Chapter 9

Perfectly Competitive Markets

Solutions to Problems

9.1 The accounting costs are

Supplies	$25,000
Employee Salaries	$170,000
Total Accounting Cost	$195,000

Accounting profit = Revenue – Accounting Cost = $250,000 - $195,000 = $55,000

The economic costs are

Supplies	$25,000
Employee Salaries	$170,000
Opportunity cost of land	$100,000
Total Economic Cost	$295,000

Economic profit = Revenue – Economic Cost = $250,000 - $295,000 = - $45,000

The negative economic profit indicates that the owners would be better off by $45,000 if they shut down the shop and rent out the land.

9.2 . She would be better off by $120,000 if she worked as a lawyer.

9.3 The table is as follows:

Output (Units)	Total Revenue (($/unit)	Total Cost ($/unit)	Profit ($)	Marginal Revenue ($/unit)	Marginal Cost ($/unit)
0	0	30	-30	50	
1	50	80	-30	50	50
2	100	100	0	50	20
3	150	130	20	50	30
4	200	172	28	50	42
5	250	226	24	50	54
6	300	296	4	50	70

When the firm is producing a positive amount of output, profit is maximized when Q = 4, regardless of the fixed cost. The firm will produce another unit when MR > MC, and cut back production when MR < MC. The relationship between MR and MC is unaffected by fixed cost.

9.4 The table is as follows:

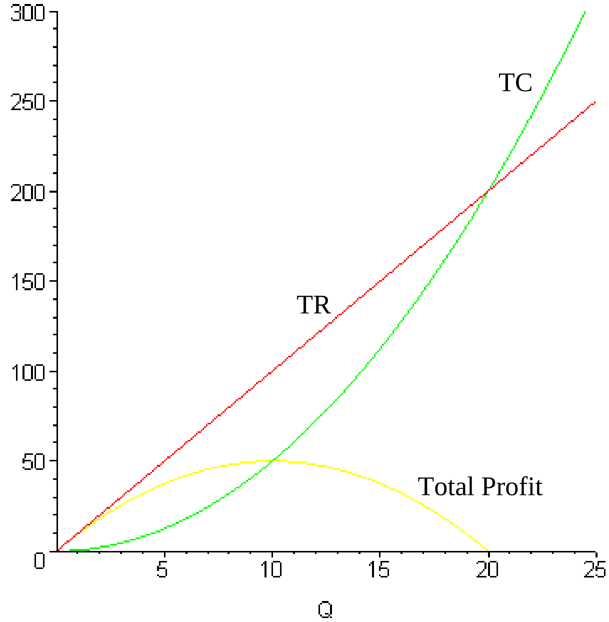
Q	TC	TVC	AFC	AC	MC	AVC
1	**200**	80	120	200	80	80
2	220	**100**	60	110	20	50
3	240	120	40	80	**20**	40
4	360	**240**	30	90	120	60
5	500	380	**24**	100	140	76
6	**660**	540	20	110	**160**	90

The firm should produce 5 units. (Up to that level of output $P > MC$, but $P < MC$ for the sixth unit.) Profit = $PQ - C$ = 150(5) – 550 = 250.

9.5 If the firm operates at a point where its SRAC curve is rising, it must mean that the SRMC curve lies above the SRAC curve. And since the firm will choose an output such that price=SRMC, it means that price is greater than SRAC. Therefore the firm is earning positive economic profit.

9.6 a) Since the firm is producing in a perfectly competitive market, the firm views the output price as exogenous. It should produce up to the point at which $P = SMC(Q)$, that is, so that $10 = Q$. So it should produce 10 units of output.

b) The graph is shown below.



The total cost function increases in Q, and at an increasing rate. Total Profit at first increases in Q and then decreases. From the graph, it appears that Profit is maximized when Q is about 10, which we found in (a).

9.7 Producer surplus equals revenue less all non-sunk costs. Thus:

Producer surplus = 200 – 160 = 40

The non-sunk costs of 160 include the variable cost of 120 and the non-sunk fixed cost of 40.

Profit = Revenue minus all costs = 200 – 120 – 60 – 40 = –20.

To decide whether to operate or shut down, the firm should look at producer surplus (rather than profit). Producer surplus (40) shows how much better off he would be operating (with a profit = –20) than shutting down (with a profit = –60). So he should stay in business in the short run; he will lose money, but not as much as if he were to shut down.

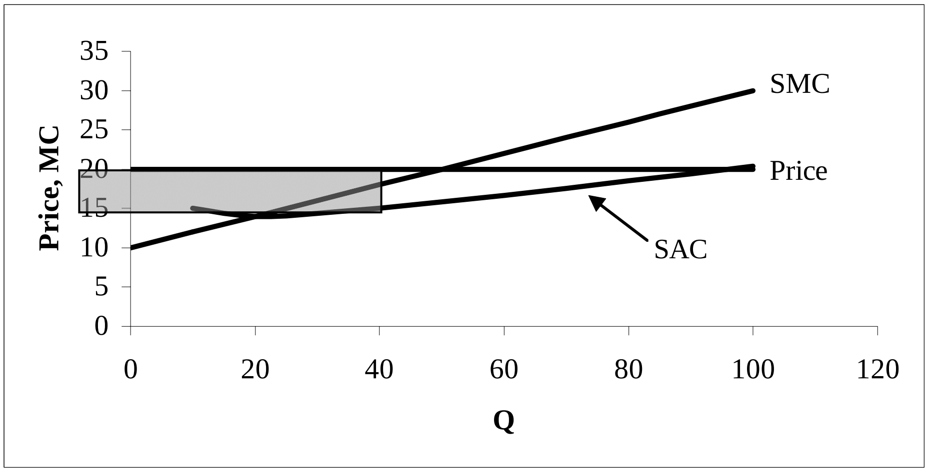
9.8 a) In order to maximize profit Ron should operate at the point where $P = MC$.

$$20 = 10 + 0.20Q$$
$$Q = 50$$

b) Ron's profit is given by $\pi = TR - TC$.

$$\pi = 20(50) - (40 + 10(50) + 0.10(50)^2)$$
$$\pi = 210$$

c) The firm's profit is equal to the shaded area in the graph below. It is a rectangle whose height is the market price and the average cost of the 50th unit, and whose width is the 50 units being produced.



d) If all fixed costs are sunk, then *ANSC* = *AVC* = $(10Q + 0.1Q^2)/Q = 10 + 0.1Q$. So the first step is to find the minimum of *ANSC* by setting *ANSC* = *SMC*, or $10 + 0.1Q = 10 + 0.2Q$ which occurs when $Q = 0$. The minimum level of *ANSC* is thus 10. For prices below 10 the firm will not produce and for prices above 10, its supply curve is found by setting $P = SMC$:

$$P = 10 + .2Q$$
$$Q = 5P - 50$$

The firm's short-run supply curve is thus

$$s(P) = \begin{cases} 0 & \text{if } P < 10 \\ 5P - 50 & \text{if } P \geq 10 \end{cases}$$

e) If all fixed costs are non-sunk, as in this case, then *ANSC* = *ATC* = $(40/Q) + 10 + 0.1Q$. The minimum point of *ANSC* occurs where *ANSC* = *SMC*:

$$\frac{40}{Q} + 10 + .1Q = 10 + .2Q$$
$$Q = 20$$

The minimum level of *ANSC* is thus 14. For prices below 14 the firm will not produce and for prices above 14, its supply curve is found by setting $P = SMC$ as before.

$$s(P) = \begin{cases} 0 & \text{if } P < 14 \\ 5P - 50 & \text{if } P \geq 14 \end{cases}$$

9.9 a) First, find the minimum of AVC by setting $AVC = SMC$.

$$AVC = \frac{TVC}{Q} = \frac{Q^2}{Q}$$
$$AVC = Q$$

$$Q = 2Q$$
$$Q = 0$$

The minimum level of AVC is thus 0. When the price is 0 the firm will produce 0, and for prices above 0 find supply by setting $P = SMC$.

$$P = 2Q$$
$$Q = \tfrac{1}{2}P$$

Thus,

$$s(P) = \tfrac{1}{2}P$$

b) Market supply is found by horizontally summing the supply curves of the individual firms. Since there are 20 identical producers in this market, market supply is given by

$$S(P) = 20s(P)$$
$$S(P) = 10P$$

c) Equilibrium price and quantity occur at the point where $S(P) = D(P)$.

$$10P = 110 - P$$
$$P = 10$$

Substituting $P = 10$ back into $D(P)$ implies equilibrium quantity is $Q = 100$. So at the equilibrium, $P = 10$ and $Q = 100$.

9.10 a) The firm will not produce any output when the price falls below the point where *SMC* = *ANSC*, i.e. the minimum of the *ANSC* curve. Therefore

$50/Q + 40 + 0.5Q = 40 + Q$

This implies $Q = 10$. The corresponding price, below which the firms will not produce, is equal to $MC(10) = ANSC(10) = 50$.

b) Each firm will produce according to the relation, $P = MC$, or $P = 40 + Q$. This means that each firm's supply curve is $Q = P - 40$ if $P \geq 50$ and zero if $P < 50$. Therefore market supply equals $12(P - 40)$ and in equilibrium this must equal market demand, $360 - 2P$. Therefore the equilibrium price is $P = 60$. At this price, each firm produces 20 units of output. The firm's profit is $PQ - V(Q) - F$ and this equals 30. Substituting $Q = 20$ and $P = 60$, we get total fixed costs, $F = 170$. Since non-sunk fixed costs are 50, sunk fixed costs must total up to 120.

9.11 The firm's *ANSC* curve is given by $32/Q + 2Q$. To find the shut-down price, we find the minimum level of *ANSC*. This occurs at the quantity at which *ANSC* equals *MC*, or $32/Q + 2Q = 4Q$. Solving for Q yields $Q = 4$, and substituting this into the expression for *ANSC* tells us that the minimum level of *ANSC* is equal to $32/4 + 2(4) = \$8$. At prices below \$8, a firm's supply is 0. At prices above \$8, a firm produces a quantity at which $P = SMC$: $P = 4Q$, or $Q = P/4$. Thus, the short-run supply curve for a firm is:

$$\boldsymbol{s}(\boldsymbol{P}) = \begin{cases} 0 & \text{if } \boldsymbol{P} < 8. \\ \dfrac{\boldsymbol{P}}{4} & \text{if } \boldsymbol{P} \geq 8 \end{cases}$$

Since there are 60 identical producers, each with this supply curve, the short-run market supply curve $S(P)$ is 60 times $s(P)$, or:

$$\boldsymbol{S}(\boldsymbol{P}) = \begin{cases} 0 & \text{if } \boldsymbol{P} < 8. \\ 15\boldsymbol{P} & \text{if } \boldsymbol{P} \geq 8 \end{cases}$$

To find the equilibrium price, we equate market supply to market demand and solve for P: $15P = 400 - 5P$, or $P = 20$.

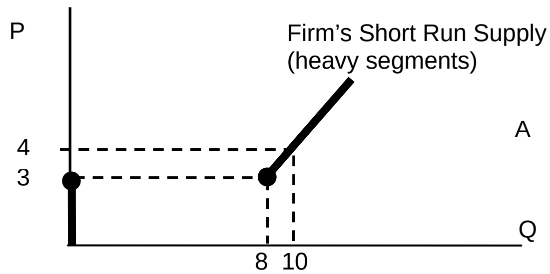
9.12 a) $C = F + 2Q^2$. $MC = 4Q$.
Breakeven price = 40. When P = 40, the firm would produce Q so that MC = P; 40 = 4Q; Q = 10.
Profit = $PQ - F - 2Q^2 = 40(10) - F - 2(10)^2 = 200 - F = 0$. So F = 200.

b) The total nonsunk fixed cost is $NSC = 128 + 2Q^2$.
The firm will shut down if the market price is less than the minimum of ANSC.
$ANSC = (128 + 2Q)^2/Q$.

At minimum of ANSC, we know that ANSC = MC, or that $[128 + 2Q^2]/Q = 4Q$, so the quantity at the shutdown price is Q = 8.
The shutdown price will be where Q = 8; MC = 4Q = 4(8) = 32. So the shutdown price is P = 32.
(Alternatively, you can verify that when Q = 8, then ANSC = 32.)

c) The firm's supply schedule will be Q = 0 when P < 32.
When P > 32, the firm will supply according to the optimal quantity choice rule P = MC; thus P = 4Q, so that Q = 4/P.
When P = 32, the firm will be indifferent between shutting down (Q = 0) or operating with Q = 8.

To summarize, $Q = \begin{cases} P/4 & \text{when } P > 32 \\ 0 & \text{when } P < 32 \\ 0 \text{ or } 8 & \text{when } P = 32 \end{cases}$



d) With 10 firms in the market, total market supply will be 10(P/4) = 2.5P. Market demand is 180 – 2.5P.
In equilibrium 2.5P = 180 – 2.5P, so P = 36 (note: P > 32, so the firms do produce).
e) For profits to be zero, the price would be P = 40, and each firm would produce 40/4 = 10 units.
The quantity demanded in the market would be 180 – 2.5(40) = 80 units. Thus, there is room for only 80/10 = 8 firms.

9.13 Total industry supply is the sum of the supply curves of the individual firms. Since we have 100 type *A* firms, total supply from type *A* firms is $100s_A(P) = 200P$, and since we have 30 type *B* firms, total supply from type B firms is $30s_B(P) = 300P$. The short-run industry supply curve is thus $S(P) = 200P + 300P = 500P$. The short-run market equilibrium occurs at the price at which quantity supplied equals quantity demanded, or $5000 - 500P = 500P$, or $P = 5$. At this price, a type *A* firm supplies 10 units, while a type *B* firm supplies 50 units.

9.14 To determine the quantity supplied for a given price, set $P = SMC$.

$$P = 2Q$$
$$Q = \tfrac{1}{2}P$$

Thus the supply curve for each firm is $s(P) = \frac{1}{2}P$. If each firm is producing 20 units, then

$$20 = \tfrac{1}{2}P$$
$$P = 40$$

So the market price is 40. Substituting into demand reveals

$$D(P) = 240 - \tfrac{1}{2}(40)$$
$$D(P) = 220$$

If each firm is producing 20 units, the market will have $220/20 = 11$ firms.

9.15 Since each firm is earning zero economic profit, we know $P = SAC$. Since each firm supplies where $P = SMC$, set $SAC = SMC$.

$$\frac{400}{Q} + 5 + Q = 5 + 2Q$$
$$Q = 20$$

Since $P = 5 + 2Q$, $P = 45$. If market price is $P = 45$, $D(P) = 240$. Finally, if total market demand is $Q = 240$ and each firm is producing 20 units, there will be $240/20 = 12$ firms in the market.

9.16 If the firm operates at a point where its *SAC* curve is rising, it must mean that the marginal cost curve is above the *SAC* curve. And since the firm must set price=MC, it means that price is greater than average cost. Therefore the firm earns positive economic profit.

If it operates at a point where the *SAC* curve is falling, it means S*MC* < *SAC* and therefore price is less than average cost. Therefore the firm is making negative economic profit in the short run. However, the fact that the firm is still operating means that marginal cost must be above the average non-sunk cost curve, so that it is better for the firm to continue operating, albeit at a loss, than to shut down.

9.17 Given a market price P, the firm will produce from each plant so that MC = P.
The profit maximizing quantity supplied at plant 1 will be $2Q_1 = P$, or $Q_1 = P/2$.
The profit maximizing quantity supplied at plant 2 will be $4Q_2 = P$, or $Q_2 = P/4$.
The quantity supplied by the whole firm will $Q_{Firm} = Q_1 + Q_2$. Thus $Q_{Firm} = 3P/4$.
So 1/3 of the firm's total production will come from plant 2.

9.18 a) When P <10, only Type B firms will operate, and the market supply will be 4(2P) = 8P.
When P >10, both types of firms will operate, and the market supply will be 4(2P) + 6(-10 + P) = -60 + 14P.
To summarize, the market supply will be $Q_{Market}^{Supply} = \begin{cases} -60+14P, & \text{when } P > 10 \\ 8P, & \text{when } P \leq 10 \end{cases}$
Let's first assume the equilibrium price exceeds 10, so that all firms are producing. If this is true, setting market supply equal to market demand: -60 + 14P = 108 – 10P, so that P = 7; however, the market supply we have used is valid for P>10, but not valid for P = 7.
So the equilibrium price must be less than 10, with only Type B firms producing (and Type A firms not producing).
Setting market supply equal to market demand: 8P = 108 – 10P, so that P = 6.
We have found that in equilibrium, only Type B firms produce, and the equilibrium price is 6.

b) Let's first assume the equilibrium price exceeds 10, so that all firms are producing. If this is true, setting market supply equal to market demand: -60 + 14P = 228 – 10P, so that P = 12; the market supply we have used is valid for P=12. At this equilibrium both types of firms will be producing.

9.19 We know that if a firm produces positive output, it produces where P=SMC. In this case, when the firm produces positive output, $Q = 3P - 30$, or $P = \frac{Q}{3} + 10$. This means that the equation of the firm's short run marginal cost is $SMC(Q) = \frac{Q}{3} + 10$.

9.20 a) When the supply curve is vertical at a positive quantity, the quantity supplied is unresponsive to price, and the price elasticity of supply is equal to 0 (supply is perfectly inelastic).

b) When the supply curve is horizontal at a positive quantity, price elasticity of supply is infinite (supply is perfectly elastic).

c) When the supply curve is a straight line going through the origin, the price elasticity of supply must equal 1. We can this as follows. The equation of a straight line supply curve through the origin takes the form $Q = aP$, where a is the slope of the supply curve. Thus $\Delta Q/\Delta P = a$. The price elasticity of supply is equal to $(\Delta Q/\Delta P)(P/Q) = a(P/Q) = a(P/aP) = 1$.

9.21 As with example 9.4 in the text, we can estimate the slope of the supply curve as

$$\frac{\Delta Q}{\Delta P} = \frac{4,000,000 - 3,800,000}{1.00 - 0.20}$$
$$\text{Slope} = 250,000$$

Elasticity can then be estimated as

$$\varepsilon_{Q,P} = \frac{\Delta Q}{\Delta P}\left(\frac{P}{Q}\right)$$
$$\varepsilon_{Q,P} = 250,000\left(\frac{1.00}{4,000,000}\right)$$
$$\varepsilon_{Q,P} = \frac{1}{16}$$

This implies the market supply of roses is quite inelastic.

9.22 The long-run equilibrium price in a perfectly competitive equilibrium equals the minimum level of long-run average cost. This is given as $5 per ton. Each producer supplies a quantity of output equal to the point at which long-run average is minimized. This is given as 2 million tons per year. Market demand at the long-run equilibrium price of $5 per ton is equal to 205 – 5 = 200 million tons per year. This implies that there must be 100 active firms in the long-run equilibrium because (200 million tons per year)/(2 million tons per year per firm) = 100.

9.23 In a long-run equilibrium all firms earn zero economic profit implying $P = AC$ and each firm produces where $P = MC$. Thus,

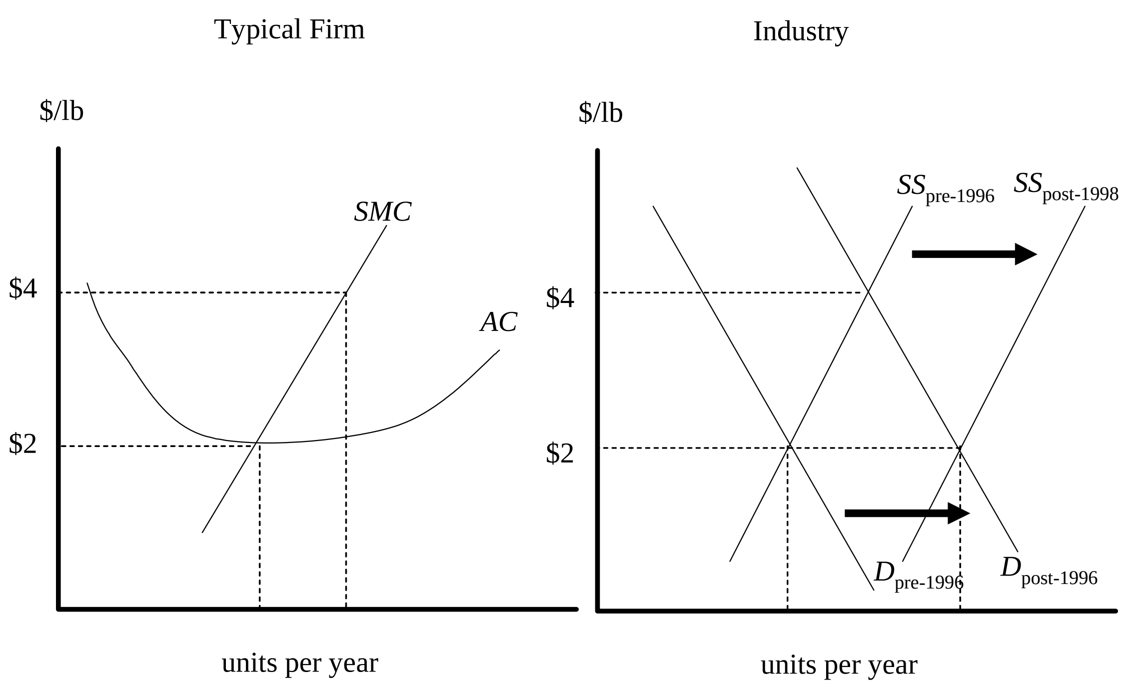
$$40 - 12Q + Q^2 = 40 - 6Q + \tfrac{1}{3}Q^2$$
$$Q = 9$$

So each individual firm produces $Q = 9$, and the long-run equilibrium price must be $P = 40 - 12(9) + 9^2 = 13$. Since $D(P) = 2200 - 100P$,

$$D(P) = 2200 - 100(13)$$
$$D(P) = 900$$

If each firm produces 9 units, the market will have 100 firms in equilibrium.

9.24 The scenario described in the problem can be explained as a constant-cost perfectly competitive industry that experienced an increase in demand (i.e., rightward shift in the demand curve) in early 1996 as shown in the figure below. The price between 1990-1995 reflects a market that is in long-run equilibrium. The increase in price in early 1996 reflects the movement to a short-run equilibrium following the increase in demand. Once price stabilizes at the new short-run equilibrium, firms earn positive economic profits, which attracts new entry. As new entry occurs during 1997 and 1998, the short-run supply curve shifts rightward, causing price to fall. Entry is no longer profitable once price is reestablished at the minimum level of long-run average cost for a typical firm. As a result of the increase in demand, the market now contains more active producers in 2002 than it did in 1990.



9.25 For this total cost function, $MC = c$. Since each firm will supply where $P = MC$, in equilibrium $P = c$. If in equilibrium $P = c$,

$$D(P) = a - bc$$

Equilibrium market quantity is $a - bc$.

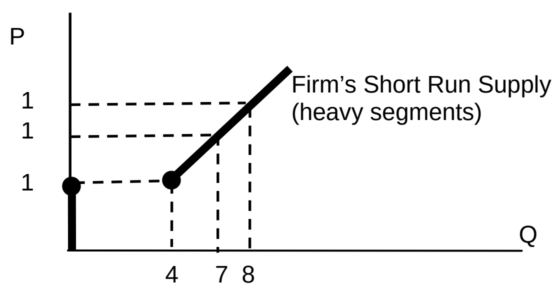
In order to determine the number of firms we need to know the quantity that each individual firm will produce. In this case marginal cost is constant implying perfectly elastic supply. Thus, at $P = c$ a firm may produce any quantity. Therefore, the number of firms cannot be determined.

9.26 This statement is true.
Profit = Revenue – Total Cost = Revenue – Nonsunk Cost – Sunk Cost
Producer Surplus = Revenue – Nonsunk Cost
In the long run, there are no sunk costs, so profit is the same as producer surplus.

9.27 a)

Q	1	2	3	4	5	6	7	8
MC	4	6	8	10	12	14	16	18
V	3	8	15	24	35	48	63	80
Prod surplus =PQ– V - 16	4(1)-3 -16 =-15	6(2) – 8 - 16 = -12	8(3) – 15- 16 = -7	10(4) – 24- 16 = 0			16(7) – 63-16 =33	
Profit = PQ – V – 64	4(1) -3 -64 =-63	6(2) – 8 - 64 = -60	8(3) – 15 - 64 = -55	10(4) – 24 - 64 = -48	12(5) – 35 - 64 = -39	14(6) – 48 - 64 = -28	16(7) – 63- 64 = -15	18(8) – 80- 64 = 0

We know that the supply curve for the firm is just the marginal cost curve for all prices greater than the shut down price. At the shut down price: Producer surplus = Revenue – V – $F_{Nonsunk}$ = 0.
$F_{Nonsunk} = F_{Total} – F_{Sunk}$ = 64 – 48 = 16.
Simple calculations from the table show that **the shut down price is P = 10**. If the firm elects to produce when P = 10, it chooses Q so that MC = P, that is, Q = 4.
Producer surplus = Revenue – V – $F_{Nonsunk}$ = 10(4) – 24 – 16 = 0.
The graph of the firm's supply function is as follows. Note that it is the same as the firm's supply function when P > 10.



b) When P = 16, the firm chooses Q so that MC = P, that is, Q = 7.
Producer surplus = Revenue – V – $F_{Nonsunk}$.
Producer surplus = Revenue – V – $F_{Nonsunk}$ = 16(7) – 63 – 16 = 33.

c) Again, calculations from the table show that **the breakeven price is P = 18**.
When P = 18, the firm chooses Q so that MC = P, that is, Q = 8.
Profit = Revenue – V – F_{Total} = 18(8) – 80 – 64 = 0.

9.28 In the short run, as demand increases, price is driven up and firms can earn positive economic profits. In the short run, however, the number of firms is fixed, so total market supply is simply the sum of the supply of each individual firm. In the long run, though, the firms cannot continue to earn positive economic profit. New firms will enter, driving the price back down until economic profit is zero. In a constant cost industry this occurs at the same equilibrium price as prior to the increase in market demand. Thus, in the long run, any quantity will be supplied and the number of firms will adjust so that each firm earns zero economic profit. The primary difference in the derivation then is that in the short run the number of firms is fixed, but in the long run the number of firms will adjust to maintain zero economic profit.

9.29 a) In a long-run competitive equilibrium $P = MC$ and $P = AC$, implying $MC = AC$.

$$\sqrt{wr}(120 - 40Q + 3Q^2) = \sqrt{wr}(120 - 20Q + Q^2)$$
$$Q = 10$$

b) In a long-run competitive equilibrium $P = MC$ so that (with $r = 1$ and $Q = 10$)

$$P = \sqrt{w(1)}(120 - 40(10) + 3(10)^2)$$
$$P = 20\sqrt{w}$$

c) Given demand for labor and setting $r = 1$ and $Q = 10$

$$L(Q, w, r) = \frac{\sqrt{r}\left(120Q - 20Q^2 + Q^3\right)}{2\sqrt{w}}$$
$$L(Q, w) = \frac{100}{\sqrt{w}}$$

d) Given market demand and setting $r = 1$

$$D(P) = \frac{10000}{P}$$
$$Q = \frac{10000}{20\sqrt{w}}$$
$$Q = \frac{500}{\sqrt{w}}$$

e) Since each firm will produce 10 units,

$$N = \frac{500/\sqrt{w}}{10}$$
$$N = \frac{50}{\sqrt{w}}$$

f) From part c), the labor demand for an individual firm is $L(Q,w) = 100/\sqrt{w}$. Overall demand for labor is then

$$\text{Demand for Labor} = \frac{50}{\sqrt{w}}\left(\frac{100}{\sqrt{w}}\right)$$
$$\text{Demand for Labor} = \frac{5000}{w}$$

g) Setting the supply of skilled labor equal to the demand for skilled labor,

$$50w = \frac{5000}{w}$$
$$w = 10$$

h) Plugging $w = 10$ into the solution for price implies $P = 63.25$; plugging $w = 10$ in market demand implies $Q = 158.10$; and plugging $w = 10$ into the solution for the number of firms and rounding down to the nearest integer implies $N = 15$.

i) If

$$D(P) = \frac{20000}{P}$$
$$Q = \frac{20000}{20\sqrt{w}}$$
$$Q = \frac{1000}{\sqrt{w}}$$

The number of firms will be

$$N = \frac{1000/\sqrt{w}}{10}$$
$$N = \frac{100}{\sqrt{w}}$$

Overall labor demand will be

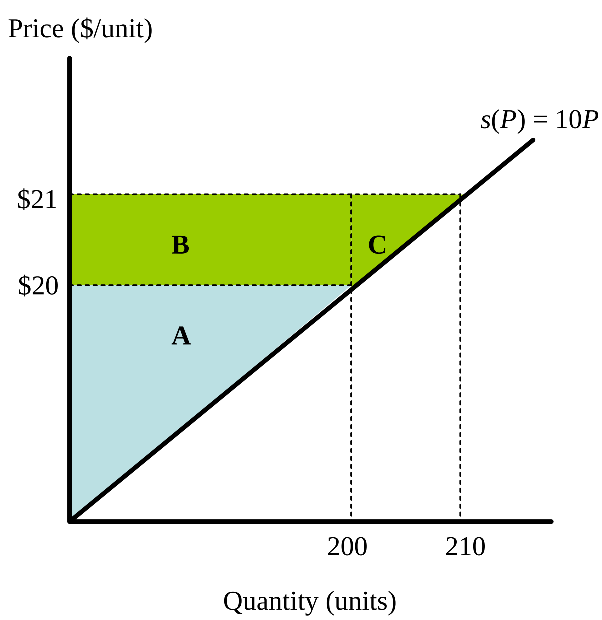
$$\text{Labor} = \frac{100}{\sqrt{w}}\left(\frac{100}{\sqrt{w}}\right)$$
$$\text{Labor} = \frac{10000}{w}$$

Setting the supply of labor equal to the demand for labor implies

$$50w = \frac{10000}{w}$$
$$w^2 = 200$$
$$w = 14.14$$

Plugging $w = 14.14$ into the solution for price implies $P = 75.21$; plugging $w = 14.14$ into market demand implies $Q = 265.92$; and plugging $w = 14.14$ into the solution for the number of firms and rounding down to the nearest integer implies $N = 26$.

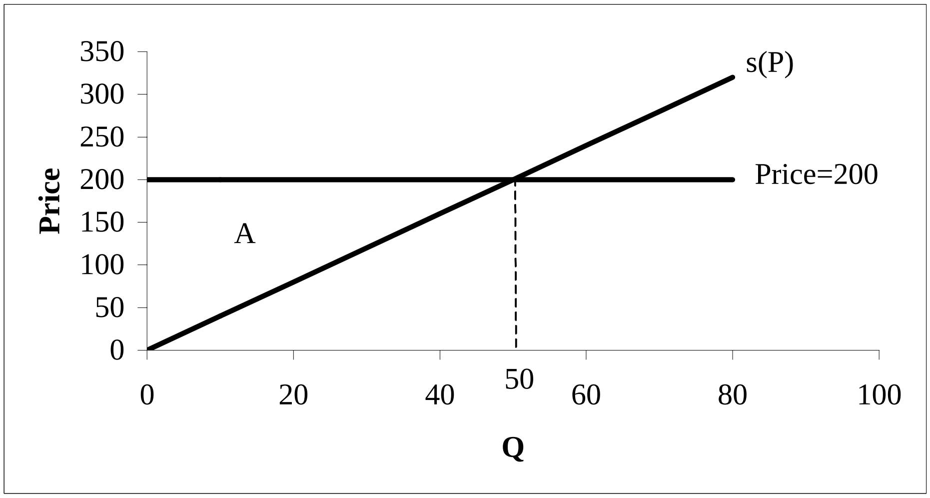
9.30 The solution is shown in the figure below. The producer surplus at a price of $20 is equal to the area of triangle *A*, or (1/2)(20)(200) = $2,000. When the price increases to $21, producer surplus increases by area *B* ($200) plus area *C* ($5), or $205.



9.31 Since an individual firm will supply where $P = SMC$,

$$P = 4Q$$
$$Q = \tfrac{1}{4}P$$

Assuming a firm will supply for any positive price this implies $s(P) = \frac{1}{4}P$. Graphically we have



Producer surplus for an individual firm is given by area A in the figure above which is $\frac{1}{2}(200)50 = 5000$. Since all firms are identical, overall producer surplus will be $100(5000) = 500{,}000$.

9.32 a) Minimum efficient scale occurs at the point where average cost reaches a minimum. This point occurs where $MC = AC$.

$$2Q = \frac{144}{Q} + Q$$
$$Q = 12$$

At $Q = 12$,

$$AC = \frac{144}{Q} + Q$$
$$AC = 24$$

b) In the long-run, the equilibrium price will be determined by the minimum level of average cost for firms with average CEOs. Thus, $P = 24$. At this price, firms having average CEOs will earn zero economic profit and firms with exceptional CEOs will earn positive economic profit.

c) At the price, the firms with an average CEO will produce where $P = MC$

$$24 = 2Q$$
$$Q = 12$$

The firms with an exceptional CEO will also produce where $P = MC$

$$Q = 24$$

d) At this price

$$D(P) = 7200 - 100P$$
$$D(P) = 4800$$

e) Since there are 100 exceptional CEOs and assuming they are all employed, the total supply from exceptional CEO firms will be

$$S_E = 100(24)$$
$$S_E = 2400$$

This leaves $Q = 4800 - 2400 = 2400$ units to be supplied by firms with average CEOs. Thus,

$$N_A = \frac{2400}{12}$$
$$N_A = 200$$

f) To calculate the exceptional CEO's economic rent we must compute the highest salary the firm would pay this CEO. This salary is the amount that would drive economic profit to zero. Call this amount S^*. Since the exceptional CEO firm is producing $Q = 24$, the firm's average cost is

$$AC = \frac{144}{24} + \frac{1}{2}(24)$$
$$AC = 18$$

Since $P = 24$, the exceptional CEO has produced a $6 per unit cost advantage. This implies

$$\frac{S^*}{24} - \frac{144}{24} = 6$$
$$S^* = 288$$

Economic rent is the difference between this salary, $288,000, and the reservation wage of $144,000. Thus, the exceptional CEO's economic rent is $144,000.

g) Firms that hire exceptional CEOs for $144,000 will gain all of the CEO's economic rent and will therefore earn economic profit of $144,000.

h) In a long-run competitive equilibrium, exceptional CEO salaries should be bid up as other firms compete for the exceptional CEOs. This should bid up the salary of the CEOs until economic profits for firms with exceptional CEOs are driven to zero. Thus, exceptional CEO salaries should approach $288,000 in a long-run equilibrium.

