## ANSWERS TO END-OF-CHAPTER QUESTIONS

- Explain why the choice between 1, 2, 3, 4, 5, 6, 7, and 8 "units" or 1000, 2000, 3000, 4000, 5000, 6000, 7000, and 8000 movie tickets, makes no difference in determining elasticity in Table 20.1.
  Price elasticity of demand is determined by comparing the percentage change in price and the percentage change in quantity demanded. The percentage change in quantity will remain the same regardless of whether the difference is between 1 unit and 2 units or 1000 units and 2000 units.
- 20-2 (*Key Question*) Graph the accompanying demand data and then use the midpoints formula for Ed to determine price elasticity of demand for each of the four possible \$1 price changes. What can you conclude about the relationship between the slope of a curve and its elasticity? Explain in a nontechnical way why demand is elastic in the northwest segment of the demand curve and inelastic in the southeast segment.

Product price	Quantity demanded
\$5	1
4	2
3	3
2	4
1	5

See the graph accompanying the answer to 20-4. Elasticities, top to bottom: 3; 1.4; .714; .333. Slope does not measure elasticity. This demand curve has a constant slope of -1 (= -1/1), but elasticity declines as we move down the curve. When the initial price is high and initial quantity is low, a unit change in price is a *low* percentage while a unit change in quantity is a *high* percentage change. The percentage change in quantity exceeds the percentage change in price, making demand elastic. When the initial price is low and initial quantity is high, a unit change in price is a *high* percentage change while a unit change in quantity is high, a unit change in price is a *high* percentage change while a unit change in quantity is high, a unit change in price is a *high* percentage change while a unit change in quantity is a *low* percentage change. The percentage change in quantity is a low percentage change.

20-3 Draw two linear demand curves parallel to one another. Demonstrate that for any specific price change demand is more elastic on the curve closer to the origin.

Two linear demand curves that are parallel to one another will have the same slope. (Slope is equal to the absolute vertical change divided by the absolute horizontal change.) For any specific change in price, the absolute change in quantity demanded would be the same on both of the parallel demand curves. This absolute change in quantity will represent a larger percentage change on the demand curve closest to the origin. The percentage change in the price will be the same for both demand curves. Since the formula for price elasticity places the percentage change in quantity demanded in the numerator and the percentage change in price in the denominator, elasticity will be greater on the curve closest to the origin.

In the example given Ed, equals 4—between points A and B on D1, the demand curve closest to the origin. Ed equals 2—between points C and D, the corresponding change on D2.

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20-4 (*Key Question*) Calculate total-revenue data from the demand schedule in question 2. Graph total revenue below your demand curve. Generalize on the relationship between price elasticity and total revenue.

See the graph. Total revenue data, top to bottom: \$5; \$8; \$9; \$8; \$5. When demand is elastic, price and total revenue move in the opposite direction. When demand is inelastic, price and total revenue move in the same direction.



- 20-5 (*Key Question*) How would the following changes in price affect total revenue. That is, would total revenue increase, decline, or remain unchanged?
  - a. Price falls and demand is inelastic.
  - b. Price rises and demand is elastic.
  - c. Price rises and supply is elastic.
  - d. Price rises and supply is inelastic.
  - e. Price rises and demand is inelastic.
  - f. Price falls and demand is elastic.
  - g. Price falls and demand is of unit elasticity.

Total revenue would increase in (c), (d), (e), and (f); decrease in (a) and (b); and remain the same in (g).

20-6 (*Key Question*) What are the major determinants of price elasticity of demand? Use these determinants and your own reasoning in judging whether demand for each of the following products is elastic or inelastic:

(a) bottled water, (b) tooth paste; (c) Crest toothpaste; (d) ketchup, (e) diamond bracelets; (f) Microsoft Windows operating system.

Substitutability, proportion of income; luxury versus necessity, and time. Elastic: (a), (c), (e). Inelastic: (b), (d), and (f).

20-7 What effect would a rule stating that university students must live in university dormitories have on the price elasticity of demand for dormitory space? What impact might this in turn have on room rates?

The ruling would make the price elasticity of demand more inelastic than if there were no such rule, assuming that there is not another equivalent university nearby to which students could transfer. Although universities are nonprofit organizations, the rule would certainly allow them to raise rates without worrying so much about students moving out to live elsewhere.

20-8 "If the demand for farm products is highly price inelastic, a bumper crop may reduce farm incomes." Evaluate and illustrate graphically.

The statement is true. As shown on the graph, the increased supply, S2, results in a considerably reduced income compared to the pre-bumper crop situation, S1. When demand is highly price inelastic, as it is here, the increase in quantity demanded as a result of a price decline is proportionately far less than the decline in price. Note that the decline in price from \$9 to \$4 results in a decline in farm revenue or income of \$21 (= \$45-\$24).

20-9 You are chairperson of a state tax commission responsible for establishing a program to raise new revenue through excise taxes. Would elasticity of demand be important to you in determining those products on which excises should be levied? Explain.

Elasticity of demand would be very important to me. I would select goods for which the demand was price inelastic. When demand is price inelastic, the decrease in quantity demanded as a result of the price increase caused by the excise tax is proportionately less than the increase in price. As a result, tax revenues will increase. An ideal good would be one for which the demand was perfectly inelastic. In such a case, there would be no decrease in quantity demanded at all when an excise tax was levied. Also, it would be helpful to find a good whose consumption is harmful. On these two counts, cigarettes and liquor make excellent candidates for excise taxes; to the extent that there is any cutback in consumption at all, the majority view now is that this is a good thing.

## Chapter 20: Demand and Supply: Elasticities and Applications

20-10 (*Key Question*) In November 1998 Vincent van Gogh's self-portrait sold at auction for \$71.5 million. Portray this sale in a demand and supply diagram and comment on the elasticity of supply. Comedian George Carlin once mused, "If a painting can be forged well enough to fool some experts, why is the original so valuable?" Provide an answer.

The supply is perfectly inelastic—vertical—at a quantity of 1 unit. The \$71.5 million price is determined where the downward sloping demand curve intersected this supply curve.

If more than one picture where available (all but one having to be a copy), the demand would likely decrease enormously.

20-11 Because of a legal settlement over state health care claims, in 1999 the U.S. tobacco companies had to raise the average price of a pack of cigarettes from \$1.95 to \$2.45. The projected decline in cigarette sales was 8 percent. What does this imply for the elasticity of cigarettes? Explain.

The price elasticity of demand for cigarettes was inelastic. The percentage change in price was 23 percent whereas the percentage change in quantity demanded was only 8 percent. For those hooked on cigarettes, even a 23 percent increase will not discourage them from smoking.

20-12 (*Key Question*) Suppose the cross elasticity of demand for products A and B is +3.6 and for products C and D it is -5.4. What can you conclude about how products A and B are related? Products C and D?

A and B are substitutes; C and D are complements.

20-13 (*Key Question*) The income elasticities of demand for movies, dental services, and clothing have been estimated to be +3.4, +1.0, and +0.5 respectively. Interpret these coefficients. What does it mean if the income elasticity coefficient is negative?

All are normal goods—income and quantity demanded move in the same direction. These coefficients reveal that a 1 percent increase in income will increase the quantity of movies demanded by 3.4 percent, of dental services by 1.0 percent, and of clothing by 0.5 percent. A negative coefficient indicates an inferior good—income and quantity demanded move in the opposite direction.

20-14 A recent study found that an increase in the price of beer would reduce the amount of marijuana consumed. Is cross elasticity between the two products positive or negative? Are these products substitutes or complements? What might be the logical relationship?

The cross elasticity of the two products is negative. The products appear to be complementary. As one drinks beer, one also smokes marijuana.

20-15 Why is it desirable for ceiling prices to be accompanied by government rationing? And for price floors to be accompanied by programs that purchase surpluses, restrict output, or increase demand? Show graphically why price ceilings entail shortages and price floors result in surpluses. What effect, if any, does elasticity of demand and supply have on the size of these shortages and surpluses? Explain.

A ceiling price that is set below the equilibrium price necessarily results in the quantity demanded being greater than the quantity supplied. This creates a shortage, as shown in Figure 20.4. To ensure that the restricted supply may be shared fairly among all those desiring it, government rationing is necessary.

A floor price that is set above the equilibrium price necessarily results in the quantity supplied being greater than the quantity demanded. This creates a surplus, as shown in Figure 20.5. The government must purchase the surplus (and store it and/or sell it abroad), or restrict supply to the quantity that will be bought at the floor price, or develop new uses for the product.

If the elasticity of demand and/or supply were inelastic, the shortage or surplus created by the government-set price will be less than if the demand and/or supply were elastic.