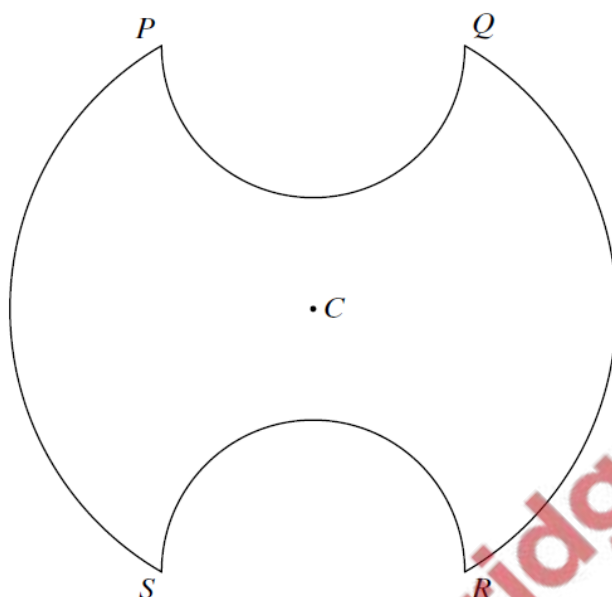


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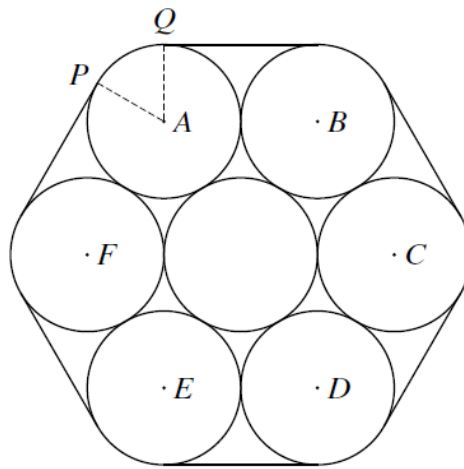


The diagram shows a symmetrical metal plate. The plate is made by removing two identical pieces from a circular disc with centre C . The boundary of the plate consists of two arcs PS and QR of the original circle and two semicircles with PQ and RS as diameters. The radius of the circle with centre C is 4 cm, and $PQ = RS = 4$ cm also.

(a) Show that angle $PCS = \frac{2}{3}\pi$ radians. [2]

(b) Find the exact perimeter of the plate. [3]

(c) Show that the area of the plate is $(\frac{20}{3}\pi + 8\sqrt{3})$ cm². [5]



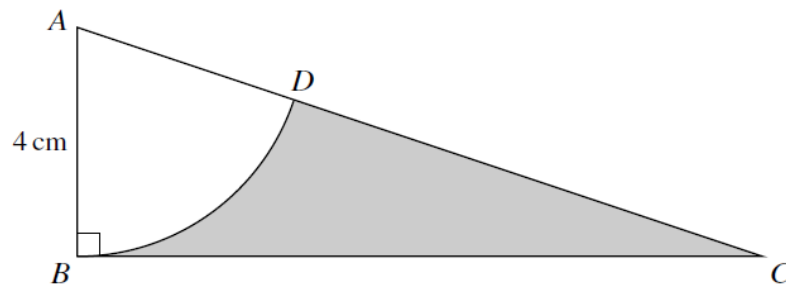
The diagram shows a cross-section of seven cylindrical pipes, each of radius 20 cm, held together by a thin rope which is wrapped tightly around the pipes. The centres of the six outer pipes are A , B , C , D , E and F . Points P and Q are situated where straight sections of the rope meet the pipe with centre A .

(a) Show that angle $PAQ = \frac{1}{3}\pi$ radians. [2]

(b) Find the length of the rope. [4]

(c) Find the area of the hexagon $ABCDEF$, giving your answer in terms of $\sqrt{3}$. [2]

(d) Find the area of the complete region enclosed by the rope. [3]

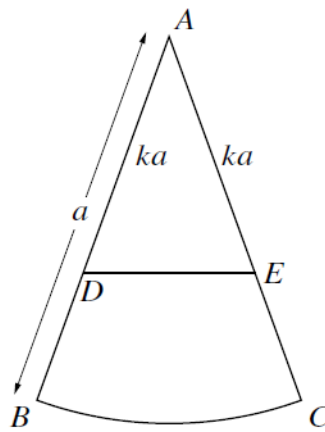


The diagram shows a triangle ABC , in which angle $ABC = 90^\circ$ and $AB = 4$ cm. The sector ABD is part of a circle with centre A . The area of the sector is 10 cm^2 .

(a) Find angle BAD in radians. [2]

(b) Find the perimeter of the shaded region. [4]





The diagram shows a sector ABC which is part of a circle of radius a . The points D and E lie on AB and AC respectively and are such that $AD = AE = ka$, where $k < 1$. The line DE divides the sector into two regions which are equal in area.

(a) For the case where angle $BAC = \frac{1}{6}\pi$ radians, find k correct to 4 significant figures. [5]

(b) For the general case in which angle $BAC = \theta$ radians, where $0 < \theta < \frac{1}{2}\pi$, it is given that $\frac{\theta}{\sin \theta} > 1$.

Find the set of possible values of k . [3]