

AS and A-level MATHS

Vectors

Mark scheme

Specification content coverage: J1, J2, J3, J4, J5

Question	Solutions	Mark
1	Displacement	1
	Total	1
2	$8\mathbf{b} - 2\mathbf{a}$	1
	Total	1
3	$\overrightarrow{QM} = \overrightarrow{QP} + \overrightarrow{PM}$ $\overrightarrow{QM} = -\mathbf{q} + \frac{1}{2}\mathbf{r}$ or $\overrightarrow{QM} = \frac{1}{2}\mathbf{r} - \mathbf{q}$	2 (1 mark for each term)
	Total	2
4	$(3\mathbf{i} - \mathbf{j}) - 2(2\mathbf{i} - 3\mathbf{j})$ $= 3\mathbf{i} - \mathbf{j} - 4\mathbf{i} + 6\mathbf{j}$	1
	$= -\mathbf{i} + 5\mathbf{j}$	1
	Total	2
5 (a)	$\sqrt{(-3)^2 + 4^2} = 5$ $\frac{1}{5} \begin{pmatrix} -3 \\ 4 \end{pmatrix}$ or $\begin{pmatrix} -\frac{3}{5} \\ \frac{4}{5} \end{pmatrix}$ $\tan \theta = \frac{3}{4}$ $\theta = 36.9^\circ$	1 1 (or i, j form) 1 (use of trig)
	Total	4

6	$(4 \cos 30)\mathbf{i} - (4 \sin 30)\mathbf{j}$ $= 2\mathbf{i}\sqrt{3} - 2\mathbf{j}$	1 1 (or decimal equivalent)
	Total	2
7 (a)	$\overrightarrow{OA} = 4\mathbf{i} + 5\mathbf{j}$	1
	Total	1
7 (b)	$\overrightarrow{AB} = (6\mathbf{i} + 3\mathbf{j}) - (4\mathbf{i} + 5\mathbf{j})$ $= 2\mathbf{i} - 2\mathbf{j}$ $ \overrightarrow{AB} = \sqrt{2^2 + (-2)^2}$ $= 2\sqrt{2}$	1 1 (must be simplified)
	Total	2
8	$(3\mathbf{i} - 4\mathbf{j}) + (\mathbf{i} + p\mathbf{j}) = k(2\mathbf{i} - 3\mathbf{j})$ Equate coeffs \mathbf{i} : $4 = 2k \Rightarrow k = 2$ Equate coeffs \mathbf{j} : $-4 + p = -3k$ $\Rightarrow -4 + p = -6$ $p = -2$	1 1 1 1
	Total	4
9 (a)	$\sqrt{4^2 + (-9)^2}$ $= 9.85 \text{ km (3 sf)}$	1 1 (or equivalent)
	Total	2
9 (b)	$\tan \theta = \frac{9}{4}$ $\theta = 66.0^\circ$ Bearing = $90 + 66.0 = 156^\circ$	1 (use of trig) 1 (must be the bearing)
	Total	2
9 (c)	$\mathbf{v} = \frac{4\mathbf{i} - 9\mathbf{j}}{\frac{3}{4}}$ $\mathbf{v} = \left(\frac{16}{3}\mathbf{i} - 12\mathbf{j}\right) \text{ kmh}^{-1}$	1 (use of displacement/time) 1
	Total	2

10	$\overrightarrow{XY} = \begin{pmatrix} 6 \\ -12 \end{pmatrix}$ $\overrightarrow{OZ} = \begin{pmatrix} -1 \\ 3 \end{pmatrix} + \frac{3}{4} \begin{pmatrix} 6 \\ -12 \end{pmatrix} \text{ or}$ $\overrightarrow{OZ} = \begin{pmatrix} -1 \\ 3 \end{pmatrix} + \frac{3}{2} \begin{pmatrix} 6 \\ -12 \end{pmatrix}$ $\overrightarrow{OZ} = \begin{pmatrix} 3.5 \\ -6 \end{pmatrix} \text{ or } \overrightarrow{OZ} = \begin{pmatrix} 8 \\ -15 \end{pmatrix}$	<p>1</p> <p>1</p> <p>1 (must have both)</p>
Total		3
11	$\overrightarrow{OA} = \sqrt{x^2 + (2x-1)^2}$ $= \sqrt{5x^2 - 4x + 1}$ $5x^2 - 4x + 1 = 34$ $5x^2 - 4x - 33 = 0$ $(5x + 11)(x - 3) = 0$ $x = -\frac{11}{5}, 3$ $\overrightarrow{OA} = -\frac{11}{5}\mathbf{i} - \frac{27}{5}\mathbf{j} \text{ or } \overrightarrow{OA} = 3\mathbf{i} + 5\mathbf{j}$	<p>1</p> <p>1</p> <p>1</p> <p>1 (must have both)</p>
Total		4
TOTAL		32