# MATH 307: Problem Set #4

Due on: August 12, 2013

**Problem 1** *Book Problems*

7.6.1(a,d),7.6.4, 7.6.6; 8.2.3, 8.2.5, 8.2.7(bc), and 8.2.9(abc)

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**Problem 2** *Matrix Algebra*

For each of the following, find two $3 \times 3$ matrices $A$ and $B$ with coefficients in $\mathbb{R}$ that satisfy the described property and prove that they satisfy the state property. If you use a theorem to do so, be sure to carefully state the theorem and verify that your matrices satisfy the requirements of the theorem.

(a) $AB \neq BA$

(b) $A$ and $B$ similar

(c) $A$ and $B$ not similar

(d) $A$ and $B$ similar and not diagonal

(e) $A$ and $B$ not similar and not diagonal

. . . . . .

**Problem 3** *More Matrix Algebra*

Determine the eigenvalues of the following matrix

$$\begin{pmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{pmatrix}$$

Based on the eigenvalues, is the matrix singular or nonsingular?

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## **Problem 4** *Second Derivative Test Problem*

Consider the function

$$F(x, y, z) = (ax^2 + by^2 + cz^2)e^{-x^2-y^2-z^2},$$

where $a > b > c > 0$. Locate the critical points of $F$ and use the second derivative test to determine whether they are local maxima, local minima, or saddle points.

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## **Problem 5** *Independent Project Rough Draft*

For the independent project rough draft, we require a typed report of "rough draft quality" demonstrative of the current state of your knowledge of the topic you chose. In particular, it should exhibit all, but not necessarily only, the following sections:

(i) An abstract

(ii) An introduction

(iii) A background section

(iv) Several sections on your topic

(v) A section on future directions of study

(vi) A conclusion section

An appropriate length for this report is somewhere between 6 and 10 pages (though since this is a rough draft, it is okay if it isn't yet quite so long as this). Students are encouraged, though not required, to use Latex for their writeup. Trust in your instructors advice that it will make writing math much faster and prettier than other word processing programs.

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