



2.

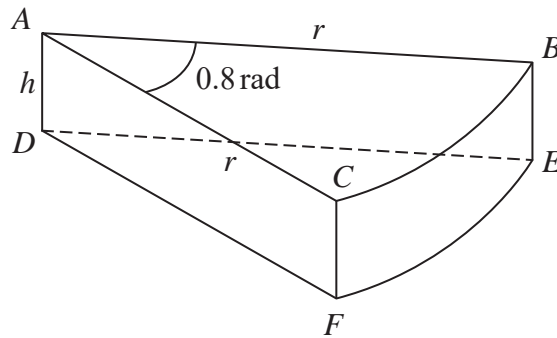


Figure 5

A company makes toys for children.

Figure 5 shows the design for a solid toy that looks like a piece of cheese.

The toy is modelled so that

- face  $ABC$  is a sector of a circle with radius  $r$  cm and centre  $A$
- angle  $BAC = 0.8$  radians
- faces  $ABC$  and  $DEF$  are congruent
- edges  $AD$ ,  $CF$  and  $BE$  are perpendicular to faces  $ABC$  and  $DEF$
- edges  $AD$ ,  $CF$  and  $BE$  have length  $h$  cm

Given that the volume of the toy is  $240 \text{ cm}^3$

(a) show that the surface area of the toy,  $S \text{ cm}^2$ , is given by

$$S = 0.8r^2 + \frac{1680}{r}$$

making your method clear.

(4)

Using algebraic differentiation,

(b) find the value of  $r$  for which  $S$  has a stationary point.

(4)

(c) Prove, by further differentiation, that this value of  $r$  gives the minimum surface area of the toy.

(2)

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