BEC1116

PRINCIPLES OF ECONOMICS

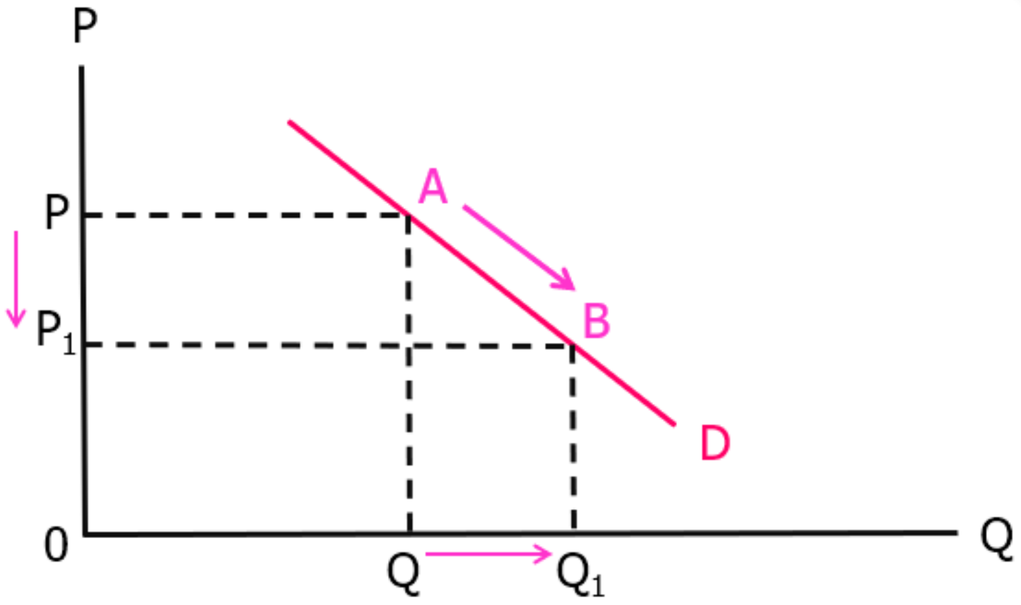
Demand and Elasticity of Demand

Change in Quantity Demanded and Change in the Level of Demand

Change in Quantity Demanded

A change in the quantity of goods and services purchased resulting from a change in the price of that good, assuming all other factors remain constant.

This change represents a movement along the same demand curve.

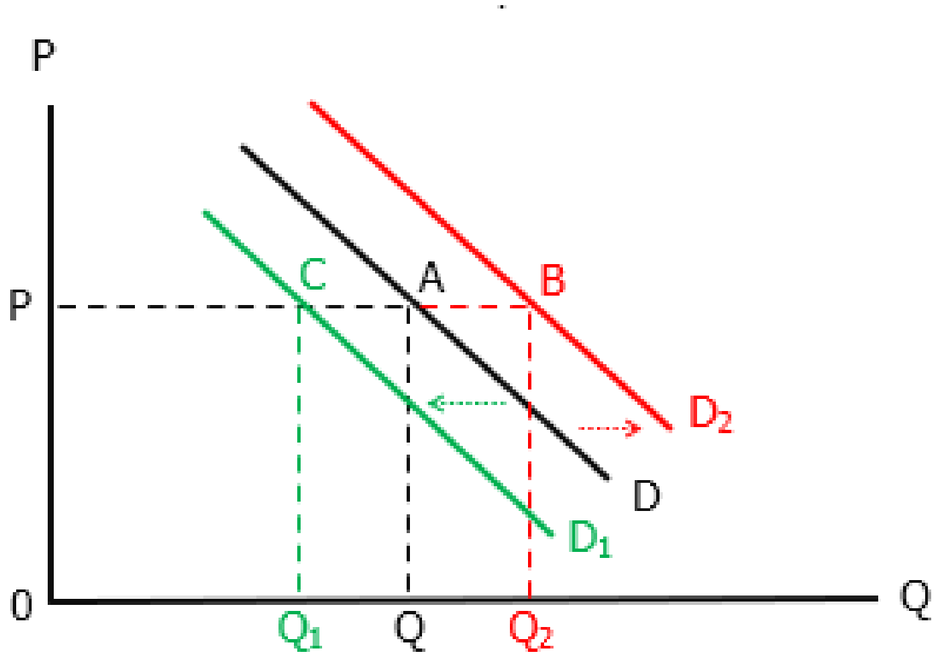


Change in Quantity Demanded and Change in the Level of Demand

Change in the Level of Demand

A change in the quantity of goods and services purchased resulting from changes in factors other than the price of that good.

This change represents a shift of the demand curve from the original curve to a new one.



Causes of Changes in the Level of Demand

- Changes in consumers’ income
- Changes in the prices of other goods
- Changes in the size and composition of the population
- Changes in tastes
- Changes in other factors, such as price expectations and economic conditions

Meaning of Elasticity of Demand

Elasticity of Demand

It is a measure of the degree of responsiveness of the quantity demanded to changes in the price offered.

If the change is large	>>	demand is highly elastic
If the change is small	>>	demand is inelastic
If there is no change at all	>>	there is no elasticity

Price Elasticity of Demand

Price elasticity of demand is the rate of change in the quantity demanded of a good (Q) relative to the rate of change in the price of that good (P).

However, changes in quantity demanded vary in magnitude. Some goods respond weakly to price changes, while others respond strongly to price changes.

Calculation of Elasticity

As a result of changes, price elasticity of demand can be calculated by measuring the percentage or rate of change in quantity demanded relative to the percentage or rate of change in price.

For example, suppose the price elasticity of demand equals 3; this can be explained as follows:

If the price of a good changes by 1%, the quantity demanded changes by 3%.

Accordingly, there are two formulas for calculating price elasticity of demand:

1. Point elasticity of demand (point method)
2. Arc elasticity of demand (arc method)

Point Elasticity of Demand (Point Method)

It is the calculation of elasticity at a specific point on the demand curve. Let Ep denote the price elasticity of demand.

P = Price of the good

Q = Quantity demanded

Δ = Change

ΔP = Change in price

ΔQ = Change in quantity demanded

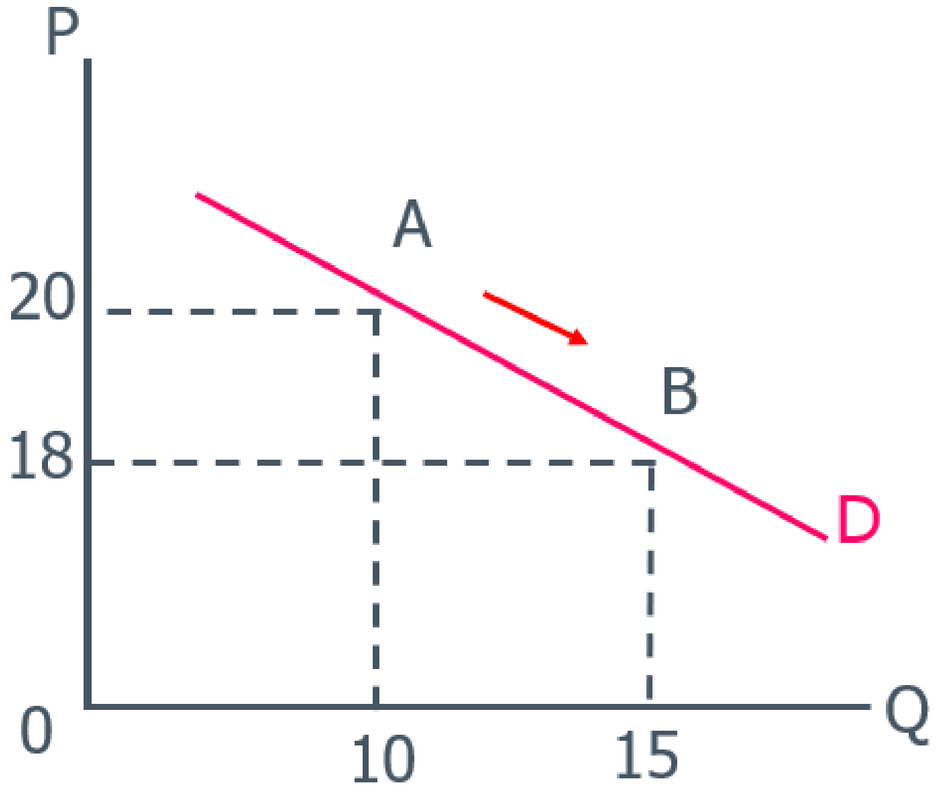
Therefore, the formula for point price elasticity of demand is given as:

$$E_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Example of Elasticity Calculation

Price elasticity of demand from movement from A >> B

At point A, the elasticity is calculated as follows:



$$E_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$= \frac{10-15}{20-18} \times \frac{20}{10}$$

$$= -\frac{5}{2} \times \frac{20}{10}$$

$$E_p = -5$$

Example of Elasticity Calculation

The elasticity at point A equals −5, which means that. when the price of a good changes by 1%, the quantity demanded changes by 5%.

The negative sign does not indicate the magnitude of elasticity; it indicates that the two variables change in opposite directions.

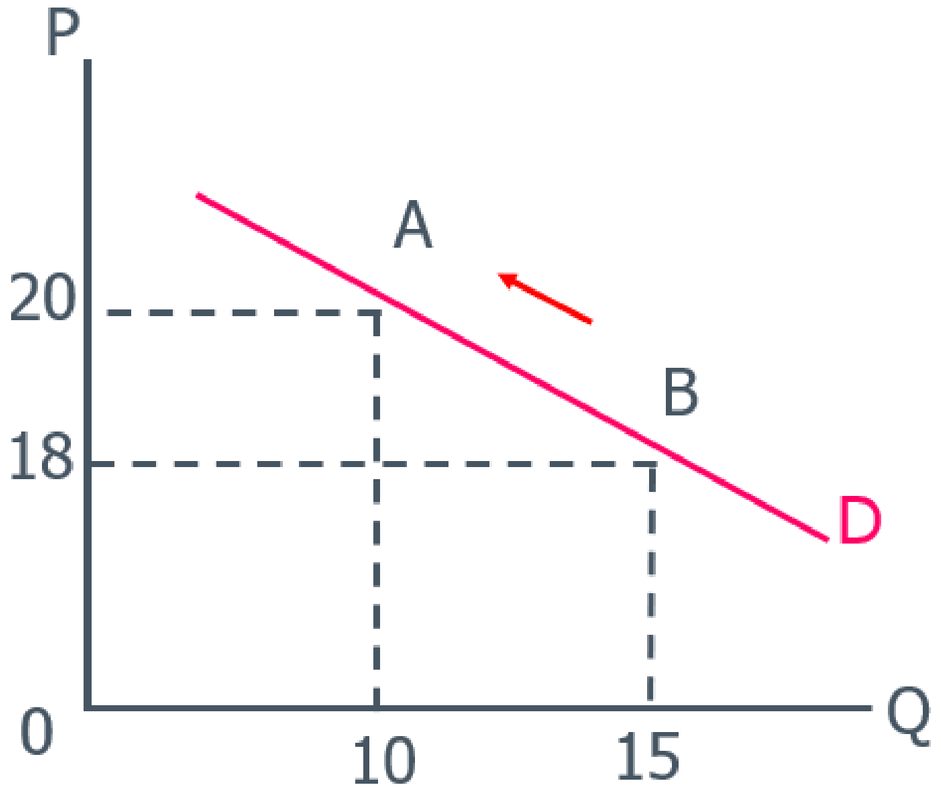
For example, in this case, if the price of the good increases by 1%, the quantity demanded decreases by 5%.

Alternatively, if the price of the good decreases by 1%, the quantity demanded increases by 5%.

Example of Elasticity Calculation

Price elasticity of demand from movement from B >> A

At point B, the elasticity is calculated as follows:



$$E_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$= \frac{15-10}{18-20} \times \frac{18}{15}$$

$$= -\frac{5}{2} \times \frac{18}{15}$$

$$E_p = -3$$

Example of Elasticity Calculation

The elasticity at point B equals −3, which means that

If the price of the good increases by 1%, the quantity demanded decreases by 3%.

Or, if the price of the good decreases by 1%, the quantity demanded increases by 3%

From the calculations at both points, it is found that the point elasticities of demand at points A and B are different.

To resolve the issue of which value should be used as the initial value for calculating elasticity over this range, the average (midpoint) method between points A and B is used instead.

Arc Elasticity of Demand (Arc Method)

It measures elasticity over a segment of the demand curve, with the calculated value being the average elasticity of all points within that segment.

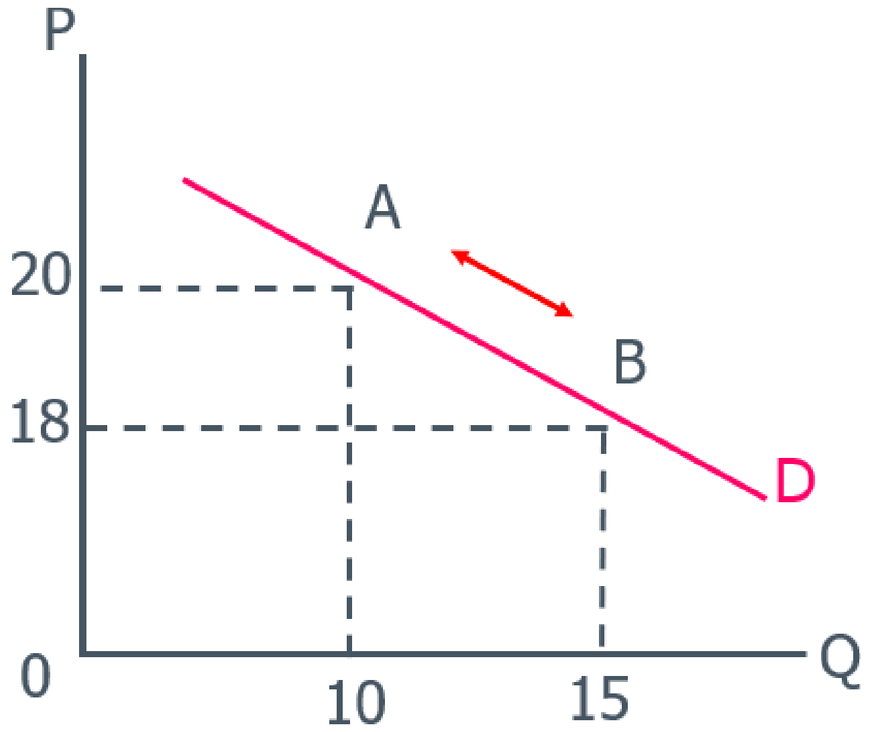
The formula for price elasticity of demand over a range (arc method) is given as:

$$E_p = \frac{\Delta Q}{\Delta P} \times \frac{P_1 + P_2}{Q_1 + Q_2}$$

Example of Arc Elasticity of Demand Calculation

Arc elasticity of demand between A and B

Between points A and B, the elasticity is calculated as follows:



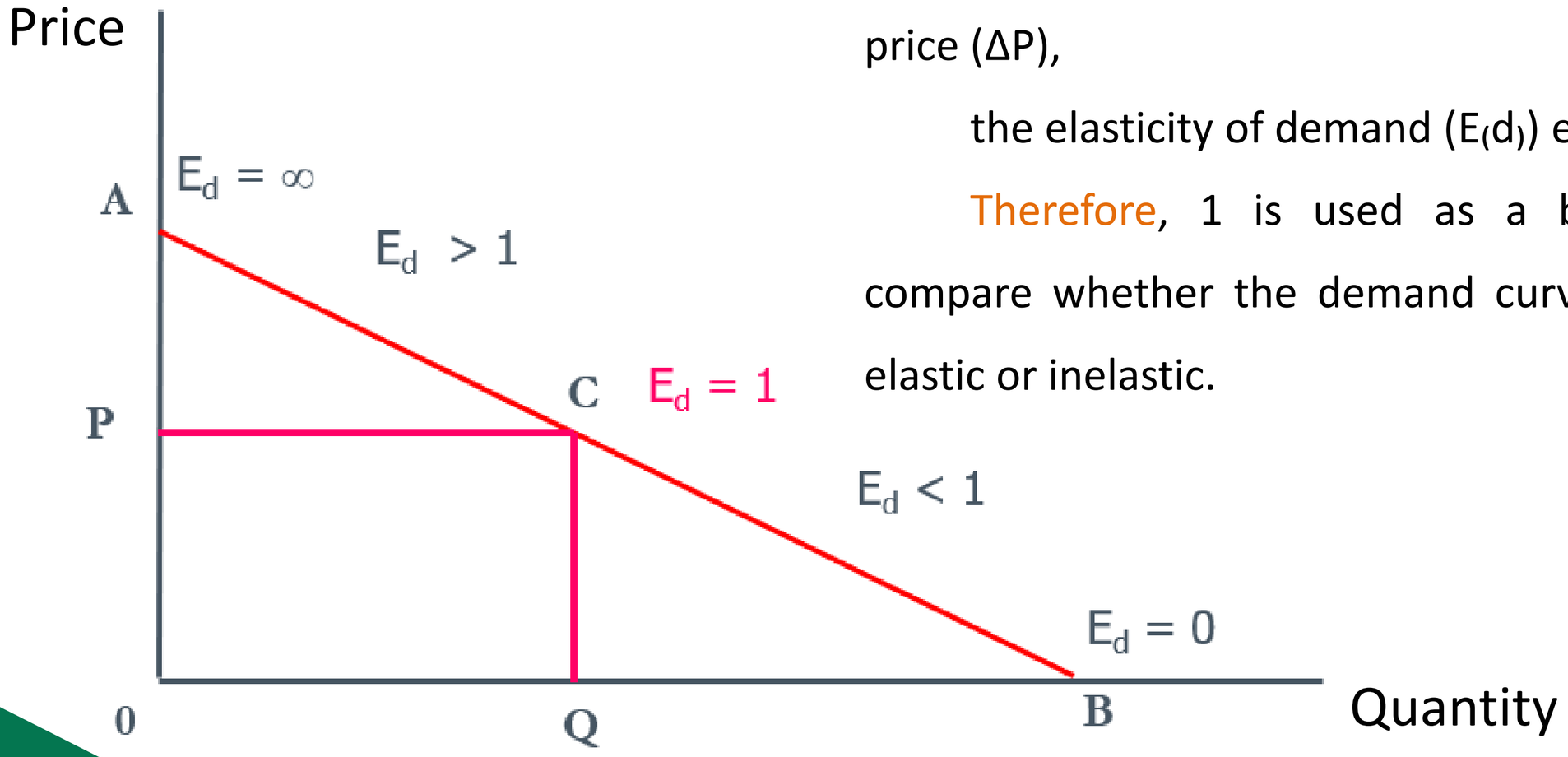
$$E_p = \frac{\Delta Q}{\Delta P} \times \frac{P_1 + P_2}{Q_1 + Q_2}$$

$$= \frac{10-15}{20-18} \times \frac{20+18}{10+15}$$

$$= -\frac{5}{2} \times \frac{38}{25}$$

$$E_p = -3.8$$

Elasticity and the Shape of the Demand Curve



if the percentage change in quantity demanded (ΔQ) equals the percentage change in price (ΔP),

the elasticity of demand ($E_{(d)}$) equals 1.

Therefore, 1 is used as a benchmark to compare whether the demand curve is relatively elastic or inelastic.

Elasticity and the Shape of the Demand Curve

If the percentage change in quantity demanded (ΔQ) is less than the percentage change in price (ΔP),
this indicates low elasticity of demand (Ed < 1) (inelastic).

If the percentage change in quantity demanded (ΔQ) is greater than the percentage change in price (ΔP),
this indicates high elasticity of demand (Ed > 1) (elastic).

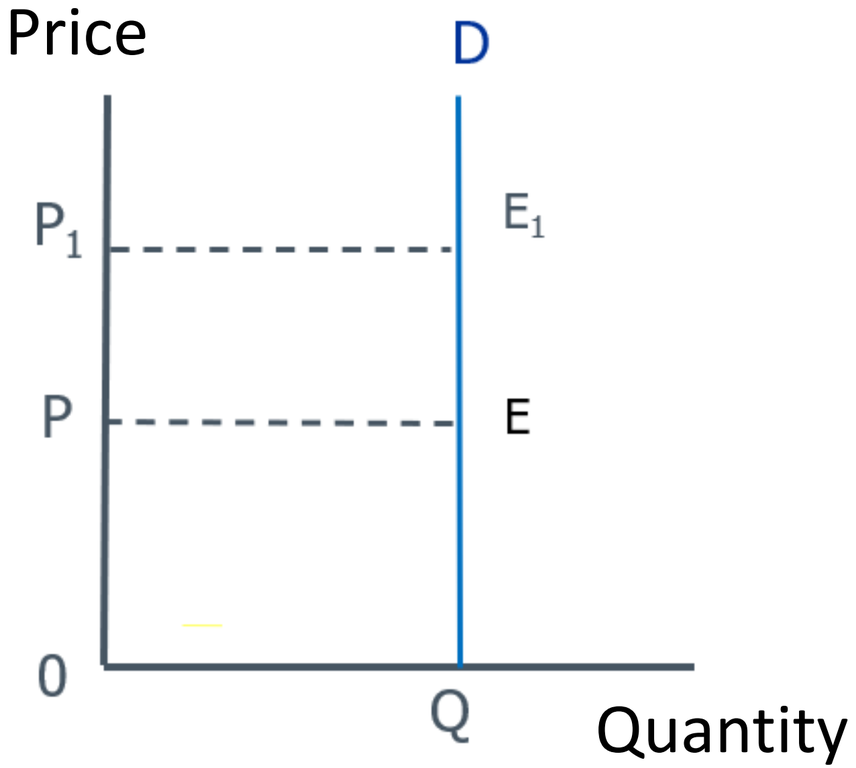
Elasticity and the Shape of the Demand Curve

There are three special cases in which the elasticity is the same at every point along the demand curve, as follows:

1. A perfectly inelastic demand curve (vertical line).
2. A rectangular hyperbola demand curve
3. A perfectly elastic demand curve (horizontal line).

Perfectly Inelastic Demand

(Vertical Demand Curve)

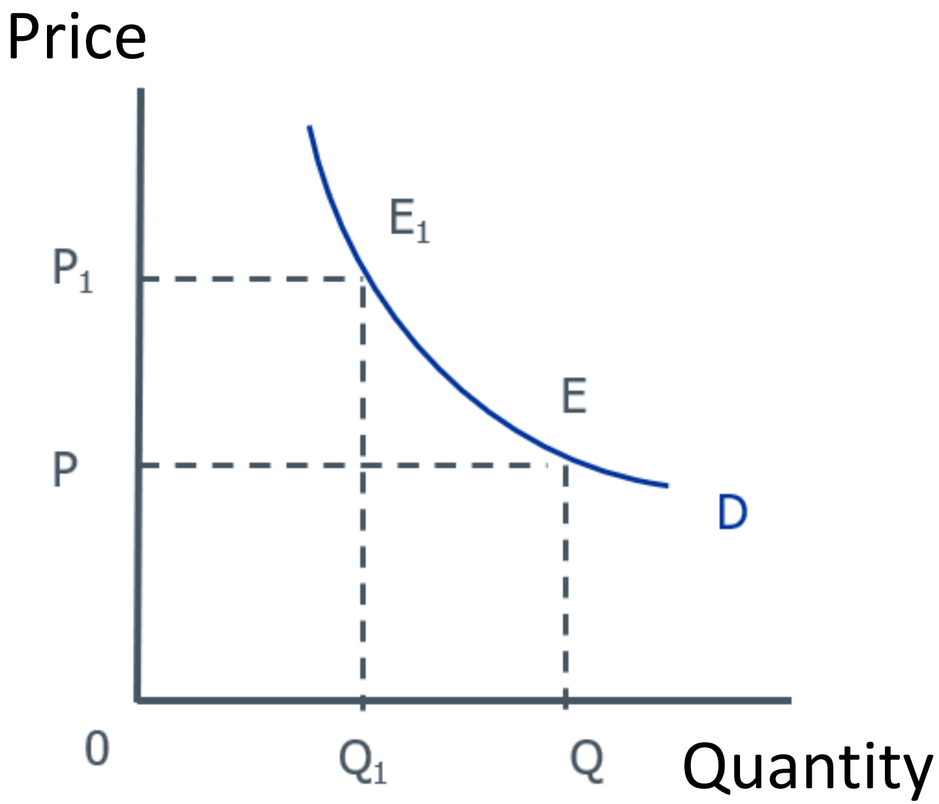


In this case, regardless of how much the price changes, the quantity demanded remains unchanged.

This indicates that quantity demanded does not respond to changes in price at any point on the demand curve.

The elasticity of demand equals 0 along the entire curve.

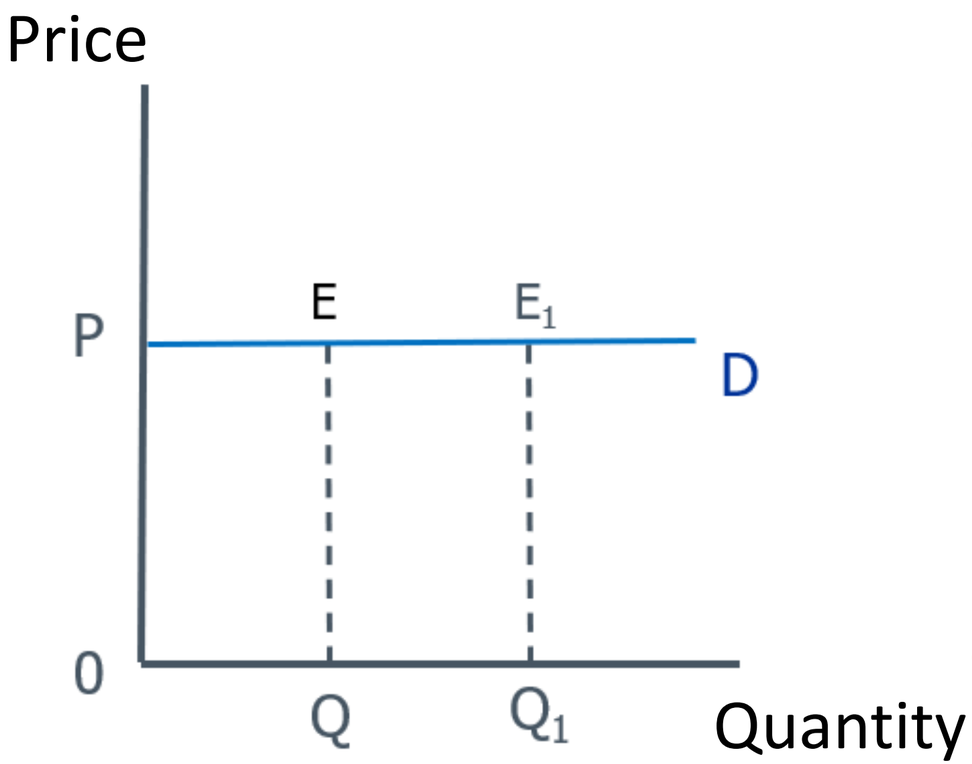
RECTANGULARHYPERBOLAR



This curve has a special property in that the area under the curve is the same everywhere.

In the case where the demand curve has this shape, every point on the demand curve has elasticity equal to 1 along the entire curve(Unitary Elasticity of Demand)

Demand Curve Parallel to the Horizontal Axis



In this case, the quantity demanded changes infinitely at a given price level.

Elasticity of Demand = ∞ (Infinite Elasticity)

However, if the price increases even slightly, no quantity will be demanded at all.

Elasticity of Demand and Its Relationship with Total Revenue

Because buyers adjust the quantity they purchase in response to changes in the price of goods,

a change in price (ΔP) set by sellers therefore affects the quantity sold >> which in turn affects sellers' revenue as well.

The impact may be positive >> ΔP causes sales revenue to increase, or negative >> ΔP causes sales revenue to decrease.

Therefore, sellers can anticipate in advance the direction in which revenue will change as a result of ΔP. This enables sellers to formulate appropriate policies, which can be achieved by applying knowledge of the elasticity of demand to help answer this question.

Total Revenue of the Seller

Total revenue is the total income that a seller receives from sellin goods.

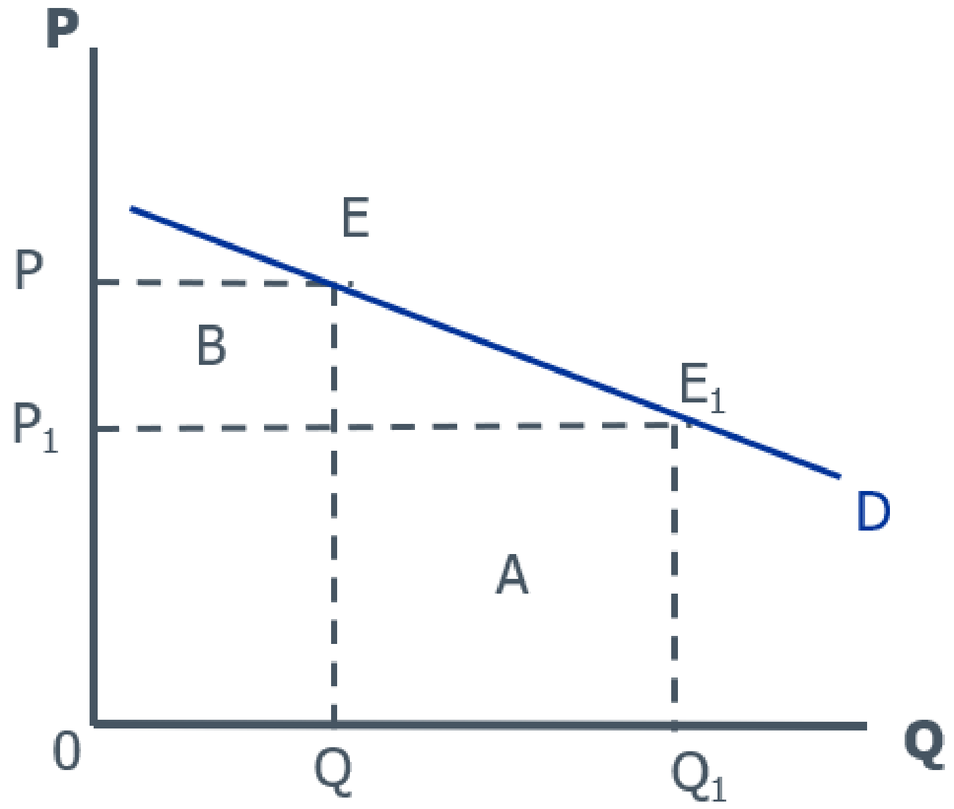
It is obtained from the product of the price of the goods and the quantity sold.

Seller’s total revenue = Price of the goods × Quantity purchased

$$TR = P * Q$$

Case where $E_d > 1$

Ed>1: the demand curve is relatively flat



■ Highly Elastic Demand

Case where $P \downarrow \rightarrow Q \uparrow$

The rate of increase in quantity demanded Q is greater than the rate of decrease in price P. When $E_d > 1$,a decrease in price causes quantity demanded to increase by a larger proportion, resulting in an increase in total revenue (TR).

$P \downarrow \rightarrow TR \uparrow$— Area A

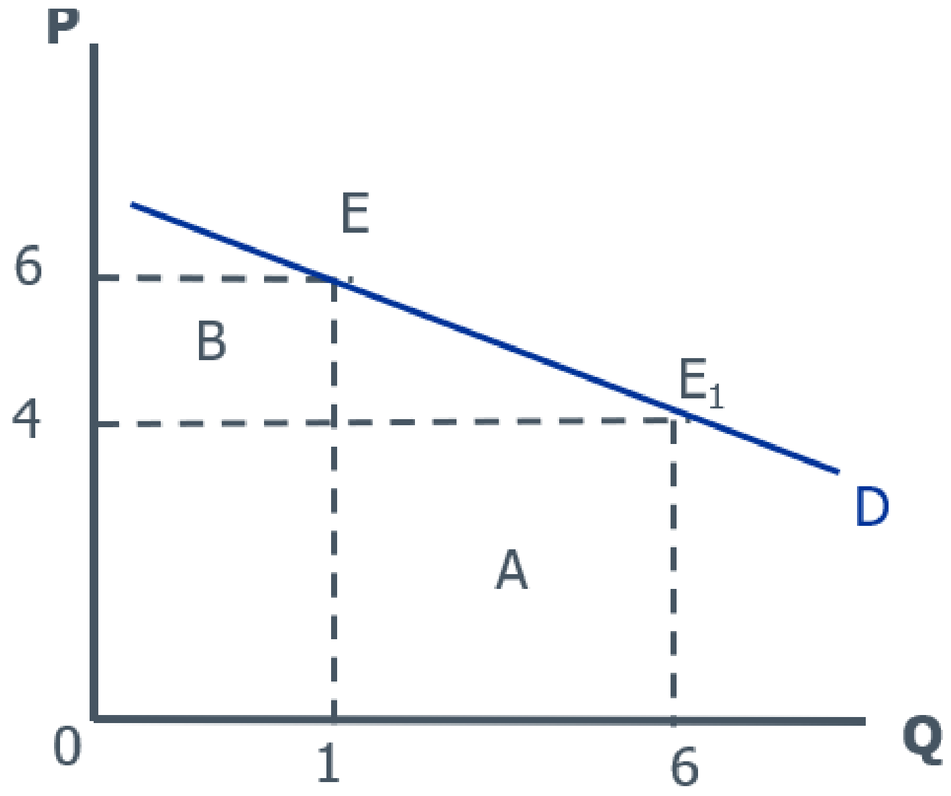
Case where $P \uparrow \rightarrow Q \downarrow$

The rate of decrease in quantity demanded Q is greater than the rate of increase in price P. When $E_d > 1$,an increase in price causes quantity demanded to decrease, resulting in a decrease in total revenue (TR).

$P \uparrow \rightarrow TR \downarrow$— Area B

Example: Case of $E_d > 1$

Ed > 1 the demand curve is relatively flat.



Case: $P \downarrow \rightarrow Q \uparrow$

Area A:

$$TR = P \times Q = 4 \times 6 = 24$$

Case: $P \uparrow \rightarrow Q \downarrow$

Area B:

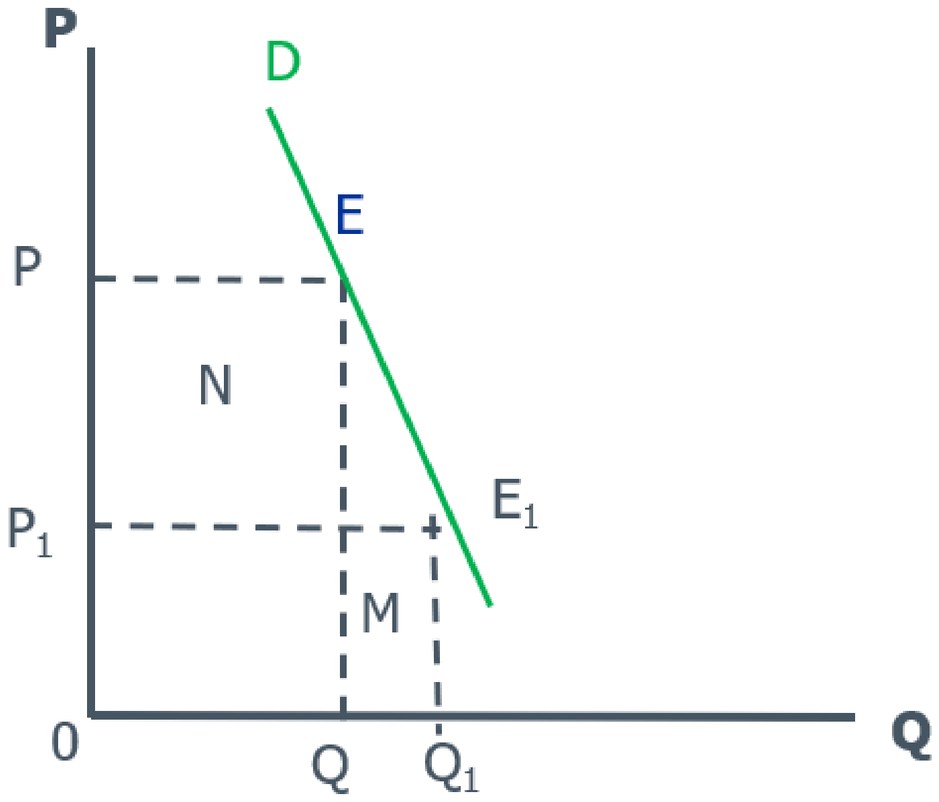
$$TR = P \times Q = 6 \times 1 = 6$$

It can be concluded that when demand is elastic E_d>1, price (P) and total revenue (TR) move in opposite directions.

$$P \downarrow \rightarrow TR \uparrow$$
$$P \uparrow \rightarrow TR \downarrow$$

Case of $E_d < 1$:Inelastic Demand

$E_d < 1$,the demand curve is relatively steep.



Case: $\boldsymbol{P \downarrow \rightarrow Q \uparrow}$

The rate of increase in quantity demanded (Q) is smaller than the rate of decrease in price (P).

When $E_d < 1$,a decrease in price leads to only a small increase in quantity demanded, resulting in a decrease in total revenue (TR).

$\boldsymbol{P \downarrow \rightarrow TR \downarrow}$ ***Area M***

Case: $\boldsymbol{P \uparrow \rightarrow Q \downarrow}$

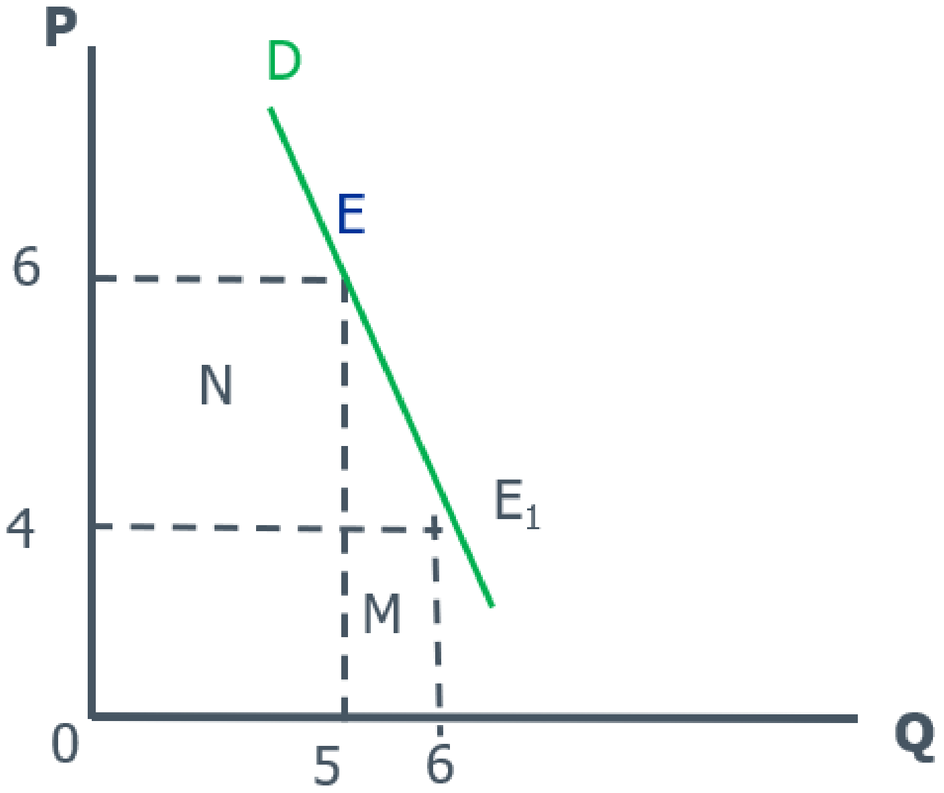
The rate of decrease in quantity demanded (Q) is smaller than the rate of increase in price (P).

When $E_d < 1$,an increase in price leads to only a small decrease in quantity demanded, resulting in an increase in total revenue (TR).

$\boldsymbol{P \uparrow \rightarrow TR \uparrow}$ ***Area N***

Example: Case of $E_d < 1$

Ed<1, the demand curve is relatively steep.



Case: $P \downarrow \rightarrow Q \uparrow$

Area M:

$$\boldsymbol{TR = P \times Q = 4 \times 6 = 24}$$

Case: $P \uparrow \rightarrow Q \downarrow$

Area N:

$$\boldsymbol{TR = P \times Q = 6 \times 5 = 30}$$

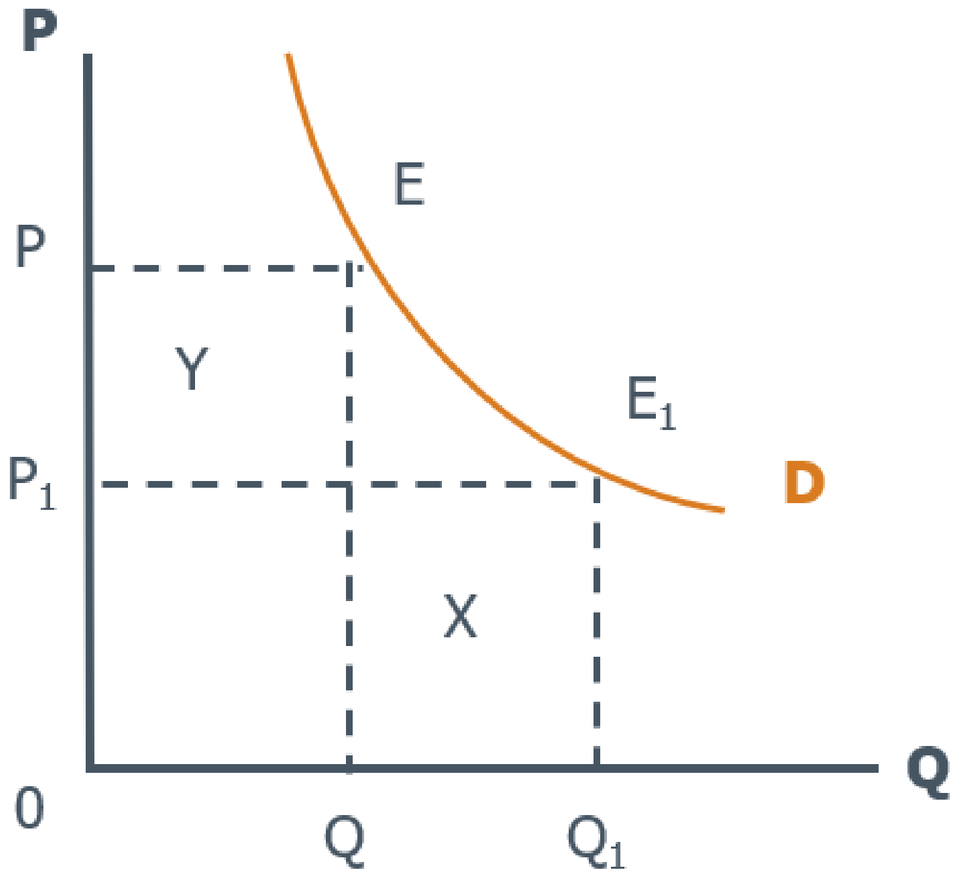
Conclusion:

When demand is inelastic $E_d < 1$,(price (P) and total revenue (TR) move in the same direction.

$$\boldsymbol{P \uparrow \rightarrow TR \uparrow}$$
$$\boldsymbol{P \downarrow \rightarrow TR \downarrow}$$

Example: Case of $E_d = 1$

Ed=1, the demand curve is a rectangular hyperbola.



Case : $P \downarrow \rightarrow Q \uparrow$

The rate of increase in quantity demanded (Q) is equal to the rate of decrease in price (P).

When $E_d = 1$,a decrease in price results in total revenue (TR) remaining unchanged.

$$P \downarrow \rightarrow \overline{TR}$$

Area X

Case : $P \uparrow \rightarrow Q \downarrow$

The rate of decrease in quantity demanded (Q) is equal to the rate of increase in price (P).

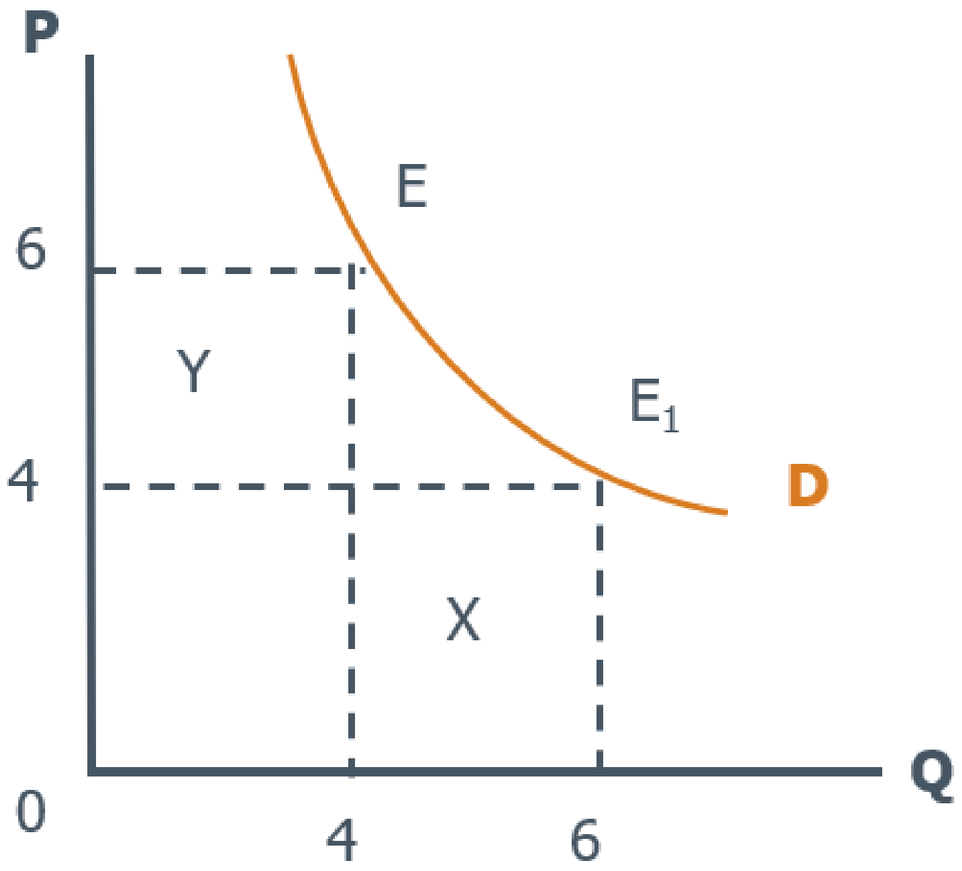
When $E_d = 1$,an increase in price results in total revenue (TR) remaining unchanged.

$$P \uparrow \rightarrow \overline{TR}$$

Area Y

Case of $E_d = 1$:Unit Elastic Demand

Ed=1, the demand curve is a rectangular hyperbola.



Case: $P \downarrow \rightarrow Q \uparrow$

Area X: $TR = P \times Q = 4 \times 6 = 24$

Case: $P \uparrow \rightarrow Q \downarrow$

Area Y: $TR = P \times Q = 6 \times 4 = 24$

Conclusion:

When the elasticity of demand equals one $E_d = 1$,(the relationship between price (P) and total revenue (TR) is such that **total revenue remains unchanged**.

$$P \uparrow \rightarrow \overline{TR}$$

$$P \downarrow \rightarrow \overline{TR}$$

Benefits of Learning About Elasticity

Examples:

In the case where the government intends to impose a tax (Tax) **per unit of a product** in order to increase government revenue, the government must understand the degree of elasticity of demand for each type of product. E_d If the price of a product increases → the quantity demanded decreases → the amount of tax revenue collected will decrease accordingly.

In the case of business firms, knowledge of price elasticity of demand E_d and its relationship with total revenue (TR) is beneficial for business decision-making and achieving success.

Firms will be able to determine whether each product should be priced higher or lower, and whether prices should be increased or decreased, depending on the elasticity of demand E_d of each product.