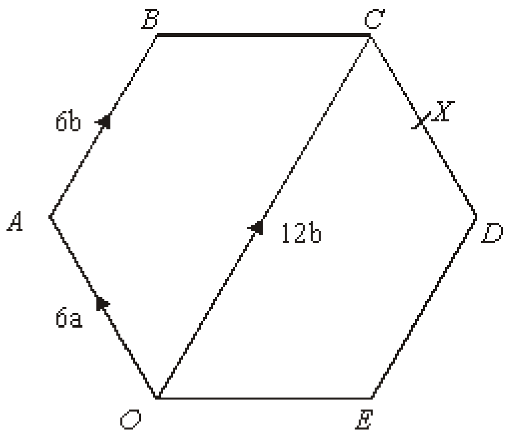
Q1.



The diagram shows a regular hexagon *OABCDE*.

$\overline{OA} = \overline{DC} = 6\mathbf{a}$ $\overline{OC} = 12\mathbf{b}$

(a) Find $\overline{BC}$, in terms of **a** and **b**.

....

(1)

X is the midpoint of *CD*.

Y is the point on *BC* extended, such that *BC* : *CY* = 3 : 2

(b) Prove that *O*, *X* and *Y* lie on the same straight line.

(4)
(Total 5 marks)

Q2.

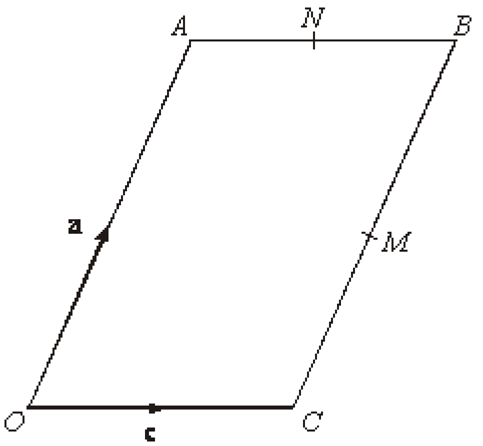


Diagram **NOT** accurately drawn

OABC is a parallelogram.
M is the midpoint of *CB*.
N is the midpoint of *AB*.

$\overrightarrow{OA} = a$
$\overrightarrow{OC} = c$

(a) Find, in terms of **a** and/or **c**, the vectors

(i) $\overrightarrow{MB}$

....

(ii) $\overrightarrow{MN}$

....

(2)

(b) Show that CA is parallel to MN.

(2)
(Total 4 marks)

Q3.

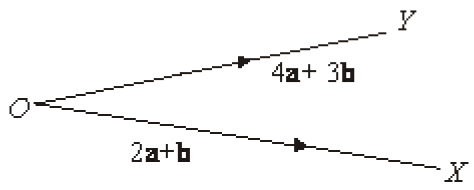


Diagram **NOT** accurately drawn

$\overrightarrow{OX} = 2\mathbf{a} + \mathbf{b}$
$\overrightarrow{OY} = 4\mathbf{a} + 3\mathbf{b}$

(a) Express the vector $\overrightarrow{XY}$ in terms of **a** and **b**.
Give your answer in its simplest form.

....
(2)

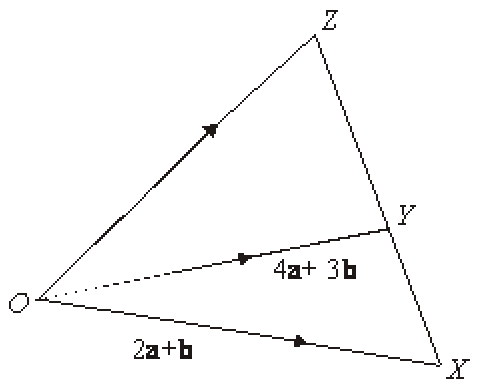


Diagram **NOT** accurately drawn

XYZ is a straight line.
XY : *YZ* = 2 : 3.

(b) Express the vector $\overrightarrow{OZ}$ in terms of **a** and **b**.
Give your answer in its simplest form.

....
(3)
(Total 5 marks)

Q4.

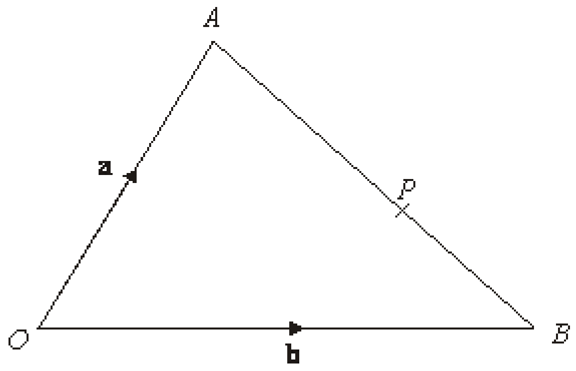


Diagram **NOT** accurately drawn

OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$

$\overrightarrow{OB} = \mathbf{b}$

(a) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**.

$\overrightarrow{AB}$ = ...

(1)

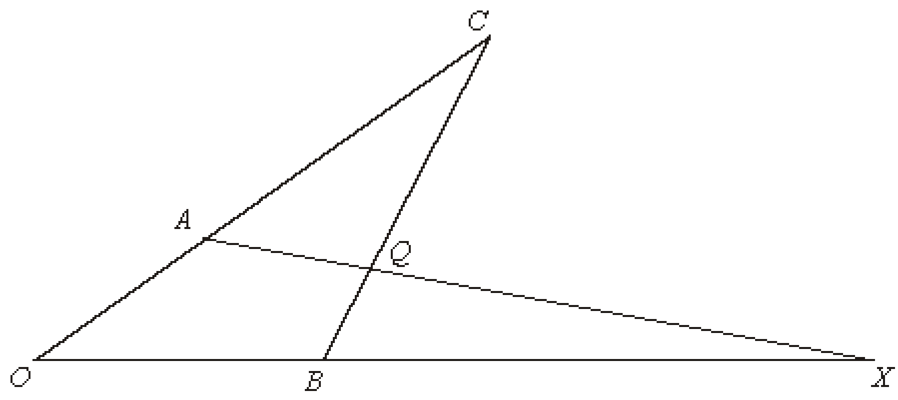
P is the point on *AB* such that *AP* : *PB* = 3 : 2

(b) Show that $\overrightarrow{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$

(3)
(Total 4 marks)

Q5.

Diagram **NOT** accurately drawn



In the diagram,

$\overrightarrow{OA} = 4\mathbf{a}$ and $\overrightarrow{OB} = 4\mathbf{b}$

OAC, OBX and BQC are all straight lines

$AC = 2OA$ and $BQ:QC = 1:3$

(a) Find, in terms of **a** and **b**, the vectors which represent

(i) $\overrightarrow{BC}$

....

(ii) $\overrightarrow{AQ}$

....

(4)

Given that $\overrightarrow{BX} = 8\mathbf{b}$

(b) Show that AQX is a straight line.

(3)
(Total 7 marks)

M1.

		Working	Answer	Mark	Additional Guidance
	(a)	– 6**b** – 6**a** + 12**b**	6**b** – 6**a**	1	**B1** cao
QWC (ii, iii)	(b)	$\overline{BC}$ = –6**b** – 6**b** + 12**b** = 6**b** – 6**a** $\overline{CY}$ = 4**b** – 4**a** $\overline{OX}$ = 12**b** – 3**a** $\overline{OY}$ = 12**b** + 4**b**–4**a** = 16**b** – 4**a** $\overline{OX}$: $\overline{OY}$ = 3 : 4		4	**M1** for attempt to find $\overline{CY}$ or sight of ⅔(6**b** – 6**a**) **M1** for attempt to find $\overline{OX}$ or sight of 12**b** – 3**a** **M1** for attempt to find $\overline{OY}$ or sight of 12**b** + 4**b** – 4**a** **A1** for *OX* : *OY* = 3 : 4 shows that *OX* and *OY* are co-linear **QWC: labelling must be consistent and correct**
					Total for Question: 5 marks

M2.

	Working	Answer	Mark	Additional Guidance
(a)(i)		$\frac{1}{2}$**a**	2	**B1** for $\frac{1}{2}$ **a** oe
(ii)		$\frac{1}{2}$**a** – $\frac{1}{2}$**c**		**B1** for $\frac{1}{2}$ **a** – $\frac{1}{2}$ **c** oe
(b)	$\overline{CA}$ = **a** – **c** $\overline{MN} = \frac{1}{2}$ (**a** – **c**)	$\overline{MN} = \frac{1}{2}\overline{CA}$	2	**B1** for ($\overline{CA}$ =) **a** – **c** or $\overline{CB} + \overline{BA}$ oe **B1** (dep) for correct proof, e.g. '$\overline{CA} = 2\overline{MN}$'

				or '$\overrightarrow{CA}$ is a multiple of $\overrightarrow{MN}$' (NB: condone absence/misuse of vector notation)
Total for Question: 4 marks				

M3.

	Working	Answer	Mark	Additional Guidance
(a)	4**a** + 3**b** – (2**a** + **b**)	2**a** + 2**b**	2	**M1** ($\overrightarrow{OX} + \overrightarrow{XY} = \overrightarrow{OY}$) or 4**a** + 3**b** – (2**a** + **b**) oe **or** an intention to do $\overrightarrow{XO} + \overrightarrow{OY}$ eg. –2**a** + **b** + 4**a** + 3**b** **A1** cao
(b)	$\overrightarrow{XZ}$ = 3**a** + 3**b** or $\overrightarrow{XZ}$ = 5**a** + 5**b** $\overrightarrow{OZ} = \overrightarrow{OX} + \overrightarrow{XZ}$ = 2**a** + **b** + 5**a** + 5**b**	7**a** + 6**b**	3	**M1** for $\overrightarrow{OZ} = \overrightarrow{OX} + \overrightarrow{XZ}$ oe **or** $\overrightarrow{OZ} = \overrightarrow{OY} + \overrightarrow{YZ}$ oe (may be given in terms of **a** and **b**) **M1**(indep) for $(\overrightarrow{YZ} =)\frac{3}{2}$("2**a** + 2**b**") (= 3**a** + 3**b**) **or** $(\overrightarrow{XZ} =)\frac{5}{2}$ ("2**a** + 2**b**") (= 5a **+** 5**b**) **A1** cao SC : **B2** for 7**a** + 9**b** or 7**a** + 11**b**
Total for Question: 5 marks				

M4.

	Working	Answer	Mark	Additional Guidance
(a)		**b** – **a**	1	**B1** for **b** – **a** or – **a** + **b** oe

(b)	$\vec{OP} = \vec{OA} + \vec{AP}$ $\vec{OP} = a + \frac{3}{5}(\mathbf{b} - \mathbf{a})$ $\vec{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$	proof	3	**M1** for $\vec{OP} = \vec{OA} + \vec{AP}$ oe or $\vec{OP} = \vec{OB} + \vec{BP}$ oe **M1** for $\overline{AP} = \frac{3}{5}$ × "(**b** – **a**)" oe or $\overline{BP} = \frac{2}{5}$ × "(**a** – **b**)" oe **A1** for **a** + $\frac{3}{5}$ × (**b** – **a**) oe or **b** + $\frac{2}{5}$ × (**a** – **b**) oe leading to given answer with correct expansion of brackets seen
				Total for Question: 4 marks

M5.

	Working	Answer	Mark	Additional Guidance
(a) (i) (ii)	$\overline{BC} = \overline{CO} + \overline{OB}$ $\overline{AQ} = \overline{AO} + \overline{OB} + \overline{BQ}$	12a + 4b 3b – a	4	**M1** $\overline{BC} = \overline{CO} + \overline{OB}$ **A1** cao

(b)	$\overrightarrow{OX} = 12b$, $\overrightarrow{AX} = -4a + 12b$ $= 4(-a + 3b)$	Correct reason, with correct working	3	**B1** $\overrightarrow{OX} = 12b$ **B1** $\overrightarrow{AX} = -4a + 12b$ **C1** convincing explanation
				Total for Question: 7 marks

E2. The use of vector notation in this question was generally poor. In part (a)(i), about half the candidates were able to score 1 mark for 1/2**a**. A common incorrect answer in part (a)(ii) was 1/2**a** + 1/2**c**. In part (b), about a quarter of the candidates were able to write down a correct vector for $\overrightarrow{CA}$ and show that *CA* is parallel to *MN*. Common correct answers here were and $\overrightarrow{CA} = 2\overrightarrow{MN}$ and $\overrightarrow{MN} = \frac{1}{2}$(**a** – **c**).

E3. Over 70% of candidates failed to gain any marks for this question. Fully correct solutions were seen from only 5% of candidates. Of those who made some attempt, most added the vectors, and those who attempted subtraction often did 4*a* + 3*b* – 2*a* + *b* omitting the brackets, they gained the method mark but not the accuracy mark. In part (b) most just ignored the 3/2 and just added or subtracted the vectors given.
It was rare to see a vector equation written down. A few realised the significance of XZ : YZ = 3 : 2 but applied it to OY or OX.

E4. **Specification A**

Part (a) was correctly answered by about half the candidates, but incorrect responses included (*ab*)/2, *a* + *b*, *a* – *b*, and *p*. It appeared that candidates were confused by part b, and it was noticeable that a lot of those who correctly responded to part (a) did not even attempt part (b). There were some very neat logical arguments but on the whole the responses were messy with lots of crossing out and arrows directing you to the next line of their answer. Of those who gained some credit the most common mistake was using PB instead of BP, (there was little appreciation that the opposite direction results in a negative vector), followed by those who missed out brackets and hence only multiplied part of the vector. Some candidates tried to draw a scale drawing as the proof. A few candidates tried to give a justification in words.

Specification B

Some candidates where able to write down a correct expression for the vector *AB* in terms of **a** and **b**. Part (b) proved to be a challenge, even for those who scored in part (a). The key ideas were to understand that *OP* = *OA* + *AP* by the triangle law and that *AP* = $\frac{3}{5}AB$. Those that did usually were able to expand the brackets correctly and achieve the correct given answer.