

MEASUREMENT OF ELASTICITY OF DEMAND

There are three methods of measuring the elasticity of demand.

1. Outlay method or total expenditure method

According to this method of measuring the elasticity of demand, there are three ways as below.

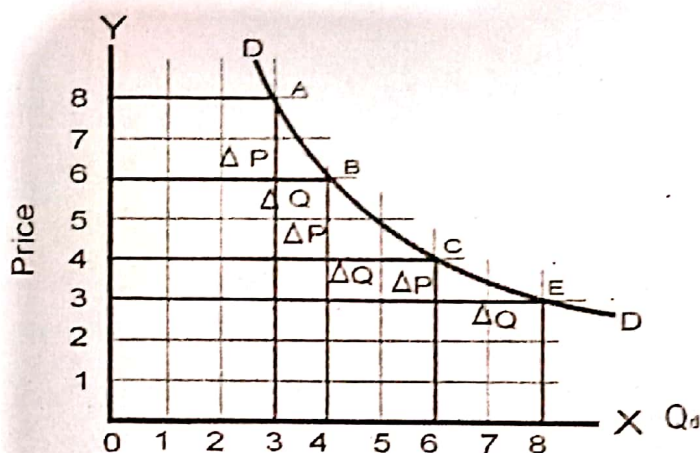
a) Equal to unity

When the price of a commodity decreases the quantity demanded will increase but the total expenditure remain constant; on the other hand when the price of a commodity increases the quantity demand will decrease but the total expenditure also remain constant the elasticity

of demand is called equal to unity as in the schedule.

P_x	Q_x	Total Expenditure
Rs.8.00	3 Kg	Rs.24.00
Rs.6.00	4 Kg	Rs.24.00
Rs.4.00	6 Kg	Rs.24.00
Rs.3.00	8 Kg	Rs.24.00

In the above schedule, the total expenditure remains constant with the decrease or increase in price of the commodity. With the help of the above schedule, the shape of this type of demand curve is made as in the following diagram:



DD is a demand curve which has elasticity of demand equal to unity and its shape is like a rectangular hyperbola. The distance of DD from both axis is equal.

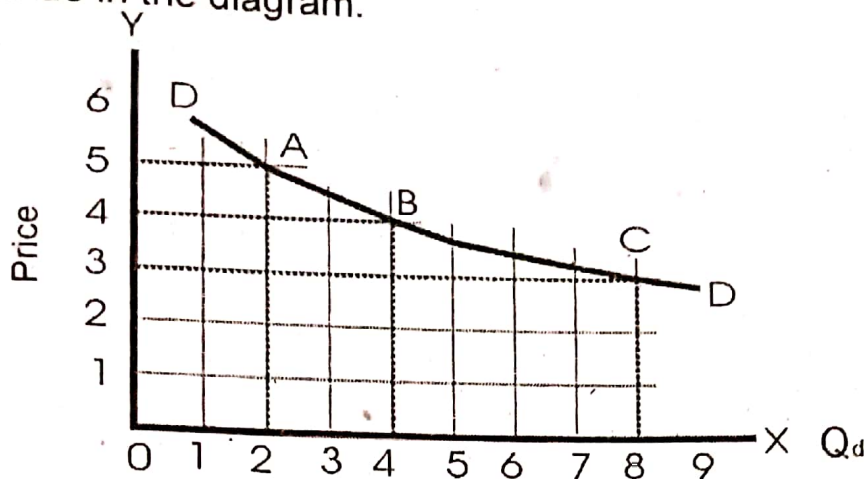
b) Greater than unity.

When the price of a commodity decreases and its quantity demanded increases, but the total outlay will also increase or a change in price causes total expenditure to change in the opposite direction. It is explained in the following schedule.

P_x	Q_x	Total Expenditure
Rs.5.00	2 Unit	Rs.10.00
Rs.4.00	4 Unit	Rs.16.00
Rs.3.00	8 Unit	Rs.24.00

With the help of the above schedule, the shape of this type of demand

curve is made in the diagram.



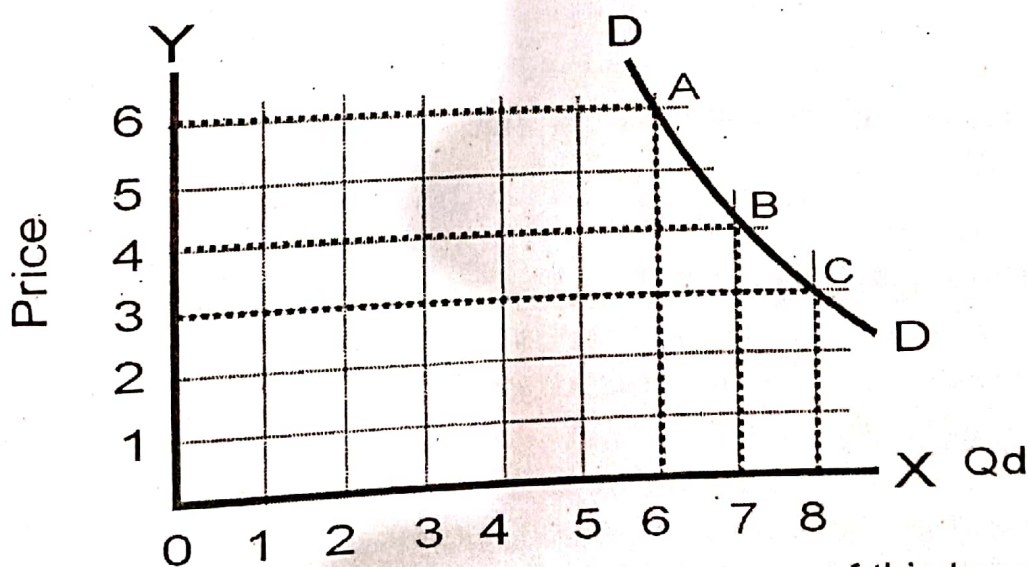
DD is a demand curve which has elasticity of demand more than unity. It is a flatter demand curve, which has horizontal tendency.

c) **Less than unity**

When the price decreases the quantity demanded will increase proportionately less than the change in demand, but the total expenditure will also decrease and vice versa. It is explained in the following schedule.

P_x	Q_x	Total Expenditure
Rs.7.00	6 Unit	Rs.42.00
Rs.5.00	7 Unit	Rs.35.00
Rs.3.00	8 Unit	Rs.24.00

In the schedule price decreases from Rs.7.00 to Rs.3.00 and quantity demanded increases from 6 Kg to 8 Kg with low rate. The total expenditure decreases. If the schedule is read from below the total expenditure increases. It is explained with the following diagram.



With the help of the above schedule the shape of this type of demand curve is made. DD is a demand curve which has elasticity of demand

less than unity. It is a steeper demand curve which has vertical tendency.

2. Percentage method

In this method, the elasticity of demand is determined with the ratio of percentage change in quantity demanded and the percentage change in price of a commodity. It is also called the Flux method.

$$E_d = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

This method has also three shapes as under:

a) Equal to unity

When the percentage change in quantity demanded is equal to the percentage change in price and then the elasticity of demand is equal to unity. E.g. change in price=10%, then change in quantity demanded=10%

$$E_d = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}} = \frac{10}{10} = 1$$

b) Greater than unity:

When the percentage change in quantity demanded is more than the percentage change in price, then the elasticity of demand is more than unity.

E.g. Change in price=10%

Then change in quantity demanded=15%

$$E_d = \frac{15}{10} = 1.5 > 1$$

c) Less than unity:

When the percentage change in quantity demanded is less than the percentage change in price and then the elasticity of demand is less than unity.

E.g. Change in price=10%

Then change in quantity demanded=5%

$$E_d = \frac{5}{10} = 0.5 < 1$$

3. Proportionate method or formula method:

In this method, there are two types of elasticity of demand i.e point elasticity and arc elasticity.

a) Point elasticity.

Definition

The proportionate change in the quantity demanded resulting from a very small proportionate change in price OR we have to measure the elasticity of demand on a point of demand curve is called the point elasticity.

Symbolically, it is written as:

$$E_d = \frac{\text{Proportionate change in quantity demanded}}{\text{Proportionate change in Price}}$$

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

Where Q = Quantity demanded,
 ΔQ = Change in quantity demanded,

P = Price

ΔP = Change in price

It is explained with the help of following schedule.

P	Q
Rs. 5.00	2.00 Kg
Rs. 4.95	2.02 Kg

$$Q = 2, Q_1 = 2.02,$$

$$\Delta Q = Q_1 - Q$$

$$\Delta Q = 2.02 - 2.00 = 0.02$$

$$P = 5.00, P_1 = 4.95,$$

$$\Delta P = P_1 - P$$

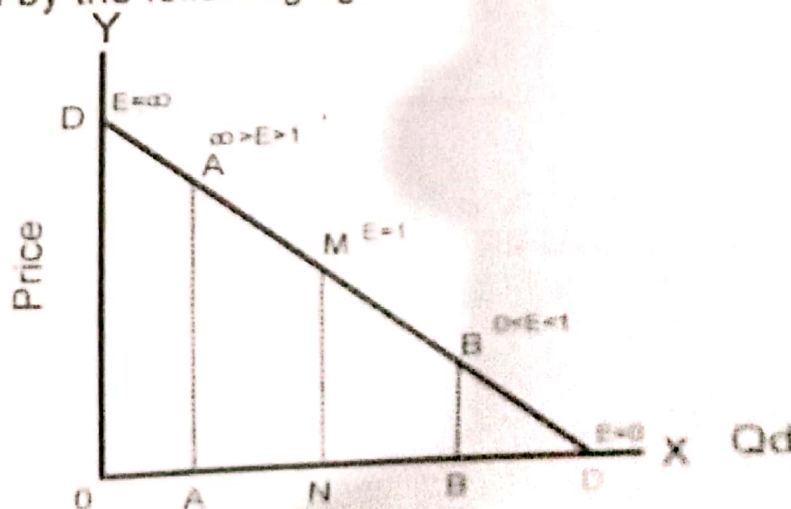
$$\Delta P = 4.95 - 5.00 = -0.05$$

$$E_d = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{0.02}{-0.05} \times \frac{5.00}{2.00} = \frac{0.10}{-0.10} = -1$$

The point elasticity is equal to unity while the negative sign indicates the inverse relationship between price and quantity demanded.

By Geometric Method

The geometrical measurement of point elasticity on a demand curve is explained by the following figure.



Suppose the length of demand curve is 4 inches and the point

elasticity of demand is geometrically explained as:

- (i) At point M, the mid point of demand curve DD'

$$E_d = \frac{MD'}{MD} = \frac{2}{2} = 1$$

- (ii) At point D

$$E_d = \frac{MD'}{MD} = \frac{4}{0} = \infty$$

- (iii) Within the point M and D

$$E_d = \infty > E > 1$$

- (iv) At point D'

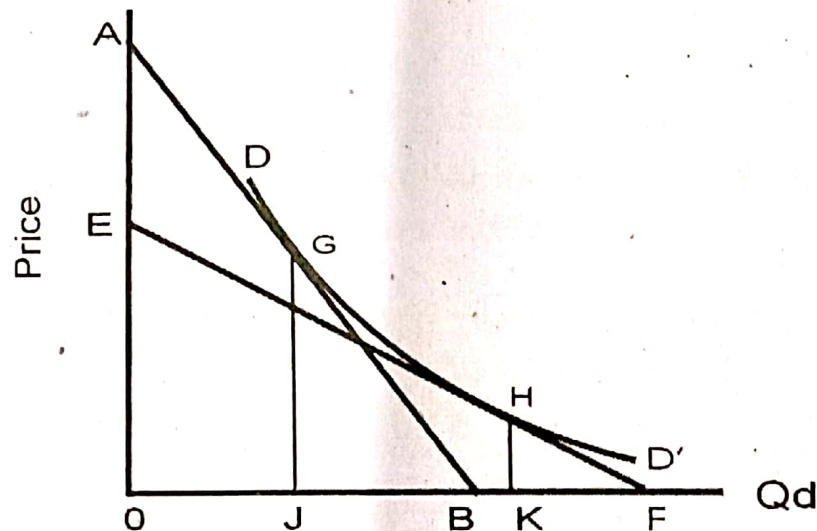
$$E_d = \frac{0}{DD'} = \frac{0}{4} = 0$$

- (v) Within the point M and D'

$$E_d = 1 > E > 0$$

Point Elasticity of demand on a curve

Now we can measure elasticity of demand on different points on a curved demand curve as shown in the figure.



DD is a curved demand line. We want to find point elasticity at point G and H. Draw a tangent AB on point G and a tangent EF on point H. According to horizontal axis formula, draw perpendiculars from point G and H on X-axis. Then

At point G
$$E_d = \frac{GB}{AG}$$

At point G, $GB > AG$. Therefore, elasticity of demand is greater than unity

And at point H $E_d = \frac{HF}{EH}$

At point H, $EH > HF$. Therefore the elasticity of demand is less than unity.

b) Arc elasticity

The proportionate change in the quantity demanded resulting from appreciable proportionate change in price, is called Arc elasticity. In other words, the co-efficient of price elasticity of demand between two points on a demand curve is called Arc elasticity, symbolically, it is written as:

$$\begin{aligned} \text{Arc elasticity of demand} &= \frac{\frac{Q_2 - Q_1}{Q_1 + Q_2}}{\frac{P_2 - P_1}{P_1 + P_2}} \\ &= \frac{Q_2 - Q_1}{Q_1 + Q_2} \times \frac{P_1 + P_2}{P_2 - P_1} = \frac{Q_2 - Q_1}{P_2 - P_1} \times \frac{P_1 + P_2}{Q_1 + Q_2} = \frac{\Delta Q}{\Delta P} \times \frac{P_1 + P_2}{Q_1 + Q_2} \end{aligned}$$

Schedule

P	Q
Rs.3.00	8 Kg
Rs.4.00	6 Kg

$$P_1 = \text{Rs.3.00}$$

$$Q_1 = 8 \text{ Kg}$$

$$P_2 = \text{Rs.4.00}$$

$$Q_2 = 6 \text{ Kg}$$

$$\Delta P = P_2 - P_1 = 4 - 3 = 1$$

$$\Delta Q = Q_2 - Q_1 = 6 - 8 = -2$$

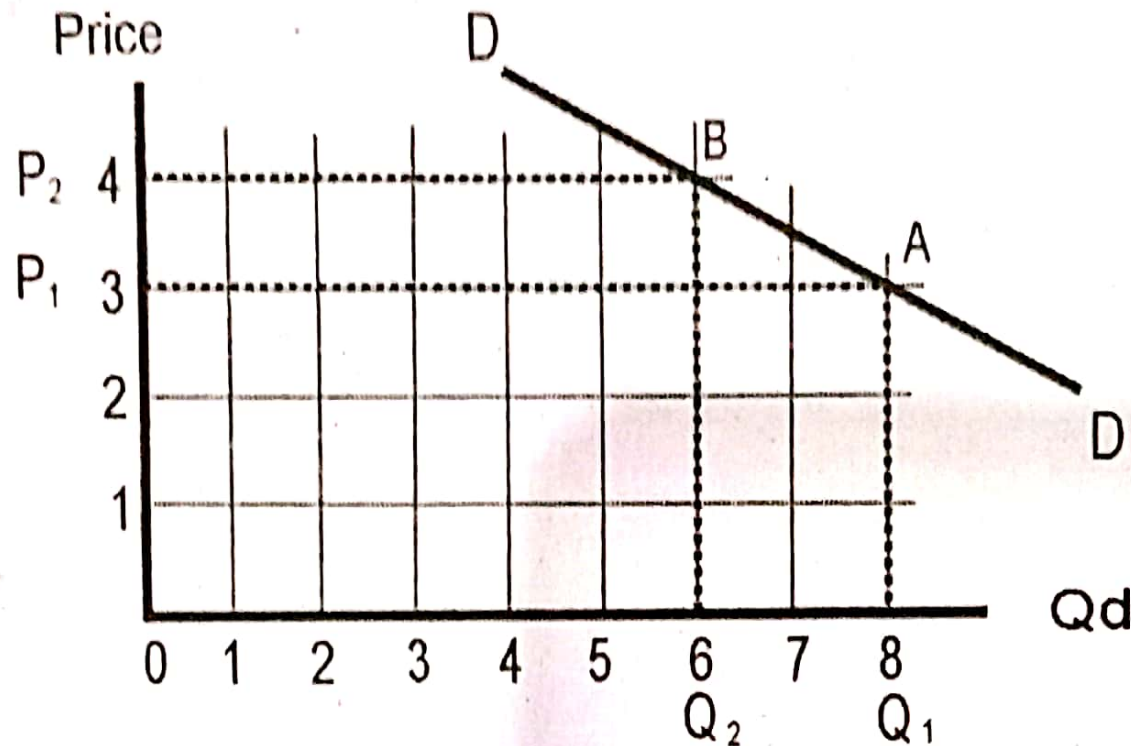
Putting the values in the formula we have:

$$E_d = \frac{\Delta Q}{\Delta P} \times \frac{P_1 + P_2}{Q_1 + Q_2} = \frac{-2}{1} \times \frac{3+4}{8+6} = -1$$

The arc elasticity is equal to unity. The sign of price elasticity is negative, because the slope of demand curve is negative.

The chord connects two points A and B on the demand curve defined by the initial and new levels of price and quantity of the commodity. The measure of Arc elasticity is the elasticity of section AB of the demand

curve as shown in the figure.



Therefore, the Arc elasticity is a measure of the average elasticity of the portion of demand curve which connects the two points A and B. Price is P_1 and Quantity demanded is Q_1 at point A while at point B, Price and quantity demanded P_2 and Q_2 . The values of these points are substituted in the formula and the elasticity of demand is equal to unity.