

STEP II, 2008, Q8

- 8 The points A and B have position vectors \mathbf{a} and \mathbf{b} , respectively, relative to the origin O . The points A , B and O are not collinear. The point P lies on AB between A and B such that

$$AP : PB = (1 - \lambda) : \lambda.$$

Write down the position vector of P in terms of \mathbf{a} , \mathbf{b} and λ . Given that OP bisects $\angle AOB$, determine λ in terms of a and b , where $a = |\mathbf{a}|$ and $b = |\mathbf{b}|$.

The point Q also lies on AB between A and B , and is such that $AP = BQ$. Prove that

$$OQ^2 - OP^2 = (b - a)^2.$$



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