Autumn 2023 Su

MATH 126 Midterm Exam 2

Tuessday November 21, 50 minutes during your quiz section:

Name: ____________ Quiz section: ________

7-digit UW ID: ____________

Exam Instruction:

- **You have 50 minutes to complete the exam. The exam contains 4 multi-part questions. Distribute your time accordingly.**
- Show your work to earn full credit. If you can not completely solve a problem, providing reasonable work and steps may still earn you some partial credit.
- The last page is a scratch paper, tear it off and do NOT turn it in unless you have written down additional work on it to be graded.
- **Do NOT write within 1 cm of the edge!** Your exam will be scanned for grading. If you run out of space, specify "see scratch paper", then write you additional work on the scratch paper and turn it in together with your exam.
- You can bring one hand-written double-sided 8.5" $\times$ 11" page of notes.
- The only allowed calculator is TI-30X IIS.
- Cell phone must be turned off and put away for the duration of the exam.
- **You must finish the exam independently. Giving or receiving any assistance on the exam is considered cheating, which will result in a grade of zero for the exam.**
- **Do NOT discuss the exam questions in person or online after your exam.**

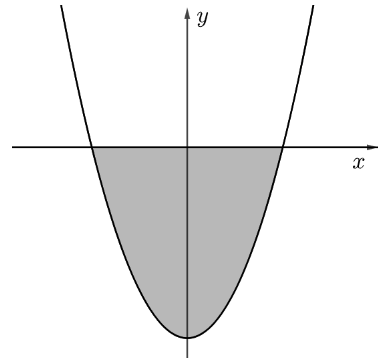
1. (11 pts) Consider the function $f(x, y) = \cos(x)\cos(y)$.

   (a) Find all the critical points of the function for $-\frac{\pi}{2} < x < \pi$, $-\frac{\pi}{2} < y < \pi$.

   (b) Classify if the function has a local maximum, local minimum, or a saddle point at each critical point you found in (a).

2. (11 pts) Consider the function $f(x, y) = x^2y + y^2$

(a) Find the absolute (global) maximum and minimum values of f on the region D enclosed by the parabola $y = x^2 - 4$ and the x-axis.



absolute (global) maximum on D: $f(\quad , \quad) =$

absolute (global) minimum on D: $f(\quad , \quad) =$

(b) Circle your answer to the following questions, no need to show work or explain.

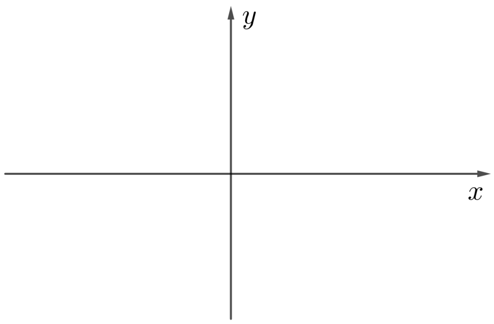
Does f attain any absolute (global) maximum on the entire $\mathbb{R}^2$? Yes No

Does f attain any absolute (global) minimum on the entire $\mathbb{R}^2$? Yes No

3. (11 pts) Consider the integral

$$\int_{-1}^{1}\int_{-\frac{\pi}{2}}^{\sin^{-1} y} (x+\cos x)^3 \, dxdy$$

(a) Sketch and shade the region of integration on the xy plane.

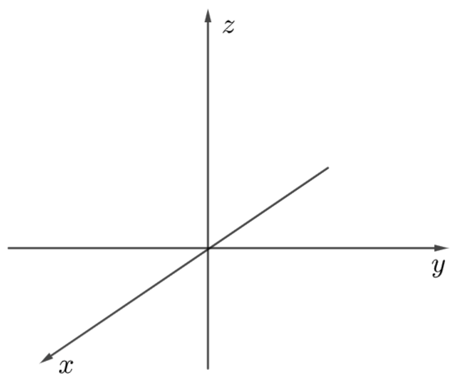


(b) Reverse the order of integration and evaluate the integral.

4. (12 pts) Part (a) and (b) of this question are independent.

(a) Setup a double integral in Polar coordinate to find the volume of the solid enclosed by the hyperboloid $-x^2 - y^2 + 2z^2 = 4$ and the cone $z = \sqrt{x^2 + y^2}$.
Do **NOT** evaluate the integral.

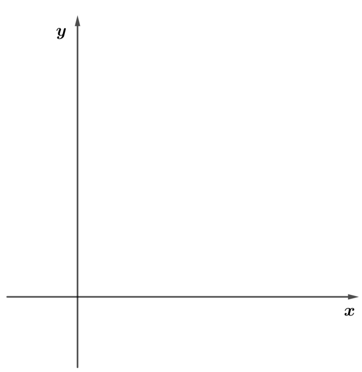
$$\int_{\square}^{\square} \int_{\square}^{\square} \boxed{} \, d\square \, d\square$$



You do not have to sketch the 3D graph.

(b) Setup the integral $\iint\limits_D y\, dA$ in Polar coordinate, D is the region **in the first quadrant** that lies inside the circle $x^2 + y^2 = 4x$ and outside the circle $x^2 + y^2 = 4y$.
Do **NOT** evaluate the integral.

$$\int_{\square}^{\square} \int_{\square}^{\square} \boxed{} \, d\square \, d\square$$



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