MAT 133 Calculus II
2021 Spring 1

Final Exam Information and Review (all times Grinnell Time)

The exam is **Wednesday, March 24 at 9 AM**. You need to be on Zoom by 9:00 AM that day and can leave Zoom whenever you are done. I will be on by 8:45 AM. **The exam is 3 hours.** You will download the exam questions from Gradescope just like on the quizzes and prior exams. It will release at 8:58 AM.

You can mute and turn off your video for Zoom during the exam. If there is a typo or clarification during the exam, I will say it out loud on Zoom and type it in chat, so check chat occasionally. If you have a question during the exam, you can type it to me privately in chat and I will try to respond that way. If we need to chat briefly, we can do so in a Breakout Session.

Besides pencil and paper (or a tablet if you write your homeworks on one) you may only use the textbook (physical version or pdf) and a basic scientific calculator, a unit circle, and the trig identities sheet from March 1. **You may not use notes, nor other webpages, nor friends, nor graphing calculators.**

You will write your solutions on your own paper. Please write as neatly as you reasonably can and let me know clearly which problem is which and what your answer(s) are. You should also include scratch work you want me to grade but, again, clearly mark your solutions. You will have to scan the file somehow (see the syllabus for suggestions) and be finished by 12:00 PM. **There is a 5 minute grace period to deal with technology, but ONLY 5 minutes. Everything must be to me by 12:05 PM so make sure you practice the upload process.**

If you run into any technical issues during the exam, email me right away.

Office Hours

I will host office/study hours at the class Zoom link:
Monday 9-11 AM and Tuesday 8-9 AM, 11-12 PM, and 1-3 PM

Material on the Exam

Integration Techniques

We covered material from 8.1-8.5, and 8.8 including:

- integration by parts
- trig integrals
- trig substitution
- integration by partial fractions
- improper integrals

Parametric/Polar Equations
We covered material from 11.1 and 11.3 including:
- parametric equations and graphs
- polar coordinates and graphs

Vectors
These topics are in 13.1-13.5 and 14.1-14.2.
- vectors
- dot and cross products
- equations of lines and planes
- vector functions
- space curves
- derivative of vector function

Partial Derivatives
We covered material from 15.1 and 15.3-15.8.
- functions of several variables
- partial derivatives
- tangent plane and linear approximation
- chain rule
- directional derivatives
- gradient vector
- maximums and minimums (local an absolute)
- Lagrange multipliers

Double and Triple Integrals
Sections covered on this material were 16.4. 16.6-16.8
- Riemann sums for multivariable functions
- iterated integrals
- double integrals over a general region
- double intergrals in polar coordinates
- triple integrals
- triple integrals in cylindrical coordinates

Not on the Final
- limits and continuity of multivariable functions
- trapezoid/midpoint/Simpson's Rule
- spherical coordinates

Suggestions
- Work lots of problems, especially those on material you don't understand as well.
- When possible, ask yourself WHY you are solving a problem a certain way or WHY the result is true.
- Do not look at solutions unless you are desperate.
- Check your work!!

Book Practice Problems

See the previous exam reviews for practice problems from the material covered on the first 3 exams.

- pg. 705 **Concept Check**: 4
- pg. 706-707 **Exercises**: 7-9, 17, 18
- pg. 1057 **Concept Check**: 1abcd, 2abc, 3, 6abc, 8a
- pg. 1058-1059 **Exercises**: 1, 3-10, 13-27, 39, 45, 46

Sample Problems from Chapter 16

These are questions from the material covered since the last exam. For sample problems for the material covered before that, see the previous exam review sheets.

1. (a) Sketch the curve with the polar equation $r = \sin\theta - \cos\theta$.
(b) How would you describe the line $y = \sqrt{3}x$ in polar coordinates?
(c) What's another way to describe the line in (b) in polar coordinates?

2. Evaluate the integral $\int_0^6 \int_{y/2}^3 \frac{y}{x^3+1}\,dx\,dy$.

3. Evaluate the integral $\int_{-2}^{2} \int_{0}^{\sqrt{4-x^2}} \sqrt{x^2+y^2}\,dy\,dx$.

4. Calculate the following integrals.

(a) $\int_{\frac{1}{\sqrt{3}}}^{\sqrt{3}} \int_0^{\sqrt{2}} \frac{y}{1+x^2}\,dy\,dx$

(b) $\int_2^5 \int_1^4 \frac{x}{y} + \frac{y}{x}\,dy\,dx$

(c) $\iint_R x\cos y\,dA$ where R is the region bounded by $y = 0$, $y = x^2$ and $x = 2$.

(d) $\iint_R e^{-x^2-y^2}\,dA$ where R is the region bounded by the semicircle $x = \sqrt{16-y^2}$ and the y-axis.

5. Evaluate the following integrals

(a) $\int_{-1}^{1}\int_{2}^{4}\int_{0}^{2} \frac{x}{(y+z)^2}\,dx\,dy\,dz$.

(b) $\iiint_R 3xy\,dV$ where R lies under the plane $z = 5 + x + y$ and above the region in the xy-plane bounded by the curves $y = \sqrt{x}$, $y = 0$ and $x = 4$.

(c) $\iiint_R z$ where R is the region between $x^2 + y^2 = z$ and $z = 9$.

6. Let R be the region in the first octant bounded by the planes $z = 1 - x$ and $y = 2 - 2z$. (See picture below.) Express, **but do not evaluate** the triple integrals $\iiint_R f(x,y,z)\,dV$ as an iterated integral in each of the six possible ways.