

# ECO2011 Basic Microeconomics

Mankiw Chapter 5 (Elasticity)

2023

# Motivation

- Suppose the price of gas increases, maybe because of tension in the Middle East, how would consumer respond to the higher price?
- By how much would the consumer change their consumption of gas then?
- Any idea of a sensible way to measure how much quantity changes when price changes?

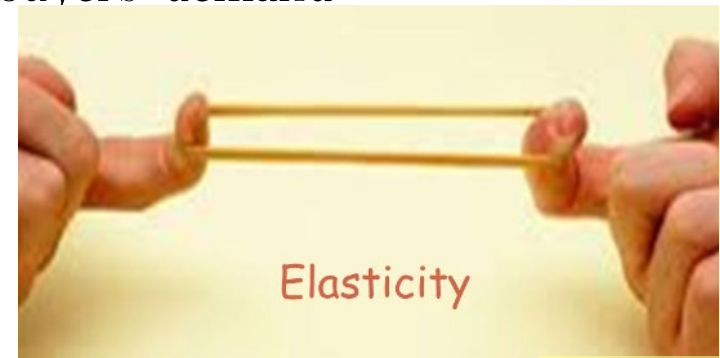
# The Elasticity of Demand

- Elasticity

- Measure of the responsiveness of  $Q^d$  or  $Q^s$ 
    - To a change in one of its determinants

- Price elasticity of demand

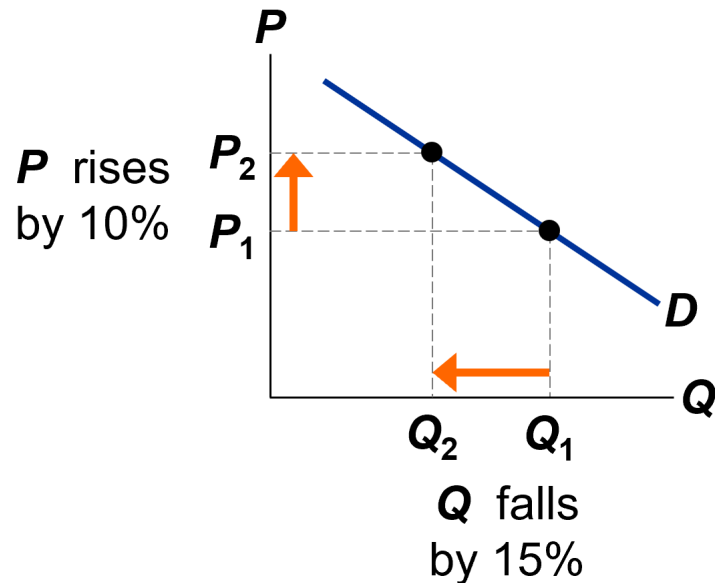
- How much the quantity demanded of a good responds to a change in the price of that good
    - Loosely speaking, it measures the price-sensitivity of buyers' demand



Internet photo

# Price Elasticity of Demand

■ Price elasticity of demand =  $\frac{\text{percentage change in } Q^d}{\text{percentage change in } P}$



$$= \frac{15\%}{10\%} = 1.5$$

Along a D curve, P and Q move in opposite directions, which would make *price elasticity negative*.

- We will drop the minus sign and report all price elasticities as positive numbers.

# Calculating Percentage Changes

- Standard method of computing the percentage (%) change:

$$= \frac{\text{end value} - \text{start value}}{\text{start value}} \times 100\%$$

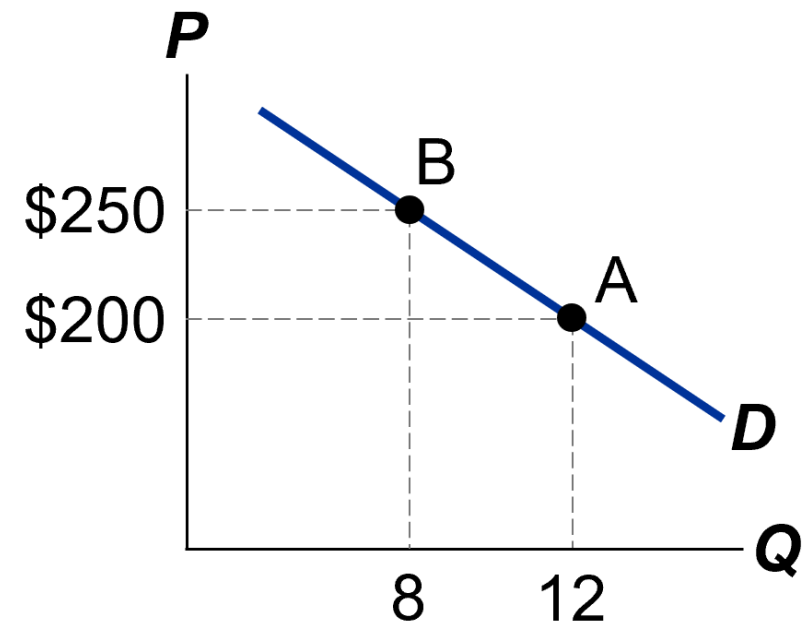
- Going from A to B:

- the % change in P =  $(\$250 - \$200) / \$200 = 25\%$
- the % change in Q =  $-33\%$
- Price elasticity =  $33/25 = 1.33$

- Going from B to A:

- the % change in P =  $-20\%$
- the % change in Q =  $50\%$
- Price elasticity =  $50/20 = 2.5$

- We get different values!**



# The Price Elasticity of Demand

- Midpoint method
  - The midpoint is the number halfway between the start and end values
    - The average of those values

$$\text{percentage change} = \frac{\text{end value} - \text{start value}}{\text{midpoint}} \times 100\%$$

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

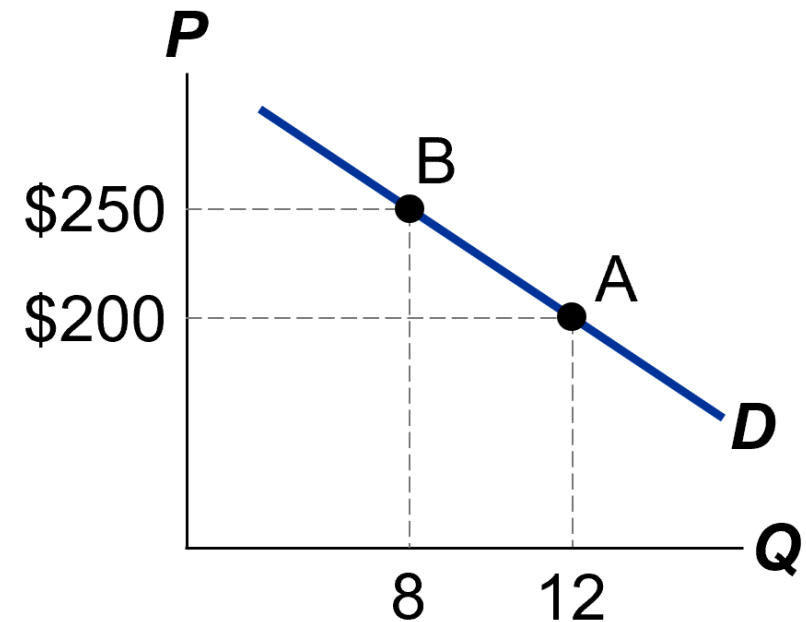
# Calculating Percentage Changes

- Using the midpoint method of computing % changes:

$$\% \text{ change in } P = \frac{\$250 - \$200}{\$225} \times 100\% = 22.2\%$$

$$\% \text{ change in } Q = \frac{12 - 8}{10} \times 100\% = 40\%$$

$$\text{Price elasticity} = \frac{40\%}{22.2\%} = 1.8$$



# Active Learning 1

## Calculate an elasticity

Use the following information to calculate the price elasticity of demand for iPhones:

- if  $P = \$400$ ,  $Q_d = 10,600$
- if  $P = \$600$ ,  $Q_d = 8,400$
- Use the midpoint method to calculate percentage changes.



Using the midpoint method to calculate percentage changes:

% change in P =

$$\left[ (\$600 - \$400) / \$500 \right] \times 100 = 40\%$$

% change in Qd =

$$\left[ (10,600 - 8,400) / 9,500 \right] \times 100 = 23.16\%$$

Price elasticity of demand =

$$= \% \text{ change in } Q_d / \% \text{ change in } P$$

$$= 23.16 / 40 = 0.58$$

# The Price Elasticity of Demand

- Determinants of price elasticity of demand
  - We look at a series of examples comparing two common goods
- In each example:
  - Suppose prices of both goods rise by 20%
  - Which good has the highest price elasticity of demand? Why?
  - What lesson we learn about the determinants of price elasticity of demand?

# Example 1: Breakfast cereal vs. Sunscreen

- Prices of both of these goods rise by 20%. For which good does  $Q^d$  drop the most? Why?
  - Breakfast cereal has close substitutes, so buyers can easily switch if the price rises



Internet photo



Internet photo

- Sunscreen has no close substitutes, so a price increase would not affect demand very much
- Price elasticity is higher when close substitutes are available

## Example 2: Blue Jeans vs. Clothing

- Prices of both of these goods rise by 20%. For which good does  $Q^d$  drop the most? Why?
  - For a narrowly defined good, blue jeans, there are many substitutes  
There are fewer substitutes available for broadly defined goods (clothing)
- Price elasticity is higher for narrowly defined goods than for broadly defined ones.

## Example 3: Insulin vs. Yachts

- Prices of both of these goods rise by 20%. For which good does  $Q^d$  drop the most? Why?
  - Insulin is a necessity to diabetics. A rise in price would cause little or no decrease in demand
  - A yacht is a luxury. If the price rises, some people will forego it.
- Price elasticity is higher for luxuries than for necessities.

## Example 4: Gasoline in the Short Run vs. Gasoline in the Long Run

- The price of gasoline rises 20%. Does  $Q^d$  drop more in the short run or the long run? Why?
  - There's not much people can do in the short run, other than ride the bus or carpool.
  - In the long run, people can buy smaller cars or live closer to work.
- Price elasticity is higher in the long run

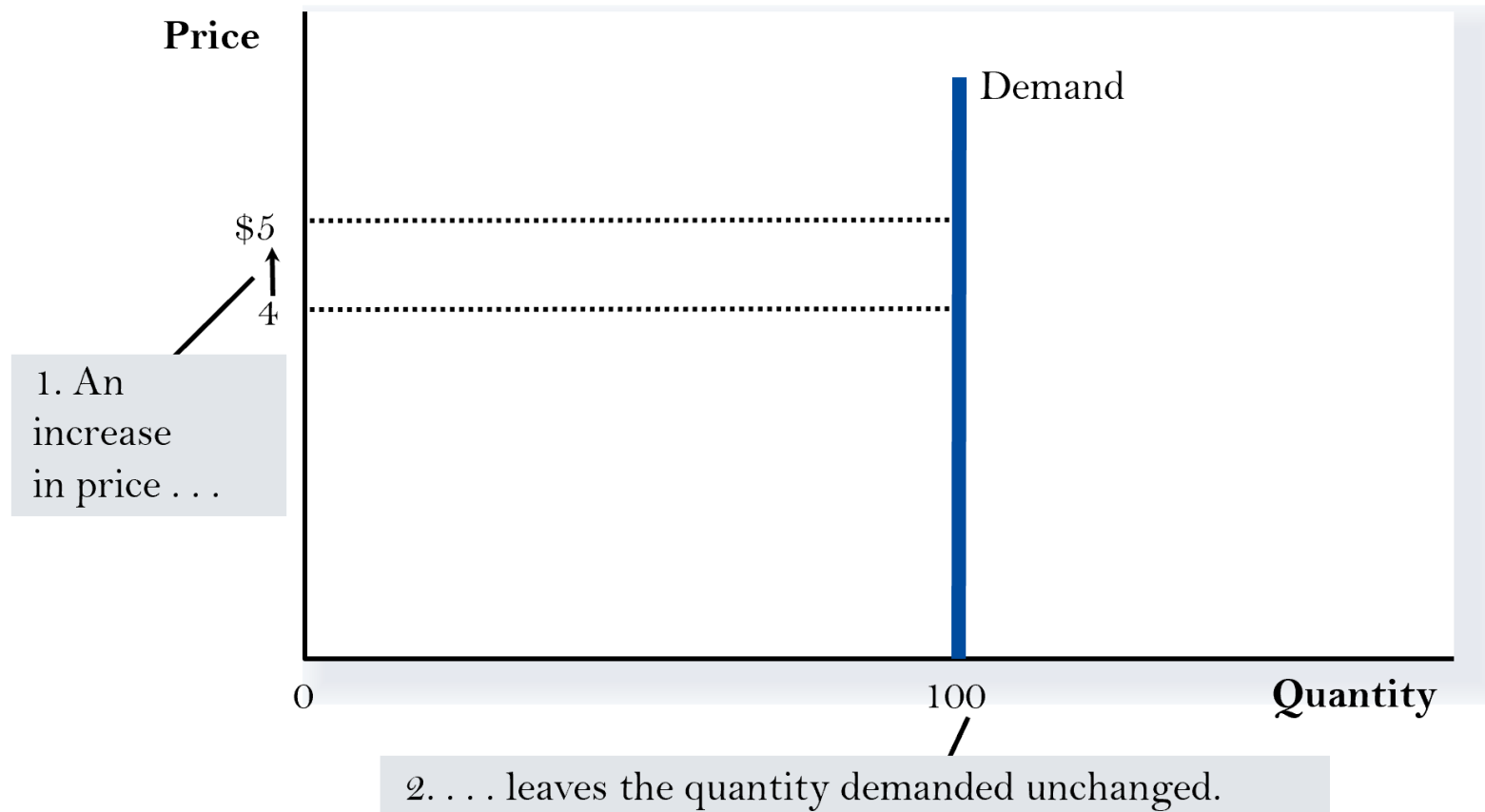


Internet photo

# Variety of demand curves

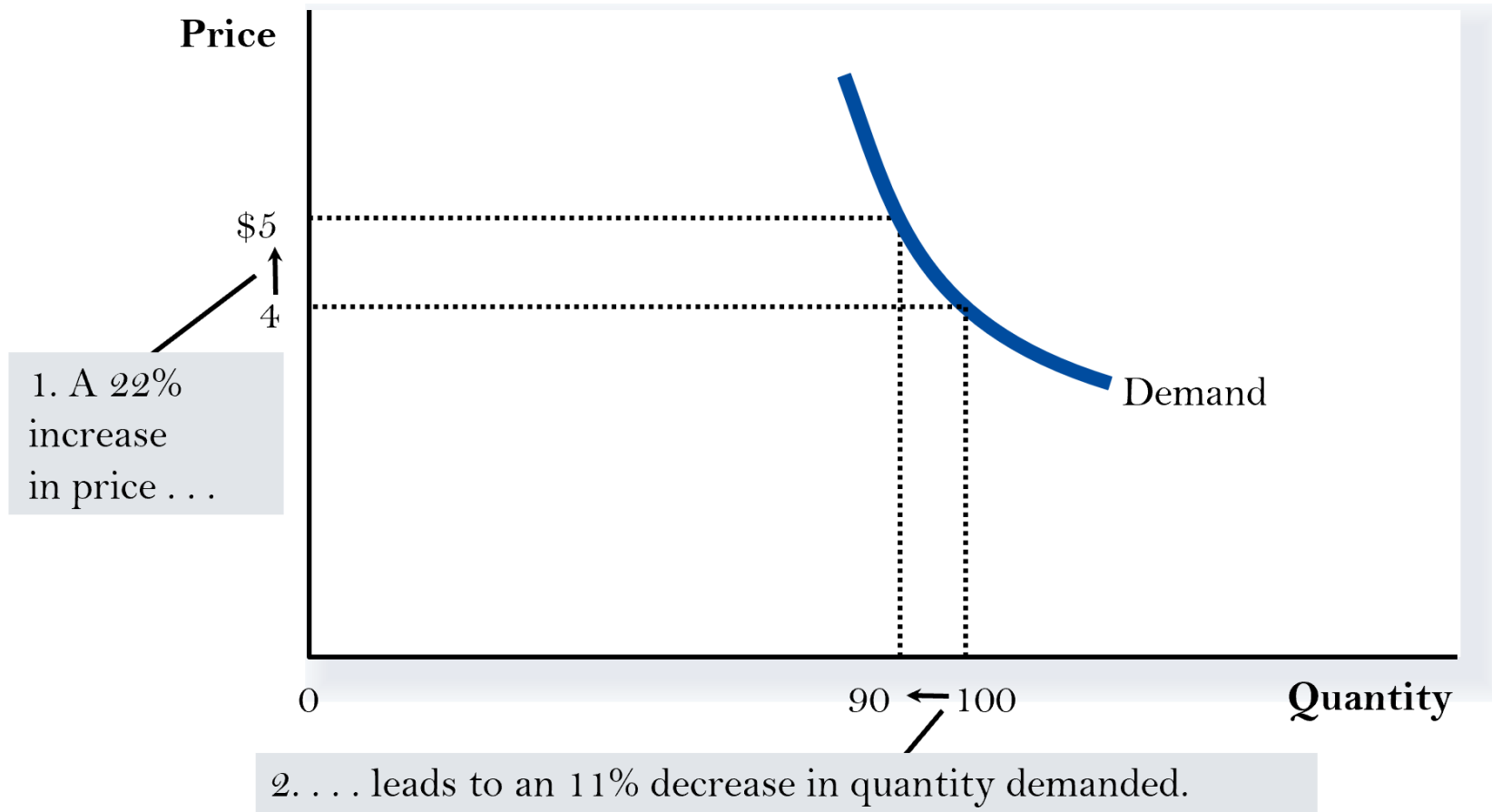
- Demand is
  - elastic
  - inelastic
  - unit elasticity
  - perfectly inelastic
  - perfectly elastic
- The flatter the demand curve
  - The greater the price elasticity of demand

# Perfectly Inelastic Demand: Elasticity Equals 0

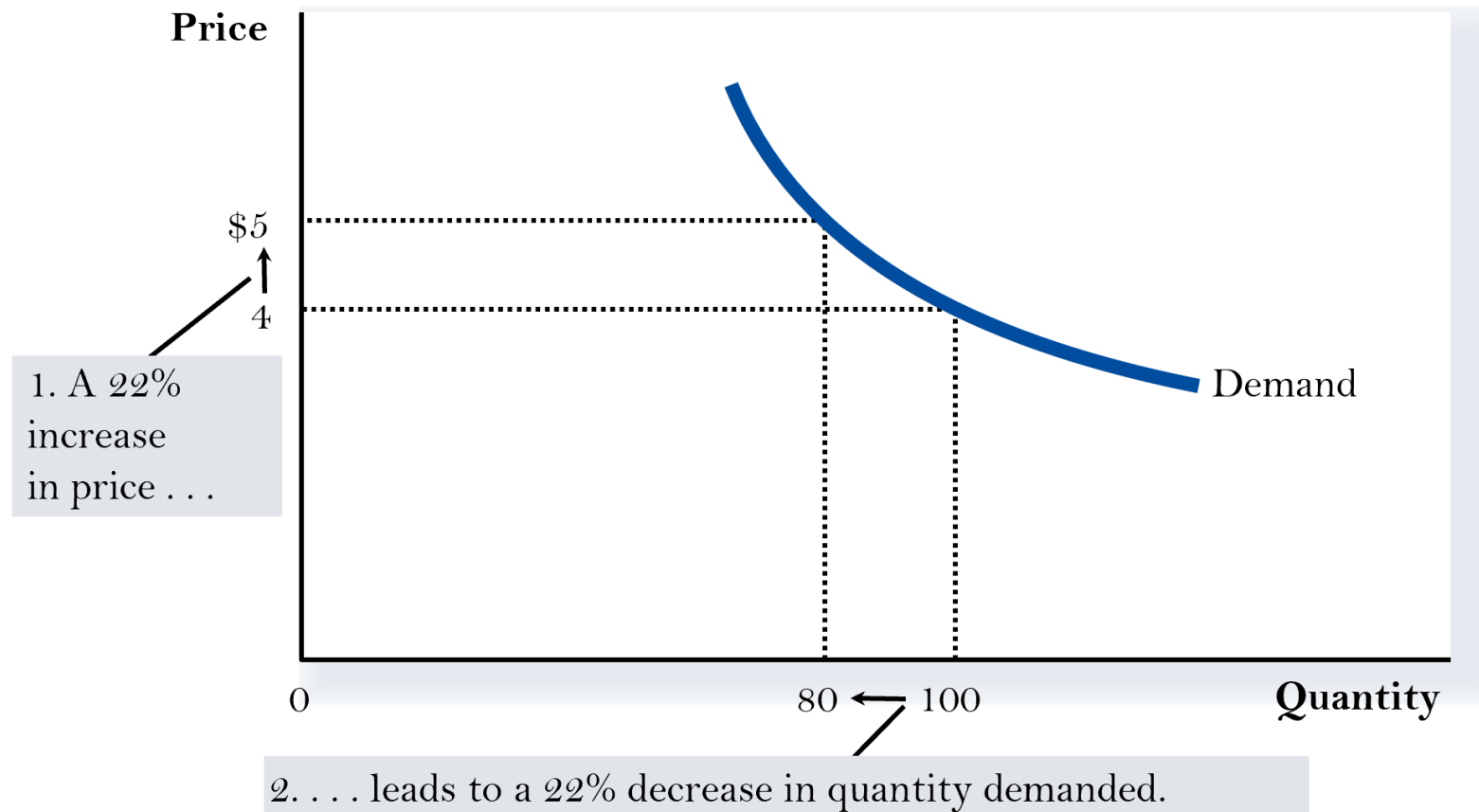




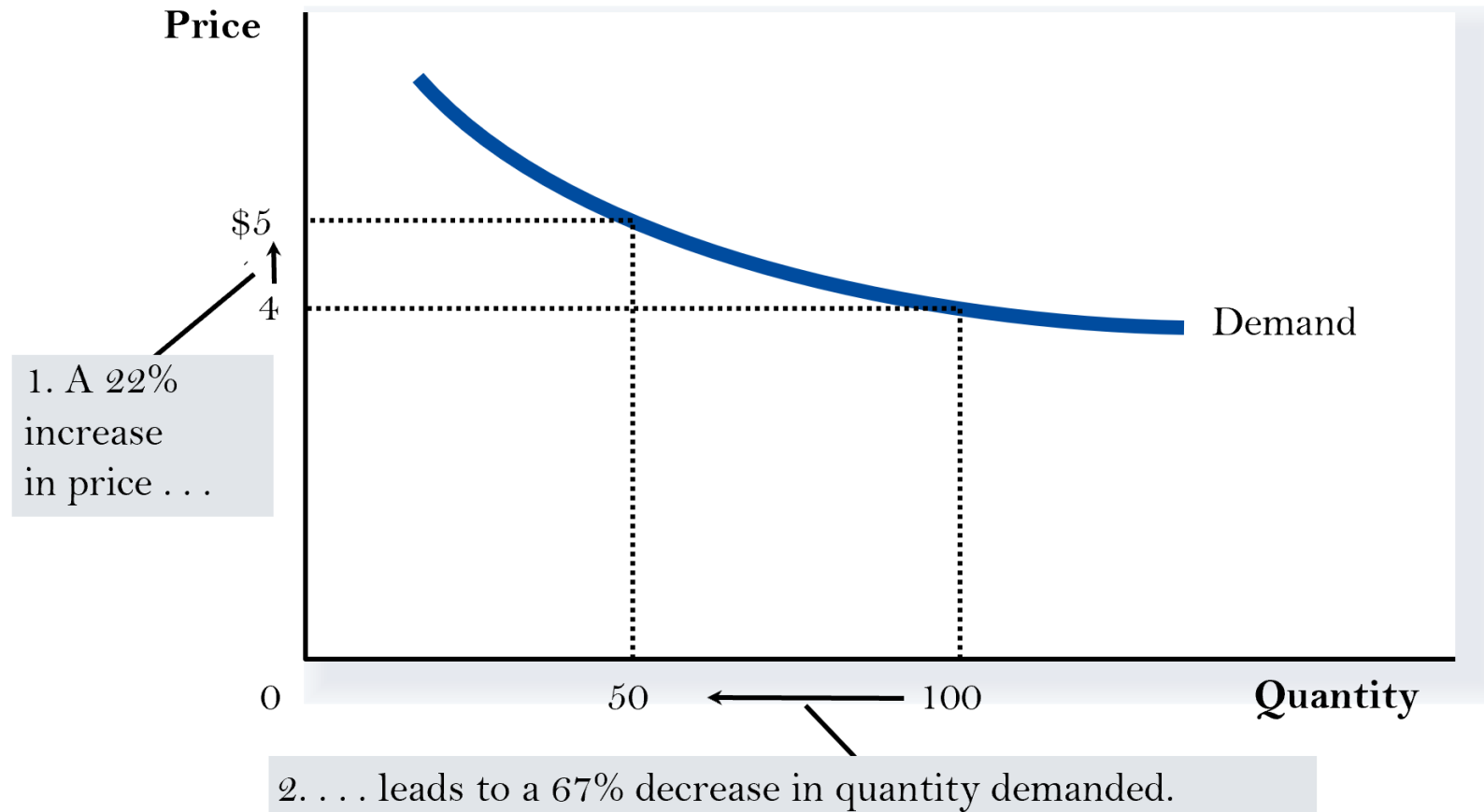
# Inelastic Demand: Elasticity Is Less Than 1



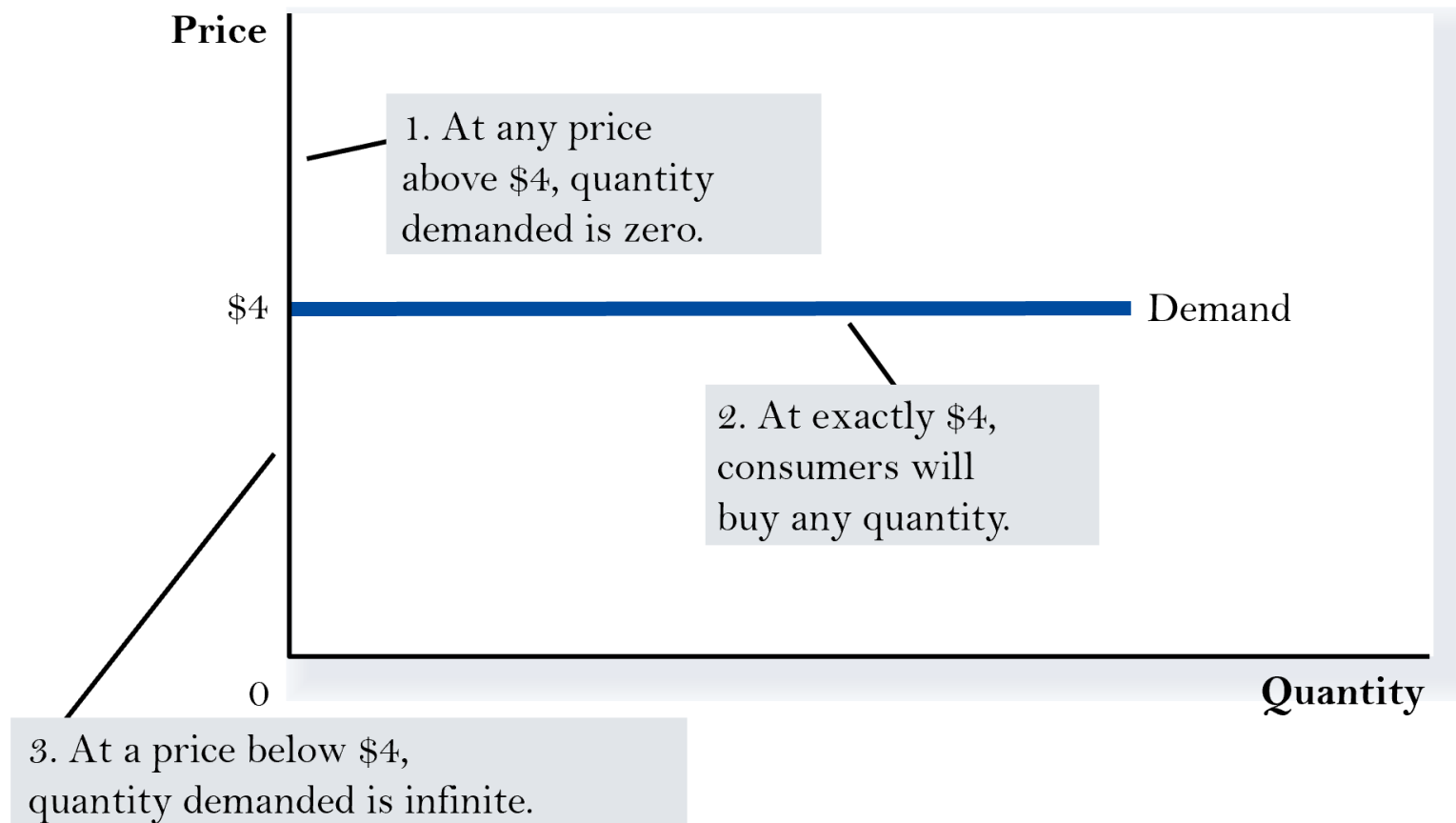
# Unit Elastic Demand: Elasticity Equals 1



# Elastic Demand: Elasticity Is Greater Than 1



# Perfectly Elastic Demand: Elasticity Equals Infinity



# A Few Elasticities from the Real World

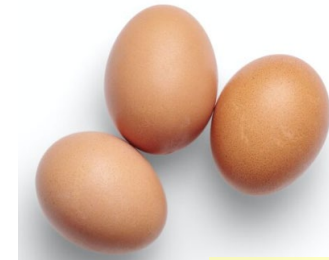


Internet photo



Internet photo

Eggs	0.1
Healthcare	0.2
Cigarettes	0.4
Rice	0.5
Housing	0.7
Beef	1.6
Peanut Butter	1.7
Restaurant Meals	2.3
Mountain Dew	4.4



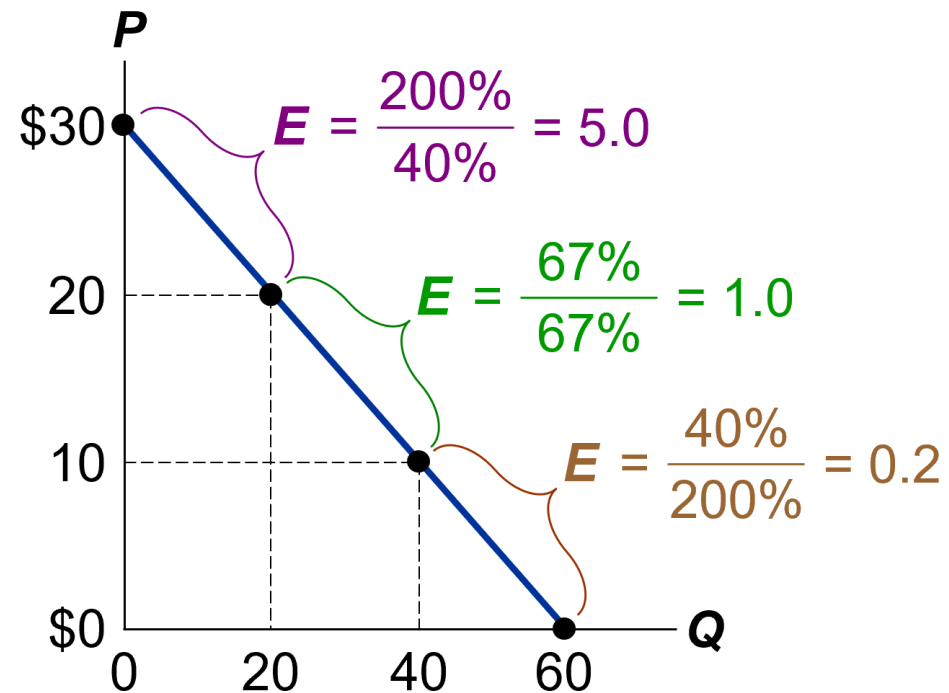
Internet photo



Internet photo

# Elasticity along a Linear Demand Curve

- The slope of a linear demand curve is constant, but its elasticity is not.



# Price Elasticity and Total Revenue

- Continuing our scenario, if you raise your price from \$200 to \$250, would your revenue rise or fall?

$$\text{Total Revenue (TR)} = P \times Q$$

- A price increase has two effects on revenue:
  - Higher revenue: because of the higher  $P$
  - Lower revenue: you sell fewer units (lower  $Q$ )
- Which of these two effects is bigger?
  - It depends on the price elasticity of demand

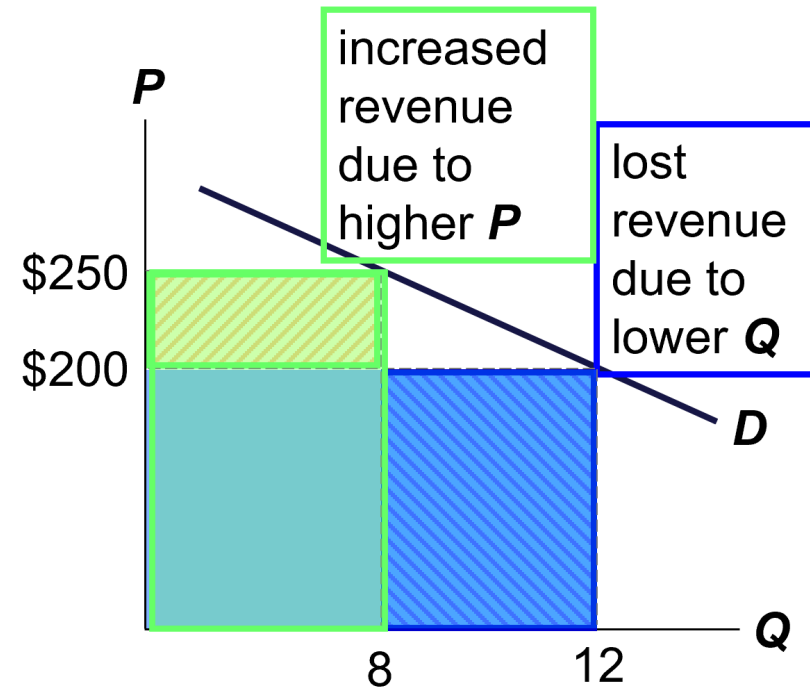
# Price Elasticity and Total Revenue

- For a price increase, if demand is elastic
  - $E > 1$ : % change in  $Q >$  % change in  $P$
  - TR decreases: the fall in revenue from lower  $Q >$  the increase in revenue from higher  $P$
- For a price increase, if demand is inelastic
  - $E < 1$ : % change in  $Q <$  % change in  $P$
  - TR increases: the fall in revenue from lower  $Q <$  the increase in revenue from higher  $P$



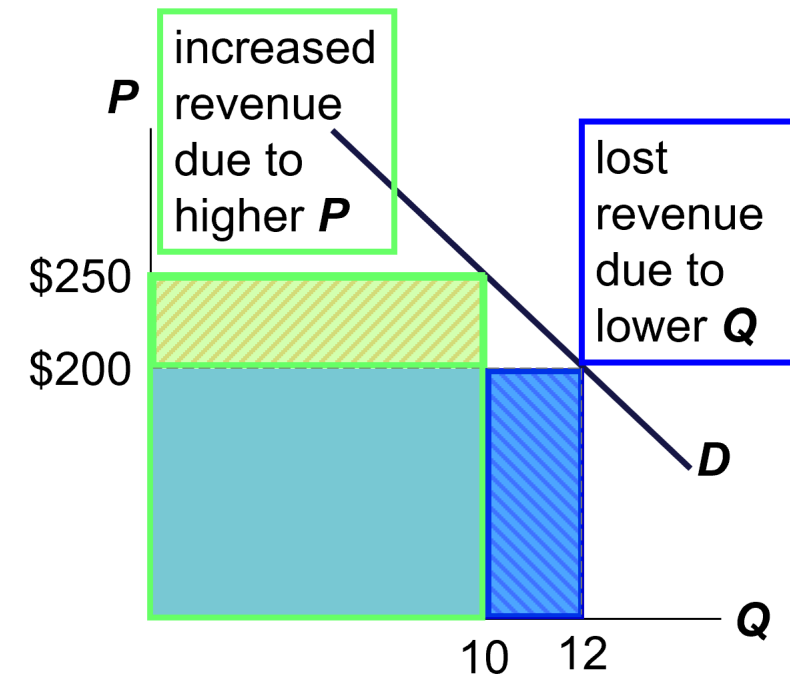
# Price Elasticity and Total Revenue

- Elastic demand (elasticity = 1.8)
- If  $P = \$200$ ,  $Q = 12$ , and revenue = \$2400
- If  $P = \$250$ ,  $Q = 8$ , and revenue = \$2000
- When  $D$  is elastic, a price increase causes revenue to fall.



# Price Elasticity and Total Revenue

- Inelastic demand (elasticity = 0.82)
- If  $P = \$200$ ,  $Q = 12$ , and revenue = \$2400
- If  $P = \$250$ ,  $Q = 10$ , and revenue = \$2500
- When  $D$  is inelastic, a price increase causes revenue to rise.



**A.** Pharmacies raise the price of insulin by 10%.

- Does total expenditure on insulin rise or fall?

**B.** As a result of a fare war, the price of a luxury cruise falls 20%.

- Does luxury cruise companies' total revenue rise or fall?

A. Expenditure =  $P \times Q$

Since demand is inelastic,  $Q$  will fall less than 10%, so expenditure rises.

B. Revenue =  $P \times Q$

The fall in  $P$  reduces revenue, but  $Q$  increases, which increases revenue. Which effect is bigger?

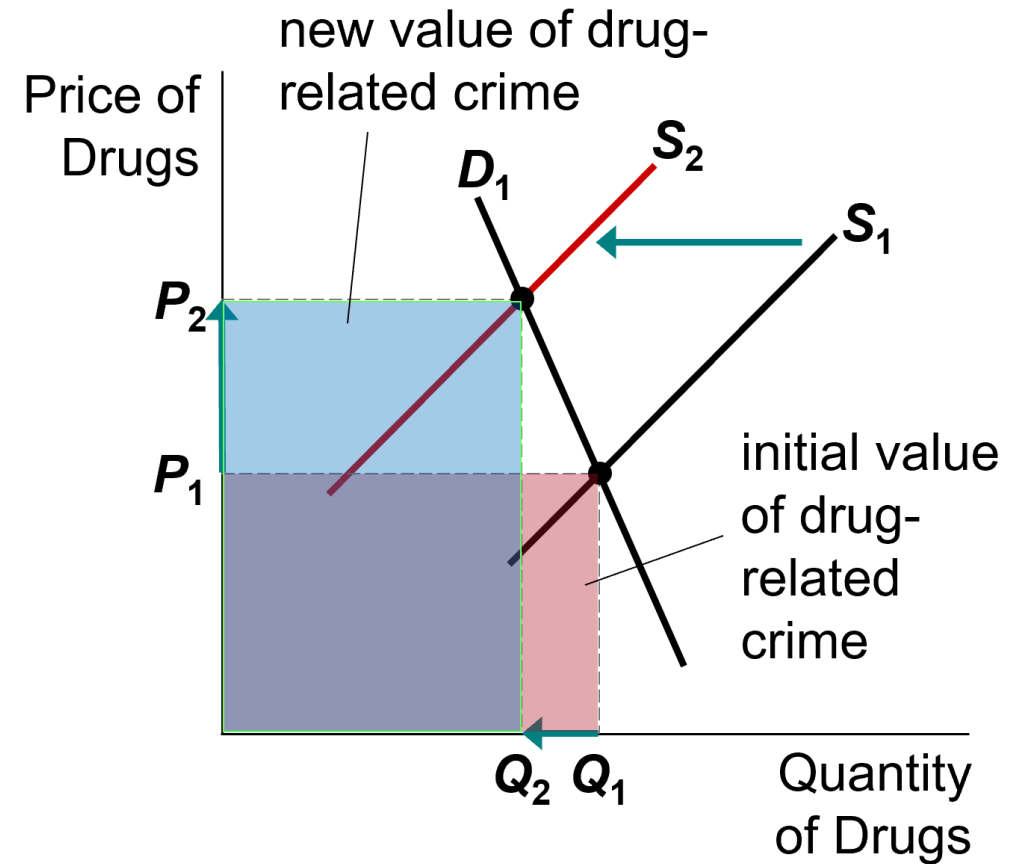
Since demand is elastic,  $Q$  will increase more than 20%, so revenue rises.

# Case Study: Does Drug Interdiction Increase or Decrease Drug-related Crime?

1. Increase the number of federal agents devoted to the war on drugs
  - Illegal drugs: supply curve shifts left
    - Higher price and lower quantity
  - Amount of drug-related crimes
    - Inelastic demand for drugs
    - Higher drugs price: higher total revenue
    - Increase drug-related crime

# Policy 1: Interdiction

- Interdiction reduces the supply of drugs.
- Demand for drugs is inelastic:  $P$  rises proportionally more than  $Q$  falls.
- Result: an increase in total spending on drugs, and in drug-related crime



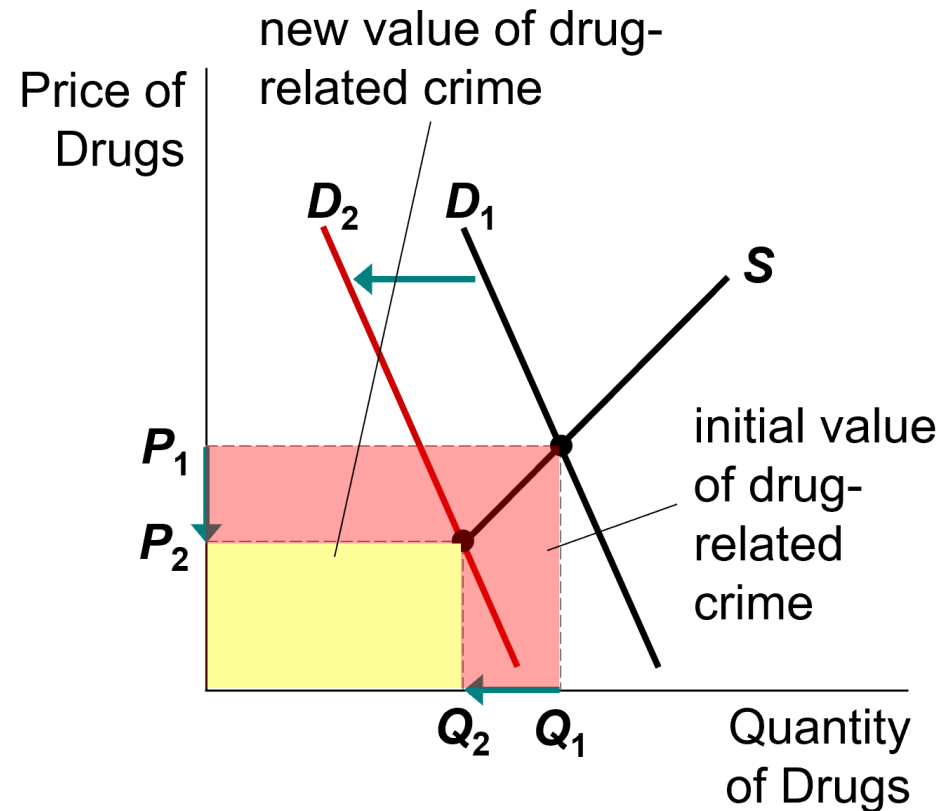
# Case Study: Does Drug Interdiction Increase or Decrease Drug-related Crime?

## 2. Policy of drug education

- Reduce demand for illegal drugs
- Left shift of demand curve
- Lower quantity
- Lower price
- Reduce drug-related crime

# Policy 2: Education

- Education reduces the demand for drugs.
- $P$  and  $Q$  fall.
- Result:  
A decrease in total spending on drugs, and in drug-related crime.



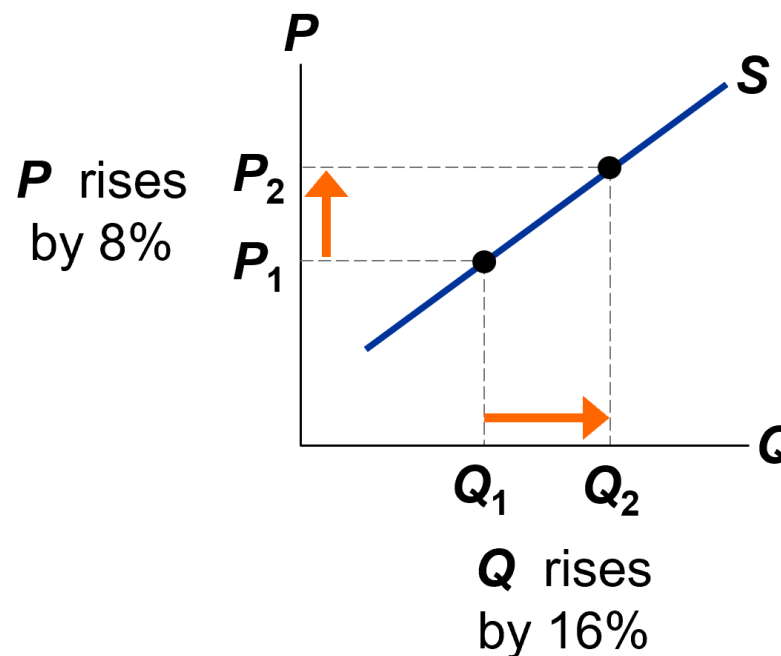


# The Price Elasticity of Supply

- Price elasticity of supply
  - How much the quantity supplied of a good responds to a change in the price of that good
  - Percentage change in quantity supplied
    - Divided by the percentage change in price
  - Loosely speaking, it measures sellers' price-sensitivity

# Price Elasticity of Supply

$$\text{Price elasticity of supply} = \frac{\text{percentage change in } Q^s}{\text{percentage change in } P} = \frac{16\%}{8\%} = 2$$

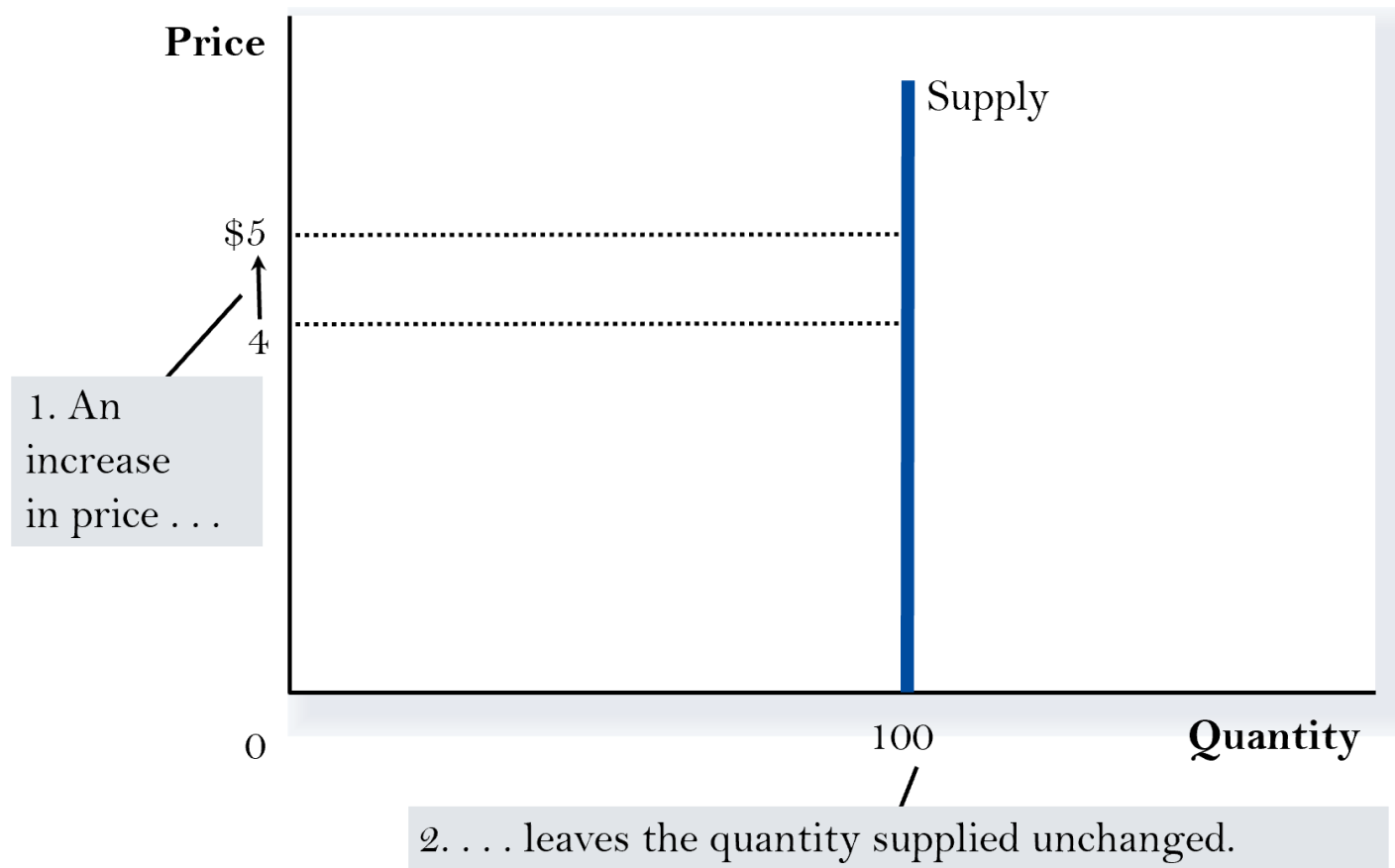


- Again, we use the midpoint method to compute the percentage changes.

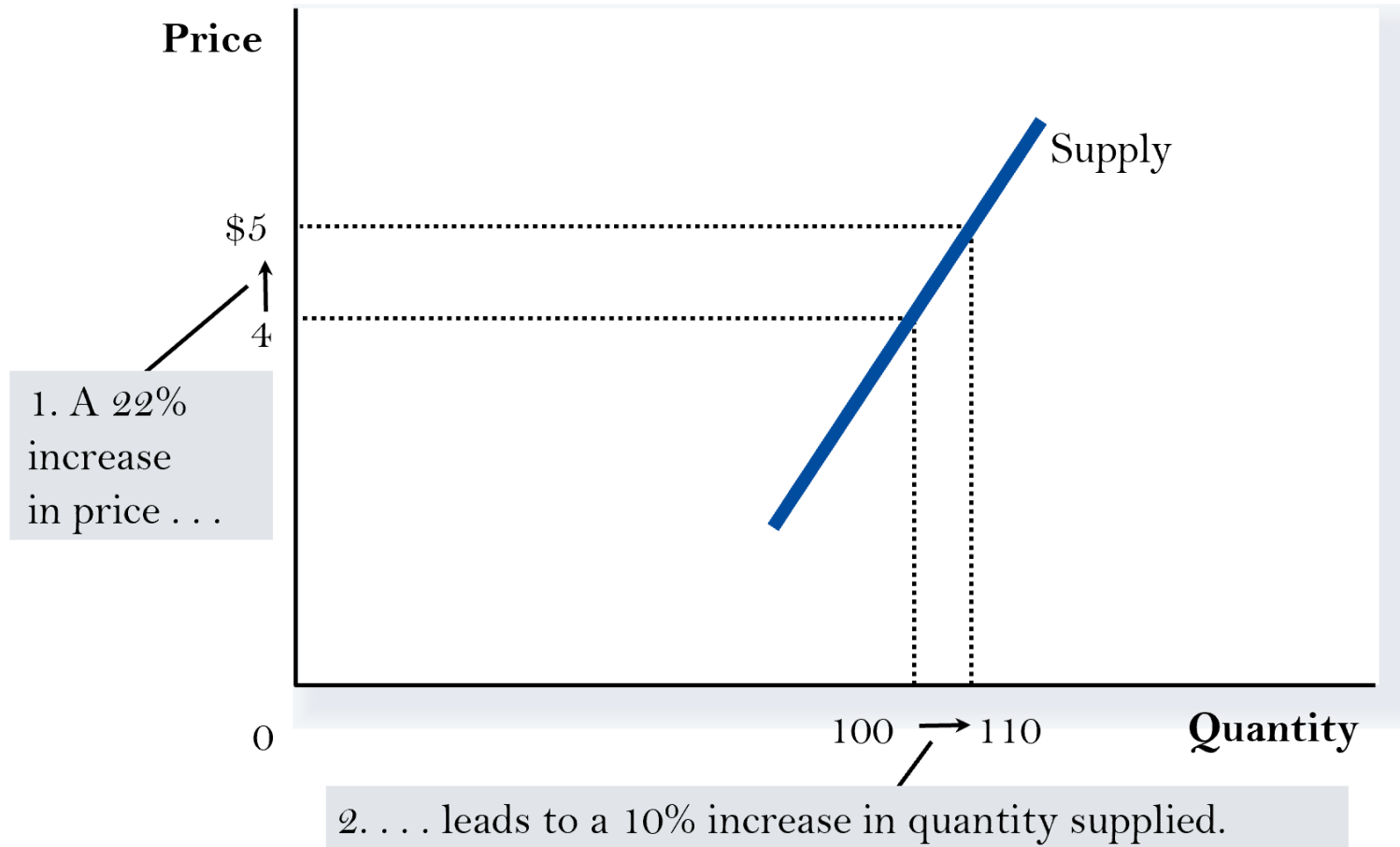
# Variety of supply curves

- Supply is
  - elastic
  - inelastic
  - unit elasticity
  - perfectly inelastic
  - perfectly elastic
- The flatter the supply curve
  - The greater the price elasticity of supply

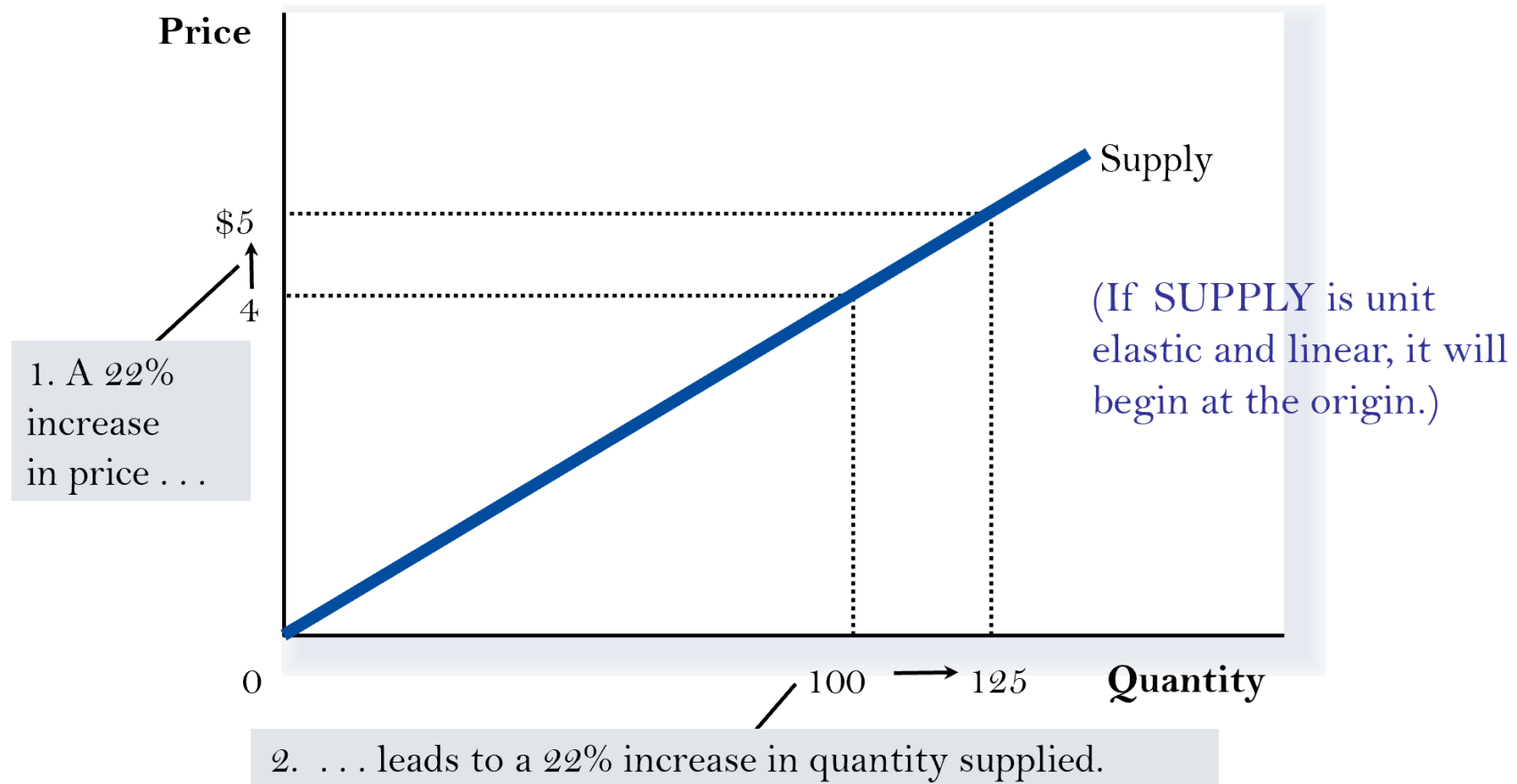
# Perfectly Inelastic Supply: Elasticity Equals 0



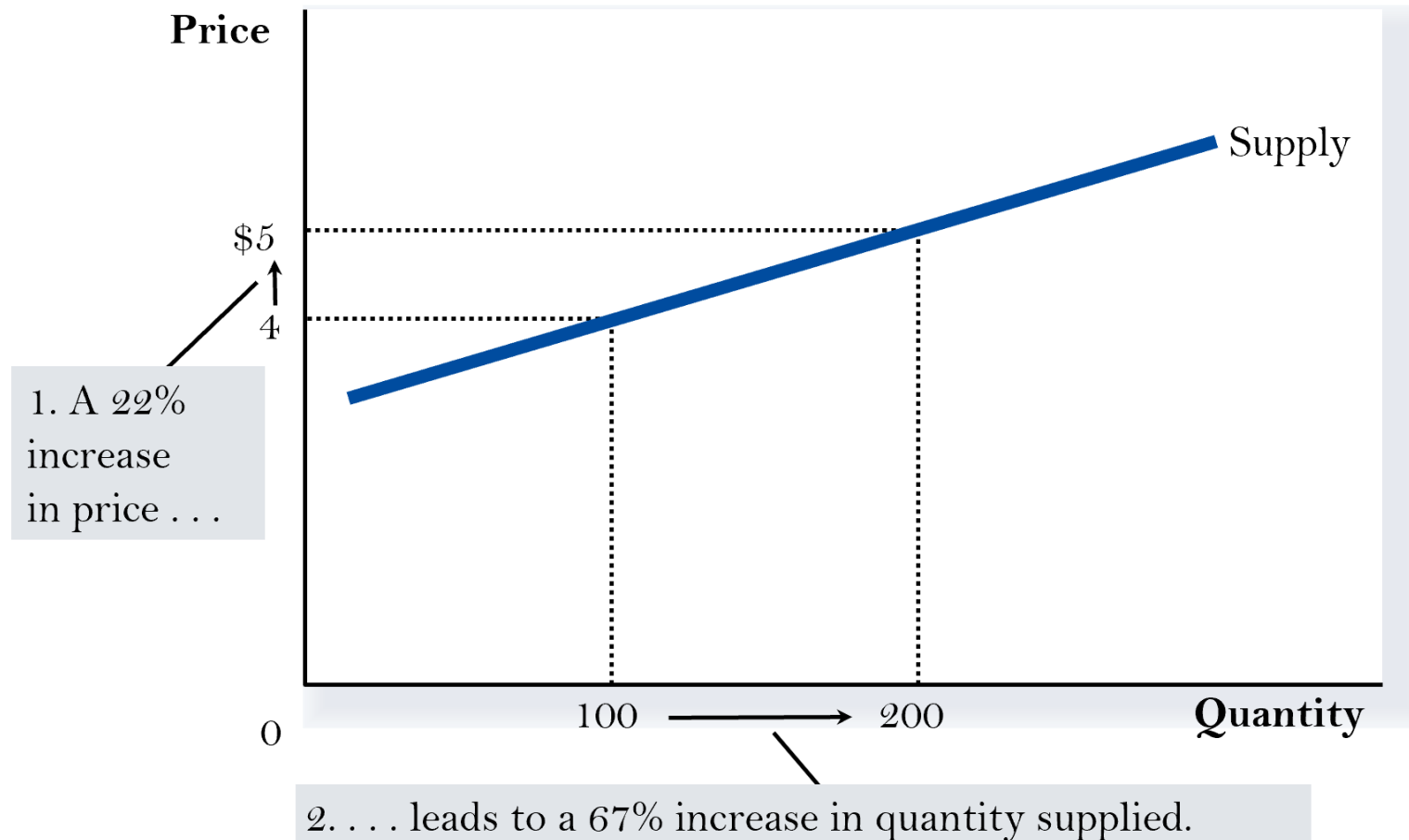
# Inelastic Supply: Elasticity Is Less Than 1



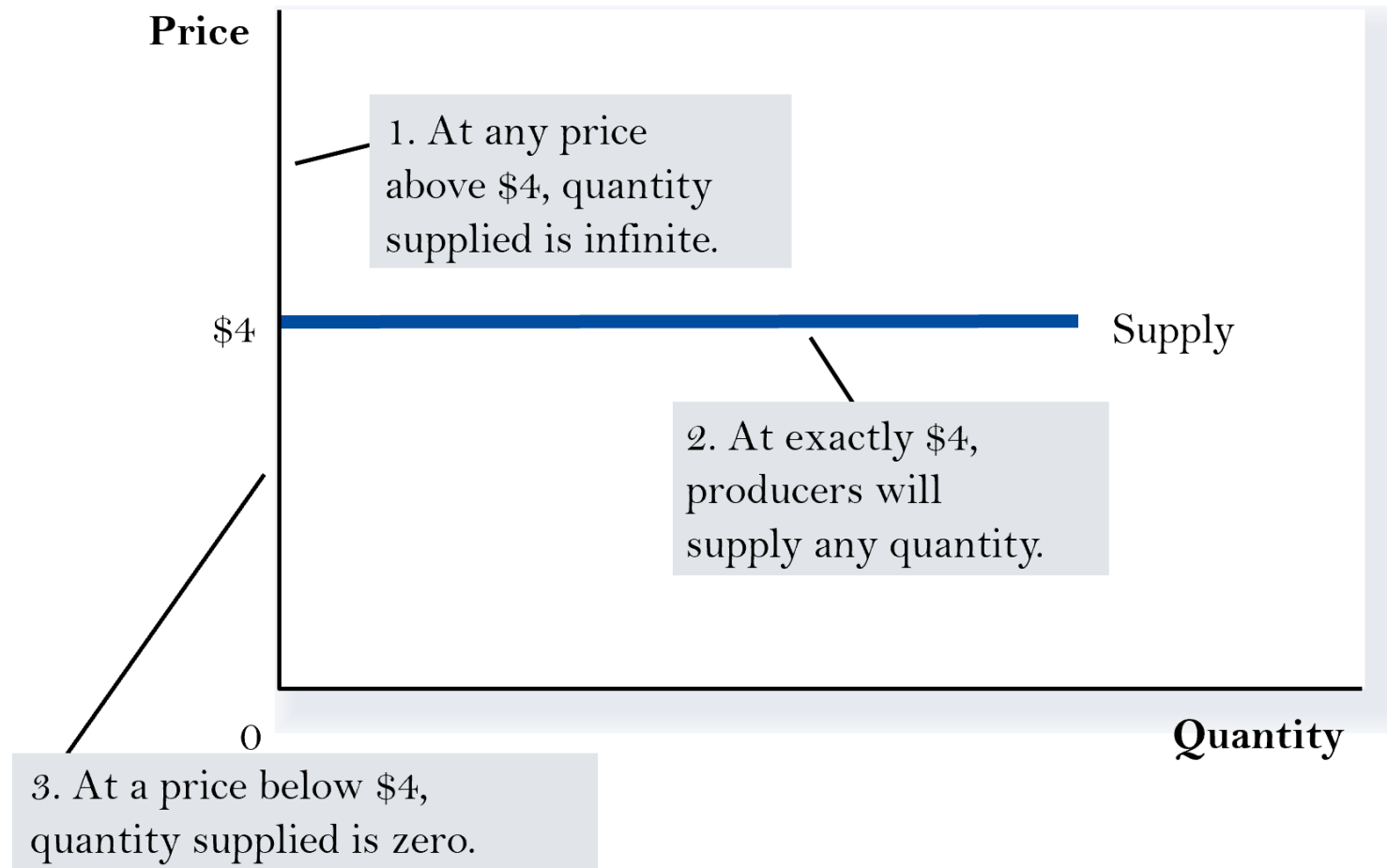
# Unit Elastic Supply: Elasticity Equals 1



# Elastic Supply: Elasticity Is Greater Than 1



# Perfectly Elastic Supply: Elasticity Equals Infinity





# The Determinants of Supply Elasticity

- Greater price elasticity of supply
  - The more easily sellers can change the quantity they produce
    - Supply of beachfront property - harder to vary and thus less elastic than supply of new cars
- Price elasticity of supply is greater in the long run than in the short run
  - In the long run: firms can build new factories, or new firms may be able to enter the market

## Active Learning 3

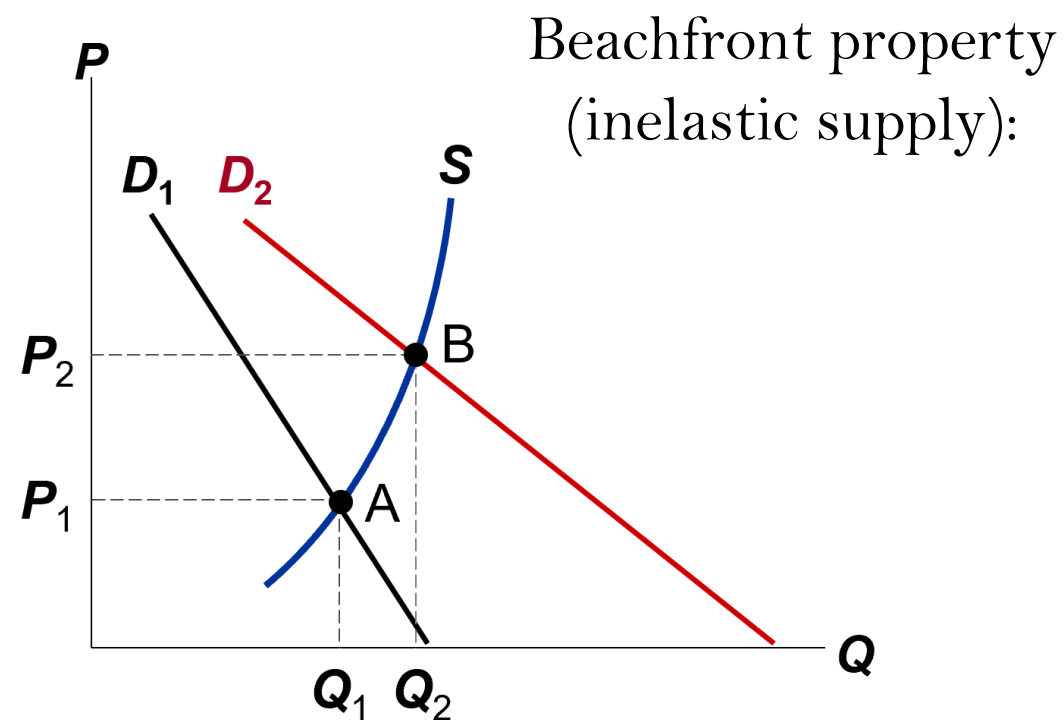
### equilibrium

## Elasticity and changes in

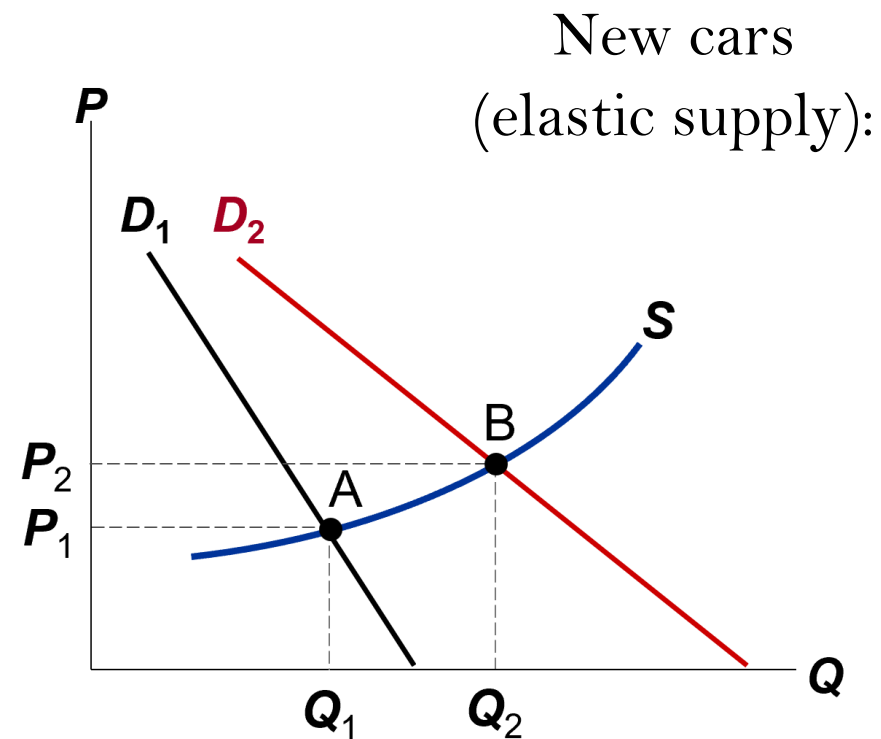
The supply of beachfront property is inelastic. The supply of new cars is elastic. Suppose population growth causes demand for both goods to double (at each price,  $Q_d$  doubles).

- For which product will  $P$  change the most?
- For which product will  $Q$  change the most?

When supply is *inelastic*, an increase in demand has a bigger impact on price than on quantity.

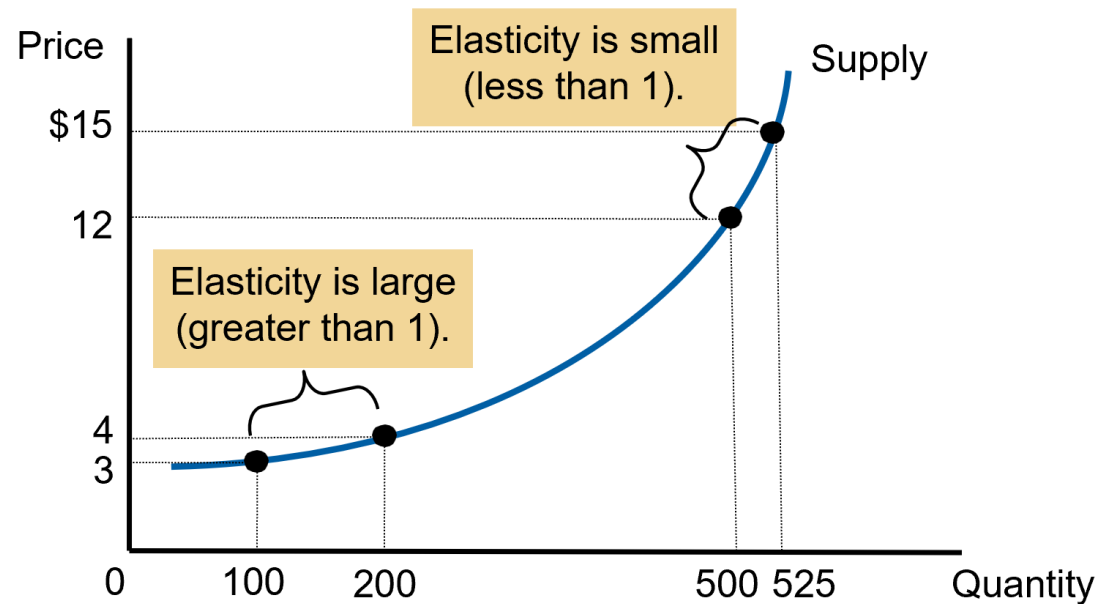


- When supply is *elastic*, an increase in demand has a bigger impact on quantity than on price.



# How the Price Elasticity of Supply Can Vary

- Supply often becomes less elastic as  $Q$  rises, due to capacity limits.



# Other Elasticities of Demand

- Income elasticity of demand
  - How much the quantity demanded of a good responds to a change in consumers' income
  - Percentage change in quantity demanded
    - Divided by the percentage change in income
  - Normal goods: income elasticity  $> 0$
  - Inferior goods: income elasticity  $< 0$

# Other Elasticities of Demand

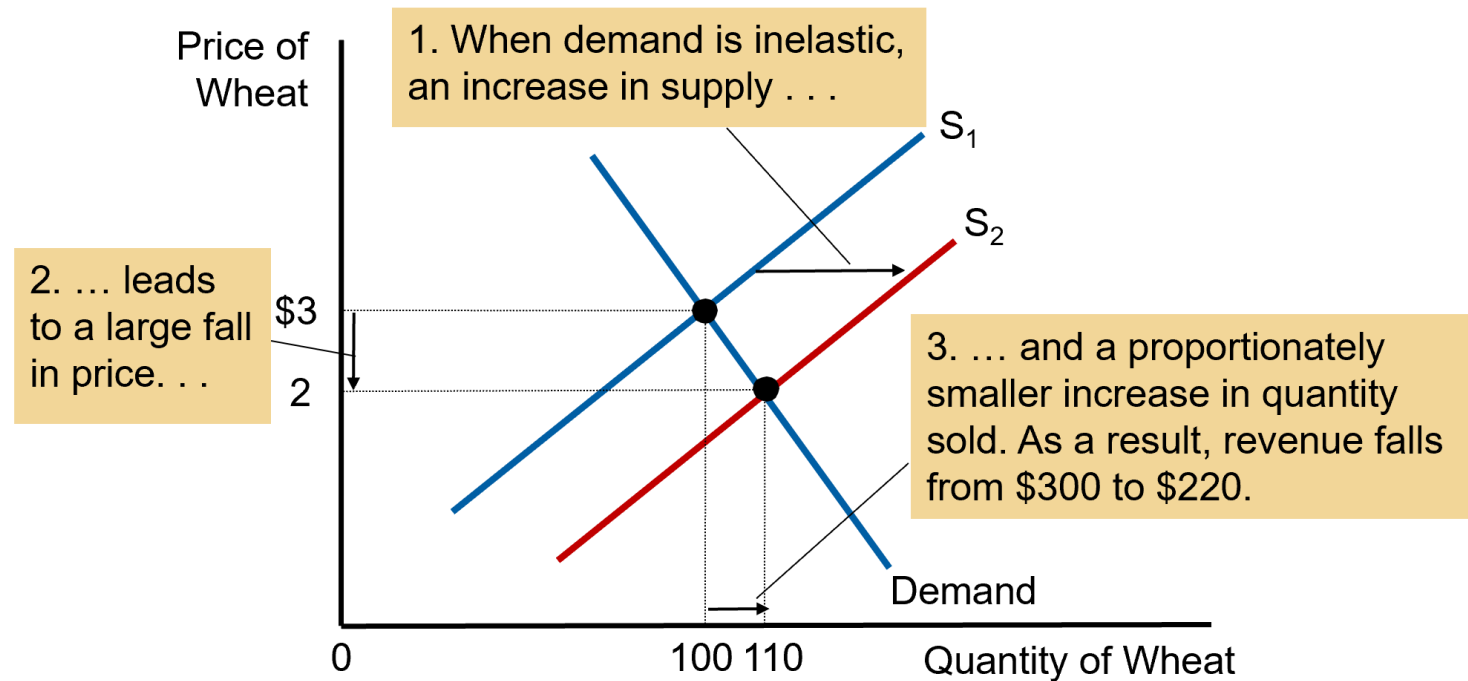
- Cross-price elasticity of demand
  - How much the  $Q^d$  of one good responds to a change in the price of another good
  - Percentage change in  $Q^d$  of the first good
    - Divided by the percentage change in price of the second good
  - Substitutes: cross-price elasticity  $> 0$
  - Complements: cross-price elasticity  $< 0$

# Case Study: Can Good News for Farming Be Bad News for Farmers?

- New hybrid of wheat – increase production per acre 20%
  - Supply curve shifts to the right
  - Higher quantity and lower price
  - Demand is inelastic: total revenue falls
- Paradox of public policy: induce farmers not to plant crops



# Case Study : Can Good News for Farming Be Bad News for Farmers?

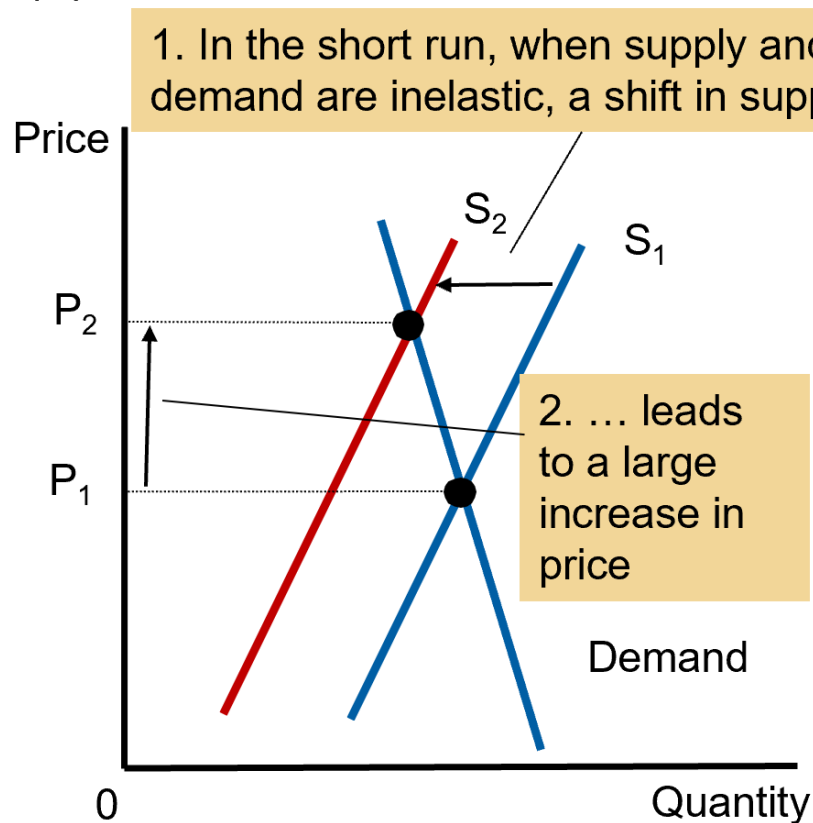


# Case Study : Why Did OPEC Fail to Keep the Price of Oil High?

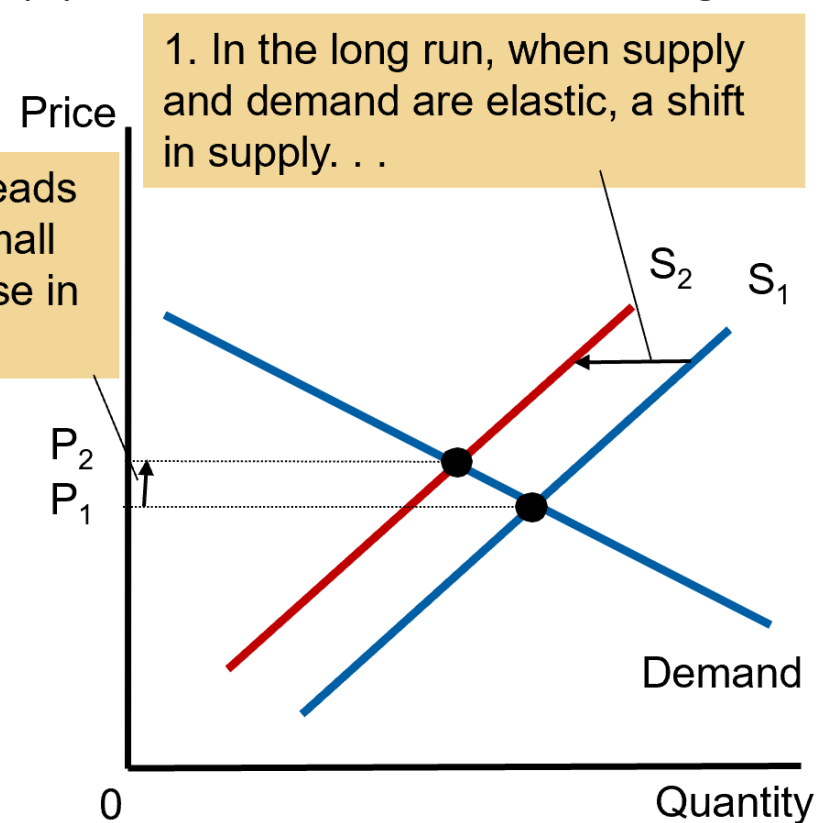
- Increase in prices 1973-1974, 1971-1981
- Short-run: supply and demand are inelastic
  - Decrease in supply: large increase in price
- Long-run: supply and demand are elastic
  - Decrease in supply: small increase in price

# Case Study : Why Did OPEC Fail to Keep the Price of Oil High?

(a) The Oil Market in the Short Run



(b) The Oil Market in the Long Run



# Can You Answer the Following Questions?

- What is elasticity?
- What kinds of issues can elasticity help us understand?
- What is the price elasticity of demand?  
How is it related to the demand curve?  
How is it related to revenue & expenditure?
- What is the price elasticity of supply?  
How is it related to the supply curve?
- What are the income and cross-price elasticities of demand?

End