UNIVERSITY OF MANITOBA

DATE: October 22, 2007 — MIDTERM

TITLE PAGE

DEPARTMENT & COURSE NO: MATH 1300 — TIME: 1 hour

EXAMINATION: Vector Geometry & Linear Algebra — EXAMINER: various

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NAME: (Print in ink) _____

STUDENT NUMBER: (in ink) _____

SIGNATURE: (in ink) _____

(I understand that cheating is a serious offense)

Please indicate your instructor and section by checking the appropriate box below:

☐	A01	slot 2	MWF - 9-30 am	Y. Zhang
☐	A02	slot 4	T,Th - 8:30 am	P. Mendelsohn
☐	A03	slot 8	MWF - 1:30 pm	N. Zorboska
☐	A04	slot 9	T,Th - 11:30 am	S. Kalajdzievski
☐	A05	slot 6	MWF - 11:30 am	R. Craigen
☐	A91	Challenge for Credit (SJR)		

INSTRUCTIONS TO STUDENTS:

This is a 1 hour exam. **Please show your work clearly.**

No texts, notes, or other aids are permitted. Calculators, cellphones or electronic translators are also not permitted.

This exam has a title page, 5 pages of questions and also 1 blank page for rough work. Please check that you have all the pages. You may remove the blank page if you want, but do not remove the staple.

The value of each question is indicated in the lefthand margin beside the statement of the question. The total value of all questions is 60 points.

Answer all questions on the exam paper in the space provided beneath the question. If you need more room, you may continue your work on the reverse side of the page, but CLEARLY INDICATE that your work is continued.

Question	Points	Score
1	10	
2	10	
3	9	
4	10	
5	8	
6	13	
Total:	60	

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PAGE: 1 of 5

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1. Solve each system by the method indicated, showing your work (full marks will not be awarded for the answer alone or any other method than the one requested.)

[5] (a) Use *Cramer's Rule*

$$\begin{aligned} 2x_1 - 3x_2 &= 5 \\ 3x_1 - 5x_2 &= 7 \end{aligned}$$

[5] (b) Use *Gauss-Jordan Elimination*

$$\begin{aligned} 2x - 4y - 3z &= 2 \\ -x + 2y + 2z &= 2 \end{aligned}$$

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2. Suppose that the augmented matrix of a system in variables x, y and z has been partially reduced through elementary row operations to the following form:

$$\left[\begin{array}{ccc|c} 1 & 0 & -2 & 1 \\ 0 & 1 & 0 & a \\ 0 & a & a & b \\ 0 & 0 & 0 & 0 \end{array}\right].$$

[3] (a) Find all values (if any) of a and b for which the system is inconsistent.

[3] (b) Find all values (if any) of a and b for which the system has a unique solution.

[4] (c) Solve the system in the case that there are infinitely many solutions.

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3. Suppose that $2A^{-1} = \begin{bmatrix} 1 & -1 \\ 1 & 2 \end{bmatrix}$. Find:

[4] (a) A

[2] (b) A^T

[3] (c) adj(A).

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[10] 4. Let $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & -2 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ and $C = \begin{bmatrix} -2 & 0 & 0 \\ 0 & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{3} \end{bmatrix}$. Determine whether each expression is defined. If it is defined, calculate the resulting matrix.

(a) AB

(b) CA^T

(c) B^2A

(d) $A + C$.

[8] 5. Use row operations to find the inverse of $A = \begin{bmatrix} -1 & 0 & 1 \\ 0 & -\frac{1}{2} & 1 \\ 0 & -1 & 3 \end{bmatrix}$.

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6. Calculate determinants as instructed.

(a) Given that $\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = 7$, deduce the value of each of the following (marks for answer only):

[3] i. $\begin{vmatrix} a+2d & b+2e & c+2f \\ g & h & i \\ d & e & f \end{vmatrix}$

[3] ii. $\begin{vmatrix} 3a-b & b & c \\ 3d-e & e & f \\ 3g-h & h & i \end{vmatrix}$

[7] (b) Use row operations, cofactor expansion or any combination of these (show work) to find:

$$\begin{vmatrix} 1 & 0 & 1 & -1 \\ -2 & 0 & 1 & 0 \\ 2 & 3 & 1 & 1 \\ 1 & 0 & 2 & 1 \end{vmatrix}$$