

Econ 30010  
**Intermediate Microeconomic Theory**  
**Answers for Chapter 11 Problems**

6. Since marginal cost is independent of quantity,  $Q$ , it is a constant which we denote by  $c$ . That is,  $MC(Q) = c$ . Note that  $c$  is the same for both the winter and the summer.

United Airlines' profit-maximizing quantity,  $Q^M$ , must imply  $MR(Q) = MC(Q)$ . In the winter,

$$MR(Q) = \frac{dTR(Q)}{dQ} = \frac{d((a_1 - bQ)Q)}{dQ} = a_1 - 2bQ. \text{ Therefore, profit maximization implies}$$

$$a_1 - 2bQ = c$$

or

$$Q^M = \frac{a_1 - c}{2b}$$

$$\text{and } P^M = P(Q^M) = \frac{a_1 + c}{2}.$$

Using the same method, in the summer profit maximization implies  $a_2 - 2bQ = c$  or

$$Q^M = \frac{a_2 - c}{2b} \text{ and } P^M = \frac{a_2 + c}{2}.$$

Because  $a_2 > a_1$ , the price in the summer will be higher than the price charged in the winter.

7. a. To calculate the firm's profit-maximizing price and quantity, we first need to derive the formulas for marginal revenue and marginal cost. Since

$$TR(Q) = P(Q)Q = (120 - 2Q)Q,$$

$$MR(Q) = 120 - 4Q.$$

The firm's short-run total cost function is

$$TC(Q) = 1400 + Q^2.$$

Therefore,

$$MC(Q) = \frac{dTC(Q)}{dQ} = 2Q.$$

To maximize profit, the monopolist must produce the quantity for which  $MR(Q) = MC(Q)$  or  $Q^M = 20$ . Using the inverse demand curve,  $P^M = P(Q^M) = 80$ . Using the profit equation, notice that  $\Pi(20) = -200$ .

b. Since economic profit is negative, the firm should not operate in the long-run. However, the firm should operate in the short-run when price is greater than average variable cost. At a quantity of 20,  $AVC(20) = 20$ . Since  $P^M = 80$ , the firm is covering all of its variable costs of production and some of its fixed costs. This means the firm should continue to operate in the short run. Note that sunk costs do not factor into the economic decision.

19. a.  $MR(Q_1+Q_2) = 968 - 40(Q_1+Q_2)$ .

To maximize profit the firm needs to solve the two equations that imply

$$MR(Q_1+Q_2) = MC_1(Q_1) = MC_2(Q_2).$$

$MC_1 = MC_2$  implies  $8 = 1 + .5Q_2$  or  $Q_2 = 14$ . Then  $MR = MC_1$  implies

$968 - 40(Q_1 + 14) = 8$  or  $40Q_1 = 400$  or  $Q_1 = 10$ . With total production of 24, the firm should charge  $P = 488$ .

b. If  $MC_1 = 10$ , then  $Q_2 = 18$ ,  $Q_1 = 5.95$ , and  $P = 489$ .

24. a. To calculate the firm's profit-maximizing quantity, we must find the quantity for which  $MR(Q) = MC(Q)$  or

$$100 - 4Q = \frac{Q}{2}.$$

Thus,  $Q^M = 22.2$ . Then using the inverse demand curve equation,  $P^M = 55.6$ .

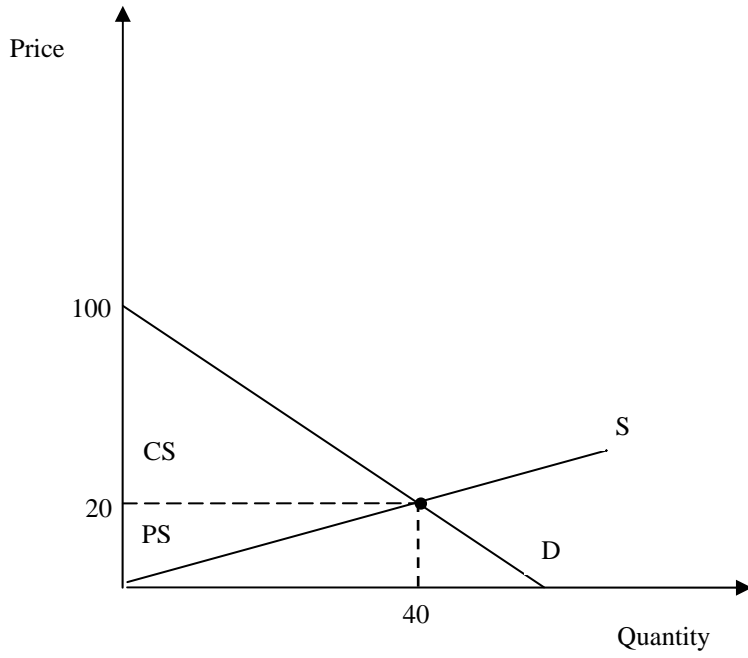
b. In a perfectly competitive environment, remember that marginal revenue is equal to price so in a competitive market,  $P = Q/2$ . Thus, the market supply curve equation is  $Q = 2P$ . Equating the quantity supplied with the quantity demanded implies  $2P = 50 - P/2$ . Thus, the competitive equilibrium price,  $P^*$ , is 20 and the equilibrium quantity,  $Q^*$ , is 40.

c. In a competitive market, the quantity supplied equals the quantity demanded. The following graph shows the consumer surplus, CS, and the producer surplus, PS. Recall that the area for a triangle is  $.5(\text{base} \times \text{height})$ . Thus, marginal cost pricing implies

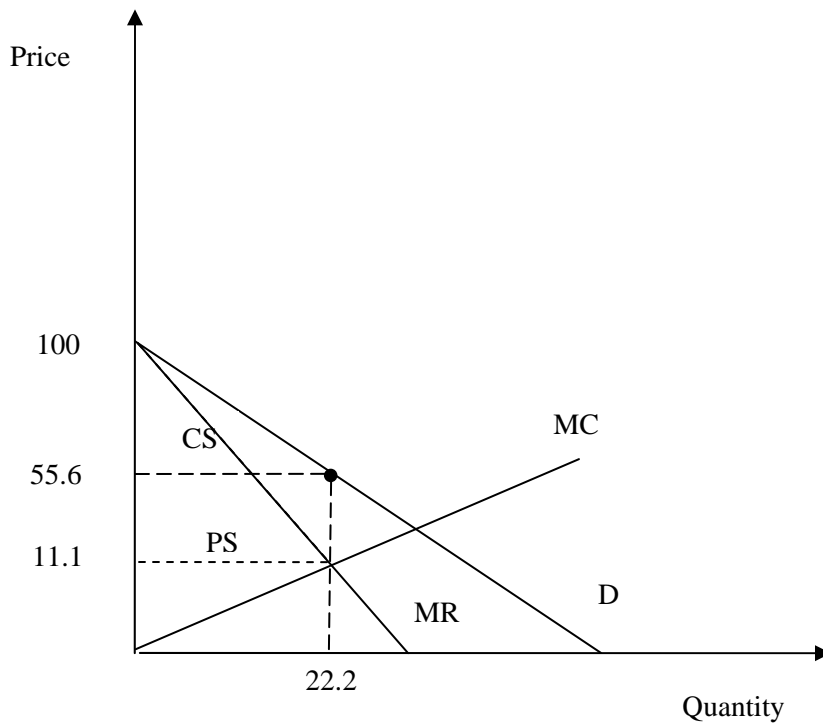
$$CS = .5(100 - 20)40 = 1600,$$

$$PS = .5(20)40 = 400,$$

and total surplus equal to 2000.



With monopoly pricing, consumer and producer surplus is described in the following graph.



Thus, monopoly pricing implies

$$CS = .5(100 - 55.6)22.2 = 493.83,$$

$$PS = .5 * 11.1 * 22.2 + (55.6 - 11.1)22.2 = 1111.11,$$

and total surplus of 1605. The deadweight loss due to monopoly pricing is the difference in total surplus values or  $2000 - 1605 = 395$  or 19.7%.

d. Under the new demand, the competitive equilibrium price and quantity are unchanged,  $CS$  increases to 3200,  $PS$  remains equal to 400, and total surplus increases to 3600. The monopolist's profit-maximizing price and output now equal  $P^M = 95.29$  and  $Q^M = 21.18$ . Therefore,  $CS = (180 - 95.29)(21.18)/2 = 897$ ,  $PS = (95.29 - 10.59)(21.18) + (10.59)(21.18)/2 = 1906$ , and total surplus = 2803. The deadweight loss under the new market demand is  $3600 - 2803 = 797$  or 22.1%

The difference in the deadweight loss occurs because the second demand curve is less elastic. With the original demand, the price elasticity of demand at the competitive equilibrium is -1.25 and with the new demand it is -1.12. With less elastic demand, both the monopolist's mark-up over marginal cost and the reduction in output from the competitive level are larger. Both changes increase the deadweight loss associated with monopoly pricing.