Math 313. Spring 2017. HW 1.

Name _____

Instructions for written homework.

- Place the written part of the homework to our TA **Jakob Hansen** mailbox by 4pm Jan 27, Friday. Her mailbox is located at the Math department mailroom. Please keep in mind that the mailroom is closed at 5pm.
- The Matlab part of the homework is due at 11:59pm, Jan 29, Sunday. Your files should be uploaded to canvas before that time.
- You are encouraged to work with others on these problems. You are expected to write the solutions yourself.
- Your solutions should be legible and well organized. **Graders will deduct points for solutions that are difficult to read, or are disorganized.** For the benefit of the grader, please turn in solutions to problems in the assigned order.
- Staple your pages together. Do not turn in notebook paper with tattered edges. **Homework that is unstapled or is lacking a name will not be graded.**

Problem 1 (Reading)**.** Make sure to skim Chapter 1, Sections 2.1 - 2.5 in the book.

Problem 2 (Written part)**.** Do the following exercises from the book
Section 2.1 # 26
Section 2.2 # 12
Section 2.4 # 4, 5, 6, 32, 37
Section 2.5 # 10, 11, 25, 27

Problem 3 (Matlab)**.** Consider the problem of find the coefficients of the fourth-degree polynomial

$$f(t) = a_0 + a_1 t + a_2 t^2 + a_3 t^3 + a_4 t^4$$

that passes through five specified points. Assume the datapoints are given by a 5×2 matrix:

$$datapoints = \begin{bmatrix} 1 & 1 \\ -2 & 3 \\ 0 & 2 \\ 3 & -2 \\ 4 & 9 \end{bmatrix}$$

meaning that the graph of the polynomial pass through the points (1,1), (-2,3), etc. We can rephrase this problem as solving a system of linear equations: $A\vec{x} = \vec{b}$, where $\vec{x}$ will consist

of the unknowns a_0, a_1, a_2, a_3 and a_4, and A is a 5×5 matrix (what is A?)
Write a MATLAB .m file that does the following, **without using any loops**!

a. Define the vector $\vec{b}$ using the datapoints;

b. Define the matrix A. (hints: for the above datapoints, write down the first column of A, then the second column of A, etc)

c. Generate a plot of the polynomial over the range $5 \leq t \leq 5$. (Choose a reasonable step size for t.)

d. Finally, overlay your plot with a plots of the 5 data points. Make sure your polynomial passes through all the points! (See hints 5 and 6.)

e. Be sure to comment your code, so someone else could follow your work.

(**Do not need to submit this part**) Write a function (a MATLAB .m file) to find out the coefficients of a n-th degree polynomial? This function takes a $(n+1) \times 2$ matrix as an input, and outputs the coefficients of the polynomial. Here n can be any positive integer and your function should be able to read the degree n from the input matrix.

Some MATLAB hints

a. If you have a matrix M, then $M(:, 2)$ returns the second column of it

b. ones(m,1) creates a column vector with m entries of all 1s.

c. To take the third power of each entry of a vector t, use $t.\hat{}\, 3$, not $t\hat{}\, 3$.

d. If you have some column vectors u, v, w of the same length m, you can concatenate them like $[u\ v\ w]$ to make a $m \times 3$ matrix, for instance.

e. The command hold on prevents the current plot from being erased when you plot something new. Theres also hold off.

f. The function scatter takes in two vectors and makes a plot of those points in the plane.

g. $[m, n]$ =size(X) returns the size of matrix X in separate variables m and n.