Name ______________________________

56:271 Nonlinear Programming
Quiz #7—Fall 2003

Consider the Geometric Programming problem

$$\text{Minimize } \frac{x_1}{x_2^2} + 4\frac{x_2}{x_1}$$

subject to

$$0 < x_1 \leq \tfrac{1}{2}$$

$$0 < x_2$$

a. Restate the first constraint in "standard" GP form.

b. Complete the GP dual of the above problem:

$$\text{Maximize } \left(\frac{1}{\delta_1}\right)^{\delta_1}\left(\frac{4}{\delta_2}\right)^{\delta_2}\left(\frac{2}{\delta_3}\right)^{\delta_3}\lambda_1^{\lambda_1}$$

subject to

c. Is the GP dual objective function above: (circle) convex? concave? both? neither?
d. What is the "degree of difficulty" of this problem? ________
e. What are the optimal values of the GP dual variables?

δ_1= _______ , δ_2= _______ , δ_3= _______ , λ_1= _______

f. What is the optimal value of the dual objective function? ___________
g. In the optimal solution of the (primal) problem, what fraction of the optimal cost is due to the *first* term of the objective function, i.e., $\frac{x_1}{x_2^2}$?

h. What is the minimum value of the primal objective function? ___________
i. What are the optimal values of x_1 and x_2?

j. If the first constraint were $0 < x_1 \leq \tfrac{1}{4}$ instead, how would you answer part (g)?

Suppose the constraint $x_2 - x_1 \geq \tfrac{1}{3}$ *were to be added to the problem.*

k. Can this new constraint be written in posynomial GP form? (If possible, do so.)

l. What would be the "degree of difficulty" if this new constraint were included? ___________