$$d_n = (n-1)(d_{n-1} + d_{n-2}) \quad (n > 2),$$

as required.

The observation above remains true if "determinant" is replaced by "permanent", where

$$\operatorname{per} A = \sum a_{1i} a_{2j} \ldots a_{nl}.$$

In this case the *number* of terms is the value of per$A$ when $a_{ii} = 0$ and $a_{ik} = 1$ ($i \neq k$) for all $i, k = 1, \ldots, n$. Thus

$$d_n = \operatorname{per}(J_n - I_n),$$

where each entry in J_n is 1, and I_n is the unit matrix of order n. However, determinants are simpler to manipulate than permanents although the latter appear in combinatorial mathematics [2].

References

1. M. T. L. Bizley, A note on derangements, *Mathl. Gaz.* LI, 118–120 (No. 376, May 1967).
2. J. Riordan, *An introduction to combinatorial analysis.* Wiley (1958).

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The yángmǎ and the rhombic dodecahedron

DEAR SIR,

Having made the yángmǎ by the method in Mr. Brunton's letter in the February 1973 issue (p. 66) of the *Mathematical Gazette*, I hinged three together to form the cube. I inadvertently turned them around so that the three squares came together to make a figure which would fit over the corner of a cube. It was then apparent that a cube of side 2-unit lengths, where one unit length is the side of the cube made up of three yángmǎ, could be covered with twenty-four yángmǎ to give the rhombic dodecahedron ([1], p. 120). It thus gives a neat proof of the volume of the rhombic dodecahedron.

The faces of the rhombic dodecahedron would have edges of length $\sqrt{3}$, i.e. the longest edge of the yángmǎ. Consequently the volume would be 8 (the central cube) + $\frac{24}{3}$ (the yángmǎ) cubic units, i.e. 16 cubic units. If the edge of the dodecahedron is unity the volume is $16/(3\sqrt{3})$ cubic units.

It wasn't until I had done this that I realised four yángmǎ form the pyramid on the left-hand side of Fig. 148 on p. 122 in Cundy and Rollett's book [1].

Yours sincerely,

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Reference

1. H. M. Cundy and A. P. Rollett, *Mathematical models* (2nd edition). Oxford University Press (1961).