The Demand for Goods Part II

Mass demand has been created almost entirely through the development of advertising.
-Calvin Coolidge

Elasticity (E)

- degree of responsiveness, or sensitivity, to a change in price
- The response of consumers to a change in price is measured by the price elasticity of demand (E_d or PED).
- If a 1% decrease in the price of a product produces a 1% increase in demand for the product (or vice versa), the E_d is said to be one ($E_d = 1$).
- For most consumer goods and services, the E_d tends to be between 0.5 and 1.5.

Price Elasticity of Demand (E_d)

E_d is a measure used to show the responsiveness (elasticity) of the quantity demanded of a good or service to a change in its price. More precisely, it gives the percentage change in quantity demanded in response to a 1% change in price, *ceteris paribus*.

$$\text{Price elasticity} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

$$E_d = \frac{\%\ \Delta \text{ in } Q_d}{\%\ \Delta \text{ in } P}$$

[**Δ** symbolizes "change"]

Suppose a university's enrollment drops by 20% because tuition rises by 10%, what is the price elasticity of demand?

$$E_d = \frac{-20\%}{+10\%} = \frac{-0.20}{+0.10} = -2$$

[**meaning, each 1% increase in price (tuition) causes a 2% decrease in quantity demanded (enrollment)**]

Price elasticities (E_d) are almost always negative (although we often ignore the sign) because quantity demanded decreases when prices increase. However, the absolute value of E_d will always be greater than zero.

Finding Percentage Change

Remember that E_d = % Δ in Q_d ⁄ % Δ in P.

The previous example provided the percentage changes. But what if we don't know? How do we find the percentage change in Q_d and P?

- Subtract the previous number (n_1) from the new number (n_2).
- Divide the difference (n_Δ) you get by n_1.
- Multiply the answer by 100.

Look at the following examples.

Application

① $n_2 - n_1 = n_\Delta$ ② $(n_\Delta / n_1) \times 100 = \%\Delta$

If there is an <u>increase</u> from \$3 (P_1) to \$5 (P_2), what is the percentage change?

$$\frac{\$2}{\$3} = 0.66 \times 100 = 66\% \ \Delta \text{ in } P$$

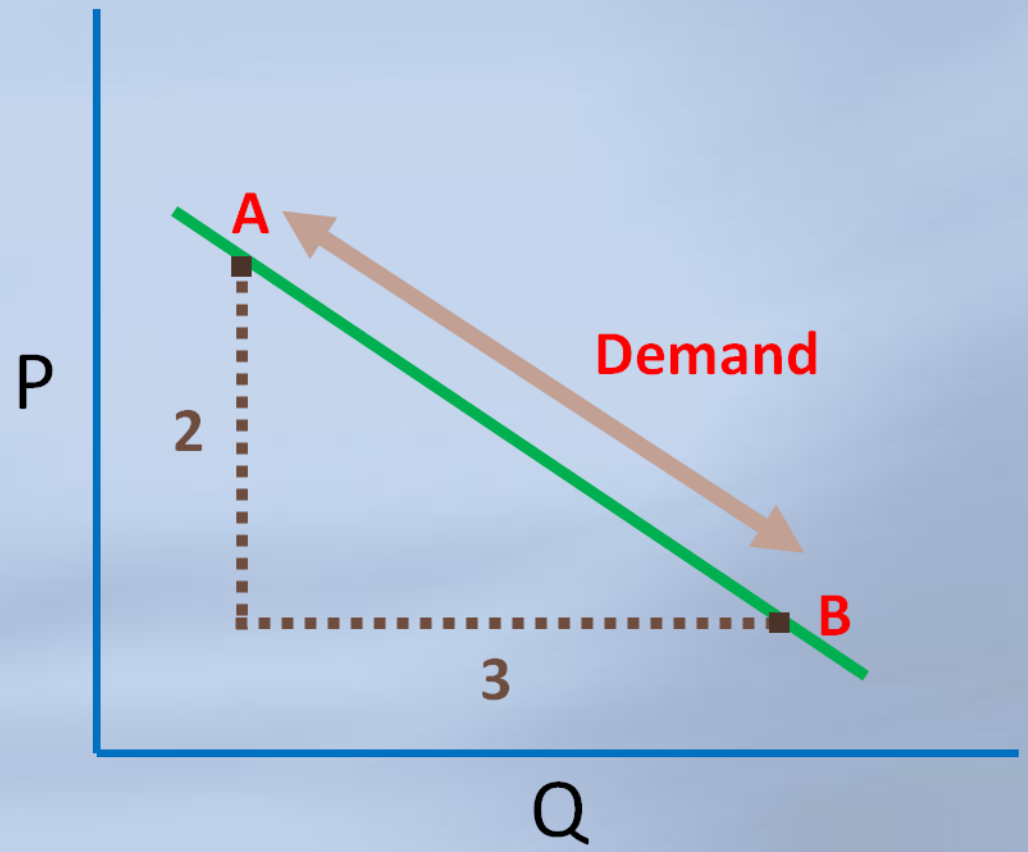
If there is a <u>decrease</u> from 5 (Q_{d1}) units to 3 (Q_{d2}), what is the percentage change?

$$\frac{-2}{5} = -0.40 \times 100 = -40\% \ \Delta \text{ in } Q_d$$

One Problem

When we move along a demand curve between two points, we get different answers for elasticity depending on whether we are moving <u>up</u> or <u>down</u> the demand curve.

Chart:
Direction Along the Demand Curve



Moving in one direction, your calculations would include A – B. In the other, B – A.

Using Averages

Economists solve this problem of different base points by using the midpoints as the base points of change in P and Q_d … by using the average Q_d and the average P to calculate E_d. (Average = $n_1 + n_2 / 2$.)

$$\% \Delta \text{ in } Q_d = \frac{\Delta \text{ in } Q_d}{\text{average } Q_d} \qquad \% \Delta \text{ in } P = \frac{\Delta \text{ in } P}{\text{average } P}$$

We're not going to worry too much in this course about using averages, but I do want you to be aware of the problem in case you run across it in your work.

So … To Calculate Price Elasticity…

% Δ in quantity demanded (Q_d)

$$[(Q_{d2} - Q_{d1}) / Q_{d1}]$$

DIVIDED BY

% Δ in price (P)

$$[(P_2 - P_1) / P_1]$$

It doesn't matter whether Q_d is ounces, inches, numbers or etc, or whether P is dollars, pennies, rubbles or etc. The numbers work.

Chart:
Calculating the Elasticity of Demand #1

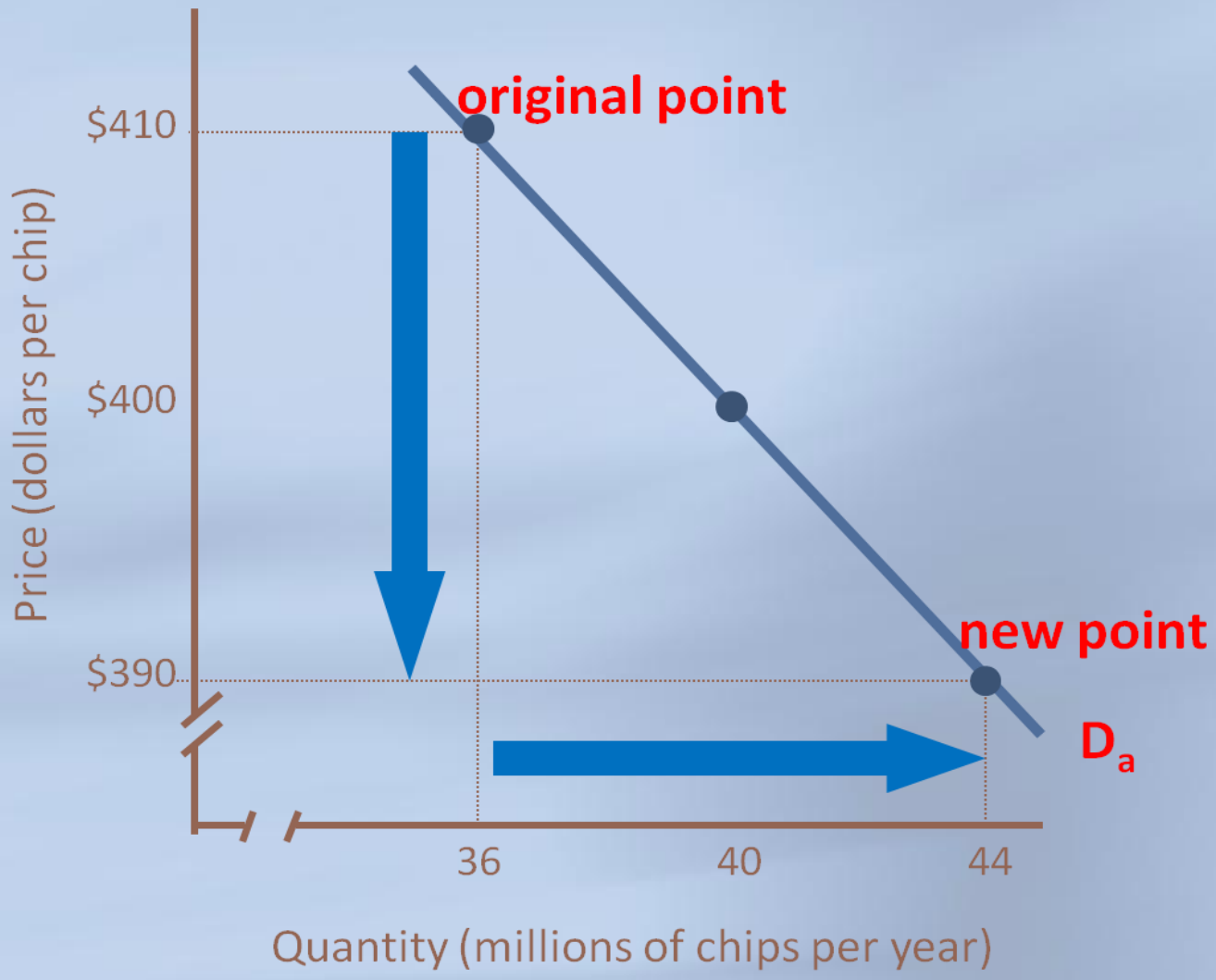


Chart:
Calculating the Elasticity of Demand #2

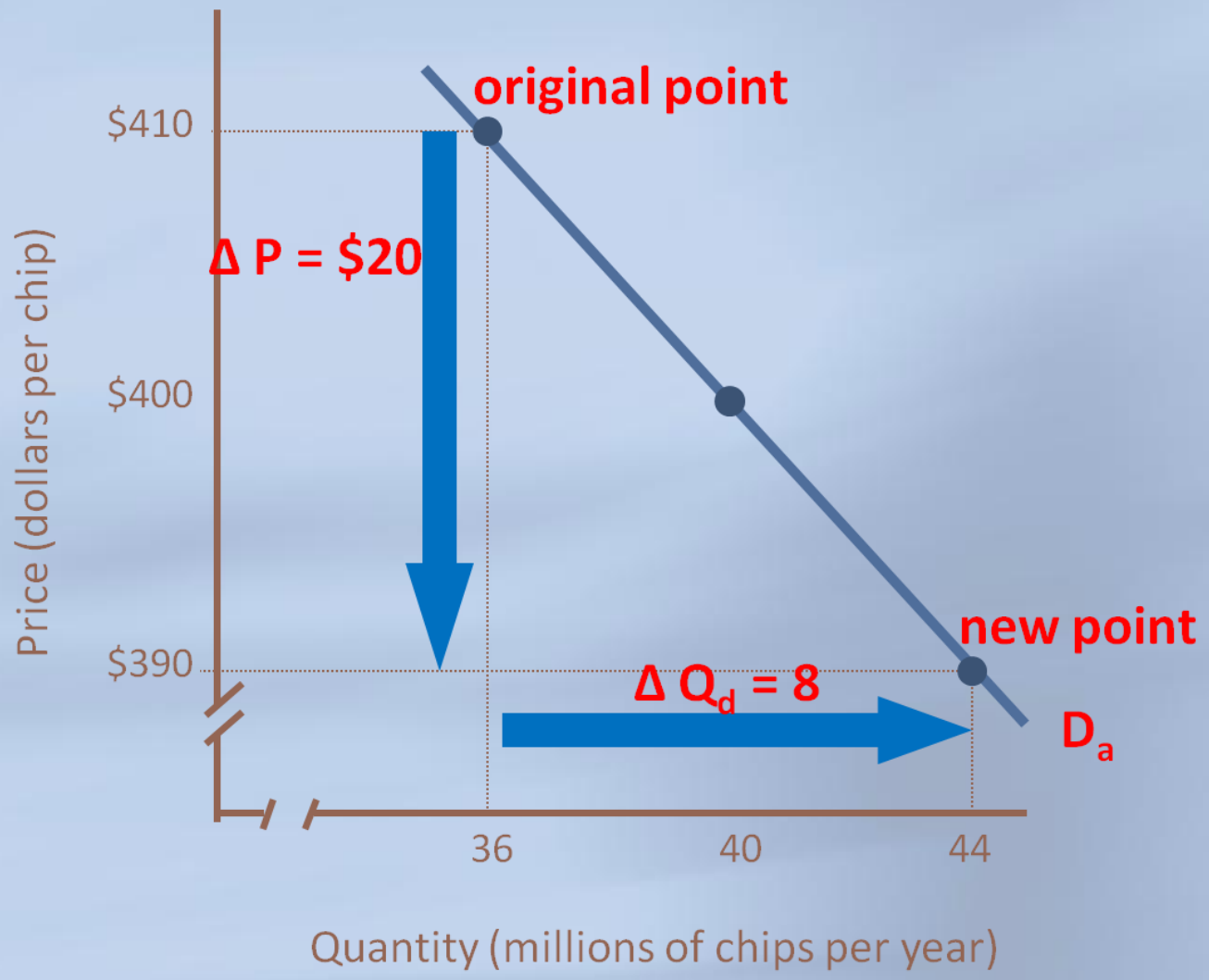


Chart:
Calculating the Elasticity of Demand #3

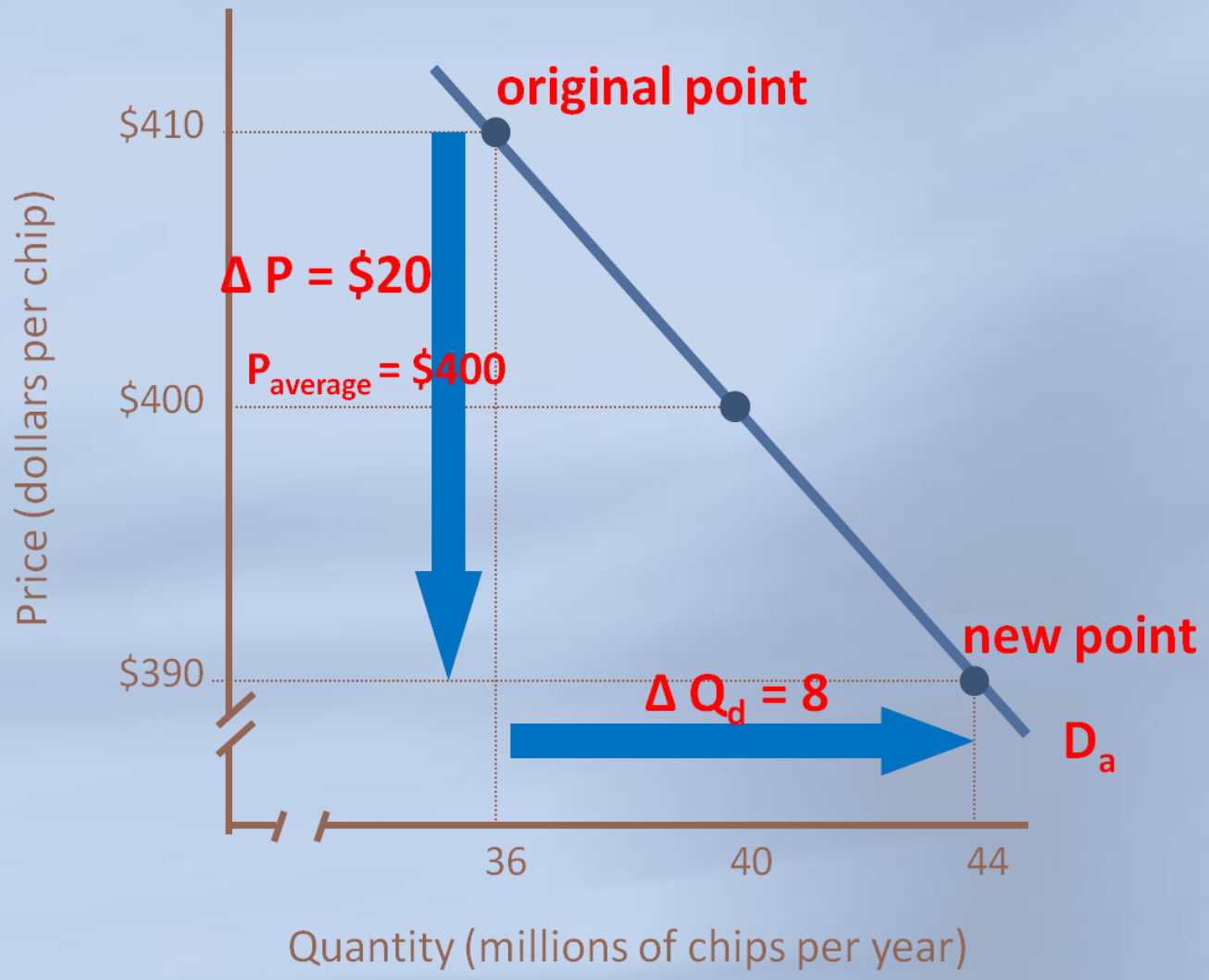
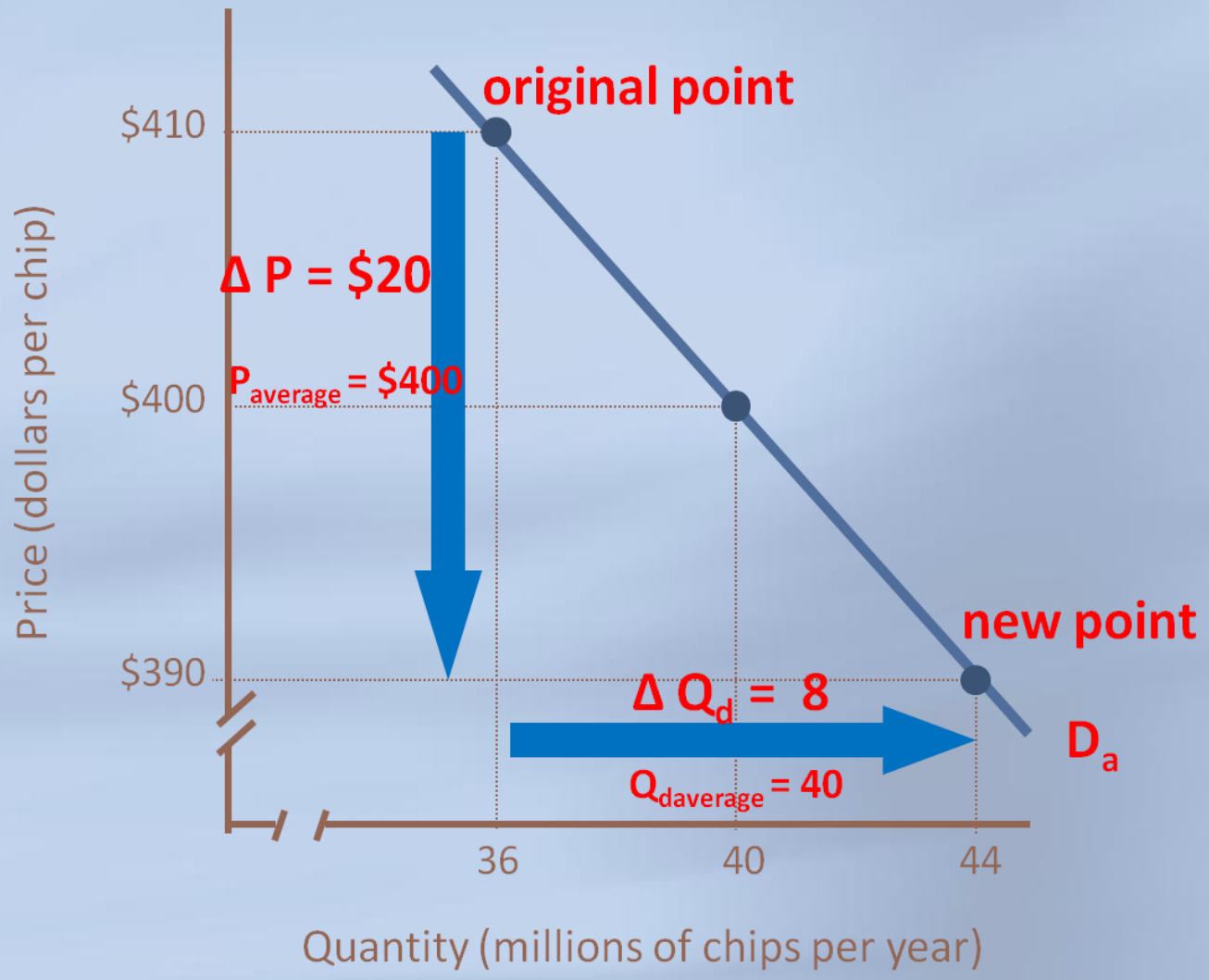


Chart:
Calculating the Elasticity of Demand #4



Three Types of E_d

- **inelastic** – In general, the demand for a good is said to be *inelastic* (or *relatively inelastic*) when the E_d is less than one (in absolute value) … that is, changes in P have a relatively small effect on Q_d.
- **unit elastic** – The demand for a good is said to have *unit* or *unitary elasticity* when the elasticity is approximately 1 … meaning the percentage change in Q_d is roughly equal to the percentage change in P. **Revenue** is maximized when P is set so that Q_d is exactly one.
- **elastic** - The demand for a good is said to be *elastic* (or *relatively elastic*) when its E_d is greater than one (in absolute value) … that is, changes in P have a relatively large effect Q_d.

Table:
E_d for Various Goods and Services

INELASTIC $E_d < 1$	Salt	0.1
	Matches	0.1
	Gasoline (short run)	0.2
	Automobiles (long run)	0.2
	Coffee	0.25
	Tobacco products (short run)	0.45
	Physician services	0.6
ELASTIC $E_d > 1$	Automobiles (short run)	1.5
	Restaurant meals	2.3
	Airline travel (long run)	2.4
	Fresh peas	2.8
	Chevrolet automobiles	4.0
	Foreign travel (long run)	4.0
	Fresh tomatoes	4.6

Chart:
Price Elasticity of Demand Ranges

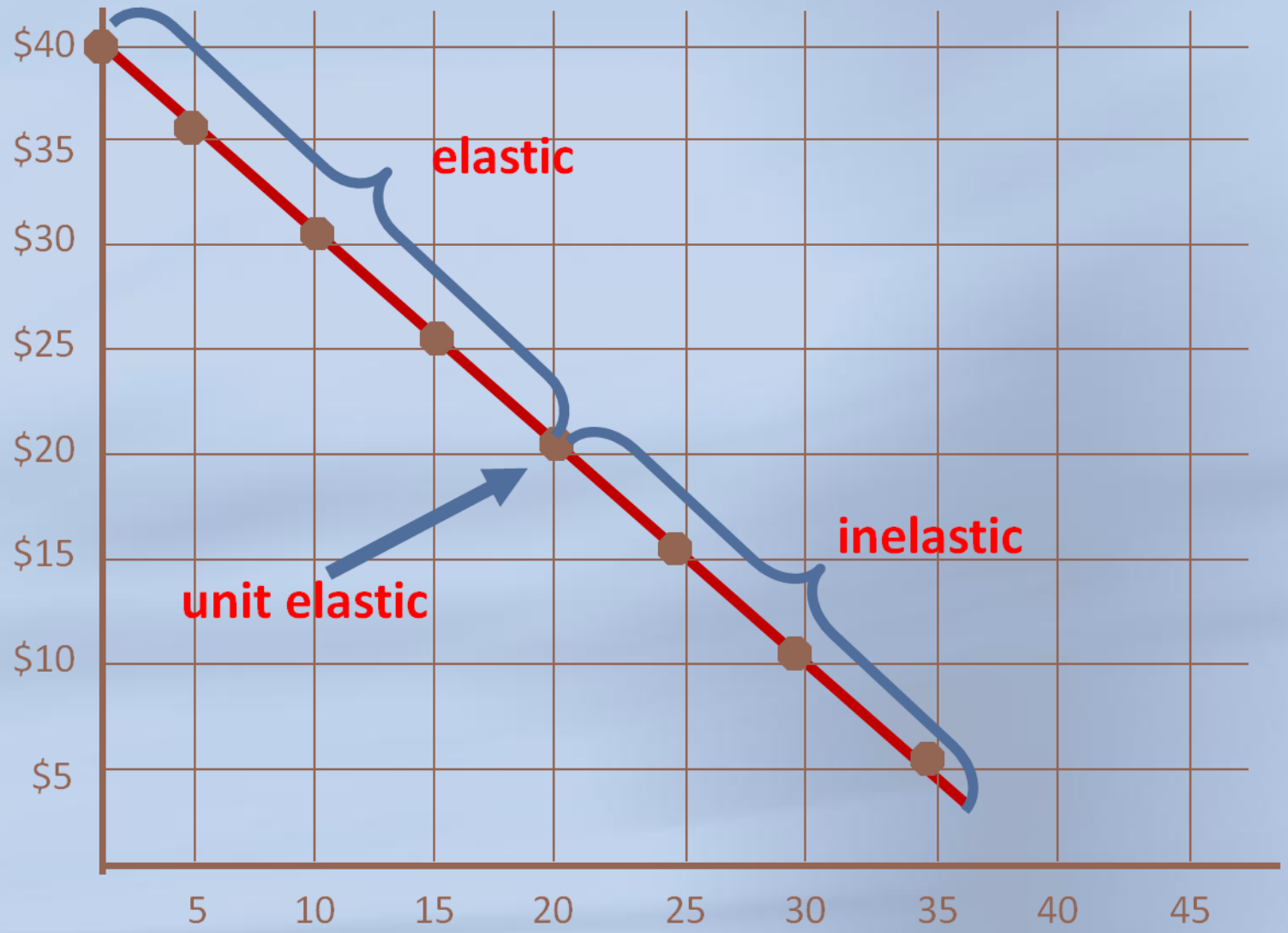


Chart:
Total Revenue Curve

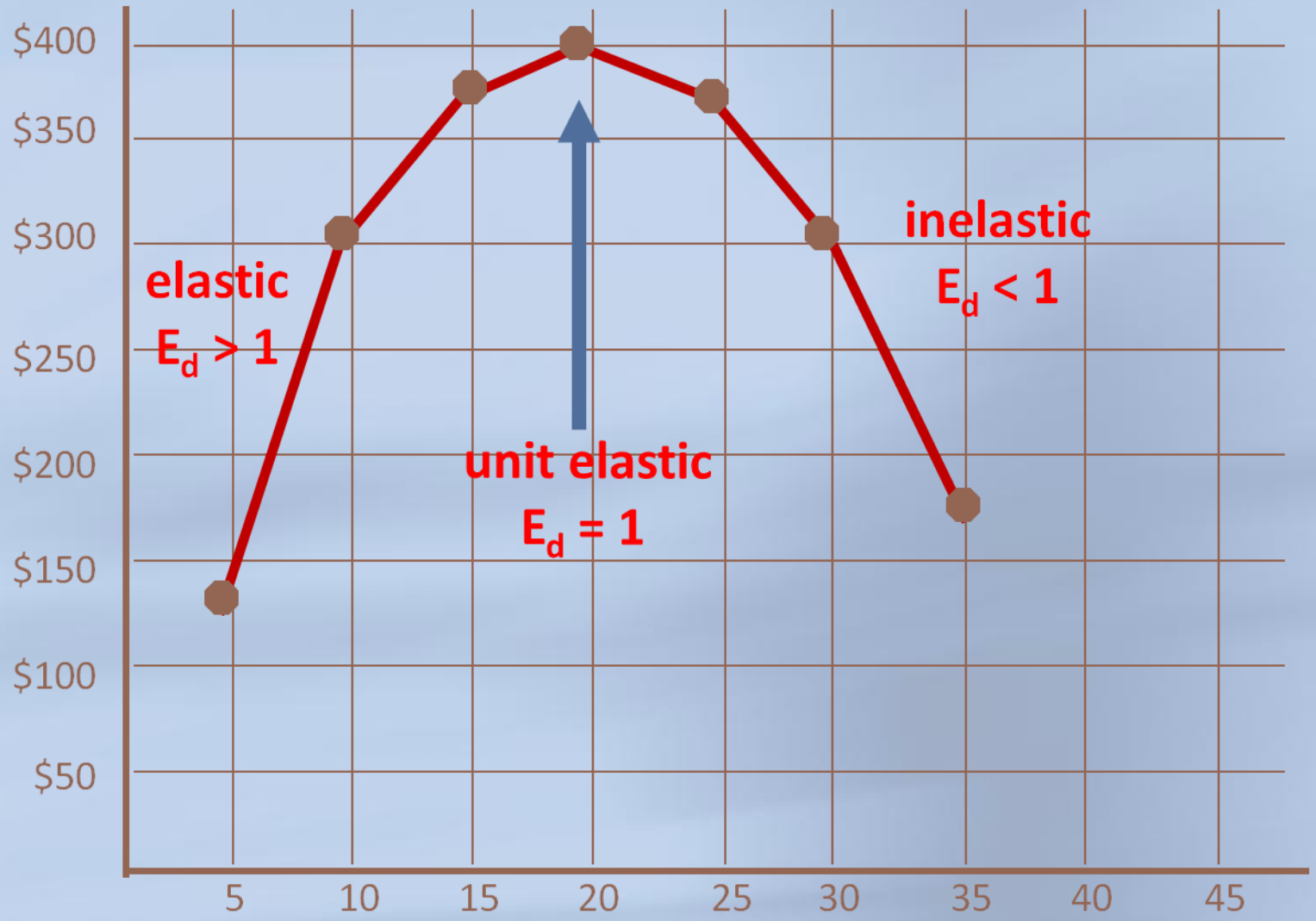


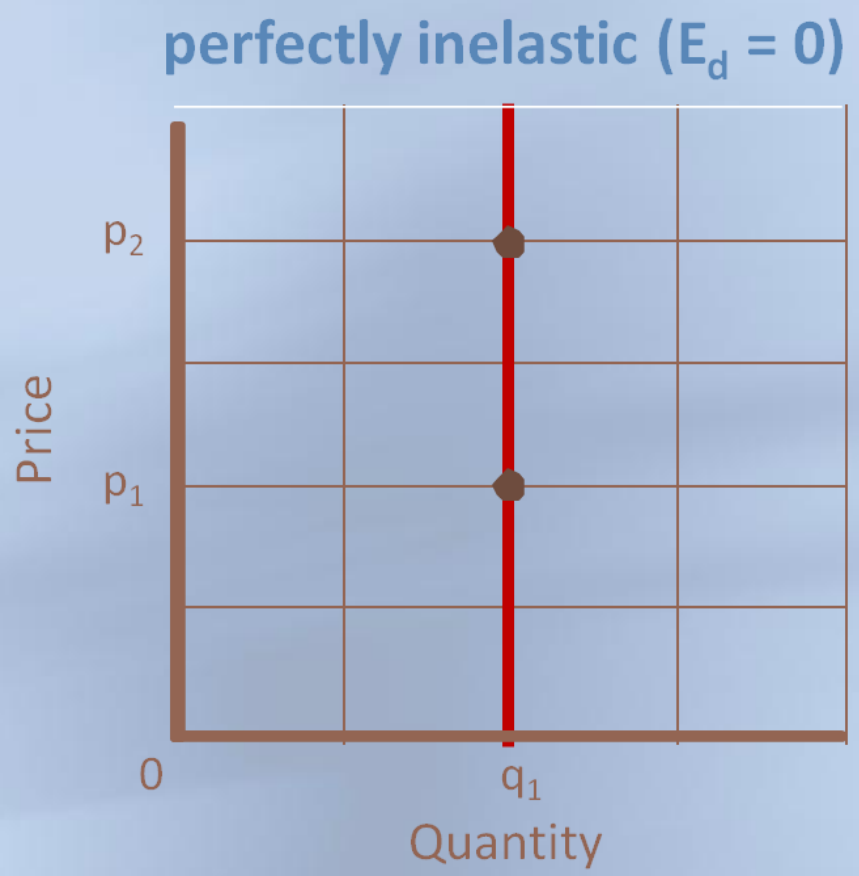
Table: Comparing Types of E_d

			Impact on a total Revenue of a	
Absolute value of elasticity coefficient	Demand is	Description	Price increase	Price decrease
Ed>1	Elastic or relatively elastic	Quantity demanded changes by a larger precentage than does price	Total revenue decreases	Total revenue increases
Ed=1	Unit or Unitary elastic	Quantity demanded changes by the same percentage as does price	Total revenue remains unchanged	Total revenue remains unchanged
Ed<1	Inelastic or relatively inelastic	Quantity demanded changes by a smaller percentage than does price	Total revenue increases	Total revenue decreases

Extremes of Elasticity

- A *horizontal* demand curve means that Q_d is **perfectly elastic**.
  - Any increase in P would cause Q_d to fall to zero.
- A *vertical* demand curve means that Q_d is **perfectly inelastic**.
  - Q_d will not change regardless of the change in P.

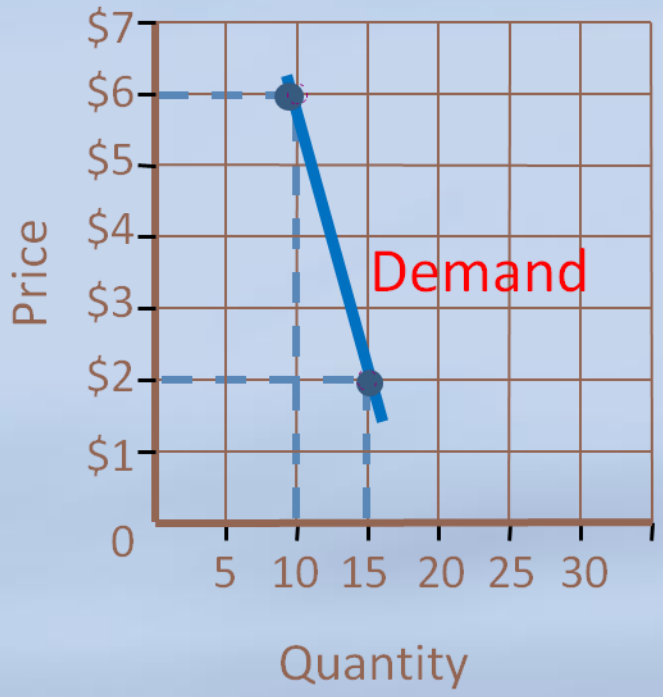
Chart:
Extremes of Elasticity



Inelastic Demand

- *The percentage change in Q_d is less than the percentage change in P*.
- In general, the demand for a good is said to be *inelastic* (or *relatively inelastic*) when the E_d is less than one (in absolute value): that is, changes in price have a relatively small effect on the quantity of the good demanded.
- $\% \Delta Q_d < \% \Delta P$
- *Price elasticity of demand < 1*
- If P increases and the revenue gained is <u>greater than</u> the revenue lost, the demand curve is price inelastic.

Chart: Inelastic Demand



- If demand is inelastic, consumers are not very responsive to changes in price. A decrease in P will lead to only a small change or no change in Q_d. Follow the demand curve from left to right as the price decreases sharply from $6 to $2, a decrease of about 67%.

  ① ($6 – $2) / $6 = 0.67 ② 0.67 X 100 = 67

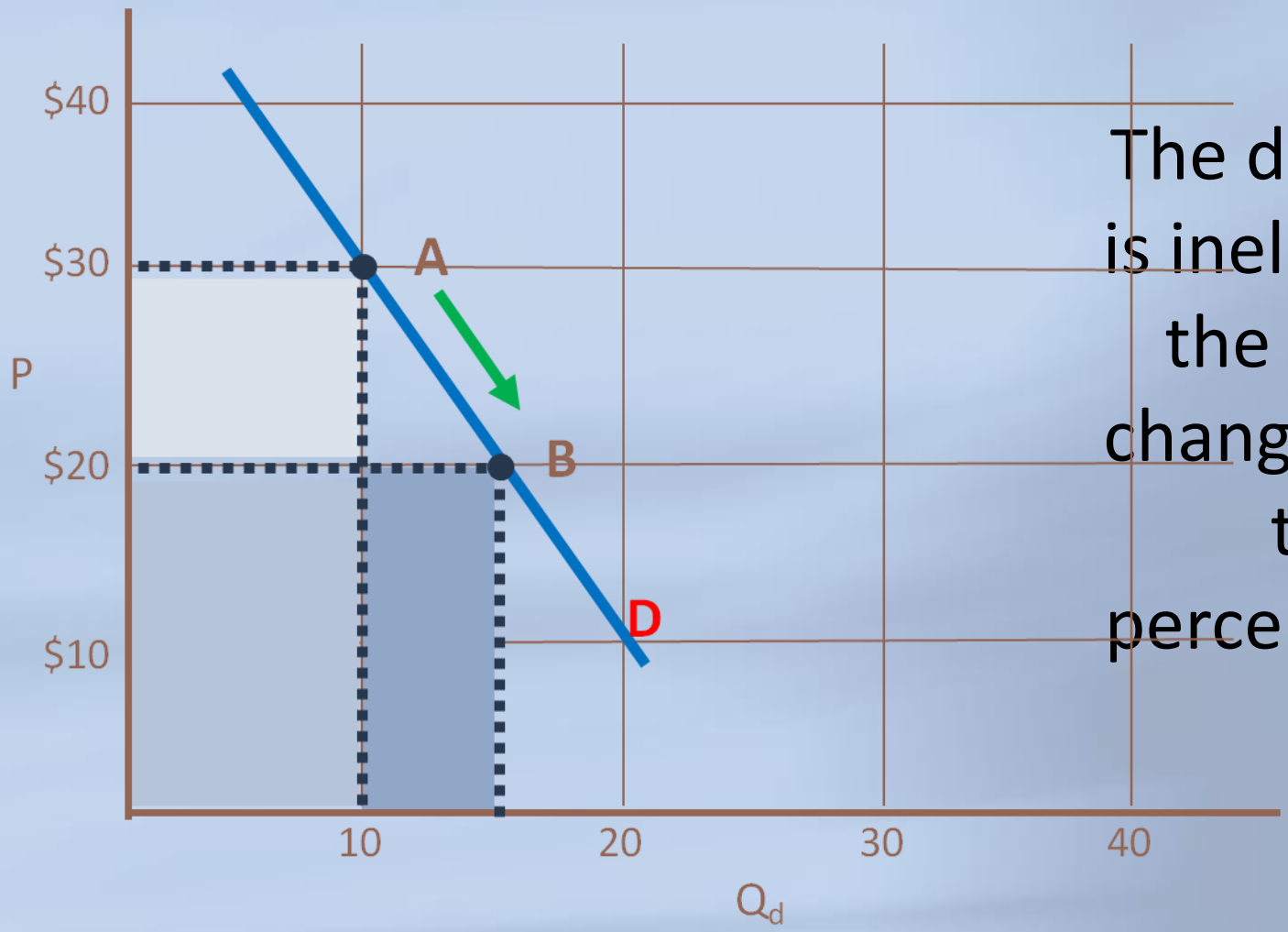
- The quantity demanded increases from 10 to 15, an increase of 50%.

  ① (10 – 15) / 10 = 0.5 ② 0.5 X 100 = 50

- Elasticity of demand is about 0.75. *The elasticity is less than 1, so demand for this good is inelastic*. The increase in Q_d is small compared to the decrease in P.

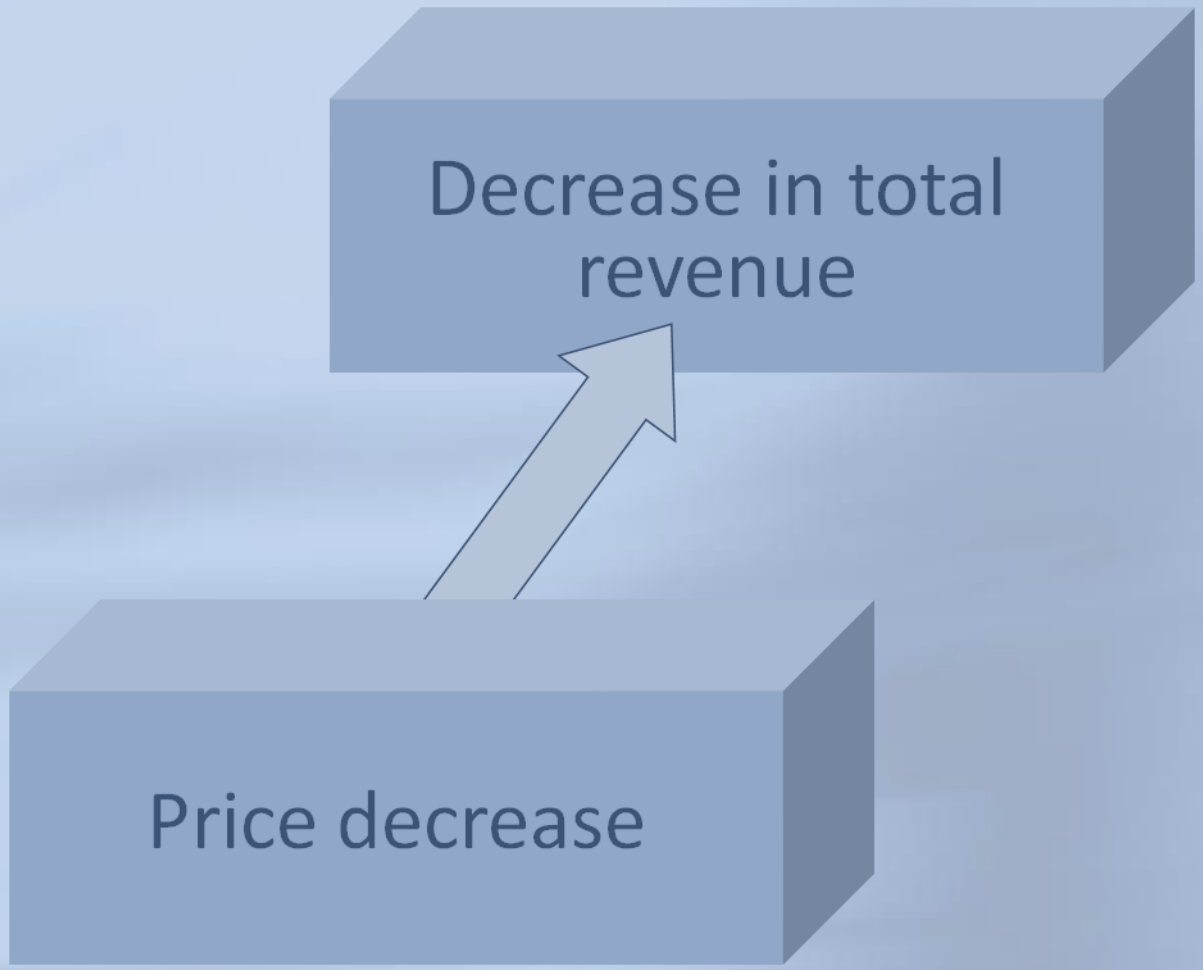
  50% / 67% = 0.75

Chart:
Inelastic Demand ($E_d < 1$)



The demand curve is inelastic because the percentage change in Q_d is less than the percentage change in P.

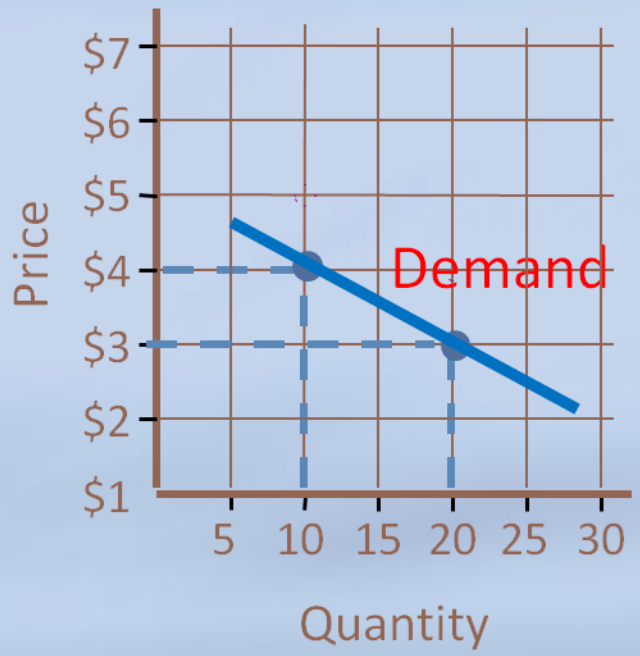
Illustration: Inelastic Demand



Elastic Demand

- *The percentage change in Q_d is greater than the percentage change in P.*
- In general, the demand for a good is said to be *elastic* (or *relatively elastic*) when the E_d is greater than one (in absolute value): that is, changes in P have a relatively large effect on the Q_d.
- $\% \Delta Q_d > \% \Delta P$
- *Price elasticity of demand > 1*
- If P increases and the revenue gained is <u>less than</u> the revenue lost, the demand curve is price elastic.

Chart: Elastic Demand



- If demand is elastic, a small change in P leads to a relatively large change in the Q_d. Follow the demand curve from left to right as the price decreases from $4 to $3, a decrease of 25%.

  ① ($4 – $3) / $4 = 0.25 ② 0.25 X 100 = 25

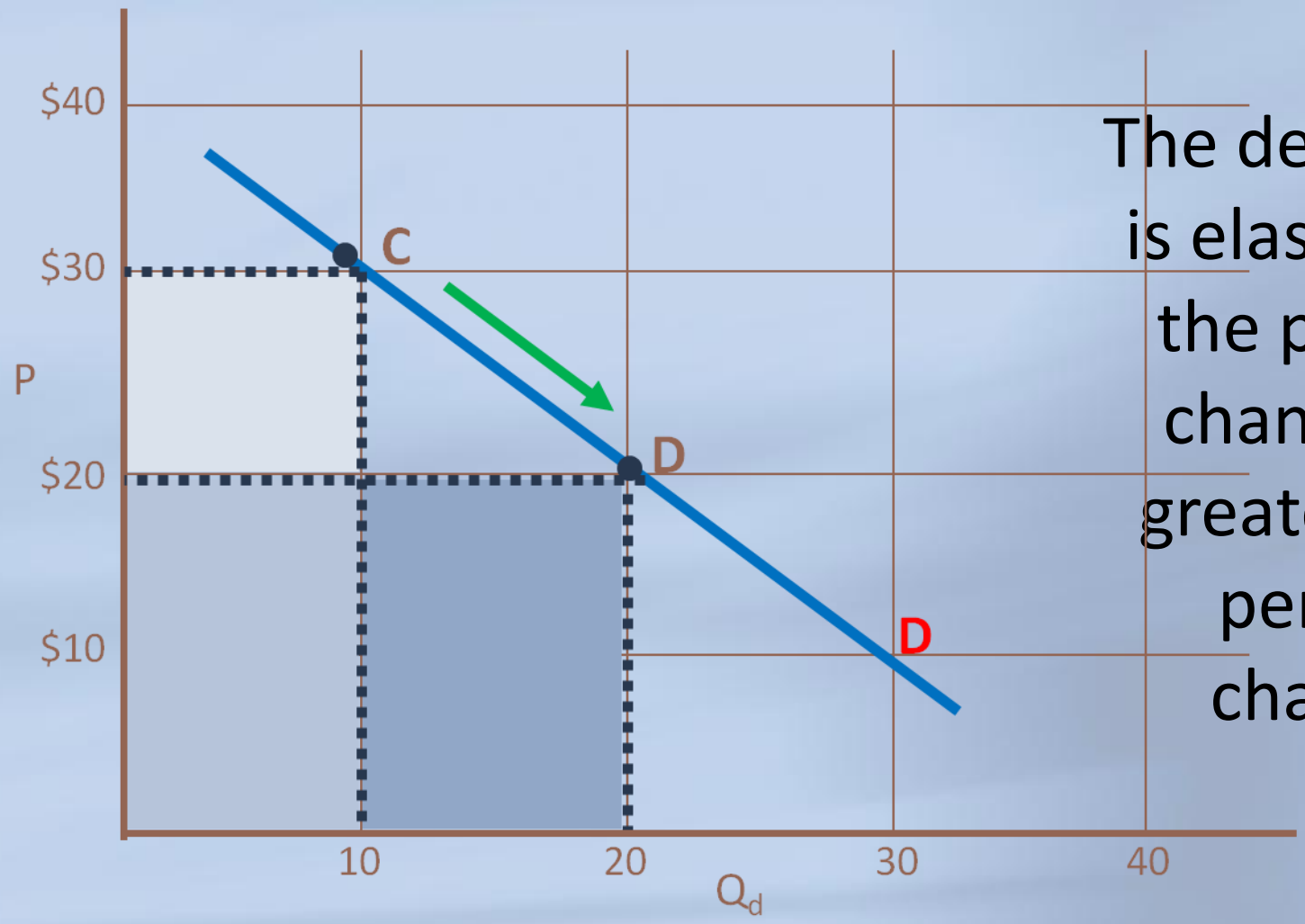
- The quantity demanded increases from 10 to 20. This is an increase of 100%.

  ① ($10 – $20) / $10 = 1 ② 1 X 100 = 100

- Elasticity of demand is equal to 4.0. *Elasticity is greater than 1, so demand is elastic.* In this example, a small decrease in P caused a large increase in Q_d.

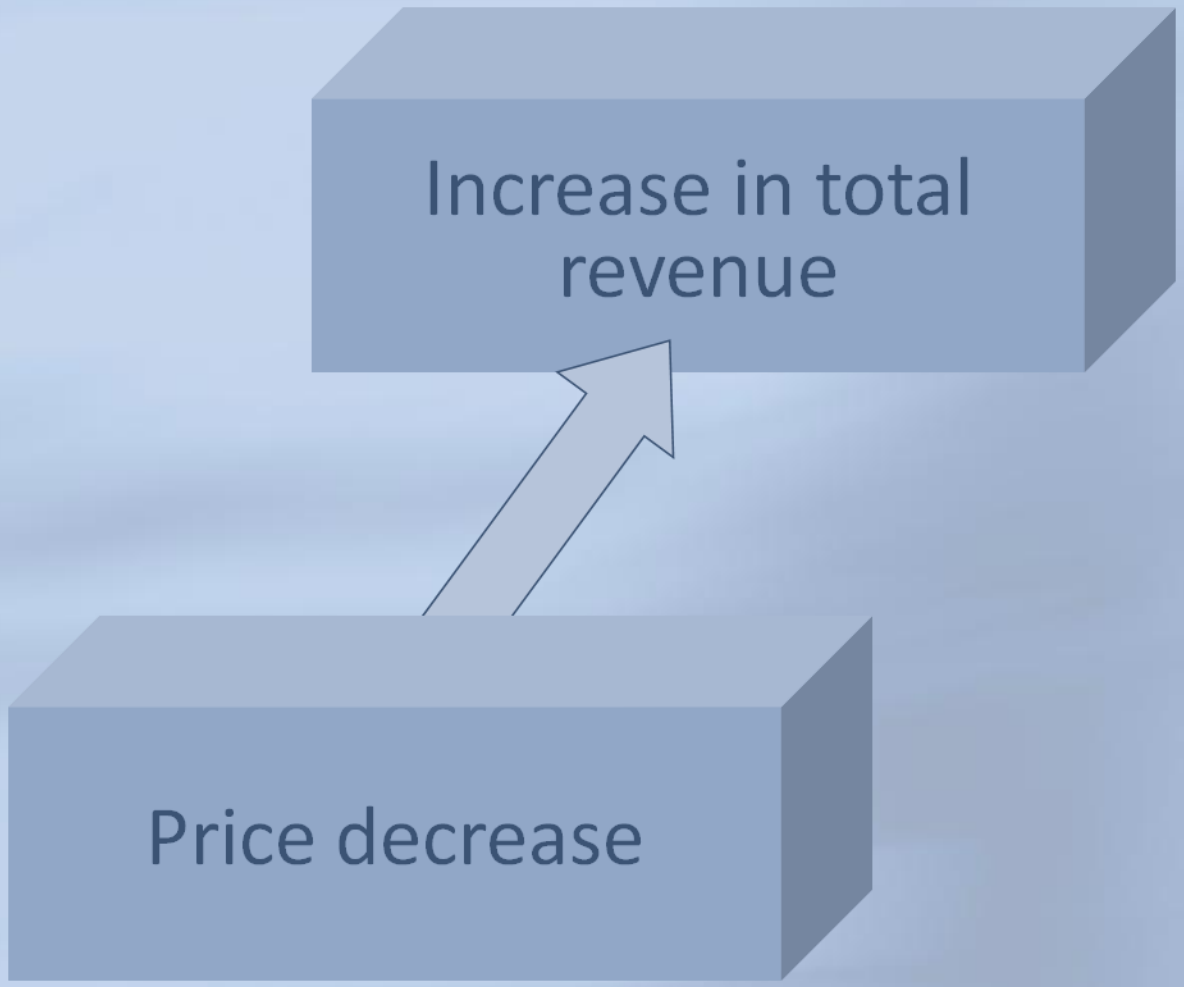
  100% / 25% = 4.0

Chart:
Elastic Demand ($E_d > 1$)



The demand curve is elastic because the percentage change in Q_d is greater than the percentage change in P.

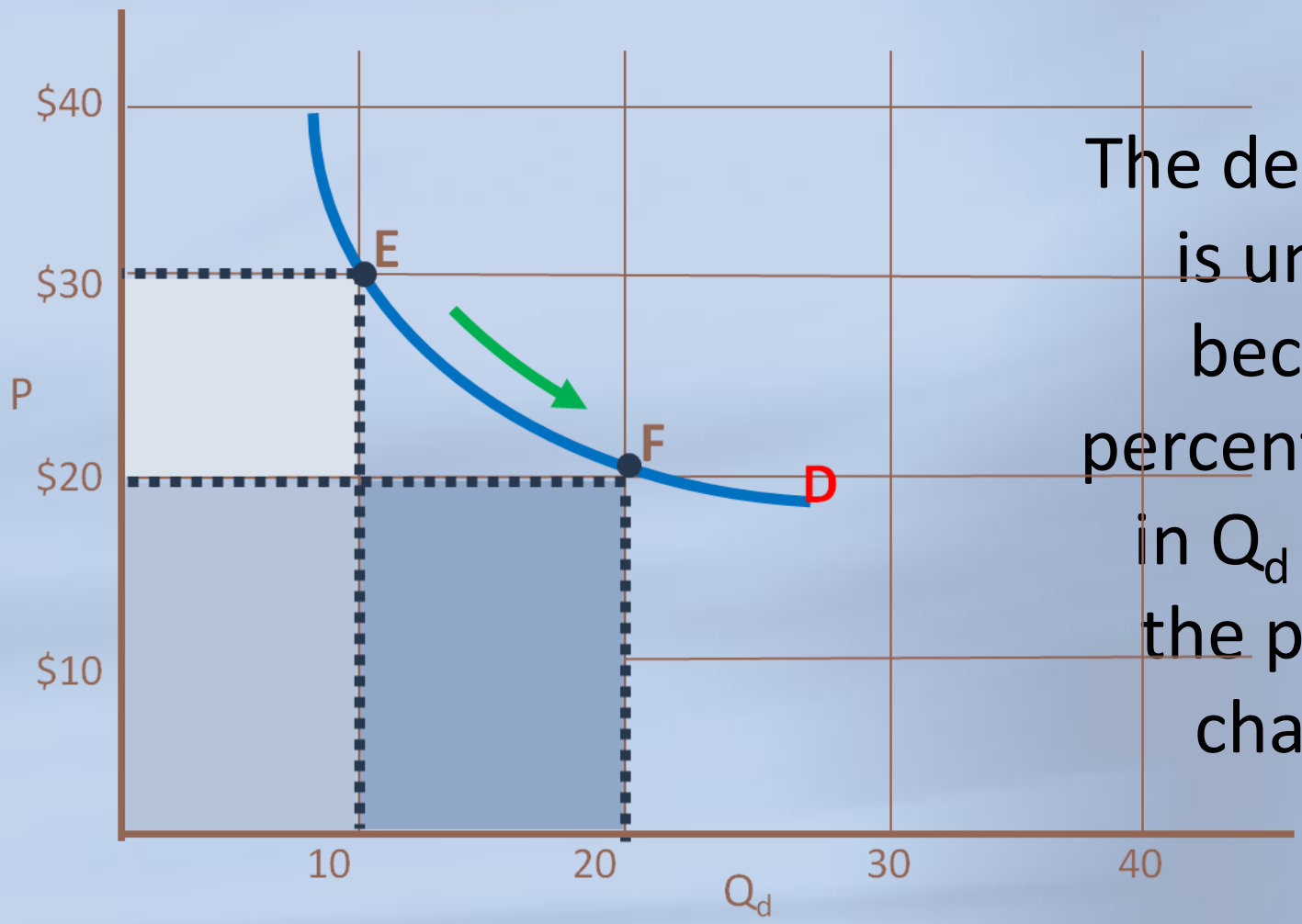
Illustration: Elastic Demand



Unit Elastic Demand

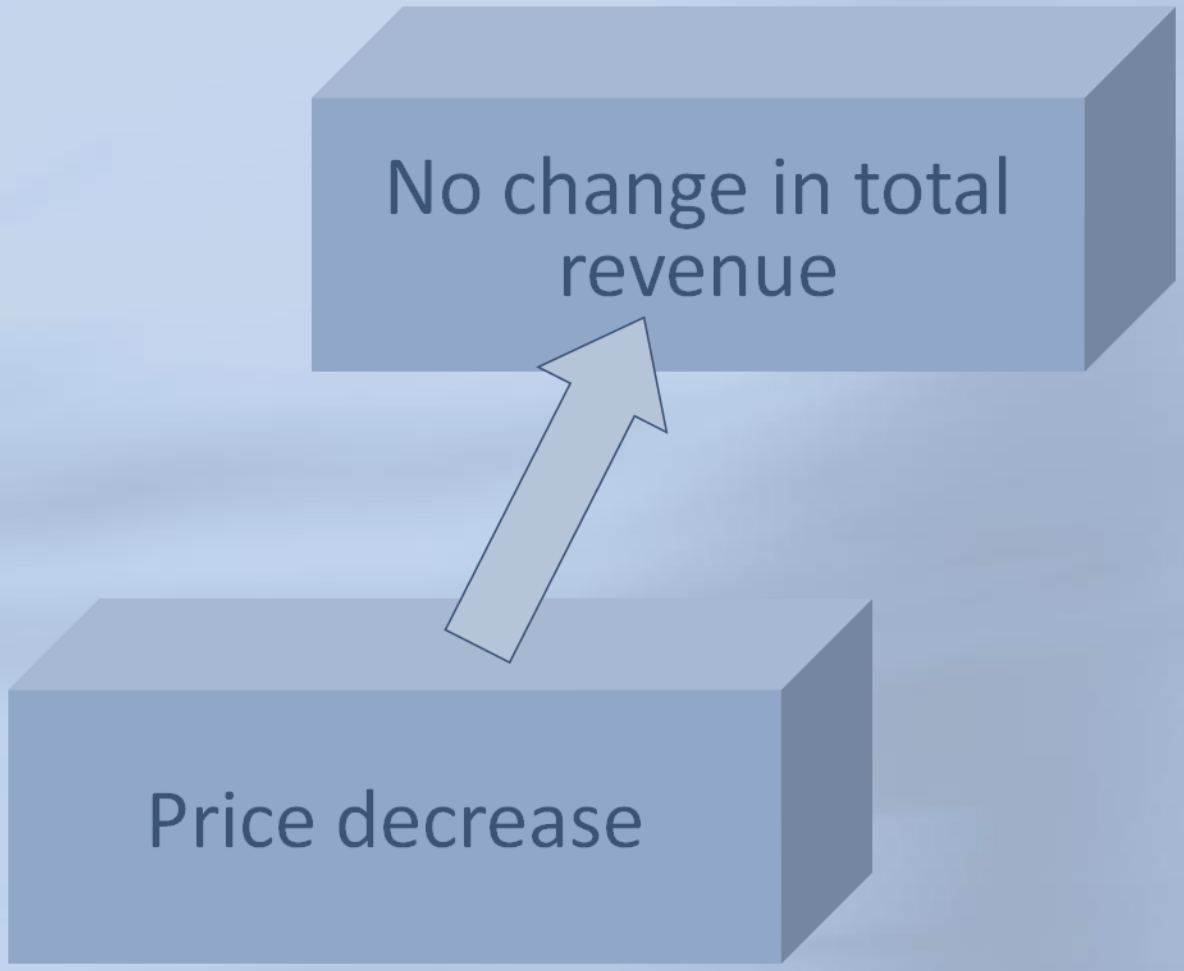
- *The percentage change in Q_d equals the percentage change in P.*
- In general, the demand for a good is said to have *unit elasticity* when the E_d is equal to one: that is, changes in P and Q_d are equal.
- $\% \Delta Q_d = \% \Delta P$
- *Price elasticity of demand = 1*
- If total revenue does not change when P increases, the demand curve is unit elastic.

Chart:
Unit Elastic Demand ($E_d = 1$)



The demand curve is unit elastic because the percentage change in Q_d is equal to the percentage change in P.

Illustration:
Unit Elastic Demand



If a college raises tuition, what happens to revenue?

If demand is **elastic**, total revenue goes down.

If demand is **inelastic**, total revenue goes up.

Continued in
The Demand for Goods Part III