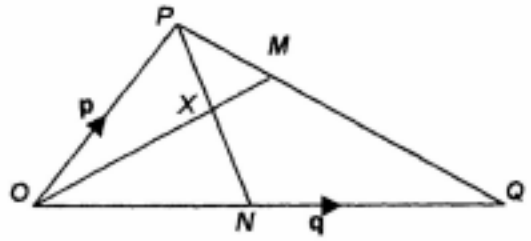
1)

10 **(i)**	$\begin{pmatrix}29\\-13\end{pmatrix}-\begin{pmatrix}5\\-6\end{pmatrix}=\begin{pmatrix}24\\-7\end{pmatrix}$	M1	M1 for subtraction
	Magnitude = 25, unit vector $\frac{1}{25}\begin{pmatrix}24\\-7\end{pmatrix}$	M1 A1	M1 for attempt to find magnitude of their vector
(ii)	$2\overrightarrow{AC}=3\overrightarrow{AB}$ or $2\overrightarrow{AB}+2\overrightarrow{BC}=3\overrightarrow{AB}$ leading to $\overrightarrow{AC}=\begin{pmatrix}36\\-10.5\end{pmatrix}$	M1	M1 for attempt to find $\overrightarrow{AC}$ – may be part of a larger method
	$\overrightarrow{OC}=\overrightarrow{OA}+\overrightarrow{AC}$ or $\overrightarrow{OB}-\overrightarrow{OA}=2\overrightarrow{OC}-2\overrightarrow{OB}$	M1	M1 for attempt to find $\overrightarrow{OC}$
	leading to $\overrightarrow{OC}=\begin{pmatrix}41\\-16.5\end{pmatrix}$	A1 A1	A1 for each
	(equivalent methods acceptable)	[7]	

2)



(i) $\overrightarrow{OM}=\overrightarrow{OP}+\overrightarrow{PM}$ = p + ⅓ $\overrightarrow{PQ}$ [or q + ⅔ $\overrightarrow{QP}$] = ⅔ p + ⅓ q	M1
$\overrightarrow{OX}$ = m (⅔ p + ⅓ q)	A1
(ii) $\overrightarrow{PN}=\overrightarrow{ON}+\overrightarrow{PO}$ = 2/5 q – p ⇒ $\overrightarrow{PX}$ = n (2/5 q – p)	M1 A1
$\overrightarrow{OX}$ = p + n (2/5 q – p)	A1√
(iii) Solve 1 – n = ⅔ m ⇒ n = 5/9 2/5 n = ⅓ m m = 2/3	M1 A1

3)

4 (i) Modulus of $(3\mathbf{i} - 4\mathbf{j})$ or $(4\mathbf{i} + 3\mathbf{j}) = 5$	B1		Anywhere.
$\overrightarrow{OP} = (3\mathbf{i} - 4\mathbf{j}) \times (10 \div 5) = 6\mathbf{i} - 8\mathbf{j}$ $\overrightarrow{OQ} = (4\mathbf{i} + 3\mathbf{j}) \times (15 \div 5) = 12\mathbf{i} + 9\mathbf{j}$	M1 A1	[3]	Mult. by 10 (or 15) ÷ modulus – once. Both correct.
(ii) $\overrightarrow{PQ} = 12\mathbf{i} + 9\mathbf{j} - (6\mathbf{i} - 8\mathbf{j}) = 6\mathbf{i} + 17\mathbf{j}$ Magnitude $= \sqrt{(6^2 + 17^2)} = \sqrt{325} = 5\sqrt{13}$	M1 M1		**q-p** or **p-q** Allow if **p+q** used.
$\lambda = 5$	A1	[3]	Allow if **p-q** used.

4)

(i) $\mathbf{a} = \frac{1}{13}(5\mathbf{i} - 12\mathbf{j})$	M1, A1	[2]	M1 for a valid attempt to obtain magnitude.
(ii) $q(5\mathbf{i} - 12\mathbf{j}) + p\mathbf{i} + \mathbf{j} = 19\mathbf{i} - 23\mathbf{j}$			
$5q + p = 19$	M1		M1 for equating like vectors
$-12q + 1 = -23$	M1		M1 for solution of (simultaneous) equations
Leading to $q = 2, p = 9$	A1	[3]	A1 for both

5)

(i)	$\sqrt{7^2 + 24^2}$	M1
	$\lvert OA \rvert = 25$	A1
(ii)	$\overrightarrow{AB} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$	B1
	$\lvert AB \rvert = 5$	B1
(iii)	$\overrightarrow{AC} = 5\overrightarrow{AB} = \begin{pmatrix} 15 \\ -20 \end{pmatrix}$	M1
	$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$	M1
	$\begin{pmatrix} 22 \\ 4 \end{pmatrix}$	A1

7

6)

(i) $\overrightarrow{OP} = \frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ oe — M1 A1

$\overrightarrow{OX} = \mu\left(\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}\right)$ — A1

(ii) $\overrightarrow{OX} = \mathbf{a} + \lambda\mathbf{b}$ or $\overrightarrow{AX} = \mu\left(\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}\right) - \mathbf{a}$ — B1

Equates **a** components — M1

$\mu = \frac{5}{3}$ — A1

Equates **b** components — M1

$\lambda = \frac{2}{3}$ — A1

[8]

7)

(i) $\overrightarrow{AQ} = 3b - a$

$\overrightarrow{OX} = \overrightarrow{OA} + \mu\overrightarrow{AQ}$

$a + \mu(3b - a)$

(ii) $\overrightarrow{BP} = 2a - b$

$\overrightarrow{OX} = \overrightarrow{OB} + \lambda\overrightarrow{BP}$

$b + \lambda(2a - b)$

(iii) Equate vectors and solve $\begin{pmatrix} 1 - \mu = 2\lambda \\ 3\mu = 1 - \lambda \end{pmatrix}$

$\mu = 0.2$

$\lambda = 0.4$

8)

(i) $\overrightarrow{OX} = \mathbf{a} + \mu(\mathbf{b}\text{-}\mathbf{a})$ or $(1 - \mu)\mathbf{a} + \mu\mathbf{b}$ — M1A1

(ii) $\overrightarrow{OS} = \frac{3}{5}\mathbf{a}$ — B1

$\overrightarrow{OT} = \frac{7}{5}\mathbf{b}$ — B1

$\overrightarrow{OX} = \frac{3}{5}\mathbf{a} + \lambda\left(\frac{7}{5}\mathbf{b} - \frac{3}{5}\mathbf{a}\right)$ or $\overrightarrow{OX} = (1 - \lambda)\frac{3}{5}\mathbf{a} + \lambda\frac{7}{5}\mathbf{b}$ — M1A1

(iii) Equate components or arrange to $(\alpha)\ \mathbf{a} = (\beta)\ \mathbf{b}$ and put $\alpha = \beta = 0$ — M1

Solve simultaneous equations — DM1

$\lambda = \frac{1}{2}$ — A1

$\mu = \frac{7}{10}$ — A1

[10]

9)

(i)	$\overrightarrow{OP} = 3\mathbf{c}$	B1
	$\overrightarrow{OQ} = \frac{3}{2}\mathbf{d}$	B1
	$\overrightarrow{DR} = \overrightarrow{CD} = \mathbf{d} - \mathbf{c}$	B1
	$\overrightarrow{OR} = \overrightarrow{OD} + \overrightarrow{DR} = 2\mathbf{d} - \mathbf{c}$	M1A1
(ii)	Finds **two** of $\overrightarrow{PQ}$, $\overrightarrow{QR}$, $\overrightarrow{PR}$	M1
	Two of $\overrightarrow{PQ} = \frac{3}{2}\mathbf{d} - 3\mathbf{c}$, $\overrightarrow{QR} = \frac{1}{2}\mathbf{d} - \mathbf{c}$, $\overrightarrow{PR} = 2\mathbf{d} - 4\mathbf{c}$	A1+A1
	Express one vector as multiple of another	M1
	3:1	A1
		[10]