

## Chapter - 2

### Theory of Demand, Supply & Equilibrium Price

#### Demand function

It shows mathematical or functional relationship bet<sup>n</sup> quantity demanded of commodity & various determinants of demand such as price of the commodity, consumers income, price of related goods (complementary & substitute), taste & preferences of the consumer. The relation may be bet<sup>n</sup> two or more than two variables.

Quantity demanded of a commodity is related with its price. The relationship bet<sup>n</sup> them can be shown in a schedule or a diagram or can be expressed in the form of an equation such as @  $D_x = f(P_x)$   
 (b)  $D_x = a - bP_x$

It shows an inverse relationship bet<sup>n</sup> demand & price as expressed by law of demand. Here, we assume other determinants of demand constant except price.

(1) Simple demand function / Single variable demand function  
 It shows the relationship bet<sup>n</sup> quantity demanded & price of the commodity other determinants remaining constant.

(2) Multivariate demand function / long run / Market demand function  
 It shows functional relationship bet<sup>n</sup> demand & all the determinants of demand. It indicates the effects of all these determinants on the demand for a commodity.

i Multivariate Generalized demand function

It implies only that, there are general relationship bet<sup>n</sup> demand & its determinants. It doesn't say about quantitative relationship.  $D_x = f(P_x, I, P_y, P_z, A)$

ii Multivariate Specified demand function

For using demand function in decision making the relationship bet<sup>n</sup> demand & its determinants must be clearly specified.  $D_x = a - bP_x + cP_I + dP_y - eP_z$

The coefficient of the equation indicates the effect of each variable on demand. The coefficient ( $b, c, d$  &  $e$ ) indicates the change in demand as a result of one units change in the associated variable such as price of commodity or consumer's income, price of substitute, price of complementary goods respectively.

### Types of Demand Function

A single variable demand function can be in the form of

(a) Linear demand function

(b) Non-linear demand function

- (a) The equation,  $D_x = f(P_x)$  doesn't show the quantitative relation bet<sup>n</sup>  $D_x$  &  $P_x$ . It shows an inverse function of its price.

The equation,  $D_x = a - bP_x$  shows the quantitative relation bet<sup>n</sup>  $D_x$  &  $P_x$ .

$D_x$  = Quantity demand for a commodity  $x$ .

$P_x$  = Price of a commodity  $x$ .

In equation, 'a' is a constant variable (term) showing initial demand irrespective to price. It shows total demand at zero price. It is autonomous demand, based on other determinants except price. 'b' is also a constant coefficient, it shows the slope of the demand curve. It reflects the quantitative relation bet<sup>n</sup> D<sub>x</sub> & P<sub>x</sub>.

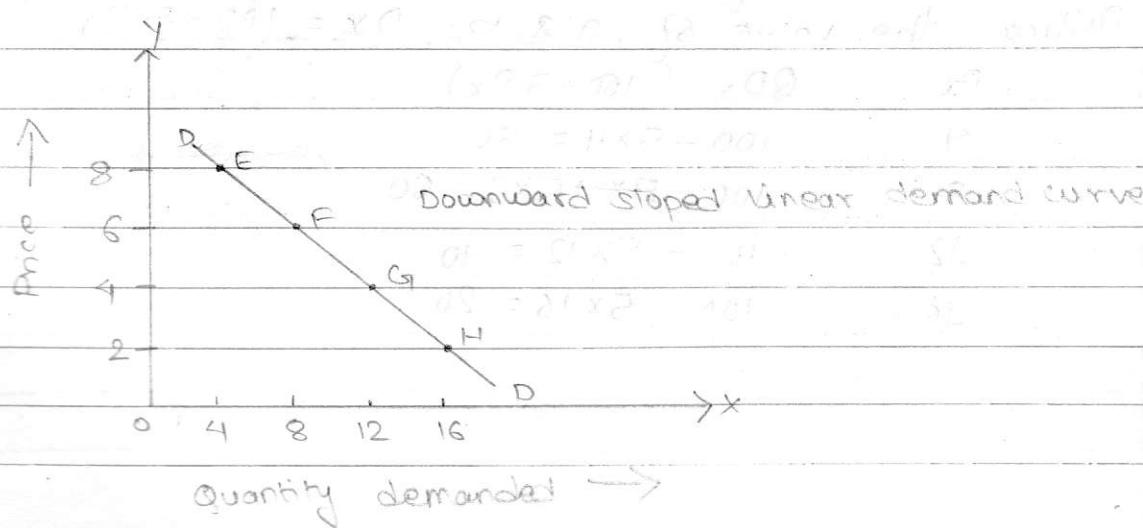
How much quantity demanded of a product changes as a result of changing its price? 'b' has negative sign denoting inverse relationship bet<sup>n</sup> demand & price, depending on law of demand. As the price falls quantity demanded of a commodity rises & vice-versa.

If the value of a & b are known, total quantity demanded of a commodity at any price can be calculated.

#### Demand Schedule

Points	P <sub>x</sub> (Rs)	Q <sub>Dx</sub> (20 - 2P <sub>x</sub> )
E	8	20 - 2 × 8 = 4
F	6	20 - 2 × 6 = 8
G	4	20 - 2 × 4 = 12
H	2	20 - 2 × 2 = 16

#### Linear Demand Curve



In the given figure, quantity demanded & prices are shown along X-axis & Y-axis respectively. The demand curve is drawn by joining the points E, F, G & H indicating demand at different price. DD curve is a linear demand curve, it slopes downward from left to right. At higher price less is demanded & vice-versa.

### (b) Non-linear demand function.

Slopes of non-linear demand curve changes all along the demand curve. The non-linear demand function is represented in a curve not in a straight line, it takes the form of a power function such as it

$$\textcircled{a} \quad D_x = aP_x^{-b} \quad \textcircled{b} \quad D_x = \frac{a}{P_x^b}$$

- # Assume that  $a=100$  &  $b=5$ , find out demand function & quantity demand at price 4, 8, 12, 16 also derive the demand curve what type of demand function it represent

Sol<sup>n</sup>, Given,

$$\text{Autonomous demand (a)} = 100$$

$$\text{Slope of demand (b)} = 5$$

Then, demand function =  $a - bP_x$

Putting the value of a & b.  $D_x = 100 - 5P_x$

$$P_x \quad QD_x \quad (100 - 5P_x)$$

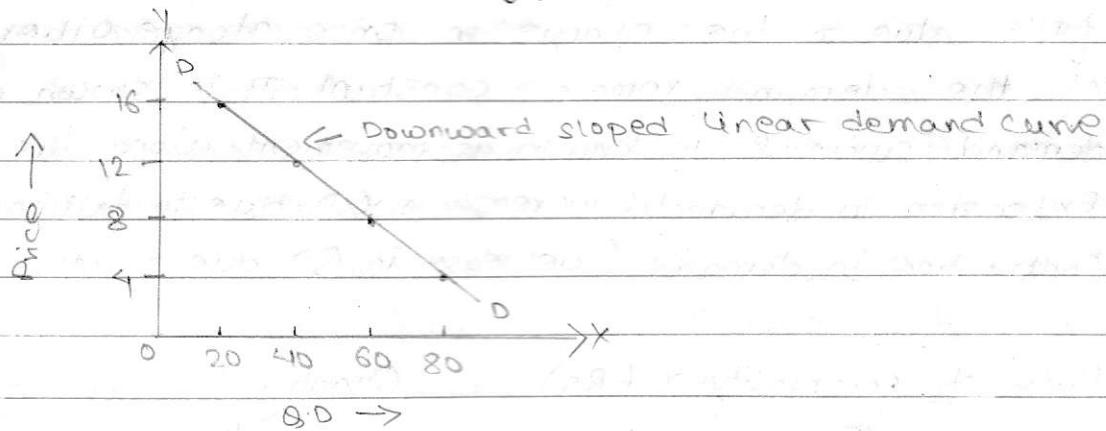
$$4 \quad 100 - 5 \times 4 = 80$$

$$8 \quad 100 - 5 \times 8 = 60$$

$$12 \quad 100 - 5 \times 12 = 40$$

$$16 \quad 100 - 5 \times 16 = 20$$

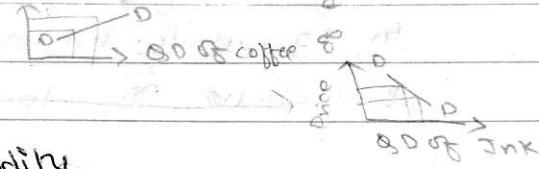
From the demand schedule we can prepare a demand <sup>curve</sup>, which is shown in the figure:



The above demand curve DD represents linear demand function

#### Determinants of demand

1. Price of a commodity
2. Consumer's Income
3. Price of related goods
  - a. Substitute goods (Tea & coffee)
  - b. Complementary goods (Pen & Ink)
4. Tastes & preferences of the commodity.
5. Expectation of rise/fall in price of the commodity.
6. Distribution of income
7. Size & composition of population
8. Advertisement
9. Climate & weather



Movement along the demand curve (change in QD due to price)

The quantity demanded of a commodity raises or falls due to the change in price alone, other determinants of the demand remain constant. It is shown on the same demand curve & is known as movement along the demand curve.

1. Extension in demand (increase in QD due to fall in price)
2. Contraction in demand (decrease in QD due to raise in price)

Price of commodity x (Rs)

15

10

5

Quantity demand of x (units)

10

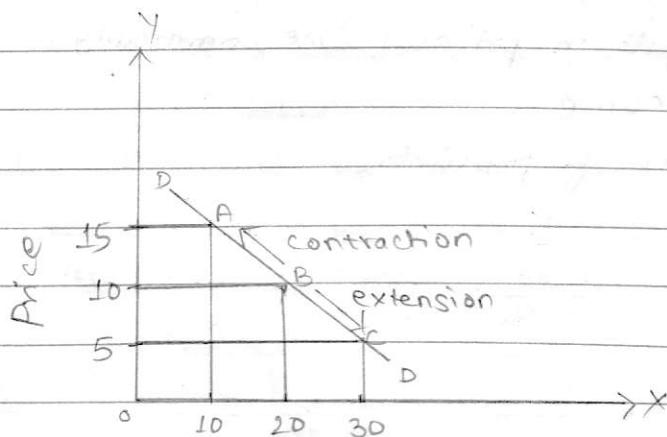
20

30

contraction

extension

In the table, when price of a commodity is Rs 10 its QD is 20 units when price increase from Rs 10 to Rs 15 its QD decrease from 20 units to 10 units. Similarly, when price decrease from Rs 10 to Rs 5 its QD increase from 20 units to 30 units. When QD increase, there is extension in demand & when QD decrease, there is contraction in demand.



QD of a commodity

In the fig, QD & price are measured along x-axis & y-axis respectively. The original QD is 20 units whereas original price is Rs 10. When price of a commodity increase from Rs 10 to Rs 15 its QD decreases from 20 units to 10 units & there is movement from B to A on the same demand curve DD which is contraction in demand curve. When price of a commodity decrease from Rs 10 to Rs 5 its QD increase from 20 units to 30 units & there is movement from B to C on the same demand curve which is extension in demand curve. Other determinants of demand remaining constant.

**Shift in Demand Curve (change in quantity due to non-price factors)**

Demand curve shifts due to change in non-price factors of the commodity. Other factors are consumer's income, price of related goods, taste & preferences, fashion, habit, prestige, etc. The shift in demand curve is shown by drawing new demand curve. There are two types of change in demand or shift in demand curve:

- 1) Rightward shift in Demand curve (Increase)
- 2) Leftward shift in Demand curve (Decrease)

### 1) Rightward shift in Demand curve

Rightward shift in demand curve refers to more demand at the same price due to favorable change in non-price factors of the commodity. In this situation the initial demand curve shifts towards right.

Reasons for the increase in demand or rightward shift

1. Increase in consumer's income
2. Increase in the price of its substitute good.
3. Decrease in the price of its complementary good.
4. Favorable change in taste & preference
5. Expectation of the rise in the price of the commodity in the future
6. Increase in population

## 2. Leftward shift in Demand curve

Leftward Shift in demand curve refers to less demand at the same price due to unfavorable change in non-price factors of the commodity. In this situation, the initial demand curve shifts towards left.

Reasons for the decrease in demand or ~~rightward~~ shift

1. Decrease in consumer's income
2. Decrease in the price of its substitute good
3. Increase in the price of its complementary good.
4. Unfavorable change in taste & preference
5. Expectation of the fall in the price of the commodity in the future.
6. Decrease in population.

Price of commodity X (Rs)

10

10

10

QD of commodity X (units)

10

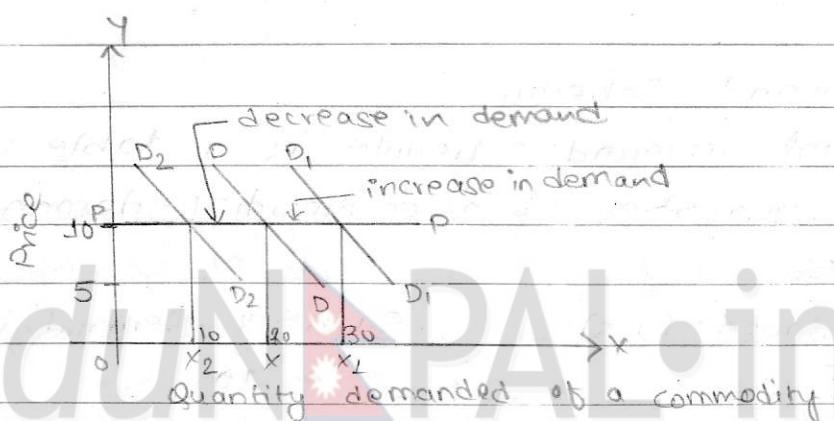
20

30

↑ Decrease in demand

↓ Increase in demand

In the table, when price of a commodity is Rs 10 its demand is 20 units. Due to favorable change occurs in the commodity, the quantity demand increase from 20 units to 30 units at the same price similarly, due to unfavorable change in factors other than price, the quantity demand decrease from 20 units to 10 units.



In the figure, PP is the price which shows the same price i.e. Rs 10. DD is the original demand curve. Due to favorable change in other determinants of demand, the demand for a commodity increase from 20 to 30 at the same price. And original demand curve DD shifts right i.e. D<sub>1</sub>D<sub>2</sub>. It indicates an increase in demand. Similarly, due to unfavorable change in other determinants of demand, the demand for a commodity decreases from 20 to 10 at the same price. And DD curve shifts to D<sub>2</sub>D<sub>2</sub> leftward. It indicates decrease in demand.

## Derivation of Individual & Market Demand Curve.

### → Derivation of an Individual Demand Curve.

The demand for a commodity made by an individual consumer is called individual demand. In other words, an individual demand refers to the quantities of a commodity demanded by an individual consumer at various prices, other things remaining the same.

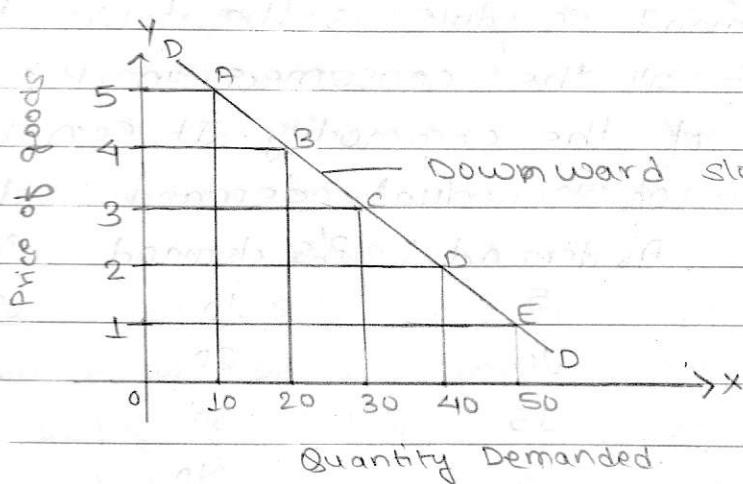
### Individual Demand Schedule

Individual demand schedule is a table which shows the different quantities of a commodity demanded at different prices.

Price of Goods (Rs)	Quantity Demanded (in units)
5	10
4	20
3	30
2	40
1	50

The above table shows that the QD is 10 units at the price Rs 5. When the price of the goods falls to Rs 4, Rs 3, Rs 2 & Rs 1, the QD gradually increases to 20 units, 30 units, 40 units & 50 units respectively. It clearly state that as the price falls, the quantity demanded by an individual increases & vice-versa.

### Individual Demand curve.



In the figure, DD is the individual demand curve. By plotting 10 units of the commodity at Rs 5, we get point 'A'. Likewise, by plotting 20 units of Rs 4, we get point 'B'. Similarly, by plotting 30 units, 40 units & 50 units of Rs 3, Rs 2 & Rs 1 respectively, we get points C, D & E. And by joining these points we get a DD curve which is known as individual demand curve. The negative slope of the demand curve DD shows the inverse relationship between price & QD for a commodity.

### ⇒ Derivation of the Market Demand curve

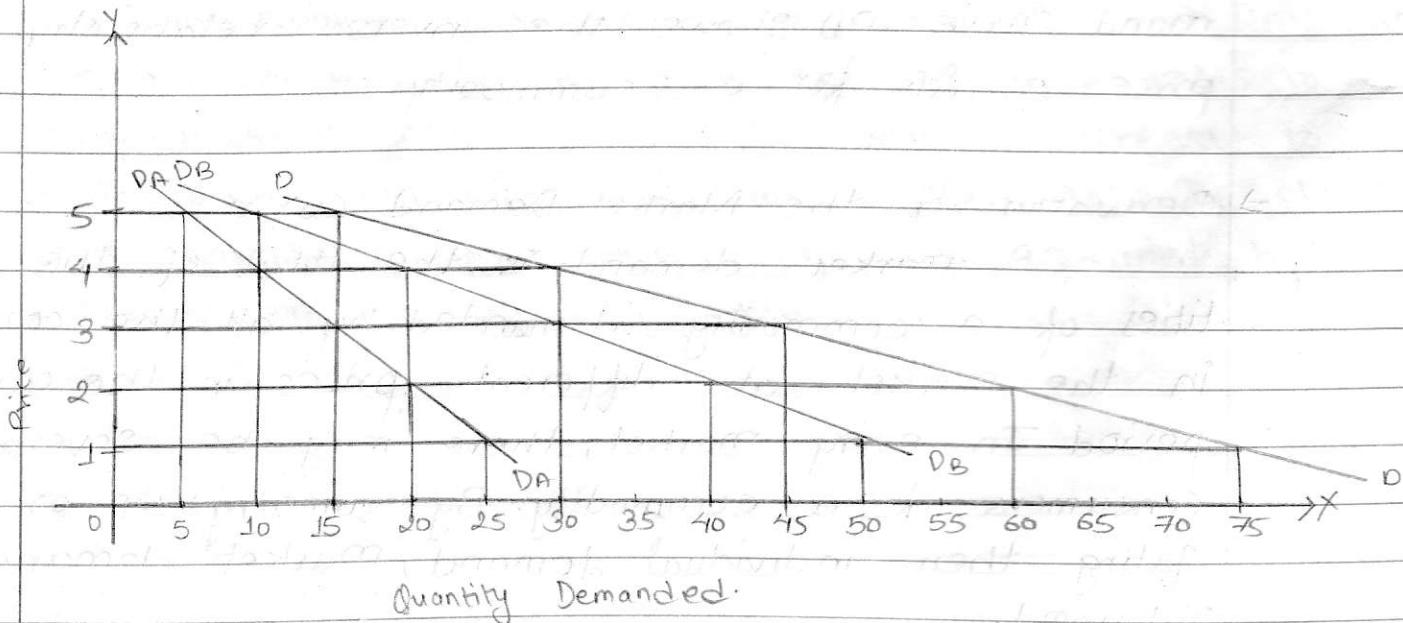
A market demand is the total of the quantities of a commodity demanded by all the consumers in the market at different prices in the given period. In every market, there may be several consumers of a commodity. By summing up or aggregating their individual demand, market demand is obtained.

### Market Demand Schedule

Market demand schedule is the table that shows total demand of all the consumers in the market at various prices of the commodity. It can be obtained by the summation of individual demand schedules.

Price Per Unit (Rs)	A's demand	B's demand	Market demand
5	5	10	$5+10=15$
4	10	20	$10+20=30$
3	15	30	$15+30=45$
2	20	40	$20+40=60$
1	25	50	$25+50=75$

The above table shows that when price of the commodity rises, its market demand decreases. For example, when per unit price of the commodity is Rs 5, A's demand is 5 units & B's demand is 10 units. Thus, the total market demand at Rs 5 is 15 units. But when price fall to Rs. 4 per units, then market demand increases to 30 units & so on.



In the figure, quantity demanded & price of a commodity are measured along X-axis & Y-axis respectively. In the fig. demand curve of the consumer 'A' & 'B' are represented by  $D_A D_A$  &  $D_B D_B$  respectively. The market demand curve has been derived from the horizontal summation of individual demand curve. When price is Rs 1, A's demand is 25 units & B's demand is 50 units. The horizontal summation of individual demand of both the consumers give market demand i.e. 75 units. Thus, by adding the different points on individual demand curve we get the market demand curve DD as shown in the figure.

### Supply Function

Supply function shows a functional relationship bet<sup>n</sup> quantity supplied & various determinants of supply. The relationship may be bet<sup>n</sup> two or more than two variables.

Supply is related with price, it can be represent as the functional relationship bet<sup>n</sup> two variables price & quantity supply of the commodity. The relationship bet<sup>n</sup> them can be expressed in the form of an equation such as  $S_x = f(P_x)$  or a schedule or a curve showing quantity supplied of commodity at various prices it shows a direct relationship bet<sup>n</sup> price & quantity supply of the commodity as indicated by the law of supply. Here, we assume other determinants of supply remaining constant.

## 1. Simple supply function / single variable supply function

In the supply function, the relationship bet<sup>n</sup> quantity of supply of the commodity & only one determinants (price) of the commodity & other determinants remaining same. It is a simple supply function indicating  $S_x = f(P_x)$  the relationship bet<sup>n</sup> price & quantity supply.

## 2. Multi variable supply function

Multi variate shows functional relation bet<sup>n</sup> supply & all determinants of supply.

### Types of supply function

#### 1. Linear Supply function

It doesn't show quantitative relationship bet<sup>n</sup> price & quantity supply of the commodity. The linear relationship bet<sup>n</sup> them can be expressed in the form of supply price equation

$$S_x = a + bP_x$$

It doesn't show quantitative relationship bet<sup>n</sup>  $S_x$  &  $P_x$  when the slope of the supply curve remains constant throughout its length it is said to be linear supply curve or straight line supply curve.

'a' is a constant parameter showing initial quantity supplies of a commodity irrespective of price. It shows total supply when price is zero. It is autonomous supply based on other determinants of supply except price.

'b' is also a constant parameter, it has positive sign denoting direct relationship bet<sup>n</sup> supply & price based on law of supply. As the price rise as increases quantity supplied increases & vice-versa.

Eg: If the value of  $a$  &  $b$  are known, total quantity supplied can be determined at various price.

Given, supply function  $\Rightarrow Q_x = 10 + 5P_x$

$$a = 10, b = 5, P_x = 1, 2, 3, 4, 5$$

Points	$P_x$	$Q_x (10 + 5P_x)$
A	1	$10 + 5 \times 1 = 15$
B	2	$10 + 5 \times 2 = 20$
C	3	$10 + 5 \times 3 = 25$
D	4	$10 + 5 \times 4 = 30$
E	5	$10 + 5 \times 5 = 35$

## Non-linear Supply function.

When slope of the supply curve changes all along the supply curve it is known as non-linear supply curve. It is expressed in power function  $S_x = aP^b$ . It is represented in a curve.

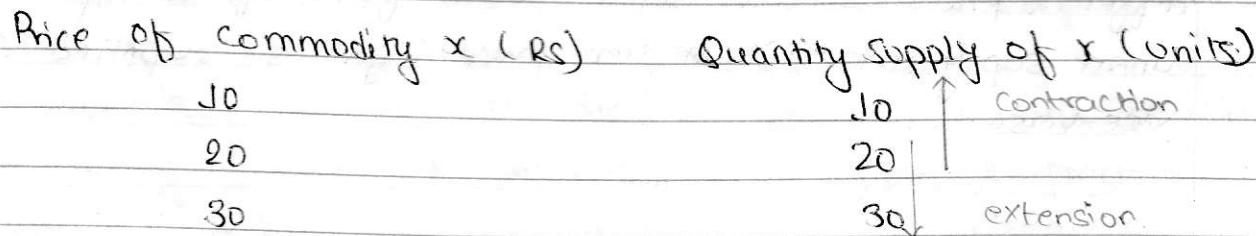
## Determinants of supply.

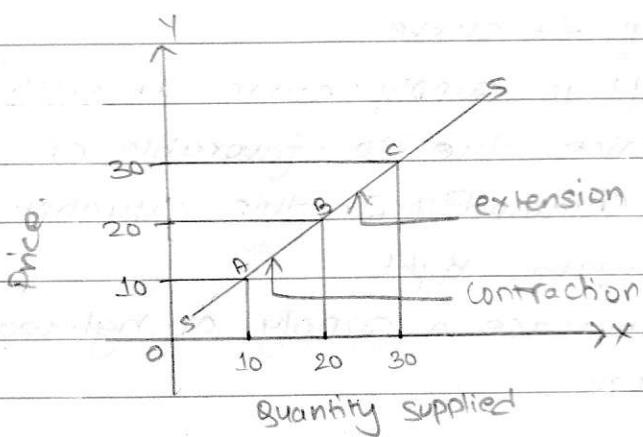
1. Price
2. The price of other goods & services
3. Expectations of producers
4. Number of producer
5. Change in technology
6. Weather
7. Change in govt. policy
8. Development of infrastructures (transport, communication, electricity, etc.)

## Movement along the Supply curve.

The quantity supplied of a commodity rises or falls due to change in price, other determinants of supply remaining constant. It is shown on the same supply curve & is known as movement along the supply curve.

1. Extension in supply (due to increase in price)
2. Contraction in Supply (due to decrease in price)





In the fig, original price is Rs 20 & original quantity supply is 20 units. When the price rises from Rs 20 to Rs 30 its quantity supply also rises from 20 units to 30 units, there is movement from point B to point C & it is extension in supply. Similarly, when the price falls from Rs 20 to Rs 10 its quantity supply also falls from 20 units to 10 units, there is movement from point B to point A & it is contraction in supply.

### Shift in Supply curve

Supply curve shifts due to change in non-price factors of the commodity like change in tax rate, cost of factors of production, technology, climate, etc. The shift in supply curve is shown by drawing new <sup>Supply</sup> demand curve. There are two types of shift in supply curve

1. Rightward Shift in supply curve
2. Leftward shift in supply curve.

## 1. Rightward Shift in Supply curve

Rightward shift in supply curve refers to more supply at the same price due to favorable change in non-price factors of the commodity. In this situation, the initial supply curve shifts towards right.

Reasons for the increase in supply or rightward shift

- Improvement in technology
- Decrease in tax
- Decrease in cost of factor of production
- Suitable weather condition
- Seller's expectation of fall in price in future.

## 2. Leftward shift in Supply curve

Leftward shift in supply curve refers to less supply at the same price due to unfavorable change in non-price factors of the commodity. In this situation, the initial supply curve shifts towards left.

Reasons for the decrease in supply or leftward shift

- Use of old technology
- Increase in tax
- Increase in cost of factor of production
- Bad weather condition
- Seller's expectation of rise in price in future.

Price of a commodity X      Quantity Supplied of X

10

10

10

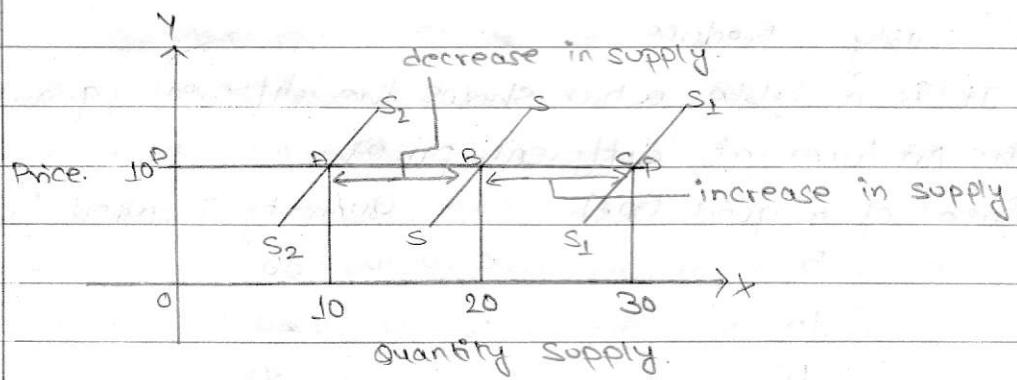
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20

30

↑ Decrease in supply

↓ Increase in supply



In the figure, PP is the price line which shows the same price. i.e Rs 10. SS is the original supply curve. Due to favorable change in other determinants of supply, the supply of a commodity increase from 20 units to 30 units. And original supply curve SS shifts to  $S_1S_1$ . It indicated increase in the supply. Similarly, due to unfavorable change in other determinants of supply except price, the supply of a commodity decrease from 20 units to 10 units. And original supply curve SS shifts to left i.e  $S_2S_2$ . It indicates decrease in the supply.

### Derivation of Individual & Market Supply Curve.

→ Derivation of an Individual Supply curve.

The supply of a commodity made by an individual producer or seller is called individual supply. In other words, an individual supply refers to the quantities of a commodity supplied by an individual producer at various prices, other things remaining the same.

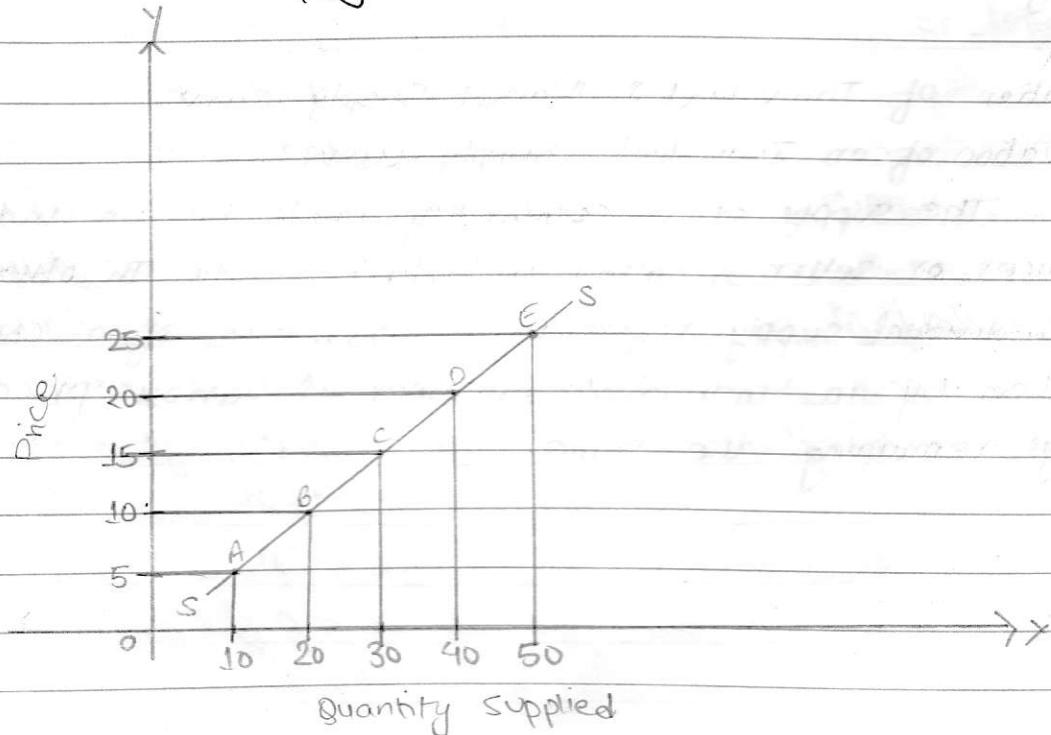
### Individual supply schedule.

It is a table which shows the different quantities supplied by the producer at different prices.

Price of a good (Rs)	Quantity Supplied (units)
5	10
10	20
15	30
20	40
25	50

The above table shows that quantity supplied is 10 units when price is Rs 5. When price of the commodity rises to Rs 10, Rs 15, Rs 20 & Rs 25 its quantity supply also rises to 20 units, 30 units, 40 units & 50 units respectively. It clearly states that as the price increase, the quantity supply also increase & vice-versa.

### Individual supply curve.



In the figure SS is the individual supply curve. By plotting 10 units of quantity supplied at Rs 5, we get point 'A'. Likewise, by plotting 20 units, 30 units, 40 units & 50 units of commodity supplied at Rs 10, Rs 15, Rs 20 & Rs 25, we get point 'B', 'C', 'D' & 'E' respectively. And by joining these points we get SS curve which is known as individual supply curve. The positive slope of the supply curve SS shows the direct relationship b/w price & supply of a commodity.

### → Derivation of the Market Supply Curve

A market supply is the total of the quantities of a commodity supplied by all the producers in the market at different prices in the given period. In every market, there may be several producers of a commodity. By summing up or aggregating their individual supply, market supply is obtained.

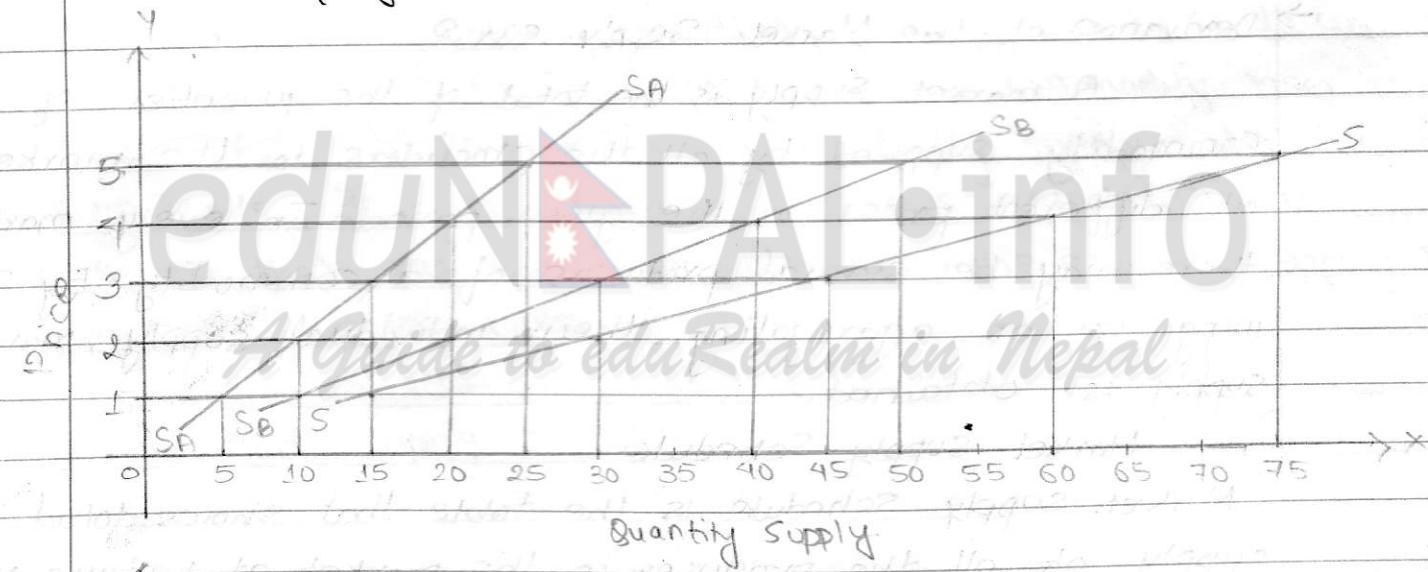
#### Market Supply Schedule

Market supply schedule is the table that shows total supply of all the producer in the market at various prices of the commodity. It can be obtained by the summation of individual supply schedules.

Price Per unit (Rs)	A's Supply	B's Supply	Market Demand
1	5	10	15
2	10	20	30
3	15	30	45
4	20	40	60
5	25	50	75

The above table shows that when price of a commodity is Rs 1 its market supply is 15 units. When price of a commodity increase from Rs 1 to Rs 2, Rs 3, , Rs. 4 & Rs 5 its market supply also increase from 15 units to 30 units, 45 units, 60 units & 75 units respectively. Which shows the positive relationship betw! price & the quantity supply of a commodity.

### Market Supply curve.



In the figure, quantity supplied & price of a commodity are measured along X-axis & Y-axis respectively. In the figure, supply curve of producer 'A' & 'B' are represented by  $SA$  &  $SB$  curve respectively. The market supply has been derived from the horizontal summation of individual supply. when price of a commodity is Rs 1. its supply by 'A' is 15 units & 'B' is 10 units & market supply is 25 units. Thus, by adding the different points on individual supply curves, we get the market supply curve  $SS$  as shown in figure.

Market Equilibrium (from book)