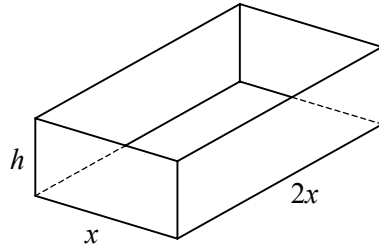


1



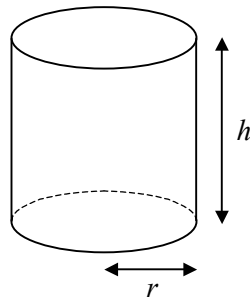
The diagram shows a baking tin in the shape of an open-topped cuboid made from thin metal sheet. The base of the tin measures x cm by $2x$ cm, the height of the tin is h cm and the volume of the tin is 4000 cm^3 .

- a Find an expression for h in terms of x .
 b Show that the area of metal sheet used to make the tin, $A \text{ cm}^2$, is given by

$$A = 2x^2 + \frac{12000}{x}.$$

- c Use differentiation to find the value of x for which A is a minimum.
 d Find the minimum value of A .
 e Show that your value of A is a minimum.

2



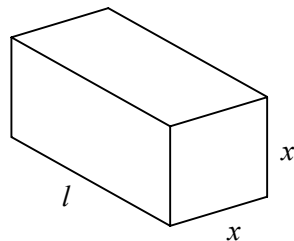
The diagram shows a closed plastic cylinder used for making compost. The radius of the base and the height of the cylinder are r cm and h cm respectively and the surface area of the cylinder is $30\,000 \text{ cm}^2$.

- a Show that the volume of the cylinder, $V \text{ cm}^3$, is given by

$$V = 15\,000r - \pi r^3.$$

- b Find the maximum volume of the cylinder and show that your value is a maximum.

3



The diagram shows a square prism of length l cm and cross-section x cm by x cm. Given that the surface area of the prism is $k \text{ cm}^2$, where k is a constant,

- a show that $l = \frac{k - 2x^2}{4x}$,
 b use calculus to prove that the maximum volume of the prism occurs when it is a cube.