

STEP II, 2012 Q6

- 6 A cyclic quadrilateral $ABCD$ has sides AB , BC , CD and DA of lengths a , b , c and d , respectively. The area of the quadrilateral is Q , and angle DAB is θ .

Find an expression for $\cos \theta$ in terms of a , b , c and d , and an expression for $\sin \theta$ in terms of a , b , c , d and Q . Hence show that

$$16Q^2 = 4(ad + bc)^2 - (a^2 + d^2 - b^2 - c^2)^2,$$

and deduce that

$$Q^2 = (s - a)(s - b)(s - c)(s - d),$$

where $s = \frac{1}{2}(a + b + c + d)$.

Deduce a formula for the area of a triangle with sides of length a , b and c .



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