

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES SCHOOLS ENRICHMENT CENTRE (AIMSSEC)

AIMING HIGH



For your company, you have to design spinning tops made from two pieces glued together, a hemisphere and a cone and plan how they will be manufactured, packaged and sold.

(1) If the radius of the circular surface where the pieces are glued together is 3 cm, and the slant height of the cone is 5 cm, work out the total volume and surface area of the spinning top (top A).

(2) If each top is packed in a box measuring 6.5 cm by 6.5 cm by 7.5 cm how many boxes will fit into a packing case with internal measurements 55 cm by 55 cm?



(3) You investigate other designs for two more tops, made the same way with the circular surface where the pieces are glued together having radius 3 cm. For top B the volume of the hemisphere is equal to the volume of the cone and for top C the surface area of the hemisphere is the same as the surface area of the cone. Find h cm, the height of the cone, for top B and for top C.

HELP

Find *h* from the right-angled triangle where *r*=3 and *s*=5.



The cone in the picture was made from the sector of the circle shown using scrap plastic.

Make your own cone and cylinder the same height using the templates on page 3, from paper or scrap card or plastic. Fill the cone with lentils, rice or something similar and investigate the relationship between the volume of the cone and the volume of the cylinder. This is not a proof of the formula but you will need to learn integral calculus to prove the formula.

The formula for the volume of the cone is $\frac{1}{3}\pi r^2 h$ and the formula for the volume of a sphere is $\frac{4}{3}\pi r^3$.

NEXT

- 1. Work out the dimensions of a cuboid with the same volume as the cylinder and with the same height as the cylinder and cone.
- 2. The templates on page 3 can be used to make the three solids, the cone, cylinder and cuboid, which all have the same base area and height. The outlines can be marked on scrap card or scrap plastic by pricking through the template, or by tracing, or you could draw your own outlines using compasses and a protractor.
- 3. In another design the base radius *r* of top D is 5 cm. Can you find the height of the cone for which the total surface area of top D is numerically equal to the total volume.

Resources: Scrap plastic, sticky tape, scissors. Templates (see page 3).

