

FINAL EXAM STUDY GUIDE

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The Final Exam Deluxe takes place on **Friday, August 12th at 10:10 am**. It counts for 50 % of your grade, and covers sections 2.3, 2.5-2.8, 3.1-3.6, 3.9, 3.10, 4.1-4.5, 4.7, 4.9, 5.1-5.5, 6.1, and 6.5 (notice that you're not tested on chapter 1 stuff!). This is the study guide for the exam, and contains **everything** you'll need to know for the exam.

Note: 1.3.4 means 'Problem 4 in section 1.3'

Know how to:

CHAPTER 2: LIMITS AND DERIVATIVES

- **Find limits of a function:**

- Step 1: Just by plugging in (2.3.3, 2.3.6, 2.3.9)
- Step 2: By noticing that it's of the form $\frac{1}{0^+} = \infty$ or $\frac{1}{0^-} = -\infty$ (2.2.25, 2.2.28, 2.2.29)
- Step 3: By factoring out the numerator and the denominator and simplifying (2.3.12, 2.3.13, 2.3.14, 2.3.15, 2.3.16, 2.3.17, 2.3.26)
- Step 4: Whenever there is a square root, by multiplying numerator and denominator by the conjugate form (2.3.21, 2.3.23, 2.3.29, 2.3.30, 2.3.60)
- Step 5: By using the squeeze theorem (2.3.35, 2.3.37, 2.3.38)
- Step 6: By calculating $\lim_{x \rightarrow a^-}$ and $\lim_{x \rightarrow a^+}$ and by noticing that they're equal or not (2.3.39, 2.3.40, 2.3.42, 2.3.46(a)(b), 2.3.47(a)(b))

Note: If you need more practice, try the following set of problems: 2.3.22, 2.3.8, 2.3.11, 2.3.12, 2.3.36

Note: On the exam, you are allowed to use l'Hopital's rule!

- Evaluate limits using continuity (2.5.33, 2.5.34, 2.6.34, 2.6.36)
- Use the intermediate value theorem to show that a given equation has at least one solution (2.5.47, 2.5.48, 2.5.49, 2.5.51(a), 2.5.52(a))

Note: Make sure to show your steps and use the words 'continuous' and 'IVT'. Also, I might not give you any intervals, sometimes you'd have to guess it!

- **Find limits at infinity of a function:**

- Step 1: Just by plugging in (2.6.15, 2.6.30)
- Step 2: By factoring out the highest power out of an expression (2.6.31)
- Step 3: By factoring out the highest power of the numerator and the denominator (2.6.16, 2.6.17, 2.6.19, 2.6.21, 2.6.33)
- Step 4: By factoring out the highest power of x out of a square root (2.6.22, 2.6.23, 2.6.24, also try those out with $-\infty$ replacing ∞ , and vice-versa) **Note:** Remember that $\sqrt{x^2} = |x| = x$ (if $x > 0$) and $= -x$ (if $x < 0$)

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- Step 5: By using the conjugate form, making sure to do Step 4 first (2.6.25, 2.6.26, 2.6.27)
- Step 6: By using the squeeze theorem (2.6.35, 2.6.53(a), 2.6.57)

Note: If you need more practice, try the following set of problems: 2.6.30, 2.6.29, 2.6.20, 2.6.37(c)

Note: Here again, you may use l'Hopital's rule!

- Find the derivative of a function using the definition of the derivative (2.8.19, 2.8.20, 2.8.21, 2.8.22, 2.8.24, 2.8.25, 2.8.28, 2.8.29)

CHAPTER 3: DIFFERENTIATION RULES

- **Differentiate functions using:**
 - Simple rules, i.e. the power rule, sum/difference rule, and $(e^x)' = e^x$ (3.1.3, 3.1.5, 3.1.6, 3.1.7, 3.1.8, 3.1.11, 3.1.12, 3.1.13, 3.1.14, 3.1.15, 3.1.17, 3.1.21, 3.1.31)
 - Product and quotient rules (3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.13, 3.2.14, 3.2.15, 3.2.17, 3.2.19, 3.2.23, 3.2.23, 3.2.26)
 - Trigonometric rules (3.3.1, 3.3.2, 3.3.5, 3.3.9, 3.3.10, 3.3.13)
 - Chain rule (3.4.7, 3.4.8, 3.4.9, 3.4.10, 3.4.13, 3.4.14, 3.4.17, 3.4.19, 3.4.23, 3.4.35, 3.4.29, 3.4.39, 3.4.40, 3.4.42, 3.4.45, 3.4.46)
 - Implicit differentiation (3.5.5, 3.5.6, 3.5.7, 3.5.9, 3.5.11, 3.5.13, 3.5.17, 3.5.19)
 - Inverse trig functions (3.5.45, 3.5.46, 3.5.47, 3.5.52)
 - Derivative of $\ln(x)$ (3.6.2, 3.6.3, 3.6.9, 3.6.10, 3.6.12, 3.6.13, 3.6.19, 3.6.28, 3.6.30, 3.6.49)
 - Logarithmic differentiation (3.6.37, 3.6.38, 3.6.41, 3.6.42, 3.6.43, 3.6.45, 4.6.46, 3.6.47, 4.6.50)
- Find equations of tangent lines to a function/curve at a given point (3.1.33, 3.1.34, 3.2.31, 3.2.32, 3.3.22, 3.3.23, 3.3.24, 3.4.51, 3.4.52, 3.4.53, 3.5.25, 3.5.26, 3.5.27, 3.5.29)
- Find second derivatives (3.1.45, 3.2.27, 3.2.28, 3.2.30, 3.2.41, 3.3.28(a), 3.3.29, 3.4.50, 3.6.23, 3.6.24)
- Solve related rates problems (3.9.6, 3.9.10, 3.9.15, 3.9.19, 3.9.27, 3.9.30, 3.9.31, and the problems on the related rates handout)
- Use linear approximations (or differentials) to estimate a given number (3.10.23, 3.10.24, 3.10.25, 3.10.26, 3.10.28)

CHAPTER 4: APPLICATIONS OF DIFFERENTIATION

- Find the absolute maximum/minimum of a function using the closed interval method (4.1.47, 4.1.48, 4.1.49, 4.1.52, 4.1.53, 4.1.60, 4.1.61)
- Use Rolle's theorem (and the IVT) to show that an equation has exactly one solution or at most one solution (4.2.17, 4.2.18, 4.2.19)
- Solve problems using the Mean Value Theorem (4.2.23, 4.2.24, 4.2.25, 4.2.26, 4.2.28, 4.2.35, 4.2.36)
- Use l'Hopital's rule to evaluate limits (any problem between 4.4.5 and 4.4.64 works, for example, try 4.4.5, 4.4.13, 4.4.15, 4.4.17, 4.4.19, 4.4.21, 4.4.27, 4.4.29, 4.4.40, 4.4.43, 4.4.47, 4.4.51, 4.4.53, 4.4.59, 3.3.63)

- Find intervals of increase/decrease, local max/min, and intervals of concavity of a function (4.3.9, 4.3.10, 4.3.13, 4.3.16). To be honest, we simply won't have time for a DISAIC method question!
- Solve optimization problems (4.7.3, 4.7.5, 4.7.11, 4.7.12, 4.7.17, 4.7.18, 4.7.19, 4.7.21, 4.7.22, 4.7.23, 4.7.24, 4.7.26, also see optimization handout)
- Find the general antiderivative of a function (4.9.1, 4.9.3, 4.9.5, 4.9.7, 4.9.13, 4.9.14, 4.9.15, 4.9.20, 4.9.23, 4.9.27)
- Find the antiderivative of a function which satisfies a certain condition like $f(0) = 3$ (4.9.29, 4.9.39, 4.9.46)

CHAPTER 5: INTEGRALS

- Evaluate an integral using the definition of the integral (5.2.21, 5.2.22, 5.2.23, 5.2.24, 5.2.26, 5.2.27)
- Evaluate a limit by expressing it as an integral, and then evaluating that integral using the FTC (5.2.69, 5.2.70, 5.3.69, 5.3.70)
- Evaluate an integral by recognizing it as an area (5.2.36, 5.2.39)
- Evaluate integrals by using the FTC (any problem between 5.3.19 and 5.3.40 and between 5.4.21 and 5.4.42 works, try 5.3.19, 5.3.21, 5.3.24, 5.3.27, 5.3.30, 5.3.31, 5.3.33, 5.3.38, 5.3.40, 5.4.21, 5.4.23, 5.4.25, 5.4.27, 5.4.30, 5.4.32, 5.4.35, 5.4.37)
- Differentiate integrals using the FTC (5.3.7, 5.3.11, 5.3.13, 5.3.14, 5.3.15, 5.3.17, 5.3.53, 5.3.55, 5.3.56)
- Evaluate $\int f(x)dx$ (5.4.5, 5.4.7, 5.4.9, 5.4.11, 5.4.12, 5.4.19)
- Evaluate integrals using the substitution rule (any problem between 5.5.7 and 5.5.70 works, try 5.5.7, 5.5.8, 5.5.9, 5.5.11, 5.5.16, 5.5.19, 5.5.21, 5.5.25, 5.5.29, 5.5.31, 5.5.41, 5.5.53, 5.5.54, 5.5.58, 5.5.59, 5.5.62, 5.5.63, 5.5.67)
- Evaluate an integral using the fact that $\int_{-a}^a f(x)dx = 0$ if f is odd (5.5.57, 5.5.60)

CHAPTER 6: APPLICATIONS OF INTEGRATION

- Find the area of the region between two given curves (any problem between 6.1.5 and 6.1.28 works, try 6.1.5, 6.1.6, 6.1.7, 6.1.9, 6.1.13, 6.1.13, 6.1.24, 6.1.25, 6.1.27. On the exam, you **won't** have to integrate with respect to y)
- Find the average value of a function on a given interval (6.5.1, 6.5.4, 6.5.2, 6.5.7)