# Cube Nets

Task 31 ... Years 2 - 10

Summary

A net of a cube is defined and students are asked to find the 11 different nets which can fold up to make a cube.

This cameo has a From The Classroom section which includes photos of the students' gallery of solutions and slideshows from two students showing how they can fold particular nets into cubes.

Materials

- 12 Geoshape squares

Content

- 2D representation of 3D objects
- nets
- sorting & classifying
- problem solving strategies
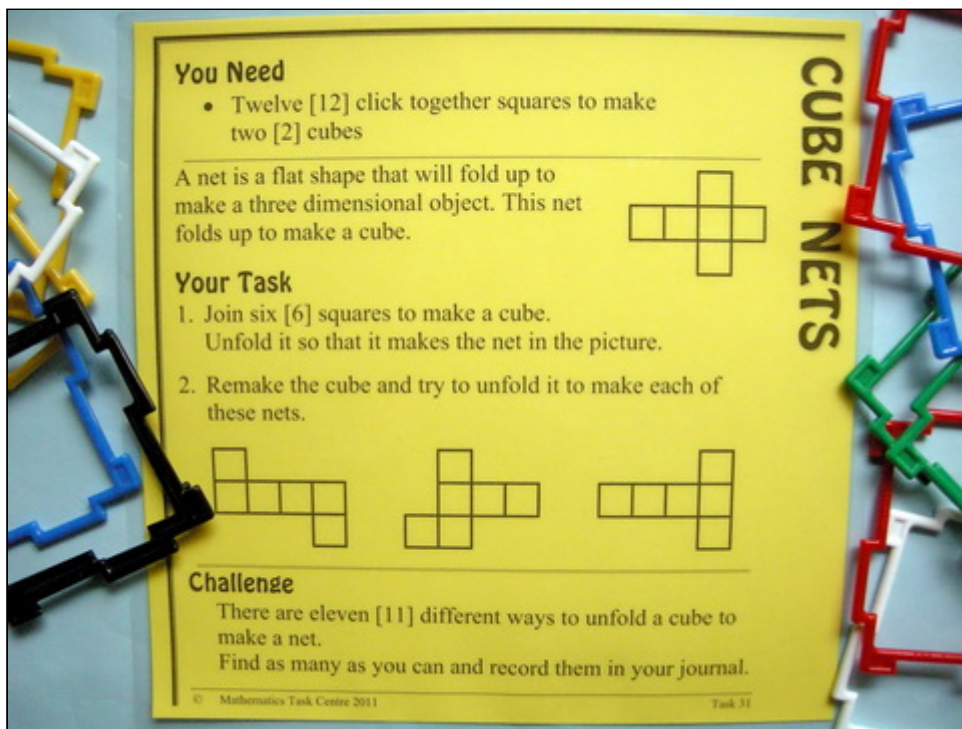
Iceberg

A task is the tip of a learning iceberg. There is always more to a task than is recorded on the card.

Generally students begin with a Guess and Check strategy, but as the data builds up (and hopefully is recorded as a set of drawings) guidelines start to emerge.

- If you get four squares making a square, the shape won't fold up.
- It's no use having 5 or 6 squares in a line, because they will fold up with missing 'tops and bottoms'.
- The longest line of squares can only be 2 or 3 or 4.
- There are several with 4.

To find all the nets now requires careful application of the strategy of *Try every possible case*. For example, begin with 4 squares in a line and one on the end making an 'l' shape. Take the sixth square 'for a walk' around this

L and place it in every possible position. Record those possibilities which make cube nets. Repeat with 4 squares in a line and the fifth square making a 't' shape, and so on.

When the students have found and recorded all 11 (perhaps in a way which shows the 'longest line families'), there are still several possible investigations.

- There are other regular polyhedra (tetrahedron, octahedron etc.). How many nets can you find for each of these?
- If you have a collection of Geoshapes, make your own 3D object, then unfold it to find its net. Is there more than one net for your shape?
- The nets of a cube are made from 6 squares. Shapes made from 6 squares in this way are called hexominoes (as in dominoes which are made from two squares). Cube nets are only some of the hexominoes. How many hexominoes are there? How do you know when you have found them all?

Extend the task further with this Extra Challenge which involves making three special pyramids from nets and putting them together to make a cube.

Note: This investigation has been included in Maths At Home. In this form it has fresh context and purpose and, in some cases, additional resources. Maths At Home activity plans encourage independent investigation through guided 'homework', or, for the teacher, can be an outline of a class investigation.

- Visit the Home Page for more Background.
- For this specific activity click the Learners link and on that page use Ctrl F (Cmd F on Mac) to search the task name. This activity makes use of a freely available web-based mathematics playground called PolyPad in addition to hands on work to introduce the problem.

Whole Class Investigation

Tasks are an invitation for two students to work like a mathematician. Tasks can also be modified to become whole class investigations which model how a mathematician works.

The best way to turn this task into a whole class lesson is to have sufficient 3d Geoshape Squares (at least 200). Then the lesson begins by everyone making a cube and unfolding it so that:

- every piece remains connected to at least on other piece,
- you keep unfolding until you can make a flat shape.

It is almost certain that at least two students will have a different result. Collect these into a gallery and this begins the discussion based around how many of these flat shapes can be made within rules. The word net does not have to be defined before starting. It can be introduced as the investigation proceeds.

Note: If the students happen to not produce different nets, the teachers can unfold their one in a different way as a stimulus to look for others. It is also not necessary to be told before beginning the investigation that there are 11 nets. The mathematician who first investigated these didn't know that. However, if the investigation languishes, it is a fact that can be dropped in to revitalise the search.

However, if the equipment is not available, the Maths At Home version above is a very good substitute.

For more ideas and discussion about this investigation, open a new browser tab (or page) and visit Maths300 Lesson 116, *Cube Nets*.

Is it in Maths With Attitude?

Maths With Attitude is a set of hands-on learning kits available from Years 3-10 which structure the use of tasks and whole class investigations into a week by week planner.

The *Cube Nets* task is an integral part of:

- MWA *Space & Logic* Years 5 & 6

The *Cube Nets* lesson is an integral part of:

- MWA *Space & Logic* Years 5 & 6
- MWA *Space & Logic* Years 7 & 8

This task is also included in the [Task Centre Kit for Aboriginal Students](#) and the Primary [Library Kit](#). Solutions for tasks in the latter kit can be found [here](#), including the 11 cube nets.

From The Classroom

### Bacchus Marsh Grammar School

Li Richardson
Year 7

Li introduced her Year 7 class to Task 31, *Cube Nets*, as a

whole class investigation.

As shown below, her preparation was based on the companion Maths300 lesson, to which she added the whiteboard dot paper, slide show and Task Centre record sheet.

Gradually the class built up its gallery of solutions, but Li did not give away the number of solutions by putting out just the right number of background sheets.
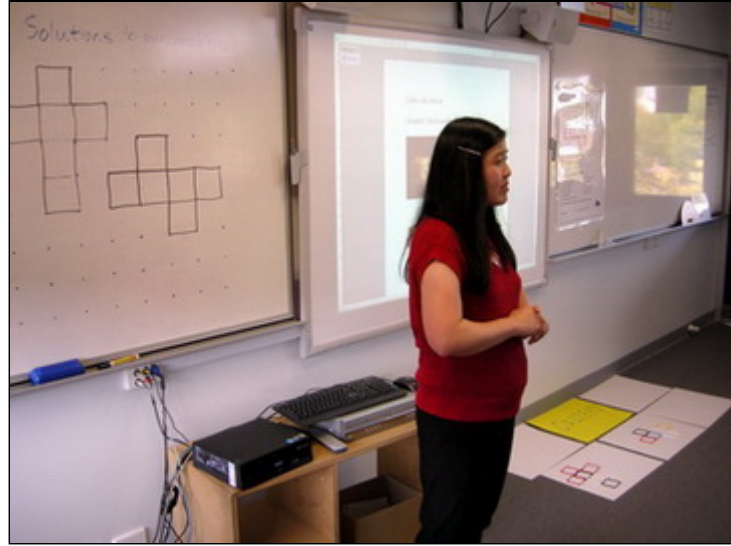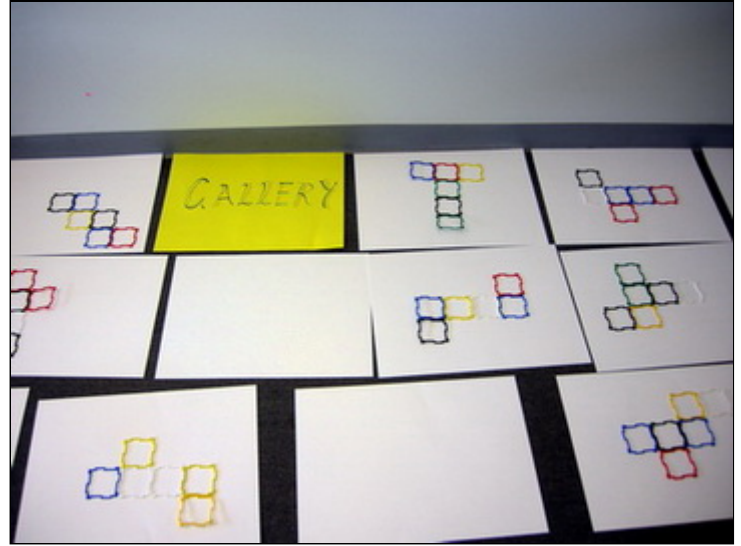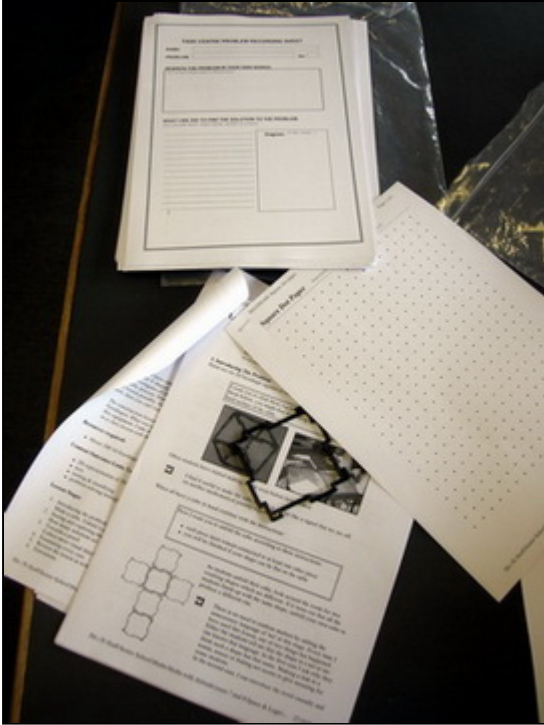
Subtly too, she placed the gallery under the Working Mathematically Process display. This was the process guiding the investigation of finding the number of nets of a cube.
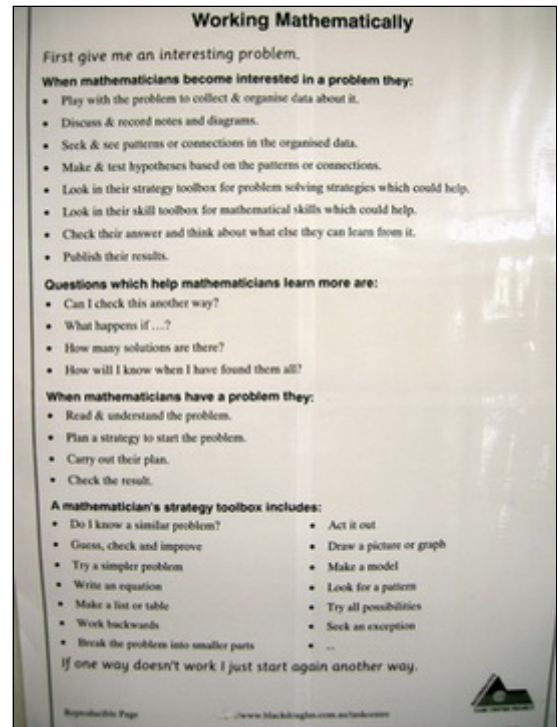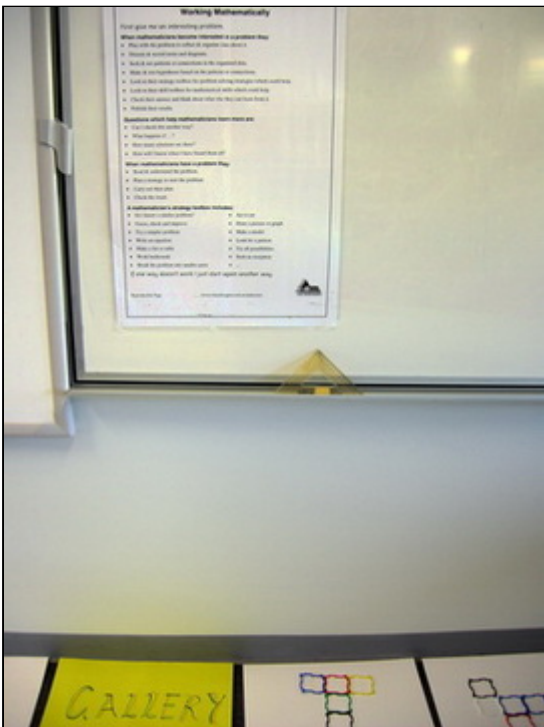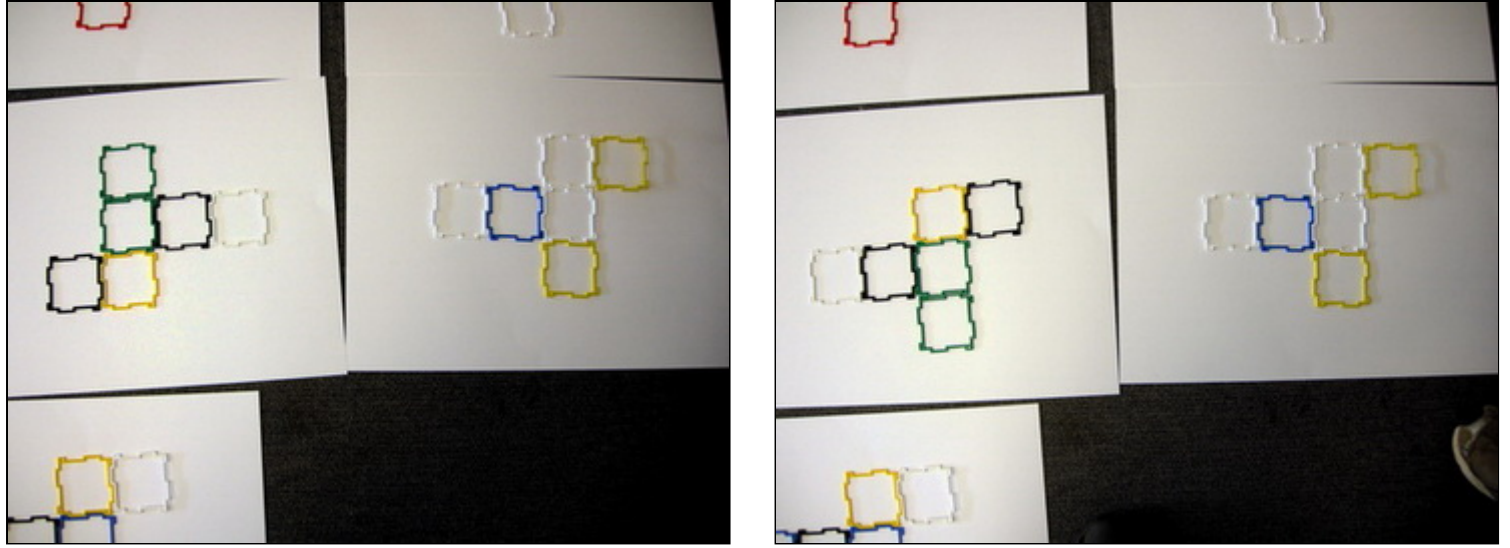

Watch as two students show how their net turns back into a cube:
Ryan's Slideshow ... James's Slideshow

(If slides don't change automatically use your keyboard arrows.)

But are all the nets in the Gallery unique?

No, if one of these is turned it becomes the other.

Follow this link to page.