Vectors 2 Answers IGCSE

1)

(b) (i) $\begin{pmatrix}2\\3\end{pmatrix}$	1	
(ii) $\begin{pmatrix}-2\\4\end{pmatrix}$	2ft	ft $\begin{pmatrix}0\\7\end{pmatrix}$ – their **(i)** **B1** ft for one correct element
(c) (i) $\frac{1}{3}\mathbf{t}$ final answer	1	
(ii) $\frac{1}{3}(-\mathbf{t}+\mathbf{r})$ final answer	2	**M1** for correct unsimplified answer or $\overrightarrow{TR} = -\mathbf{t}+\mathbf{r}$ oe or $\overrightarrow{TP} = \frac{1}{3}\overrightarrow{TR}$ oe
(iii) $\frac{1}{3}\mathbf{r}$ final answer	2	**M1** for correct unsimplified answer or $\overrightarrow{QT} + \overrightarrow{TP}$ oe for any correct path or $\frac{1}{3}\mathbf{t}$ + their **(ii)**
(iv) $QP = \frac{1}{3}OR$ oe	1dep	**Dependent** on correct answer in **(iii)**
QP is parallel to OR or $\mathbf{r}$	1dep	**Dependent** on multiple of **r** as answer in **(iii)**

2)

(a) (i) $\begin{pmatrix}9\\5\end{pmatrix}$	1	
(ii) $\begin{pmatrix}4\\7\end{pmatrix}$	1 1	If 0, **SC1** for $\overrightarrow{CB} = \begin{pmatrix}5\\-2\end{pmatrix}$ seen
(iii) $\overrightarrow{BA}$ or $-\overrightarrow{AB}$	1	BA not indicated as a vector is not enough.
(iv) 10.3 (10.29 – 10.30)	2	**M1** for (their 9)^2 + (their 5)^2
(b) (i) 2**u**	1	
(ii) $\frac{1}{2}(\mathbf{t}-\mathbf{u})$ oe	2	**M1** for $\frac{1}{2}$ (their $\overrightarrow{BA}+\overrightarrow{AD}+\overrightarrow{DC}$) or equivalent correct route for $\overrightarrow{BM}$, along obtainable vectors in terms of **t** and **u** or **M1** for correct unsimplified answer
(iii) $\frac{3}{2}\mathbf{u}+\frac{1}{2}\mathbf{t}$ oe ft	2ft	ft their **(i)** + their **(ii)** simplified or **t** + **u** – their **(b)(ii)** simplified **M1** for correct (or **ft**) unsimplified **(i)** + **(ii)** or **t** + **u** – their **(b)(ii)**

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3)

(a) $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$ oe	**2**	**M1** unsimplified or any correct route e.g $\mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a})$ or $\mathbf{OA} + \mathbf{AC}$
(b) $-1\frac{1}{2}\mathbf{a} + 1\frac{1}{2}\mathbf{b}$ oe	**2**	**M1** unsimplified or any correct route e.g. $\mathbf{CD} = 1\frac{1}{2}\mathbf{AB}$ or $\mathbf{b} - \mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a})$

4)

(a) (i) $3\mathbf{a} + \mathbf{c}$	**2**	**B1** $\boldsymbol{AO} + \boldsymbol{OC} + \boldsymbol{CB}$ or $-\mathbf{a} + \mathbf{c} + 4\mathbf{a}$
(ii) $2\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$ oe	**2**	**M1** $\mathbf{a} + \frac{1}{2}$ their **(a)(i)**
(b) D marked ¾ way along CB	**2**	**B1** D on CB

5)

(a) (i) $\begin{pmatrix} 8 \\ 1 \end{pmatrix}$	**1**	
(ii) Point (3, 4) indicated	**1**	
(iii) $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$	**1**	
(b) (i) $-\frac{5}{12}\mathbf{u} + \frac{2}{3}\mathbf{v}$ oe 2 terms	**4**	**M1** for any correct route L to K e.g. $LU + UK$ and **B1** for $LU = \mathbf{u}/4$ oe or $OL = ¾\mathbf{u}$ oe and **B1** for $UK = 2/3\ (\mathbf{v} - \mathbf{u})$ oe or $VK = 1/3(\mathbf{u} - \mathbf{v})$ oe all **B**s are soi
(ii) $\frac{13}{24}\mathrm{u} + \frac{1}{3}\mathrm{v}$ oe 2 terms	**2**	**M1** for correct route from O to M e.g. $OL + LM$ (can be in terms of **u**, **v**)

6)

(a) (i) $-3\mathbf{p} - 2\mathbf{q}$	1	allow $-(3\mathbf{p} + 2\mathbf{q})$
(ii) $-3\mathbf{p} + 4\mathbf{q}$	1	allow $-(3\mathbf{p} - 4\mathbf{q})$
(iii) $-4\mathbf{p}$	2	**M1 (ii)** $-(\mathbf{p} + 4\mathbf{q})$ or $BC - AC = BA$ or **(ii)** $-\mathbf{p} - 4\mathbf{q}$
(b) 8	1	

7)

(a) (i)	$\mathbf{p} + \mathbf{r}$	**B1**	**Answers in bracketed column form penalise only once throughout**
(ii)	$-\mathbf{p} + \mathbf{r}$	**B1**	
(iii)	$-\mathbf{p} + \frac{2}{3}\mathbf{r}$	**B1**	
(iv)	$\mathbf{p} + \frac{1}{2}\mathbf{r}$	**B1**	
(b) (i)	$\frac{3}{2} \times (-\mathbf{p} + \frac{2}{3}\mathbf{r})$ or $-\frac{3}{2}\mathbf{p} + \mathbf{r}$ isw after correct answer seen	**B1 ft**	ft only $\frac{3}{2} \times$ their **(a)(iii)**
(ii)	$\overrightarrow{QP} + \overrightarrow{PS}$ o.e. $-\frac{3}{2}\mathbf{p}$ www 2	**M1** **A1 ft**	o.e. is any correct route of at least 2 vectors ft their **(b)(i)** – **r**
(c)	lie on a straight line	**B1**	dependent on their **(b)(ii)** being a multiple of **p** **[8]**

8)

(a)		Using a right-angled triangle with 25 and 7	M1	25 and 7 seen is sufficient (or 50, 14)
		$25^2 - 7^2$ oe (or $50^2 - 14^2$)	M1	Must be a correct numerical calculation oe includes trig methods, which can round to 24, then 48 for the E mark
		$(BD) = 48$ (or 24×2)	E1	Dep on M2, correctly established
(b)	**(i)**	$\cos^{-1}\left(\frac{7}{25}\right) \times 2$ oe	M1	If scale drawing seen then M0
		147° cao	A1	www 2 147.47…. score M1 only
	(ii)	air 32 -34 or ft	B1	ft 180 – their 147
(c)	**(i)**	$\mathbf{q} + \mathbf{p}$ oe	B1	
	(ii)	$\mathbf{q} - \mathbf{p}$ oe	B1	
(d)		$\overrightarrow{OC} + \overrightarrow{CE}$ oe e.g. their $(\mathbf{q} - \mathbf{p}) + 2 \times$ their $(\mathbf{q} + \mathbf{p})$ $\mathbf{p} + 3\mathbf{q}$ cao	M1 A1	any correct unsimplified expression $2\mathbf{q}$ + their **(c) (i)** www 2
(e)		$\overrightarrow{OC} + \frac{1}{2}\overrightarrow{OB}$ oe $0.5\mathbf{p} + 2.5\mathbf{q}$ cao	M1 A1	any correct unsimplified expression $2\mathbf{q}$ + ½ their **(c) (i)** www 2
(f)				Accept any reasonable notation in both parts
	(i)	$\begin{pmatrix} 0 \\ 24 \end{pmatrix}$	B1	
	(ii)	$\begin{pmatrix} 7 \\ -24 \end{pmatrix}$	B1 B1	
(g)		50	B1	**[16]**