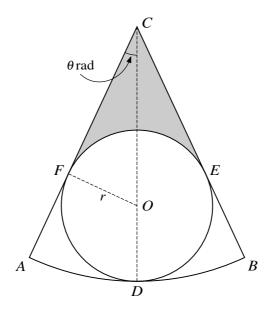The diagram shows a sector CAB which is part of a circle with centre C. A circle with centre O and radius r lies within the sector and touches it at D, E and F, where COD is a straight line and angle ACD is θ radians.

(a) Find CD in terms of r and $\sin \theta$. [3]

....

....

....

....

....

....

....

....

....

....

....

....

....

....

It is now given that $r = 4$ and $\theta = \frac{1}{6}\pi$.

(b) Find the perimeter of sector CAB in terms of π. [3]

....

....

....

....

....

....

....

....

....

....

(c) Find the area of the shaded region in terms of π and $\sqrt{3}$. [4]

....

....

....

....

....

....

....

....

....

....