

Numericals- Supply and Demand Analysis

Principles of Economics

- Equation of a straight line:

$$Y = a + bX$$

- Equation of demand curve:

$$Q^d = a + bP \quad (P = \text{price})$$

- So, $\Delta Q^d = b \Delta P$

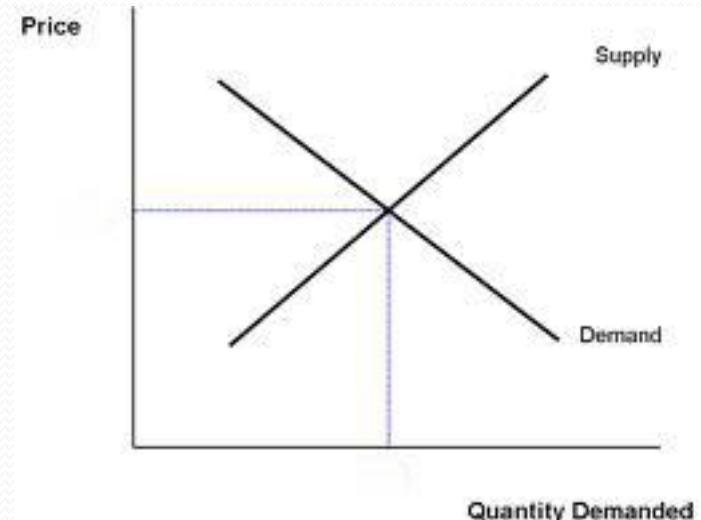
Thus, $b = \Delta Q^d / \Delta P$

- Equation of supply curve:

$$Q^s = c + dP$$

- So, $\Delta Q^s = d \Delta P$

Thus, $d = \Delta Q^s / \Delta P$



1. The weekly demand schedule for milk in Hyderabad:

Price (Rs/Ltr)	Demand
9	18
10	16
11	14
12	12
13	10
14	8

Calculate the weekly demand function.

- Let equation of the demand curve be:

$$Q^d = a + bP$$

- So, $\Delta Q^d = b \Delta P$

Thus, $b = \Delta Q^d / \Delta P$

- Consider price increase from 9 to 10:

$$\Delta P = 1; \Delta Q^d = -2$$

- So, $b = -2/1 = -2$

Therefore, $Q^d = a - 2P$

- Putting any combination of price and quantity we get:

$$18 = a - (2 \times 9)$$

$$\Rightarrow a = 36$$

- The demand function is therefore:

$$Q^d = 36 - 2P$$

2. Demand function: $Q = 34 - 2P$

Find the theoretical maximum quantity of good demanded and theoretical maximum price of the good.

- The maximum quantity that can be demanded is when the price is zero
- $$\begin{aligned} Q &= 34 - 2P \\ &= 34 - (2 \times 0) \\ &= 34 \end{aligned}$$
- The theoretical maximum price is the price at which quantity demanded is zero
- $$\begin{aligned} Q &= 34 - 2P \\ 0 &= 34 - 2P \\ \Rightarrow 2P &= 34 \\ \Rightarrow P &= 17 \end{aligned}$$

3. The weekly demand schedule for a good in Delhi:

Price (Rs)	Quantity demanded
9	36
10	32
11	28
12	24
13	20
14	16

Calculate the weekly demand function.

Answer:

$$Q = 72 - 4P$$

4. The weekly supply schedule for milk in Hyderabad:

Price	Quantity Supplied
9	9
10	10
11	11
12	12
13	13
14	14

Calculate the weekly supply function.

- Answer
- $Q=P$

5. Supply Function: $Q^s = 2P - 100$

- Find the price below which no milk will be supplied.
- Answer
- Means Quantity supplied should be zero.
- Therefore, $0 = 2P - 100$
- $P = 50$

6. Demand function: $Q^d = 100 - 3P$

Supply Function: $Q^s = 2P - 20$

Find the equilibrium output.

If price is 20, would there be surplus or deficit?

- At equilibrium $Q^d = Q^s$

Therefore: $100 - 3P = 2P - 20$

$$\Rightarrow 5P = 120$$

$$\Rightarrow P = 24$$

When $P=24$, $Q = 100 - (3 \times 24)$

$$\Rightarrow Q = 100 - 72 = 28$$

If price = 20,

$$Q^d = 100 - (3 \times 20) = 40$$

$$Q^s = (2 \times 20) - 20 = 20$$

Therefore, shortage = $40 - 20 = 20$

Calculation of Elasticity

- For calculation of elasticities:
 - If the direction of price and quantity change is given, use the initial quantity and price as base
Elasticity (e_p): %change in quantity/ %change in price
$$\Rightarrow e_p = (\Delta Q/Q_1) \times 100 / (\Delta P/P_1) \times 100$$
$$\Rightarrow e_p = (\Delta Q / \Delta P) \times (P_1 / Q_1)$$
 - When the direction of change is not given, use the mid point formula.

Elasticity (e_p): %change in quantity/ %change in price

$$\Rightarrow e_p = [\Delta Q/(Q_1+Q_2/2)] \times 100 / [\Delta P/(P_1+P_2/2)] \times 100$$
$$\Rightarrow e_p = (\Delta Q / \Delta P) \times (P_1+P_2/Q_1+Q_2)$$

7. The demand schedule for a product:

Price	Quantity demanded
3	20
4	16
5	12
6	8
7	4

Find the price elasticity of demand for an increase in the price from 5 to 6.

- $P_1 = 5, P_2 = 6; \Delta P = 1$
 - $Q_1 = 12, Q_2 = 8; \Delta Q = -4$
 - $e_p = (\Delta Q / \Delta P) \times (P_1 / Q_1)$
- $\Rightarrow e_p = (-4/1) \times (5/12) = -1.67$
- 1.67 or in absolute terms 1.67 - represents elastic demand

8. The following demand schedule is given:

Price	Quantity Demanded
3	20
4	16
5	12
6	8
7	4

Calculate the price elasticity of demand for a decrease in price from 6 to 5.

Answer: -3

-3 or in absolute terms 3- represents elastic demand

9. The monthly schedule for rice for a family is given below:

Price (Rs./kg)	Quantity demanded
12	21
13	18

Find the price elasticity of demand for rice.

- Since direction of change is not given:
 - $e_p = (\Delta Q / \Delta P) \times (P_1 + P_2 / Q_1 + Q_2)$
 - Now, $P_1 = 12$, $P_2 = 13$, $Q_1 = 21$, $Q_2 = 18$
 - $\Delta P = 1$, $\Delta Q = -3$
- $e_p = (-3/1) \times (25/39)$
= $-75/39 = -1.92$
- 1.92 or in absolute terms 1.92- represents perfect elasticity

10. Demand function for ball point pens is

$$Q^d = 100 - 0.5P$$

Find the price elasticity of the good at price Rs. 10.

N.B. When we need to compute price elasticity of demand at a particular point (price), we use point price elasticity of demand.

$$e_p = (\partial Q / \partial P) \times (P/Q)$$

- We have
- $Q^d = 100 - 0.5P$
- $\partial Q / \partial P = -0.5$
- If $P=10$, $Q_d = 100 - 0.5 \times 10 = 95$
- $e_p = (\partial Q / \partial P) \times (P/Q)$
 $= -0.5 \times 10 / 95 = -0.052$
- -0.052 or in absolute terms 0.052 - represents inelastic demand