## Question 4

 (9 marks)The points $A(1,0,4), B(5,4,0)$, and $C(7,-6,10)$ form the triangle $A B C$, as shown in Figure 2.


Figure 2
(a) (i) Find $\overrightarrow{A B}$.

(1 mark)
(ii) Find $\overrightarrow{A B} \times \overrightarrow{A C}$.

(2 marks)
(iii) Find the exact area of triangle $A B C$.

(2 marks)
(b) The point $M(4,3,1)$ divides $A B$ internally in the ratio $3: 1$. The point $N(5,-4,8)$ divides $A C$ internally in the ratio $2: 1$. That is, $\overrightarrow{A M}=3 \overrightarrow{M B}$ and $\overrightarrow{A N}=2 \overrightarrow{N C}$, as shown in Figure 3 .


Figure 3
(i) Find $\overrightarrow{A M}$ in terms of $\overrightarrow{A B}$.

(ii) Find the exact area of triangle $A M N$.

(iii) Find the coordinates of a point, $P$, on $A C$, such that:
the area of triangle $A M P=\frac{1}{12}$ the area of triangle $A B C$.


