

5 Points A , B , C and D have position vectors $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} 7 \\ 4 \end{pmatrix}$ and $\mathbf{d} = \begin{pmatrix} 4 \\ k \end{pmatrix}$.

(a) Find the value of k for which D is the midpoint of AC . [1]

(b) Find the two values of k for which $|\overrightarrow{AD}| = \sqrt{13}$. [3]

(c) Find one value of k for which the four points form a trapezium. [2]