All Giffen goods are inferior goods, but all inferior goods are not Giffen goods.

- All Giffen goods are inferior goods because all Giffen goods have negative income effect.
- However, all inferior goods are not Giffen goods because all inferior goods do not have dominating negative income effect, i.e. negative income effect is not stronger than positive substitution effect in case of all inferior goods.

So, it is rightly said that all Giffen goods are inferior goods, but all inferior goods are not Giffen goods.

Comparison between 'Normal Goods', 'Inferior Goods' and 'Giffen Goods'

Basis	Normal Goods	Inferior Goods	Giffen Goods
Substitution Effect	It is Positive.	It is Positive	It is Positive
Income Effect	It is Positive.	It is Negative.	It is Negative.
Price Effect	It is Positive as both the substitution and income effects are positive. So, demand for normal good rises with fall in its price.	It is Positive as Positive Substitution Effect is stronger than Negative Income Effect. So, its demand rises with fall in its price.	It is Negative as Negative Income Effect is stronger than Positive Substitution Effect. As a result, its demand falls with fall in its price.
Law of Demand	It applies, i.e. their demand curve slope downwards.	It applies, i.e. their demand curve slope downwards.	It does not apply, i.e. their demand curve slope upwards.
Example	**'Pepsi'** is a Normal good if with fall in its price: • *Positive Substitution Effect* increases its demand as it becomes relatively cheaper as compared to its substitute (say, coke); and • *Positive Income Effect* increases its demand due to rise in real income.	**'Amul Toned Milk'** is an Inferior good if with fall in its price: • *Positive Substitution Effect* increases its demand as it becomes relatively cheaper as compared to its substitute (say, Mother dairy Toned milk); and • *Negative Income Effect* reduces its demand as increased real income induces consumer to shift to superior commodities (say, Amul full cream milk). *The positive substitution effect is stronger than negative income effect. As a result, demand for 'Amul Toned Milk' rises with fall in its price.*	**'Jowar'** is a Giffen good if with fall in its price: • *Positive Substitution Effect* increases its demand as it becomes relatively cheaper as compared to its substitute. • *Negative Income Effect* reduces its demand as increased real income induces the consumer to shift to superior commodities (say, rice). *The negative income effect is stronger than positive substitution effect. As a result, demand for 'Jowar' falls with fall in its price.*

4

ELASTICITY OF DEMAND

LEARNING OBJECTIVES

4.1 INTRODUCTION

4.2 CONCEPT OF ELASTICITY OF DEMAND

4.3 PRICE ELASTICITY OF DEMAND

4.4 PERCENTAGE METHOD FOR MEASURING PRICE ELASTICITY OF DEMAND

4.5 DEGREES OF ELASTICITIES OF DEMAND

4.6 FACTORS AFFECTING PRICE ELASTICITY OF DEMAND

4.7 SOLVED PRACTICALS

4.1 INTRODUCTION

In the previous chapter, we studied that according to 'Law of Demand', quantity demanded increases with fall in price and decreases with rise in price. The law of demand gives us the direction of change in the quantity demanded as a result of a change in price, but it does not specify the magnitude, amount or the extent by which the quantity demanded changes with a change in its price. *In brief, it does not indicate, 'how much change' in the quantity demanded due to change in price.* Therefore, the concept of 'Elasticity of Demand' was developed to measure the magnitude of change in the quantity demanded.

For More Clarity

Suppose, price of computer falls by 20%.
- According to Law of demand, the quantity of computers demanded will increase due to fall in its price. However, it does not indicate, by how much quantity demanded of computers will increase.
- In such cases, the concept of Elasticity of Demand becomes important as it helps in knowing "how much".

The concept of elasticity was developed by Prof. Marshall in his book 'Principles of Economics'. Now-a-days, this concept has great importance in economic theory as well as in applied economics.

Let us discuss the concept of elasticity of demand in detail:

4.2 CONCEPT OF ELASTICITY OF DEMAND

Demand for a commodity is affected by a number of factors like change in its own price, change in the income of consumer, change in the prices of related goods, etc. *Elasticity of demand refers to the percentage change in demand for a commodity with respect to percentage change in any of the factors affecting demand for that commodity.*

Elasticity of demand can be calculated as:

$$\text{Elasticity of Demand} = \frac{\text{Percentage Change in Demand for X}}{\text{Percentage Change in a factor affecting the Demand for X}}$$

Out of various determinants of demand, there are 3 quantifiable determinants of demand: (1) Price of the given commodity; (2) Price of related goods; (3) Income of the consumer. So, we have 3 dimensions of elasticity of demand:

1. **Price elasticity of demand:** Price elasticity of demand refers to the percentage change in demand for a commodity with respect to percentage change in the price of the given commodity.

2. **Cross elasticity of demand:** Cross elasticity of demand refers to the percentage change in demand for a commodity with respect to percentage change in the price of a related good (substitute good or complementary good).

3. **Income elasticity of demand:** Income elasticity of demand refers to the percentage change in demand for a commodity with respect to percentage change in the income of consumer.

Cross and Income Elasticity of Demand are beyond the scope of Class XIIth *syllabus. So, present chapter deals with 'Price Elasticity of Demand'.*

4.3 PRICE ELASTICITY OF DEMAND

Price Elasticity of Demand means the degree of responsiveness of demand for a commodity with reference to change in the price of such commodity. For example, if price elasticity of demand is (-) 2, it means that one percent fall in price leads to 2 percent rise in demand or one percent rise in price leads to 2 percent fall in demand.

Some Noteworthy Points about Price Elasticity of Demand

- *It establishes a quantitative relationship* between quantity demanded of a commodity and its price, while other factors remain constant.
- Higher the numerical value of elasticity, larger is the effect of a price change on the quantity demanded.
- For certain goods, a change in price leads to a greater change in the demand, whereas, in some cases, there is a small change in demand due to change in price.
  For example, if prices of two commodities 'x' and 'y' rise by 10% and their demands fall by 20% and 5% respectively, then commodity 'x' is said to be more elastic as compared to commodity 'y'.
- Price is the most important determinant of demand. So, price elasticity of demand is sometimes shortened as 'Elasticity of Demand' or 'Demand Elasticity' or simply 'Elasticity'. Unless otherwise stated, whenever these words are used, they mean 'Price Elasticity of Demand'.

4.4 PERCENTAGE METHOD FOR MEASURING PRICE ELASTICITY OF DEMAND

It is the most common method for measuring price elasticity of demand (E_d). This method was introduced by Prof. Marshall. *This method is also known as 'Flux Method' or 'Proportionate Method' or 'Mathematical Method'.*

According to this method, elasticity is measured as the ratio of percentage change in the quantity demanded to percentage change in the price.

$$\text{Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in Price}}$$

Where:

1. Percentage change in Quantity demanded $= \dfrac{\text{Change in Quantity } (\Delta Q)}{\text{Initial Quantity } (Q)} \times 100$

2. Change in Quantity $(\Delta Q) = Q_1 - Q$

3. Percentage change in Price $= \dfrac{\text{Change in Price } (\Delta P)}{\text{Original Price } (P)} \times 100$

4. Change in Price $(\Delta P) = P_1 - P$

Proportionate Method

The percentage method can also be converted into the proportionate method. Putting the values of 1, 2, 3 and 4 in the formula of percentage method, we get:

$$E_d = \frac{\dfrac{\Delta Q}{Q} \times 100}{\dfrac{\Delta P}{P} \times 100} = \frac{\dfrac{\Delta Q}{Q}}{\dfrac{\Delta P}{P}}$$

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

Where:

Q = Initial Quantity demanded		Q_1 = New Quantity demanded
ΔQ = Change in the Quantity demanded		P = Initial Price
P_1 = New Price		ΔP = Change in Price

Let us understand some important concepts relating to the measurement of price elasticity of demand, with the help of the following illustrations:

Illustration 1. Calculate price elasticity of demand if demand increases from 4 units to 5 units due to fall in price from ₹ 10 to ₹ 8.
Solution:
Elasticity of demand in the given case will be:

$$\text{Elasticity of Demand (E}_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in Price}}$$

$$\text{Percentage change in Quantity demanded} = \frac{\text{Change in Quantity (}\Delta Q)}{\text{Initial Quantity (Q)}} \times 100$$

$$= \frac{(5-4)}{4} \times 100 = 25\%$$

$$\text{Percentage change in Price} = \frac{\text{Change in Price (}\Delta P)}{\text{Initial Price (P)}} \times 100$$

$$= \frac{(8-10)}{10} \times 100 = -20\%$$

$$E_d = \frac{25\%}{-20\%} = -1.25 \quad \text{(or 1.25 as only numerical or absolute value is taken)}$$

Negative Sign may be Ignored

The coefficient of price elasticity of demand is always a negative number (ignoring exceptions to law of demand) because of inverse relationship between price and quantity demanded. So, negative sign is always implied.

However, minus sign is often ignored while writing the value of elasticity. It is more common to say that elasticity is 1.25 than to say that it is (–)1.25. So, negative sign can be ignored and positive number can be easily taken.

Illustration 2. When price rises from ₹ 8 to ₹ 10, the demand falls from 5 units to 4 units. Now, elasticity of demand will be:

$$\text{Elasticity of Demand (E}_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage Change in Price}}$$

$$\text{Percentage change in Quantity demanded} = \frac{\text{Change in Quantity (}\Delta Q)}{\text{Initial Quantity (Q)}} \times 100$$

$$= \frac{(4-5)}{5} \times 100 = -20\%$$

$$\text{Percentage change in Price} = \frac{\text{Change in Price (}\Delta P)}{\text{Initial Price (P)}} \times 100 = \frac{(10-8)}{8} \times 100 = 25\%$$

$$E_d = \frac{-20\%}{25\%} = -0.8$$

Important Observations about Illustration 1 and 2

1. **Always consider the Absolute Values:** Elasticity should always be measured and compared in absolute terms (ignoring the negative sign), not in algebraic terms. So, elasticity of – 1.25 in the 1st illustration is taken to be higher than – 0.8 in the 2nd illustration.

One More Example: Suppose, E_d of two goods X and Y are (–) 3 and (–) 4 respectively. In such a case, Good Y is more elastic because one percent change in price results in 4 percent change in demand for Y, while only 3 percent change in demand for good X.

2. **Elasticity is affected by percentage change:** Price elasticity of demand is not affected by absolute change in demand or price. Rather, its value is influenced by percentage change in price or demand.

   For example, in both 1st and 2nd illustration, change in quantity demanded (1 unit) and change in price (₹ 2) is same. However, price elasticity in the 1st illustration (– 1.25) is different from that in the 2nd illustration (– 0.8). It happens because in the 1st illustration, demand changes by 25% and price changes by 20%, whereas, in the 2nd illustration, demand changes by 20% and price changes by 25%.

Elasticity is a 'Unit Free' measure

- The coefficient of price elasticity of demand is a pure number and is independent of price and quantity units.
- It means, elasticity is not affected whether the quantity demanded is measured in kilograms or tonnes and whether price is measured in rupees or dollars.
- It happens because elasticity considers percentage change in price and quantity demanded.

So, we can easily compare price sensitivity of inexpensive goods like needle and that of expensive goods like gold.

4.5 DEGREES OF ELASTICITIES OF DEMAND

When prices of different commodities change, the quantity demanded of each commodity reacts in a different manner. *For example,* demand of medicines or needle responds very less to a change in price as compared to AC or DVD Player. *So, degree of responsiveness of quantity demanded to a change in price may differ and hence, elasticity of demand could also differ.*

Price Elasticity of demand can be expressed in terms of numerical value, which ranges from zero to infinity. Let us discuss the various kinds of price elasticities of demand:

1. **Perfectly Elastic Demand:** ***When there is an infinite demand at a particular price and demand becomes zero with a slight rise in the price, then demand for such a commodity is said to be perfectly elastic.*** In such a case, $E_d = \infty$ and demand curve DD is a horizontal straight line parallel to X-axis as shown in **Fig. 4.1**.

Fig. 4.1

Table 4.1: Perfectly Elastic Demand

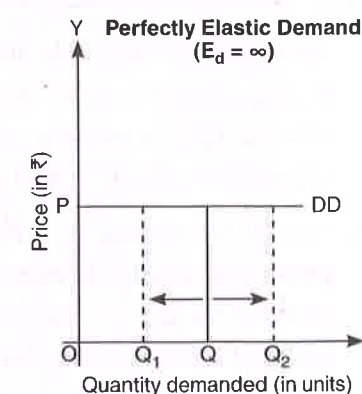| Price (in ₹)	Demand (in units)
30	100
30	200
30	300

As seen in the schedule, the quantity demanded can be 100 units, 200 units, 300 units and so on at the same price of ₹ 30. In **Fig. 4.1**, the quantity demanded can be OQ or OQ₁ or OQ₂ at the same price of OP.

It must be noted that perfectly elastic demand is an imaginary situation.

2. Perfectly Inelastic demand: *When there is no change in demand with change in price, then demand for such a commodity is said to be perfectly inelastic.* In such a case, $E_d = 0$ and the demand curve DD is a vertical straight line parallel to Y-axis as shown in **Fig. 4.2**.

Table 4.2: Perfectly Inelastic Demand

Price (in ₹)	Demand (in units)
20	100
30	100
40	100

Perfectly Inelastic Demand ($E_d = 0$)

Fig. 4.2

As seen in the schedule, the quantity demanded remains constant at 100 units, whether the price is ₹ 20, ₹ 30 or ₹ 40. In **Fig. 4.2**, the quantity demanded remains constant at OQ as the price changes from OP to OP_1 or OP_2.

It must be noted that perfectly inelastic demand is an imaginary situation.

3. Highly Elastic demand: *When percentage change in the quantity demanded is more than percentage change in price, then demand for such a commodity is said to be highly elastic.* In such a case, $E_d > 1$. The highly elastic demand curve is flatter and its slope is inclined more towards X-axis, as shown in **Fig. 4.3**.

Table 4.3: Highly Elastic Demand

Price (in ₹)	Demand (in units)
20	100
10	200

Highly Elastic Demand ($E_d > 1$)

Fig. 4.3

As seen in the schedule, the quantity demanded rises by 100% due to a 50% fall in price. In **Fig. 4.3**, the quantity demanded rises from OQ to OQ_1 with a fall in price from OP to OP_1. As QQ_1 is proportionately more than PP_1, the elasticity of demand is more than 1. *Commodities like AC, DVD player, etc. generally have highly elastic demand.*

4. Less Elastic demand: *When percentage change in the quantity demanded is less than percentage change in price, then demand for such a commodity is said to be less elastic or inelastic.* In such a case, $E_d < 1$. The less elastic demand curve is steeper and its slope is inclined more towards Y-axis, as shown in **Fig. 4.4.**

Table 4.4: Less Elastic Demand

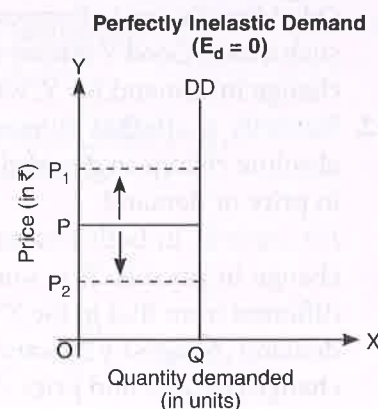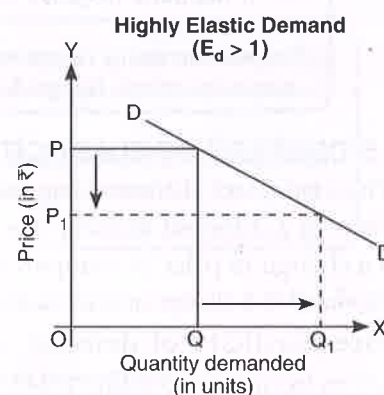| Price (in ₹)	Demand (in units)
20	100
10	120

As seen in the schedule, the quantity demanded rises by just 20% due to a 50% fall in the price. In **Fig. 4.4**, the quantity demanded rises from OQ to OQ_1 with a fall in price from OP to OP_1. QQ_1 is proportionately less than PP_1, so the elasticity of demand is less than 1. *Commodities like salt, vegetables, etc. generally have less elastic demand.*
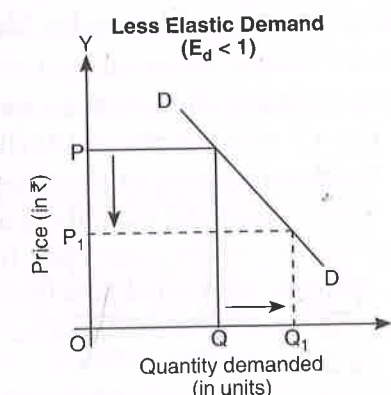
Less Elastic Demand ($E_d < 1$)

Fig. 4.4

5. Unitary Elastic Demand: *When percentage change in the quantity demanded is equal to percentage change in price, then demand for such a commodity is said to be unitary elastic.* In this case, $E_d = 1$ and the demand curve is a rectangular hyperbola. *Rectangular hyperbola is a curve under which the total area at all points will be the same.* It means, in **Fig. 4.5,** area of $OPLQ$ is equal to the area of OP_1RQ_1.

Table 4.5: Unitary Elastic Demand

Price (in ₹)	Demand (in units)
20	100
10	150

Unitary Elastic Demand ($E_d = 1$)

Fig. 4.5

As seen in the schedule, the quantity demanded rises by 50% with a 50% fall in the price. In **Fig. 4.5**, the quantity demanded rises from OQ to OQ_1 with a fall in price from OP to OP_1. As QQ_1 is proportionately equal to PP_1, the elasticity of demand is equal to one.

Commodities like scooter, refrigerator, etc. generally have unitary elastic demand.
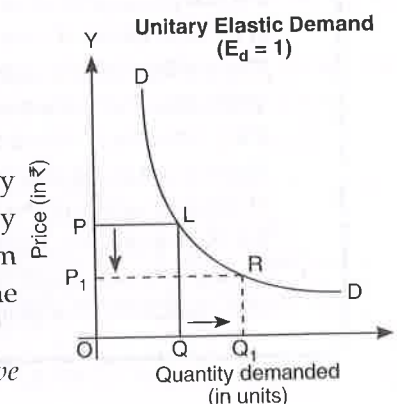
Quick Recap – Coefficients of E_d

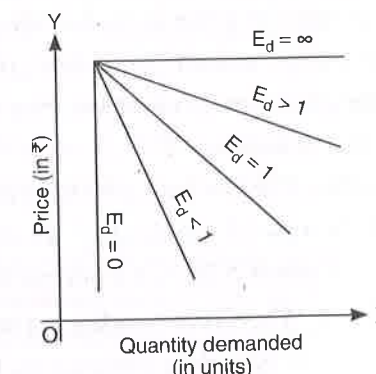| Type	Value	Description
Perfectly Elastic	($E_d = \infty$)	Infinite demand at same price
Perfectly Inelastic	($E_d = 0$)	Same demand at all prices
Highly Elastic	($E_d > 1$)	% Δ in Demand > % Δ in Price
Less Elastic	($E_d < 1$)	% Δ in Demand < % Δ in Price
Unitary Elastic	($E_d = 1$)	% Δ in Demand = % Δ in Price

Fig. 4.6

Flatter the curve, More is the Elasticity

When 2 demand curves intersect each other, then the flatter curve is more elastic at the point of intersection. In **Fig. 4.7**, demand curves DD (flatter curve) and D_1D_1 (steeper curve) intersect each other at point E. At this point, OQ quantity is demanded at the price of OP. When price rises from OP to OP_1, the quantity demanded falls from OQ to OQ_2 for demand curve DD and from OQ to OQ_1 for demand curve D_1D_1.

With the same change in price (PP_1), change in demand (QQ_2) in case of demand curve DD is more than change in demand (QQ_1) in case of demand curve D_1D_1. *It means, demand is more elastic in case of DD (flatter curve) as compared to D_1D_1 (steeper curve).*
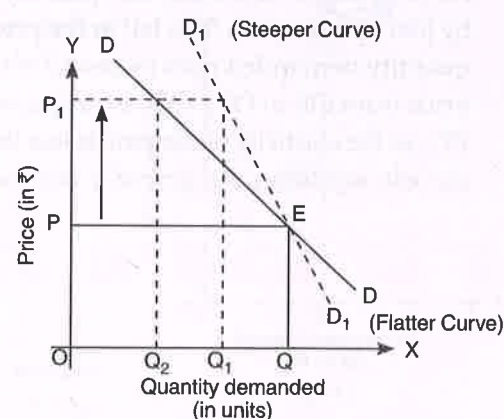

Fig. 4.7

Slope and Elasticity

- It is not possible to draw any inference about elasticity by merely looking at the slope of a curve. *Slope of a curve and its elasticity are not the same thing.*
- Slope of the demand curve measures the flatness or steepness of the demand curve and is therefore based on *absolute* change in price and quantity. On the other hand, price elasticity of demand is concerned with *percentage* change in price and quantity.
- Slope of the curve may remain constant, but its elasticity may change and be different at different points of the demand curve. *For example*, in a straight line demand curve, the slope is uniform, but elasticity keeps on changing throughout the length of the curve.
- In case of a rectangular hyperbola demand curve, $E_d = 1$ throughout the curve, but the slope keeps on changing.

4.6 FACTORS AFFECTING PRICE ELASTICITY OF DEMAND

A change in price does not always lead to the same proportionate change in demand. *For example,* a small change in price of AC may affect its demand to a considerable extent, whereas, large change in price of salt may not affect its demand. So, elasticity of demand is different for different goods.

Various *factors* which affect the elasticity of demand of a commodity are:

1. **Nature of commodity:** Elasticity of demand of a commodity is influenced by its nature. A commodity for a person may be a necessity, a comfort or a luxury.
   - When a commodity is a *necessity* like food grains, vegetables, medicines, etc., its demand is generally inelastic as it is required for human survival and its demand does not fluctuate much with change in price.

- When a commodity is a *comfort* like fan, refrigerator, etc., its demand is generally elastic as consumer can postpone its consumption.
- When a commodity is a *luxury* like AC, DVD player, etc., its demand is generally more elastic as compared to demand for comforts.

> The term 'luxury' is a relative term as any item (like AC), may be a luxury for a poor person but a necessity for a rich person.

2. **Availability of substitutes:** Demand for a commodity with large number of substitutes will be more elastic. The reason is that even a small rise in its prices will induce the buyers to go for its substitutes. *For example,* a rise in the price of Pepsi encourages buyers to buy Coke and vice-versa. Thus, availability of close substitutes makes the demand sensitive to change in the prices.

   On the other hand, commodities with few or no substitutes like wheat and salt have less price elasticity of demand.

3. **Income Level:** Elasticity of demand for any commodity is generally less for higher income level groups in comparison to people with low incomes. It happens because rich people are not influenced much by changes in the price of goods. But, poor people are highly affected by increase or decrease in the price of goods. As a result, demand for lower income group is highly elastic.

4. **Level of price:** Level of price also affects the price elasticity of demand. Costly goods like laptop, AC, etc. have highly elastic demand as their demand is very sensitive to changes in their prices.

   However, demand for inexpensive goods like needle, match box, etc. is inelastic as change in prices of such goods do not change their demand by a considerable amount.

5. **Postponement of Consumption:** Commodities like biscuits, soft drinks, etc. whose demand is not urgent, have highly elastic demand as their consumption can be postponed in case of an increase in their prices.

   However, commodities with urgent demand like life saving drugs, have inelastic demand because of their immediate requirement.

6. **Number of Uses:** If the commodity under consideration has several uses, then its demand will be elastic. When price of such a commodity increases, then it is generally put to only more urgent uses and, as a result, its demand falls. When the prices fall, then it is used for satisfying even less urgent needs and demand rises. *For example,* electricity is a multiple-use commodity. Fall in its price will result in substantial increase in its demand, particularly in those uses (like AC, Heat convector, etc.), where it was not employed formerly due to its high price.

   On the other hand, a commodity with no or few alternative uses has less elastic demand.

7. **Share in Total Expenditure:** Proportion of consumer's income that is spent on a particular commodity also influences the elasticity of demand for it. Greater the proportion of income spent on the commodity, more is the elasticity of demand for it and vice-versa. Demand for goods like salt, needle, soap, match box, etc. tends to be inelastic as consumers spend a small

proportion of their income on such goods. When prices of such goods change, consumers continue to purchase almost the same quantity of these goods.

However, if the proportion of income spent on a commodity is large, then demand for such a commodity will be elastic.

8. **Time Period:** Price elasticity of demand is always related to a period of time. It can be a day, a week, a month, a year or a period of several years. Elasticity of demand *varies directly* with the time period. Demand is generally inelastic in the short period. It happens because consumers find it difficult to change their habits, in the short period, in order to respond to a change in the price of the given commodity.

   However, demand is more elastic in long run as it is comparatively easier to shift to other substitutes, if the price of the given commodity rises.

9. **Habits:** Commodities, which have become habitual necessities for the consumers, have less elastic demand. It happens because such a commodity becomes a necessity for the consumer and he continues to purchase it even if its price rises. Alcohol, tobacco, cigarettes, etc. are some examples of habit forming commodities.

> *Finally it can be concluded that elasticity of demand for a commodity is affected by number of factors. However, it is difficult to say, which particular factor or combination of factors determines the elasticity. It all depends upon circumstances of each case.*

For "Importance of Elasticity of Demand", refer Power Booster Section.

4.7 SOLVED PRACTICALS

Formulae at a Glance

Percentage Method / Proportionate Method

$$\text{Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

$$\text{Elasticity of Demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} \quad \text{OR} \quad \frac{1}{\text{Slope of Demand Curve*}} \times \frac{P}{Q}$$

{Slope of Demand Curve* = ΔP/ΔQ}

Calculation of Elasticity of Demand (When both price and quantity are given)

Example 1. When price is ₹ 10 per unit, demand for a commodity is 100 units. As the price falls to ₹ 8 per unit, demand expands to 150 units. Calculate elasticity of demand.

Solution:

Original Quantity (Q)	= 100 units	Original Price (P)	= ₹ 10
New Quantity (Q₁)	= 150 units	New Price (P₁)	= ₹ 8
Change in Quantity (ΔQ)	= 50 units	Change in Price (ΔP)	= – ₹ 2
Elasticity of Demand (E_d) = ?			

$$\text{Price Elasticity of demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{50}{-2} \times \frac{10}{100} = (-)\,2.5$$

Ans. $E_d = (-)\,2.5$ *(Demand is highly elastic as $E_d > 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 2. When price of sugar is ₹ 5 per kg, its demand is 50 kg. When price rises by ₹ 5 per kg, its demand falls by 10 kg. Calculate the elasticity of demand.

Solution:

Original Quantity (Q)	= 50 kg	Original Price (P)	= ₹ 5
New Quantity (Q₁)	= 40 kg	New Price (P₁)	= ₹ 10
Change in Quantity (ΔQ)	= – 10 kg	Change in Price (ΔP)	= ₹ 5
Elasticity of Demand (E_d) = ?			

$$\text{Price Elasticity of demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{-10}{5} \times \frac{5}{50} = (-)\,0.2$$

Ans. $E_d = (-)\,0.2$ *(Demand is less elastic as $E_d < 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 3. The demand for a good falls to 240 units in response to rise in price by ₹ 2. If the original demand was 300 units at the price of ₹ 20, calculate price elasticity of demand.

Solution:

New Quantity (Q₁)	= 240 units	Rise in Price (ΔP)	= ₹ 2
Original Quantity (Q)	= 300 units	Original Price (P)	= ₹ 20
Change in Quantity (ΔQ)	= – 60 units	New Price (P₁)	= ₹ 22
Elasticity of Demand (E_d) = ?			

$$\text{Price Elasticity of Demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{-60}{2} \times \frac{20}{300} = (-)\,2$$

Ans. $E_d = (-)\,2$ *(Demand is highly elastic as $E_d > 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Calculation of Price or Quantity (When Elasticity of demand is given)

Example 4. The market demand for a good at ₹ 4 per unit is 100 units. Due to increase in price, the market demand falls to 75 units. Find out the new price, if the price elasticity of demand is (–) 1.

Solution:

Original Quantity (Q)	= 100 units	Original Price (P)	= ₹ 4
New Quantity (Q₁)	= 75 units	New Price (P₁)	= ?
Change in Quantity (ΔQ)	= – 25 units	Change in Price (ΔP)	= ΔP
Elasticity of Demand (E_d) = (–) 1			

Price Elasticity of demand (E_d) $= \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$$-1 = \dfrac{-25}{\Delta P} \times \dfrac{4}{100} \Rightarrow \Delta P = ₹1$$

As the quantity demanded is decreasing, price will increase. It means,

New Price = Original Price (P) + Change in Price (ΔP) = 4 + 1 = ₹ 5

Ans. New Price = ₹ 5

Example 5. When the price of good X is ₹ 5, the consumer buys 100 units of good X. At what price would he be willing to purchase 140 units of good X? The price elasticity of demand for good X is 2.

Solution:

Original Quantity (Q)	= 100 units	Original Price (P)	= ₹ 5
Original Quantity (Q_1)	= 140 units	New Price (P_1)	= ?
Change in Quantity (ΔQ)	= 40 units	Change in Price (ΔP)	= ΔP
Elasticity of Demand (E_d) = 2			

Price Elasticity of demand (E_d) $= \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$$2 = \dfrac{40}{\Delta P} \times \dfrac{5}{100} \Rightarrow \Delta P = ₹1$$

As the quantity demanded is increasing, price will decrease. It means,

New Price = Original Price (P) – Change in Price (ΔP) = ₹ 5 – ₹ 1 = ₹ 4

Ans. New Price = ₹ 4

Example 6. A consumer buys 80 units of a good at a price of ₹ 5 per unit. Suppose, the price elasticity of demand is (–) 2. At what price will he buy 64 units?

Solution:

Original Quantity (Q)	= 80 units	Original Price (P)	= ₹ 5
New Quantity (Q_1)	= 64 units	New Price (P_1)	= ?
Change in Quantity (ΔQ)	= – 16 units	Change in Price (ΔP)	= ΔP
Elasticity of Demand (E_d) = – 2			

Price Elasticity of demand (E_d) $= \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$$-2 = \dfrac{-16}{\Delta P} \times \dfrac{5}{80} \Rightarrow \Delta P = ₹0.5$$

As the quantity demanded is decreasing, price will increase. It means,
New Price = Original Price (P) + Change in Price (ΔP) = 5 + 0.5 = ₹ 5.5
Ans. New Price = ₹ 5.5

Example 7. The demand for a good at ₹ 10 per unit is 40 units. Price falls by ₹ 5. If price elasticity of demand is (–) 3, calculate the new quantity demanded.

Solution:

Original Quantity (Q)	=	40 units	Original Price (P)	=	₹ 10
New Quantity (Q_1)	=	?	Fall in Price (ΔP)	=	– ₹ 5
Change in Quantity (ΔQ)	=	ΔQ	New Price (P_1)	=	₹ 5
Elasticity of Demand (E_d) = – 3					

Price Elasticity of demand (E_d) $= \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$$-3 = \dfrac{\Delta Q}{-5} \times \dfrac{10}{40} \text{ i.e. } \Delta Q = 60 \text{ units}$$

As price is decreasing, the quantity demanded will increase. It means,
New Quantity = Original Quantity (Q) + Change in Quantity
= 40 + 60 = **100 units**
Ans. New Quantity = 100 units

Example 8. Price elasticity of demand for a product is 'unity'. A household buys 25 units of this product at the price of ₹ 5 per unit. If the price of product rises by ₹ 1, how much quantity of the product will the household buy?

Solution:

Original Quantity (Q)	=	25 units	Original Price (P)	=	₹ 5
New Quantity (Q_1)	=	?	Rise in Price (ΔP)	=	₹ 1
Change in Quantity (ΔQ)	=	ΔQ	New Price (P_1)	=	₹ 6
Elasticity of Demand (E_d) = 1					

Price Elasticity of demand (E_d) $= \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$$1 = \dfrac{\Delta Q}{1} \times \dfrac{5}{25} \text{ i.e. } \Delta Q = 5 \text{ units}$$

As price is increasing, the quantity demanded will decrease. It means,
New quantity = Original quantity (Q) – Change in quantity (ΔQ) = 25 – 5 = 20 units
Ans. New Quantity = 20 units

Example 9. When the price of a commodity falls by ₹ 2 per unit, its quantity demanded increases by 10 units. Its price elasticity of demand is (–) 1. Calculate its quantity demanded at the price before change which was ₹ 10 per unit.

Solution:

Increase in Quantity (ΔQ)	=	10 units	Original Price (P)	=	₹ 10
Original Quantity (Q)	=	?	Fall in Price (ΔP)	=	– ₹ 2
			New Price (P_1)	=	₹ 8
Elasticity of Demand (E_d) = (–) 1					

Price Elasticity of demand $(E_d) = \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$-1 = \dfrac{10}{-2} \times \dfrac{10}{Q}$ i.e. Q = 50 units

Ans. Quantity demanded at price before change (Original Quantity) = **50 units**

Example 10. The initial demand for a commodity is 80 units, the demand falls by 4 units due to rise in price by ₹ 10. If price elasticity of demand is 1.5, calculate the price before change in demand.

Solution:

Initial Demand (Q)	=	80 units	Rise in Price (ΔP)	= ₹ 10
Fall in Demand (ΔQ)	=	4 units	Original Price (P)	= ?
New Demand (Q_1)	=	76 units	Elasticity of Demand (E_d)	= 1.5

Price Elasticity of demand $(E_d) = \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$1.5 = \dfrac{4}{10} \times \dfrac{P}{80} \Rightarrow P = ₹\, 300$

Ans. Price Before Change in Demand (Original Price) = ₹ 300

Elasticity of Demand by Percentage Method

Example 11. When price of a commodity falls by 80%, the quantity demanded of it increases by 100%. Find out its price elasticity of demand.

Solution:

% Change in Demand	=	100%	% Change in Price	= − 80%
Elasticity of Demand (E_d) = ?				

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{100\%}{-80\%}$

Price Elasticity of demand $(E_d) = (-)\, 1.25$

Ans. $E_d = (-)\, 1.25$ *(Demand is highly elastic as $E_d > 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 12. When price of a commodity gets doubled, its quantity demanded reduced to half. Calculate the coefficient of price elasticity of demand.

Solution:

% Change (Fall) in Demand = − 50%	% Change (Rise) in Price	= 100%
Elasticity of Demand (E_d) = ?		

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{-50\%}{100\%}$

Price Elasticity of demand $(E_d) = (-)\, 0.5$

Ans. $E_d = (-)\, 0.5$ *(Demand is less elastic as $E_d < 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 13. A 5% fall in the price of x leads to 10% rise in the demand for x. A 20% rise in the price of y leads to 6% fall in the demand for y. Calculate the price elasticities of demand of x and y. Out of x and y, which commodity is more elastic?

Solution:

Price Elasticity of Demand for 'x'

% Change in Demand of x = 10%	% Change in Price of x = − 5%
Elasticity of Demand (E_d) = ?	

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{10\%}{-5\%}$

Price Elasticity of Demand $(E_d) = (-)\, 2$

Price Elasticity of Demand for 'y'

% Change in Demand of y = − 6%	% Change in Price of y = 20%
Elasticity of Demand (E_d) = ?	

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{-6\%}{20\%}$

Price Elasticity of Demand $(E_d) = (-)\, 0.3$

Ans. Price Elasticity of x = (−) 2; Price Elasticity of y = (−) 0.3; x is more elastic as compared to commodity y.

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 14. A consumer buys 20 units of a good at ₹ 10 per unit. When its price falls by 10%, its demand rises to 22 units. Find out the price elasticity of demand.

Solution:

Original Quantity (Q)	=	20 units	% Change in Price	=	− 10%
New Quantity (Q_1)	=	22 units	Elasticity of Demand (E_d)	=	?
Change in Quantity (ΔQ)	=	2 units			

Percentage change in demand $= \dfrac{\Delta Q}{Q} \times 100 = \dfrac{2}{20} \times 100 = 10\%$

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{10\%}{-10\%}$

Price Elasticity of Demand $(E_d) = (-)\, 1$

Ans. $E_d = (-)\, 1$ *(Demand is unitary elastic)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Price Elasticity of demand (E_d) $= \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$-1 = \dfrac{10}{-2} \times \dfrac{10}{Q}$ i.e. $Q = 50$ units

Ans. Quantity demanded at price before change (Original Quantity) = **50 units**

Example 10. The initial demand for a commodity is 80 units, the demand falls by 4 units due to rise in price by ₹ 10. If price elasticity of demand is 1.5, calculate the price before change in demand.

Solution:

Initial Demand (Q)	=	80 units	Rise in Price (ΔP)	=	₹ 10
Fall in Demand (ΔQ)	=	4 units	Original Price (P)	=	?
New Demand (Q_1)	=	76 units	Elasticity of Demand (E_d)	=	1.5

Price Elasticity of demand $(E_d) = \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q}$

$1.5 = \dfrac{4}{10} \times \dfrac{P}{80} \Rightarrow P = ₹ 300$

Ans. Price Before Change in Demand (Original Price) = ₹ 300

Elasticity of Demand by Percentage Method

Example 11. When price of a commodity falls by 80%, the quantity demanded of it increases by 100%. Find out its price elasticity of demand.

Solution:

% Change in Demand	= 100%	% Change in Price	= −80%
Elasticity of Demand (E_d) = ?			

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{100\%}{-80\%}$

Price Elasticity of demand $(E_d) = (-) 1.25$

Ans. $E_d = (-) 1.25$ *(Demand is highly elastic as $E_d > 1$)*
Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 12. When price of a commodity gets doubled, its quantity demanded reduced to half. Calculate the coefficient of price elasticity of demand.

Solution:

% Change (Fall) in Demand = − 50%	% Change (Rise) in Price	= 100%
Elasticity of Demand (E_d) = ?		

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{-50\%}{100\%}$

Price Elasticity of demand $(E_d) = (-) 0.5$

Ans. $E_d = (-) 0.5$ *(Demand is less elastic as $E_d < 1$)*
Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 13. A 5% fall in the price of x leads to 10% rise in the demand for x. A 20% rise in the price of y leads to 6% fall in the demand for y. Calculate the price elasticities of demand of x and y. Out of x and y, which commodity is more elastic?

Solution:
Price Elasticity of Demand for 'x'

% Change in Demand of x = 10%	% Change in Price of x = − 5%
Elasticity of Demand (E_d) = ?	

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{10\%}{-5\%}$

Price Elasticity of Demand $(E_d) = (-) 2$

Price Elasticity of Demand for 'y'

% Change in Demand of y = − 6%	% Change in Price of y = 20%
Elasticity of Demand (E_d) = ?	

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{-6\%}{20\%}$

Price Elasticity of Demand $(E_d) = (-) 0.3$

Ans. Price Elasticity of x = (−) 2; Price Elasticity of y = (−) 0.3; x is more elastic as compared to commodity y.
Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 14. A consumer buys 20 units of a good at ₹ 10 per unit. When its price falls by 10%, its demand rises to 22 units. Find out the price elasticity of demand.

Solution:

Original Quantity (Q)	=	20 units	% Change in Price	= − 10%
New Quantity (Q_1)	=	22 units	Elasticity of Demand (E_d) =	?
Change in Quantity (ΔQ)	=	2 units		

Percentage change in demand $= \dfrac{\Delta Q}{Q} \times 100 = \dfrac{2}{20} \times 100 = 10\%$

Price Elasticity of Demand $(E_d) = \dfrac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \dfrac{10\%}{-10\%}$

Price Elasticity of Demand $(E_d) = (-) 1$

Ans. $E_d = (-) 1$ *(Demand is unitary elastic)*
Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 15. The quantity demanded of a commodity at a price of ₹ 8 per unit is 600 units. Its price falls by 25 per cent and the quantity demanded rises by 120 units. Calculate the price elasticity of demand. Is its demand elastic? Give reason for your answer.

Solution:

Original Quantity (Q)	= 600 units	% Change in Price	= −25 %
Change in Quantity (ΔQ)	= 120 units	Elasticity of Demand (E_d)	= ?
New Quantity (Q_1)	= 720 units		

$$\text{Percentage change in demand} = \frac{\Delta Q}{Q} \times 100 = \frac{120}{600} \times 100 = 20\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \frac{20\%}{-25\%}$$

Price Elasticity of Demand (E_d) = (−) 0.8

Ans. E_d = (−) 0.8; *(Demand is less elastic because E_d < 1)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 16. Calculate the price elasticity of demand for a commodity when its price increases by 25% and quantity demanded falls from 150 units to 120 units.

Solution:

Original Quantity (Q)	= 150 units	%Change in Price	= 25 %
New Quantity (Q_1)	= 120 units	Elasticity of Demand (E_d)	= ?
Change in Quantity (ΔQ)	= −30 units		

$$\text{Percentage change in demand} = \frac{\Delta Q}{Q} \times 100 = \frac{-30}{150} \times 100 = -20\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \frac{-20\%}{25\%}$$

Price Elasticity of Demand (E_d) = (−) 0.8

Ans. E_d = (−) 0.8; *(Demand is less elastic because E_d < 1)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 17. The price of commodity is ₹ 15 per unit and its quantity demanded is 500 units. Its quantity demanded rises by 80 units as a result of fall in its price by 20 per cent. Calculate its price elasticity of demand. Is its demand inelastic? Give reason for your answer.

Solution:

Original Quantity (Q)	= 500 units	%Change in Price	= −20 %
Change in Quantity (ΔQ)	= 80 units	Elasticity of Demand (E_d)	= ?
New Quantity (Q_1)	= 580 units		

$$\text{Percentage change in demand} = \frac{\Delta Q}{Q} \times 100 = \frac{80}{500} \times 100 = 16\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \frac{16\%}{-20\%}$$

Price Elasticity of Demand (E_d) = (−) 0.8

Ans. E_d = (−) 0.8; *(Demand is less elastic because E_d < 1)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 18. When the price of a commodity is ₹ 20 per unit, its quantity demanded is 800 units. When its price rises by ₹ 5 per unit, its quantity demanded falls by 20 per cent. Calculate its price elasticity of demand. Is its demand elastic? Give reasons for your answer.

Solution:

Original Quantity (Q)	= 800 units	Original Price (P)	= ₹ 20
% Change in Quantity	= −20%	Change in Price (ΔP)	= ₹ 5
Elasticity of Demand (E_d)	= ?	New Price (P_1)	= ₹ 25

$$\text{Percentage change in price} = \frac{\Delta P}{P} \times 100 = \frac{5}{20} \times 100 = 25\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \frac{-20\%}{25\%}$$

Price Elasticity of Demand (E_d) = (−) 0.8

Ans. E_d = (−) 0.8; *(Demand is less elastic because E_d < 1)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 19. When price of a good falls from ₹ 5 to ₹ 3 per unit, its demand rises by 40%. Calculate its price elasticity of demand.

Solution:

Original Price (P)	= ₹ 5	% Change in Quantity	= 40%
New Price (P_1)	= ₹ 3	Elasticity of Demand (E_d)	= ?
Change in Price (ΔP)	= −₹ 2		

$$\text{Percentage change in price} = \frac{\Delta P}{P} \times 100 = \frac{-2}{5} \times 100 = -40\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \frac{40\%}{-40\%}$$

Price Elasticity of Demand (E_d) = (−) 1

Ans. E_d = (−) 1 *(Demand is unitary elastic)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Calculation of Elasticity of Demand *(When Total Expenditure is given)*

Example 20. Calculate price elasticity of demand:

Price (₹)	Total Expenditure (₹)
5	500
6	420

Solution:

Price (₹)	Total Expenditure (₹)	Quantity (in units) (Total Expenditure ÷ Price)
5	500	100
6	420	70

Original Quantity (Q)	=	100 units	Original Price (P)	= ₹ 5
New Quantity (Q_1)	=	70 units	New Price (P_1)	= ₹ 6
Change in Quantity (ΔQ)	=	− 30 units	Change in Price (ΔP)	= ₹ 1
Elasticity of Demand (E_d) = ?				

$$\text{Price Elasticity of Demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{-30}{1} \times \frac{5}{100} = (-)\,1.5$$

Ans. $E_d = (-)\,1.5$ *(Demand is highly elastic as $E_d > 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 21. A consumer spends ₹ 80 on a commodity when its price is ₹ 1 per unit and spends ₹ 96 when its price is ₹ 2 per unit. Calculate price elasticity of demand for the commodity by the percentage method?

Solution:

Price (₹)	Total Expenditure (₹)	Quantity in units (Total Expenditure ÷ Price)
1	80	80
2	96	48

Original Quantity (Q)	=	80 units	Original Price (P)	= ₹ 1
New Quantity (Q_1)	=	48 units	New Price (P_1)	= ₹ 2
Change in Quantity (ΔQ)	=	− 32 units	Change in Price (ΔP)	= ₹ 1
Elasticity of Demand (E_d) = ?				

$$\text{Percentage change in demand} = \frac{\Delta Q}{Q} \times 100 = \frac{-32}{80} \times 100 = -40\%$$

$$\text{Percentage change in price} = \frac{\Delta P}{P} \times 100 = \frac{1}{1} \times 100 = 100\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \frac{-40\%}{100\%}$$

Price Elasticity of Demand (E_d) = (−) 0.4

Ans. $E_d = (-)\,0.4$ *(Demand is less elastic as $E_d < 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 22. A dentist was charging ₹ 300 for a standard cleaning job and it used to generate total revenue equal to ₹ 30,000 per month. She has, since last month, increased the price of dental cleaning to ₹ 350. As a result, fewer customers are now coming for dental cleaning, but the total revenue is now ₹ 33,250. From this, what can we conclude about the elasticity of demand for her dental service?

Solution:

Fees (₹)	Total Revenue (₹)	Number of Customers (Total Revenue ÷ Fees)
300	30,000	100
350	33,250	95

Total Expenditure Method

With increase in fees, the total revenue of dentist has also increased. Hence, the elasticity of demand for her dental service is less than one.

Proportionate Method

Original Quantity (Q)	=	100	Original Price (P)	= ₹ 300
New Quantity (Q_1)	=	95	New Price (P_1)	= ₹ 350
Change in Quantity (ΔQ)	=	− 5	Change in Price (ΔP)	= ₹ 50
Elasticity of Demand (E_d) = ?				

$$\text{Price Elasticity of Demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{-5}{50} \times \frac{300}{100} = (-)\,0.3$$

Ans. $E_d = (-)\,0.3$ *(Demand is less elastic as $E_d < 1$)*

Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 23. With rise in price from ₹ 8 to ₹ 14, total expenditure on the commodity rises by 40% and becomes ₹ 1,120. Calculate price elasticity of demand. Also, indicate whether demand is elastic or inelastic.

Solution:

Price (₹)	Total Expenditure (₹)	Quantity in units (Total Expenditure ÷ Price)
8	**800	100
14	1,120	80

Original Quantity (Q)	=	100 units	Original Price (P)	= ₹ 8
New Quantity (Q_1)	=	80 units	New Price (P_1)	= ₹ 14
Change in Quantity (ΔQ)	=	− 20 units	Change in Price (ΔP)	= ₹ 6
Elasticity of Demand (E_d) = ?				

$$\text{Price Elasticity of demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{-20}{6} \times \frac{8}{100} = (-)\,0.267$$

Ans. $E_d = (-)\,0.267$ *(Demand is less elastic as $E_d < 1$)*

Note: **Calculation of Original Expenditure: Let Original Expenditure be x.

Given: New Expenditure = ₹ 1,120.

Also Given:

x + 40% of x = 1,120

$$x + \frac{40\,x}{100} = 1,120$$

140x = 1,12,000

x or Original Expenditure = ₹ 800

Miscellaneous Practicals

Example 24. The price elasticity of demand for good X is known to be twice that of good Y. Price of X falls by 5% while that of good Y rises by 5%. What is the percentage change in the quantities demanded of X and Y?

Solution:

Percentage fall in price of X = 5%; Percentage rise in price of Y = 5%

Also, price elasticity (E_d) of X is twice of good Y

Suppose, E_d of Y is 1, then E_d of X will be 2.

Therefore, a 5% fall in the price of good X will lead to a 10% rise in the demand for X and a 5% rise in the price of good Y will lead to a 5% fall in the demand for Y.

Ans. Quantity of X will rise by 10%; Quantity of Y will fall by 5%

Example 25. The price elasticities of demand for goods X and Y are known to be 1 and 2 respectively. Price of X rises by 5% while that of good Y falls by 5%. What are the percentage changes in the quantities demanded of X and Y?

Solution:
Percentage change in the quantity of X

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}}$$

$$1 = \frac{\text{Percentage change in Quantity demanded}}{5}$$

Percentage change (fall) in the quantity of X = 5%
Percentage change in the quantity of Y

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}}$$

$$2 = \frac{\text{Percentage change in Quantity demanded}}{5}$$

Percentage change (rise) in the quantity of Y= 10%

Ans. Quantity of X will fall by 5%; Quantity of Y will rise by 10%

Example 26. The demand for goods X and Y have equal price elasticity. The demand of X rises from 100 units to 250 units due to a 20 per cent fall in its price. Calculate the percentage rise in demand of Y, if its price falls by 8 per cent.

Solution:

In the given example, we will first calculate Price Elasticity of Good X

Original Quantity (Q)	=	100 units	% Change in Price	=	− 20%
New Quantity (Q_1)	=	250 units	Elasticity of Demand (E_d)	=	?
Change in Quantity (ΔQ)	=	150 units			

$$\text{Percentage change in demand} = \frac{\Delta Q}{Q} \times 100 = \frac{150}{100} \times 100 = 150\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage change in Quantity demanded}}{\text{Percentage change in price}} = \frac{150\%}{-20\%}$$

Price Elasticity of Demand $(E_d) = (-)\ 7.5$

Now, Price Elasticity of Good Y = (–) 7.5 *(as both X and Y have same price elasticity).*

Let us now calculate % Rise in Demand for Y

% Rise in Demand	=	?	% Change in Price	=	− 8%
Elasticity of Demand (E_d)	=	(−) 7.5			

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

$$(-)\ 7.5 = \frac{\text{Percentage Change in Quantity Demanded}}{-8}$$

Percentage rise in demand = 60%

Ans. Demand for Good Y will rise by 60%

Example 27. The price elasticity of demand of good X is half the price elasticity of demand of Good Y. A 25% rise in the price of good Y reduces its demand from 400 units to 300 units. Calculate percentage rise in demand of good X when its price falls from ₹ 10 to ₹ 8 per unit.

Solution:

In the given example, we will first calculate Price Elasticity of Good Y

Original Quantity (Q)	=	400 units	% Change in Price	=	25%
New Quantity (Q_1)	=	300 units	Elasticity of Demand (E_d)	=	?
Change in Quantity (ΔQ)	=	−100 units			

$$\text{Percentage Change in Demand} = \frac{\Delta Q}{Q} \times 100 = \frac{-100}{400} \times 100 = -25\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}} = \frac{-25\%}{25\%}$$

Price Elasticity of Demand $(E_d) = (-)\ 1$

Now, Price Elasticity of Good X = (–) 0.5 (as elasticity of demand of good X is half the price elasticity of demand of Good Y).

Let us now calculate % rise in Demand for X

Original Price (P)	=	₹ 10	% Rise in Quantity	=	?
Change in Price (ΔP)	=	– ₹ 2	Elasticity of Demand (E_d)	=	(–) 0.5
New Price (P_1)	=	₹ 8			

$$\text{Percentage Change in Price} = \frac{\Delta P}{P} \times 100 = \frac{-2}{10} \times 100 = -20\%$$

$$(-)\, 0.5 = \frac{\text{Percentage Change in Quantity Demanded}}{-20}$$

Percentage rise in demand for X = 10%

Ans. Demand for Good X will rise by 10%

Example 28. The percentage change in demand is three times the percentage change in price. If original demand was 30 units at the price of ₹ 7 per unit, then calculate the price elasticity of demand, given price increased by 10%. Indicate whether the demand is elastic or not. Also calculate the new quantity demanded.

Solution:

Given: Percentage change in demand = 3 times of Percentage change in price

i.e. % change (fall) in demand = 3 × 10 = – 30%   *(as price has increased by 10%)*

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demand}}{\text{Percentage Change in Price}}$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{-30}{10} = (-)\,3$$

As price is increasing, the quantity demanded will fall. It means,

New Quantity = Original Quantity (Q) – % fall in demand

= 30 – 30% of 30 = 30 – 9 = **21 units**

Ans. Price Elasticity of demand (E_d) = (–) 3; Demand is highly elastic as E_d > 1; New Quantity = 21 units.

Example 29. In case of commodity 'B', the ratio of change in price (ΔP) to original price (P) is (–) 0.4. If price elasticity of demand is (–) 0.5, calculate the percentage change in quantity demanded.

Solution:

Given: $\frac{\Delta P}{P}$ = – 0.4 *(Negative value indicates that new price is less than original price, i.e. price has*

decreased. As price is decreasing, the quantity demanded will rise.)

$$\text{Percentage Change in Price} = \frac{\Delta P}{P} \times 100 = -0.4 \times 100 = -40\%$$

$$\text{Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

$$(-)\, 0.5 = \frac{\text{Percentage Change in Quantity Demanded}}{-40\%}$$

Percentage change (rise) in Quantity Demanded = 20%

Example 30. If ratio of change in quantity (ΔQ) to original quantity (Q) is 0.5 and elasticity of demand is (–) 1.25, calculate the percentage change in price.

Solution:

Given: $\frac{\Delta Q}{Q}$ = 0.5 *(Positive Value indicated that quantity has increased. It means, new price is less*

than the original price, i.e. price has decreased.)

$$\text{Percentage Change in Demand} = \frac{\Delta Q}{Q} \times 100 = 0.5 \times 100 = 50\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

$$(-)\, 1.25 = \frac{50\%}{\text{Percentage Change in Price}}$$

Percentage change (fall) in Price = 40%

Example 31. If $\frac{\Delta Q}{Q}$ = – 0.6 and price elasticity is (–) 0.75, calculate the percentage change in price. Also calculate the new expenditure if initial expenditure was ₹ 500 at the price of ₹ 20.

Solution:

Calculation of Percentage Change in Price

Given: $\frac{\Delta Q}{Q}$ = – 0.6 *(Negative value indicates that quantity has decreased. It means, new price is more*

than the original price, i.e. price has increased.)

$$\text{Percentage Change in Demand} = \frac{\Delta Q}{Q} \times 100 = -0.6 \times 100 = -60\%$$

$$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

$$(-)\, 0.75 = \frac{-60\%}{\text{Percentage Change in Price}}$$

Percentage change (rise) in Price = 80%

Calculation of New Expenditure

Initial Expenditure = Original Quantity (Q) × Original Price (P) = 500

= Q × 20 = 500

i.e. Q = 25

New Quantity (Q_1) = Original Quantity + Change in Quantity
= 25 + (25 × −60%) = 25 − 15 = *10 units*

New Price (P_1) = Original Price + Change in Price
= 20 + (20 × 80%) = 20 + 16 = ₹ *36*

New Expenditure = New Quantity (Q_1) × New Price (P_1)
= 10 × 36 = ₹ *360*

Example 32. The demand function of commodity 'X' is given as: $Q_x = 20 − 2P_x$. Calculate its price elasticity of demand when price falls from ₹ 5 to ₹ 3.

Solution:

Given: $Q_x = 20 − 2P_x$.
Demand at Price of ₹ 5: = 20 − 2 × 5 = 10 units
Demand at Price of ₹ 3: = 20 − 2 × 3 = 14 units

Original Quantity (Q)	= 10 units	Original Price (P)	= ₹ 5
New Quantity (Q_1)	= 14 units	New Price (P_1)	= ₹ 3
Change in Quantity (ΔQ)	= 4 units	Change in Price (ΔP)	= − ₹ 2
Elasticity of Demand (E_d) = ?			

Price Elasticity of Demand (E_d) $= \dfrac{\Delta Q}{\Delta P} \times \dfrac{P}{Q} = \dfrac{4}{-2} \times \dfrac{5}{10} = (-)\,1$

Ans. $E_d = (−)$ 1 (Demand is unitary elastic as $E_d = 1$)
Negative sign of E_d indicates the inverse relationship between price and quantity demanded.

Example 33. The demand for commodity 'A' rises by 20% due to fall in price by ₹ 2 from the original price of ₹ 8.

(i) Calculate elasticity of demand by 'Percentage Method'.
(ii) Whether demand of 'A' is elastic or inelastic? Give reason for your answer.
(iii) What will be the shape of demand curve of A?
(iv) If new demand of commodity 'A' is 84 units, then calculate its original demand.

Solution: (i)

Original Price (P)	= ₹ 8	% Rise in Quantity	= 20%
Fall in Price (ΔQ)	= − ₹ 2	Elasticity of Demand (E_d)	= ?
New Price (P_1)	= ₹ 6		

Percentage Change in Price $= \dfrac{\Delta P}{P} \times 100 = \dfrac{-2}{8} \times 100 = -25\%$

$E_d = \dfrac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}} = \dfrac{20\%}{-25\%} = (-)\,0.8 \text{ or } 0.8$

It must be noted that E_d is always a negative number due to inverse relationship between price and quantity demanded. So, negative sign is always implied. So, in the given case, E_d can be written as (−) 0.8 or 0.8.

(ii) Demand of 'A' is *inelastic as elasticity of demand (0.8) is less than 1.*
(iii) The demand curve of 'A' will be a *Downward Sloping Steeper Curve.* It will be downward sloping due to inverse relationship between price and quantity demanded. It will be a steeper curve as demand is inelastic.
(iv) Let the Original demand be x.

We know: Original Demand + Rise in Demand = New Demand

x + 20% of x = 84 units

or, $x + \dfrac{20\,x}{100} = 84$ units

or, 120x = 8,400 units

x or Original Demand = *70 units*

Example 34. If the price of X is ₹ 2 and the elasticity of demand is 0.4, how much will a 10 percent reduction in quantity demanded increase the price? If the new quantity demanded is 9 units, will the total spending on X rise? If so, by what percentage?

Solution:

Calculation of Percentage rise in Price

% fall in demand	= −10%	% Rise in Price	= ?
Elasticity of Demand (E_d)	= (−) 0.4		

Price Elasticity of Demand (E_d) $= \dfrac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$

$(-)\,0.4 = \dfrac{-10}{\text{Percentage Change in Price}}$

Percentage rise in Price = 25%

Calculation of Effect on Total Spending

• *Calculation of New Price:* Price has increased by 25%.

New Price = 2 + 25% of 2 = 2 + 0.50 = ₹ 2.50.

• *Calculation of Original Demand:* Demand has decreased by 10%.

Let the Original demand be x.

We know: Original Demand − Fall in Demand = New Demand

x − 10% of x = 9 units

or, $x - \dfrac{10\,x}{100} = 9$ units

or, 90x = 900 units

x or Original Demand = 10 units

Price (₹)	Quantity (in units)	Total Expenditure in ₹ (Price × Quantity)
2	10	20
2.50	9	22.50

Yes, total spending on X rises by ₹ 2.50. The percentage increase in total spending $= \frac{2.5}{20} \times 100 = \mathbf{12.5\%}$

Example 35. When price of a good is ₹ 7 per unit, a consumer buys 12 units. When price falls to ₹ 6 per unit, he spends ₹ 72 on the good. Calculate price elasticity of demand by using the percentage method. Comment on the likely shape of demand curve based on this measure of elasticity.

Solution:

Price (₹)	Total Expenditure (₹)	Quantity in units (Total Expenditure ÷ Price)
7	84	12
6	72	12

Original Quantity (Q)	= 12 units	Original Price (P)	= ₹ 7
New Quantity (Q$_1$)	= 12 units	New Price (P$_1$)	= ₹ 6
Change in Quantity (ΔQ)	= 0	Fall in Price (ΔP)	= – ₹ 1
Elasticity of Demand (E$_d$) = ?			

$$\text{Price Elasticity of Demand (E}_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

$$\text{Percentage Change in Demand} = \frac{\Delta Q}{Q} \times 100 = \frac{0}{12} \times 100 = 0$$

We know, 0 (zero) divided by any number gives 0. So, E$_d$ = 0 and demand curve will be parallel to the Y-axis.

Ans. Price Elasticity of Demand (E$_d$) = 0; The demand curve is parallel to the Y-axis.

Example 36. The demand curve for the commodity is given as D$_x$ = 20 – 2P. If slope of the demand curve is (– 2), calculate price elasticity of demand for the commodity when the price of the commodity is ₹ 5 per unit.

Solution:

Given: D$_x$ = 20 – 2P; Putting the value of price (i.e. ₹ 5), we get D$_x$ = 20 – 2 × 5 = 10 units

$$\text{Elasticity of Demand (E}_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} \quad OR \quad \frac{1}{\text{Slope of Demand Curve*}} \times \frac{P}{Q}$$

{Slope of Demand Curve = ΔP/ΔQ}*

$$\text{Elasticity of Demand (E}_d) = \frac{1}{(-2)} \times \frac{5}{10} = (-)\ 0.25$$

Example 37. The demand curve of a commodity is expressed as D$_x$ = 40 – 5P. If slope of the demand curve is given to be (– 2), calculate price elasticity of demand for the commodity when demand is 20 units.

Solution:

Given: D$_x$ = 40 – 5P; Putting the value of demand (i.e. 20 units), we get 20 = 40 – 5P, i.e. P = ₹ 4.

$$\text{Elasticity of Demand (E}_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} \quad OR \quad \frac{1}{\text{Slope of Demand Curve}} \times \frac{P}{Q}$$

$$\text{Elasticity of Demand (E}_d) = \frac{1}{(-2)} \times \frac{4}{20} = (-)\ 0.10$$

REVISION OF KEY POINTS

- **Price Elasticity of Demand** means the degree of responsiveness of demand for a commodity with reference to change in the price of such commodity. It is negative because of inverse relationship between price and quantity demanded.

- **Percentage Method for measuring Price Elasticity of demand:**

$$\text{Percentage Method (E}_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

- **Degrees of Price Elasticity of Demand**

  (a) *Perfectly Elastic Demand:* When there is infinite demand at a particular price and demand becomes zero with a slight rise in price.

  (b) *Perfectly Inelastic Demand:* When demand remains constant and does not change with change in price.

  (c) *Highly Elastic Demand:* When % change in quantity demanded > % change in price.

  (d) *Less Elastic Demand:* When % change in quantity demanded < % change in price.

  (e) *Unitary Elastic Demand:* When % change in quantity demanded = % change in price.

- **Factors affecting Price Elasticity of Demand**

  (a) *Nature of commodity:* Luxuries have more elastic demand as compared to comforts, whereas, necessities have less elastic demand.

  (b) *Availability of substitutes:* Demand is more elastic in case of more substitutes.

  (c) *Income Level:* Demand is more elastic in case of lower income groups.

  (d) *Level of price:* Expensive goods are more elastic.

  (e) *Postponement of Consumption:* Commodities with less urgent demand are more elastic.

  (f) *Number of Uses:* Demand is more elastic for a commodity having several uses.

  (g) *Share in Total Expenditure:* Goods that comprise a larger share of consumers' budgets tend to more elastic.

  (h) *Time Period:* Demand tends to be more inelastic in short term than in long term.

  (i) *Habits:* Goods which are not habitual necessities have more elastic demand.

HOTS — HIGHER ORDER THINKING SKILLS QUESTIONS

Q. 1. Price elasticity of demand for flowers and toys are respectively (–) 0.9 and (–) 0.5. Demand for which one is more elastic and Why?

Ans. Demand for flowers is more elastic as with 1% fall in price of flowers, its demand rises by 0.9%. However, in case of toys, 1% fall in price raises the demand by just 0.5%.

Q. 2. Differentiate between law of demand and price elasticity of demand.

Ans. *(i) Law of demand states the inverse relation between price of a commodity and its quantity demanded, assuming no change in other factors. On the other hand, price elasticity of demand indicates the rate of change in quantity demanded of the commodity due to change in its price.*

(ii) Law of Demand reflects the direction of change in demand, whereas, price elasticity of demand measures the magnitude of change in demand.

Q. 3. What is the price elasticity of demand for following demand curves: (i) Straight line demand curve parallel to X-axis; (ii) Straight line demand curve parallel to Y-axis.

Ans. *The price elasticity of demand in the following cases will be: (i) Perfectly Elastic Demand; (ii) Perfectly Inelastic Demand.*

Q. 4. State with reasons, whether the following items will have elastic or inelastic demand: (i) Matchbox; (ii) Coke; (iii) Medicines; (iv) NCERT Textbook; (v) Electricity; (vi) Cigarettes; (vii) Butter for a poor person.

Ans. *(i) Matchbox has inelastic demand as consumer has to spend a very small proportion of his income.*

(ii) Coke has elastic demand as it has number of substitutes.

(iii) Medicines have inelastic demand as their consumption cannot be postponed.

(iv) NCERT Textbook has inelastic demand as it is a necessity item.

(v) Electricity has elastic demand as it can be put to several uses.

(vi) Cigarettes have inelastic demand as its consumers are habituated.

(vii) Butter for a poor person has elastic demand as it is a luxury item for the poor person.

TRUE AND FALSE

Are the following statements true or false? Give reasons.

1. When quantity demanded of a commodity does not change with change in price, then coefficient of price elasticity of demand is zero.
   True. It is a case of perfectly inelastic demand.

2. A commodity with large number of close substitutes shows high elasticity of demand.
   True. Demand for a commodity with large number of substitutes will be more elastic as a small rise in price of such commodity will induce the buyers to go for its substitutes.

3. When the percentage increase in demand of a commodity is more than percentage increase in price, then demand curve is steeper.
   False. The demand curve will be flatter as price elasticity of demand is more than one.

4. In case of horizontal straight line demand curve, demand does not change even with change in price.
   False. In case of horizontal straight line demand curve, there is an infinite demand at a particular price and demand becomes zero with a slight rise in the price.

5. A flatter demand curve is more elastic than a steeper demand curve at the point of intersection.
   True. Flatter demand curve is more elastic because with the same change in price, change in demand in case of flatter curve is more than change in demand in case of steeper curve.

6. In case of perfectly inelastic demand, expenditure on the commodity does not change with change in its price.
   False. In case of perfectly inelastic demand, demand remains constant irrespective of change in price. It means, expenditure on the commodity will change with change in price.

7. If the proportionate change in the price of a commodity is more than the proportionate change in its quantity demand per unit of time, its price elasticity of demand is greater than unity.
   False. Price elasticity of demand will be less than unity ($E_d < 1$) as proportionate change in demand is less than proportionate change in price.

8. In measuring price elasticity, price is a dependent variable and quantity is an independent variable.
   False. Price is an independent variable and quantity is a dependent variable.

9. The coefficient of price elasticity of demand is generally negative. However, minus sign is ignored for the sake of convenience.
   True. The coefficient of price elasticity of demand is generally negative due to inverse relationship between price and quantity demanded. So, it is often ignored as it is always implied.

10. Commodity with diverse uses has generally less elastic demand.
    False. The demand will be highly elastic because when price of such a commodity increases, then its demand falls considerably as it is put to urgent uses only.

11. Demand is more elastic in the long period than in the short period.
    True. Because consumers find it difficult to change their habits in the short period, whereas, in the long period, it is easy to shift to other substitutes in case price of the given commodity rises.

12. Price Elasticity of Demand of two goods A and B is (–) 3 and (–) 4 respectively. Good A has higher elasticity.
    False. B is more elastic because 1% fall (rise) in price will lead to higher percent rise (fall) in demand.

13. Price Elasticity of Demand is infinity in case of horizontal straight line demand curve.
    True. In case of horizontal straight line demand curve, slope of demand curve is zero. As a result, price elasticity of demand is infinity. It is proved as under:

$$\text{Elasticity of Demand } (E_d) = \frac{1}{\text{Slope of Demand Curve}} \times \frac{P}{Q} = \frac{1}{0} \times \frac{P}{Q} = \infty$$

14. Price Elasticity of Demand is same for the two commodities x and y if slope of their demand curves are same.
    False. When slope of demand curves of commodities x and y are same, then price elasticity of demand depends on their initial price and initial quantity. It happens because:

$$\text{Elasticity of Demand } (E_d) = \frac{1}{\text{Slope of Demand Curve}} \times \frac{P}{Q}$$

15. Price Elasticity of Demand is zero if with 20% increase in price, expenditure on the commodity also rises by 20%.
    True. When 20% increase in price leads to 20% increase in expenditure on the commodity, it means that quantity demanded remains constant. As a result, Elasticity of Demand (E_d) = 0.

GUIDELINES TO NCERT QUESTIONS

1. Explain price elasticity of demand.
   Hint: Price Elasticity of Demand means the degree of responsiveness of demand for a commodity with reference to change in the price of such commodity. It is measured as:

   $$\text{Price Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

2. Consider the demand for a good. At price ₹ 4, the demand for the good is 25 units. Suppose price of the good increases to ₹ 5, and as a result, the demand for the good falls to 20 units. Calculate the price elasticity.
   Hint: Given: Original Quantity (Q) = 25 units; Fall in Quantity (ΔQ) = – 5 units; New Quantity (Q_1) = 20 units; Original Price (P) = ₹ 4; Rise in Price (ΔP) = ₹ 1; New Price (P_1) = ₹ 5

   $$\text{Price Elasticity of Demand } (E_d) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{-5}{1} \times \frac{4}{25} = (-)\,0.8$$

   Demand is less elastic as $E_d < 1$. Negative sign indicates the inverse relationship between price and the quantity demanded.

3. Suppose the price elasticity of demand for a good is – 0.2. If there is a 5% increase in the price of the good, by what percentage will the demand for the good go down?

Hint: Given: % Change (Rise) in Price = 5%; Elasticity of Demand (E_d) = (–) 0.2

$$\text{Elasticity of Demand } (E_d) = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$
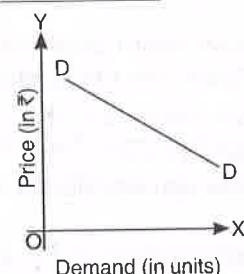
$$(-)\,0.2 = \frac{\text{Percentage Change in Quantity Demanded}}{5}$$

Percentage fall in demand = 1 %

REVISION EXERCISE

Multiple Choice Questions (MCQs)

1. If there is no change in demand for commodity 'X', even after rise in its price, then its demand is:
   - (a) Perfectly Elastic
   - (b) Perfectly Inelastic
   - (c) Less Elastic
   - (d) Highly Elastic

2. The elasticity of demand for a product will not be higher:
   - (a) When it is considered a necessity by its buyers.
   - (b) When more substitutes for the product are available.
   - (c) When it has several uses.
   - (d) When it is an expensive commodity.

3. Demand for a good is less elastic when:
   - (a) Percentage change in price > Percentage change in quantity demanded
   - (b) Percentage change in quantity demanded > Percentage change in price
   - (c) Percentage change in price = Percentage change in quantity demanded
   - (d) Demand remains same even with change in price

4. Which of the following will have elastic demand?
   - (a) Matchbox
   - (b) NCERT Textbooks
   - (c) Medicines
   - (d) Air Conditioners

5. If the price elasticity of demand for a commodity is less than unity, a decrease in price would result in:
   - (a) Proportionately less increase in the quantity demanded.
   - (b) Proportionately more increase in the quantity demanded.
   - (c) Increase in total expenditure on the product.
   - (d) None of these

6. Which one of the following statements is incorrect:
   - (a) Higher numerical value of elasticity indicates larger effect of a price change on the quantity demanded.
   - (b) Elasticity of demand can vary only between –1 and +1.
   - (c) The demand curves for all commodities which have unitary elastic demand will be rectangular hyperbola.
   - (d) Elasticity of demand establishes a quantitative relationship between quantity demanded of a commodity and its price, while other factors remain constant.

7. The following diagram represents _____ elastic demand for commodity X.

   - (a) Less
   - (b) Highly
   - (c) Unitary
   - (d) Perfectly

8. If the percentage increase in the quantity demanded of a commodity is less than the percentage fall in its price, then elasticity of demand is:
   - (a) > 1
   - (b) = 1
   - (c) < 1
   - (d) = 0

9. Price elasticity of demand is best defined as:
   - (a) Change in the tastes of consumers at different prices.
   - (b) Change in demand when income of the consumer increases.
   - (c) The rate of response of demand to a change in price.
   - (d) The rate of response of demand to change in price of related goods.

10. Which of the following influence price elasticity of demand?
    - (a) Nature of the commodity
    - (b) Income Level
    - (c) Availability of substitutes
    - (d) All of these

11. A negative sign with coefficient of price elasticity of demand denotes:
    - (a) Direct relation between price and quantity demanded
    - (b) Inverse relation between price and quantity demanded
    - (c) No relation between price and quantity demanded
    - (d) None of these

12. A 5% fall in the price of X leads to a 10% rise in its demand. In case of Good Y, a 2% rise in price leads to a 6% fall in its demand. In the given case, _____ is more elastic.
    - (a) X
    - (b) Y
    - (c) Both X and Y are equally elastic
    - (d) Both X and Y are inelastic

13. In case of _____, there is an infinite demand at a particular price and demand becomes zero with a slight rise in price.
    - (a) Perfectly inelastic demand
    - (b) Highly elastic demand
    - (c) Less elastic demand
    - (d) Perfectly elastic demand

14. If a good takes up significant share of consumers' budget, it will be:
    - (a) Less elastic
    - (b) Highly elastic
    - (c) Unitary elastic
    - (d) Perfectly elastic

15. If there is no change in quantity demanded to any charge in price, then demand is _____ and demand curve is a _____.
    - (a) perfectly elastic, horizontal straight line
    - (b) perfectly elastic, vertical straight line
    - (c) perfectly inelastic, horizontal straight line
    - (d) perfectly inelastic, vertical straight line

16. If the demand for a good is made by a rich consumer, its demand is generally:
    - (a) Less elastic
    - (b) Highly elastic
    - (c) Unitary elastic
    - (d) Perfectly elastic

17. A firm is currently selling 10,000 units of its product per month. The firm plans to reduce the retail price from ₹ 1 to ₹ 0.90. From the previous experience, the firm knows that the price elasticity of demand for the product is (–) 1.5. Assuming no other changes, the firm can now expect the sales of:
    - (a) 8,500 units
    - (b) 10,500 units
    - (c) 11,000 units
    - (d) 11,500 units

18. The demand for meals at a medium-priced restaurant is elastic. If the management of the restaurant is considering raising prices, it can expect a relatively:
    - (a) Proportionately large fall in quantity demanded
    - (b) No change in quantity demanded
    - (c) Proportionately small fall in quantity demanded
   - (d) Infinite change in quantity demanded

19. With increase in price of burgers by 22%, its demand falls by 25%. This indicates that demand for burgers is:

(a) Elastic   (b) Inelastic   (c) Unitary elastic   (d) Perfectly elastic

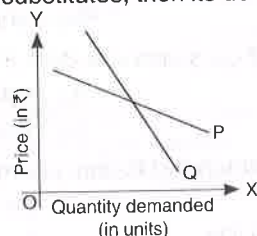**20.** Which of the following diagram correctly depicts the situation of Less Elastic Demand?

(a)   (b)   (c)   (d)
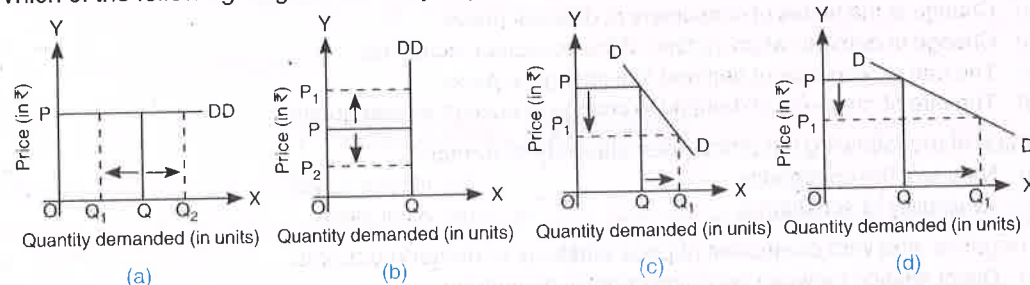
21. Among the following demand curves, which one is more elastic?
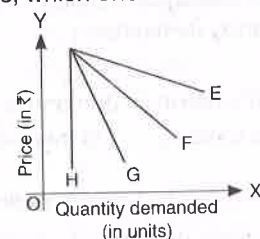
(a) F   (b) E   (c) G   (d) H

22. If a commodity has large number of substitutes, then its demand curve will be:

(a) P   (b) Q   (c) Both (a) and (b)   (d) Neither (a) nor (b)

23. Price Elasticity of Demand of a good is (–) 3. It shows that:

(a) When price falls by 1%, demand rises by 3%   (b) When price rises by 1%, demand falls by 3%

(c) Either (a) or (b)   (d) Neither (a) nor (b)

24. The Indian Government imposed heavy taxes on commodity to reduce its consumption by the public. Such heavy taxes will decrease the demand of the commodity only when:

(a) $E_d = 0$ (b) $E_d > 1$

(c) $E_d < 1$ (d) $E_d = 1$

Ans. **1.** (b); **2.** (a); **3.** (a); **4.** (d); **5.** (a); **6.** (b); **7.** (b); **8.** (c); **9.** (c); **10.** (d); **11.** (b); **12.** (b); **13.** (d); **14.** (b); **15.** (d); **16.** (a); **17.** (d); **18.** (a); **19.** (a); **20.** (c); **21.** (b); **22.** (a); **23.** (c); **24.** (b)

Very Short Answer Type Questions *(1 Mark each)*

Q. 1. Define price elasticity of demand.

Ans. Price elasticity of demand means the degree of responsiveness of demand for a commodity with reference to change in the price of such commodity.

Q. 2. Why is price elasticity of demand generally negative?

Ans. Price elasticity of demand is generally negative because of the inverse relationship between price and quantity demanded.

Q. 3. Give the formula for measuring price elasticity of demand according to percentage method.

Ans.   Elasticity of Demand $(E_d) = \dfrac{\text{Percentage Change in Demand}}{\text{Percentage Change in Price}}$

Q. 4. How is price elasticity related to a horizontal straight line demand curve?

Ans. A horizontal straight line demand curve is perfectly elastic ($E_d = \infty$)

Q. 5. How is price elasticity related to a vertical straight line demand curve?

Ans. A vertical straight line demand curve is perfectly inelastic ($E_d = 0$).

Q. 6. Demand for product X is perfectly inelastic. What will be the change in demand if price falls from ₹ 10 per unit to ₹ 5 per unit?

Ans. There will be no change in demand as demand is perfectly inelastic.

Q. 7. Under what condition will the demand curve be parallel to Y-axis?

Ans. When demand for a product is perfectly inelastic, the demand curve will be parallel to Y-axis.

Q. 8. What will be the shape of demand curve for a commodity whose expenditure rises due to increase in price when its price elasticity is zero?

Ans. The demand curve will be a vertical straight line parallel to Y-axis as demand will remain constant due to perfectly inelastic demand.

Q. 9. When is the demand of a commodity said to be inelastic?

OR

Give the meaning of 'inelastic demand'.

Ans. When percentage change in the quantity demanded is less than percentage change in price, then demand for such a commodity is said to be less elastic.

Q. 10. What is meant by unitary elastic demand?

Ans. When percentage change in the quantity demanded is equal to percentage change in price, then demand for such a commodity is said to be unitary elastic.

Q. 11. If price elasticity of demand for a product is equal to one, what will be the nature of its demand curve?

Ans. Demand curve of a product with unitary elastic demand is a rectangular hyperbola.

Q. 12. What is meant by highly elastic demand?

Ans. When percentage change in the quantity demanded is more than the percentage change in price, then demand for such a commodity is said to be highly elastic.

Q. 13. State 3 factors which affect price elasticity of demand.

Ans. (i) Nature of commodity; (ii) Availability of substitutes; (iii) Income Level.

Q. 14. How does the availability of close substitutes affect elasticity of demand for a product?

Ans. A commodity with large number of close substitutes is more elastic as compared to a commodity with less number of close substitutes.

Q. 15. How is price elasticity of demand affected by the nature of the commodity?

Ans. Price elasticity of demand for necessity goods is inelastic whereas, luxury goods have elastic demand.

Q. 16. If two demand curves intersect, which one has the higher price elasticity?

Ans. When two demand curves intersect, then the flatter curve is more elastic.

Q. 17. Why is demand for water inelastic?

Ans. Because it is a necessity.

Q. 18. When is the demand for a good said to be perfectly inelastic?

Ans. When there is no change in quantity demanded with change in price.

Q. 19. A perfectly elastic price-demand curve is parallel to the X-axis. Why or why not?

Ans. *A perfectly elastic demand curve is parallel to the X-axis because the buyers are willing to buy any quantity of the good at a given price.*

Q. 20. Arrange the following coefficients of price elasticity of demand in ascending order: –0.7, –0.3, –1.1, –0.8.

Ans. *Ascending Order: –0.3, –0.7, –0.8, –1.1. (minus sign only represents the inverse relation between price and quantity demanded).*

Q. 21. Give the formula which provides relationship between elasticity of demand and slope of demand curve.

Ans. Elasticity of Demand $(E_d) = \dfrac{1}{\text{Slope of Demand Curve}} \times \dfrac{P}{Q}$

Short Answer Type Questions *(3-4 Marks each)*

1. What is meant by price elasticity of demand? Explain any 2 factors that affect it.
2. Discuss the percentage method for calculating price elasticity of demand.
3. Draw three demand curves in which price elasticity of demand remains same at all points.
   Hint: Draw demand curves for perfectly elastic, perfectly inelastic and unitary elastic demand.
4. Distinguish between perfectly elastic demand and perfectly inelastic demand. Draw diagrams also.
5. Define unitary elastic demand and draw a demand curve for it. What is the significance of a unitary elastic demand curve?
6. Mention any three factors that affect the price elasticity of demand for a commodity.
7. How is the price elasticity of demand of a commodity affected by the number of its substitutes? Explain.
8. How does the nature of a commodity influence its price elasticity of demand?
9. When two demand curves intersect each other, which one is more elastic?
10. How is price elasticity of demand affected by: (i) Number of substitutes available for the good; (ii) Nature of the good.
11. Explain the influence of following on price elasticity of demand of a good: (i) Substitute goods; (ii) Own price of the good.

Long Answer Type Questions *(6 Marks each)*

1. Explain the percentage method of determining elasticity of demand with the help of an example.
2. Explain, in brief, the following kinds of price elasticities of demand: (i) Highly elastic demand; (ii) Less Elastic Demand; (iii) Unitary elastic demand.
3. Discuss various factors that affect price elasticity of demand.
4. Explain the significance of elasticity of demand.

Unsolved Practicals

Calculation of Elasticity of Demand (When both price and quantity are given)

1. The quantity demanded increases from 100 units to 200 units when the price decreases from ₹ 12 to ₹ 10. Calculate the elasticity of demand.
   {E_d = (–) 6}
2. As price of a commodity increases from ₹ 4 per unit to ₹ 5 per unit, demand falls from 20 units to 10 units. Find out the elasticity of demand.
   {E_d = (–) 2}

3. The prices and quantities demanded of a commodity are given below. On this basis, find out the price elasticity of demand.

Price (₹)	10	20
Demand (units)	20	15

{E_d = (–) 0.25}

4. Price of a good falls from ₹ 10 to ₹ 8. As a result, its demand rises from 80 units to 100 units. What is the price elasticity of demand?
   {E_d = (–) 1.25}
5. Demand increases by 10 units when the price decreases by ₹ 2. As a result, demand increase to 100 units and price decreases to ₹ 8. Find out the price elasticity of demand.
   {E_d = (–) 0.55}
6. Following is the market demand schedule of commodity *X*. Calculate the coefficient of price elasticity of demand, when price increases from ₹ 3 per unit to ₹ 5 per unit.

Price (₹)	7	6	5	4	3	2	1
Demand (units)	500	750	1,250	2,000	3,250	4,750	8,000

{E_d = (–) 0.92}

7. Suppose that originally, a product was being sold at ₹ 10 per unit and the quantity demanded was 1,000 units. The product price changes to ₹ 14 and, as a result, the quantity demanded changes to 500 units. Calculate the price elasticity of demand.
   {E_d = (–) 1.25}
8. A consumer purchased 10 units of a commodity when its price was ₹ 5 per unit. He purchased 12 units of the commodity when its price fell to ₹ 4 per unit. What is the price elasticity of demand for the commodity?
   {E_d = (–) 1}
9. Following are the demand schedules for commodities *A* and *B*. Which one of them has more elastic demand?

Commodity A		Commodity B	
Price (₹)	Quantity demanded (units)	Price (₹)	Quantity demanded (units)
10	100	20	100
12	90	18	110

{Ed for A = (–) 0.5, Ed for B = (–) 1; B is more elastic}

10. Following is the demand schedule of commodity *Y*:

Price (₹)	15	16	17	20
Demand (units)	100	80	50	40

Calculate the elasticity of demand when: (i) Price rises from ₹ 15 to ₹ 20; (ii) When price falls from ₹ 20 to ₹ 15.
{(i) E_d = (–) 1.8; (ii) E_d = (–) 6}

Calculation of Price or Quantity (When elasticity of demand is given)

11. The coefficient of price elasticity of demand for a commodity is 0.2. When price was ₹ 10 per unit, the quantity demanded was 40 units. If the price falls to ₹ 5 per unit, how much will be its quantity demanded?
   {44 units}
12. Market demand for a good at a price of ₹ 10 per unit is 100 units. When its price changes, its market demand falls to 50 units. Find out the new price, if the price elasticity of demand is (–) 2.
   {₹ 12.50}
13. A consumer buys 160 units of a good at a price of ₹ 8 per unit. Price falls to ₹ 6 per unit. How much quantity will the consumer buy at the new price, if price elasticity of demand is (–) 2?
   {240 units}
14. A consumer buys 200 units of a good at a price of ₹ 5 per unit. With change in price, he buys only 100 units. If price elasticity is (–) 1, find out the changed price.
   {₹ 7.5}

15. Price of a commodity decreases from ₹ 10 to ₹ 5 per unit. If the price elasticity of demand is 3 and the original quantity demanded is 40 units, calculate the new quantity demanded. {100 units}

16. The elasticity of demand for salt is zero. If the demand is 2 kg at the price of ₹ 5 per kg, calculate demand, if the price rises to ₹ 7.50 per kg? {2 Kg}

17. Price elasticity of demand for a commodity is unity and a household demands 50 units of it when its price is ₹ 2 per unit. At what price will the household demands 45 units of the commodity? {₹ 2.20}

18. The quantity demanded of a commodity falls by 5 units when price rises by ₹ 1 per unit. Its price elasticity of demand is (-) 1.5. Calculate the price before change if it this price quantity demanded was 60 units. {₹ 18}

19. When price of a commodity falls by ₹ 1 per unit, its quantity demanded rises by 3 units. Its price elasticity of demand is (-) 2. Calculate its original quantity demanded if the price before the change was ₹ 10 per unit. {15 units}

Elasticity of Demand by Percentage Method

20. As a result of a 5 per cent fall in the price of a good, its demand rises by 12 %. Find out the price elasticity of demand. {$E_d = (-) 2.4$}

21. A 3% fall in the price of X leads to a 9% rise in its demand. A 5% rise in the price of Y leads to a 5% fall in its demand. Calculate the price elasticity of demand for X and Y. Which one is more elastic? {E_d for X = (-) 3; E_d for Y = (-) 1; X is more elastic}

22. A 5% fall in the price of X leads to a 10% rise in demand for X. A 2% rise in the price of Y leads to a 6% fall in demand for Y. Calculate elasticity of demand of X and Y. {E_d for X = (-) 2; E_d for Y = (-) 3}

23. As the price of a commodity falls from ₹ 8 to ₹ 6, its demand rises from 100 units to 125 units. Find out the price elasticity of demand by percentage method. {$E_d = (-) 1$}

24. At a price of ₹ 20 per unit, the quantity demanded of a commodity is 300 units. If the price falls by 10%, its quantity demanded rises by 60 units. Calculate its price elasticity. {$E_d = (-) 2$}

25. As a result of 10% rise in the price of a good, its demand falls from 100 units to 90 units. Find out the price elasticity of demand. {$E_d = (-) 1$}

26. A household increases its demand for a commodity from 40 units to 50 units when its price falls by 10%. What is the price elasticity of demand for the commodity? {$E_d = (-) 2.5$}

Calculation of Elasticity of Demand (When Total Expenditure is given)

27. As price of a commodity falls from ₹ 7 per kg to ₹ 5 per kg, the total expenditure on it increases from ₹ 3,500 to ₹ 6,250. Find out the elasticity of demand. {$E_d = (-) 5.25$}

28. A consumer spends ₹ 80 on a commodity at a price of ₹ 1 per unit and ₹ 100 at a price of ₹ 2 per unit. What is the price elasticity of demand? {$E_d = (-) 0.375$}

29. Mr. Ram spent ₹ 200 on a commodity and bought 20 units of it. When its price changed, he spent ₹ 300 and bought 15 units. Find out the elasticity of demand. {$E_d = (-) 0.25$}

30. On the basis of information given below, compare price elasticities of Goods A and B:

Good A		Good B	
Price per unit (₹)	Total Expenditure (₹)	Price per unit (₹)	Total Expenditure (₹)
4	20	3	15
5	15	4	4

{E_d for A = (-) 1.6; E_d for B = (-) 0.6; A is more elastic}

Miscellaneous Practicals

31. The price elasticity of demand of good X is double the price elasticity of demand of Good Y. A 10% rise in the price of good Y results in fall in its demand by 60 units. If original demand of commodity Y was 400, calculate percentage rise in quantity demanded of good X when its price falls from ₹ 10 to ₹ 8 per unit. {Percentage rise in quantity demanded of good X = 60%}

32. A consumer buys a certain quantity of a good at a price of ₹ 10 per unit. When price falls to ₹ 8 per unit, she buys 40% more quantity. Calculate price elasticity of demand. {$E_d = (-) 2$}

33. At a price of ₹ 5 per pen, the demand is 40 pens. The elasticity of demand is 0.75 and increase in price is ₹ 1. Calculate the change in quantity of pens demanded. {Change in Quantity Demanded = 6 Pens}

34. The price elasticity of demand of commodity X is ½ of price elasticity of demand of commodity Y. When price of X falls by 40%, its demand rises by 20 units. Calculate price elasticity of demand of commodity X and Y, if originally 100 units of X were demanded at price of ₹ 5 per unit. {Price Elasticity of Demand of X = (-) 0.50; Price Elasticity of Demand of Y = (-) 1}

35. If $\frac{\Delta P}{P} = 0.2$ and price elasticity is (-) 2, calculate the percentage fall in demand. Also calculate the original expenditure if new expenditure is ₹ 180 at price of ₹ 6. {Percentage fall in Demand = 40%; Original Expenditure = ₹ 250}

36. The demand function of good 'A' is given as: $Q_A = 40 - 5P_A$. Calculate its price elasticity when price rises from ₹ 4 to ₹ 6. {$E_d = (-) 1$}

37. The ratio of change in price (ΔP) to original price (P) is 0.4 and elasticity of demand is (-) 1.50, calculate the percentage change in demand. {Percentage change in Demand = 60%}

38. Price elasticity of demand for a product is unity. Its demand is 25 units at a price of ₹ 5 per unit. If the price of product rises to ₹ 6 per unit, how much quantity of the product will be demanded? {20 units}

39. The price of a commodity is ₹ 12 per unit and its quantity demanded is 500 units. When price rises by ₹ 3 per unit, its quantity demanded falls by 150 units. Calculate its price elasticity of demand. Is demand elastic? {$E_d = (-) 1.20$; Yes, demand is elastic as $E_d > 1$}

40. Commodities A and B have equal price elasticity of demand. The demand of X rises from 100 units to 150 units due to a 20 per cent fall in its price. Calculate the percentage fall in demand of Y if its price rises by 8 per cent. {Percentage fall in demand of Y = 20%}

41. The price of a commodity is ₹ 10 per unit and its quantity demanded at this price is 500 units. If its quantity demanded rises by 75 units due to fall in price by 10 per cent, calculate its price elasticity of demand. {$E_d = (-) 1.5$}

42. From the following data, calculate price elasticity of demand:

Price (₹)	Demand (units)
9	100
9	150

{$E_d = \infty$}

43. When price of a good is ₹ 13 per unit, the consumer buys 11 units of that good. When price rises to ₹ 15 per unit, the consumer continues to buy 11 units. Calculate price elasticity of demand. {$E_d = 0$}

44. The price elasticity of demand of a commodity is –0.5. At a price of ₹ 20 per unit, total expenditure on it is ₹ 2,000. Its price is reduced by 10 per cent. Calculate its demand at the reduced rate.
{105 units}

45. A consumer buys 20 units of a good at a price of ₹ 5 per unit. He incurs an expenditure of ₹ 120, when he buys 24 units. Calculate price elasticity of demand using the percentage method. Comment upon the likely shape of demand curve based on this information.
{Price elasticity of demand (E_d) = Infinity; As demand is perfectly elastic, demand curve will be horizontal straight line parallel to X-axis}

46. The price of a commodity is ₹ 20 per unit and total expenditure on it is ₹ 1,000. When its price falls to ₹ 18 per unit, total expenditure increases by 8 per cent. Calculate its price elasticity of demand by percentage method.
{E_d = (–) 2}

47. The price elasticity of demand of X is (–) 1.25. Its price falls from ₹ 10 to ₹ 8 per unit. Calculate percentage change in its demand.
{Percentage change (fall) in its demand = 25%}

48. The price elasticity of demand for a good is – 0.4. If its price increases by 5 percent, by what percentage will its demand fall? Calculate.
{Demand will fall by 2%}

49. The demand for good rises by 20 percent as a result of fall in its price. Its price elasticity of demand is (–) 0.8. Calculate the percentage fall in price.
{Price will fall by 25%}

50. A 5 per cent fall in the price of a good raises its demand from 300 units to 318 units. Calculate its price elasticity of demand.
{Price elasticity of demand (E_d) = (–) 1.20}

51. Price of a good rises from ₹ 7 per unit to ₹ 9 per unit but its demand remains unchanged. Calculate price elasticity of demand of the good.
{Price elasticity of demand (E_d) = 0, i.e. Perfectly Inelastic}

52. Price elasticity of demand of a good is – 0.75. Calculate the percentage fall in its price that will result in 15 per cent rise in its demand.
{Price will fall by 20%}

53. Price of a good rises by 25 per cent but there is no effect on demand of the good due to this price rise. Calculate price elasticity of demand.
{Price elasticity of demand (E_d) = 0, i.e. Perfectly Inelastic}

54. A consumer spends ₹ 2,000 on a good priced at ₹ 8 per unit. When price rises by 25%, the consumer continues to spend the same amount on the good. Calculate price elasticity of demand by the Percentage Method.
{Price Elasticity of Demand = (–) 0.80}

55. A consumer buys 18 units of a good at a price of ₹ 9 per unit. The price elasticity of demand for the good is (–)1. How many units the consumer will buy at a price of ₹ 10 per unit? Calculate.
{16 units}

56. Price elasticity of demand of a good is (–)1. When its price per unit falls by one rupee, its demand rises from 16 to 18 units. Calculate the price before change.
{₹ 9}

57. A consumer buys 30 units of a good at a price of ₹ 10 per unit. Price elasticity of demand for the good is (–) 1. How many units the consumer will buy at a price of ₹ 9 per unit? Calculate.
{33 units}

58. When price of a good falls from ₹ 15 per unit to ₹ 12 per unit, its demand rises by 25 percent. Calculate price elasticity of demand.
{Price elasticity of demand (E_d) = (–) 1.25}

59. Price elasticity of demand of a good is (–) 1. Calculate the percentage change in price that will raise the demand from 20 units to 30 units.
{Price will fall by 50%}

60. Price elasticity of demand of two goods A and B is (–) 3 and (–) 4 respectively. Which of the two goods has higher elasticity and why?
{Good B has higher elasticity as compared to A. It is because with change in price by 1%, demand for B changes by 4% while in case of good A it is only 3%.}

61. The quantity demanded of a good is 1,500 units at the price of ₹ 10 per unit. Its price elasticity of demand is (–) 1.5. Calculate its quantity demanded, when its price falls to ₹ 8 per unit.
{1,950 units}

62. The price elasticity of demand of a good is (–) 0.5. At a price of ₹ 20 per unit its demand is 300 units. At what price will its demand increase by 10 percent?
{₹ 16}

63. A consumer spends ₹ 1,000 on a good priced at ₹ 8 per unit. When price rises by 25 per cent, the consumer continues to spend ₹ 1,000 on the good. Calculate price elasticity of demand by percentage method.
{Price Elasticity of Demand (E_d) = (–) 0.8}

64. A consumer spends ₹ 60 on a good priced at ₹ 5 per unit. When price falls by 20 per cent, the consumer continues to spend ₹ 60 on the good. Calculate price elasticity of demand by percentage method.
{Price Elasticity of Demand (E_d) = (–) 1.25}

65. A consumer spends ₹ 100 on a good priced at ₹ 4 per unit. When price falls by 50 per cent, the consumer continues to spend ₹ 100 on the good. Calculate price elasticity of demand by percentage method.
{Price Elasticity of Demand (E_d) = (–) 2}

66. A consumer spends ₹ 1,000 on a good priced at ₹ 10 per unit. When its price falls by 20 percent, the consumer spends ₹ 800 on the good, Calculate the price elasticity of demand by the Percentage method.
{Price Elasticity of Demand (E_d) = 0}

67. Price elasticity of demand of good X is – 2 and of good Y is – 3. Which of the two goods is more price elastic and why?
{Y is more price elastic because 1% fall (rise) in price will lead to higher percent rise (fall) in demand}

68. What will be the effect of 10 percent rise in price of a good on its demand if price elasticity of demand is (a) Zero, (b) – 1, (c) – 2.
{(a) Zero or no change; (b) 10% fall; (c) 20% fall}

69. Price elasticity of demand for the two goods X and Y are zero and (–) 1 respectively. Which of the two is more elastic and why?
{Y is more elastic than X because 1% change in price of good Y leads to 1% change in quantity demanded, while 1% change in good X has no effect on demand of good X}

70. Price of a commodity falls from ₹ 20 to ₹ 15 per unit. Its demand rises from 600 units to 750 units. Calculate its price elasticity of demand.
{Price Elasticity of Demand (E_d) = (–)1}

71. The demand curve for the commodity is given as D_x = 10 + 2P. If slope of the demand curve is (– 2), calculate price elasticity of demand for the commodity when the price of the commodity is ₹ 5 per unit.
{E_d = (–) 0.125}

72. The demand curve of a commodity is expressed as D_x = 20 – 2P. If slope of the demand curve is given to be (– 2), calculate price elasticity of demand for the commodity when demand is 10 units.
{E_d = (–) 0.25}

73. Price of a commodity falls from ₹ 40 to ₹ 30 per unit. Quantity demanded initially was 60 units. By how much the quantity will rise if elasticity of demand is established to be unitary?
{15 units}

74. When price of a commodity X falls by 10 per cent, its demand rises from 150 units to 180 units. Calculate its price elasticity of demand. How much should be the percentage fall in its price so that its demand rises from 150 to 210 units?
{Price Elasticity of Demand = (–) 2; Percentage fall in Price = 20%}

75. When the price of a good rises from ₹ 10 per unit to ₹ 12 per unit, its quantity demanded falls by 20 percent. Calculate its price elasticity of demand. How much would be the percentage change in its quantity demanded, if the price rises from ₹ 10 per unit to ₹ 13 per unit?
{Price Elasticity of Demand = (–) 1; Percentage fall in Quantity Demanded = 30%}

As seen in Fig. 4.8, elasticity at a particular point 'N' is calculated as $\dfrac{NQ}{NP}$

Elasticity at point 'N' = $\dfrac{NQ \text{ (Lower Segment)}}{NP \text{ (Upper Segment)}}$
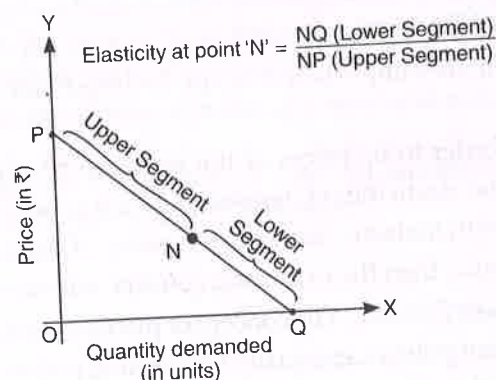
Fig. 4.8

Similarly, elasticity of demand on different points of a straight line demand curve is shown in **Fig. 4.9**:

1. **Unitary Elastic Demand:** At the mid-point of the demand curve, i.e. at point B, the lower and upper segments (BD and BE) are exactly equal. Thus, elasticity at point B $= \dfrac{LS}{US} = \dfrac{BD}{BE} = 1$

2. **Highly Elastic Demand:** At every point above the mid-point B but below E, i.e., between E and B, the elasticity will be greater than one. It happens because lower segment is greater than the upper segment.

So, E_d at point A $= \dfrac{LS}{US} = \dfrac{AD}{AE} > 1$ *(as AD > AE).*

3. **Less Elastic Demand:** At every point below the mid-point B but above D, i.e., between B and D, the elasticity will be less than one. It happens because lower segment is less than upper segment.

So, Ed at point C $= \dfrac{LS}{US} = \dfrac{CD}{CE} < 1$ *(as CD > CE).*

4. **Perfectly Elastic Demand:** At any point on the Y-axis (like point E), elasticity is equal to infinity because at this point, there is no upper segment of demand curve. So, E_d at point

E $= \dfrac{LS}{US} = \dfrac{ED}{0} = \infty$ (as any number, when divided by zero, gives infinity).

5. **Perfectly Inelastic Demand:** At any point on the X-axis (like point D), elasticity is equal to zero because at this point, there is no lower segment of demand curve. So, E_d at point

D $= \dfrac{LS}{US} = \dfrac{0}{ED} = 0$ (as zero, when divided by any number, gives zero).
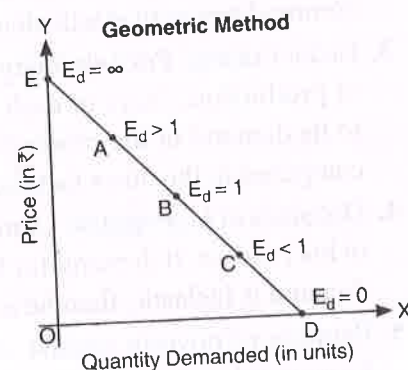

Geometric Method

Fig. 4.9

3. Relationship between Price Elasticity of Demand and Total Expenditure

The price elasticity of demand for a good and the total expenditure made on the good are greatly related to each other. At times, it becomes important to determine the effect on the expenditure on a good due to change in price of the good.

We know that the price of a good and the demand for the good are inversely related to each other. *So, responsiveness of demand in relation to change in price (i.e. price elasticity of demand) determines the change in expenditure.*

1. **Elasticity is more than One ($E_d > 1$):** When demand is elastic, a fall in the price of a commodity results in increase in total expenditure on it. On the other hand, when price increases, total expenditure decreases. It means, in case of highly elastic demand, price and total expenditure move in the opposite directions.

Table 4.6: Highly Elastic Demand

Price (in ₹)	Quantity (in units)	Total Expenditure (in ₹) (Price x Quantity)
5	100	500
4	140	560

In Table 4.6, $E_d > 1$ because total expenditure rises with fall in price.

2. **Elasticity is less than One ($E_d < 1$):** When demand is inelastic, a fall in the price of a commodity leads to fall in total expenditure on it. On the other hand, when price increases, total expenditure also increases. It means, in case of less elastic demand, price and total expenditure move in the same direction.

Table 4.7: Less Elastic Demand

Price (in ₹)	Quantity (in units)	Total Expenditure (in ₹) (Price x Quantity)
5	100	500
4	120	480

In Table 4.7, $E_d < 1$ because total expenditure also falls with fall in price.

3. **Elasticity is equal to One ($E_d = 1$):** When demand is unitary elastic, a fall or rise in the price of the commodity does not change the total expenditure. It means, total expenditure will remain unchanged in case of unitary elastic demand.

Table 4.8: Unitary Elastic Demand

Price (in ₹)	Quantity (in units)	Total Expenditure (in ₹) (Price x Quantity)
5	100	500
4	125	500

In Table 4.8, $E_d = 1$ because total expenditure remains same even after fall in price.

Total Expenditure Method

Price Elasticity of demand can also be calculated by Total Expenditure Method. This method was suggested by Prof. Marshall. This method is also known as Total Outlay or Total Revenue method. Under this method, price elasticity is measured by comparing Total Expenditure (TE) on the commodity before and after the change in price. It has three possibilities:

(i) $E_d > 1$, if TE is inversely related to the price.

(ii) $E_d < 1$, if TE is directly related to the price.

(iii) $E_d = 1$, if TE does not change with change in price.

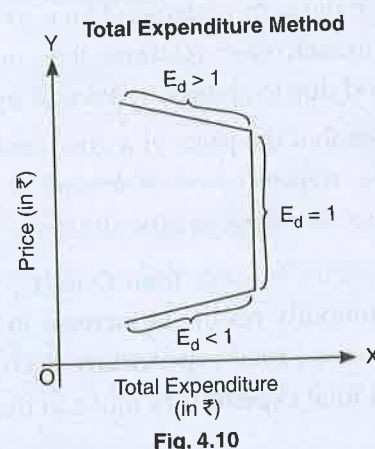The three cases are diagrammatically shown in **Fig. 4.10.**

Total Expenditure Method

$E_d > 1$

$E_d = 1$

$E_d < 1$

Price (in ₹)

Total Expenditure (in ₹)

Fig. 4.10

Limitation of this Method: Total Expenditure method suffers from one defect. It fails to give the exact magnitude of elasticity. By this method, we can only know whether the elasticity is equal to one, greater than one or less than one. Hence, this method is restrictive and provides only a rough measure of elasticity.

PRODUCTION FUNCTION

LEARNING OBJECTIVES

5.1 INTRODUCTION

We are aware that both consumers and producers are needed for smooth functioning of an economy. In the previous three chapters, we focused our attention on the behaviour of consumers. Now, we will pay attention towards the producers.

A producer makes use of various inputs for production of goods and services. Production is an important economic activity as it enhances the utility of the product by changing it in the form needed by the consumers. *For example,* leather is of less use in its raw form until it is transformed into some desirable product like shoes, bags, jackets etc. The term *production,* in economics, covers a much wider range of activities, than in its everyday use.

To an economist, production means any process that converts a commodity or commodities into a different commodity. ***Production refers to transformation of inputs into output.*** *For example:* To manufacture shoes (output), we need various inputs like leather, nails, land, labour, capital, services of entrepreneur etc.

5.2 PRODUCTION FUNCTION

There exists some relationship between inputs and output of a firm. In Economics, such a relationship is known as production function. ***Production function is an expression of the technological relation between physical inputs and output of a good.***

Symbolically: $O_x = f(i_1, i_2, i_3 \ldots\ldots\ldots i_n)$

{Where: O_x = Output of commodity x; f = Functional relationship; $i_1, i_2, \ldots i_n$ = Inputs needed for O_x}