Math 3592H **Honors Mathematics I** **Fall Semester 2017**

Assignment 12 – Due **Tuesday** 12/5/2017. There will be no quiz on this day. The third midterm exam is on December 7. You will be tested on the material in Sections 2.1 - 2.6 that we have studied.

Read: Hubbard and Hubbard Section 2.7 and the following parts of Section 2.8: only pages 232-236, the beginning of Example 2.8.15 and the beginning of Example 2.8.16. We will not do Kantorovich's theorem or Lipschitz conditions in Section 2.8.

Exercises (Due **Tuesday** 12/5/2017):
2.7: 1*, 2, 3, 5, 6
2.8: 2, 4, 6b*, 7a, 10, 12a
2.11: 22b, 23

Extra questions:

1. For each of the following matrices, representing a linear map $\mathbb{R}^2 \to \mathbb{R}^2$, either find a basis consisting of eigenvectors or else show that such a basis cannot exist.

$$(a) * \begin{pmatrix} 3 & -1 \\ 2 & 0 \end{pmatrix}; \qquad (b) * \begin{pmatrix} 22 & -9 \\ 49 & -20 \end{pmatrix}; \qquad (c) \begin{pmatrix} 4 & -1 \\ 2 & 1 \end{pmatrix}; \qquad (d) \begin{pmatrix} 13 & -6 \\ 0 & -13 \end{pmatrix}$$

2. (a)* Regarding each of the matrices in question 1 as the matrix of a linear map expressed with respect to the standard basis of $\mathbb{R}^2$, find the matrix of this linear map when expressed with respect to the basis $\begin{pmatrix} 1 \\ 2 \end{pmatrix}, \begin{pmatrix} -1 \\ -1 \end{pmatrix}$.

3.* Find a matrix P so that PAP^{-1} is diagonal, where $A = \begin{pmatrix} 3 & -1 \\ 2 & 0 \end{pmatrix}$.

4. Find a basis for $\mathbb{R}^3$ consisting of eigenvectors of the following matrix, or else show that such a basis does not exist:

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & 2 & 0 \end{pmatrix}$$

Comments: We did not quite finish Section 2.6 last week, but we had done enough for you to do the homework questions. The part of Section 2.6 we missed out was theoretical and had to do with the base change matrix and the fact that any two bases for a vector space have the same size. I advise you not to read about the base change matrix. I will not test you on it, it is hard to understand, and it is not the best way to compute coordinates with respect to a new basis.