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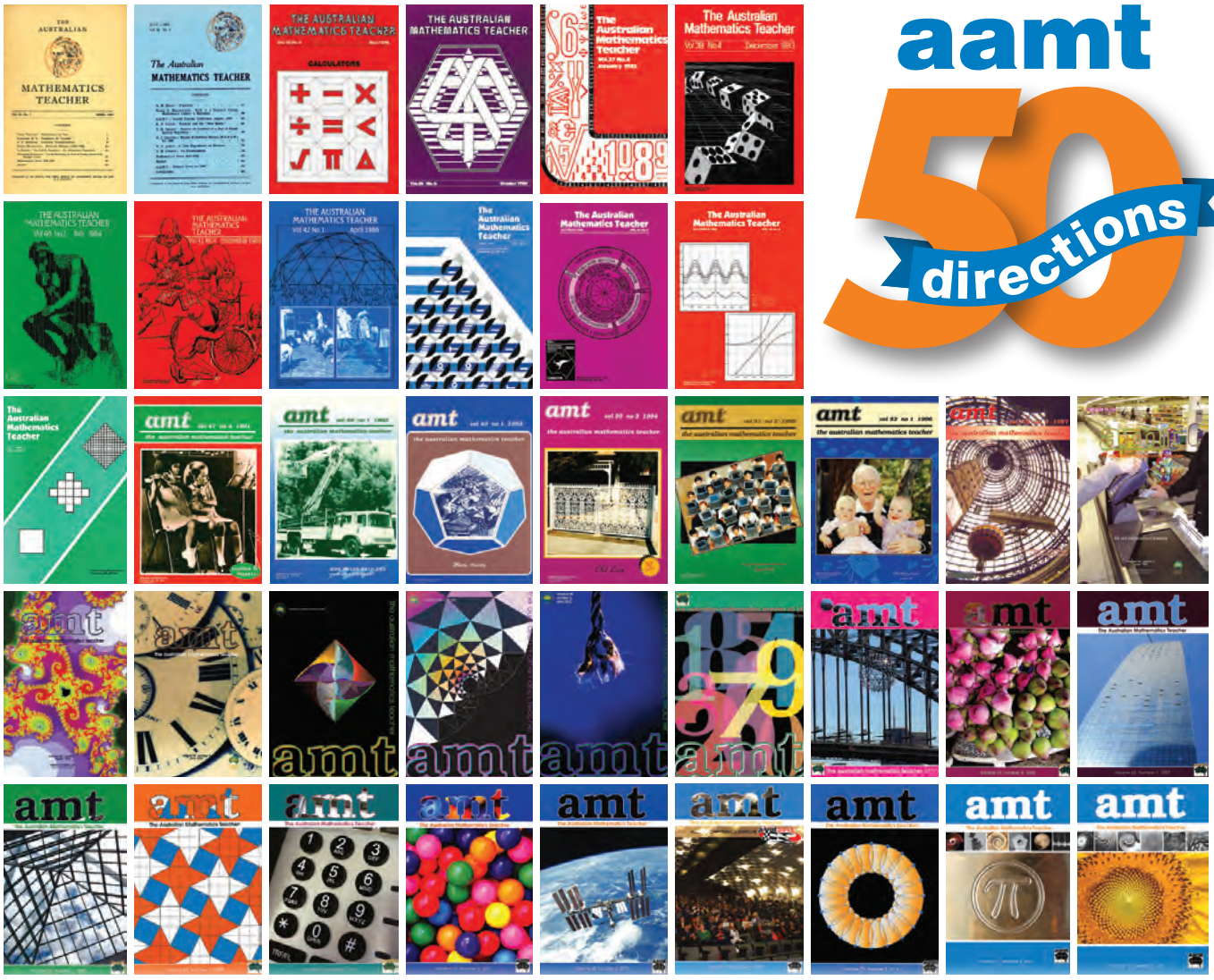

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Volume 72 Number 3

amt contents

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(Editorial, AMT, Vol. 1, No. 1, April 1945.)

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Curve stitching

...or how to form curves with straight lines

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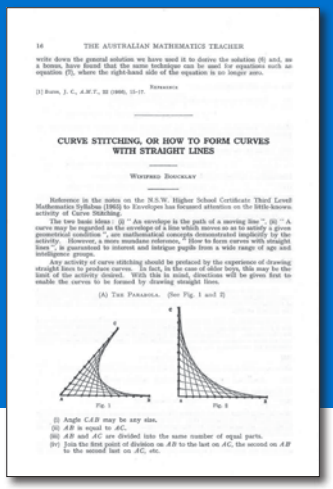

CURVE STITCHING, OR HOW TO FORM CURVES WITH STRAIGHT LINES

Winifred Bouckley

Reference in the notes on the N.S.W. Higher School Certificate Third' Levell Mathematics Syllabus (1065) to Envelopes has focussed attention on the little-known, activity of Curve Stitching.

The two basic ideas : (i) "An envelope is the path of a moving line". (ii) "A curve may be regarded as the envelope of a line which moves so as to satisiy a given geometrical condition ", are mathematical concepts demonstrated implicitly by the activity. However, a more mundane reference, "How to form curves wtth straight lines", is guaranteed to interest and intrigue pupils from a wide range of age and intelligence groups.

Any activity of curve stitching should be pref-aci!d by the e.xperience of drawing: straight lines to produce curves. lo fact, in tho case of older boys, tbis may be the limit of the activity desired. With this in mind, directions will be given first to enable the currves to be formed by drawing straight lines.

A. The parabola

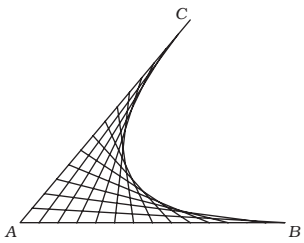

Figure1

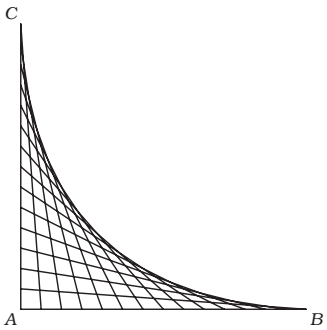

Figure 2

(i) Angle CAB may be any size.
(ii) AB is equal to AC
(iii) AB and AC are divided into the same number of equal parts.
(iv) Join the first point of division on AB to the last on AC, the second on AB to the second last on AC, etc.

B. Based on a circle

(I) The envelope of equal chords of a circle

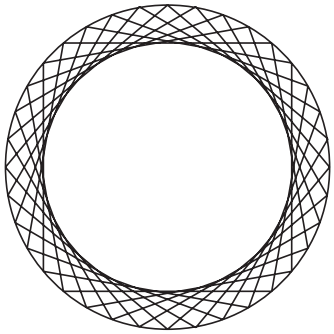

Figure 3

(i) Divide the circumference of the circle into a number of equal parts, e.g. 36. This could be done using a protractor.
(ii) Join the first point of division to any other point of division, e.g. lst to 8th.
(iii) Continue round the circumference joining 2nd to 9th, 3rd to lOth, etc.
(iv) The lines form the envelope, an inner circle. The further apart the joined points are, the smaller this circle.

(2) The cardioid

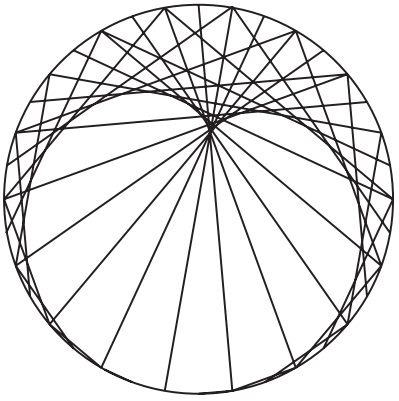

Figure 4

(i) Divide the circumference into a number of equal parts, e.g. 36, and number t(I)he points of division lightly in pencil.

(ii) Join point 1 to 2, 2 to 4, 3 to 6, 4 to 8, etc, up to 36 to 70. (N.B. One extremity moves one division, the other extremity two divisions.

(3) Extension of (2)

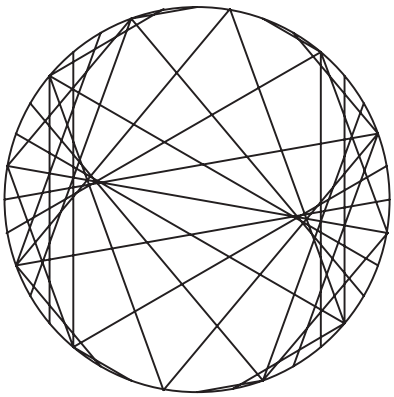

Figure 5

(i) As for (2).

(ii) Join 1 to 3, 2 to 6, 3 to 9, 4 to 12, etc.

C. Envelopes based on two concentric circles

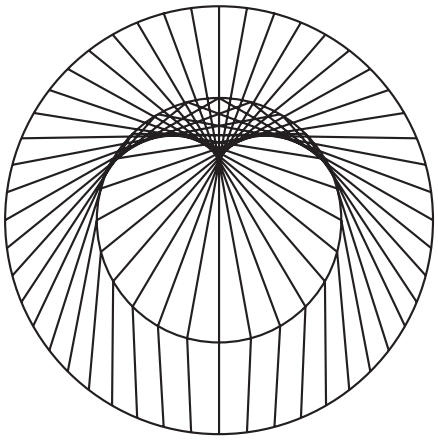

Figure 6

(i) Divide the circumference of the inner circle into 24 equal parts and that of the outer circle into 2 × 24, i.e; 48 equal parts. (Fig. 6.)

(ii) Join points on one circle to points on the other circle moving around both circles in the same direction or alternatively in opposite directions.

D. Tractory

(i) As a suggestion, take AB = 2 inches and BC = 3 inches. (Fig. 7.)

(ii) Divide BC into 12 equal parts.

(iii) All the lines drawn are equal in length to AB, and each touches the preceding line. Dividers are useful here. (N.B. Compare the falling of cards or dominoes.)

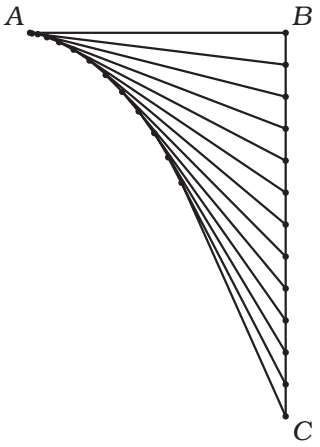

Figure 7

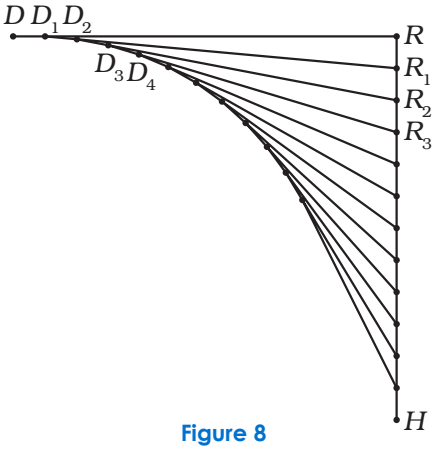

Figure 8

E. The Curve of Pursuit

(i) D, R, and H represent original positions of a dog, a rabbit, and a hole respectively. DR = RH = 3 inches approximately. The rabbit is running towards the hole, the dog towards the rabbit, both at the same speed.

(ii) RH is divided into 12 equal parts. (Fig. 8.)

(iii) DR is the first intended path of the dog, but by the time the dog gets to D_1 the rabbit will be at R_1. (DD_1 = RR_1.)

(iv) D_1 R_1 is the second intended path of the dog; point D_2 for the dog corresponds to point R_2 for the rabbit, etc.

Curve stitching

However intriguing the above series of developments may be, the curve stitching based on them can give a much greater sense of satisfaction of achievement, and challenge to the imagination as regards colour and design. The materials required are:

(i) thin cardboard of any colour, including black;
(ii) coloured thread (sewing cotton, thicker knitting cotton, embroidery silk, 3-ply wool), split raffia, etc.; ordinary sewing cotton can produce very pleasing colour shading;
(iii) needles appropriate to the thread.

As regards general procedure, the first envelope mentioned, the parabola, may serve as an example. (See Fig. I) The basic angle is drawn on the cardboard, the divisions marked out and holes made using a needle. (A much easier method is to make the divisions and holes using a sewing machine with unthreaded needle.) Knotting the coloured thread to be used, make a stitch from the first division on *AB* to the last on *AC* on the top of the cardboard, then behind the card to the second last divisio11 on *AC*. Continue with a stitch at the front across to the second division on *AB*, and so on. The whole may be done using the same coloured thread, but, with divisions close together, ordinary sewing cotton gives extremely good results if a change in colour is made after about six long stitches.

In curve stitching, all stitches to neighbouring holes ar made behind the cardboard, while all the longer stitches are on the top of the cardboard. When the envelope is completed, stitching along the original lines (*AB* and *AC* above) covers the holes.

The number of designs which may be created using the basic envelopes mentioned is very great. The following are a few ideas based on the parabola.

As may be imagined, much beautiful work could be done with original design :and colour combination applicable to embroidery on woven materials. At the other end of the scale, much interesting work could be done with prepared cardboard by young children and those in lower ability groups. Apparently curve stitching has found much favour with pupils in West Africa.

In this paper discussion has of necessity been confined to two dimensions. The formation of curved surfaces from straight lines in three dimensions, e.g. joining by string or wire corresponding points on two non-coplanar circles, etc., may stimulate the imagination.

In conclusion, one feels that there is something in this unusual aspect of mathematics to appeal to pupils of both sexes aged from 8 to 80 years.

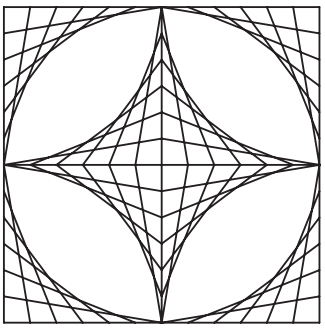

Figure 9

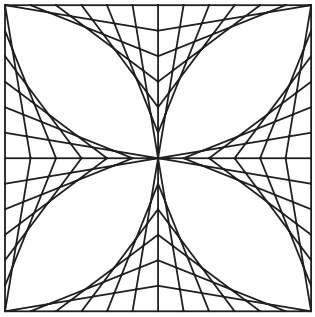

Figure 10

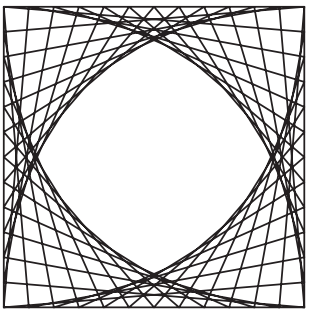

Figure 11

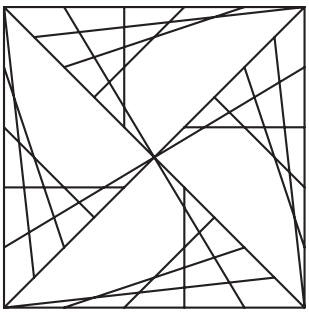

Figure 12

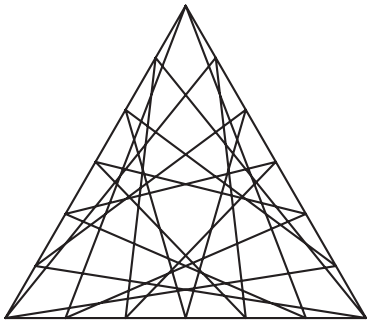

Figure 13