Chapter 12
Pricing and Advertising

■ Chapter Outline

■ Teaching Tips

Chapter 12 continues the presentation of monopoly models but switches emphasis to price-setting behavior. The material on price discrimination is worth covering in detail for several reasons. First, students generally find the topic quite interesting, as they are aware of some types of price discrimination but haven't thought about them much (e.g., movie ticket prices), and are completely unaware of other types (such as dry cleaning prices). Also, price discrimination is an effective way to emphasize the importance of market power—for example, by comparing a monopolist charging a single price to the same firm practicing a perfect price discrimination. Finally, it is a good topic for generating class discussion. If you challenge the class to come up with illustrations of price discrimination, they sometimes will raise new and interesting examples. When discussing the conditions necessary to price discriminate, you might emphasize the ability to prevent resales. Finally, be sure that the class understands that price differences that result from cost differences are not price discrimination.

Section 12.5 on two-part tariffs and Section 12.6 on tie-in and bundled sales are topics where the class should be able to take the lead in providing examples. Although they are often simply another tool for firms to extract consumer surplus, two-part tariffs and tie-ins do not seem to provoke the same reaction as price discrimination. This may be the case due to the pro-efficiency effects of many bundled products (such as tires and cars). On the other hand, the Internet browser offered by Microsoft as part of the Windows package evoked strong debate over what constitutes a separate but bundled commodity, and what should be considered an integral part of the original commodity. As an exercise, you might ask the class to draw up a set of guidelines that regulators should follow when deciding if a product bundle increases efficiency, or is a source of monopoly rents.

The last section covers advertising. You might want to discuss that in the case of advertising what matters is if consumers *believe* that there is a meaningful difference between products, rather than whether the products are meaningfully different or not. For example, beer makers spend enormous sums of money on advertising in an attempt to convince consumers that their product has a unique taste. The uniqueness is largely a perceived one, however, as most consumers cannot identify "their" brand in taste tests. If you have time, a fun classroom experiment is to demonstrate this result using soda. You will need to poll the class to see if they prefer diet or regular soda as a group. Then buy three or four types of cola and have students try to identify their brand (which they pre-identify by writing it on a 3×5 card) using unmarked cups. Students have great confidence in their abilities to identify brands but are not usually very successful.

■ Additional Applications

Gasoline[1]

Because only firms with market power can price discriminate, price discrimination is not observed in competitive markets. It may be possible, however, to price discriminate in monopolistically competitive markets. If retail gasoline stations are monopolistically competitive rather than purely competitive, they may be able to price discriminate. Borenstein (1991) finds that they do discriminate. The difference between the price and marginal cost is greater for unleaded than leaded gasoline.

[1]Severin Borenstein, "Selling Costs and Switching Costs: Explaining the Retail Gasoline Margins," *Rand Journal of Economics* 22(3), Autumn, 1991: 354–369.

The residual demand elasticity that a station faces depends on the market elasticity of demand for gasoline and the willingness of consumers to switch stations. If a gas station raises its prices, some customers may buy less gasoline while others may switch to another dealer. Those customers who cut their purchases are treating the gas station like a monopoly. The customers who switch dealers view the various dealers as substitutes for each other. Gas stations have markups that range from 5% to 10% above marginal cost, which implies that they face elasticities of –10 to –20. These elasticities are much greater than the price elasticity of demand for gasoline, which is less than –2. Thus the residual elasticity facing a station appears to be primarily determined by the willingness of customers to switch dealers.

Buyers of leaded gasoline are likely to differ from purchasers of unleaded. In the earlier 1980s, many cars still burned leaded gasoline. At that time, consumers who purchased unleaded were wealthier and more likely to use credit cards for their purchase, which made them less willing to switch stations. Since 1986, however, many stations have stopped carrying leaded gasoline, increasing the average distance between sellers. As a result, it became more costly for a purchaser of leaded gas (but not unleaded) to switch dealers, and the dealers' market power over buyers of leaded gas increased relative to their power over buyers of unleaded. These factors explain why the markup of price over marginal cost for regular unleaded increased relative to leaded until 1986 and then decreased thereafter.

1. Do you think that the "pay at the pump" technology employed by some companies is an effort to save on labor costs or decrease demand elasticity?

2. What would you predict about the elasticity of demand for diesel fuel for automobiles? Why?

Ethnic Pricing on Airlines[2]

"Ethnic pricing" is a form of price discrimination that has long been practiced both in developing countries and Europe. Under ethnic pricing, individuals of some nationalities are able to purchase airline tickets at a substantially lower cost than others. Remarkably, this includes individuals who are married to one another. Brendan McInerney and his Japanese wife wanted to fly from Frankfurt, Germany to Osaka, Japan, for Christmas in 1997. Although they were both able to buy tickets in the same level of seating on the same Lufthansa flight, Mr. McInerney was initially charged 2700 marks, compared to the 1700 marks charged to his wife. The sole reason for the price difference was their ethnicity. She is Japanese; he is not. Although illegal in Germany, the practice appears to be fairly commonplace there. Airline industry experts note that the agencies that receive the complaints have no police power to stop them. McInerney eventually received the same fare as his wife after complaining. "In America, this is called racial discrimination," he protested.

The policy was apparently designed to allow guest workers (a generic term for an individual not working in his or her home country) the opportunity to visit relatives back home. The fares were only available on request through specified travel agencies that had made special deals with the air carriers. Some examples appear next.

Airline	Route	Normal Price	"Ethnic Price"
Lufthansa	Frankfurt–Tokyo	$1524	$960
Lufthansa	Frankfurt–Seoul	$1524	$903
British Airways	Istanbul–London	$ 385	$199

[2]Brandon Mitchener, "'Ethnic Pricing' Means Unfair Air Fares," *Wall Street Journal,* December 5, 1997: B1, B14.

Lufthansa officials did not deny that such pricing occurs, but claimed that they resorted to it only to match the prices of other airlines that were doing the same thing. The British Airways special was called the "Ho Ho Ho Special" for British citizens in Turkey. With a British passport, the airfare was reduced 48%. U.S. air carriers also practiced ethnic pricing unitl 1988, when official U.S. Department of Transportation policy finally banned it.

1. Should it still be considered price discrimination if the tickets based on ethnicity are cheaper and not more expensive?

2. How is this practice different from senior citizen discounts in the United States?

■ Discussion Questions

1. Give some examples of markets where products differ physically, but consumers treat the products as nearly perfect substitutes.

2. Give some examples of where products do not differ physically, but consumers treat the products as imperfect substitutes.

3. Why might an individual be strongly opposed to racial or gender-based discrimination, but not opposed to the type of price discrimination discussed in this chapter?

4. Should the government permit price discrimination? Under what circumstances?

5. U.S. firms may discriminate against consumers, but not other firms. Can you think of a justification for treating these two types of buyers differently?

6. Many economists argue that laws prohibiting price discrimination were designed to protect small businesses from paying higher prices than large businesses. Why might the government want to protect this group? Should this law be changed?

7. Should the U.S. government enforce export restrictions on software by anyone other than the manufacturer? (Such restrictions would allow U.S. firms to charge higher prices than in the domestic market by preventing resales.)

8. Does the sale of personal seat licenses ("psls"), wherein fans pay large up-front fees for the right to purchase season tickets, constitute price discrimination?

■ Additional Questions and Problems

1. "All you can eat" buffets are an example of which pricing strategy discussed in this chapter? What about hotels that have a "kids eat free in the hotel restaurant" policy?

2. A monopolist sells in two states and practices price discrimination by charging separate prices in each state. The monopolist produces at constant marginal cost $MC = 10$. Demand in market 1 is $Q_1 = 50 - p_1$. Market 2 demand is $Q_2 = 90 - 1.5p_2$. What price will be charged in each market? Suppose a third party enters the market, not as a producer but as a reseller, capable of reselling by transporting the goods from market to market at a cost of $4 per unit. How does this affect the monopolist?

3. Suppose a monopolist's costs are described by the function $C = 200 + 2Q^2$, and it faces a demand curve of $Q = 240 - p$. If it cannot price discriminate, what are the profit-maximizing price and quantity? What are the profits? If the monopolist uses block pricing by setting an intermediate price but cannot charge more than two different prices in total, what would be the best prices to choose? How does the use of an intermediate price change profits and consumer surplus compared to the single price result?

4. Suppose that instead of block pricing in the question above, the firm is able to practice perfect price discrimination. What are the values of output, profit, and consumer surplus?

5. True or false; explain your answer. If all consumers have identical tastes and preferences, perfect price discrimination is impossible.

6. Tuan lives in a town with only one movie rental store. Suppose Tuan's demand for movie rentals per month is $Q = 16 - 2P$. The movie store currently charges \$5 per movie, but is thinking of adding a flat monthly cardholder fee and dropping the price to \$2 per rental. At this new price, what is the largest cardholder fee that Tuan will pay? If the rental store has a constant marginal cost of \$2, which strategy is more profitable?

7. In most cases, when a consumer purchases season tickets for a professional sports team, the consumer must purchase pre-season games as well at the same price as regular season games. What type of pricing strategy does this represent?

8. Why do firms place ads with coupons in the paper, instead of simply offering a sale price in the same ad?

9. A firm believes the elasticity of demand it faces in its own country is −1.1 and in the other country is −1.5. Suppose the firm can charge \$1 for its products in its own country and can prevent resales between these two countries. What price will it charge in the other country?

10. Perfect price discrimination generates higher total welfare than imperfect price discrimination. Explain why?

■ Answers to Additional Questions and Problems

1. "All you can eat" buffets are examples of product bundling. Consumers cannot purchase the items individually, nor can they choose to not purchase certain items in the line. Most consumers end up paying for menu selections that they do not select. "Kids eat free" plans are an example of a product tie-in because the children cannot eat free unless they are accompanied by a paying adult. The only way to get the low (free) price for children is to purchase a more expensive adult meal.

2. To get the profit-maximizing output and price levels, set marginal cost equal to marginal revenue in each market and solve.

$$MR_1 = 50 - 2Q_1 = 10 = MC$$
$$Q_1^* = 20$$
$$p_1^* = 30$$
$$MR_2 = 60 - 1.33Q_2 = 10 = MC$$
$$Q_2^* = 37.5$$
$$p_2^* = 35$$

Because the reseller can transport goods from Market 1 to Market 2 for \$4 per unit, the reseller could underprice the monopolist in Market 2 by \$1. This forces the monopolist to reduce the market price to \$34 per unit. Output increases to 39 units, and revenue increases to \$1326 from \$1312.50, but because of the additional output, costs increase by \$15, and profits fall by \$1.50.

3. The standard monopoly solution is $Q^* = 40$, $p^* = \$200$, which generates profits of \$8000. If an intermediate price can be chosen, the maximum consumer surplus can be captured by choosing a price halfway between the maximum price of \$240 and the monopoly price of \$200. The monopolist sells 20 units for \$220 and 20 units for \$200. Profits are increased by \$400.

4. With perfect price discrimination, the monopolist sets $MC = p$ to determine the best output level. Costs are \$4808. Revenue is the entire area under the demand curve from $Q = 0$ to 48, or \$10,368 (area *abcd* in Figure 12.1). Profits are \$5560, and consumer surplus is zero.

$$4Q = 240 - Q$$
$$Q^* = 48$$
$$R = 192 \times 48 + \frac{1}{2}(240 - 192) \times 48$$
$$= 10368$$
$$C = 200 + 2 \times (48)^2 = 4808$$
$$\pi = R - C = 10368 - 4808 = 5560$$

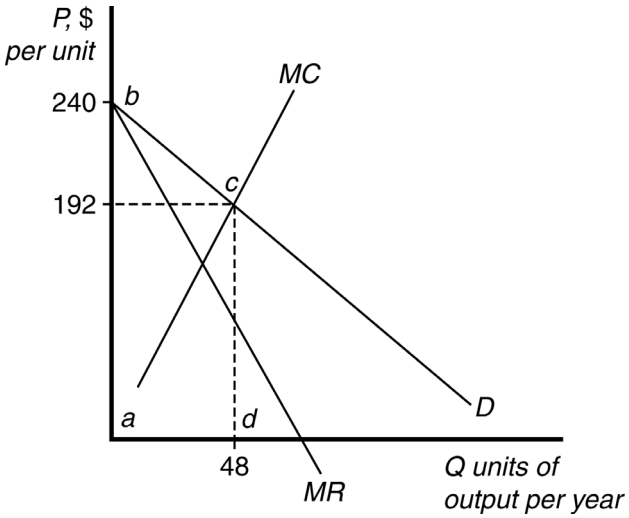

Figure 12.1

5. False. Even though all consumers have identical tastes and preferences, each consumer still possesses a downward sloping individual demand curve, which makes the market demand curve slope downward as well. The monopolist is unable to discriminate based on differences across individuals, but could still discriminate based on willingness to pay for additional units.

6. At the original price of \$5 per rental, Tuan rents 6 videos per month. His total expenditure per month is \$30. Firm cost for these rentals is \$12, leaving profits of \$18 per month. Under the new pricing strategy, Tuan will continue to purchase as long as the flat fee is less than or equal to his consumer surplus. Figure 12.2 shows that at a price of \$2, consumer surplus is equal to $(1/2)(6 \times 12) = \$36$. Thus the firm can charge a monthly fee or \$36 plus a \$2 fee per movie, and earn profits of \$36, or twice the profits of the \$5 price with no fee.

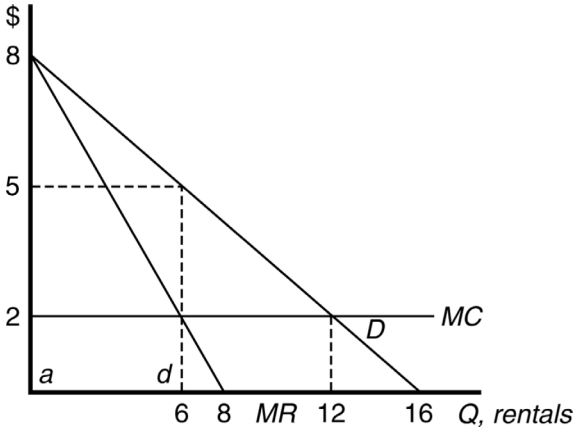

Figure 12.2

7. This is an example of product bundling. Consumers are forced to accept and pay for games that the teams would otherwise have a difficult time marketing, because most elite players do not play in all pre-season games, which reduces demand.

8. By using coupons, firms restrict discounts to those consumers willing to take the time required to clip the coupons and bring them to the store. Those consumers with more inelastic demand or less information (i.e., they did not know about the coupon) will not clip the coupon and will pay the higher price. This strategy allows the firm to segment the market and extract more consumer surplus from less-informed and less price-sensitive consumers.

9. Using Formula (12.3), the price charged in the other country will be $(1 - 1/1.1)/(1 - 1/1.5) = 0.27$.

10. Perfect price discrimination is a welfare improvement to imperfect price discrimination because there is no deadweight loss under perfect price discrimination: The producer gets all the surplus.

■ Answers to Questions and Problems in the Text

1. In order to price discriminate, Alexx must have market power—the ability to set prices. Consumers must have varying price sensitivities, and Alexx must be able to identify individual consumers or groups of individuals based on willingness to pay. Alexx must also be able to prevent reselling after the initial sale.
2. This policy allows the firm to maximize its profit by price discriminating if people who put a lower value on their time (so are willing to drive to the store and move their purchases themselves) have a higher elasticity of demand than people who want to order over the phone and have the goods delivered.

3. The colleges may be providing scholarships as a form of charity, or they may be price discriminating by lowering the final price for less wealthy families (who presumably have higher elasticities of demand).

4. The pharmaceutical firms offer the discount to low-income seniors because the seniors would probably not purchase the medicines if they were not discounted. By segregating this portion of the market, they are able to price discriminate profitably because the marginal cost of producing the extra medications is very low. Thus if they can still charge higher prices to the rest of the market, they will profit from the discounted prescriptions as well. (In addition to the short-run profits, the pharmaceutical firms get good publicity, which could forestall more costly regulation in the future.)

5. Since adults cannot use children's tickets to enter Disneyland, there won't be a resale problem. On the other hand, for nonlocal visitors, a small difference in ticket price does not mean much compared to their travel cost. In other words, their willingness to pay the price is higher than locals.

6. When there is a big price different across the border and shipping the car from Canada to the United States is relatively cheap, consumers in Canada are able to make a profit by reselling their cars in the United States. To prevent this kind of resale that would decrease Ford's profit from price discrimination, Ford required Canadian dealers to sign an agreement that prohibited moving vehicles to the United States. Since the prevention might not be effective, in the following year Ford cut the supply in Canada to only 2000 cars to practically eliminate the resale problem.

7. Google is essentially practicing price discrimination perfectly by taking advantage of advertisers' desire to reach small, difficult-to-find segments of the population and varying the price of ads according to advertisers' willingness to pay. The amount that firms will pay for advertisements depends on the difficulty of making a match. Firms will pay more to advertise when there are fewer self-identified potential customers—fewer people searching for a phrase. That is, firms bid more when there are fewer customers and the need to target the advertisement is greater. Therefore, a firm that provides local services should be willing to pay more for an ad in a small town because there are fewer self-identified potential customers.

8. If the difference in the cost of a car renting service is equal to the difference in the rental price between the two cities, then there is no price discrimination. Otherwise, there may be price discrimination, especially as resales of the service is practically impossible.

9. Lower profit margin indicates the PC market is becoming more competitive. In other words, the market power of PC producers is decreasing, therefore lowering their ability to price discriminate.

10. a. This is third-degree price discrimination. Suppose 1000 tickets were available; then price is determined by the bidder with the 1000th highest willingness to pay. All bidders with higher willingness to pay get the same price.
    b. This is first-degree price discrimination, as each bidder is charged at a price equal to his or her willingness to pay.

11. The difference in profit between a single price monopoly and perfect price discrimination is the area A and C in the application, which is $375 million.

12. This is a called a two-part tariff. The union can set the price at the level w^* where demand and supply curves cross and request a lump-sum contribution whose total is equal to the area below the demand curve and above the price level w^*. If the workers are not identical, say, if their ages are different, then the value of that uniform lump sum contribution may be different for different workers.

13. See Figure 12.3. The monopolist produces where price equals marginal cost. Total revenue is the area under the demand curve from the origin to Q^*, or $OafQ^*$. Total cost is $0dbQ^*$. Profits are $adg - gbf$.

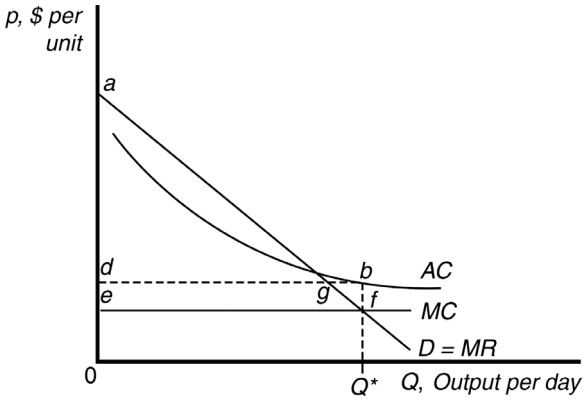

Figure 12.3

14. Yes. Even if a consumer purchased 40 units per day, the average price would just equal the monopoly price, but the consumer surplus would fall from \$450 to \$400. In addition, the consumer in panel (b) pays \$60 for 30 units, but the consumer in panel (a) must purchase 40 units to achieve the same average price. If they only bought 30 units, their average price would be \$63.33.

15. See Figure 12.4. Output expands, as do profit and consumer surplus. When the markets are combined, the monopolist sells Q_2^* for \$5, all to customers in Market 2. When the markets can be separated, price and quantity remain unchanged in Market 2, but the monopolist also sells Q_1^* for p_1.

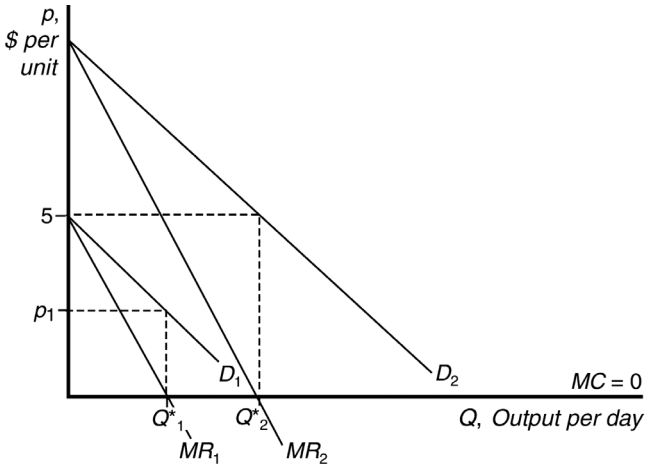

Figure 12.4

16. Before the item is discounted, the department store attempts to sell the item to customers with relatively high reservation prices. If after a while the item is not sold out, the department store may try to sell the item to customers with lower reservation prices by putting the item on sale.

17. Yes. The monopoly's ability to price discriminate depends on the marginal cost. Suppose there are two groups of potential consumers. If the marginal cost is so high that one group will not buy the good at a price acceptable to the monopoly, then the monopoly is not able to price discriminate in this case.

18. No. If no consumers want the second product, profits are reduced by bundling it with the first product. The reason is that because there is no demand for the second product, consumer demand for the bundled products will be equal to the demand for the first (desired) product alone. If there is no secondary market for the undesired product and the consumer must pay to dispose of it, then profits will be reduced rather than increased, as consumer demand falls to reflect the disposal cost.

19. If $m = 7$, the marginal revenue curve crosses the marginal cost curve above the kink point. The monopoly will charge the monopoly price as if there is only one country, the country with higher demand. If $m = 4$, the marginal cost curve crosses the marginal revenue curve three times, including the vertical portion of the marginal revenue cost. At the first cross point to the left of the kink point, we have $9 - 2Q = 4$. Hence $Q = 2.5$ and $p = 6.5$, the profit is $2.5 \times (6.5 - 4) = 5.25$. For the cross point on the vertical section, $Q = 3$ and $p = 6$, the profit is $3^{*}(6 - 4) = 6$. For the cross point to the right of the kink point, $4 = 7 - (2/3)Q$. Hence $Q = 4.5$ and $p = 5.5$. The profit is $4.5 \times (5.5 - 4) = 6.75$. Hence the monopoly will set the price at 5.5.

20. Abbott raised the price of Norvir such that it can make more profit from it if the demand elasticity is low. At the same time, not raising the price of Kaletra will give its own product a price advantage on the market.

21. Audio-PowerPoint answer by James Dearden is also available (12A GM Pricing).
    a. Multi market price discrimination.
    b. In the market the demand is relatively more elastic; the price will be relatively lower.
    c. Auto in future is a substitute of auto today. So as if there is an expectation that the future price of auto is going to rise, the demand for auto today increases. The national discounting plan that is targeted to reduce slumping sales is NOT a form of price discrimination. That is a response to current lower demand.

22. Audio-PowerPoint answer by James Dearden is also available (12B Mets Pricing).
    a. The demand for more popular games is relatively less elastic, therefore a higher price can be charged. That is price discrimination based on different characteristics of demand in two markets.
    b. A lower price for cheap seats for unpopular games decreases the demand for tickets for Yankee games. Assume for simplicity that the total cost is zero. Then the goal is to maximize total revenue $TR_Y + TR_M = P_Y Q_Y + P_M Q_M$. Taking derivative with respect to P_M and putting it equal to zero, we get:

$$\frac{\partial (TR_Y + TR_M)}{\partial P_M} = P_Y \frac{\partial Q_Y}{\partial P_M} + Q_M + P_M \frac{\partial Q_M}{\partial P_M} = 0 \rightarrow P_Y \frac{\partial Q_Y}{\partial P_M} = -\left(Q_M + P_M \frac{\partial Q_M}{\partial P_M} \right).$$

    Note that

$$\frac{\partial Q_Y}{\partial P_M} > 0 \quad \text{and} \quad \frac{\partial Q_M}{\partial P_M} < 0.$$

    Therefore it sets P_M such that the above equality holds.

23. Audio-PowerPoint answer by James Dearden is also available (12C Grocery Store Pricing).
    a. The supermarket cannot approach perfect price discrimination. Therefore it is multi market price discrimination.
    b. The price markup ($P - MC$) is inversely related to elasticity. The demand, which is less elastic, can be charged a higher price.

24. Audio-PowerPoint answer by James Dearden is also available (12D Publisher Pricing).
    a. The university will only buy Journals A and B.
    b. The net gain for the university if it buys the journals individually is (2000 − 1600) + (1100 − 800) = 400 + 300 = 700. The net gain of buying a bundle cannot be less than $700, therefore the maximum it is willing to pay is (2000 + 1100 + 1400) − 700 = $3800.
    c. The individual prices that maximize revenue for the publisher are $1800 for Journal A, $1100 for Journal B, and $1400 for Journal C. In this case the total revenue will be $7500. The maximum revenue for mixed bundles is to sell Bundles A, B, and C for $4300 to University 1 and the same bundle for $4000 to University 2. In this case its revenue will be $8300.

25. a. The marginal cost is zero, so the *MC* curve is the *X* axis. The amount of tickets sold will be T^*, where the *MR* curve intersects *X* axis.
    b. The concerts' failure may indicate monopoly price, but not that the monopoly set too high a price.
    c. If the monopoly can perfectly price discriminate, it can obtain all the producer surplus below the demand curve.

26. No, it is not reasonable to conclude that U.S. drivers subsidize European gasoline prices. If oil companies have market power in the United States and Europe and can price discriminate, they will treat each market as a separate market setting prices and quantities at profit-maximizing levels independent of the other market.

27. The larger a magazine's or newspaper's circulation, the more advertisers will pay per advertisement. Therefore, many magazines and newspapers will drop their subscription price to boost circulation and in turn increase advertising revenue.

    Monopolies maximize profit by producing such that marginal revenue equals marginal cost and then charging the price indicated by the demand curve. Advertising revenue is much like a specific (per-unit) subsidy or negative tax. Advertising revenue shifts the demand curve for subscriptions up, as a subsidy would. This shifts the marginal revenue curve up as well. Since the marginal revenue curve with the advertising subsidy is above the marginal revenue curve without advertising, the profit-maximizing quantity is higher and the corresponding price indicated by the original demand curve is lower. Thus advertising increases output and decreases subscription prices. As advertising dollars shrink, the demand curve (and the marginal revenue curve) with advertising will shift down toward the demand curve with no advertising, and the profit-maximizing quantity will decrease and the corresponding price will increase.

28. Equating the right-hand sides of the demand and supply functions, $100 - w = w - 20$, and solving, we find that $w = 60$. Substituting that into either the demand or supply function, we find that $H^* = 100 - 60 = 60 - 20 = 40$. To find w^*, we need to equate areas *A* and *C* in the figure in Solved Problem 12.1. We could integrate, but with a linear demand function it is easier to calculate the area of triangles. The area of *A* is $\frac{1}{2}(100 - w^*)^2$, while the area of *B* is $\frac{1}{2}(w^* - 60)^2$. Equating these areas and solving, we find that $w^* = 80$. Substituting that into the demand function, we obtain $\overline{H} = 20$.

29. Setting marginal revenue equal to marginal cost yields $Q^* = 30$, $p^* = 60$. Profit is $900, consumer surplus is $450, welfare is $1350 (*PS* + *CS*), and deadweight loss is $450.

30. The profit function of the monopoly described in Figure 12.3 is

$$\pi = p_1 Q_1 + p_2 (Q_2 - Q_1) + p_3 (Q_3 - Q_2) - mQ_3.$$

The monopoly faces a demand curve $p = 90 - Q$. Then, $Q = 90 - p$ and we can write

$$Q_1 = 90 - p_1$$
$$Q_2 = 90 - p_2$$
$$Q_3 = 90 - p_3.$$

Using these expressions, the profit function can be rewritten as

$$\begin{aligned}\pi &= p_1(90 - p_1) + p_2(90 - p_2 - 90 + p_1) + p_3(90 - p_3 - 90 + p_2) - m(90 - p_3)\\ &= p_1(90 - p_1) + p_2(p_1 - p_2) + p_3(p_2 - p_3) - m(90 - p_3)\\ &= 90p_1 - p_1^2 + p_1p_2 - p_2^2 + p_2p_3 - p_3^2 - 90m + mp_3.\end{aligned}$$

FOC:

$$\frac{\partial \pi}{\partial p_1} = 90 - 2p_1 + p_2 = 0$$
$$\frac{\partial \pi}{\partial p_2} = p_1 - 2p_2 + p_3 = 0$$
$$\frac{\partial \pi}{\partial p_3} = p_2 - 2p_3 + m = 0$$

Here $m = 30$. Solving simultaneously, we find that profit-maximizing prices are $p_1 = 75$, $p_2 = 60$, and $p_3 = 45$.

31. a. The monopoly can set the price to be 60 and the minimum amount to be 60 to achieve the same outcome as in the perfect price discrimination case.
    b. For an initial price of 90, the total demand will be zero.

32. See MyEconLab Chapter 12, "Aibo," for more details. The two marginal revenue curves are $MR_J = 3{,}500 - Q_J$ and $MR_A = 4{,}500 - 2Q_A$. Equating the marginal revenues with the marginal cost of \$500, we find that $Q_J = 3{,}000$ and $Q_A = 2{,}000$. Substituting these quantities into the inverse demand curves, we learn that $p_J = \$2{,}000$ and $p_A = \$2{,}500$. Rearranging Equation 11.9, we know that the elasticities of demand are $\varepsilon_J = p/(MC - p) = 2{,}000/(500 - 2{,}000) = -\frac{4}{3}$ and $\varepsilon_A = 2{,}500/(500 - 2{,}500) = -\frac{5}{4}$. Thus using Equation 12.3, we find that

$$\frac{p_J}{p_A} = \frac{2{,}000}{2{,}500} = 0.8 = \frac{1 + 1/(-\frac{5}{4})}{1 + 1/(-\frac{4}{3})} = \frac{1 + 1/\varepsilon_A}{1 + 1/\varepsilon_J}.$$

The profit in Japan is $(p_J - m)Q_J = (\$2{,}000 - \$500) \times 3{,}000 = \$4.5$ million, and the U.S. profit is \$4 million. The deadweight loss is greater in Japan, \$2.25 million ($= \frac{1}{2} \times \$1{,}500 \times 3{,}000$), than in the United States, \$2 million ($= \frac{1}{2} \times \$2{,}000 \times 2{,}000$).

33. By differentiating, we find that the American marginal revenue function is $MR_A = 100 - 2Q_A$, and the Japanese one is $MR_J = 80 - 4Q_J$. To determine how many units to sell in the United States, the monopoly sets its American marginal revenue equal to its marginal cost, $MR_A = 100 - 2Q_A = 20$, and solves for the optimal quantity, $Q_A = 40$ units. Similarly, because $MR_J = 80 - 4Q_J = 20$, the optimal quantity is $Q_J = 15$ units in Japan. Substituting $Q_A = 40$ into the American demand function, we find that $p_A = 100 - 40 = \$60$. Similarly, substituting $Q_J = 15$ units into the Japanese demand function, we learn that $p_J = 80 - (2 \times 15) = \$50$. Thus the price-discriminating monopoly charges 20% more in the United States than in Japan. We can also show this result using elasticities. From Equation 2.22, we know that the elasticity of demand is $\varepsilon_A = -p_A/Q_A$ in the United States and $\varepsilon_J = -1/2p_J/Q_J$ in Japan. In the equilibrium, $\varepsilon_A = -60/40 = -3/2$ and $\varepsilon_J = -50/(2 \times 15) = -5/3$. As Equation 12.3 shows, the ratio of the prices depends on the relative elasticities of demand: $p_A/p_J = 60/50 = (1 + 1/\varepsilon_J)/(1 + 1/\varepsilon_A) = (1 - 3/5)/(1 - 2/3) = 6/5$.

34. With multimarket price discrimination, a monopoly will equate the marginal revenue for each group to its common marginal cost, $MC = m$, such that the marginal revenues for the two countries are equal:

$$MR^C = m = MR^J.$$

In this example, with multimarket price discrimination, a monopoly will set price in Canada such that

$$\varepsilon_C = p_C/(m - p_C),$$

where ε_C is the price elasticity of demand in Canada, p_C is the price in Canada, and m is the marginal cost of production. Substituting \$21.40 for p_C and \$1.00 for m,

$$\varepsilon_C = 21.40/(1.00\text{-}21.40)$$
$$\varepsilon_C = -1.049.$$

Similarly, with multimarket price discrimination, a monopoly will set price in Japan such that

$$\varepsilon_J = p_J/(m - p_J),$$

where ε_J is the price elasticity of demand in Japan, p_J is the price in Japan, and m is the marginal cost of production. Substituting \$32.00 for p_J and \$1.00 for m,

$$\varepsilon_J = 32/(1.00 - 32)$$
$$\varepsilon_J = -1.032.$$

35. From the problem, we know that the profit-maximizing Chinese price is $p = 3$ and that the quantity is $Q = 0.1$ (million). The marginal cost is $m = 1$. Using Equation 11.11, $(p_C - m)/p_C = (3 - 1)/3 = -1/\varepsilon_C$, so $\varepsilon_C = -3/2$. If the Chinese inverse demand curve is $p = a - bQ$, then the corresponding marginal revenue curve is $MR = a - 2bQ$. Warner maximizes its profit where $MR = a - 2bQ = m = 1$, so its optimal $Q = (a - 1)/(2b)$. Substituting this expression into the inverse demand curve, we find that
its optimal $p = (a + 1)/2 = 3$, or $a = 5$. Substituting that result into the output equation, we have $Q = (5 - 1)/(2b) = 0.1$ (million). Thus $b = 20$, the inverse demand function is $p = 5 - 20Q$, and the marginal revenue function is $MR = 5 - 40Q$. Using this information, you can draw a figure similar to Figure 12.4.

36. Using Eq. 12.2,

$$p_{US}(1 - 1/2) = 10 = p_J(1 - 1/5)$$
$$p_{US} = \$20, \qquad p_J = \$12.50.$$

37. Set marginal revenue in each market equal to marginal cost to determine the quantities. Plug the quantities into the demand functions to determine prices.

$$MR_1 = 100 - 2Q_1 = 30 = MC$$

$$MR_2 = 120 - 4Q_2 = 30 = MC$$

$$Q_1 = 35;\ p_1 = 65$$

$$Q_2 = 22.5;\ p_2 = 75$$

38. Marginal revenue depends on price and elasticity of demand:

$$MR^1 = p_1\left(1 + \frac{1}{\varepsilon_1}\right)$$

$$MR^2 = p_2\left(1 + \frac{1}{\varepsilon_2}\right)$$

From Solved Problem 12.3 we know that $p_1 = p_2 = 60$. Since multimarket price discrimination leads to prices that equate marginal revenues, that is, $MR^1 = MR^2$, we may write

$$p_1\left(1 + \frac{1}{\varepsilon_1}\right) = p_2\left(1 + \frac{1}{\varepsilon_2}\right)$$

$$\Rightarrow 60\left(1 + \frac{1}{\varepsilon_1}\right) = 60\left(1 + \frac{1}{\varepsilon_2}\right) \Rightarrow \varepsilon_1 = \varepsilon_2.$$

39. Suppose a two-part tariff includes a fixed entry fee *F*, plus a per-unit cost *m*. In this case, the average price per unit is *F*/*q* + *m*, which exceeds the marginal price *m*. Thus consumers who purchase more units pay a lower average or per-unit price.

40. See figure in Solved Problem 12.4. Without advertising, the optimal number of subscriptions is determined by the intercept of MR^1 and MC. This gives optimal output and price levels Q_1 and p_1. Presence of advertising has the same effect on the demand curve as a subsidy, that is, demand shifts outward, from D^1 to D^2. The new optimal point is set by the intercept of MR^2 and MC. With advertising, the new equilibrium is a pair Q_2 and p_2. Increasing a increases subscriptions.

41. Giving a lump-sum subsidy to Canadian publishers lowers their marginal cost regardless of how many subscriptions they sell. If *MC* drops, the publisher can charge a lower price for a subscription, which will increase subscription sales.

42. Assume one unit of advertising costs $1. Then monopoly solves

$$\max_{p,A} \pi = R(p,A) - C(p) - A.$$

First order conditions are

$$\frac{\partial \pi}{\partial p} = \frac{\partial R}{\partial p} - \frac{dC}{dp} = 0$$

$$\frac{\partial \pi}{\partial A} = \frac{\partial R}{\partial A} - 1 = 0.$$

A pair p^* and A^* that solves the first-order conditions maximizes the monopoly's profit.

43. Assume one unit of advertising costs \$1. The profit function is

$$p = (100 - Q + A^{1/2})Q - 10Q - A.$$

The resulting first-order conditions are

$$\partial p/\partial A = (Q/2)A^{-1/2} - 1 = 0$$

$$\partial p/\partial Q = 100 - 2Q + A^{1/2} - 10 = 0$$

$$A^* = 900$$

$$Q^* = 60$$

$$p^* = 70.$$

44. Given the demand and cost information, the profit function is

$$p = (a - bQ + cA^a)Q - mQ - A.$$

The resulting first-order conditions are

$$\partial p/\partial A = acQA^{a-1} - 1 = 0$$

$$\partial p/\partial Q = a - 2bQ + cA^a - m = 0.$$

Solving for A^* and Q^* yields

$$A^* = (acQ^*)^{-(1/a-1)}$$

with Q^* is solution to $(a - m) - 2bQ + c(acQ^*)^{-(a/a-1)} = 0$.

45. If pharmaceutical firms are rational, then they advertise because advertising increases their profit. Profit is revenue less total cost. It is reasonable then to infer that as sales increase due to advertising, production and distribution costs of pharmaceutical companies increase more slowly than revenue.

46. Solution also provided in Jim Dearden's audio presentation.

The optimal lump-sum fee $L = CS_{\text{seniors}} = \frac{1}{2}(4-p)^2$, where p is the optimal price.

The profit function is:

$$\pi = 400pq_1 + 400pq_2 + 800L = 400p(5-p) + 400p(4-p) + 400(4-p)^2.$$

The F.O.C. is:

$$\frac{d\pi}{dp} = 2000 - 800p + 1600 - 800p - 3200 + 800p = 400 - 800p = 0$$

$$\Rightarrow \quad p^* = 0.5$$

$$\Rightarrow \quad L^* = \frac{1}{2}(4-p^*)^2 = 6.125,$$

i.e. the optimal lump-sum fee is $L^* = \$6.125$ and the optimal price is $p^* = \$0.5$.

47. Solution also provided in Jim Dearden's audio presentation.

a. Without price discrimination, the profit function is:

$$\pi = [(10000 - 100p) + (9000 - 100p)] \cdot (p - 5).$$

The F.O.C. is:

$$\frac{d\pi}{dp} = 19000 - 200p - 200(p - 5) = 0 \quad \Rightarrow \quad p^* = 50.$$

The profit-maximizing quantity in the gate market is $Q_G^* = 10000 - 100 \cdot 50 = 5000,$ and the profit-maximizing quantity in the municipal offices is $Q_M^* = 9000 - 100 \cdot 50 = 4000.$

The maximum possible profit is

$$\pi(p^*) = [(10000 - 100 \cdot 50) + (9000 - 100 \cdot 50)] \cdot (50 - 5) = 405000.$$

b. With price discrimination, the profit function in the gate market is:

$$\pi_G = (10000 - 100p_G) \cdot (p_G - 5).$$

The profit function in the municipal offices is:

$$\pi_M = (9000 - 100p_G) \cdot (p_G - 5).$$

The F.O.C. for the gate market is:

$$\frac{d\pi_G}{dp_G} = 10000 - 100p_G - 100(p_G - 5) = 0$$
$$\Rightarrow \quad p_G^* = 52.5$$
$$\Rightarrow \quad Q_G^* = 10000 - 100p_G^* = 4750.$$

The F.O.C. for the municipal offices market is:

$$\frac{d\pi_M}{dp_M} = 9000 - 100p_M - 100(p_M - 5) = 0$$
$$\Rightarrow \quad p_M^* = 47.5$$
$$\Rightarrow \quad Q_M^* = 9000 - 100p_M^* = 4250.$$

The maximum possible profit in both markets is:

$$\pi = \pi_G + \pi_M = Q_G^* \times (p_G^* - 5) + Q_M^* \times (p_M^* - 5) = 406250.$$