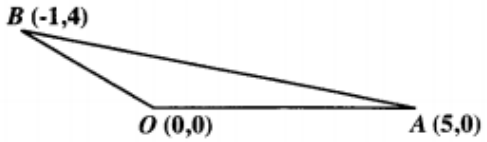
Question 1

(a) The figure below, **not drawn to scale**, shows the points O (0,0), A (5,0) and B (−1,4) which are the vertices of a triangle OAB.



(i) Express in the form $\begin{pmatrix} a \\ b \end{pmatrix}$ the vectors

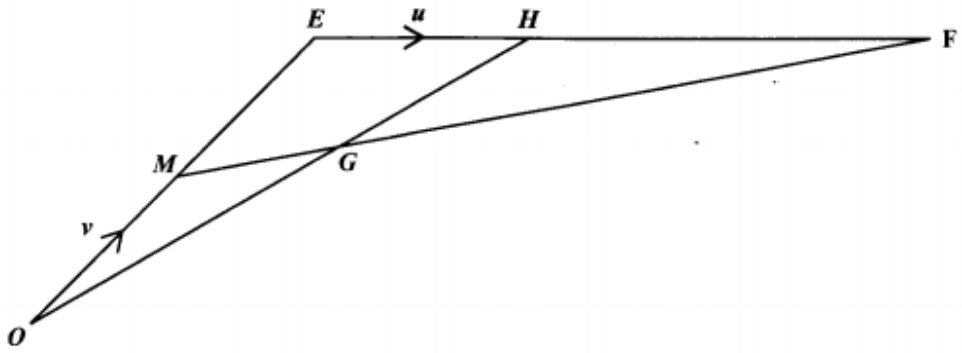
a) $\overrightarrow{OB}$

b) $\overrightarrow{OA} + \overrightarrow{OB}$ **(3 marks)**

(ii) If $M(x,y)$ is the midpoint of AB, determine the values of x and y. **(2 marks)**

(b) In the figure below, **not drawn to scale**, OE, EF and MF are straight lines. The point H is such that $EF = 3EH$. The point G is such that $MF = 5MG$. M is the midpoint of OE.

The vector $\overrightarrow{OM} = v$ and $\overrightarrow{EH} = u$.



(i) Write in terms of $\boldsymbol{u}$ and/or $\boldsymbol{v}$, an expression for:

a) $\overrightarrow{HF}$ **(1 mark)**

b) $\overrightarrow{MF}$ **(2 marks)**

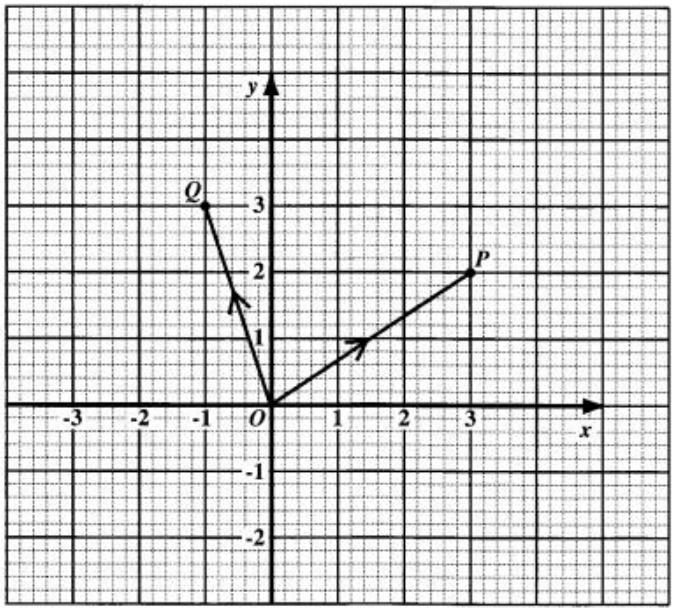
c) $\overrightarrow{OH}$ **(2 marks)**

(ii) Show that $\overrightarrow{OG} = \frac{3}{5}\left(2v + u\right)$ **(2 marks)**

(iii) Hence, prove that O, G and H lie on a straight line. **(3 marks)**

Question 2

The diagram below shows position vectors $\overrightarrow{OP}$ and $\overrightarrow{OQ}$.



(a) Write as a column vector, in the form $\begin{pmatrix} x \\ y \end{pmatrix}$

(i) $\overrightarrow{OP}$ **(1 mark)**

(ii) $\overrightarrow{OQ}$ **(1 mark)**

(b) The point R has coordinates $(8, 9)$.

(i) Express $\overrightarrow{QR}$ as a vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$. **(2 marks)**

(ii) Using a vector method, show that $\overrightarrow{OP}$ is parallel to $\overrightarrow{QR}$. **(1 mark)**

(iii) Determine the magnitude of the vector $\overrightarrow{PR}$. **(2 marks)**

(c) The point S has coordinates (a, b).

(i) Write $\overrightarrow{QS}$ as a column vector, in terms of a and b. **(2 marks)**

(ii) Given that $\overrightarrow{QS} = \overrightarrow{OP}$, calculate the value of a and the value of b. **(3 marks)**

(iii) Using a vector method, show that $OPSQ$ is a parallelogram. **(3 marks)**