

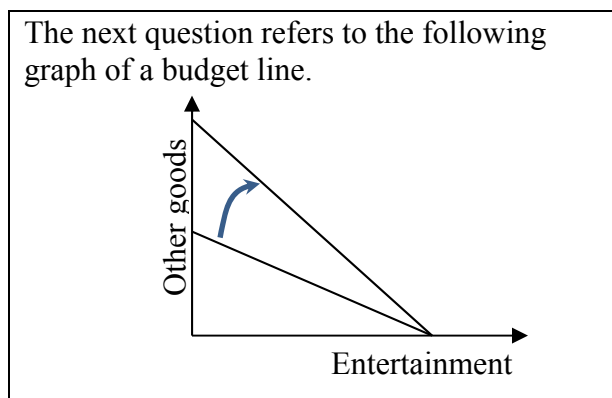
EXAMINATION #2 VERSION C
“Consumers and Demand”
October 1, 2015

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 monotonicity implies that indifference curves
- get flatter as they approach the horizontal axis.
 - get steeper as they approach the horizontal axis.
 - slope up.
 - slope down.
 - 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
- an increase in income.
 - a decrease in income.
 - an increase in the price of entertainment.
 - a decrease in the price of entertainment.
 - an increase in the price of other goods.
 - a decrease in the price of other goods.

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

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

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

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

- (5) Suppose the income elasticity of demand for beans is -0.2. Then beans are

- an inferior good.
- a necessary good.
- a luxury (or superior) good.
- 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 *underestimate* the increase in the cost of living from five years ago to this year?

- a. $\frac{p_1^{\text{new}} q_1^{\text{new}} + p_2^{\text{new}} q_2^{\text{new}}}{p_1^{\text{old}} q_1^{\text{new}} + p_2^{\text{old}} q_2^{\text{new}}}$
- b. $\frac{p_1^{\text{new}} q_1^{\text{old}} + p_2^{\text{new}} q_2^{\text{old}}}{p_1^{\text{old}} q_1^{\text{old}} + p_2^{\text{old}} q_2^{\text{old}}}$
- c. $\sqrt{\frac{p_1^{\text{new}} q_1^{\text{old}} + p_2^{\text{new}} q_2^{\text{old}}}{p_1^{\text{old}} q_1^{\text{old}} + p_2^{\text{old}} q_2^{\text{old}}}} \times \frac{p_1^{\text{new}} q_1^{\text{new}} + p_2^{\text{new}} q_2^{\text{new}}}{p_1^{\text{old}} q_1^{\text{new}} + p_2^{\text{old}} q_2^{\text{new}}}$
- 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 \$5 and the price of other goods is \$6. 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?

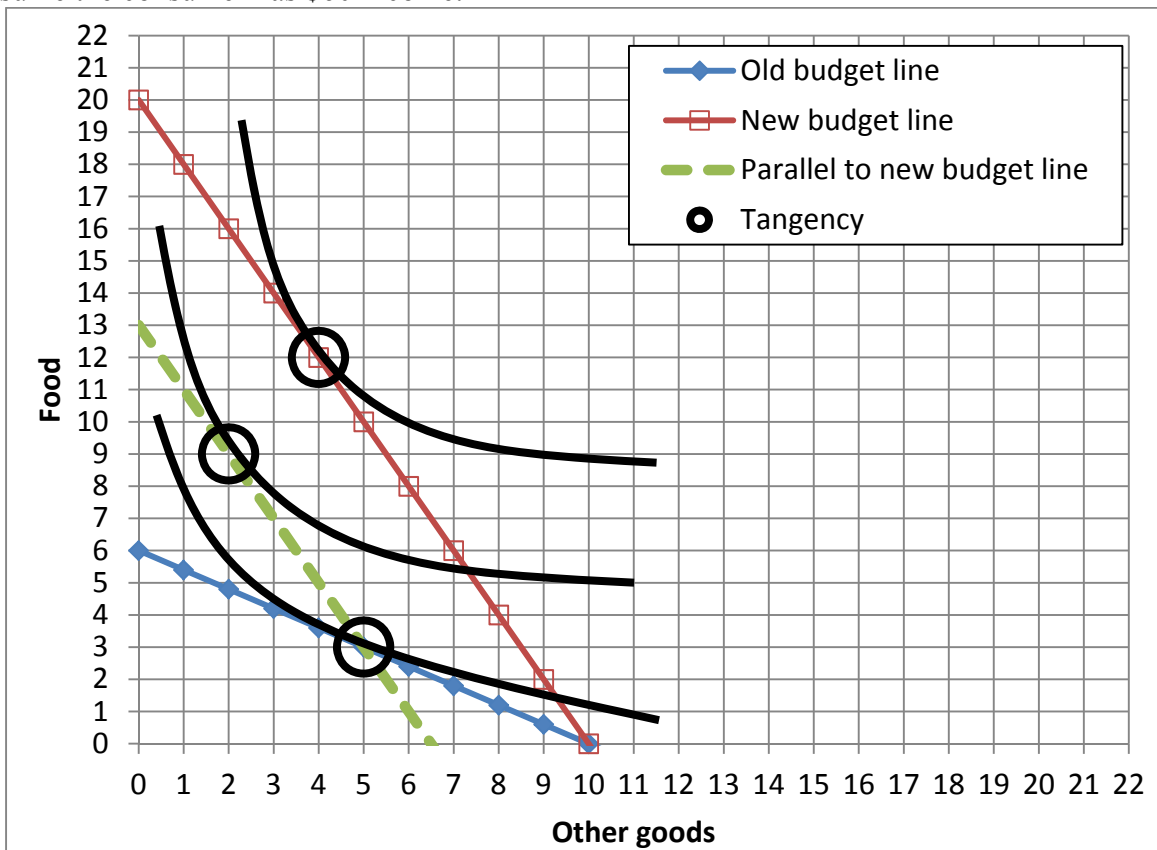
lattes
units of other goods

(2) [Price elasticity of demand: 10 pts] Suppose the price elasticity of demand for water is -0.6, and the water utility *raises* 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 \$60 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: Δq^{sub} .
- Compute the change in quantity of food demanded due to the income effect: Δq^{inc} .

\$	
	units
\$	
	units
	units
	units

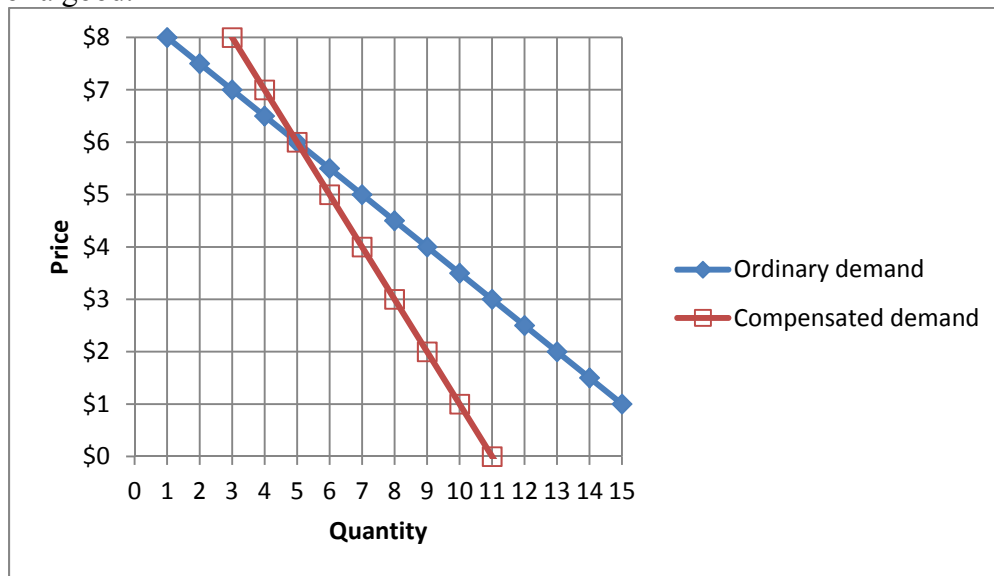
(4) [Cost-of-living indexes: 6 pts] Suppose we are given the following data on prices and quantities consumed of health care and other goods.

	Health care		Other goods	
	Price	Quantity	Price	Quantity
Old period	\$3	3 units	\$4	4 units
New period	\$3	10 units	\$5	5 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 falls from \$6 to \$2.

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

\$
\$

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:

$U(q_1, q_2) = q_1^2 (q_2 + 5)^3$, 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 \$3. The consumer has \$85 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

$$q_1^* = \frac{I+2p_2}{3p_1} + 5.$$

- 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: $U(q_1, q_2) = q_1^3 q_2^2$, 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, ε denotes the own-price elasticity of demand, S denotes the share of total consumer spending devoted to the good (a fraction), η denotes the income elasticity of demand, and $\varepsilon^{\text{comp}}$ denotes the compensated demand elasticity.

Suppose that for energy, $\varepsilon = -0.7$, $S = 0.2$, and $\eta = 0.8$. 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]