# Principles of Economics
## Twelfth Edition

GLOBAL EDITION

# Chapter 5
## Elasticity

## Principles of Economics
TWELFTH EDITION

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# Chapter 5  Elasticity

- The model of supply and demand tells us a good deal about how a change in the price of a good affects behavior.

- But knowing the direction of a change is not enough.

- Economists measure market responsiveness using the concept of elasticity.

- **elasticity**  A general concept used to quantify the response in one variable when another variable changes.

$$\text{elasticity of A with respect to B} = \frac{\%\Delta A}{\%\Delta B}$$

# Price Elasticity of Demand

**price elasticity of demand** The ratio of the percentage change in quantity demanded to the percentage change in price; measures the responsiveness of quantity demanded to changes in price.

$$\text{price elasticity of demand} = \frac{\%\,Change\ in\ Quanity\ demanded}{\%\,change\ in\ price}$$

# FIGURE 5.1 Slope Is Not a Useful Measure of Responsiveness

a.



b.
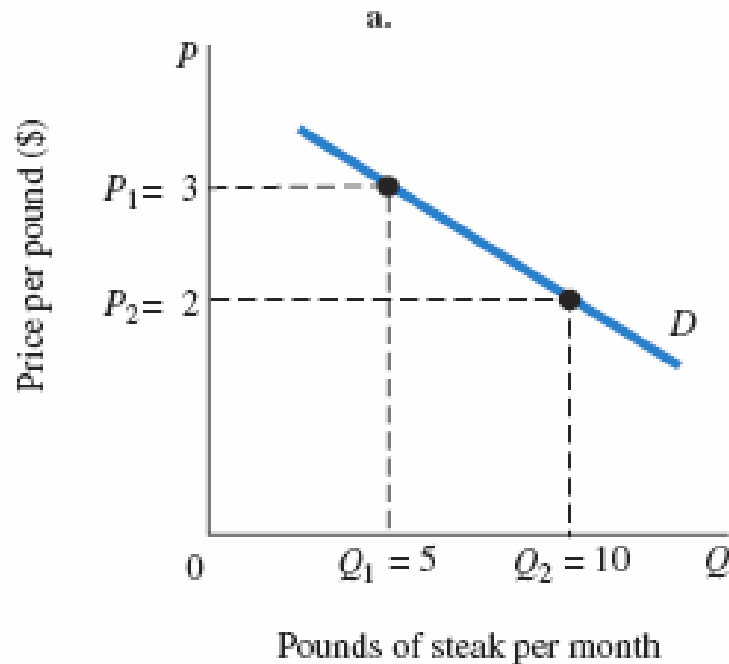


Slope: $\dfrac{\Delta Y}{\Delta X} = \dfrac{P_2 - P_1}{Q_2 - Q_1}$

$= \dfrac{2 - 3}{10 - 5} = -\dfrac{1}{5}$
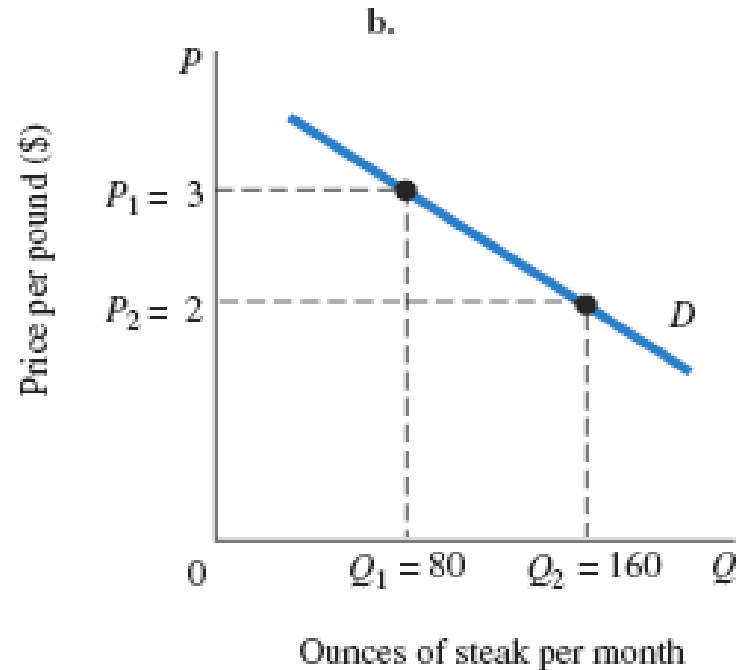
Slope: $\dfrac{\Delta Y}{\Delta X} = \dfrac{P_2 - P_1}{Q_2 - Q_1}$

$= \dfrac{2 - 3}{160 - 80} = -\dfrac{1}{80}$

Changing the unit of measure from pounds to ounces changes the numerical value of the demand slope dramatically, but the behavior of buyers in the two diagrams is identical.
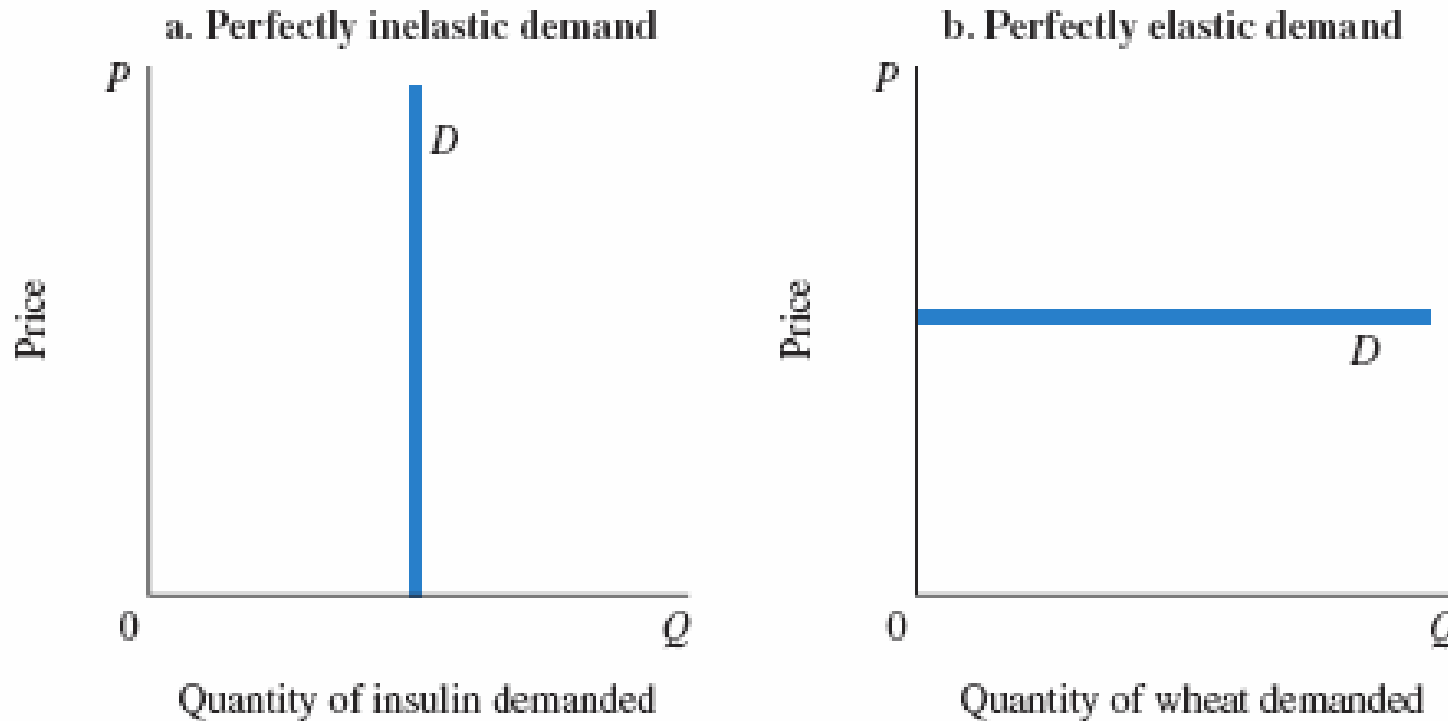
- **perfectly inelastic demand**  Demand in which quantity demanded does not respond at all to a change in price.

- **perfectly elastic demand**  Demand in which quantity drops to zero at the slightest increase in price.

- A good way to remember the difference between the two perfect elasticities is:

Perfectly Elastic
and Perfectly Inelastic

# FIGURE 5.2 Perfectly Inelastic and Perfectly Elastic Demand Curves



a. Perfectly inelastic demand

b. Perfectly elastic demand

Panel (a) shows a perfectly inelastic demand curve for insulin. Price elasticity of demand is zero. Quantity demanded is fixed; it does not change at all when price changes.
Panel (b) shows a perfectly elastic demand curve facing a wheat farmer. A tiny price increase drives the quantity demanded to zero. In essence, perfectly elastic demand implies that individual producers can sell all they want at the going market price but cannot charge a higher price.

- **elastic demand**  A demand relationship in which the percentage change in quantity demanded is larger than the percentage change in price in absolute value (a demand elasticity with an absolute value greater than 1).

- **inelastic demand**  Demand that responds somewhat, but not a great deal, to changes in price. Inelastic demand always has a numerical value between 0 and 1.

- **unitary elasticity**  A demand relationship in which the percentage change in quantity of a product demanded is the same as the percentage change in price in absolute value (a demand elasticity with an absolute value of 1).

- Because it is generally understood that demand elasticities are negative (demand curves have a negative slope), they are often reported and discussed without the negative sign.

## Calculating Percentage Changes

- Here is how we calculate percentage change in quantity demanded using the initial value as the base:

$$\%\text{change in quantity demanded} = \frac{\text{change in quantity demanded}}{Q_1} \times 100\%$$

$$= \frac{Q_2 - Q_1}{Q_1} \times 100\%$$

- We can calculate the percentage change in price in a similar way.

- By using $P_1$ as the base, the percentage of change in $P$ is:

$$\%\text{change in price} = \frac{\text{change in price}}{P_1} \times 100\%$$

$$= \frac{P_2 - P_1}{P_1} \times 100\%$$

# Elasticity Is a Ratio of Percentages

- Recall the formal definition of elasticity:

$$\text{price elasticity of demand} = \frac{\%\ \text{change in quantity demanded}}{\%\ \text{change in price}} \times 100\%$$

# The Midpoint Formula

- **midpoint formula** A more precise way of calculating percentages using the value halfway between $P_1$ and $P_2$ for the base in calculating the percentage change in price and the value halfway between $Q_1$ and $Q_2$ as the base for calculating the percentage change in quantity demanded.

$$\%\text{change in quantity demanded} = \frac{\text{change in quantity demanded}}{Q_1} \times 100\%$$

$$= \frac{Q_2 - Q_1}{Q_1} \times 100\%$$

# Point Elasticity *(1 of 3)*

- **point elasticity**  A measure of elasticity that uses the slope measurement.

- Elasticity is the percentage change in quantity demanded divided by the percentage change in price, i.e.,

$$\frac{\dfrac{\Delta Q}{Q_1}}{\dfrac{\Delta P}{P_1}}$$

where $\Delta$ denotes a small change and Q1 and P1 refer to the original price and quantity demanded.

- The formula can be rearranged and written as:

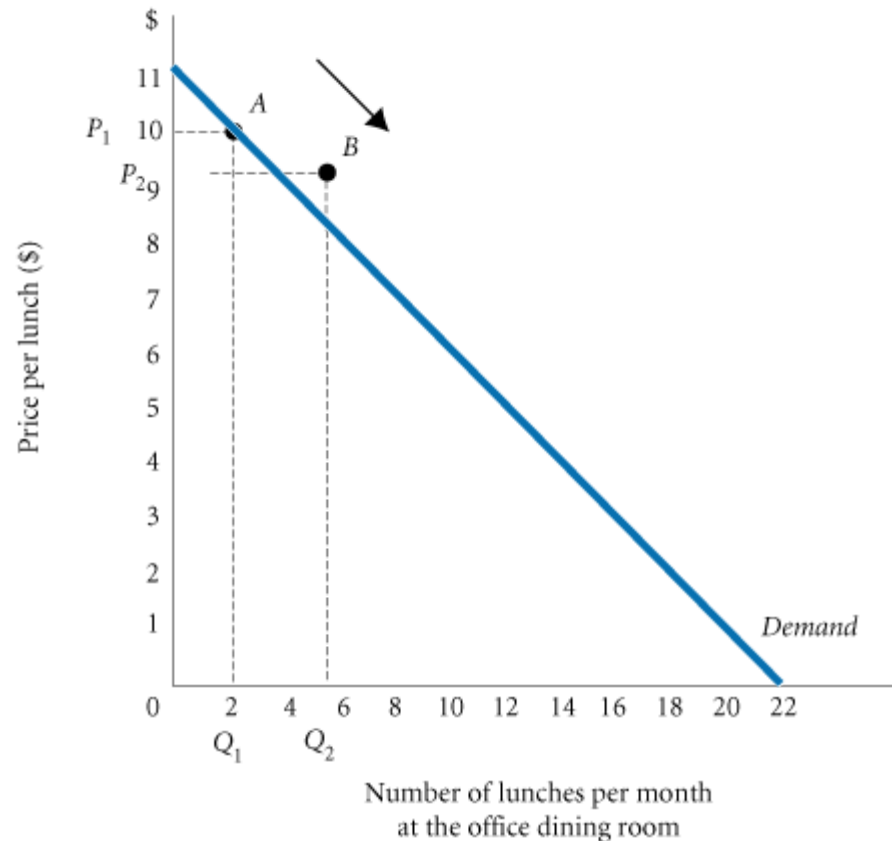$$\frac{\Delta Q}{\Delta P} \cdot \frac{P_1}{Q_1}$$

- Notice that $\Delta Q/\Delta P$ is the reciprocal of the slope.

- Using the point method avoids the problem of calculating elasticity over a segment of the curve.

# Elasticity Changes along a Straight-Line Demand Curve

**TABLE 5.1  Demand Schedule for Office Dining Room Lunches**

**FIGURE 5.3  Demand Curve for Lunch at the Office Dining Room**

| Price (per Lunch) | Quantity Demanded (Lunches per Month) |
|---|---|
| $11 | 0 |
| 10 | 2 |
| 9 | 4 |
| 8 | 6 |
| 7 | 8 |
| 6 | 10 |
| 5 | 12 |
| 4 | 14 |
| 3 | 16 |
| 2 | 18 |
| 1 | 20 |
| 0 | 22 |



To calculate price elasticity of demand between points *A* and *B* on the demand curve, first calculate the percentage change in quantity demanded:
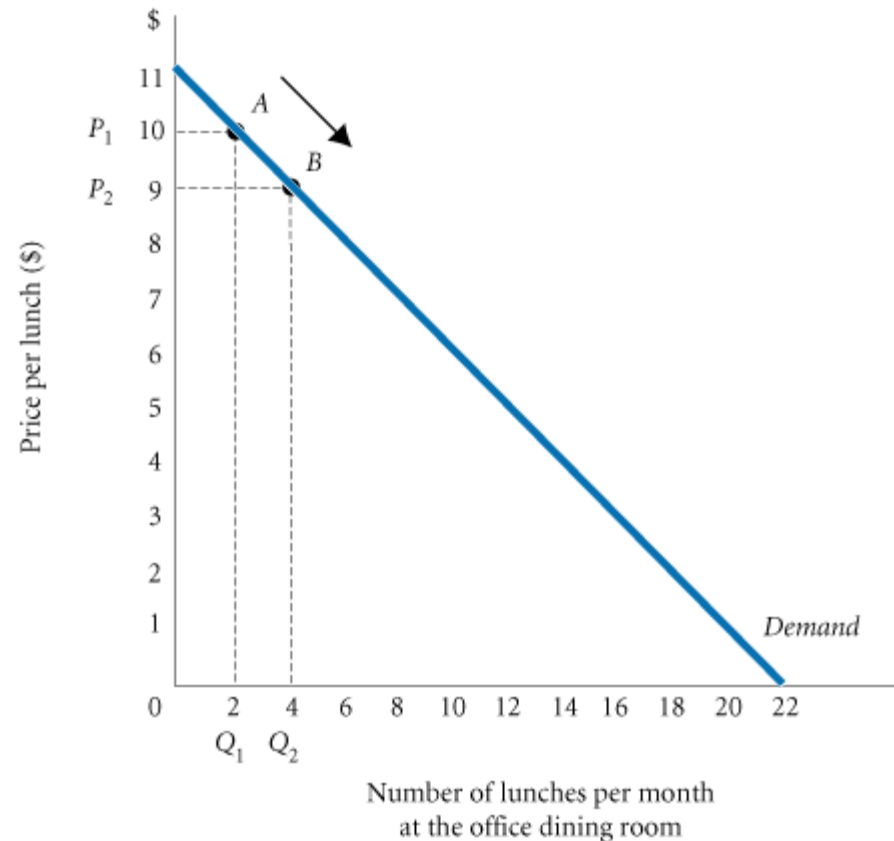
$$\% \text{ change in quantity demanded} = \frac{4-2}{(2+4)/2} \times 100\% = \frac{2}{3} \times 100\% = 66.7\%$$

# Elasticity Changes along a Straight-Line Demand Curve

**TABLE 5.1 Demand Schedule for Office Dining Room Lunches**

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**FIGURE 5.3 Demand Curve for Lunch at the Office Dining Room**



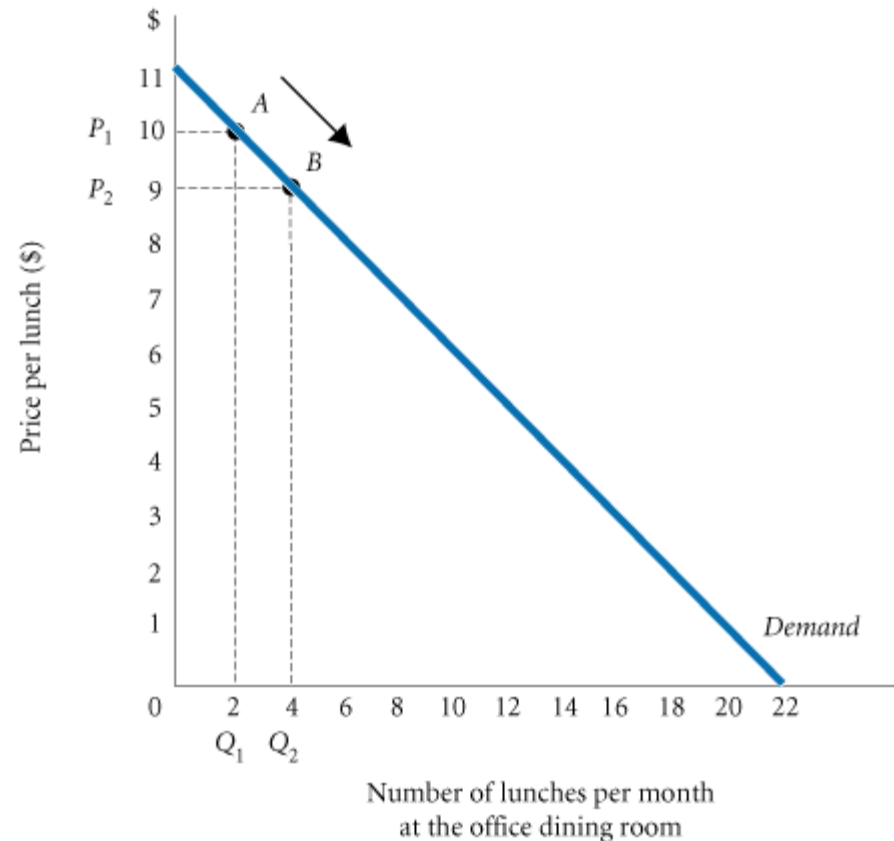Next, calculate the percentage change in price:

$$\% \text{ change in price } = \frac{9 - 10}{(10 + 9)/2} \times 100\% = \frac{-1}{9.5} \times 100\% = -10.5\%$$

# Elasticity Changes along a Straight-Line Demand Curve

**TABLE 5.1  Demand Schedule for Office Dining Room Lunches**

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|:---:|:---:|
| $11 | 0 |
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**FIGURE 5.3  Demand Curve for Lunch at the Office Dining Room**


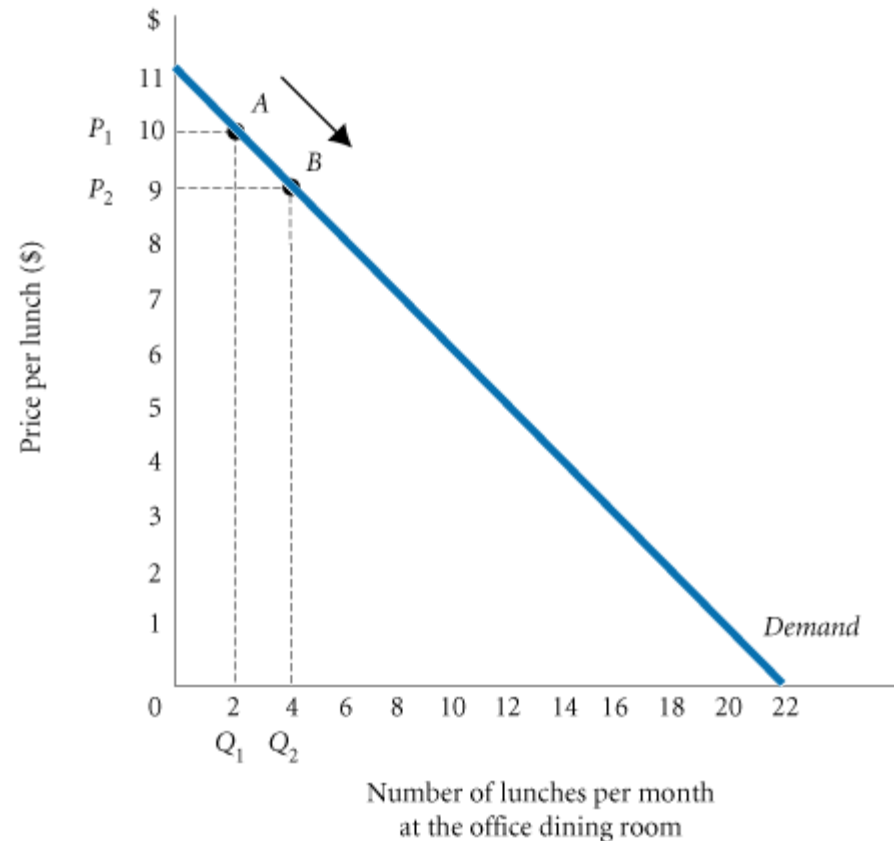
Finally, calculate elasticity:

$$\text{elasticity of demand} = \frac{66.7\%}{-10.5\%} = -6.33$$

# Elasticity Changes along a Straight-Line Demand Curve

**TABLE 5.1  Demand Schedule for Office Dining Room Lunches**

| Price (per Lunch) | Quantity Demanded (Lunches per Month) |
|---|---|
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| 4 | 14 |
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| 2 | 18 |
| 1 | 20 |
| 0 | 22 |

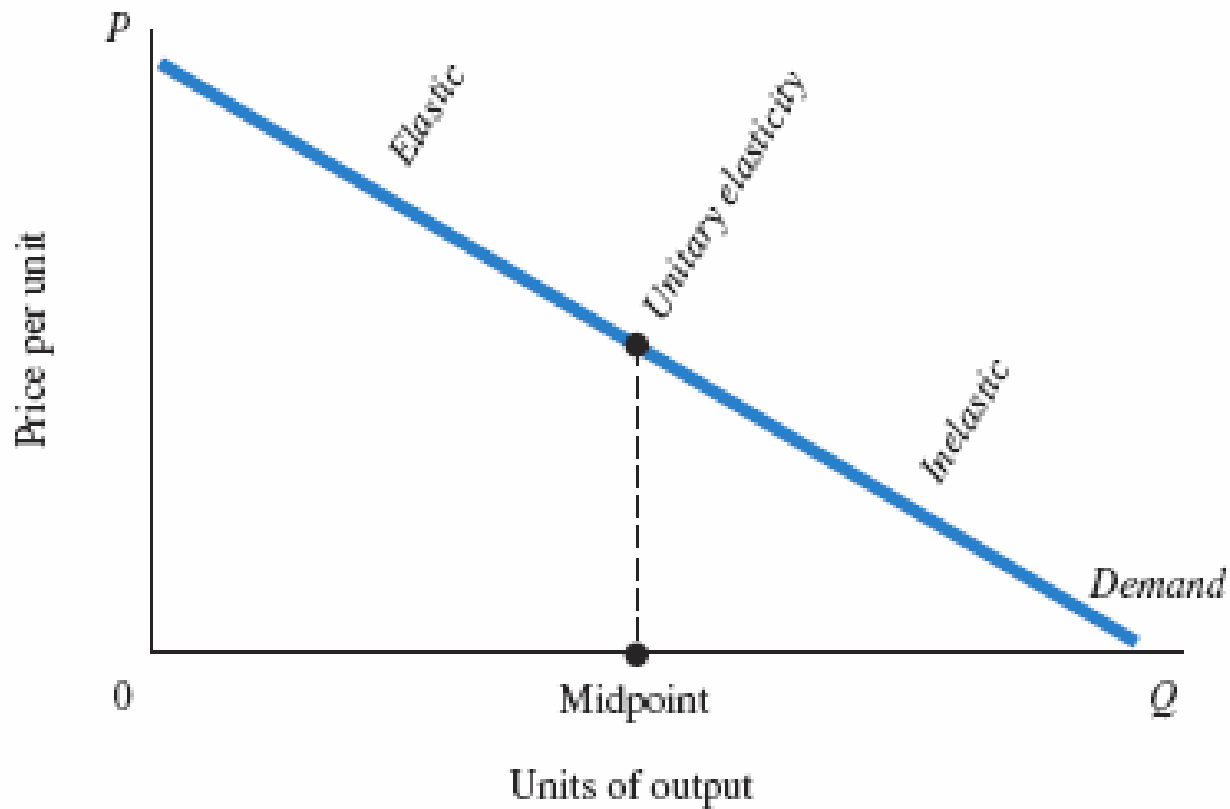**FIGURE 5.3  Demand Curve for Lunch at the Office Dining Room**



Between points A and B, demand is quite elastic, at −6.33.
Between points C and D, demand is quite inelastic, at −.294.

# FIGURE 5.4 Point Elasticity Changes along a Demand Curve

- In any market, $P \times Q$ is total revenue ($TR$) received by producers:

$$TR = P \times Q$$

total revenue = price × quantity

Effects of price changes
on quantity demanded:
$$P \uparrow \rightarrow Q_D \downarrow$$
and
$$P \downarrow \rightarrow Q_D \uparrow$$

When price ($P$) declines, quantity demanded ($Q_D$) increases. The two factors, $P$ and $Q_D$, move in opposite directions.

- Because total revenue is the product of *P* and *Q*, whether *TR* rises or falls in response to a price increase depends on which is bigger: the percentage increase in price or the percentage decrease in quantity demanded.

Effect of price increase on

a product with inelastic demand:     $\uparrow P \times Q_D \downarrow = TR \uparrow$

# Elasticity and Total Revenue (3 of 4)

- If the percentage decline in quantity demanded following a price increase is larger than the percentage increase in price, total revenue will fall.

Effect of price increase on

a product with elastic demand: $\uparrow P \times Q_D \downarrow = TR \downarrow$

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- The opposite is true for a price cut. When demand is elastic, a cut in price increases total revenue.

Effect of price cut on a product with elastic demand:

$$\downarrow P \times Q_{\mathrm{D}} \uparrow = TR \uparrow$$

- When demand is inelastic, a cut in price reduces total revenue.

Effect of price cut on a product with inelastic demand:

$$\downarrow P \times Q_{\mathrm{D}} \uparrow = TR \downarrow$$

# The Determinants of Demand Elasticity

**Availability of Substitutes**

- Perhaps the most obvious factor affecting demand elasticity is the availability of substitutes.

**The Importance of Being Unimportant**

- When an item represents a relatively small part of our total budget, we tend to pay little attention to its price.

# The Determinants of Demand Elasticity

*(2 of 2)*

**Luxuries versus Necessities**

- Luxury goods (e.g., yachts) tend to have relatively elastic demand, and necessities (e.g., food) have inelastic demand.

**The Time Dimension**

- In the longer run, demand is likely to become more elastic because households make adjustments over time, and producers develop substitute goods.

**Income Elasticity of Demand**

- **income elasticity of demand**  A measure of the responsiveness of demand to changes in income.

$$\text{income elasticity of demand} = \frac{\%\text{change in quantity demanded}}{\%\text{change in price}}$$

**Cross-Price Elasticity of Demand**

- **cross-price elasticity of demand** A measure of the response of the quantity of one good demanded to a change in the price of another good.

$$\text{cross} - \text{price elasticity of demand} = \frac{\%\text{change in quantity of } Y \text{ demanded}}{\%\text{change in price of } X}$$

# Elasticity of Supply

- **elasticity of supply** A measure of the response of quantity of a good supplied to a change in price of that good. Likely to be positive in output markets.

$$\text{elasticity of supply } = \frac{\%\text{change in quantity supplied}}{\%\text{ change in price}}$$

- **elasticity of labor supply** A measure of the response of labor supplied to a change in the price of labor.

$$\text{elasticity of labour supply} = \frac{\%\text{change in quantity of labour supplied}}{\%\text{change in the wage rate}}$$

# REVIEW TERMS AND CONCEPTS

- cross-price elasticity of demand

- elastic demand

- elasticity

- elasticity of labor supply

- elasticity of supply

- excise tax

- income elasticity of demand

- inelastic demand

- midpoint formula

- perfectly elastic demand

- perfectly inelastic demand

- point elasticity

- price elasticity of demand

- unitary elasticity