Oxford Cambridge and RSA

GCE

Further Mathematics A

Unit **Y531**: Pure Core

Advanced Subsidiary GCE

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

Annotations and abbreviations

Annotation in scoris	Meaning
✓and✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme	**Meaning**
E1	Mark for explaining a result or establishing a given result
dep*	Mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working
AG	Answer given
awrt	Anything which rounds to
BC	By Calculator
DR	This question included the instruction: In this question you must show detailed reasoning.

Subject-specific Marking Instructions for AS Level Further Mathematics A

a Annotations should be used whenever appropriate during your marking. The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded. For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

b An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct solutions leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly. Correct but unfamiliar or unexpected methods are often signalled by a correct result following an apparently incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, escalate the question to your Team Leader who will decide on a course of action with the Principal Examiner.
If you are in any doubt whatsoever you should contact your Team Leader.

c The following types of marks are available.

M
A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

A
Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

B
Mark for a correct result or statement independent of Method marks.

E
Mark for explaining a result or establishing a given result. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

d When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep*' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

E The abbreviation FT implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only – differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, what is acceptable will be detailed in the mark scheme. If this is not the case please, escalate the question to your Team Leader who will decide on a course of action with the Principal Examiner.
Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

F Unless units are specifically requested, there is no penalty for wrong or missing units as long as the answer is numerically correct and expressed either in SI or in the units of the question. (e.g. lengths will be assumed to be in metres unless in a particular question all the lengths are in km, when this would be assumed to be the unspecified unit.) We are usually quite flexible about the accuracy to which the final answer is expressed; over-specification is usually only penalised where the scheme explicitly says so. When a value is given in the paper only accept an answer correct to at least as many significant figures as the given value. This rule should be applied to each case. When a value is not given in the paper accept any answer that agrees with the correct value to 2 s.f. Follow through should be used so that only one mark is lost for each distinct accuracy error, except for errors due to premature approximation which should be penalised only once in the examination. There is no penalty for using a wrong value for g. E marks will be lost except when results agree to the accuracy required in the question.

G Rules for replaced work: if a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests; if there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others. NB Follow these maths-specific instructions rather than those in the assessor handbook.

H For a genuine misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A mark in the question. Marks designated as cao may be awarded as long as there are no other errors. E marks are lost unless, by chance, the given results are established by equivalent working. 'Fresh starts' will not affect an earlier decision about a misread. Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

I If a calculator is used, some answers may be obtained with little or no working visible. Allow full marks for correct answers (provided, of course, that there is nothing in the wording of the question specifying that analytical methods are required). Where an answer is wrong but there is some evidence of method, allow appropriate method marks. Wrong answers with no supporting method score zero. If in doubt, consult your Team Leader.

J If in any case the scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Marks	AO	Guidance	
1	(i)		$\begin{pmatrix}1\\3\\-2\end{pmatrix}\times\begin{pmatrix}-3\\-6\\4\end{pmatrix}$	**M1**	1.1a	Use of cross product	Correct pairs of numbers used together, allow one numerical or sign error.
			$\begin{pmatrix}0\\2\\3\end{pmatrix}$	**A1**	1.1	or any non-zero multiple	
	Alt		$3-2a=0$	**M1**		Assuming a vector of the form $\begin{pmatrix}0\\1\\a\end{pmatrix}$ and understanding that both dot products are zero. Allow one numerical or sign error	
			$\begin{pmatrix}0\\1\\1.5\end{pmatrix}$	**A1**		or any non-zero multiple	
	Alt		$a+3b-2c=0$ $-3a-6b+4c=0$ $\Rightarrow a=0, 3b-2c=0$	**M1**		Use dot product with both vectors to find two simultaneous equations. Either eliminate a **or** b & c to show that $a=0$ **or** $3b$-$2c=0$	
			$\begin{pmatrix}0\\2\\3\end{pmatrix}$	**A1**		or any non-zero multiple	
				[2]			

Question		Answer	Marks	AO	Guidance	
	(ii)	$\dfrac{x-0}{2}$ or $\dfrac{y-3}{1}$ or $\dfrac{z-(-2)}{\frac{1}{2}}$	**M1**	1.1a	Or $x=(0+)2\lambda$ or $y=3+(1)\lambda$ or $z=\dfrac{\lambda-4}{2}$ or form **(r – a) x b =0**	Can be implied by correct answer
		$\mathbf{r}=\begin{pmatrix}0\\3\\-2\end{pmatrix}+\ldots$	**A1**	1.1	Could have any multiple of the direction vector added. e.g. [4, 5, -1]	If M0 then SC1 for $\begin{pmatrix}0\\3\\-2\end{pmatrix}+\ldots$ (i.e. no λ attached)
		$\ldots+\lambda\begin{pmatrix}2\\1\\\frac{1}{2}\end{pmatrix}$	**A1**	1.1	Vector could be any multiple e.g. [4, 2, 1]. Any sensible parameter name (not e.g. r, x, y or z). Not dependent on previous A mark so M1 A0 A1 is possible.	If M0 then SC1 for $\begin{pmatrix}0\\3\\-\end{pmatrix}+\lambda\begin{pmatrix}2\\1\\-\end{pmatrix}$
			[3]			
2		$u=\dfrac{1}{x}$	**B1**	2.2a	SOI	Other letters can be used as the variable. If "x" used allow B1 for sight of $2\left(\frac{1}{x}\right)^3+3\left(\frac{1}{x}\right)^2-5\left(\frac{1}{x}\right)+4$ $(=0)$
		$u^3\left(2\left(\dfrac{1}{u}\right)^3+3\left(\dfrac{1}{u}\right)^2-5\left(\dfrac{1}{u}\right)+4\right)=0$	**M1**	1.1	For substituting $\dfrac{1}{u}$ into the given equation and attempting to multiply by u^3	If no u^3 outside brackets then need to see at least two terms multiplied by u^3.
		$4u^3-5u^2+3u+2=0$	**A1**	1.1	Or multiple of this (with integer coefficients). Condone x as variable. Must have "= 0"	

Question			Answer	Marks	AO	Guidance	
	Alt		$\alpha+\beta+\gamma=-{}^{3}/_{2}$; $\alpha\beta+\beta\gamma+\gamma\alpha=-{}^{5}/_{2}$; $\alpha\beta\gamma=-2$	M1		Allow one sign slip	
			$\frac{1}{\alpha}+\frac{1}{\beta}+\frac{1}{\gamma}=\left(\frac{\alpha\beta+\beta\gamma+\gamma\alpha}{\alpha\beta\gamma}\right)={}^{5}/_{4}$ $\frac{1}{\alpha\beta}+\frac{1}{\beta\gamma}+\frac{1}{\gamma\alpha}=\left(\frac{\alpha+\beta+\gamma}{\alpha\beta\gamma}\right)={}^{3}/_{4}$ $\frac{1}{\alpha\beta\gamma}=-{}^{1}/_{2}$	M1		At least 2 correct	
			$4x^3-5x^2+3x+2=0$	A1		oe **Must be integer coefficients** Must have "= 0"	
				[3]			
3	(i)		$\lvert z_1\rvert=\sqrt{13}$	B1	1.1		
			arg(z_1) = arctan(-3/2)	M1	1.1	Allow arctan(3/2) for M1 M0 if no working i.e. just an angle of -0.983 or -56.3° (Do not penalise here if degree sign is missing). Allow finding another angle as long as part of a method to find a correct argument.	Need to see some evidence of use of arctan or $\tan^{(-1)}$ $\tan\theta=\frac{3}{2}$ and $\theta=0.983$ is enough E.g. $\frac{3}{2}\pi+\arctan\left(\frac{2}{3}\right)$
			$\sqrt{13}\text{cis}(-0.983)$ $\sqrt{13}\text{cis}(5.30)$	A1	1.1	Any equivalent mod-arg form (including exponential). Condone -56.3° or 304° if degree symbol shown, or has been shown somewhere in the working. Must not have a π attached to -0.983 A1 cannot be awarded if M0 awarded. Must have some evidence of use of arctan.	Condone -0.98 or -56° if correct angle to 3s.f. seen before Condone 5.3 $[\sqrt{13},-0.983]$ $\sqrt{13}e^{-0.983i}$ $\sqrt{13}(\cos(-0.983)+i\sin(-0.983))$ Allow $\sqrt{13}(\cos(0.983)-i\sin(0.983))$
				[3]			

Question			Answer	Marks	AO	Guidance	
	(ii)		$2a + 8i - 3ai - 12i^2$	**M1**	1.1	Expanding brackets; allow one error	
			$2a + 12 + (8 - 3a)i$	**A1**	1.1	i terms must be collected	
				[2]			
	(iii)		$2a + 12 = 8 - 3a$	**M1**	2.2a	Equating their real and imaginary parts. No i	
			$a = -\frac{4}{5}$	**A1ft**	1.1	or -0.8	Follow through provided that *a* appears in both the real and imaginary parts.
				[2]			
	(iv)		$8 - 3a = 0$	**M1**	2.2a	Or $2a + 12 + (8 - 3a)i = 2a + 12 - (8 - 3a)i$	Setting imaginary part of **(ii)** to 0.
			$a = \frac{8}{3}$	**A1ft**	1.1	or awrt 2.67	
				[2]			
4	(i)		e.g. $2(-a - 2) - 1(a - 2) + 2(2 + 2)$ (1st row) or $2(-a - 2) - 1(a - 4) + 2(1 + 2)$ (1st col)	**M1**	1.1a	Attempt to expand determinant. Could use any row or column or other method	
			$= -2a - 4 - a + 2 + 8 = 6 - 3a$	**A1 (AG)**	1.1	Must be convincing	
				[2]			
	(ii)		2	**B1**	2.2a		
				[1]			
	(iii)		Matrix of cofactors: $\begin{pmatrix} -a-2 & 2-a & 4 \\ 4-a & 2a-4 & -2 \\ 3 & 0 & -3 \end{pmatrix}$	**M1***	1.1a	At least 4 co-factors correct, or correct apart from sign. Could be seen in separate calculations or in $\mathbf{A}^{-1}$. Could be transposed, even if stated as matrix of cofactors. If ambiguity use $\mathbf{A}^{-1}$. If $\mathbf{A}^{-1}$ not given then make whichever assumption, transposed or not, which results in most marks.	If not anywhere in matrix form only award M1 if it is clear where the cofactors come from. Cofactor must not be multiplied by anything Alternative method using cross product also ok. Matrix of cofactors is given by $(C_2 \times C_3, C_3 \times C_1\ C_1 \times C_2)$
				A1	1.1	6 cofactors correct	Must include correct sign.
				M1dep*	1.1	Transposing matrix of cofactors and dividing by determinant	

Question			Answer	Marks	AO	Guidance	
			$\mathbf{A}^{-1} = \frac{1}{6-3a}\begin{pmatrix} -a-2 & 4-a & 3 \\ 2-a & 2a-4 & 0 \\ 4 & -2 & -3 \end{pmatrix}$	**A1**	1.1	cao	
				[4]			
5	**(i)**		$2^3 + 3\times 2^2 \times 3\mathrm{i} + 3\times 2\times(3\mathrm{i})^2 + (3\mathrm{i})^3$	**M1**	1.1	Binomial expansion. Must be 4 terms with 1, 3, 3, 1 soi and correct powers. Condone missing brackets	Or by $(2 + 3\mathrm{i})^2\times(2 + 3\mathrm{i})$ but marks only to awarded once all binomial brackets expanded.
			$2^3 + 3\times 2^2 \times 3\mathrm{i} - 3\times 2\times 3^2 - 3^3\mathrm{i}$ or better	**A1**	1.1	All correct and $\mathrm{i}^2 = -1$ twice.	Must see evidence of i^2 becoming -1 (could be in a table, expanding brackets etc)
			$-46+9\mathrm{i}$	**A1**	1.1		SC if the only working seen is $(-5+12\mathrm{i})(2+3\mathrm{i}) = -46+9\mathrm{i}$ award B1
				[3]			
	(ii)		$(2+3\mathrm{i})^2 = -5+12\mathrm{i}$	**B1**	1.1	May be seen in **(i)**. May be in working below.	If only seen in (i) and not implied by working for this part award B0
			$3(-46+9\mathrm{i}) - 8(-5+12\mathrm{i}) + 23(2+3\mathrm{i}) + 52$	**M1**	3.1a	Attempt to substitute their z^2 and z^3 into $3z^3 - 8z^2 + 23z + 52$	$3(2+3\mathrm{i})^3 - 8(2+3\mathrm{i})^2 + 23(2+3\mathrm{i}) + 52$ enough for M1
			$= -138 + 27\mathrm{i} + 40 - 96\mathrm{i} + 46 + 69\mathrm{i} + 52$ $= -138 + 138 + 96\mathrm{i} - 96\mathrm{i} = 0$	**A1 (AG)**	1.1	Convincingly cancels to 0	Must show some collection/cancellation Could be gathering real and imaginary terms
				[3]			
	(iii)		$2-3\mathrm{i}$ is also a root	**B1**	1.1	Seen or implied	
			$(z-(2+3\mathrm{i}))(z-(2-3\mathrm{i}))$	**M1**	2.2a	...is the required quadratic factor	
			$= z^2 - 4z + 13$	**A1**	1.1		
			$(z^2 - 4z + 13)(3z+4)$	**A1**	2.2a	Can be deduced by inspection Must be written as a product of linear factor and quadratic factor	Condone "= 0" present.
	Alt		$2-3\mathrm{i}$ is also a root	**B1**		Seen or implied	
			$z - 2 = \pm 3\mathrm{i}$ $(z-2)^2 = -9$	**M1**		Using the two roots to get an equation in z^2	
			$z^2 - 4z + 13 (= 0)$	**A1**			

Question			Answer	Marks	AO	Guidance	
			$(z^2 - 4z + 13)(3z + 4)$	A1		Can be deduced by inspection	Condone "= 0" present.
				[4]			
6	(i)		$\lvert\mathbf{A}\rvert = -2t - 6t$ or $\lvert\mathbf{B}\rvert = -4t - 4t$	M1	1.1a	Correct expression for either seen or implied	
			$\lvert\mathbf{B}\rvert = -8t = \lvert\mathbf{A}\rvert$	A1	2.2a	Both correct and statement of equality	Need to have an indication that candidate understands that they have shown that these are equal. Could be done by re-writing $\lvert\mathbf{A}\rvert$= -8t immediately next to $\lvert\mathbf{B}\rvert$= -8t. $\lvert\mathbf{A}\rvert=\lvert\mathbf{B}\rvert$ is fine after having shown both are equal to -8t, but -8t = -8t is not ok for the A mark.
				[2]			
	(ii)		$\begin{pmatrix} t & 6 \\ t & -2 \end{pmatrix}\begin{pmatrix} 2t & 4 \\ t & -2 \end{pmatrix} = \begin{pmatrix} 2t^2 + 6t & 4t - 12 \\ 2t^2 - 2t & 4t + 4 \end{pmatrix}$	M1	3.1a	Must be attempt at proper matrix multiplication (i.e. columns into rows). Condone one error	
			$\lvert\mathbf{AB}\rvert = \begin{vmatrix} 2t^2 + 6t & 4t - 12 \\ 2t^2 - 2t & 4t + 4 \end{vmatrix} =$ $(2t^2 + 6t)(4t + 4) - (2t^2 - 2t)(4t - 12)$	M1	2.1	Correct expression of determinant of their matrix.	Condone one error
			$= 8t^3 + 8t^2 + 24t^2 + 24t - (8t^3 - 24t^2 - 8t^2 + 24t)$ $= 64t^2 = (-8t)(-8t) = \lvert\mathbf{A}\rvert\lvert\mathbf{B}\rvert$	A1	2.1	Convincing expansion, correct answer and conclusion	Similar to question above. Need candidate to conclude that $\lvert\mathbf{AB}\rvert = \lvert\mathbf{A}\rvert\,\lvert\mathbf{B}\rvert$ Condone not seeing (-8t)(-8t) explicitly
				[3]			
	(iii)		Set *their* $\lvert\mathbf{AB}\rvert = -1$ or $\lvert\mathbf{A}\rvert\lvert\mathbf{A}\rvert = \lvert\mathbf{A}\rvert^2 = -1$	M1	3.1a	Seen or implied	$64t^2 = -1$ or $(-8t)^2 = -1$
			$\Rightarrow 64t^2 = -1$ so t must be complex/imaginary/not real	A1ft	3.2a	Accept t = –i/8 or t = i/8	Allow follow through if their $\lvert\mathbf{AB}\rvert$ is of the form kt^2.
				[2]			
7			k = 1, 49 is divisible by 7	M1	2.1	Basis case. Must explicitly state divisibility (49 ÷ 7 = 7 is OK).	Do not condone k = 0 unless later stated 1 > 0
			Assume true for n = k i.e. that $2^{k+1} + 5\times9^k$ is divisible by 7 oe	M1	2.1	Statement of inductive hypothesis. Allow "= 7p" without further	

Question			Answer	Marks	AO	Guidance	
						qualification.	
			Considering $2^{k+1+1} + 5\times9^{k+1}$ and rewriting the first term as $2\times2^{k+1}$ or the second term as $9\times5\times9^{k}$	M1	1.1	Might not all be done before next step. Do not allow if e.g. 45^k.	Needs to have a 2^{k+1} or 5×9^k so that the $n=k$ case can be used.
			$2(7p - 5\times9^k) + 9\times5\times9^k$ or $2\times2^{k+1} + 9(7p - 2^{k+1})$	M1	1.1	Uses inductive hypothesis properly. Do not allow if e.g. 45^k.	Do not allow M1 if both replacements made unless recovered later
			$7(2p + 5\times9^k)$ or $7(9p - 2^{k+1})$ (which is divisible by 7)	A1	2.2a	Simplification with sufficient working to establish divisibility for $k+1$	
			So true for $n = k \Rightarrow$ true for $n = k + 1$. But true for $n = 1$. So true for all positive integers $n \geq 1$	E1	2.4	Clear conclusion for induction process.	A formal proof by induction is required for full marks.
				[6]			
8	**(i)**		$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$	B1	3.1a	$\Rightarrow b = 3, d = 4$	
			Determinant $= ad - bc = 5$	B1	3.1a	$4a - 3c = 5$	Or det $= -5$ and follow through
			$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ y \end{pmatrix}$	B1	1.2	Understanding of invariant point seen or implied	
			$(1 - a)x = by$ or $(1 - d)y = cx$	M1	2.2a	May have $b = 3$ and/or $d = 4$ already substituted	$(1 - a)x = 3y$ or $-3y = cx$
			$\dfrac{1-a}{c} = \dfrac{b}{1-d}$ Or $\dfrac{1-a}{b} = \dfrac{c}{1-d}$	M1	1.1	Eliminating x and y	
			$c = a - 1$	A1	1.1		
			e.g. $4a - 3(a - 1) = 5$	M1	1.1	Attempting to solve their simultaneous equations	If no working and incorrect then M0A0.
			$\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$	A1	3.2a	Condone $a = 2$, etc as long as Matrix seen as $\mathbf{A} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$	
				[8]			

Question			Answer	Marks	AO	Guidance	
	(ii)		Need $\begin{pmatrix}3 & 1\\2 & 2\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}3x+y\\2x+2y\end{pmatrix}=\begin{pmatrix}x\\y\end{pmatrix}$	**M1**	1.1	Substituting a general point into their matrix, calculating an image point and equating it to the object point.	
			$2x+y=0$	**A1**	2.2a	Final form must be $y = -2x$ or $x = -\frac{1}{2}y$ or a numerical multiple of $2x + y = 0$.	Need to have considered both x and y coordinates.
				[2]			
	(iii)		$\begin{pmatrix}3 & 1\\2 & 2\end{pmatrix}\begin{pmatrix}x\\x+c\end{pmatrix}=\begin{pmatrix}3x+x+c\\2x+2x+2c\end{pmatrix}$	**M1***	3.1a		
			So $\begin{pmatrix}X\\Y\end{pmatrix}=\begin{pmatrix}4x+c\\4x+2c\end{pmatrix}$ ...	**M1dep***	2.2a		
			...and $Y=X+c$	**A1**	1.1	Could see the y component of the vector written as $4x + c + c$.	
	Alt		$\begin{pmatrix}3 & 1\\2 & 2\end{pmatrix}\begin{pmatrix}x\\mx+c\end{pmatrix}=\begin{pmatrix}X\\mX+c\end{pmatrix}$ $3x+mx+c=X$ $2x+2mx+2c=mX+c$ $2x+2mx+2c=m(3x+mx+c)+c$	**M1**		Need to eliminate X, i.e. an equation in x, m and c.	
			$x(m^2+m-2)+c(m-1)=0$ $x(m+2)(m-1)+c(m-1)=0$	**M1**			
			If $m = 1$, $c\ (m - 1) = 0$ satisfied by any c	**A1**			
				[3]			

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