201-SH2-AB - Exercises #19 - Elasticity

1. For each demand equation, compute the elasticity of demand and determine whether the demand is elastic, unitary, or inelastic at the indicated price.

   (a) $x = -\frac{5}{4}p + 20; \qquad p = 10$

   (b) $x = -\frac{3}{2}p + 9; \qquad p = 2$

   (c) $x + \frac{1}{3}p - 20 = 0; \qquad p = 30$

   (d) $p = 144 - x^2; \qquad p = 96$

   (e) $p = 169 - x^2; \qquad p = 29$

2. The demand equation for the Roland portable hair dryer is given by

$$x = \frac{1}{5}(225 - p^2) \qquad (0 \leq p \leq 15)$$

   where x (measured in units of a hundred) is the quantity demanded per week and p is the unit price in dollars.

   (a) Compute the elasticity of demand.

   (b) Is the demand elastic or inelastic when $p = 8$? And when $x = 25$?

   (c) At what price is the demand unitary?

   (d) If the demand is increased by 1% from $x = 25$, what will be the corresponding percentage change in price? Will the revenue increase or decrease?

   (e) If the unit price is increased by 2% from \$8, what will be the corresponding percentage change in demand? Will the revenue increase or decrease?

3. The management of Titan Tire Company has has determined that the quantity demanded x of their Super Titan tires per week is related to the unit price p by the equation

$$x = \sqrt{144 - p} \qquad (0 \leq p \leq 144)$$

   where p is measured in dollars and x in units of a thousand.

   (a) Compute the elasticity of demand when $p = 63$, $p = 96$, and $x = 6$.

   (b) Is the demand elastic, unitary, or inelastic when $p = 63$, $p = 96$, and $x = 6$?

4. The proprietor of Showplace, a video store, has estimated that the rental price p (in dollars) of prerecorded DVDs is related to the quantity x (in thousands) rented per day by the demand equation

$$x = \frac{2}{3}\sqrt{36 - p^2} \qquad (0 \leq p \leq 6)$$

   Currently, the rental price is \$2/disc.

   (a) Compute the elasticity of demand.

   (b) Is the demand elastic or inelastic at this rental price?

   (c) If the rental price is increased by 3%, what will be the corresponding percentage change in demand? Will the revenue increase or decrease?

5. The quantity demanded each week x (in units of a hundred) of the Mikado digital camera is related to the unit price p (in dollars) by the demand equation

$$x = \sqrt{400 - 5p} \qquad (0 \le p \le 80)$$

   (a) Compute the elasticity of demand.

   (b) Is the demand elastic or inelastic when $p = 40$? When $x = 10$?

   (c) At what price is the demand unitary?

   (d) If the demand is increased by 4% from $x = 10$, what will be the corresponding percentage change in price? Will the revenue increase or decrease?

   (e) If the unit price is increased by 5% from \$40, what will be the corresponding percentage change in demand? Will the revenue increase or decrease?

6. The demand equation for a certain product is $2x + 5p - 60 = 0$, where p is the unit price and x is the quantity demanded of the product. Find the elasticity of demand and determine whether the demand is elastic or inelastic, at the indicated prices.

   (a) $p = 3$

   (b) $p = 6$

   (c) $p = 9$

7. The demand equation for a certain product is $x = 100 - 0.01p^2$.

   (a) Find the elasticity of demand.

   (b) Is the demand elastic, unitary, or inelastic when $p = 40$?

   (c) If the price is \$40 and it is raised by 6%, what will be the corresponding percentage change in demand? Will the revenue increase or decrease?

8. $\star$ The demand equation for a certain product is

$$p = 9\sqrt[3]{1000 - x}$$

   (a) Find the elasticity of demand.

   (b) Is the demand elastic, unitary, or inelastic when $p = 60$?

   (c) If the price is \$60 and it is raised by 7%, what will be the corresponding percentage change in demand? Will the revenue increase or decrease?

Answers

1. (a) $E(p) = -\dfrac{p}{p-16}$; $E(10) = \dfrac{5}{3}$; or $\eta = \dfrac{p}{p-16} = -\dfrac{5}{3}$; elastic

   (b) $E(p) = -\dfrac{p}{p-6}$; $E(2) = \dfrac{1}{2}$; or $\eta = \dfrac{p}{p-6} = -\dfrac{1}{2}$; inelastic

   (c) $E(p) = -\dfrac{p}{p-60}$; $E(30) = 1$; or $\eta = \dfrac{p}{p-60} = -1$; unitary

   (d) $E(p) = -\dfrac{p}{2p-288}$; $E(96) = 1$; or $\eta = \dfrac{p}{2p-288} = -1$; unitary

   (e) $E(p) = -\dfrac{p}{2p-338}$; $E(29) \approx 0.104$; or $\eta = \dfrac{p}{2p-338} \approx -0.104$; inelastic

2. (a) $E(p) = -\dfrac{2p^2}{p^2 - 225}$ or $\eta = \dfrac{2p^2}{p^2 - 225}$

   (b) Inelastic when $p = 8$; elastic when $x = 25$

   (c) $p = 8.66$

   (d) Price decreases by 0.625%; Revenue will increase

   (e) Demand decreases by 1.59%; Revenue will increase

3. (a) $E(p) = -\dfrac{p}{2p - 288}$ or $\eta = \dfrac{p}{2p - 288}$

   $E(63) = \dfrac{7}{18}$ or $\eta = -\dfrac{7}{18}$

   $E(96) = 1$ or $\eta = -1$

   When $x = 6$, we have $p = 108$ and $E(108) = \dfrac{3}{2}$ or $\eta = -\dfrac{3}{2}$

   (b) Inelastic; unitary; elastic

4. (a) $E(p) = -\dfrac{p^2}{p^2 - 36}$ or $\eta = \dfrac{p^2}{p^2 - 36}$

   (b) Inelastic

   (c) Demand will decrease by 0.375%; Revenue will increase

5. (a) $E(p) = -\dfrac{p}{2p - 160}$ or $\eta = \dfrac{p}{2p - 160}$

   (b) Inelastic when $p = 40$; elastic when $x = 10$

   (c) \$53.33

   (d) Price decreases by 2.667%; Revenue will increase.

   (e) Demand decreases by 7.5%; Revenue will increase

6. $E(p) = -\dfrac{p}{p - 12}$ or $\eta = \dfrac{p}{p - 12}$

   (a) $E(3) = \dfrac{1}{3}$ or $\eta = -\dfrac{1}{3}$; inelastic

   (b) $E(6) = 1$ or $\eta = -1$; unitary

   (c) $E(9) = 3$ or $\eta = -3$; elastic

7. (a) $E(p) = -\dfrac{2p^2}{p^2 - 10\,000}$ or $\eta = \dfrac{2p^2}{p^2 - 10\,000}$

   (b) Inelastic

   (c) Demand decreases by 2.29%; Revenue will increase

8. (a) $E(p) = -\dfrac{3p^3}{p^3 - 729\,000}$ or $\eta = \dfrac{3p^3}{p^3 - 729\,000}$

   (b) Elastic

   (c) Demand decreases by 8.84%; Revenue will decrease

Source: Soo T. Tan. *Applied Calculus for the Managerial, Life, and Social Sciences.* 10th Edition