Practice Test 3B for Calculus II, Math 1502, October 17, 2013

PRINT Name:

PRINT Section:

PRINT 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.
PRINT your name, your section number as well as the name of your TA on EVERY PAGE of this test. This is very important.

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I: Consider the system of equations

$$\begin{aligned} x + 2y + uz &= 1 \\ -x + z &= v \\ 5x + 6y + 7z &= 1 \end{aligned}$$

For which values of u and v does this system have a) no solution, b) exactly one solution, c) infinitely many solutions? Find the solution in case b) and find all the solutions in case c).

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II: Let $T : R^2 \to R^2$ be the linear transformation obtained by first performing a rotation of 30° and then performing a reflection about the $x = y$ axis. Find the matrix associated with T.

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III: Are the following vectors linearly independent?

$$\vec{v}_1 = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} \ , \ \vec{v}_2 = \begin{bmatrix} 3 \\ 2 \\ 4 \end{bmatrix} \ , \ \vec{v}_3 = \begin{bmatrix} 3 \\ -2 \\ 5 \end{bmatrix}$$

If not, give all the possible linear combinations of the zero vector in terms of $\vec{v}_1, \vec{v}_2, \vec{v}_3$.

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IV: a) What defines a linear transformation?

b) Which of the following linear transformations $T : R^3 \to R^3$ is linear:

$$T_1(\vec{x}) = A\vec{x} + \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

where A is a 3×3 matrix.

$$T_2(\vec{x}) = \begin{bmatrix} |x| + z \\ z + x \\ x \end{bmatrix}$$

$$T_3(\vec{x}) = \begin{bmatrix} x + z \\ y + x \\ x \end{bmatrix}$$

c) What is the matrix associated with the linear transformation

$$T(\vec{x}) = \vec{a} \times \vec{x}$$

where

$$\vec{a} = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

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V: Consider the linear transformation $T : R^3 \to R^3$ that has the property that

$$T(\vec{e}_1 + \vec{e}_2) = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} \ , \ T(\vec{e}_2 + \vec{e}_3) = \begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix} \ , \ T(\vec{e}_2 - \vec{e}_3) = \begin{bmatrix} 0 \\ -6 \\ -2 \end{bmatrix}$$

Is this linear transformation onto?