

Answers to the Problems – Chapter 11

1.
 - a. Lin is operating in a perfectly competitive market.
 - b. The equilibrium price is determined by the equilibrium between the market demand and the market supply.
 - c. Lin's marginal revenue equals the market price for a box of cookies.
 - d. Lin will sell no boxes of fortune cookies.
 - e. All buyers will want to buy Lin's cookies, so the demand for Lin's cookies is essentially infinite. More realistically, Lin would probably sell the quantity that maximizes his profit but that profit will be less than if he sells at the going market price of \$10 a box.
 - f. The elasticity of demand for Lin's cookies is infinite. The elasticity of demand in the market for cookies is not infinite.
2.
 - a. Quick Copy's marginal revenue equals the market price so it is 10 cents per page.
 - b. Quick Copy's profit-maximizing quantity is 80 pages an hour.
Quick Copy maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. In perfect competition, marginal revenue equals price, which is 10 cents a page. Marginal cost is 10 cents when Quick Copy produces 80 pages an hour.
 - c. Quick Copy's economic profit is \$2.40 an hour.
Economic profit equals total revenue minus total cost. Total revenue equals \$8.00 an hour (10 cents a page multiplied by 80 pages). The average total cost of producing 80 pages is 7 cents a page, so total cost equals \$5.60 an hour (7 cents multiplied by 80 pages). So economic profit equals \$8.00 minus \$5.60, which is \$2.40 an hour.
3.
 - a. (i) At \$14 a pizza, Pat's profit-maximizing output is 4 pizzas an hour and economic profit is \$10 an hour.
Pat's maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. In perfect competition, marginal revenue equals price, which is \$14 a pizza. Marginal cost is the change in total cost when output is increased by 1 pizza an hour. The marginal cost of increasing output from 3 to 4 pizzas an hour is \$13 (\$54 minus \$41). The marginal cost of increasing output from 4 to 5 pizzas an hour is \$15 (\$69 minus \$54). So the marginal cost of the fourth pizza is half-way between \$13 and \$15, which is \$14. Marginal cost equals marginal revenue when Pat produces 4 pizzas an hour..
Economic profit equals total revenue minus total cost. Total revenue equals \$64 (\$14 multiplied by 4). Total cost is \$54, so economic profit is \$10.
 - (ii) At \$12 a pizza, Pat's profit-maximizing output is 3 pizzas an hour and economic profit is -\$5.
Pat's maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. Marginal revenue equals price, which is \$12 a pizza. Marginal cost of increasing output from 2 to 3 pizzas an hour is \$11 (\$41 minus \$30). The marginal cost of increasing output from 3 to 4 pizzas an hour is \$13. So the marginal cost of the third pizza is half-way between \$11 and \$13, which is \$12. Marginal cost equals marginal revenue when Pat produces 3 pizzas an hour.
Economic profit equals total revenue minus total cost. Total revenue equals \$36 (\$12 multiplied by 3). Total cost is \$41, so economic profit is -\$5.
 - (iii) At \$10 a pizza, Pat's profit-maximizing output is 2 pizzas an hour and economic profit is -\$10.
Pat's maximizes its profit by producing the quantity at which marginal revenue equals marginal cost. Marginal revenue equals price, which is \$10 a pizza. Marginal cost of

increasing output from 1 to 2 pizzas an hour is \$9 (\$30 minus \$21). The marginal cost of increasing output from 2 to 3 pizzas an hour is \$11. So the marginal cost of the second pizza is half-way between \$9 and \$11, which is \$10. Marginal cost equals marginal revenue when Pat produces 2 pizzas an hour.

Economic profit equals total revenue minus total cost. Total revenue equals \$20 (\$10 multiplied by 2). Total cost is \$30, so economic profit is -\$10.

- b. Pat's shutdown point is at a price of \$10 a pizza.
The shutdown point is the price that equals minimum average variable cost. To calculate total variable cost, subtract total fixed cost (\$10, which is total cost at zero output) from total cost. Average variable cost equals total variable cost divided by the quantity produced. For example, the average variable cost of producing 2 pizzas is \$10 a pizza. Average variable cost is a minimum when marginal cost equals average variable cost. The marginal cost of producing 2 pizzas is \$10. So the shutdown point is a price of \$10 a pizza.
 - c. Pat's supply curve is the same as the marginal cost curve at prices equal to or above \$10 a pizza and the y-axis at prices below \$10 a pizza.
 - d. Pat and firms with the same cost as Pat will exit the pizza industry if in the long run the price is less than \$13 a pizza.
Pat's Pizza Kitchen and other firms with the same costs will leave the industry if they incur an economic loss in the long run. To incur an economic loss, the price will have to be below minimum average total cost. Average total cost equals total cost divided by the quantity produced. For example, the average total cost of producing 2 pizzas is \$15 a pizza. Average total cost is a minimum when it equals marginal cost. The average total cost of 3 pizzas is \$13.67, and the average total cost of 4 pizzas is \$13.50. Marginal cost when Pat's produces 3 pizzas is \$12 and marginal cost when Pat's produces 4 pizzas is \$14. At 3 pizzas, marginal cost is less than average total cost; at 4 pizzas, marginal cost exceeds average total cost. So minimum average total cost occurs between 3 and 4 pizzas—\$13 at 3.5 pizzas an hour.
 - e. Pat and firms with the same cost as Pat will enter the pizza industry if in the long run the price is greater than \$13 a pizza.
The reasoning is essentially the reverse of the reasoning behind the answer to part (d). Pat's Pizza Kitchen and other firms with the same costs will enter the industry if they can earn an economic profit. To earn an economic profit, the price will have to be above minimum average total cost. Average total cost equals total cost divided by the quantity produced. For example, the average total cost of producing 2 pizzas is \$15 a pizza. Average total cost is a minimum when it equals marginal cost. The average total cost of 3 pizzas is \$13.67, and the average total cost of 4 pizzas is \$13.50. Marginal cost when Pat's produces 3 pizzas is \$12 and marginal cost when Pat's produces 4 pizzas is \$14. At 3 pizzas, marginal cost is less than average total cost; at 4 pizzas, marginal cost exceeds average total cost. So minimum average total cost occurs between 3 and 4 pizzas—\$13 at 3.5 pizzas an hour.
5. a. The market price is \$8.40 per box of paper.
The market price is the price at which the quantity demanded equals the quantity supplied. The firm's supply curve is the same as its marginal cost curve at prices above minimum average variable cost. Average variable cost is a minimum when marginal cost equals average variable cost. Marginal cost equals average variable cost at the quantity 250 boxes a week. So the firm's supply curve is the same as the marginal cost curve for the outputs equal to 250 boxes or more. When the price is \$8.40 a box, each firm produces 350 boxes and the quantity supplied by the 1,000 firms is 350,000 boxes a week. The quantity demanded at \$8.40 is 350,000 a week.
- b. The industry output is 350,000 boxes a week.

- c. Each firm produces 350 boxes a week.
- d. Each firm incurs an economic loss of \$581 a week.
Each firm produces 350 boxes at an average total cost of \$10.06 a box. The firm can sell the 350 boxes for \$8.40 a box. The firm incurs a loss on each box of \$1.66 and incurs an economic loss of \$581 a week.
- e. In the long run, some firms exit the industry because they are incurring economic losses.
- f. The number of firms in the long run is 750.
In the long run, as firms exit the industry, the price rises. In long-run equilibrium, the price will equal the minimum average total cost. When output is 400 boxes a week, marginal cost equals average total cost and average total cost is a minimum at \$10 a box. In the long run, the price is \$10 a box. Each firm remaining in the industry produces 400 boxes a week. The quantity demanded at \$10 a box is 300,000 a week. So the number of firms is 300,000 boxes divided by 400 boxes per firm, which is 750 firms.
- g. In the long run, the price equals the minimum average total cost, \$10 a box.
- h. In the long run, the 750 firms together produce the equilibrium quantity of 300,000 boxes.
- 5. a. The market price is \$7.65 a box, the equilibrium industry quantity is 300,000 boxes a week, and each firm incurs an economic loss of \$834 a week.
When the price is \$7.65 a box, each firm produces 300 boxes and the quantity supplied by the 1,000 firms is 300,000 boxes a week. The quantity demanded at \$7.65 is 300,000 a week. Each firm produces 300 boxes at an average total cost of \$10.43 a box. The firm can sell the 300 boxes for \$7.65 a box. The firm incurs a loss on each box of \$2.78 and incurs an economic loss of \$834 a week.
- b. In the long run, the market price is \$10.00 a box, the equilibrium industry quantity is 200,000 boxes a week, and each firm makes zero economic profit, that is, earns a normal profit.
In the long run, the price equals the minimum average total cost, which is \$10.00 a box. The quantity demanded at \$10 a box is 200,000 a week.
- c. This industry has constant costs because the cost schedule does not change as the number of firms changes. The long-run supply curve will be horizontal at a price of \$10 per box.
- 6. a. Once at the competitive equilibrium quantity, which is the same as the efficient quantity, the sum of consumer surplus plus producer surplus is as large as possible. So the consumer surplus can be increased but only at the expense of a larger decrease in producer surplus. For instance, a price ceiling set below the equilibrium price forces the price downward and might increase consumer surplus depending on the extent of the decrease in the quantity produced. However, the decrease in producer surplus would be larger than the increase in consumer surplus. In addition, in the long run the price ceiling will lead to exit from the industry so that the quantity supplied decreases even more and the consumer surplus shrinks.
- b. Once at the competitive equilibrium quantity, which is the same as the efficient quantity, the sum of consumer surplus plus producer surplus is as large as possible. So the producer surplus can be increased but only at the expense of a larger decrease in consumer surplus. For instance, a price floor set above the equilibrium price forces the price upward and might increase producer surplus depending on the extent of the decrease in the quantity demanded. However, the decrease in consumer surplus would be larger than the increase in producer surplus.
- c. The consumer is on his or her demand curve and so is making the best possible use of his or her income. Substituting away from this good cannot make the consumer better off.

- d. In the long-run equilibrium, the perfectly competitive firms are producing the good at the lowest possible average total cost, so it is not possible to produce the good from a lower average total cost.

Critical Thinking

1.
 - a. Bee keepers provide identical services (one bee keeper's bees are the same as any other bee keeper's bees), there are many bee keepers, and there are no barriers to entry into or exit from the market. Hence bee keeping is a perfectly competitive market.
 - b. The bee keeper will shut down.
 - c. Bee keeping is afflicted by the Varroa mite, which kills bees. The supply of bees has decreased so the price bee keepers receive for their services has increased. Bee keepers currently earn an economic profit. The economic profit attracts entry, which increases the supply and lowers the economic profit. The economic profit also makes it worthwhile for a bee keeper to incur more costs to keep his or her bees healthy, so bee keepers' average cost curves rise. Eventually the following price from entry and the rising costs from keeping bees healthy eliminate the economic profit so that in the long run bee keepers earn zero economic profit.
 - d. The demand for American-made honey increases. In the short run, the price of American-made honey rises. Bee keepers increase the number of their hives and offer more pollination services. The price of pollination services falls. Bee keepers earn an economic profit. In the long run, entry occurs into the bee keeper market. The supply of honey increases, which increases the equilibrium quantity of honey and drives the equilibrium price of honey downward. The supply of pollination services increases, which increases the equilibrium quantity of pollination services and lowers the equilibrium price of these services. Both of these changes reduce bee keepers' economic profit. Entry continues until all the economic profit is competed away and bee keepers earn zero economic profit.
2. The prices of DVD players and pocket calculators have fallen because of massive technological advances that have been made in producing these products. These advances have lowered the costs of producing these products. In the short run, the firms that made these products and adopt the new technology made economic profits. But in the long run competition has squeezed out the economic profit so that the firms earned zero economic profit, that is, they earned a normal profit.
3. The increase in world population has increased the demand for wheat. The increase in demand raises the price of wheat and individual wheat farmers earn an economic profit. The economic profit, however, leads to entry and new farmers enter the market. The supply of wheat increases, forcing the price down. Entry continues until the price falls enough so that the firms earn zero economic profit, that is, earn a normal profit.
4. The decrease in the U.S. birth rate and the development of disposable diapers have both decreased the demand for diaper services. The price of diaper service fell and the diaper service firms suffered economic losses. Some firms exited the market and the decrease in supply raised the price of diaper service and reduced the surviving firms' economic losses. Eventually enough firms exited the market that the surviving firms earned zero economic profit, that is, earned a normal profit. So the long-run decrease in the quantity of diaper services is larger than the short-run decrease.

Web Activities

1.
 - a. The United States is limiting textile imports to protect the U.S. textile industry, that is, to keep U.S. textile firms open and thereby keep U.S. textile workers employed.
 - b. The textile quotas raise the price of textiles in the United States so that U.S. textile firms earn a larger profit than otherwise. If the student assumes that U.S. textile firms earn an economic profit, the figure for the individual firm should look like Figure 11.4(b) on page 245. If the student assumes that the quotas raise the price so that the firms earn a normal profit, the figure should be similar to Figure 11.4(a). The figure for the textile market will show the supply curve decreasing as a result of the quota so that the consumer surplus shrinks.
 - c. Your students' answers will differ according to their views. Unless they have already studied the chapter on international trade, it is unlikely that the students will mention that the quota has a net negative effect on the U.S. economy.