
Weekly Problem Sets: The following is a list of homework problems to be done each week.

**HW 1: Due Feb 1**
Section 1.1: 8, 10, 21, 25.
Section 1.2: 6, 28.
Section 1.3: 22.
Section 1.4: 2, 13, 26, 49.

**HW 2: Due Feb 8**
Section 1.5: 6, 13, 16, 31, 32, 36.
Section 1.6: 6, 16, 24, 32, 37.

**HW 3: Due Feb 15**
Section 2.1: 6, 10, 12, 21, 29.
Section 2.2: 3, 11, 21, 22, 29.
Section 2.4: 5, 7.

**HW 4: Due Feb 29**
Section 3.1: 5, 13, 23.
Section 3.2: 11, 18, 25.
Section 3.3: 9, 10, 32, 35.
Section 3.4: 8, 10, 31, 32.

**HW 5: Due Mar 7**
Section 3.5: 2, 6, 11, 30, 36.
Section 3.6: 4, 8, 13, 26, 27, 34, 38, 52.

**HW 6: Due Mar 14**
Section 4.1: 11, 16, 20, 22, 28, 32, 35.
Section 4.2: 6, 11, 16, 20, 30.

**HW 7: Due Mar 28**
Section 4.3: 13, 15, 19, 21, 22.
Section 4.4: 2, 7, 14, 21, 23, 24.

**HW 8: Due Apr 8**
Section 4.5: 2, 8, 13, 15.
Section 4.6: 1, 15, 19, 23.
Section 5.1: 9, 12, 26, 34, 39, 46.
HW 9: Due Apr 11
Section 5.2: 10, 13, 16, 24.
Section 5.3: 8, 12, 20, 23, 26, 33, 38, 40, 41.

HW 10: Due Apr 18
Section 5.4: 4, 13, 14, 16.
Section 5.5: 4, 10, 17, 32, 33.
Section 5.6: 2, 18.

HW 11: Due Apr 25
Section 6.1: 10, 20, 30.
Section 7.2: 9, 19, 28.
Section 7.3: 2, 9, 12 (graphing not necessary).

HW 12: Due May 2
Section 7.3: 2, 9, 12 (plot by hand using method from class, keep a copy of HW 11).
Section 7.3: 15, 16 (with plot).
Section 7.3: 18.
Section 7.5: 2, 5 (with hand plot).
Section 7.5: 7, 16.

Pre-requisite: Math 222.
Credit may not be received for both Math 320 and Math 340.

Professor: M. Slemrod, Departments of Mathematics, Office Hours: Tuesdays and Thursdays 10:00-11:00a in Van Vleck 523, slemrod@math.wisc.edu, http://www.math.wisc.edu/~slemrod

Teaching Assistant: Melanie Ruiz

Exams: There will be two in-class exams: Tuesday, March 4, 2008 and Thursday, April 17, 2008. Please let me know IMMEDIATELY if you have a conflict with these dates. Each exam is worth 30% of the final grade.

Final Exam: The final is Friday, May 16, 5:05-7:05 PM and is worth 40% of the final grade.

Calculators: Calculators and/or computer software may be used to help with homework problems but are not permitted during exams.

Course description: Differential equations are the fundamental tools that scientists and engineers use to model physical reality. The importance of differential equations to science and engineering cannot be over-emphasized. A distinct subject in its own right, linear algebra is a part of mathematics concerned with the structure inherent in mathematical systems. We shall study these subjects together for three reasons: (1) The viewpoint of linear algebra is immensely helpful in uncovering the order underlying the topic of differential equations; it helps us understand the “why” and not just the “how” of our calculations; (2) Linear algebra is essential to the theory of differential equations; (3) Linear algebra is crucial to the computer approximations which are often the only way to solve the most challenging differential equations.
Throughout this course, we will seek to answer the following basic questions:

- When does a differential equation have a solution? When is that solution unique?
- Can one construct the (unique) solution of a differential equation in terms of elementary functions? If not, can one approximate its solution numerically and/or understand it qualitatively?
- How does one choose the differential equation(s) used to model a physical system? What are the strengths and limitations of such models? Specifically, what is the significance of \textit{linearity} in our models and applications?

**Course outline:** The course covers material in Chapters 1-9 of the text. The topics are listed below with corresponding chapter and a rough estimate of class time.

Chapter 1 (1.5 weeks): First-Order ODEs (continuing from 221/222 with some review).
Chapter 2 (1.5 week) Mathematical Models and Numerical Methods.
Chapter 3 (2.5 weeks) Linear Systems and Matrices.
Chapter 4 (1.5 weeks) Vectors Spaces (mainly 4.1-4.4).
Chapter 5 (2 weeks) Higher-Order Linear ODEs.
Chapter 6 (1 week) Eigenvalues and Eigenvectors (sections 6.1-6.2).
Chapter 7 (2 weeks) Homogeneous Linear Systems of ODEs.
Chapter 8 (1 week) Nonhomogeneous Linear Systems of ODEs (sections 8.1-8.2).

Total Weeks = 14 (15 minus two exam days; allows 1 week flexibility)