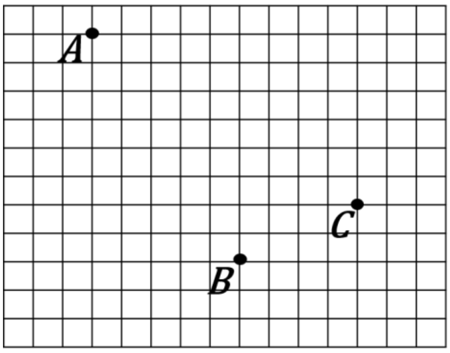
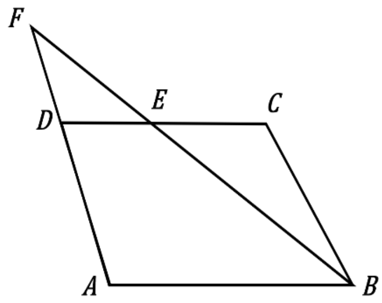
5 MUST KNOW QUESTIONS TO *CONQUER*

VECTORS

1	The position vector of P, relative to O, is $\begin{pmatrix}2\\1\end{pmatrix}$ and the coordinates of Q are $(-4, 3)$. (a) Calculate $\lvert\overrightarrow{PQ}\rvert$. (b) Given that X is the mid-point of PQ, express $\overrightarrow{OX}$ as a column vector. (c) Find the coordinates of R such that $\overrightarrow{OR} = 3\overrightarrow{OP} + \overrightarrow{OQ}$. (d) Z is the point OQ produced such that $\overrightarrow{OZ} = 20$ units. Express $\overrightarrow{OZ}$ as a column vector. Ans: (a) $\sqrt{40}$ units or $2\sqrt{10}$ units (b) $\begin{pmatrix}-1\\2\end{pmatrix}$ (c) (2, 6) (d) $\begin{pmatrix}-16\\12\end{pmatrix}$
2	The points A, B and C are marked on the grid.  (a) Given that $\overrightarrow{OA} = \begin{pmatrix}\frac{2}{7}\end{pmatrix}$, locate the origin O and state the coordinated of B. (b) Find the vector $\overrightarrow{AC}$. (c) If $\overrightarrow{AC} = 3\,\overrightarrow{AD}$ and $ABED$ is a parallelogram, mark and label clearly, in the grid, the points D and E. Ans: (a) $B(7, -1)$ (b) $\begin{pmatrix}9\\-6\end{pmatrix}$

3 $ABCD$ is a parallelogram. E is a point on DC such that $DE = \frac{2}{3}EC$.
The lines AD and BE when produced, meet at F.
Given that $\overrightarrow{AB} = \begin{pmatrix} 10 \\ 0 \end{pmatrix}$ and $\overrightarrow{AD} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$.



(a) Express each of the following as a column vector.

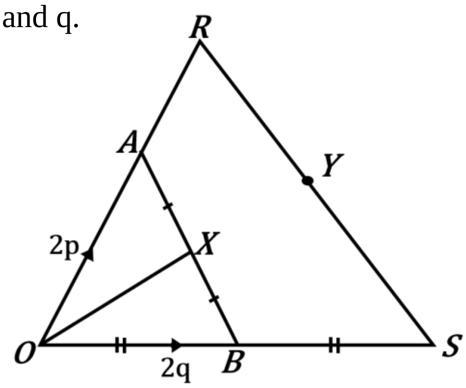
(i) $\overrightarrow{CE}$,

(ii) $\overrightarrow{FE}$.

(b) Find the value of $\dfrac{\text{area of } \Delta ABF}{\text{area of parallelogram } ABCD}$

Ans: (a) (i) $\begin{pmatrix} -6 \\ 0 \end{pmatrix}$ (ii) $\begin{pmatrix} 6 \\ -3\frac{1}{3} \end{pmatrix}$ (b) $\frac{5}{6}$

4 In ΔORS, the point A on OR is such that $OA = 2AR$. B is the midpoint of OS, X is the midpoint of AB. In the diagram, $\overrightarrow{OA} = 2\text{p}$, $\overrightarrow{OB} = 2\text{q}$ and $SY = \frac{4}{3}YR$.



(a) Express as simply as possible, in terms of p and q.

(i) $\overrightarrow{AX}$,

(ii) $\overrightarrow{OX}$,

(iii) $\overrightarrow{RS}$,

(iv) $\overrightarrow{OY}$.

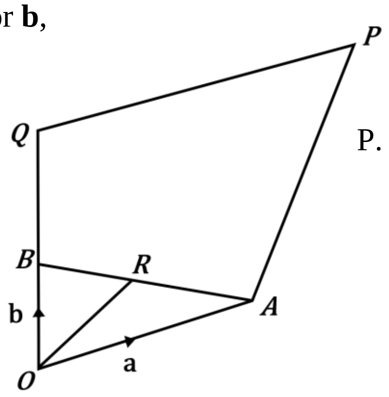
What do the results in (ii) and (iv) tell you about O, X and Y?

(b) Find the numerical value of

(i) $\dfrac{\text{Area of } \Delta OAX}{\text{Area of } \Delta OAY}$,

(ii) $\dfrac{\text{Area of } \Delta OAX}{\text{Area of } \Delta ORS}$,

Ans: (a)(i)$\mathbf{q} - \mathbf{p}$ (ii)$\mathbf{p} + \mathbf{q}$ (iii)$4\mathbf{q} - 3\mathbf{p}$ (iv) $\frac{12}{7}(\mathbf{p} + \mathbf{q})$
$\overrightarrow{OY} = \frac{12}{7}\overrightarrow{OX}$; O, X and Y are collinear. (b)(i) $\frac{7}{12}$ (ii)$\frac{1}{6}$

5	In the diagram $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$. R lies on AB such that AR : RB = 3 : 2. Q lies on OB produced such that BQ = 2OB. $\overrightarrow{QP} = 2\overrightarrow{OA}$. (i) Express, as simply as possible, in terms of **a** and/or **b**, (a) $\overrightarrow{OR}$, (b) $\overrightarrow{OP}$. (ii) Make two statements about the points O, R and P. (iii) Find (a) $\frac{\text{Area of } \Delta OAR}{\text{Area of } \Delta OAB}$, (b) $\frac{\text{Area of } \Delta OAR}{\text{Area of } \Delta ARP}$, (c) $\frac{\text{Area of } \Delta OAP}{\text{Area of } \Delta OQP}$, (d) $\frac{\text{Area of } \Delta OAP}{\text{Area of } \Delta BRPQ}$,  Ans: (i)(a) $\frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$ (ii) O, R and P are collinear points, magnitude of $OR = \frac{1}{5}OP$ (iii)(a) $\frac{3}{5}$ (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $\frac{15}{28}$