Fun Maths Puzzles Volume 22 Term 4 2007

Puzzling Soma Cube

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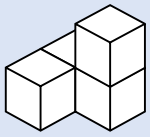
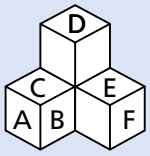
Take three or four identical cubes.

How many mathematically distinct ways can you fit these together to make three-dimensional objects that have at least one 90-degree bend in them? (Hint: see below.)

Draw each shape using an isometric projection, like this:



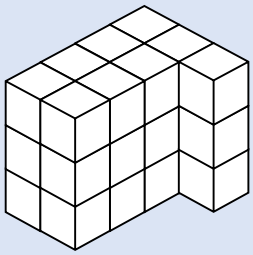
Consider the following example of a 4-cube with multiple 90-degree bends. Draw the resulting figure, each time you add only one more cube to touch either square A, or B, C, D, E or F. Draw the resulting objects when you add one more cube to two or more of the letters. (How do the volume and surface area change, with each addition.)



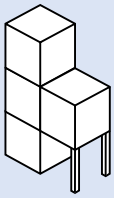
Draw the 4-cube object as though you were standing to the left of square A. (Ditto, looking from the right of square F.)

Fit these shapes together to make a 3x3x3 cube! (This is Piet Hein's classic Soma cube puzzle, invented by the Danish polymath in 1929.)

Many other three-dimensional shapes can be made, using the set of Soma pieces: here is one — a Bumpy Parcel:



If a Soma cube piece is a house, and a unit-square of roof costs $1000, and a unit-square of external wall costs $1200, and a unit-square of floor costs $1500, and a unit-square of external wall costs $800, and a pillar (to hold up an otherwise unsupported room-corner costs $500, how much does each Soma house cost? This will vary depending on how it is placed flat on the ground, possibly needing supporting pillars!



References and Sources of Further Activities

One of the polularisers of Piet Hein's classic Soma cube puzzle — Gardner, M. (1961). *More Mathematical Puzzles and Diversions*. Harmondsworth: Penguin.

Giles, G. 1979, *3-D Sketching: DIME Mathematical Aids*, Oliver and Boyd, Edinburgh.

Gough, J. (1999). "Accurate Perspective Drawing in 3-D", *Vinculum*, vol. 36, no. 3, pp. 13-18.

Gough, J. (2001). *Learning to play: Playing to learn — Mathematics Games That Really Teach Mathematics*. Mathematical Association of Victoria [MAV], Brunswick.

Lovitt, C., Clarke, D. *The Mathematics and Curriculum and Teaching Program (MCTP) Vol. 2* Curriculum Development Centre; Canberra, 1988, ('Four Cube Houses' pp 505 - 510).

Hint: There are seven distinct 3-cube and 4-cube objects with a "bend"