MATH 126 – CHAPTER 14 PRACTICE EXAM

Sample E

Your Name

Your Signature

About this practice exam

These problems are drawn from previous Math 126 exams, assigned WebAssign homework, and course worksheets/test preps. They have been reorganized into a complete practice exam. This is one of five practice exams designed to help you prepare for Exam 2. The questions and difficulty are *not* a prediction of the actual exam. Sources and related homework appear below each problem. Try the exam under timed conditions, then use the solutions to review your work.

Instructions

- CHECK that your practice exam contains 8 problems on 6 pages (3 double-sided sheets), including this cover page and one scratch page at the end.
- Allow 50 minutes.
- Work as though this were a closed-book exam. You may use one $8\frac{1}{2}'' \times 11''$ sheet of handwritten notes (front and back) and a TI-30X IIS calculator. Do not share notes or calculators.
- Unless otherwise specified, give answers in exact form (for example, $\pi/4$ or $\sqrt{2}$ rather than decimals).
- In order to receive full credit, show all your work.
- **Write your answers in the provided blanks or clearly box your final answers.**
- If you need more room, use the scratch page at the end and clearly indicate where your additional work can be found.
- **Do not write within 1 centimeter of the edge of the page.**

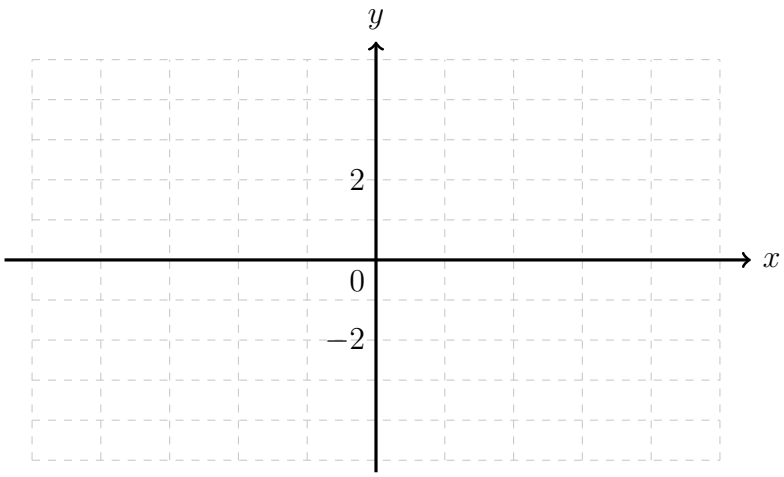
Problem	1	2	3	4	5	6	7	8	Total
Points	4	8	4	4	7	13	8	12	60

GOOD LUCK!

1. (4 pts) Level curves – *Section: 14.1*

Modeled on: WebAssign HW 14.1 contour and level-curve questions.

For $z = ye^{-x}$, sketch and label the level curves $z = k$ for $k = -2, -1, 0, 1, 2$ on the axes below. Show generally correct shapes; label each curve and its y-intercept.



2. (8 pts) Tangent plane from two curves – *Sections: 14.3, 14.4*

Source: WebAssign HW 14.4, Problem 7 (Stewart 14.4.042).

A smooth surface S contains both curves $\mathbf{r}_1(t) = \langle 4 + 2t, 1 - t^2, 3 - 5t + t^2 \rangle$ and $\mathbf{r}_2(u) = \langle 3 + u^2, 2u^3 - 1, 2u + 1 \rangle$. Find its tangent plane at $P = (4, 1, 3)$. Explain how the curves determine it.

3. (4 pts) Implicit partial derivative – *Sections: 14.3, 14.5*

Source: Loveless, Spring 2024 Math 126 Exam 2, Problem 1(a). Similar practice: HW 14.5 implicit derivatives; Week 6 Thursday TP.

If $2\sin(\pi z) = \ln y + x^2yz - 4y$ defines $z = z(x, y)$, find $\partial z/\partial x$ at $(x, y, z) = (2, 1, 1)$.

4. (4 pts) Gradient and steepest increase – *Section: 14.6*

Source: WebAssign HW 14.6, Problem 7 (Stewart 14.6.029.MI).

For $f(x, y) = 7\sin(xy)$, find the maximum rate of increase at $(0, 3)$ and a unit vector in that direction.

5. (7 pts) Find and classify – *Section: 14.7*

Source: WebAssign HW 14.7, Problem 3 (Stewart 14.7.010).

Find and classify all critical points of $f(x, y) = 6 - x^4 + 2x^2 - y^2$ using the second derivative test.

6. (13 pts) Global extrema on a square – *Section: 14.7*

Source: WebAssign HW 14.7, Problem 6 (Stewart 14.7.035).

Find the absolute maximum and minimum values of $f(x, y) = x^2 + y^2 + x^2y + 9$ on $D = \{(x, y) : |x| \leq 1, |y| \leq 1\}$. Check the interior, all four edges, and corners.

7. (8 pts) Lagrange multipliers – *Section: 14.8*

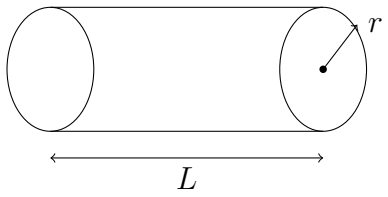
Adapted from: WebAssign HW 14.8, Problems 2–4 (basic constrained extrema).

Use Lagrange multipliers to find the maximum and minimum values of $f(x, y) = 2x + 3y$ subject to $x^2 + y^2 = 13$.

8. (12 pts) Cylindrical mailing tube – *Sections: 14.7, 14.8*

Source: WebAssign Optimization Applications HW, Problem 7 (Stewart 14.8.022).

A cylindrical mailing tube must have length plus girth at most 114 inches (girth is the circular end's circumference). Find the radius and length giving the greatest volume. Use substitution or Lagrange multipliers; identify the objective and constraint and explain why this is a maximum.



You may use this page for scratch-work or extra room.

All work on this page will be ignored unless you clearly indicate on the relevant problem that additional work appears here, and label that work with the problem number.