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MTH U371 **LINEAR ALGEBRA** **Spring 2005**

QUIZ 3

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1. 12 points Let $A = \begin{bmatrix} 1 & 0 & 2 & 0 & 3 \\ 2 & 0 & 4 & -1 & 7 \\ -1 & 3 & 0 & 6 & 2 \end{bmatrix}$.

(a) Find the row reduced echelon form of A.

(b) Find a basis for the image of A.

(c) Find a basis for the kernel of A.

(d) Find the rank and the nullity of A.

2. 10 points Consider the folowing four vectors in $\mathbb{R}^4$.

$$\vec{v}_1 = \begin{bmatrix} 1 \\ 2 \\ -3 \\ 2 \end{bmatrix}, \quad \vec{v}_2 = \begin{bmatrix} 0 \\ 4 \\ 0 \\ -4 \end{bmatrix}, \quad \vec{v}_3 = \begin{bmatrix} 1 \\ -1 \\ -2 \\ 4 \end{bmatrix}, \quad \vec{v}_4 = \begin{bmatrix} 0 \\ 1 \\ -5 \\ 4 \end{bmatrix}.$$

(a) Are the vectors $\vec{v}_1$, $\vec{v}_2$, $\vec{v}_3$, $\vec{v}_4$ independent or dependent? If they are independent, say why. If they are dependent, exhibit a linear dependence relation among them.

(b) Do the vectors $\vec{v}_1$, $\vec{v}_2$, $\vec{v}_3$, $\vec{v}_4$ form a basis for $\mathbb{R}^4$? Explain your answer.

(c) Do the vectors $\vec{v}_1$, $\vec{v}_2$, $\vec{v}_3$, $\vec{v}_4$ span $\mathbb{R}^4$? Explain your answer.

3. 8 points Let V be the subspace of $\mathbb{R}^3$ defined by the equation $2x_1 - 3x_2 + 4x_3 = 0$.

(a) Express V as the kernel of a matrix A.

(b) Express V as the image of a matrix B.

(c) Find a basis for V.