

Mathematics 20D Syllabus (Updated Spring 2016)

Based on *Elementary Differential Equations* (10th edition) by Boyce and DiPrima.

| Lecture | Section | Topic |
|---------|---------|---|
| 1 | 1.1–1.3 | Intro: Math modeling w/ ODE, Classification of ODE and PDE |
| 2 | 2.1 | Linear equations; Method of Integrating Factors |
| 3 | 2.2 | Separable Equations |
| 4 | 2.3–2.4 | Modeling w/ First Order Equations; Differences between Linear and Nonlinear Equations |
| 5 | 2.5 | Autonomous Equations and Population Dynamics |
| 6 | 2.6 | Exact Equations and Integrating Factors |
| 7 | 3.1 | Second Order Linear Equations: Fundamental Solutions of Linear Homogeneous Equations |
| 8 | 3.2 | Linear Independence and the Wronskian |
| 9 | 3.3 | Complex Roots of the Characteristic Equation |
| 10 | 3.4 | Repeated Roots; Reduction of Order |
| 11 | 3.5 | Nonhomogeneous Equations; Method of Undetermined Coefficients |
| 12 | 3.6 | Variation of Parameters |
| 13 | 7.1-7.2 | Systems of First Order Linear Equations: Intro, Review of Matrices |
| 14 | 7.3 | Linear Algebraic Equations; Linear Independence, Eigenvalues, Eigenvectors |
| 15 | 7.4 | Basic Theory of Systems of First Order Linear Equations |
| 16 | 7.5 | Homogeneous Linear Systems with Constant Coefficients |
| 17 | 7.6 | Complex Eigenvalues |
| 18 | 7.7-7.8 | Fundamental Matrices, Repeated Eigenvalues |
| 19 | 7.9 | Nonhomogeneous Linear Systems |
| 20 | 5.1 | Review of Power Series; Using Power Series to Solve ODEs |
| 21 | 5.2-5.3 | Series Solutions Near an Ordinary Point |
| 22 | 6.1 | The Laplace Transform: Definition of the Laplace Transform |
| 23 | 6.2 | Solution of Initial Value Problems |
| 24 | 6.3-6.4 | Step Function; Differential Equations with Discontinuous Forcing Functions |
| 25 | 6.5 | Impulse Functions |

MATLAB Portion of Math 20D Syllabus

Math 20D has lectures and recitation sections like all other big classes. Distinctive in Math 20D (and Math 18) is that regular Math 20D homework is accompanied by homework in MATLAB, and typically there is a simple quiz on MATLAB which is provided through a department testing procedure (so the instructor does not need to do much work). Most instructors count the MATLAB homework 4% of the grade and the MATLAB “final quiz” 6% of the grade for a total of 10%.

MATLAB homework assignments can be found online at www.math.ucsd.edu/~math20d

1. Introduction to MATLAB (do in week 2)
2. Visualizing Solutions to ODEs using DFIELD and PPLANE (start your direction fields lectures first)
3. Numerical Methods with First-Order Equations (do anytime you like)
4. Systems of ODEs (do most of your ODE systems lectures first)

The department provides tutors for the MATLAB Assignments, a MATLAB final quiz, and grading of the MATLAB portion of the course. The intention is that the Math 20D professor need not worry about MATLAB instruction at all or even worry much about logistics. We suggest the instructor announce (post on web):

1. The webpage for the MATLAB assignments is www.math.ucsd.edu/~math20d
2. MATLAB tutoring is available in the basement B432. It starts in week 2, students can just walk in (schedule to be posted on the web)
3. The dates you want MATLAB homework assignments to be due (typically to complement your class midterms and quizzes)
4. Where to turn homework in: the homework drop boxes in the basement of APM
5. Your grading policy
6. The week when you want your students to take the MATLAB final quiz (e.g. 9th week). MATLAB staff handles and posts schedule of times in that week.

Our MATLAB offering is run by a professor, whose role is to help you. You should always feel free to contact her/him and you will get an email from her/him a bit before your course starts. The department also employs a senior MATLAB TA.

An important feature of the MATLAB homework is that it fills gaps in the lectures:

1. Math 20D Applications are in the MATLAB assignments, which is pedagogically a natural place for them. Thus we expect that many of the application type word problems in Math 20D are in the MATLAB assignments.
2. Numerical ODE is not covered in lectures, but is MATLAB Assignment 3.
3. Systems of ODE are touched on in Assignment 2, which is before you hit them in lecture; hopefully this helps your class presentation.

Student feedback on this disjointness from the class has been surprisingly positive. We suggest you take a quick look at the MATLAB assignments online with an eye to how their math content supplements the course.