*********!!!!!!!!!!!!!!!! The midterm date: November 3, 2009 (Tuesday) !!!!!!!!!!!!!!!!*********

!!!!!!!!!!!!!!!!********* The midterm will be in HH 141, Starting time: 8am *********!!!!!!!!!!!!!!!!

165 f09	Sample Midterm	Exam Time: Tu. 11/3/09, 8:00 - 9:30
Name:		Student No.:

Circle the name of your instructor: Prof. Salur (MW 2pm) Prof. Arikan (MWF 10am)

Instructions:

- Answer ALL questions from Section A
- You may use a handwritten sheet of notes. Calculators are NOT permitted.
- Read all questions carefully
- Unless explicitly told otherwise, you should explain all your answers fully.
- Do NOT seperate the pages of your exam.

Problem	Points	Score
A1	16	
A2	16	
A3	16	
A4	12	
A5	12	
A6	12	
A7	16	
Total	100	

Name:

Section A: Answer ALL questions.

Problem A1: [16=8+8 pts] Consider the family of curves given by the equation $y^2 = 2x + c$ where c is a constant, and x, y are variables.

(**a**) What is the differential equation which gives the slope of the family at a point (x, y)?

(**b**) Find the the orthogonal trajectories to the family given above. Give your answer in explicit form.

Name:

Problem A2: [16=8+8 pts]

(**a**) Find the general solution of the equation

$$\frac{dy}{dx} - (\tan x)y = 8\sin^3 x.$$

(**b**) Solve the initial value problem

$$y' = y^3 \sin x, \qquad y(0) = 1.$$

Name:

Problem A3: [16=6+10 pts]

(**a**) For which value(s) of k is the following system of linear equations consistent?

$$\begin{aligned} x + 2y &= 1 \\ 2x + ky &= -5 \end{aligned}$$

(**b**) Find the solution(s) to the following system of linear equations:

$$\begin{aligned} 3x + y + 5z &= 5 \\ x + y - z &= 1 \\ 2x + y + 2z &= 3 \end{aligned}$$

Write your answer in vector format. If the system is inconsistent, write "inconsistent". Justify your answer. (No credit will be given for a method not based on either Gaussian or Gauss-Jordan elimination)

Name:

Problem A4: [12=5+5+2 pts] Consider the matrix

$$A = \begin{pmatrix} -2 & 3 & -1 \\ 2 & 1 & 5 \\ 0 & 2 & 3 \end{pmatrix}.$$

(**a**) Compute $adj(A)$.

$adj(A) =$

(**b**) Compute $det(A)$.

$det(A) =$

(**c**) Is A invertible? If so, find A^{-1}, if not justify your answer.

Name:

Problem A5: [12=4+4+4 pts] Suppose that

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = 3$$

(**a**) Find $\begin{vmatrix} a & b & c \\ 2g+d & 2h+e & 2i+f \\ g & h & i \end{vmatrix}$

(**b**) Find $\begin{vmatrix} g & h & i \\ d & e & f \\ 2a & 2b & 2c \end{vmatrix}$

(**c**) Find $\begin{vmatrix} 2a & d & g \\ 2b & e & h \\ 2c & f & i \end{vmatrix}$

Name:

Problem A6: [12=4+4+4 pts] For each set of vectors, decide whether or not the set is linearly independent. Fully justify your answers.

(**a**) $\{e^t, e^{-t}, t\}$

(**b**) $\left\{ \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}, \begin{pmatrix} 1 \\ -4 \\ 1 \end{pmatrix} \right\}$

(**c**) $\left\{ \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}, \begin{pmatrix} 3 & 4 \\ 5 & 6 \end{pmatrix}, \begin{pmatrix} 4 & 5 \\ 6 & 7 \end{pmatrix}, \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix} \right\}$

Name:

Problem A7: [16=8+8 pts]

(**a**) Is $B = \left\{ \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ -1 \end{pmatrix} \right\}$ a basis for $\mathbb{R}^3$? Justify your answers.

(**b**) Determine a basis for the subspace S of $\mathbb{R}^4$ consisting of all solutions to the linear system

$$\begin{aligned} x_1 - 2x_2 + 3x_3 + x_4 &= 0 \\ -2x_1 + 3x_2 - 4x_3 + x_4 &= 0 \end{aligned}$$

What is the dimension, $dim(S)$, of S?