Math 2373, CSE Lin. Alg. and Diff. Eq., Spring 2019, Univ. of Minn.
HOMEWORK ASSIGNMENTS THROUGH WEEK 7 (stay tuned for homework through week 12)

All assignments are from the required text by Farlow, Hall, McDill and West (except for a few
“home-made” problems written right on this sheet). Answers to all problems must be justified—
unexplained numerical answers will get no credit. Calculations must be done by hand unless you are
given specific instructions to do otherwise. Remember that you are practicing up for the exams.

Week 1 homework due Tuesday, Jan. 29

- Sec. 3.2, pp.143–145: 5,6,8,12,13,14,16,19,21,22,26,30,33,34
- Use the row operation notation on p. 134 of the text correctly to explain each step of row-
reduction needed to reduce the matrices in problems 12,13,14,16,19,21,22 to reduced row ech-
elon form. In 33,34 we give you a pass to use the \texttt{rref} command on your calculator, but other
that that all work must be done by hand. Furthermore, in answering 26,30,33,34 don’t just
discuss solutions—find all of them. In the case of more than one solution give the answer in
the form demonstrated in Ex. 7 on pp. 139–140.

Week 2 homework due Tuesday, Feb. 5

- Sec. 3.1, pp. 127–130: 2,3,4,5,6,7,12,14,18,22
- Sec. 3.2, pp.143–145: 1,2,4,66 (To do 66 you may use your calculator to calculate \texttt{rref} but then in case of infinitely many solutions you must write out the solution following Ex. 7 on pp. 139–140.)
- Sec. 3.4, pp. 164–167: 1,2,3,4,12,13,16,17,18,39,42 (When/if using row operations, use the
notation from p.134 of the text. In 39 and 42, write out the determinants carefully but then
you can evaluate them with your calculator.)
- Problem 15 from Sec. 3.4 is not assigned but you must know what it says to do 16, 17, 18.
- Sec. 2.2, pp. 70–73: 1,2,6,8,16,18: This portion “frozen out,” i.e., cancelled. (We use only the
integrating factor method to solve first order linear differential equations in this course.)

Week 3 homework due Tuesday, Feb. 12

- Sec. 2.2, pp. 70–73: 1,2,6,8,16,18,22,23,29,30 (We use only the integrating factor method to
solve first order linear differential equations in this course.)
- Sec. 3.3, pp. 154–156: 1,2,6,7,8,13,20,21 (Problems 20 and 21 use the important formula
\( x = A^{-1}b \) which needless to say you must know.)
- Sec. 3.3: 15 is not assigned but you must know it!
- Sec. 2.4, pp. 84–87: 2(a,c),3(a,c),6
- Home-made: An enormous tank initially contains 400 gallons of water in which is dissolved 50
lbs of salt. Brine containing 4 lbs of salt per gallon enters the tank at the rate of 5 gallons per
minute. The well mixed brine leaves the tank at the slower rate of 3 gallons per minute. Find
an expression for the number of pounds of salt in the tank at time \( t \). (Don’t worry about the
tank overflowing.)
Week 4 homework due Tuesday, Feb. 19

- Sec. 1.2, pp. 20–24: 1, 2, 13, 14, 16–21
- Sec. 1.3, pp. 29–32: 11, 14, 18, 25–30, 32
- Sec. 2.3, pp. 77–80: 4, 5, 7, 8, 12, 16, 24, 31
- Sec. 2.4, pp. 84–87: 16, 20
- Home-made problem 1: Solve the boundary value problem
  \[ \frac{dy}{dt} = 0.06y - 12M, \quad y(0) = 250000, \quad y(30) = 0 \]
  where as part of the problem you have to determine the constant \( M \). Interpret your result in terms of paying down a mortgage.
- Home-made problem 2: Solve the initial value problem
  \[ \frac{dy}{dt} = (y + 1)(y - 3), \quad y(0) = 1 \]
  and sketch the solution on the same axes with the direction field of the differential equation and the equilibrium solutions. Say which equilibrium solution is stable and which unstable. 

Typos corrected on February 10, 2019 in both home-made problems.

Week 5 homework due Tuesday, Feb. 26 | Midterm I, Feb. 19

- Sec. 4.1, pp. 205–210: 2, 3, 4, 15, 16, 17, 24, 25, 26, 40, 41, 42, 43
- Your answers to 40, 41, 42, 43 should each be justified by relating numerical details of the IVP to features of the graphs using new vocabulary in Sec. 4.1, e.g., period, circular frequency, and so on.

Week 6 homework due Tuesday, Mar. 5

- Sec. 3.6: p. 191: 7–11, 64
- You may use the rref button under the “full disclosure” rule for your work in Sec. 3.6 but you must still explain in words how you get your final answers.
- Sec. 4.2: pp. 222–229: 1, 2, 3, 5, 7, 11, 16, 17, 19, 22
- Sec. 4.3: pp. 238–243: 1, 2, 3, 7, 11, 12, 13, 16, 62
- Ignore the instruction “give a basis...” in 4.3: 1, 2, 3, 7
- Concepts from Sec. 3.6 are covered this week not only in homework and worksheets but also in the lab. You are responsible on upcoming tests for all of this material exclusive of that specifically related to the MATLAB software.

Week 7 homework due Tuesday, Mar. 12

- Sec. 3.4, pp. 164–167: 46, 50
- The method of problem 50 is needed to do one of the lab exercises.
- Sec. 4.4, pp. 253–254: 9, 13, 21, 23, 41, 43, 44, 46, 49
- Sec. 5.3, pp. 324–326: 2, 4, 7, 8, 11, 20, 22, 26, 30
- Ignore instruction to sketch eigenspaces. In case of complex eigenvalues write \( A = \alpha I_2 + \beta J \) where \( \alpha \pm \beta i \) are the eigenvalues of \( A \) and \( \beta > 0 \), as discussed in class. Skip the eigenvectors.
- For the three-by-three problems in §5.3 here are the eigenvalues:
  - Eigenvalues for 20 are 1, 2, 3.
  - Eigenvalues for 22 are \(-1, 0, 0\).
  - Eigenvalues for 26 are \(-1, 2, 4\).
  - Eigenvalues for 30 are 1, 1, 2.
- In general our policy is to supply eigenvalues for three-by-three matrices; we do not ask students to calculate them.