

Math 1b. Calculus, Series, and Differential Equations

Review Guide for Midterm I

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Midterm Details

The first midterm will primarily cover Chapter 5 and 6, but you will also be responsible for any previous material covered in the course. The midterm exam will be on Tuesday, March 14 at 7-9 PM in Science B. There will also be a course-wide review session on Friday, March 10 at 2:30-4:30 PM in Science D. We plan to videotape the review session, and you should be able to access the video by clicking on Lecture Videos at the course website.

Studying and Reviewing

- You can find copies of old midterms clicking on Previous Exams at the course website. Solutions to these exams will be posted on the course website no later than Friday, March 10. Course assistants will conduct exam preparation workshops this week in section, and you may pick up an advance copy of the solutions to the previous exams by attending any CA section. A list of CA section times can be found at <http://www.courses.fas.harvard.edu/~math1b/sections/>.
- You should also try working some of the problems in the review sections of Chapter 5 (pp. 433-436) and Chapter 6 (pp. 493-495). We will post solutions to these problems on the course website no later than Friday, March 10. You may pick up an advance copy of the solutions by attending any CA section.
- Be sure to take advantage of the TF office hours, CA sections, and the MQC in Science 309.

Topics for Midterm I

- To understand and be able to apply the definite integral and the Fundamental Theorem of Calculus (Sections 5.1-4.4).
- To be able to evaluate definite and indefinite integrals using substitution (Section 5.5).
- To be able to evaluate definite and indefinite integrals using integration by parts (Section 5.6).

- To be able to evaluate trigonometric integrals (Section 5.7).
- To be able to evaluate definite and indefinite integrals using partial fractions (Section 5.7).¹
- To understand and be able to the Midpoint Rule to approximate definite integrals (Section 5.9).
- To understand and be able to the Trapezoid Rule to approximate definite integrals (Section 5.9).
- To understand and be able to Simpson's Rule to approximate definite integrals (Section 5.9).
- To understand and be able to apply error estimates for the Midpoint, Trapezoid, and Simpson's Rule (Section 5.9). *You do not need to memorize the error estimate formulas for these rules, but you should know how to apply them.*
- To understand and be able to evaluate integrals of the form $\int_a^\infty f(x) dx$, $\int_{-\infty}^a f(x) dx$, and $\int_{-\infty}^\infty f(x) dx$ (Improper Integrals of Type 1) (Section 5.10).
- To understand and be able to evaluate integrals of the form $\int_a^b f(x) dx$, where f is discontinuous at a or b (Improper Integrals of Type 2) (Section 5.10).
- To understand and be able to apply the comparison test for improper integrals (Section 5.10).
- To be able to calculate the area between two curves and to understand the connection between

$$\int_a^b f(x) - g(x) dx$$

and Riemann Sums (Section 6.1). *Omit Areas Enclosed by Parametric Curves.*

- To understand and be able to calculate volumes by integrating over cross-sectional area (Section 6.2).
- To understand and be able to calculate volumes of solids of revolution (Section 6.2). *Omit the method of cylindrical shells.*
- To understand and be able to use Riemann Sums and the definite integral to calculate "mass" when density varies. <http://www.courses.fas.harvard.edu/~math1b/handouts/chapter27.pdf>
- To understand and be able to compute arc length (Section 6.3). *Omit arc length of parametrically defined curves.*
- To understand and be able to compute the average value of a function (Section 6.4).
- To understand and be able to apply the definite integral when computing work done (Section 6.5). *Omit the material on hydrostatic pressure and force and moments and centers of mass from Section 6.5.*

¹The material in Sections 5.5–5.7 was covered in the Techniques Exam and will not be emphasized on the midterm. However, a knowledge of techniques of integration may be essential in doing problems on any of the following exam topics.