

**EXAMINATION #2 VERSION B**  
**“Consumers and Demand”**  
**September 29, 2016**

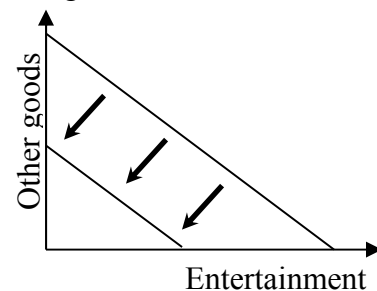
INSTRUCTIONS: This exam is closed-book, closed-notes. Calculators, mobile phones, and wireless devices are NOT permitted. Point values for each question are noted in brackets.

**I. MULTIPLE CHOICE:** Circle the one best answer to each question. Use margins for scratch work. [2 pts each—12 pts total]

(1) Which utility function below violates the assumption of "monotonicity" or "more is better"?

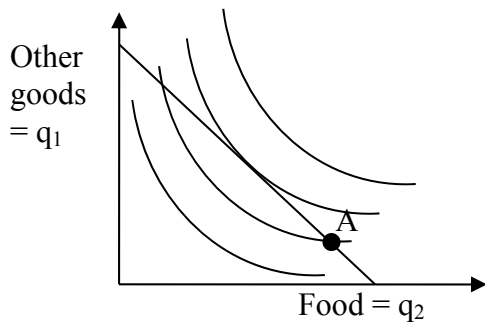
- a.  $U(q_1, q_2) = 5q_1^{1/2} + 4q_2^{1/2}$ .
- b.  $U(q_1, q_2) = (-5/q_1) + (-4/q_2)$ .
- c.  $U(q_1, q_2) = 3q_1q_2$ .
- d.  $U(q_1, q_2) = (5q_1)/(4q_2)$ .
- e.  $U(q_1, q_2) = -5q_1^{-1/2} - 4q_2^{-1/2}$ .
- f.  $U(q_1, q_2) = 3q_1^5q_2^4$ .

The next question refers to the following graph of a budget line.



- (2) In the graph above, the shift in the budget line could be caused by
- a. an increase in income.
  - b. a decrease in income.
  - c. an increase in the price of entertainment.
  - d. a decrease in the price of entertainment.
  - e. an increase in the price of other goods.
  - f. a decrease in the price of other goods.

The next two questions refer to the following graph of a consumer's budget line and indifference curves. Suppose the consumer is currently at bundle A for some reason.



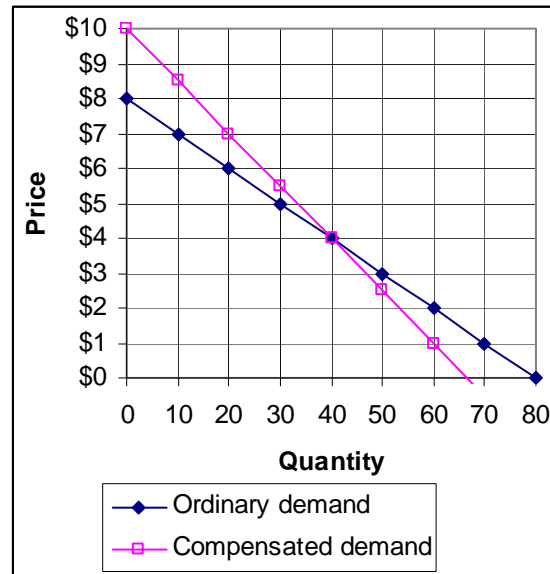
(3) This consumer could enjoy higher utility, without increasing total spending, by

- purchasing less food and more other goods.
- purchasing more food and fewer other goods.
- purchasing less food and fewer other goods.
- any of the above.
- none of the above.

(4) Let  $MU_1$  denote the marginal utility of other goods and  $MU_2$  the marginal utility of food for this consumer. Let  $p_1$  denote the price of other goods and  $p_2$  denote the price of food. At bundle A in the graph above,

- $MU_2 = MU_1$  and  $p_2 = p_1$ .
- $MU_2/MU_1 = p_2/p_1$ .
- $MU_2/MU_1 < p_2/p_1$ .
- $MU_2/MU_1 > p_2/p_1$ .
- cannot be determined from information given.

The next two questions refer to the following graph of ordinary and compensated demand curves for some good.



(5) If the price rises from \$4 to \$7, then consumer surplus decreases by

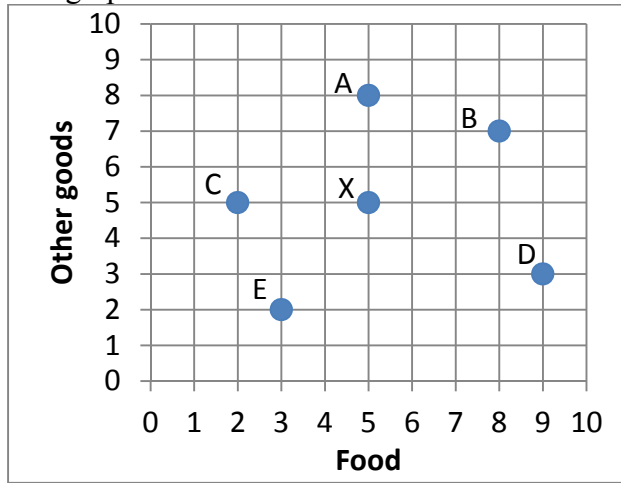
- \$3.
- \$75.
- \$90.
- \$120
- none of the above.

(6) The increase in income that would exactly compensate consumers for a rise in price from \$4 to \$7, leaving the consumer just as well off as before the price change, would be

- \$3.
- \$75.
- \$90.
- \$120
- none of the above.

**II. SHORT ANSWER:** Please write your answers in the boxes on this question sheet. Use margins for scratch work.

(1) [Preferences: 5 pts] The graph below shows six bundles or combinations of goods.



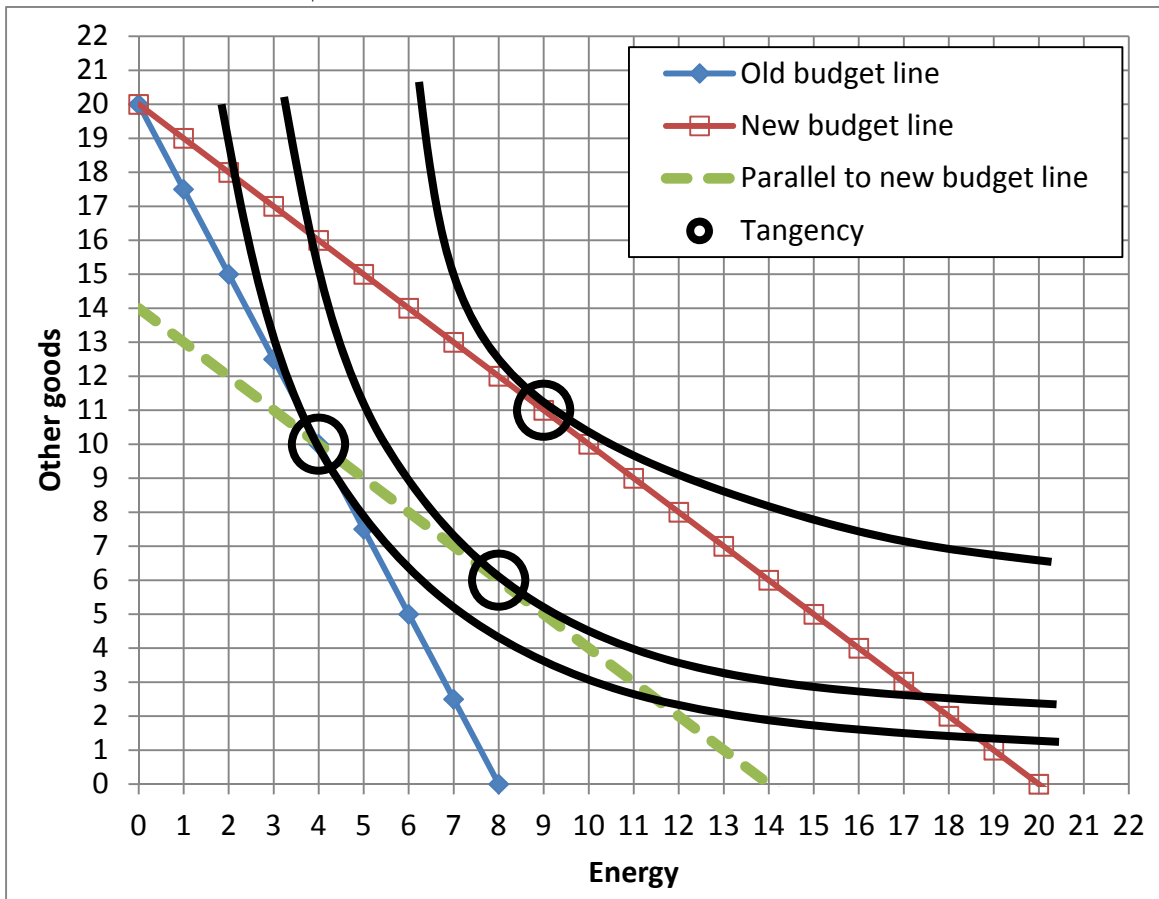
The consumer's indifference curves are unknown, but the consumer's preferences are assumed to follow the assumption of *monotonicity*. Compare bundle X to the other five bundles from the consumer's perspective. In each box below, write "*more preferred than bundle X*," "*less preferred than bundle X*," or "*cannot be determined*."

a. Bundle A:		d. Bundle D:	
b. Bundle B:		e. Bundle E:	
c. Bundle C:			

(2) [Price elasticity of demand: 10 pts] Suppose the price elasticity of demand for electricity is  $-1.2$ , and the electric utility company *lowers* the price of electricity by 5 %.

a. Is the demand for electricity <i>elastic</i> or <i>inelastic</i> ?	
b. Will the quantity demanded of electricity <i>increase</i> or <i>decrease</i> ?	
c. By about how much?	%
d. Will the revenue received by the electric utility company <i>increase</i> or <i>decrease</i> ?	
e. By about how much?	%

(3) [Substitution and income effects: 12 pts] Consider the indifference-curve diagram below. Assume the consumer has \$80 income.



- What was the price of energy on the old budget line?
- Given the old budget line, how much energy does the consumer demand?
- What is the price of energy on the new budget line?
- Given the new budget line, how much energy does the consumer demand?
- Compute the change in quantity of energy demanded due to the substitution effect:  $\Delta q^{\text{sub}}$ .
- Compute the change in quantity of energy demanded due to the income effect:  $\Delta q^{\text{inc}}$ .

\$	
	units
\$	
	units
	units
	units

(4) [Cost-of-living indexes: 6 pts] Suppose we are given the following data on prices and quantities consumed of health care and other goods.

	Health care		Other goods	
	Price	Quantity	Price	Quantity
Old period	\$5	6 units	\$10	2 units
New period	\$10	6 units	\$10	7 units

Assume that all cost-of-living indexes equal 100 in the old period.

a. Compute the Laspeyres cost-of-living index in the new period.

b. Compute the Paasche cost-of-living index in the new period.

c. Give a *formula* for the Fisher cost-of-living index in the new period.


**III. PROBLEMS:** Please write your answers in the boxes on this question sheet. Show your work and circle your final answers.

(1) [Budgets and choice: 16 pts] A consumer has the following utility function:  
 $U(q_1, q_2) = (q_1 - 5)^2 q_2^3$ , where  $q_1$  denotes the quantity of food and  $q_2$  denotes the quantity of other goods. The price of food is \$4 and the price of other goods is \$2. The consumer has \$70 in income to spend on these items.

- a. [4 pts] Give an equation for the consumer's budget line. The variables  $q_1$  and  $q_2$  should be the only unknowns.

- b. [4 pts] Find a formula for the consumer's marginal rate of substitution in consumption of other goods for food—that is, the |slope| of the consumer's indifference curve with food on the vertical axis and other goods on the horizontal axis. The variables  $q_1$  and  $q_2$  should be the only unknowns. Circle your final answer.

- c. [6 pts] Solve for the quantities of food ( $q_1^*$ ) and other goods ( $q_2^*$ ) that this consumer will choose. Circle your final answers.

(2) [Properties of individual demand functions: 16 pts] Suppose an alleged demand function is  $q_1^* = \frac{I}{5 p_1} + \frac{p_2}{10 p_1} + 3$ , where  $I$  denotes the consumer's income,  $p_1$  denotes the price of good #1, and  $p_2$  denotes the price of good #2.

- a. Is this function homogeneous of degree zero in income and prices? Justify your answer.

- b. Is good #1 an ordinary good or a Giffen good? Justify your answer.

- c. Is good #1 an inferior good or a normal good? Justify your answer.

- d. Are goods #1 and #2 substitutes, complements, or unrelated in demand? Justify your answer.

(3) [Finding individual demand functions: 12 pts] A consumer has the following utility function:  $U(q_1, q_2) = q_1^4 q_2^3$ , where  $q_1$  denotes the quantity of housing and  $q_2$  denotes the quantity of other goods.

- a. [4 pts] Find a formula for the consumer's marginal rate of substitution in consumption of other goods for housing—that is, the |slope| of the consumer's indifference curve with housing on the vertical axis and other goods on the horizontal axis. The variables  $q_1$  and  $q_2$  should be the only unknowns. Circle your final answer.

Let  $p_1$  denote the price of housing and let  $p_2$  denote the price of other goods. Let  $I$  denote the consumer's income.

- b. [4 pts] Solve for the consumer's demand function for housing—that is, the formula showing  $q_1^*$  as a function of  $p_1$ ,  $p_2$ , and  $I$ . Show your work and circle your final answer. [Hint: check that your answer is homogeneous of degree zero.]

- c. [4 pts] Solve for the consumer's demand function for other goods—that is, the formula showing  $q_2^*$  as a function of  $p_1$ ,  $p_2$ , and  $I$ . Show your work and circle your final answer. [Hint: check that your answer is homogeneous of degree zero.]



(4) [Slutsky equation: 8 pts] Recall that the Slutsky equation in elasticity form is given by  $\epsilon = -S\eta + \epsilon^{\text{comp}}$ , where  $\epsilon$  denotes the own-price elasticity of demand,  $S$  denotes the share of total consumer spending devoted to the good (a fraction),  $\eta$  denotes the income elasticity of demand, and  $\epsilon^{\text{comp}}$  denotes the compensated demand elasticity.

Suppose that for food,  $\epsilon = -0.2$ ,  $S = 0.4$ , and  $\eta = 0.3$ . Now suppose that the price of food increases by five percent.

- a. First, suppose nothing else changes. Will the quantity demanded of food increase or decrease? By how much?

- b. Alternatively, suppose the government cushions the blow of higher food prices by giving everyone a cash transfer equal to five percent of last year's spending on food. Will the quantity demanded of food increase or decrease? By how much? [Hint: first find  $\epsilon^{\text{comp}}$ .]

**IV. CRITICAL THINKING:** Answer just *one* of the questions below (your choice). [5 pts]

- (1) Amy's utility function is  $U = q_1 q_2$ , where  $q_1$  denotes the quantity of food and  $q_2$  denotes the quantity of other goods. Suppose the price of food is \$6 and the price of other goods is \$2. Compute the *minimum* amount of income that Amy must have to attain a target level of utility of  $\bar{U} = 75$  utils. Show your work and circle your final answer.
- (2) Suppose that when a consumer's income rises 5%, then the share of that consumer's budget devoted to a particular item rises by 2%. Is the item an inferior good, a necessary good, or a luxury (or superior) good? Compute the income elasticity of demand.

Circle the question you are answering and write your answer below. Full credit requires good grammar, legible writing, accurate spelling, and correct reasoning.

[end of exam]