NAME _____

Peking University

Intermediate Microeconomics

Fall 2022

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Homework 3

Due: Monday, November 14

Instructions:

1. Print your name on the answer sheet.
2. This homework assignment consists of 5 multiple-choice questions with each one worth 4 points and 2 short-answer questions for 80 points, 100 points total. Make sure you have a complete question set.
3. Please write down all your answers on the answer sheet. Answers written on the question sheet will NOT be graded.
4. The space provided on the answer sheet should be sufficient for your answer. If you need additional space, attach a blank paper.
5. Please write neatly. If I cannot read an answer, you will receive no credit for it.
6. Show enough of your work so that I can tell how you arrived at the answer. You will receive credit for sound reasoning. Partial credit will be awarded wherever I deem there is sufficient justification.
7. When drawing graphs, make sure to label everything, including the axes. It is not particularly important to draw your graphs with perfect precision.
8. Turn in the answer sheet ONLY.

C

1. A production function defines the output that can be produced

Efficiency ≠ low cost

A. at the lowest cost, given the inputs available.
B. for the average firm.
C. if the firm is technically efficient.
D. in a given time period if no additional inputs are hired.
E. as technology changes over time.

Use input efficiently, don't care if inputs cost the least

technology changes ⟶ function changes

B

2. A firm's marginal product of labor is 4 and its marginal product of capital is 5. If the firm adds one unit of labor, but does not want its output quantity to change, the firm should

$MP_L = 4$

$MP_K = 5$

A. use five fewer units of capital.
B. use 0.8 fewer unit of capital.
C. add 0.8 unit of capital.
D. use 1.25 fewer units of capital.
E. add 1.25 units of capital.

$\frac{dK}{dL} = -\frac{MP_L}{MP_K} = -\frac{4}{5} = -0.8$

$|MRTS_{LK}| = \frac{MP_L}{MP_K}$

B

3. A firm uses two factors of production. Irrespective of how much of each factor is used, both factors always have positive marginal products which imply that

A. isoquants are relevant only in the long-run.
B. isoquants have negative slope.
C. isoquants are convex.
D. isoquants can become vertical or horizontal.
E. None of the above.

B

4. Suppose the production of long-distance airline flights is described by a fixed proportion production process in which three crew members (i.e., labor) are required for each aircraft (i.e., capital). If the airline operates with four crew members per plane, then

the general case (L-shaped isoquants)

A. the production process violates diminishing margin returns.
B. production at this point is technically inefficient.
C. the isoquants for this production process are upward sloping.
D. the airline will have negative profits.
E. All of the above.

A

5. A farmer uses M units of machinery and L hours of labor to produce C tons of corn with the production function $C = L^{0.5} + M^{0.75}$. This production function exhibits

! This isn't Cobb-Douglas function

A. decreasing returns to scale for all output levels.
B. constant returns to scale for all output levels.
C. increasing returns to scale for all output levels.
D. no clear pattern of returns to scale.

Expand & Shrink

$C_0 = L_0^{0.5} + M_0^{0.75}$

$C_1 = (2L_0)^{0.5} + (2M_0)^{0.75}$

6. **Aeron has preferences for chocolate (Good 1) and soda (Good 2) represented by the utility function of** x_1 x_2

$$u(x_1, x_2) = (x_1 + 10) \cdot (x_2 + 10) - 100$$

Moreover, he faces a standard budget constraint with an income of m, and the price of chocolate is constant at p_1 per bar, while the price of soda is constant at p_2 per bottle.

1) **Derive Aeron's demand functions for chocolate and soda, $x_1(p_1, p_2, m)$ and $x_2(p_1, p_2, m)$.**
2) **Suppose $m = 36$, $p_1 = 4$ and $p_2 = 2$, but then the price of soda were to increase to $p_2' = 8$. Pick up the movement in the demanded bundles associated with the Slutsky substitution effect and the income effect due to this price change.**

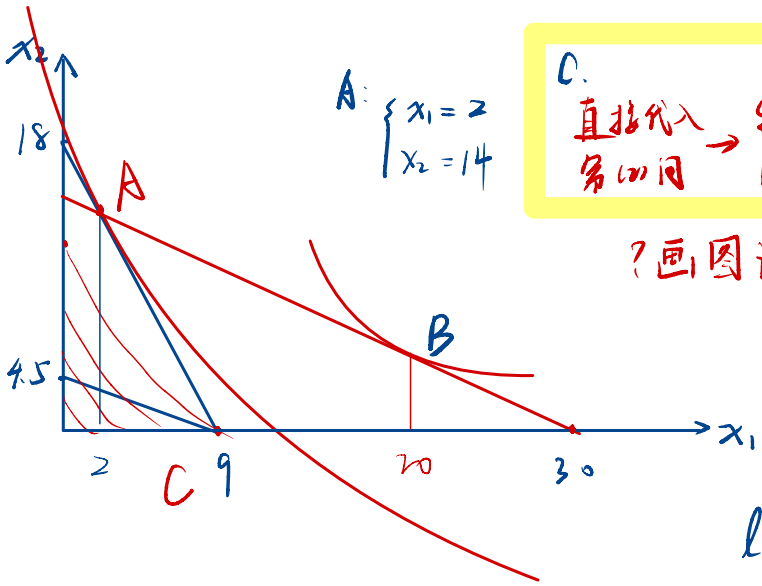
$p_1x_1 + p_2x_2 = m$

$L(x_1, x_2, \lambda) = x_1x_2 + 10x_1 + 10x_2 - \lambda(p_1x_1 + p_2x_2 - m)$

FOC's

$$\begin{cases} \frac{\partial L}{\partial x_1} = x_2 + 10 - \lambda p_1 = 0 \\ \frac{\partial L}{\partial x_2} = x_1 + 10 - \lambda p_2 = 0 \\ \frac{\partial L}{\partial \lambda} = m - p_1x_1 - p_2x_2 = 0 \end{cases} \Rightarrow \begin{cases} x_1 = \frac{10(p_2 - p_1) + m}{2p_1} \\ x_2 = \frac{m - 10(p_2 - p_1)}{2p_2} \end{cases}$$

! Constraint!
make $x_1 \geq 0$, $x_2 \geq 0$
condition of income



A: $\begin{cases} x_1 = 2 \\ x_2 = 14 \end{cases}$

C.
直接代入 → $\begin{cases} x_1 = 9 \\ x_2 = -0.5 \end{cases}$ ×
多边问

?画图说明

$\Delta x^s = 20 - 2 = 18$

$\Delta x^n = 9 - 20 = -11$

l_{AB}: $x_1 + 2x_2 = 30$

or $4x_1 + 8x_2 = 120$

$\begin{cases} x_1 = 20 \\ x_2 = 5 \end{cases}$

$x_2 + 10 > 19 - x_1$

$x_2 >$

l_{JK}: $x_1 + 2x_2 \leq 9$

$\frac{x_2 + 10}{4} = \frac{MU_{x_1}}{P_1} > \frac{MU_{x_2}}{P_2}$ $\frac{x_1 + 10}{8} \leq \frac{19 - 2x_1}{8}$ $\frac{9.5 - x_1}{4}$

Constraint → Never forget! → immediately

Others →

If $m \geq 10(p_1 - p_2)$ & $m \geq 10(p_2 - p_1)$

If $p_1 > p_2$, check $m < 10(p_1 - p_2)$

$\begin{cases} x_1^* = 0 \\ x_2^* = \frac{m}{p_2} \end{cases}$

If $p_1 < p_2$, check $m < 10(p_2 - p_1)$

$\begin{cases} x_1^* = \frac{m}{p_1} \\ x_2^* = 0 \end{cases}$

! When considering thoroughly, you don't have to use graph to demonstrate, but just gives you intuition

2). If $m = 36$ $p_1 = 4$ $p_2 = 2$

then $m \geq 10(p_1 - p_2)$ & $m \geq 10(p_2 - p_1)$

we can use conclusion

$\Rightarrow \begin{cases} x_1 = 2 \\ x_2 = 14 \end{cases}$

· If $m = 36$ $p_1 = 4$ $p_2 = 8$

then $m < 10(p_2 - p_1)$

$\Rightarrow \begin{cases} x_1 = 9 \\ x_2 = 0 \end{cases}$

holding purchasing power constant

original bundle ↑

At $P_1 = 4$ & $P_2 = 8$, to buy Bundle $(2, 14)$

need $m = 4 \times 2 + 8 \times 14 = 120$

· If $m = 120$, $P_1 = 4$, $P_2 = 8$

then $m \geq 10(p_2 - p_1)$

$\Rightarrow \begin{cases} x_1 = 20 \\ x_2 = 5 \end{cases}$

From Bundle $(2, 14)$ to $(20, 5)$

Slutsky Substitution effect

From Bundle $(20, 5)$ to $(9, 0)$

Income effect

Sunk cost: never get back!

But the Medallion can be resold

And the cost of it doesn't

· Write out the Demand func

Supply

Elasticity formula

Optimization

2种算法 ① Lagrange

② 比值法

7. Bernice's preferences can be represented by a utility function

$$U(x, y) = \min\{x, y\}$$

She faces prices of (2, 1), and her income is 12. Then the prices change to (3, 1). What are the compensating and equivalent variations?

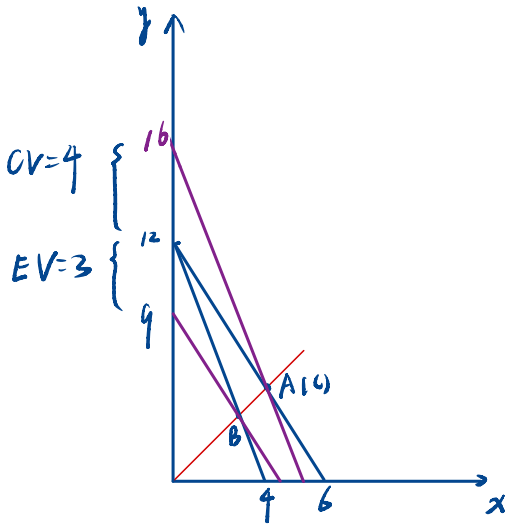
$2x + y = 12$

A (4,4)
B (3,3)

CV = 6

$4 \times 3 + 4 \times 1 = 16$

$2 \times 3 + 1 \times 3 = 9$



$$\begin{cases} p_1 x_1 + p_2 x_2 = m \\ x_1 = x_2 \end{cases}$$

perfect complements

$$x_1 = x_2 = \frac{m}{p_1 + p_2}$$

$$x = y = \frac{m}{P_x + P_y}$$

Demand changes from (4,4) to (3,3)

CV: $\frac{m}{3+1} = 4$

$\Rightarrow m = 16$

$\Rightarrow CV = 16 - 12 = 4$

EV: $\frac{m'}{2+1} = 3$

$\Rightarrow m' = 9$

$\Rightarrow EV = 12 - 9 = 3$