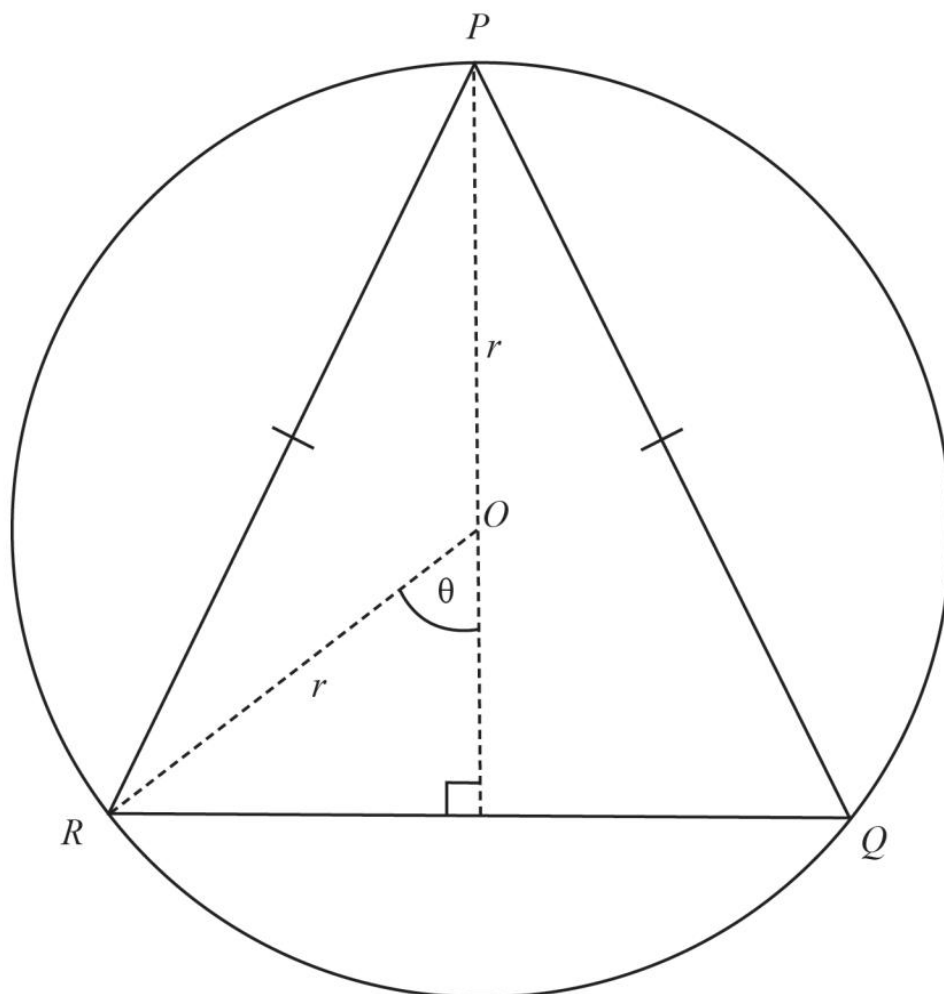


**Question 8****(7 marks)**

An isosceles triangle  $\triangle PQR$  is inscribed inside a circle of fixed radius  $r$  and centre  $O$ . Let  $\theta$  be defined as in the diagram below.



- (a) Show that the area  $A$  of the triangle  $\triangle PQR$  is given by  $A = r^2 \sin \theta (1 + \cos \theta)$ . (2 marks)

- (b) Using calculus, determine the value of  $\theta$  that maximises the area  $A$  of the inscribed triangle. State this area in terms of  $r$  exactly. Justify your answer.  
(Hint: you may need the identity  $\sin^2 x = 1 - \cos^2 x$  in your working.) (5 marks)