

STEP II, 2004, Q6

- 6 The vectors \mathbf{a} and \mathbf{b} lie in the plane Π . Given that $|\mathbf{a}| = 1$ and $\mathbf{a} \cdot \mathbf{b} = 3$, find, in terms of \mathbf{a} and \mathbf{b} , a vector \mathbf{p} parallel to \mathbf{a} and a vector \mathbf{q} perpendicular to \mathbf{a} , both lying in the plane Π , such that

$$\mathbf{p} + \mathbf{q} = \mathbf{a} + \mathbf{b}.$$

The vector \mathbf{c} is not parallel to the plane Π and is such that $\mathbf{a} \cdot \mathbf{c} = -2$ and $\mathbf{b} \cdot \mathbf{c} = 2$. Given that $|\mathbf{b}| = 5$, find, in terms of \mathbf{a} , \mathbf{b} and \mathbf{c} , vectors \mathbf{P} , \mathbf{Q} and \mathbf{R} such that \mathbf{P} and \mathbf{Q} are parallel to \mathbf{p} and \mathbf{q} , respectively, \mathbf{R} is perpendicular to the plane Π and

$$\mathbf{P} + \mathbf{Q} + \mathbf{R} = \mathbf{a} + \mathbf{b} + \mathbf{c}.$$



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