Mathematics 1350H – Linear algebra I: Matrix algebra
TRENT UNIVERSITY, Summer 2014
Quizzes

Quiz #1. Thursday, 15 May, 2014. *[10 minutes]*

1. Find a vector in $\mathbb{R}^2$ [*i.e.* a 2-D vector] parallel to the line $y = 2x - 1$. *[2]*
2. Find a vector of length 1 parallel to the line $y = 2x - 1$. *[1]*
3. Find a vector in $\mathbb{R}^2$ perpendicular to the line $y = 2x - 1$. *[2]*

Quiz #2. Tuesday, 20 May, 2014. *[12 minutes]*

Consider the lines given by the vector-parametric equation $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} + t \begin{bmatrix} 1 \\ -3 \end{bmatrix}$ and the normal equation $\begin{bmatrix} 1 \\ -3 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ -3 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 2 \end{bmatrix}$.

1. Sketch both lines. *[1]*
2. What is the angle between the lines? Why? *[1]*.
3. Find equations of the form $y = mx + b$ for both lines. *[3]*

Quiz #3. Thursday, 22 May, 2014. *[15 minutes]*

1. Find an equation of the form $ax + by + cz = d$ of the plane in $\mathbb{R}^3$ that includes the points $(-1, 2, 0)$, $(0, 2, 1)$, and $(-1, 3, 1)$. *[5]*

Quiz #4. Tuesday, 27 May, 2014. *[15 minutes]*

1. Find all the solutions, if any, to the following system of linear equations:

$$\begin{array}{rcrcrcr} x & + & y & & & = & 2 \\ 2x & + & y & - & z & = & 2 \\ x & + & 2y & - & z & = & 0 \end{array} \qquad [4]$$

2. Each of the equations in the given system represents a plane in $\mathbb{R}^3$. What does your answer to the question above tell you about how these planes intersect? *[1]*

Quiz #5. Thursday, 29 May, 2014. *[15 minutes]*

1. Determine whether $\begin{bmatrix} 5 \\ 3 \\ 1 \end{bmatrix} \in \text{Span}\left\{ \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix} \right\}$ or not. *[4]*
2. What, if anything, does your answer to question 1 tell you about whether or not $\left\{ \begin{bmatrix} 5 \\ 3 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix} \right\}$ is a linearly independent set of vectors? *[1]*

Quiz #6. Thursday, 5 June, 2014. *[15 minutes]*

1. Suppose $\mathbf{A}$ and $\mathbf{B}$ are $n \times n$ matrices such that $\mathbf{A}$ and $\mathbf{AB}$ both have inverses. Either show that $\mathbf{B}$ must have an inverse too, or give an example demonstrating that $\mathbf{B}$ does not have to have an inverse. *[5]*

Quiz #7. Tuesday, 10 June, 2014. *[15 minutes]*

Determine whether each of the following collections of vectors is a subspace of $\mathbb{R}^2$.

1. $U = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} \middle| \; x + y = 1 \right\}$ *[1.5]*
2. $V = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} \middle| \; x + y = 0 \right\}$ *[1.5]*
3. $W = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} \middle| \; x + y = 0 \text{ and/or } x - y = 0 \right\}$ *[2]*

Quiz #8. *Take-home! [Due in class on Tuesday, 17 June, 2014.]*

You may use your textbook, your notes, and all handouts from this class, but you may not consult any other sources or persons.

1. Mr. Pisistratus Patriarch lived up to his somewhat unusual name. He had nine children, and no fewer than 31 grandchildren. In his will he left an exact number of dollars to each grandchild. Each girl was to get \$7 more than each boy. All 31 grandchildren were alive when Patriarch died, and their legacies totaled \$470. Of this amount, \$74 went to Mrs. Inkpen's children (she was Patriarch's eldest daughter). How many daughters had Mrs. Inkpen? Please give your reasoning in detail. *[5]*

Quiz #9. Tuesday, 17 June, 2014. *[15 minutes]*

Let $\mathbf{A} = \begin{bmatrix} 1 & 4 & 7 & 10 \\ 2 & 5 & 8 & 11 \\ 3 & 6 & 9 & 12 \end{bmatrix}$.

1. Use the Gauss-Jordan method to row-reduce $\mathbf{A}$. *[2]*
2. Find a basis for col($\mathbf{A}$). *[1]*
3. Find a basis for row($\mathbf{A}$). *[1]*
4. Find a basis for null($\mathbf{A}$). *[1]*

Quiz #10. Thursday, 19 June, 2014. *[15 minutes]*

1. Find the eigenvalues of $\mathbf{A} = \begin{bmatrix} 4 & 4 \\ 5 & 3 \end{bmatrix}$. *[3]*
2. Find a non-zero eigenvector for each eigenvalue of $\mathbf{A}$. *[2]*