

## Homework 4

### Answers

**Problem 1** Nadia likes spare ribs,  $R$ , and fried chicken,  $C$ . Her utility function is

$$U = 10R^2C \tag{1}$$

Her marginal utilities are  $MU_R = 20RC$  and  $MU_C = 10R^2$ . Her weekly income is \$90, which she spends on only ribs and chicken.

a. If she pays \$10 for a slab of ribs and \$5 for a chicken, what is her optimal consumption bundle? Show her budget line, indifference curve, and optimal bundle,  $e_1$  in a diagram.

$$C^* = 6, R^* = 6$$

b. Suppose the price of a chicken doubles to \$10. How does her optimal consumption of chicken and ribs change? Show her new budget line and optimal bundle,  $e_2$ , in your diagram.

$$C^* = 3, R^* = 6$$

c. Solve for Nadia's demand for chicken when the price of a chicken is  $p_c$ , for any  $p_c$ .

$$C^* = \frac{30}{p_c}$$

**Problem 2** The cost function for John's shoe repair is  $c(q) = 100 + 10q - q^2 + \frac{1}{3}q^3$ , so that marginal cost is  $c'(q) = 10 - 2q + q^2$ . Shoe repair is a perfectly competitive industry.

a. Suppose the price of shoes is \$80. Solve for John's profit-maximizing quantity of shoes repaired. What is John's profit in this case?

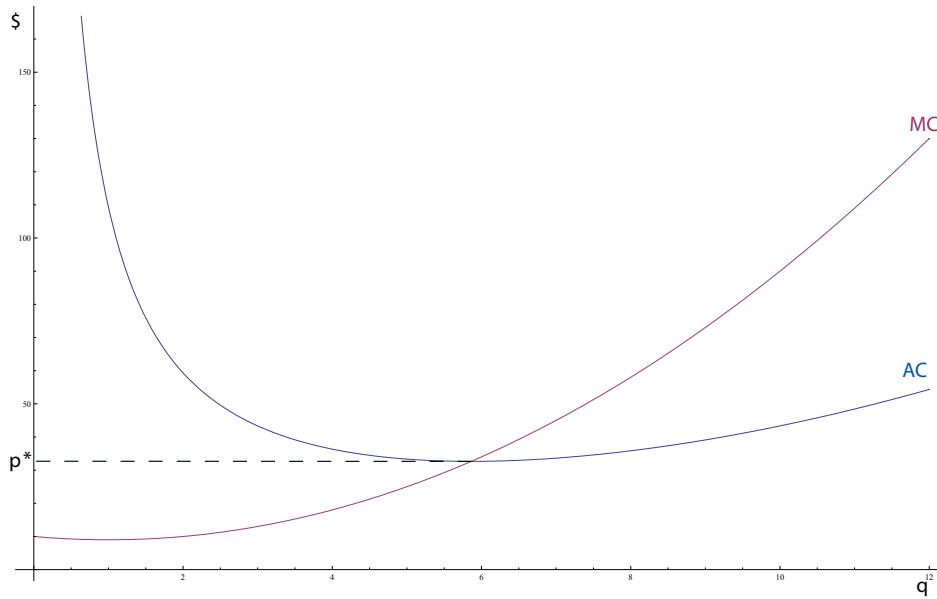
The profit-maximizing quantity  $q$  solves  $80 = 10 - 2q + q^2$ , or  $q = 9.43$ .

b. What is John's supply curve, relating the price of a shoe repair  $p$  to the quantity of shoes he repairs,  $q$ ?

$$p = 10 - 2q + q^2$$

c. Draw a picture of John's average cost curve (hint: average cost is  $\frac{c(q)}{q} = \frac{100}{q} + 10 - q + \frac{1}{3}q^2$ ) and his marginal cost curve. Indicate where in your picture John's supply curve is. Also indicate the price below which John would shut down his business in the long run.

The supply curve is his MC curve above his average cost curve. In the long run, he would shut down at any price below  $p^*$ . Note that this ignores the fact that he might continue to operate in the short run (if  $p > AVC$ ) but shut down in the long run.

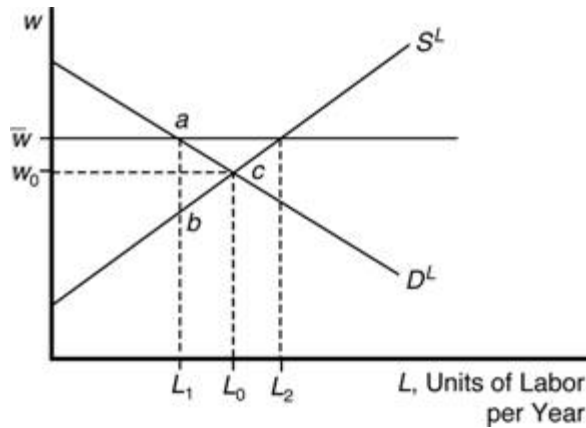


**Problem 3** Each firm in a competitive market has a cost function of  $c(q) = 16 + q^2$ . The market demand function is  $Q = 24 - p$ . Determine the long-run equilibrium price, quantity per firm, market quantity, and number of firms.

Marginal cost is  $MC = 2q$ . Each firm's average cost is  $AC = \frac{16}{q} + q$ . Each firm's long run quantity will be where  $MC = AC$ , or where  $2q = \frac{16}{q} + q$ , i.e.  $q = 4$ . The long run price is equal to the marginal cost of producing 4 units, or 8. At this price, quantity demanded by the market is 16. Therefore, there must be 4 firms operating in the market. If this sounds like an implausibly low number for a competitive market, note that this could denote, say, four thousand firms.

**Problem 4** What are the welfare effects of a binding minimum wage? Use a graphical approach to show what happens if all workers are identical. Then verbally describe what is likely to happen to workers who differ by experience, education, age, gender, and race.

The welfare loss due to the minimum wage is triangle abc. When the minimum wage is instituted, employment falls to  $L_1$  from  $L_0$ . Because labor supply at the new higher wage increases to  $L_2$ , unemployment is increased by the institution of the minimum wage. Because of the excess supply, less experienced workers are likely to be losers with the new policy. In addition, if discrimination exists on the basis of age, gender, or race, those workers in the less desired group are also likely to be hurt by the minimum wage. Note that this analysis differs from the agricultural subsidies we discussed in class, as the government does not support the minimum wage by purchasing excess labor, as they do with some subsidized crops.



**Problem 5** If the demand curve for books is  $p = 60 - Q$ , and the supply curve is  $p = Q$ , what are the welfare effects of a tax on buyers of \$2? Make sure to give consumer and producer surplus before and after the tax, as well as the deadweight loss and government revenue resulting from the tax.

Before the tax, both consumer and producer surplus are 450. After the tax, consumer and producer surplus are both 420.5, government revenue is \$58, and the deadweight loss of the tax is \$1.

**Problem 6** Suppose demand for wheat is  $Q = 100 - 10p$  and supply is  $Q = 10p$ . The government imposes a price ceiling of  $p = 3$

a. Describe how the equilibrium changes.

With the price ceiling, price will be \$3, quantity supplied will be 30, and quantity demanded will be 70. The quantity actually traded will thus be 30.

b. What effect does this ceiling have on consumer surplus, producer surplus, and deadweight loss?

Consumer surplus increases by 40, producer surplus decreases by 80, and so the DWL is 40.

**Problem 7** A government is considering implementing either a quota or a tariff, each of which would reduce imports by the same amount. Which does the government prefer, and why?

The government prefers the tariff because it receives revenue it can spend. In either case, consumer surplus is reduced to area A. With the quota, the government collects no revenue. With the tariff, the government collects  $B + C + D + E$  as revenue.

