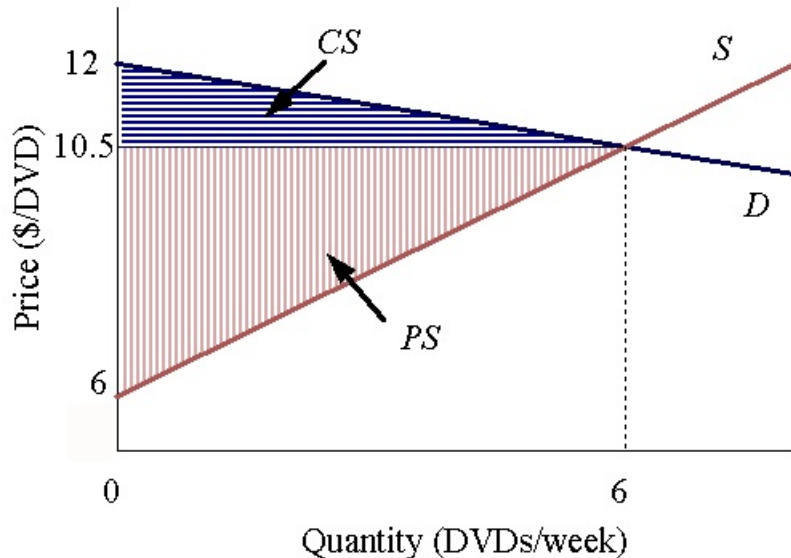


## Problem Set Five Solutions

### Chapter 7

1. Suppose the weekly demand and supply curves for used DVDs in Lincoln , Nebraska, are shown in the diagram. Calculate and **graph**:



a. The weekly consumer surplus.

*Answer:* Consumer surplus is the triangular area between the demand curve and the price line. Consumer surplus is  $0.5 (\$1.50/\text{unit}) (6 \text{ units/week}) = \$4.50/\text{week}$ .

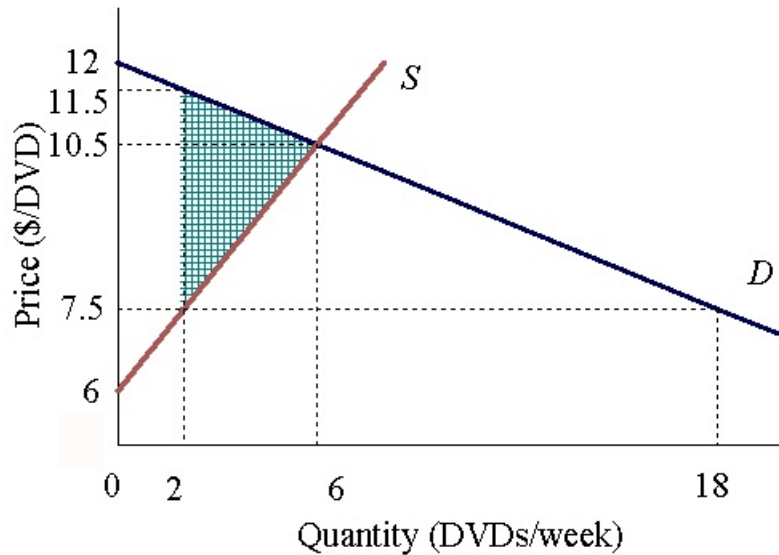
b. The weekly producer surplus.

*Answer:* Producer surplus is the triangular area between the supply curve and the price line. Producer surplus is  $0.5 (\$4.50/\text{unit}) (6 \text{ units/week}) = \$13.50/\text{week}$ .

c. The maximum weekly amount that producers and consumers in Lincoln (as a group) would be willing to pay to be able to buy and sell used DVDs in any given week.

*Answer:* The maximum weekly amount that consumers and producers together would be willing to pay to trade in used DVDs is the sum of gains from trading in used DVDs. The total economic surplus generated is  $\$4.50 + \$13.50 = \$18/\text{week}$ .

2. Refer to Problem 1. Suppose a coalition of students from Lincoln High School succeeds in persuading the local government to impose a price ceiling of \$7.50 on used DVDs, on the grounds that local suppliers are taking advantage of teenagers by charging exorbitant prices.



a. Calculate the weekly shortage of used DVDs that will result from this policy.

*Answer:* At a price of \$7.50, the quantity supplied per week is 2. The quantity demanded at this price is 18 per week, which implies a weekly shortage of  $18 - 2 = 16$  used DVDs.

b. Calculate and **graph** the total economic surplus lost every week as a result of the price ceiling.

*Answer:* The weekly economic surplus lost as a result of the price ceiling is the area between the demand and supply curves, and between the new quantity exchanged and the equilibrium quantity.  $0.5 (11.5 - 7.5) (6 - 2) = 0.5 (4) (4) = \$8/\text{wk}$ .

3. The Kubak crystal caves are renowned for their stalactites and stalagmites. The warden of the caves offers a tour each afternoon at 2pm sharp. The caves can be shown to only four people per day without disturbing their fragile ecology. Occasionally, however, more than four people want to see the caves on the same day. The following schedule lists the people who wanted to see the caves on September 24, 2003, together with their respective times of arrival and reservation prices for taking the tour that day.

	Arrival time	Reservation price (\$)
Hermann	1:48	20
Jon	1:50	14
Kate	1:53	30
Jack	1:56	15
Penny	1:57	40
Fran	1:59	12
Faith	2:00	17

a. If the tour is “free” and the warden operates on a first-come, first-served basis, what will the total consumer surplus be for the four people who get to go on the tour that day?

*Answer:* When there is no charge for the tour, consumer surplus is the sum of the reservation price for those taking the tour. The combined consumer surplus when the four who arrive first take the tour is  $\$20 + \$14 + \$30 + \$15 = \$79$ .

b. Suppose the warden solicits volunteers to postpone their tour by offering increasing amounts of cash compensation until only four people still wish to see the caves that day. If he gives each volunteer the same compensation payment, how much money will he have to offer to generate the required number of volunteers? What is the total economic surplus under this policy?

*Answer:* An offer of \$15 compensation generates 3 volunteers to return another day: Fran, Jack and Jon. The four who go on the tour receive a total consumer surplus of  $\$40 + \$30 + \$20 + \$17 = \$107$ . The warden pays \$45 in compensation payments to the three volunteers. Total economic surplus from the tour operation is now \$107, which is \$28 higher than before.

c. Why is the compensation policy more efficient than the first-come, first-served policy?

*Answer:* The compensation policy is more efficient than the first-come-first-served policy because it establishes a market for a scarce resource that would otherwise be allocated by non-market means. Only those people to whom the tour is worth more than \$15 will actually take it.

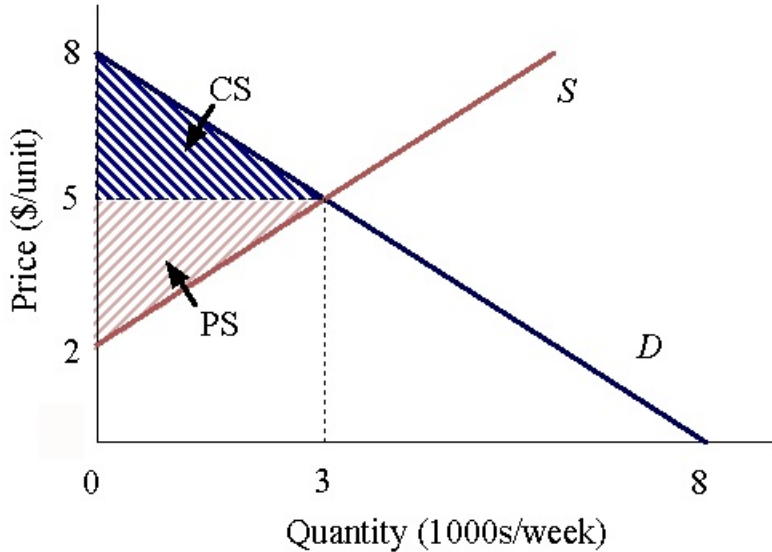
d. Describe a way of financing the warden’s compensation payments that will make everyone, including the warden, either better off or no worse off than under the first-come, first-served approach.

*Answer:* Suppose the Warden auctions off the right to take the tour by steadily increasing the tour price by \$1 increments until only 4 people are willing to pay. The auction will stop when the price reaches \$16, and Faith, Penny, Herman, and Kate will be the four remaining. The warden will collect \$64 from the auction. He can then give refunds to Herman and Kate, who would have gotten to go for free under the first-come-first-served scheme, so they will be just as well off as before. He can give \$16 to Jack, which is \$1 more than enough to compensate him for not getting to go. And he can give \$15 to Jon, which is also \$1 more than enough to compensate him. That leaves the warden with \$1, so he too is better off than before. Faith is \$1 better off than before, and Penny is \$24 better off than before. All others are exactly as well off as before.

4. Suppose the weekly demand for a certain good, in thousands of units, is given by the equation  $P = 8 - Q$ , and the weekly supply is given by the equation  $P = 2 + Q$ , where P is the price in dollars.

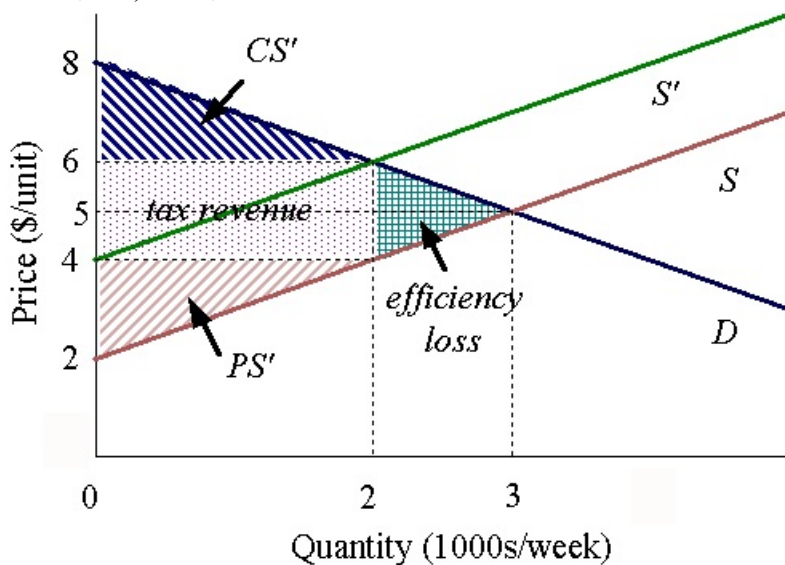
a. What is the equilibrium price and quantity? Calculate and **graph** consumer surplus, producer surplus, and the total weekly economic surplus generated at the market equilibrium.

*Answer:* The equilibrium price is \$5 and the equilibrium quantity is 3,000 units/week. Consumer surplus is the area between the demand curve and the price line:  $0.5 (8 - 5) 3,000 = \$4,500/\text{week}$ . Producer surplus is the area between the supply curve and the price line:  $0.5 (5 - 2) 3,000 = \$4,500/\text{week}$ . Therefore, the total economic surplus is \$9,000/week.



b. Suppose a per-unit tax of \$2, to be collected from sellers, is imposed on this market. Find the new price and quantity. How much government revenue will this tax generate each week? Calculate and **graph** the direct loss in economic surplus experienced by participants in this market as a result of the tax.

*Answer:* The tax shifts the supply curve up by \$2. The new equilibrium price is \$6 and quantity is 2,000/week. Consumer surplus is now  $0.5 (8 - 6) (2,000) = \$2,000/\text{week}$ . Net of the tax, sellers receive a price of \$4 per unit. Producer surplus is now  $0.5 (4 - 2) (2,000) = \$2,000/\text{week}$ . The tax revenue collected is  $(\$2/\text{unit})(2,000 \text{ units/wk}) = \$4,000/\text{week}$ . The efficiency loss is the area between the demand and supply curves between the new and the old quantities:  $0.5 (6 - 4) (3,000 - 2,000) = \$1,000/\text{week}$ .



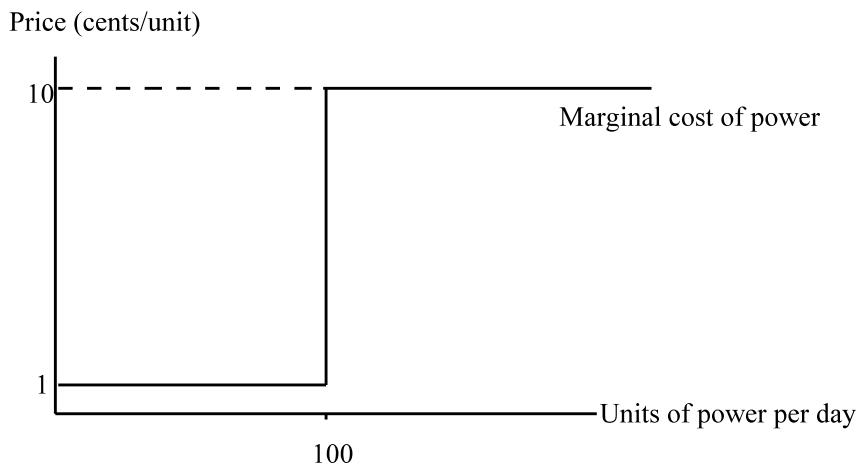
5. Is a company's producer surplus the same as its profit? (Hint: A company's total cost is equal to the sum of all marginal costs incurred in producing its output, plus any fixed costs.)

*Answer:* No, they differ by fixed costs. Profit is the difference between the company's total revenue and its total cost. Producer surplus is the difference between total revenue and the firm's reservation price for the quantity it sells. Its reservation price is the marginal costs of producing each unit. So producer surplus is the difference between total revenue and the sum of all marginal costs incurred. That is not the same as profit, which is total revenue minus the sum of not only all marginal costs incurred, but also fixed costs.

6. In Charlotte, North Carolina, citizens can get their electric power from two sources: a hydroelectric generator and a coal-fired steam generator. The hydroelectric generator can supply up to 100 units of power per day at a constant marginal cost of one cent per unit. The steam generator can supply any additional power that is needed at a constant marginal cost of 10 cents per unit. When electricity costs 10 cents per unit, residents of Charlotte demand 200 units per day.

a. Draw the marginal cost curve of electric power production in Charlotte.

*Answer:*



b. How much should the city charge for electric power? Explain. Should it charge the same price for a family whose power comes from the hydroelectric generator as it does for a family whose power comes from the steam generator?

*Answer:* The city should charge 10 cents per unit since that is the marginal cost when residents use at least 100 units/day, which they will if the city charges 10 cents or less. It should charge 10 cents per unit to all users, even those who are receiving their power from the hydroelectric facility, since if those users were to cut their consumption, they would free up hydroelectric capacity, which could then be used to serve others who are currently receiving their power from the more costly steam generator.