

Vectors

Foundation and Higher tiers

Total marks: 44

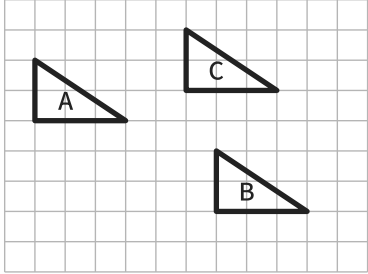
Marks

- M** Method mark, for a correct method. It can be implied by a correct answer.
- A** Accuracy mark, for a correct answer. It needs the method mark before it.
- B** A mark for a correct value or statement, with or without working.
- ft** Follow through: the mark is given for using an earlier wrong answer correctly.
- oe** Or equivalent.
- [a, b]** Any value from a to b inclusive.

Questions

Q	Skill	Spec	Tier	Grade	Calculator	Marks
1	Translations as column vectors	G24	Foundation	2	No	3
2	Combining translations	G24	Foundation	3	No	2
3	Column vector arithmetic	G25	Common	4	No	3
4	Draw a vector	G25	Common	4	No	2
5	Parallel column vectors	G25	Common	5	No	1
6	Equations with column vectors	G25 A17	Common	5	No	3
7	Vectors on a grid of parallelograms	G25	Common	5	No	3
8	Vector paths and the midpoint	G25	Common	6	No	3
9	Vectors with a ratio	G25	Common	7	No	3
10	Vector proof: parallel lines	G25	Higher	7	No	3
11	Parallel column vectors with an unknown	G25 A17	Common	7	No	3
12	Vector proof: points on a straight line	G25	Higher	8	No	5
13	Vector problem: where two lines meet	G25	Higher	9	No	5
14	Vector problem: extending a line	G25	Higher	9	No	5
	Total					44

Question 1 G24 · Foundation · Grade 2 · 3 marks

Q	Answer	Mark	Comments
1(a)	$\begin{pmatrix} 6 \\ -3 \end{pmatrix}$	B1	
1(b)	correct shape C 	B2	B1 for a translation of A by $\begin{pmatrix} 5 \\ k \end{pmatrix}$ or by $\begin{pmatrix} k \\ 1 \end{pmatrix}$

Question 2 G24 · Foundation · Grade 3 · 2 marks

Q	Answer	Mark	Comments
2	$\begin{pmatrix} -2 \\ 3 \end{pmatrix}$	B2	B1 for one correct component

Question 3 G25 · Common · Grade 4 · 3 marks

Q	Answer	Mark	Comments
3(a)	$\begin{pmatrix} 9 \\ -3 \end{pmatrix}$	B1	
3(b)	$2\mathbf{b} = \begin{pmatrix} -4 \\ 8 \end{pmatrix}$ or one correct component	M1	
	$\begin{pmatrix} 7 \\ -9 \end{pmatrix}$	A1	

Question 4 G25 · Common · Grade 4 · 2 marks

Q	Answer	Mark	Comments
4	an arrow 5 squares right and 1 square down 	B2	B1 for $2\mathbf{p}$ or $-\mathbf{q}$ drawn correctly, or the right line with no arrow

Question 5 G25 · Common · Grade 5 · 1 mark

Q	Answer	Mark	Comments
5	$\begin{pmatrix} 4 \\ -6 \end{pmatrix}$	B1	

Question 6 G25 A17 · Common · Grade 5 · 3 marks

Q	Answer	Mark	Comments
6	$6 + m = 1$ or $2k - 5 = 7$	M1	oe
	$k = 6$	A1	
	$m = -5$	A1	

Question 7 G25 · Common · Grade 5 · 3 marks

Q	Answer	Mark	Comments
7(a)	$3\mathbf{a} + \mathbf{b}$	B1	
7(b)	$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$ or one correct part	M1	oe, a correct route
	$-2\mathbf{a} + 2\mathbf{b}$	A1	

Question 8 G25 · Common · Grade 6 · 3 marks

Q	Answer	Mark	Comments
8(a)	$-\mathbf{a} + \mathbf{b}$	B1	oe
8(b)	$\overrightarrow{OM} = \mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a})$	M1	oe, a correct route with their AB
	$\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$	A1	with no errors

Question 9 G25 · Common · Grade 7 · 3 marks

Q	Answer	Mark	Comments
9	$\overrightarrow{OB} = \mathbf{a} + \mathbf{c}$	M1	oe
	$\overrightarrow{CD} = -\mathbf{c} + \frac{1}{4}(\mathbf{a} + \mathbf{c})$	M1	oe, a correct route
	$\frac{1}{4}\mathbf{a} - \frac{3}{4}\mathbf{c}$	A1	oe

Question 10 G25 · Higher · Grade 7 · 3 marks

Q	Answer	Mark	Comments
10	$\vec{OX} = \frac{2}{3}\mathbf{a}$ or $\vec{OY} = \frac{2}{3}\mathbf{b}$	M1	
	$\vec{XY} = -\frac{2}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$	M1	oe
	$\vec{XY} = \frac{2}{3}(\mathbf{b} - \mathbf{a}) = \frac{2}{3}\vec{AB}$ so XY is parallel to AB	A1	with $\vec{AB} = \mathbf{b} - \mathbf{a}$ seen

Question 11 G25 A17 · Common · Grade 7 · 3 marks

Q	Answer	Mark	Comments
11	$k\mathbf{a} + \mathbf{b} = \begin{pmatrix} 2k-3 \\ -k+4 \end{pmatrix}$	M1	oe
	$2k - 3 = 2(4 - k)$	M1	oe, the top part is twice the bottom part
	$\frac{11}{4}$	A1	oe, 2.75

Question 12 G25 · Higher · Grade 8 · 5 marks

Q	Answer	Mark	Comments
12(a)	$\vec{OD} = \frac{2}{3}(\mathbf{a} + \mathbf{c})$	M1	oe
	$\vec{AD} = -\frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{c}$ or $\vec{AE} = -\frac{1}{2}\mathbf{a} + \mathbf{c}$	M1	oe
	both $\vec{AD}$ and $\vec{AE}$ correct	A1	
	$\vec{AE} = \frac{3}{2}\vec{AD}$, so they are parallel, and they share the point A	A1	a complete proof
12(b)	2 : 1	B1	oe, ft their multiple in (a)

Question 13 G25 · Higher · Grade 9 · 5 marks

Q	Answer	Mark	Comments
13	$\vec{OM} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$ and $\vec{BD} = \frac{2}{3}\mathbf{a} - \mathbf{b}$	M1	oe
	$\vec{OX} = k(\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b})$ and $\vec{OX} = \mathbf{b} + t(\frac{2}{3}\mathbf{a} - \mathbf{b})$	M1	oe, two routes to X
	$\frac{1}{2}k = \frac{2}{3}t$ and $\frac{1}{2}k = 1 - t$	M1	equating the parts in $\mathbf{a}$ and in $\mathbf{b}$
	$k = \frac{4}{5}$ or $t = \frac{3}{5}$	M1	solving their equations
	4 : 1	A1	

Question 14 G25 · Higher · Grade 9 · 5 marks

Q	Answer	Mark	Comments
14	$\vec{OP} = \frac{3}{4}\mathbf{a}$ and $\vec{OQ} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$	M1	oe
	$\vec{PQ} = -\frac{1}{4}\mathbf{a} + \frac{1}{2}\mathbf{b}$	M1	oe
	$\vec{PR} = -\frac{3}{4}\mathbf{a} + k\mathbf{b}$ where $\vec{OR} = k\mathbf{b}$	M1	oe, and $\vec{PR}$ is a multiple of $\vec{PQ}$
	$\vec{PR} = 3\vec{PQ}$ so $k = \frac{3}{2}$	M1	oe, matching the parts in $\mathbf{a}$ and then in $\mathbf{b}$
	2 : 1	A1	