MATH 126 – CHAPTER 14 PRACTICE EXAM

Sample D

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 5 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	Total
Points	8	11	15	14	12	60

GOOD LUCK!

1. (8 pts) Tangent plane – *Sections: 14.3, 14.4*

Source: Ostroff, Winter 2019 Exam 2, Problem 1. Similar practice: HW 14.4.

Write the equation of the tangent plane to $z = x^2y - x$ at $(2, 3, 10)$.

2. (11 pts) Find and classify – *Section: 14.7*

Source: Loveless, Spring 2023 Math 126 Exam 2, Problem 2(a). Similar practice: HW 14.7; Week 7 Tuesday Worksheet.

Find and classify all critical points of $f(x, y) = 6x^2 - 3x^2y + y^3 - 3y$. Show the second derivative test.

3. (15 pts) Felix walking on a surface – *Sections: 14.5, 14.6*

Source: Loveless, Autumn 2013 Math 324 Exam 2, Problem 1. Similar practice: HW 14.5 and 14.6; Week 7 Tuesday Worksheet.

Felix walks on $z = f(x, y) = \frac{1}{4}x^2 + \frac{1}{3}y^3 - \frac{1}{2}xy^2$ (all distances in miles). Positive y is north and positive x is east.

(a) **[5 pts]** Given $x(1) = 2$, $y(1) = 1$, $x'(1) = 3$, and $y'(1) = -4$, find dz/dt at $t = 1$ (hours). Give units.

(b) **[5 pts]** At $(8, 2)$, find the *unit* direction for steepest downhill motion.

(c) **[5 pts]** At $(8, 2)$, find the slope when Felix walks 30° east of north.

4. (14 pts) Global extrema on a half-disk – *Section: 14.7*

Source: Loveless, Winter 2024 Exam 2, Problem 4. Similar practice: HW 14.7; Week 7 Thursday Test Prep.

Find the absolute maximum and minimum values of $f(x, y) = 5 + 2x^2 + y^2 + 8y$ on $D = \{(x, y) : y \geq 0,\ x^2 + y^2 \leq 25\}$. Check interior points, every boundary component, and endpoints. State where the extrema occur.

5. (12 pts) Aquarium material costs – *Sections: 14.7, 14.8*

Source: WebAssign Optimization Applications HW, Problem 5 (Stewart 14.7.054).

An open-top rectangular aquarium has slate on the bottom and glass on the four sides. Its volume is V, and slate costs three times as much per unit area as glass. Find the dimensions minimizing material cost, in terms of V. Clearly give the cost and volume constraint.

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.