1. Defining Features of Perfect Competition

Perfect competition describes a specific market environment where both buyers and sellers are price-takers. A perfectly competitive market is characterised by several defining features:

- **Large Number of Buyers and Sellers:** The market comprises so many individuals that each one is negligible relative to the total market size. Consequently, no single buyer or seller can influence the market price through their individual actions.

- **Homogeneous Products:** Every firm produces and sells an identical product. Because products cannot be differentiated, buyers are indifferent about which firm they purchase from, provided the price is the same.

- **Free Entry and Exit:** There are no barriers for firms wishing to enter or leave the industry. This condition is vital for maintaining a large number of firms and ensuring that supernormal profits are eventually eliminated.

- **Perfect Information:** All participants have complete knowledge regarding prices, product quality, and other market details.

These features lead to price-taking behaviour. A price-taking firm believes it can sell any quantity of its output at the prevailing market price but will sell nothing if it sets a price even slightly higher. Similarly, a buyer believes they cannot obtain the product at a price lower than the market rate.

2. Revenue Concepts for a Price-Taking Firm

Revenue is the money a firm earns by selling its output.

- Total Revenue (TR): Defined as the market price (p) multiplied by the quantity sold (q) ($TR=p\times q$). Graphically, the TR curve is an upward-sloping straight line passing through the origin, as price is constant. The slope of this line is equal to the market price.

- Average Revenue (AR): Total revenue per unit of output ($AR=TR/q$). For a price-taking firm, Average Revenue equals the market price ($AR=p$).

- Marginal Revenue (MR): The increase in total revenue resulting from a unit increase in output ($MR=\Delta TR/\Delta q$). For a perfectly competitive firm, Marginal Revenue also equals the market price ($MR=p$).

- The Price Line: Because $AR=MR=p$, plotting price against output yields a horizontal straight line at the market price level. This line also represents the perfectly elastic demand curve facing an individual firm, meaning it can sell any amount at price p.

3. Profit Maximisation

A firm's profit (π) is the difference between its total revenue and its total cost of production ($\pi=TR-TC$). Firms are assumed to be "ruthless profit maximisers". To maximise profit at a positive output level q_0, three conditions must hold simultaneously:

1. **Condition 1 ($P=MC$):** Profit increases as long as $MR>MC$ and falls if $MR<MC$. Since $MR=P$ in perfect competition, the firm must produce where Price equals Marginal Cost.

2. **Condition 2 (MC is Non-decreasing):** The marginal cost curve must be upward-sloping

(or at least not falling) at the point of equilibrium. If MC were falling, a slight reduction in output would yield higher profits because the saved cost would exceed the lost revenue.

3. **Condition 3 (Continuity of Production):**
    - **Short Run:** The market price must be greater than or equal to the minimum Average Variable Cost ($p \geq AVC$). If $p < AVC$, the firm minimizes losses by producing zero output and exiting.
    - **Long Run:** The market price must be greater than or equal to the minimum Average Cost ($p \geq AC$). If $p < AC$, the firm incurs a loss and will exit the market.

4. The Supply Curve of a Firm

The supply curve shows the quantity a firm chooses to sell at various market prices, keeping technology and input prices constant.

- **Short Run Supply Curve:** This is the rising part of the Short Run Marginal Cost (SMC) curve from and above the minimum AVC point. For prices below minimum AVC, the supply is zero.
- **Long Run Supply Curve:** This is the rising part of the Long Run Marginal Cost (LRMC) curve from and above the minimum $LRAC$ point. For prices below minimum $LRAC$, the supply is zero.
- **Shut-Down Point:** In the short run, this is the point of minimum AVC. In the long run, it is the point of minimum $LRAC$.
- **Normal Profit and Break-even Point:** Normal profit is the minimum profit needed to keep a firm in business and is considered part of total costs. The break-even point is the output level where the firm earns exactly normal profit (where $P = \min AC$).

5. Determinants of a Firm's Supply Curve

Since the supply curve is a segment of the MC curve, any factor affecting MC will shift the supply curve:

- **Technological Progress:** Innovations that allow a firm to produce more output with fewer inputs lower the marginal cost. This causes a rightward (downward) shift in the supply curve.
- **Input Prices:** An increase in the price of inputs (e.g., higher wages) raises production costs and shifts the MC curve upward. This results in a leftward (upward) shift of the supply curve.
- **Unit Tax:** A tax imposed per unit sold increases the firm's costs, shifting the supply curve to the left.
- **Movements vs. Shifts:** A change in the market price of the good itself causes a movement along the supply curve. Changes in technology or input prices cause the entire curve to shift.

6. Market Supply and Price Elasticity of Supply

- Market Supply Curve: Derived by the horizontal summation of individual firms' supply curves. It shows the aggregate output all firms produce at different prices. As the number of firms in the market increases, the market supply curve shifts to the right.
- Price Elasticity of Supply (es): Measures the responsiveness of quantity supplied to changes in price.

- Formula: $eS = \%\Delta \text{ Price} \%\Delta \text{ Quantity Supplied} = \Delta P \Delta Q \times QP$.
- Measurement (Geometric Method): For a straight-line supply curve:
  - If it intercepts the price-axis (positive range), $eS > 1$.
  - If it intercepts the quantity-axis (positive range), $eS < 1$.
  - If it passes through the origin, $eS = 1$.

7. Price Determination and Market Equilibrium

Equilibrium is a state where the plans of all consumers and firms match, and the market clears.

- **Equilibrium Price ($p*$):** The price at which market demand equals market supply ($qD(p*) = qS(p*)$).
- **Excess Demand:** Occurs when price is *below* $p*$, causing consumers to demand more than firms supply; this leads to an "Invisible Hand" mechanism raising prices.
- **Excess Supply:** Occurs when price is *above* $p*$, causing firms to supply more than consumers demand; this drives prices down.

8. Effects of Shifts in Demand and Supply

When the number of firms is fixed, shifts in demand or supply curves affect $p*$ and $q*$:

- **Demand Shifts:** A rightward shift (due to higher income for a normal good) increases both equilibrium price and quantity. A leftward shift decreases both.
- **Supply Shifts:** A leftward shift (due to higher input prices) increases equilibrium price but decreases quantity. A rightward shift decreases price and increases quantity.
- **Simultaneous Shifts**: If both curves shift rightward, quantity increases, but the effect on price depends on the magnitude of the shifts. If demand shifts right and supply left, price increases, but quantity depends on magnitude.

9. Market Equilibrium: Free Entry and Exit

With free entry and exit, the mechanism of equilibrium changes significantly.

- **Price Level:** The existence of supernormal profits attracts new firms, shifting supply right and lowering prices until profits are wiped out. Conversely, losses cause firms to exit, raising prices. Therefore, in equilibrium, the market price is always equal to the minimum average cost ($p = \min AC$).
- **Impact of Shifts:** Under free entry/exit, a shift in demand does not affect the equilibrium price. Instead, it only changes the equilibrium quantity and the number of firms in the same direction as the change in demand. The quantity effect is more pronounced here than in a market with a fixed number of firms.

10. Applications: Price Controls

The government may intervene to regulate prices when they are deemed undesirable:

- **Price Ceiling:** A government-imposed upper limit (e.g., on wheat) set below the equilibrium price. This leads to excess demand and potential shortages, often requiring rationing or causing black markets.
- **Price Floor:** A lower limit set above the equilibrium price (e.g., agricultural support

prices). This results in excess supply, requiring the government to purchase surplus stocks to prevent price falls.