4. Square yards in four square poles.
6. Furlongs in $\frac{1}{4}$ mile.
7. Yards in one mile.
9. Cubic inches in one foot.
10. Yards in one furlong.
12. Pints in six gallons.
13. Inches in one fathom.

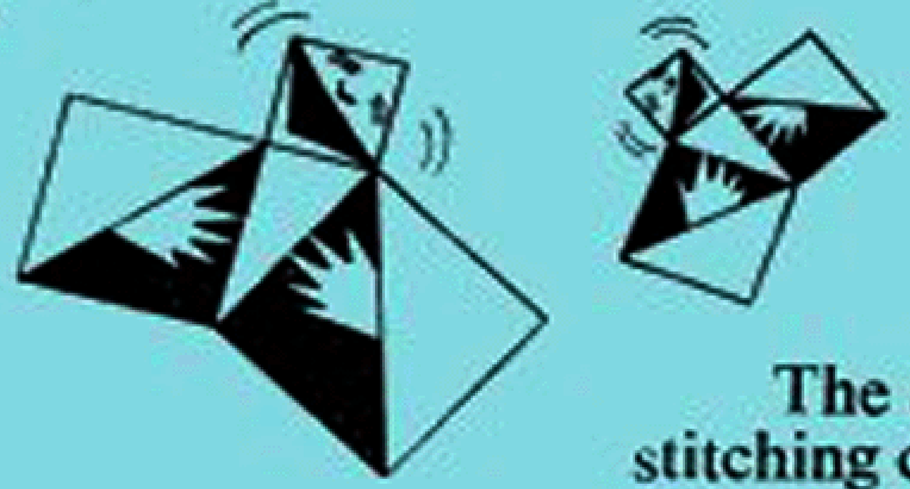
Clues Down

1. Yards in two poles.
3. Weight in pounds of eight bushells of water.
5. Pounds in one hundredweight.
8. Pounds in $\frac{1}{4}$ stone, ounces in $\frac{1}{4}$ pound, quarters in $\frac{1}{4}$ hundredweight.
9. Square inches in one square foot.
11. Cubic feet in one cubic yard.



A.M.A.

THEOREMS IN STITCHES!



The attractive art of curve stitching can be used to demonstrate some of the well-known geometrical theorems.

For example, in four stages, a construction will demonstrate the theorem that *the vertex of a right-angle, subtended by two fixed points in the same plane, lies on a circle.*

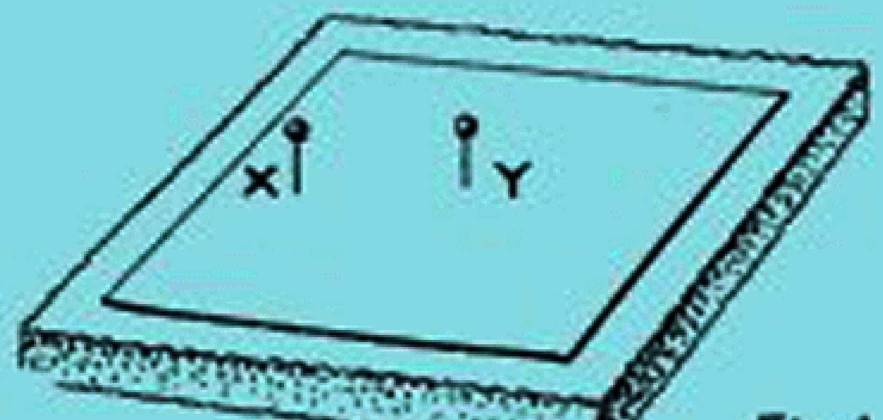


Fig. i

1. Place a piece of card (about 15 cm. square) on a polystyrene tile and firmly push two pins, X and Y through the card and into the tile, fig. 1.
2. Prepare a template with the two straight sides AP and BP subtending a right-angle APB, and each side greater in length than the distance XY.
3. Plot the locus of P as the template is moved such that AP and BP remain in contact with the pins X and Y respectively (fig. ii and fig. iii). When sufficient points have been plotted, reverse the template and complete the locus to reveal the circumference of a circle (fig. iv).
4. After removing the pins, use needle and coloured thread to stitch the design shown in fig. v.

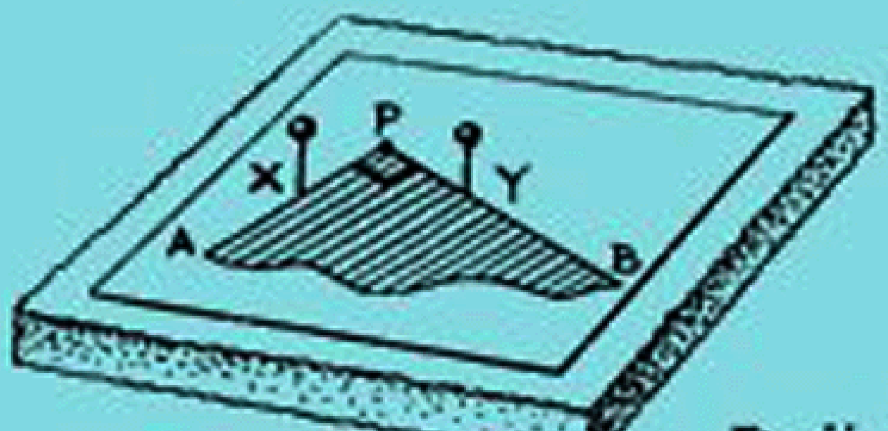


Fig. ii

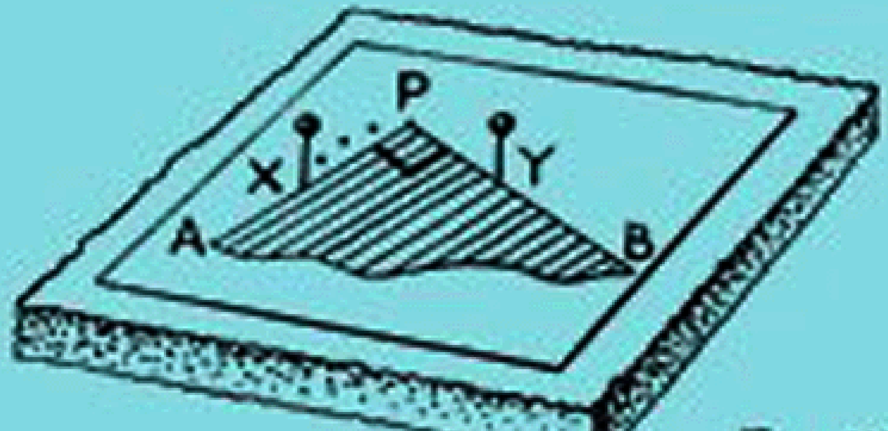


Fig. iii

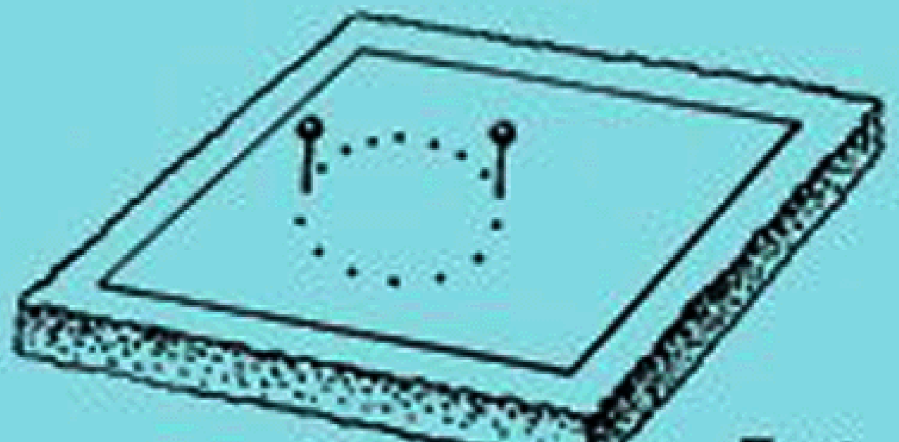


Fig. iv

In a similar way, it can be shown that *the vertex of any given angle subtended by two fixed points in the same plane lies on an arc of a circle passing through the two points* (fig. vii). Repeat stage 1, ensuring that the distance XY is less than the distance AB on the template APB (fig. vi). If AP and BP maintain contact with X and Y respectively, the locus of P is an arc of a circle (fig. vii).

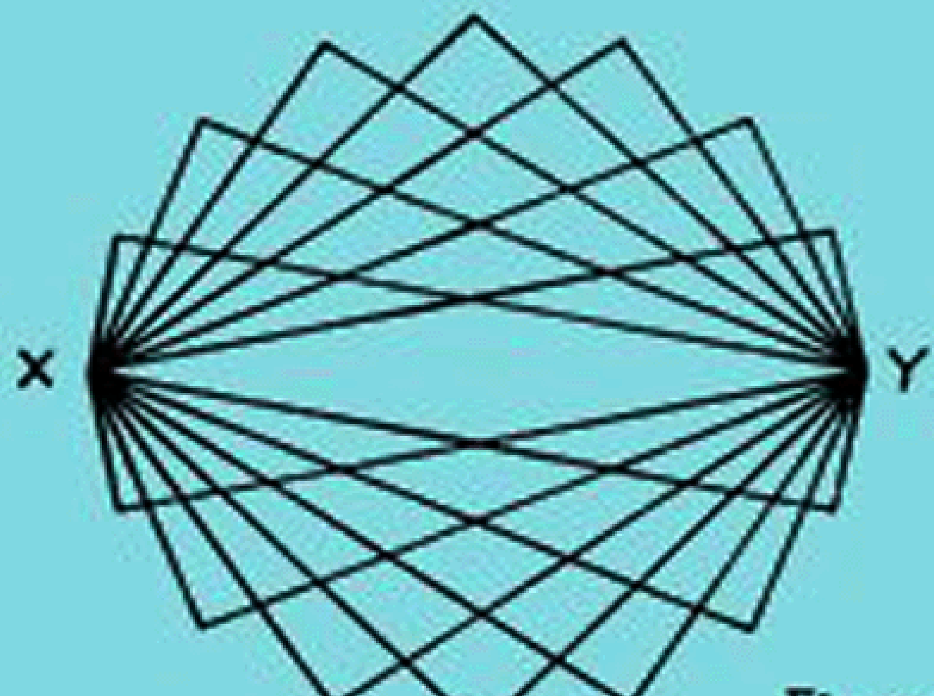
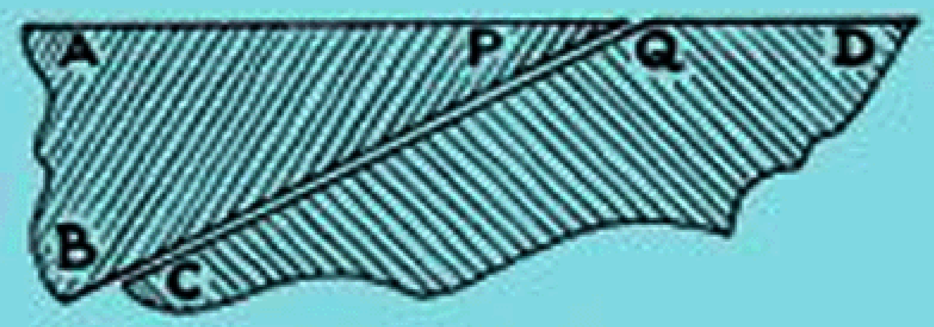


Fig. v



$(A\hat{P}B + C\hat{Q}D = 180°)$ Fig. vi

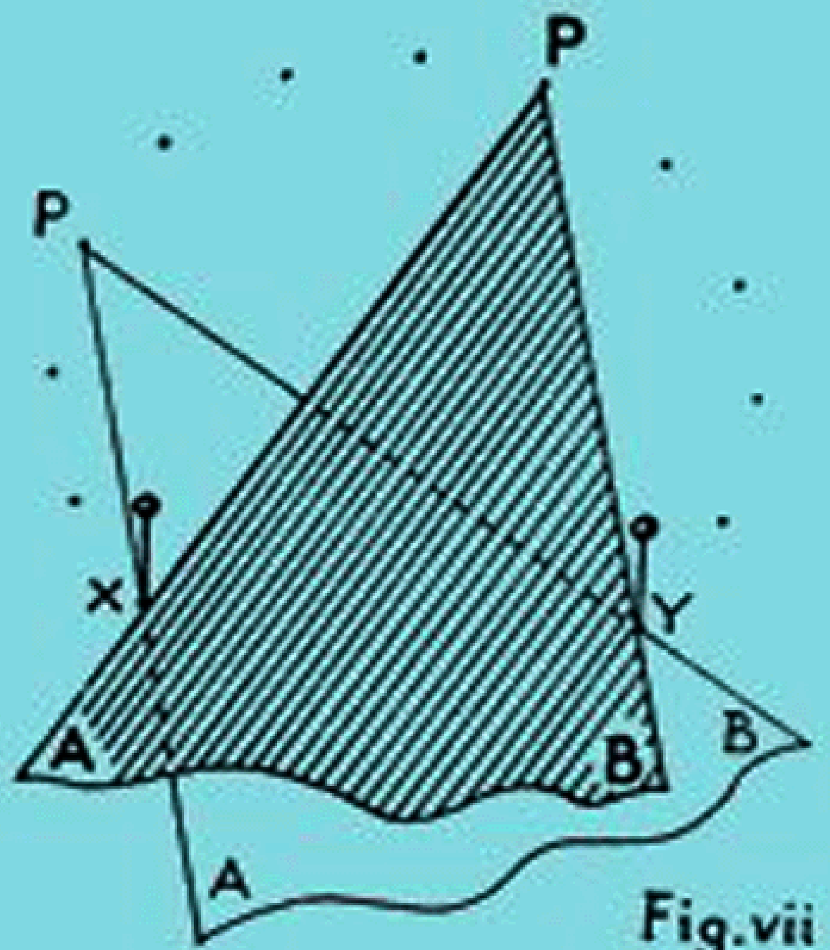


Fig. vii

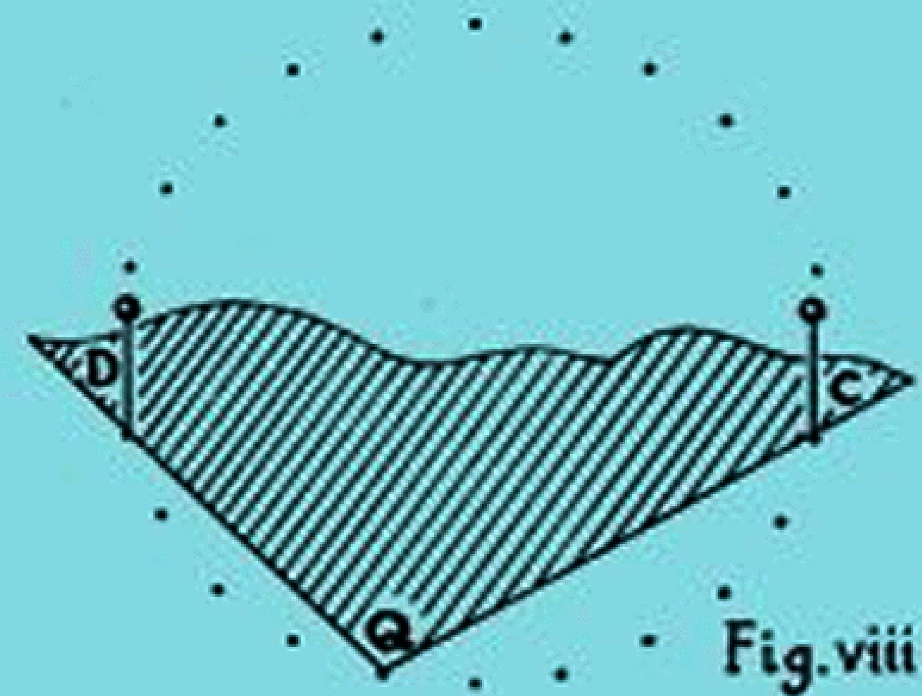


Fig. viii

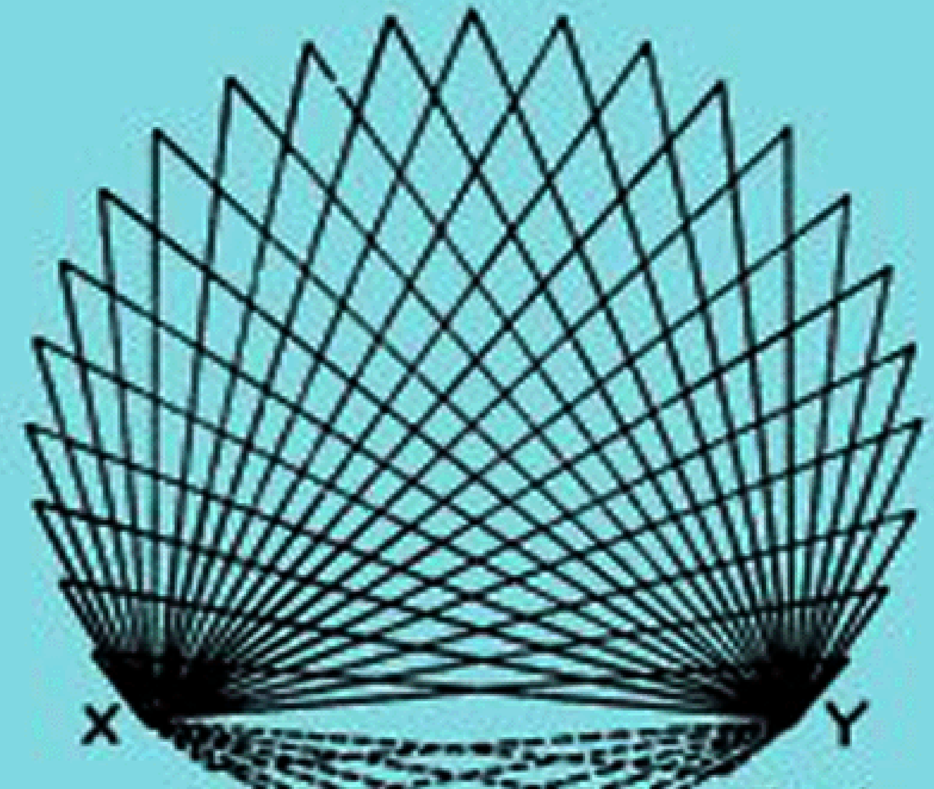


Fig. ix

Fig. viii shows how the circle is completed when the template CQD is used to plot the locus of Q. Coloured thread clearly illustrates that *the vertices of a quadrilateral in which the opposite angles are supplementary* (*have a sum of* 180°) *lie on the circumference of a circle* (fig. ix).

It should be possible to get several other theorems into stitches! Book tokens will be sent for those which are published.

D.I.B.