University of Ottawa
Department of Mathematics and Statistics

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

Assignment 4: due Thursday, March 18, 2010, 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.**

Question	1	2	3	4	5	Total
Score						
Max. score	5	4	4	3	7	23

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FAMILY NAME (CAPITALS)	________________________________
FIRST NAME (CAPITALS)	________________________________

Good luck! Bonne chance !

(1) (a) (2 pts) In the formula below replace α by the **second-last** digit of your student number, and write the expression in the form $a + bi$ for $a, b, \in \mathbb{R}$:

$$\frac{3+4i}{\alpha+2i}\,.$$

(b) (3 pts) Solve the quadratic equation $2x^2 + (2 + 10i)x + (-4 + 5i) = 0$. Simplify as much as possible. Hint: The formula for the roots of a quadratic polynomial also holds for quadratic polynomials with complex coefficients.

(2) **(Lines)** (4 pts) Let L_1 and L_2 be lines with vector equation $\vec{p} = \vec{p}_{01} + s\vec{d}_1$ and $\vec{p} = \vec{p}_{02} + t\vec{d}_2$ where

$$\vec{p} = \begin{bmatrix} x \\ y \\ z \end{bmatrix},\ \vec{p}_{01} = \begin{bmatrix} 0 \\ 3 \\ 0 \end{bmatrix},\ \vec{d}_1 = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix},\ \vec{p}_{02} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix},\ \vec{d}_2 = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}.$$

Find the vector equation of the line that goes through the intersection of L_1 and L_2 and is perpendicular to the plane with equation $x - y + z = 1$.

(3) **(Planes)** (4 pts) Calculate the distance of the point $P(1, 2, 3)$ from the plane with equation $3x - 2y + z = -1$. Also find the point on the plane closest to P.

(4) **(Orthogonal decomposition)** (3 pts) Let $\vec{v} = [2, -2, 1]^T$ and $\vec{u} = [3, 4, 5]^T$. Write $\vec{u} = \vec{u}_1 + \vec{u}_2$ where $\vec{u}_1$ is parallel to $\vec{v}$ and $\vec{u}_2$ is orthogonal to $\vec{v}$.

(5) **(area)** (7 pts) (a) Verify that the point $D(0,0,1)$ is on the plane determined by the points $A(1,1,-1)$, $B(2,0,1)$, and $C(1,-1,3)$.
(b) Show that the vectors $\overrightarrow{AB}$ and $\overrightarrow{DC}$, as well as the vectors $\overrightarrow{AD}$ and $\overrightarrow{BC}$ are parallel, so that $ABCD$ is a parallelogram.
(c) Find the area of the parallelogram $ABCD$.