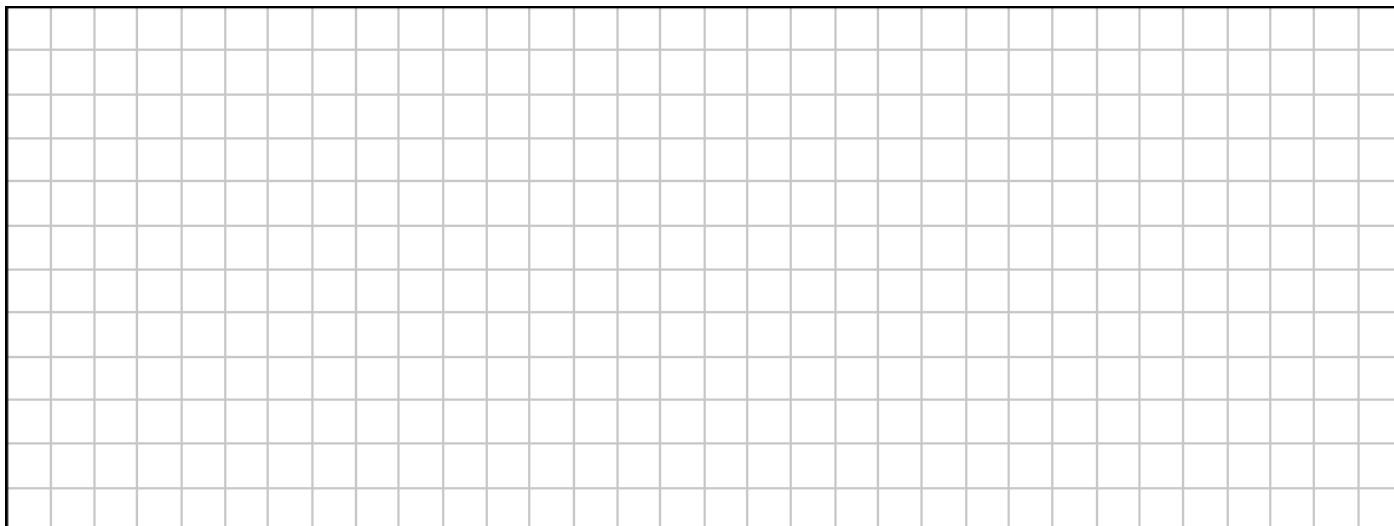


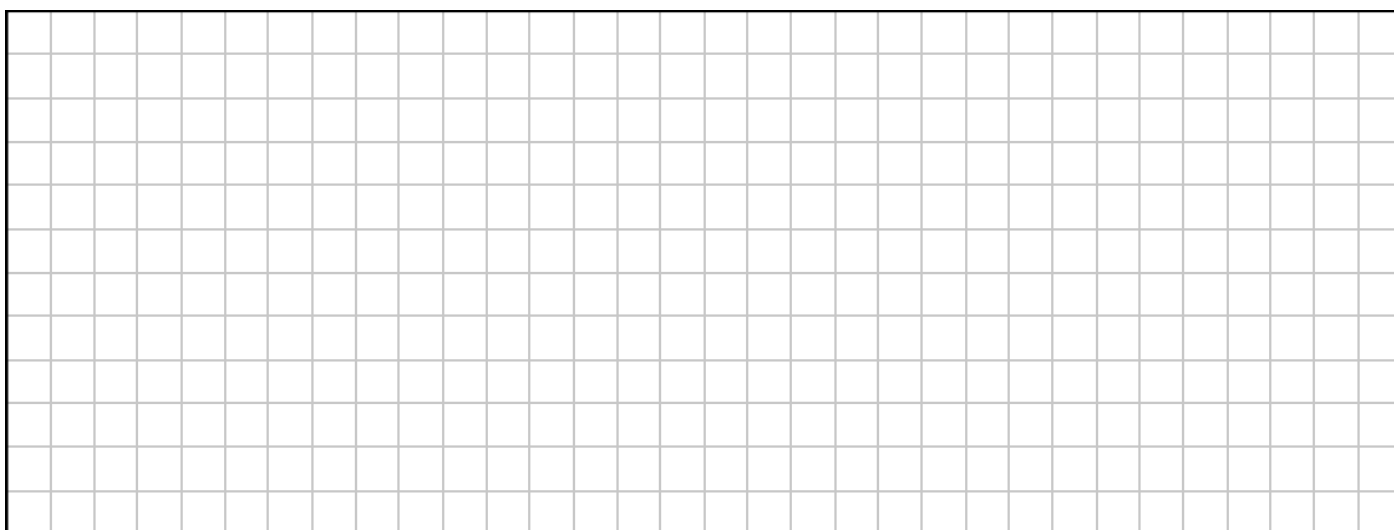
# 2024 LCHL PAPER 2 Q8

This section is to be completed having corrected the question. Enter your score in the box above ↑.


Thoughts (Easy/ Hard, State the Topic, Links to other Topics, Similar Questions?)

A large rectangular grid area for writing thoughts, consisting of 20 columns and 25 rows of small squares.

What formulae or rules did I need? Is there anything I should learn off?

A large rectangular grid area for writing formulae or rules, consisting of 20 columns and 25 rows of small squares.

Is there anything I still don't understand? What do I need to revise? Should I return to this question?

A large rectangular grid area for writing reflections, consisting of 20 columns and 25 rows of small squares.

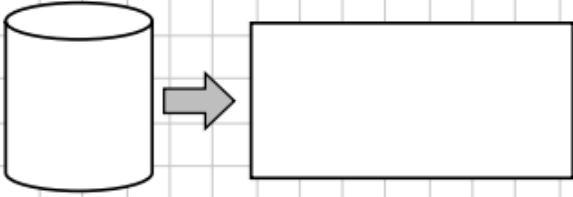
► 2024 LCHL Paper 1 – Question 8

Tommy makes ornaments from metal and glass.

- (a) He makes an open metal cylinder with a height of 15 cm and a radius of 5 cm.  
The **net** of this cylinder is a rectangle.

Find the dimensions of this rectangle.

Give your answers in cm, correct to 1 decimal place where appropriate.



The diagram shows a 3D cylinder on the left. An arrow points to the right, where a 2D rectangle is shown, representing the net of the cylinder. The cylinder's height is 15 cm and its radius is 5 cm. The rectangle's height is equal to the cylinder's height, and its width is equal to the circumference of the cylinder's base.

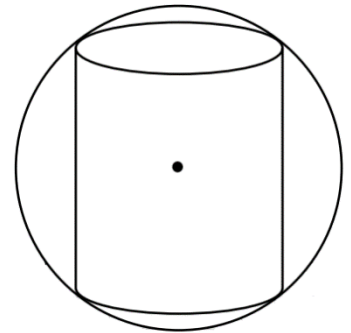
Dimensions: \_\_\_\_\_ by \_\_\_\_\_

- (b) Tommy makes another cylinder with a height of 22 cm and a diameter of 12 cm.

This cylinder fits exactly inside a glass sphere.

The top and bottom edges of the cylinder touch the sphere.

Find the **volume** of the **sphere**, in  $\text{cm}^3$ , correct to 1 decimal place. Use the Theorem of Pythagoras in your solution.



A large grid area for writing the solution to part (b).

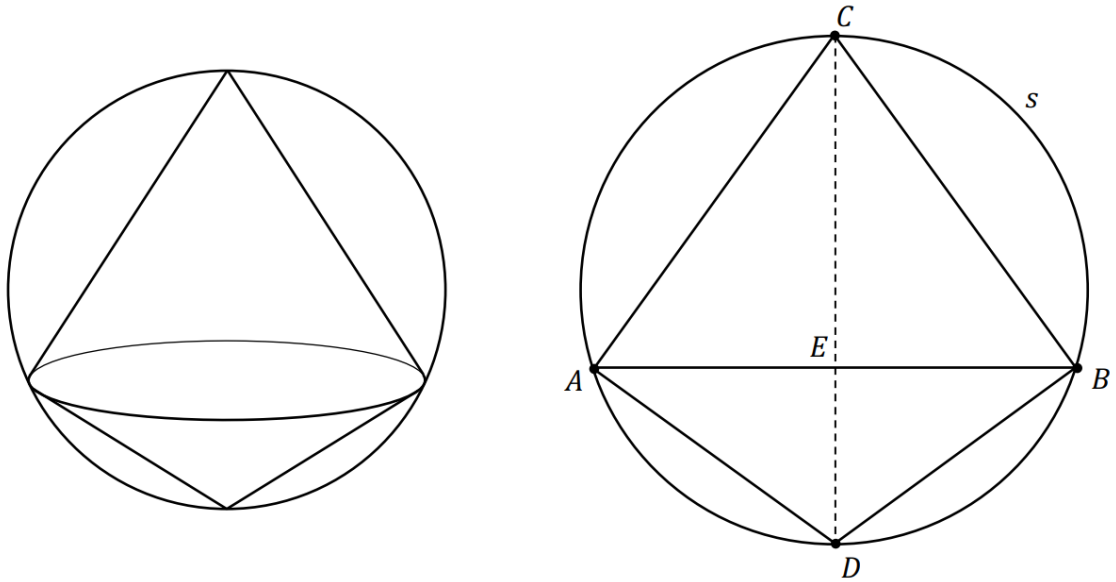
(c) Another ornament is made of two cones inscribed in a sphere.

The top cone is upright; the bottom cone is inverted. The cones have the same base.

A vertical cross-section of the ornament, taken through the centre of the sphere, shows the cones as two triangles,  $ABC$  and  $ADB$ , with a common side  $[AB]$ .  $ABC$  is the top cone.

The points  $A$ ,  $B$ ,  $C$ , and  $D$  all lie on the circle  $s$ , which represents the cross-section of the sphere.

The lines  $AB$  and  $CD$  intersect at the point  $E$ .



(i) The diagram is symmetrical about the line  $DC$ . State why  $|\angle CBD| = 90^\circ$ .

--

(ii) Hence, or otherwise, **prove** that the triangles  $BCE$  and  $DBE$  are **similar**.

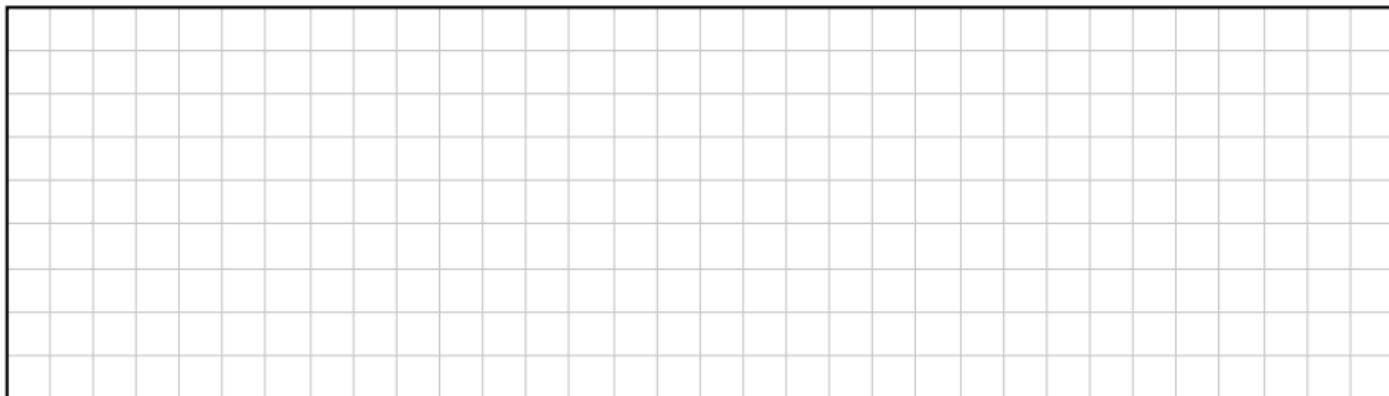
Give a reason for each statement that you make, where appropriate.

--

- (iii) The top cone has a radius of  $r$  and a height of  $h$ ; that is,  $|EB| = r$  and  $|EC| = h$ .  
The sphere, represented by  $s$ , has a radius of 10 cm.

Use the similar triangles  $BCE$  and  $DBE$  to show that:

$$r^2 = 20h - h^2$$



- (iv) Hence, write the volume of the top cone in terms of  $h$  and  $\pi$ , **and** find the value of  $h$  that gives the **maximum volume** for the top cone.

