

University of Ottawa
Department of Mathematics and Statistics

MAT 1302B : Mathematical Methods II
Professor: Hadi Salmasian

Third Midterm Exam – Version A

March 24, 2017

Surname _____ First Name _____

Student # _____ DGD _____

Instructions:

- (a) You have 80 minutes to complete this exam.
- (b) All work to be considered for grading should be written in the space provided. The reverse side of pages is for scrap work. If you find that you need extra space in order to answer a particular question, you should continue on the reverse side of the page and indicate this **clearly**. Otherwise, the work written on the reverse side of pages will not be considered for marks.
- (c) Write your student number at the top of each page in the space provided.
- (d) No notes, books, scrap paper, calculators or other electronic devices are allowed.
- (e) You are strongly recommended to write in **pen**, not pencil.
- (f) You may use the last page of the exam as scrap paper.
- (g) Cellular phones, unauthorized electronic devices or course notes (unless an open-book exam) are not allowed during this exam. **Phones and devices must be turned off and put away in your bag**. Do not keep them in your possession, such as in your pockets. If caught with such a device or document, the following may occur: you will be asked to leave immediately the exam and academic fraud allegations will be filed which may result in you obtaining a 0 (zero) for the exam.

By signing below, you acknowledge that you have ensured that you are complying with the above statement.

Signature _____

Please do not write in the table below.

Question	1	2	3	4	5	6	Total
Maximum	3	2	3	5	3	5	21
Grade							

1. [3 points] For each of the following sets, write **Yes** if the set is a subspace of \mathbb{R}^n for the *given* value of n , and write **No** if it is not. You will receive .5 points for each correct answer and lose .25 points for each incorrect answer.

___ Nul A where A is a 4×5 matrix, $n = 4$.

___ $\text{Span} \left\{ \begin{bmatrix} 2 \\ -1 \\ -\frac{1}{2} \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ \frac{1}{3} \end{bmatrix} \right\}, n = 3$.

___ $\left\{ \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} \mid \begin{bmatrix} 2 & -1 & 3 \\ \frac{1}{3} & 2 & -\frac{3}{2} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}, n = 3$.

___ Col B where B is a 6×4 matrix, $n = 4$.

___ $\left\{ \begin{bmatrix} t \\ -3t \\ 0 \\ 2t \end{bmatrix} \mid t \in \mathbb{R} \right\}, n = 4$.

___ $\left\{ \begin{bmatrix} s \\ -s \\ 0 \\ -2s \end{bmatrix} \mid s \geq 1 \right\}, n = 4$.

2. [2 points] For each of the following statements, indicate if it is true (**T**) or false (**F**). You will receive .5 points for each correct answer, and will lose .25 points for each incorrect answer.

___ Every list of n distinct vectors in \mathbb{R}^n forms a basis of \mathbb{R}^n .

___ If two rows of an $n \times n$ matrix A are equal, then $\det(A) = 0$.

___ If A is a 6×6 matrix, then $\det(-A) = \det(A^T)$.

___ The rank of a matrix A is equal to the number of non-pivot columns of A .

Student # _____

MAT 1302B Third Midterm Exam

3. **[3 points]** Calculate the following determinant. You should write your answer in the form $a + bi$ where $a, b \in \mathbb{R}$.

$$\begin{vmatrix} 1+i & 1 & -\frac{3}{5+i} \\ 0 & \frac{1}{2+i} & -2i+1 \\ 0 & 0 & -2 \end{vmatrix} =$$

Student # _____

MAT 1302B Third Midterm Exam

4. **[5 points]** Calculate the determinant of the matrix A given below using the row reduction method.

$$A = \begin{bmatrix} 2 & -1 & 2 & 0 & -3 \\ 0 & 0 & 3 & 1 & 2 \\ 0 & -1 & 1 & 3 & -6 \\ 0 & 0 & 3 & 6 & 3 \\ -2 & 1 & 1 & -4 & 3 \end{bmatrix}$$

Student # _____

MAT 1302B Third Midterm Exam

5. **[3 points]** Let

$$A = \begin{bmatrix} 2 & 5 & 1 & 3 & -1 \\ -2 & -5 & -1 & -6 & 3 \\ 4 & 10 & 2 & 6 & -2 \end{bmatrix}.$$

Find a basis for $\text{Col } A$.

Student # _____

MAT 1302B Third Midterm Exam

6. Suppose that

$$A = \begin{bmatrix} -2 & 4 & 1 & 0 & 8 \\ 0 & 0 & 2 & 0 & 4 \\ 2 & -4 & -1 & -1 & -13 \end{bmatrix}$$

(a) [**4 points**] Find a basis for $\text{Nul } A$.

(b) [**1 point**] Determine $\text{rank}(A)$. Justify your answer.

Student # _____

MAT 1302B Third Midterm Exam

This page is intentionally left blank. You may use it as scrap paper.