Exam 2

Linear Algebra, Dave Bayer, April 3, 2003

Name: ______________________________

[**1**] (6 pts)	[**2**] (6 pts)	[**3**] (6 pts)	[**4**] (6 pts)	[**5**] (6 pts)	**TOTAL**

Please work only one problem per page, starting with the pages provided, and identify all continuations clearly.

[**1**] Let A be the matrix

$$A = \begin{bmatrix} 1 & -1 & 2 & -3 & 5 & -7 \\ -1 & 2 & -3 & 5 & -7 & 12 \\ 2 & -3 & 5 & -7 & 12 & -19 \end{bmatrix}.$$

Compute the row space and column space of A.

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[2] Let

$$\mathbf{v}_1 = (1, 2, -3, -4), \quad \mathbf{v}_2 = (1, -2, 3, -4), \quad \mathbf{v}_3 = (0, 2, -3, 0), \quad \mathbf{v}_4 = (1, -2, -3, 4).$$

Find a basis for the subspace $V \subset \mathbb{R}^4$ spanned by $\mathbf{v}_1$, $\mathbf{v}_2$, $\mathbf{v}_3$, and $\mathbf{v}_4$. Extend this basis to a basis for $\mathbb{R}^4$.

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[3] Let V be the vector space of all polynomials $f(x)$ of degree ≤ 3. Find a basis for the subspace W defined by $f(0) = f(1) = f(2)$. Extend this basis to a basis for V.

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[4] Let $\mathbf{v}_1 = (1,1)$ and $\mathbf{v}_2 = (1,2)$. Let $L : \mathbb{R}^2 \to \mathbb{R}^2$ be the linear transformation such that

$$L(\mathbf{v}_1) = \mathbf{v}_1 + \mathbf{v}_2, \quad L(\mathbf{v}_2) = \mathbf{v}_1 - \mathbf{v}_2.$$

Find a matrix that represents L with respect to the usual basis $\mathbf{e}_1 = (1,0)$, $\mathbf{e}_2 = (0,1)$.

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[5] Let $L : \mathbb{R}^3 \to \mathbb{R}^3$ be the linear transformation such that $L(\mathbf{v}) = \mathbf{v}$ for all $\mathbf{v}$ belonging to the subspace $V \subset \mathbb{R}^3$ defined by $x + y = 2z$, and $L(\mathbf{v}) = 2\mathbf{v}$ for all $\mathbf{v}$ belonging to the subspace $W \subset \mathbb{R}^3$ defined by $x = y = 2z$. Find a matrix that represents L with respect to the usual basis

$$\mathbf{e}_1 = (1, 0, 0), \quad \mathbf{e}_2 = (0, 1, 0), \quad \mathbf{e}_3 = (0, 0, 1).$$

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Problem: ______

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