Section 1: The scalar product

Exercise level 1

1. Find the following scalar products.
   (i) $\begin{pmatrix}3\\1\end{pmatrix}.\begin{pmatrix}4\\-5\end{pmatrix}$
   (ii) $(2\mathbf{i}+3\mathbf{j}).(-\mathbf{i}+2\mathbf{j})$

2. Find the following scalar products.
   (i) $\begin{pmatrix}1\\-4\\2\end{pmatrix}.\begin{pmatrix}3\\2\\-5\end{pmatrix}$
   (ii) $(\mathbf{i}+2\mathbf{j}+3\mathbf{k}).(4\mathbf{i}-2\mathbf{k})$

3. The vectors $\begin{pmatrix}3\\2\\-1\end{pmatrix}$ and $\begin{pmatrix}4\\-2\\k\end{pmatrix}$ are perpendicular.
   Find the value of k.

4. Find the angle between the vectors
   (i) $3\mathbf{i}-5\mathbf{j}$ and $2\mathbf{i}+\mathbf{j}$
   (ii) $\mathbf{i}-2\mathbf{j}+3\mathbf{k}$ and $2\mathbf{i}+\mathbf{j}-\mathbf{k}$

5. Three points have coordinates A (2, 3, -1), B (1, 4, 0) and C(1, 8, -3).
   (i) Find $\overrightarrow{AB}$ and $\overrightarrow{AC}$
   (ii) Find $\overrightarrow{AB}.\overrightarrow{AC}$
   (iii) Find the angle between $\overrightarrow{AB}$ and $\overrightarrow{AC}$.