



The diagram shows a triangular prism with a horizontal rectangular base $ADFC$, where $CF = 12$ units and $DF = 6$ units. The vertical ends ABC and DEF are isosceles triangles with $AB = BC = 5$ units. The mid-points of BE and DF are M and N respectively. The origin O is at the mid-point of AC .

Unit vectors \mathbf{i} , \mathbf{j} and \mathbf{k} are parallel to OC , ON and OB respectively.

- (i) Find the length of OB . [1]
- (ii) Express each of the vectors \overrightarrow{MC} and \overrightarrow{MN} in terms of \mathbf{i} , \mathbf{j} and \mathbf{k} . [3]
- (iii) Evaluate $\overrightarrow{MC} \cdot \overrightarrow{MN}$ and hence find angle CMN , giving your answer correct to the nearest degree. [4]