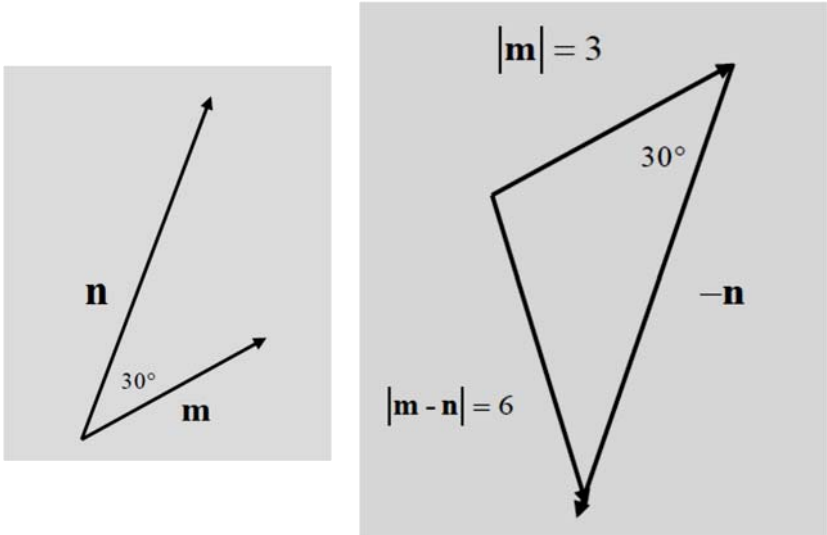


Year 11 to Year 12 Transition Paper

Vectors

Mark Scheme

Question	Scheme	Marks
1 (i)	Explains that a and b lie in the same direction or	B1
		(1)
(ii)		M1
	Attempts $\frac{\sin 30^\circ}{6} = \frac{\sin \theta}{3}$	M1
	$\theta = \text{awrt } 14.5^\circ$	A1
	Angle between vector m and vector m - 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: $ AB = \sqrt{(5)^2 + (10)^2}$	M1
	$ AB = 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' $ AB = \sqrt{(-9)^2 + (3)^2}$	M1
	$ AB = 3\sqrt{10}$	A1ft
		(2)
		(4 marks)

Question	Scheme	Marks
4(a)	$(\overline{BC} =) \begin{pmatrix} -2 \\ -7 \end{pmatrix} + \begin{pmatrix} 10 \\ 11 \end{pmatrix} (= \begin{pmatrix} 8 \\ 4 \end{pmatrix})$	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. $\begin{pmatrix} 63 \\ 211 \end{pmatrix} - \begin{pmatrix} 5 \\ 8 \end{pmatrix} (= \begin{pmatrix} 58 \\ 203 \end{pmatrix})$ with e.g. "58" $\div 2 (=29)$ and "203" $\div 7 (=29)$ OR e.g. $\begin{pmatrix} 63 \\ 211 \end{pmatrix} - \begin{pmatrix} 3 \\ 1 \end{pmatrix} (= \begin{pmatrix} 60 \\ 210 \end{pmatrix})$ with e.g. "60" $\div 2 (=30)$ and "210" $\div 7 (=30)$	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 $\begin{pmatrix} 6 \\ -9 \end{pmatrix} + \begin{pmatrix} -1 \\ -3 \end{pmatrix} (= \begin{pmatrix} 5 \\ -12 \end{pmatrix})$ or or $\begin{pmatrix} 1 \\ 3 \end{pmatrix} - \begin{pmatrix} 6 \\ -9 \end{pmatrix}$ or $\begin{pmatrix} 1 \\ 3 \end{pmatrix} + \begin{pmatrix} -6 \\ 9 \end{pmatrix} (= \begin{pmatrix} -5 \\ 12 \end{pmatrix})$	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
	$(AP : PM =) \left \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} \right : \left \frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b} \right \text{ oe}$ $(AP : AM =) \left \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} \right : 2\mathbf{a} + \mathbf{b} (= 3 : 4) \text{ oe}$ $(AM : PM =) 2\mathbf{a} + \mathbf{b} : \left \frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b} \right (= 4 : 1) \text{ oe}$ $AP = 3PM \text{ oe eg } \frac{3}{2}\mathbf{a} + \frac{3}{4}\mathbf{b} = 3\left(\frac{1}{2}\mathbf{a} + \frac{1}{4}\mathbf{b}\right) \text{ oe}$ $AM = \frac{4}{3}AP \text{ oe}$ $AM = 4PM \text{ oe}$	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	
	$k = 3$ $\overrightarrow{OP} = "3" \times "2\mathbf{b}"$	M1	
	(Alternative for M1M1 $\overrightarrow{OP} : 2\mathbf{a} = 2\mathbf{b} : \frac{2}{3}\mathbf{a}$)		
	6b	A1	
		(4)	
(c)	$\overrightarrow{AQ} = -\frac{4}{3}\mathbf{a} + 2 \times \left(-\frac{2}{3}\mathbf{a} + 2\mathbf{b}\right)$	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	$\overrightarrow{BQ} = -3\mathbf{b} + \frac{2}{3}\mathbf{a} + 2 \times \left(-\frac{2}{3}\mathbf{a} + 2\mathbf{b}\right)$	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)