

UNIVERSITY OF MANITOBA

DATE: March 8, 2011  
COURSE: MATH 1210  
EXAMINATION: Techniques of Classical & Linear Algebra

Midterm #2  
TITLE PAGE  
TIME: 45 minutes

FAMILY NAME: (Print in ink, capitals) \_\_\_\_\_

GIVEN NAME(S): (Print in ink, capitals) \_\_\_\_\_

STUDENT NUMBER: \_\_\_\_\_

LAB SECTION (A, B, C, or D): \_\_\_\_\_

SIGNATURE: (in ink) \_\_\_\_\_

(I understand that cheating is a serious offence. I have read the instructions below twice.)

A01          R. Thomas

A02          T. Mohammed

**INSTRUCTIONS TO STUDENTS:**

This is a 45 minute exam. **Please show your work clearly.**

No calculators, texts, notes, or other aids are permitted. No cellphones or electronic translators, or other electronic devices able to receive or transmit a signal are permitted.

This exam has a title page and 3 pages of questions. Please check that you have all the pages.

The value of each question is indicated in the lefthand margin beside the statement of the question. The total value of all questions is 30 points.

Question	Points	Score
1	9	
2	6	
3	7	
4	8	
Total:	30	

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

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[9] 1. Given the vectors  $\mathbf{u} = \begin{bmatrix} 9 \\ 3 \\ 4 \end{bmatrix}$  and  $\mathbf{v} = \begin{bmatrix} -3 \\ 1 \\ 2 \end{bmatrix}$ , write down

(a)  $\mathbf{v} + \mathbf{u}$ ,

(b)  $7\mathbf{v}$ ,

(c)  $\|\mathbf{v}\|$ ,

(d)  $\mathbf{u} \cdot \mathbf{v}$ .

(e) Are  $\mathbf{u}$  and  $\mathbf{v}$  perpendicular?

(f) How do you know that?

(g) What is the cosine of the angle between  $\mathbf{u}$  and  $\mathbf{v}$ ?

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- [6] 2. Referring to the vectors  $\mathbf{u}$  and  $\mathbf{v}$  of question 1, find the point of intersection, if any, of the line  $\mathbf{x} = \mathbf{u} + p\mathbf{v}$ , where  $p$  is a real number, with the plane  $4x + 2y + z = 30$ .

- [7] 3. Solve for the unknown matrix  $X$  the matrix equation  $A + B^T - X = C + 3I$ , given that

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 4 & -1 \\ 1 & 2 \end{bmatrix}, \text{ and } C = \begin{bmatrix} 3 & 2 \\ 1 & -1 \end{bmatrix},$$

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- [8] 4. Given the equation  $x^2 + 16x - 17 = 0$ , state in specific detail what each of
- (a) the fundamental theorem of algebra,
  - (b) the rational-roots theorem,
  - (c) the bounds theorem, and
  - (d) Descartes' rules of signs tells us about the equation.
  - (e) Solve the equation without using the quadratic-equation formula.