

3-D (Intermediate UKMT)

These questions must be attempted **without a calculator**

Topics covered in the questions below may not necessarily be from the topic of the title.

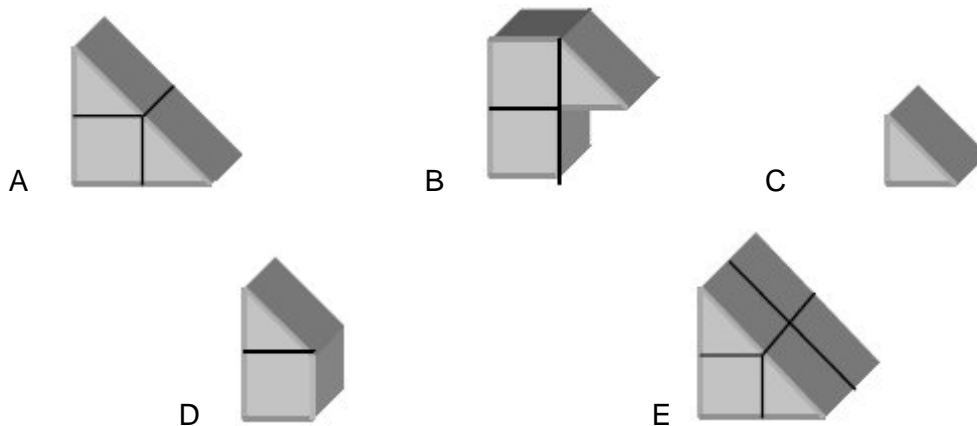
1. A solid 'star' shape is created by gluing a square-based pyramid, in which each edge is of length 1 unit, precisely onto each face of a cube of edge 1 unit.

How many faces does this 'star' have?

- A 18 B 24 C 30 D 36 E 48

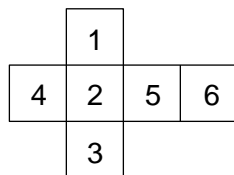
2. Four of these shapes can be placed together to make a cube.

Which is the odd one out?



3. The figure shows a net for a cube with a number on each face. When the cube is made, three faces meet at each vertex. The numbers on the three faces which meet at each vertex are multiplied together.

What is the largest product obtained?



- A 40 B 60 C 72 D 90 E 120

4. Each edge of a cube is coloured either red or black. If every face of the cube has at least one black edge, what is the smallest possible number of black edges?

- A 2 B 3 C 4 D 5 E 6

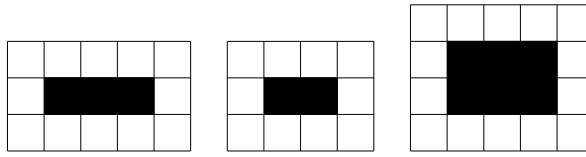
5. The total length of all the edges of a cube is L cm.

If the surface area of the cube has the same numerical value $L\text{cm}^2$ what is its volume in cm^3 ?

- A 1 B L C 2 D L^3 E 8

6. Three rectangular-shaped holes have been drilled passing all the way through a solid $3 \times 4 \times 5$ cuboid. The diagrams show the front, side and top views of the resulting block.

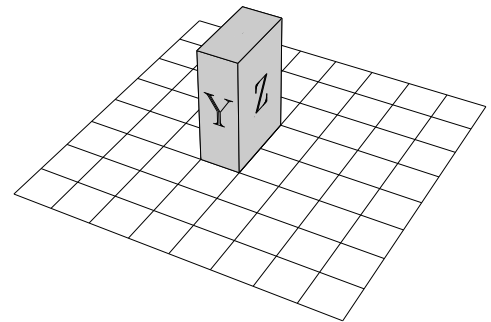
What fraction of the original cuboid remains?



- A $\frac{13}{30}$ B $\frac{7}{15}$ C $\frac{1}{2}$ D $\frac{8}{15}$ E $\frac{17}{30}$

7. A $1 \times 2 \times 3$ block is placed on an 8×8 board, as shown with the 1×2 face 'X' at the bottom. It is rolled over an edge without slipping onto the 1×3 face Y, then onto the 2×3 face Z, then onto X, Y, Z again in that order.

How many different squares on the board has the block occupied altogether, including the starting and ending positions?



- A 18 B 19 C 20 D 21 E 22

8. Platinum is a very rare metal, even rarer than gold. Its density is 21.45 g/cm^3 .

Assuming that the world production has been about 110 tonnes for each of the past 50 years, and negligible before that, which of the following has a comparable volume to that of the total amount of platinum ever produced?

- A a shoe box B a cupboard C a house
D Buckingham Palace E the Grand Canyon

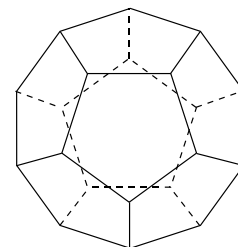
9. A wooden cube with edge length 12 cm is cut into cubes with edge length 1 cm.

What is the total length of all the edges of all these centimetre cubes?

- A 12 cm B 12^2 cm C 12^3 cm D 12^4 cm E 12^5 cm

10. A *regular dodecahedron* is a polyhedron with twelve faces, each of which is regular pentagon. A *space diagonal* of the dodecahedron is a line segment which joins two vertices of the dodecahedron which do not lie in the same face.

How many space diagonals are there in the dodecahedron?



- A 100 B 110 C 170 D 200 E 220