

**EXAMINATION #2 VERSION B**  
**“Consumers and Demand”**  
**October 1, 2015**

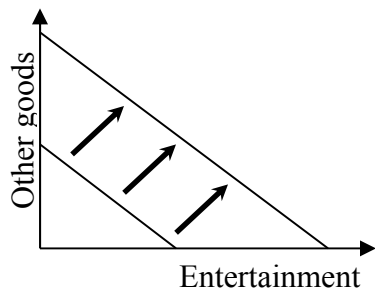
**INSTRUCTIONS:** This exam is closed-book, closed-notes. Calculators, mobile phones, and wireless devices are NOT permitted. Point values for each question are noted in brackets.

**I. MULTIPLE CHOICE:** Circle the one best answer to each question. Use margins for scratch work. [1 pts each—6 pts total]

(1) The assumption of diminishing marginal rate of substitution implies that indifference curves

- a. slope up.
- b. slope down.
- c. get flatter as they approach the horizontal axis.
- d. get steeper as they approach the horizontal axis.
- e. none of the above.

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.

(3) Which function below is homogeneous of degree zero in income and prices?

- a.  $q_1^* = 0.08 I - 3p_1 + 0.05 p_2$ .
- b.  $q_1^* = 0.05 I + 0.2/p_1$ .
- c.  $q_1^* = 0.03 I + 0.9 (p_2/p_1)$ .
- d.  $q_1^* = I/(5p_1) + 7$ .
- e. All are homogeneous of degree zero.

(4) Which of the following demand functions exhibits a constant price elasticity of demand?

- a.  $q_1^* = 5 + 0.5 p_2/p_1 + I/(3p_1)$ .
- b.  $q_1^* = 5 p_1^{-1.3} I^{1.1} p_2^{0.2}$ .
- c.  $q_1^* = I/(5p_1) + 4$ .
- d.  $q_1^* = 170 - 2 p_1 + 0.2 I - 0.1 p_2$ .
- e. None of the above.

(5) Suppose the income elasticity of demand for televisions is 1.5. Then televisions are

- a. an inferior good.
- b. a necessary good.
- c. a luxury (or superior) good.
- d. None of the above.

(6) Let  $q_1^{old}$  and  $q_2^{old}$  denote the quantities of good 1 and good 2 purchased by a typical consumer five years ago. Let  $p_1^{old}$  and  $p_2^{old}$  denote the prices of those goods five years ago. Let  $q_1^{new}$  and  $q_2^{new}$  denote the quantities of good 1 and good 2 purchased by a typical consumer this year. Let  $p_1^{new}$  and  $p_2^{new}$  denote the prices of those goods this year. Which formula below tends to *overestimate* the increase in the cost of living from five years ago to this year?

- a.  $\frac{p_1^{new} q_1^{new} + p_2^{new} q_2^{new}}{p_1^{old} q_1^{new} + p_2^{old} q_2^{new}}$
- b.  $\frac{p_1^{new} q_1^{old} + p_2^{new} q_2^{old}}{p_1^{old} q_1^{old} + p_2^{old} q_2^{old}}$
- c.  $\sqrt{\frac{p_1^{new} q_1^{old} + p_2^{new} q_2^{old}}{p_1^{old} q_1^{old} + p_2^{old} q_2^{old}}} \times \frac{p_1^{new} q_1^{new} + p_2^{new} q_2^{new}}{p_1^{old} q_1^{new} + p_2^{old} q_2^{new}}$
- d. all of the above.
- e. none of the above.

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

(1) [Budget line: 6 pts] Suppose the price of lattes is \$4 and the price of other goods is \$2. Suppose a consumer has \$60 to spend on these two goods. Consider the consumer's budget line, with lattes on the vertical axis and other goods on the horizontal axis.

- a. What is the budget line's intercept on the lattes axis?
- b. What is the budget line's intercept on the other-goods axis?
- c. What is the slope of the budget line with lattes on the vertical axis and other goods on the horizontal axis?

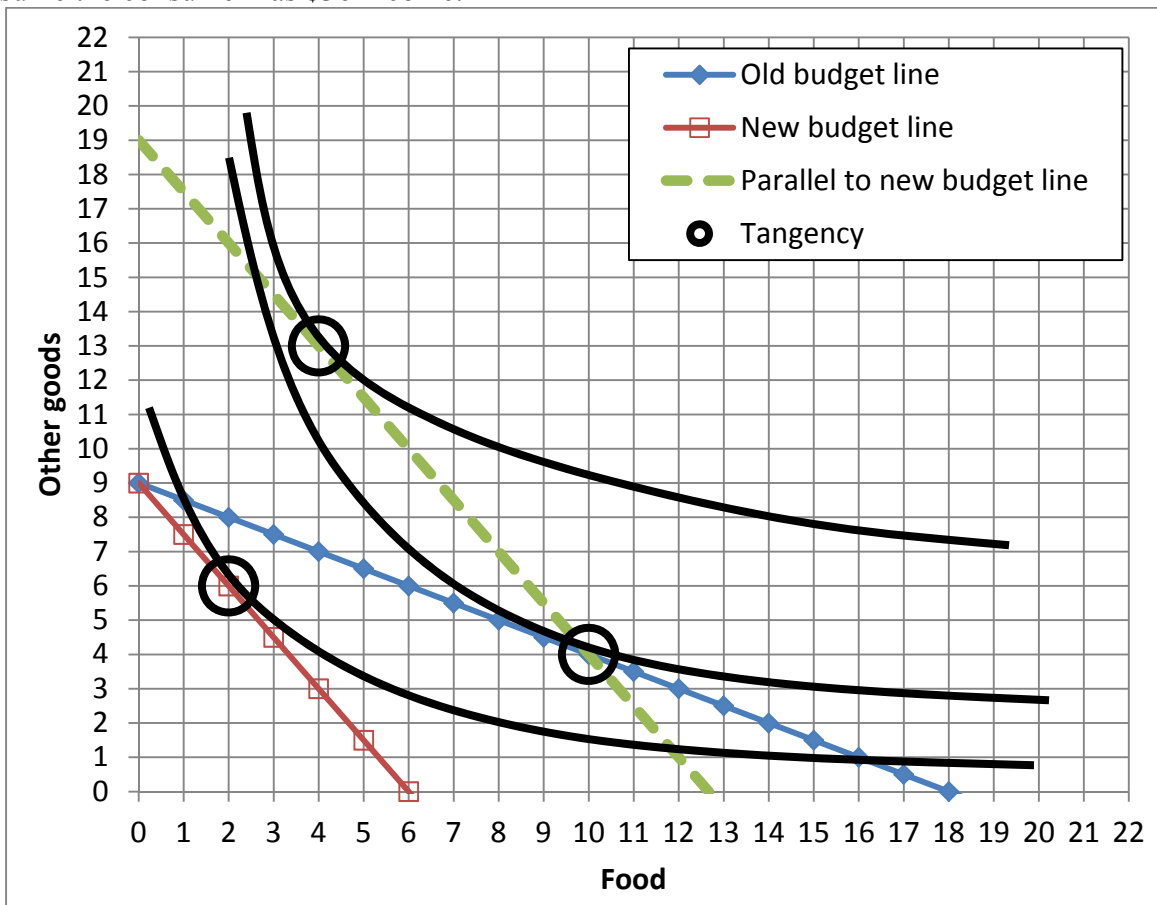
lattes
units of other goods

(2) [Price elasticity of demand: 10 pts] Suppose the price elasticity of demand for water is  $-0.8$ , and the water utility *lowers* the price of water by 5 %.

- a. Is the demand for water *elastic* or *inelastic* ?
- b. Will the quantity demanded of water *increase* or *decrease*?
- c. By about how much?
- d. Will the revenue received by the water utility *increase* or *decrease*?
- e. By about how much?

%
%

(3) [Substitution and income effects: 12 pts] Consider the indifference-curve diagram below. Assume the consumer has \$36 income.



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

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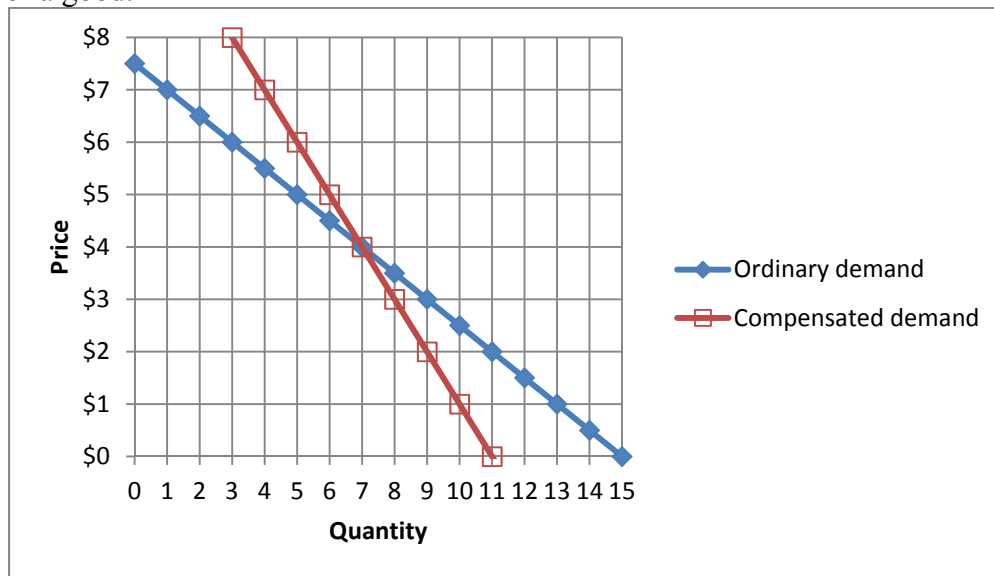
(4) [Cost-of-living indexes: 6 pts] Suppose we are given the following data on prices and quantities consumed of health care and other goods.

	Health care		Other goods	
	Price	Quantity	Price	Quantity
Old period	\$5	4 units	\$10	3 units
New period	\$5	12 units	\$15	4 units

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

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


(5) [Consumer welfare: 6 pts] The following graph shows the ordinary and compensated demand for a good.



Suppose the price of the good rises from \$4 to \$6.

- Are consumers *better off* or *worse off*?
- Compute the change in consumer surplus.
- Compute the compensating variation in income.

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**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:

$U(q_1, q_2) = (q_1 - 5)^3 q_2^2$ , where  $q_1$  denotes the quantity of food and  $q_2$  denotes the quantity of other goods. The price of food is \$10 and the price of other goods is \$5. The consumer has \$150 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. [8 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

$$q_1^* = \frac{I - p_2}{5 p_1} + 7. \quad (\text{Assume that } I > p_2.)$$

- 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:  $U(q_1, q_2) = q_1^4 q_2$ , 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] The Slutsky equation in elasticity form is given by the following:

$\varepsilon = -S \eta + \varepsilon^{\text{comp}}$ , where, as usual,  $\varepsilon$  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  $\varepsilon^{\text{comp}}$  denotes the compensated demand elasticity.

Suppose that for energy,  $\varepsilon = -0.8$ ,  $S = 0.05$ , and  $\eta = 0.4$ . Now suppose that the price of energy increases by 10%.

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

- b. Alternatively, suppose the government cushions the blow of higher energy prices by giving everyone a cash transfer equal to 10 percent of last year's spending on energy. Will the quantity demanded of energy increase or decrease? By how much? [Hint: first find  $\varepsilon^{\text{comp}}$ .]



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

- (1) Suppose Adam buys only pizzas ( $q_p$ ) and mango smoothies ( $q_s$ ). Suppose the prices of both items increase by 20% from the old period to the new period. That is,

$$p_p^{\text{new}} = 1.2 p_p^{\text{old}} \quad \text{and} \quad p_s^{\text{new}} = 1.2 p_s^{\text{old}}.$$

(However, we do not know what quantities Bob chooses in either period.) Which increases fastest—Adam's *Laspeyres* cost-of-living index, his *Paasche* cost-of-living index, or his *Fisher* cost-of-living index? Justify your answer with an algebraic proof. (Ignore the graph.)

- (2) Suppose Brianna now rides the bus 20 times per month. The bus fare is \$2. Which would Brianna prefer: a reduction in the fare from \$2 to \$1.50, or an increase in monthly income of \$10? Justify your answer with a graph of a demand curve.

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]