

# IB Geometry and Trigonometry Problem 006

The figure is not to scale.



The figure shows the circle with centre  $O$  and radius  $r$ .

Points  $P$ ,  $R$  and  $Q$  are on the circumference,  $\angle POQ = 2\theta$ , for  $0 < \theta < \frac{\pi}{2}$ .

- A. Use the law of cosines to show that  $PQ = 2r \sin \theta$ .
- B. Let  $l$  be the length of arc  $PRQ$ . Given that  $1.3PQ - l = 0$ , find the value of  $\theta$ .
- C. Consider the function  $f(\theta) = 2.6 \sin \theta - 2\theta$ , for  $0 < \theta < \frac{\pi}{2}$ .
  - i. Sketch the graph of  $f$ .
  - ii Give the root of  $f(\theta) = 0$ .
- D. Use the curve  $f$  to find the values of  $\theta$  for which  $l < 1.3PQ$ .