

STEP III, 2000 Q3

- 3 Given that $\alpha = e^{i\frac{\pi}{3}}$, prove that $1 + \alpha^2 = \alpha$.

A triangle in the Argand plane has vertices A , B , and C represented by the complex numbers p , $q\alpha^2$ and $-r\alpha$ respectively, where p , q and r are positive real numbers. Sketch the triangle ABC .

Three equilateral triangles ABL , BCM and CAN (each lettered clockwise) are erected on sides AB , BC and CA respectively. Show that the complex number representing N is $(1 - \alpha)p - \alpha^2r$ and find similar expressions for the complex numbers representing L and M .

Show that lines LC , MA and NB all meet at the origin, and that these three line segments have the common length $p + q + r$.



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