

7-9: REMOTE MATHS

EDITION 15

MEASUREMENT AND GEOMETRY - INVESTIGATIONS

Mathematical language: volume, cuboid, cylinder, cones, spheres, cubed, cuboid, centimetres, surface area, volume, cylinder, cones, sphere.

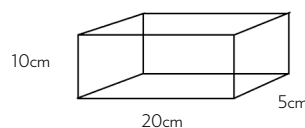
INVESTIGATION 1: BOX AND TIN DESIGNS

PART 1: CUBOIDS

The company you are working for has been asked to design and make metal containers. The first is to have a volume of 1 litre and be rectangular in shape (cuboid). The company's main concern is to keep costs to a minimum. In order to do this, it does not want to use any more metal than is necessary. Two sample designs have been prepared for the cuboid (refer to the diagrams).

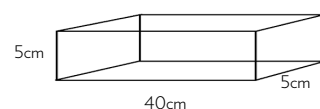
Your task is to:

- Which of the two proposed designs will cost the company less to produce and why?
- Create 5 new cuboid containers with a volume of 1 litre and calculate the surface area to find the most efficient design.
- Draw diagrams and show your working for both volume and total surface area for each cuboid.
- Summarise your results in a systematic way (in a table).



$$\begin{aligned}L &= 20 \text{ cm, } W = 5 \text{ cm, } H = 10 \text{ cm} \\ \text{Volume} &= 20 \times 5 \times 10 \\ &= 1000 \text{ cm}^3 \\ &= 1 \text{ litre}\end{aligned}$$

$$\begin{aligned}\text{Total surface area} \\ &= 2 \times 100 + 2 \times 50 + 2 \times 200 \\ &= 700 \text{ cm}^2\end{aligned}$$



$$\begin{aligned}L &= 40 \text{ cm, } W = 5 \text{ cm, } H = 5 \text{ cm} \\ \text{Volume} &= 40 \times 5 \times 5 \\ &= 1000 \text{ cm}^3 \\ &= 1 \text{ litre}\end{aligned}$$

$$\begin{aligned}\text{Total surface area} \\ &= 2 \times 200 + 2 \times 200 + 2 \times 25 \\ &= 850 \text{ cm}^2\end{aligned}$$

Both satisfy the volume requirements.

PART 2: CYLINDERS

The company is now bidding for the tender to make a metal cylinder with the volume of 1 litre. You have been assigned the task of designing a cylinder of minimum cost.

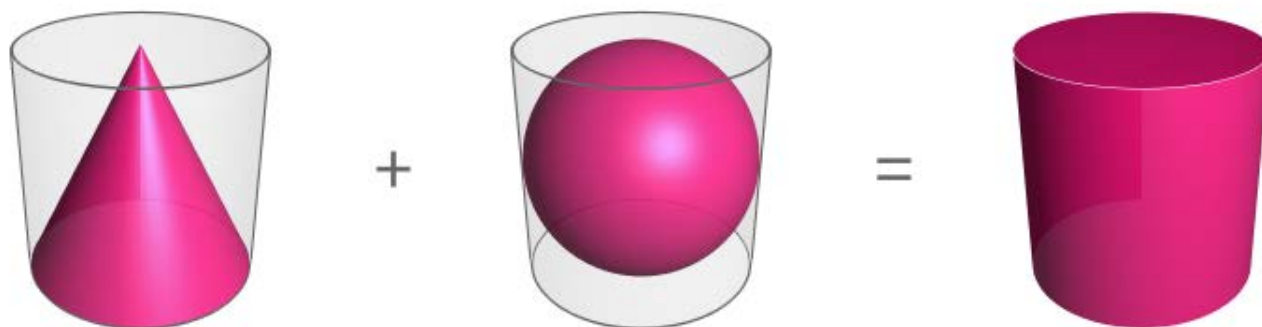
- Calculate the surface area for 5 cylinders of different dimensions all with the volume of 1 litre.
- Draw diagrams and show your working for both volume and total surface area for each cylinder.
- Summarise your results in a systematic way (in a table).
- **Extending prompt:** Using a spreadsheet (eg. Excel), set out a systematic way of calculating volume and surface area to allow you to find the cuboid and cylinder of minimum cost.

INVESTIGATION 2

VOLUMES OF SPHERES, CYLINDERS AND CONES

Visit and read the information on the Mathigon website <https://mathigon.org/course/circles/spheres-cones-cylinders>

- Archimedes discovered that if you add the volume of a cone and a sphere you get the volume of their bounding cylinder.
- Can you show why this is the case?
- You may want to first read more about sphere volume: <https://mathigon.org/course/circles/spheres-cones-cylinders#sphere-volume>



Look out for more tasks next week!