

**Math 524 Exam 10: 12/4/8**

Please read the exam instructions.

Notes, books, papers, calculators and electronic aids are all forbidden for this exam. Please write your answers on **separate paper**, indicate clearly what work goes with which problem, and put your name on every sheet. Cross out work you do not wish graded; incorrect work can lower your grade, even compared with no work at all. Keep this list of problems for your records. Show all necessary work in your solutions; if you are unsure, show it. Each problem is worth 10 points. You have approximately 30 minutes.

1. Find all  $2 \times 2$  complex matrices that are simultaneously diagonal, Hermitian, and unitary.
2. Find all  $2 \times 2$  real matrices that are simultaneously symmetric and orthogonal.
3. Find all  $2 \times 2$  complex matrices that are simultaneously anti-symmetric and unitary.
4. Find the maximum of  $2x^2 + 4xy + 5y^2$  subject to  $x^2 + y^2 = 1$ .