Name _____

56:271 Nonlinear Programming
Quiz #4 – Fall 2003

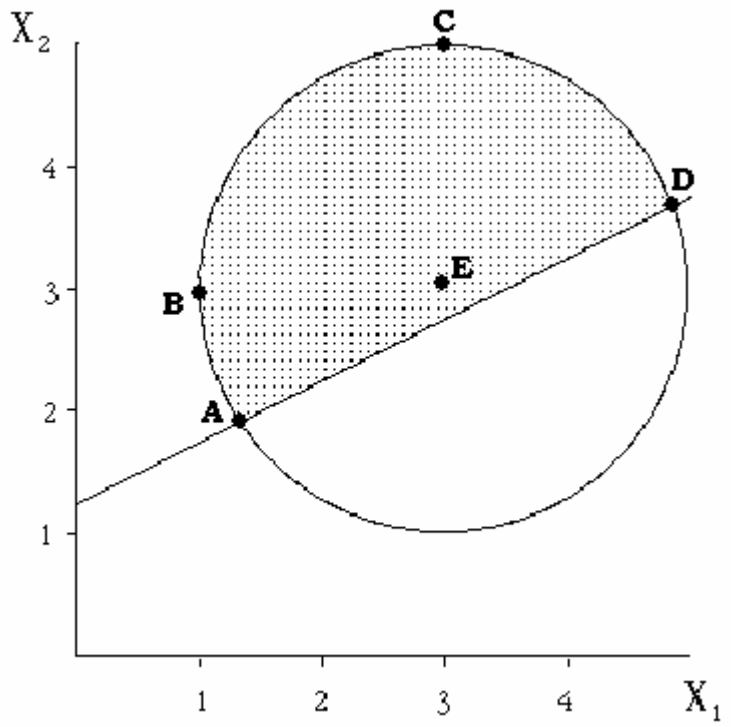
Consider the minimization problem:

$$\textit{Minimize} \quad f(x) = x_1$$

subject to

$$\begin{cases} g_1(x) = \frac{1}{2} x_1 - x_2 + 1.25 \le 0 \\ g_2(x) = (x_1 - 3)^2 + (x_2 - 3)^2 - 4 \le 0 \end{cases}$$

with feasible region as shown:



	X_1	X_2
A	1.006	1.753
B	1	3
C	3	5
D	4.877	3.689
E	3	3

To answer the questions below, you need not compute the gradients—you need only to estimate them.

1. Insert "+" or "–" in the blanks below:

$$L(x_1, x_2, \lambda_1, \lambda_2) = x_1 \_\_\_\_ \lambda_1 \left(\tfrac{1}{2} x_1 - x_2 + 1.25 \right) \_\_\_\_ \lambda_2 \left((x_1 - 3)^2 + (x_2 - 3)^2 - 4 \right)$$

and indicate any sign restrictions for the Lagrangian multipliers (λ)

λ_1:	___nonpositive	___nonnegative	___not restricted in sign
λ_2:	___nonpositive	___nonnegative	___not restricted in sign

2. At each of the points A, B, C, & D, indicate
   - the ***steepest descent*** direction and
   - the gradients of the ***tight*** constraints.

3. Which of the 5 points above are stationary points of the Lagrangian function for this problem? ? *(circle)* A B C D E

4. Which of the 5 points above satisfy the Karush-Kuhn-Tucker conditions for this problem? *(circle)* A B C D E