SI Session: Exam I Review
Mondays: 3:00 PM – 4:30 PM
Tuesdays: 1:30 PM – 3:00 PM
Thursdays: 1:30 PM – 3:00 PM
Room 1239 SNAD

Prof. McCurdy : Linear Algebra
Fall 2008
SI Leader : Neil Jody

[1] Solve the following system. $\begin{cases} x_1 + 3x_2 - 2x_3 = 10 \\ 2x_1 + 3x_2 + 5x_3 = -1 \\ -x_1 + 2x_2 + 4x_3 = -9 \end{cases}$

[2] Express the vector $\begin{bmatrix} 3 \\ -1 \\ -8 \end{bmatrix}$ as a linear combination of the vectors $\begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$, $\begin{bmatrix} 4 \\ 5 \\ 1 \end{bmatrix}$, and $\begin{bmatrix} 2 \\ 7 \\ 3 \end{bmatrix}$.

[3] Consider the linear transformation $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined by

$$T(\vec{x}) = \begin{bmatrix} 2 & 3 & 1 \\ 1 & 4 & -2 \\ 1 & 2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}. \text{ Let } \vec{u} = \begin{bmatrix} -2 \\ -1 \\ 5 \end{bmatrix}$$

(a) Find the image of T under $\vec{u}$

(b) Is $\vec{u}$ in the range of T?

[4] Suppose that the RREF of a matrix A is $\begin{bmatrix} 1 & 0 & -2 & 0 & 4 \\ 0 & 1 & 3 & 0 & -1 \\ 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$.

Write the solution set of the equation $A\vec{x} = \vec{0}$ in parametric vector form.

[5] Are the vectors $\begin{bmatrix} 1 \\ 2 \\ 1 \\ 1 \end{bmatrix}$, $\begin{bmatrix} 4 \\ -2 \\ 2 \\ -1 \end{bmatrix}$, and $\begin{bmatrix} 2 \\ 3 \\ 1 \\ 2 \end{bmatrix}$ *linearly dependent* or *linearly independent*?(Justify your answer.)

[6] Do the vectors $\begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}, \begin{bmatrix} 4 \\ -1 \\ 2 \end{bmatrix}, \begin{bmatrix} 2 \\ 4 \\ 7 \end{bmatrix}$, and $\begin{bmatrix} 1 \\ 1 \\ -8 \end{bmatrix}$ *span* $\mathbb{R}^3$. (Justify your answer.)

[7] Consider the linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^3$ defined by

$$T(\vec{x}) = \begin{bmatrix} 1 & 4 \\ 2 & 3 \\ 1 & 6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

(a) Is T one-to-one?
(b) Is T onto?
(Justify your answer.)

[8] Let $\vec{x} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ and $\vec{y} = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$. Give an example of a nonzero vector which is in the *span* of $\vec{x}$ and $\vec{y}$.

[9] Find a value c so the system of equations $\begin{cases} x_1 + x_2 = 2 \\ -3x_1 + cx_2 = -6 \\ 2x_1 + x_2 = 7 \end{cases}$ will be *consistent*.

[10] Describe geometrically what each transformation does to a vector in R^2.

(a) $T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right) = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$

(b) $T\left(\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\right) = \begin{bmatrix} -3 & 0 \\ 0 & -3 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$