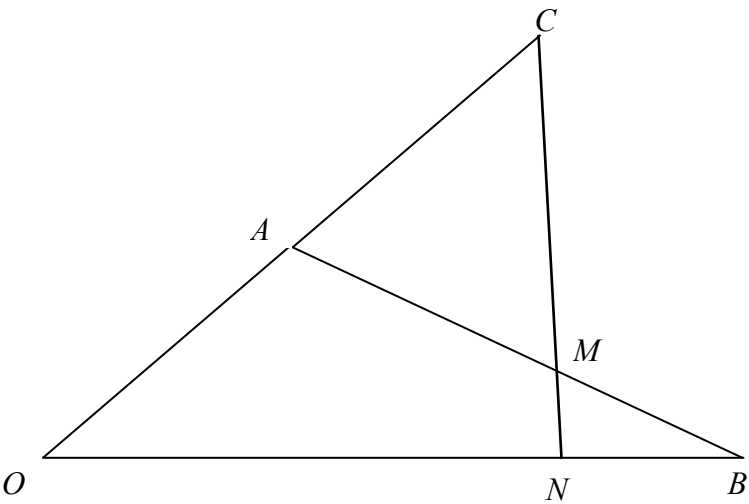


**Question 10 (Total 6 marks)**

| Part | Working or answer an examiner might expect to see   | Mark | Notes   |
|------|---|------|---|
|      |   |      |   |
| (a)  | $\overrightarrow{CM} = \overrightarrow{CA} + \overrightarrow{AM} = \overrightarrow{CA} + \frac{2}{3} \overrightarrow{AB}$   | M1   | This mark is given for a method to find an expression for $\overrightarrow{CM}$                                 |
|      | $\overrightarrow{CM} = -\mathbf{a} + \frac{2}{3}(\mathbf{b} - \mathbf{a}) = -\frac{5}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$   | A1   | This mark is given for a correct expression for $\overrightarrow{CM}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ |
| (b)  | $\overrightarrow{ON} = \overrightarrow{OC} + \overrightarrow{CN} = \overrightarrow{OC} + k\overrightarrow{CM}$  | M1   | This mark is given for a method to find an expression for $\overrightarrow{ON}$                                 |
|      | $\begin{aligned} \overrightarrow{ON} &= 2\mathbf{a} + k\left(-\frac{5}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}\right) \\ &= \left(2 - \frac{5}{3}k\right)\mathbf{a} + \left(\frac{2}{3}k\right)\mathbf{b} \end{aligned}$ | A1   | This mark is given for a correct expression for $\overrightarrow{ON}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ |
| (c)  | $\left(2 - \frac{5}{3}k\right) = 0 \text{ so } k = \frac{6}{5}$   | M1   | This mark is given for deducing that the coefficient of $\mathbf{a} = 0$ and finding a value for $k$            |
|      | $\overrightarrow{ON} = 0 \times \mathbf{a} + \left(\frac{2}{3} \times \frac{6}{5}\right)\mathbf{b} = \frac{4}{5}\mathbf{b}$ <p>Hence <math>ON:NB = \frac{4}{5} : \frac{1}{5} = 4:1</math></p>                         | A1   | This mark is given for finding $\overrightarrow{ON}$ and giving a valid conclusion                              |