CHAPTER 9

MONOPOLISTIC COMPETITION AND OLIGOPOLY

Chapter Outline

I. Monopolistic Competition: A Case of Many Firms
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Chapter Summary

Questions

1. Product differentiation enables an individual firm in a monopolistically competitive industry to have some control over price.

2. The oligopoly firm with a kinked demand curve believes that if it raises price to a level above that at which the kink occurs, no other firms in the industry will follow with corresponding price increases. However, if the firm were to lower price to a level below that at which the kink occurs, it believes all other firms in the industry would respond with price cuts. The monopolistically competitive firm believes that no other firms in the industry will respond if it changes price. However, most firms in a monopolistically competitive industry tend to raise or lower prices at about the same time. Thus, the monopolistically competitive firm usually does not perceive its true or actual demand curve, at least according to the Chamberlin theory.

3. Some examples of monopolistically competitive industries would probably include car washes, beauty salons, restaurants, and printing shops. Entry into the industry is relatively easy in each case and products are differentiated.

4. The models generate different conclusions because they have different assumptions regarding the behavior of the firms. Chamberlin and the price leadership theory both argue that firms recognize their mutual interdependence and settle on an industry price. However, the Chamberlinian result of a monopoly price is not always obtained in cases of price leadership.

5. An oligopolistic firm in this situation would charge a different price if its marginal cost curve intersected its marginal revenue curve at an output level different from that corresponding to the kink.

6. Probably so. General Motors has at times supplied as much as 50 to 60 percent of the automobiles produced domestically and sold in the U.S., and it retains a leadership position in the industry.

7. Industry output should be allocated among the firms in a cartel so that the marginal cost for each firm is equal to industry marginal revenue and marginal cost at the optimal level of industry output. Because one or more firms are economically or politically more powerful than the others and may, therefore, successfully demand a larger share of the market than would be economically optimal for the industry as a whole, the cartel might choose to do otherwise.

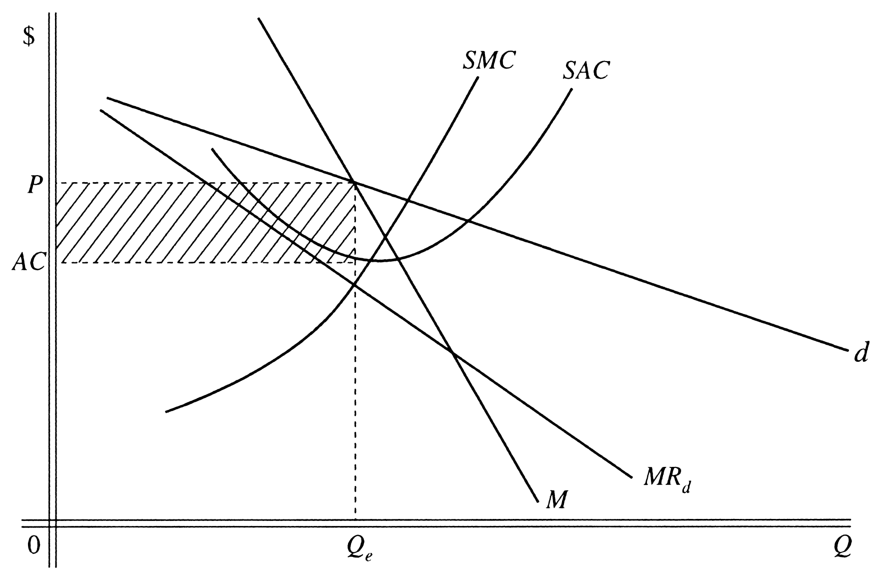
8. Entry into a monopolistically competitive industry is relatively easy. Therefore, when firms in this type of industry are making economic profits, other firms enter and drive down the price. In an oligopolistic industry, there are substantial barriers to entry, thus preventing the entrance of many firms.

9. A price war often develops when an individual gasoline station lowers price, whereas other service stations will not necessarily follow a price increase.

10. The dominant firm estimates the quantities that the small firms would supply at each possible price, assuming that they behave as purely competitive firms, accepting the price which it sets as a “given” and producing where $P = MC$ (as long as price is greater than average variable cost). The demand curve for the dominant firm can then be obtained by subtracting the aggregate quantity supplied by the small firms at each price from the total quantity demanded in the market at the corresponding price.

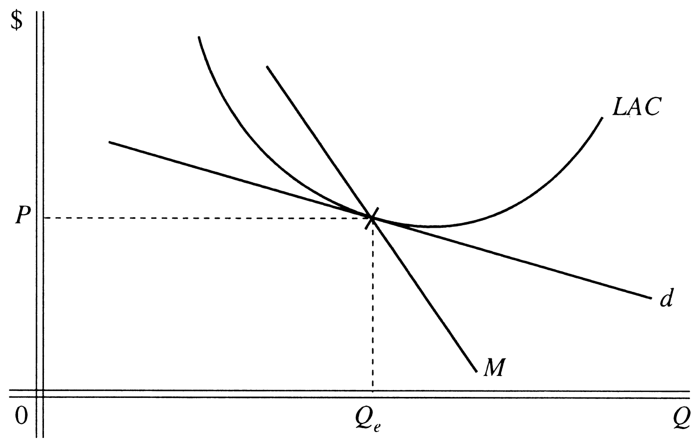
Problems

1. **(a.–c.)**



The intersection of M with d must occur at the same quantity where $SMC = MR_d$.

2.



The above diagram is the correct one for the long run. In the given diagram, d intersects the LAC curve, indicating that the firm's managers believe that lowering price will yield $\pi > 0$. The d curve must be tangent to LAC in order to have a stable long-run situation.

3.

$$Q_K = 5{,}000 - 25{,}000P_K$$
$$-25{,}000P_K = Q_K - 5{,}000$$
$$P_K = -.00004Q_K + .2$$

$TR_K = P_K(Q_K) = (-.00004Q_K + .2)Q_K = -.00004Q_K^2 + .2Q_K$

Total revenue is maximized where $MR_K = MC = 0$.

Since MR_K will have twice the negative slope of P_K,

$$MR_K = -.00008Q_K + .2 = 0$$
$$-.00008Q_K = -.2$$
$$Q_K = 2{,}500$$

a. $P_K = -.00004(2{,}500) + .2$
$P_K = -.1 + .2 = \$.10$

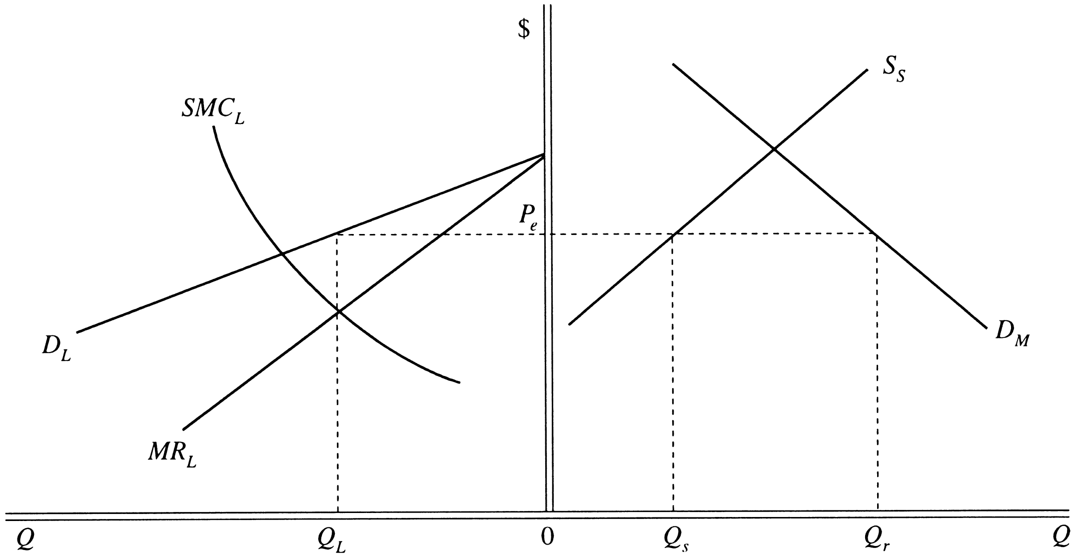
b. Under the Cournot assumption, the two firms together will produce 2/3(Q*), where $P_K = 0$ at Q*. At $P_K = 0$,

$$-.00004Q_K + .2 = 0$$
$$-.00004Q_K = -.2$$
$$Q_K = 5{,}000$$

Total quantity produced = (2/3)(5,000) = 3,333 units, approximately. Each firm will produce (l/2)(3,333) = 1,667 units, approximately. The price will be $P_K = -.00004(3{,}333) + .2 = \$-.13 + \$.20 = \$.07$. Revenue of each firm = \$.07(1,667) = \$116.69.

c. Yes, if the firms were to cooperate and each produce one-half the monopoly output (where TR is maximized, at $Q = 2{,}500$ units). Thus, each firm should produce 1,250 units at a price of \$.10. Total revenue for each firm is \$1,250(\$.10) = \$125, an increase of \$8.31 for each firm.

4. **(a.–c.)** The completed diagram follows.



Note that $OQ_L = OQ_T - OQ_S$.

5. $Q_M = 81{,}000 - 200P$

$Q_s = 1{,}000 + 50P$

$MC_L = 100 + .014Q$

The large firm's demand function is given by $Q_M - Q_s$:

$Q_L = 81{,}000 - 200P - 1{,}000 - 50P$

$Q_L = 80{,}000 - 250P_L$

The large firm will maximize profit where $MR_L = MC_L$.

$Q_L = 80{,}000 - 250\,P_L$

$-250P_L = Q_L - 80{,}000$

$P_L = -.004Q_L + 320$

$TR_L = (-.004Q_L + 320)Q_L$

$$MR_L = \frac{dTR_L}{dQ_L} = -0.008Q_L + 320$$

When $MR_L = MC_L$, $-\ .008Q_L + 320 = 100 + .014Q_L$

$-.022Q_L = -\ 220$

$Q_L = \underline{\underline{10{,}000}}$ units

$P_L = -.004(10{,}000) + 320$

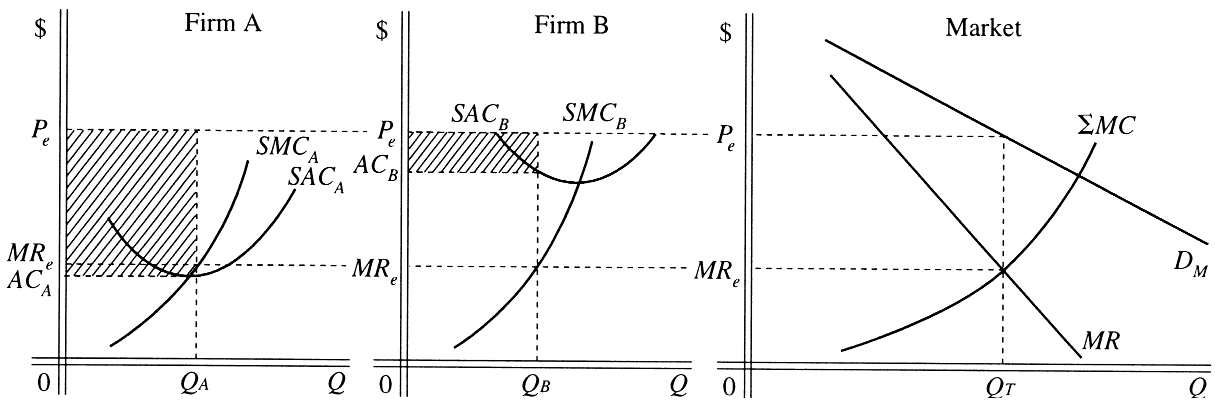
$P_L = -40 + 320 = \$280$

a. $P_L = \underline{\underline{\$280}}$

b. $Q_L = \underline{\underline{10{,}000}}$ units

c. $Q_s = 1{,}000 + 50(280) = \underline{\underline{15{,}000}}$ units

6. The completed diagrams follow.



a. The market price is P_e.

b. The quantity sold by Firm A is OQ_A; that sold by Firm B is OQ_B.

c. The total profits of the cartel are the two shaded areas. Note that $OQ_A + OQ_B = OQ_T$

7. From the given demand curve and profit-maximizing price we have a total cartel output of $Q = 200{,}000 - 4{,}000(37.5) = 50{,}000$. The marginal revenue curve for the given demand curve is $MR = 50 - .0005Q$. At $Q = 50{,}000$, the MR will be 25. Setting each member's MC equal to 25 yields the following outputs, which sum to 50,000.

$Q_1 = 23/.001 = \underline{\underline{23{,}000}}$

$Q_2 = 23.1/.0012 = \underline{\underline{19{,}250}}$

$Q_3 = 15.5/.002 = \underline{\underline{7{,}750}}$.

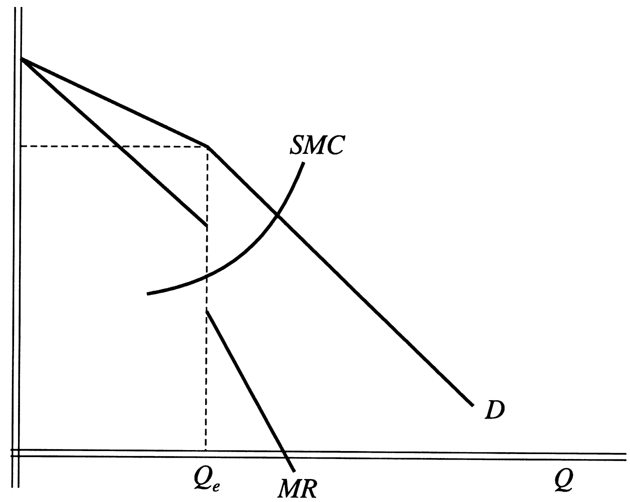
8. **a.**

MR	*Q*	*P*	*TR*	*TVC*	*AVC*	*AFC*	*SMC*
	0	120	0	0	–	–	
115							60
	10	115	1150	600	60	60.00	
105							20
	20	110	2200	800	40	30.00	
95							10
	30	105	3150	900	30	20.00	
85							22
	40	100	4000	1120	28	15.00	
75							38
	50	95	4750	1500	30	12.00	
65							90
	60	90	5400	2400	40	10.00	
55							110
	70	85	5950	3500	50	8.57	
45							130
	80	80	6400	4800	60	7.50	
35							240
	90	75	6750	7200	80	6.67	

b. $Q_e = \underline{\underline{50}}$. Beyond the 50 output level, $SMC > MR$.

c. $P_e = \underline{\underline{\$95}}$. $T\pi = (TR - TC) = 4{,}750 - 1{,}500 - 600 = \underline{\underline{\$2{,}650}}$.

9. The completed diagram follows. Note that for prices above the one at the kink *MR* is a line that bisects any horizontal line drawn between the flat portion of *D* and the vertical axis. For prices below the one at the kink, *MR* bisects any horizontal line drawn between the vertical axis and the steep portion of *D*. There is a gap in *MR* at Q_e. For the firm to wish to remain at price P_e and quantity Q_e requires that *SMC* pass through the gap. That way, for quantities less than Q_e, $MR > MC$, while for quantities greater than Q_e, $MR < MC$. (We have not shown *SAC* or *AVC* below. However, operation at Q_e would require that $P_e > AVC$.)



10. Profit maximization or loss minimization at $Q > 0$ for this firm will require three conditions: (1) that its demand and market share curves intersect where P = \$400, (2) that $SMC = MR$ at the output value consistent with $P = \$400$, and (3) that $P \geq AVC$.

For the first condition, we have $5{,}000 - 10P = 3{,}000 - 5P$. Solving, we obtain $5P = 2{,}000$, and $P = \$400$. For the second condition, we first substitute $P = 400$ into the demand curve equation, $Q = 5{,}000 - 10P$, and obtain $Q = 1{,}000$. From the demand curve, $P = 500 - 0.1Q$, and $MR = 500 - 0.2Q$. Thus, $MR = 500 - 200 = 300$. We compare this with marginal cost at $Q = 1{,}000$. $SMC = 100 + 0.2Q = 300$. Thus, $SMC = MR$, and the firm is maximizing profit (minimizing loss) *if* its *AVC* is covered.

Note: Some students may observe that since SMC is the derivative of *TVC*, which has no constant term, the equation for *TVC* must be $TVC = 100Q + 0.1Q^2$. Therefore, $AVC = TVC/Q = 100 + 0.1Q$. At $Q = 1{,}000$, $AVC = 200$. Since $P = 400$, the firm definitely should operate.

11. To answer this problem it is first necessary to determine the range of the gap in *MR* that occurs at the quantity value where the demand curve is kinked. There, $1{,}400 - 20P = 800 - 10P$. $10P = 600$, $P = 60$, and, by substitution into either demand curve equation, $Q = 200$.

For the more elastic portion of the demand curve, at output equal to 200, $P = 70 - .05Q$, and $MR = 70 - 0.1Q = 50$. For the less elastic portion of the demand curve, $P = 80 - 0.1Q$, and $MR = 80 - 0.2Q = 40$. Therefore, *MC* must be between 40 and 50 at $Q = 200$ in order for the firm to rationally choose that output. However, $MC = 60$, so the firm should raise price even though rivals will not follow.

To find the correct quantity and price, set the *MR* equation for the more elastic portion of the demand curve equal to the *MC* of 60. (This will be the demand curve with the lowest price and *MR* intercept.) Thus, $70 - 0.1Q = 60$, and $Q = \underline{\underline{100}}$. $P = 70 - .05Q = \underline{\underline{\$65}}$. (In this case, we know the firm should operate since the constant *MC* is also *AVC*, and the price of \$65 exceeds the *AVC* of \$60.)

C1. $Q = 25{,}000 - 2{,}000P$
$AVC = \$5$

a. Profit will be maximized where $MR = MC$. Since AVC is constant, $AVC = MC = \$5$.

$$Q = 25{,}000 - 2{,}000P$$
$$-2{,}000P = Q - 25{,}000$$
$$P = -.0005Q + 12.5$$
$$\text{TR} = \text{P}(Q) = (-.0005Q + 12.5)(Q) = -.0005\,Q^2 + 12.5Q$$
$$\text{MR} = \frac{dTR}{dQ} = -.001Q + 12.5$$

At the profit-maximizing output,

$$-.001Q + 12.5 = 5$$
$$-.001Q = -7.5$$
$$Q = \underline{\underline{7{,}500}} \text{ homes}$$
$$P = -.0005Q + 12.5 = -3.75 + 12.5 = \underline{\underline{\$8.75}}$$

b.

Total revenue = \$8.75(7,500)	= \$65,625
Less: Total cost = \$12,000 + 5(7,500)	= \$49,500
Total profit = $TR - TC$	= \$16,125

c.

$$Q' = 22{,}000 - 2{,}000P$$
$$-2{,}000\text{P} = Q' - 22{,}000$$
$$\text{P} = -.0005Q' + 11$$
$$\text{TR} = \text{P}(Q') = (-.0005Q' + 11)Q' = -.0005Q'^2 + 11Q'$$
$$MR = \frac{dTR}{dQ'} = -.001Q' + 11$$

Profit is maximized where $MR = MC$:

$$-.001Q' + 11 = 5$$
$$-.001Q' = -6$$
$$Q' = \underline{\underline{6{,}000}}$$
$$P = -.0005Q' + 11 = -.0005(6{,}000) + 11 = \underline{\underline{\$8.00}}$$

d. Profit in Part c is found as follows:

Total revenue = \$8.00(6,000)	= \$48,000
Less: Total cost = \$12,000 + 5(6,000)	= \$42,000
Total profit	= \$6,000

Total profit with the original demand curve and \$5,000 per month additional advertising expenditures would be the total profit in Part b less \$5,000 or

$\$16{,}125 - 5{,}000 = \underline{\underline{\$11{,}125}}$

Thus, profit is decreased by \$5,125 when advertising expenditures are cut by \$5,000.

e. Restore advertising expenditure to its original level.

C2. This problem illustrates the situation faced by an oligopolistic firm with a kinked demand curve.

$Q = 700 - 50P$ demand curve above kink

$-50P = Q - 700$

$P = -.02Q + 14$

$TR = P \cdot Q = (-.02Q + 14)Q$ above the kink

$MR = \dfrac{dTR}{dQ} = -.04Q + 14$ above the kink

$Q' = 200 - 10P$ below the kink

$-10P = Q' - 200$

$P = -.1Q' + 20$

$TR = P \cdot Q' = (-.1Q' + 20)Q'$ below the kink

$MR = \dfrac{dTR}{dQ'} = -.2Q' + 20$ below the kink

To find the profit-maximizing level of output, we first find the level of output at which the kink occurs, obtained by substituting $P = \$12.50$ into either of the following demand functions:

$Q = 700 - 50(12.50) = 700 - 625 = 75$

or $Q' = 200 - 10(12.50) = 200 - 125 = 75$.
We must also locate both the upper and lower values of MR at this point:
$MR = -.04Q + 14 = 11$ upper value
$MR' = -.2Q' + 20 = 5$ lower value

a. With a marginal cost of \$8, profit is maximized at $Q = 75$ units and $P = \$12.50$ (\$8 is between $MR = \$11$ and $MR' = \$5$).

b. A marginal cost of \$11.50 will equal MR at a level of output less than 75 units, so we must use the upper MR function to solve for the profit-maximizing level of output (where $MR = MC$).

$MR = -.04Q + 14 = 11.50$

$-.04Q = -2.50$

$Q = \underline{\underline{62.5 \text{ or approximately } 62 \text{ units of output}}}$

$P = -.02Q + 14 = -.02(62) + 14 = -1.24 + 14 = \underline{\underline{\$12.76}}$.

C3. a. $MR = 160 - Q_x$

$SMC = 40 - 3Q_x + Q_x^2$

Where $MR = SMC$, $160 - Q_x = 40 - 3Q_x + Q^2_x$; $Q^2_x - 2Q_x - 120 = 0$.

Factoring, we obtain $(Q_x + 10)(Q_x - 12) = 0$,

$Q_x = -10$ or $Q_x = 12$, so $\underline{\underline{12}}$ is the correct root.

$AR = P = 160 - 6 = 154$

b. $T\pi = 154(12) - 500 - 40(12) + 1.5(12)^2 - 1/3(12)^3$
$= 1{,}848 - 500 - 480 + 216 - 576 = \underline{\underline{\$508}}$.

C4. a. This is a kinked demand curve, and the kink is located by solving for the intersection of the two given linear demand curves:

$400 - 4P = 250 - 2P$

$2P = 150$; and $P = \underline{\underline{75}}$.

Therefore, $Q = 400 - 4P = 400 - 300 = \underline{\underline{100}}$.

Also, $Q = 250 - 2P = 250 - 150 = \underline{\underline{100}}$.

b. Here one must determine whether MC will pass though the gap in MR that results from the kink in the demand curve. Let MR_u be the upper MR and MR_L the lower. From the demand curve $Q = 400 - 4P$, we have the following:

$P = 100 - 0.25Q$, and $MR_u = 100 - 0.5Q$.

At $Q = 100$, $MR_u = 100 - 50 = 50$

From the demand curve $Q = 250 - 2P$, we have:

$P = 125 - 0.5Q$ and $MR_L = 125 - Q$

At $Q = 100$, $MR_L = 125 - 100 = 25$.

For the given STC, $MC = 20 + 0.2Q$ and at $Q = 100$, thus $MC = 20 + 20 = 40$. Since the MC value lies within the gap between $MR = 25$ and $MR = 50$, the firm will maximize profit (min. loss) at $Q = 100$ and $P = 75$. This assumes, of course, that $P > AVC$, which is true in this case ($75 > 30$).

c. Now $MC = 30 + 0.5Q$ which at $Q = 100$ is $30 + 50 = 80$. Since 80 is greater than 50, the value of MR_u at the kink, the firm will maximize profit (min. loss) at a quantity lower than 100. The relevant MR will be MR_u. Thus,

$MC = MR_u$; $30 + 0.5Q = 100 - 0.5Q$

$Q = 70$; and $P = 100 - 0.25(Q) = 100 - 17.50 = \underline{\underline{\$82.50}}$.

Profit will be greater than normal, since

$(TR - STC) = 70(82.50) - 60 - 30(70) - 0.25(70)^2$

$= 5{,}775 - 60 - 2{,}100 - 1{,}225 = 2{,}390$.

C5. a. The firm is a dominant price leader, and its demand curve is found by subtracting the small firms' supply curve from the market demand curve. Let quantity demanded for the large firm be Q_L. Thus,

$Q_L = 7{,}520 - 75P - 120 - 25P = 7{,}400 - 100P$, and $P = 74 - 0.01Q_L$. It follows that $MR_L = 74 - 0.02Q_L$ and that the large firm will maximize profit where its own MC equals MR_L. Thus,

$8 + 0.002Q_L = 74 - 0.02Q_L$;

$0.022Q_L = 66$, and $Q_L = \underline{\underline{3{,}000}}$.

$P = 74 - 0.01Q_L = 74 - 30 = \underline{\underline{\$44}}$.

b. $Q_S = 120 + 25(44) = \underline{\underline{1{,}220}}$. Note also that $Q_d = 7{,}520 - 75(44) = 4{,}220$, which is the sum of the smaller firms' quantity supplied and that of Aqualor.

c. For Aqualor, $TR = 3{,}000(44) = \$132{,}000$. Its total cost is $TC = 85{,}000 + 8(3{,}000) + 0.001(3{,}000)^2 = \$118{,}000$. So, profit will be $\underline{\underline{\$14{,}000}}$.

C6. a. Starcom has a kinked demand curve. From the given demand curve equations ($Q = 3{,}000 - 20P$ for price increases and $Q = 1{,}800 - 10P$ for price decreases) we obtain current price and quantity:

$3{,}000 - 20P = 1{,}800 - 10P$; $1{,}200 = 10P$; $P = \underline{\underline{\$120}}$.

By substitution into either demand curve, $Q = \underline{\underline{600}}$.

b. For this section and the next one, we must determine the upper and lower limits of the gap in MR at $Q = 600$. From the demand curve for price increases, $P = 150 - .05Q$ while $MR = 150 - .1Q$, and from that for price decreases, $P = 180 - .1Q$ while $MR = 180 - .2Q$. Substituting 600 for Q into the MR equations yields

Upper limit of gap: $MR = 150 - 60 = \$90$;

Lower limit of gap: $MR = 180 - 120 = \$60$.

From the given cost function, $MC = 3 + .1Q = \$63$ when $Q = 600$. This value lies within the gap, so Starcom is maximizing profit.

c. For the new cost function, $MC = 7 + .16Q = \$103$ when $Q = 600$. This is above the upper limit of the MR gap, so we must set the new MC equal to the MR curve for price increases:

$7 + .16Q = 150 - .1Q$; $.26Q = 143$; $Q = \underline{\underline{550}}$.

Substituting into the relevant demand curve,

$P = 150 - .05Q = 150 - .05(550) = \underline{\underline{\$122.50}}$.

Finally,

$T\pi = 122.50(550) - 20{,}000 - 7(550) - .08(550)^2$
$= 67{,}375 - 20{,}000 - 3{,}850 - 24{,}200 = \underline{\underline{\$19{,}325}}$.

C7. For the given demand curve, $P = 38 - .01Q$, and $MR = 38 - .02Q$. If the correct price is \$29, then:
$29 = 38 - .01Q$; $Q = 9/.01 = 900$.
We can now calculate the relevant MR and set it equal to the MC for each plant to determine the allocation.

$MR = 38 - .02Q = 38 - .02(900) = 20$.

$MC_A = 10 + .02Q_A = 20$; $Q_A = 10/.02 = \underline{\underline{500}}$.

$MC_T = 8 + .03Q_T = 20$; $Q_T = 12/.03 = \underline{\underline{400}}$.

C8. Since Ajax knows that lowering price will precipitate a price war and, therefore, an inelastic response in quantity, this answer turns on the relation between the firm's MC at the \$82 price and the MR from the price increase demand curve. For that demand curve, $Q = 1{,}260 - 10P$, so that $P = 126 - 0.1Q$ and $MR = 126 - 0.2Q$. Substituting $P = \$82$ into the Q equation yields

$Q = 1{,}260 - 10(82) = 440$.

At this quantity, $MR = 126 - 0.2(440) = 38$. From the given total cost function, $STC = 10{,}000 + 34Q$, short-run marginal cost is $SMC = 34$. Since $MR > SMC$ and lowering Q does not affect SMC but causes MR to rise, profit will only *fall* if price is raised. Also, since there is an implied discontinuity in the demand curve (kink at $P = 82$, $Q = 440$) and cutting price will produce an inelastic quantity response, a price decrease will yield $MR < 0$. This also will reduce profit, so \$82 is the optimal price.

Note: that some students may set the marginal revenue equation for the price increase demand curve equal to the SMC of 34. This will yield $Q = 460$ and $P = 80$, an incorrect answer since the given demand curve does not apply to prices below \$82.