Outline

1. Syllabus Highlights

2. Taylor Series
Welcome
Adding the Course

Speak to Robin Toney in the Math office on the 4th floor of DRL.

Space is limited.
Syllabus Highlights

Course Webpage:
http://www.math.upenn.edu/~ryblair/Math104/index.html

Here you will find

1. Lecture slides
2. Homework assignments
3. A copy of the syllabus
4. A link to Blackboard (were your quiz homework and test scores are posted)
5. Other useful links
Email

1. Include Math 104 in the subject line
2. Send it from a Penn account
3. The body should include your name and your recitation number
4. Allow 24 hrs for a reply
5. Direct quiz questions to your TA, everything else to me
Required Text: Thomas’ Calculus, Custom Edition for the University of Pennsylvania.

Grading

1. 20% Homework (10% online and 10% Handed in)
2. 20% Quizzes
3. 15% Midterm 1
4. 15% Midterm 2
5. 30% Final
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1. 20% Homework (10% online and 10% Handed in)
2. 20% Quizzes
3. 15% Midterm 1
4. 15% Midterm 2
5. 30% Final

Course grades are curved using the final exam in accordance with the math departments 30-30-30-10 policy.
Written Homework

1. Written homework will be assigned each week based on the material covered that week.
2. You can find the current homework assignment on the course website.
3. Homework will be collected in recitation.
4. The first written Homework will be posted tonight and due on Jan 21 or Jan 23.
Online Homework

1. Online Homework will be assigned each week based on the material covered that week.
2. You complete online homework through math lab here is a link: http://portal.mypearson.com/mypearson-login.jsp
There will be a quiz in each recitation.

Quiz questions will be based on the homework assigned the previous week.
There will be a quiz in each recitation.

Quiz questions will be based on the homework assigned the previous week.

Next week’s quiz question will be based on the material found in the syllabus.
Exams

Mark your calendars

1. Midterm 1: Feb. 12
2. Midterm 2: CHANGED TO Mar. 21
3. Final: May 1
Classroom Decorum: (Common Courtesy)

1. No Talking
2. No Texting
3. Cellphone Ringers Off
4. Laptops only used for taking notes
Classroom Decorum: (Common Courtesy)

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If these constraints are too much, feel free to step outside.
The **Taylor series** generated by a function $f$ at $x = a$ is

$$
\sum_{k=0}^{\infty} \frac{f^{(k)}(a)}{k!} (x - a)^k = f(a) + f'(a)(x - a) + \frac{f''(a)}{2}(x - a)^2 + \ldots
$$
Definition

The Taylor series generated by a function $f$ at $x = a$ is

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\sum_{k=0}^{\infty} \frac{f^{(k)}(a)}{k!} (x - a)^k = f(a) + f'(a)(x - a) + \frac{f''(a)}{2}(x - a)^2 + \ldots
$$

Exercise: Verify that the Taylor series of $e^x$ at $x = 0$ is $\sum_{k=0}^{\infty} \frac{x^k}{k!}$
Taylor Series are closely related to approximations

**Example:** Graph the following functions side-by-side:

- $e^x$
- $1$
- $1 + x$
- $1 + x + \frac{x^2}{2}$
- $1 + x + \frac{x^2}{2} + \frac{x^3}{6}$
Taylor Series are closely related to approximations

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Core Idea: A Taylor Series is the LIMIT of successively better polynomial approximations!
Tricks to finding Taylor Series

**Problem:** Find the Taylor series for \( f(x) = \ln(x + 1) \) at \( x = 0 \).

**Trick:** No trick, just substitute into the formula for Taylor series and find the pattern.
Tricks to finding Taylor Series

**Problem:** Find the Taylor series for $f(x) = \ln(x + 1)$ at $x = 0$.

**Trick:** No trick, just substitute into the formula for Taylor series and find the pattern.

**Answer:** $\sum_{k=1}^{\infty} (-1)^{k-1} \frac{x^k}{k}$
Tricks to finding Taylor Series

**Problem:** Find the Taylor series for $f(x) = \ln(x)$ at $x = 1$.

**Trick:** Save yourself time and use the Taylor Series we just found.
Tricks to finding Taylor Series

**Problem:** Find the Taylor series for \( f(x) = \ln(x) \) at \( x = 1 \).

**Trick:** Save yourself time and use the Taylor Series we just found.

**Answer:** \( \sum_{k=1}^{\infty} (-1)^{k-1} \frac{(x-1)^k}{k} \)
Tricks to finding Taylor Series

**Problem:** Find the first 3 terms of the Taylor series for $f(x) = x \sin(3x)$ at $x = 0$.

**Trick:** Use the fact that you know that Taylor Series for $\sin(x)$.
Problem: Find the first 3 terms of the Taylor series for $f(x) = e^x \sin(x)$ at $x = 0$.

Trick: Use the fact that you know that Taylor Series for $\sin(x)$ and you know the Taylor Series for $e^x$. 