5

Elasticity and Its Application

Elasticity . . .

- … allows us to analyze supply and demand with greater precision.

- … is a measure of how much buyers and sellers respond to changes in market conditions

THE ELASTICITY OF DEMAND

- The *price elasticity of demand* is a measure of how much the quantity demanded of a good responds to a change in the price of that good.
- When we talk about *elasticity*, that responsiveness is always measured in percentage terms.
- Specifically, the price elasticity of demand is the percentage change in quantity demanded due to a percentage change in the price.

Computing the Price Elasticity of Demand

- The price elasticity of demand is computed as the percentage change in the quantity demanded divided by the percentage change in price.

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

The Price Elasticity of Demand and Its Determinants

- Availability of Close Substitutes
- Necessities versus Luxuries
- Definition of the Market
- Time Horizon

The Price Elasticity of Demand and Its Determinants

- Demand tends to be more elastic:
  - the larger the number of close substitutes.
  - if the good is a luxury.
  - the longer the time period.

The Midpoint Method: A Better Way to Calculate Percentage Changes and Elasticities

- The midpoint formula is preferable when calculating the price elasticity of demand because it gives the same answer regardless of the direction of the price change.

$$\text{Price elasticity of demand} = \frac{(Q_2 - Q_1)/[(Q_2 + Q_1)/2]}{(P_2 - P_1)/[(P_2 + P_1)/2]}$$

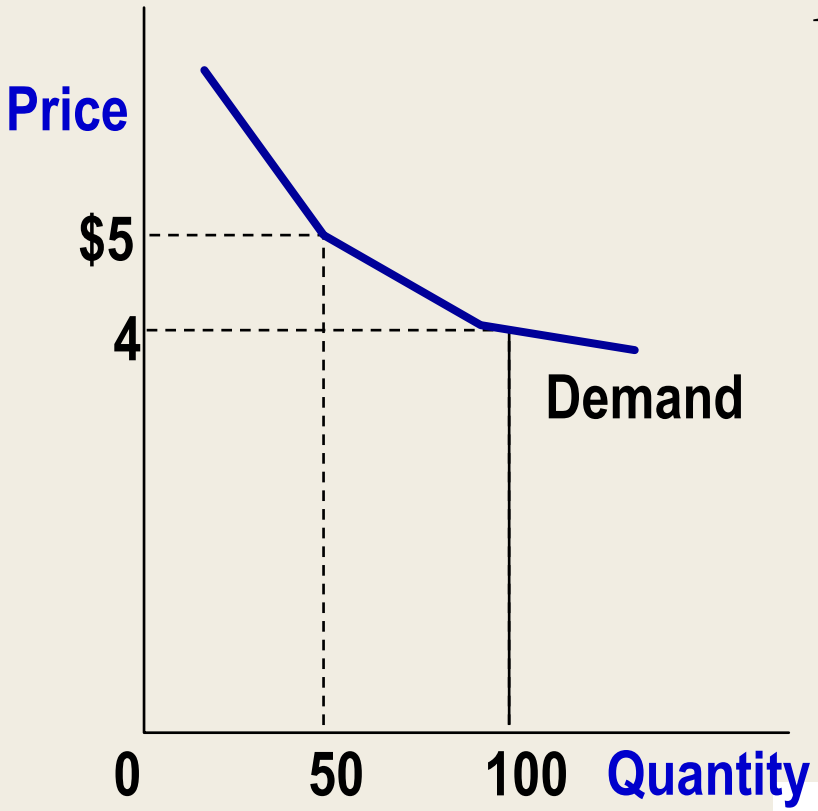
The Midpoint Method: A Better Way to Calculate Percentage Changes and Elasticities

- Example: If the price of an ice cream cone increases from $2.00 to $2.20 and the amount you buy falls from 10 to 8 cones, then your elasticity of demand, using the midpoint formula, would be calculated as: x/y, where x=(8-10)/((10+8)/2), and y=(2.20-2.00)/((2.00+2.20)/2)= -2.32

The Variety of Demand Curves

- Inelastic Demand
  - Quantity demanded does not respond strongly to price changes.
  - Absolute Value of Price elasticity of demand is between zero and one.
- Elastic Demand
  - Quantity demanded responds strongly to changes in price.
  - Absolute Value of Price elasticity of demand is greater than one.

Computing the Price Elasticity of Demand



$$E_D = \frac{(100-50)/(100+50)/2}{(4.00-5.00)/(4.00+5.00)/2}$$

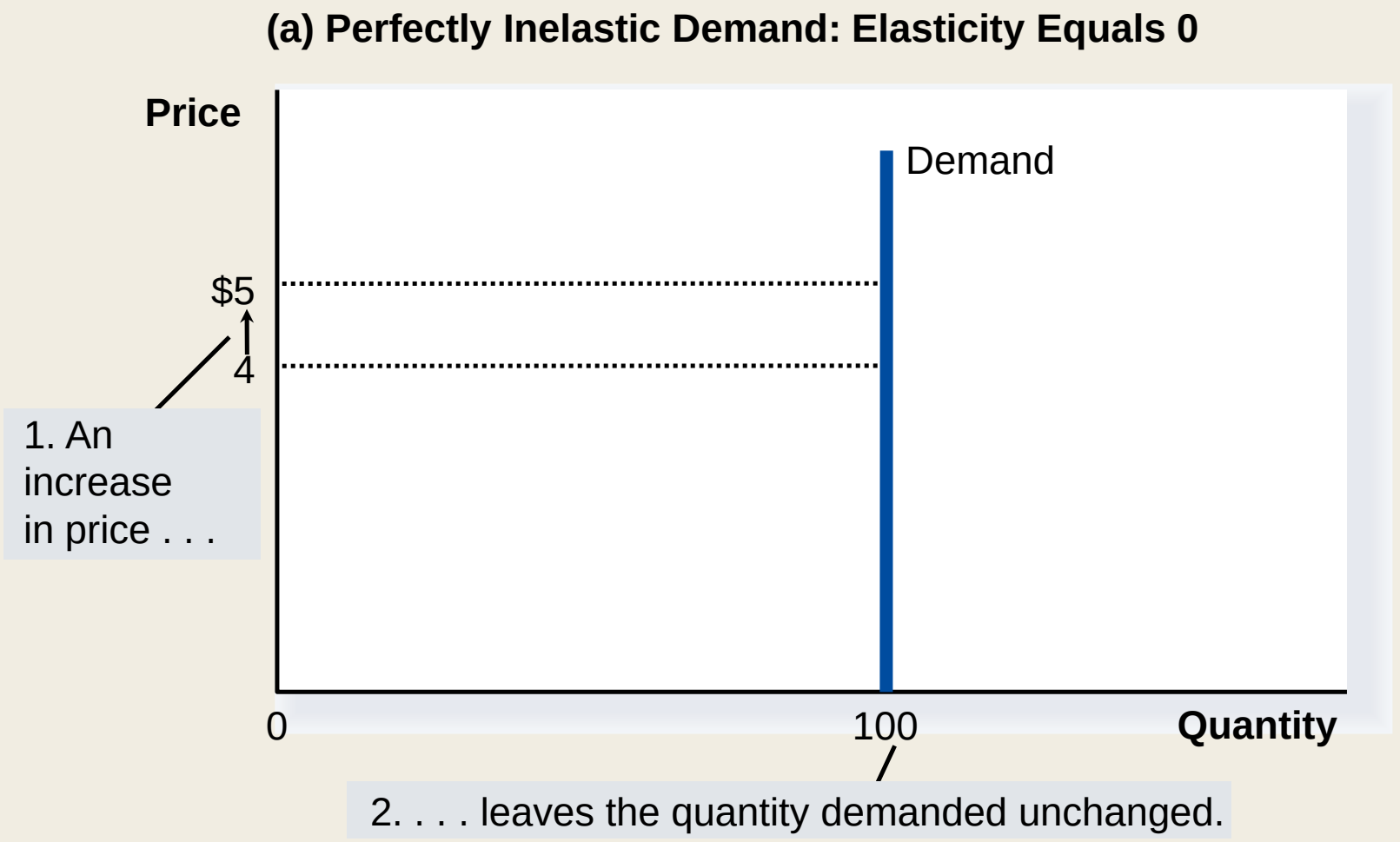
$$= \frac{67 \text{ percent}}{-22 \text{ percent}} = -3$$

Demand is price elastic.

The Variety of Demand Curves

- Perfectly Inelastic
  - Quantity demanded does not respond to price changes.
- Perfectly Elastic
  - Quantity demanded changes infinitely with any change in price.
- Unit Elastic
  - Quantity demanded changes by the same percentage as the price.

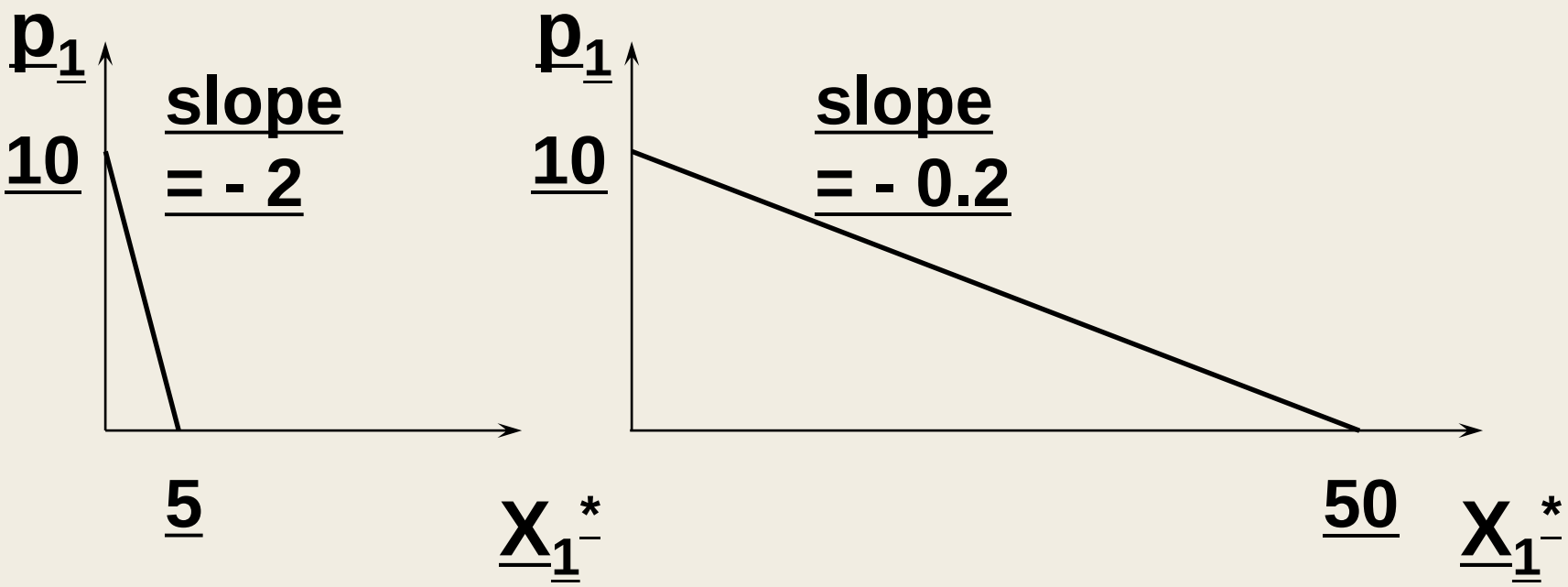
Figure 1 The Price Elasticity of Demand



The Variety of Demand Curves

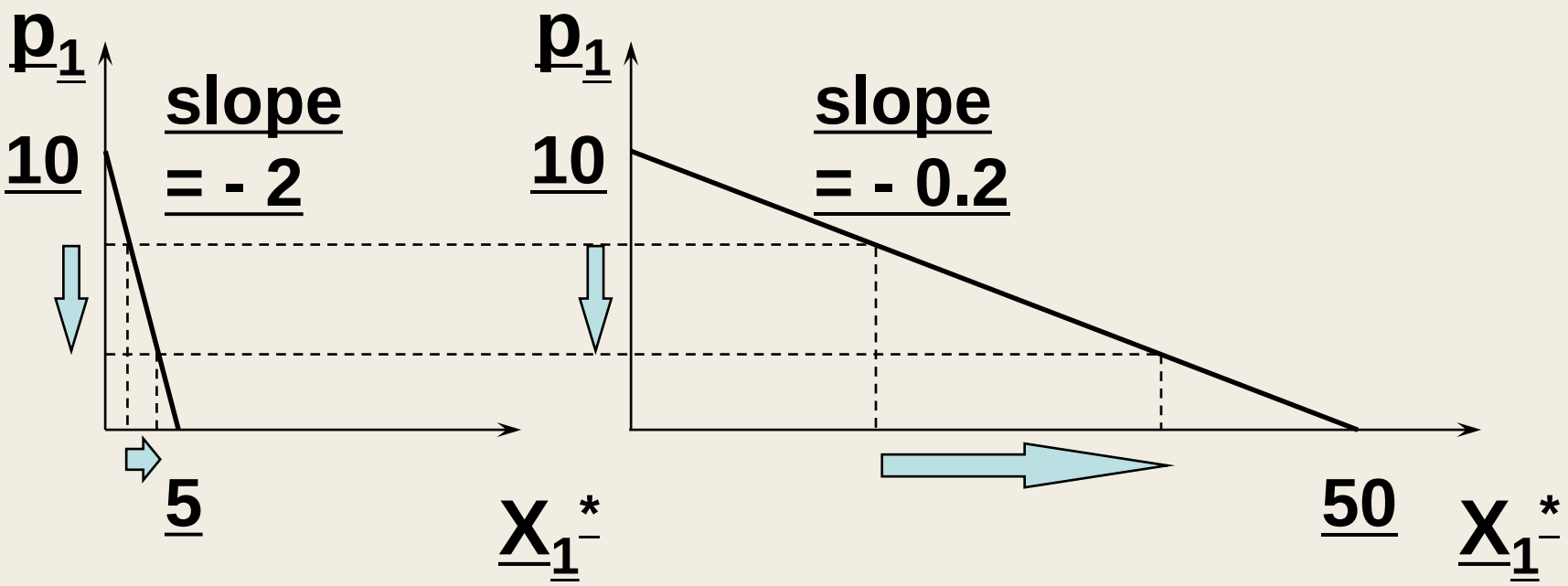
- Because the price elasticity of demand measures how much quantity demanded responds to the price, it is closely related to the slope of the demand curve.
- But it is not the same thing as the slope!

Own-Price Elasticity of Demand



In which case is the quantity demanded X_1^* more sensitive to changes to p_1?

Own-Price Elasticity of Demand



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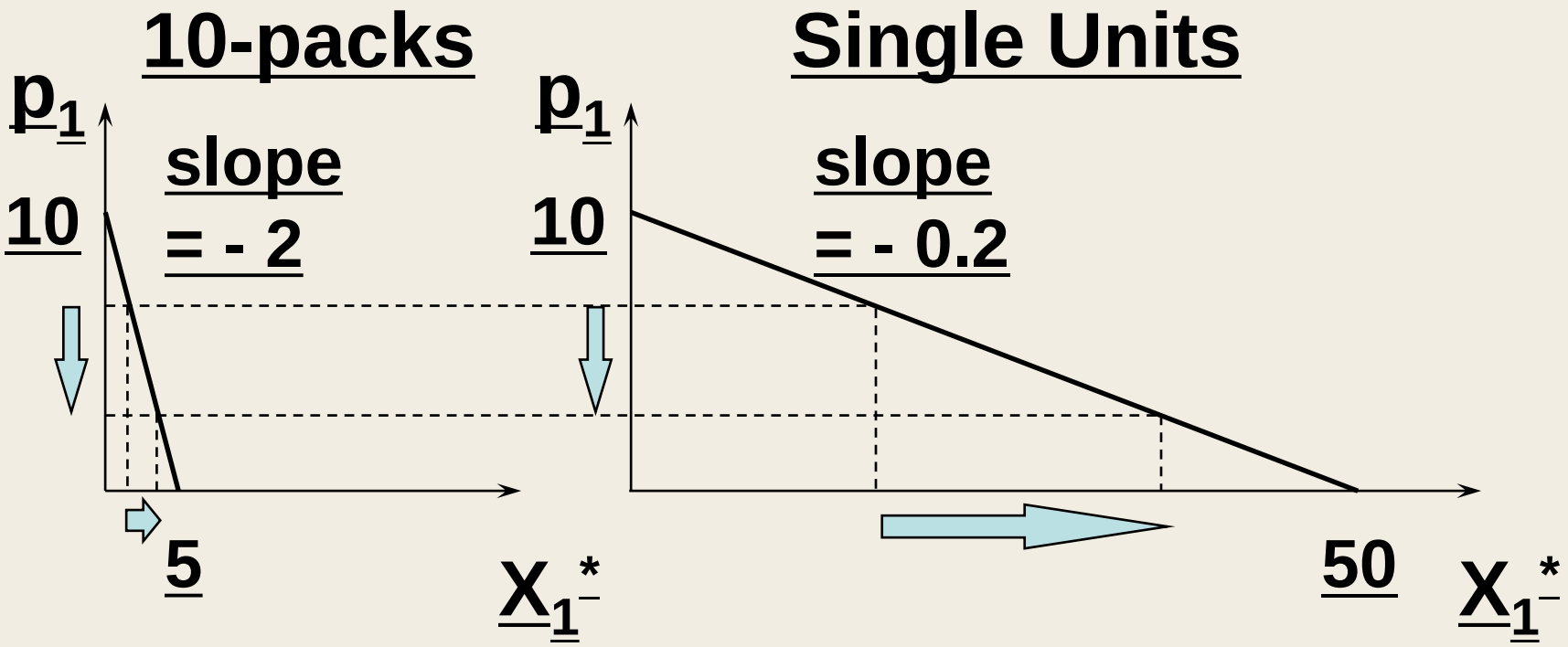

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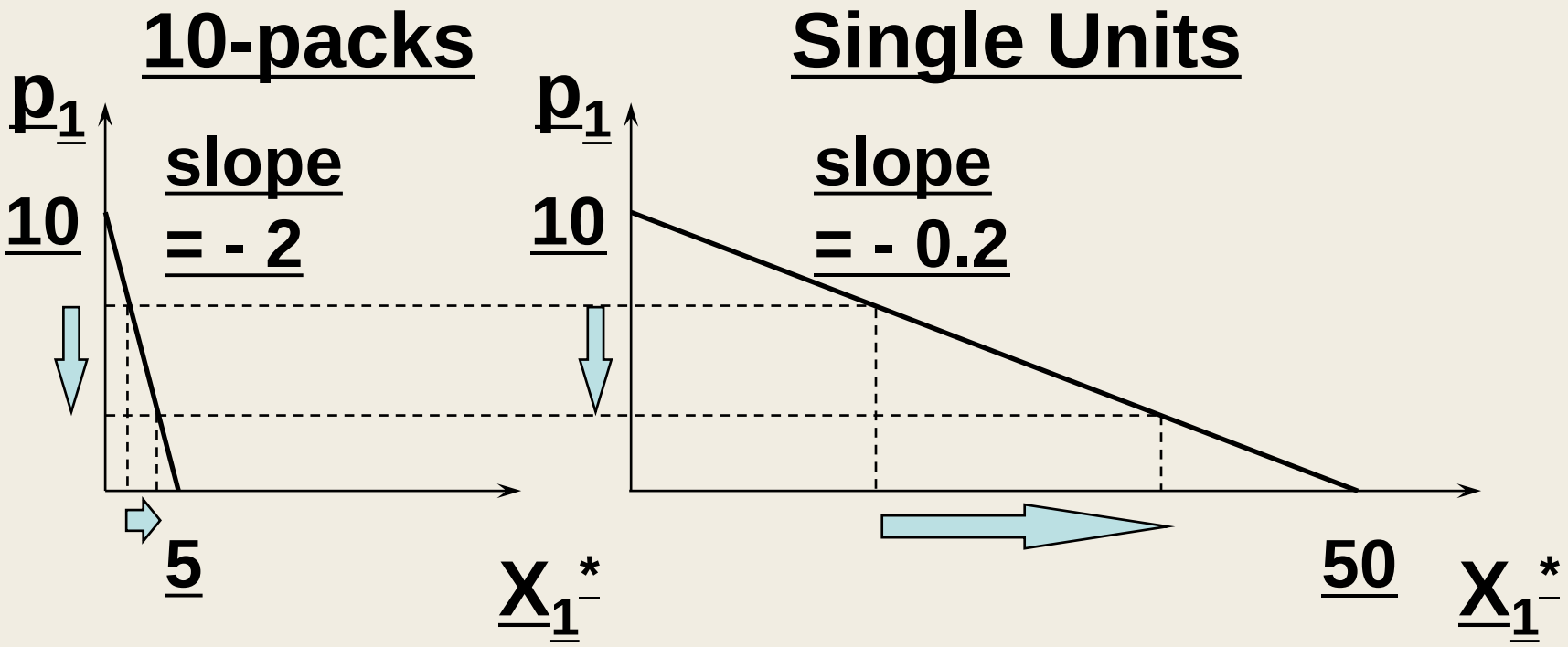


In which case is the quantity demanded X_1^* more sensitive to changes to p_1?
It is the same in both cases.

Own-Price Elasticity of Demand

- Q: Why not just use the slope of a demand curve to measure the sensitivity of quantity demanded to a change in a commodity's own price?
- A: Because the value of sensitivity then depends upon the (arbitrary) units of measurement used for quantity demanded.

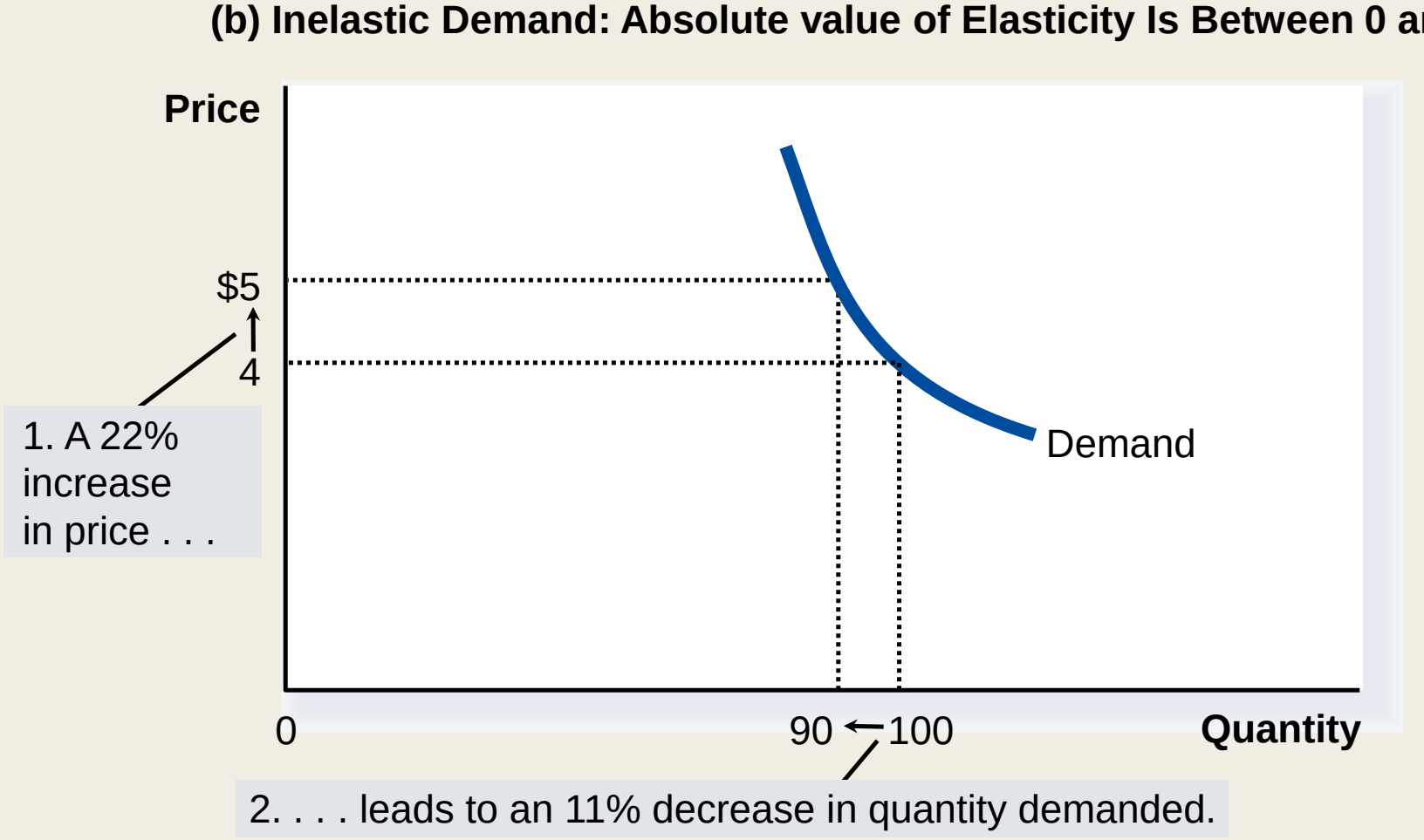
Own-Price Elasticity of Demand

$$\varepsilon_{x_1^*,p_1} = \frac{\%\Delta x_1^*}{\%\Delta p_1}$$

is a ratio of percentages and so has no units of measurement.

Hence own-price elasticity of demand is a sensitivity measure that is independent of units of measurement.

Figure 1 The Price Elasticity of Demand



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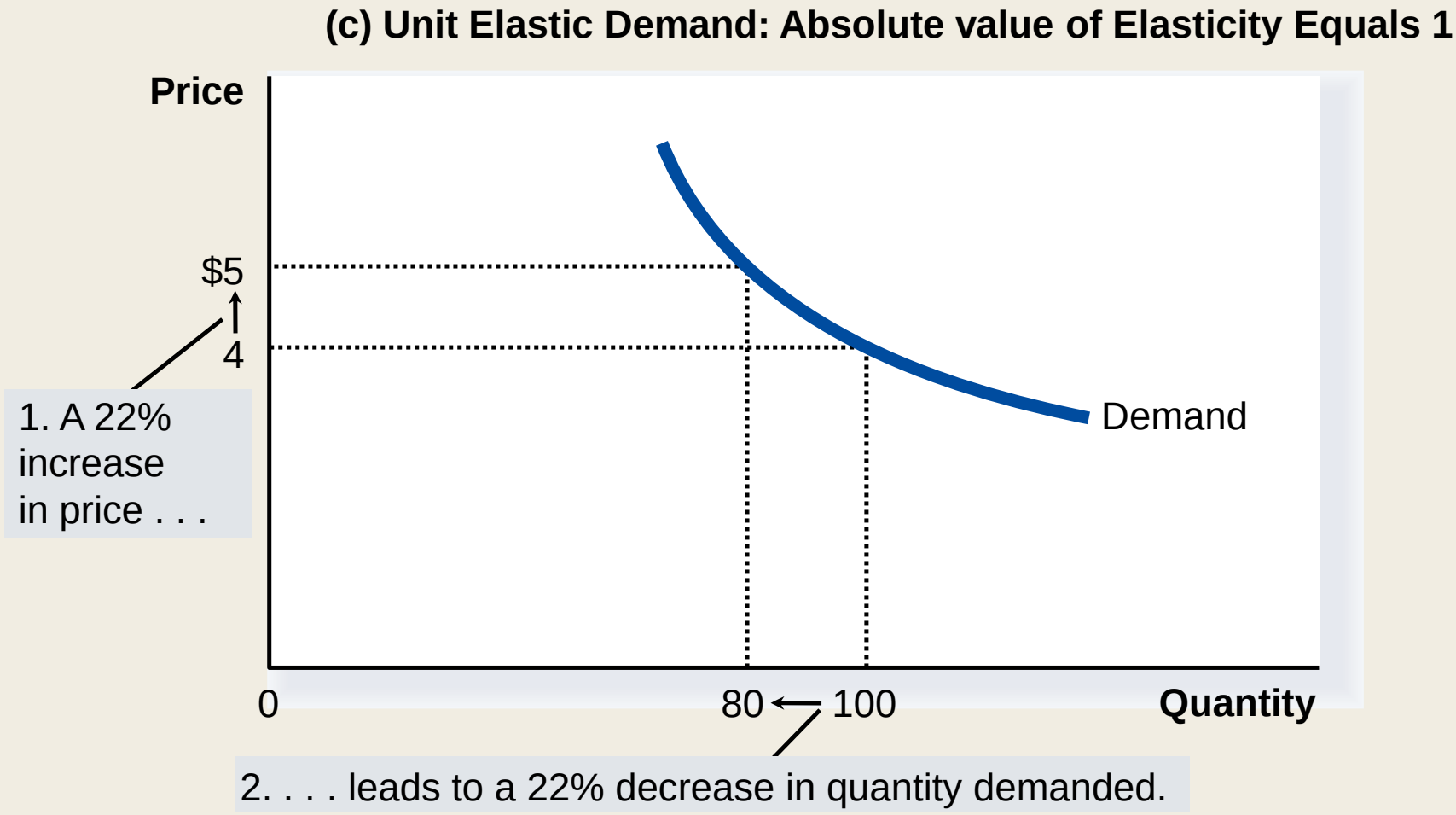

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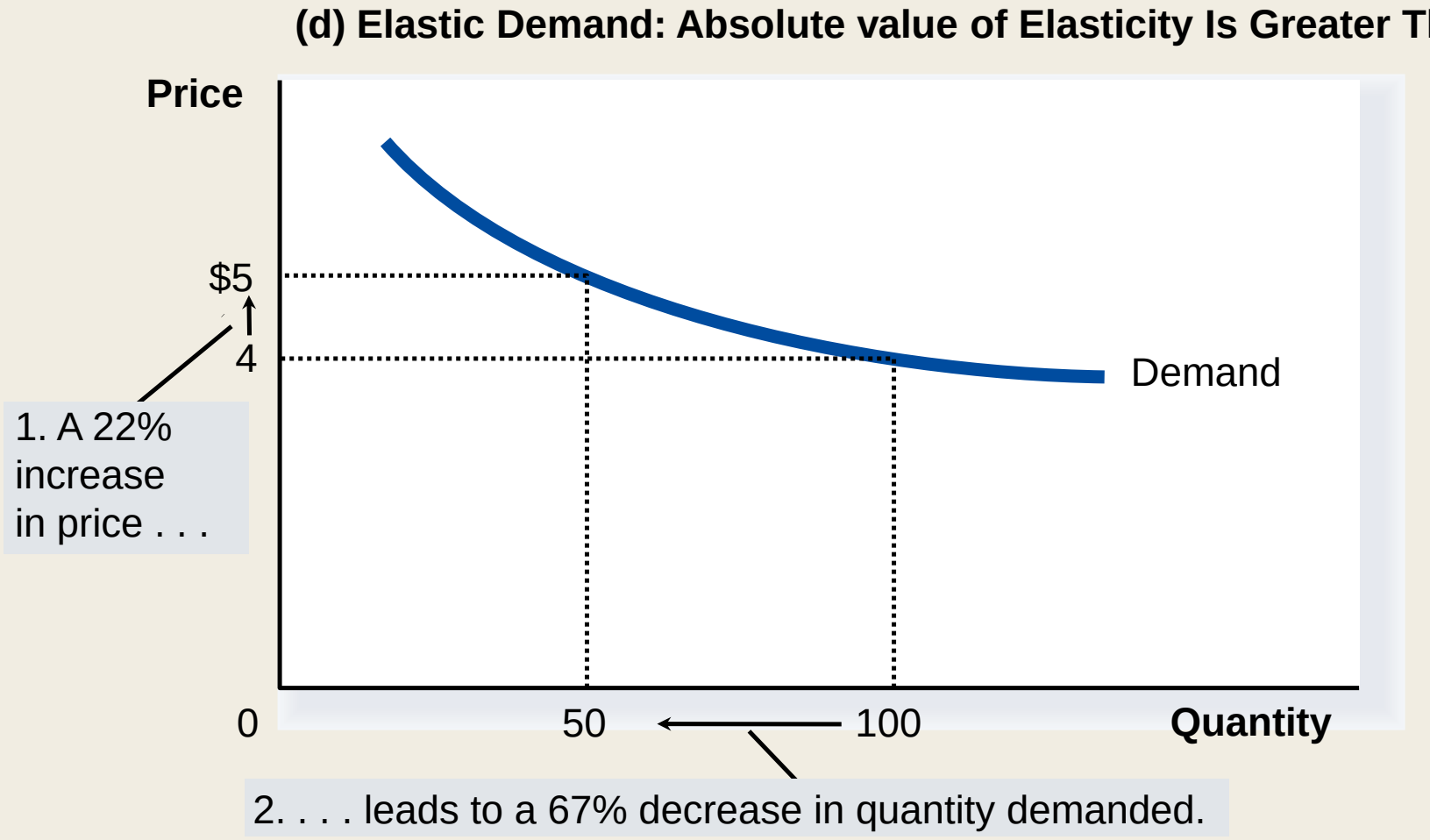

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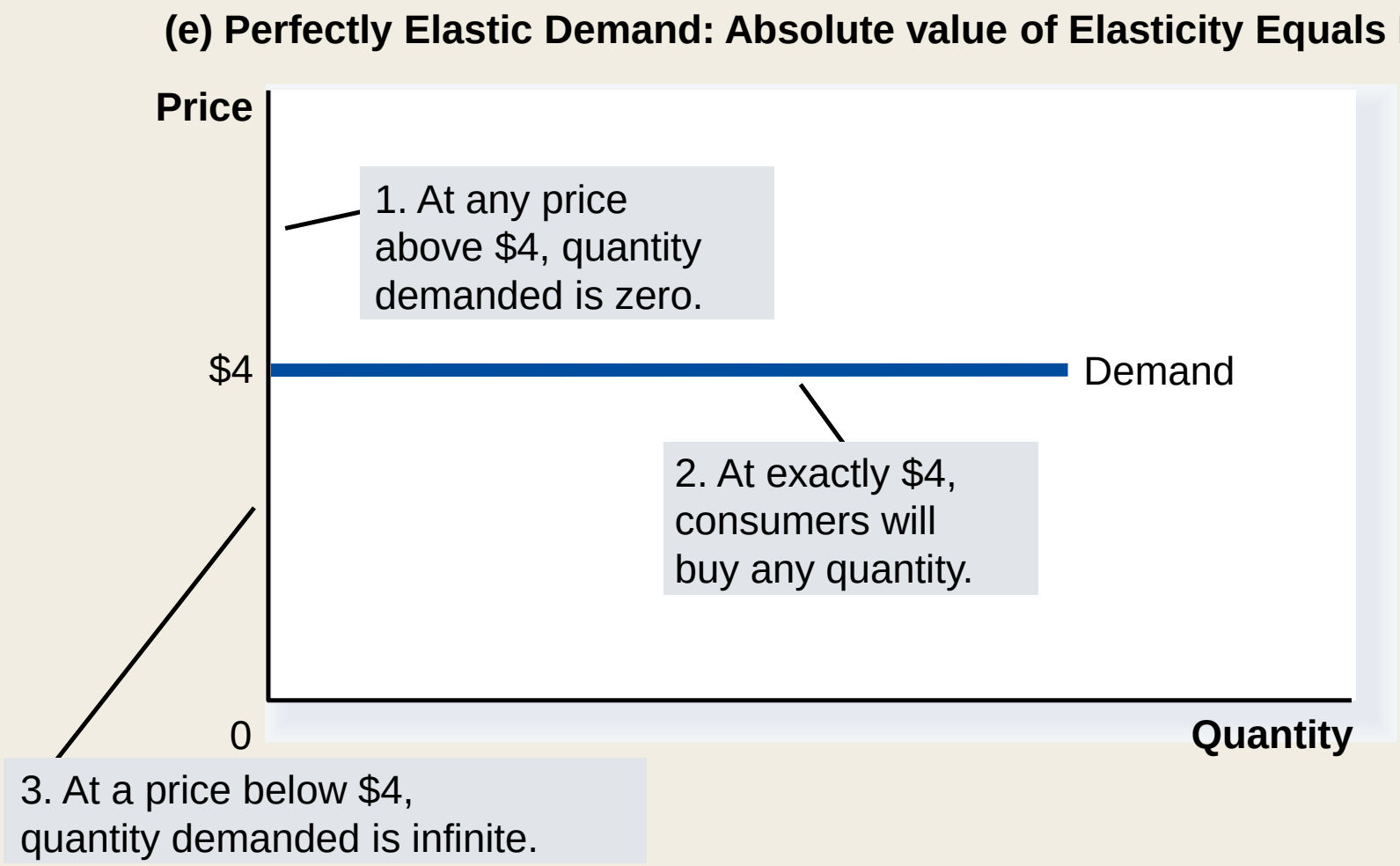
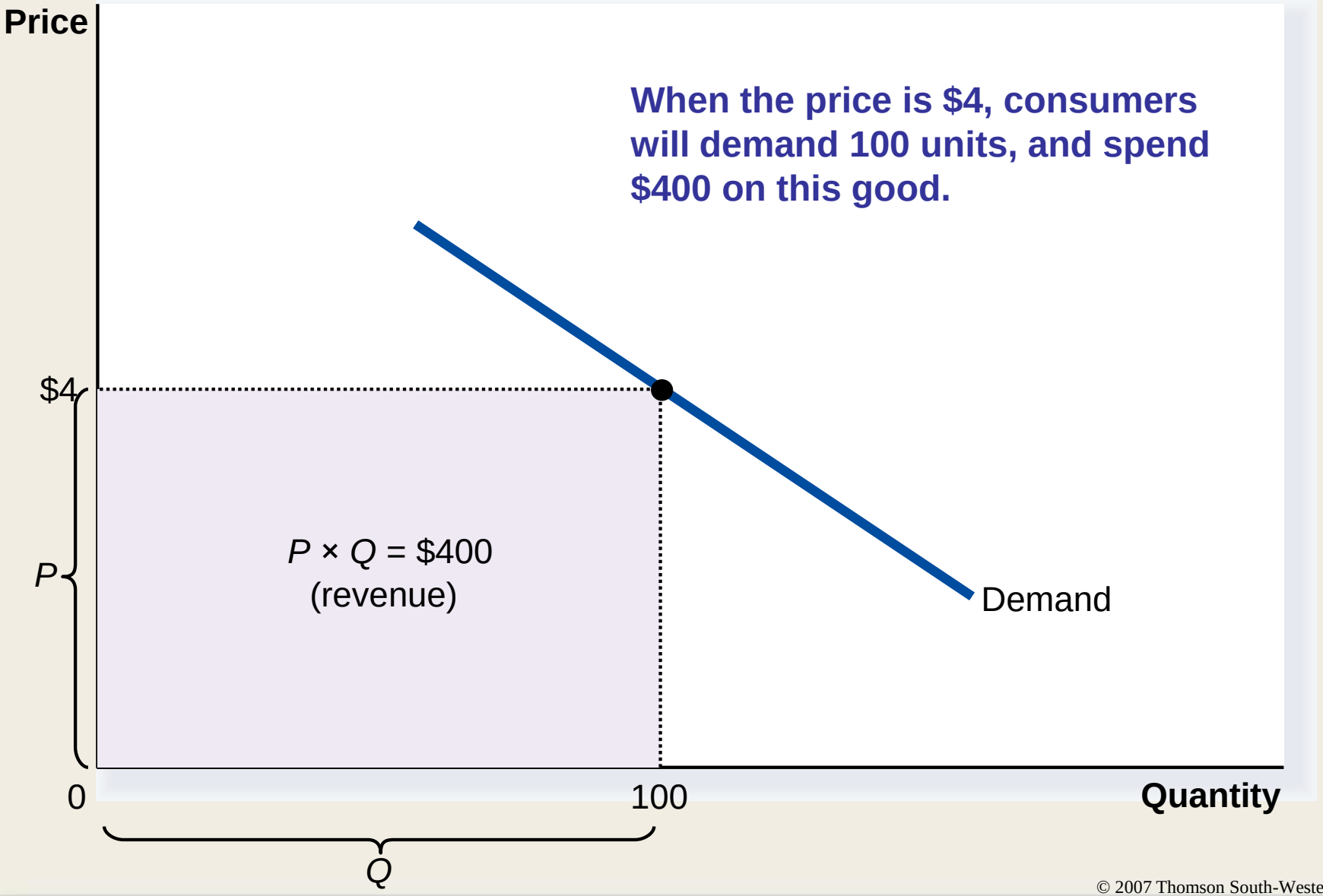


Total Revenue and the Price Elasticity of Demand

- *Total revenue* is the amount paid by buyers and received by sellers of a good.
- Computed as the price of the good times the quantity sold.

$$TR = P \times Q$$

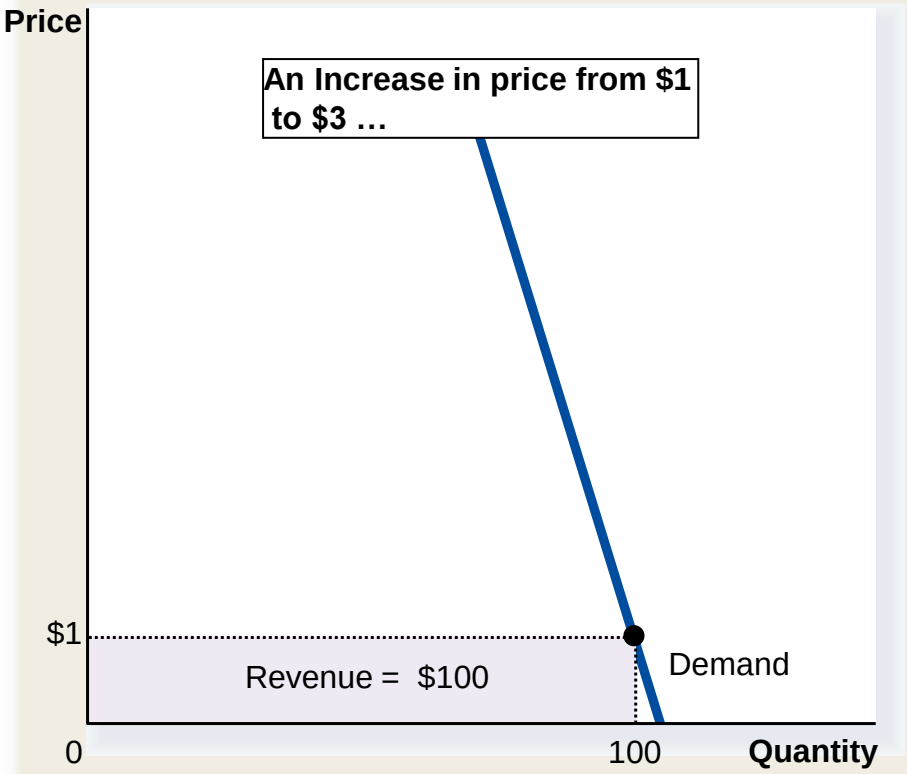
Figure 2 Total Revenue

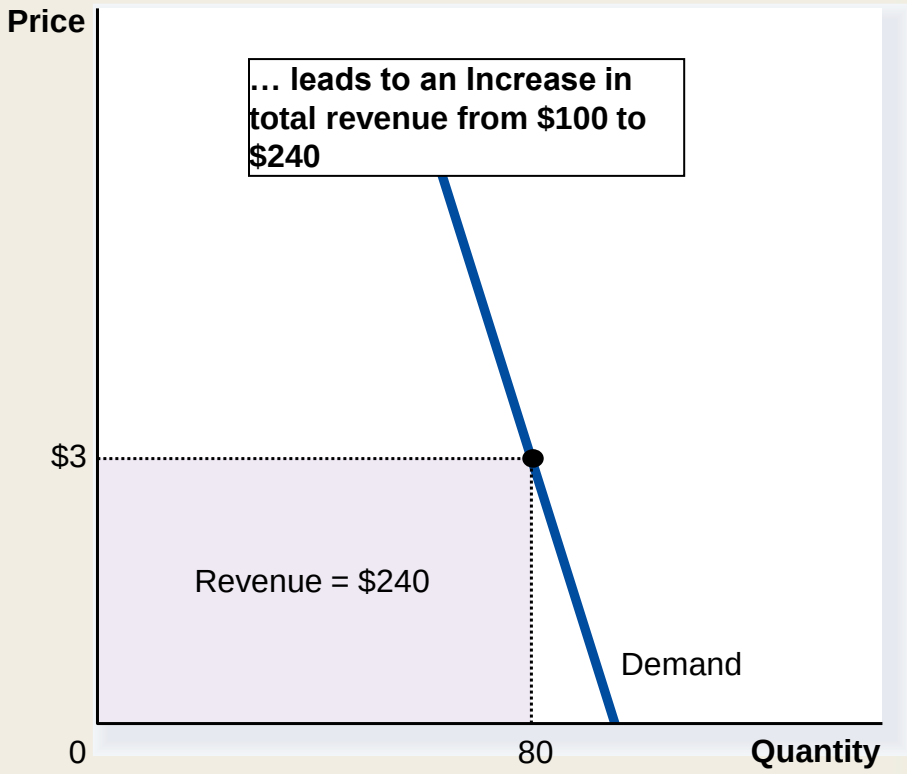


Elasticity and Total Revenue along a Linear Demand Curve

- With an inelastic demand curve, an increase in price leads to a decrease in quantity that is proportionately smaller. Thus, total revenue increases.

Figure 3 How Total Revenue Changes When Price Changes: Inelastic Demand

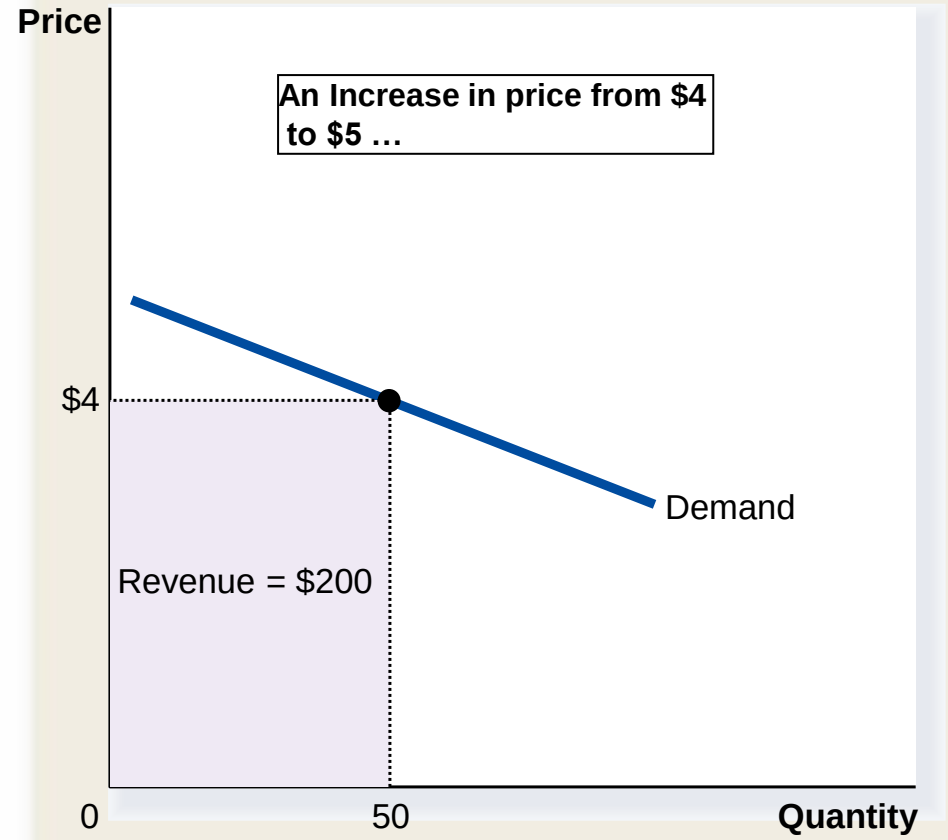


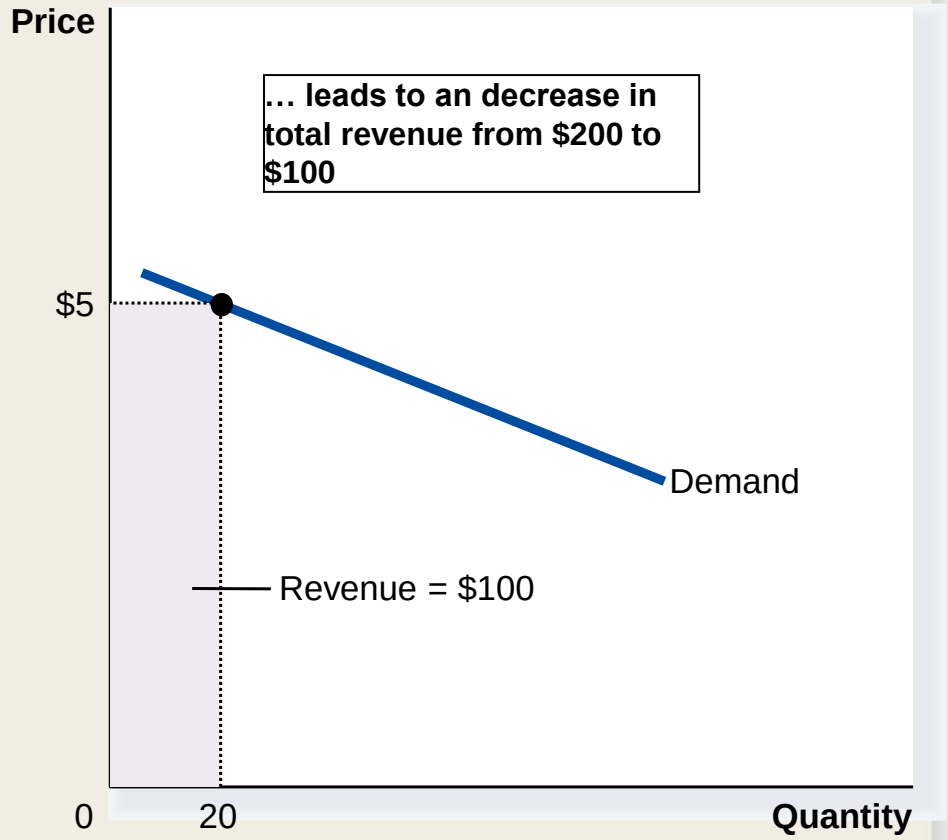


Elasticity and Total Revenue along a Linear Demand Curve

- With an elastic demand curve, an increase in the price leads to a decrease in quantity demanded that is proportionately larger. Thus, *total revenue decreases*.

Figure 3 How Total Revenue Changes When Price Changes: Elastic Demand



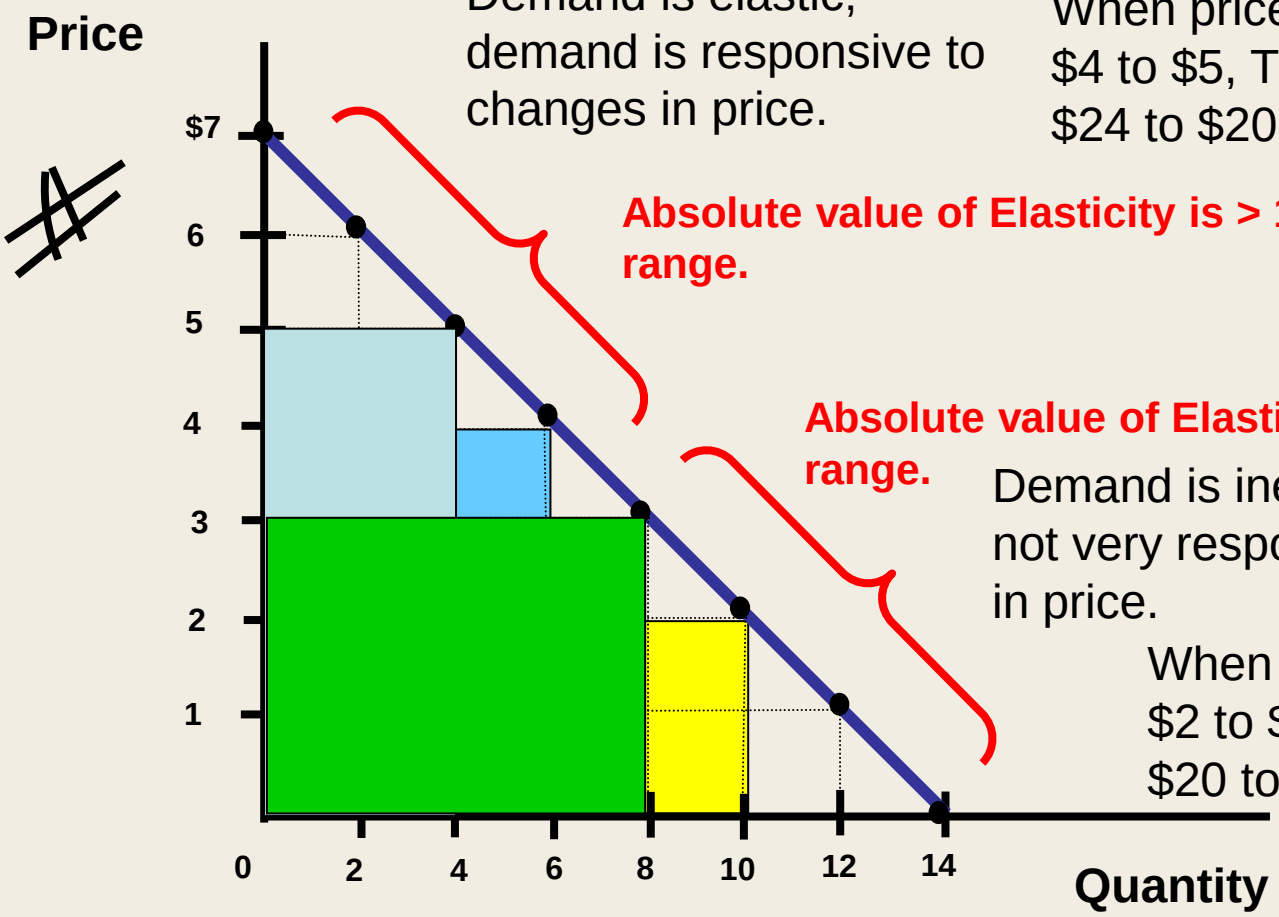


Note that with each price increase, the Law of Demand still holds – an increase in price leads to a decrease in the quantity demanded. It is the change in TR that varies!

Elasticity of a Linear Demand Curve

Price	Quantity	Total Revenue (Price × Quantity)	Percent Change in Price	Percent Change in Quantity	Elasticity	Description
$7	0	$0				
			15	200	13.0	Elastic
6	2	12				
			18	67	3.7	Elastic
5	4	20				
			22	40	1.8	Elastic
4	6	24				
			29	29	1.0	Unit elastic
3	8	24				
			40	22	0.6	Inelastic
2	10	20				
			67	18	0.3	Inelastic
1	12	12				
			200	15	0.1	Inelastic
0	14	0				

Figure 4 Elasticity of a Linear Demand Curve



Demand is elastic; demand is responsive to changes in price.

When price increases from $4 to $5, TR declines from $24 to $20.

Absolute value of Elasticity is > 1 in this range.

Absolute value of Elasticity is < 1 in this range.

Demand is inelastic; demand is not very responsive to changes in price.

When price increases from $2 to $3, TR increases from $20 to $24.

Other Demand Elasticities

- Income Elasticity of Demand
  - *Income elasticity of demand* measures how much the quantity demanded of a good responds to a change in consumers' income.
  - It is computed as the percentage change in the quantity demanded divided by the percentage change in income.

Other Demand Elasticities

- Computing Income Elasticity

$$\text{Income elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

Remember, all elasticities are measured by dividing one percentage change by another

Other Demand Elasticities

- Income Elasticity
  - Types of Goods
    - Normal Goods: Income elasticity is positive
    - Inferior Goods: Income elasticity is negative
  - Higher income raises the quantity demanded for normal goods but lowers the quantity demanded for inferior goods.

Other Demand Elasticities

- Income Elasticity
  - Goods consumers regard as necessities tend to be income inelastic
    - Examples include food, fuel, clothing, utilities, and medical services.
  - Goods consumers regard as luxuries tend to be income elastic.
    - Examples include sports cars, furs, and expensive foods.

Other Demand Elasticities

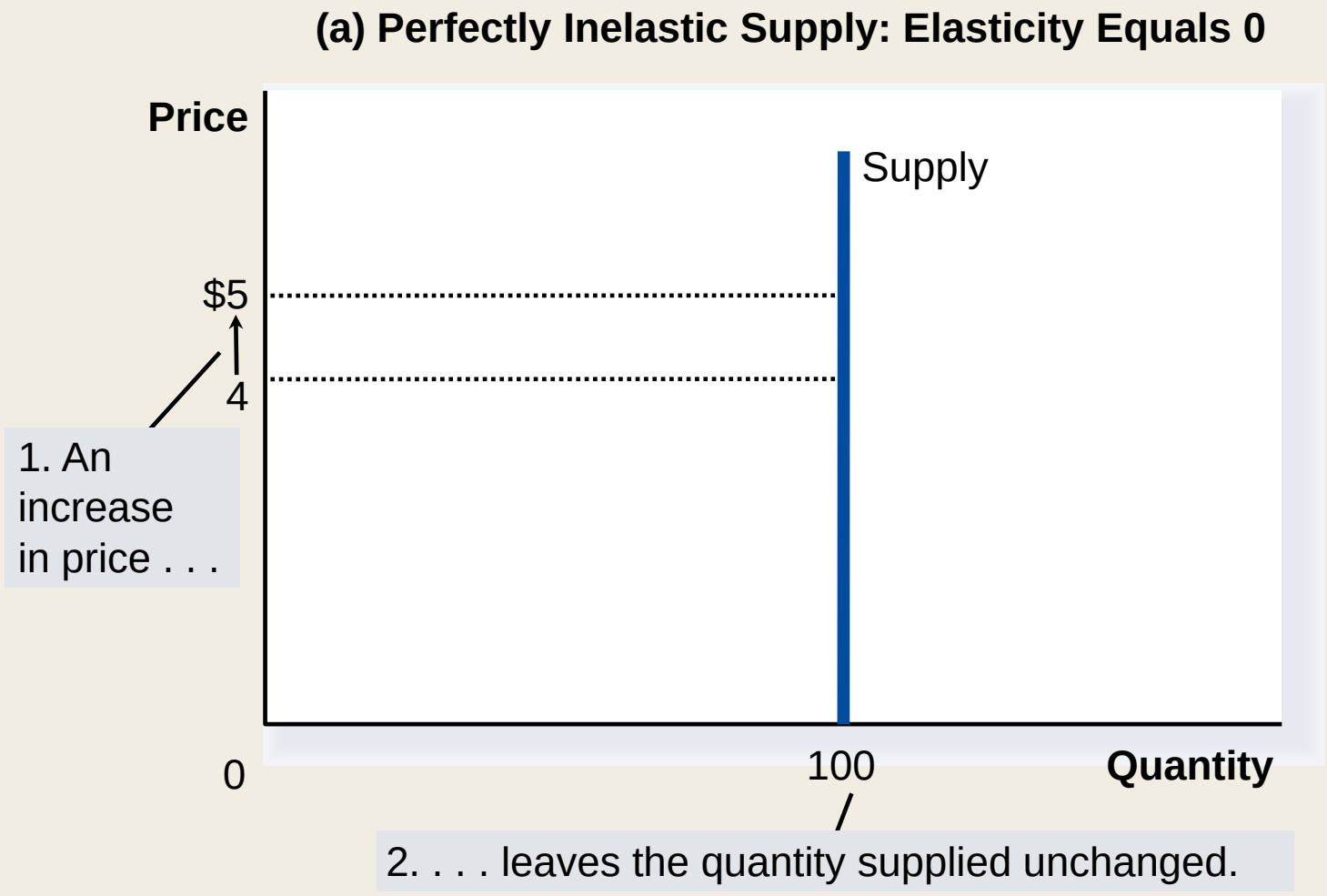
- *Cross-price elasticity of demand*
  - A measure of how much the quantity demanded of one good responds to a change in the price of another good, computed as the percentage change in quantity demanded of the first good divided by the percentage change in the price of the second good
  - For complements, cross price elasticity is negative
  - For substitutes, cross price elasticity is positive

$$\text{Cross-price elasticity of demand} = \frac{\%\text{change in quantity demanded of good 1}}{\%\text{change in price of good 2}}$$

THE ELASTICITY OF SUPPLY

- *Price elasticity of supply* is a measure of how much the quantity supplied of a good responds to a change in the price of that good.
- Price elasticity of supply is the percentage change in quantity supplied resulting from a percentage change in price.

Figure 5 The Price Elasticity of Supply



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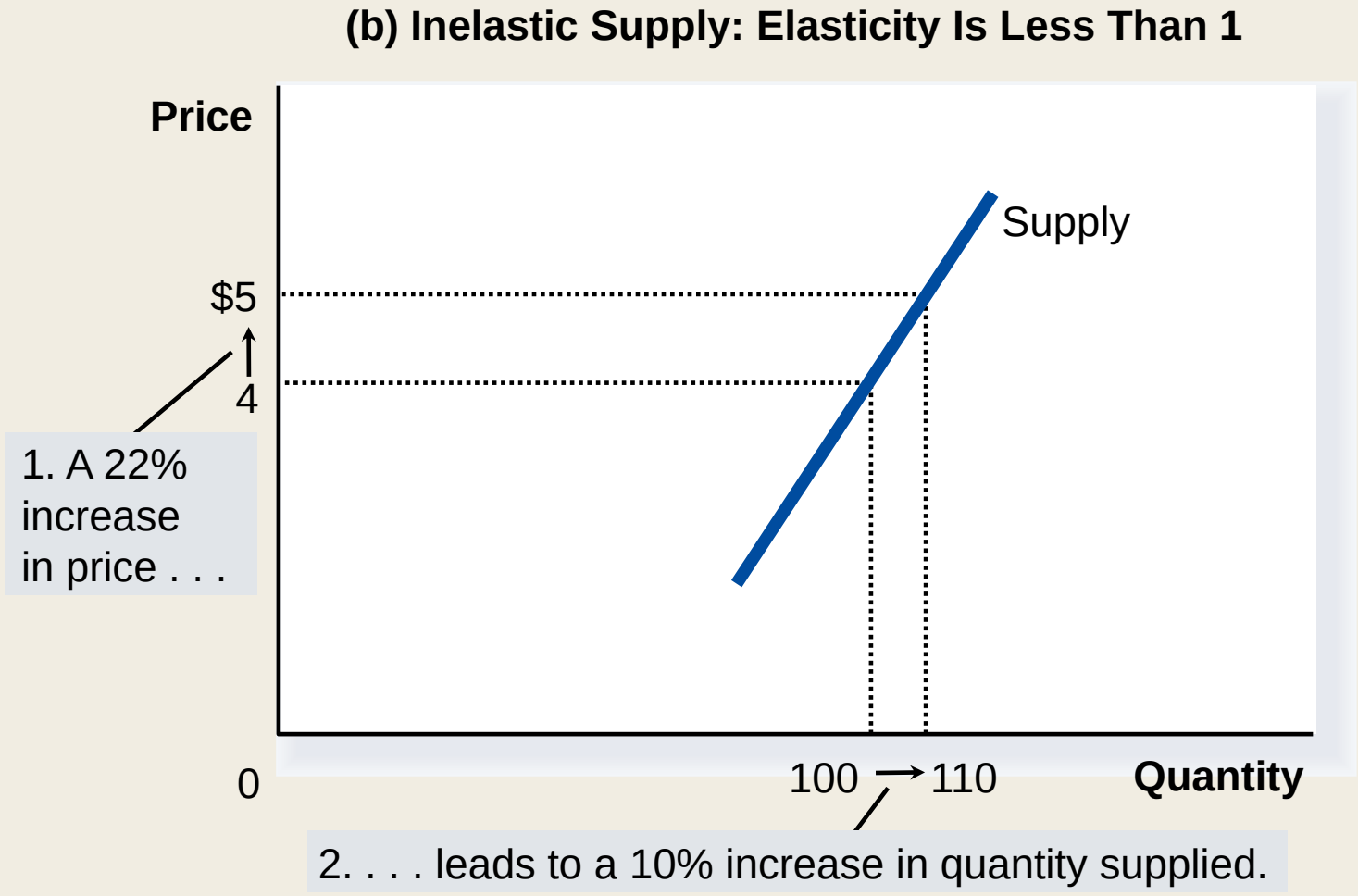

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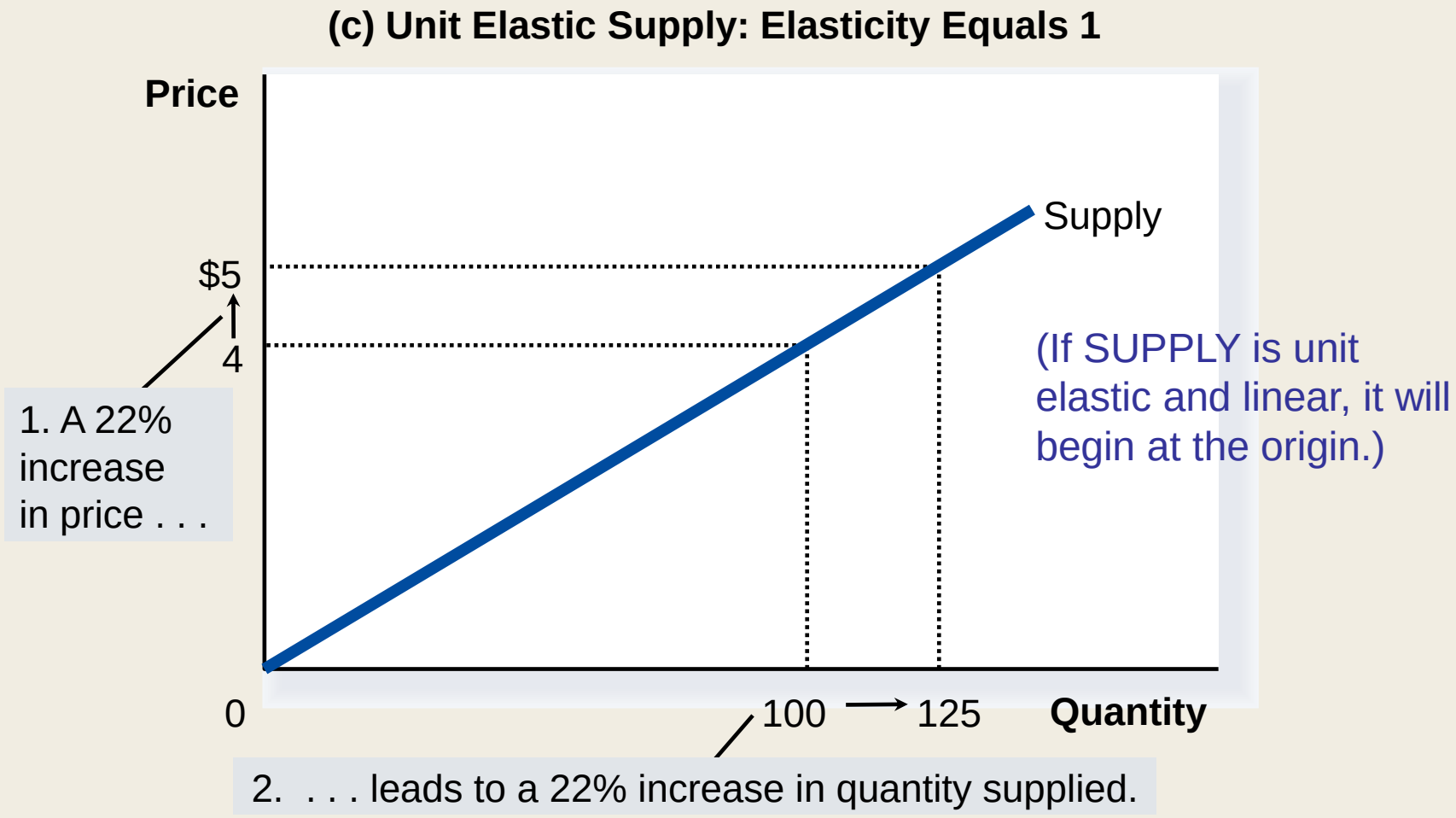

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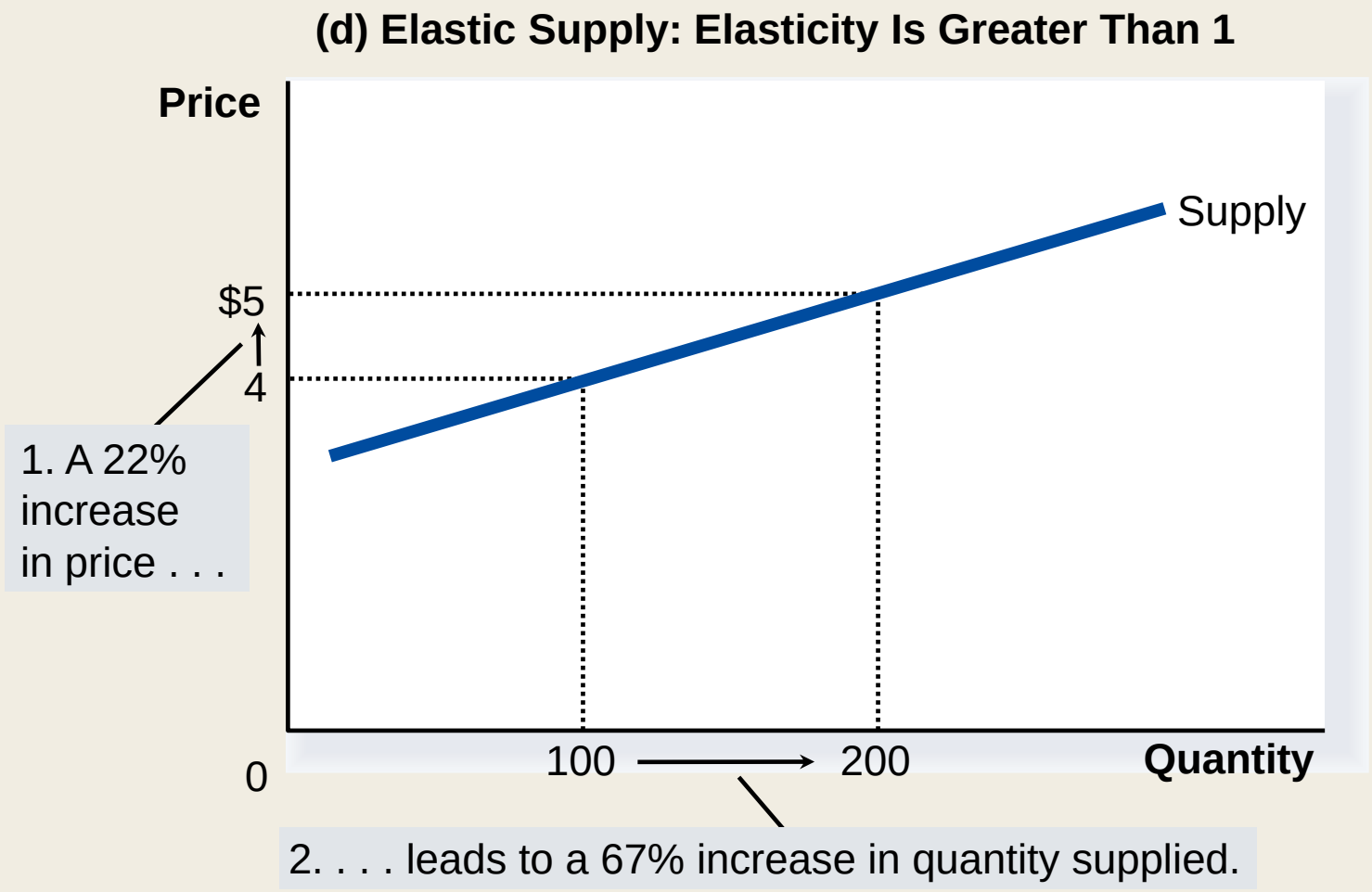

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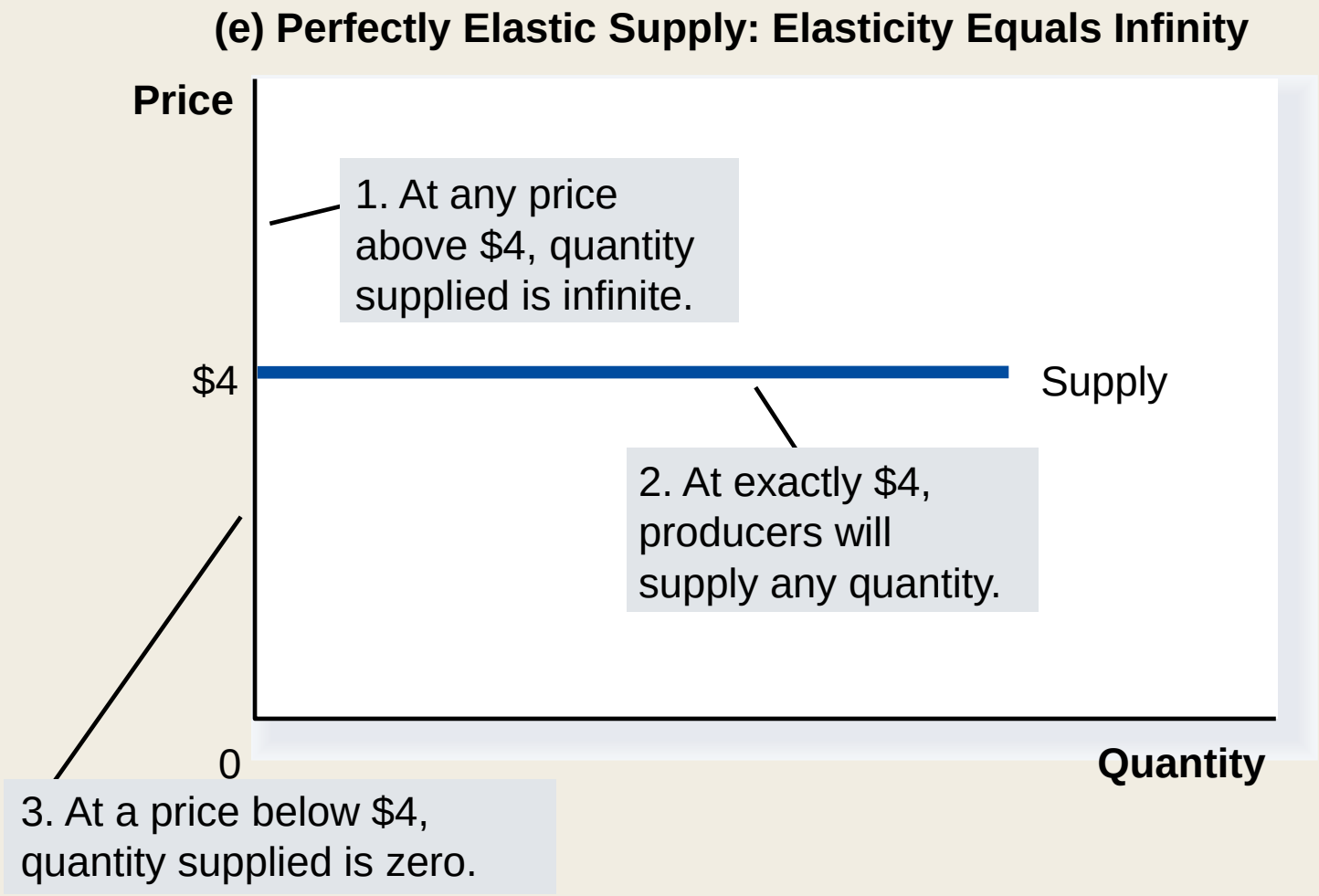


The Price Elasticity of Supply and Its Determinants

- Ability of sellers to change the amount of the good they produce.
  - Beach-front land is inelastic.
  - Books, cars, or manufactured goods are elastic.
- Time period
  - Supply is more elastic in the long run.

Computing the Price Elasticity of Supply

- The price elasticity of supply is computed as the percentage change in the quantity supplied divided by the percentage change in price.

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

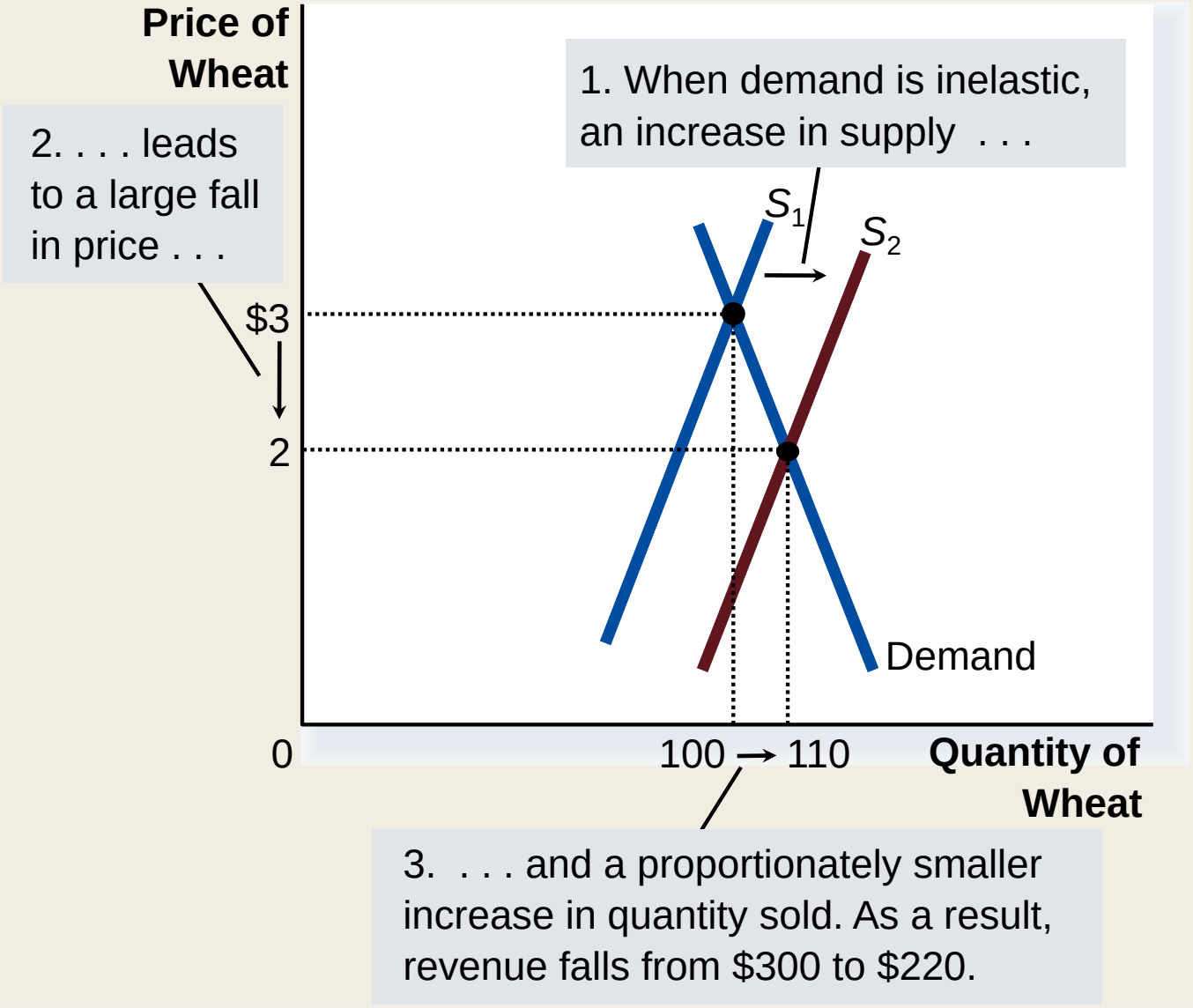
TWO APPLICATIONS OF SUPPLY, DEMAND, AND ELASTICITY

- Can good news for farming be bad news for farmers?
- What happens to wheat farmers and the market for wheat when university agronomists discover a new wheat hybrid that is more productive than existing varieties?

Can Good News for Farming Be Bad News for Farmers?

- Examine whether the supply or demand curve shifts.
- Determine the direction of the shift of the curve.
- Use the supply-and-demand diagram to see how the market equilibrium changes.

Figure 7 An Increase in Supply in the Market for Wheat



Compute the Price Elasticity of Demand When There Is a Change in Supply

$$E_D = \frac{\dfrac{100 - 110}{(100 + 110)/2}}{\dfrac{3.00 - 2.00}{(3.00 + 2.00)/2}}$$

$$= \frac{-0.095}{0.4} \approx -0.24$$

Demand is inelastic.

Why Did OPEC Fail to Keep the Price of Oil High?

- Supply and Demand can behave differently in the short run and the long run
  - In the short run, both supply and demand for oil are relatively inelastic
  - But in the long run, both are elastic
    - Production outside of OPEC
    - More conservation by consumers

Summary

- Price elasticity of demand measures how much the quantity demanded responds to changes in the price.
- Price elasticity of demand is calculated as the percentage change in quantity demanded divided by the percentage change in price.
  - If a demand curve is elastic, total revenue falls when the price rises.
  - If it is inelastic, total revenue rises as the price rises.

Summary

- The income elasticity of demand measures how much the quantity demanded responds to changes in consumers' income.
- The cross-price elasticity of demand measures how much the quantity demanded of one good responds to the price of another good.
- The price elasticity of supply measures how much the quantity supplied responds to changes in the price.

Summary

- In most markets, supply is more elastic in the long run than in the short run.
- The price elasticity of supply is calculated as the percentage change in quantity supplied divided by the percentage change in price.
- The tools of supply and demand can be applied in many different types of markets.