CHAPTER

5

Supply

CONCEPT REVIEW

Demand is the willingness to buy a good or service and the ability to pay for it.

CHAPTER 5 KEY CONCEPT

Supply is the willingness and ability of producers to offer goods and services for sale.

WHY THE CONCEPT MATTERS

You may not think of yourself as a producer, but you are. You offer your labor when you do chores around the house or work at a part-time job. If you have a car, you sometimes provide transportation for your friends. Also, if you belong to a sports or academic team, you supply your skills and knowledge. List five things that you supply. Then list the costs you incur and the rewards you receive for supplying them. How would your willingness and ability to supply these things be affected if these costs and rewards changed?

Online Highlights

More at ClassZone.com

Economics Update
Go to **ECONOMICS UPDATE** for chapter updates and current news on the use of robots in industry. (See Case Study, pp. 158–159.) ▶

Animated Economics
Go to **ANIMATED ECONOMICS** for interactive lessons on the graphs and tables in this chapter.

Interactive Review
Go to **INTERACTIVE REVIEW** for concept review and activities.

How does the use of robots affect the supply of goods and services? See the Case Study on pages 158–159.

SECTION 1

What Is Supply?

OBJECTIVES

In Section 1, you will

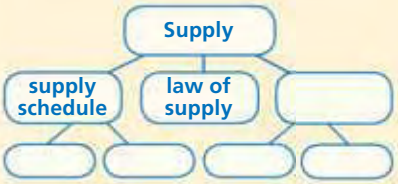
- define *supply* and outline what the law of supply says
- explain how to create and interpret supply schedules
- explain how to create and interpret supply curves

KEY TERMS

supply, *p. 130*
law of supply, *p. 131*
supply schedule, *p. 132*
market supply schedule, *p. 132*
supply curve, *p. 134*
market supply curve, *p. 134*

TAKING NOTES

As you read Section 1, complete a cluster diagram like the one shown using the key concepts and other helpful words and phrases. Use the Graphic Organizer at **Interactive Review @ ClassZone.com**



The Law of Supply

KEY CONCEPTS

In Chapter 4, you learned about the demand side of market interactions and how consumers serve their interests by purchasing the best products at the lowest possible price. You also discovered that there are other factors that change demand at every price. Demand, however, is only one side of the market equation. In this chapter, you will learn about the supply side of the equation in order to understand why producers want to provide products at the highest possible price.

QUICK REFERENCE

Supply is the desire and ability to produce and sell a product.

Supply refers to the willingness and ability of producers to offer goods and services for sale. Anyone who provides goods or services is a producer. Manufacturers who make anything from nutrition bars to automobiles are producers. So, too, are farmers who grow crops, retailers who sell products, and utility companies, airlines, or pet sitters who provide services.

The two key words in the definition of supply are *willingness* and *ability*. For example, the Smith family grows various fruits and vegetables on their small farm. They sell their produce at a local farmers' market. If the prices at the market are too low, the Smiths may not be willing to take on the expense of growing and

Supplying a Service Service providers, such as utility companies, are producers too.

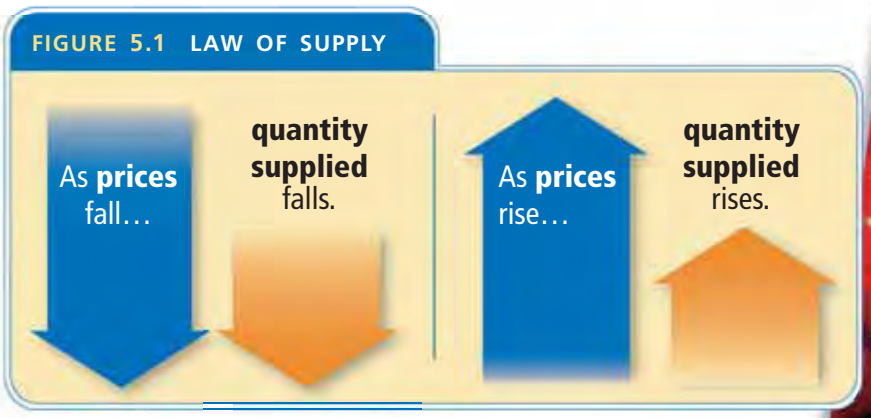
transporting their produce. Also, if the weather is bad and the Smiths' crops of fruits and vegetables are ruined, they will not be able to supply anything for the market. In other words, they will not offer produce for sale if they do not have both the willingness and the ability to do so.

As is true with demand, price is a major factor that influences supply. The **law of supply** states that producers are willing to sell more of a good or service at a higher price than they are at a lower price. Producers want to earn a profit, so when the price of a good or service rises they are willing to supply more of it. When the price falls, they want to supply less of it. In other words, price and quantity supplied have a direct relationship. This relationship is illustrated in Figure 5.1.

QUICK REFERENCE

The **law of supply** states that when prices decrease, quantity supplied decreases, and when prices increase, quantity supplied increases.

FIGURE 5.1 LAW OF SUPPLY



EXAMPLE Price and Supply

Let's take a closer look at how price and quantity supplied are related by returning to the Smiths and their produce business. The Smiths travel to the Montclair Farmers' Market every Wednesday and Saturday to sell a variety of fruits and vegetables—blueberries, peaches, nectarines, sweet corn, peppers, and cucumbers. However, their specialty crop is the tomato. How should the Smiths decide on the quantity of tomatoes to supply to the farmers' market? The price they can get for their crop is a major consideration.

The Smiths know that the standard price for tomatoes is $1 per pound. What quantity of tomatoes will the Smiths offer for sale at that price? They decide that they are willing to offer 24 pounds. What if the price of tomatoes doubled to $2 per pound? The Smiths might decide that the price is so attractive that they are willing to offer 50 pounds of tomatoes for sale on the market. In contrast, if the price fell to 50 cents, the Smiths might decide to supply only 10 pounds. Furthermore, at prices under 50 cents per pound, they may not be willing to supply any tomatoes. Look again at the definition of the law of supply. As you can see, it provides a concise description of how producers behave.

Economics Update

Find an update on farmers' markets at **ClassZone.com**

APPLICATION Analyzing Effects

A. You sell peppers at the Montclair Farmers' Market. If the price of peppers increased from 40 cents to 60 cents each, how would your quantity supplied of peppers change? How would your quantity supplied change if the price decreased to 25 cents?

Supply Schedules

KEY CONCEPTS

A **supply schedule** is a table that shows how much of a good or service an individual producer is willing and able to offer for sale at each price in a market. In other words, a supply schedule shows the law of supply in table form. A **market supply schedule** is a table that shows how much of a good or service all producers in a market are willing and able to offer for sale at each price.

QUICK REFERENCE

A **supply schedule** lists how much of a good or service an individual producer is willing and able to offer for sale at each price.

A **market supply schedule** lists how much of a good or service all producers in a market are willing and able to offer for sale at each price.

EXAMPLE Individual Supply Schedule

A supply schedule is a two-column table that is similar in format to a demand schedule. The left-hand column of the table lists various prices of a good or service, and the right-hand column shows the quantity supplied at each price.

The Smiths' supply of tomatoes can be expressed in a supply schedule (Figure 5.2). How many pounds of tomatoes are the Smiths willing to sell when the price is $1.25 per pound? What if the price is $0.50 per pound? Or $2.00 per pound? Your answers to these questions show that the Smiths' quantity supplied of tomatoes depends on the price.

FIGURE 5.2 THE SMITHS' TOMATO SUPPLY SCHEDULE

	Price per Pound ($)	Quantity Supplied (in pounds)
a →	2.00	50
	1.75	40
	1.50	34
	1.25	30
	1.00	24
	0.75	20
b →	0.50	10

a At the top price of $2.00, the Smiths are willing to sell 50 pounds of tomatoes.

b At $0.50, the Smiths are willing to provide only 10 pounds of tomatoes for sale.

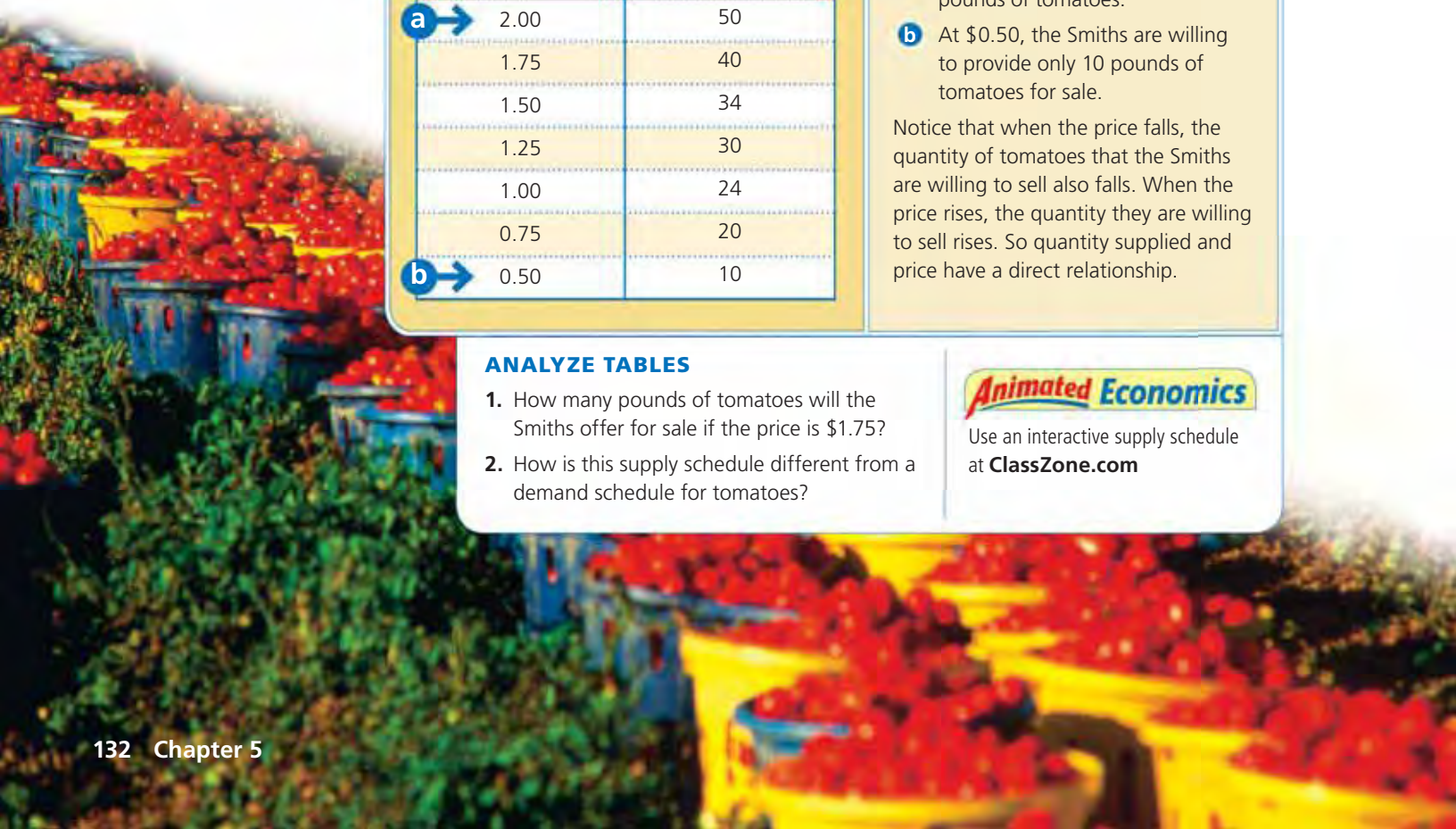
Notice that when the price falls, the quantity of tomatoes that the Smiths are willing to sell also falls. When the price rises, the quantity they are willing to sell rises. So quantity supplied and price have a direct relationship.

ANALYZE TABLES

1. How many pounds of tomatoes will the Smiths offer for sale if the price is $1.75?
2. How is this supply schedule different from a demand schedule for tomatoes?

Animated Economics

Use an interactive supply schedule at **ClassZone.com**



EXAMPLE Market Supply Schedule

The supply schedule in Figure 5.2 shows how many pounds of tomatoes an individual producer, the Smith family, is willing and able to offer for sale at each price in the market. The schedule also shows that, in response to changes in price, the Smiths will supply a greater or lesser number of tomatoes. However, sometimes an individual supply schedule does not provide a complete picture of the quantity of a good or service that is being supplied in a given market. For example, several fruit and vegetable stands at the Montclair Farmers' Market sell tomatoes. If you want to know the quantity of tomatoes available for sale at different prices at the entire farmers' market, you need a market supply schedule. This shows the quantity supplied by all of the producers who are willing and able to sell tomatoes.

Take a look at the market supply schedule for tomatoes in Figure 5.3. Notice that it is similar to the Smiths' supply schedule, except that the quantities supplied are much larger. It also shows that, as with individual quantity supplied, market quantity supplied depends on price.

FIGURE 5.3 TOMATO MARKET SUPPLY SCHEDULE

	Price per Pound ($)	Quantity Supplied (in pounds)
a →	2.00	350
	1.75	300
	1.50	250
b →	1.25	200
	1.00	150
	0.75	100
c →	0.50	50

a At the top price of $2.00, the fruit and vegetable stands will offer 350 pounds of tomatoes for sale.

b At $1.25, the quantity supplied of tomatoes is 200 pounds.

c At the low price of $0.50, the quantity supplied falls to 50 pounds.

So, markets behave in the same way as individual suppliers. As prices decrease, the quantity supplied of tomatoes decreases. As prices increase, the quantity supplied increases.

ANALYZE TABLES

1. How does the quantity supplied of tomatoes change when the price rises from $0.75 a pound to $1.75 a pound?
2. How does this market supply schedule illustrate the law of supply?

In Chapter 4, you learned that Rafael, the owner of Montclair Video Mart, used market research to create a market demand schedule. Market research can also be used to create a market supply schedule. Producers in some markets are able to use research conducted by the government or by trade organizations to learn the prices and quantity supplied by all the producers in a given market.

APPLICATION Applying Economic Concepts

B. Imagine that you own a health food store that sells several brands of nutrition bars. Create a supply schedule showing how many bars you would be willing to sell each month at prices of $5, $4, $3, $2, and $1.

Supply Curves

KEY CONCEPTS

A **supply curve** is a graph that shows how much of a good or service an individual producer is willing and able to offer for sale at each price. To create a supply curve, transfer the data from a supply schedule to a graph. A **market supply curve** shows the data from the market supply schedule. In other words, it shows how much of a good or service all of the producers in a market are willing and able to offer for sale at each price.

QUICK REFERENCE

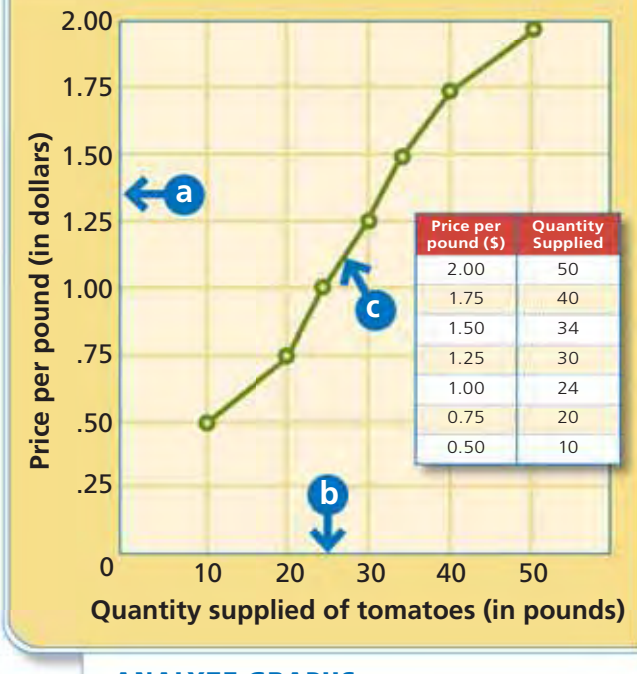
A **supply curve** shows the data from a supply schedule in graph form.

A **market supply curve** shows the data from a market supply schedule in graph form.

EXAMPLE Individual Supply Curve

Study the supply curve (Figure 5.4) created from the Smiths' supply schedule. How many pounds of tomatoes will the Smiths supply at $1.50 per pound? How will the Smiths' quantity supplied change if the price increases or decreases by 25 cents? Find the answers to these questions by running your finger along the curve. As you can see, the supply curve is a graphic representation of the law of supply. When the price increases, the quantity supplied increases; when the price decreases, the quantity supplied decreases. Note that the supply curve in Figure 5.4, and the schedule on which it is based, were created using the assumption that all other economic factors except price remain the same. You'll learn more about these other factors in Section 3.

FIGURE 5.4 THE SMITHS' TOMATO SUPPLY CURVE



Price per pound ($)	Quantity Supplied
2.00	50
1.75	40
1.50	34
1.25	30
1.00	24
0.75	20
0.50	10

Notice that **supply curves** always slope upward from lower left to upper right.

- **a** The vertical axis of the graph shows prices, with the highest at the top.
- **b** The horizontal axis shows quantities supplied, with the lowest on the far left.
- **c** The specific quantities supplied at specific prices listed on the supply schedule are plotted as points on the graph and connected to create the supply curve.

ANALYZE GRAPHS

1. How many pounds of tomatoes will the Smiths offer for sale when the price is $1.50?
2. How does this supply curve illustrate the law of supply?

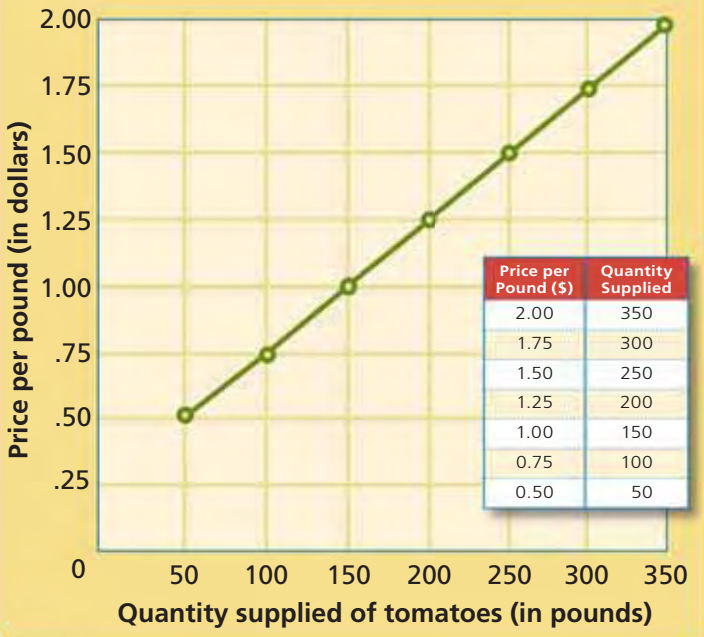
Animated Economics

Use an interactive supply curve at **ClassZone.com**

EXAMPLE Market Supply Curve

Like the Smiths' individual supply curve, the market supply curve for all the stands that sell tomatoes at the Montclair Farmers' Market shows the quantity supplied at different prices. In other words, the graph shows the quantity of tomatoes that all of the producers, or the market as a whole, are willing and able to offer for sale at each price. The market supply curve (Figure 5.5) differs in scope from the Smiths' individual supply curve, but it is constructed in the same way. As in Figure 5.4, the vertical axis displays prices and the horizontal axis displays quantities supplied.

FIGURE 5.5 TOMATO MARKET SUPPLY CURVE



Price per Pound ($)	Quantity Supplied
2.00	350
1.75	300
1.50	250
1.25	200
1.00	150
0.75	100
0.50	50

Notice that **market supply curves** slope upward from lower left to upper right, just as individual supply curves do.

The main difference between the two types of curves is that the quantities supplied at each price are much larger on a market supply curve. This is because the curve represents a group of producers (a market), not just one producer.

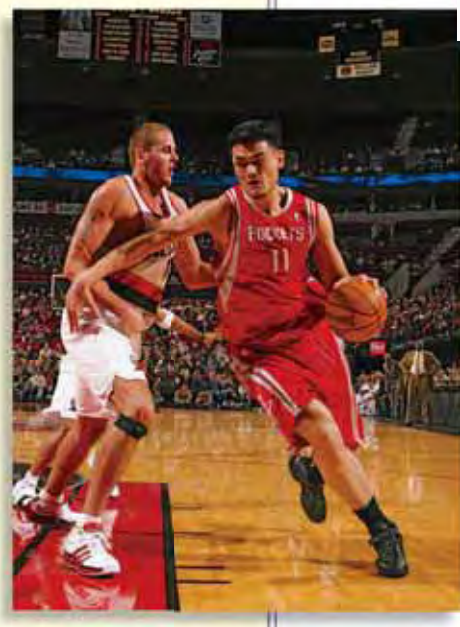
ANALYZE GRAPHS

1. At which price will all the fruit and vegetable stands want to sell 200 pounds of tomatoes?
2. How is the slope of this supply curve different from the slope of a market demand curve?

Look at Figure 5.5 one more time. What is the quantity supplied at $1.50? How will quantity supplied change if the price increases by 25 cents or decreases by 25 cents? Once again, find the answers to these questions by running your finger along the curve. As you can see, the market supply curve, just like the individual supply curve, vividly illustrates the direct relationship between price and quantity supplied. If the price of tomatoes increases among all of the suppliers at the farmers' market, then the quantity supplied of tomatoes also increases. And, conversely, if the price decreases, then the quantity supplied decreases as well. As with the individual supply curve, the market supply curve is constructed on the assumption that all other economic factors remain constant—only the price per pound of tomatoes changes.

A GLOBAL PERSPECTIVE

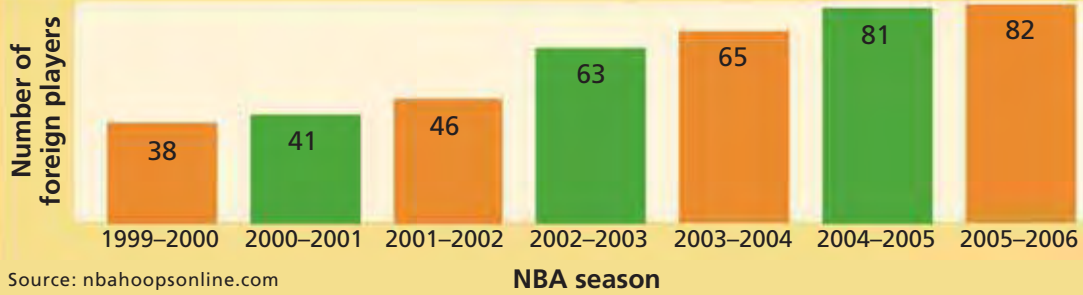
The NBA Goes International



Until recently, nearly all of the National Basketball Association's (NBA) players were U.S-born. Before 1984, there were only 12 foreign-born players in the league, but that has changed. Opening day rosters in the 2005–06 season listed 82 international players, and they hailed from all over the world—from Spain and Slovenia in Europe to Senegal and the Sudan in Africa. Why has the supply of international players risen so dramatically? The average annual salary of an NBA player, which has risen from about $2 million in 1997 to over $4 million in 2006, is a likely explanation.

The international players are not the only group reaping monetary rewards. With people in China watching Yao Ming (at right), and French fans following Tony Parker, the NBA's overseas merchandise sales have increased rapidly. In 2004, the NBA sold an estimated $600 million in merchandise outside of the United States—about 20 percent of its overall merchandise sales.

FIGURE 5.6 INTERNATIONAL PLAYERS IN THE NBA



Source: nbahoopsonline.com

CONNECTING ACROSS THE GLOBE

1. **Synthesizing Economic Information** How do price and quantity supplied relate to salaries and labor in the NBA?
2. **Drawing Conclusions** What effect might a large drop in NBA salaries have on international sales of NBA merchandise?

Supply curves for all producers follow the law of supply. Whether the producers are manufacturers, farmers, retailers, or service providers, they are willing to supply more goods and services at higher prices, even though it costs more to produce more. A farmer, for example, spends more on seeds and fertilizer to grow more soybeans. Why are farmers and other producers willing to spend more when prices are higher? The answer is that higher prices signal the potential for higher profits, and the desire to increase profits drives decision making in the market. You will learn more about the costs of production and about maximizing profits in Section 2.

SMARTGrapher
Create a supply curve at **ClassZone.com**

APPLICATION Applying Economic Concepts

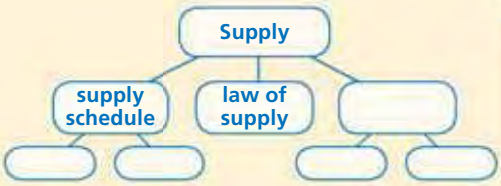
C. Look back at the supply schedule for nutrition bars you created for Application B on page 133. Use it to create a supply curve.

SECTION 1 Assessment

Online Quiz
ClassZone.com

REVIEWING KEY CONCEPTS

1. Explain the differences between the terms in each of these pairs:
   - **a.** *supply* / *law of supply*
   - **b.** *supply schedule* / *supply curve*
   - **c.** *market supply schedule* / *market supply curve*
2. Why does a supply curve slope upward?
3. What do the points on a market supply curve represent?
4. If the price of a video game increased, what would the law of supply predict about the quantity supplied of the game?
5. How is the law of supply similar to the law of demand? How is it different?
6. **Using Your Notes** How is a supply schedule different from a market supply schedule? Refer to your completed cluster diagram. Use the Graphic Organizer at **Interactive Review @ ClassZone.com**



CRITICAL THINKING

7. **Explaining an Economic Concept** Focus on one item you buy regularly for which the price has changed. How did this shift in price influence supply?
8. **Making Inferences** The market supply schedule on page 133 shows that the quantity supplied of tomatoes priced at 50 cents per pound was 50 pounds. However, market research of customers at the farmers' market showed that the market demand at that price was 250 pounds of tomatoes. How do you explain the difference?
9. **Applying Economic Concepts** Return to the supply schedule for nutrition bars you created for Application B on page 133. Assume that the class represents all the sellers of nutrition bars in the market. Tabulate these individual supply schedules to create a market supply schedule. Then use that schedule to draw a market supply curve.
10. **Challenge** Why might producers not always be able to sell their products at the higher prices they prefer? Think about the laws of demand and supply and the different attitudes that consumers and producers have toward price. How might the market resolve this difference? (You will learn more about this in Chapter 6.)

ECONOMICS IN PRACTICE

Making a Market Supply Curve

Suppose that you are the head of the sporting goods dealers' association in your city. You survey all the stores that sell skis and determine how many pairs of skis they are willing to sell at various prices. Your research enables you to make the following market supply schedule.

Price per Pair ($)	Quantity Supplied
500	600
425	450
350	325
275	225
200	150
125	100

Create a Supply Curve Use this market supply schedule to draw a market supply curve. Be sure to label each axis of your graph.

Challenge Write a caption for your supply curve explaining what it shows.

Use SMARTGrapher @ ClassZone.com to complete this activity.

SECTION 2

What Are the Costs of Production?

OBJECTIVES

In Section 2, you will

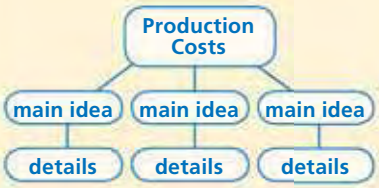
- analyze how businesses calculate the right number of workers to hire
- determine how businesses calculate production costs
- explain how businesses use those calculations to determine the most profitable output

KEY TERMS

marginal product, *p. 138*
specialization, *p. 138*
increasing returns, *p. 139*
diminishing returns, *p. 139*
fixed cost, *p. 140*
variable cost, *p. 140*
total cost, *p. 140*
marginal cost, *p. 140*
marginal revenue, *p. 142*
total revenue, *p. 142*
profit-maximizing output, *p. 143*

TAKING NOTES

As you read Section 2, complete a hierarchy diagram like this one to track main ideas and supporting details. Use the Graphic Organizer at **Interactive Review @ ClassZone.com**



Labor Affects Production

KEY CONCEPTS

Let's look at an individual producer and the costs involved in supplying goods to the market. Janine owns a small factory that produces custom blue jeans. The factory has three sewing machines, and when there are three workers, one day's product is 12 pairs of jeans. She wonders how hiring one more worker will affect production. The change in total product that results from hiring one more worker is called the **marginal product**. With four workers, the factory produces 19 pairs of jeans a day, so the new employee's marginal product is 7 pairs of jeans. With a fifth worker, output jumps from 19 to 29—a marginal product of 10. Why did marginal product increase?

Each of Janine's original three workers had a sewing machine to operate, but they also had to cut cloth, package the finished jeans, and keep the shop clean. So, Janine's employees only spent half of their time sewing. The fourth employee helped with the other tasks, so marginal product increased. But the sewing machines were often still idle. The fifth worker allowed labor to be divided even more efficiently, which caused marginal product to increase markedly. Having each worker focus on a particular facet of production is called **specialization**. But does hiring more workers always cause marginal product to increase?

QUICK REFERENCE

Marginal product is the change in total output brought about by adding one more worker.

Specialization is having a worker focus on a particular aspect of production.

EXAMPLE Marginal Product Schedule

A marginal product schedule shows the relationship between labor and marginal product. As you can see from Janine's marginal product schedule (Figure 5.7), one or two workers produced very little. But marginal product was still slightly larger with each added worker. Then with between three and six workers, the benefits of specialization become increasingly apparent. With up to six employees, Janine's operation experiences **increasing returns**, meaning each new worker adds more to total output than the last, as shown by the marginal product.

QUICK REFERENCE

Increasing returns occur when hiring new workers causes marginal product to increase.

FIGURE 5.7 JANINE'S MARGINAL PRODUCT SCHEDULE

Number of Workers	Total Product	Marginal Product
0	0	0
1	3	3
2	7	4
3	12	5
4	19	7
5	29	10
6	42	13
7	53	11
8	61	8
9	66	5
10	67	1
11	65	−2

a. Four workers can produce 19 pairs of jeans. **Specialization** causes a healthy increase in **marginal product.**

b. With seven workers, total product still increases, but marginal product begins to decrease.

c. With eleven workers, total product decreases, and the marginal product is a negative number.

ANALYZE TABLES

1. At what number of workers is total product highest?
2. On the basis of this table, does it make sense for Janine to hire more than six workers? Explain your answer.

Figure 5.7 shows that increasing returns stop with the seventh worker. This is also related to specialization. Workers seven, eight, nine, and ten can still add to productivity, but their work overlaps with that of the first six workers. With between seven and ten employees, Janine's operation experiences **diminishing returns**, as each new worker causes total output to grow but at a decreasing rate. With eleven workers, total output actually decreases, and Janine experiences negative returns. This may happen as employees become crowded and operations become disorganized. It is rare, however, for a business to hire so many workers that it has negative returns.

QUICK REFERENCE

Diminishing returns occur when hiring new workers causes marginal product to decrease.

APPLICATION Drawing Conclusions

A. Why do Janine's increasing returns peak with six employees?

Production Costs

KEY CONCEPTS

The goal of every business is to earn as much profit as possible. Profit is the money that businesses get from selling their products, once the money it costs to make those products has been subtracted. Businesses have different kinds of costs. **Fixed costs** are expenses that the owners of a business must incur whether they produce nothing, a little, or a lot. **Variable costs** are business costs that vary as the level of production output changes. Businesses find the **total cost** of production by adding fixed and variable costs together. Finally, businesses are interested in knowing their **marginal cost**, or the additional cost of producing one more unit of their product.

QUICK REFERENCE

Fixed costs are those that business owners incur no matter how much they produce.

Variable costs depend on the level of production output.

Total cost is the sum of fixed and variable costs.

Marginal cost is the extra cost of producing one more unit.

EXAMPLE Fixed and Variable Costs

Janine's fixed costs include the mortgage on her factory, her insurance, and the utilities that are on even when the factory is closed at night and on weekends. These costs are the same whether she is producing no jeans, 3 pairs, or 42 pairs of jeans per day. She must also pay the salaries of managers who keep the company running but are not involved directly in production.

Wages are one of Janine's chief variable costs. As she hires additional workers to increase the level of production, her costs for wages increase. She also incurs additional costs for more fabric, thread, zippers, and buttons as well as increased electricity costs to run the machines and light the factory. Shipping her jeans to customers is another variable cost. The more pairs of jeans that Janine's factory produces, the more her variable costs increase. Conversely, if she decides to cut back the hours or the number of workers, or if she closes the factory for a week's vacation, her variable costs decrease.

To determine the total cost to produce a certain number of pairs of jeans, Janine can add her fixed and variable costs. And by figuring out her marginal cost, she can determine what it costs to produce each additional pair of jeans.

EXAMPLE Production Costs Schedule

By looking at Figure 5.8, we can see Janine's costs and how they change as her quantity of jeans produced changes. Remember that her total product increased through the addition of the tenth worker and declined after the eleventh worker was added. The change in the number of workers is a major factor in the increase in variable costs at each quantity. You'll notice that the fixed costs remain the same no matter what the total product amounts to.

FIGURE 5.8 JANINE'S PRODUCTION COSTS SCHEDULE

Number of Workers	Total Product	Fixed Costs ($) (a)	Variable Cost ($) (a)	Total Cost ($)	Marginal Cost ($)
0	0	40	0	40	—
1	3	40	30 (b) →	70	10
2	7	40	62	102	8
3	12	40	97	137	7
4	19	40	132	172	5
5	29	40	172	212	4
6	42	40	211	251	3
7	53	40	277	317	6
8	61	40	373	413	12
9	66	40	473	513	20
10	67	40	503	543	30
11	65	40	539	579	—

(a) **Fixed costs** remain constant, while **variable costs** change at each quantity.

(b) Calculate **total costs** by adding together fixed costs and variable costs.

ANALYZE TABLES

1. How do the variable costs change when the total product increases from 7 pairs to 12 pairs?
2. When Janine has no workers, why are her fixed and total costs the same?

CONNECT TO MATH

To determine marginal cost, divide the change in total cost by the change in total product.

1. In Figure 5.8, total cost with four workers is $172; with three workers it is $137. 172−137=35
2. Total product with four workers is 19; with three workers it is 12. 19−12=7
3. Marginal cost in this case is figured by dividing 35 by 7. 35÷7=5

Marginal cost is determined by dividing change in total cost by change in total product. Notice in Figure 5.8 that marginal cost declines at first and then increases. The initial decline occurs because of increasing worker efficiency due to specialization. After that the marginal cost increases because of diminishing returns.

Janine now knows when her returns are increasing or diminishing and what it costs her to produce each additional pair of jeans. Her next step is to figure out her revenue, the money she makes from selling jeans, at each level of production.

APPLICATION Analyzing and Interpreting Data

B. Why does it cost Janine more to produce 65 pairs of jeans with 11 workers than to produce 66 pairs of jeans with 9 workers?

Earning the Highest Profit

KEY CONCEPTS

QUICK REFERENCE

Marginal revenue is the money made from the sale of each additional unit of output.

Total revenue is a company's income from selling its products.

Before a business can decide how much to produce in order to earn as much profit as possible, it must figure its marginal revenue and total revenue. **Marginal revenue** is the added revenue per unit of output, or the money made from each additional unit sold. In other words, marginal revenue is the price. If, for example, baseball hats were priced at $5 each, the money earned from each additional hat sold would be $5. **Total revenue** is the income a business receives from selling a product. It can be expressed by the formula **Total Revenue = P × Q**, where *P* is the price of the product and *Q* is the quantity purchased at that price. (Recall that you used this same formula to calculate total revenue on page 101.)

EXAMPLE Production Costs and Revenues Schedule

You have seen how Janine explored the relationship between labor and marginal product. You have also seen what it cost her to produce various quantities of jeans. Next, you will learn how she calculates her revenue and her profits.

Look at Figure 5.9, which shows Janine's costs, revenues, and profit for various levels of total product. Janine calculates her total revenue by multiplying the marginal revenue—$20 per pair of jeans—by the total product. Then she can determine her profit by subtracting her total costs from her total revenue. Remember that Janine is trying to decide how many workers she should hire and how many pairs of jeans she should produce in order to make the most profit. To make these decisions, she needs to perform a marginal analysis, which is a comparison of the added costs and benefits of an economic action. In other words, she needs to look at the costs and benefits of adding each additional worker and producing additional pairs of jeans.

Using Figure 5.9, Janine can see that when she has no employees, and therefore does not produce any jeans, she loses money because she still incurs fixed costs. If she hires one worker who produces three pairs of jeans, her costs are $70, but she only collects $60 in total revenue. Therefore, she still doesn't earn a profit. When she hires a second worker and together the two workers produce seven pairs of jeans, costs are $102 and revenues are $140, so she earns a very small profit of $38. Janine has finally passed the break-even point, the point at which enough revenue is being generated to cover expenses. At the break-even point, total costs and total revenue are exactly equal.

Like all business owners, Janine wants to do a lot better than break even. She wants to earn as much profit as possible. She can see that as she adds additional workers and produces more jeans, her profits increase.

FIGURE 5.9 JANINE'S PRODUCTION COSTS AND REVENUES SCHEDULE

Number of Workers	Total Product	Total Cost ($)	Marginal Cost ($)	Marginal Revenue ($)	Total Revenue ($) (a)	Profit ($) (b)
0	0	40	—	—	0	−40
1	3	70	10	20	60	−10
2	7	102	8	20	140 (c)	38
3	12	137	7	20	240	103
4	19	172	5	20	380	208
5	29	212	4	20	580	368
6	42	251	3	20	840	589
7	53	317	6	20	1,060	743
8	61	413	12	20	1,220	807
9	66	513	20 (d)	20	1,320	807
10	67	543	30	20	1,340	797
11	65	579	—	20	1,300	721

(a) Total revenue = marginal revenue (price) x total product.

(b) Profit = total revenue – total cost.

(c) When **total revenue** first exceeds total cost, a producer has passed the break-even point.

(d) At profit-maximizing output, marginal cost = marginal revenue.

ANALYZE TABLES

1. How does Janine calculate her total revenue and profits when she produces 42 pairs of jeans?
2. What happens to Janine's profits when she increases production from 66 to 67 pairs of jeans? Why does this happen?

When you look at Figure 5.9 again, you can see that Janine's profits continue to rise as she adds workers—up to and including the ninth worker—and produces more jeans. Why does this happen? Recall that during the stage of diminishing returns (see Figure 5.7 on page 139), total production continues to rise, but it rises more slowly. Although Janine is getting less production from each additional worker, marginal revenue is still greater than marginal cost, so Janine hires more workers, produces more, and increases profits.

When Janine's factory has nine workers producing 66 pairs of jeans, it has reached the level of production where it realizes the greatest amount of profit. This is called **profit-maximizing output**. This level of output is reached when the marginal cost and the marginal revenue are equal (here, both at $20). After that point, profits begin to decline. When Janine adds a tenth worker, the marginal product of one pair of jeans increases total revenue, but the increase in marginal cost is greater than the increase in marginal revenue. Since the goal of every business is to maximize profit, having a tenth employee runs counter to Janine's best interests.

QUICK REFERENCE

Profit-maximizing output is the level of production at which a business realizes the greatest amount of profit.

APPLICATION Analyzing and Interpreting Data

C. If the price of jeans increased to $22 per pair, how would it affect Janine's total revenue and profit?

For more on evaluating sources, see the Skillbuilder Handbook, page R28.

Evaluating Sources

There are many sources of economic information, including news articles, reports, books, and electronic media. Knowing how to interpret sources is how we gain economic information.

TECHNIQUES FOR READING SOURCE MATERIAL The following passage appeared on the Web site of the Portland Cement Association. The passage is a source of information about the supply of cement in the United States in 2004. To interpret this source of information, use the following strategies.

Identify the subject of the passage. Then ask yourself what, if any, economic concept is involved. This passage is about cement. The economic concept discussed is supply.

Cement Supply Falls Short

Several factors have converged to create tight supplies of cement, the key ingredient in concrete, which is used in nearly every type of construction.

First, strong construction markets have increased demand. The flare in demand arrived on the heels of an unusually active winter for construction, traditionally a down period when plants can stockpile cement in anticipation of the spring construction surge. Instead, there was no letup in demand during the 2003/04 winter and little opportunity to prepare a strong inventory for spring when construction activity traditionally increases.

Another factor is freight—limited availability of transport ships and escalating shipping rates. According to figures from the U.S. Geological Survey, 2003 U.S. portland cement consumption was 107.5 million metric tons. Of that total, 23.2 million tons or 21.6 percent was imported cement.

Since the beginning of the spring 2004, shipping rates have skyrocketed and availability of ships is limited. The booming Asian economies are straining worldwide cement capacity and shipping availability.

Source: www.cement.org

Identify economic factors that are relevant to the discussion. The cement shortage is explained in part by an increase in market demand and by the rising cost and limited availability of ships to carry imported cement.

Evaluate the passage's credibility. Do you think the source of the passage is reliable? Are other cited sources reliable? Information from this association and the U.S. Geological Survey is likely to be reliable.

THINKING ECONOMICALLY Interpreting

1. According to the passage, what variables affect the supply of concrete in the United States?
2. Do you think cement will continue to be in short supply in the United States? Explain your answer using information from the passage.
3. Who do you think is most likely to benefit from the information provided in the passage? Why?

SECTION 2 Assessment

Online Quiz
ClassZone.com

REVIEWING KEY CONCEPTS

1. Explain the differences between the terms in each of these groups:
   - **a.** *marginal product*
     profit-maximizing output
   - **b.** *increasing returns*
     diminishing returns
   - **c.** *fixed cost*
     variable cost

2. Why does the marginal cost in Janine's factory decrease as marginal product increases?

3. Explain why marginal revenue and price are the same in Figure 5.9 on page 143.

4. What changes for a company when it reaches the break-even point?

5. How does a business use marginal analysis to decide how many workers to employ?

6. **Using Your Notes** How does a business calculate its total costs? Refer to your completed hierarchy diagram. Use the Graphic Organizer at **Interactive Review @ ClassZone.com**

CRITICAL THINKING

7. **Categorizing Economic Information** Categorize the following costs incurred by a bookstore owner as fixed or variable: accountant, electricity for extra holiday hours, wages, clerks' insurance, manager's salary, purchase of books, rent, telephone.

8. **Applying Economic Concepts** Suppose that you own a video store that has total costs of $3,600 per month. If you charge $12 for each DVD you sell, how many do you need to sell each month in order to break even? Explain how you arrived at your answer.

9. **Applying Economic Concepts** The owner of a factory that produces soccer balls determines that his marginal product is at its peak when he has 100 employees. He determines that his marginal cost and marginal revenue are equal when he has 150 employees. What number of employees should he hire in order to maximize his profits? Explain the reason for your answer.

10. **Challenge** Many companies choose to manufacture their products in countries where workers are paid lower wages than in the United States. Which variable costs decrease and which ones increase as a result of this decision? Why do companies make this choice? Consider what you know about the relationship of costs to profits as you formulate your answer.

ECONOMICS IN PRACTICE

Calculating Costs and Revenues

Suppose you are a manufacturer of video games. You have analyzed your costs of production to create the following table.

Total Product	Fixed Cost ($)	Variable Cost ($)
0	500	0
25	500	800
50	500	1,200
100	500	1,800
175	500	2,550
275	500	3,350
350	500	4,250
400	500	5,750

Calculate Costs Copy the information in the table on your own paper and add two columns: Total Costs and Marginal Costs. Use the information given to calculate the values and fill in those two columns.

Challenge You sell the video games for $40 each. Add columns for Marginal Revenue, Total Revenue, and Profit to your chart and calculate the values for each quantity of total product.

SECTION 3

What Factors Affect Supply?

OBJECTIVES

In Section 3, you will

- explain the difference between change in quantity supplied and change in supply
- understand how to determine a change in supply
- identify the factors that can cause a change in supply

KEY TERMS

change in quantity supplied, *p. 146*
change in supply, *p. 148*
input costs, *p. 148*
labor productivity, *p. 149*
technology, *p. 149*
excise tax, *p. 149*
regulation, *p. 150*

TAKING NOTES

As you read Section 3, complete a chart like this one showing each factor that causes change in supply. Use the Graphic Organizer at **Interactive Review @ ClassZone.com**

Factor That Changes Supply	Reason Why Supply Changes

Changes in Quantity Supplied

KEY CONCEPTS

The supply schedules and supply curves that you studied in Section 1 were created using the assumption that all other economic factors except the price of tomatoes would remain the same. If all other factors remain the same, then the only thing that influences how many tomatoes producers will offer for sale is the price of those tomatoes. The supply curve shows that pattern.

In Chapter 4, you learned the difference between change in demand and change in quantity demanded. Change in quantity demanded is shown by the points along an existing demand curve, while change in demand actually shifts the demand curve itself. Similarly, the different points on a supply curve show change in quantity supplied. **Change in quantity supplied** is an increase or decrease in the amount of a good or service that producers are willing to sell because of a change in price.

QUICK REFERENCE

Change in quantity supplied is a rise or fall in the amount producers offer for sale because of a change in price.

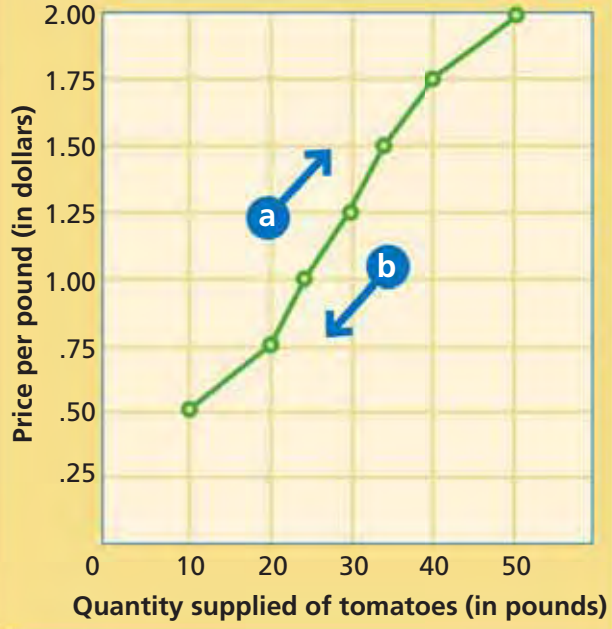
A change in the price of bicycles. . .

. . . causes a change in the quantity supplied.

EXAMPLE Changes Along a Supply Curve

Each new point on the supply curve shows a change in quantity supplied. A change in quantity supplied does not shift the supply curve itself. Let's look again at the Smiths' supply curve for tomatoes (Figure 5.10). Note the quantities supplied at each price. Notice that as quantity supplied changes, the change is shown by the direction of movement, right or left, along the supply curve. A movement to the right indicates an increase in both price and quantity supplied. A movement to the left shows a decrease in both price and quantity supplied.

FIGURE 5.10 CHANGES IN QUANTITY SUPPLIED



A **change in quantity supplied** doesn't shift the supply curve. The change refers to movement along the curve itself. Each point on the curve represents a new quantity supplied.

- **a** As you move to the right along the curve, the quantity supplied increases.
- **b** As you move to the left along the curve, the quantity supplied decreases.

ANALYZE GRAPHS

1. What is the change in quantity supplied when price increases from $0.75 to $1.50?
2. What is the change in price when quantity supplied changes from 50 to 24 pounds?

Animated Economics

Use an interactive supply curve to see changes in quantity supplied at **ClassZone.com**

Just as Figure 5.10 shows change in quantity supplied by one individual, a market supply curve shows similar information for an entire market. However, market supply curves have larger quantities supplied, and therefore larger changes to quantity supplied, because they combine the data from all the individual supply curves in the market. For example, when the price increases from $0.75 to $1.75 on the market supply curve (Figure 5.5), the quantity supplied increases from 100 pounds to 300. Compare this with the change in quantity supplied at those prices in Figure 5.10.

APPLICATION Applying Economic Concepts

A. Changes in quantity supplied do not shift the position of the supply curve. Why?

Changes in Supply

KEY CONCEPTS

QUICK REFERENCE

Change in supply occurs when a change in the marketplace prompts producers to sell different amounts at every price.

Consider what might happen if the workers at an automobile factory negotiate a large wage increase so that it's more expensive to produce each automobile. As the firm's costs increase, it is less willing and able to offer as many automobiles for sale. Any action such as this, which changes the costs of production, will change supply. **Change in supply** occurs when something prompts producers to offer different amounts for sale at every price. When production costs increase, supply decreases; when production costs decrease, supply increases.

Just like change in demand, change in supply actually shifts the supply curve. Six factors cause a change in supply: input costs, labor productivity, technology, government actions, producer expectations, and number of producers.

FACTOR 1 Input Costs

QUICK REFERENCE

Input costs are the price of the resources used to make products.

Input costs are a major factor that affects production costs and, therefore, supply. **Input costs** are the price of the resources needed to produce a good or service. For example, Anna makes nutrition bars that contain peanuts. If the price of peanuts increases, Anna's costs increase. She cannot afford to produce as many nutrition bars, and her supply curve shifts to the left (Figure 5.11). When the price of peanuts decreases, her costs decrease. She is willing and able to increase the quantity she can supply at every price, and the curve shifts to the right (Figure 5.12).

FIGURES 5.11 AND 5.12 SHIFTS IN SUPPLY

FIGURE 5.11 **DECREASE IN SUPPLY**

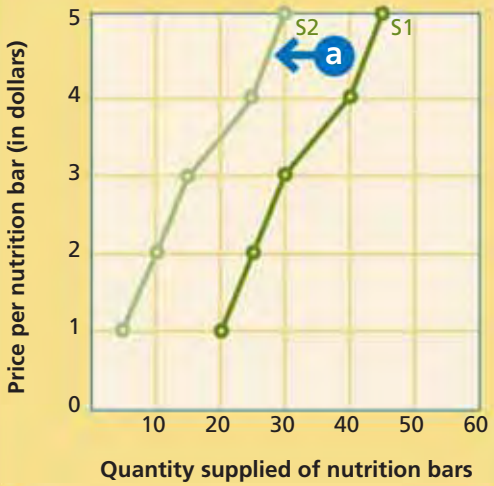
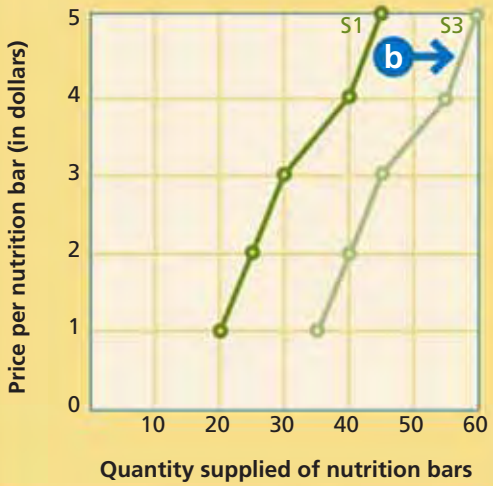


FIGURE 5.12 **INCREASE IN SUPPLY**



When a **change in supply** occurs, the supply curve shifts.

- **a** As Figure 5.11 shows, a shift to the left (S2) indicates a decrease in supply.
- **b** As Figure 5.12 shows, a shift to the right (S3) indicates an increase in supply.

ANALYZE GRAPHS

1. In Figure 5.11, how has the supply of nutrition bars changed at every price?
2. In Figure 5.12, how has the supply of nutrition bars changed at every price?

Animated Economics

Use an interactive version of shifting supply curves at **ClassZone.com**

FACTOR 2 Labor Productivity

Labor productivity is the amount of goods and services that a person can produce in a given time. Increasing productivity decreases the costs of production and therefore increases supply. For example, a specialized division of labor can allow a producer to make more goods at a lower cost, as was the case at Janine's factory in Section 2. Her marginal costs decreased when there were six workers, each of whom had a separate job to do.

Better-trained and more-skilled workers can usually produce more goods in less time, and therefore at lower costs, than less-educated or less-skilled workers. For example, a business that provides word-processing services can produce more documents if its employees type quickly and have a lot of experience working with word-processing software.

QUICK REFERENCE

Labor productivity is the amount of goods and services that a person can produce in a given time.

Technology entails applying scientific methods and innovations to production.

FACTOR 3 Technology

One way that businesses improve their productivity and increase supply is through the use of technology. **Technology** involves the application of scientific methods and discoveries to the production process, resulting in new products or new manufacturing techniques. Influenced by the profit motive, manufacturers have, throughout history, used technology to make goods more efficiently. Increased automation, including the use of industrial robots, has led to increased supplies of automobiles, computers, and many other products. (See the Case Study on pages 158–159.)

Improved technology helps farmers produce more food per acre. It also allows oil refiners to get more gasoline out of every barrel of crude oil and helps to get that gasoline to gas stations more quickly and more safely. In addition, technological innovations, such as the personal computer, enable workers to be more productive. This, in turn, helps businesses to increase the supply of their services, such as processing insurance claims or selling airline tickets.

The Typewriter's End The move from typewriter to computer shows how technology helps to boost productivity.

FACTOR 4 Government Action

Government actions can also affect the costs of production, both positively and negatively. An **excise tax** is a tax on the production or sale of a specific good or service. Excise taxes are often placed on items such as alcohol and tobacco—things whose consumption the government is interested in discouraging. The taxes increase producers' costs and, therefore, decrease the supply of these items.

Taxes tend to decrease supply; subsidies have the opposite effect. You learned in Chapter 3 that a subsidy is a government payment that partially covers the cost of an economic activity. The subsidy's purpose is to encourage or protect that activity. Most forms of energy production in the United States receive some form of subsidy. For example, subsidies helped to double the supply of ethanol, a gasoline substitute made from corn, between 2000 and 2004.

QUICK REFERENCE

An **excise tax** is a tax on the making or selling of certain goods or services.

QUICK REFERENCE

Regulation is a set of rules or laws designed to control business behavior.

Government **regulation**, the act of controlling business behavior through a set of rules or laws, can also affect supply. Banning a certain pesticide might decrease the supply of the crops that depend on the pesticide. Worker safety regulations might decrease supply by increasing a business's production costs or increase supply by reducing the amount of labor lost to on-the-job injuries.

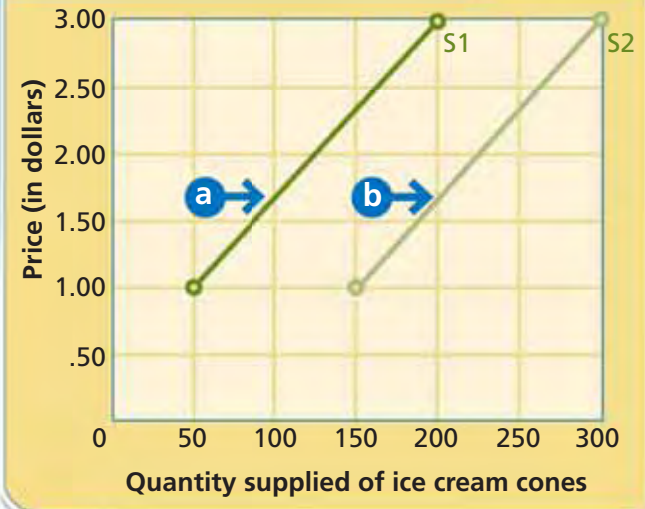
FACTOR 5 Producer Expectations

If producers expect the price of their product to rise or fall in the future, it may affect how much of that product they are willing and able to supply in the present. Different kinds of producers may react to future price changes differently. For example, if a farmer expects the price of corn to be higher in the future, he or she may store some of the current crop, thereby decreasing supply. A manufacturer who believes the price of his or her product will rise may run the factory for an extra shift or invest in more equipment to increase supply.

FACTOR 6 Number of Producers

When one company develops a successful new idea, whether it's designer wedding gowns, the latest generation of cell phones, or fast-food sushi, other producers soon enter the market and increase the supply of the good or service. When this happens, the supply curve shifts to the right, as you can see in Figure 5.13.

FIGURE 5.13 NUMBER OF PRODUCERS



a This supply curve (S1) shows the number of ice cream cones sold in a week at each price when Casey is the only supplier in the market.

b This curve (S2) shows the number of ice cream cones sold in a week at each price when three more suppliers enter the market.

ANALYZE GRAPHS

1. About how many ice cream cones were sold at $1.00 when Casey was the only producer in the market?
2. How do these two curves show the effect of the number of producers on the supply of ice cream cones in the market?

An increase in the number of producers means increased competition, which may eventually drive less-efficient producers out of the market, decreasing supply. (You'll learn more about competition in Chapter 7.) Competition has a major impact on supply, as producers enter and leave the market constantly.

ECONOMICS ESSENTIALS

FIGURE 5.14 Factors That Cause a Change in Supply

Input Costs Input costs, the collective price of the resources that go into producing a good or service, affect supply directly.

Number of Producers A successful new product or service always brings out competitors who initially raise overall supply.

Labor Productivity Better-trained or more-skilled workers are usually more productive. Increased productivity decreases costs and increases supply.

Producer Expectations The amount of product producers are willing and able to supply may be influenced by whether they believe prices will go up or down.

Technology By applying scientific advances to the production process, producers have learned to generate their goods and services more efficiently.

Government Action Government actions, such as taxes or subsidies, can have a positive or a negative effect on production costs.

ANALYZE CHARTS

A newspaper article states that the supply of snowboards has risen dramatically over the past six months. Choose four of the six factors that cause a change in supply and explain how each might have resulted in the recent influx of snowboards.

Figure 5.13 shows what happens to the supply of ice cream cones in a neighborhood as more producers enter the market. When Casey opened his ice cream store it was the only one in the area. It was an instant success. Within six months, three competing stores had opened in the neighborhood, and the supply of ice cream cones increased at all price levels. A year later, though, this intense competition forced one of the producers to leave the market.

APPLICATION Applying Economic Concepts

B. Choose an item of food or clothing that you buy regularly. List as many input costs as you can that might affect the supply of that product. Compare your list with a classmate's and see if you can add to each other's lists.

ECONOMICS PACESETTER

Robert Johnson: Supplying African-American Entertainment

In this section, you've learned about the factors that influence supply. You've also seen some examples of how these factors work. The story of media entrepreneur Robert Johnson provides a real-world example of how the entrance of a new supplier can affect a market.

FAST FACTS

Robert Johnson

Title: Chairman of BET Holdings II, Inc., retired

Born: April 8, 1946, Hickory, Mississippi

Major Accomplishment: BET is the leading supplier of cable TV programming aimed at African Americans.

Other Enterprises: Digital music networks, publishing, events production, BET.com Web portal, NBA team Charlotte Bobcats, and WNBA Charlotte Sting

Honors: Broadcasting and Cable Magazine Hall of Fame Award, NAACP Image Award

EXAMPLE Expanding the Number of Producers

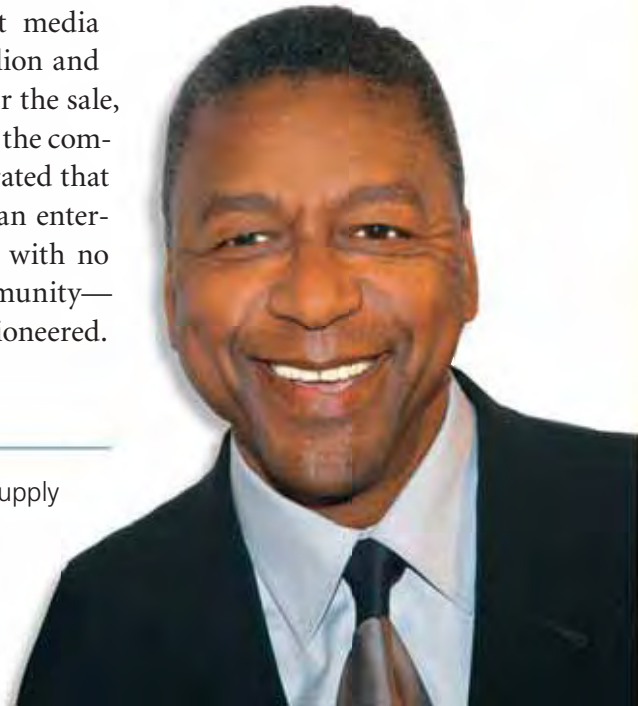
In the late 1970s, Robert Johnson was working as a Washington lobbyist for the National Cable Television Association. He recognized that current suppliers in the cable TV industry were ignoring a substantial market—African Americans. To fill this void, Johnson conceived the idea for Black Entertainment Television (BET), the first cable channel owned by and focused on African Americans.

To launch his dream, Johnson took out a $15,000 bank loan. He also persuaded a major investor to put up $500,000. Next, he secured space on a cable TV satellite for his new channel. BET's first program appeared on January 8, 1980. The company grew from offering two hours of programming a week to round-the-clock programming on five separate channels. Cable operators in the United States, Canada, and the Caribbean saw the value of this kind of targeted programming, and began to buy BET's shows.

At first, BET targeted young viewers with programs similar to those on MTV. As the cable TV industry grew and became more profitable, Johnson invested in more diverse programming. Of this transition he explained, "Now we're a music video channel with a public affairs footprint. . . ." BET could "play music, but also . . . cover issues that are of concern to African Americans." BET.com, the number one Internet portal for African Americans, soon followed.

In 2001, Johnson sold BET to the giant media company Viacom International Inc. for $3 billion and became the nation's first black billionaire. After the sale, Johnson stayed on at BET and continued to run the company for five more years. His success demonstrated that there was a strong market for African-American entertainment. As a result, many suppliers—some with no traditional ties to the African-American community—now offer the kind of programming Johnson pioneered.

A Vast Reach BET supplies programming to more than 80 million households in Canada, the United States, and the Caribbean.



Economics Update

Find an update on Robert Johnson at **ClassZone.com**

APPLICATION Making Inferences

C. What effects might BET's success have on the supply of African-American programming?

SECTION 3 Assessment

Online Quiz
ClassZone.com

REVIEWING KEY CONCEPTS

1. Explain the differences between the terms in each of these pairs:
   - **a.** *change in quantity supplied* / *change in supply*
   - **b.** *input costs* / *technology*
   - **c.** *excise tax* / *regulation*
2. What else besides raw materials would be included in input costs?
3. Why might an increase in oil prices lead to a decrease in the supply of fruits and vegetables in your local supermarket?
4. Why do excise taxes and subsidies affect supply differently?
5. Does expectation of a change in price affect supply? Illustrate your answer with examples.
6. **Using Your Notes** How does a change in number of producers affect supply? Refer to your completed chart.

   Use the Graphic Organizer at **Interactive Review @ ClassZone.com**

Factor That Changes Supply	Reason Why Supply Changes

CRITICAL THINKING

7. **Applying Economic Concepts** How do each of these examples of government actions affect the supply of gasoline?
   - **a.** In 2005, the government continued support for ethanol, a gasoline substitute.
   - **b.** The state of California requires a special blend of gasoline that meets stricter environmental standards than other regions in the country.
   - **c.** Many states use gasoline taxes to help fund highway construction and maintenance.
8. **Making Inferences** Why do you think governments want to influence the supply of alcohol and tobacco products by imposing excise taxes?
9. **Analyzing Effects** Take out the market supply curve for skis that you created on page 137. Add new curves showing how supply would be changed in each of the following cases. Share your graph with a classmate and explain your reasoning.
   - **a.** The price of titanium, used in skis, declines dramatically.
   - **b.** A large manufacturer decides to stop producing skis.
10. **Challenge** How does an increased number of producers affect the prices of goods in a market? What is the reason for this effect? Think about what you know about demand and supply and review Figure 5.12 as you formulate your answer.

ECONOMICS IN PRACTICE

Explaining Changes in Supply

Suppose that you are a manufacturer of personal digital music players (PDMPs). What factors affect supply for PDMPs? The chart below lists examples of a change in supply in the market for PDMPs. For each example, identify which factor that affects supply is involved and state whether supply increases or decreases.

Example of Change That Affects Supply	Factor and How It Affected Supply
You give each worker in your factory a specialized job.	
Price of computer chips used in PDMPs rises.	
New machinery speeds up the manufacturing process.	
Your success prompts three new companies to start producing PDMPs.	
A new law requires producers to recycle the wastewater from their factories.	

Challenge Identify which of the six factors that affect supply does not appear on this chart. What would be an example of how that factor might affect the market for PDMPs?

SECTION 4

What Is Elasticity of Supply?

OBJECTIVES

In Section 4, you will

- define the term *elasticity of supply*
- explain the difference between elastic and inelastic supply
- identify the factors that affect elasticity of supply

KEY TERMS

elasticity of supply, *p. 154*

TAKING NOTES

As you read Section 4, complete a cluster diagram like the one shown. Use the Graphic Organizer at **Interactive Review @ ClassZone.com**

Elasticity of Supply

KEY CONCEPTS

According to the law of supply, as price increases so will the supply of a good or service. When Toyota Motor Corporation introduced its Prius hybrid in 2000, it was surprised by the automobile's instant popularity. Consumers were willing to pay more than the manufacturer's suggested price. Yet Toyota was not able to increase supply at the same pace that consumer demand and prices rose. Even five years later, Toyota could not meet rising demand. This inability to effectively respond to and meet increased demand suggests that the supply of the Prius was inelastic.

In Chapter 4, you learned that elasticity of demand measures how responsive consumers are to price changes. In a similar way, **elasticity of supply** is also a measure of how responsive producers are to price changes.

QUICK REFERENCE

Elasticity of supply is a measure of how responsive producers are to price changes in the marketplace.

If a change in price leads to a relatively larger change in quantity supplied, supply is said to be elastic. In other words, supply is elastic if a 10 percent increase in price causes a greater than 10 percent increase in quantity supplied. If a change in price leads to a relatively smaller change in quantity supplied, supply is said to be inelastic. If the price and the quantity supplied change by exactly the same percentage, supply is unit elastic.

Inelastic Supply The supply of expensive and complicated items, such as this Prius hybrid, is often inelastic.

EXAMPLE Elastic Supply

Let's look at an example of elastic supply. Figure 5.15 illustrates how the quantity supplied of a new style of leather boots was elastic. As the boots gained in popularity, a shortage developed. The boot makers raised the price of the boots from $60 to $150 dollars, and the quantity supplied more than kept up, escalating from 10,000 to 50,000 pairs. The producer was able to rapidly increase the quantity supplied because, unlike car manufacturing for instance, the raw materials needed to make boots are neither particularly expensive nor hard to come by. The actual manufacturing process is also, relatively speaking, fairly uncomplicated and easy to increase.

EXAMPLE Inelastic Supply

In Chapter 4, you learned that demand for gasoline was inelastic. The supply of gasoline is also inelastic. Although gasoline prices rose 20 to 30 percent between 2004 and 2005, producers were not able to increase supply by the same amount because of the limited supply of crude oil and refining capacity.

Figure 5.16 shows how the supply of olive oil is also inelastic. When the price of olive oil rose by a factor of four, supply could not keep pace, as the oil comes from the previous season's olives and is exported from the Mediterranean region.

FIGURE 5.15 ELASTIC SUPPLY CURVE

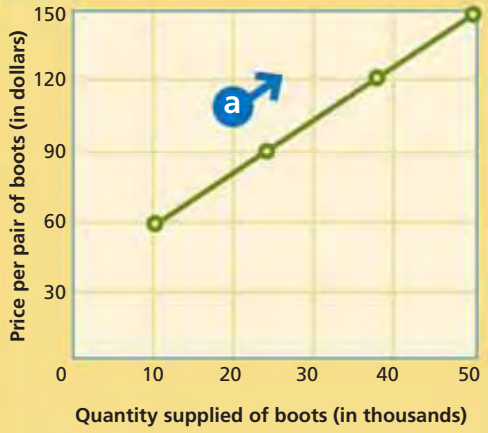
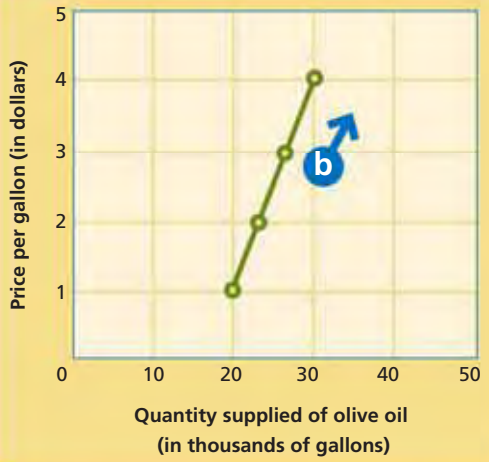


FIGURE 5.16 INELASTIC SUPPLY CURVE



a The curve in Figure 5.15 slopes gradually. It slopes more horizontally than vertically because of greater changes in quantity supplied.

b The curve in Figure 5.16 slopes steeply. It slopes more vertically than horizontally because of lesser changes in quantity supplied.

ANALYZE GRAPHS

1. If the price of leather rose dramatically for the boots in Figure 5.15, how might this affect elasticity of supply?
2. In the United States, would the supply of corn oil be more elastic than the supply of olive oil? Why or why not?

Animated Economics

Use elastic and inelastic supply curves at **ClassZone.com**

APPLICATION Drawing Conclusions

A. A bakery produces 200 muffins per week that sell for $1.50 each. When the price increases to $2.00, it produces 300 muffins per week. Is supply elastic or inelastic? Explain your answer.

What Affects Elasticity of Supply?

KEY CONCEPTS

Just as there are factors that cause a change in supply, there are also factors that affect the elasticity of supply. There are far fewer of these factors than for elasticity of demand. The ease of changing production to respond to price change is the main factor in determining elasticity of supply. Given enough time, the elasticity of supply increases for most goods and services. Supply will be more elastic over a year or several years than it will be if the time frame to respond is a day, a week, or a month.

Industries that are able to respond quickly to changes in price by either increasing or decreasing production are those that don't require a lot of capital, skilled labor, or difficult-to-obtain resources. For example, the quantity supplied of dog-walking services can increase rapidly with the addition of more people to walk dogs. A small business that sells crafts made from recycled materials would be able to respond quickly to changes in the price of its various products by applying its resources to increase the supply of its higher priced items.

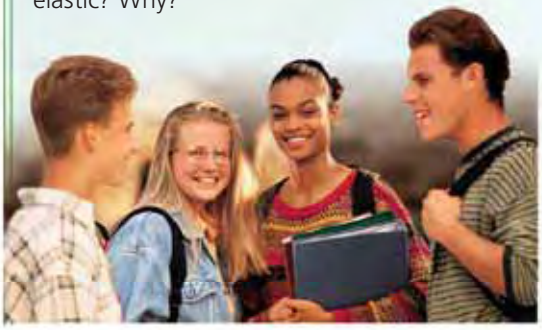
For other industries, it takes a great deal of time to shift the resources of production to respond to price changes. Automakers and oil refiners are examples of industries that rely on large capital outlays or difficult-to-obtain resources. It might take such suppliers a considerable amount of time to respond to price changes.

YOUR ECONOMIC CHOICES

ELASTICITY OF SUPPLY

Which supply of cupcakes is more elastic?

You're planning to sell cupcakes at your school's football game to raise funds for a charitable cause, but it's hard to say in advance how many fans will attend the game. You can place an order with a bakery (which you need to do a week early) or have volunteers do the baking the night before the game. Which supply of cupcakes is more elastic? Why?



APPLICATION Applying Economic Concepts

B. Is the elasticity of a farmer's crop of sweet corn greater at the beginning of the growing season or in the middle of the growing season? Why?

SECTION 4 Assessment

Online Quiz
ClassZone.com

REVIEWING KEY CONCEPTS

1. Use each of the following three terms in a sentence that gives an example of the term as it relates to supply:
   a. *elastic* **b.** *inelastic* **c.** *elasticity of supply*
2. How is elasticity of supply similar to elasticity of demand? How is it different?
3. Is the supply of genuine antique furniture elastic or inelastic? Why?
4. What is the difference between industries that have elastic supply and those that have inelastic supply?
5. What is the main factor that affects elasticity of supply and how does it affect elasticity?
6. **Using Your Notes** How is time related to elasticity of supply? Refer to your completed cluster diagram. Use the Graphic Organizer at **Interactive Review @ ClassZone.com**

CRITICAL THINKING

7. **Analyzing Causes** Between 1997 and 2002, many gold producers cut their budgets for exploring for new sources in order to stay profitable when the price of gold was less than $350 per ounce. When the price rose above $400 per ounce in 2004, gold producers were not able to respond quickly to the increase. Use what you know about elasticity of supply to explain this cause-and-effect relationship.
8. **Analyzing Data** In May, Montclair Electronics sold 100 portable DVD players at $150 each. High consumer demand at the start of the summer travel season increased the price to $180. In June, the store sold 115 DVD players at the higher price. Is the supply of DVD players elastic or inelastic? Show your math calculations to support your answer.
9. **Applying Economic Concepts** Analyze the factors that determine elasticity of supply to explain why it is difficult for orange growers to respond quickly to changes in the price of orange juice.
10. **Challenge** Prices are up 8 percent at the local juice shop. Its raw materials are inexpensive and easy to find, and the labor is unskilled. Should the shop be able to raise quantity supplied more than 8 percent? Why?

ECONOMICS IN PRACTICE

Calculating Elasticity

The growing market for bottled yogurt smoothies is shown in the supply schedule below. Use the information in the table to determine whether the quantity supplied is growing proportionately more than increases in price. Would you expect supply for yogurt smoothies to be elastic or inelastic over a period of six months?

Price ($)	Quantity Supplied of Smoothies
2.00	600
1.75	450
1.50	300
1.25	200

Create a Supply Curve Use the information in the supply schedule to create a supply curve for yogurt smoothies. What does the slope of this curve indicate about elasticity of supply for yogurt smoothies?

Challenge Adapt the information in the Math Challenge on page 121 to calculate the elasticity of supply using the data in the supply schedule above. Substitute quantity supplied for quantity demanded in the formula.

Use SMARTGrapher @ **ClassZone.com** to complete this activity.

Case Study

Economics Update
Find an update on this Case Study at **ClassZone.com**

Robots—Technology Increases Supply

Background The increasing sophistication of technology continues to have a profound impact on the production and supply of manufactured goods. Robots—machines that can be programmed to perform a variety of tasks—are a prime example of technology's effect on industry.

Today, industrial robots perform a wide variety of functions. Although robots do everything from packaging pharmaceuticals to dispensing genetic material in biotechnical laboratories, half of all industrial robots are used to make automobiles. Robots are ideal for lifting heavy objects and for performing repetitive activities that humans find boring. Lately, though, robots are being used more for tasks that require refined skills.

What's the issue? How does technology increase supply? Study these sources to discover how robots can increase productivity.

A. Online Article

Japan's low birthrate is likely to result in a shortage of workers. This article discusses how Toyota plans to use robots to solve this problem.

Toyota to Use "Super" Robots

As the Japanese labor pool declines, Toyota turns to robots.

Toyota is deploying at all 12 of its domestic plants robots capable of performing several simultaneous operations. It aims to be the first automaker to introduce robots that, in addition to machine work and engine assembly, perform the finishing touches on the assembly line. . . .

In the automobile industry robots mainly perform relatively dangerous tasks such as welding and coating, while, in order to preserve quality, human workers accomplish such complicated final processes as attaching interior trim.

But Toyota plans to introduce robots to final assembly processes after establishing the necessary control technology and safeguards, and developing parts easily assembled by android [robotic] hands.

Even this super robot will not result in the total replacement of man by machine; rather it will reinforce the strengths of the production line and compensate for manpower shortages in a truly Toyota-style production innovation.

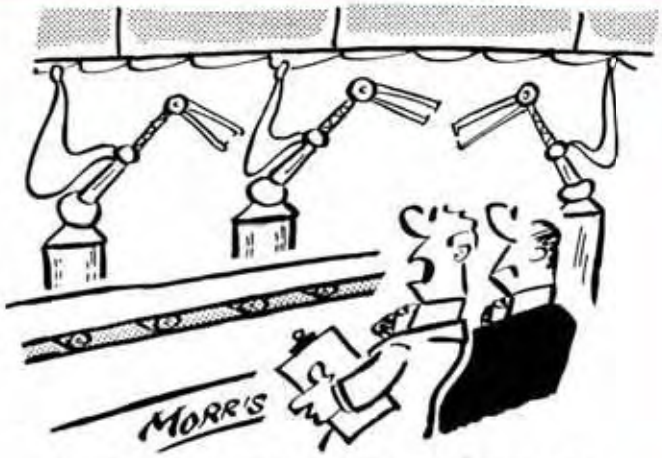
The company plans to use robots to keep production costs at the level of those in China. . . . Toyota presently uses between 3,000 and 4,000 standard robots. It expects a total of 1,000 super robots to join them.

Source: japaninc.net

Thinking Economically Will the use of robots as described in this article affect the supply of Toyota automobiles? Explain your answer.

B. Political Cartoon

John Morris drew this cartoon about the use of robots in manufacturing. *Parity* means "equality." In the cartoon, *parity* refers to equal pay and benefits.



"The robots have gone on strike - they want parity with the robots at Ford."

Source: www.CartoonStock.com

Thinking Economically How are the robots in the cartoon affecting productivity?

C. Industry Report

Epson, a maker of industrial robots, presents a case study involving the use of robots in a bakery.

Robots Decorate Cakes

English bakery turns to robots during peak seasons.

Problem: A large English commercial bakery decorates cakes with written messages iced on the top—a task generally undertaken by skilled staff. . . .

During seasonal holiday periods consumer demand for these decorated cakes increases fourfold. Training of additional staff to cope with the expanded demand . . . takes a significant period of time and so volume planning is critical.

Solution: System Devices, the EPSON Robots agent for the [United Kingdom], worked with Integrated Dispensing Systems to design and build a robotic cake decorating cell that . . . used an EPSON SCARA robot. . . .

Cakes are fed to the EPSON robot via a conveyor. A simple optical positioning system ensures that the cakes are presented to the robot in a consistent position.

A CAD [computer-aided design] file of the decoration shape is downloaded to the robot. Because individual cake heights may vary, a laser range finder tells the robot the height of each cake as it enters the work cell. The robot moves over the top of the cake and writes the decorative inscription. . . .

Benefits: Ability to boost production during peak seasonal demand periods; consistently high product quality due to reduced variability on decorations; reduced . . . training costs.

Source: www.robots.epson.com

Thinking Economically In this report, how does the use of robots help the supplier respond to a seasonal change in demand? Would this robotic solution help a department store facing a holiday staffing shortage? Why or why not?

THINKING ECONOMICALLY Synthesizing

1. Which of the six factors that can cause a change in supply is highlighted in the three documents? Does this factor generally increase or decrease supply?
2. Which document, B or C, addresses the issue of elasticity? Explain.
3. In which article, A or C, are the robots an example of variable costs? Why?

Interactive Review

Review this chapter using interactive activities at ClassZone.com

- Online Summary
- Quizzes
- Vocabulary Flip Cards
- Graphic Organizers
- Review and Study Notes

Online Summary

Complete the following activity either on your own paper or online at **ClassZone.com**

Choose the key concept that best completes the sentence. Not all key concepts will be used.

break-even point
change in quantity supplied
change in supply
diminishing returns
elasticity of supply
fixed cost
increasing returns
input costs
law of supply
marginal cost
marginal product
marginal revenue
productivity
profit-maximizing output
supply
supply curve
supply schedule
total product
total revenue
variable cost

__1__ is the quantity of a product that producers are willing and able to offer for sale. According to the __2__, when price increases, quantity supplied increases, and when price decreases, quantity supplied decreases. Quantity supplied can be displayed on a chart called a __3__ or on a graph called a __4__.

__5__ is the change in __6__ caused by hiring one additional worker. When marginal product begins to decrease, production is in the stage of __7__.

Total cost is the sum of __8__ and variable costs. __9__ is the additional cost of producing one more unit. When marginal cost equals __10__, a company has reached __11__.

A __12__ occurs when producers are willing to sell different amounts of a product at every price. The six factors that change supply are input costs, __13__, technology, government action, producer expectations, and number of producers.

The term __14__ describes how responsive producers are to price changes. It is measured by comparing __15__ to change in price.

CHAPTER 5 Assessment

REVIEWING KEY CONCEPTS

What Is Supply? (pp. 130–137)

1. What two requirements of supply must someone meet to be considered a producer?
2. What does it mean to say that quantity supplied and price have a direct relationship?

What Are the Costs of Production? (pp. 138–145)

3. How does marginal product change during the three stages of production?
4. What is the relationship of total costs to profit?

What Factors Affect Supply? (pp. 146–153)

5. What is the difference between change in quantity supplied and change in supply?
6. How do input costs affect supply?

What Is Elasticity of Supply? (pp. 154–159)

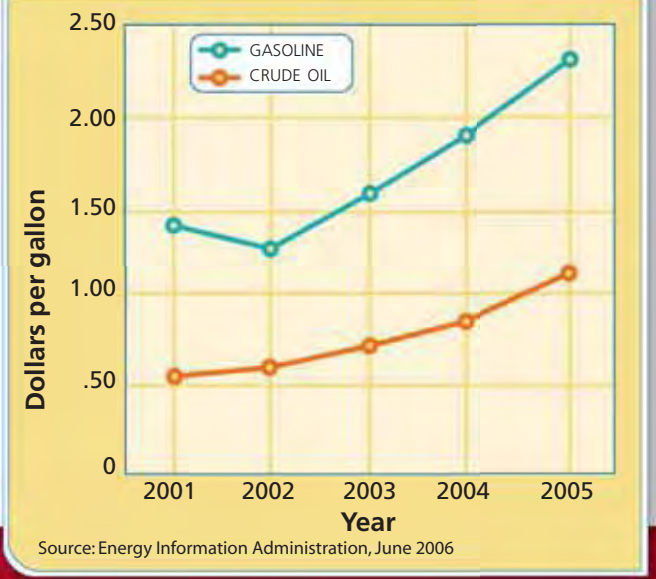
7. How are elastic and inelastic supply different?
8. How might you calculate elasticity of supply?

APPLYING ECONOMIC CONCEPTS

Look at the graph below showing price changes for two commodities: crude oil and gasoline.

9. How is the price of gasoline related to the price of crude oil?
10. What factor that affects the supply of gasoline is shown in this graph? How does this factor affect the supply of gasoline?

FIGURE 5.17 U.S. PRICES OF CRUDE OIL AND GASOLINE



Source: Energy Information Administration, June 2006

CRITICAL THINKING

11. Analyzing Data Suppose that you own a factory producing backpacks that sell for $20 each. Use the information in this table to calculate marginal cost, total revenue, and profit at each level of output. Identify the break-even point and profit-maximizing output.

BACKPACK PRODUCTION COSTS

Production Costs	
Total Product	Total Cost ($)
100	3,500
200	5,300
300	7,000
400	8,000
500	8,800
600	9,800
700	11,800
800	14,300
900	17,000

12. Analyzing Effects A city puts a new rule into effect about the kinds of beverages that may be sold in schools. Sugary sodas must be replaced by bottled water, fruit juices, and sports drinks. How will this decision affect the supply of each category of beverage at the schools? What factor that affects supply is demonstrated in this situation?

13. Drawing Conclusions Both demand and supply for gasoline are inelastic. Would the elasticity of supply and demand be the same for sports cars? Why or why not?

14. Challenge When a string of hurricanes hit Florida, preparation for and cleanup from the storms increased demand for plywood. Yet prices rose only slightly, partly because large chains shipped plywood from stores around the country in anticipation of the increased demand. How does this story illustrate the law of supply and elasticity of supply?

SIMULATION

How Much Are You Willing to Supply?

Choose a partner. Imagine that the two of you run a software company. Your best-selling product is a program that helps businesses manage their inventory. Next year you will produce 20,000 units. The following partial supply schedule shows the prices at which you will likely sell your product during that period.

SOFTWARE SUPPLY SCHEDULE

Price ($)	Quantity Supplied
70	7,500
65	
60	
55	
50	1,000

Step 1 Copy the schedule onto a sheet of paper and fill in the missing amounts in the Quantity Supplied column. Be sure that the amounts you choose adhere to the law of supply.

Step 2 Draw a supply curve to illustrate your schedule. Be sure to label each axis of your curve.

Step 3 Get together with three other groups. These are your competitors. Bring all of your individual supply schedules together to make a market supply schedule. Then convert the market supply schedule into a market supply curve.

Step 4 You and your competitors find out that several other companies are getting ready to introduce similar inventory-control software. On your market supply curve, show how this development causes a shift in supply.

Step 5 Although writing your program was difficult, now that it is written, it is relatively quick and easy to produce copies for sale. Is the supply of your product elastic or inelastic? Why?

Use SMARTGrapher **@ ClassZone.com** to complete this activity.