University of Arkansas
Department of Mathematics

Exam 3

Calculus III

Printed Name (Last, First): ____________________ Student ID: ____________________

TA Name: ____________________ Drill Time: ____________________

Instructions, Rules, Submission, etc.

This cover page should answer any questions you may have about the exam. Failure to follow these policies may result in a score of **zero**.

	Am I allowed to ...	**Answer**
...	look something up in my notes? the book? from the homework?	Yes
...	graph something with Geogebra? Desmos?	Yes
...	plug an integral into MatLab? Mathematica? Google?	No
...	discuss the exam with a classmate?	No

What if I have a question? I will be available in our chat room (`Dr. Wigglesworth's Room`) at these times: 8:35-9:25 am, and 12:55-1:45 pm. I will also answer any emails you send **before 6pm**. Any questions sent by email after 6pm will not be answered.

How will I submit my exam? You will submit this exam through Gradescope. If you have not submitted an assignment on Gradescope yet, that means you have received zeros on several assignments. You absolutely must get Gradescope set up in order to submit your exam. There are several ways to submit your exam. All of them end with you uploading a pdf to Gradescope.

1. Print this pdf, fill out the exam, scan it, then upload via Gradescope.
2. Save this pdf to a tablet, fill it out. Save the filled out version to a pdf, then upload it in Gradescope.
3. Use blank sheets of paper. One cover page with your name, student ID, TA Name, etc. Then use **one sheet of paper for each question**. Write your solutions on looseleaf paper, scan them then upload the pdf to Gradescope.

What if I don't have a scanner? Please DO NOT take photos of your work with your phone. Instead, there are several apps that will allow you to use the camera on your phone as a scanner: AdobeScan (this one is free!), Scannable, Genius Scan, TurboScan, among others.

What if I don't know how to use Gradescope? Can I email you my exam? No! Exams submitted via email will not be accepted. You will receive a **zero**.

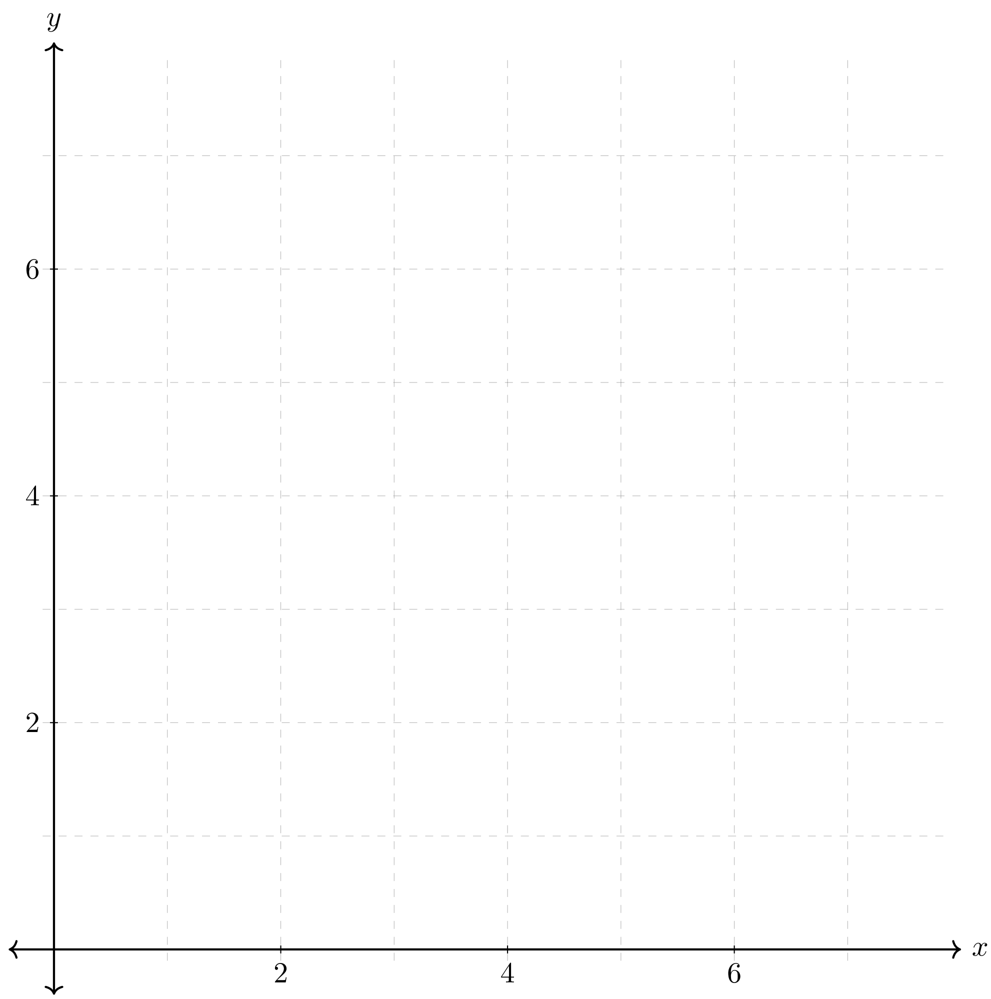
What if I don't have a printer? Read the above more carefully.

SUBMISSION DEADLINE – 1:00AM on Tuesday, April 7.

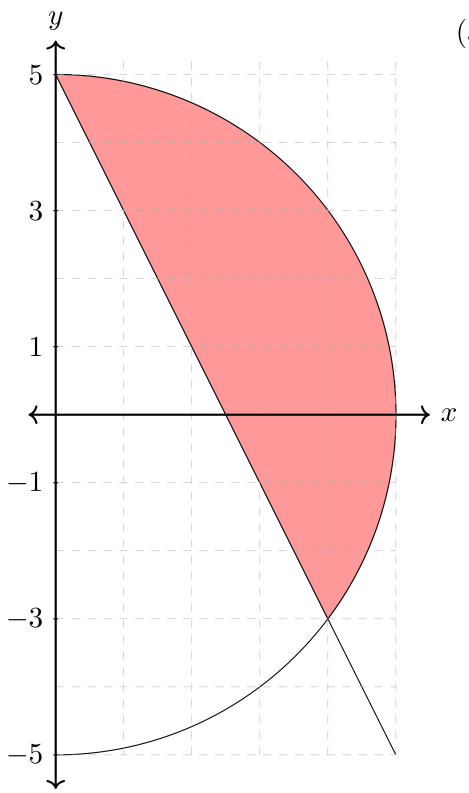
1. **[10 points]** Consider the iterated integral

$$\int_0^3 \int_2^7 e^{-x^2-y^2} \sin(x)\, dx dy.$$

Draw the region of integration in the xy-plane which is being integrated over.



2. **[10 points each]** Consider the region R bounded by the two curves shown in the figure: $x^2 + y^2 = 25$ and $y = 5 - 2x$. Let $f\colon \mathbb{R}^2 \to \mathbb{R}$ be a function.



(a) Write the double integral $\iint_R f(x,y)\ dA$ as an iteated integral in Euclidean coordinates. Use any order of integration you like.

$$\iint_R f(x,y)\ dA =$$

(b) Now express the integral $\iint_R xy\ dA$ as an iterated integral using polar coordinates. You do not need to evaluate the integral. Just set it up with appropriate integrand and limits of integration.

$$\iint_R xy\ dA =$$

3. **[10 points]** Set up a triple integral that computes the volume of the region in $\mathbb{R}^3$ bounded above by the surface $z = 27 - x^2 - 2y^2$ and bounded below by the surface $z = 2x^2 + y^2$. To see a visualization of the region in question, follow this link: `https://www.geogebra.org/3d/kbvsxhbc`. Use Euclidean coordinates.

4. Consider the iterated integral

$$\int_{-3}^{3}\int_{0}^{\sqrt{9-x^2}}\int_{\sqrt{x^2+y^2}}^{\sqrt{9-x^2-y^2}} (x^2+y^2)^{3/2}\, dzdydx.$$

(a) **[5 points]** This is a triple integral over a solid region D in $\mathbb{R}^3$. Describe the shape of the solid in a couple of english sentences. You can draw a picture if you wish, but are not required to.

(b) **[8 points]** Change the integral into cylindrical coordinates. You do not need to evaluate the integral.

(c) **[7 points]** Change the integral into spherical coordinates. You do not need to evaluate the integral.

5. **[20 points]**[1] Compute the integral $I = \iint_R (xy)\, dA$ where R is the square with vertices $(0,0), (1,1), (2,0)$, and $(1,-1)$, by making the change of variables $x = u + v$, $y = u - v$.

[1]The following things will earn you points:

- Computing the appropriate "correction factor" for the integrand.
- Sketching the appropriate regions of integration in both the xy-plane the uv-plane.
- Explicitly using the change of variables formula.
- Appropriate limits of integration.
- Evaluating the integral correctly.

6. Evaluate the following integral by changing the order of integration:

$$\int_0^1 \int_{\sqrt[3]{y}}^1 \sqrt{1 - x^4}\,dx\,dy.$$