

FRE/ECON374 Land Economics Problem Set 4 (100 Points)

Due: 2nd December 2011 at 11 AM.

Solutions

Instructions:

- a) Please answer all questions below. They carry equal weight.
- b) Problem sets are to be handed in at the beginning of class at 11 AM, Friday, December 2nd 2011. Please do not upload your problem sets in vista. If you do, they will not be graded.
- c) Any problem set received after the time it is due will not be graded.
- d) Please label and mark all graphs clearly (if applicable).

Questions:

Question 1. Consider the market for Kyanite. The inverse demand curve is given by $p=15-q$, where p is the price in million dollars, and q is quantity in hundred pounds. The total cost of production is given by $TC=5q+(q^2)/2$, thus $MC=5+q$.

- a. What is the market clearing price and quantity of Kyanite? Illustrate this on a well marked graph.

The price is 10 million dollars per hundred pounds. The quantity is 5 hundred pounds. See graph at the end of the question.

Now consider that there are only 2 hundred pounds of Kyanite available. In other words, there is a natural supply restriction.

- b. What is the price at this quantity?

The price of Kyanite when supply is restricted to 2 hundred pounds is 13 million dollars per hundred pounds.

- a. Define Ricardian/differential rent.

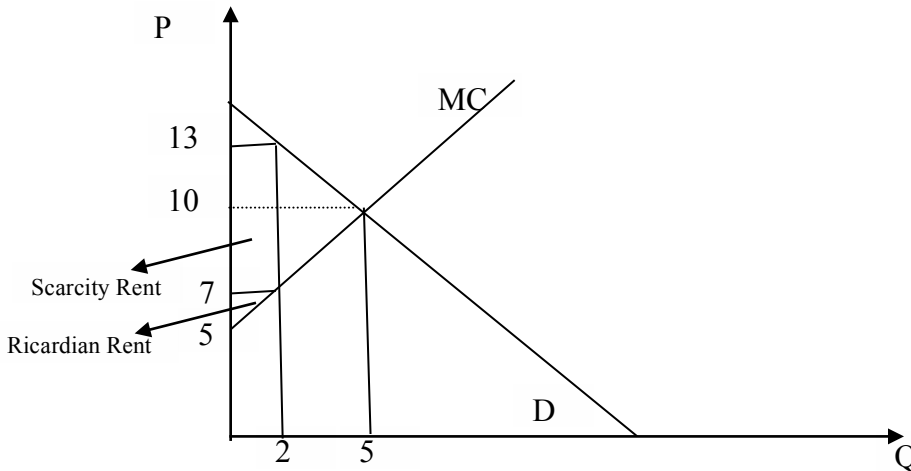
Ricardian or differential rent is profit that derives from differences in productivity across different units. Consider production with an upward sloping marginal cost curve. The first units are produced at a lower cost than later units. This difference in marginal cost deriving from a difference in productivity across these units creates differential rent.

- b. What is the ricardian rent at the restricted quantity? Illustrate on your graph.

The quantity produced is 2 hundred pounds. The marginal cost of production is 7 million dollars. The lowest cost of production is 5 million dollars. Ricardian, or differential rent is thus $\frac{1}{2}(2*2)=2$ million dollars.

c. What is the scarcity rent at the restricted quantity? Illustrate.

The price is 13 million dollars. The marginal cost of production is 7 million dollars. Thus scarcity rent is $2*6=12$ million dollars.



Question 2. The music industry has fixed the retail price of a music disc at \$8. The cost of transporting the disc to the market is 10 cents per disc per mile. Assume that there is a single road (extending in only one direction) to this market and firms can locate uniformly along this road at a distance of 1 mile from each other. Assume that there is a firm producing at the market center (at mile 0). Assume the firm's marginal cost schedule is given in the table at the end of this question.

a. What is the distance in miles from the market for the last firm that produces for this market?

The last firm in this market will produce at 40 miles from the market. The cheapest cost for producing a cd is \$4 and given the cost of 10 cents for transportation a firm located at 40 miles from the market can produce cds without losing money.

b. How many firms produce for this market?

From the answer for a) this implies that there are 41 firms in this market.

c. What is the total quantity of compact discs produced for this market? Please explain carefully how you got your answer.

The total quantity of compact discs produced for this market. To answer this question correctly it is important to know that some firms will produce 200 cds and some will produce 100 cds. The last firm to produce 200 cds is the firm at 20 miles from the market. Any firm beyond 20 miles will lose money from producing more than 100 cds. Every firm from mile 21 till 40 produces 100 cds. Thus the total number of cds is $21 \cdot 200 + 20 \cdot 100 = 6200$ cds.

- d. Illustrate your solution to this problem on a graph with profit on the y axis and distance from the market on the x axis.

This graph should have a kink at 20 miles. Firms producing at a distance closer to 20 miles have a larger quantity produced and thus a different slope than those after 20 miles.

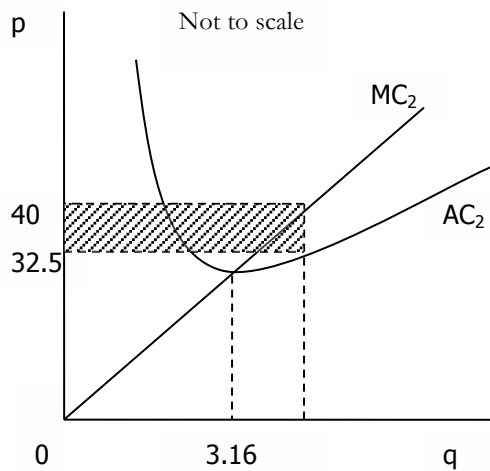
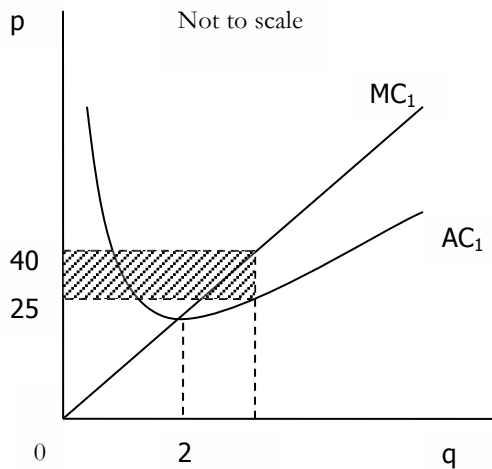
Marginal Cost Schedule for Producing Compact Discs

Production Scale	Cost Per Unit
$q \text{ (quantity)} \leq 100$	\$ 4
$100 < q \leq 200$	\$6
$200 < q$	\$10

Question 3 Karine is a landowner in Quebec who owns two fields and grazes cows on both. Field 1 has a natural pond; however in Field 2 Karine must pump in water. The total cost of producing tankers of milk (q) in each field is represented by: $TC_1 = 10 + 50q^2$ and $TC_2 = 150 + 150q^2$. The corresponding marginal costs are: $MC_1 = 100q$, and $MC_2 = 300q$. The price of milk is set at $p = 300$ per tanker.

- a) Plot AC_1 and MC_1 on one diagram and AC_2 and MC_2 on another. These plots do not have to drawn to scale but should capture the shape of each curve accurately.

$$AC_1 = 20/q + 5q \quad MC_1 = 10q \quad AC_2 = 50/q + 5q \quad MC_2 = 10q$$



- b) Calculate, and show on your diagrams, the quantity Karine will produce in each field.
 Answer: Profit is maximized at $p = MC$ in each field, $40 = 10q$, and find $q_1 = q_2 = 4$.
- c) Calculate, and show on your diagrams, the Ricardian rent Karine gets from each field.
 Answer: Ricardian rent is $p - AC$ at the quantity produced multiplied by quantity produced; the shaded areas in the diagrams. In Field 1 = $(40 - 25) \times 4 = 60$. In Field 2 = $(40 - 32.5) \times 4 = 30$.
- d) Now suppose the Canadian Dairy Board restricts Karine through a complex production quota. Karine can only produce on Field 1 and can produce only 2 tankers of milk. Calculate Karine's total rent from her quota allocation. What portion of this rent can be classified as Ricardian and what portion can be classified as scarcity rent?
 No solution provided, this is similar to question 1.