Practice Test 4A for Calculus II, Math 1502, November 10, 2010

Name:

Section:

Name of TA:

This test is to be taken without calculators and notes of any sorts. The allowed time is 50 minutes. Provide exact answers; not decimal approximations! For example, if you mean $\sqrt{2}$ do not write $1.414\ldots$. Show your work, otherwise credit cannot be given.
Write your name, your section number as well as the name of your TA on EVERY PAGE of this test. This is very important.

Problem	Score
I	
II	
III	
IV	
Total	

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I: (25 points) Consider the matrix

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 4 & -12 \\ 1 & 3 & -7 \end{bmatrix} .$$

a) Find the QR factorization of this matrix.

Let

$$\vec{b} = \begin{bmatrix} 1 \\ 4 \\ 2 \end{bmatrix} .$$

b) Is $\vec{b} \in Img(A)$?

c) If not compute all the least square solutions of "$A\vec{x} = \vec{b}$".

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II: (25 points) Consider again the matrix A above.

a) Find a basis for $Ker(A)$ and $Img(A)$. What is the dimension of $Ker(A)$ what is the dimension of $Img(A)$?

b) Find an equation for $Img(A)$.

c) FInd an equation for $Img(A^T)$. Find a basis for $Ker(A^T)$.

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III: (25 points) Consider all vectors $\vec{x} \in \mathbb{R}^4$ of the form

$$\vec{x} = \begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix}$$

that satisfy the equation $w + 2x - y + z = 0$.

a) Is this set of vectors a subspace of $\mathbb{R}^4$?

b) If the answer to a) is yes, find a basis for this subspace S.

c) Find a basis for the orthogonal complement of S.

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IV: (25 points) Consider the plane in $\mathbb{R}^3$ given by

$$x + 2y + 2z = 3$$

and the vector

$$\vec{b} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

a) Is this plane a subspace of $\mathbb{R}^3$?

Find the distance of the tip of the vector $\vec{b}$ to the plane. Use two approaches.

b) Use a geometric approach by finding the vector normal to the plane and then finding the point on the plane whose distance to the tip of $\vec{b}$ is shortest.

c) As a second approach formulate this problem as a least square problem?