

Introduction :

In the previous chapter you have already studied the law of demand which shows the inverse relationship between quantity demanded and price of a commodity. The law of demand does not explain the extent of a change in demand due to a change in the price. Thus, law of demand fails to explain the quantitative relationship between price and quantity demanded. Therefore, Prof. Alfred Marshall explained the concept of elasticity of demand.

Concept of Elasticity of Demand :

The term elasticity indicates responsiveness of one variable to a change in the other variable. Elasticity of demand refers to the degree of responsiveness of quantity demanded to a change in its price or any other factor.

According to Prof. Marshall, “Elasticity of demand is great or small according to the amount demanded which rises much or little for a given fall in price and quantity demanded falls much or little for a given rise in price.”

It is clear from the above definition that elasticity of demand is a technical term which describes the responsiveness of change in quantity demanded to fall or rise in its price. In other words, it is the ratio of percentage change in quantity demanded of a commodity to a percentage change in price.

Types of Elasticity of Demand :

- 1) Income elasticity
- 2) Cross elasticity
- 3) Price elasticity

1) Income elasticity : It refers to the degree of responsiveness of a change in quantity demanded to a change in the income only, other factors including price remain

unchanged. It is expressed as :

$$E_y = \frac{\text{Percentage change in Qty. Demanded}}{\text{Percentage change in Income}}$$

Symbolically,

$$\begin{aligned} E_y &= \frac{\% \Delta Q}{\% \Delta Y} \\ &= \frac{\Delta Q}{Q} \div \frac{\Delta Y}{Y} \\ &= \frac{\Delta Q}{Q} \times \frac{Y}{\Delta Y} \end{aligned}$$

Where,

Δ = Represents change

Q = Original demand

Y = Original income

ΔQ = Change in quantity demanded

ΔY = Change in income of a consumer

You should know :

- **Positive income elasticity**

Normal goods for which demand increases with increase in income.

- **Negative income elasticity**

Inferior or goods for which demand decreases with increase in income of consumer.

- **Zero income elasticity**

Necessary goods for which demand remains constant with increase in income of the consumer.

- 2) Cross elasticity :** It refers to a change in quantity demanded of one commodity due to a change in the price of other commodity. (Complementary goods or substitutes)

$$E_c = \frac{\text{Percentage change in Qty. demanded of A}}{\text{Percentage change in Price of B}}$$

(A = Original commodity, B = Other commodity)

$$\begin{aligned}\text{Symbolically, } E_c &= \frac{\% \Delta Q_A}{\% \Delta P_B} \\ &= \frac{\Delta Q_A}{Q_A} \div \frac{\Delta P_B}{P_B} \\ &= \frac{\Delta Q_A}{Q_A} \times \frac{P_B}{\Delta P_B}\end{aligned}$$

Where,

Q_A = Original quantity demanded of commodity A

ΔQ_A = Change in quantity demanded of commodity A

P_B = Original price of commodity B

ΔP_B = Change in price of commodity B

You should know :

- Positive cross elasticity : Substitute goods. Example, tea and coffee.
- Negative cross elasticity : Complementary goods. Example, tea and sugar.
- Zero cross elasticity : Non-related goods. Example, tea and books.

3) Price elasticity : According to Prof. Alfred Marshall, price elasticity of demand is a ratio of proportionate change in the quantity demanded of a commodity to a given proportionate change in its price.

$$Ed = \frac{\text{Percentage change in Quantity Demanded}}{\text{Percentage change in Price}}$$

$$\text{Symbolically, } Ed = \frac{\% \Delta Q}{\% \Delta P},$$

$$Ed = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P}$$

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

Where,

Q = Original quantity demanded

ΔQ = Difference between the new quantity and original quantity demanded

P = Original price

ΔP = Difference between new price and original

price

Types of Price Elasticity of Demand :

1) Perfectly Elastic Demand ($Ed = \infty$) :

When a slight or zero change in the price brings about an infinite change in the quantity demanded of that commodity, it is called perfectly elastic demand. It is only a theoretical concept. For example, 10% fall in price may lead to an infinite rise in demand.

$$Ed = \frac{\text{Percentage change in Quantity Demanded}}{\text{Percentage change in Price}} = \infty$$

$$Ed = \infty$$

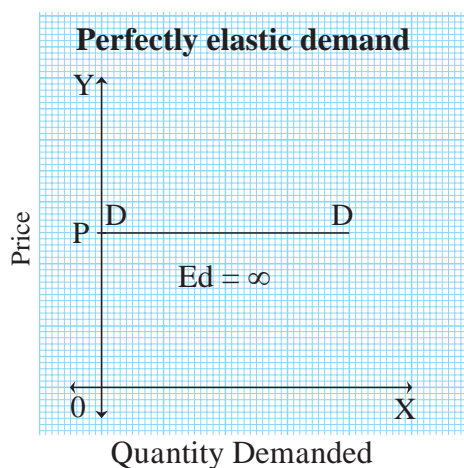


Fig. 3.11

In figure 3.11, the demand curve is a horizontal line parallel to the X axis indicating perfectly elastic demand.

2) Perfectly inelastic demand ($Ed = 0$) :

When a percentage change in price has no effect on the quantity demanded of a commodity it is called perfectly inelastic demand. For example, 20% fall in price will have no effect on quantity demanded.

$$Ed = \frac{\% \Delta Q}{\% \Delta P}$$

$$Ed = \frac{0}{20} = 0$$

$$Ed = 0$$

In practice, such a situation rarely occurs. For example, demand for salt, milk.

Perfectly inelastic demand $E_d = 0$

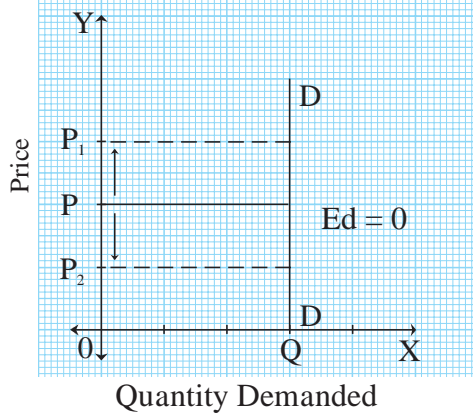


Fig. 3.12

In figure 3.12, when price rises from OP to OP_1 or when price falls from OP to OP_2 , demand remains unchanged at OQ . Therefore, the demand curve is a vertical straight line parallel to the Y axis, indicating perfectly inelastic demand.

3) Unitary elastic demand ($E_d = 1$) :

When a percentage change in price leads to a proportionate change in quantity demanded then demand is said to be unitary elastic. For example, 50% fall in price of a commodity leads to 50% rise in quantity demanded.

$$E_d = \frac{\% \Delta Q}{\% \Delta P} = \frac{50}{50} = 1 \quad \therefore E_d = 1$$

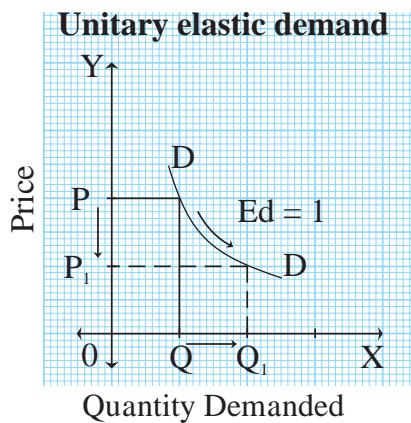


Fig. 3.13

In figure 3.13, when price falls from OP to OP_1 (50%), demand rises from OQ to OQ_1 (50%). Therefore, the slope of the demand curve is a 'rectangular hyperbola'.

4) Relatively elastic demand ($E_d > 1$) :

When a percentage change in price leads to

more than proportionate change in quantity demanded, the demand is said to be relatively elastic. For example, 50% fall in price leads to 100% rise in quantity demanded.

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

$$E_d = \frac{100}{50} \quad \therefore E_d = 2$$

$$E_d > 1$$

Relatively elastic demand

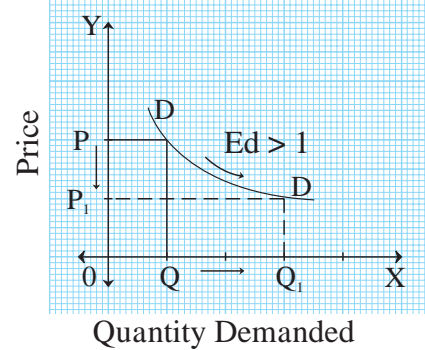


Fig. 3.14

In figure 3.14, when price falls from OP to OP_1 (50%), demand rises from OQ to OQ_1 (100%). Therefore, the demand curve has a flatter slope.

5) Relatively inelastic demand ($E_d < 1$) :

When a percentage change in price leads to less than proportionate change in the quantity demanded, demand is said to be relatively inelastic. For example, 50% fall in price leads to 25% rise in quantity demanded.

$$E_d = \frac{\% \Delta Q}{\% \Delta P} = \frac{25}{50} = 0.5$$

$$E_d = 0.5 \quad \therefore E_d < 1$$

Relatively inelastic demand. $E_d < 1$

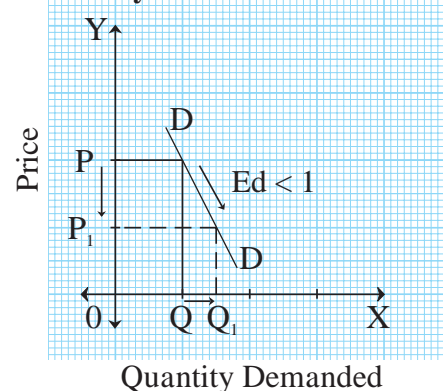


Fig. 3.15

In figure 3.15, when price falls from OP to OP₁ (50%), demand rises from OQ to OQ₁ (25%). Therefore, the demand curve has a steeper slope.

Find out :

Identify the type of price elasticity of demand for the following goods.

- 1) Cosmetics 2) Medicine
- 3) School uniform 4) Air conditioners

Try this :

Complete the table

Sr. No.	Degree of elasticity of demand	Types of elasticity of demand	Description Percentage
1		Perfectly inelastic	Change in price does not affect demand at all.
2	Ed = 1		Change in demand is equal to change in price
3	Ed > 1	Relatively elastic	
4		Relatively inelastic	Change in demand is less than change in price
5	Ed = ∞		Slight change in price brings infinite change in demand.

Methods of Measuring Price Elasticity of Demand :

- 1) **Ratio or Percentage method** : Ratio method is developed by Prof. Marshall. According to this method, elasticity of demand is measured by dividing the percentage change in demand by the percentage change

in price. Percentage method is also known as Arithmetic method. Price elasticity is measured as :

$$Ed = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in Price}}$$

$$Ed = \frac{\% \Delta Q}{\% \Delta P}$$

Mathematically, the above formula can be presented as under.

$$Ed = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P} \therefore Ed = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P}$$

Numerical example :

Price (₹)	Qty. Demanded (in Kg)	Formula
20	10	$Ed = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P}$
25	09	

Original Price, P = 20, New price P = 25

ΔP = 5 (Difference between new and original price)

Original Quantity Demanded, Q = 10, New demand = 9

ΔQ = 1 (Difference between new and original quantity demanded)

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

$$Ed = \frac{1}{10} \times \frac{20}{5}$$

$$Ed = 0.4$$

$$Ed < 1$$

It means elasticity of demand is relatively inelastic.

Do you know?

While using percentage method of measuring price elasticity of demand we must keep following points in our mind :

- 1) Value of elasticity of demand is negative because of the negative slope of demand curve but for the sake of simplicity we ignore negative sign.

- 2) Price elasticity of demand is a pure number. It does not depend upon units in which price of the commodity and its quantity are measured.

2) Total Expenditure Method : This method was developed by Prof. Marshall. In this method, total amount of expenditure before and after the price change is compared.

Here the total expenditure refers to the product of price and quantity demanded.

$$\text{Total expenditure} = \text{Price} \times \text{Quantity demanded}$$

In this connection, Marshall has given the following propositions :

A) Relatively elastic demand ($E_d > 1$) :

When with a given change in the price of a commodity total outlay increases, elasticity of demand is greater than one.

B) Unitary elastic demand ($E_d = 1$) :

When price falls or rises, total outlay does not change or remains constant, elasticity of demand is equal to one.

C) Relatively inelastic demand ($E_d < 1$) :

When with a given change in price of a commodity total outlay decreases, elasticity of demand is less than one.

This can be explained with the help of the following example.

Table 3.4 : Total outlay method

	Price in ₹ (P)	Quantity demanded in units (Q)	Total outlay (P×Q) ₹	Elasticity of demand
A	10	6	60	$E_d > 1$
	20	5	100	
B	30	4	120	$E_d = 1$
	40	3	120	
C	50	2	100	$E_d < 1$
	60	1	60	

In table 3.4 in example 'A' original price is

₹ 10 per unit and quantity demanded is 6 units. Therefore, total expenditure incurred is ₹ 60. When price rises to ₹ 20 quantity demanded falls to 5 units, the total expenditure incurred is ₹ 100. In this case, total outlay is greater than original expenditure. Hence, in this example elasticity of demand is greater than one. ($E_d > 1$) that is relatively elastic demand.

In example 'B', original price is ₹ 30 per unit and quantity demanded is 4 units. Therefore total expenditure is ₹ 120. When price rises to ₹ 40 quantity demanded falls to '3' units. Total expenditure incurred is ₹ 120. In this case total outlay is same (equal) to original expenditure. Hence, in this example, elasticity of demand is equal to one ($E_d = 1$) that is unitary elastic demand.

In example 'C', original price is ₹ 50 per unit and quantity demanded is 2 units. Therefore total expenditure is ₹ 100. When price rises to ₹ 60, quantity demand falls to 1 unit and total expenditure incurred is ₹ 60. In this case total outlay is less than original expenditure. Hence, elasticity of demand is less than one ($E_d < 1$) that is relatively inelastic demand.

Find out :

As the price of peanut packets increases by 5% the demand for number of peanut packets falls by 8%. What is the elasticity of demand for peanut packets?

Apply the formula, $E_d = \frac{\% \Delta Q}{\% \Delta P}$

3) Point method or Geometric Method :

Prof. Marshall has developed another method to measure elasticity of demand, which is known as point method or geometric method. The ratio method and total outlay methods are unable to measure elasticity of demand at a given point on the demand curve.

At any point on the demand curve, elasticity of demand is measured with the help of the following formula :

$$\text{Point elasticity of demand (Ed)} = \frac{\text{Lower segment of demand curve below a given point (L)}}{\text{Upper segment of demand curve above a given point (U)}}$$

Demand curve may be either linear or non-linear as shown below :

A) Linear Demand Curve : When the demand curve is linear i.e. a straight line, we extend the demand curve to meet the Y axis at 'A' and X axis at 'B'. Price elasticity of demand at 'X' axis is zero and 'Y' axis is infinite. Elasticity of demand will be different at each point.

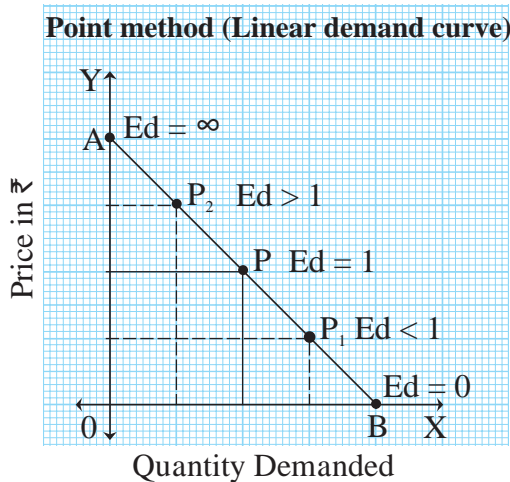


Fig. 3.16

Let us assume that AB is a demand curve and its length is 8 cm. Point elasticity at various points on a linear demand curve can be measured as follows :

- At point P, the point elasticity is measured as :

$$P = \frac{PB}{PA} = \frac{4}{4} = 1$$
 Thus, at point P, demand is unitary elastic (ed = 1)
- At point P₁, the point elasticity is measured as :

$$P_1 = \frac{P_1B}{P_1A} = \frac{2}{6} = 0.33$$

Thus, at point P₁, demand is relatively inelastic (ed < 1)

- At point P₂, the point elasticity is measured as :

$$P_2 = \frac{P_2B}{P_2A} = \frac{6}{2} = 3$$
 Thus, at point P₂, demand is relatively elastic (ed > 1)
- At point A, the point elasticity is ∞ because upper segment is zero. (perfectly elastic demand)
- At point B, the point elasticity is zero because lower segment is zero (perfectly inelastic demand.)

B) Non-linear demand curve : When the demand curve is non-linear i.e. convex to origin, to measure price elasticity of demand we have to draw a tangent 'AB' touching the given point on the demand curve and extending it to meet 'Y' axis at point 'A' and 'X' axis at point 'B'.

$$Ed = \frac{\text{Lower segment of the tangent below a given point}}{\text{Upper segment of the tangent above a given point}} = \frac{L}{U}$$

Point method - Non-linear demand curve

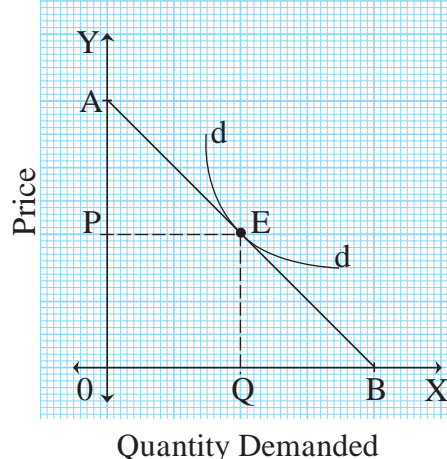


Fig. 3.17

If EB = EA (Ed = 1) - Unitary elastic demand
 EB > EA (Ed > 1) - Relatively elastic demand
 EB < EA (Ed < 1) - Relatively inelastic demand

Factors influencing the elasticity of demand :

Elasticity of demand depends upon several factors which are discussed below :

- 1) **Nature of commodity** : By nature we can classify commodities as necessities, comforts and luxury goods. Demand for necessities like foodgrains, medicines, textbooks etc. is relatively inelastic and for comforts and luxury goods like cars, perfumes, furniture etc. demand is relatively elastic.
- 2) **Availability of substitutes** : Demand for a commodity will be more elastic, if its close substitutes are available in the market. For example, lemon juice, sugarcane juice etc. But commodities having no close substitutes like salt the demand will be inelastic.
- 3) **Number of uses** : Single use goods have a less elastic demand. Multi-use goods have more elastic demand, For example, coal, electricity etc.
- 4) **Habits** : Habits make demand for certain goods relatively inelastic. For example, addicted goods, drugs etc.
- 5) **Durability** : The demand for durable goods is relatively elastic. For example, furniture, washing machine etc. Demand for perishable goods is inelastic. For example, milk, vegetables etc.
- 6) **Complementary goods** : The demand for a commodity which is used in conjunction with other commodities to satisfy a single want is relatively inelastic. For example, a fall in the price of mobile handsets may lead to rise in the demand for sim cards.
- 7) **Income of the consumer** : Demand for goods is usually inelastic, if the consumer has high income. The demand pattern of a very rich and an extremely poor person is rarely affected by significant changes in the price.

8) **Urgency of needs** : Goods which are urgently needed will have relatively inelastic demand. For example, medicines. Luxury goods which are less urgent have relatively elastic demand.

9) **Time period** : Elasticity of demand is always related to period of time. It varies with the length of time period. Generally speaking, longer the duration of period greater will be the elasticity of demand and vice-versa. This is because a consumer can change the consumption habits in the long run in favour of cheaper substitutes of the commodities.

You should know :

Determinants	Nature	Price elasticity of demand
1) Availability of factors	a) Abundant	a) Relatively elastic
	b) Few	b) Relatively inelastic
2) Nature of commodity	a) Necessary goods	a) Relatively inelastic
	b) Luxury goods	b) Relatively elastic
3) Habits	a) Habituated	a) Relatively inelastic
	b) Not Habituated	b) Relatively elastic
4) Time period	a) Short-run	a) Relatively inelastic
	b) Long-run	b) Relatively elastic
5) Postpone-ment of consumption	a) Possibility of Postpone-ment	a) Relatively elastic
	b) Impossible to Postpone	b) Relatively inelastic
6) Number of uses of a commodity	a) Several	a) Relatively elastic
	b) Specific	b) Relatively inelastic

Importance of Elasticity of Demand :

The concept of elasticity of demand is of great importance to producers, farmers, workers and the Government. Lord Keynes considered this concept to be the most important contribution of Alfred Marshall. Significance of the concept becomes clear from the following applications :

- 1) **Importance to a Producer :** Every producer has to decide the price of his product at which he has to sell it. For this purpose, elasticity of demand becomes important. If the demand for a product is relatively inelastic, he will fix up a higher price and vice-versa. The concept of elasticity of demand is also useful to a monopolist to practice price discrimination.
- 2) **Importance to Government :** Taxation policy of the Government is based on the concept of elasticity of demand. Those commodities whose demand is relatively inelastic will be taxed more because it will not affect their demand much and vice-versa.
- 3) **Important in Factor Pricing :** The concept of elasticity of demand is useful in determination of factor prices. The factor of production for which demand is relatively inelastic can command a higher price as compared to those having elastic demand. For example, workers can ask for higher wages, if the demand for the product produced by them is relatively inelastic.
- 4) **Importance in Foreign Trade :** The concept of elasticity of demand is useful to determine terms and conditions in foreign trade. The countries exporting commodities for which demand is relatively inelastic can raise their prices. For example, Organization of Petroleum Exporting Countries (OPEC) have increased the price of oil several times. The concept is also useful in formulating export and import policy of a country.
- 5) **Public Utilities :** In case of public utilities like railways which have an inelastic demand, Government can either subsidise or nationalise them to avoid consumers exploitation.
- 6) **Proportion of expenditure :** If the proportion of expenditure in a person's income is small, then demand for the product is relatively inelastic. For example, news papers. If the proportion of expenditure is large, then demand for the product is relatively elastic.

EXERCISE

Q. 1. Complete the following statements :

- 1) Price elasticity of demand on a linear demand curve at the X axis is
 - a) zero
 - b) one
 - c) infinity
 - d) less than one
- 2) Price elasticity of demand on a linear demand curve at the Y-axis is equal to
 - a) zero
 - b) one
 - c) infinity
 - d) greater than one
- 3) Demand curve is parallel to X axis, in case of
 - a) perfectly elastic demand
 - b) perfectly inelastic demand
 - c) relatively elastic demand
 - d) relatively inelastic demand
- 4) When percentage change in quantity demanded is more than the percentage change in price, the demand curve is
 - a) flatter
 - b) steeper
 - c) rectangular
 - d) horizontal

5) $E_d = 0$ in case of

- a) luxuries
- b) normal goods
- c) necessities
- d) comforts

Q. 2. Give economic terms :

- 1) Degree of responsiveness of quantity demanded to change in income only.
- 2) Degree of responsiveness of a change in quantity demanded of one commodity due to change in the price of another commodity.
- 3) Degree of responsiveness of a change of quantity demanded of a good to a change in its price.
- 4) Elasticity resulting from infinite change in quantity demanded.
- 5) Elasticity resulting from a proportionate change in quantity demanded due to a proportionate change in price.

Q. 3. Complete the correlation :

- 1) Perfectly elastic demand : $E_d = \infty$:: : $E_d = 0$
- 2) Rectangular hyperbola : : Steeper demand curve : Relatively inelastic demand.
- 3) Straight line demand curve : Linear demand curve :: : non linear demand curve.
- 4) Pen and ink : :: Tea and Coffee: Substitutes.
- 5) Ratio method : $E_d = \frac{\% \Delta Q}{\% \Delta P}$:: : $E_d =$
Lower segment
Upper segment

Q. 4. Assertion and Reasoning type questions :

- 1) **Assertion (A) :** Elasticity of demand explains that one variable is influenced by another variable.
Reasoning (R) : The concept of elasticity of demand indicates the effect of price and changes in other factors on demand.

Options : 1) (A) is True, but (R) is False

2) (A) is False, but (R) is True

- 3) Both (A) and (R) are True and (R) is the correct explanation of (A)
- 4) Both (A) and (R) are True and (R) is not the correct explanation of (A)

- 2) **Assertion (A) :** A change in quantity demanded of one commodity due to a change in the price of other commodity is cross elasticity.

Reasoning (R) : Changes in consumers income leads to a change in the quantity demanded.

Options : 1) (A) is True, but (R) is False

- 2) (A) is False, but (R) is True
- 3) Both (A) and (R) are True and (R) is the correct explanation of (A)
- 4) Both (A) and (R) are True and (R) is not the correct explanation of (A)

- 3) **Assertion (A) :** Degree of price elasticity is less than one in case of relatively inelastic demand.

Reasoning (R) : Change in demand is less than the change in price.

Options : 1) (A) is True, but (R) is False

- 2) (A) is False, but (R) is True
- 3) Both (A) and (R) are True and (R) is the correct explanation of (A)
- 4) Both (A) and (R) are True and (R) is not the correct explanation of (A)

Q. 5. Distinguish between :

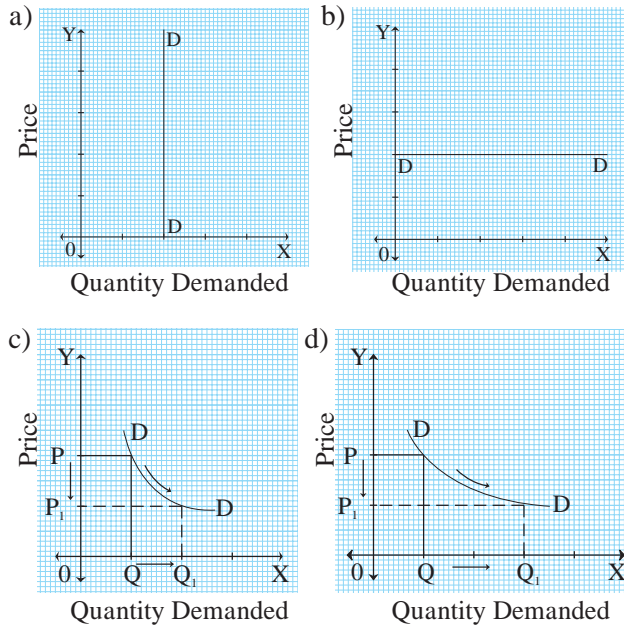
- 1) Relatively elastic and Relatively inelastic demand.
- 2) Perfectly elastic demand and Perfectly inelastic demand.

Q. 6. Answer the following questions :

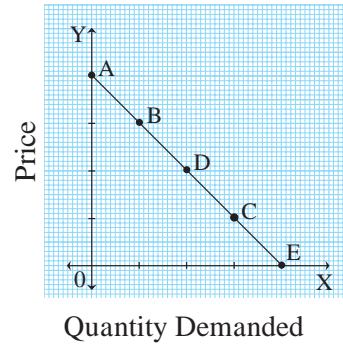
- 1) Explain the factors influencing elasticity of demand.
- 2) Explain the total outlay method of measuring elasticity of demand?
- 3) Explain importance of elasticity of demand.

Q. 7. Observe the following figure and answer the questions :

- 1) Identify and define the degrees of elasticity of demand from the following demand curves.



- 2) In the following diagram AE is the linear demand curve of a commodity. On the basis of the given diagram state whether the following statements are True or False. Give reasons to your answer.



- 1) Demand at point 'C' is relatively elastic demand.
- 2) Demand at point 'B' is unitary elastic demand.
- 3) Demand at point 'D' is perfectly inelastic demand.
- 4) Demand at point 'A' is perfectly elastic demand.

