Tetrahedron Nets

Task 32 ... Years 2 - 10

Summary

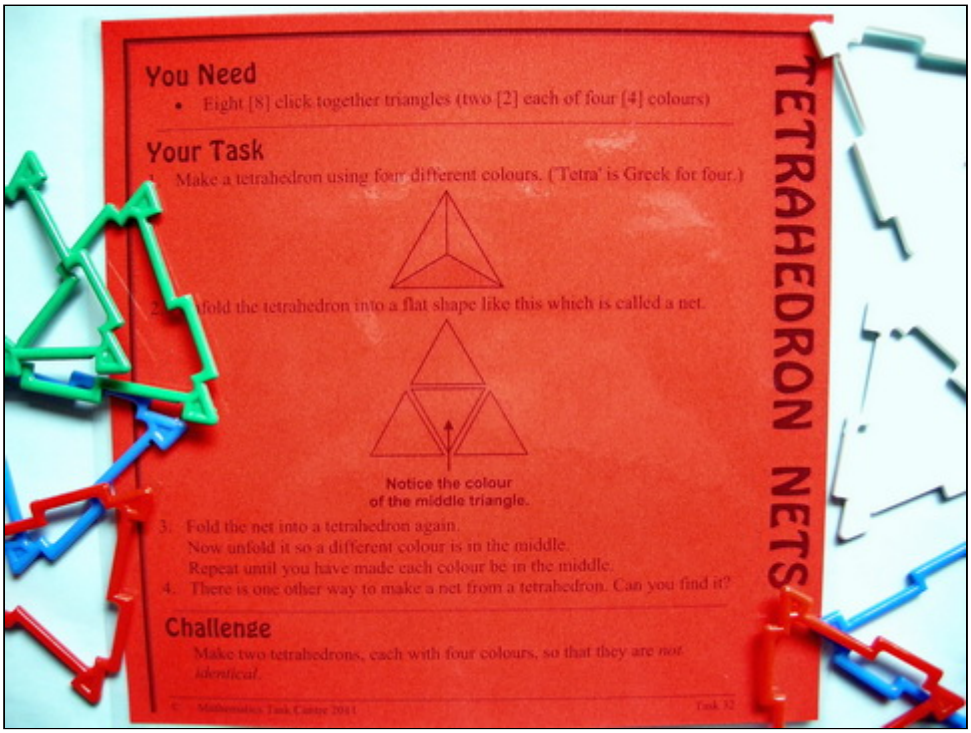
By making a tetrahedron and unfolding it to make its net, students discover its symmetric properties. The challenge is extended to looking for an alternative net and to discovering that 3D objects can be reflected.

Materials

- 8 Geoshape triangles

Content

- 2D representation of 3D objects
- nets
- axis of symmetry (3D)
- reflection in 3D
- problem solving strategies
- square numbers



Iceberg

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

On The Card

1. Perhaps the easiest way of making all the colours be in the middle of the net is to make each colour in turn the base, then unfold from the apex. Alternatively, students could place each colour in turn in the middle, then clip on the other triangles and fold up to make the tetrahedron.
2. One other net for the tetrahedron is a chain of 4 triangles which make a parallelogram. How do you know when you have found the nets of a tetrahedron?
3. When the non-identical tetrahedra are found, they will be mirror images of each other.

Photo A

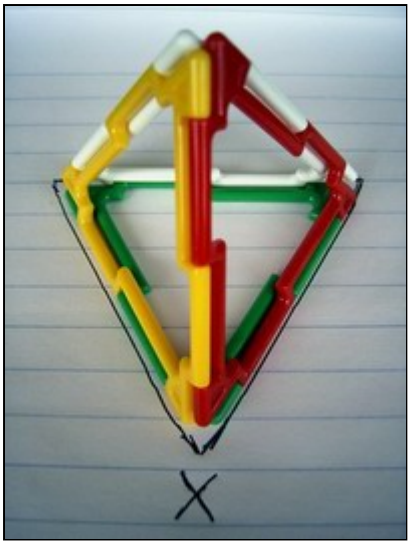
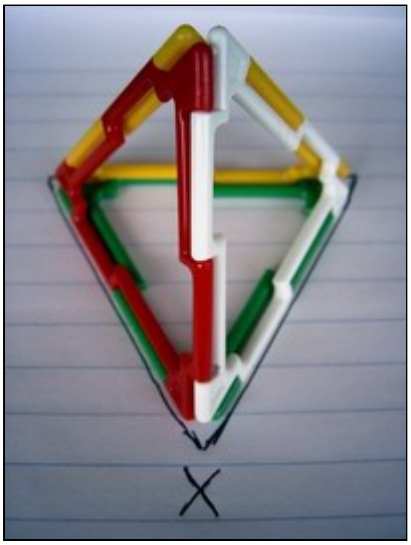
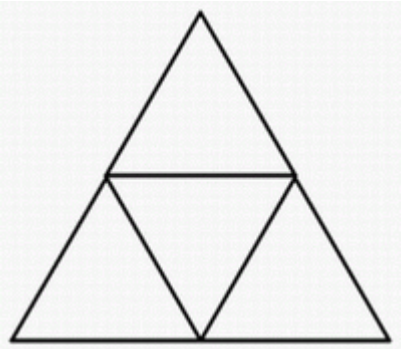


Photo B



Size 2 Tetrahedron: One face



More in 3D

1. Explore the 'axles' which can be created by dropping a perpendicular from an apex to the midpoint of the opposite face.
2. Place the tetrahedron on your page and trace the base as in Photo A. **X** marks the spot where you imagine yourself standing.
3. Now look at Photo B. Find a way to describe what you see from **X** now. How was the tetrahedron transformed from the first photo to the second?
4. How many ways are there to transform the tetrahedron so that **X** will see something different each time? How do you know when you have found them all?
5. You have been focussing on the base, but each time you place the tetrahedron on the base outline in a new way, the whole tetrahedron is really being placed back in exactly the same position in space. It is like it is being put back into an invisible shell which remained in exactly the same place as you rotated around an 'axle'. These new positions are called the symmetries of the regular tetrahedron.
6. The faces of a regular tetrahedron are all the same size and shape. Combine your pieces to make a different regular object. Sketch it. What name do you think mathematicians would give this new object.
7. Explore the net(s) and symmetry(ies) of your new object.
8. Extend the task further with this Extra Challenge which involves making four special irregular objects from nets and putting them together to make a tetrahedron.

More in 2D

The tetrahedron you make in this task is a Size 1 tetrahedron. A Size 2 tetrahedron has *each face* made like the picture opposite.

1. Make one face of the Size 2 tetrahedron. How many triangles to make the complete Size 2 tetrahedron?
2. How many triangles will it take to make one face of the Size 3 tetrahedron? There is enough equipment in the task to check the guess, but not to exactly make the face. How many triangles to make the complete Size 3 tetrahedron?

3. Investigate the number of triangles to make one face, and the complete Size 4, 5, 6,... tetrahedron. Look for patterns. Triangle dot paper might help.

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 satisfactorily turn this task into a whole class lesson is to have sufficient 3d Geoshape Triangles (at least 200). The questions and problems above can be used to guide the investigation.

Some exploration of tetrahedra can take place with newspaper rolled into tubes. Use only three small pieces of masking tape to hold each roll in its tube shape. Tubes with diameter about the thickness of a thumb form the edges. Joiners are made by rolling the newspaper into very tight rolls and again holding with three strips of masking tape. These are then cut through the middle piece of tape to make two 'half' rolls. Bending these in two makes V shape joiners which fit into the ends of the tubes.

At this stage *Tetrahedron Nets* does not have a matching lesson on Maths300.

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.

Tetrahedron Nets is not in any MWA kit. However it can be used to enrich the *Space & Logic* kit at Years 5/6 and Years 9/10.

This task is included in the Task Centre Kit for Aboriginal Students.

Follow this link to Task Centre Home page.