CHAPTER IN PERSPECTIVE
In Chapter 5 we study the price elasticity of demand, the price elasticity of supply, the cross elasticity of demand, and the income elasticity of demand.

Define, explain the factors that influence, and calculate the price elasticity of demand.
The price elasticity of demand is a measure of the extent to which the quantity demanded of a good changes when the price of the good changes and all other influences on buyers’ plans remain the same. The price elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in price, with the negative sign ignored. Demand is elastic if the percentage change in the quantity demanded exceeds the percentage change in price. Demand is unit elastic if the percentage change in the quantity demanded equals the percentage change in price. Demand is inelastic if the percentage change in the quantity demanded is less than the percentage change in price. Elasticity is a units-free measure. Along a linear demand curve demand is unit elastic at the midpoint of the curve, demand is elastic at all points above the midpoint of the curve, and demand is inelastic at all points below the midpoint of the curve. The total revenue from the sale of a good equals the price of the good multiplied by the quantity sold. If price and total revenue change in opposite directions, demand is elastic. If a price change leaves total revenue unchanged, demand is unit elastic. If price and total revenue change in the same direction, demand is inelastic.

Define, explain the factors that influence, and calculate the price elasticity of supply.
The price elasticity of supply is a measure of the extent to which the quantity supplied of a good changes when the price of the good changes and all other influences on sellers’ plans remain the same. The two main influences on the price elasticity of supply are production possibilities and storage possibilities. The price elasticity of supply equals the percentage change in the quantity supplied divided by the percentage change in the price. If the price elasticity of supply is greater than 1, supply is elastic. If the price elasticity of supply equals 1, supply is unit elastic. If the price elasticity of supply is less than 1, supply is inelastic.

Define and explain the factors that influence the cross elasticity of demand and the income elasticity of demand.
The cross elasticity of demand is a measure of the extent to which the demand for a good changes when the price of a substitute or complement changes, other things remaining the same. The cross elasticity of demand is positive for substitutes and negative for complements. The income elasticity of demand is a measure of the extent to which the demand for a good changes when income changes, other things remaining the same. The income elasticity of demand is positive for a normal good and negative for an inferior good.
EXPANDED CHAPTER CHECKLIST

When you have completed this chapter, you will be able to:

1 Define, explain the factors that influence, and calculate the price elasticity of demand.
   - Define price elasticity of demand.
   - Use the midpoint method to calculate the percentage change in price and the percentage change in the quantity demanded.
   - Define elastic demand, unit elastic demand, and inelastic demand.
   - Use a graph to illustrate perfectly elastic demand and perfectly inelastic demand.
   - List and explain the influences on the price elasticity of demand.
   - Calculate the price elasticity of demand.
   - Discuss elasticity along a linear demand curve.
   - Use the total revenue test to determine the price elasticity of demand.
   - Discuss the relationship between farm prices and total revenue.
   - Explain how we can use price elasticity of demand to design effective policies for dealing with addiction to drugs.

2 Define, explain the factors that influence, and calculate the price elasticity of supply.
   - Define the price elasticity of supply.
   - Define elastic supply, unit elastic supply, and inelastic supply.
   - Use a graph to illustrate perfectly elastic supply and perfectly inelastic supply.
   - List and explain the influences on the price elasticity of supply.
   - Calculate the price elasticity of supply.

3 Define and explain the factors that influence the cross elasticity of demand and the income elasticity of demand.
   - Define and calculate the cross elasticity of demand.
   - Explain why the cross elasticity of demand is positive for substitutes and negative for complements.
   - Define and calculate the income elasticity of demand.
   - Discuss the three ranges into which the income elasticity of demand falls.

KEY TERMS
- Price elasticity of demand (page 118)
- Elastic demand (page 120)
- Unit elastic demand (page 120)
- Inelastic demand (page 120)
- Perfectly elastic demand (page 120)
- Perfectly inelastic demand (page 120)
- Total revenue (page 126)
- Total revenue test (page 126)
- Price elasticity of supply (page 130)
- Perfectly elastic supply (page 130)
- Elastic supply (page 130)
- Unit elastic supply (page 130)
- Inelastic supply (page 130)
- Perfectly inelastic supply (page 130)
- Cross elasticity of demand (page 135)
- Income elasticity of demand (page 136)

CHECKPOINT 5.1

- Define, explain the factors that influence, and calculate the price elasticity of demand.

Practice Problem 5.1
A 10 percent increase in the price of a good has led to a 2 percent decrease in the quantity demanded of that good.

a. How would you describe the demand for this good?

b. Are substitutes for this good easy to find or does it have poor substitutes?
c. Is this good more likely to be a necessity or a luxury? Why?
d. Is this good more likely to be narrowly or broadly defined? Why?
e. Calculate the price elasticity of demand for this good.
f. Has the total revenue from the sale of the good changed? Explain your answer.
g. The good might be which of the following goods: orange juice, bread, toothpaste, theater tickets, clothing, blue jeans, Super Bowl tickets? Why?

**Solution to Practice Problem 5.1**
The Practice Problem concentrates on the difference between elastic and inelastic demand.

**Quick Review**
- **Elastic demand** When the percentage change in the quantity demanded exceeds the percentage change in price. The elasticity of demand is greater than 1 in value.
- **Inelastic demand** When the percentage change in the quantity demanded is less than the percentage change in price. The elasticity of demand is less than 1 in value.
- **Factors affecting elasticity** The demand for a good is more elastic if a substitute is easy to find. The factors that influence the ability to find a substitute for a good are whether the good is a luxury or a necessity, how narrowly it is defined, and the amount of time available to find a substitute for it.

a. How would you describe the demand for this good?
The demand for the good is inelastic because the percentage change in the quantity demanded, 2 percent, is less than the percentage change in the price, 10 percent.

b. Are substitutes for this good easy to find or does it have poor substitutes?
The demand for a good is inelastic if a substitute for it is hard to find. Because demand is inelastic, this good probably has poor substitutes.

c. Is this good more likely to be a necessity or a luxury? Why?
This good is probably a necessity. An example of a necessity is food. A necessity has poor substitutes—you must eat—so the demand for a necessity is inelastic.

d. Is this good more likely to be narrowly or broadly defined? Why?
The demand for a broadly defined good is inelastic. For example, the demand for Pepsi is elastic because other soft drinks are good substitutes. But the demand for liquid to drink is inelastic because there are only poor substitutes.

e. Calculate the price elasticity of demand for this good.
The elasticity equals the percentage change in the quantity demanded divided by the percentage change in the price, which is (2 percent) ÷ (10 percent) = 0.2.

f. Has the total revenue from the sale of the good changed? Explain your answer.
Total revenue increases. A rise in the price of a good with an inelastic demand increases total revenue.

g. The good might be which of the following goods: orange juice, bread, toothpaste, theater tickets, clothing, blue jeans, Super Bowl tickets? Why?
The demand is inelastic, so the good might be bread because bread is a necessity. The good might be toothpaste, because toothpaste has poor substitutes. Or the good might be clothing because clothing is broadly defined.

**Additional Practice Problem 5.1a**
The table gives the demand schedule for bags of cat food.

<table>
<thead>
<tr>
<th>Price (dollars per bag of cat food)</th>
<th>Quantity (bags of cat food per year)</th>
<th>Total revenue (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

A graph of this demand schedule gives a linear demand curve.
a. Finish the table by calculating the total revenue for each row.
b. When is the demand elastic? inelastic? unit elastic?
c. Explain your answers to part (b).

Solution to Additional Practice Problem 5.1a
a. Finish the table by calculating the total revenue for each row.
The completed table is below. Total revenue equals the price times the quantity sold.

<table>
<thead>
<tr>
<th>Price (dollars per bag of cat food)</th>
<th>Quantity (bags of cat food per year)</th>
<th>Total revenue (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

b. When is the demand elastic? inelastic? unit elastic?
The demand is elastic at prices greater than $3 a bag. The demand is inelastic at prices less than $3 a bag. The demand is unit elastic at a price of $3 a bag.

c. Explain your answers to part (b).
Demand is unit elastic at the midpoint of the demand curve. When demand is unit elastic, a price change leaves total revenue unchanged. The midpoint of the curve occurs when the price is $3 a bag, so demand is unit elastic at a price of $3 a bag.

Demand is elastic at all points above the midpoint of the demand curve. So when the price is greater than $3 a bag, demand is elastic. When demand is elastic, price and total revenue change in opposite directions. For example, when the price rises from $4 to $5, total revenue decreases from $32 to $20.

Demand is inelastic at all points below the midpoint of the demand curve. So when the price is less than $3 a bag, demand is inelastic. When demand is inelastic, price and total revenue change in the same direction. For example, when the price rises from $1 to $2, total revenue increases from $20 to $32.

Self Test 5.1
Fill in the blanks
To calculate the percentage change in price, the midpoint formula divides the change in price by the average of the initial and the new price and then multiplies by 100. If the percentage change in the quantity demanded exceeds the percentage change in the price, demand is elastic. The demand for a product is more elastic if there are more substitutes for it. The demand for a necessity is generally inelastic. The price elasticity of demand equals the percentage change in the price; quantity demanded divided by the percentage change in the quantity demanded. Moving along a straight-line demand curve, the slope is constant (is constant; varies) and the elasticity is constant (is constant; varies). If demand is elastic, an increase in price decreases total revenue.

True or false
1. The price elasticity of demand equals the magnitude of the slope of the demand curve.
2. If the price increases by 10 percent and the quantity demanded decreases by 8 percent, the price elasticity of demand equals 1.25.
3. If as the price of a good increases, the quantity demanded of it remains the same, then demand for the good is perfectly inelastic.
4. Above the midpoint of a straight-line demand curve, demand is elastic.
5. When the price of a service increases by 5 percent and the quantity demanded decreases by 5 percent, total revenue remains unchanged.
Multiple choice

1. The price elasticity of demand is a measure of the extent to which the quantity demanded of a good changes when ____ changes and all other influences on buyers’ plans remain the same.
   a. income
   b. the price of a related good
   c. the price of the good
   d. the demand

2. Suppose the price of a movie falls from $9 to $7. Using the midpoint method, what is the percentage change in price?
   a. 33 percent
   b. −33 percent
   c. 25 percent
   d. −25 percent

3. Demand is elastic if
   a. consumers respond strongly to changes in a product’s price.
   b. a large percentage change in price brings about a small percentage change in quantity demanded.
   c. a small percentage change in price brings about a small percentage change in quantity demanded.
   d. the quantity demanded is not responsive to price changes.

4. During the winter of 2000–2001, the price of electric power increased enormously in California but the quantity demanded decreased only a little. This response indicates that the demand for electric power in California was
   a. inelastic.
   b. elastic.
   c. unit elastic.
   d. perfectly elastic.

5. If substitutes for a good are readily available, the demand for that good is
   a. small.
   b. elastic.
   c. inelastic.
   d. large.

6. If the price of a product increases by 5 percent and the quantity demanded decreases by 5 percent, then the elasticity of demand is
   a. 0.
   b. 1.
   c. indeterminate.
   d. 5.

7. The price of a bag of pretzels rises from $2 to $3 and the quantity demanded decreases from 100 to 60. What is the price elasticity of demand?
   a. 1.0
   b. 1.25
   c. 40.0
   d. 20.0

8. When a firm raises the price of its product, what happens to total revenue?
   a. If demand is elastic, total revenue will decrease.
   b. If demand is unit elastic, total revenue will increase.
   c. If demand is inelastic, total revenue will decrease.
   d. If demand is elastic, total revenue will increase.

Complete the graph

1. In Figure 5.1, label the axes and then draw a demand curve for a good that has a perfectly elastic demand.

FIGURE 5.1
2. In Figure 5.2, darken the part of the demand curve along which demand is elastic. Label the point on the demand curve at which demand is unit elastic.

**FIGURE 5.2**

<table>
<thead>
<tr>
<th>Quantity (units per month)</th>
<th>Price (dollars per unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>60</td>
<td>1</td>
</tr>
</tbody>
</table>

**CHECKPOINT 5.2**

**Define, explain the factors that influence, and calculate the price elasticity of demand.**

**Practice Problem 5.2**

You are told that a 10 percent increase in the price of a good has led to a 1 percent increase in the quantity supplied of the good after one month. Use this information to answer the following questions:

a. How would you describe the supply of this good?

b. What can you say about the production possibilities of this good?

c. Calculate the price elasticity of supply.

d. If after one year, the quantity supplied has increased by 25 percent, describe how the supply has changed over the year.

e. Calculate the elasticity of supply after one year.

**Solution to Practice Problem 5.2**

Practice Problem 5.2 is similar to Practice Problem 5.1. Note the similarity between the price elasticity of supply and the price elasticity of demand: In both cases we divide the percentage change in the quantity (supplied or demanded) by the percentage change in the price.

**Quick Review**

- **Price elasticity of supply** A measure of the extent to which the quantity supplied of a good changes when the price of the good changes and all other influences on sellers’ plans remain the same.

a. How would you describe the supply of this good?

The supply of this good is inelastic because the percentage change in the quantity supplied is less than the percentage change in the price.

2. Short answer and numeric questions

1. Complete the table below by calculating the price elasticity of demand.

<table>
<thead>
<tr>
<th>Percentage change in price</th>
<th>Percentage change in quantity demanded</th>
<th>Price elasticity of demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>B 8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C 3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>D 6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>E 1</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

a. Which row has the most elastic demand?

b. Which row has the least elastic demand?

2. Suppose the price elasticity of demand for oil is 0.3. If the quantity of oil decreases by 6 percent, what is the effect on the price of oil?

3. What does it mean when the demand for a good is inelastic?

4. What is the relationship between how narrowly a good is defined and the number of substitutes it has?

5. What is the relationship between a rise in price, the elasticity of demand for the good, and the change in total revenue? What is the relationship between a rise in price, the elasticity of demand for the good, and your expenditure on the good?
b. What can you say about the production possibilities of this good?
The factors of production that are used to produce this good are likely to be quite unique because the percentage increase in the quantity supplied after one month is not large.

c. Calculate the price elasticity of supply.
The elasticity of supply is the percentage change in the quantity supplied divided by the percentage change in price, which is \( \frac{1\%}{10\%} = 0.1 \).

d. If after one year, the quantity supplied has increased by 25 percent, describe how the supply has changed over the year.
The supply of the good has become more elastic during the year. With the passage of time, different production processes can be used and new producers can enter the market.

e. Calculate the elasticity of supply after one year.
The elasticity of supply equals the percentage change in the quantity supplied divided by the percentage change in price, which is \( \frac{25\%}{10\%} = 2.5 \).

Additional Practice Problem 5.2a
Over one month the elasticity of supply of avocados is 0.1 and over 5 years the elasticity of supply of avocados is 2.0. If the price of avocados rises 10 percent, what is the increase in the quantity supplied in one month and in 5 years? Why is there a difference in the quantities?

Solution to Additional Practice Problem 5.2a
The increase in the quantity supplied equals the percentage change in the price times the elasticity of supply. In one month the quantity supplied increases by \((10\%) \times (0.1)\), which is 1 percent. In 5 years the quantity supplied increases by \((10\%) \times (2.0)\), which is 20 percent. The increase in the quantity supplied is much greater after 5 years because more changes can be made as more time passes. Existing avocado trees can be more carefully cultivated and additional fertilizer used. Eventually additional avocado trees can be planted, mature, and then be harvested. The supply of avocados increases as time passes, making the supply more elastic.

Self Test 5.2
Fill in the blanks
When supply has a vertical supply curve, then the supply of the good is perfectly ____ (elastic; inelastic). Goods that can be produced at an almost constant opportunity cost have an ____ (elastic; inelastic) supply. As time passes, the elasticity of supply ____ (increases; decreases). The price elasticity of supply equals the percentage change in the ____ (price; quantity supplied) divided by the percentage change in the ____ (price; quantity supplied). If the elasticity of supply is greater than 1, supply is ____ (elastic; inelastic).

True or false
1. If the percentage change in the quantity supplied is zero when the price changes, supply is perfectly elastic.
2. Goods that can be produced at a constant (or very gently rising) opportunity cost have an elastic supply.
3. The supply of apples is perfectly elastic on the day of a price change.
4. The supply of a storable good is perfectly inelastic.
5. When the price of a pizza is $20, 10 pizzas are supplied and when the price rises to $30 a pizza, 14 pizzas are supplied. The price elasticity of supply of pizzas is 0.83.

Multiple choice
1. The price elasticity of supply is a measure of the extent to which the quantity supplied of a good changes when the ____ and all other influences on sellers’ plans remain the same.
   a. cost of producing the product increases
   b. quantity of the good demanded increases
   c. supply increases
   d. price of the good changes
2. When the percentage change in the quantity supplied exceeds the percentage change in price, then the good has ____ supply.
   a. an elastic
   b. an inelastic
   c. a unit elastic
   d. a perfectly inelastic

3. The supply of beachfront property on St. Simon’s Island is
   a. elastic.
   b. unit elastic.
   c. negative.
   d. inelastic.

4. If a good has a rapidly increasing opportunity cost of producing additional units, we would expect that ____ for that good is ____.
   a. demand; elastic
   b. supply; elastic
   c. demand; inelastic
   d. supply; inelastic

5. The greater the amount of time that passes after a price change, the
   a. less elastic supply becomes.
   b. more elastic supply becomes.
   c. more negative supply becomes.
   d. more positive supply becomes.

6. The price elasticity of supply equals the percentage change in the
   a. quantity demanded divided by the percentage change in the price of a substitute or complement.
   b. quantity supplied divided by the percentage change in price.
   c. quantity demanded divided by the percentage change in price.
   d. quantity demanded divided by the percentage change in income.

7. If a firm supplies 200 units at a price of $50 and 100 units at a price of $40, what is the price elasticity of supply?
   a. 0.33
   b. 1.00
   c. 3.00
   d. Not enough information is given to calculate the answer.

8. If the price of a good increases by 10 percent and the quantity supplied increases by 5 percent, then the elasticity of supply is
   a. greater than one and supply is elastic.
   b. negative and supply is inelastic.
   c. less than one and supply is elastic.
   d. less than one and supply is inelastic.

**Complete the graph**

**FIGURE 5.3**

1. In Figure 5.3, label the axes and then draw a supply curve for a good that has a perfectly inelastic supply.

**Short answer and numeric questions**

1. Suppose that the elasticity of supply of wheat is 0.3 and the elasticity of supply of magazines is 1.3. If the price of wheat rises 10 percent, what is the increase in the quantity of wheat supplied? If the price of a magazine rises 10 percent, what is the increase in the quantity of magazines supplied?

<table>
<thead>
<tr>
<th>Price (dollars)</th>
<th>Quantity supplied (units per week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 5</td>
<td>10</td>
</tr>
<tr>
<td>B 15</td>
<td>30</td>
</tr>
<tr>
<td>C 25</td>
<td>50</td>
</tr>
<tr>
<td>D 35</td>
<td>90</td>
</tr>
</tbody>
</table>

2. The table above gives a supply schedule. Calculate the price elasticity of supply between points A and B; between points B and C; and between points C and D.

3. Describe the elasticity of supply of a good that can be stored.

4. Why does the elasticity of supply increase as time passes after a price change?
CHECKPOINT 5.3

Define and explain the factors that influence the cross elasticity of demand and the income elasticity of demand.

Practice Problem 5.3

1. If the quantity demanded of good A increases by 5 percent when the price of good B rises by 10 percent and other things remain the same:
   a. Are goods A and B complements or substitutes? Why?
   b. Describe how the demand for good A changes.
   c. Calculate the cross elasticity of demand of good A with respect to good B.

2. If, when incomes rise by 5 percent and other things remain the same, the quantity demanded of good C increases by 1 percent:
   a. Is good C a normal good or an inferior good? Why?
   b. Describe how the demand for good C changes when income increases.
   c. Calculate the income elasticity of demand for good C.

Solution to Practice Problem 5.3

This Practice Problem studies cross elasticity of demand and income elasticity of demand. Remember that when you calculate the cross elasticity of demand for a good that you must divide the percentage change in the quantity of the good by the percentage change in the price of a substitute or complement.

Quick Review

- Cross elasticity of demand: A measure of the extent to which the demand for a good changes when the price of a substitute or complement changes, other things remaining the same.
- Income elasticity of demand: A measure of the extent to which the demand for a good changes when income changes, other things remaining the same.

1a. Are goods A and B complements or substitutes? Why?
   A substitute is a good that can be consumed in place of another good. A rise in the price of a substitute brings an increase in the quantity demanded of the other good. In the problem, a rise in the price of good B increases the quantity of good A demanded, so goods A and B are substitutes.

   1b. Describe how the demand for good A changes.
   As the price of good B rises, the demand for good A increases and the demand curve for good A shifts rightward.

   1c. Calculate the cross elasticity of demand of good A with respect to good B.
   The cross elasticity of demand equals the percentage change in the quantity demanded of good A divided by the percentage change in the price of good B, which is (5 percent) ÷ (10 percent) = 0.50.

2a. Is good C a normal good or an inferior good? Why?
   Good C is a normal good because when income increases the demand for the good increases.

   2b. Describe how the demand for good C changes when income increases.
   As income increases, the demand for good C increases and its demand curve shifts rightward.

   2c. Calculate the income elasticity of demand for good C.
   The income elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in income, which is (1 percent) ÷ (5 percent) = 0.20.

Additional Practice Problem 5.3a

Pepsi and Coke are substitutes. Pepsi and Tropicana orange juice also are substitutes. But quite likely the two cross elasticities of demand differ in size. Which cross elasticity do you think is larger and why?
Solution to Additional Practice Problem 5.3a

The cross elasticity between Pepsi and Coke is likely much larger than the cross elasticity between Pepsi and Tropicana orange juice. For many people, Pepsi and Coke are close to indistinguishable. Even a slight rise in the price of a Coke will increase the quantity of Pepsi demanded significantly, so their cross elasticity is large. Pepsi and Tropicana orange juice are less close substitutes. So, although an increase in the price of Tropicana orange juice will increase the demand for Pepsi, the increase will be relatively slight and the cross elasticity will be small.

Self Test 5.3

Fill in the blanks

The ____ (price; cross; income) elasticity of demand is a measure of the extent to which the demand for a good changes when the price of a substitute or complement changes, other things remaining the same. The cross elasticity of demand is ____ (positive; negative) for a substitute and ____ (positive; negative) for a complement. The income elasticity of demand equals the percentage change in ____ (the quantity demanded; income) divided by the percentage change in ____ (quantity demanded; income). The income elasticity of demand is ____ (positive; negative) for a normal good and ____ (positive; negative) for an inferior good.

True or false

1. If the cross elasticity of demand is negative, the two goods are substitutes.

2. If the cross elasticity between hamburgers and hot dogs is positive, then hamburgers and hot dogs are substitutes.

3. An inferior good has a negative income elasticity of demand.

4. When the income elasticity of demand of a good is positive, the good is a normal good.

5. A normal good is a good that has a positive cross elasticity of demand.

Multiple choice

1. The measure used to determine whether two goods are complements or substitutes is called the
   a. price elasticity of supply.
   b. cross elasticity of demand.
   c. price elasticity of demand.
   d. income elasticity.

2. If beef and pork are substitutes, the cross elasticity of demand between the two goods is
   a. negative.
   b. positive.
   c. indeterminate.
   d. elastic.

3. When the price of a pizza is $10, the quantity of soda demanded is 300 drinks. When the price of pizza is $15, the quantity of soda demanded is 100 drinks. The cross elasticity of demand equals
   a. –0.25.
   b. –0.40.
   c. –2.50.
   d. –25.00.

4. If two goods have a cross elasticity of –2, then when the price of the one increases, the demand curve of the other good
   a. shifts rightward.
   b. shifts leftward.
   c. remains unchanged.
   d. might shift rightward, leftward or remain unchanged.

5. Income elasticity of demand equals the percentage change in
   a. quantity demanded divided by the percentage change in the price of a substitute or complement.
   b. quantity supplied divided by the percentage change in price.
   c. quantity demanded divided by the percentage change in price.
   d. quantity demanded divided by the percentage change in income.

6. When income increases from $20,000 to $30,000 the number of home-delivered piz-
zas per year increases from 22 to 40. The income elasticity of demand for homedelivered pizza equals
a. 1.45.
b. 0.69.
c. 0.58.
d. 0.40.

7. If a product is a normal good, then its income elasticity of demand is
a. zero.
b. positive.
c. negative.
d. indeterminate.

8. The income elasticity of demand for used cars is less than zero. A used car is
a. an inferior good.
b. a normal good.
c. an inelastic good.
d. a perfectly inelastic good.

**Complete the graph**

**FIGURE 5.4**

Price (dollars per large screen television)

![Graph showing the demand curve for large screen televisions](image)

1. The income elasticity of demand for large screen televisions is positive. In Figure 5.4, show the change in the demand curve for large screen televisions when income increases.

**Short answer and numeric questions**

1. Do you think the cross elasticity of demand between Pepsi and Coke is positive or negative, large or small? Why?

2. The income elasticity of demand for inter-city bus trips is negative. What does this fact tell you about inter-city bus trips?

<table>
<thead>
<tr>
<th>Percentage change in income</th>
<th>Percentage change in quantity demanded</th>
<th>Income elasticity of demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>B 5</td>
<td>−10</td>
<td></td>
</tr>
<tr>
<td>C 5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>D 6</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

3. Complete the table above. Which row indicates an inferior good and which row indicates a good that is income elastic?
SELF TEST ANSWERS

CHECKPOINT 5.1

Fill in the blanks

To calculate the percentage change in price, the midpoint formula divides the change in price by the average of the initial and the new price and then multiplies by 100. If the percentage change in the quantity demanded exceeds the percentage change in the price, demand is elastic. The demand for a product is more elastic if there are more substitutes for it. The demand for a necessity is generally inelastic. The price elasticity of demand equals the percentage change in the quantity demanded divided by the percentage change in the price. Moving along a straight-line demand curve, the slope is constant and the elasticity varies. If demand is elastic, an increase in price decreases total revenue.

True or false
1. False; page 124
2. False; page 122
3. True; page 120
4. True; page 124
5. True; page 126

Multiple choice
1. c; page 118
2. d; page 118
3. a; page 120
4. a; page 120
5. b; page 120
6. b; page 122
7. b; page 122
8. a; page 126

Complete the graph
1. Figure 5.5 labels the axes and illustrates a demand curve for a good with a perfectly elastic demand; page 121.
2. In Figure 5.6, demand is elastic along the dark portion of the demand curve. Demand is unit elastic at the midpoint of curve. Demand is inelastic along the demand curve below the midpoint; page 124.

Short answer and numeric questions
1. The complete table is below; page 122.

<table>
<thead>
<tr>
<th>Percentage change in price</th>
<th>Percentage change in quantity demanded</th>
<th>Price elasticity of demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>

a. The most elastic demand is in row E; page 122.
b. The least elastic demand is in row C (the demand is perfectly inelastic); page 122.

2. The price rises by 20 percent; page 122.
3. Demand is inelastic if the percentage change in the quantity demanded is less than the percentage change in the price; page 120.

4. The more narrow the definition of the good, the more substitutes exist. For example, there are more substitutes for a slice of Pizza Hut pizza than for pizza in general; page 120.

5. When the price of a good rises, total revenue increases if demand is inelastic, total revenue does not change if demand is unit elastic, and total revenue decreases if demand is elastic. When the price of a good rises, your expenditure on the good increases if demand is inelastic, your expenditure does not change if demand is unit elastic, and your expenditure decreases if demand is elastic; page 126.

**CHECKPOINT 5.2**

**Fill in the blanks**

When supply has a vertical supply curve, then the supply of the good is perfectly inelastic. Goods that can be produced at an almost constant opportunity cost have an elastic supply. As time passes, the elasticity of supply increases. The price elasticity of supply equals the percentage change in the quantity supplied divided by the percentage change in the price. If the elasticity of supply is greater than 1, supply is elastic.

**True or false**

1. False; page 130
2. True; page 130
3. False; page 132
4. False; page 132
5. True; page 132

**Multiple choice**

1. d; page 130
2. a; page 130
3. d; page 130
4. d; page 130
5. b; page 132
6. b; page 132
7. c; page 132
8. d; page 132

**Complete the graph**

1. Figure 5.7 labels the axes and illustrates a supply curve for a good with a perfectly inelastic supply; page 131.

**FIGURE 5.7**

Price (dollars)

Quantity (units per year)

**Short answer and numeric questions**

1. If the price of wheat rises 10 percent, the increase in the quantity supplied equals (10 percent) × (0.3), which is 3 percent. If the price of a magazine rises 10 percent, the increase in the quantity supplied equals (10 percent) × (1.3), which is 13 percent; pages 130 and 133.

2. The price elasticity of supply between points A and B is 1.00; between points B and C is 1.00; and between points C and D is 1.71; page 132.

3. The elasticity of supply of a good that can be stored depends on the decision to keep the good in storage or offer it for sale. A small price change can make a big difference to this decision, so the supply of a storable good is highly elastic; page 132.

4. As time passes after a price change, it becomes easier to change production plans and supply becomes more elastic. For example, many manufactured goods have an inelastic supply if production plans have had only a short period in which to change. But after all the technologically possible ways of adjusting production have been exploited, supply is extremely elastic for most manufactured items; page 132.
CHECKPOINT 5.3

Fill in the blanks
The cross elasticity of demand is a measure of the extent to which the demand for a good changes when the price of a substitute or complement changes, other things remaining the same. The cross elasticity of demand is positive for a substitute and negative for a complement. The income elasticity of demand equals the percentage change in quantity demanded divided by the percentage change in income. The income elasticity of demand is positive for a normal good and negative for an inferior good.

True or false
1. False; page 135
2. True; page 135
3. True; page 136
4. True; page 136
5. False; page 136

Multiple choice
1. b; page 135
2. b; page 135
3. c; page 135
4. b; page 136
5. d; page 136
6. a; page 136
7. b; page 136
8. a; page 136

Complete the graph
1. Because the income elasticity of demand is positive, we know that large screen televisions are a normal good. In Figure 5.8 an increase in income shifts the demand curve rightward from $D_0$ to $D_1$; page 136.

Short answer and numeric questions
1. The cross elasticity of demand between Pepsi and Coke is most likely positive and large. Pepsi and Coke are substitutes for most people, so their cross elasticity of demand is positive. They are close substitutes for many people, so their cross elasticity of demand is large; page 135.
2. The fact that the income elasticity of demand for inter-city bus trips is negative indicates that an inter-city bus trip is an inferior good. When people’s incomes increase, they take fewer inter-city bus trips and instead fly, drive, or take the train; page 136.

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<td>2.0</td>
</tr>
<tr>
<td>B 5</td>
<td>−10</td>
<td>−2.0</td>
</tr>
<tr>
<td>C 5</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>D 6</td>
<td>6</td>
<td>1.0</td>
</tr>
</tbody>
</table>

3. The completed table is above. The good in Row B is an inferior good. The good in row A is income elastic; page 136.