Hampshire Services
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Pyramids

A challenging problem-solving task for KS3

HIAS Maths Team
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www.hants.gov.uk

Overview

In this document

You will find a geometry task that develops problem solving skills across a sequence of lessons for high attaining key stage 3 pupils. With thanks to the Hampshire Leading Maths teachers.

Points to consider when using this resource

As with all classroom-based activities, this will need to be adapted to suit your group.

Pyramids

Previous knowledge needed:

- Some familiarity with nets of solids
- Some trigonometry
- Pythagoras theorem

Equipment:

- Net of 3 pyramids
- Scissors
- Sellotape
- A3 paper or card
- Ruler
- Protractor

Session 1

1. Give out the 3 pyramids net

2. Explain that when it is made up it consists of three pyramids joined together which will fold together to form a cube.

3. Get pupils to make it up (sellotape works well in securing the edges). The shading is there to help identify the faces of the cube and the base of the pyramids.

4. When they have made it ask them what is shows about the volume of the pyramid in relation to the cube.
    - *It shows the volume of the pyramid is 1/3 the volume of the cube since the 3 pyramids are congruent and fit together to form the cube.*

5. How do we know the faces fit exactly?
    - *Expect some argument concerning diagonals.*

6. What other questions could we ask?

    - *Calculate the exact lengths of each side of the pyramid.*
    - *Calculate the angles between the faces of the pyramid.*
    - *Can we use this model to generalise the formula for the volume of a pyramid?*

Session 2

1. Ask the pupils to draw a net for 3 joined pyramids that fit together to make a cuboid 5cm by 6cm by 7cm. They will need A3 paper to have enough room for the net.

2. Once the net is drawn they can make the model to check it works.

3. Then repeat the same questions as session 1.
    - *Calculate the exact lengths of each side of the pyramid.*
    - *Calculate the angles between the faces of the pyramid.*
    - *Can we use this model to generalise the formula for the volume of a pyramid?*

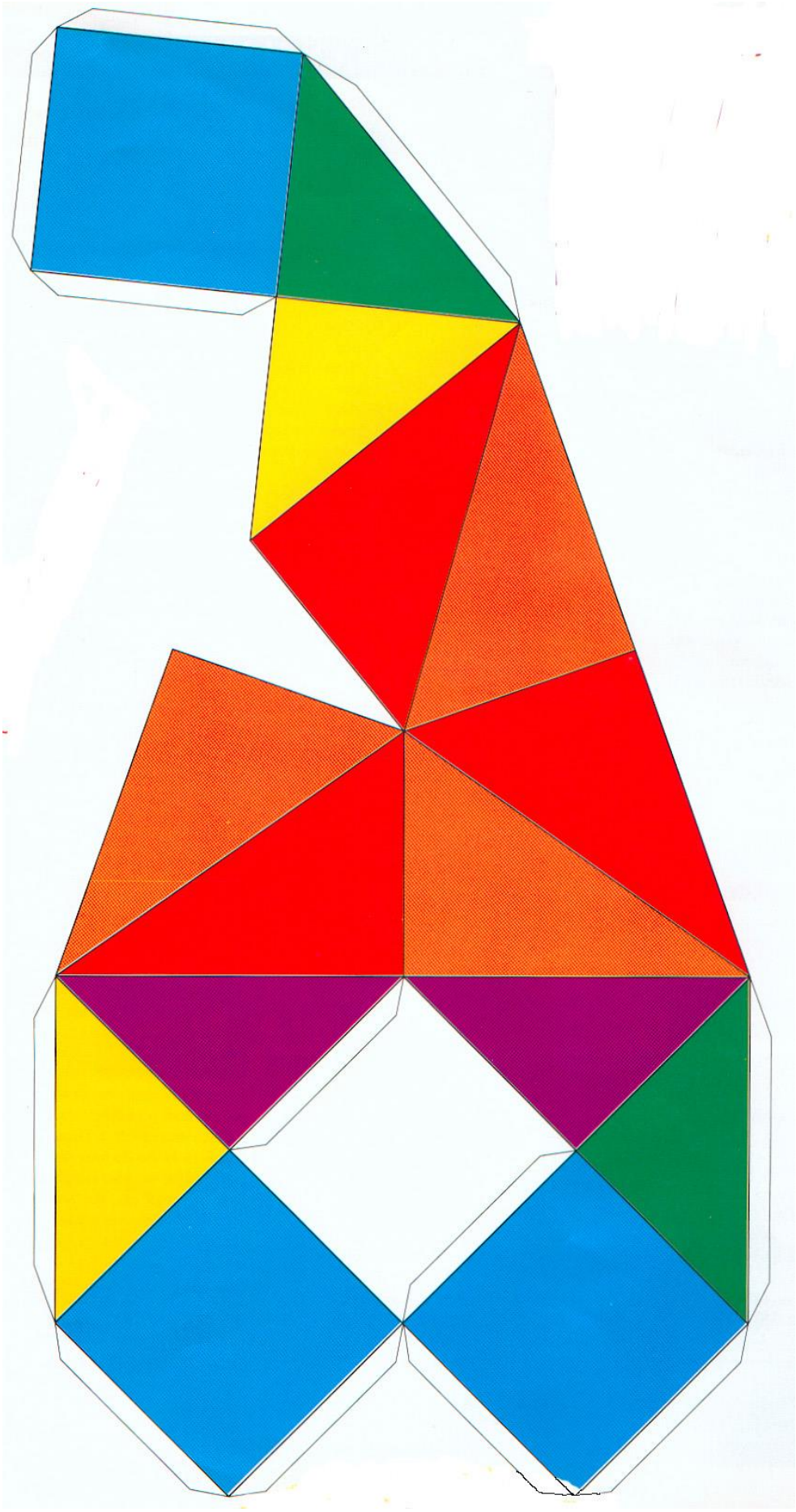
Plenary

Why can we not do this for anything but a rectangular based pyramid?

Teaching notes

The calculations of angles needs a lesson if pupils have done trigonometry since some 3D trig work is needed to confirm what we suspect (that the dihedral angle is 60°)

For the net: Use the blue squares as the bases of a pyramid. The right angled isosceles triangles are perpendicular to the blue base. The scalene triangles for the sloping sides of the pyramids.



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