

Problem Set

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Part I: Foundational Concepts, Scarcity, and Scope (10 Problems)

- E1:** [S] Define **Opportunity Cost (OC)**. If a student spends 4 hours studying economics instead of working at a job that pays \$15/hour, what is the OC of studying?
- E2:** [S] Classify the following statement as **Positive** or **Normative**: “The government *ought* to increase the minimum wage to reduce poverty.”
- E3:** [S] State the core economic problem that necessitates decision-making regarding “What to produce?”, “How to produce?”, and “For Whom to produce?”.
- E4:** [S] Explain the difference between **Productive Efficiency** and **Allocative Efficiency** based on the Production Possibilities Frontier (PPF) concept.
- E5:** [I]) Explain the **Fallacy of Composition** using a simple economic example (e.g., saving money).
- E6:** [I]) A country can produce 100 units of cloth or 50 units of food. Assuming constant OC, what is the OC of one unit of cloth (in terms of food)?
- E7:** [I]) Identify the key characteristics that differentiate a **Command Economy** from a **Market Economy**.
- E8:** [I]) A policymaker observes that a new tax (Event A) was implemented, and six months later, economic growth slowed down (Event B). The policymaker concludes A caused B. Which logical fallacy might they be committing?
- E9:** [C] Consider an individual facing a budget constraint. Structure a solution that uses the concept of marginal benefit and marginal cost to formally derive the optimal decision rule, linking it to the principle of maximizing efficiency.
- E10:** [C] The concept of scarcity implies a need for an economic system. Analyze how the problem of scarcity is addressed differently in a purely Market Economy versus a purely Command Economy, focusing on the role of prices versus central planning.

Part II: Demand, Supply, and Equilibrium Analysis (15 Problems)

- E11:** [S] State the **Law of Demand** and the **Law of Supply** in terms of the relationship between Price (P) and Quantity (Q).
- E12:** [S] Given $Q_D = 100 - 4P$ and $Q_S = 10 + 2P$. Find the equilibrium price (P^*) and equilibrium quantity (Q^*).
- E13:** [S] If the price of Good X increases, explain whether this causes a **shift** in the demand curve for Good X or a **movement along** the demand curve for Good X.
- E14:** [S] For the demand function $Q_D = 100 - 4P$, graph the demand curve, showing the P -intercept and the Q -intercept.

- E15:** [S] Identify two non-price determinants that cause the supply curve for a product to shift.
- E16:** [S] If the market price is \$20, and the equilibrium price is \$15, will this market experience a shortage or a surplus?
- E17:** [I] Given $Q_D = 20 - 3P + 0.1I$ (where I is Income) and $Q_S = 5P - 4$. If $I = 100$, find the new equilibrium price and quantity.
- E18:** [I] Good A and Good B are complements. If the price of Good A decreases, explain the resulting effect on the equilibrium price and quantity of Good B (using a two-graph analysis).
- E19:** [I] Assume the supply function is $Q_S = 2P + 10$. If the government imposes a per-unit tax (t) of \$3 on producers, write the new supply function Q'_S .
- E20:** [I] Explain the condition of **Stable Equilibrium** in a standard demand-supply model, where P adjusts according to the difference between Q_D and Q_S .
- E21:** [I] The market for coffee is initially in equilibrium. Simultaneously, (1) the price of tea (a substitute) increases, and (2) a drought destroys coffee crops. Analyze the final effect on P^* and Q^* for coffee.
- E22:** [I] Given $Q_D = 50$ and $Q_S = 2P$. Find the deadweight loss (DWL) triangle area if the government sets a price floor at $P = 30$. (Requires finding P^*).
- E23:** [C] The demand for a product is $Q_D = 100 - P$ and supply is $Q_S = 2P - 20$. If a per-unit tax t is placed on producers, mathematically derive the expression for the **tax incidence** borne by consumers ($\Delta P_{\text{consumer}}/t$) as a function of the demand and supply slopes.
- E24:** [C] Consider a system where demand is a function of income I and price P : $Q_D(P, I)$, and supply is $Q_S(P)$. Use total differentiation to derive the instantaneous change in equilibrium price (dP^*/dI) when income changes, in terms of $\frac{\partial Q_D}{\partial P}$, $\frac{\partial Q_S}{\partial P}$, and $\frac{\partial Q_D}{\partial I}$.
- E25:** [C] Prove that if the demand curve is linear and the supply curve is vertical (perfectly inelastic), the entire burden of a sales tax (t) will fall on the consumer (Hint: combine linear demand/vertical supply equations with the condition $P_D - P_S = t$).

Part III: Elasticity, Revenue, and Good Classification (15 Problems)

- E26:** [S] Define the formula for the **Price Elasticity of Demand** (E_D).
- E27:** [S] If a 10% increase in price leads to a 5% decrease in quantity demanded, calculate E_D and classify the demand as Elastic or Inelastic.
- E28:** [S] Define the term **Inferior Good** using the concept of Income Elasticity of Demand (E_I).
- E29:** [S] If demand is **Inelastic** ($|E_D| < 1$), what action should a firm take regarding price to increase its Total Revenue (TR)?
- E30:** [S] Goods X and Y are **Substitutes**. State the sign (positive/negative) of the Cross-Price Elasticity of Demand (E_{XY}).

- E31:** [S] Given a point on a linear demand curve $P = \$10$, $Q_D = 50$. If the slope of the demand curve is -2 , calculate the point elasticity of demand.
- E32:** [I]) The demand function is $Q_D = 200 - P^2$. Calculate the price elasticity of demand when $P = 10$. (Requires calculus for dQ/dP).
- E33:** [I]) A firm sells 100 units at $P = \$50$ and 120 units at $P = \$40$. Calculate the **Midpoint (Arc) Elasticity** of Demand between these two points.
- E34:** [I]) Good Z has $E_I = -0.5$. If consumer income increases by 10%, calculate the resulting percentage change in the quantity demanded for Good Z. Classify Good Z.
- E35:** [I]) Explain, using the concept of elasticity, why taxing a good with perfectly inelastic demand would be the government's preference for maximizing tax revenue.
- E36:** [I]) Prove that for a linear demand curve $Q = a - bP$, the point elasticity of demand transitions from elastic to inelastic as price falls from the P -intercept to the Q -intercept.
- E37:** [I]) The demand for a complementary good (Good A) is $Q_A = 100 - 5P_A - 2P_B$. If $P_A = 10$ and $P_B = 5$, calculate the Cross-Price Elasticity E_{AB} .
- E38:** [C] Consider a demand function that is constant elasticity: $Q = 100P^{-\alpha}$, where α is the absolute value of elasticity. Find the value of α that maximizes Total Revenue, and explain the economic interpretation of this constant elasticity.
- E39:** [C] Given the definition of Marginal Revenue ($MR = \frac{d(P \cdot Q)}{dQ}$) and the elasticity definition $E_D = \frac{dQ}{dP} \frac{P}{Q}$. Prove the mathematical relationship: $MR = P \left(1 + \frac{1}{E_D}\right)$. (This combines calculus and economic theory).
- E40:** [C] Analyze the effect of a specific tax (t) on the market equilibrium of a good whose demand is unit elastic ($|E_D| = 1$) and supply is linear ($Q_S = c + dP$). Determine the effect of the tax on Total Revenue (TR) collected by the producer after the tax is paid to the government.

Part IV: Policy Analysis and Advanced Theory (10 Problems)

- E41:** [S] Define a **Price Ceiling** and state the condition under which it is **binding** (effective).
- E42:** [S] In the context of the labor market, if a **Minimum Wage** is set above the market equilibrium wage, what is the resulting economic outcome called? (Based on the labor surplus definition).
- E43:** [S] Define **Deadweight Loss (DWL)** in the context of government price controls or taxation.
- E44:** [S] Explain why a non-binding price floor has no effect on the market outcome.
- E45:** [I]) Suppose $Q_D = 10 - P$ and $Q_S = P - 2$. The government imposes a price ceiling at $P_{\max} = 3$. Calculate the resulting **shortage** quantity.
- E46:** [I]) When a government imposes an excise tax on a product, the total revenue of the firm may increase, decrease, or remain the same. Explain this outcome by relating it to the Price Elasticity of Demand.

E47: [I]) A firm is a monopolist with demand $P = 100 - Q$ and Marginal Cost $MC = 20$. Find the profit-maximizing output level (Q_M). (Requires $MR = MC$ and MR derivation).

E48: [C]A market is defined by $Q_D = 100 - 2P$ and $Q_S = P - 20$. The government imposes a unit tax of $t = 9$ on the **consumer**. Structure the solution to calculate: (i) the new equilibrium quantity, (ii) the price paid by consumers (P_D), and (iii) the Deadweight Loss (DWL) due to the tax.

E49: [C]Analyze the efficiency consequences of a binding price ceiling. Prove conceptually that a binding price ceiling leads to a reduction in both Producer Surplus and Consumer Surplus (for some consumers), resulting in Deadweight Loss.

E50: [C]Using the concept of consumer preferences (e.g., utility functions or indifference curves), formally define a **Giffen Good**. Explain how the existence of a Giffen Good is a theoretical counter-example to the Law of Demand, combining the Income Effect and the Substitution Effect.