ADA PINPOINT TOPIC PACKS

(1)Vectors (13 Qns)
(2)Vector Arithmetic (0 Qns)

40_to_100_Percent_Pinpoint_AI_Pack

Time Allocation = 57mins , Max = 50 Marks

Calculated Grade Boundaries:

Grade	Marks
4-	3
4	6
4+	9
5-	12
5	14
5+	17
6-	20
6	23
6+	25
7-	28
7	31
7+	34
8-	37
8	39
8+	42
9-	45
9	48
9+	50

Question 1 (AO2): (No Calc) 32% of students got this right (3 marks)

15.

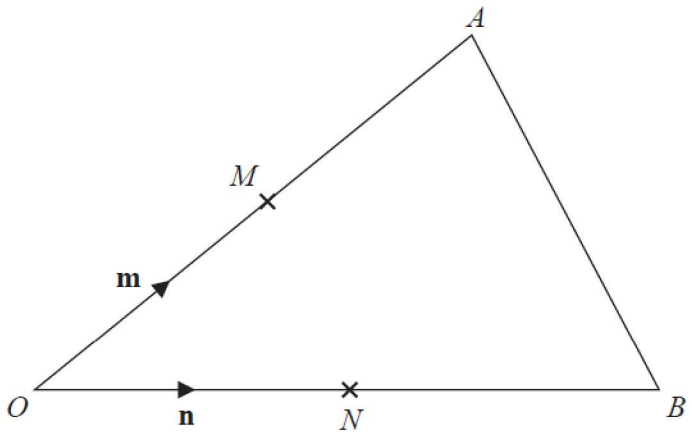


Diagram **NOT** accurately drawn

OAB is a triangle.
M is the midpoint of *OA*.
N is the midpoint of *OB*.

$\overrightarrow{OM} = \mathbf{m}$

$\overrightarrow{ON} = \mathbf{n}$

Show that *AB* is parallel to *MN*.

(Total 3 marks)

Question 2 (AO1): 31% of students got this right (4 marks)

17.

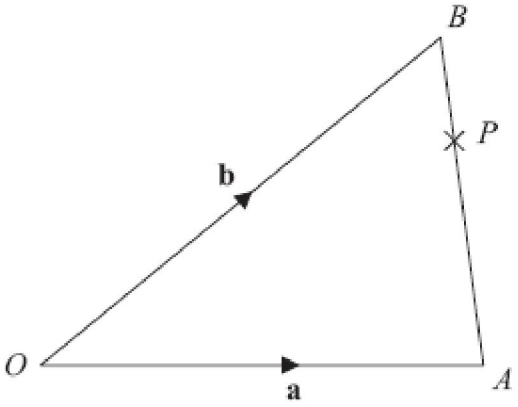


Diagram **NOT** accurately drawn

OAB is a triangle.

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

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

.....

(1)

P is the point on *AB* such that *AP* : *PB* = 3 : 1

(b) Find $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.

.....

(3)

(Total 4 marks)

Question 3 (AO2): 31% of students got this right (4 marks)

18.

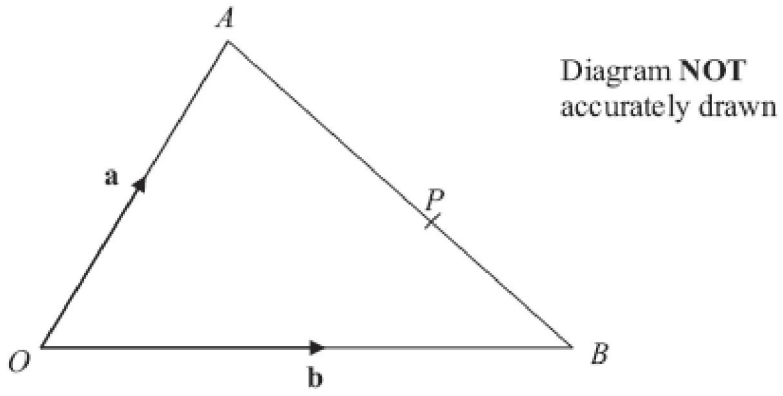


Diagram **NOT** accurately drawn

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)

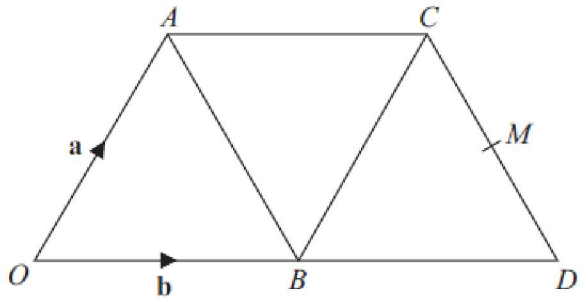
Question 4 (AO2): (No Calc) 27% of students got this right (5 marks)

18. *OACD* is a trapezium made from three equilateral triangles.

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

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

M is the midpoint of *CD*.



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

.....

(1)

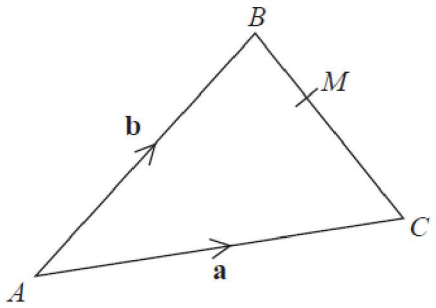
(b) Show that $\overrightarrow{OC}$ is parallel to $\overrightarrow{BM}$.

(4)

(Total 5 marks)

Question 5 (AO2): (No Calc) 26% of students got this right (1 marks)

16 a



M is the point such that $BM : MC$ is 1 : 2

Here is Burt's method to find $\overrightarrow{BM}$ in terms of **a** and **b**.

$$\begin{aligned}\overrightarrow{BC} &= \overrightarrow{BA} + \overrightarrow{AC} \\ &= -\mathbf{b} + \mathbf{a} \\ &= \mathbf{a} - \mathbf{b} \\ \overrightarrow{BM} &= \frac{1}{2}\overrightarrow{BC} \\ &= \frac{1}{2}(\mathbf{a} - \mathbf{b})\end{aligned}$$

(a) Evaluate Burt's method.

.....

.....

(1)

Question 6 (AO2): 18% of students got this right (4 marks)

15.

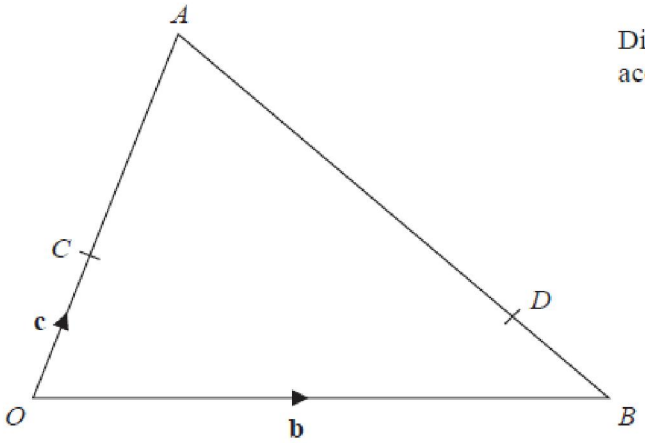


Diagram **NOT** accurately drawn

In the diagram,

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

$\overrightarrow{OC} = \mathbf{c}$

$\overrightarrow{OC} = \frac{1}{3}\overrightarrow{OA}$

$\overrightarrow{BD} = \frac{1}{4}\overrightarrow{BA}$

Find CD in terms of **b** and **c**.

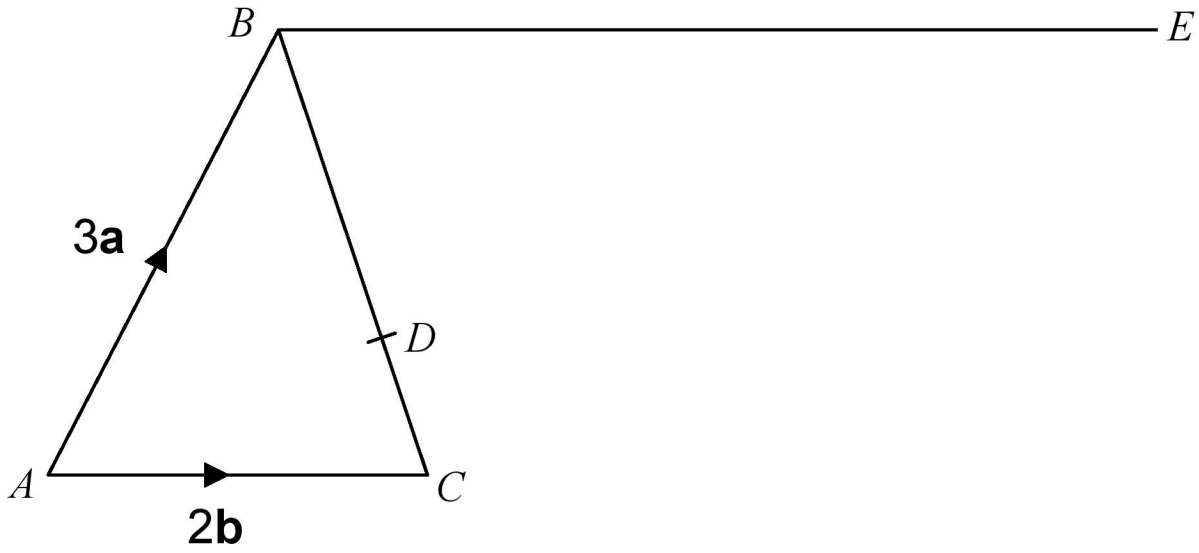
Give your answer in its simplest form.
You must show all your working.

.....

(Total 4 marks)

Question 7 (AO2): 17% of students got this right (4 marks)

19



The diagram shows triangle ABC.

$AI\rightarrow$ $3\mathbf{a}$

$A($ $\rightarrow$ $2\mathbf{b}$

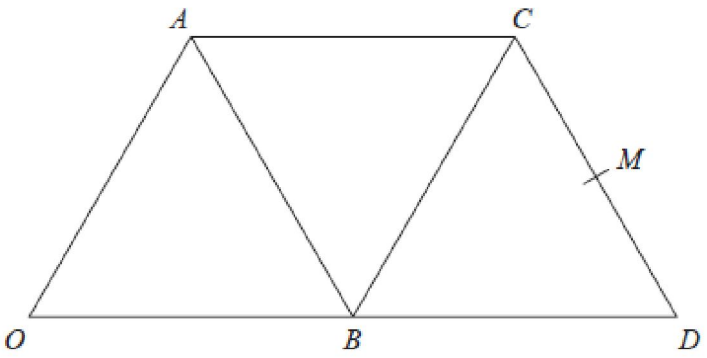
$E\rightarrow$ = $3AC$ $\rightarrow$

D is the point on BC such that $BD : DC = 3 : 1$

Prove that ADE is a straight line.

Question 8 (AO3): (No Calc) 13% of students got this right (3 marks)

20.



OACD is a trapezium and *OACB* is a parallelogram.
B is the midpoint of *OD*.
M is the midpoint of *CD*.

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

Given that $\overrightarrow{BM} = k \times \overrightarrow{OC}$ where k is a scalar,

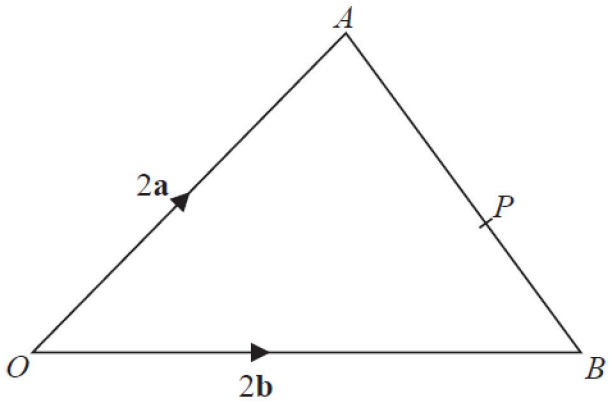
use a vector method to find the value of k.

.....

(Total for Question 20 is 3 marks)

Question 9 (AO3): 11% of students got this right (4 marks)

20



OAB is a triangle.
P is the point on AB such that $AP : PB = 5 : 3$

$\overrightarrow{OA} = 2\mathbf{a}$

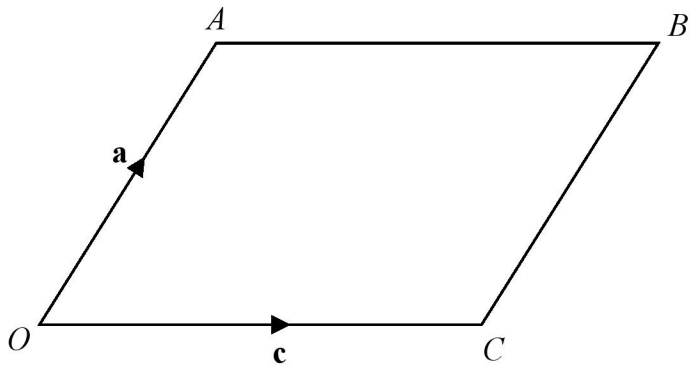
$\overrightarrow{OB} = 2\mathbf{b}$

$\overrightarrow{OP} = k(3\mathbf{a} + 5\mathbf{b})$ where k is a scalar quantity.

Find the value of k.

Question 10 (AO3): (No Calc) 8% of students got this right (4 marks)

19



$OABC$ is a parallelogram.

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

X is the midpoint of the line AC.
OCD is a straight line so that $OC : CD = k : 1$

Given that $\overrightarrow{XD} = 3\mathbf{c} - \frac{1}{2}\mathbf{a}$

find the value of k.

$k =$ .....

(Total for Question 19 is 4 marks)

Question 11 (AO2): 8% of students got this right (4 marks)

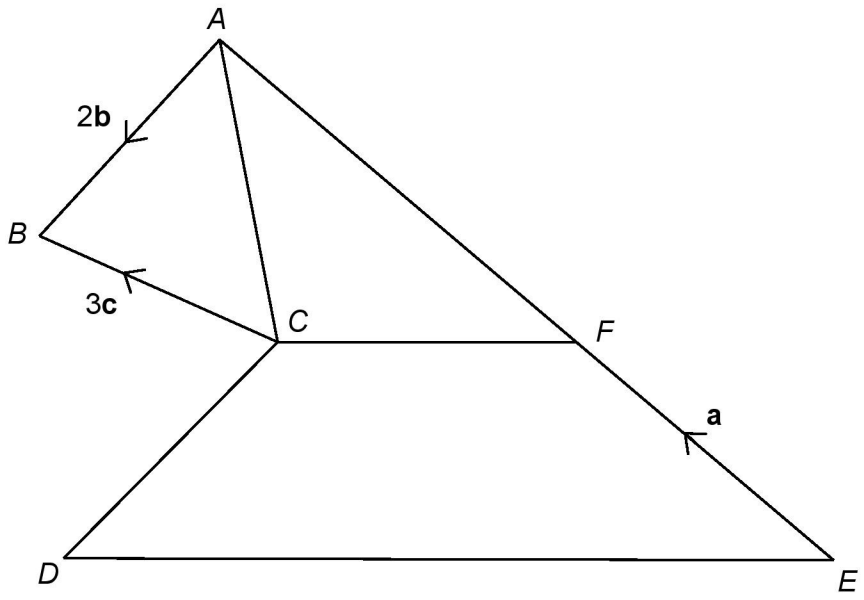
23 *AFE* is a straight line.

AF : *FE* = 3 : 2

DE is parallel to *CF.*

DE = 2*CF*

$\overrightarrow{EF} = \mathbf{a}$ $\overrightarrow{AB} = 2\mathbf{b}$ $\overrightarrow{CB} = 3\mathbf{c}$



Work out $\overrightarrow{DE}$ in terms of **a**, **b** and **c**.

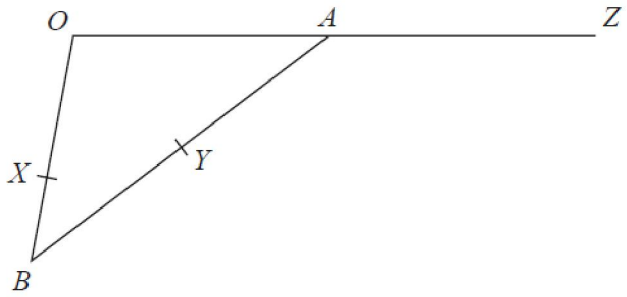
[4 marks]

Question Order Created by Pinpoint Learnings Automatic Differentiation Algorithmn

Answer _____

Question 12 (AO3): 7% of students got this right (5 marks)

21



OAB is a triangle.
A is the midpoint of *OZ*
Y is the midpoint of *AB*
X is a point on *OB*

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OX} = 2\mathbf{b}$ $\overrightarrow{XB} = \mathbf{b}$

Prove that *XYZ* is a straight line.

(Total for Question 21 is 5 marks)

Question 13 (AO3): 7% of students got this right (5 marks)

***20**

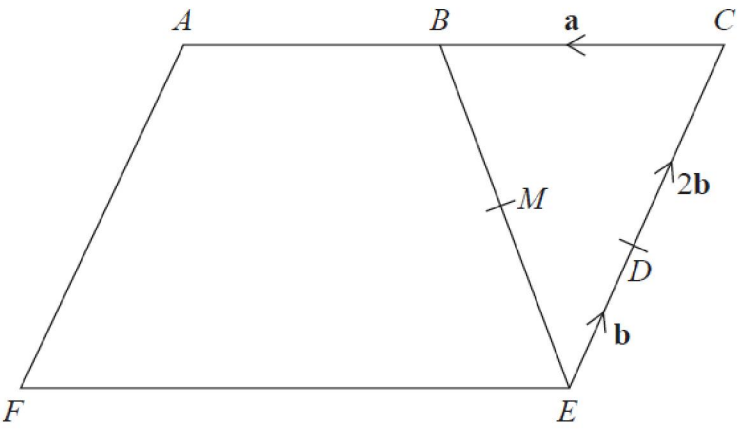


Diagram **NOT** accurately drawn

$ACEF$ is a parallelogram.
B is the midpoint of AC.
M is the midpoint of BE.

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

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

$\overrightarrow{DC} = \mathbf{2b}$

Show that AMD is a straight line.

(Total for Question 20 is 5 marks)

Answers to Qn 1 (AO2): (No Calc) 32% of students got this right

15.			Proof	3	M1 for $\overrightarrow{MN} = \overrightarrow{MO} + \overrightarrow{ON}$ (= **n** – **m**) or $\overrightarrow{NM} = \overrightarrow{OM} + \overrightarrow{NO}$ (= **m** – **n**) or $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$ (= 2**n** – 2**m**) or $\overrightarrow{BA} = \overrightarrow{OA} + \overrightarrow{BO}$ (= 2**m** – 2**n**) M1 for $\overrightarrow{MN}$= **n** – **m** and $\overrightarrow{AB}$= 2**n** – 2**m** oe C1 (dep on M1, M1) for fully correct proof, with $\overrightarrow{AB}$= 2$\overrightarrow{MN}$ or $\overrightarrow{AB}$ is a multiple of $\overrightarrow{MN}$ [SC M1 for $\overrightarrow{MN}$= 0.5**n** – 0.5**m** and $\overrightarrow{AB}$ = **n** – **m**] C1 (dep on M1) for fully correct proof, with $\overrightarrow{AB}$= 2$\overrightarrow{MN}$ or $\overrightarrow{AB}$ is a multiple of of $\overrightarrow{MN}$]

Answers to Qn 2 (AO1): 31% of students got this right

17.	(a)		$\mathbf{b} - \mathbf{a}$	1	B1 for $\mathbf{b} - \mathbf{a}$ or $-\mathbf{a} + \mathbf{b}$
	(b)	$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$ $\overrightarrow{AP} = \frac{3}{4} \times (\mathbf{b} - \mathbf{a})$ $\overrightarrow{OP} = \mathbf{a} + \frac{3}{4} \times (\mathbf{b} - \mathbf{a})$ OR $\overrightarrow{OP} = \overrightarrow{OB} + \overrightarrow{BP}$ $\overrightarrow{BP} = \frac{1}{4} \times (\mathbf{a} - \mathbf{b})$ $\overrightarrow{OP} = \mathbf{b} + \frac{1}{4} \times (\mathbf{a} - \mathbf{b})$	$\frac{1}{4}(\mathbf{a} + 3\mathbf{b})$	3	B1 for $\frac{3}{4} \times$ '$(\mathbf{b} - \mathbf{a})$' M1 for $(\overrightarrow{OP} =)\ \overrightarrow{OA} + \overrightarrow{AP}$ or $(\overrightarrow{OP} =)\ \overrightarrow{OA} + \frac{3}{4}\overrightarrow{AB}$ or $\mathbf{a} \pm \frac{3}{4} \times$ '$(\mathbf{b} - \mathbf{a})$' A1 for $\frac{1}{4}(\mathbf{a} + 3\mathbf{b})$ or $\frac{1}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$ **OR** B1 for $\frac{1}{4} \times$ '$(\mathbf{a} - \mathbf{b})$' M1 for $(\overrightarrow{OP} =)\ \overrightarrow{OB} + \overrightarrow{BP}$ or $(\overrightarrow{OP} =)\ \overrightarrow{OB} + \frac{1}{4}\overrightarrow{BA}$ or $\mathbf{b} \pm \frac{1}{4} \times$ '$(\mathbf{a} - \mathbf{b})$' A1 for $\frac{1}{4}(\mathbf{a} + 3\mathbf{b})$ or $\frac{1}{4}\mathbf{a} + \frac{3}{4}\mathbf{b}$

Answers to Qn 3 (AO2): 31% of students got this right

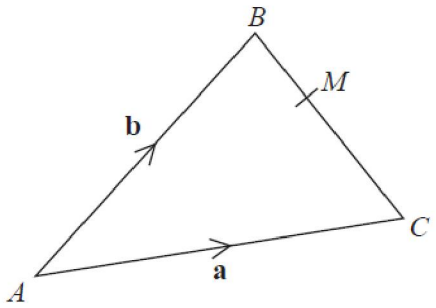
Question		Working	Answer	Mark	Notes
18.	(a)		**b – a**		B1 for **b** − **a** or − **a** + **b** oe
	(b)	$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$ $\overrightarrow{OP} = \mathbf{a} + \frac{3}{5}(\mathbf{b} - \mathbf{a})$ $\overrightarrow{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$	proof		M1 for $\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$ oe or $\overrightarrow{OP} = \overrightarrow{OB} + \overrightarrow{BP}$ oe M1 for $\overrightarrow{AP} = \frac{3}{5}(\mathbf{b} - \mathbf{a})$ oe or $\overrightarrow{BP} = \frac{2}{5}(\mathbf{a} - \mathbf{b})$ oe A1 for $\mathbf{a} + \frac{3}{5}(\mathbf{b} - \mathbf{a})$ or $\mathbf{b} + \frac{2}{5}(\mathbf{a} - \mathbf{b})$ oe leading to given answer with correct expansion of brackets seen

Answers to Qn 4 (AO2): (No Calc) 27% of students got this right

Question		Working	Answer	Mark	Notes
18.	(a)		$\mathbf{b} - \mathbf{a}$	1	B1
	(b)		$\overrightarrow{BM} = \frac{1}{2}\overrightarrow{OC}$ hence parallel	4	B1 $\overrightarrow{OC} = \mathbf{a} + \mathbf{b}$ M1 $\overrightarrow{BM} = \overrightarrow{BC} + \overrightarrow{CM}$ oe or $\overrightarrow{BM} = \mathbf{a} + \frac{1}{2}$("$\mathbf{b} - \mathbf{a}$") A1 $\frac{1}{2}(\mathbf{a} + \mathbf{b})$ C1 $\overrightarrow{BM} = \frac{1}{2}\overrightarrow{OC}$ hence parallel

Answers to Qn 5 (AO2): (No Calc) 26% of students got this right

16 a



M is the point such that $BM : MC$ is $1 : 2$

Here is Burt's method to find $\overrightarrow{BM}$ in terms of **a** and **b**.

$$\begin{aligned}\overrightarrow{BC} &= \overrightarrow{BA} + \overrightarrow{AC} \\ &= -\mathbf{b} + \mathbf{a} \\ &= \mathbf{a} - \mathbf{b} \\ \overrightarrow{BM} &= \frac{1}{2}\overrightarrow{BC} \\ &= \frac{1}{2}(\mathbf{a} - \mathbf{b})\end{aligned}$$

(a) Evaluate Burt's method.

He treated M as a midpoint.

1+2 = 3 so M is $\frac{1}{3}$ along BC

Instead he needed $\overrightarrow{BM} = \frac{1}{3}\overrightarrow{BC}$

(1)

Answers to Qn 6 (AO2): 18% of students got this right

Question		Working	Answer	Mark	Notes
15			$\frac{3\mathbf{b}-\mathbf{c}}{4}$	4	M1 for $\overrightarrow{CD} = \overrightarrow{CO} + \overrightarrow{OB} + \overrightarrow{BD}$ M1 (indep) for $\overrightarrow{CO} + \overrightarrow{OB} = -\mathbf{c} + \mathbf{b}$ or $\overrightarrow{BA} = -\mathbf{b} + 3\mathbf{c}$ M1 for $-\mathbf{c} + \mathbf{b} + \frac{1}{4}(-\mathbf{b} + 3\mathbf{c})$ A1 for $\frac{3\mathbf{b}-\mathbf{c}}{4}$ **OR** M1 for $\overrightarrow{CD} = \overrightarrow{CA} + \overrightarrow{AD}$ M1 (indep) for $\overrightarrow{CA} = 2\mathbf{c}$ or $\overrightarrow{AB} = -3\mathbf{c} + \mathbf{b}$ M1 for $2\mathbf{c} + \frac{3}{4}(-3\mathbf{c} + \mathbf{b})$ A1 for $\frac{3\mathbf{b}-\mathbf{c}}{4}$

Answers to Qn 7 (AO2): 17% of students got this right

Question	Working	Answer	Mark	Notes
19		proof	B1	for $\overrightarrow{BC} = 2\mathbf{b} - 3\mathbf{a}$ **or** $\overrightarrow{CB} = 3\mathbf{a} - 2\mathbf{b}$ **or** $\overrightarrow{BE} = 6\mathbf{b}$
			M1	for a correct vector expression for $\overrightarrow{AD}$ **or** $\overrightarrow{DE}$**, or** $\overrightarrow{AE}$ e.g. $\overrightarrow{AD} = \overrightarrow{AB} + \frac{3}{4}\overrightarrow{BC}$ **or** $\overrightarrow{AD} = \overrightarrow{AC} + \frac{1}{4}\overrightarrow{CB}$ **or** $\overrightarrow{DE} = \frac{3}{4}\overrightarrow{CB} + \overrightarrow{BE}$, **or** $\overrightarrow{AE} = \overrightarrow{AB} + 3\overrightarrow{AC}$
			A1	for $\overrightarrow{AD} = \frac{3}{4}(2\mathbf{b} + \mathbf{a})$ **and** $\overrightarrow{DE} = \frac{9}{4}(2\mathbf{b} + \mathbf{a})$ **or** $\overrightarrow{AE} = 3(2\mathbf{b} + \mathbf{a})$ with either $\overrightarrow{AD} = \frac{3}{4}(2\mathbf{b} + \mathbf{a})$ **or** $\overrightarrow{DE} = \frac{9}{4}(2\mathbf{b} + \mathbf{a})$
			C1	for a fully correct proof, eg $\overrightarrow{DE} = 3\overrightarrow{AD}$, so the vectors are parallel and have point D in common

Answers to Qn 8 (AO3): (No Calc) 13% of students got this right

20		0.5	M1	writes $\overrightarrow{CD}$ as $-\mathbf{a}+\mathbf{b}$ or $\overrightarrow{MD}$ as $\frac{1}{2}(-\mathbf{a}+\mathbf{b})$ oe
			M1	writes $\overrightarrow{BM}$ as $\overrightarrow{BD}+\overrightarrow{DM}$ or $\mathbf{b}-\frac{1}{2}$ ("$-\mathbf{a}+\mathbf{b}$") or $\overrightarrow{BC}+\overrightarrow{CM}$ or $\mathbf{a}+\frac{1}{2}$ ("$-\mathbf{a}+\mathbf{b}$") where "$-\mathbf{a}+\mathbf{b}$" is ft their expression for $\overrightarrow{CD}$ or $2\times\overrightarrow{MD}$
			A1	For stating k as 0.5, and supported by a vector method

Answers to Qn 9 (AO3): 11% of students got this right

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
20		$\frac{1}{4}$	P1 starts process eg $\overrightarrow{AB} = 2\mathbf{b} - 2\mathbf{a}$ P1 process to find $\overrightarrow{AP}$ or $\overrightarrow{BP}$ P1 complete process to find $\overrightarrow{OP}$ A1 for $\frac{1}{4}$ oe

Answers to Qn 10 (AO3): (No Calc) 8% of students got this right

Question 19 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\overline{OX} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$	P1	This mark is given for the first step to solve the problem
	$\overline{OD} = \overline{OX} + \overline{XD} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c} + 3\mathbf{c} - \frac{1}{2}\mathbf{a}$ $\overline{CD} = \overline{OD} - \overline{OC} = 3.5\mathbf{c} - \mathbf{c} = 2.5\mathbf{c}$	P1	This mark is given for a process to find a vector expression for $\overline{CD}$
	$\overline{OC} : \overline{CD} = k : 1 = \mathbf{c} + 2.5\mathbf{c}$	P1	This mark is given for a process to find the value of k (using ratios)
	$k = \frac{1}{2.5} = \frac{2}{5}$	A1	This mark is given for the correct answer only

Answers to Qn 11 (AO2): 8% of students got this right

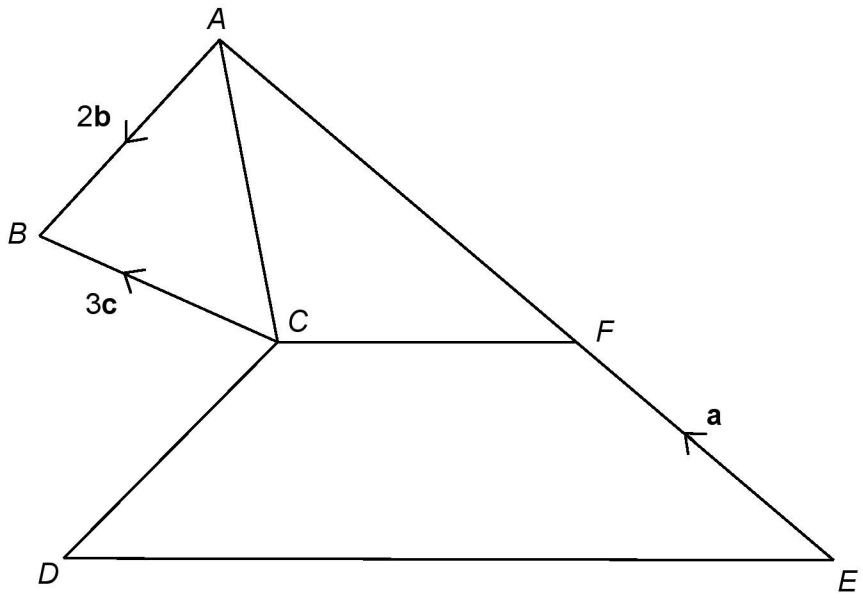
23 *AFE* is a straight line.

AF : *FE* = 3 : 2

DE is parallel to *CF*.

DE = 2*CF*

$\overrightarrow{EF} = \mathbf{a}$ $\overrightarrow{AB} = 2\mathbf{b}$ $\overrightarrow{CB} = 3\mathbf{c}$



Work out $\overrightarrow{DE}$ in terms of **a**, **b** and **c**.

[4 marks]

$\overrightarrow{FA} = 1.5\mathbf{a}$ or $\overrightarrow{AF} = -1.5\mathbf{a}$

AC = 2**b** - 3**c** or CA = 3**c** - 2**b** or FB = 1.5**a** + 2**b**

CF = 3**c** - 2**b** - 1.5**a**

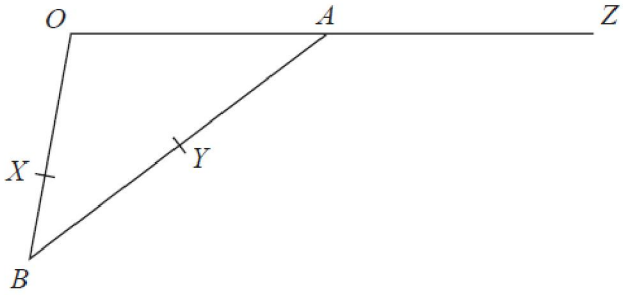
DE = 2CF

6**c** - 4**b** - 3**a**

Answer

Answers to Qn 12 (AO3): 7% of students got this right

21



OAB is a triangle.
A is the midpoint of *OZ*
Y is the midpoint of *AB*
X is a point on *OB*

$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OX} = 2\mathbf{b}$ $\overrightarrow{XB} = \mathbf{b}$

Prove that *XYZ* is a straight line.

$\overrightarrow{XZ} = 2\boldsymbol{a} - 2\boldsymbol{b} = 2(\boldsymbol{a} - \boldsymbol{b})$

$\overrightarrow{BA} = \boldsymbol{a} - 3\boldsymbol{b}$

$\overrightarrow{XY} = \boldsymbol{b} + \frac{1}{2}(\boldsymbol{a} - 3\boldsymbol{b}) = \frac{1}{2}\boldsymbol{a} + \boldsymbol{b} - \frac{3}{2}\boldsymbol{b} = \frac{1}{2}\boldsymbol{a} - \frac{1}{2}\boldsymbol{b} = \frac{1}{2}(\boldsymbol{a} - \boldsymbol{b})$

Since $\overrightarrow{XY}$ and $\overrightarrow{XZ}$ both contain $(\boldsymbol{a} - \boldsymbol{b})$ they are parallel and so XYZ is a straight line.

(Total for Question 21 is 5 marks)

Answers to Qn 13 (AO3): 7% of students got this right

*20			Proof	5	M1for finding one other vector expressed as **a** and/or **b** M1 for method to find one of $\overrightarrow{CM}$, $\overrightarrow{MF}$or $\overrightarrow{CF}$ eg $\overrightarrow{CM}$ = −**a**+ ½(3**a** +**b**) oe, $\overrightarrow{MF}$= ½(3**a** + **b**) + **b** oe or $\overrightarrow{CF}$ = 2**a**+2**b** oe M1 for method to find two of $\overrightarrow{CM}$, $\overrightarrow{MF}$ or $\overrightarrow{CF}$ A1 for two of $\overrightarrow{CM}$ = ½ (**b** + **a**), $\overrightarrow{MF}$ = 1.5(**b** + **a**), $\overrightarrow{CF}$=2(**b**+**a**) ie simplified but oe C1 (dep on working shown) for conclusion relating to correct working