1.

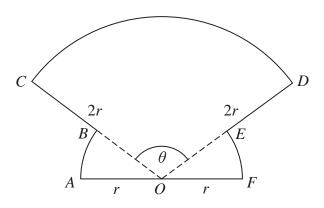


Figure 1

The shape *OABCDEFO* shown in Figure 1 is a design for a logo.

In the design

- OAB is a sector of a circle centre O and radius r
- sector *OFE* is congruent to sector *OAB*
- ODC is a sector of a circle centre O and radius 2r
- *AOF* is a straight line

Given that the size of angle COD is θ radians,

(a) write down, in terms of θ , the size of angle AOB

(1)

(b) Show that the area of the logo is

$$\frac{1}{2}r^2(3\theta+\pi)\tag{2}$$

(c) Find the perimeter of the logo, giving your answer in simplest form in terms of r, θ and π .

(2)

2.

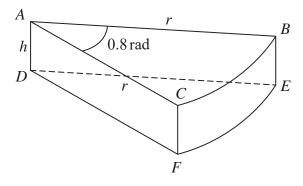


Figure 5

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 rcm 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 cm³

(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)

