14 Advanced Pricing Techniques

Learning Objectives

After reading Chapter 14 and working the problems for Chapter 14 in the textbook and in this Student Workbook, you will learn how to handle a number of advanced pricing techniques that are more complicated than setting a single, uniform price, or setting prices form multiple products when a firm produces two or more goods that may be related in consumption or production. And, to make sure you don't take the easy way out in making your pricing decisions, we show you why the still widely-used pricing technique, cost-plus pricing, is the wrong way to set prices if profit-maximization is your goal in pricing – which, of course it should be unless you're running a nonprofit organization! In this chapter we will teach you:

- Why charging a single, uniform price for every unit of a product you sell allows consumers to pay less than the maximum amount they would be willing to pay – buyers are able to keep their consumer surplus– which means the pricing decision does not generate the maximum possible total revenue and economic profit.
- How pricing your product according to first-degree, second-degree, or third-degree methods of price discrimination can generate greater revenue and profit than charging a single, uniform price.
- How to make profit-maximizing decisions when producing multiple products that are related either in consumption or in production.
- Why cost-plus pricing, usually fails to result in the profit-maximizing price.

Essential Concepts

This chapter is divided into six sections, and the *Essential Concepts* for this chapter are organized accordingly.

CAPTURING CONSUMER SURPLUS VIA PRICE DISCRIMINATION

1. *Uniform pricing* occurs when businesses charge the same rice for every unit of the product they sell. Price discrimination is a more profitable alternative to uniform pricing, if market conditions allow this practice to be profitably executed.
2. *Price discrimination* is the technique of charging different prices for the same product for the purpose of capturing consumer surplus, turning consumer surplus into economic profit.

3. Price discrimination between two products A and B exists when the price-to-marginal cost ratio differs between products:

$$\frac{P_A}{MC_A} \neq \frac{P_B}{MC_B}$$

4. To practice price discrimination profitably three conditions are necessary:
   (i) the firm must possess some degree of market power,
   (ii) a cost-effective means of preventing resale between lower-price and higher-price buyers must be implemented, and
   (iii) price elasticities must differ between individual buyers or groups of buyers.

FIRST-DEGREE (OR PERFECT) PRICE DISCRIMINATION

1. Under *first-degree price discrimination*, the discriminating firm examines each individual's demand separately, and charges each consumer the maximum price he or she is willing to pay for every unit.
2. Since every unit is sold for its demand price, first-degree price discrimination allows the firm to capture all consumer surplus.
3. First-degree price discrimination, while perfect in the sense of capturing all consumer surplus, is very difficult to execute because (i) it requires precise information about every one of the buyer's demand for the good, and (ii) the seller must negotiate a different price for every unit sold to every buyer (that's a lot of different prices!)

SECOND-DEGREE PRICE DISCRIMINATION

1. When the same consumer buys more than one unit of a good or service at a time, the marginal value placed on consuming additional units declines as more units are consumed. *Second-degree price discrimination* takes advantage of this falling marginal valuation by reducing the average price as the amount purchased increases.
2. There are many ways to design pricing plans that offer reduced average prices as quantity purchased increases. We look at two of these: (i) two-part pricing, and (ii) declining block pricing.

   Two-part Pricing

3. Under two-part pricing, the firm charges buyers a fixed access chare (A) to purchase as many units as they wish for a constant usage fee (f) per unit. The total expenditure for a buyer purchasing q units of the good, $TE(q)$, is

$$TE(q) = A + fq$$

   The average price is equal to $TE(q)$ divided by the number of units purchased:

$$p = \frac{TE}{q} = \frac{A}{q} + f ,$$

   which shows that p falls as q rises (i.e., quantity discount).

4. Determining the optimal values for A and f is a complex task, but we can give solutions for two simplified situations. By showing you how this works for two

rather simple situations, we can show you the basic way in which two-part pricing increases revenue and profit:

(i) When all consumers have identical demands for a product (and demand is precisely known), a manager can capture the entire consumer surplus through two-part pricing by setting the usage fee equal to marginal cost ($f^* = MC$) and setting the access charge equal to one of the identical buyers' consumer surplus ($A^* = CS$).

(ii) When two groups of buyers have identical demand curves, it may be profitable to charge each group identical access charges and usage fees. The optimal usage fee is the level for which $MR_f = MC_f$, where MR_f is the change in total revenue attributable to changing the usage fee, and MC_f is the change in total cost attributable to changing the usage fee. The optimal access charge is equal to the consumer surplus of a single buyer in the group with the lower consumer surplus.

Declining Block Pricing

5. Declining block pricing is a common form of second-degree price discrimination that offers quantity discounts over successive discrete blocks of quantities purchased.

THIRD-DEGREE PRICE DISCRIMINATION

1. If a firm sells in two distinct markets (1 and 2) –that is, practices third-degree price discrimination– then it should allocate output (sales) between the two markets such that $MR_1 = MR_2$, which will maximize the total revenue ($TR_1 + TR_2$) for the firm. This is known as the equal-marginal-revenue principle.
2. When setting prices in multiple markets, the application of the equal-marginal-revenue principle results in the more elastic market getting the lower price and the less elastic market getting the higher price: If $|E_1| > |E_2|$, then $P_1 < P_2$.
3. The optimal level of total output for a third-degree price discriminating firm is the level for which $MR_T = MC$, where MR_T is the total marginal revenue. Hence, for profit maximization, the firm should produce the level of output and allocate the sales of this output between the two markets so that

$$MR_T = MC = MR_1 = MR_2$$

MULTIPLE PRODUCTS

Related in Consumption

1. If a firm produces two products, X and Y, the firm maximizes profit by producing and selling output levels for which

$$MR_X = MC_X \quad \text{and} \quad MR_Y = MC_Y$$

When the products X and Y are related in consumption (as either substitutes or complements), MR_X is a function not only of Q_X but also of Q_Y, as is MR_Y. Consequently, the marginal conditions set forth above must be satisfied simultaneously.

Related in Production as Substitutes

2. If a firm produces two products, X and Y, that compete for the firm's limited production facilities, the firm should allocate the production facility so that the marginal revenue product of the production facility is equal for the two products, $MRP_X = MRP_Y$. If in the long run the firm can vary its usage of (or size of) the production facility, the optimal level of usage of the facility is that at which $MRP_T = MC$. Hence, for profit maximization the firm should select the level of usage of its production facility and allocate this level of usage between the production of the two products so that

$$MRP_T = MC = MRP_X = MRP_Y$$

Related in Production as Complements

3. To maximize profit, the manager produces the level of joint product where the joint marginal revenue equals marginal cost: $MR_J = MC$. If the profit-maximizing level of joint production exceeds the output where the MR_J kinks, then, for the good with negative marginal revenue, the units beyond the point of zero marginal revenue are disposed of rather than sold in the market. The profit-maximizing prices are found using the demand functions for the two goods.

COST-PLUS PRICING (DON'T DO IT)

1. Cost-plus pricing is a common technique for pricing when firms cannot or do not wish to estimate demand and cost conditions and apply the $MR = MC$ rule to find the profit-maximizing price and output on the firm's demand curve.
2. The price charged represents a markup (margin) over average cost:

$$P = (1 + m)ATC$$

   where m is the markup on unit cost (expressed as a fraction, rather than a percentage).
3. Cost-plus pricing does not generally produce the profit-maximizing price because (1) it fails to incorporate information about demand and marginal revenue, and (2) it utilizes average, not marginal, cost to compute price.

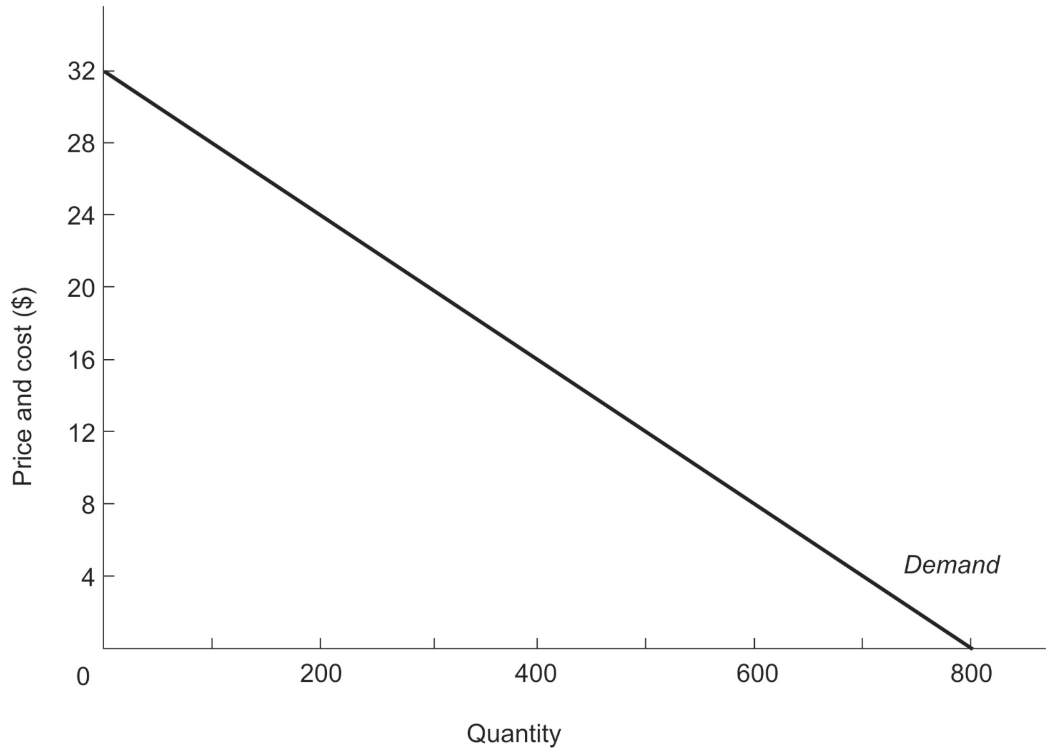
Matching Definitions

capturing consumer surplus	second-degree price discrimination
complements in consumption	substitutes in consumption
complements in production	substitutes in production
consumer arbitrage	third-degree price discrimination
cost-plus pricing	total marginal cost curve
declining block pricing	two-part pricing
first-degree price discrimination	uniform pricing
price discrimination	

1. ____________________ Charging the same price for every unit of a product.
2. ____________________ Devising pricing schemes to transform consumer surplus into economic profit.
3. ____________________ Charging different prices for the same product.
4. ____________________ Low-price buyers resell product to buyers in high-price markets, establishing a single uniform price.
5. ____________________ Every unit is sold for the demand price and all consumer surplus is captured.
6. ____________________ A firm offers lower prices for larger quantities and lets buyers self-select the price they pay by choosing how much to buy.
7. ____________________ Buyers pay a fixed access charge and a constant user fee.
8. ____________________ Form of second-degree price discrimination that offers quantity discounts over successive blocks of quantities purchased.
9. ____________________ Firms charge different groups of customers different prices for the same good or service.
10. ____________________ The change in $TR_1 + TR_2$ caused by an incremental change in total quantity Q_T
11. ____________________ Products that are used together and purchased together.
12. ____________________ Products are substitutes and buyers purchase only one of the firm's products.
13. ____________________ Goods produced by the same firm that compete for limited production facilities.
14. ____________________ Two or more goods that are produced using a common input.
15. ____________________ A method of determining price by setting price equal to average total cost plus a portion (m) of average cost as a markup.

Study Problems

1. Shell Designs, Inc. faces the following monthly demand for its designer coffee mugs, which are hand-made using a special clay from imported from Costa Rica:



The average cost of producing each hand-made coffee mug is $8, and costs are constant.

a. If Shell Designs decides to sell its coffee mugs over the Internet, it will have to charge a uniform price. The profit-maximizing uniform price is $________ per mug, and it will sell __________ hand-made mugs per month on the Internet. Shell's monthly profit will be $______________ per month.

b. The trouble with selling coffee mugs on the Internet at uniform prices is that consumers enjoy $______________ of consumer surplus, which could be captured if Shell Designs sold its mugs at art and craft shows where it could practice first-degree price discrimination (at least in theory).

c. Not only does Shell Designs lose profit in the amount of the consumer surplus computed in part *b*, but it also could make $____________ of additional profit on the extra coffee mugs it could sell if each buyer could be forced to pay their individual maximum price (i.e., "mugged" into paying their demand price) instead of the uniform price under perfect price discrimination.

d. If Shell Designs decides to sell its mugs only at art and craft shows and employs a sales person with the uncanny—perhaps even supernatural—ability to look at buyers' eyes and know precisely the maximum price they will pay for a hand-made coffee mug, the company can sell _________ mugs per month under perfect (i.e., first-degree) price discrimination.[1]

e. Under first-degree price discrimination, the sales person will have to negotiate or haggle with every customer, in effect, charging _______ different prices.

f. Under perfect price discrimination, Shell Designs earns $_________ in total revenue each month and incurs $_________ in total costs. Profit under first-degree price discrimination is $__________ per month, which exceeds the uniform profit by $________ per month. This gain in profit is exactly equal to the sum of ________________ and _________________.

2. Zak is a photographer who owns and operates Sport Shotz Photo, a company that specializes in photographing children's sporting events and selling action shots to parents. Every year the Westfield Horse Owners Association (WHOA) sponsors an equestrian show for children. Zak can count on 20 parents wanting to buy photos of their children, and, as luck would have it, all 20 parents have exactly the same demand for photos. Zak knows the identical demand precisely:

Price per photo	Quantity of photos demanded
$25	1
18	2
12	3
10	4
8	5
6	6
4	7
3	8
2	9
1	10

Zak's costs marginal and average costs are constant and equal to $5 per photo.

a. Zak currently charges a (uniform) price of $18 each for his photos. How much profit does he make on the WHOA horse show under this pricing plan?

b. If Zak decides to engage in perfect price discrimination, how many photos will he sell to each family? How much profit does he make on each family? What is his total profit on the WHOA horse show under first-degree price discrimination?

c. Rather than haggle with each one of the 20 parents over the price of each photo he sells, Zak decides to adopt a pricing plan that he read about in

[1] Note to the particularly astute student: Let's assume for some strange reason that the superior sales person can only read the eyes of Shell Design customers and would be only an "ordinary" sales person at any other company who might wish to hire her. Why do we need to make this additional assumption?

Havard Business Review. He will charge a fixed fee (A) to shoot photos of each family's child and then charge a fee (f) for each photo purchased. What are the profit-maximizing values for A and f?

d. Under the optimal two-part pricing plan in part *c*, how much profit does he make on each family? What is his total profit on the WHOA horse show under optimal two-part pricing? How does this profit compare with profit under first-degree price discrimination?

3. Belmont Industries sells its product in two distinct markets. The demand functions for these two markets are estimated to be

$$\textit{Market } 1: \quad Q_1 = 25{,}000 - 5{,}000P_1$$
$$\textit{Market } 2: \quad Q_2 = 40{,}000 - 5{,}000P_2$$

Belmont Industries' marginal cost function is $MC = 1.25 + 0.0001Q$.

a. Find Belmont Industries' inverse demand functions.

Market 1: P_1 = ____________________

Market 2: P_2 = ____________________

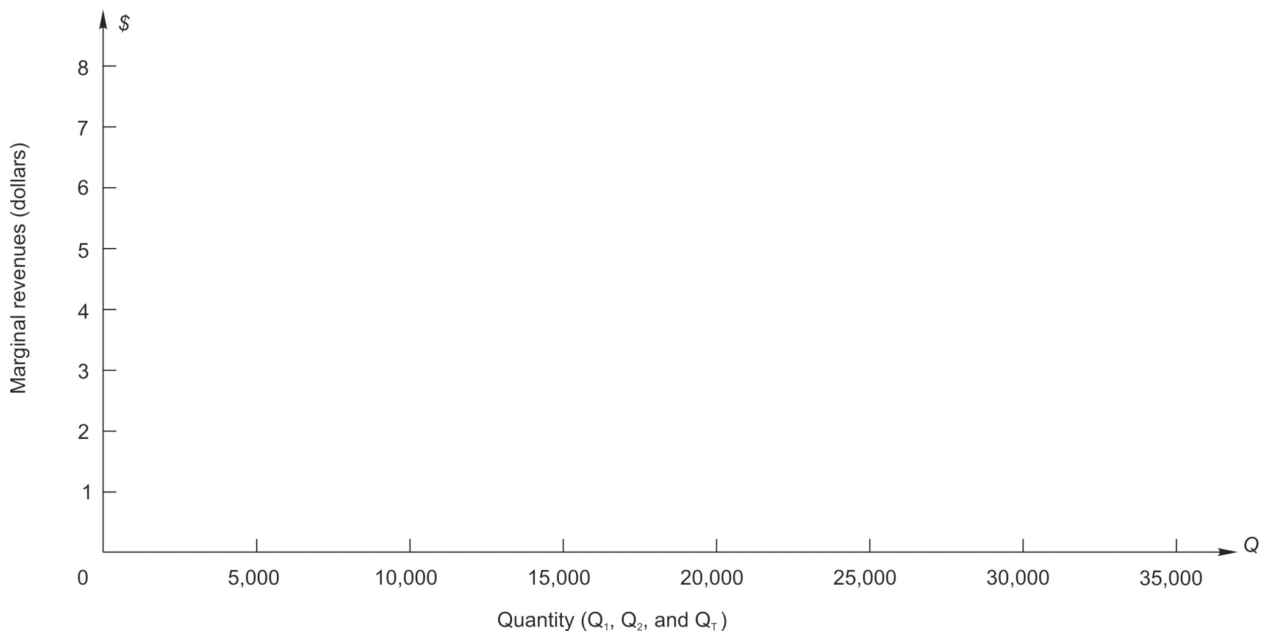
b. Find Belmont's marginal revenue and inverse marginal revenue functions.

Market 1: MR_1 = _________________ Q_1 = _______________________

Market 2: MR_2 =_________________ Q_2 = _______________________

c. Belmont's total marginal revenue function is MR_T = ____________________.

d. On the axes below, construct lines for MR_1, MR_2, and MR_T.



e. Belmont Industries' profit is maximized by producing and selling a total of __________ units.

f. The manager of Belmont Industries maximizes profit by selling __________ units in market 1 and selling __________ units in market 2.

g. In order to maximize profit, the manager must set prices in the two markets as

$$P_1^* = \$\_\_\_\_\_\_\_\_\_\_$$

$$P_2^* = \$\_\_\_\_\_\_\_\_\_\_$$

h. Measured at the prices in part *g*, the point elasticities of demand are

$$E_1 = \_\_\_\_\_\_\_\_\_\_$$

$$E_2 = \_\_\_\_\_\_\_\_\_\_$$

The higher price is charged in the _____________ (less, more) elastic market.

i. In the preceding figure in which you have constructed marginal revenue and demand curves, now construct the marginal cost curve and verify that you have correctly calculated the profit-maximizing prices and outputs.

4. Consider a firm with market power that sells a "regular" and "deluxe" version of a product. The manager estimates the demand functions for the two products are

$$Q_R = 800 - 60P_R + 40P_D$$

$$Q_D = 1{,}000 - 40P_D + 20P_R$$

By solving the demand functions simultaneously, the manager obtains the following estimated inverse demand functions:

$$P_R = 45 - 0.025Q_R - 0.025Q_D$$

$$P_D = 47.5 - 0.0375Q_D - 0.0125Q_R$$

The marginal cost functions are estimated to be

$$MC_R = 0.5 + 0.01Q_R$$

$$MC_D = 0.6 + 0.01Q_D$$

a. Verify that the manager correctly performed the derivation of the inverse demand functions from the demand functions.

b. The marginal revenue functions are:

MR_R = __________________________

MR_D = __________________________

c. The profit-maximizing levels of output and prices are:

Q_R = __________	units	P_R = $__________	
Q_D = __________	units	P_D = $__________	

5. Simpson Corporation produces two products (X and Y) that are substitutes in production. The demand functions for the two products are forecasted to be

$$Q_X = 120 - 6P_X$$

$$Q_Y = 48 - 4P_Y$$

The manufacturing process uses a common production facility, and the outputs of the two products are determined by the amounts of time the facility is employed to produce them:

$$Q_X = 1.0H_X$$
$$Q_Y = 2.0H_Y$$

where H_X and H_Y are the number of hours per week the production facility is used to produce good X and good Y, respectively. The marginal cost for using the production facility is estimated to be

$$MC = 9 + 0.1H_T$$

where H_T is the total number of hours per week that the plant operates ($H_T = H_X + H_Y$).

a. The marginal revenue products of the production facility in X and Y are

$MRP_{H_X} =$ ____________________________

$MRP_{H_Y} =$ ____________________________

b. The marginal revenue product of total hours of plant operation, MRP_T, is

$MRP_T =$ __________________________________.

c. The profit-maximizing level of usage of the production facility is __________ hours per week. The optimal allocation of the production facility between the production of X and Y is

$H_X =$ __________

$H_Y =$ __________

d. The profit-maximizing outputs and prices are

$Q_X^* =$ __________ and $P_X^* =$ ___________

$Q_Y^* =$ __________ and $P_Y^* =$ ___________

6. Waring Chemical Supply produces styrene and ulene, which are complements in production. The production process yields equal amounts of both products. The owner and manager of Waring Chemical Supply must decide how much styrene and ulene to produce and sell and what prices to charge. The owner wants to make the pricing and production decisions in a way that maximizes the profit of the firm.

The forecasted monthly demand for styrene and ulene are

$$Q_S = 10{,}000 - 50P_S \quad \text{and} \quad Q_U = 12{,}000 - 40P_U$$

where quantities are measured in gallons demanded per month and prices are expressed in dollars per gallon. The owner of Waring Chemical estimates that marginal cost of producing the joint products is

$$MC = 200 - 0.06Q_J$$

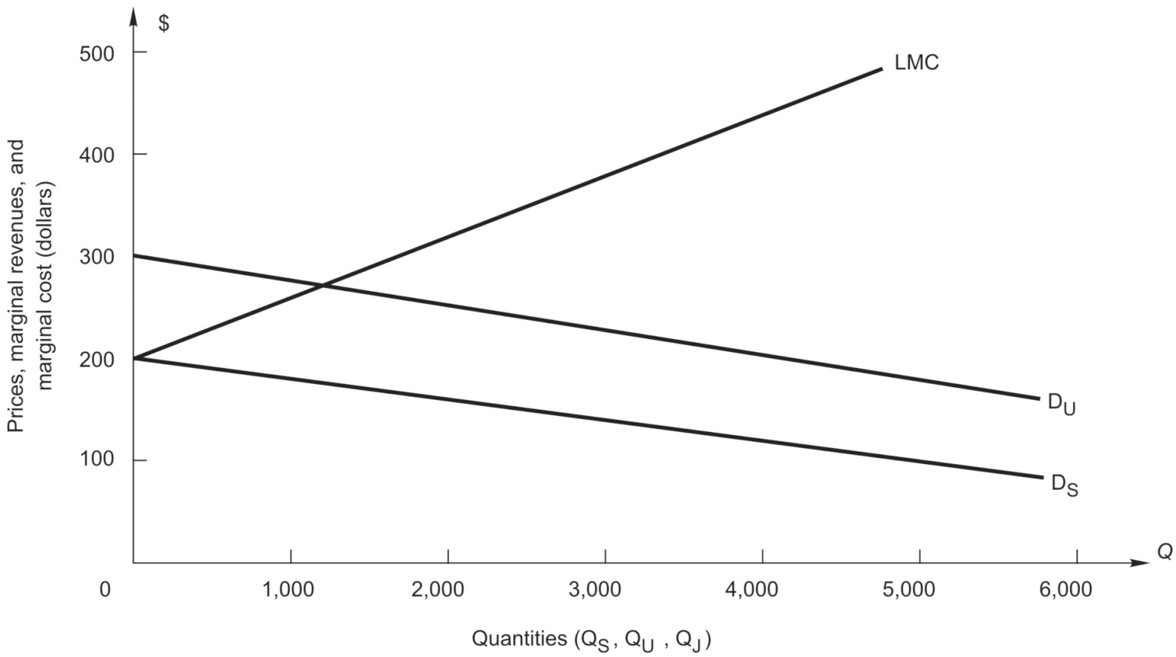
where Q_J is the number of gallons of joint product ($Q_J = Q_S = Q_U$).

a. Derive the marginal revenue functions for styrene and ulene

$MR_S =$ ________________________________

$MR_U =$ ________________________________

Construct these two marginal revenue functions on the axes provided on the following page.



b. Derive the joint marginal revenue function algebraically and then graphically on the axes above

MR_J = ______________________________ for $0 < Q_J <$ _________, and

= ______________________________ for ______ $< Q_J <$ ______

c. The profit-maximizing level of production and sales are

$Q_J^* =$ _______ $Q_S^* =$ _______ $Q_U^* =$ _______

Verify these levels on your graph above.

d. The profit-maximizing prices to charge for the two chemicals are

$P_S^* =$ _______ $P_U^* =$ _______

At these prices, the total revenue generated by selling the two products is $______________.

Now suppose Waring Chemical discovers a new production technique that allows production to occur at a constant marginal cost of $25 per additional gallon; that is, the new marginal cost function is $MC = 25$.

e. The profit-maximizing level of production of the joint product is ________ gallons per week. The amount sold each week is ________ gallons of styrene and ________ gallons of ulene. In order to maximize profit, the manager must dispose of ________ units of _________ each week rather than sell those units.

f. The profit-maximizing prices to charge for the two chemicals are

$P_S^* =$ _________ $P_U^* =$ _______

At these prices, the total revenue generated by selling the two products is $______________.

7. Bruce Slover is the senior production and pricing manager at DrillQuick, a Houston-based company that manufactures a patented drill bit called the "Blaster," which is used in the petroleum industry. His company has historically used a 25 percent markup on the average total costs of producing Blasters. The average variable cost of production is constant and equal to $7,500 per bit. Total fixed cost is $50,000 per quarter-year of production. DrillQuick currently produces 250 bits per quarter.

   a. The average variable cost of producing a Blaster bit is $________, which also equals the ______________ (average total, short-run marginal, average fixed) cost of production. Average fixed cost of production is $___________. Average total cost of producing a Blaster bit is $__________.

   b. Using a 25 percent markup on average total cost, Slover calculates the cost-plus price for a Blaster bit to be $__________ per bit. DrillQuick earns quarterly profit of $_____________ by selling 250 bits per quarter.

   Slover wants to determine whether cost-plus pricing is yielding the maximum possible profit for DrillQuick. After undertaking a statistical estimation of demand for Blaster drill bits, he estimates DrillQuick faces the following linear demand for its bits:

$$Q = 640 - 0.04P$$

   where Q is the number of Blaster bits demanded each quarter and P is the price charged for Blaster bits.

   c. The inverse demand for Blaster bits is $P =$ _______________________.

   d. The marginal revenue for Blaster bits is $MR =$ _______________________.

   e. Setting $MR = SMC$, Slover discovers that DrillQuik should be producing _______ bits per quarter in order to maximize its profit.

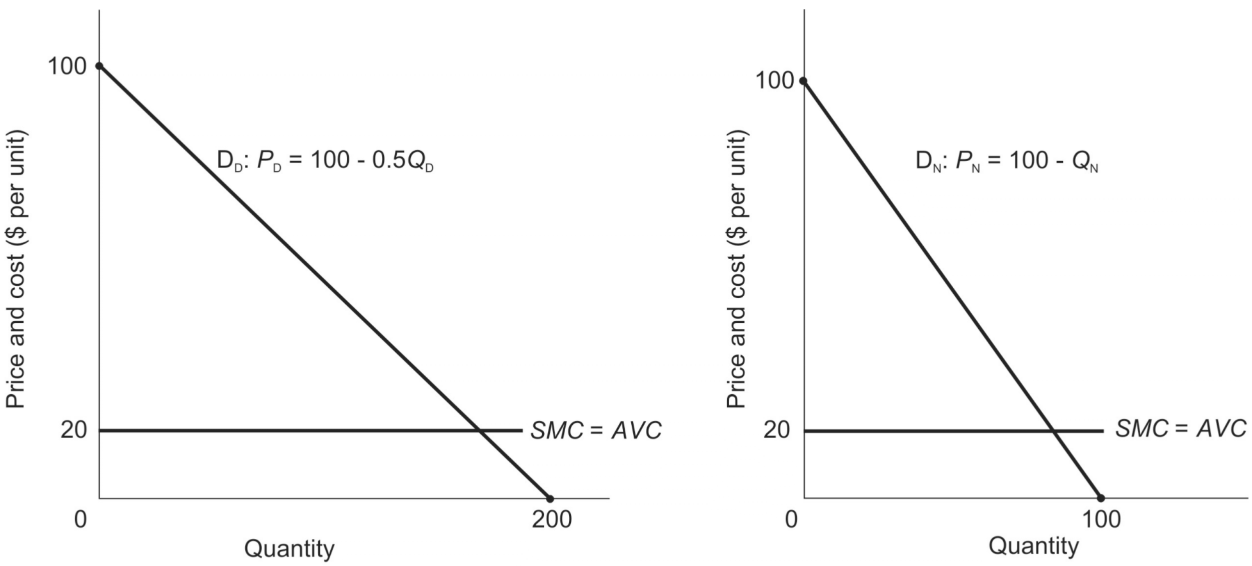
   f. Based on the estimated demand, Slover discovers that the profit-maximizing price is $___________, which is ___________ (higher than, lower than, equal to) the cost-plus price in part *b*.

   g. Using the $MR = SMC$ approach to set price, Slover calculates that DrillQuik can earn economic profit of $______________ each quarter, which is _________ (more than, less than, the same as) the profit earned using cost-plus pricing.

   h. Explain why you would expect the outcome for profits in part *g*.

Multiple Choice / True-False

In questions 1–5, a firm sells its product to two groups of buyers: daytime buyers and nighttime buyers. There are 50 daytime buyers, all of whom have identical demands given by D_D in the figure below. There are 50 nighttime buyers, all of whom have identical demands given by D_N in the figure below. The firm's variable costs are constant ($SMC = AVC = \$20$) and its total fixed cost is \$250,000. The marketing director must devise a two-part pricing plan that will maximize the firm's profit.



Panel A - One Daytime buyer's demand **Panel B - One Nighttime buyer's demand**

1. Assuming the firm will serve both daytime and nighttime buyers, what is the MR_f function?
   a. $MR_f = 5{,}000 - 200f$
   b. $MR_f = 7{,}500 - 250f$
   c. $MR_f = 8{,}000 - 250f$
   d. $MR_f = 7{,}500 - 200f$

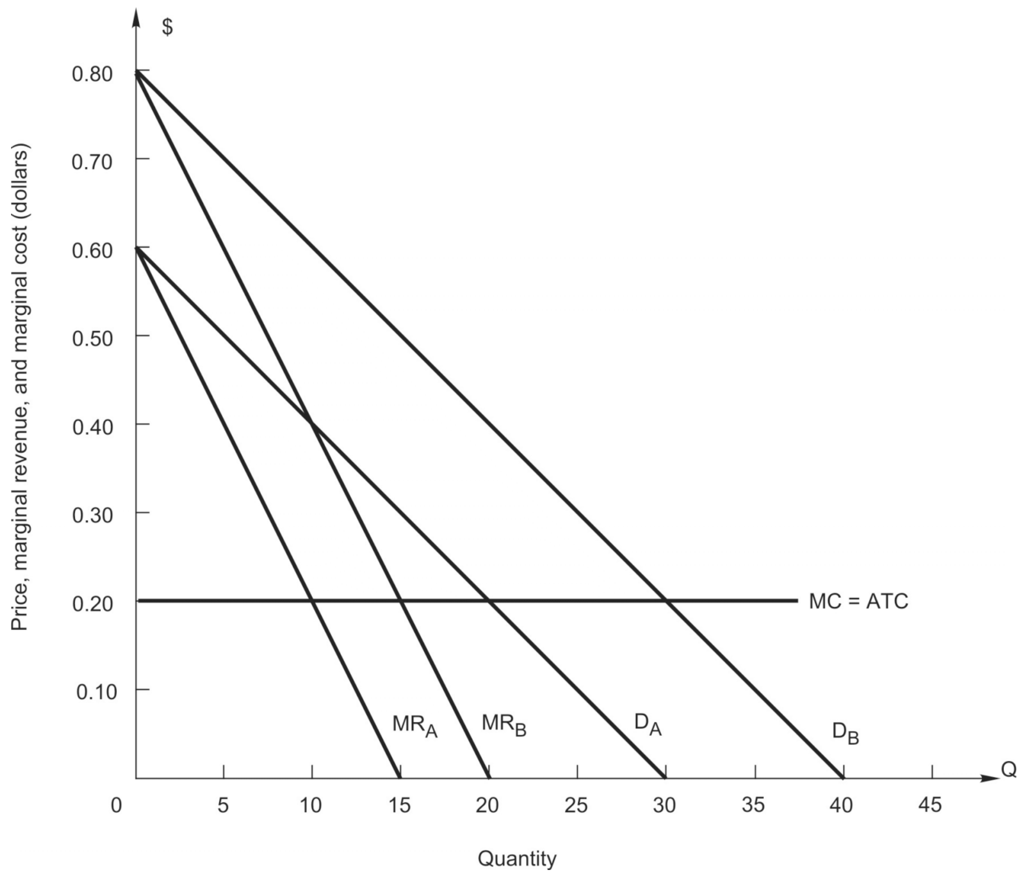
2. Assuming the firm will serve both daytime and nighttime buyers, what is the MC_f function?
   a. $MC_f = -2{,}000$
   b. $MC_f = -3{,}000$
   c. $MC_f = 8{,}000 - 250f$
   d. $MC_f = 7{,}500 + 200f$

3. Assuming the firm will serve both daytime and nighttime buyers, what is the optimal access charge (A^*) and the optimal usage fee (f^*)?
   a. $A^* = \$1{,}000$ and $f^* = \$20$
   b. $A^* = \$1{,}000$ and $f^* = \$25$
   c. $A^* = \$1{,}800$ and $f^* = \$40$
   d. $A^* = \$2{,}000$ and $f^* = \$50$

4. How much profit will the firm earn by charging the optimal access charge and optimal access fee?
    a. $80,000
    b. $90,000
    c. $100,000
    d. $110,000

5. Should the firm bother to sell output to the nighttime market?
    a. Yes, because only $70,000 of profit is earned by serving only the daytime buyers.
    b. Yes, because only $10,000 of profit is earned by serving only the daytime buyers.
    c. No, because $240,000 of profit is earned by serving only the daytime buyers.
    d. No, because $300,000 of profit is earned by serving only the daytime buyers.

In questions 6–8, a firm with market power can divide its sales into two submarkets and practice third-degree price discrimination, the demands and marginal revenues of which are shown in the figure below.



6. The total output of the monopolist is
    a. 5 units.
    b. 10 units.
    c. 15 units.
    d. 20 units.
    e. 25 units.

7. In order to maximize profit, how must the total output be distributed between markets?
    a. $Q_A = 5$ and $Q_B = 10$
    b. $Q_A = 10$ and $Q_B = 15$
    c. $Q_A = 15$ and $Q_B = 25$
    d. $Q_A = 15$ and $Q_B = 10$

8. What prices should be charged in each of the markets?
    a. $P_A = \$0.30$ and $P_B = \$0.20$
    b. $P_A = \$0.20$ and $P_B = \$0.40$
    c. $P_A = \$0.40$ and $P_B = \$0.50$
    d. $P_A = \$0.25$ and $P_B = \$0.35$

In questions 9–11 use the following:

A firm produces two products, *X* and *Y*, which are related in consumption. After estimating the demand functions and solving them simultaneously, the manager determines the inverse demand functions to be

$$P_X = 36 - 0.0025Q_X - 0.01Q_Y$$
$$P_Y = 45 - 0.0125Q_Y - 0.03Q_X$$

The marginal cost functions are estimated to be

$$MC_X = 22 + 0.015Q_X$$
$$MC_Y = 12 + 0.005Q_Y$$

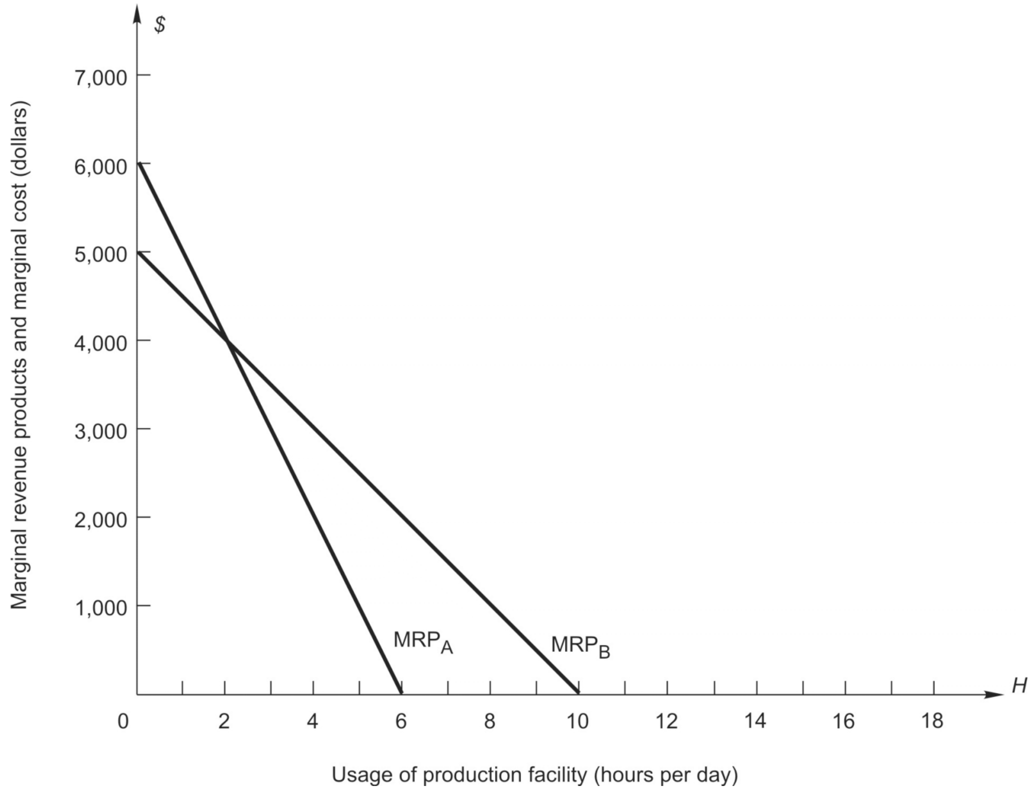
9. The marginal revenue functions are
    a. $MR_X = 36 - 0.005Q_X - 0.01Q_Y$ and $MR_Y = 45 - 0.025Q_Y - 0.03Q_X$
    b. $MR_X = 72 - 0.005Q_X - 0.02Q_Y$ and $MR_Y = 90 - 0.025Q_Y - 0.06Q_X$
    c. $MR_X = 36 - 0.005Q_X - 0.02Q_Y$ and $MR_Y = 45 - 0.025Q_Y - 0.06Q_X$
    d. $MR_X = 36 - 0.005Q_X - 0.03Q_Y$ and $MR_Y = 45 - 0.025Q_Y - 0.09Q_X$

10. What are the optimal levels of *X* and *Y*?
    a. $Q_X = 300$ and $Q_Y = 800$
    b. $Q_X = 600$ and $Q_Y = 400$
    c. $Q_X = 300$ and $Q_Y = 300$
    d. $Q_X = 200$ and $Q_Y = 600$

11. What are the optimal prices for *X* and *Y*?
    a. $P_X = \$25.00$ and $P_Y = \$25.50$
    b. $P_X = \$30.00$ and $P_Y = \$32.50$
    c. $P_X = \$21.50$ and $P_Y = \$20.00$
    d. $P_X = \$27.25$ and $P_Y = \$26.00$

For questions 12–14, use the figure below that shows the *MRP* curves for products A and B, which are substitutes in production. The marginal cost of using the production facility is estimated to be constant and equal to $2,000:

$$MC = 2{,}000$$



12. What is the optimal number of hours per day that the production facility should be used?
    a. 6 hours per day
    b. 8 hours per day
    c. 10 hours per day
    d. 12 hours per day
    e. 14 hours per day

13. How should the total number of hours be allocated to production of A and B?
    a. $H_A = 2$ hours and $H_B = 4$ hours
    b. $H_A = 4$ hours and $H_B = 4$ hours
    c. $H_A = 5$ hours and $H_B = 5$ hours
    d. $H_A = 4$ hours and $H_B = 6$ hours

14. Suppose the marginal cost of using the production facility is $MC = 1{,}000$. How should the total number of hours be allocated to production of A and B?
    a. $H_A = 5$ hours and $H_B = 8$ hours
    b. $H_A = 4$ hours and $H_B = 4$ hours
    c. $H_A = 2.5$ hours and $H_B = 3.5$ hours
    d. $H_A = 4$ hours and $H_B = 6$ hours

In questions 15–18, consider Jupiter Bicycle Company, a firm that manufactures two types of bicycles, road bikes and dirt bikes. The two bicycles are substitutes in production and must share Jupiter's production facility. The two bicycles have the following "production functions":

$$Q_R = 2.0H_R \quad \text{and} \quad Q_D = 4.0H_D$$

where H_R and H_D are the number of hours per week spent producing road and dirt bicycles, respectively. The inverse demand functions are forecasted to be

$$P_R = 900 - 25Q_R \quad \text{and} \quad P_D = 500 - 3.125Q_D$$

The marginal cost of the firm's plant is estimated to be

$$MC = 300 + 50H_T$$

where H_T is the total number of hours Jupiter operates its bicycle factory.

15. Jupiter maximizes profit by operating its bicycle plant ______ hours per week.
    a. 6
    b. 8
    c. 12
    d. 14

16. The manager of Jupiter Bicycle Company should allocate the total number of hours between road bikes and dirt bikes as follows:
    a. 4 hours on road bicycles and 4 hours on dirt bicycles
    b. 4 hours on road bicycles and 10 hours on dirt bicycles
    c. 6 hours on road bicycles and 6 hours on dirt bicycles
    d. 6 hours on road bicycles and 8 hours on dirt bicycles

17. Jupiter's weekly output of the two bicycles should be
    a. 8 road bicycles per week and 40 dirt bicycles per week.
    b. 12 road bicycles per week and 24 dirt bicycles per week.
    c. 8 road bicycles per week and 16 dirt bicycles per week.
    d. 10 road bicycles per week and 20 dirt bicycles per week.

18. Jupiter should charge the following prices for the two bicycles:
    a. P_R = \$100 and P_D = \$95
    b. P_R = \$200 and P_D = \$175
    c. P_R = \$700 and P_D = \$375
    d. P_R = \$350 and P_D = \$125

19. Which of the following are *practical* problems that arise with the implementation of cost-plus pricing?
    a. For short-run pricing applications, the fraction of fixed costs to include in the computation is completely arbitrary.
    b. Determining the value of average total cost to multiply by 1 + *m* is difficult when unit costs vary with the level of output level.
    c. Choosing the markup (*m*) to employ is largely a guessing game.
    d. all of the above.
    e. both *b* and *c*.

20. There are two *theoretical* reasons why the cost-plus pricing method of setting price is not likely (except by luck) to result in profit-maximization. Find these two theoretical problems with cost-plus pricing in the choices below.
   a. The cost-plus pricing formula uses average instead of marginal cost.
   b. The cost-plus pricing formula fails to include any information about demand or marginal revenue.
   c. The cost-plus pricing formula is a linear function of average cost, and thus can only be applied in linear demand situations.
   d. both *a* and *b.*
   e. both *b* and *c.*

Answers

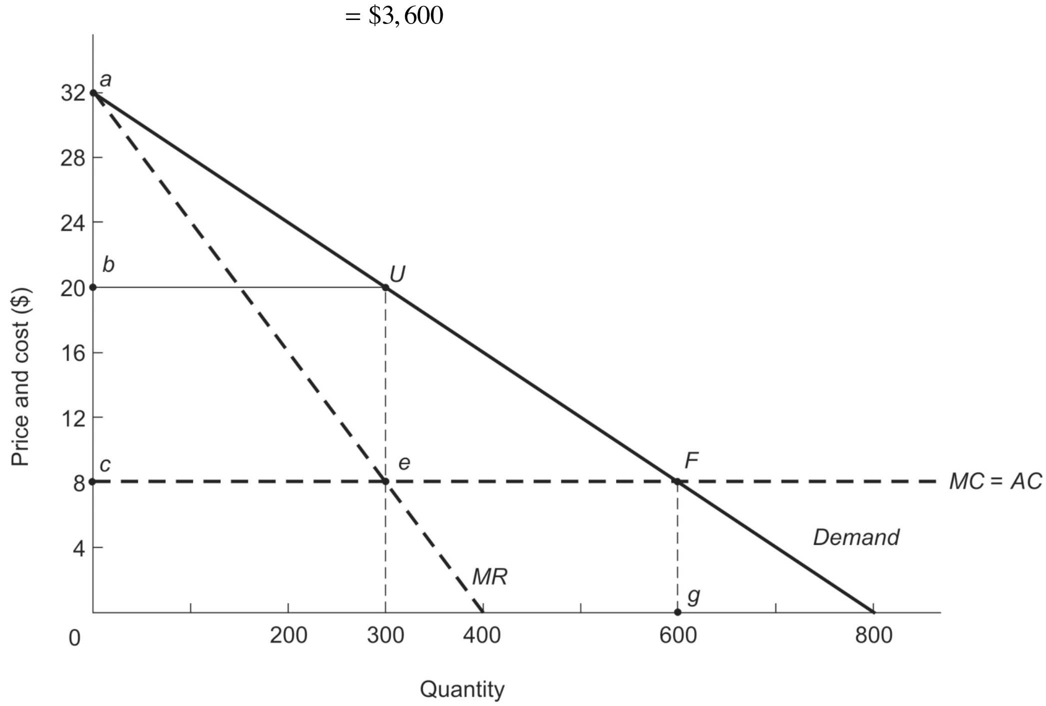
MATCHING DEFINITIONS

1. uniform pricing
2. capturing consumer surplus
3. price discrimination
4. consumer arbitrage
5. first-degree price discrimination
6. second-degree price discrimination
7. two-part pricing
8. declining block pricing
9. capacity expansion as a barrier to entry
10. total marginal revenue (MR_T)
11. complements in consumption
12. substitutes in consumption
13. substitutes in production
14. complements in production
15. cost-plus pricing

STUDY PROBLEMS

1. a. To find the profit-maximizing uniform price, you must first construct the *MR* curve (the dotted line in the figure below) and the *MC* = *AC* cost curve (a horizontal line at $8 since costs are constant). Point *U* shows the profit-maximizing *P* and *Q*: $20 and 300 mugs per month. Monthly profit is $3,600:

$$\begin{aligned}\pi &= TR - TC \\ &= (\$20 \times 300) - (\$8 \times 300) = (\$20 - \$8) \times 300 \\ &= \$3,600\end{aligned}$$



b. $1,800. Consumer surplus is the area below demand above uniform price over the range of output zero to 300 units [i.e., area of triangle $abU = 0.5 \times 300 \times (\$32 - \$20)$].

c. $1,800. By charging demand price instead of a uniform price of $20 for every mug, Shell Designs can increase its sales beyond 300 mugs to 600 mugs at point F. The extra 300 mugs sold at demand prices along the segment of demand from U to F generates additional profit equal to the area of the triangle UeF $(= 0.5 \times (600 - 300) \times (\$20 - \$8)$.

d. 600 mugs per month. See point F in the figure above.

e. 600 different prices. Each mug has a different demand price.

f. $12,000; $4,800; $7,200; the captured consumer surplus; the profit on the extra units sold between points U and F. The computation of profit at point F:

$$\begin{aligned}\pi &= TR - TC \\ &= \text{ area of trapezoid } 0aFg - \text{ area of rectangle } 0cFg \\ &= \left[600 \times \left(\frac{\$32 + \$8}{2}\right)\right] - 600 \times \$8 \\ &= \$12{,}000 - \$4{,}800 \\ &= \$7{,}200\end{aligned}$$

2. a. At $18 per photo, each family buys 2 photos, and Zak receives $36 of revenue per family. His total cost is $10 (= 2 × $5), so he makes $26 profit per family. Since there are 20 families buying photos, his total profit at WHOA is $520.

b. As long as demand price exceeds his marginal cost, he will increase profit by selling another photo. With the given demand, he will sell each family 6 photos, charging the demand price for each photo sold. On the first photo sold, he gets $25 and spends $5 to make the photo, which results in $20 profit on the first photo. Following this reasoning, his profit on the third through sixth photos can be computed as $13, $7, $5,$3, and $1, respectively. Adding these figures, Zak's profit on each family is $49, and his total profit at WHOA is $980 (= 20 × $49).

c. A^* = $49 (the consumer surplus for each family) and f^* = $5 (the marginal cost of photos)

d. Total expenditure by each family to purchase 6 photos is $79, $TE(6) = 49 + 5 \times 6$. Zak's production costs are $30 (= 6 × $5), so he makes $49 profit on each family, and a total profit on WHOA of $980. This is the same amount of profit as he would make under first-degree price discrimination (as we knew it would be!)

3. a. $P_1 = 5 - 0.0002Q_1$ and $P_2 = 8 - 0.0002Q_2$

b. $MR_1 = 5 - 0.0004Q_1 \Rightarrow Q_1 = 12{,}500 - 2{,}500MR_1$

$MR_2 = 8 - 0.0004Q_2 \Rightarrow Q_2 = 20{,}000 - 2{,}500MR_2$

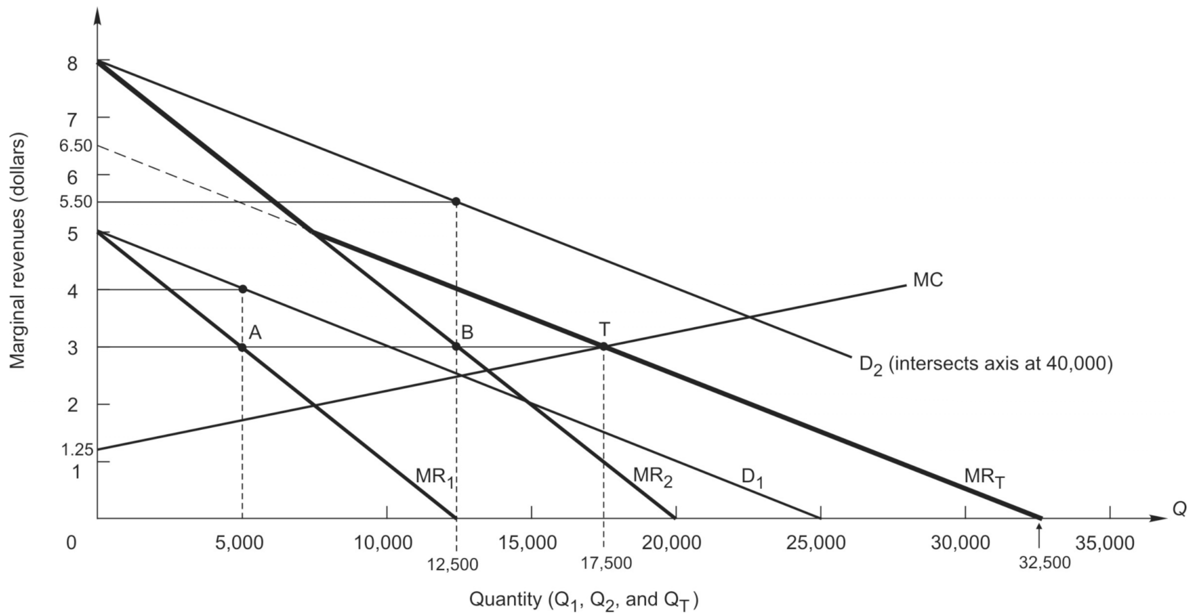
c. Set $MR_1 = MR_2 = MR_T$ and sum:

$$Q_1 + Q_2 = Q_T = (12{,}500 - 2{,}500MR_1) + (20{,}000 - 2{,}500MR_2)$$

$$Q_T = 32{,}500 - 5{,}000MR_T \Rightarrow MR_T = 6.5 - 0.0002Q_T \text{ (for } Q_T > 7{,}500)$$

[Note: To find the kink, set $MR_2 = 5$ and solve for Q_{kink}.]

d. See the figure below.



e. $MR_T = MC_T \Rightarrow Q_T = 17{,}500$ units

f. MR_T (17,500) = \$3. Substitute \$3 into both inverse marginal revenue functions:

$$Q_1 = 5{,}000\ (= 12{,}500 - 2{,}500 \times 3)$$

$$Q_2 = 12{,}500\ (= 20{,}000 - 2{,}500 \times 3)$$

g. $P_1 = 5 - 0.0002(5{,}000) = \$4$

$P_2 = 8 - 0.0002(12{,}500) = \$5.50$

h. $E_1 = -4$ [= 4/(4–5)]; $E_2 = -2.2$ [= 5.50/(5.50–8)]; Market 2 has the less elastic demand since $|E_2| < |E_1|$. Remember, the higher price is charged in the market with the less elastic demand.

i. See the previous figure.

4. a. Follow the substitution procedure described in footnote 8 on page 591 of your textbook:

First, using the equation for Q_R, solve for P_R:

$$P_R = 13.33 - 0.0167Q_R + 0.67P_D$$

Next, using the equation for Q_D, solve for P_D:

$$P_D = 25 - 0.025Q_D + 0.5P_R$$

[Note: You could alternatively have solved for P_D in the equation for Q_R and for P_R in the equation for Q_D.]

Now, cross-substitute the solution for P_R into the equation for P_D and the solution for P_D into the equation for P_R:

$$P_D = 25 - 0.025Q_D + 0.5[13.33 - 0.0167Q_R + 0.67P_D]$$

$$P_R = 13.33 - 0.0167Q_R + 0.67[25 - 0.025Q_D + 0.5P_R]$$

Now P_D is expressed as a function of Q_D and Q_R , as is P_R:

$$P_R = 45 - 0.025Q_R - 0.025Q_D$$

$$P_D = 47.5 - 0.0375Q_D - 0.0125Q_R$$

This verifies that the inverse demand functions can indeed be derived from the estimated demand functions.

b. See footnote 9 on page 591 of your textbook for an explanation of how to get the marginal revenue functions:

$$MR_R = 45 - 0.05Q_R - 0.025Q_D$$
$$MR_D = 47.5 - 0.0125Q_R - 0.075Q_D$$

c. Set $MR_R = MC_R$ and $MR_D = MC_D$ and solve simultaneously for Q_R and Q_D $\Rightarrow$ $Q_R^* = 545$ and $Q_D^* = 472$. Now solve for the profit-maximizing prices by substituting Q_R^* and Q_D^* into the inverse demand functions

$$P_R^* = \$19.57 = 45 - 0.025 \times 545 - 0.025 \times 472$$

$$P_D^* = \$23 = 47.5 - 0.0125 \times 472 - 0.0375 \times 545$$

Note that your answer will likely differ slightly from this answer because of rounding.

5. a. Take the inverses of the two demand functions and find the marginal revenue functions

$$P_X = 20 - 0.16667Q_X \quad \text{and} \quad P_Y = 12 - 0.25Q_Y$$
$$MR_X = 20 - 0.3333Q_X \quad \text{and} \quad MR_Y = 12 - 0.5Q_Y$$

Express marginal revenues as functions of facility hours, H_X and H_Y, by substituting the production relations, $Q_X = 1.0H_X$ and $Q_Y = 2.0H_Y$:

$$MR_X = 20 - 0.3333H_X \quad \text{and} \quad MR_Y = 12 - 0.5(2H_Y) = 12 - H_Y$$

Now derive the MRP functions

$$MRP_{Hx} = MR_X \times MP_{Hx} = (20 - 0.3333H_X) \times 1 = 20 - 0.3333H_X$$
$$MRP_{Hy} = MR_Y \times MP_{Hy} = (12 - H_Y) \times 2 = 24 - 2H_Y$$

b. Take inverses of the MRP functions

$$H_X = 60 - 3MRP_{Hx}$$
$$H_Y = 12 - 0.5MRP_{Hy}$$

Sum $H_X + H_Y$ to get H_T (Remember, optimal plant usage requires $MRP_{Hx} = MRP_{Hy} = MRP_T$.):

$$H_T = (60 - 3MRP_T) + (12 - 0.5MRP_T) = 72 - 3.5MRP_T$$

Finally, take the inverse to get MRP_T as a function of H_T

$$MRP_T = 20.57143 - 0.28714H_T$$

c. To find the optimal, or profit-maximizing, level of usage of the production facility, set $MRP_T = MC$ and solve for H_T^*

$$MRP_T = 20.57143 - 0.28714H_T = 9 + 0.1H_T \Rightarrow H_T^* = 30 \text{ hours per week.}$$

MRP_T at the optimal level of hours is found by substituting H_T^* into MRP_T:

$$MRP_T^* = 12 \ (= 20.571 - 0.2875 \times 30)$$

Because optimal allocation of plant time between the two goods X and Y requires satisfying the equimarginal principle, $MRP_{Hx} = MRP_{Hy} = MRP_T$, H_X^* and H_Y^* are found by evaluating the inverse MRP functions at MPR_T^*

$$H_X^* = 60 - 3 \times 12 = 24$$
$$H_Y^* = 12 - 0.5 \times 12 = 6$$

d. The profit-maximizing outputs and prices are found as follows:

$$Q_X^* = 1.0H_X^* = 24 \text{ units per week} \quad \text{and} \quad P_X^* = 20 - 0.16667 \times 24 - \$16$$
$$Q_Y^* = 2.0H_Y^* = 12 \text{ units per week} \quad \text{and} \quad P_Y^* = 12 - 0.25 \times 12 = \$9$$

6. a. First find the inverse demand functions:

$$P_S = 200 - 0.02Q_S \qquad \text{and} \qquad P_U = 300 - 0.025Q_U$$

Then, the marginal revenue functions are easily written as

$$MR_S = 200 - 0.04Q_S \qquad \text{and} \qquad MR_U = 300 - 0.05Q_U$$

See the figure on page 320 for the graphs of these two *MR* functions.

b. The joint marginal revenue function is derived by summing $MR_S + MR_U = MR_J$ at all output levels ($Q_S = Q_U = Q_J$) for which both MR_S and MR_U are positive. When one of the *MR*s becomes zero, it is no longer vertically summed. In this problem, MR_S becomes negative beyond 5,000 gallons. Thus, the joint marginal revenue function is the (vertical) sum of both *MR*s only over the range of output 0 to 5,000. MR_U becomes negative beyond 6,000 gallons, so for the range $5{,}000 < Q_J < 6{,}000$, $MR_J = MR_U$. The algebraic summing is done as follows:

For $0 < Q_J < 5{,}000$:

$$MR_J = MR_S + MR_U = 200 - 0.04Q_J + 300 - 0.05Q_J$$
$$= 500 - 0.09Q_J$$

For $5{,}000 < Q_J < 6{,}000$:

$$MR_J = MR_U$$
$$= 300 - 0.05Q_J$$

c. To find the profit-maximizing levels of production and sales, MR_J is set equal to MC, and the solution is Q_J^* which, by the joint nature of production, is also Q_S^* and Q_U^* :

$$MR_J = MC \Rightarrow 500 - 0.09Q_J = 200 + 0.06Q_J \Rightarrow Q_J^* = 2{,}000 \text{ gallons per month}$$

Since each gallon of the joint product yields one gallon of styrene and one gallon of ulene, $Q_S^* = 2{,}000 = Q_U^*$. At $Q_J = 2{,}000$, both *MR*s are positive, so all 2,000 units of each product will be sold.

d. The profit-maximizing prices are

$$P_S^* = 200 - 0.02 \times 2{,}000 = \$160$$
$$P_U^* = 300 - 0.05 \times 2{,}000 = \$250$$

The associated total revenues are

$$TR_S^* = \$160 \times 2{,}000 = \$320{,}000$$
$$TR_U^* = \$250 \times 2{,}000 = \$400{,}000$$
$$TR_{total} = TR_S^* + TR_U^* = \$720{,}000$$

e. When $MC = 25$; $MR_J = MC$ at more than 5,000 gallons of chemical. Thus, $MR_J = 300 - 0.05Q_J$. Setting $MR_J = MC$ and solving for Q_J shows that $Q_J^* = 5{,}500$. Thus, Waring Chemical *produces* 5,500 gallons of both styrene and ulene, but *sells* all of the ulene while *selling* only 5,000 gallons of styrene (i.e., disposes of 500 gallons of styrene).

f. The profit-maximizing prices are

$$P_S^* = 200 - 0.02 \times 5{,}000 = \$100$$

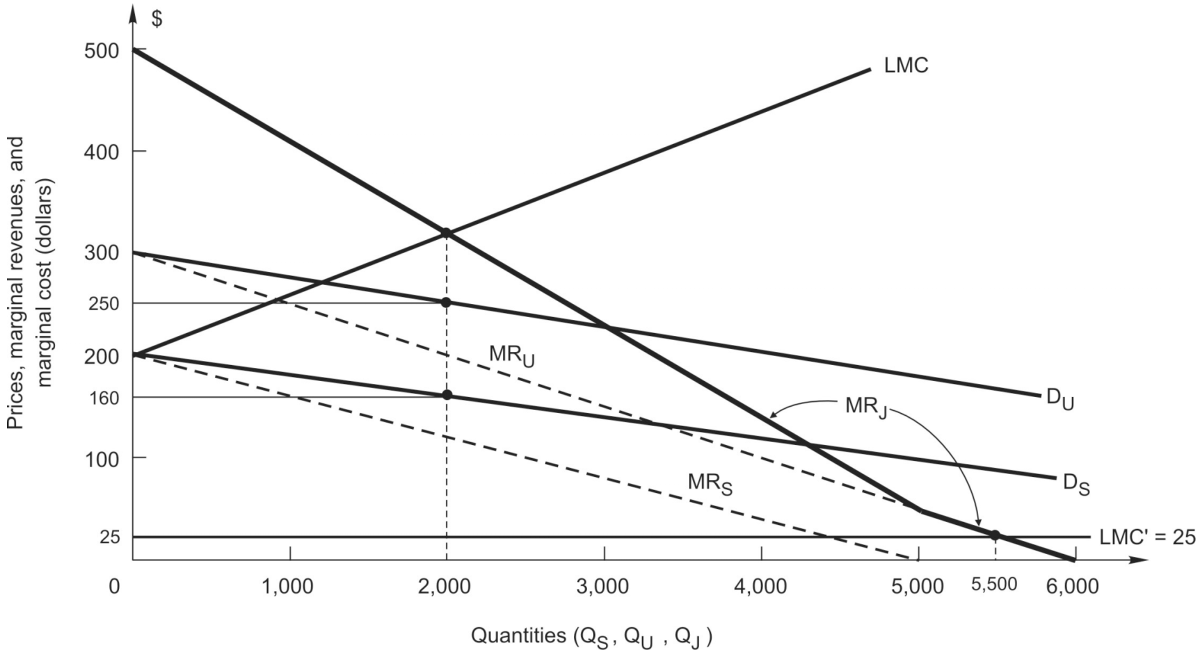
$$P_U^* = 300 - 0.05 \times 2{,}000 = \$162.50$$

The associated total revenues are

$$TR_S^* = \$100 \times 5{,}000 = \$500{,}000$$

$$TR_U^* = \$162.50 \times 5{,}500 = \$893{,}750$$

$$TR_{total} = TR_S^* + TR_U^* = \$1{,}393{,}750$$



7. a. \$7,500 (this value is given in the problem); *SMC* (Recall that when short-run costs are constant, *SMC* = *AVC* and when long-run costs are constant, *LMC* = *LAC*); \$200 (= *TFC*/*Q* = \$51,000/255); *ATC* = \$7,700 (= *AVC* + *AFC*)

b. \$9,625 (= 1.25 × *ATC* = 1.25 × \$7,700) ; \$490,875 [=(*P* – *ATC*)*Q* = (\$9,625 – \$7,700) × 255]

c. $P = 16{,}000 - 25Q$

d. $MR = 16{,}000 - 50Q$

e. $Q^* = 170$ bits per quarter ($MR = SMC \Rightarrow 16{,}000 - 50Q = 7500 \Rightarrow Q^* = 170$)

f. $P^* = \$11{,}750$ ($= 16{,}000 - 25 \times 170$) ; higher than

g. \$671,500 [$= (P^* - AVC)Q^* - TFC = (11{,}750 - 7{,}500) \times 170 - 51{,}000$]

h. Since cost-plus pricing does NOT generally result in profit-maximization, the profit using the *MR* = *MC* approach will be higher because it gives the best possible profit outcome.

MULTIPLE CHOICE / TRUE-FALSE

1. a $MR_f = 50(100 - [(-1)(0) - 2(50)(-2)]f = 5,000 - 200f$

2. b $MC_f = 20[50(-1) + 50(-2)] = -3,000$

3. c Setting $MR_f = MC_f$ and solving for f^* $\Rightarrow f^* = \$40$. The optimal access charge is equal to the consumer surplus of one of the nighttime buyers: $A^* = .5 \times 60 \times (\$100 - \$40) = \$1,800$.

4. d With the user fee set at \$40, daytime buyers each purchase 120 units and the nighttime buyers each purchase 60 units. This will generate total usage fees of \$360,000. A total of 100 access charges will be received, which adds another \$180,000 to total revenue, and so TR = \$540,000. Total variable cost is \$180,000, because 9,000 units will be produced and sold at a unit variable cost of \$20. So, profit is \$110,000 (= \$540,000 – \$180,000 – \$250,000)

5. a Yes, since the profit of serving only the daytime buyers is \$70,000, which is \$40,000 less profit than setting A^* and f^* to serve both daytime and nighttime buyers.

6. e MR_T (which you must derive via horizontal summation) equals MC at $Q = 25$

7. b $MR_T = 0.20 = MR_A = MR_B$ when $Q_A = 10$ and $Q_B = 15$

8. c Reading off D_A and D_B: $P_A = \$0.40$ and $P_B = \$0.50$

9. a See footnote 9, page 591 of your textbook.

10. a $MR_X = 36 - 0.005Q_X - 0.01Q_Y = 22 + 0.015Q_X = MC_X$

    $MR_Y = 45 - 0.025Q_Y - 0.03Q_X = 12 + 0.005Q_Y = MC_Y$

    Solving for optimal outputs: $Q_X^* = 300$ units and $Q_Y^* = 800$ units

11. d $P_X^* = 36 - 0.0025(300) - 0.01(800) = \$27.25$

    $P_Y^* = 45 - 0.0125(800) - 0.03(300) = \$26.00$

12. c MRP_T = 2,000 at 10 hours per day (You must construct total marginal revenue product by horizontal summations of MRP_A and MRP_B.)

13. d $MRP_A = MRP_B = 2,000$ at $H_A = 4$ hours per day and $H_B = 6$ hours per day.

14. a $MRP_A = MRP_B = 1,000$ at $H_A = 5$ hours per day and $H_B = 8$ hours per day.

15. d $MRP_R = 1,800 - 200H_R$ and $MRP_D = 2,000 - 100H_D$. $MRP_T = 1,933.33 - 66.67H_T$

    Setting $MRP_T = MC \Rightarrow H_T^* = 14$.

16. b At $H_T^* = 14$, $MRP_T^* = 1,000$. Set $MRP_R = MRP_D = 1,000$ and solve for H_R^* and H_D^*

    $H_R^* = 9\text{ M} - 0.005 \times 1,000 = 4$

    $H_D^* = 20 - 0.1 \times 1,000 = 10$

17. a $Q_R^* = 2H_R^* = 2 \times 4 = 8$ road bikes per week

    $Q_D^* = 4H_D^* = 4 \times 10 = 40$ dirt bikes per week

18. c $P_R^* = 900 - 25 \times 8 = \$700$

    $P_D^* = 500 - 3.125 \times 40 = \$375$

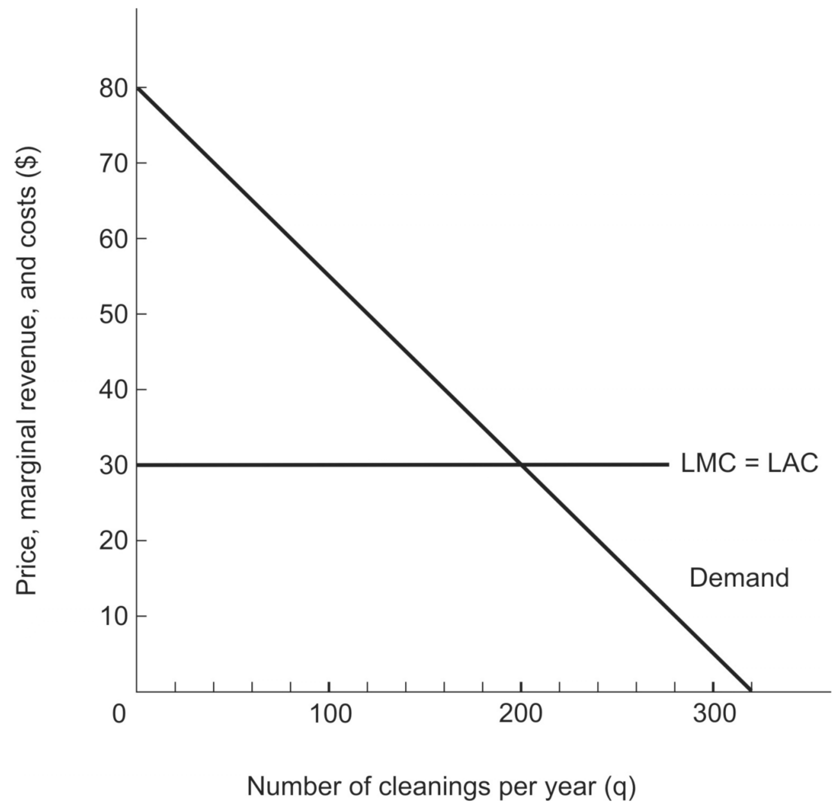
19. e Both *b* and *c* are *practical* problems with cost-plus pricing. Choice *a* cannot be correct because fixed costs do not matter in making optimal pricing decisions.

20. d Both a and b are theoretical problems with cost-plus pricing.

Homework Exercises

1. Marvel Cleaning Service, Inc. is a firm that specializes in cleaning business offices, and Marvel enjoys a monopoly position because it is the only firm allowed to provide cleaning service at the TechCenter industrial office park – the monopoly is believed to enhance security. There are 25 equal-sized offices in TechCenter, each one leased to a different company. TechCenter is closed 45 days a year (Sundays plus official federal holidays), which limits the demand for Marvel's cleaning services to a maximum of 320 cleanings per year for each one of the 25 companies leasing offices.

   Marvel believes it faces an identical demand by each one of the 25 businesses in TechCenter. This demand curve is shown below. Marvel's costs are constant and equal to $30 per office cleaning.



The owner of Marvel Cleaning Service is considering three types of pricing: (1) uniform pricing, (2) first-degree price discrimination, and (3) block pricing with three pricing blocks.

a. If Marvel practices uniform pricing, it will charge $________ for an office cleaning and will face a quantity demanded from each of the 25 identical firms of __________ cleanings per year. At TechCenter, Marvel's total profit per year is $__________(i.e., the sum of the profits from the 25 businesses in TechCenter). Each one of the businesses enjoys $____________ of consumer surplus under uniform pricing.

b. If Marvel can practice first-degree price discrimination, it will collect total revenue from each firm in at TechCenter of $_________. Under perfect price discrimination, Marvel will be hired to clean each office _________ times per year, and Marvel will earn total annual profit of $_____________ (i.e., the sum of the profits from the 25 businesses in TechCenter). Each one of the businesses enjoys $____________ of consumer surplus under perfect price discrimination.

c. If Marvel employs block pricing by choosing three pricing blocks –\$60, \$40, and \$20– the total expenditure by each business can be expressed as follows:

$$
\begin{aligned}
TE(q) &= \$\underline{\quad\quad} + \$60q && \text{for } q \le \underline{\quad\quad} \quad \text{(Block 1)}\\
&= \$\underline{\quad\quad} + \$40(q - \underline{\quad\quad}) && \text{for } q \le \underline{\quad\quad} \quad \text{(Block 2)}\\
&= \$\underline{\quad\quad} + \$20(q - \underline{\quad\quad}) && \text{for } q \le \underline{\quad\quad} \quad \text{(Block 3)}
\end{aligned}
$$

Under this three block pricing plan, each of the businesses in TechCenter will buy ______ cleanings per year. The total expenditure by each business is $__________, and Marvel will earn total annual profit of $_____________ (i.e., the sum of the profits from the 25 businesses in TechCenter). Each one of the businesses enjoys $____________ of consumer surplus under this block-pricing plan.

2. Dr. Rogers takes a managerial economics course at Feenix College of International Business Strategy and learns that cost-plus pricing is the best way to ensure that she earns a "desirable" or "reasonable" level of profit. She decides that her skills as a pediatric physician should earn 75% as much as the costs of providing health care services, so she chooses a markup of 75% on her average total costs.

Dr. Rogers, a respected pediatric physician, has a reputation for being one of the best "baby and kid doctors" in the area. Dr. Rogers enjoys a rather substantial degree of market power in this market. A marketing research firm has estimated the demand for her work as a linear function of the price she decides to charge:

$$Q = 600 - 0.5P$$

where Q is the number of pediatric examinations performed each month, and P is the average price of a pediatric exam. Her accountant tells her that her average variable costs are constant and equal to \$240 per exam. Her total fixed cost each month is \$36,000 per month.

a. Derive the inverse demand for Dr. Rogers's pediatric exams.

$P =$ ______________________________

b. Derive the marginal revenue for Dr. Rogers's pediatric exams.

$MR =$ ______________________________

Currently Dr. Rogers has a full schedule of patients and enjoys a waiting list each month of about 25 patients who cannot get in to see her. She plans her work schedule to work 20 days per month and to see 20 patients per work day, which allows her to see 400 patients per month. Currently, she charges a price (on average) of \$350 per patient.

c. Explain why Dr. Rogers currently experiences a waiting list of 25 patients each month.

d. Currently, Dr. Rogers's costs to service 400 patients per month are

$AVC = \$\_\_\_\_\_\_\_\_$, $AFC = \$\_\_\_\_\_\_\_\_$, and $ATC = \$\_\_\_\_\_\_\_\_$

The doctor's monthly profit is $______________.

e. As previously mentioned, Dr. Rogers decides to begin setting her price using a 75 percent markup on her current average total costs (use *ATC* from part *d*):

$m = \_\_\_\_\_\_\_\_$ and $P = \$\_\_\_\_\_\_\_\_$

f. The doctor computes her expected profit from her decision to begin implementing cost-plus pricing by using the cost-plus price (computed in part *e* above), and she (incorrectly) believes she will continue to see 400 patients each month after implementing the cost-plus price in part *e*. By treating 400 patients, she predicts her profit will be $_____________ per month. Her actual profit when she implements the price in part *e* will be $_____________, which is less than the amount she expects. Explain why.

g. Dr. Rogers, while happy that cost-plus pricing has improved her profits, is troubled by her profit shortfall. She picks up a copy of Thomas and Maurice's *Managerial Economics* text, and, after reading Chapter 12, she applies the $MR = MC$ rule to find her profit-maximizing price, number of patients, and profit:

$P^* = \$\_\_\_\_\_\_\_\_$, $Q^* = \_\_\_\_\_\_\_\_$, and maximum profit = $____________

h. Explain why her implementation of cost-plus pricing in part *e* failed to maximize her profit.

3. Good-Looking Pants, Inc. sells designer jeans in the United States and Europe. For 2008, Good-Looking has estimated its demand functions in both markets to be

United States:	$Q_{US} = 80{,}000 - 1{,}000P_{US}$
Europe:	$Q_E = 40{,}000 - 666.67P_E$

The estimated marginal cost of producing jeans in 2008 is

$$MC = 12.5 + 0.0005Q$$

a. The inverse demand functions and marginal revenue functions are

$P_{US} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$ $\qquad P_E = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$

$MR_{US} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$ $\qquad MR_E \;\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$

b. The total marginal revenue function for Good-Looking Pants is

$MR_T = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$

c. The manager of Good-Looking Pants will maximize the firm's profit by producing ______________ pairs of designer jeans in 2008.

d. Profit is maximized by splitting the total output of jeans between U.S. buyers and European buyers in the following way:

Q_{US} = ____________ pairs of jeans

Q_E = ____________ pairs of jeans

e. The profit-maximizing price of a pair of Good-Looking jeans is $_________ in the United States and $_________ in Europe.

f. The ______________ (higher, lower) price must be charged to the buyer in the more elastic market. Compute the point elasticities of demand in both markets at the prices set in part *d* in order to verify your answer.

E_{US} = _______

E_E = _______