Math 1B first midterm review sheet

Sep 27, 2009

1 Some things that you should know

The numbers in parentheses are the sections of the textbook where the corresponding topics are described. The topics in boldface are (in my opinion) those that you should review first — any topic below can be on the exam, but the boldface ones are likely to be used in several problems.

- **Table of integrals** (5.4)
- **Substitution in integrals, indefinite and definite** (5.5)
- **Integration by parts, indefinite and definite** (7.1)
- Reduction formulas — you do not have to remember them by heart, but you might be asked to derive one (7.1)
- **Trigonometric identities, except those in the red box on page 465** (see the sheet I gave in one of the sections, also available on section website)
- **Strategy for integrating trigonometric expressions** (7.2)
- **Trigonometric substitutions for** $\sqrt{a^2 - x^2}, \sqrt{a^2 + x^2}, \sqrt{x^2 - a^2}$ (7.3)
- **Integration of rational functions by partial fractions: writing the denominator as a product of linear and irreducible quadratic terms, splitting a polynomial term by long division, writing partial fractions expansion with unknown coefficients, finding the coefficients, integrating the resulting expression** (7.4)
- Rationalizing substitution (7.4)
- **Strategy for integration** (7.5)
- Approximate integration formulas: left/right endpoint, midpoint, trapezoidal, Simpson's (7.7)

- Error bounds for approximate integration — no need to learn the formulas by heart, they will be provided on the exam if needed (7.7)
- **Calculating improper integrals: splitting into several integrals, taking limits of antiderivatives** (7.8)
- Comparison Theorem for improper integrals (7.8)
- Arc length and arc length function (8.1)
- Area of a surface of revolution (8.2)
- Hydrostatic force (8.3)
- Moments and centroids (8.3)
- Theorem of Pappus (8.3)
- **Limits of sequences: reduction to limits of functions** (11.1)
- Limit laws for sequences (page 678)
- Monotonic sequences (11.1)
- Squeeze Theorem for limits of sequences (11.1)
- Sum of series as the limit of the sequence of partial sums (11.2)
- Geometric series (11.2)
- Test for divergence of series (page 692)
- Integral Test for series (11.3)
- Remainder estimates for the Integral Test for series (11.3)

2 Some common mistakes

Here are some common mistakes I found in your quizzes — be sure not to make them on the exam!

- Arithmetic mistakes — for example, you get the wrong sign when simplifying the final answer. These will be penalized on the exam, though not too severely.
- Forgetting +C in the indefinite integral — I did not deduct points for that on the quizzes, but this will not be the case on the exam.
- Mistaking a definite integral for an indefinite one and vice versa. Remember: a definite integral is a **number** and an antiderivative is a **function**.

- Taking the limit of $f(x)$ to justify why an improper integral $\int_a^b f(x)\,dx$ converges. You have to take the limit of the antiderivative instead, and $\lim f(x) = 0$ does not guarantee that the integral will converge! Same applies to series.
- Integrating by division, e.g. $\int e^{-x^2}\,dx = \frac{e^{-x^2}}{-2x}$. This is wrong — check by differentiation!
- Algebraic mistakes, e.g. $\int \frac{dx}{x^2+x^3} = \int \frac{dx}{x^2} + \int \frac{dx}{x^3}$.