Problem Set 4

Econ 115a

October 8, 2003

Unusually, this problem set is due on **Monday**, Oct. 13. The midterm is Oct. 15 in class. No problem set and no sections next week.

1. Define
   (a) Iso-Quant
   (b) Average Variable Cost
   (c) Sunk Cost
   (d) Increasing Returns to Scale

2. Let’s come back to the problem of Widgets-R-Us, which uses labor, \( L \), and capital, \( K \), to produce Widgets. Recall that the production function is \( Q = \sqrt{L}\sqrt{K} \), giving a marginal productivity of labor of

\[
MP_L = \frac{1}{2} \frac{\sqrt{K}}{\sqrt{L}}
\]

and a the marginal productivity of capital of

\[
MP_K = \frac{1}{2} \frac{\sqrt{L}}{\sqrt{K}}.
\]

Again, the firm faces a wage rate of \( w \) and a cost of capital of \( r \). This time, let both capital and labor vary.

(a) What is the formula for the slope of the iso-quant?
(b) Graph the solution to the cost-minimizing input choices, conditional on an output level \( \bar{Q} \).
(c) Give the formulas for the the cost-minimizing input choices of \( L \) and \( K \) (each answer will depend on the input prices and on \( \bar{Q} \), as well as on this specific production function.)
(d) Given this production function, what is the formula for the cost function.
3. Consider the cost function

\[ C(Q) = 10 + 2Q^2 \]

which implies marginal cost of \(4Q\).

(a) What is the fixed cost of this firm?

(b) If price is 8, what is the average cost of a perfectly competitive firm?

(c) Would this firm like to stay in the industry or exit? Does the answer depend on whether the firm can recover its fixed cost on exiting (i.e. whether the fixed costs are sunk?)

4. Say that the marginal cost function of each of \(N\) firms is

\[ mc = 5q, \]

where \(q\) is firm output. What is the supply function of the industry?