

Math 300: Junior Colloquium

Spring 2017

Calculus 2 Topics List

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Your talk should have a clear statement of what you're talking about, an explanation of the topic, and at least one or two quick examples; it's especially nice to have an example where something doesn't work properly if that applies.

I will want to have a copy of your notes/plans for the talk by 10:30 AM Wednesday—you can email to me a LaTeX file, or email me a scan/photo of your notes, or drop them off in the basket outside my office. If you're late on this, you will lose points. (Feel free to send it in on Tuesday or Monday). Once you enter your name on the Doodle poll you are responsible for that topic.

I will give you feedback Wednesday evening—probably a few pointers, and also making sure you have nothing outright false in your talk plans. Then on Thursday morning you will present your talk in the room (I will let you know when we find out where).

1. Riemann Sums and Numerical Integration

Define Riemann sums, and how they relate to area. Define the integral in terms of Riemann sums. Show how you can use finite Riemann sums to approximate integrals.

2. Fundamental Theorem of Calculus

Give the fundamental theorem of calculus in both forms. Computing the derivative of integrals with a variable in the limits. Using antiderivatives to calculate definite integrals.

3. Integration and u -substitution

Using u -substitution to calculate integrals. Need to cover indefinite integrals, which requires substituting back to x , and definite integrals, which requires changing the bounds of integration.

4. Integration by Parts

How does integration by parts work? A couple examples. How do you decide which part to differentiate and which part to integrate? Sometimes you have to repeat.

5. Improper Integrals

Talk about how to compute improper integrals. This includes integrals of functions that have asymptotes, and also integrals whose limits are infinite.

6. Applications

Areas between curves. Work, averaging, maybe some volumes.

7. Sequences and Series

Definition of a sequence, and what it means to converge. Definition of a series, and what it means to converge. The harmonic series. What is a geometric series? When does it converge, and what to?

8. Positive Series Convergence

What is a p -series and when does it converge? How can we tell when a series of positive terms converges? Integral test, comparison test, limit comparison test.

9. Absolute and Conditional Convergence

What is absolute convergence, and when does it happen? Ratio and root tests, and using the comparison test for absolute convergence. What is conditional convergence? Alternating series test.

10. Power Series, radius and interval of convergence

Define a power series. Define radius of convergence, and talk about how to find it (ratio and root tests). What are the three possible answers? How is the *interval* of convergence different from the radius, and how do we find that?

11. Taylor series

What is a Taylor series, and why do we want them? What can we use them for? How do we compute them? Define Taylor Polynomials.

12. Important power/Taylor series

Look at some important Taylor series. Including e^x , $\frac{1}{1-x}$, $\sin x$, $\cos x$, and possibly $\ln(x)$, $\arctan(x)$.