9-3-08

MICRO REVIEW

- PROD. FUNCTION, MARG/AV. PRODUCTS
- ISOQUANTS
- COST MINIMIZATION
- PROFIT MAXIMIZATION
- PPF

- PREFERENCES
- BUDGET CONSTRAINT
- UTILITY MAXIMIZATION

PROD. FUNCTIONS

2 FACTORS $\to L$, $\to K$

GOOD: q

$$q = f(L, K)$$

OR

1 FACTOR: L

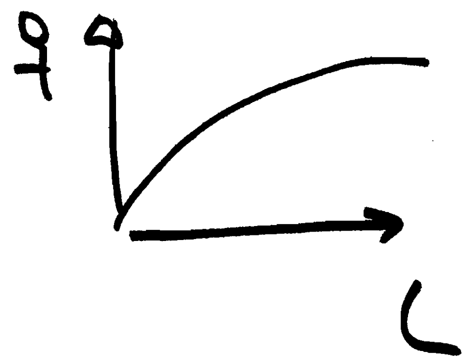
GOOD: q

$$q = f(L)$$

EXAMPLES

1) 1 FACTOR

Ex1: $q = L^{1/2} = \sqrt{L}$



$\boxed{\text{MPL is } \downarrow}$

WHERE $MPL = \left.\dfrac{\Delta q}{\Delta L}\right|_{\text{SMALL CHANGES}}$

$\boxed{\downarrow \text{APL}} = \dfrac{q}{L} = \dfrac{L^{1/2}}{L} = \dfrac{1}{L^{1/2}}$

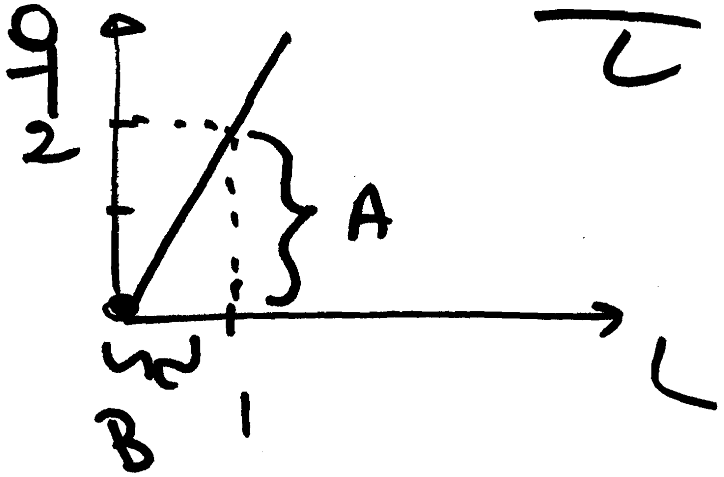
$$MPL = \frac{1}{2} \frac{1}{L^{1/2}}$$

$$APL = \frac{1}{L^{1/2}}$$

EX 2: $q = 2L$ LINEAR PROD FUNCTION

$$MPL = \frac{\Delta q}{\Delta L} = 2$$

$$APL = \frac{q}{L} = 2$$



$$|SLOPE| : \frac{A}{B} = 2$$

UNIT LABOR COEFFICIENT
OR
UNIT LABOR REQUIREMENT
= # OF UNITS OF LABOR NEEDED TO PRODUCE 1 UNIT OF OUTPUT

$$q = 2 \cdot L$$

$$\underbrace{\text{UNIT LABOR COEFF OR REQUIREMENT}}_{a} = \frac{1}{2}$$

NOTICE $\quad a = \dfrac{1}{APL}$

Ex 3: $q = \frac{1}{3} \cdot L$

$$APL = \frac{1}{3} = MPL$$

$$\Rightarrow \quad a = 3$$

2 FACTOR PROD. FUNCTION

$$q = f(L, k)$$

EX 1:

$$q = 2 \cdot L^{1/2} \cdot k^{1/2}$$

HERE $MPL = \frac{\Delta q}{\Delta L}\Big|$ EVERYTHING ELSE CONSTANT

$MPK = \frac{\Delta q}{\Delta k}\Big|$

(PARTIAL DERIVATIVES)

MPL ↓

MPk ↓

RETURNS TO SCALE:

% Δ q WHEN ALL INPUTS ~~&~~ CHANGE BY THE SAME %

HERE WE HAVE
CONSTANT RETURNS TO SCALE

$\Longrightarrow$

$\% \Delta q = \% \Delta L = \% \Delta K$

$\Longrightarrow$ AVERAGE COST
IS <u>CONSTANT</u>

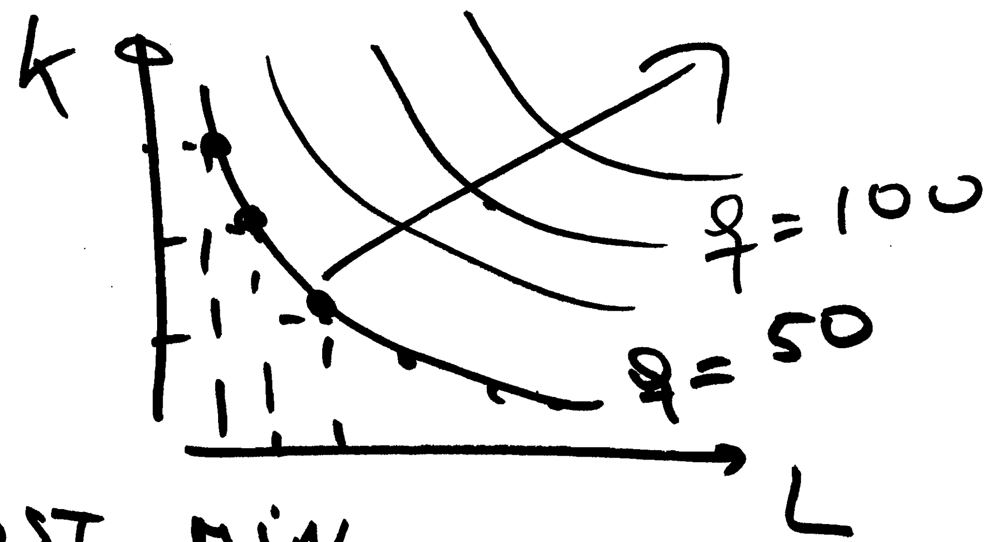
$\Longrightarrow$ "OPTIMAL" FIRM SIZE
IS UNDERMINED

$\Rightarrow$ EASY TO WORK WITH

<u>ISOQUANT</u> = COMBINATIONS
OF L & K
THAT YIELD THE
SAME TOTAL OUTPUT

$\downarrow$
EQUAL

IN OUR EXAMPLE WE HAVE LOTS OF SUBSTITUTION BETWEEN INPUTS (K, L)



COST MIN

MIN $\quad w \cdot L + r \cdot K$

SUBJECT TO

$$q = 50$$

WHERE

w = WAGE

r = RENTAL PRICE OF CAPITAL

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ISOCOST:

$$\bar{C} = w \cdot L + r \cdot k$$

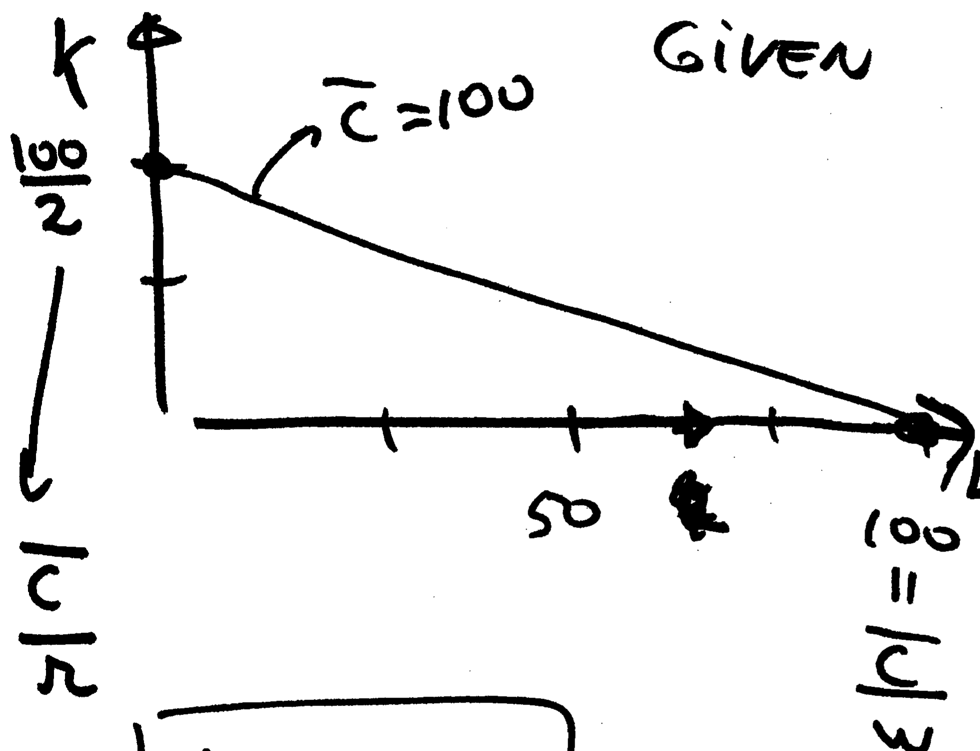
GIVEN

EX:

$\bar{C} = 100$

$w = 1$

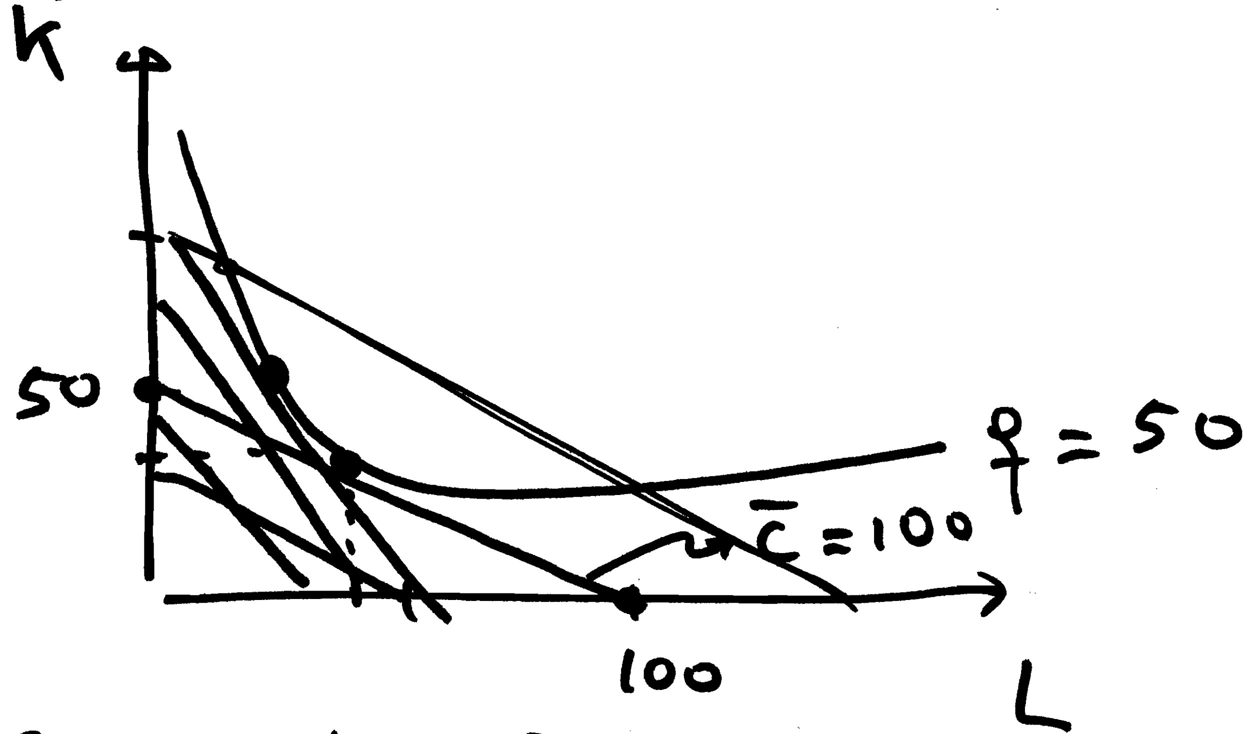
$r = 2$



$$100 = 1 \cdot L + 2 \cdot k$$

$$\boxed{|\text{SLOPE}|} = \frac{\bar{C}/r}{\bar{C}/w} = \boxed{\frac{w}{r}}$$

ISOCOST MAP



COST MIN. $\Rightarrow$

$$\left| \text{SLOPE ISOQUANT} \right| = \left| \text{SLOPE ISOCOST} \right| = \frac{w}{r}$$

$$\uparrow \frac{w}{r} \Rightarrow \downarrow \frac{L}{K} \text{ OR } \uparrow \frac{K}{L}$$

PROFIT MAXIMIZATION

1) APPROACH 1

- CALCULATE "COST FUNCTION" (CHEAPEST WAY TO PRODUCE ANY OUTPUT q): $C(q)$
- USE PROFIT MAX CONDITION:

$$p = MC$$

2) APPROACH 2

PROFIT MAX. INPUT DEMANDS

MAX

PROFITS = TOTAL REVENUE - TOTAL COSTS

$$p \cdot \underset{\downarrow f(L,k)}{q} - [w \cdot L + r \cdot k]$$

$$= \underline{p \cdot f(L,k) - [wL + rk]}$$

PROBLEM MAX PROFITS
"BY CHOOSING K & L
OPTIMALLY"
$\Rightarrow$ PROFIT MAX. INPUT
DEMANDS

MATH:

$$\max_{(K,L)} \quad p \cdot f(L,K) - W \cdot L - r \cdot K$$

$$\Rightarrow \quad \frac{\partial}{\partial L} = 0$$

$$\frac{\partial}{\partial K} = 0$$

This is

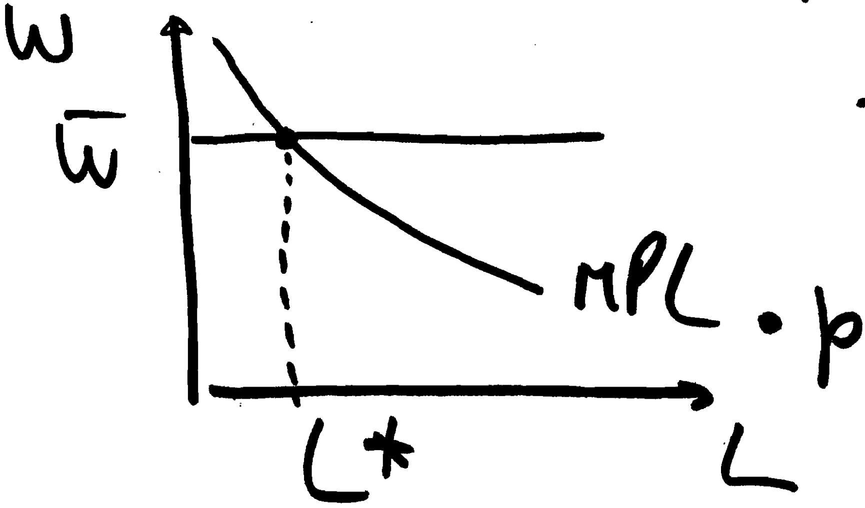
$$\underbrace{p \cdot MPL(\ ) = W}$$

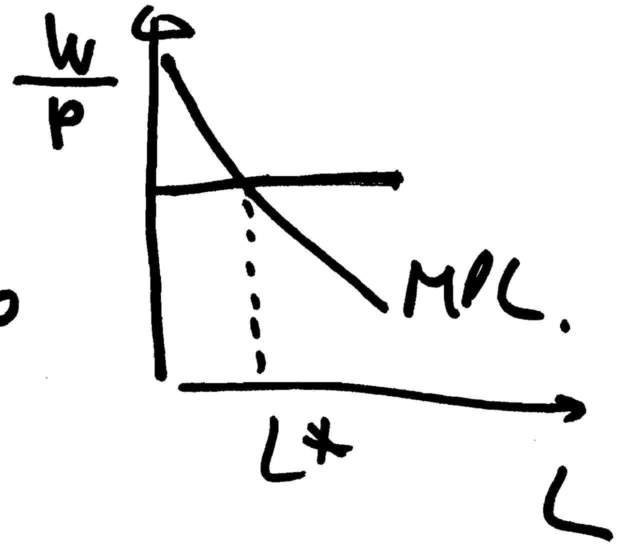
$$\underbrace{p \cdot MPK(\ )}_{\text{VALUE OF MARG. PRODUCT}} = \underbrace{r}_{\text{FACTOR PRICE}}$$

EXAMPLES:

ⓐ "NICE" $f(L,K)$

WITH ↓ MPL , ↓ MPK





WE ASSUME THAT

$\uparrow \frac{K}{L} \Rightarrow$ MPL ↑

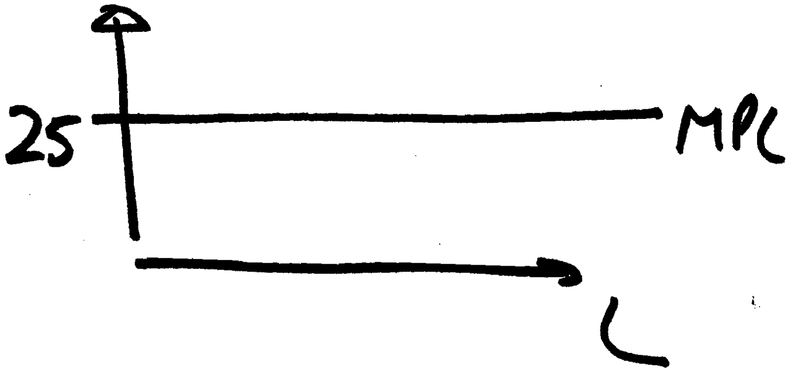
MPK ↓

TECH. CHANGE SHIFTS BOTH MPL, MPK CURVES OUT

(b) LINEAR PROD. FUNCTION
ONE FACTOR: LABOR

$q = 25 \cdot L \Rightarrow MPL = 25$

$a = \frac{1}{25}$



$\Rightarrow$ EQUILIBRIUM OR PROFIT MAX IS DEFINED IFF

$\frac{w}{p} = 25$

- PPF

• 1 FACTOR, 2 GOODS
  L   X, Y

$$\left.\begin{array}{l} X = f_X(L_X) \\ Y = f_Y(L_Y) \end{array}\right] \text{TECHNOLOGY}$$

$$(*) \quad \bar{L} = L_X + L_Y \;\Big]\; \text{FEASIBILITY}$$

$\bar{L}$ ↓ LABOR ENDOWMENT

PPF: MAX $X = f_X(L_X)$

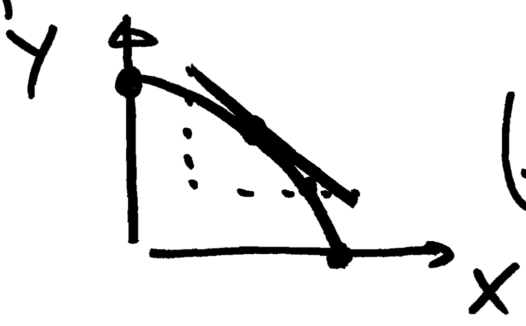
SUBJECT TO

$Y = f_Y(L_Y)$

& (*)

IF f's ARE "NICE"

↓ ↓ MPRODUCTS



$$|\text{SLOPE}| = \left|\frac{\Delta Y}{\Delta X}\right| = \;= \text{MRTS}$$

- ASSUME f's ARE LINEAR

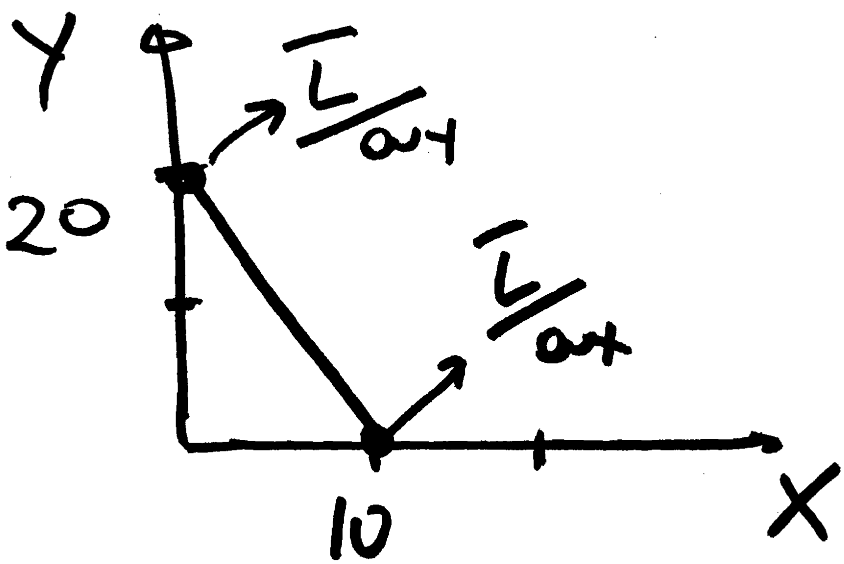
① $X = \frac{1}{10} \cdot L_X$

$\bar{L} = 100$

② $Y = \frac{1}{5} \cdot L_Y$

FEASIBILITY:

③ $100 = L_X + L_Y$



IF $Y=0$

$\Rightarrow X = 10$

IF $X = 0$

$\Rightarrow Y = 20$

MATH: ① $\Rightarrow L_X = 10 \cdot X$

② $\Rightarrow L_Y = 5 \cdot Y$

$\boxed{100 = 10X + 5 \cdot Y}$ PPF Eq.

IN THIS CASE:

$$MPL_X = 1/10 \quad , \quad a_X = 10$$

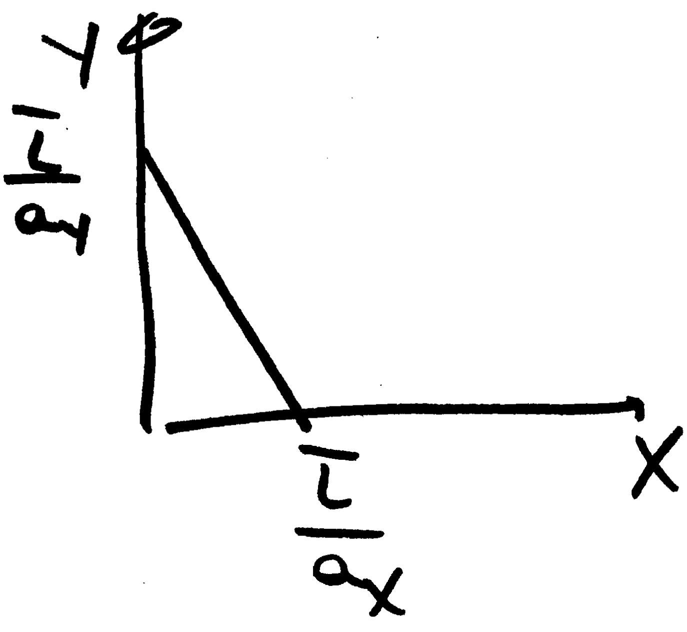
$$MPL_Y = 1/5 \quad , \quad a_Y = 5$$

IF NO X IS PRODUCED:

$$\overline{Y} = \frac{\overline{L}}{a_Y} = \frac{100}{5} = 20$$

IF NO Y IS PRODUCED:

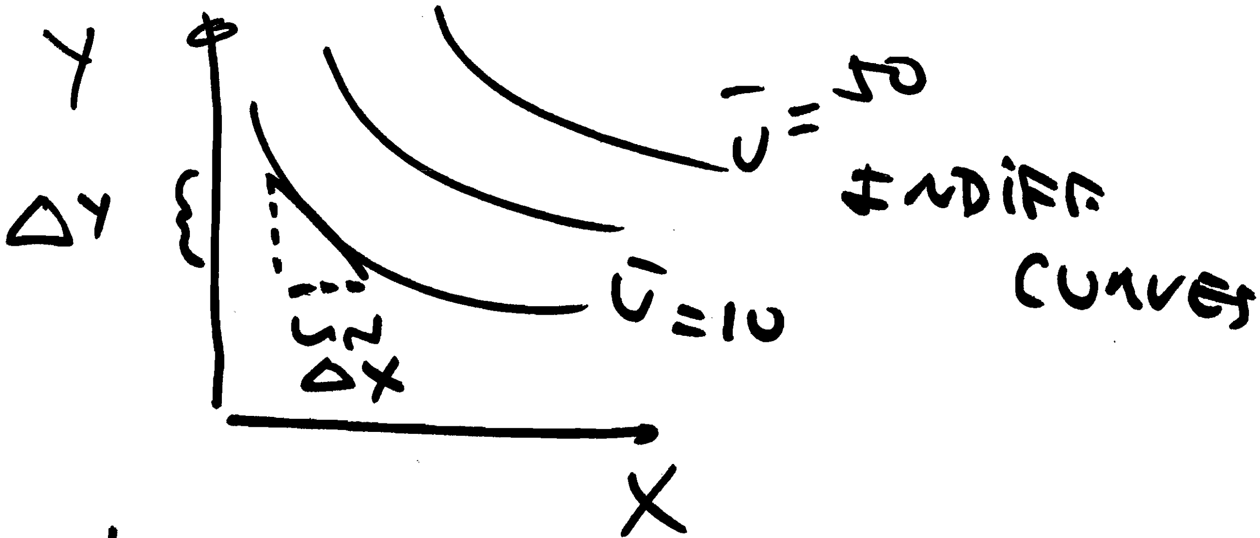
$$\overline{X} = \frac{\overline{L}}{a_X} = \frac{100}{10} = 10$$



$$\left|\begin{matrix}\text{SLOPE}\\ \text{PPF}\end{matrix}\right| = \frac{\frac{\overline{L}}{a_Y}}{\frac{\overline{L}}{a_X}}$$

$$= \frac{a_X}{a_Y} = \frac{10}{5} = \boxed{2}$$

PREFERENCES



$$\left|\frac{\Delta Y}{\Delta X}\right| = \left|\text{SLOPE OF IC}\right| = \text{MRS}$$

DID 9-11

- B.C.
- ISOVALUE
- CLOSE ECONOMY C.E
- SMALL OPEN ECON C.E

NEXT

GAINS FROM TRADE