ECON 173 - Intermediate Microeconomic Analysis
Drake University, Fall 2022
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EXAMINATION #2 ANSWER KEY
"Consumers and Demand"

Version A

I. Multiple choice

(1)b . (2)a. (3)e. (4)a. (5)c. (6)b. (7)b. (8)b. (9)c. (10)b.

II. Short answer

(1) a. inelastic. b. decrease. c. 7 %.
d. increase. e. 3 %.

(2) a. necessary good. b. increase. c. 2 %.
d. decrease. e. 6 %.

(3) Note: This graph is based on Slutsky's approach to income and substitution effects, not Hicks's approach.
a. \$4. b. 9 units. c. \$12.
d. 4 units. e. – 2 units. f. – 3 units.

(4) a. $\varepsilon^{comp} = -0.29$. b. decrease. c. 3 %.
d. decrease e. 2.9 %.

(5) a. Laspeyres = 140. b. Paasche = 130. c. $\sqrt{140 \times 130}$.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $100 = 5\ q_1 + 8\ q_2$.

b. $MRSC = MU_2/MU_1 = (q_1\text{-}4) / q_2$.

c. Solve the tangency condition ($MRSC = p_2/p_1 = 8/5$) jointly with equation for budget line (see part a) to get $q_1^* = 12$, $q_2^* = 5$.

(2) [Properties of individual demand functions]

a. Homogeneity of degree zero means that if income and all prices are multiplied by the same factor, the quantity demanded never changes. Check homogeneity of the demand function by replacing I by (aI), replacing p_1 by (ap_1), and replacing p_2 by (ap_2) , where a is an arbitrary factor:

$$\frac{(a\,I)}{(a\,p_1)} - \frac{(a\,p_2)}{(a\,p_1)} + 3 = \frac{I}{3\,p_1} - \frac{p_2}{p_1} + 3\ .$$

Note that the "a" factor cancels. So multiplying income and prices by some arbitrary positive factor a *does not* change the quantity demanded. The function <u>is homogeneous of degree zero</u> in income and prices.

b. $\frac{\partial q_1^*}{\partial p_1} = -\frac{I}{3} p_1^{-2} + p_2\, p_1^{-2} = \left(-\frac{I}{3} + p_2\right) p_1^{-2}$. This expression is negative if $(I/3)>p_2$, so good #1 is an <u>ordinary good</u>, not a Giffen good.

c. $\frac{\partial q_1^*}{\partial I} = \frac{1}{3p_1}$. This expression is positive, so good #1 is a <u>normal good</u>, not an inferior good.

d. $\frac{\partial q_1^*}{\partial p_2} = -\frac{1}{p_1}$. This expression is negative, so goods #1 and #2 are <u>complements</u>, not substitutes.

(3) [Finding individual demand functions]

a. MRS = $MU_2/MU_1 = q_1 / (4q_2)$.

b. Solve MRS = $q_1 / (4q_2) = p_2/p_1$ (the tangency condition) jointly with $I = p_1q_1 + p_2q_2$ (the budget constraint) to get $q_1^* = \frac{4I}{5\,p_1}$, and

c. $q_2^* = \frac{I}{5\,p_2}$.

[There are many ways to solve the equations jointly. One way to begin is to cross-multiply the tangency condition to get $p_1\, q_1 = 4\, p_2\, q_2$. Then substitute into the budget constraint: $I = (4\, p_2\, q_2) + p_2\, q_2$. Then solve for q_2^* as a function of p_2 and I. Finally, substitute your expression for q_2^* into either the budget constraint or the tangency condition and solve for q_1^*.]

III. Critical thinking

(1) Recall the approximation rule:

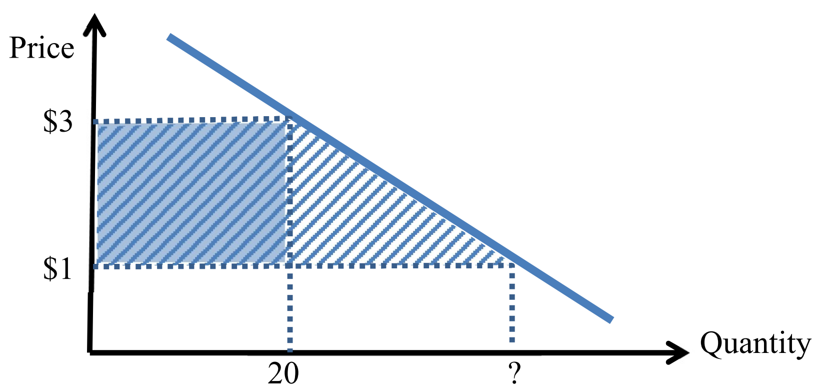
% change spending = % change price + % change quantity.

We are given that % change price = +10% and % change spending = +7%, so % change quantity = -3%. By definition, the price elasticity of demand is

ε = % change quantity / % change price = -3%/10% = -0.3 .

Demand is *inelastic* because the price elasticity of demand is less than one in absolute value.

(2) We are given that at a price of \$3, a consumer buys 20 gallons of gasoline. We are not given the quantity demanded when the price is \$1, but it is surely greater than 20 gallons by the law of demand. The increase in consumer surplus from this price reduction is the area of the striped trapezoid in the graph below. This area is necessarily greater than the area of the shaded rectangle, which is \$40. So, the consumer would prefer the price reduction to the increase in income.



Version B

I. Multiple choice

(1)d . (2)b. (3)a. (4)e. (5)b. (6)c. (7)a. (8)d. (9)c. (10)d.

II. Short answer

(1) a. elastic. b. decrease. c. 6 %.
d. decrease. e. 1 %.

(2) a. luxury or superior good. b. increase. c. 9 %.
d. increase. e. 3 %.

(3) Note: This graph is based on Slutsky's approach to income and substitution effects, not Hicks's approach.
a. \$10. b. 3 units. c. \$3.
d. 12 units. e. 6 units. f. 3 units.

(4) a. $\varepsilon^{comp} = -0.18$. b. decrease. c. 8 %.
d. decrease e. 7.2 %.

(5) a. Laspeyres = 160. b. Paasche = 140. c. $\sqrt{160 \times 140}$.

III. Problems

(1) [Budgets and choice]

a. Equation for budget line (income=spending): $100 = 5\ q_1 + 7\ q_2$.

b. MRSC = $MU_2/MU_1 = \frac{q_1+8}{q_2}$.

c. Solve the tangency condition (MRSC = $p_2/p_1 = 7/5$) jointly with equation for budget line (see part a) to get $q_1^* = 6$, $q_2^* = 10$.

(2) [Properties of individual demand functions]

a. Homogeneity of degree zero means that if income and all prices are multiplied by the same factor, the quantity demanded never changes. Check homogeneity of the demand function by replacing I by (aI), replacing p_1 by (ap_1), and replacing p_2 by (ap_2), where a is an arbitrary factor:

$$\begin{aligned} &5\ (a\ p_1)^{-0.9}\ (a\ I)^{1.5}\ (a\ p_2)^{-0.1} \\ &= a^{-0.9}\ a^{1.5}\ a^{-0.1}\ (5\ p_1^{-0.9}\ I^{1.5}\ p_2^{-0.1}) \\ &= a^{0.5}\ (5\ p_1^{-0.9}\ I^{1.5}\ p_2^{-0.1}) \end{aligned}$$

Note that the "a" factor does *not* cancel. So multiplying income and prices by some arbitrary positive factor a *does* change the quantity demanded. The function is NOT homogeneous of degree zero in income and prices.

b. $\frac{\partial q_1^*}{\partial p_1} = -0.9\ (5\ p_1^{-1.9}\ I^{1.5}\ p_2^{-0.1})$. This expression is negative, so good #1 is an ordinary good, not a Giffen good.

c. $\frac{\partial q_1^*}{\partial I} = 1.5\ (5\ p_1^{-0.9}\ I^{0.5}\ p_2^{-0.1})$. This expression is positive, so good #1 is a normal good, not an inferior good.

d. $\frac{\partial q_1^*}{\partial p_2} = -0.1\ (5\ p_1^{-0.9}\ I^{1.5}\ p_2^{-1.1})$. This expression is negative, so goods #1 and #2 are complements, not substitutes.

(3) [Finding individual demand functions]

a. MRS = MU_2/MU_1 = $(2q_1) / (3q_2)$.

b. Solve MRS = $(2q_1) / (3q_2) = p_2/p_1$ (the tangency condition) jointly with $I = p_1q_1 + p_2q_2$ (the budget constraint) to get $q_1^* = \frac{3I}{5p_1}$, and

c. $q_2^* = \frac{2I}{5p_2}$.

[There are many ways to solve the equations jointly. One way to begin is to cross-multiply the tangency condition to get $(2/3)\ p_1\ q_1 = p_2\ q_2$. Then substitute into the budget constraint: $I = I = p_1q_1 + (2/3)\ p_1\ q_1$. Then solve for q_1^* as a function of p_1 and I. Finally, substitute your expression for q_1^* into either the budget constraint or the tangency condition and solve for q_2^*.]

III. Critical thinking

Same as Version A.

[end of answer key]