

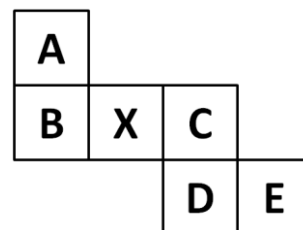


Stage 3 ★ Mixed Selection 1

1. Net result

The net shown here is cut out and folded to form a cube.

Which face is then opposite the face marked X ?



2. Cubic vision

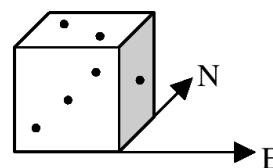
A wooden cube measuring 11cm by 11cm by 11cm is made from centimetre cubes.

What is the greatest number of centimetre cubes visible from any point?

3. Dicey directions

The diagram shows an ordinary die in which the scores on opposite faces always total 7.

It is placed on a horizontal table with the '1' face facing East. The die is moved four times, rotating it each time through 90° about an edge. The faces in contact with the table are first 1, then 2, then 3, then 5.



In which direction is the '1' facing after this sequence of moves?

4. Painted purple

A wooden cube has three of its faces painted red and the other three of its faces painted blue, so that opposite faces have different colours. It is then cut into 27 identical smaller cubes.

How many of these new cubes have at least one face of each colour?

5. Sugary diversion

An ant is crawling in a straight line from one corner of a table to the opposite corner when he bumps into a one centimetre cube of sugar. Instead of crawling round it, or eating his way through it, he climbs straight up and over it before continuing on his intended route.

How much does the detour add to the length of his journey?

These problems are adapted from UKMT Mathematical Challenge problems (ukmt.org.uk).



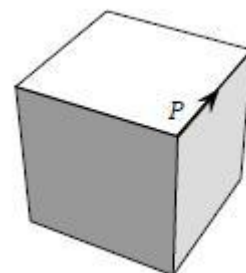
Stage 3 ★ Mixed Selection 2

1. Crawl around the cube

An ant crawls carefully around the edges of a cube, starting at point P and in the direction of the arrow.

At the end of the first edge, it chooses to go either left or right. It then turns the other way at the end of the next edge and continues like this, turning right or left alternately at the end of each successive edge.

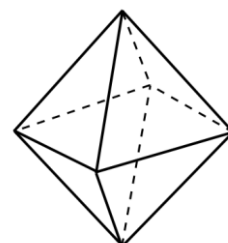
After how many edges does the ant return to point P for the first time?



2. Painted octahedron

The faces of a regular octahedron are to be painted so that no two faces which have an edge in common are painted in the same colour.

What is the smallest number of colours required?



3. Daniel's Star

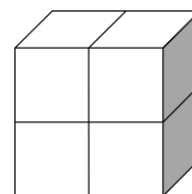
Daniel creates a solid 'star' shape by gluing square-based pyramids onto each face of a cube, so that the cube is completely hidden.

How many faces does his 'star' have?

4. Four cubes

Four cubes, each with a surface area of 24cm^2 are placed together to make a cuboid as shown.

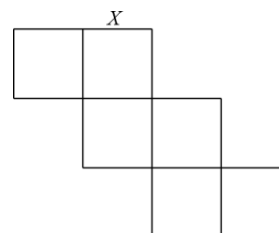
What is the surface area of this cuboid, in cm^2 ?



5. Net profit

The diagram shows the net of a cube.

Which edge meets the edge X when the net is folded to form the cube?



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