

STEP III, 2007, Q6

- 6 The distinct points P , Q , R and S in the Argand diagram lie on a circle of radius a centred at the origin and are represented by the complex numbers p , q , r and s , respectively. Show that

$$pq = -a^2 \frac{p - q}{p^* - q^*}.$$

Deduce that, if the chords PQ and RS are perpendicular, then $pq + rs = 0$.

The distinct points A_1, A_2, \dots, A_n (where $n \geq 3$) lie on a circle. The points B_1, B_2, \dots, B_n lie on the same circle and are chosen so that the chords $B_1B_2, B_2B_3, \dots, B_nB_1$ are perpendicular, respectively, to the chords $A_1A_2, A_2A_3, \dots, A_nA_1$. Show that, for $n = 3$, there are only two choices of B_1 for which this is possible. What is the corresponding result for $n = 4$? State the corresponding results for values of n greater than 4.



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