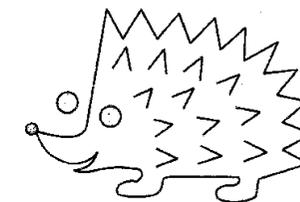


# Teacher Notes Nets & 3D Shapes



Hedgehog Mathematical Sheets

Objectives:

Construct nets of pyramidal shapes called yangma that form a cube or cuboid  
Derive formula for volume of pyramid

Key Words:

volume, net, cube, cuboid, pyramid, isosceles, scalene [yangma]

Prior Learning:

Construct nets for cube, cuboid, square-based pyramid, prism; formula for volume of cube/cuboid

Resources:

Sheets from singinghedgehog [blog page], scissors, gluesticks, rulers [compasses, protractors]

Lesson Notes:

The shape being made here is called a yangma, first mentioned in a collection of Chinese maths known as The Nine Chapters, from around 2000 years ago.

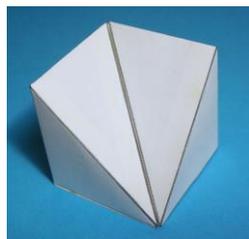


Figure 1

Sheet 1 - depending on time available, each child can make a set or work in threes to make a set per group; you may well wish to do this with your less coordinated pupils. [extension: construct formally] Children usually want to colour these in! To help with the next task, they should colour all matching 2D shapes the same eg squares red, isosceles triangles blue, scalene green.

To form the cube you need two yangma as in fig.1 then add the third on top.

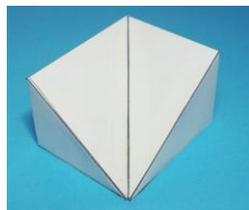


Figure 2

Sheet 2 - Before they start, pupils should note that the three nets are different and measure the sides of the rectangles. Depending on your printer, the lengths should be 27mm, 36mm, 45mm ie 3,4,5 multiplied by 9. [extension: why 3,4,5?]

As before pupils should colour matching 2D shapes the same; this will need some planning!

There are obviously several successful orientations [extension?] but a similar set up to before, as in fig. 2, will lead to a successful cuboid.

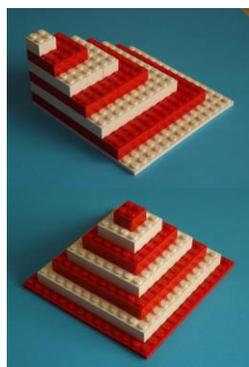


Figure 3

Follow-up - pupils should be able to infer the formula for the volume of a yangma but may need support such as fig. 3 for extending to all pyramids.

They should then find the volume of one yangma from sheet 1 and confirm it is a third of the cube.

Pupils can then verify that the volumes of three shapes from sheet 2 are equal and also one third.

Extensions: formulae for surface area of a pyramid

Euler's polyhedron formula

make an octahedron and derive surface area and volume formulae

make a stella octangula (sheet from singinghedgehog) [Good around Christmas!]

infer (make or sketch?) that three triangular-based pyramids form a triangular prism