

Show all work. You may leave arithmetic expressions in any form that a calculator could evaluate. By putting your name on this paper, you agree to abide by the university's code of academic integrity in completing the quiz. Use no books, calculators, cellphones, other electronic devices, communication with others, scratchpaper, etc.

Name \_\_\_\_\_

1. (10) Let  $f(\mathbf{x}) = \frac{1}{2}\mathbf{x}^T\mathbf{H}\mathbf{x} - \mathbf{x}^T\mathbf{b}$ , where  $\mathbf{H}$  and  $\mathbf{b}$  are constant, independent of  $\mathbf{x}$ , and  $\mathbf{H}$  is symmetric positive definite. Given vectors  $\mathbf{x}^{(0)}$  and  $\mathbf{p}^{(0)}$ , find the value of the scalar  $\alpha$  that minimizes  $f(\mathbf{x}^{(0)} + \alpha\mathbf{p}^{(0)})$ .

2. (10) Consider the problem

$$\min_{\mathbf{x}} 5x_1^4 + x_1x_2 + 6x_2^2$$

subject to the constraints  $\mathbf{x} \geq \mathbf{0}$  and  $x_1 - 2x_2 = 4$ . Formulate this problem as an unconstrained optimization problem using feasible directions and a barrier function.