

Intermediate Microeconomic Theory

Review/Homework Questions, Test 1

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Winter 2007

Instructions: Please review the following key concepts and answer the questions below. A subset of these questions will be assigned as graded homework. These assignments and due dates will be announced in class. Please review all questions, however, as one or more of them may be on your exam.

I. Introductory and Review Material

Key Concepts:

- microeconomics
- solution concepts: optimization and equilibrium
- positive versus normative economics
- deduction versus induction
- demand (price, price of substitutes and complements, income, tastes, number of consumers)
- supply (price, input prices, technology, number of competitors)
- consumer and producer surplus
- comparative statics
- marginal benefit and marginal cost
- slope-intercept form of a line
- polynomial function
- derivative
- solution to a system of linear equations

Questions:

1. Assume a market with the following inverse demand and supply functions.

$$\text{(Inverse Demand) } p = 120 - Q$$

$$\text{(Inverse Supply) } p = 2Q$$

where p is price and Q is market output.

- A. Determine the price and quantity intercepts of the inverse demand function.
- B. What is the slope of the inverse demand function?
- C. Use algebra to calculate the equilibrium p and Q and describe your answer with a graph.
- D. Determine the dollar value of consumer surplus.
- E. Determine the dollar value of producer surplus.

2. Consider the following polynomial function.

$$6x^2 - xy + 6x^3 = 0$$

- A. Determine the first derivative of this function with respect to (wrt) x (i.e., dy/dx).
- B. Determine the second derivative of this function wrt x (i.e., d^2y/dx^2).
- C. Determine the critical value of the function (i.e., the relative maximum or minimum).
- D. Graph the function for $x \in [-2, 2]$.

3. Consider the following polynomial function.

$$y = 6x^4$$

- A. Determine the first derivative of this function wrt x (i.e., dy/dx).
- B. Determine the second derivative of this function wrt x (i.e., d^2y/dx^2).
- C. Determine the critical value of the function (i.e., the relative maximum or minimum).
- D. Graph the function for $x \in [-2, 2]$.

4. Consider the following function with three variables: x_1 , x_2 , and y .

$$y = x_1^3 + x_1 x_2$$

- A. Determine the partial derivative of y wrt x_1 (i.e., $\partial y/\partial x_1$).
- B. If x_2 is a function of z , use the chain rule to determine dy/dz .

5. Use a figure to show how each of the following will shift the demand curve for oranges.

- A. A report from the Surgeon General that oranges cause cancer.
- B. An increase in the price of apples.
- C. An increase in the disposable income.
- D. An increase in the cost of producing oranges.

6. Use a simple demand (D) and supply (S) model to show how a change in each of the demand shifters (price of substitutes and complements, income, tastes, number of consumers) will affect the equilibrium price and quantity.

7. Use a simple D and S model to show how a change in each of the supply shifters (input prices, technology, number of competitors) will affect the equilibrium price and quantity.

8. On separate figures for each part (A, B, and C), show the following.

- A. An increase in both D and S will increase equilibrium quantity and may increase, decrease, or leave the equilibrium price unchanged.
- B. A decrease in D and an increase in S will reduce the equilibrium price but may increase, decrease, or leave the equilibrium quantity unchanged.
- C. An increase in D and a decrease in S will increase the equilibrium price but may increase, decrease, or leave the equilibrium quantity unchanged.

II. Consumer Constraints, Preferences, and Choices

Key Concepts:

good versus bad
 budget constraint and line
 composite good
 consumption opportunity set (budget set)
 opportunity cost
 sales, excise, and lump sum taxes
 rationing
 utility (cardinal and ordinal)
 marginal utility
 preference assumptions (Regular Preferences: complete, reflexive, transitive, convex, nonsatiation, heterogeneity, ordinal)
 indifference curve (convex, perfect substitutes, perfect complements, bads, neutrals)
 marginal rate of substitution
 optimal choice (interior and boundary optima)

Questions:

1. Assuming just two goods (1 and 2 = composite commodity), show how a change in prices and income will affect a consumer's consumption opportunity set (COS).
2. Assuming just two goods (1 and 2), show that rationing good 1 may decrease the consumer's COS and utility.
3. If Allen were indifferent between Coke and Pepsi, what would Allen's indifference curves look like for these goods?
4. What is the relationship between two goods (1 and 2) if the MRS between them is zero or infinity? Explain.
5. Bob likes cashews better than almonds and likes almonds better than walnuts. He likes pecans equally well as macadamia nuts and prefers macadamia nuts to almonds. Assuming his preferences are transitive, which does he prefer:
 - A. pecans or walnuts?
 - B. macadamia nuts or cashews?
6. Mary consumes just two goods (1 and 2). Her budget line has intercepts of 20 for q_1 and 40 for q_2 , and $p_2 = \$10$.
 - A. What is p_1 ?
 - B. What is Mary's income (m)?
 - C. What will be Mary's willingness to exchange good 2 for good 1 in equilibrium (i.e., her MRS)?

7. Must a consumer purchase a positive quantity of each commodity to be in equilibrium? Explain.
8. Use an IC-BL diagram to show how the following changes will affect a consumer's purchase of broccoli.
 - A. An increase in the price of broccoli.
 - B. An increase in consumer income.
 - C. New health information indicating that broccoli consumption is good for you.

III. Optimal Choices and Consumer Demand

Key Concepts:

normal good
 inferior good
 Giffen good
 price-consumption curve (price offer curve)
 income-consumption curve (income offer curve)
 Engle curve
 individual consumer demand
 substitution effect
 income effect
 Slutsky identity (equation)

Questions:

1. Use an IC-BL diagram to derive an Engle curve for good 1.
2. Will a consumer purchase more or less of an inferior good when its price declines? Explain.
3. Use IC-BL diagrams to derive a demand curve for a normal good, an inferior good (not Giffen), and a Giffen good.
4. If Bob views two goods as perfect substitutes, describe his demand function for good 1.
5. Use the Slutsky identity to explain why a consumer's demand function will have a positive slope for a super inferior good.
6. Over the last 100 years the average number of children per family has declined in the face of rapidly rising family incomes. This implies that children are an inferior good. True or False? Explain.
7. Can all goods purchased by a consumer be inferior? Explain.
8. The government imposes an excise tax on gasoline but refunds all of the gas-tax revenues to gasoline consumers in the form of a (lump-sum) tax rebate. Use an IC-BL diagram to show how this policy will affect the average consumer's consumption of gasoline.

IIIB. Market Demand and Consumer Surplus (Review Only)

Key Concepts:

- market demand (D)
- total revenue (TR)
- average revenue (AR)
- marginal revenue (MR)
- elasticity (own price, cross price, income)
- Engle Aggregation Condition

Questions:

1. Which of the following commodities are likely to be substitutes and which are likely to be complements?
 - A. A mathematics class and an economics class.
 - B. Tennis balls and a tennis racket.
 - C. A plane trip and a train trip to the same location.
 - D. Bacon and eggs.

2. Assume a market has the following inverse demand function.

(Inverse Demand) $p = 12 - 2Q$,

 where p is price and Q is market output.
 - A. Determine the equation for the market's total revenue function.
 - B. Determine the marginal revenue function for this market.
 - C. Calculate the price elasticity of demand at $p^* = 6$.
 - D. Calculate consumer surplus at $p^* = 6$.
 - E. Graph the total revenue, average revenue, and marginal revenue curves for this market. (Be sure to label all important intercepts and optimum value(s).)

3. For two linear and parallel demand curves, which one will have a smaller price elasticity of demand? Explain.

4. In a two good world, explain why both goods can be normal but both cannot be inferior. (Note that the Engle Aggregation Condition for two goods is: $k_1 \eta_1 + k_2 \eta_2 = 1$, where k_i is the budget share for good i).

5. Explain why a firm will never want to operate on the inelastic region of its demand function. (Hint, consider a linear demand function and assume that the firm's goal is to maximize profit.)

6. Tickets for a rock concert sell for \$20 each, but at that price the demand is substantially greater than the available number of tickets (or seats). Is the exchange value or marginal benefit of an additional ticket greater than, less than, or equal to \$20? Explain.

Intermediate Microeconomic Theory Review/Homework Questions, Test 2

V. Tremblay

Winter 2007

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IV. Risk and Uncertainty

Key Concepts:

- probability
- lottery
- expected value
- expected utility theorem
- expected utility
- risk averse, loving, neutral

Questions:

1. Draw a utility function over wealth, $U(w)$, for a person who is a risk lover over low levels of w and risk neutral over high levels of risk. Does this utility function provide a reasonable explanation for an average person?

2. Assume that Alison faces the following risky event or lottery with two possible outcomes: receive \$100 with probability $5/8$ and receive \$4 with probability $3/8$. What is the expected value of the lottery? Calculate Alison's expected utility of this lottery if his utility function over wealth (w) is $U = w^{1/2}$. Is Alison risk loving, averse, or neutral. What is the maximum amount that Alison would be willing to pay to ensure a value of \$100?

V. Production Theory

Key Concepts:

- production function
- short run, long run
- total product
- average product
- marginal product
- law of diminishing (marginal) returns
- isoquant
- MRTS (TRS)
- isocost
- principle of substitution
- expansion path
- constant, increasing, and decreasing returns to scale

Questions:

1. What is a production function and how does it relate to the “black box” theory of the firm?
2. Why does the “law of diminishing (marginal) returns” have such a crucial effect on production theory?
3. If the $MP_L > AP_L$, is the AP_L increasing or decreasing?
4. Assume a firm’s output depends on the quantity of its variable input (L). Given your knowledge of production theory, fill in the gaps in the table below.

L	TP _L	MP _L	AP _L
0	0	-	-
1	150		
2			200
3		200	
4	760		
5		150	
6			150

5. On the same graph, draw two isoquants, one indicating that two inputs are perfect complements (i.e., a fixed-proportions technology) and the other showing that inputs are perfect substitutes.
6. Is it always better to hire a more productive worker than a less productive worker? Evaluate.
7. A political campaign manager has to decide whether to emphasize television advertisements or letters to potential voters in a reelection campaign. How might knowledge about the production function of this campaign (i.e., the shape of the isoquants) help the campaign manager plan an optimal strategy?
8. Suppose the economy takes a down turn, and the price of labor falls by 50 percent and is expected to stay that way for a long time. Use a graph to show how this change in the relative price of L to K will affect the firm’s expansion path.
9. Suppose that a production function for labor (L) and capital (K) is given by:

$$q = 12 L^{1/2} K^{1/2}$$
 - A. Does this production function exhibit constant, increasing, or decreasing returns to scale? Explain.
 - B. Does this production function exhibit diminishing marginal returns? Explain.
10. Compare and contrast the following concepts: (1) increasing returns to scale, (2) decreasing returns to scale, (3) constant returns to scale, and (4) the law of diminishing returns.

VI. Cost Theory**Key Concepts:**

cost function
opportunity cost

accounting costs (historical, explicit)
 private and social costs
 cost minimization
 total cost, average cost, and marginal cost (short and long run)
 economies and diseconomies of scale
 minimum efficient scale (MES)
 economies of scope

Questions:

1. State colleges are more efficient at providing education than private colleges because state colleges charge lower tuition. Evaluate.
2. If a firm's marginal cost is rising, does this mean that the average cost is also rising?
3. The total short-run cost curve (STC) of a company is given by the equation:

$$STC = 240 + 2q.$$
 - A. What is the company's fixed cost?
 - B. If the company produces 100 units of output, what would be the company's SAVC, SAFC, and its SATC?
4. For a simple 2-input production process (L and K), derive the connection between AP_L and SAVC and between MP_L and SMC.
5. Why might a firm choose a plant size that does not minimize the firm's long-run average cost?
6. Assume a firm faces the following long-run total cost function (LTC).

$$LTC = 2q - 2q^2 + q^3,$$
 for $q \in [0, 2]$. Derive the long-run average cost function (LAC) and the long-run marginal cost function (LMC) and graph them both on a single diagram.
7. Suppose a firm faces the following long-run total cost function (TC):

$$TC = b q + d q^2 + e q^3,$$
 where b, d, and e are constants. Use calculus and appropriate constraints on b, d, and e to show when the cost function exhibits economies of scale.
8. A computer company produces hardware and software using the same facility. (i.e., with the same L and K). The total cost of producing software (S) and hardware (H) equals:

$$TC = a S + b H - d S H,$$
 where a, b, and d are positive constants. Are there economies of scope in the production of H and S? Explain.
9. Explain how a technological change will affect a firm's production and cost functions (total, average, and marginal).

Intermediate Microeconomic Theory Review/Homework Questions, Test 3

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VII. Perfect Competition

Key Concepts:

- assumptions of perfect competition
- price taker, price maker
- barrier to entry
- profit maximization assumption
- profit maximization rule
- firm demand in perfect competition
- shut down condition (short run and long run)
- firm optimum/equilibrium in the short run and long run
- firm supply versus industry supply
- industry supply in the very short run, short run, and long run
- long-run supply with constant, increasing, and decreasing costs
- elasticity of supply
- efficiency: technical, economic, productive, and allocative
- producer surplus
- market restrictions: quota, price control, excise tax
- deadweight loss

Questions:

1. Since perfect competition is rare in the real world, why do we study it?
2. A firm's total revenue is \$100, its total cost is \$120, and its total fixed cost is \$40. Should the firm stay in business?
3. Free markets are sometimes said to be efficient because the cost of production (nature) determines the equilibrium price and consumer demand determines the equilibrium quantity traded in the long run. Evaluate.
4. Assume that each firm in a perfectly competitive market faces the following long-run total cost function (LTC) and inverse demand function.

$$\text{LTC} = 2q - 2q^2 + q^3;$$

$$\text{Inverse Demand: } p = 1001 - Q,$$

where p is price, q is firm output, and Q is industry output. Determine the long-run equilibrium:

- | | |
|--|---|
| A. Price, | C. Industry output (Q), and |
| B. Representative firm's output (q), | D. Number of firms in the industry (n). |

5. Starting from the long-run equilibrium in a perfectly competitive and increasing cost industry, use a single diagram to show the effect of an increase in demand on price and output in the market period, the short run, and the long run.

6. Assume a market with the following demand and long-run supply functions.

$$\text{Inverse Demand: } p = a - Q;$$

$$\text{Inverse Supply: } p = Q,$$

where “a” is a positive constant.

- A. Determine the allocatively efficient price and output level for this market.
- B. At the equilibrium, determine consumer surplus and producer surplus.
- C. How would your answer to the questions above change if the market became open to free trade, which led to a lower (exogenous) output price?

7. Is the deadweight loss of an excise tax greater when the demand and supply functions are more or less price elastic? Explain.

VIII. Monopoly

Key Concepts:

assumptions of monopoly
 price taker, price maker
 sources of monopoly (input control, economies of scale, government)
 firm demand in monopoly
 profit maximization rule
 shut down condition (short run and long run)
 monopoly supply function
 Lerner Index
 excise tax incidence and monopoly
 price-discrimination (types 1, 2, 3)
 deadweight loss due to monopoly
 natural monopoly
 cartel
 antitrust and monopoly

Questions:

1. Explain why a monopolist never operates on the inelastic region of its demand function.
2. Explain how the shape of a monopolist’s total revenue curve differs from that of a perfectly competitive firm.
3. Monopoly power diminishes as the monopolist’s price elasticity of demand falls. Evaluate.
4. There will be no social problem with monopoly if all of its profits were taxed away and redistributed to consumers. Evaluate.

5. Price discrimination tends to be more common in service industries. Why?
6. If a monopolist sells output in two separated markets with consumers who have different demand elasticities, will it be profit maximizing for the monopolist to charge the same price in each market? Explain.
7. Assume that the author of a book receives royalties in the form of a fixed percent of the total revenues of a book. Show that the author will want its book publisher to sell more books than is profit maximizing for the publisher. (You might assume that the publisher is a monopolist who faces linear demand and marginal cost functions.)