Question 5 (9 marks)

(a) Figure 4 shows the points $A(1, 2, -3)$, $B(5, 3, -2)$, $C(6, 7, -3)$, and $D(2, 6, -4)$.

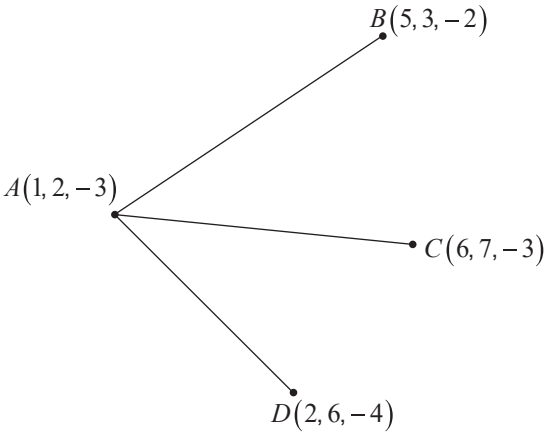

Figure 4

(i) Find $\overrightarrow{AB} \bullet \overrightarrow{AC}$.

(2 marks)

(ii) Find $\cos \angle BAC$.

(1 mark)

(iii) Find $\cos \angle CAD$.

(1 mark)

(b) Let $\overrightarrow{OP} = \boldsymbol{p}$ and $\overrightarrow{OQ} = \boldsymbol{q}$.

(i) On Figure 5, clearly show the vector $\overrightarrow{OR} = \boldsymbol{p} + \boldsymbol{q}$.

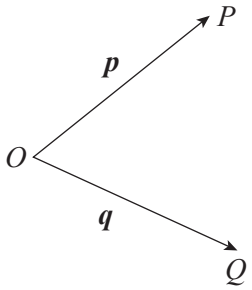

Figure 5

(1 mark)

(ii) If $|\boldsymbol{p}| = |\boldsymbol{q}|$, prove that $\overrightarrow{OR}$ bisects $\angle POQ$.

(2 marks)

(c) Figure 6 shows $\overrightarrow{OE} = [2, 5, -7]$ and $\overrightarrow{OF} = [10, 14, 4]$. Find a vector $\overrightarrow{OG}$ that bisects $\angle EOF$.

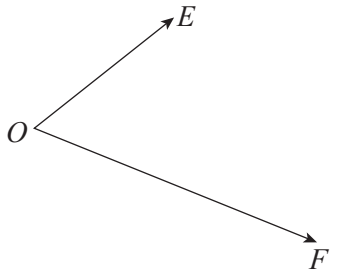

Figure 6

(2 marks)