# Page 1

## University of Ottawa

## Department of Mathematics and Statistics

### MAT 1341: Introduction to Linear Algebra
### Instructor: Erhard Neher

### Assignment 1; due May 24, 2006, 18:00 in the class room

**Family Name:** ______________________________

**First Name:** ______________________________

**Student number:** ___________________________

### Please read these instructions carefully:

- Enter your name on this page and the next, but your student number only on this page. You will get back the exam without this first page.
- The table below is for the TA. Do not write in the table. For privacy reasons, this page of the assignment will be detached, and you will only get back the remaining pages of the assignment. Therefore, **fill in your name on both pages** and your student number on this page only.

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| Quest. | 1 – 6 | 7. | 8. | Total |
|---|---|---|---|---|
| maximal | 6 | 8 | 6 | 20 |
| score | | | | |

## University of Ottawa

## Department of Mathematics and Statistics

### MAT 1302D: Mathematical Methods II, Instructor: Erhard Neher

### Assignment 2; due May 24, 18:00 in the class room

**Family Name:** ______________________________

**First Name:** ______________________________

### Please read these instructions carefully:

- Read each question carefully, and answer all questions in the space provided after each question. For questions 7 and 8, you may use the backs of pages if necessary, but be sure to indicate to the marker that you have done this.
- Questions 1 to 6 are worth 1 point each, and no part marks will be given. However, you must show some work to obtain the point. Simply writing the correct answer will earn you 0.
- Questions 7 and 8 and are worth 8 and 6 points respectively, and part marks can be earned. The correct answers here require justification written legibly and logically: You must convince the TA and me that you know why your solution is correct.
- You have to submit this assignment at the beginning of the class on Wednesday, May 24, at 18:00 in the classroom at the latest. If you wish to submit it earlier, please do so at the secretariat of the Department of Mathematics, room 103A, 8:45–12:00 and 13:00–17:00.

**Good luck! Bonne Chance!**

**1. (1 point)** Calculate all possible products between the matrices

$$A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} -1 & 0 \\ 2 & 3 \\ 1 & 4 \end{bmatrix}.$$

**My answer:**____________________________

**2. (1 point)** Let $A$ and $B$ be arbitrary matrices. Which combination of true/false is correct for the following statements:

- If $AB = BA$ then $A$ and $B$ are both square and of the same size.
- If $A$ has a row of zeros then also $AB$ has a row of zeros.
- $(A + B)^2 = A^2 + 2AB + B^2$ always holds.

(A) true, false, true
(B) false, true, false
(C) true, true, false
(D) true, false, false
(E) false, false, true
(F) false, false, false

**My answer:**____________________________

**3. (1 point)** Find the inverse of the matrix

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 2 & 3 \\ 1 & 3 & 1 \end{bmatrix}.$$

**My answer:**______________________________

**4. (1 point)** Find $A$ if

$$\left( A + 3 \begin{bmatrix} 1 & -1 & 0 \\ 1 & 2 & 4 \end{bmatrix} \right)^T = \begin{bmatrix} 2 & 1 \\ 0 & 5 \\ 3 & 8 \end{bmatrix}.$$

**My answer:**______________________________

**5. (1 point)** Find basic solutions for the homogeneous linear system whose coefficient matrix is given below and express the general solution as a linear combination of these basic solutions.

$$\begin{bmatrix} 1 & 2 & 1 & -1 & 3 \\ 1 & 2 & 2 & 1 & 2 \\ 2 & 4 & 2 & -1 & 7 \end{bmatrix}$$

**My answer:**________________________

**6. (1 point)** Suppose $A$ is a $3 \times 3$-matrix and $AX = 0$ has a unique solution. Which combination of true/false is correct for the following statements:

- The reduced row echelon form of $A$ is the $3 \times 3$ identity matrix $I_3$.
- There may exist column vectors $B$ for which the equation $AX = B$ is not consistent.
- The equation $AX = B$ is uniquely solvable for every column vector $B \in \mathbb{R}^3$.

(A) true, false, true
(B) false, true, false
(C) true, true, false
(D) true, false, false
(E) false, false, true
(F) false, false, false

**My answer:**________________________

**7. (8 points)** Consider the system of linear equations

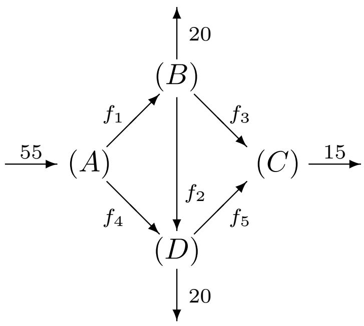
$$\begin{array}{rcrcrcr} x & + & y & + & 2z & = & -1 \\ x & + & 2y & + & kz & = & 0 \\ -x & + & ky & + & 2z & = & 0 \end{array}$$

where $k$ is a real parameter. Find the conditions on $k$, so that the system has

(i) infinitely many solutions,
(ii) a unique solution, and
(iii) no solution.

In the cases (i) and (ii) write done all respectively the unique solution.

**8. (6 points)** Consider the following network of irrigation channels.




(a) **(1 point)** Write down a system of linear equations in the variables $f_1, \ldots, f_5$ that describes the flow in the network.
(b) **(3 points)** Solve the system in (a). Show all details of your solution!
(c) **(2 points)** If the canal BC is closed, what range of flow on AD must be maintained so that no canal carries a flow of more than 30?