Price Elasticity of Demand

We know there is an *inverse relationship between price and quantity demanded.*

But *how much* does quantity demanded change when price changes?

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WHAT YOU WILL LEARN IN THIS CHAPTER

- Why economists use **elasticity** to measure responsiveness to changes in prices or incomes
- **The price elasticity of demand,** the **income elasticity of demand,** and the **cross-price elasticity of demand** are important indicators of consumer behavior in response to changes in prices and income
- the **price elasticity of supply** is an important indicator of producer behavior in response to changes in price

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Price Elasticity of Demand

A demand curve is **elastic** when an increase in price reduces the quantity demanded **a lot**

When the same increase in price reduces quantity demanded **just a little,** then the demand curve is **inelastic.**

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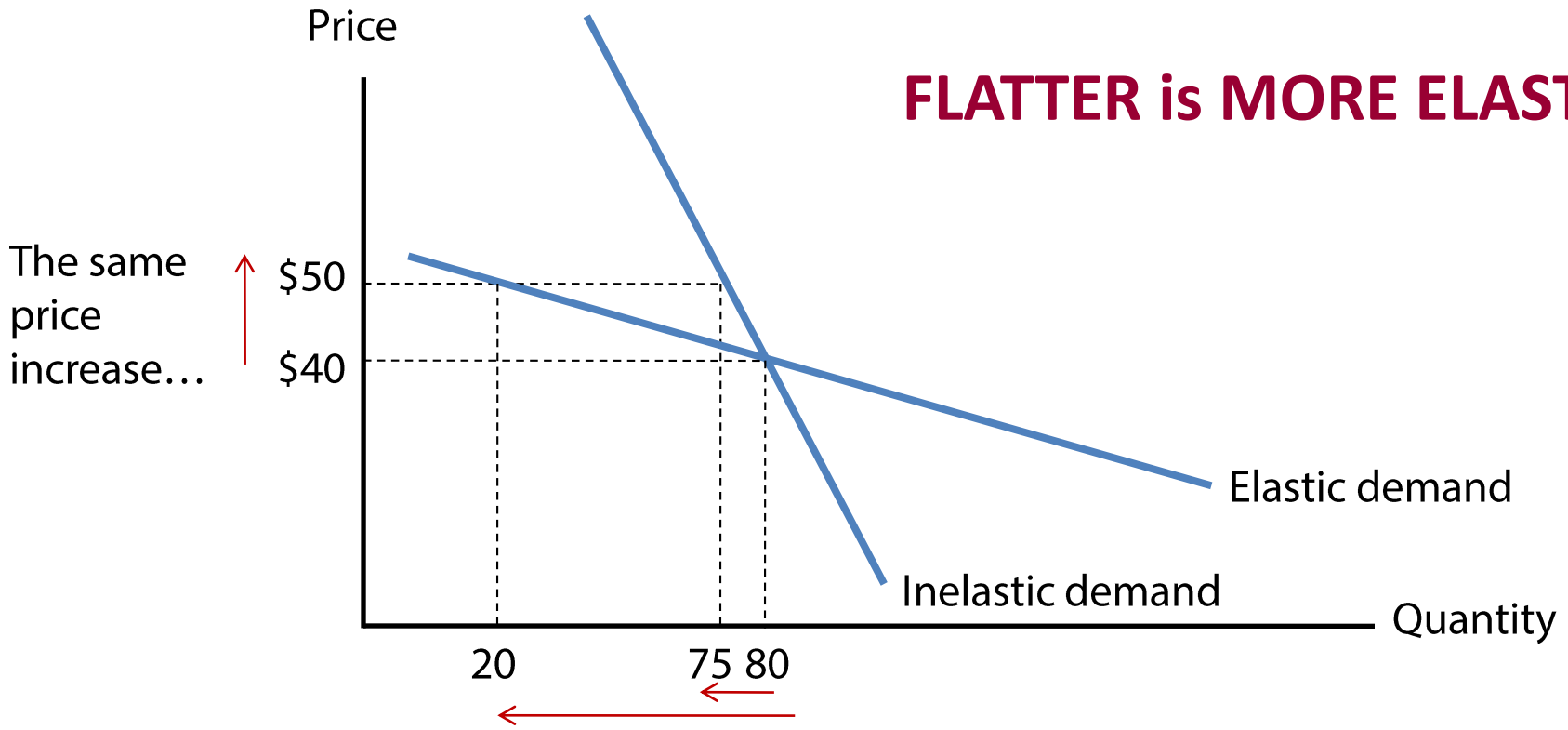
Price Elasticity of Demand

The more responsive quantity demanded is to a change in price, the more elastic is the demand curve.



… causes a big decrease in quantity demanded if demand is elastic.

… causes a small decrease in quantity demanded if demand is inelastic.

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Defining and Measuring Elasticity

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

Example:

If the price of oil increases by 10% and the quantity demanded falls by 5%, then the price elasticity of demand for oil is:

$$\frac{-5\%}{10\%} = -0.5$$

Note: since we know that price and quantity demanded will always move in opposite directions (law of demand) ***we usually drop the minus sign*** **(for price elasticity of demand ONLY).**

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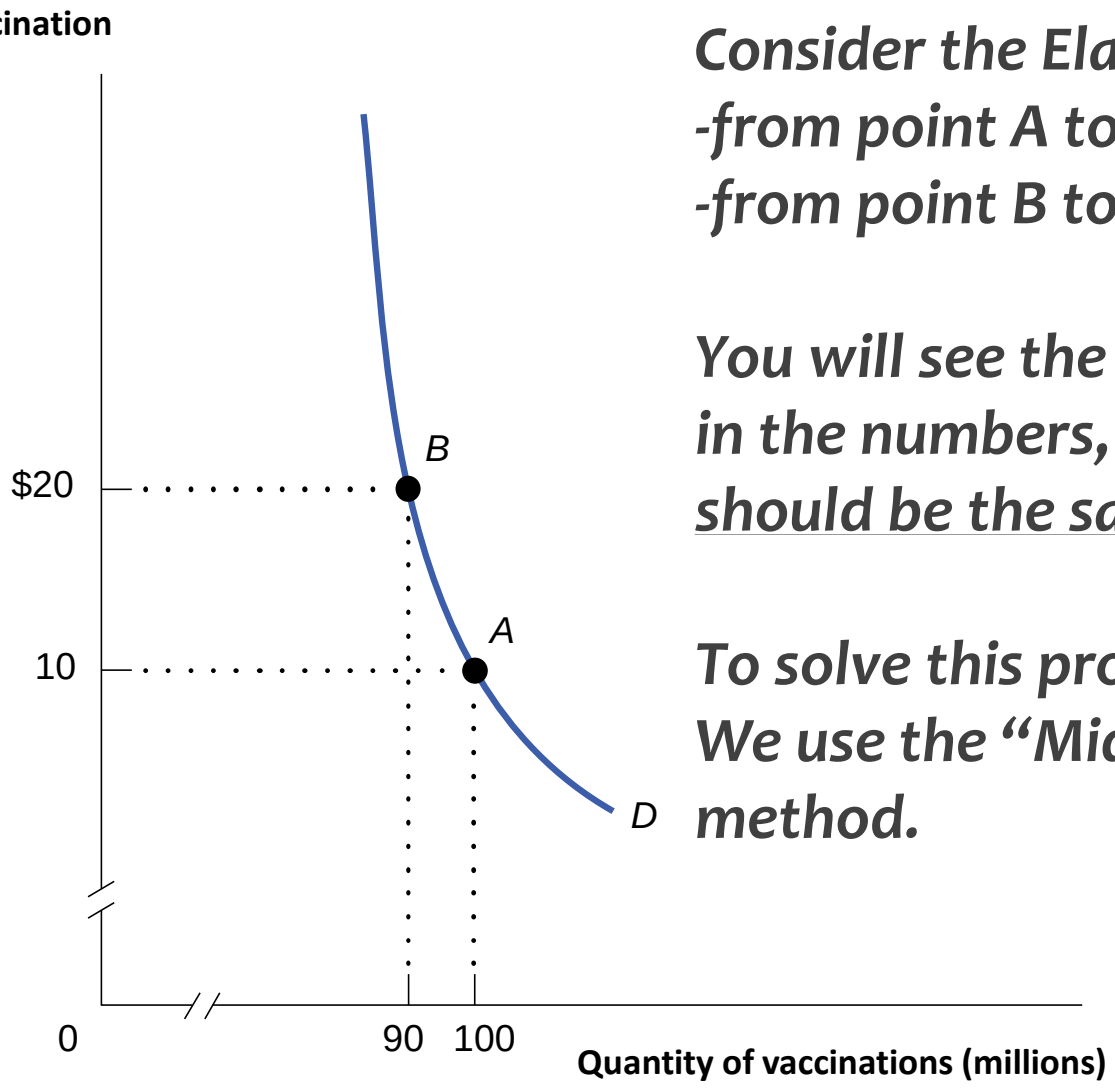
Demand for Vaccinations



Consider the Elasticity
-from point A to B
-from point B to A

You will see the difference in the numbers, when it should be the same.

To solve this problem, We use the "Midpoint" method.

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Midpoint Method of Demand Elasticity

Example: **At the initial price of $10, the quantity demanded is 100. When the price rises to $20, the quantity demanded is 90.**

$$\%\ \text{change in quantity demanded} = \frac{90-100}{100+90/2} \times 100 = -10.5\%$$

$$\%\ \text{change in price} = \frac{20-10}{10+20/2} \times 100 = 66.6\%$$

$$\textbf{Price elasticity of demand} = \frac{-10.5\%}{66.6\%} = -0.15$$

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Active Learning: Practice

If the price of a sushi roll drops from $8 to $4 and sales rise from 20 to 40 units, what is the (absolute value) of the price elasticity of demand?

a) 0.5

b) 0.66

c) 1

d) 2

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Estimating Elasticities

Good	Price elasticity of demand
Inelastic demand	
Eggs	0.1
Beef	0.4
Stationery	0.5
Gasoline	0.5
Elastic demand	
Housing	1.2
Restaurant meals	2.3
Airline travel	2.4
Foreign travel	4.1

Economists (and many others) are interested in price elasticity of demand. Estimating elasticity is crucial to understanding and predicting market outcomes.

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Five Types of Price Elasticity of Demand

Classification of price elasticity of demand:

A good can have a price elasticity as low as zero or as high as infinity.

If the $|Ed| < 1$, the demand curve is inelastic.

If the $|Ed| > 1$, the demand curve is elastic.

If the $|Ed| = 1$, the demand curve is unit elastic.

If the $|Ed| = 0$, the demand curve is Perfectly inelastic.

If the $|Ed| = \infty$, the demand curve is Completely Elastic.

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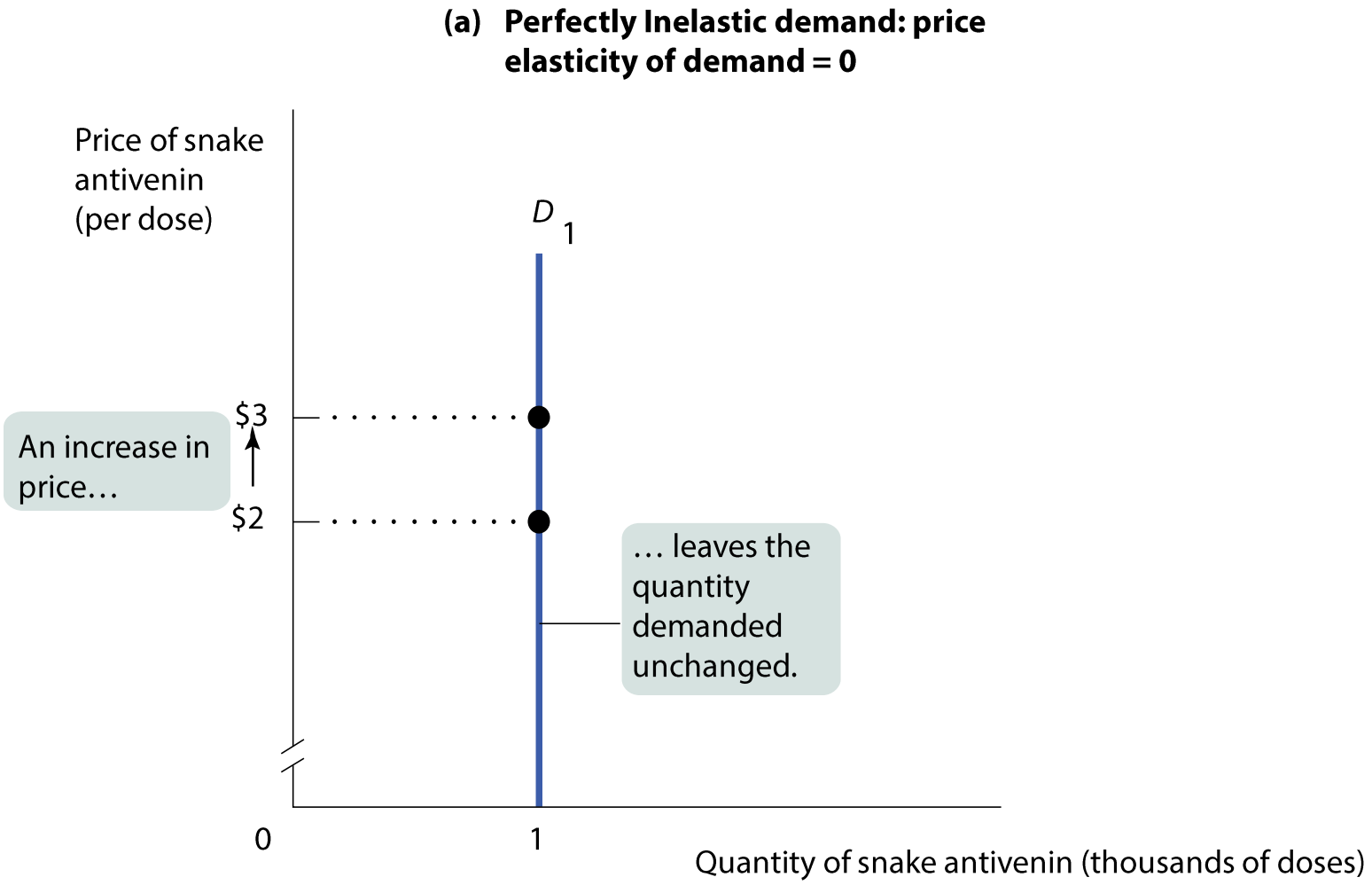
Extremely Low Elasticity of Demand



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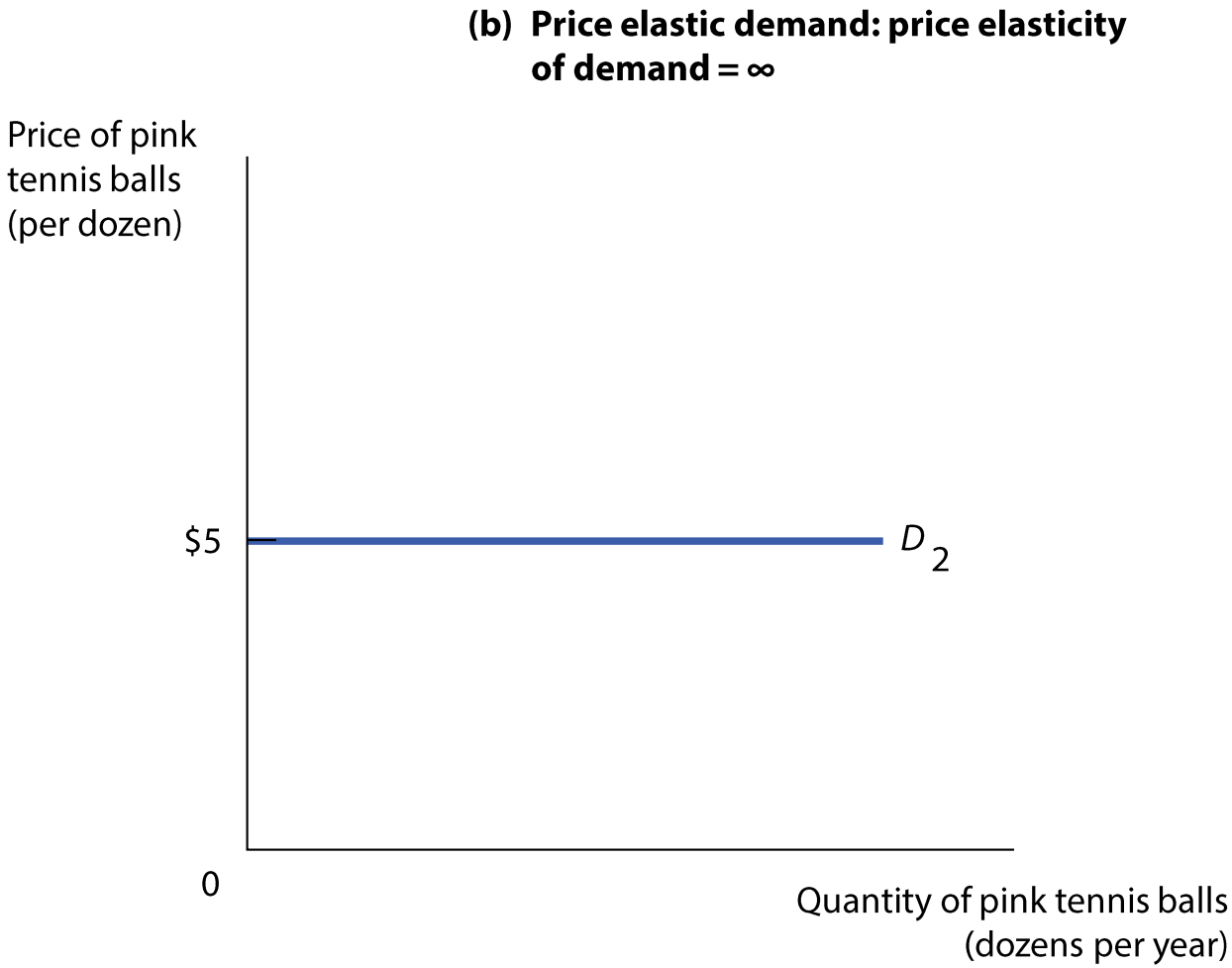
Extremely High Price Elasticity of Demand



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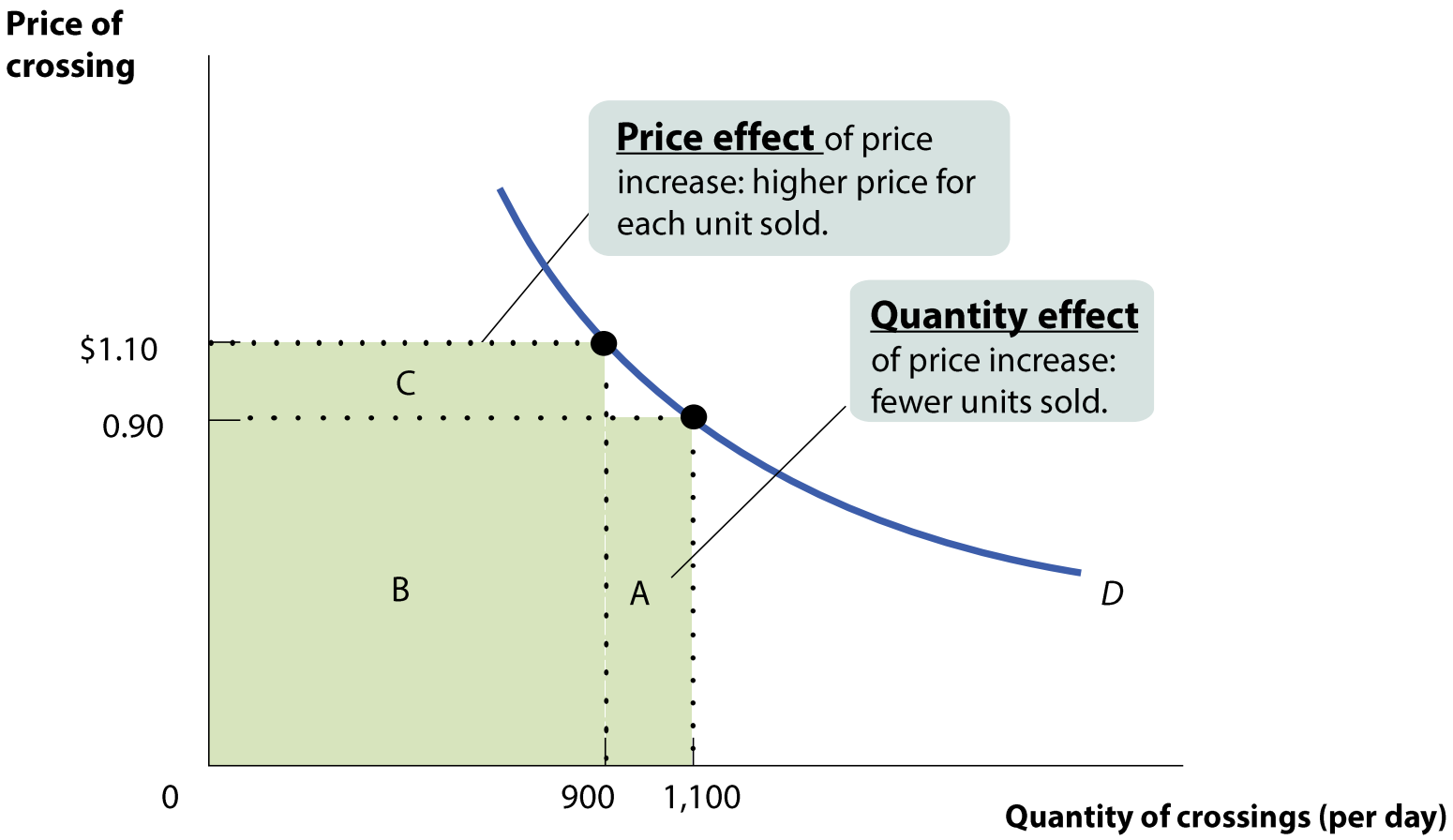
Effect of a Price Increase on Total Revenue



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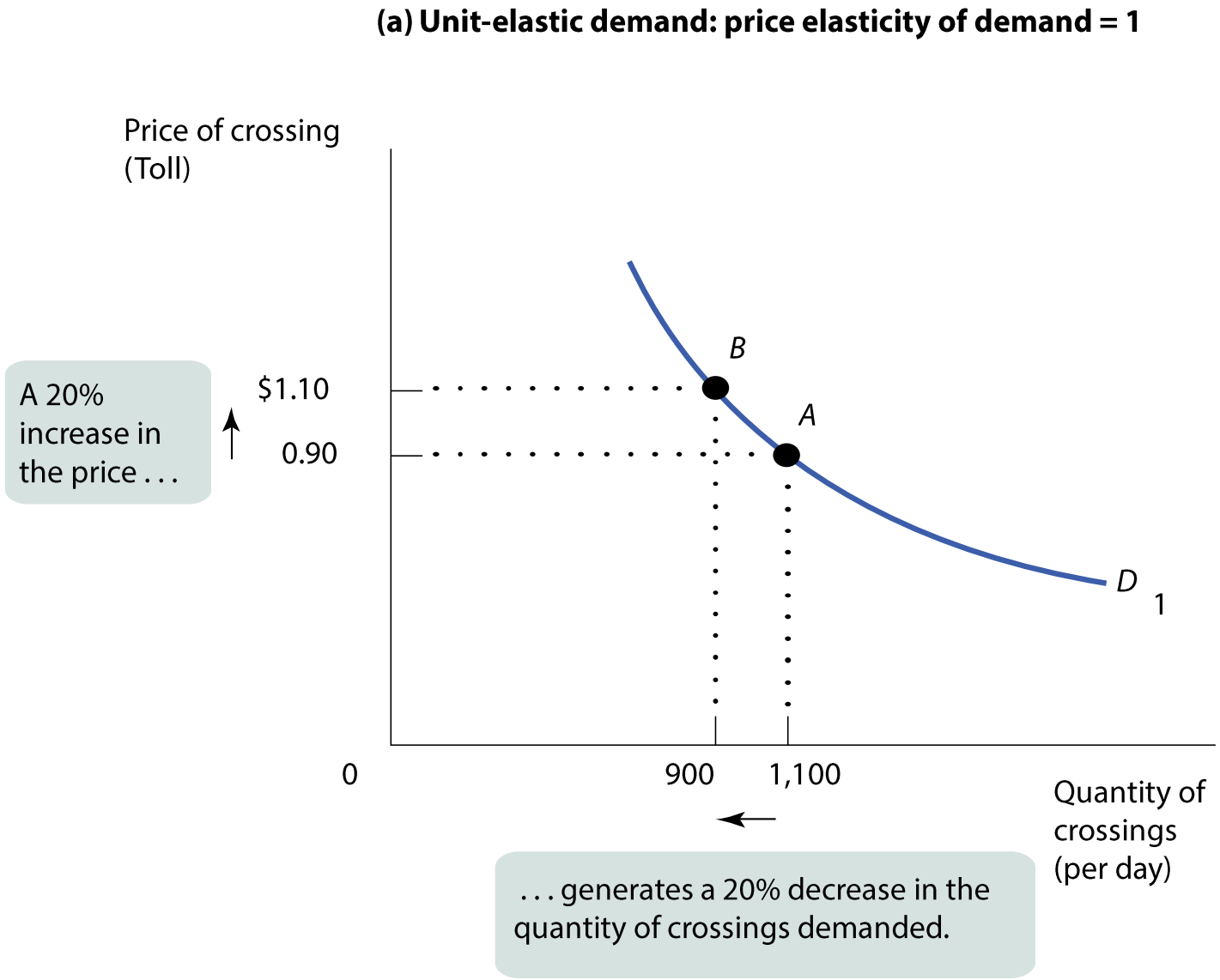
Unit Elasticity of Demand



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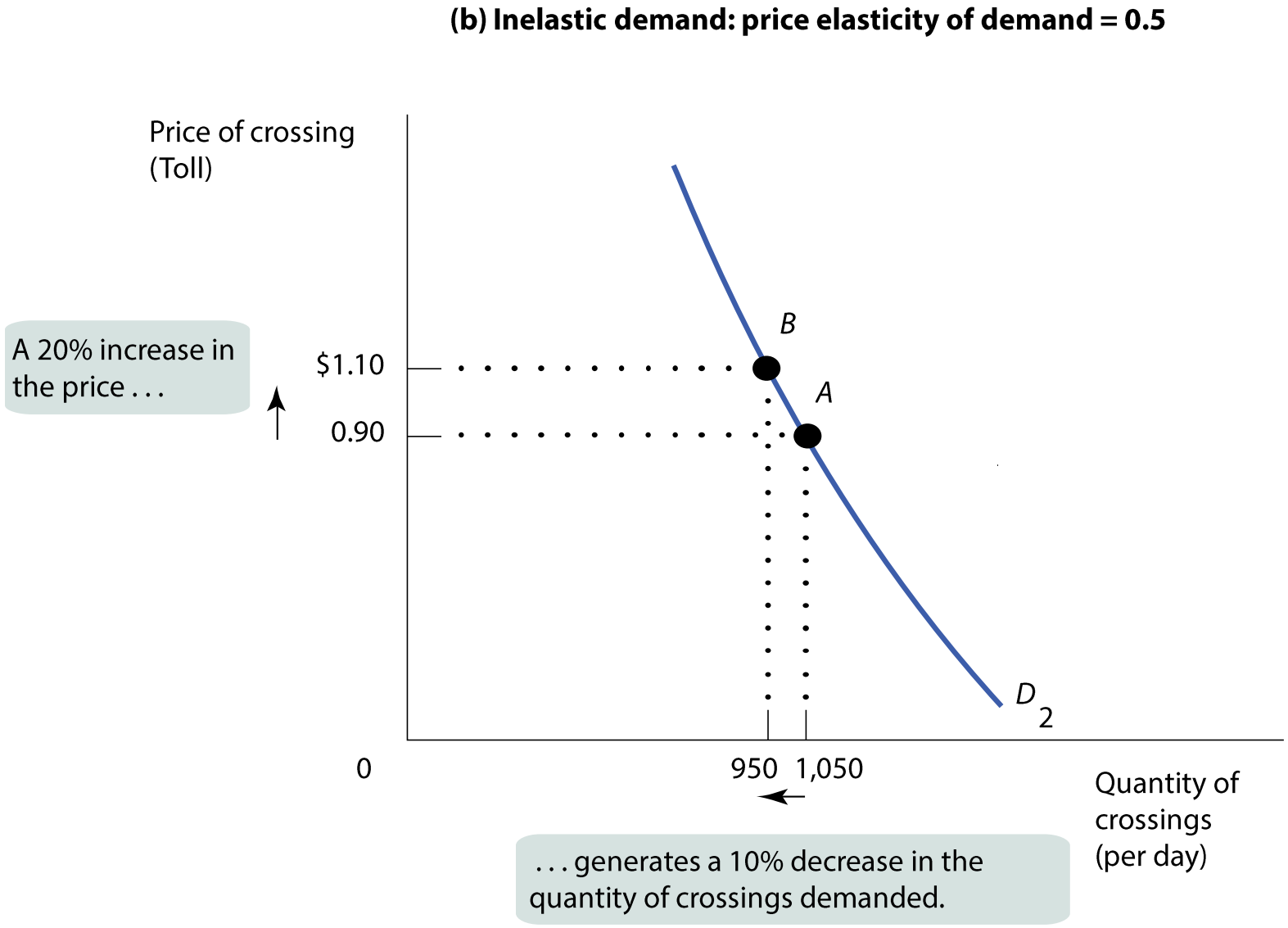
Inelastic Demand



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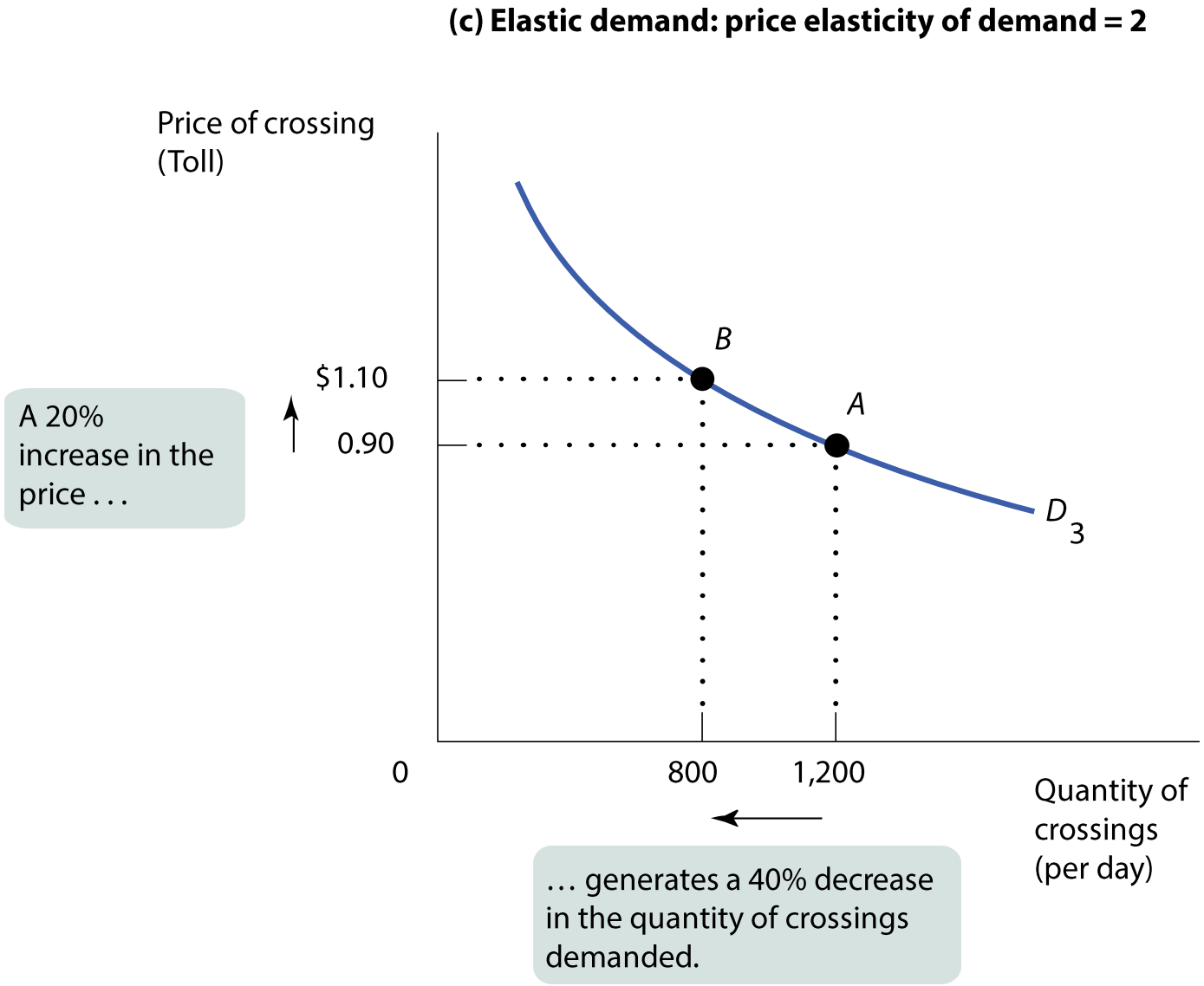
Elastic Demand



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Elasticity and Total Revenue

What happens if salt prices go up? TR will likely rise.

People's demand on salt is inelastic.

An increase in price will cause a *reduction in the quantity demanded*. But being "inelastic" in demand, people do not change much in quantity demanded, so the quantity effect is small.

When demand is inelastic,
the price effect dominates the quantity effect

$$TR = P^{\uparrow} \times Q^{\downarrow}$$

In this case, total revenue will rise when the price rises (and vice versa).

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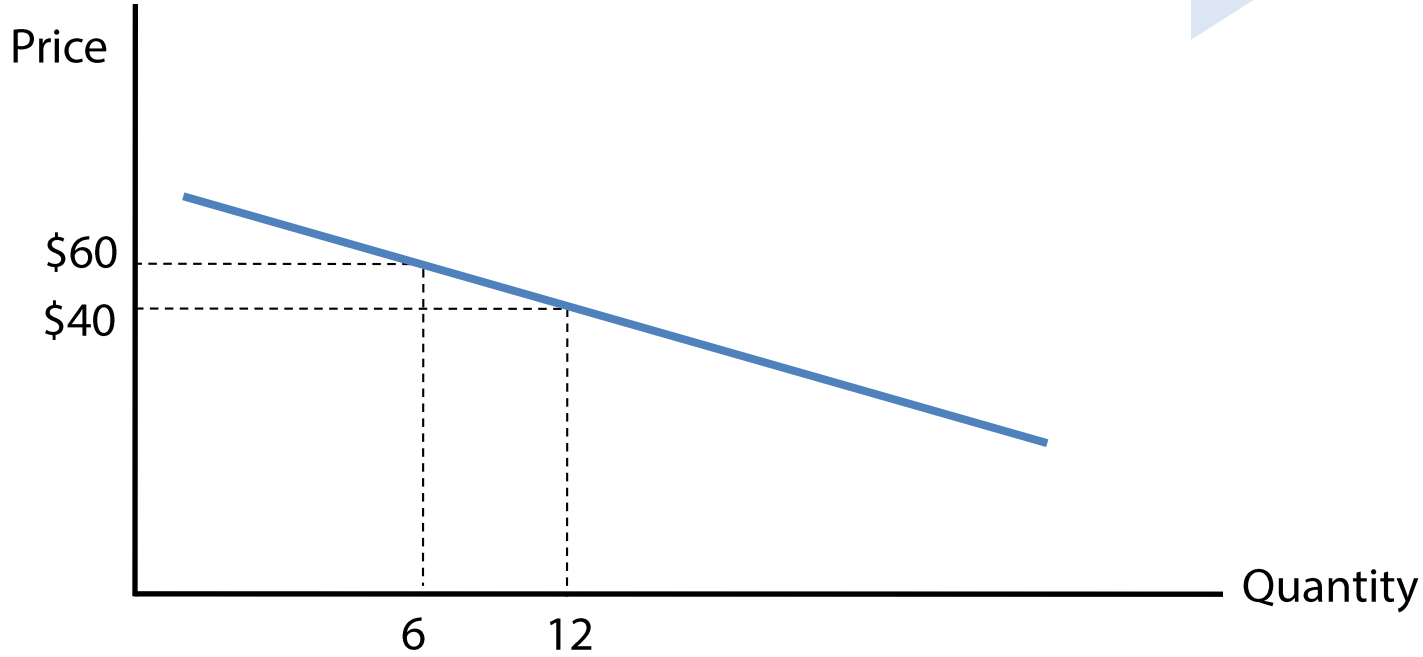
Active Learning: Practice



If price falls from $60 to $40, total revenue changes by _____, so demand is _____.

a) $240; inelastic

b) $480; elastic

c) $360; inelastic

d) $120; elastic

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Elasticity and Total Revenue

What happens if airfare goes up by 10% ?
TR will likely fall. By how much percent?
(elasticity of airfare is around 2.4)

When demand is elastic,
the quantity effect dominates the price effect.

- An increase in price will cause significant reduction in the quantity demanded.
- In this instance, total revenue will fall when the price rises.

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Elasticity and Total Revenue

When demand is unit-elastic,

the quantity effect equals the price effect.

In this instance, total revenue doesn't change.

What happens if* tire prices *goes up?

TR will not change.

Active Learning: Practice

The elasticity of demand for eggs has been estimated to be 0.1 (very inelastic). If egg producers raise their prices by 10 percent, what will happen to their total revenue?

a) It will increase.

b) It will decrease.

c) It won't change.

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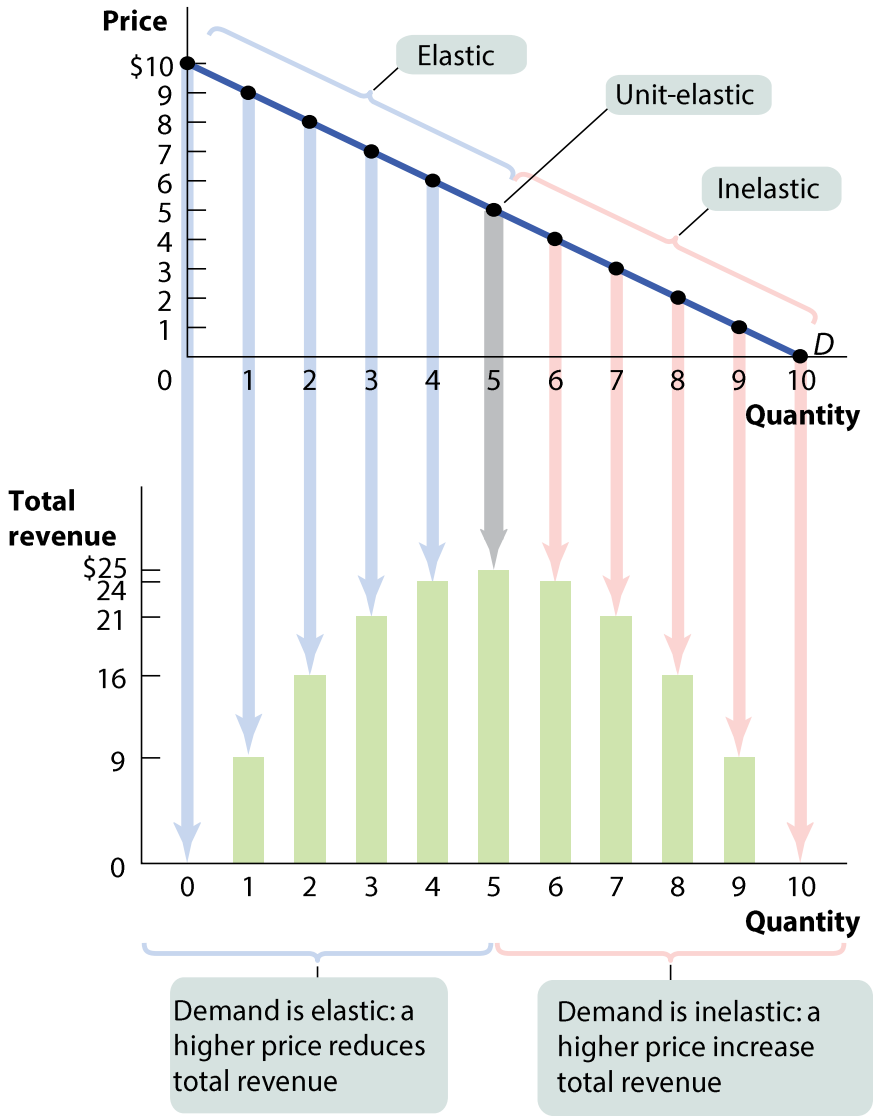
Demand Schedule and Total Revenue



Demand Schedule and Total Revenue for a Linear Demand Curve

Price	Quantity demanded	Total revenue
$0	10	$0
1	9	9
2	8	16
3	7	21
4	6	24
5	5	25
6	4	24
7	3	21
8	2	16
9	1	9
10	0	0

The price elasticity of demand changes along the demand curve.

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What Factors Determine the Price Elasticity of Demand?

1. **The availability of close substitutes is very important.**

   Fewer substitutes makes it harder for consumers to adjust *Q* when *P* changes, so *demand is inelastic.*

   Many substitutes? Switching brands when prices change is EASY, *so demand is elastic.*

When the patent expires on a brand-name drug and five generic drugs come on the market, what happens to elasticity of demand?
a) It rises.
b) It falls.

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What Factors Determine the Price Elasticity of Demand?

2. **Whether the good is a necessity or a luxury also affects the elasticity of demand.**

   For necessities, we do not change Q much when P changes.

   For luxuries, we are more sensitive to *P* changes.

vs.

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What Factors Determine the Price Elasticity of Demand?

3. The share of income spent on the good matters.

   We are less sensitive to price changes *when the good feels cheap.*

   We are more sensitive to price changes *when the good feels expensive.*

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What Factors Determine the Price Elasticity of Demand?

4. The length of time elapsed since the price change matters.

   Less time to adjust means lower elasticity.

   Over time consumers can adjust their behavior by finding substitutes (making demand more elastic).

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Other Demand Elasticities

The *cross-price elasticity of demand* measures how sensitive the quantity demanded of *good A* is to the price of *good B*.

Cross-price elasticity of demand =

$$\frac{\%\ \text{change in quantity of A demanded}}{\%\ \text{change in price of B}}$$

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Cross-Price Elasticity of Demand

For substitutes, cross-price elasticity of demand is positive.

An increase in the price of one brand of cookies will increase the demand for other brands.

$$$

$

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Cross-Price Elasticity of Demand

For complements, cross-price elasticity of demand is negative.

An increase in the price of milk causes a decrease in demand for Oreos.

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Active Learning: Practice

The price of good B increases by 4%, causing the quantity demanded of good A to decrease by 6%. The cross-price elasticity of demand is _____, and the goods are _____.

a) 1.5; substitutes

b) –1.5; complements

c) 0.67; complements

d) –2.4; substitutes

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Active Learning: Practice

A recent report by the US Centers for Disease Control (CDC) studied the effect of an increase in the price of beer on the incidence of new cases of STDs (sexually-transmitted diseases) in young adults.

The report concluded that a beer tax increase of $0.20 (from $5.90 to $6.10 per six-pack) could reduce overall gonorrhea rates by 8.9%.

a. Use the midpoint to calculate the cross-price elasticity of demand between beer and the incidence of gonorrhea.

b. Are beer and gonorrhea complements or substitutes?

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Income Elasticity of Demand

The *income elasticity of demand* measures how sensitive the quantity demanded of a good is to changes in income.

Income elasticity of demand =

$$\frac{\%\ \text{change in quantity demanded}}{\%\ \text{change in income}}$$

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Income Elasticity of Demand

The income elasticity of demand can be used to distinguish normal from inferior goods.

For normal goods, income elasticity is positive.

For inferior goods, income elasticity is negative.

Fast food: negative income elasticity

Normal goods can be income-elastic or not.

For income-elastic goods, income elasticity is greater than 1.

For income-inelastic goods, income elasticity is positive but less than 1.

What do you consider the income elasticity of demand of a "Vacation"?

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Active Learning: Practice

Tonya consumes 10 boxes of ramen noodles a year when her yearly income is $40,000. After her income falls to $30,000 a year, she consumes 40 boxes of ramen noodles a year. Calculate her income elasticity of demand for ramen noodles.

a) 4.2

b) –4.2

c) –2.25

d) 2.25

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