# Math Xa
# Reviewing for the Final Exam

## Fall 2003

The final exam will cover Chapters 1–16 in *Calculus: An Integrated Approach to Functions and Their Rates of Change*, omitting sections 2.5 and Chapter 15. You will be responsible for the topics listed below. We have included some suggested exercises for each topic and be sure to review review Midterms I and II. We will not post solutions to the suggested exercises; however, you can check with any of the TFs or CAs if you are uncertain of your answers.

- Understand and be able to apply the concept of function and use functional notation.

  *Suggested Exercises—Section 1.2: 2, 12, 14, 16, 17; pp. 10–15.*

- Be able to represent and interpret functions numerically, algebraically, graphically, and verbally.

  *Suggested Exercises—Section 1.3: 1, 6, 8, 13, 14, 29, 30, 43, 55; pp. 34–47.*

- Understand and be able to apply different properties and characteristics of a function such as continuity, and monotinicity (increasing and decreasing).

  *Suggested Exercises—Section 2.1: 5–9; pp. 58–61.*

- Know a small repertoire of functions, including linear functions, the absolute value function, and the square function. Understand and be able to use even and odd functions.

  *Suggested Exercises—Section 2.2: 4, 11–18; pp. 70–73.*

- Understand and be able to find the average rate of change of a function.

  *Suggested Exercises—Section 2.3: 3, 6, 10, 13, 14; pp. 77–81.*

- Understand and be able to apply the information about a function given by its graph.

  *Suggested Exercises—Section 2.4: 1, 2, 3, 4, 12, 14; pp. 89–94.*

- Understand and be able to use the algebra of functions; i.e., the addition, subtraction, multiplication, and division of functions to obtain new functions.

  *Suggested Exercises—Section 3.1: 3, 6, 8, 10; pp. 105–108.*

- Understand and be able to apply the concept of composition of functions.

  *Suggested Exercises—Section 3.2: 5–10, 19, 20; pp. 113–119.*

- Be able to decompose a complicated function into the composition of two more easily understood functions.

  *Suggested Exercises—Section 3.3: 10–17; pp. 121–122.*

- Understand and be able to apply the connection between basic algebraic transformations of a function and what happens to the graph of the function. That is, you should know about shifting, stretching, shrinking, and reflecting functions.

  *Suggested Exercises—Section 3.4: 4, 5, 10–18; pp. 133–138.*

- Understand the concept of local linearity and that, locally, any curve looks like a straight line.

  *Suggested Exercises—Section 4.2: 2–8; pp. 151–153.*

- Understand and be able to apply the concept of a linear function. Understand the slope of a linear function as a rate of change.

  *Suggested Exercises—Section 4.3: 2, 8; pp. 155–157.*

- Be able to apply the concept of a linear function to modeling situations.

  *Suggested Exercises—Section 4.4: 1, 2, 5; pp. 164–168.*

- Understand the derivative as a rate of change. Understand the derivative as the slope of a tangent line to the graph of a function.

  *Suggested Exercises—Section 5.1: 1, 4, 6, 17; pp. 181–187.*

- Understand and be able to apply the formal definition of a derivative.

  *Suggested Exercises—Section 5.2: 2, 7, 16; pp. 192–194.*

- Be able to interpret the derivative quantitatively, understand the meaning of the derivative, and be familiar with notation.

  *Suggested Exercises—Section 5.3: 2, 5, 6, 7, 8; pp. 200–205.*
  *Section 5.4: 3, 4; pp. 212–215.*

- Understand and be able to use quadratic functions in both a calculus setting and a non-calculus setting.

  *Suggested Exercises—Section 6.1: 1, 4, 5, 7; p. 222.*
  *Section 6.2: 1–5; pp. 228–230.*
  *Section 6.3: 1, 2, 3, 6, 7, 8, 9; pp. 235–237.*
  *Section 6.4: 1, 3, 9; pp. 241–243.*

- Understand and be able to apply the concept of limit. Understand and be able to apply the concept of one-sided limits. Understand and be able to apply the concept of continuity.

  *Suggested Exercises—Section 7.1: 2, 5, 6, 7, 8, 9, 17; pp. 256–258.*
  *Section 7.2: 2, 3, 4, 6, 10, 11, 16–21; pp. 262–265.*
  *Section 7.4: 1, 3, 5, 6, 17; pp. 276–278.*

- Understand and be able to apply the concept of linear approximation.

  *Suggested Exercises—Section 8.1: 2, 5; pp. 284–285.*

- Understand the rules of differentiation and be able to apply the rules fluently.

  - $\dfrac{d}{dx}k = 0$, where $k$ is constant.
  - $\dfrac{d}{dx}kf(x) = k\dfrac{d}{dx}f(x)$, where $k$ is constant.
  - $\dfrac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$.

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- $\dfrac{d}{dx}[f(x)g(x)] = f(x)g'(x) + f'(x)g(x).$
- $\dfrac{d}{dx}\left(\dfrac{f(x)}{g(x)}\right) = \dfrac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}.$
- $\dfrac{d}{dx}x^n = nx^{n-1},$ where $n$ is any real number.
- $\dfrac{d}{dx}\sqrt{x} = \dfrac{1}{2\sqrt{x}}.$
- $\dfrac{d}{dx}e^x = e^x.$
- $\dfrac{d}{dx}b^x = b^x \cdot (\ln b).$
- $\dfrac{d}{dx}\ln x = \dfrac{1}{x}.$
- $\dfrac{d}{dx}\log_b x = \dfrac{1}{x \cdot (\ln b)}.$

*Suggested Exercises—Section 8.3: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11; pp. 300–301.*
*Section 9.4: 12, 15; pp. 338–340.*
*Section 14.1: 1, 2, 3, 4, 5, 6, 7; pp. 471–472.*
*Section 14.2: 1, 2, 3, 4, 5, 10; pp. 475–476.*
*Section 14.3: 2–12; pp. 481–485.*

- Understand and be able to apply the concept of an exponential function.

  *Suggested Exercises—Section 9.1: 2; pp. 307–309.*
  *Section 9.2: 32, 34, 35, 36, 37; pp. 316–320.*
  *Section 9.3: 2, 4, 8; pp. 330–334.*

- Understand and be able to apply the First Derivative Test to determine extreme points.

  *Suggested Exercises—Section 10.1: 10, 11, 12, 13, 14, 15, 16; pp. 354–356.*

- Understand the meaning of the second derivative. Be able to sketch the graph of a curve using information from the first and second derivative. Understand and be able to apply the Second Derivative Test to determine extreme points.

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*Suggested Exercises—Section 10.2: 3, 4, 6, 7, 8, 9, 11, 12; pp. 358–360.*

- Understand and be able to determine local and global extrema and apply these techniques to solving optimization problems.

  *Suggested Exercises—Section 10.3: 1, 3, 6, 7, 14, 20; pp. 366–371.*
  *Section 16.3: 4–6, 13–18, 23–29, 35; pp. 529–534.*

- Understand and be able to analyze cubic and polynomial functions.

  *Suggested Exercises—Section 11.1. Exercises 14–21; pp. 377–379.*
  *Section 11.2: 10, 11, 12, 14, 16, 19, 20; pp. 388–390.*
  *Section 11.3: 8, 12; pp. 399–403.*

- Understand and be able to to analyze rational functions, including asymptotic behavior.

  *Suggested Exercises—Section 11.4: 3, 5, 12; pp. 417–420.*

- Understand and be able to apply the concept of an inverse function. To be able to find inverse functions when possible.

  *Suggested Exercises—Section 12.1. Exercises 1, 2, 8; pp. 427–428.*
  *Section 12.2: 4, 9, 10; pp. 432–434.*
  *Section 12.3: 5, 6; pp. 434–436.*

- Understand and be able to apply the definition of a logarithm and be able to use the various properties of logarithms fluently.

  *Suggested Exercises—Section 13.1: 3, 4, 5; pp. 443–444.*
  *Section 13.2: 2, 4, 6, 8, 10, 12; pp. 448–449.*
  *Section 13.3: 4, 8, 12, 14, 16, 18, 20, 22, 25, 28; pp. 459–462.*
  *Section 13.4: 4, 5, 6; p. 466.*

- Understand the chain rule and be able to find the derivative of the composition of two functions.

  *Suggested Exercises—Section 16.1: 5, 8, 11, 13, 17, 18, 22–25; pp. 519–521.*
  *Section 16.2: 5; p. 522.*