Review for Exam 2

MAT 229, Spring 2021

Week 7

Exam rules

- The second exam is schedule for this weekend. It consists of two parts, an IMath part and a pen and paper part taken under Lockdown Browser.
- You can use Mathematica on the IMath part. On the pen and paper you can have one page of notes (front and back) and a scientific calculator but no other notes, books, Mathematica, or other devices are allowed.
- Each part has a set time limit of 30 minutes. You can take each part separately any time between Friday, February 26, 8:00 pm ET and Sunday, February 28, 8:00 ET.

Format

- Questions will be similar to daily homework questions and weekly assignment questions.
- On the pen and paper part you must show your work. For example, if you need to evaluate a definite integral, you must derive the antiderivative and express how you evaluate it.

Topics

- From calculus 1
  - Find area
  - Find volume for solids of revolution
- From topics on first exam
  - Exponential and logarithmic functions
  - Inverse trigonometric functions
- Indeterminate limits
    - L'Hopital's rule
    - The different indeterminate forms
- Integration by parts
  - $\int u\,dv = u\,v - \int v\,du$

- Be familiar with the types of integrals for which this technique is useful.
  - $\int x^n e^{a x}\, dx$
  - $\int x^n \sin(a x)\, dx$
  - $\int x^n \cos(a x)\, dx$
  - $\int x^n \ln(x)\, dx$
  - $\int x^n$(inverse trig function) dx

- Trigonometric integrals
  - $\int \sin^n(a x) \cos^m(a x)\, dx$ if at least one of n or m is an odd integer. Use substitution $u = \sin(a x)$, $du = a \cos(a x)\, dx$ or $u = \cos(a x)$, $du = -a \sin(a x)\, dx$, depending on whether n or m is odd. Then use Pythagorean identity $\cos^2(a x) + \sin^2(a x) = 1$.
  - $\int \sin^n(a x) \cos^m(a x)\, dx$ if both are even integers. Use trigonometric identities $\sin^2(a x) = \frac{1-\cos(2\, a x)}{2}$ and $\cos^2(a x) = \frac{1+\cos(2\, a x)}{2}$ to reduce the powers.
  - $\int \tan^n(a x) \sec^m(a x)\, dx$ if m is even. Use substitution $u = \tan(a x)$, $du = a \sec^2(a x)\, dx$ along with the Pythagorean identity $\sec^2(a x) = 1 + \tan^2(a x)$.
  - $\int \tan^n(a x) \sec^m(a x)\, dx$ if n is odd. Use substitution $u = \sec(a x)$, $du = a \sec(a x) \tan(a x)\, dx$ along with the Pythagorean identity $\tan^2(a x) = \sec^2(a x) - 1$

- Trigonometric substitution
  - If the integral involves $\sqrt{a^2 - x^2}$ use $x = a \sin(\theta)$ and $dx = a \cos(\theta)\, d\theta$.
  - If the integral involves $\sqrt{a^2 + x^2}$ use $x = a \tan(\theta)$ and $dx = a \sec^2(\theta)\, d\theta$.
  - If the integral involves $\sqrt{x^2 - a^2}$ use $x = a \sec(\theta)$ and $dx = a \sec(\theta) \tan(\theta)\, d\theta$.

- Numerical integration
  - Left endpoint rule
  - Right endpoint rule
  - Midpoint rule with error estimate
  - Trapezoid rule with error estimate
  - Simpson's rule with error estimate

Studying

- Try problems you haven't worked from the exercises from the corresponding sections of either Stewart's calculus book or the Active Calculus textbook.
- Review the written assignments, IMath assignments, and the labs. Remember which ones caused you the most trouble. Find similar examples in the textbook and the posted outlines, then try similar exercises in the textbook.
- Contact me by email if you have questions. You can also visit the Math/Stats Tutoring Lab.