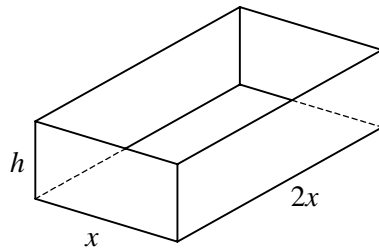


1



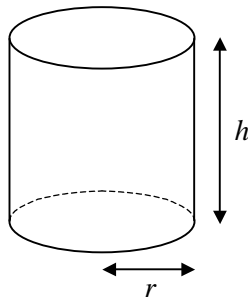
The diagram shows a baking tin in the shape of an open-topped cuboid made from thin metal sheet. The base of the tin measures  $x$  cm by  $2x$  cm, the height of the tin is  $h$  cm and the volume of the tin is  $4000 \text{ cm}^3$ .

- 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



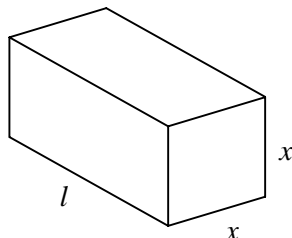
The diagram shows a closed plastic cylinder used for making compost. The radius of the base and the height of the cylinder are  $r$  cm and  $h$  cm respectively and the surface area of the cylinder is  $30\,000 \text{ cm}^2$ .

- 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.