Norwegian University of Science and Technology
Department of Mathematical Sciences

TMA4115, Spring 2013, Test 12

Exercise group number:

Name:

NTNU username:_____`@stud.ntnu.no`

You have 20 minutes to solve the 3 problems. Each problem is worth 10 points, and you need at least 15 points to pass the test. Your answers must be written on this sheet of paper (you can use additional sheets if you need more space for your answers). You are allowed to use a Citizen SR-270X or a Hewlett Packard HP30S calculator, and Rottman's "Matematisk Formelsamling", but no books or notes.

Problem 1 Let $\mathbf{u} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $\mathbf{v} = \begin{bmatrix} 8 \\ 1 \end{bmatrix}$. Write $\mathbf{v}$ as a sum of a vector in $\text{Span}\{\mathbf{u}\}$ and a vector orthogonal to $\mathbf{u}$.

Problem 2 Let $\mathbf{u}_1 = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$, $\mathbf{u}_2 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$, and $\mathbf{v} = \begin{bmatrix} 1 \\ 3 \\ 5 \end{bmatrix}$. Find the distance of $\mathbf{v}$ from the plane in $\mathbb{R}^3$ spanned by $\mathbf{u}_1$ and $\mathbf{u}_2$.

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Problem 3 Apply the Gram–Schmidt process to the vectors

$$\begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}, \quad \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \quad \begin{bmatrix} 2 \\ 3 \\ 2 \end{bmatrix},$$

to find an orthonormal basis for $\mathbb{R}^3$. Find the coordinates of $\left[\begin{smallmatrix} 3 \\ 2 \\ 1 \end{smallmatrix}\right]$ relative to this orthonormal basis.