

**MATH112Z CALCULUS II, FALL 2019
MIDTERM 1 REVIEW**

Midterm 1 topics:

(1) Integration techniques:

- Sec 7.1, integration by parts: $\int u dv = uv - \int v du$
- Sec 7.2, trig integrals: be able to evaluate

$$\int \sin^m x \cos^n x dx, \quad \int \sec^m x \tan^n x dx$$

As for trig formulas, you should know derivatives of $\sin x$, $\cos x$, $\tan x$, $\sec x$; the identities $\sin^2 x + \cos^2 x = 1$, $\tan^2 x + 1 = \sec^2 x$; and the half angle formula. The product to sum formula will be provided if needed.

- Sec 7.3, trig substitution: for radicals

$$\sqrt{a^2 - x^2}, \quad \sqrt{a^2 + x^2}, \quad \sqrt{x^2 - a^2}$$

know what trig substitution should be used, see the table in Section 7.3.

- Sec 7.4, partial fraction decomposition: be able to integrate rational functions using partial fraction decomposition. Here, you should know how to factorize $ax^2 + bx + c$ and $x^3 \pm a^3$.

(2) Approximate integration, Sec 7.7: be able to apply midpoint rule, trapezoidal rule and Simpson's rule to obtain approximations for definite integrals. Understand that more subdivisions yield a more accurate approximation. Be able to use the error estimates. (You do not need to memorize the error formula.)

(3) Improper integrals, Sec 7.8: Understand the two types of improper integrals. Be able to determine whether an improper integral is convergent or divergent. Be able to evaluate a convergent improper integral. Know how to apply the comparison theorem.

(4) Applications of integrals:

- Sec 8.1: be able to find the arclength of a curve. Understand the definition of the arclength parameter.
- Sec 8.2: be able to find the area of a surface of revolution.

- (5) Sec 1.4 and Sec 1.5: You should review these sections if you are not confident about inverse functions, inverse trigs and properties of logarithmic and exponential functions. You should know derivatives of inverse trigs and their derivation. Also, you should be familiar with basic integral formula listed in the table in Section 7.5, except for #8, #10, #12. You should be familiar with integration methods such as substitution and be able to apply them with other integration techniques listed above.

Some suggestions:

- Make sure you understand all the topics listed above.
- Make sure you can do all the homework problems without external helps. There are many exercises similar to the hw problems in the textbook. Please practice and find help if there is any trouble.
- Notice that some problems may take time to solve. You should be familiar with the methods to save time in the exam.