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Surname			
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A-level MATHEMATICS

Unit Further Pure 4

Wednesday 24 May 2017

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

• the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer all questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do not use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.



For Exam	iner's Use
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



		Answer all questions. Answer each question in the space provided for that question.	
1		The matrices A and B are given by $\begin{bmatrix} 0 & m \end{bmatrix}$	
		$\mathbf{A} = \begin{bmatrix} 2 & -1 & 1 \\ 0 & p & -4 \end{bmatrix} \text{ and } \mathbf{B} = \begin{bmatrix} 0 & p \\ 2 & -2 \\ 1 & -3 \end{bmatrix}$	
		where p is a constant.	
	(a)	Find BA in terms of <i>p</i> .	[3 marks]
	(b)	Show that BA is a singular matrix for all values of p .	[3 marks]
QUESTION PART REFERENCE	Ans	swer space for question 1	



QUESTION PART REFERENCE	Answer space for question 1



2 Three planes have equations	
5x + 2y + 11z = 45	
2x - y + 5z = 15	
-3x + 3y + az = b	
where a and b are constants. The planes do not meet at a unique point.	
(a) Find the value of <i>a</i> .	
	[3 marks]
(b) There are two possible geometrical configurations for the planes. Identify e	each
configuration and find the corresponding values of b .	
	[4 marks]
QUESTION PART Answer space for question 2	
REFERENCE	



QUESTION PART REFERENCE	Answer space for question 2



3
 The points A, B and C have position vectors

$$a = \begin{bmatrix} 2 \\ -p \\ -1 \end{bmatrix}$$
, $b = \begin{bmatrix} 0 \\ 2p+1 \\ -1 \end{bmatrix}$ and $c = \begin{bmatrix} p-1 \\ 4 \\ 3 \end{bmatrix}$

 respectively, relative to the origin O where p is a constant.

 (a)
 Find $(a \times b).c$ in terms of p .

 [3 marks]

 (b)
 These three position vectors define the edges of a parallelepiped, with volume 13 cubic units. Find all the possible values of p .

 [4 marks]



QUESTION PART REFERENCE	Answer space for question 3
REFERENCE	





QUESTION PART REFERENCE	Answer space for question 4



A 3 by 3 matrix N has characteristic equation $2\lambda^3 + \lambda^2 + k\lambda + 6 = 0$, where k is a constant. One of the eigenvalues of N is -3. [2 marks] (ii) Find the other two eigenvalues, showing all your working. [2 marks] An eigenvector corresponding to the eigenvalue -3 is $\begin{bmatrix} -4\\3\\1 \end{bmatrix}$. [1 mark]

(ii) Find the values of x, y and z if $\mathbf{N}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -4 \\ 3 \\ 1 \end{bmatrix}$.

Find the value of *k*.

(i) Find $\mathbf{N}^2 \begin{bmatrix} -4 \\ 3 \\ 1 \end{bmatrix}$.

QUESTION PART REFERENCE Answer space for question 5



5

(a) (i)

(b)

[1 mark]

IB/G/Jun17/MFP4

QUESTION PART REFERENCE	Answer space for question 5
REFERENCE	



6 Let
$$\Delta(x) = \begin{vmatrix} a^{-1} & b^{+1} & x^{-1} \\ x^{2} - b^{2} & x^{2} - a^{2} & a^{2} - b^{2} \\ 2 & -2 & 2 \end{vmatrix}$$

(a) Factorise $\Lambda(x)$ as fully as possible.

(b) Solve $\Delta(x) = 0$.

[2 marks]

[2 marks]



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QUESTION PART REFERENCE	Answer space for question 6

1 3

7
 A plane transformation T is defined by

$$T: \begin{bmatrix} x' \\ z' \end{bmatrix} = M \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

 where $M = \begin{bmatrix} 2 & 4 & 3 \\ 1 & 1 & 1 \\ 0 & 3 & k+1 \end{bmatrix}$ and k is a constant.

 (a)
 In the case when M is a singular matrix, show that the image of every point under T lies in the plane $3x - 6y - 2z = 0$. [4 marks]

 (b)
 In the case when M is a non-singular matrix:

 (i)
 find M^{-1} , in terms of k; [5 marks]

 (ii)
 show that there is one value of k for which T has a line of invariant points and find the Cartesian equations of this line. [5 marks]

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 Answer space for question 7

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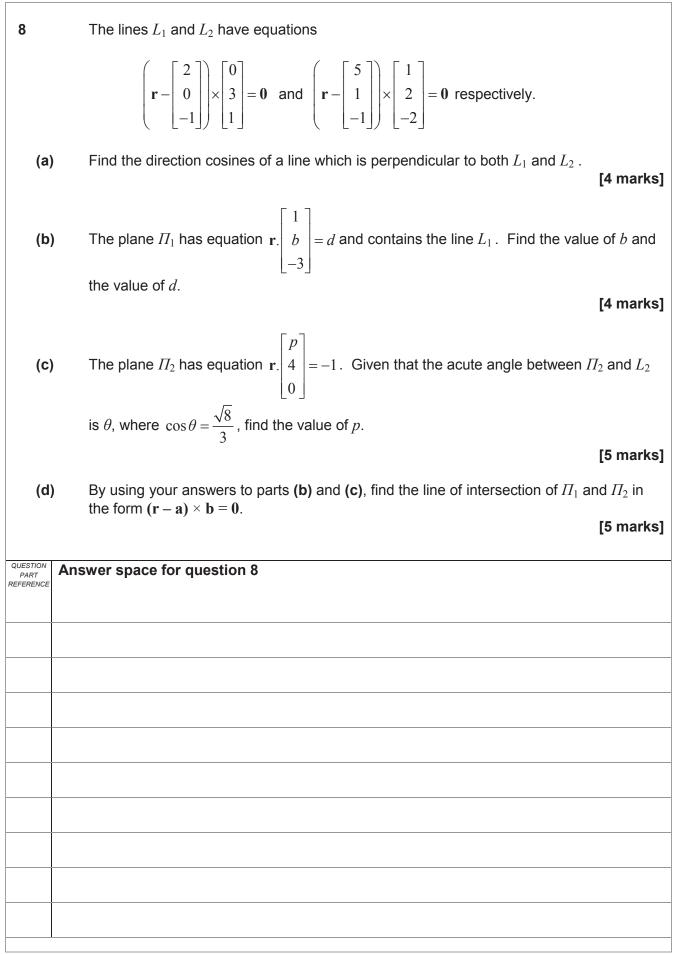


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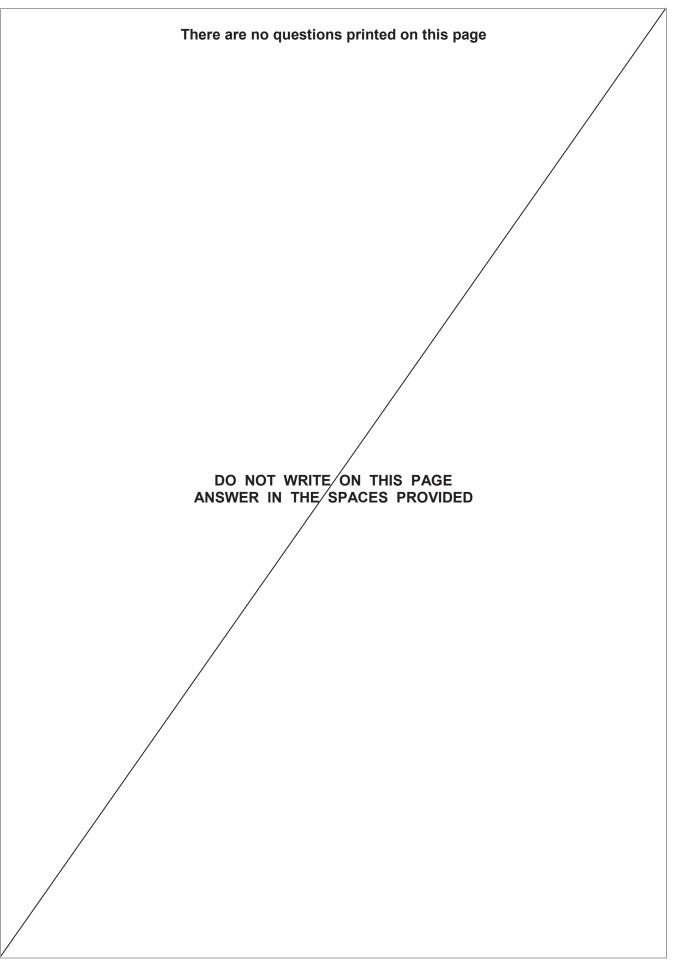


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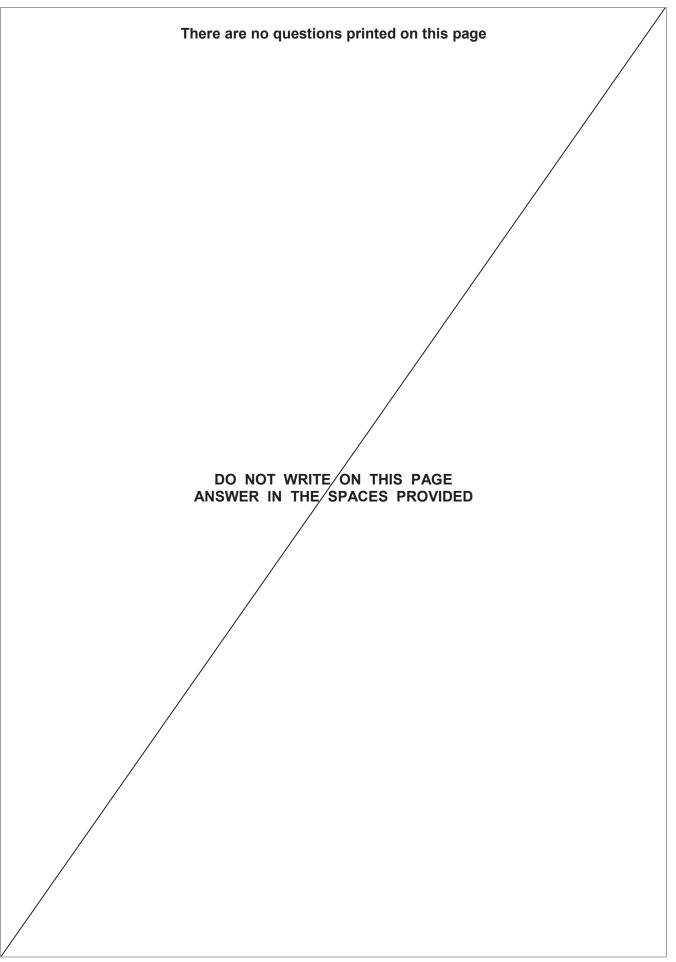


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	END OF QUESTIONS

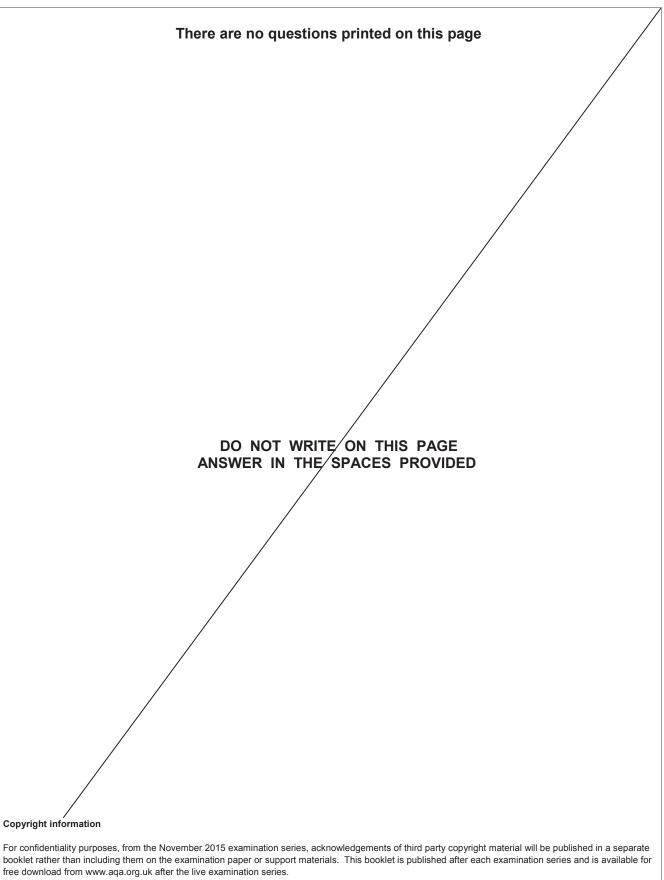












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