

Mathematical Model for a Supply-Demand Curve

1 Objectives

- Understand the fundamental principles of supply and demand in economics.
- Develop mathematical models to represent the relationship between price and quantity for supply and demand.
- Derive and analyze the equilibrium price and quantity using mathematical equations.
- Visualize the supply-demand curves using graphs and interpret the equilibrium condition.

2 Theory

The **supply-demand curve model** is a fundamental concept in economics, describing how the price of a product influences the quantity demanded by consumers and the quantity supplied by producers.

Demand Curve

The demand curve shows an **inverse relationship** between price (P) and quantity demanded (Q_d).

$$Q_d = a - bP$$

Where:

- a : Maximum demand (when $P = 0$).
- b : Sensitivity of demand to price changes (slope).

Supply Curve

The supply curve shows a **direct relationship** between price (P) and quantity supplied (Q_s).

$$Q_s = c + dP$$

Where:

- c : Minimum supply (when $P = 0$).
- d : Sensitivity of supply to price changes (slope).

Equilibrium

Equilibrium occurs when the market clears, i.e., $Q_d = Q_s$. At equilibrium:

$$c + dP = a - bP$$

Solving for P (equilibrium price):

$$P = \frac{a - c}{b + d}$$

Substituting P into either equation gives the equilibrium quantity Q .

3 Tasks

1. Derive the equilibrium price and quantity.
2. Plot the supply and demand curves.
3. Analyze how a government-imposed tax of R.s 10 per unit affects the equilibrium.

4 Expected Outcomes

By the end of the lab, students will be able to:

- Write and manipulate supply-demand equations.
- Solve for equilibrium price and quantity mathematically.
- Graph supply-demand curves and interpret economic outcomes.
- Understand how external factors like taxes or subsidies shift the curves.

5 Assessment

- **Accuracy of Calculations (30%):** Correctly derive equilibrium values.
- **Graphical Representation (30%):** Clear and accurate plots of supply-demand curves.
- **Scenario Analysis (20%):** Interpret changes due to external factors.
- **Report (20%):** Summarize findings, include equations, graphs, and observations.