consequently the expression b^3 cannot be used because it would be ambiguous).

If the entry for $c * b$ in the body of the table is changed from e to a, then $*$ becomes commutative, and hence certainly power-associative; but $*$ remains non-alternative, both left and right.

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3343. Concurrent circles of equal radii

The suggestion at the end of Mathematical Note 3324 (May 1972) that "an extension to spheres would be interesting" is covered in my article "Chains of Circles" in *Mathematics Teaching* for Spring 1971.

The only difference between my approach and that of Professor Harley Flanders—which in the circumstances is immaterial—is that he begins with equal circles through a point while I begin with equal circles through pairs of points on a base circle. As can readily be seen, the two figures come to the same; in a sense, one is the dual of the other.

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The cube dissected into three yángmǎ

DEAR SIR,

I was intrigued to read in Mr. Kiang's article about the ancient Chinese method of finding the volume of a sphere (May 1972) a reference to "...a familiar object known as a yángmǎ". There is also a note that "a cube can actually be cut into 3 yángmǎ" (Fig. 1).

It may amuse your readers to know that the net for this solid, a square-based skew pyramid, can be constructued from a square of paper, after the manner of Origami, entirely without the aid of compasses, straight-edge or scale and that this can make a very

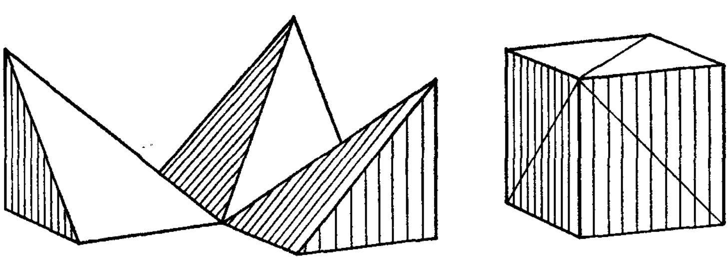

FIGURE 1

useful visual aid for the mathematics room, since it suggests a way to formulate the volume of a pyramid.

It should be clear from Fig. 2 that the net can be circumscribed by a square, $ABCD$, and is symmetrical about the diagonal AC; since F is the mid-point of AE the whole square can be folded along $AC, FG, EH, F'G'$ and $E'H'$ so long as the point E can be found. One can then construct the net. Now, E divides AD in the ratio $2:\sqrt{2}$, i.e. $\sqrt{2}:1$, and, in the $\triangle ACD$, $AC:CD = \sqrt{2}:1$.

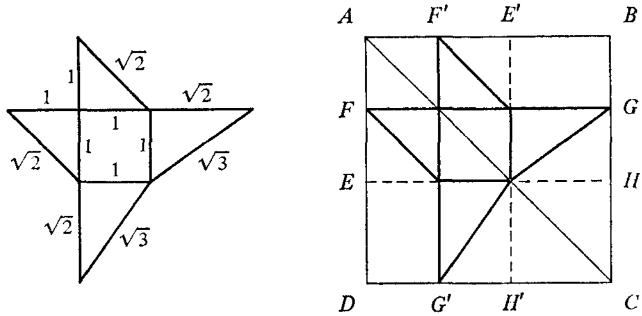

FIGURE 2

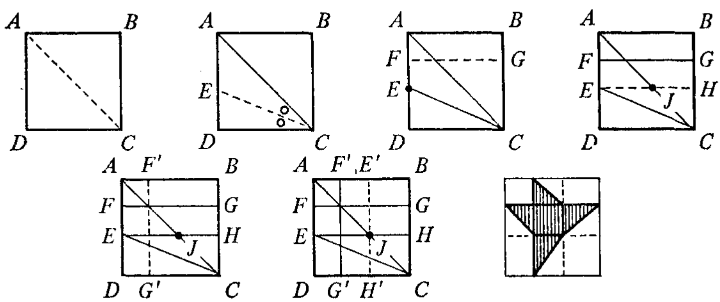

FIGURE 3

Using Euclid VI.1 the bisector of the angle at C will meet AD in E. The procedure is illustrated in Fig. 3.

1. Fold the square on the diagonal AC.
2. Fold DC on to AC to locate E on AD.
3. Fold FG, the perpendicular bisector of AE.
4. Fold EH, perpendicular to AD, to meet AC in J.
5. Fold $F'G'$, the perpendicular bisector of EJ.
6. Fold $E'H'$ perpendicular to EH through J.

For the completed development, join up as indicated.

All that remains to do, to produce the model illustrated in Fig. 1, is to mark this net simultaneously onto three pieces of card, with pin-holes through the appropriate vertices, and cut out, after scoring with a blunt knife-blade, allowing flaps for sticking. If these pyramids are hinged together they make the excellent visual aid referred to above.

Yours etc.,

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