Math 4355 – Spring 2017 Name:

HW #2

Please, write clearly and justify all your steps, to get proper credit for your work.

(1-3) Solve problems Ex. 9,10,11 p.35, from the textbook.

(4) Let $V = L^2([-\pi, \pi])$ and consider the subspace $V_0 \subset V$ given by

$$V_0 = \text{span}\{1, \cos x, \sin x\}$$

(i) Find an ON basis for V_0 (note that V_0 is a subspace of $L^2([-\pi, \pi])$ so that the functions are only defined on $[-\pi, \pi]$).

(ii) Show that the space $V_1 = \text{span}\{\cos(2x), \sin(2x)\} \subset V$ is orthogonal to V_0. Is V_1 the orthogonal complement of V_0? Justify your answer.

(iii) Find the orthogonal projection of $f(x) = \cos(3x)$ onto V_0

(iv) Find the orthogonal projection of $f(x) = x$, for the interval $[-\pi, \pi]$, onto V_0 and onto V_1.

(5) (Matlab project) Define a variable with the command "x=0:0.001:1;" in Matlab. This defines a row vector with values ranging from 0 to 1 in steps of 0.001 increment. Now plot the several functions fn(x) in the sequences defined in Ex.7 for n=2, n=10, and n=50. Think about a way to produce the piecewise definition of the functions. Refer to Matlab Help if needed. You may want to call the resulting vectors of function values f2, f10, and f50. Plotting the functions is simply done by "plot(x,f2);" and similarly for f10 and f50. Save the plots and print them. Attach a printout of your plots to your homework, together with the Matlab code you used to generate the function values.

[NOTE: you can use Python rather than Matlab]