Elasticity and Its Applications

Elasticity

- The focus of this lecture is the elasticity. Students will learn about the price elasticity of demand, price elasticity of supply, cross elasticity, income elasticity and its application.

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

- Example: Rice farmer, IIT Hyderabad researchers have devised a new hybrid of rice.

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

THE ELASTICITY OF DEMAND

- ***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.

- Price elasticity of demand is the percentage change in quantity demanded given a percent change in the price.

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 more narrowly defined the market.
  - the longer the time period.

Determinants of Price Elasticity of Demand

Various factors influence the price elasticity of demand. Here are some of them:

1. Substitutes: If a product can be easily substituted, its demand is elastic, like Gap's jeans. If a product cannot be substituted easily, its demand is inelastic, like gasoline.

2. Luxury Vs Necessity: Necessity's demand is usually inelastic because there are usually very few substitutes for necessities. Luxury product, such as leisure sail boats, are not needed in a daily bases. There are usually many substitutes for these products. So their demand is more elastic.

3. *Price/Income* Ratio: The larger the percentage of income spent on a good, the more elastic is its demand. A change in these products' price will be highly noticeable as they affect consumers' budget with a bigger magnitude. Consumers will respond by cutting back more on these product when price increases. On the other hand, the smaller the percentage of income spent on a good, the less elastic is its demand.

4. Time lag: The longer the time after the price change, the more elastic will be the demand. It is because consumers are given more time to carry out their actions. A 1-day sale usually generate less sales change per day as a sale lasted for 2 weeks.

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.

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

Computing the Price Elasticity of Demand

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

- 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 would be calculated as:

$$\frac{\dfrac{(10 - 8)}{10} \times 100}{\dfrac{(2.20 - 2.00)}{2.00} \times 100} = \frac{20\%}{10\%} = 2$$

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 change.

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

Why midpoint method is better?

- Point A: Price = 4, Quantity = 120

- Pont B: Price = 6, Quantity = 80

- $E_A = 33/50 = 0.66$ (Quantity fall & Price rise)

- $E_B = 50 /33 = 1.5$ (Price fall & Quantity rise)

- Different arises because of shift in base

- To avoid this problem, one can use Midpoint method

- Midpoint method gives the same answer regardless of direction of change.
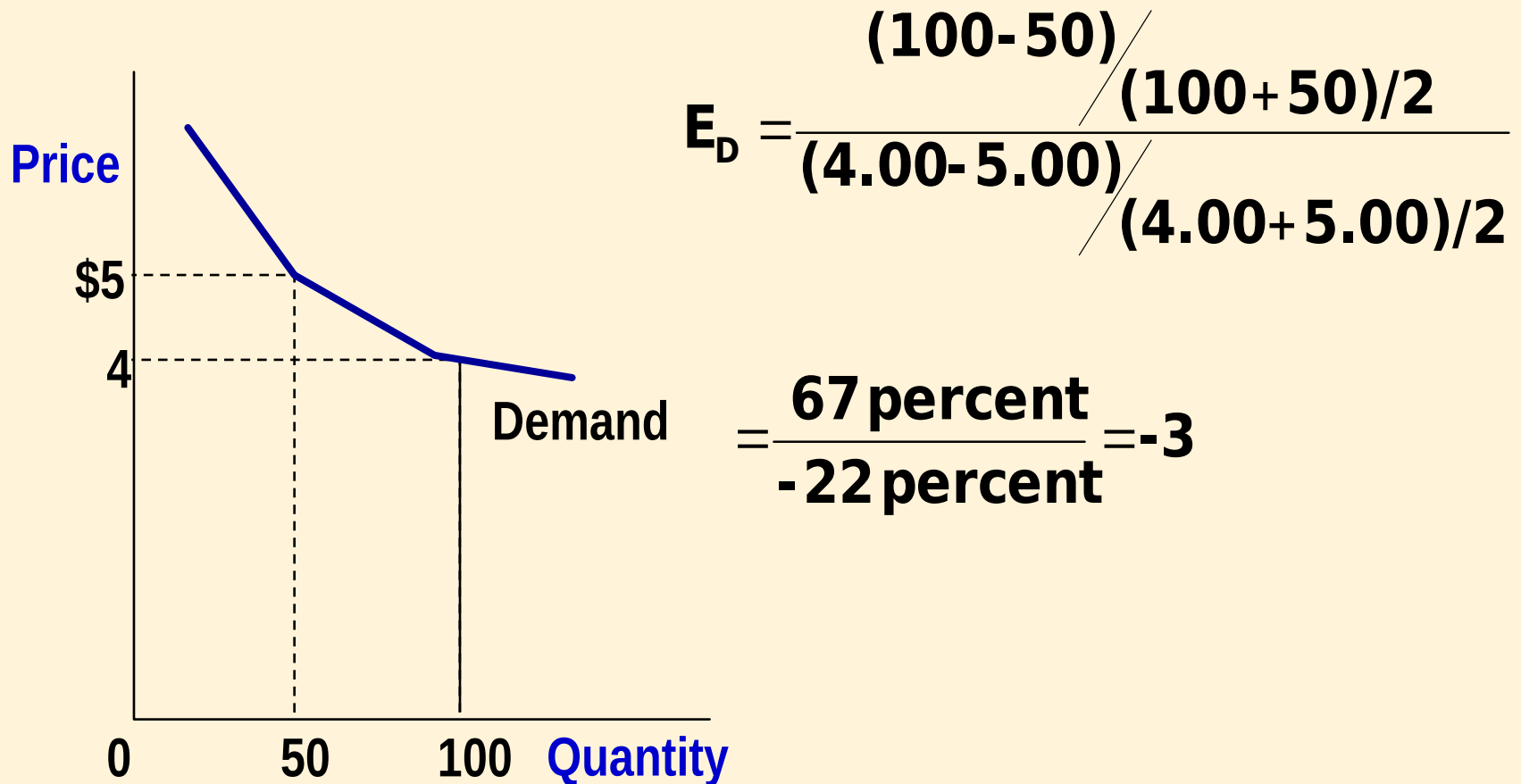
The Midpoint Method…..

- 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:

$$\frac{\dfrac{(10 - 8)}{(10 + 8) / 2}}{\dfrac{(2.20 - 2.00)}{(2.00 + 2.20) / 2}} = \frac{22\%}{9.5\%} = 2.32$$

The Variety of Demand Curves

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

Computing the Price Elasticity of Demand

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

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

Price

$5

4

Demand

0   50   100   Quantity

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.

An Example

DEMAND FUNCTION FOR PRODUCT X: P = 2.5-0.01Q

P = PRICE; Q = QUANTITY, TR = TOTAL REVENU
Ed = PRICE ELASTICITY OF DEMAND

	A	B	C	D	E	F	G	H	I	
Q:	0	50	100	150	200	250	300	350	400	450
P:	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Ed:		17	5	2.6	1.57	1	0.64	0.38	0.2	0.06	

ELASTICITY OF DEMAND;
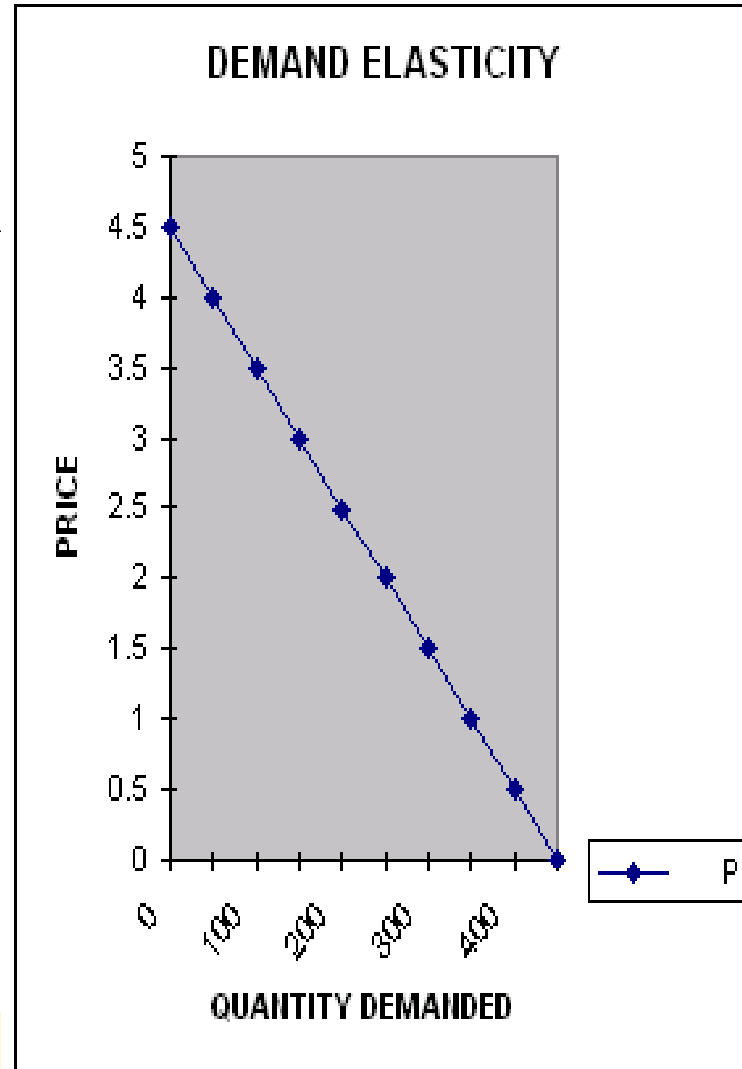FROM A TO E Ed >1
FROM E TO F Ed =1
FROM F TO J Ed <1

DEMAND ELASTICITY

Figure 1 The Price Elasticity of Demand

(a) Perfectly Inelastic Demand: Elasticity Equals 0

Price

Demand

$5

4

1. An increase in price . . .

0

100

Quantity

2. . . . leaves the quantity demanded unchanged.
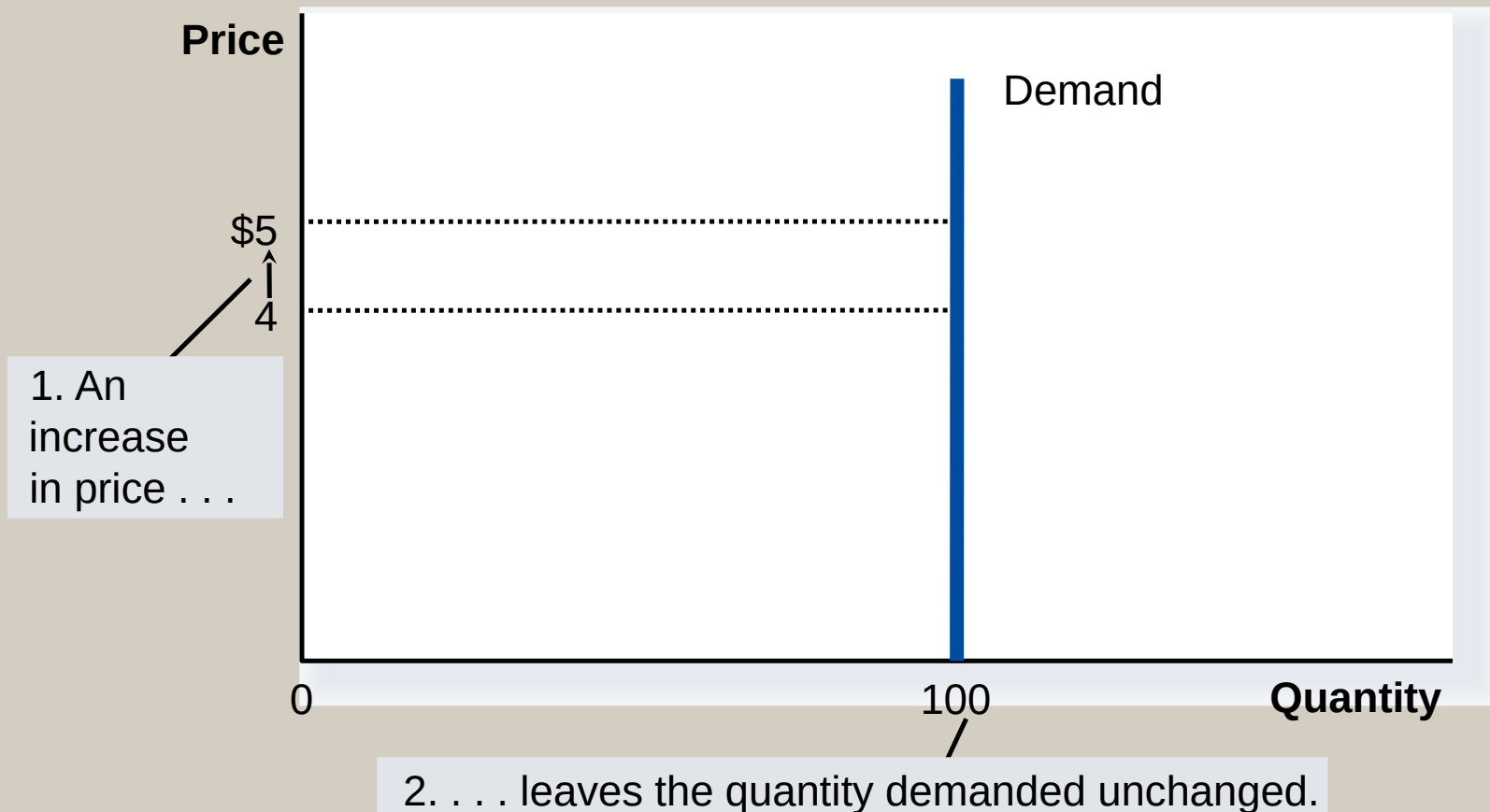
Figure 1 The Price Elasticity of Demand

(b) Inelastic Demand: Elasticity Is Less Than 1

Price

$5

4

Demand

1. A 22% increase in price . . .

0   90   100   Quantity

2. . . . leads to an 11% decrease in quantity demanded.
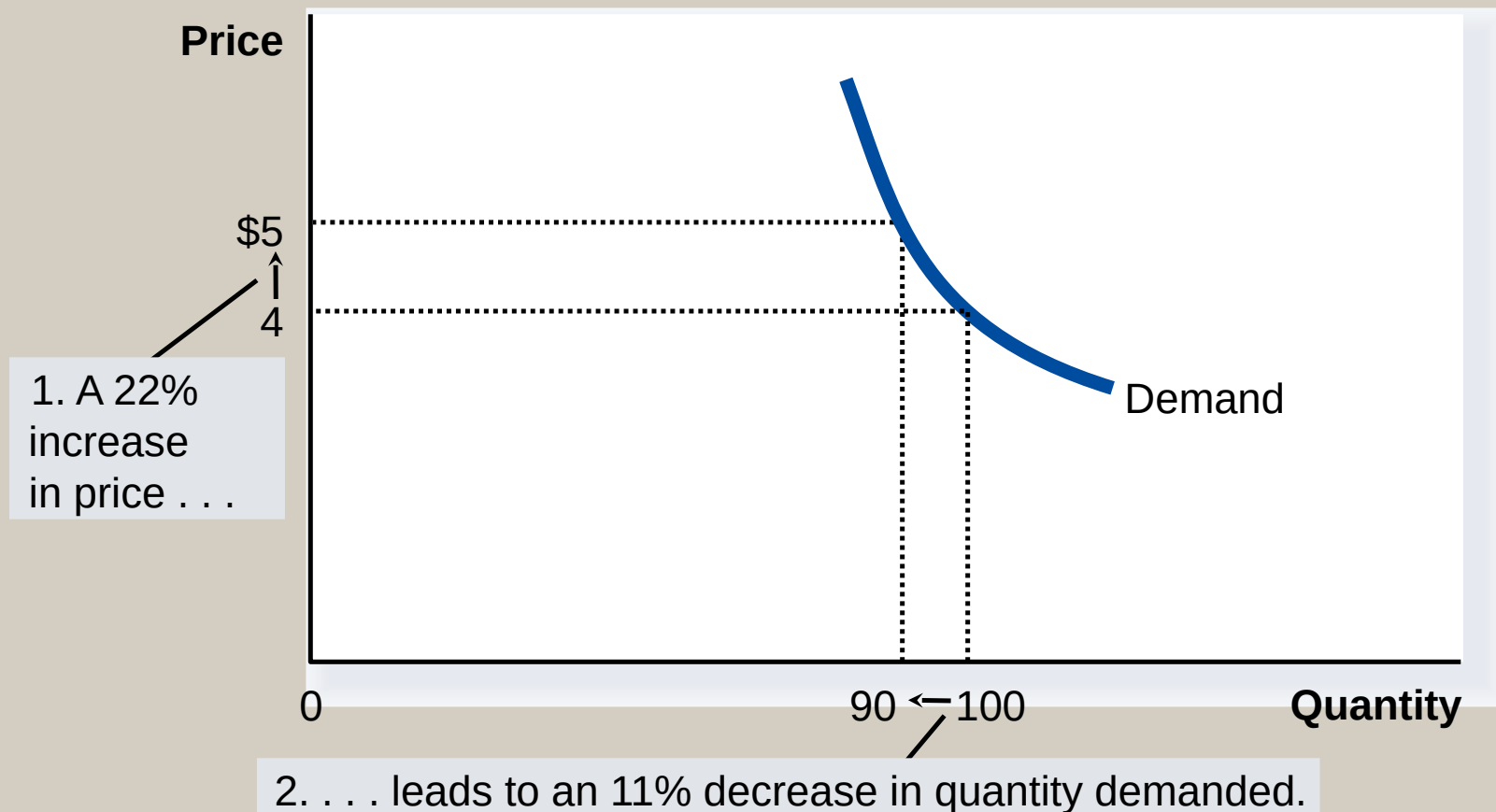
Figure 1 The Price Elasticity of Demand

(c) Unit Elastic Demand: Elasticity Equals 1

Price

$5

4

1. A 22% increase in price . . .

Demand

0

80 ← 100

Quantity

2. . . . leads to a 22% decrease in quantity demanded.
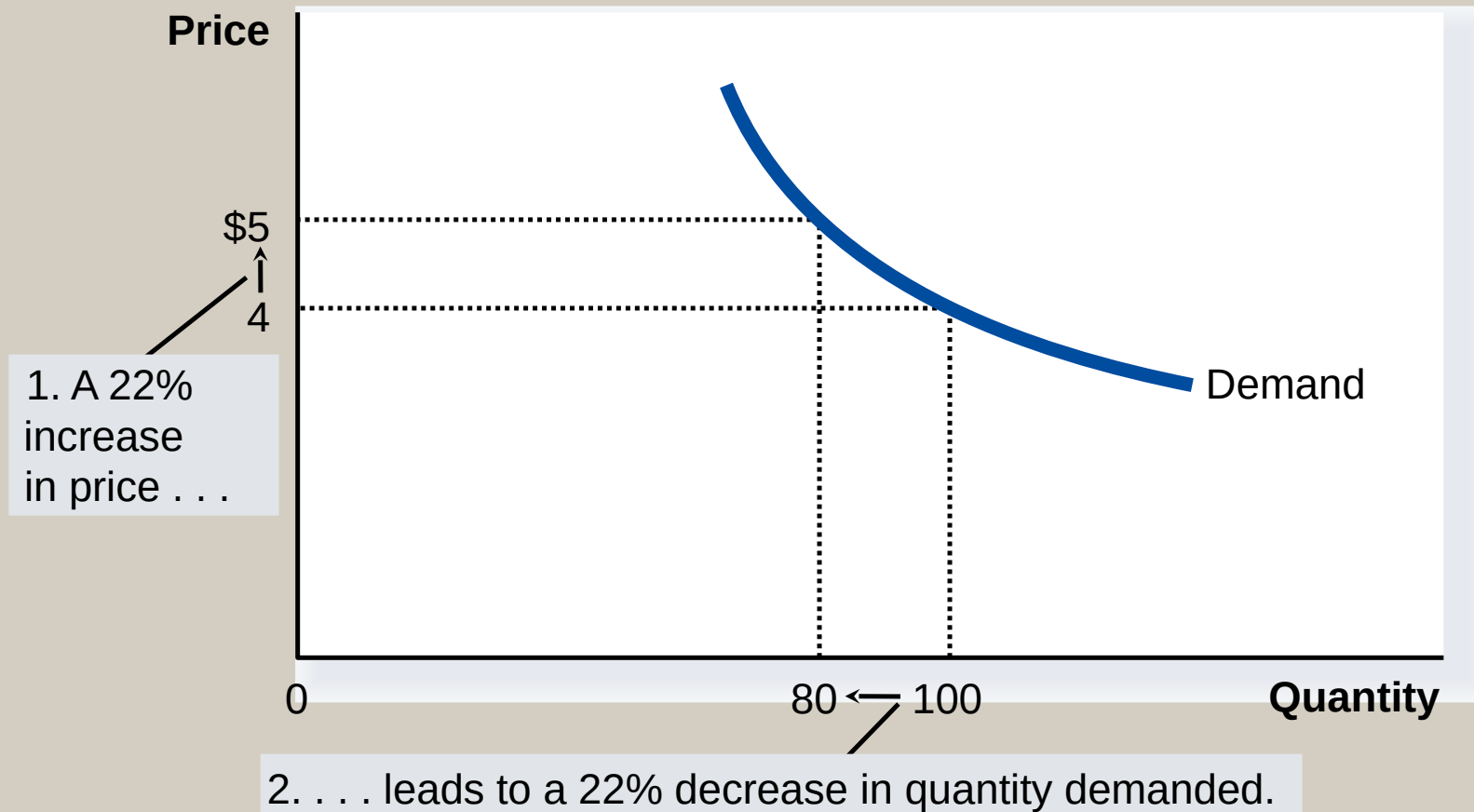
Figure 1 The Price Elasticity of Demand

(d) Elastic Demand: Elasticity Is Greater Than 1

Price

$5

4

Demand

1. A 22% increase in price . . .

0   50   100   **Quantity**

2. . . . leads to a 67% decrease in quantity demanded.
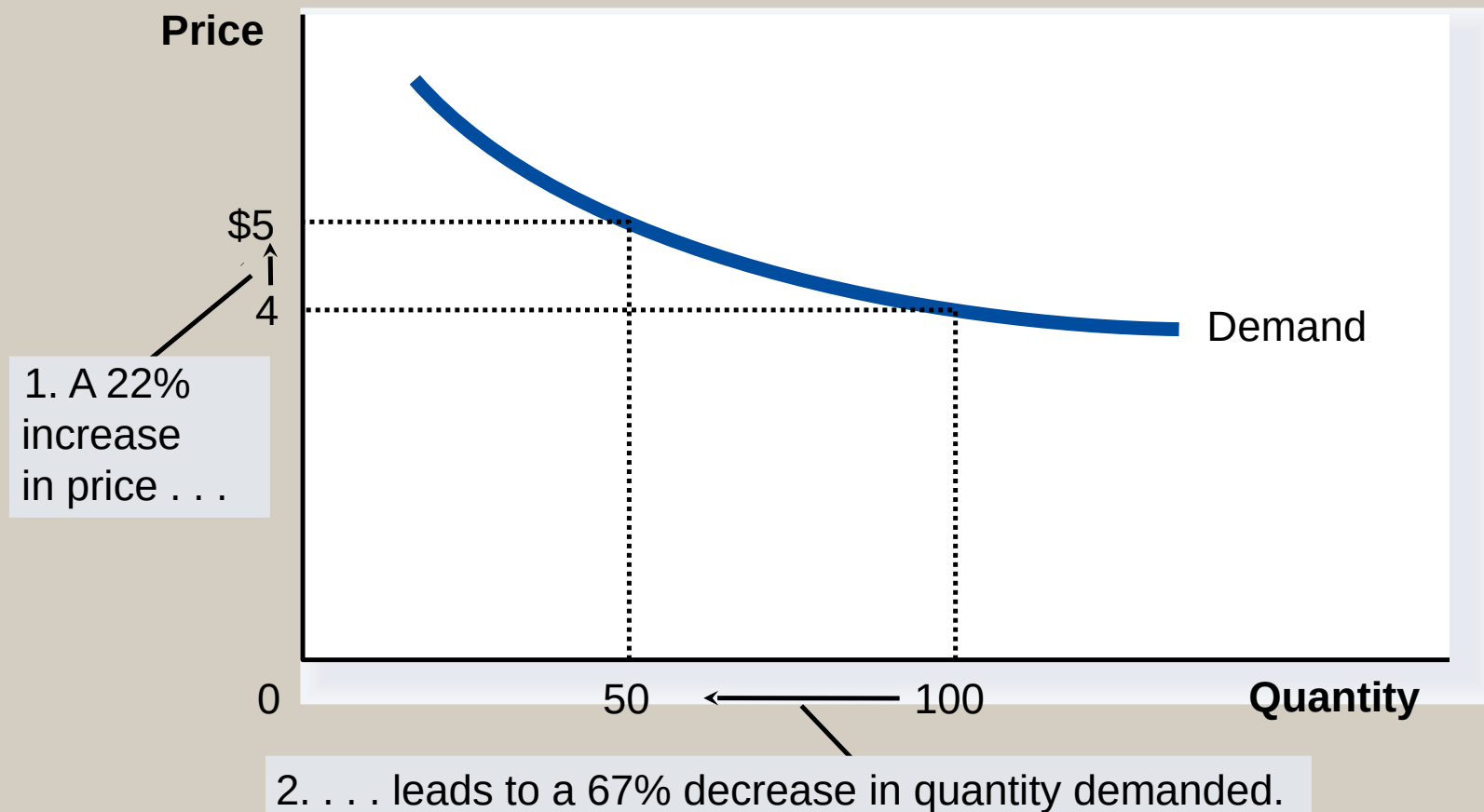
Figure 1 The Price Elasticity of Demand

(e) Perfectly Elastic Demand: Elasticity Equals Infinity

Price

1. At any price above $4, quantity demanded is zero.

$4 ─────────────────── Demand

2. At exactly $4, consumers will buy any quantity.

0

Quantity
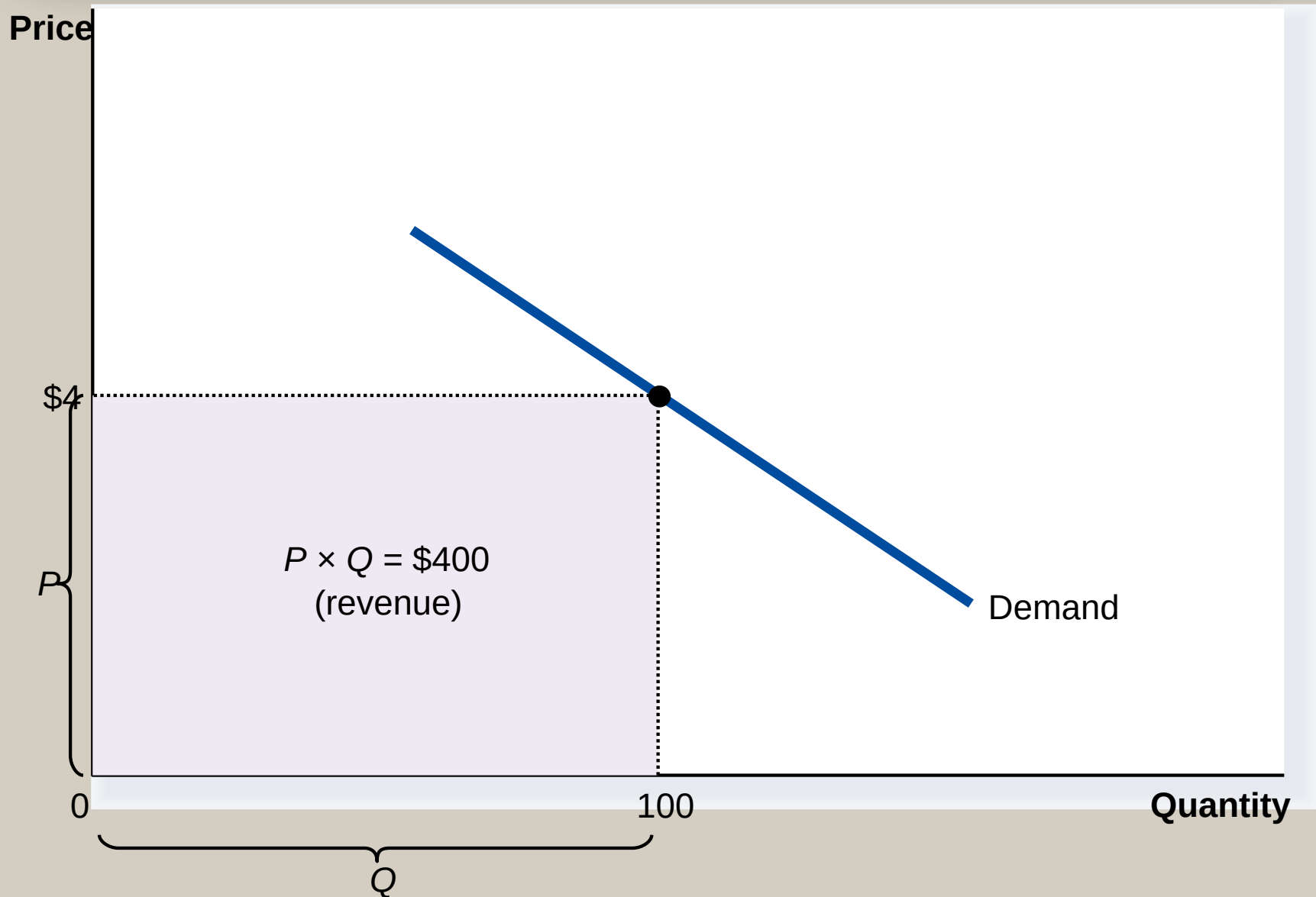
3. At a price below $4, quantity demanded is infinite.
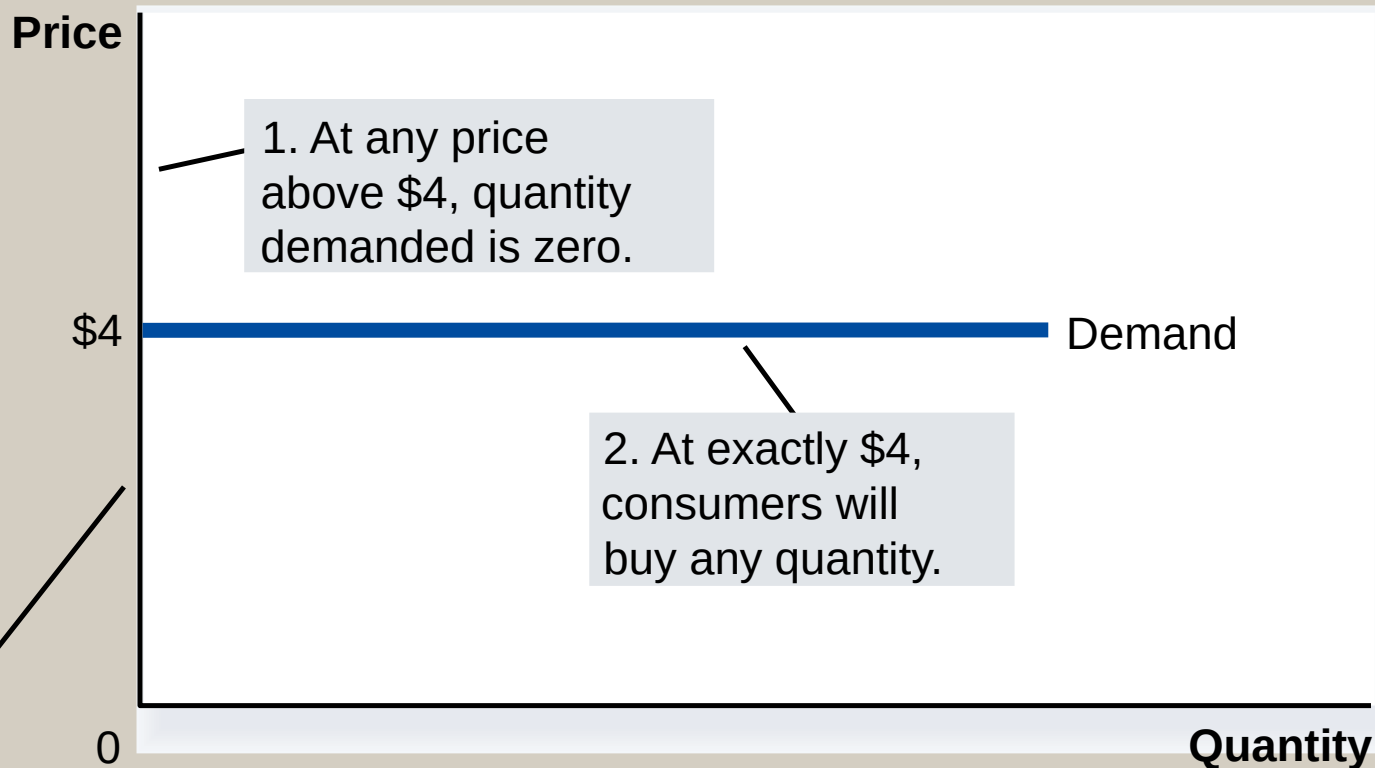
Relation betweenTotal Revenue and the Price Elasticity of Demand

- ***Total revenue*** is the amount paid by buyers and received by sellers of a good.

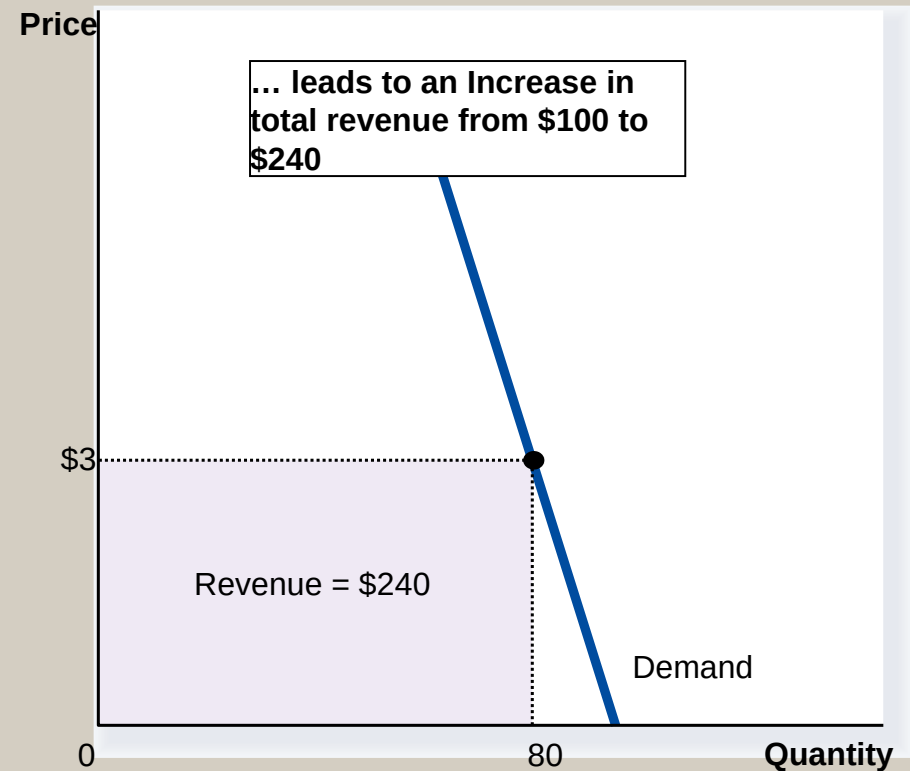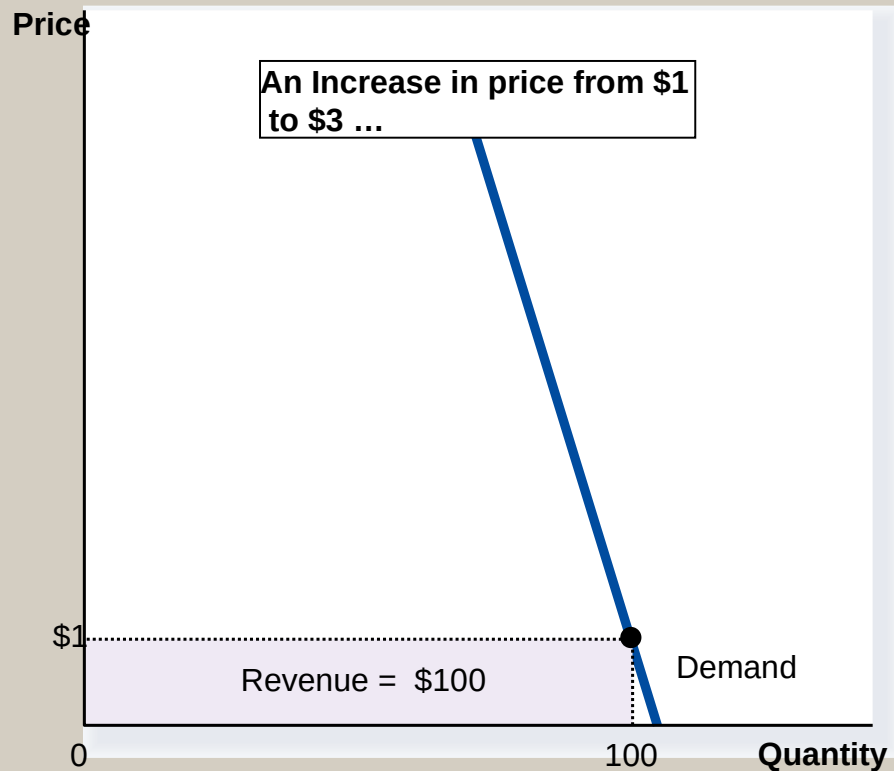- Computed as the price of the good times the quantity sold.

$$TR = P \text{ x } Q$$

Figure 2 Total Revenue

Price

$4

P

$P \times Q = \$400$
(revenue)

Demand

0

100

Quantity

Q

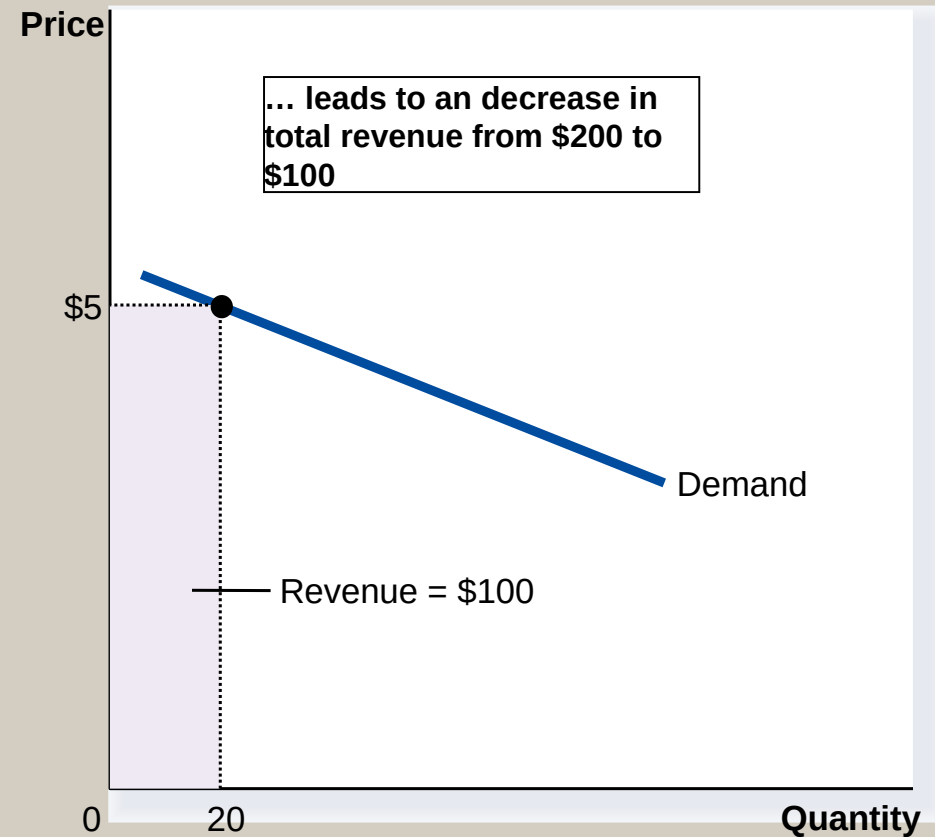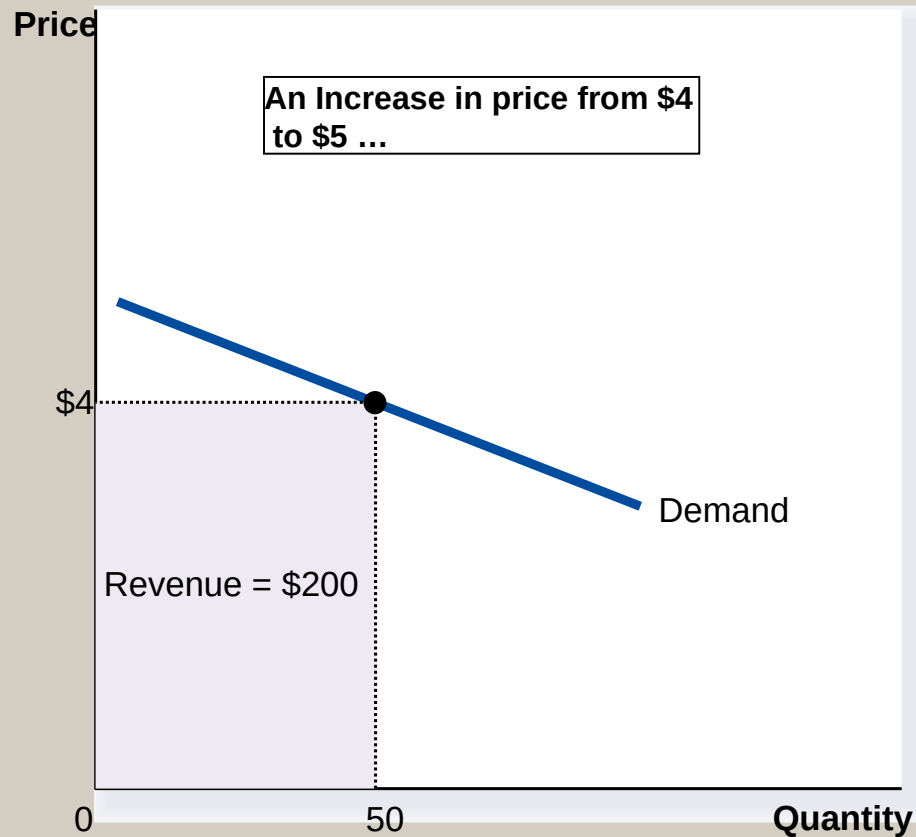# Elasticity and Total Revenue along a Linear Demand Curve

- 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

Price

An Increase in price from $1 to $3 …

$1

Revenue = $100

Demand

0   100   **Quantity**

Price

… leads to an Increase in total revenue from $100 to $240

$3

Revenue = $240

Demand

0   80   **Quantity**

- 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 4 How Total Revenue Changes When Price Changes: Elastic Demand

Price

An Increase in price from $4 to $5 …

$4

Revenue = $200

Demand

0   50   **Quantity**

Price

… leads to an decrease in total revenue from $200 to $100

$5

Revenue = $100

Demand

0   20   **Quantity**

TR Test Example

DEMAND FUNCTION FOR PRODUCT X: P = 2.5-0.01Q

P = PRICE; Q = QUANTITY, TR = TOTAL REVENUE
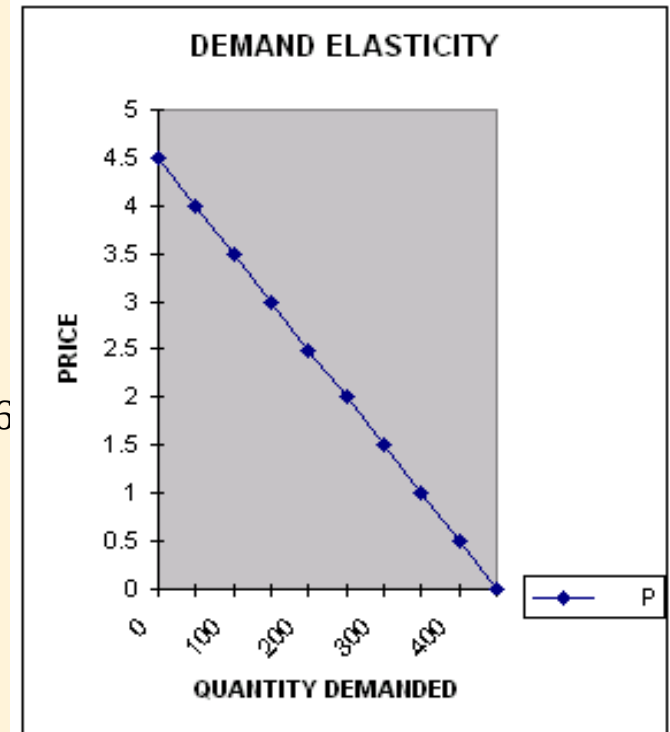Ed = PRICE ELASTICITY OF DEMAND

	A	B	C	D	E	F	G	H	I
Q:	0	50	100	150	200	250	300	350	400
P:	4.5	4	3.5	3	2.5	2	1.5	1	0.5
TR:	0	200	350	450	500	500	450	350	200
Ed:	17	5	2.6	1.57	1	0.64	0.38	0.2	0.06

ELASTICITY OF DEMAND;

FROM A TO E Ed >1   TR increases

FROM E TO F Ed =1   TR remains same.

FROM F TO I Ed <1   TR decreases.

DEMAND ELASTICITY

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.

Computing Income Elasticity

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

Income Elasticity

- Types of Goods
  - Normal Goods
  - Inferior Goods

- Higher income raises the quantity demanded for normal goods but lowers the quantity demanded for inferior goods.

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.

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 percent change in price.

Figure 6 The Price Elasticity of Supply
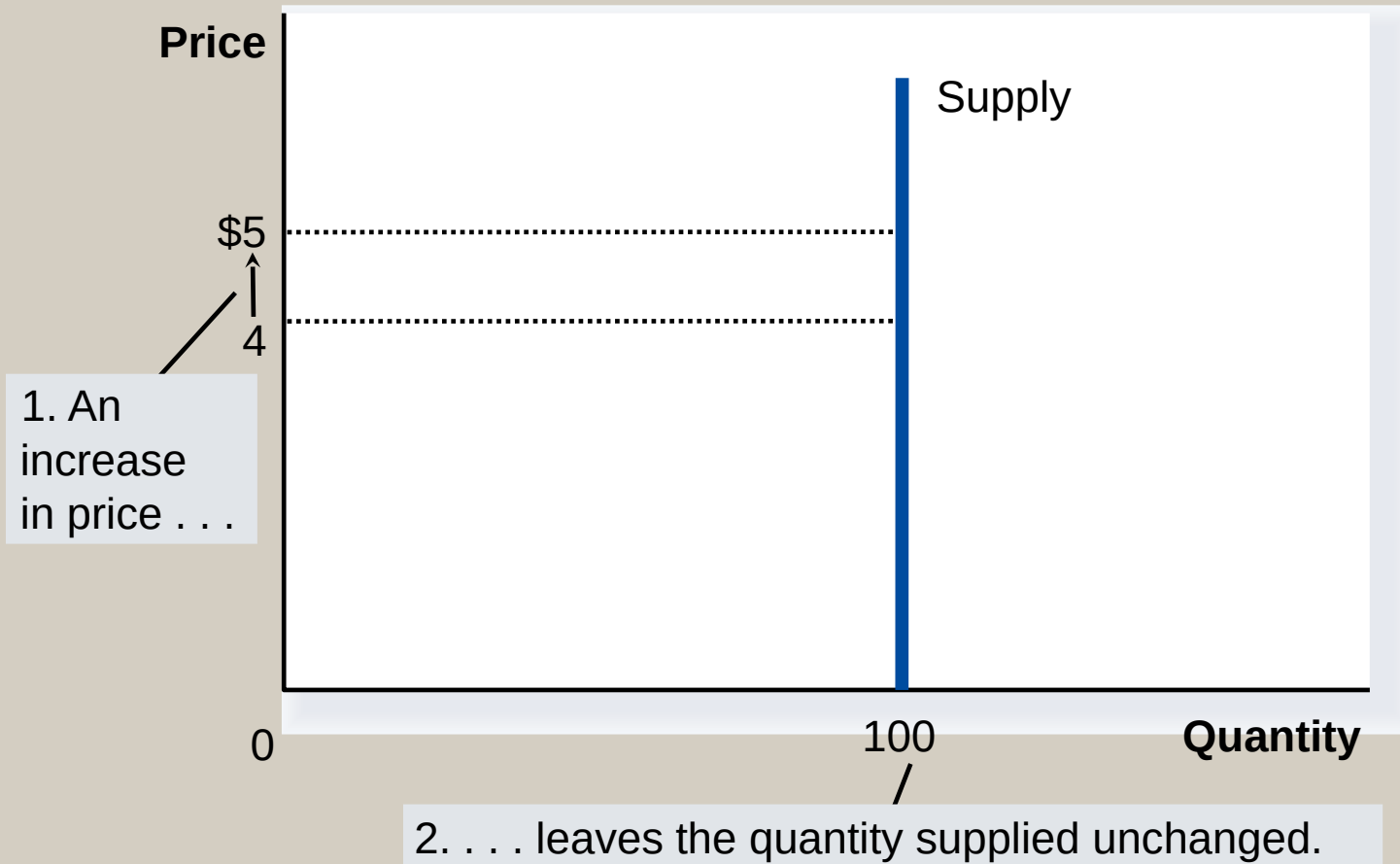
(a) Perfectly Inelastic Supply: Elasticity Equals 0

Price

Supply

$5

4

1. An increase in price . . .

0

100

Quantity

2. . . . leaves the quantity supplied unchanged.

Figure 6 The Price Elasticity of Supply

(b) Inelastic Supply: Elasticity Is Less Than 1

Price

$5

4

Supply

1. A 22% increase in price . . .

0

100 → 110

Quantity

2. . . . leads to a 10% increase in quantity supplied.
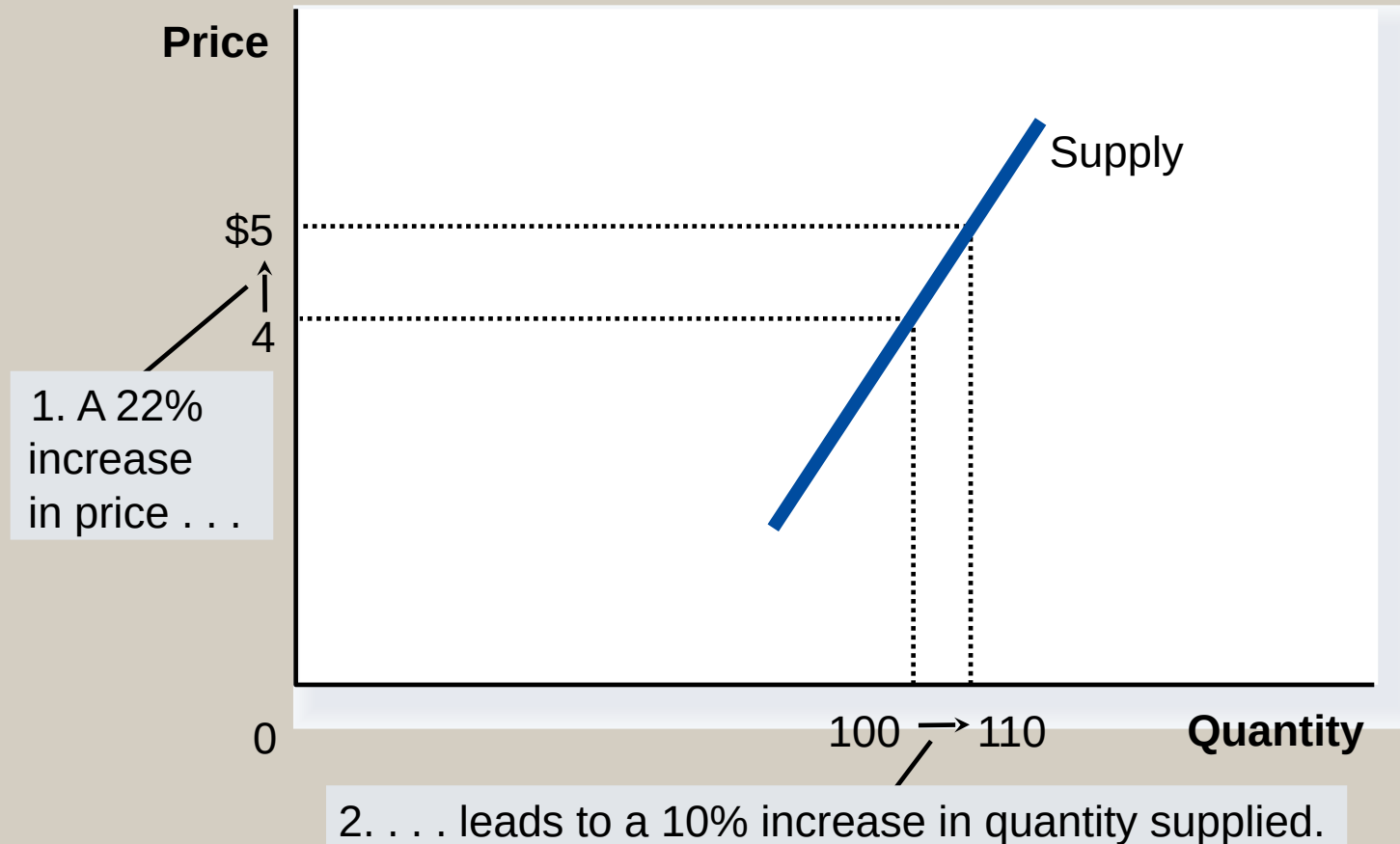
Figure 6 The Price Elasticity of Supply

(c) Unit Elastic Supply: Elasticity Equals 1

Price

$5

4

1. A 22% increase in price . . .

Supply

0   100   → 125   **Quantity**

2. . . . leads to a 22% increase in quantity supplied.
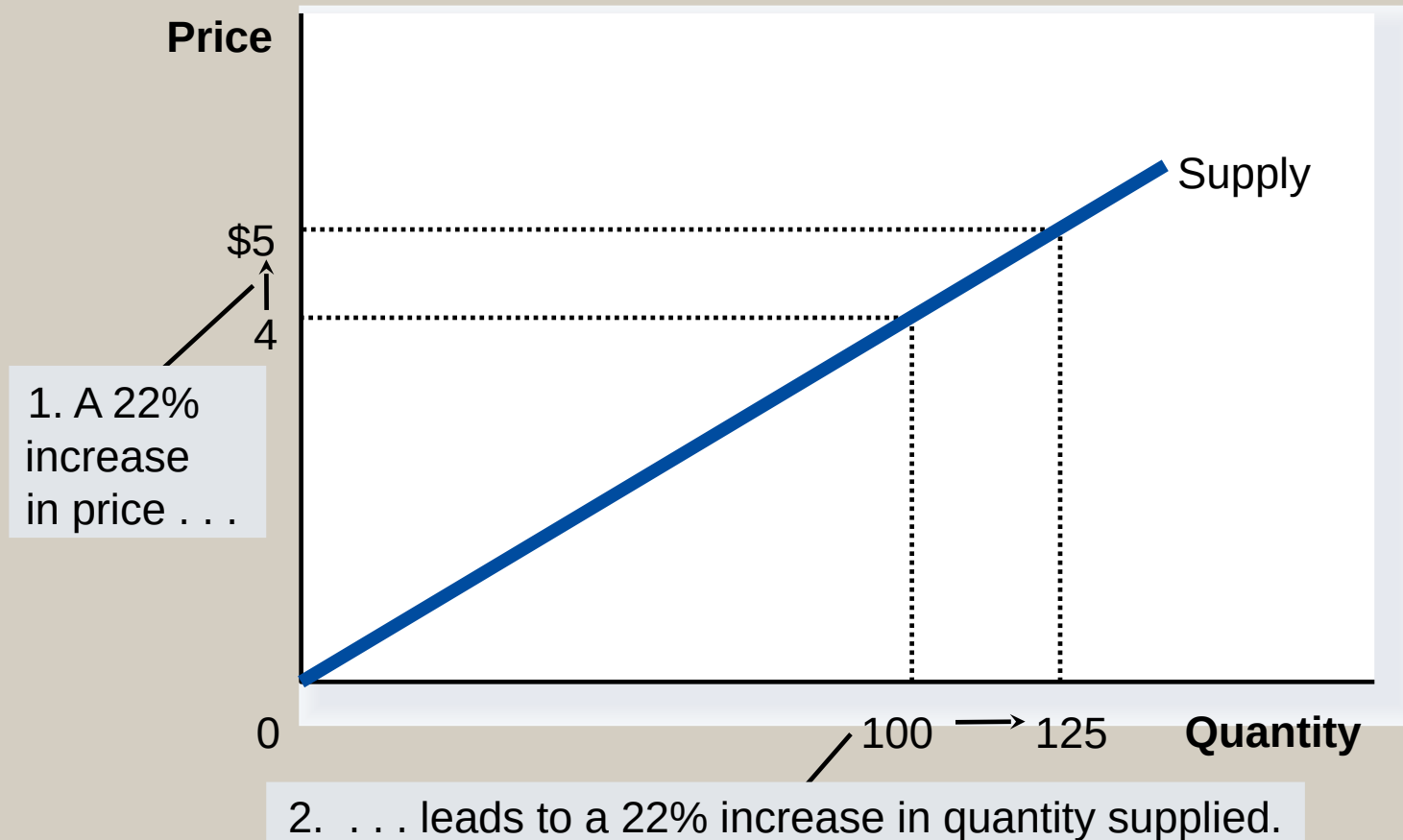
Figure 6 The Price Elasticity of Supply

(d) Elastic Supply: Elasticity Is Greater Than 1

Price

Supply

$5

4

1. A 22% increase in price . . .

0   100   200   Quantity

2. . . . leads to a 67% increase in quantity supplied.
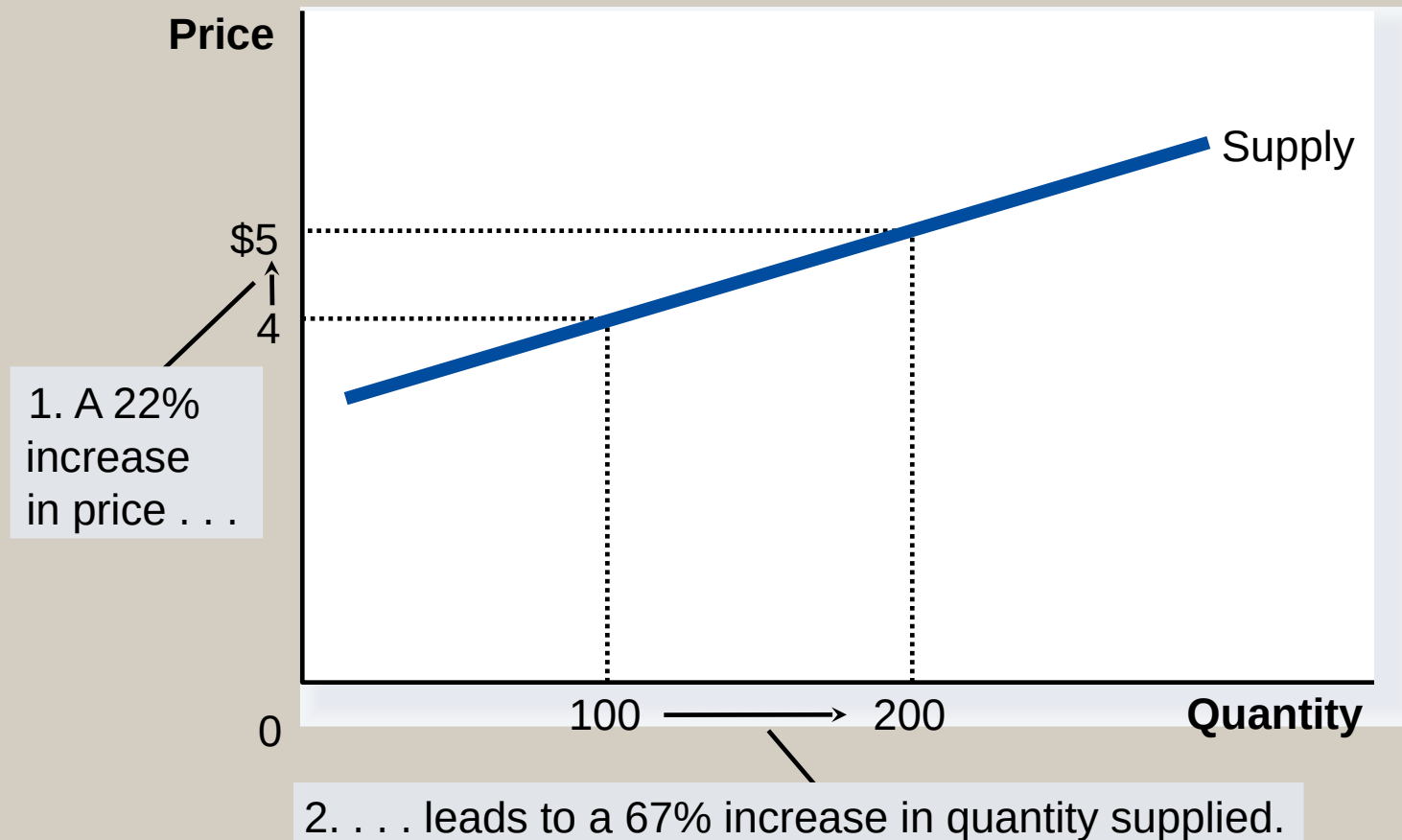
Figure 6 The Price Elasticity of Supply

(e) Perfectly Elastic Supply: Elasticity Equals Infinity

Price

1. At any price above $4, quantity supplied is infinite.

$4 ——————————————————— Supply

2. At exactly $4, producers will supply any quantity.

0

Quantity

3. At a price below $4, quantity supplied is zero.
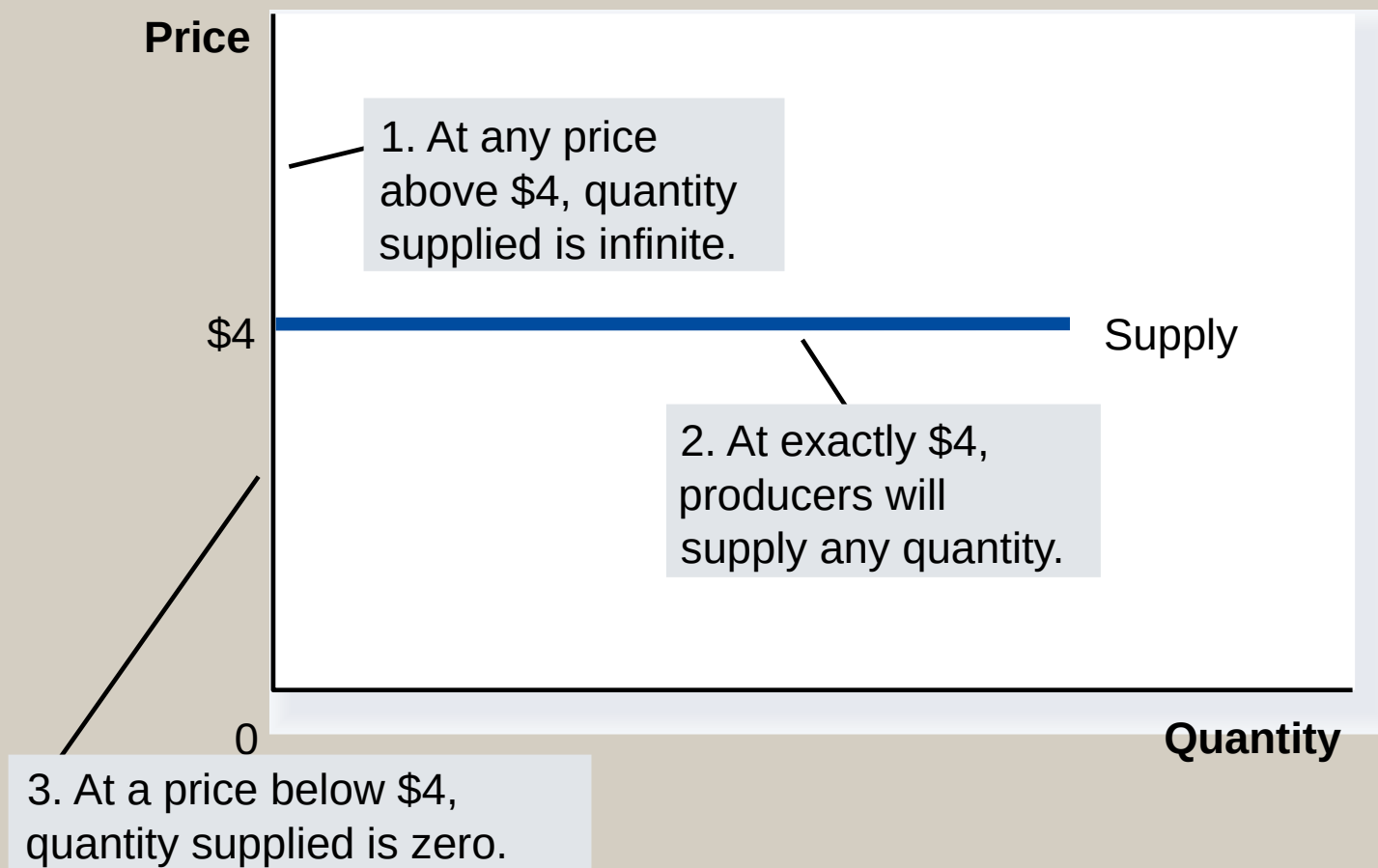
APPLICATIONS OF SUPPLY, DEMAND, AND ELASTICITY

- 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?

Figure 8 An Increase in Supply in the Market for Wheat
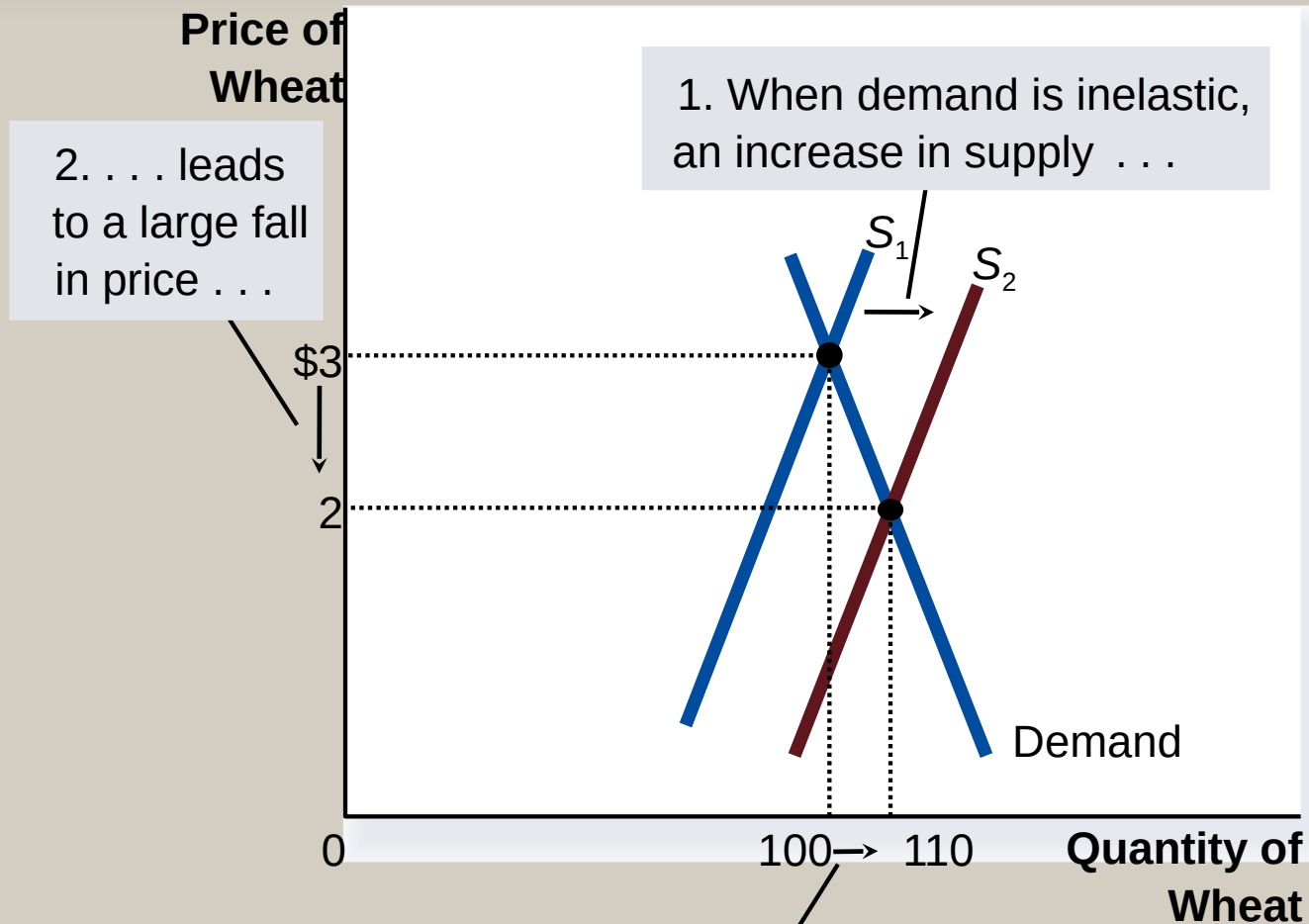
Why did OPEC fail to keep the price of oil high?

(a) The Oil Market in the Short Run

Price of Oil

1. In the short run, when supply and demand are inelastic, a shift in supply . . .

S_2

S_1

P_2

2. . . . leads to a large increase in price.
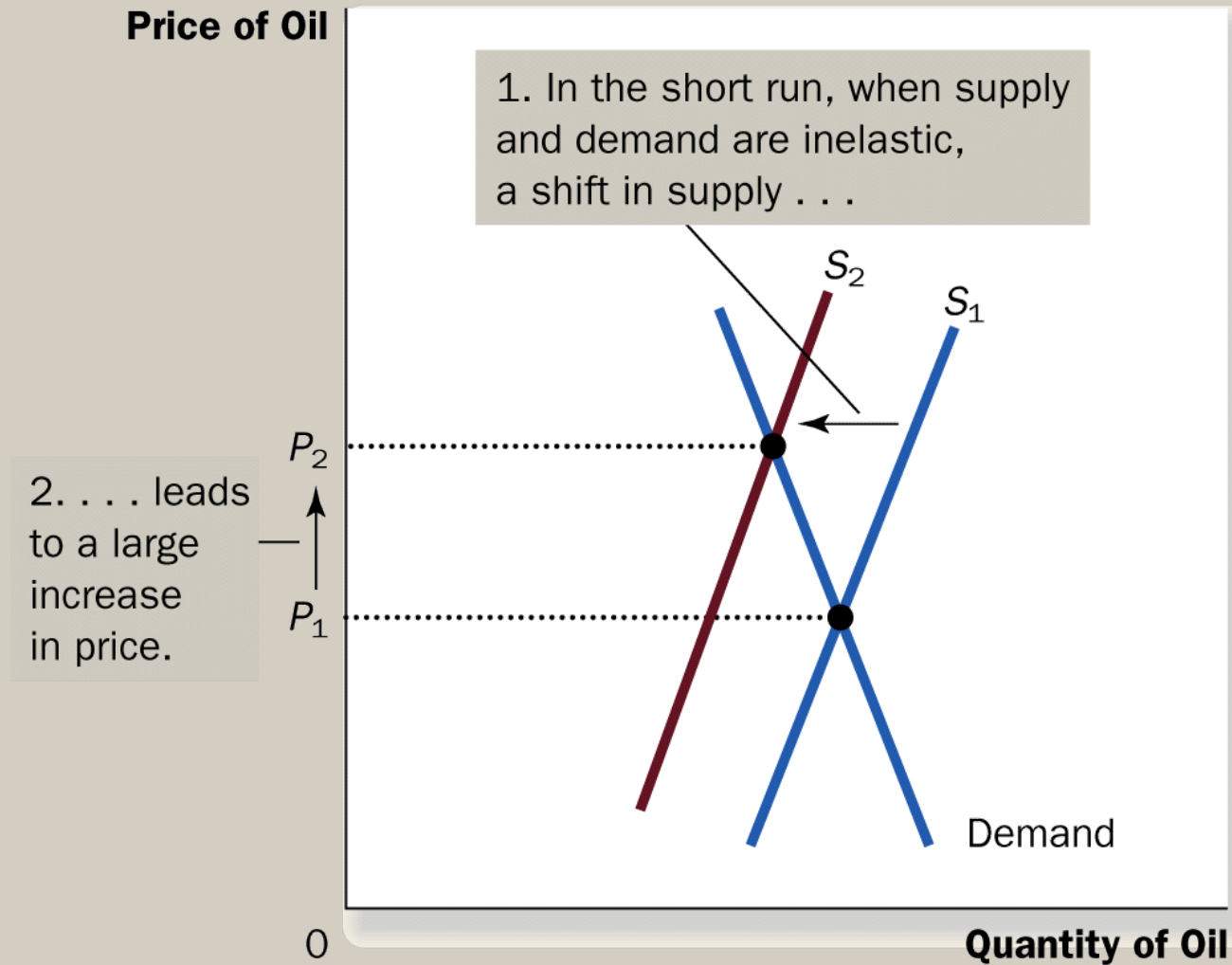
P_1

Demand

0

Quantity of Oil

Figure 9b A Reduction in Supply in the World Market for Oil

(b) The Oil Market in the Long Run

Price of Oil

1. In the long run, when supply and demand are elastic, a shift in supply . . .

S_2

S_1

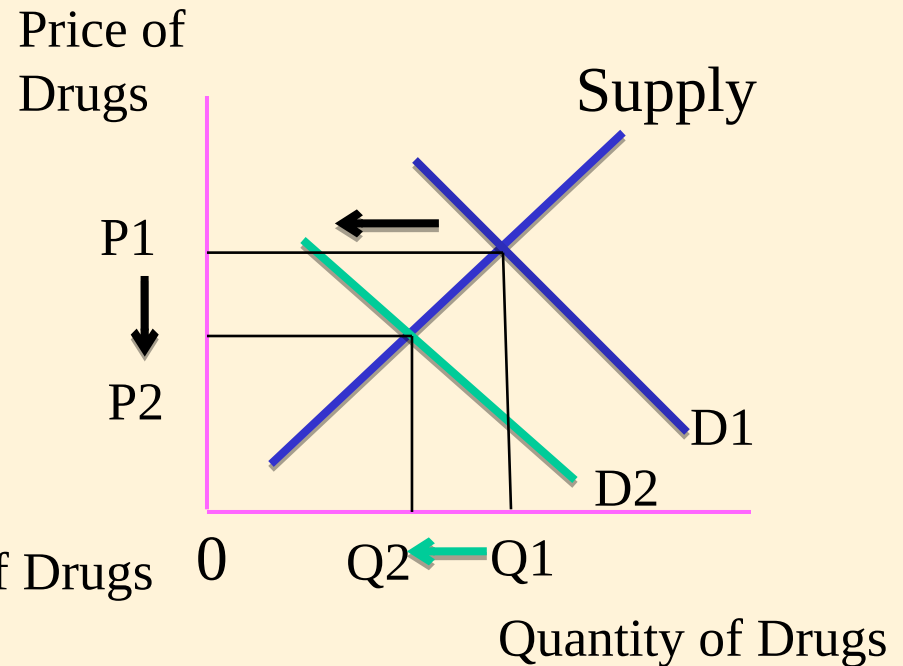2. . . . leads to a small increase in price.

P_2

P_1

Demand

0

Quantity of Oil
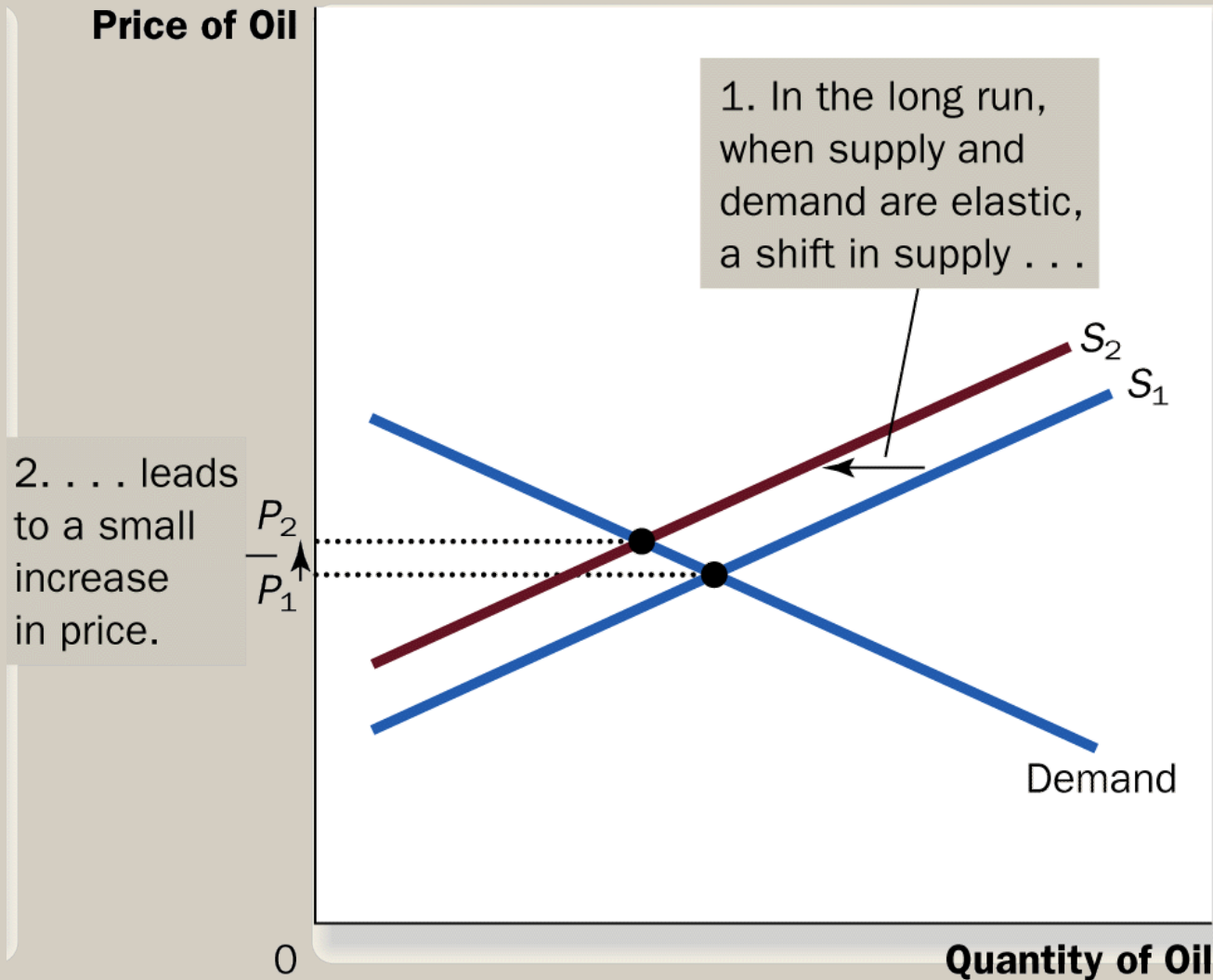
Does Drug Prohibition Increase or Decrease Drug-Related Crime?
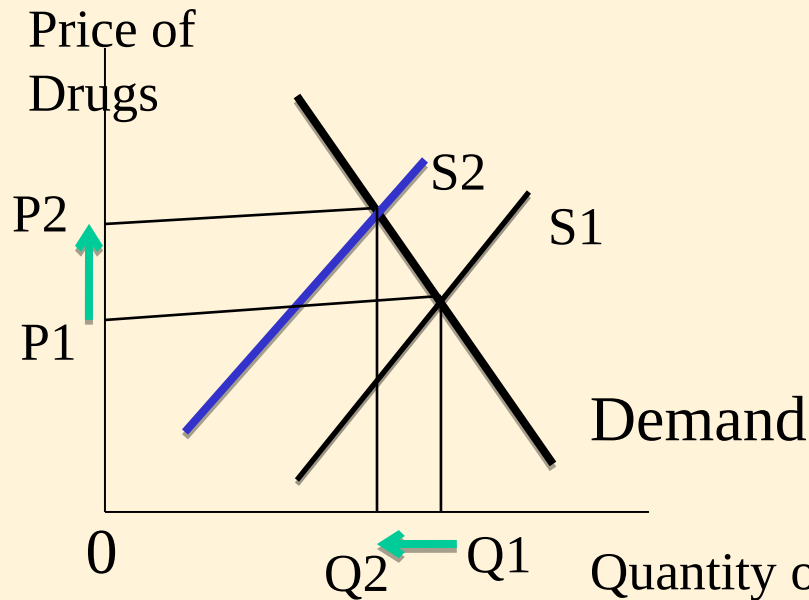
(a) Drug Prohibition

(b) Drug Education