Practice problems and previous topics

I have assigned odd problems, so that you can check your answers with those in the back of the book. Please feel free to ask questions about these and any other problems in office hours.

Topics on Midterm II

Rough topics.

- Double integrals in polar coordinates (see Week 4 book problems).
- §11.1 Linear systems of ODEs – real eigenvalues
  
  (General solution with eigenvalues and eigenvectors, saddles and nodes, stability, phase portraits) 
  NOTE: phase portraits are not covered in the book, but are similar to the “direction field.” See the movie (Powerpoint 5) on my website.
- §11.1 Linear systems of ODEs – imaginary eigenvalues
  
  (Euler’s formula, spirals and centers, stability, phase portraits)

Suggested problems for linear systems of ODEs:

Page 607-8: Problem 11 (for this problem, see if you can sketch the phase portrait – check your answer with the given direction field)

Page 609: Problem 23

Page 610: Problems 31, 33, 37, 39, 43, 47, 51, 53, 55, 59, 61, 65. (for these problems, also sketch the phase portrait. Check your answer with the solutions on next page).

- §11.3 Non-linear systems of ODEs
  
  (Linearization about a fixed point, stability).

Suggested problems for non-linear systems of ODEs:

Page 629: Problems 5, 7, 9


Note: The book provides a trick to determine the sign of the eigenvalues of a 2x2 matrix using the trace and the determinant. You can learn this trick if you wish; however, you are not responsible for learning it.
Phase portraits for problems in §11.1, page 610.

Figure 1: Computer generated plots for problems 31, 33, 37, 39, 43, 47, 51, 53, 55, 59, 61, 65.