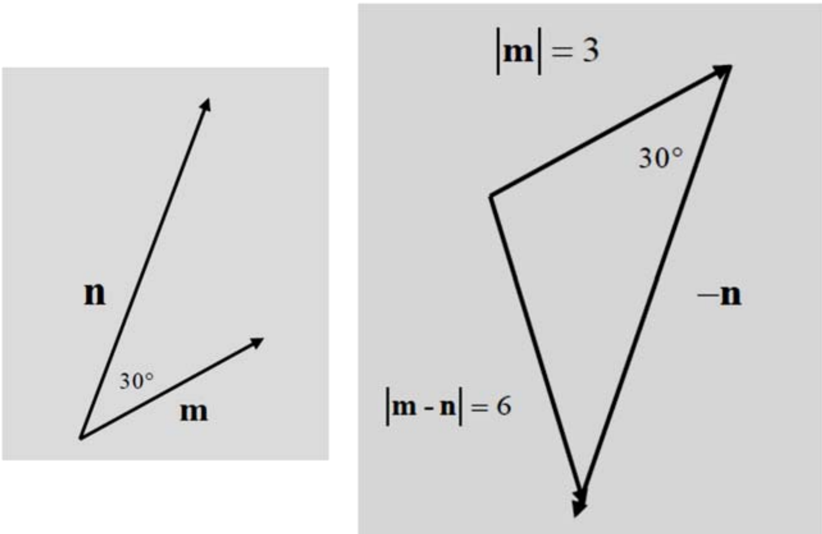
Year 11 to Year 12 Transition Paper

Vectors

Mark Scheme

Question	Scheme	Marks
1 (i)	Explains that **a** and **b** lie in the same direction oe	B1
		(1)
(ii)		M1
	Attempts $\dfrac{\sin 30°}{6} = \dfrac{\sin\theta}{3}$	M1
	$\theta = \text{awrt } 14.5°$	A1
	Angle between vector $\mathbf{m}$ and vector $\mathbf{m} - \mathbf{n}$ is awrt $135.5°$	A1
		(4)
		(5 marks)

Question	Scheme	Marks
2 (a)	Attempts $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ or similar	M1
	$\overrightarrow{AB} = 5\mathbf{i} + 10\mathbf{j}$	A1
		(2)
(b)	Finds length using Pythagoras: $\lvert AB \rvert = \sqrt{(5)^2 + (10)^2}$	M1
	$\lvert AB \rvert = 5\sqrt{5}$	A1 ft
		(2)
		(4 marks)

Question	Scheme	Marks
3 (a)	Attempts $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ or similar	M1
	$\overrightarrow{AB} = -9\mathbf{i} + 3\mathbf{j}$	A1
		(2)
(b)	Finds length using 'Pythagoras' $\lvert AB \rvert = \sqrt{(-9)^2 + (3)^2}$	M1
	$\lvert AB \rvert = 3\sqrt{10}$	A1ft
		(2)
		(4 marks)

Question	Scheme	Marks
4(a)	$\left(\overrightarrow{BC}=\right)\begin{pmatrix}-2\\-7\end{pmatrix}+\begin{pmatrix}10\\11\end{pmatrix}\left(=\begin{pmatrix}8\\4\end{pmatrix}\right)$	M1
	$\begin{pmatrix}5\\8\end{pmatrix}+"\begin{pmatrix}8\\4\end{pmatrix}"$ **or** $\begin{pmatrix}10\\11\end{pmatrix}+"\begin{pmatrix}3\\1\end{pmatrix}"$	M1
	(13, 12)	A1
		(3)
(b)	e.g. $\begin{pmatrix}63\\211\end{pmatrix}-\begin{pmatrix}5\\8\end{pmatrix}\left(=\begin{pmatrix}58\\203\end{pmatrix}\right)$ **with** e.g. "58" ÷ 2 (=29) **and** "203" ÷ 7 (=29) **OR** e.g. $\begin{pmatrix}63\\211\end{pmatrix}-\begin{pmatrix}3\\1\end{pmatrix}\left(=\begin{pmatrix}60\\210\end{pmatrix}\right)$ **with** e.g. "60" ÷ 2 (=30) **and** "210" ÷ 7 (=30)	M1
	Proof (with justification)	A1ft
		(2)
		(5 marks)

Question	Scheme	Marks
5	M2 for $\sqrt{5^2+(-12)^2}$ **or** $\sqrt{(-5)^2+12^2}$ **or** $\sqrt{5^2+12^2}$ If not M2 then M1 for $\begin{pmatrix}6\\-9\end{pmatrix}-\begin{pmatrix}1\\3\end{pmatrix}$ or $\begin{pmatrix}6\\-9\end{pmatrix}+\begin{pmatrix}-1\\-3\end{pmatrix}\left(=\begin{pmatrix}5\\-12\end{pmatrix}\right)$ **or** or $\begin{pmatrix}1\\3\end{pmatrix}-\begin{pmatrix}6\\-9\end{pmatrix}$ or $\begin{pmatrix}1\\3\end{pmatrix}+\begin{pmatrix}-6\\9\end{pmatrix}\left(=\begin{pmatrix}-5\\12\end{pmatrix}\right)$	M2
	13	A1
		(3)
		(3 marks)

Question	Scheme	Marks
6	$\overrightarrow{PM} = -\frac{3}{2}\mathbf{a} - \frac{3}{4}\mathbf{b} + 4\mathbf{a} + \frac{1}{2}(2\mathbf{b} - 4\mathbf{a})\left(= \frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}\right)$ $\overrightarrow{AM} = 4\mathbf{a} + \frac{1}{2}(2\mathbf{b} - 4\mathbf{a})(= 2\mathbf{a} + \mathbf{b})$ $\overrightarrow{AM} = 2\mathbf{b} + \frac{1}{2}(4\mathbf{a} - 2\mathbf{b})(= 2\mathbf{a} + \mathbf{b})$ $\overrightarrow{MA} = \frac{1}{2}(2\mathbf{b} - 4\mathbf{a}) - 2\mathbf{b}\,(= -2\mathbf{a} - \mathbf{b})$ $\overrightarrow{MA} = \frac{1}{2}(4\mathbf{a} - 2\mathbf{b}) - 4\mathbf{a}\,(= -2\mathbf{a} - \mathbf{b})$	M1
	$(AP : PM =)\left\lvert\frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}\right\rvert : \left\lvert\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}\right\rvert$ oe $(AP : AM =)\left\lvert\frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b}\right\rvert : \lvert 2\mathbf{a} + \mathbf{b}\rvert (= 3:4)$ oe $(AM : PM =)\lvert 2\mathbf{a} + \mathbf{b}\rvert : \left\lvert\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}\right\rvert (= 4:1)$ oe $AP = 3PM$ oe eg $\frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} = 3(\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b})$ oe $AM = \frac{4}{3}AP$ oe $AM = 4PM$ oe	M1
	3:1	A1
		(3)
		(3 marks)

Notes

M1: for finding $\overrightarrow{PM}$ or $\overrightarrow{AM}$ or $\overrightarrow{MA}$
M1: For use of a correct ratio or fraction linking *AP* and *PM* **or** *AP* and *AM* **or** *AM* and *PM* (in either order) vectors must be in form $p\mathbf{a} + q\mathbf{b}$
A1: See scheme

Question	Scheme		Marks
7(a)	$-\frac{2}{3}\mathbf{a}+2\mathbf{b}$		M1
	$-\frac{2}{3}\mathbf{a}+2\mathbf{b}$		A1
			(2)
(b)	$\overrightarrow{OP}=2\mathbf{a}+k\left(-\frac{2}{3}\mathbf{a}+2\mathbf{b}\right)$		M1
	$2\mathbf{a}-\frac{2}{3}k\mathbf{a}=0$		M1
	$k=3$ $\overrightarrow{OP}=\text{"3"}\times\text{"2}\mathbf{b}\text{"}$ (Alternative for M1M1 $\overrightarrow{OP}:2\text{a}=2\text{b}:\frac{2}{3}\text{a}$)		M1
	$6\mathbf{b}$		A1
			(4)
(c)	$\overrightarrow{AQ}=-\frac{4}{3}\mathbf{a}+2\times\left(\text{"}-\frac{2}{3}\mathbf{a}+2\mathbf{b}\text{"}\right)$		M1
	$\overrightarrow{AQ}=-\frac{8}{3}\mathbf{a}+4\mathbf{b}$		A1
	$\overrightarrow{AB}=-2\mathbf{a}+3\mathbf{b}$ **or**	$\overrightarrow{BQ}=-\frac{2}{3}\mathbf{a}+\mathbf{b}$	B1
	$\overrightarrow{AQ}=\frac{4}{3}\overrightarrow{AB}\ \therefore A,B$ and Q are collinear	$\overrightarrow{AB}=3\overrightarrow{BQ}\ \therefore A,B$ and Q are collinear	A1
			(4)
(c) **Alt**	$\overrightarrow{BQ}=-3\mathbf{b}+\frac{2}{3}\mathbf{a}+2\times\left(\text{"}-\frac{2}{3}\mathbf{a}+2\mathbf{b}\text{"}\right)$		M1
	$\overrightarrow{BQ}=-\frac{2}{3}\mathbf{a}+\mathbf{b}$		A1
	$\overrightarrow{AB}=-2\mathbf{a}+3\mathbf{b}$ **or**	$\overrightarrow{AQ}=-\frac{8}{3}\mathbf{a}+4\mathbf{b}$	B1
	$\overrightarrow{AB}=3\overrightarrow{BQ}\ \therefore A,B$ and Q are collinear	$\overrightarrow{AQ}=4\overrightarrow{BQ}\ \therefore A,B$ and Q are collinear	A1
			(4)
			(10 marks)