Math 126 E - Autumn 2023
Midterm Exam Number Two
November 16, 2023

Name: _____ Student ID no. : _____

Signature: _____

1	13	
2	4	
3	16	
5	13	
6	14	
Total	60	

This grid is purely decorative.
The exam is graded online.

- This exam consists of **FIVE** problems on **FOUR** double-sided pages. The fourth page is left blank for scratch work.
- Show all work for full credit.
- You may use a TI-30X IIS (or equivalent) calculator during this exam. Other calculators and electronic devices are not permitted.
- You do not need to simplify your answers.
- If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.
- Draw a box around your final answer to each problem.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- If you run out of room, write on one of the scratch work pages **and indicate that you have done so**. If you still need more room, raise your hand and ask for an extra page.
- You may use one hand-written double-sided 8.5″ by 11″ page of notes.
- You have 50 minutes to complete the exam.

You may use this page for scratch-work.

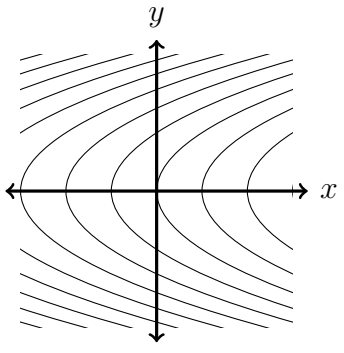
All work on this page will be ignored unless you write & circle "see first page" below a problem.

1. **[13 points]** Consider the function $f(x, y) = 6xy + x^3 - y^2$.

   Find all critical points for f, then classify each one as a local maximum, local minimum, or saddle point.

2. **[4 points]** Give an example of a function $f(x, y)$ whose level curves are all parabolas that look like this:

   Just write a formula for f. You do not need to show work.
   There are many possible answers.



3. **[16 points]** Let $\mathcal{D}$ be the closed disc of radius 3 centered at the origin.

   Find the absolute minimum and maximum values of $f(x, y) = x^2 + 4x + 2y^2$ on $\mathcal{D}$.

4. (a) **[8 points]** Find the equation of the plane tangent to $z = xy^2 - \sqrt{x} - 3\sin(y-2)$ at the point $(4, 2, 14)$.

(b) **[5 points]** Use your answer to part (a) to find an approximate value of y that satisfies the following equation:

$$14.22 = 3.92y^2 - \sqrt{3.92} - 3\sin(y-2)$$

5. **[7 points per part]** For each of the following prompts, write the indicated iterated integral.

   Do not try to evaluate these integrals! Just set them up as instructed.

   (a) Write an iterated integral for the volume below the surface $z = e^x + y^3$, above the surface $z = 1 + \sin(y)$, and over the rectangle $[3, 5] \times [2, 4]$ in the xy-plane.

   (b) Rewrite $\displaystyle\int_1^{64} \int_{\frac{x-1}{21}}^{\log_4 x} x^2 \sin(y^3)\, dy\, dx$ by reversing the order of integration.

You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle "see back page" below a problem.

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