

Simon Fraser University

Math 232

Midterm 1
Instructor : Aaron Bradford

Date: 8 June 2007
Time: 11:30 - 12:20

Last Name (print): _____ **First Name:** _____

Signature: _____ **SFU Email ID:** _____

Instructions:

1. DO NOT OPEN THIS EXAM UNTIL INSTRUCTED TO DO SO.
2. Ensure that you have 5 pages of questions.
3. No calculators, notes or books are allowed.
4. Except for question 1, credit will not be given for answers with no explanation.
5. Answer each question in the space provided. Continue on the back of the previous page if necessary.
6. You may not use determinants (or any other material beyond chapter 2) to answer any questions.
7. Good luck!

Question	Mark	Maximum
1		3
2		3
3		5
4		5
5		5
6		5
Total		26

1. **(½ point each)** Mark the following statements as either true or false. No explanation is required.

- a. ____ The weights c_1, \dots, c_p in the linear combination $c_1 \vec{v}_1 + \dots + c_p \vec{v}_p$ cannot all be zero.
- b. ____ If the equation $A\vec{x} = \vec{b}$ is inconsistent, then \vec{b} is not in the set spanned by the columns of A .
- c. ____ The equation $A\vec{x} = \vec{b}$ is homogeneous if the zero vector is a solution.
- d. ____ If \vec{x} and \vec{y} are linearly independent, and if $\vec{z} \in \text{Span}(\vec{x}, \vec{y})$, then $\{\vec{x}, \vec{y}, \vec{z}\}$ is linearly dependent.
- e. ____ If A is a 3×5 matrix and T is a transformation defined by $T(\vec{x}) = A\vec{x}$, then the domain of T is \mathbb{R}^3 .
- f. ____ If A can be row-reduced to the identity matrix, then A must be invertible.

2. **(3 points)** Compute AB , where $A = \begin{pmatrix} 4 & -2 \\ -3 & 0 \\ 3 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 3 \\ 2 & -1 \end{pmatrix}$. Why is BA undefined?

3. **(1 point – 3 points – 1 point)** This question is concerned with the following system:

$$\begin{cases} x_2 + 4x_3 = -5 \\ x_1 + 3x_2 + 5x_3 = -2 \\ 3x_1 + 7x_2 + 7x_3 = 4 \end{cases}$$

- a. Write down the augmented matrix of the system.
- b. Solve the linear system and write the solution in parametric vector form.

- c. Is the set of vectors $\left\{ \begin{pmatrix} 0 \\ 1 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ 3 \\ 7 \end{pmatrix}, \begin{pmatrix} 4 \\ 5 \\ 7 \end{pmatrix} \right\}$ linearly independent? [hint: justify your answer using your work from (b)]

4. **(2 points – 3 points)**

a. Without performing any row-operations, decide whether or not the matrix

$$\begin{pmatrix} 1 & 3 & 7 & 4 \\ 0 & 5 & 9 & 6 \\ 0 & 0 & 0 & 10 \\ 0 & 0 & 0 & 0 \end{pmatrix} \text{ is invertible. Justify your answer.}$$

b. Find the inverse of the matrix $A = \begin{pmatrix} 1 & 0 & -1 \\ -4 & 1 & 3 \\ 3 & -2 & 2 \end{pmatrix}$. Show your work.

5. (1 point – 2 points – 2 points)

- Define what it means for a transformation $T : \mathbb{R}^n \rightarrow \mathbb{R}^m$ to be **linear**.
- Show that the transformation $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ given by $T(x_1, x_2) = (3x_1 - 5x_2, x_1 + 2x_2)$ is linear by verifying that it satisfies the definition of linear.
- Find the standard matrix of the transformation T given in (b)

