Instructor's Name (Print)	Student's Name (Print)	

Student's Signature

THE UNIVERSITY OF WESTERN ONTARIO LONDON CANADA DEPARTMENT OF MATHEMATICS

Mathematics 1229A Test 2

Friday, November 16, 2018

Code 111

7:00 p.m. - 8:30 p.m.

INSTRUCTIONS

- 1. Fill in the tops of this page and the back of this page completely. Be sure to print your name legibly.
- 2. Fill in the top of the scantron card completely. **Both print AND code** your Student Number, Section Number (see below) and Exam Code (shown above).
- 3. CALCULATORS AND NOTES ARE NOT PERMITTED.
- 4. DO NOT UNSTAPLE THE BOOKLET.
- 5. There are two parts to this examination: PART A (18 marks) in multiple choice format and PART B (7 marks) in written answer format.
- 6. In Part A, **circle** the correct answer to each question **on this paper** AND fill in the appropriate box on the **scantron** card <u>with an HB pencil</u>. This question paper will be returned to you.
- 7. In Part B, write your answer in the space provided.
- 8. Questions are printed on both sides of the paper. They begin on Page 1 and continue to Page 5. Be sure that your booklet is complete.
- 9. You must hand in this question paper, your scantron card, and all rough work sheets.
- 10. Circle your section in the list below.

Instructor Campus/College		Time	Section
Lindsey	Main	9:30 MWF	001
Pasini	Main	12:30 MWF	002
Olds	Main	1:30 MWF	003
Pasini	Main	8:30 MWF	004
Ghorbanpour	Brescia	8:30 MTuTh	530
O'Hara	Brescia	$9:30~\mathrm{MTuW}$	531
Rastegari	Huron	11:30 MWF	550
Mollahajiaghaei	Huron	8:30 Tu	551
Kuzmin	King's	10:30 Tu, 9:30 Th	570
Turnbull	King's	1:30 Tu, 12:30 Th	571
Turnbull	King's	1:30 M, 12:30 W	572
Kuzmin	King's	7:00 MW	573
Kuzmin	King's	8:30 MW	574

11. TOTAL MARKS = 25.

Student Number (Print)	Student's Name (Print)

FOR GRADING ONLY

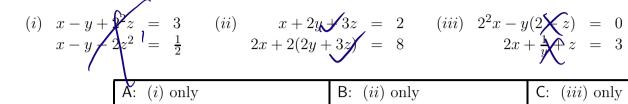
PAGE	MARK
1–3	
4	
5	
TOTAL	

PART A (18 marks)

NOTE: YOUR ANSWERS TO THE PROBLEMS IN PART A MUST BE INDICATED ON THE SCANTRON SHEET. YOU SHOULD ALSO CIRCLE YOUR ANSWERS IN THIS BOOKLET.

1. Consider the systems of equations shown below. Which of the systems is/are linear in the unknowns x, y and z?





D: none of (i), (ii) and (iii)

E: all of (i), (ii) and (iii)

2. Find the augmented matrix for the following system of linear equations:

A: $\begin{bmatrix} 1 & -1 & -1 & 3 \\ 2 & 1 & -1 & 5 \end{bmatrix}$	$B \colon \left[\begin{array}{cc c} 1 & -3 & -1 & 1 \\ 2 & 1 & -1 & 5 \end{array} \right]$	$C \colon \left[\begin{array}{ccc c} 1 & -3 & -1 & 0 & 1 \\ 2 & 1 & 0 & -1 & 5 \end{array} \right]$
D: $\begin{bmatrix} 1 & -3 & -1 & -1 & 0 \\ 2 & 1 & 0 & -1 & 5 \end{bmatrix}$	$E \colon \left[\begin{array}{ccc c} 1 & -3 & -1 & 0 & 1 \\ 2 & 1 & -1 & 0 & 5 \end{array} \right]$	

 $\bar{m}ark$

3. Which one of the following matrices is **not** in row-reduced echelon form?

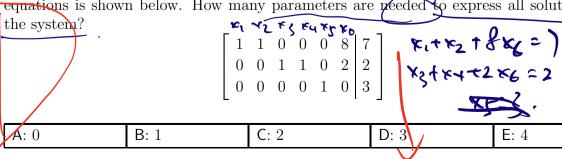
A: 0 0 0 B: 0 1 2 C: 0 0 1 D: 0	$\begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 2 \end{bmatrix}$	E: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	$ \cdot $
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4. Find all values (a, b) for which $\begin{bmatrix} 0 & a & b \\ 0 & 0 & b \end{bmatrix}$

is in row-reduced echelon form.

(1,1) only B: (1,0) and (0,0) only (0,1) and (1,0) only

The row-reduced echelon form of the augmented matrix corresponding to a system of linear equations is shown below. How many parameters are needed to express all solutions for



x2+x4+2x6=2

mark

6. Let B be the row-reduced echelon form of the matrix A shown here:

	$A = \left[\begin{array}{rrr} 2 & 4 & 8 \\ -1 & 2 & 8 \\ 2 & 0 & -4 \end{array} \right]$	=7 -1 2	4	120402
Find the first row of matrix B . A: $\begin{bmatrix} 1 & 0 & 2 \end{bmatrix}$ B: $\begin{bmatrix} 1 & 0 & -2 \end{bmatrix}$	<u></u>	> - 27	[203	<u>]</u> .

 $\frac{1}{mark}$

7. Find the value(s) of k for which the system of linear equations whose augmented matrix is shown below has exactly one solution, x+2x2



all $k \neq 0$ C: k = 3 only $\overline{\mathsf{D}}$: all values of kk=1 only E: no value of k

1 mark The system of linear equations with augmented matrix



represents the intersection of 3 hyperplanes in \Re^4 . Find the value(s) of k for which the intersection is a line.

A: all values of kB: k = -1 only C: k = 0 only D: all $k \neq -2$ E : no value of k

9. The matrix shown below is the augmented matrix for a system of 3 linear equations in the k; -4 3 unknowns x, y and z.

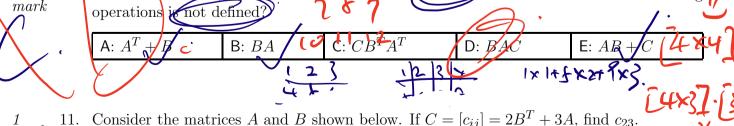


Find the value(s) of k for which the system of linear equations has no solution.

4 only A: all values of kB: no value of kE: k = 4 only

mark

 4×3 matrix and C is a 3×3 matrix. Which one of the following A is a 3×4 matrix, B is a



11. Consider the matrices A and B shown below. If $C = [c_{ij}] = 2B^T + 3A$, find c_{23} .

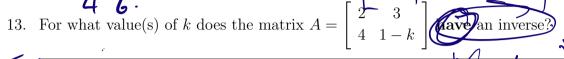
D: 1 E: not defined

·k	12.	For the matrices given below, what is the $(3,2)$ -entry of \overrightarrow{AB} $\begin{bmatrix} -2 \\ -3 \end{bmatrix}$ $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$	1 19
	_	$\begin{bmatrix} 5 & 2 \end{bmatrix}$	

$$A = \begin{bmatrix} 5 & 2 \\ -1 & 4 \\ 2 & -3 \end{bmatrix}$$

$$A = \begin{bmatrix} 5 & 2 \\ -1 & 4 \\ 2 & -3 \end{bmatrix} \quad \text{and } B^T = \begin{bmatrix} 2 & 2 \\ -3 & 2 \\ -2 & -1 \\ 5 & -4 \end{bmatrix}$$

A: -1	B: -3	C: 4	D: 0	E: not defined	
2 3			2310	1 2 2 10 =>	120
46.			$\begin{bmatrix} 1 & 3 \end{bmatrix}$		KI 4
For what value(s) of k does the	ne matrix $A =$	- , , M ay	re an inverse?) 🔪 🔪 🧷	10



A: all $k \neq -5$	B: $k = -5$ only	C: all $k \neq 1$	D: $k \neq k$	E: no alue of k
			70 (



/		_		
A: $k = 3$ only	B: all $k \neq 3$	C: $k = 0$ only	D: $k = 1$ only	E: no value of k
			3-2 3	3)
			2 4 -6	<i>t</i> 7/.

$\frac{1}{mark}$	15.	Let $A =$	$= \begin{bmatrix} -1 \\ 0 \end{bmatrix}$	$\begin{bmatrix} 2 \\ 0 \end{bmatrix}$. Find	d A ²⁰¹	8.	2 7[-11	2	2	10	3 3 3	
7		/	2]	Γ	1	2]	Γ ₁	_2]		Γ _{_1}	_	<u>.</u>		$[(-1)^{2018}]$

		/ -	00	1 _		0	0		
A:	$\begin{bmatrix} 1 & 2 \\ 0 & 0 \end{bmatrix}$	$B \colon \left[\begin{array}{cc} -1 & 2 \\ 0 & 0 \end{array} \right]$	C: $\begin{bmatrix} 1 & - \\ 0 & 0 \end{bmatrix}$	$\begin{bmatrix} 2 \\ 0 \end{bmatrix}$	$D \colon \left[\begin{array}{c} -1 \\ 0 \end{array} \right]$	$\begin{bmatrix} -2 \\ 0 \end{bmatrix}$	E: [$(-1)^{2018}$	$\begin{bmatrix} 2^{2018} \\ 0 \end{bmatrix}$

$\begin{bmatrix} 3 & 0 \end{bmatrix}$	<i>q</i> ,	$\int a d$	2
1 16. If 1 -1	h is the inverse of the ma	$\operatorname{trix} \left \begin{array}{c c} b & \acute{e} \end{array} \right $	2 , find the value of i .
mark 0 2	\overline{i}	$c \mid f$	-3
Batca-1	2d+1122 6-31=	ر ا ا ا	

A: O B: O C: -1 D: 1 E: cannot be determined by the character of the contraction O

If A is an $n \times n$ square matrix such that $A - A^T = O$, where O is the $n \times n$ zero matrix, which one of the following must always be true?

A: $A = \mathbb{Q}$	$B: A = A^T$	C: A is a diagonal matrix
D: A is an identity matrix	E: A is invertible	

 $\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \text{ has } A^{-1} = \begin{bmatrix} 4 & 0 & 0 \\ 7 & -1 & 2 \\ 9 & 5 & -8 \end{bmatrix}.$ You are given that A =

Consider the system f linear equations shown here:

If it is known that (4, 11, -2) is the unique solution to the system of equations, find the value of b_1 .

A.1 B: 2	C: -1	D: 0	E: 4	

PART B (7 marks)

SHOW YOUR WORK FOR ALL QUESTIONS IN PART B

3 19. Consider the following system of linear equations in the unknowns x_1 , x_2 , x_3 and x_4 .

$$x_1 - 2x_2 + x_4 = 2$$

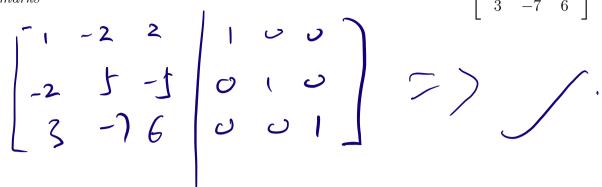
 $2x_1 - 4x_2 - 3x_3 - 4x_4 = 1$
 $x_1 - 2x_2 - 3x_3 - 5x_4 = -1$

(a) Write the augmented matrix corresponding to this system of equations.

(b) Find the row-reduced echelon form of the matrix you wrote in part (a).

(c) Use your row-reduced echelon form augmented matrix from part (b) to find **all** solutions to the system of equations.

2 20. Using the method of row reduction, find A^{-1} where $A = \begin{bmatrix} 1 & -2 & 2 \\ -2 & 5 & -5 \\ 3 & -7 & 6 \end{bmatrix}$.



$$\underset{marks}{2} \text{ 21. Let } B = \left[\begin{array}{cc} 2 & 0 \\ 3 & 2 \end{array} \right] \text{. Find } \left(2B^{-1}B - B^T\right)^2.$$