

Final Exam Conceptual Review

Math 145, Fall 2017

- The Final Exam is on **Wednesday, December 13** from **4:30 - 7:00 pm** in **301 Snow**.
 - The exam will be **cumulative**, and review sheets from material before Midterm 2 are posted online.
 - The post - Midterm 2 material consists of §§5.3 – 5.8, 7.1, and mathematical induction (which will only appear on the final exam as extra credit).
 - You may use both sides of a 8.5" x 11" sheet of paper during the exam.
 - You may use a calculator, but its use should **never** replace a method from class.
 - You are **highly encouraged** to come to the instructor with questions! Look for **office hours** posted on the course website. If you can't attend them, feel free to **make an appointment**.
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Antiderivatives (§5.3)

- *Concepts:* Antiderivative / indefinite integral, power rule for antiderivatives, linearity of antiderivatives, basic rules for antiderivatives, differential equation (with initial conditions)
 - *Goals:* Find antiderivatives using basic antiderivative rules, solve differential equations (with initial conditions)
 - *Homework problems:* §5.3: #3, 9, 22, 31, 41, 42
 - *Additional practice problems:* §5.3: #17, 35, 40, 46, 53, 63
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Fundamental theorem of calculus, Part I (§5.4)

- *Concepts:* Fundamental theorem of calculus, Part I (FTC I); antiderivative of $y = \frac{1}{x}$
 - *Goals:* Understand and apply FTC I to calculate definite integrals, understand and apply the antiderivative of $y = \frac{1}{x}$
 - *Homework problems:* §5.4: #9, 19, 33, 41, 47, 55, 62
 - *Additional practice problems:* §5.4: #29, 34, 56, 64
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Fundamental theorem of calculus, Part II (§5.5)

- *Concepts:* Fundamental theorem of calculus, Part II (FTC II); area functions $A(x) = \int_a^x f(t) dt$
 - *Goals:* Understand and apply FTC II, interpret area functions and find derivatives of their composition with other functions
 - *Homework problems:* §5.5: #1, 5, 9, 11, 13, 19, 23, 25, 26, 31, 33, 37, 39, 44, 45, 48
 - *Additional practice problems:* §5.5: #3, 13, 26, 32, 41, 43
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Net change as integral of rate of change (§5.6)

- *Concepts:* Net change as integral of rate of change, total displacement/distance traveled
- *Goals:* Calculate/estimate net change as integral of rate of change, calculate total displacement/distance traveled as integral of velocity/absolute value of velocity

- *Homework problems:* §5.6: #1, 7, 11, 19
 - *Additional practice problems:* §5.6: #5, 9, 15, 17
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Substitution method for integrals (§5.7)

- *Concepts:* Substitution method for integrals (reverse rule of chain rule for derivatives)
 - *Goals:* Apply substitution method to compute antiderivatives and definite integrals
 - *Homework problems:* §5.7: #7, 11, 15, 23, 27, 45, 73, 77, 89, 91, 94, 97, 98
 - *Additional practice problems:* §5.7: #12, 17, 22, 41, 67, 80, 91, 101
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Integration by parts (§7.1)

- *Concepts:* Integration by parts method for integrals (reverse rule of product rule for derivatives)
 - *Goals:* Apply integration by parts, combined with other methods, to compute antiderivatives and definite integrals
 - *Homework problems:* §7.1: #3, 7, 11, 13, 21, 25, 29, 35, 51, 46, 55, 77
 - *Additional practice problems:* §7.1: #27, 38, 52, 60, 63, 75, 76
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Mathematical induction (extra credit) (Childs book)

- *Concepts:* The principle of mathematical induction used to prove a statement about all natural numbers (or all $n \geq a$ for some integer a)
- *Goals:* Apply the principle of mathematical induction to prove a statement
- *Homework problems:* §7.1: #1, 2, 3, 8, 13, 14 in Childs
- *Additional practice problems:*

1. Prove that for all integers $n > 1$,

$$1 + 3 + 3^2 + \cdots + 3^{n-1} = 3^n - 1.$$

2. Prove that for all positive integers n , $3^{4n} - 1$ is a multiple of 5.
3. Prove that $2^{2n} > n^4$ for all integers $n \geq 4$.
4. Prove that for all integers $n \geq 1$,

$$1^4 + 2^4 + 3^4 + \cdots + n^4 = \frac{n(n+1)(2n+1)}{(3n^2+3n-1)} 30.$$