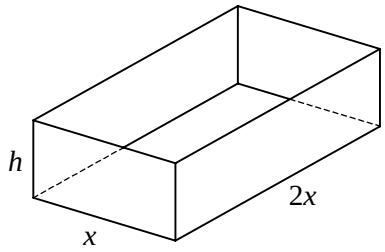
DIFFERENTIATION

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 cm^2, is given by

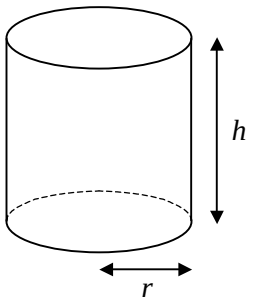
$$A = 2x^2 + \frac{12000}{x}.$$

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



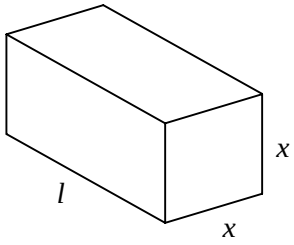
The diagram shows a closed plastic cylinder used for making compost. The radius of the base and the height of the cylinder are r cm and h cm respectively and the surface area of the cylinder is 30 000 cm^2.

a Show that the volume of the cylinder, V 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 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.