Intermediate Microeconomics

Exercises

Agribusiness Teaching Center

Easter Term 2015

Exercise

Suppose a monopolist has

$$TC = 100 + 10Q + 2Q^2$$

and the demand curve it faces is

$$p = 90 - 2Q$$

What will be the price, quantity, and profit for this firm?

Exercise №11.1

A monopolist can produce at constant average and marginal costs of $AC = MC = 5$. The firm faces a market demand curve given by $Q = 53 – P$.

i. Calculate the profit-maximising price-quantity combination for the monopolist. Also calculate the monopolist's profit and consumer surplus.

ii. What output level would be produced by this industry under perfect competition (where price = marginal cost)?

Exercise №11.1

A monopolist can produce at constant average and marginal costs of $AC = MC = 5$. The firm faces a market demand curve given by $Q = 53 – P$.

iii. Calculate the consumer surplus obtained by consumers in part ii. Show that this exceeds the sum of the monopolist's profits nd consumer surplus received in part i.

iv. What is the value of the *deadweight loss* from monopolisation?

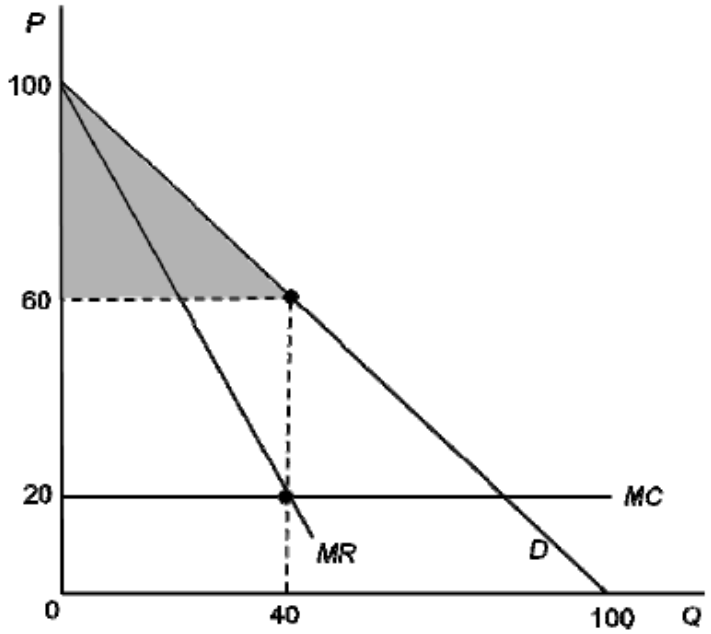
Exercise №11.10

Because of huge fixed cost of running pipes to everyone's home, natural gas is a natural monopoly. Suppose demand is Q = 100 – P, and marginal cost is ¥20, and the fixed cost of setting up the natural gas pipelines is ¥1000.

i. Compute the industry outcome (quantity, price, profit, consumer surplus, and social welfare) under unregulated monopoly.

Exercise №11.10: Solution to part *i*.

Setting $MR = MC$ yields $Q^m = 40$. Substituting into demand, $P^m = 60$. Profit is $\pi^m = 600$, which is computed as total revenue (60×40) minus total cost $TC = 1000 + 20Q = 1000 + (20 \times 40) = 1{,}800$. Consumer surplus equals the area of the shaded triangle in the graph below: $CS^m = 800$. Social welfare is $W^m = \pi^m + CS^m = 1{,}400$.



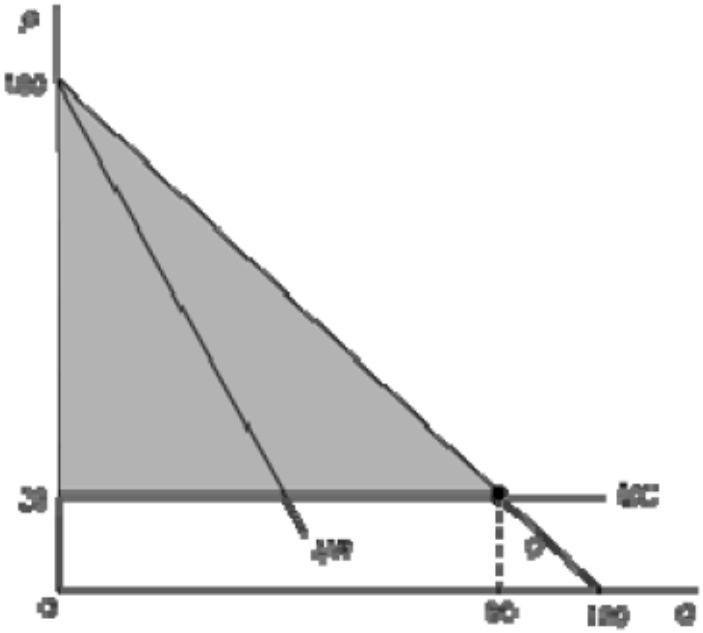
Exercise №11.10

Because of huge fixed cost of running pipes to everyone's home, natural gas is a natural monopoly. Suppose demand is Q = 100 – P, and marginal cost is ¥20, and the fixed cost of setting up the natural gas pipelines is ¥1000.

ii. What regulatory price maximises social welfare? Compute the industry outcome (quantity, price, profit, consumer surplus, and social welfare) under this price. Would this policy be sustainable in the long-run?

Exercise №11.10: Solution to part *ii.*

Social welfare is maximized by setting $P = MC$. From the demand curve, $P = 100 - Q$. So $100 - Q = 20$ implies $Q^* = 80$. Then $P^* = 20$, $\pi^* = -1{,}000$, $CS^* = 3{,}200$ (the area of the shaded triangle), and $W^* = 2{,}200$. This policy would not be sustainable in the long run without subsidies because the firm is making negative profit and would exit if it could.



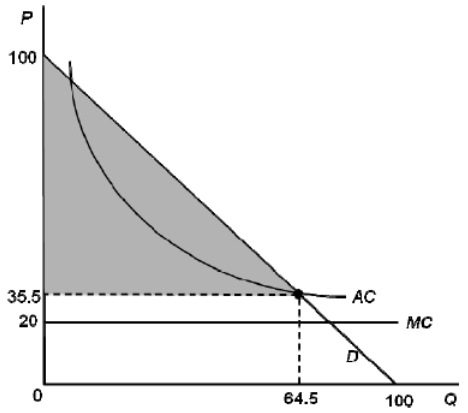
Exercise №11.10

Because of huge fixed cost of running pipes to everyone's home, natural gas is a natural monopoly. Suppose demand is Q = 100 – P, and marginal cost is ¥20, and the fixed cost of setting up the natural gas pipelines is ¥1000.

iii. Compute the industry outcome (quantity, price, profit, consumer surplus, and social welfare) with the laxer regulatory policy of constraining price to be no greater than average cost. Would this policy be sustainable in the long-run?

Exercise №11.10: Solution to part *iii*.

See the figure below for this outcome. Compute the quantity under this form of regulation by finding the intersection between P (from the inverse demand q curve) and AC. To compute AC, start from $TC = 1000 + 20Q$, implying $AC = TC/Q = (1000/Q) + 20$. Setting $100 - Q = (1000/Q) + 20$ leads to the quadratic equation $Q^2 - 80Q + 1000 = 0$ with roots (15.5, 64.5). The two roots correspond to the two intersections shown on the graph. As the graph shows, the relevant root is the larger one, $Q^r = 64.5$ (the superscript refers to "regulation"). We also have $P^r = 35.5$, $\pi^r = 0$ (this must be true because $P = AC$ implies zero profit), $CS^r = 2{,}079.8$ (the area of the shaded triangle in the graph), and $W^r = 2{,}079.8$. This policy could be sustainable in the long run because the firm is at least breaking even, so has no incentive to exit.



Exercise №10.4

There are 200kg of food on an island that must be allocated between 2 marooned sailors. The utility function of the first sailor is given by

$$Utility = sqrt(F_1)$$

where F_1 is the quantity of food consumed by the first sailor. For the second sailor, utility (as a function of food consumption) is given by

$$Utility = \tfrac{1}{2}\, sqrt\,(F_2)$$

i. If the food is allocated equally between the sailors, how much utility will each receive?
ii. How should food be allocated between the sailors to ensure equality of utility?

Exercise №10.4

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iii. Suppose that the second sailor requires a utility level of at least 5 to remain alive. How should food be allocated so as to maximise the sum of utilities subject to the restraint that the second sailor receives that minimum level of utility?

iv. What other criteria might you use to allocate the available food between the sailors?

Exercise: Mark-up

It is a conventional practice among apparel retailers to set the retail price of clothing at twice the cost paid to the manufacturer. For example, if the retailer pays £7 for a pair of jeans, the jeans will retail for £14.

What must the price elasticity of demand be for this practice to be profit maximising?

Exercise: Monopoly

- Draw a graph that shows a shift in the demand curve that causes the optimal monopoly price to change, while the quantity remains the same.

Preferences

Nancy is taking a course from Professor Goodheart, who will count only her best midterm grade, and from Professor Stern, who will count only her worst midterm grade.

In one of her classes, Nancy has scores 40 on her first midterm and 50 on her second midterm. When the first midterm score is measured on the horizontal axis, and the second midterm score on the vertical axis, her indifference curve has a slope of zero at the point (40; 50).

Which class is this?

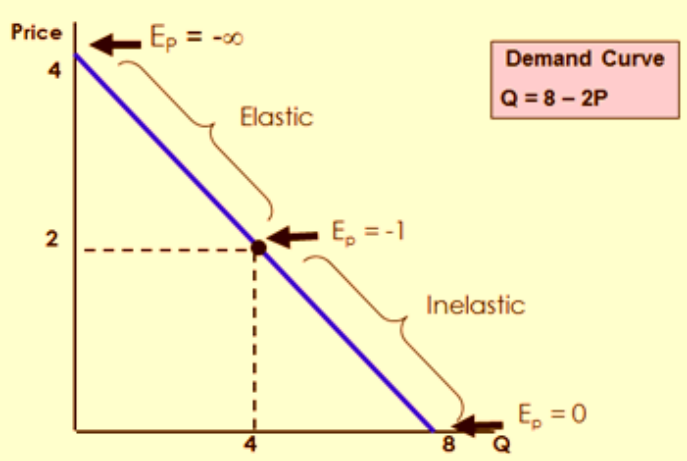
Price Elasticity of Demand

Assume a linear demand:

$$q = a - b \cdot p$$

Find the price elasticity of demand along the curve (look at the points where p=0, q=0, and the mid-point).

Price Elasticity of Demand



$$q = a - b \cdot p$$

$$\varepsilon = -b \cdot p / q$$

$$\varepsilon = \frac{\partial q}{\partial p} \cdot \frac{p}{q}$$

$q = 0 \quad \rightarrow \quad \varepsilon = -\infty$

$p = 0 \quad \rightarrow \quad \varepsilon = 0$

$q = \frac{1}{2}\, a \quad \rightarrow \quad \varepsilon = -1$

Utility and indifference

Hayarpi's utility function is

$$U(X, Y) = X \cdot Y$$

i. Suppose he originally consumed 4 units of X and 12 units of Y: If his consumption of Y is reduced to 8, how much X must he have to be as well as he was to begin with.

ii. which bundle would Milan like better:

   (a) 3 units of X and 10 units of Y; or

   (b) 4 units of X and 8 units of Y:

Production function

- Suppose the production function for T-shirts can be represented as

$$q = L^{0.25} K^{0.75}$$

i. Show that the production function has constant returns to scale.

ii. Show that the marginal productivity of labor diminishes in the short run.

iii. When K= 1 and q = 2, what is the slope of the isoquant? If there is insufficient information to answer the question, describe what information is needed.

Basic decision making rule

Vardan has two career options. He can work for someone else for £50,000 a year or he can run his own business. The annual revenue of Vardan's business is £100,000, while explicit costs are £40,000 annually.

Explain which career option Vardan, as a profit-maximizer, will select and why.

Cost function and Production

In the sunglasses industry the total cost function is given as

$$TC = 100q + 100q^2$$

Are the returns to scale increasing, decreasing, or constant?

Production

- There are two distinct and separated markets, A and B, for a good with demand curves as follows:

  (a) Market A: $p_A = 240 - 2q_A$

  (b) Market B: $p_B = 120 - 2q_B$

- One firm supplies both of these markets. This firm has a constant marginal cost of output equal to €20 and zero fixed costs. The firm seeks to maximise profits.

i. what price should the firm charge in each market?

ii. how much should it sell in each market?

iii. how much is the total profit?

- Now assume that the firm's marginal cost curve is MC=2Q.

iv. how the answers to i.-iii. Change in this case?

Exercise №1.5: Equlibrium

Consider a demand curve of the form

$$Q_D = -2P + 20$$

where Q_D is the quantity demanded of a good and P is the price of the good. Graph this demand curve. Also draw a graph of the supply curve

$$Q_S = 2P - 4$$

where Qs is the quantity supplied. Assume that all the Qs and P's are nonnegative. At what values of P and Q do these curves intersect – that is, where does $Q_D = Q_S$.

- Now suppose at each price that individuals demand four more units of output – that the demand curve shifts to

$$Q_{D'} = -2P + 24$$

Graph this new demand curve. At what values of P and Q des the new demand curve intersect the old supply curve – that is, where does

$$Q_{D'} = Q_S.$$

Exercise №2.1

Ms Caffeine enjoys coffee (C) and tea (T) according to the function

$$U(C, T) = 3C + 4T.$$

a. What does her utility function say about her MRS of coffee for tea? What do her indifference curves look like?

b. If coffee and tea cost €3 each and Ms Caffeine has €12 to spend on these products, how much coffee and tea should she buy to maximise her utility?

c. Draw the graph of her indifference curve map and her budget constraint, and show that the utility-maximising point occurs only on the T-axis where no coffee is bought.

d. Would this person buy any coffee if she had more money to spend?

e. How would her consumption change if the price of coffee fell to €2?

Exercise №9.3

The handmade snuffbox industry is composed of 100 identical firms, each having short-run total costs given by

$$STC = 0.5q^2 + 10q + 5$$

where q is the output of snuffboxes per day.

a. What is the short-run supply curve for each snuffbox maker? What is the short-run supply curve for the market as a whole?

b. Suppose the demand for total snuffbox production is given by

$$Q = 1100 - 50P$$

What is the equilibrium in this market? What is each firm's total short-run profit?

c. Graph the market equilibrium and compute total producer surplus in this case.

d. Show that the total producer surplus you calculated in part c is equal to total industry profits plus industry short run fixed costs.

Exercise №9.3

e. Suppose now that the government imposed a $3 tax on snuffboxes. How would this tax change the market equilibrium?

f. How would the burden of this tax be shared between snuffbox buyers and sellers?

g. Calculate the total loss of producer surplus as a result of the taxation of snuffboces. Show that this loss equals the change in total short-run profits in the snuffboxe industry. Why don’t fixed costs enter into this computation of the chage in short-run producer surplus?