5. The square-based pyramid P has vertices A, B, C, D and E. The position vectors of A, B, C and D are **a**, **b**, **c** and **d** respectively where

$$\mathbf{a} = \begin{pmatrix} -2 \\ 3 \\ -1 \end{pmatrix}, \quad \mathbf{b} = \begin{pmatrix} 5 \\ 8 \\ -6 \end{pmatrix}, \quad \mathbf{c} = \begin{pmatrix} 2 \\ 5 \\ 3 \end{pmatrix}, \quad \mathbf{d} = \begin{pmatrix} 6 \\ 1 \\ 1 \end{pmatrix}$$

(a) Find the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$, $\overrightarrow{AD}$, $\overrightarrow{BC}$, $\overrightarrow{BD}$ and $\overrightarrow{CD}$.

(3)

(b) Find

(i) the length of a side of the square base of P,

(ii) the cosine of the angle between one of the slanting edges of P and its base,

(iii) the height of P,

(iv) the position vector of E.

(9)

A second pyramid, identical to P, is attached by its square base to the base of P to form an octahedron.

(c) Find the position vector of the other vertex of this octahedron.

(3)