

1 (a)	$\frac{5}{3}\mathbf{b} - \frac{2}{3}\mathbf{a}$ final answer	3	<p><b>B2</b> for <math>[\overrightarrow{AC} = ] \frac{5}{3}(\mathbf{b} - \mathbf{a})</math> or</p> $\frac{5}{3}\mathbf{b} - \frac{5}{3}\mathbf{a}$ <p>or <math>[\overrightarrow{BC} = ] \frac{2}{3}(\mathbf{b} - \mathbf{a})</math> or</p> $\frac{2}{3}\mathbf{b} - \frac{2}{3}\mathbf{a}$ <p>or <b>M1</b> for a correct vector route for <math>\overrightarrow{OC}</math> or <math>[\overrightarrow{AB} = ] \mathbf{b} - \mathbf{a}</math></p> <p>If 0 scored, <b>SC1</b> for answer</p> $-\frac{5}{3}\mathbf{b} + \frac{2}{3}\mathbf{a}$ oe
1(b)	$\overrightarrow{DB} = \frac{2}{5}\mathbf{a}$ or $\overrightarrow{BD} = -\frac{2}{5}\mathbf{a}$	<b>M1</b>	
	$\overrightarrow{DB}$ is a multiple of $\overrightarrow{OA}$ , hence parallel oe	<b>A1</b>	Or $BD = \frac{2}{5}AO$ , hence parallel
2(a)	$\frac{5}{2}\mathbf{c}$ oe final answer	1	
2(b)	$4\mathbf{a} + \frac{3}{2}\mathbf{c}$ or $\frac{8\mathbf{a} + 3\mathbf{c}}{2}$ final answer	2	<p><b>B1</b> for final answer <math>4\mathbf{a} + k\mathbf{c}</math> oe or <math>k\mathbf{a} + 1.5\mathbf{c}</math> oe ,</p> $k \neq 0$ or $\overrightarrow{AP} = 3\mathbf{a}$ soi or <b>M1</b> for a correct route along the lines of the diagram using the given vertex letters
2(c)	1 : 10 oe	1	
3(a)(i)	(-1, 4.5)	1	
3(a)(ii)	(-1, 13)	1	
3(a)(iii)	7.21[1...]	2	<b>M1</b> for $(-4)^2 + 6^2$ oe
3(b)(i)	$\mathbf{b} - \mathbf{a}$	1	

3(b)(ii)	$\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$ or $\frac{1}{4}(\mathbf{a} + \mathbf{b})$	3	<p><b>M1</b> for correct vector route along the lines of the diagram</p> <p><b>B1</b> for <math>\overline{BC} = \frac{\mathbf{a}}{2}</math> soi</p> <p>or for <math>\overline{NB} = \frac{1}{4}\text{their}(\mathbf{b} - \mathbf{a})</math> soi</p> <p>or <math>\overline{NA} = \frac{3}{4}\text{their}(\mathbf{a} - \mathbf{b})</math> soi</p>
4(a)(i)	$\begin{pmatrix} 1 \\ -8 \end{pmatrix}$	2	<p><b>B1</b> for answer <math>\begin{pmatrix} 1 \\ p \end{pmatrix}</math> or <math>\begin{pmatrix} p \\ -8 \end{pmatrix}</math></p> <p>After 0 scored, <b>SC1</b> for answer <math>\begin{pmatrix} -1 \\ 8 \end{pmatrix}</math></p>
4(a)(ii)	(-1, -2)	1	
4(a)(iii)	10 and -4	3	<p><b>B2</b> for answer 10 or -4 nfw or <math>n - 3 = \pm 7</math> oe or <math>n^2 - 6n - 40 [=0]</math></p> <p>or <b>M1</b> for <math>\sqrt{74} = \sqrt{(-3 - 2)^2 + (n - 3)^2}</math> oe</p>
4(b)	2 : 3 nfw	3	<p><b>B2</b> for <math>\overline{PL} = \frac{2}{5}\mathbf{q}</math> oe or <math>\overline{RL} = -\frac{3}{5}\mathbf{q}</math> oe</p> <p>or <b>M1</b> for correct vector route for <math>\overline{KL}</math> along the lines of the diagram or <math>\overline{PL} = \frac{1}{2}\mathbf{q} - \frac{1}{10}\mathbf{q}</math> oe or</p> <p><math>\overline{RL} = -\frac{1}{2}\mathbf{q} - \frac{1}{10}\mathbf{q}</math> oe</p>
5(a)(i)	11.7 or 11.66...	2	<b>M1</b> for $10^2 + (-6)^2$ oe
5(a)(ii)	(23, -14)	2	<p><b>B1</b> for one coordinate correct</p> <p>or for <math>\begin{pmatrix} 30 \\ -18 \end{pmatrix}</math> seen</p> <p>After 0 scored, <b>SC1</b> for (-14, 23)</p>
5(b)(i)	$4\mathbf{p} + \mathbf{q}$	1	
5(b)(ii)	$3\mathbf{p} + \frac{3}{5}\mathbf{q}$ oe simplified vector final answer	2	<p><b>B1</b> for <math>\overline{BX} = \frac{3}{5}\mathbf{q}</math> or <math>\overline{XB} = -\frac{3}{5}\mathbf{q}</math></p> <p>or <b>M1</b> for a correct route along the lines of the diagram</p>
5(b)(iii)	$4\mathbf{p} - \frac{2}{5}\mathbf{q}$ oe simplified vector final answer	2	<p><b>B1</b> for <math>\overline{CX} = -\frac{2}{5}\mathbf{q}</math> or <math>\overline{XC} = \frac{2}{5}\mathbf{q}</math></p> <p>or <b>M1</b> for a correct route along the lines of the diagram</p>

6(a)	Vector $3\mathbf{p}$ drawn 	1	
6(b)	Vector $\mathbf{q} - \mathbf{p}$ drawn 	1	If 0 scored in (a) and (b), award <b>SC1</b> for two correct lines with no/incorrect arrows
7(a)	$A$ positioned correctly 	1	
7(b)	$B$ positioned correctly 	1	
7(c)	$2\mathbf{q} - \mathbf{p}$ oe	2	<b>B1</b> for $2\mathbf{q}$ oe or for $-\mathbf{p}$ oe If 0 scored, <b>SC1</b> for answer $\mathbf{p} - 2\mathbf{q}$
8(a)(i)	$\begin{pmatrix} -7 \\ 1 \end{pmatrix}$ final answer	1	
8(a)(ii)	$4^2 + (\pm 3)^2$	<b>M1</b>	
	$1^2 + (\pm 5)^2$	<b>M1</b>	
	Correct concluding statement eg $\sqrt{25} < \sqrt{26}$ or $5 > 5.1[0]$ wrong or $ f  = 5$ $ g  = 5.099$ so $ f $ is not greater than $ g $	<b>A1</b>	

8(b)(i)	$-\frac{1}{3}\mathbf{a} + \mathbf{b}$ or $\frac{1}{3}(-\mathbf{a} + 3\mathbf{b})$	<b>1</b>	
8(b)(ii)	$\frac{1}{6}\mathbf{a} + \frac{1}{2}\mathbf{b}$ or $\frac{1}{6}(\mathbf{a} + 3\mathbf{b})$	<b>2</b>	<b>M1FT</b> for a correct vector route for $\overline{OQ}$
8(b)(iii)	$[\overline{AR} = ] -\frac{1}{2}\mathbf{a} + \frac{3}{2}\mathbf{b}$ or $\frac{1}{2}(-\mathbf{a} + 3\mathbf{b})$ or $-\frac{1}{2}(\mathbf{a} - 3\mathbf{b})$	<b>B2</b>	<b>M1</b> for $-\mathbf{a} + 3 \times \text{their (b)(ii)}$ or $-\frac{2}{3}\mathbf{a} + \frac{1}{2}\text{their(b)(i)} + 2 \times \text{their (b)(ii)}$
	$OQ = \frac{1}{3}OR$ , $OP = \frac{1}{3}OA$ and $P\hat{O}R = A\hat{O}R$		<b>M1</b> for <u>two</u> of $OQ = \frac{1}{3}OR$ , $OP = \frac{1}{3}OA$ or $P\hat{O}R = A\hat{O}R$
	$\overline{AR} = \frac{3}{2}\overline{PB}$ oe	<b>B1</b>	Dep on B2
	Similar triangles $O\hat{P}Q = O\hat{A}R$ or Similar triangles $O\hat{Q}P = O\hat{R}A$		Dep on B2
9(a)	$3\mathbf{p}$	<b>1</b>	
9(b)	$\frac{1}{2}(3\mathbf{p} + 5\mathbf{q})$ oe	<b>1</b>	
9(c)	$\frac{1}{2}(3\mathbf{p} + 9\mathbf{q})$ oe	<b>1</b>	<b>FT</b> $2\mathbf{q}$ oe + <i>their (b)</i> isw
9(d)	1.5 oe	<b>2</b>	<b>B1</b> for $[\overline{DE} = ]\mathbf{p} + 3\mathbf{q}$ ; or for $k(\mathbf{p} + 3\mathbf{q})$
10(a)	$\angle BAX = \angle OCX$ , alternate [angles] $\angle ABX = \angle COX$ , alternate [angles] $\angle AXB = \angle CXO$ , [vertically] opposite	<b>3</b>	<b>B1</b> for two correct pairs of angles <b>B1</b> for correct reason for one pair of angles
10(b)(i)	<b>4</b>	<b>1</b>	
10(b)(ii)	$9 - 6c$ or $3(3a - 2c)$	<b>2</b>	<b>B1</b> for answer $9a + kc$ or $ka - 6c$ ( $k \neq 0$ )
10(c)(i)	3 : 2	<b>2</b>	<b>B1</b> for $3k : 2k$ , where $k$ is an integer
10(c)(ii)	9 : 4	<b>1</b>	<b>FT</b> <i>their</i> $3^2 : \text{their } 2^2$
10(c)(iii)	4 : 5	<b>1</b>	
11(a)	7	<b>3</b>	<b>M1</b> for $ \overline{OP}  = \sqrt{(-3)^2 + (4)^2}$ <b>B1</b> for $ \overline{PQ}  = 2$
11(b)(i)	$\begin{pmatrix} -3 + 2k \\ 4 \end{pmatrix}$ oe	<b>1</b>	
11(b)(ii)	$4\frac{1}{2}$ oe	<b>2</b>	<b>B1</b> for expressing $\overline{OM}$ as a multiple (by 4) of $\overline{OT}$ or <b>B1</b> for $T$ is (6, 4); or for $\overline{OT} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$



<b>15 (a) (i)</b>	6.08	<b>1</b>	
<b>(ii)</b>	$\begin{pmatrix} 1 \\ 4 \end{pmatrix}$	<b>2</b>	<b>M1</b> for $\overrightarrow{AF} = \overrightarrow{AH} + \overrightarrow{HF}$ oe or <b>B1</b> for $\frac{1}{2}\begin{pmatrix} 6 \\ 1 \end{pmatrix}$
<b>(iii) (a)</b>	$\begin{pmatrix} 4 \\ -7 \end{pmatrix}$	<b>1</b>	
<b>(b)</b>	$\overrightarrow{GD} = 2\overrightarrow{FH}$ stated or appropriate numerical vector statement	<b>1</b>	dep
<b>(iv)</b>	(9.5, 3)	<b>1ft</b>	
<b>16 (a) (i)</b>	<b>b - a</b>	<b>1</b>	
<b>(ii)</b>	<b>3b - 2a</b>	<b>1</b>	
<b>(b) (i)</b>	$\frac{4}{3}\mathbf{a}$	<b>2FT</b>	<b>M1</b> for such as $\overrightarrow{BO} + \overrightarrow{OC} + \overrightarrow{CE}$ Or $BD - ED$ or $-\mathbf{b} + \mathbf{a} + AE$ Or <b>B1</b> for $(\overrightarrow{CE}) = \pm \frac{1}{3}$ their <b>(a)(ii)</b> Or $(\overrightarrow{DE}) = \pm \frac{2}{3}$ their <b>(a)(ii)</b>
<b>(ii)</b>	trapezium	<b>1</b>	
<b>17 (a) (i)</b>	Convincing argument	<b>3</b>	www e.g. need to see <b>b - a</b> and $\frac{5}{3}(\mathbf{b} - \mathbf{a})$ <b>B1</b> for $\overrightarrow{DE} = \mathbf{b} - \mathbf{a}$ oe <b>B1</b> for $\overrightarrow{DB} = \frac{2}{3}\mathbf{a}$ or $\overrightarrow{EC} = \frac{2}{3}\mathbf{b}$ oe soi
<b>(ii)</b>	9 : 25 oe	<b>2</b>	<b>B1</b> for at least 3 : 5 oe seen
<b>18(a)</b>	$\begin{pmatrix} -4 \\ -3 \end{pmatrix}$	<b>1</b>	
<b>(b)</b>	$\begin{pmatrix} -3 \\ -4 \end{pmatrix}$	<b>1</b>	
<b>(c)</b>	5 cao	<b>1</b>	

**19 (a) (i)**  $\begin{pmatrix} 4 \\ -5 \end{pmatrix}$  **1**

**(ii)** 6.4(0) to 6.41 or  $\sqrt{41}$  cao **1**

	(b) (i)	(a) $\mathbf{b} - \mathbf{a}$	1	
		(b) $3\mathbf{a} - \mathbf{a}$	1	
		(c) $4(\mathbf{b} - \mathbf{a})$	2	<b>B1</b> for correct unsimplified $\overline{CD}$ or for $3(\mathbf{b} - \mathbf{a})$
	(ii)	(a) $1 : 4$	1	
		(b) $1 : 15$	1	
20	(a)	(i) 6.08	1	
		(ii) $\begin{pmatrix} 2 \\ -1.5 \end{pmatrix}$	2	<b>B1</b> for $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$ or $\frac{1}{2}\begin{pmatrix} 6 \\ 1 \end{pmatrix}$ oe or <b>M1</b> for $(\overline{EH} =) \overline{EA} + \overline{AH}$
		(iii) $\begin{pmatrix} 2 \\ -1.5 \end{pmatrix}$	1	
		(iv) Equal and parallel	1	Dependent on (ii) and (iii) correct.
		(v) Shows $G$ is midpoint of $CD$	2	<b>M1</b> for $\begin{pmatrix} -3 \\ 0 \end{pmatrix} + \begin{pmatrix} -2 \\ -4 \end{pmatrix} + \begin{pmatrix} 6 \\ 1 \end{pmatrix}$ oe seen or <b>B1</b> for $(\overline{CD} =) 2\overline{CG} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$

Mega Lecture