MTH 165: Linear Algebra with Differential Equations

2nd Midterm

April 4, 2013

NAME (please print legibly): ______________________________

Your University ID Number: ______________________________

Indicate your instructor with a check in the box:

Dan-Andrei Geba	MWF 10:00 - 10:50	
Giorgis Petridis	MWF 13:00 - 13:50	
Eyvindur Ari Palsson	MW 14:00 - 15:15	

- **The presence of of electronic devices (including calculators), books, or formula cards/sheets at this exam is strictly forbidden.**
- **Show your work and justify your answers. You may not receive full credit for a correct answer if insufficient work is shown or insufficient justification is given.**
- **Clearly circle or label your simplified final answers.**
- **You are responsible for checking that this exam has all ?? pages.**

QUESTION	VALUE	SCORE
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
TOTAL	60	

1. (10 points) Find the inverse of the matrix

$$A = \begin{bmatrix} -7 & -3 & 1 \\ 2 & 1 & 0 \\ -28 & -13 & 3 \end{bmatrix}.$$

2. (10 points) Use cofactor expansion and/or row reduction to evaluate the determinant of the following matrix

$$\begin{bmatrix} 1 & 2 & 2 & 4 \\ -2 & 2 & -2 & 2 \\ 2 & 1 & -1 & -2 \\ -1 & -4 & 4 & 2 \end{bmatrix}.$$

3. (10 points) In each of the following, determine whether the subset S is a subspace of the given vector space V:

i) $V = \mathbb{R}^4$ and $S = \{(x_1, x_2, x_3, x_4) \in \mathbb{R}^4 \mid x_1 x_4 = 0\}$;

ii) $V = M_{2\times 2}(\mathbb{R})$ and $S = \{A \in M_{2\times 2}(\mathbb{R}) \mid A = 2A^T\}$.

4. (10 points) Using the Wronskian, determine whether or not the functions

$$f_1(x) = \sin x\,,\ \ f_2(x) = \sin 2x\,,\ \ f_3(x) = e^x$$

are linearly independent on $\mathbb{R}$.

5. (10 points) Find a subset of

$$S = \left\{ \begin{pmatrix} 3 \\ 2 \\ 2 \\ 2 \end{pmatrix}, \begin{pmatrix} 2 \\ 1 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} 4 \\ 3 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix} \right\}$$

that forms a basis for the subspace of $\mathbb{R}^4$ generated by S, i.e., $\operatorname{span} S$.

6. (10 points) For the matrix

$$A = \begin{bmatrix} 3 & 1 & -3 & 11 & 10 \\ 5 & 8 & 2 & -2 & 7 \\ 2 & 5 & 0 & -1 & 14 \end{bmatrix},$$

find a basis and the dimension for nullspace$\,(A)$.