

EUCLIDEAN CARPENTRY

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Our problem is simply stated:

Given three points A, B and C positioned as in figure 1, draw the circular arc passing through C and ending at A and B.

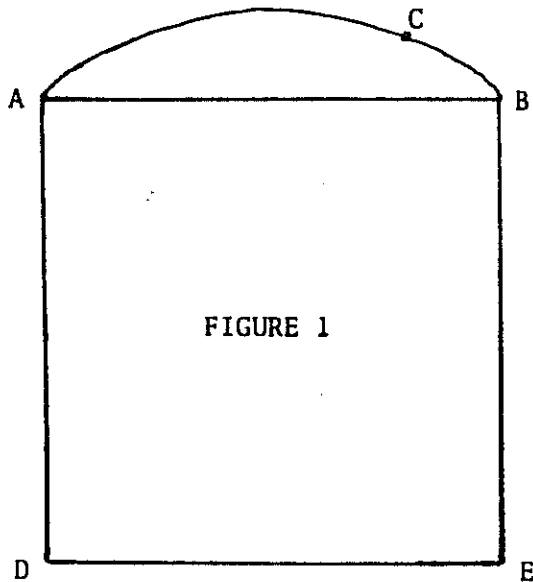


FIGURE 1

As a home handyman, I have met this problem several times and feel sure the reader will have also. To be specific, suppose we wish to convert an already existing door-opening (ABED) of figure 1) into an archway by removing the shaded region. The position of C may be determined by aesthetic or structural considerations. Before doing any cutting we must first draw the circular arc.

A way of doing this, which might be called the conventional way, is to locate the arc's centre as the point of intersection of the perpendicular bisectors for AC and BC. Then fastening a length of string to a nail at the centre, trace the arc with a pencil attached to the string.

Apart from this construction being difficult to carry out accurately, whenever I try it something always goes wrong:

The string stretches, so the curve starting at A misses B;

The pencil slips out of the string;

The string winds round the nail at the centre;

The centre is inaccessible, or as in the case of our doorway there is simply nothing at the centre to attach the string to.

Less well known and seldom used is a simpler, more reliable way of carrying out our task.

One of the commoner propositions of Euclidean geometry (Euclid Book III Proposition 21) states

In a circle the angles in the same segment are equal to one another (provided the angles have the same circumference as base).

What is often not appreciated is that this property characterizes the circle, and so provides the answer to our problem.

Using two pieces of wood, each at least as long as AB, form a rigid frame as illustrated in figure 2 with outside corner at C and the outside of the two legs touching A and B. Drive nails part way in at A and B. Slide the frame so that the two legs remain in contact with the nails at A and B, then the corner traces out the desired circular arc.

If the corner angle of the frame is made a right angle, the above procedure leads to the semicircle on the diameter AB. By this means the circle on a given diameter may readily be drawn using a carpenter's square, set square or the like.

Exercise: Establish the truth of the constructions described above.

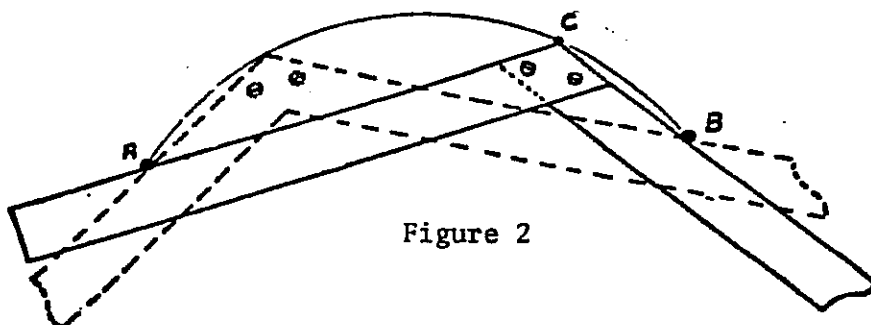
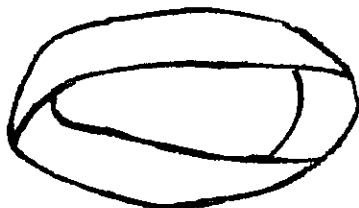


Figure 2



A TOPOLOGICAL LIMERICK

A mathematician confided

That a Moebius strip is one-sided,

And you can get quite a laugh

When you cut it in half,

'Cause it stays in one piece when divided.