# University of Ottawa
# Department of Mathematics and Statistics

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

### Assignment 3: due March 11, 2009, 11:30 in the classroom

| | |
|---|---|
| FAMILY NAME (CAPITALS) | ______________________ |
| FIRST NAME (CAPITALS) | ______________________ |
| Signature | ______________________ |
| Student number | ______________________ |

**Please read these instructions carefully:**

- The table below is for the TA. Do not write in it.
- The assignment has to be submitted with the two cover pages.
- For privacy reasons, this page of the assignment will be detached, and you will only get back the remaining pages. Therefore, **fill in your name on both pages and your student number on this page only.**

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| Question | 1 | 2 | 3 | 4 | Total |
|---|---|---|---|---|---|
| Score | | | | | |
| Max. score | 3 | 5 | 6 | 8 | 22 |

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**Good luck! Bonne chance !**

(1) (3 pts) In the matrix below, replace $\alpha$ by the **last** digit of your student number and calculate its determinant.

$$\begin{bmatrix} 1 & 1 & 1 & -2 & -1 \\ 1 & -1 & 2 & -3 & 0 \\ 1 & 3 & \alpha+1 & 3 & 3 \\ 3 & 1 & 4 & -6 & 2 \\ -1 & -1 & -1 & 2 & 2 \end{bmatrix}$$

(2) (5 pts) Find a basis for the following subspace of $\mathbb{R}^4$ and determine its dimension:

$$U = \left\{ \begin{bmatrix} a & b & c & d \end{bmatrix}^T : a + b + c + d = 0 \in \mathbb{R} \right\}.$$

(3) (6 pts) For the matrix

$$A = \begin{bmatrix} 1 & -3 & -4 & 3 \\ -4 & 6 & -2 & 3 \\ -3 & 7 & 6 & -4 \end{bmatrix}$$

find

(a) (2 pts) the reduced row echelon form,
(b) (1 point) a basis of the row space,
(c) (1 point) a basis of the column space,
(d) (2 pts) a basis of the null space,

(4) (8 pts) In each case determine if $U$ is a subspace of the given vector space $V$. Either verify all three conditions defining a subspace or give a concrete example showing that one of the conditions is not fulfilled.

(a) $V = \mathbb{M}_{3,3}$, $U = \{X \in V : X \text{ is not invertible}\}$.

(b) $V = \mathbb{F}[\mathbb{R}]$ (the vector space of functions defined on $\mathbb{R}$), $U = \{f \in V : f \text{ is differentiable and } f + 2f' = \mathbf{0}\}$

(c) $V = \mathbb{P}_4$ and $U = \{p : p(x) = 2xq(x) \text{ for some } q \in \mathbb{P}_2\}$.