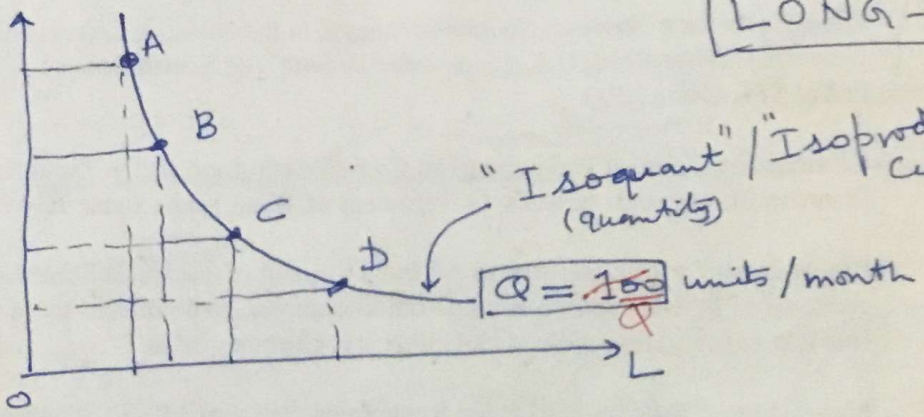
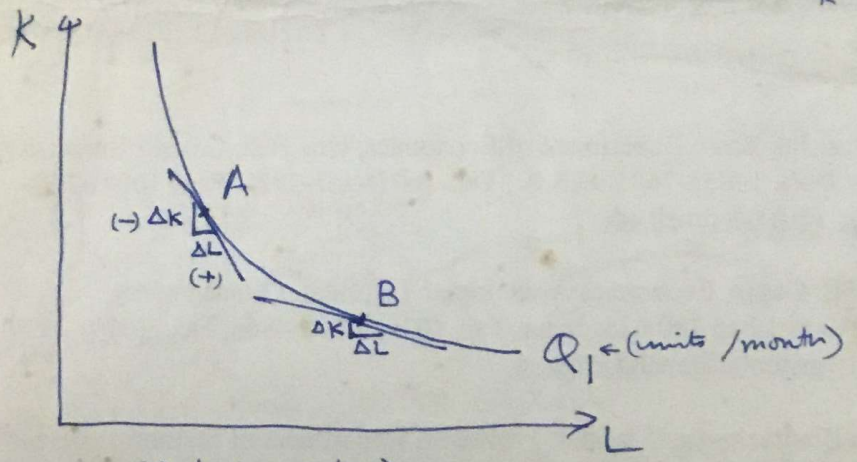
- A firm / business always wishes to utilize various factors of production (inputs, such as labour, capital, land, raw materials etc.) in a manner so as to produce ~~its~~ a given output at the "lowest / minimum" cost.

Producer's Equilibrium

Assume only two factors of production - Labour (L) and capital (K).

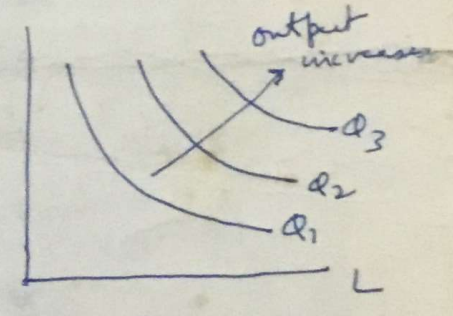
LONG-RUN





(Ratio is negative)

$\frac{(-)\ -\Delta K}{(+)\ -\Delta L}$ $(-)$ = Slope of Isoquant at A



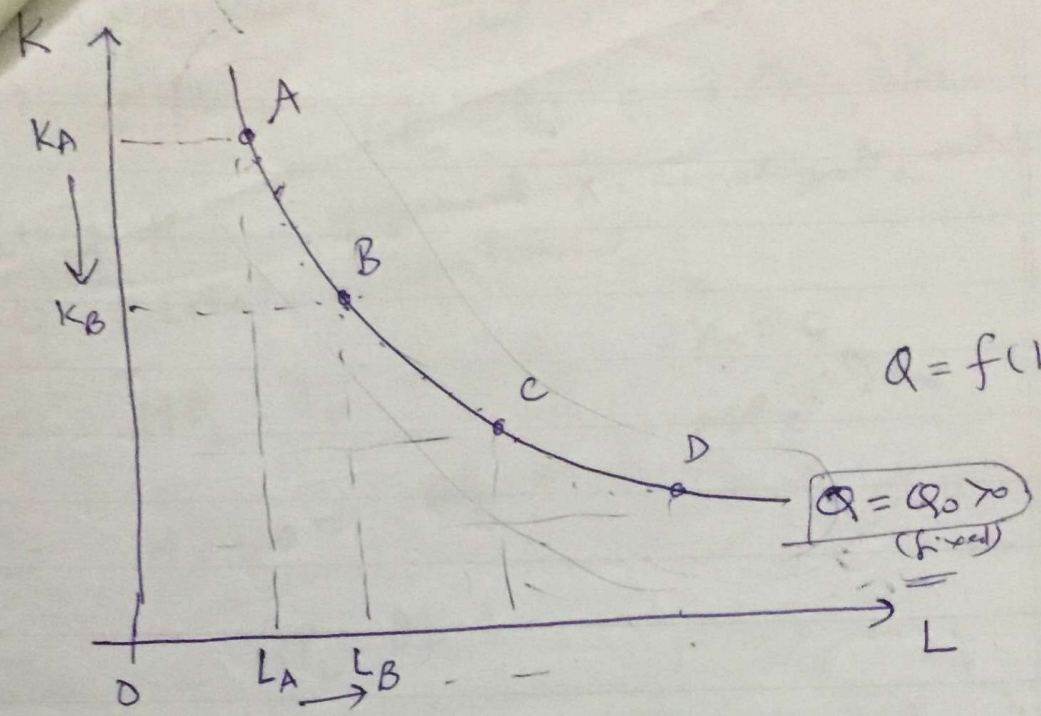
- Isoquants never intersect each other
- need not be parallel to each other. (depends on technology)

Definition: Marginal Rate of "Technical" Substitution (MRTS) refers to the rate at which a firm / business can substitute labour for capital on the margin, i.e. "small" amount of labour can be substituted for "small" amounts of capital ("small" = Marginal)

eg. $\Delta L = +1$ unit/month, $\Delta K = -2$ units/month, output remains the same

Then $MRTS = \frac{2}{1} = 2$ $\left(\text{Slope} = \frac{\Delta K}{\Delta L} = \frac{-2}{+1} = -2\right)$

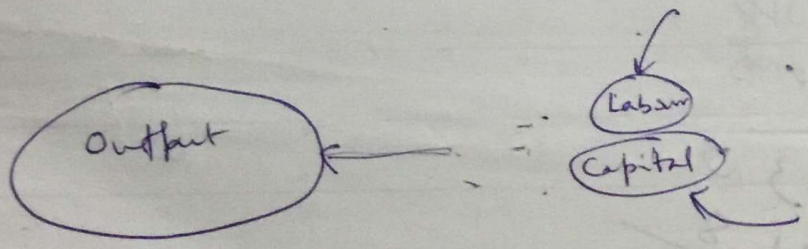
So, in general, MRTS = "positive value" of the slope of Isoquant at a given point.

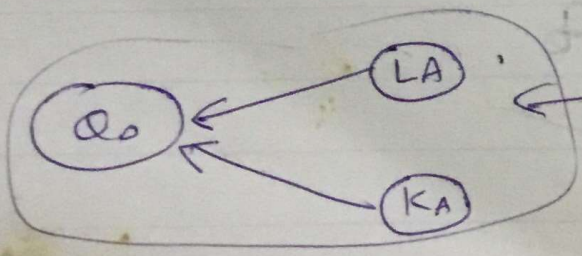


$Q = f(L, K)$

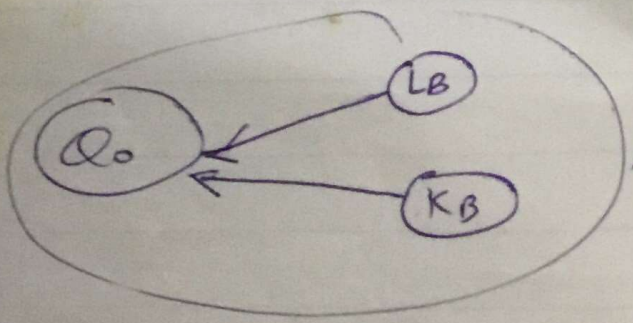
A: $Q_0 = f(L_A, K_A)$: $(L = L_A,\ K = K_A)$

$\Rightarrow Q = Q_0$





Method or Technique/Process of Production/ Producing a given level of output $= Q_0 > 0$.



Another Method / Technique/ Process of producing Q_0 units of output.

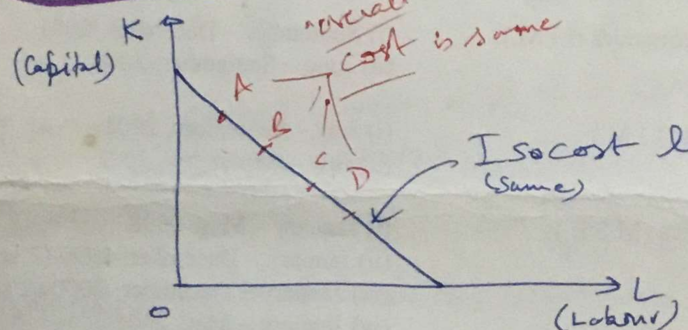
At point B, (moving down along the isoquant) capital changes by a smaller amount for given small increase in labour, compared to point A (slope is less at B than at A) (2)

∴ MRTS at B is less than MRTS at A.

∴ MRTS declines / diminishes as we move from left to right or down along a given isoquant / isoquant curve. This assumption is called "Diminishing Marginal rate of Technical Substitution" (DMRTS Assumption)

~~Recapitulate~~ Summarise : ① (Isoquant) / Isoproduct curve and its properties

② (Isocost line)



Cost of Labour
= (Price of labour) × (quantity of labour)
= $(P_L)\,L$

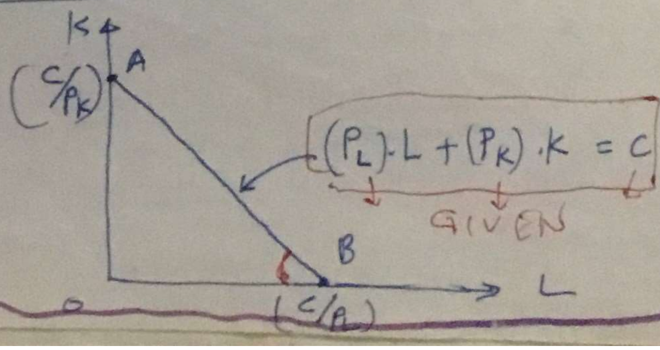
e.g. P_L = Rs 50 ~~Salary~~ (wage / salary per worker)
L = 100 workers

∴ Total wage Bill of the firm = (Rs 50) × (100)
= Rs. 5000
= Cost of Labour

Similarly, Cost of capital
= (Price of capital) × (quantity of capital)
= $(P_K)\cdot K$ (total)

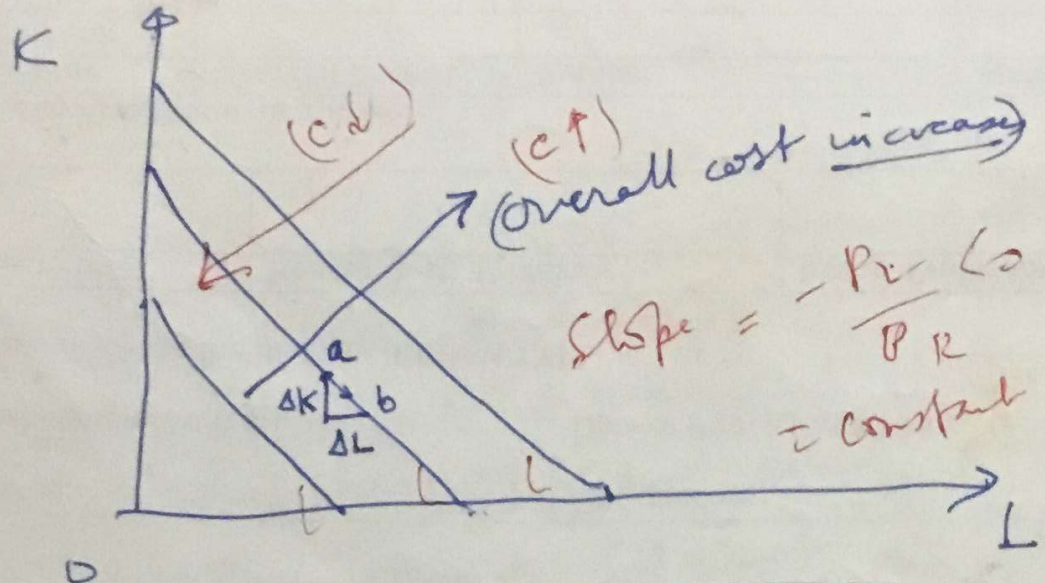
∴ "Overall cost" of the firm
= Cost of labour + Cost of capital
= $(P_L)\cdot L + (P_K)\cdot K$.

Now, along an isocost line (given, given), overall cost of the firm remains the same, i.e. $(P_L)\cdot L + (P_K)K$ = Constant = C (say)



Slope = $-\frac{P_L}{P_K}$ = $-\frac{(C/P_K)}{(C/P_L)} = -\frac{P_L}{P_K} < 0$ = constant

Several Isocost lines can be drawn



Slope $= -\frac{P_L}{P_K}$ (constant)

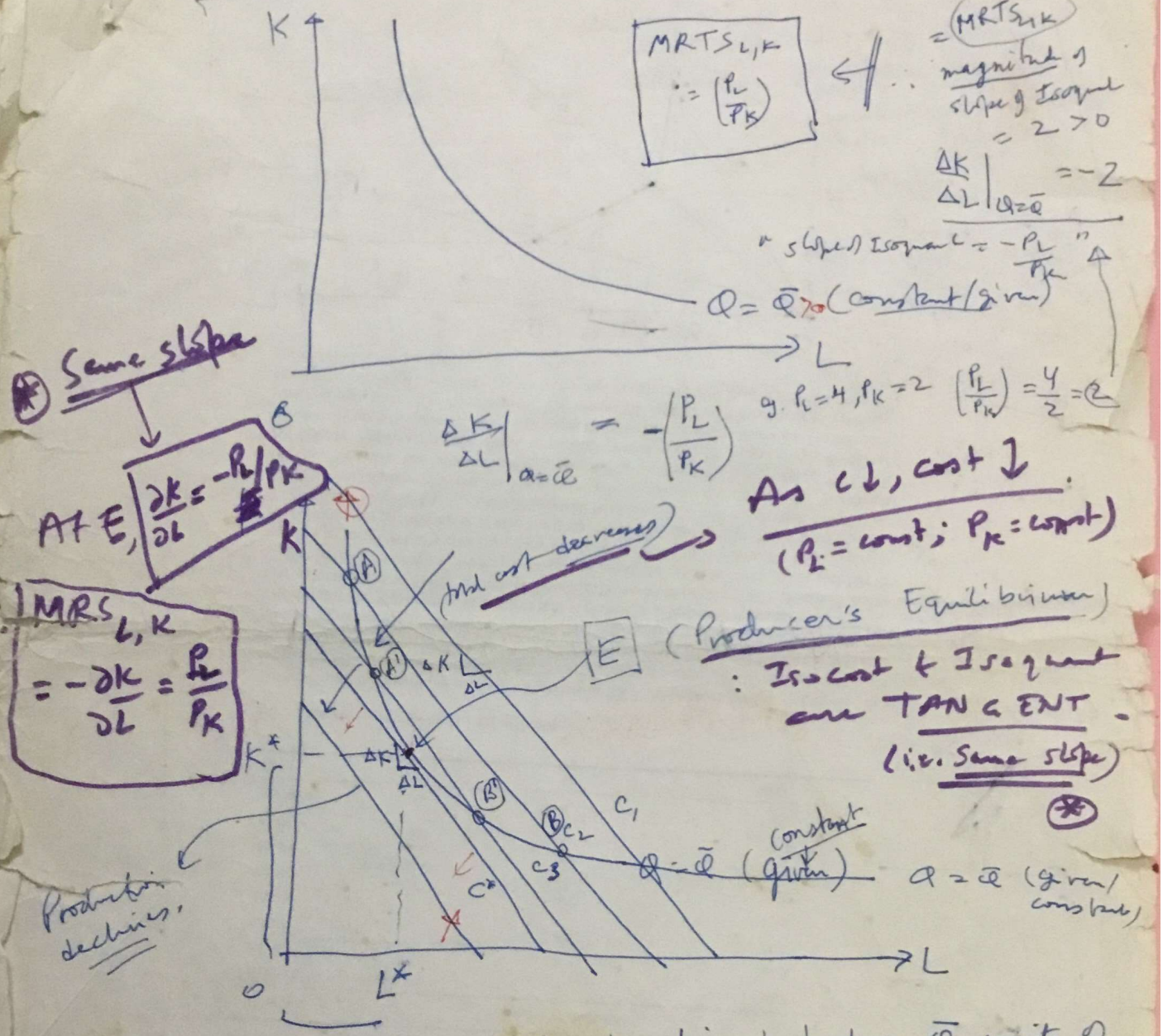
Properties

1. All isocost lines are straight lines
2. All Isocost lines are "parallel" to each other
3. Slope of any Isocost line $= \frac{\Delta K}{\Delta L} = -\frac{P_L}{P_K}$ (negatively sloped)

As we move from a to b, L increases by ΔL and K decreases by ΔK, but total cost remains the same.

Similarly: L increases by ΔL and hence, total cost increases by $P_L(\Delta L)$.
K decreases by ΔK and hence, " decreases by $P_K(\Delta K)$.

Firm's objective is to produce any given level of output ($\bar{Q}$) at the "lowest/minimum cost"



(L^*, K^*) will be employed by the firm to produce $\bar{Q}$ units of output at the lowest/minimum total cost.

Note: At point E, Isocost line (C^*) is "tangent" to the Isoquant / Isoproduct curve ($Q = \bar{Q}$). $\therefore$ slope of Isocost line C^* = slope of Isoquant $\therefore$ Magnitude of slope of Isocost line C^* = magnitude of slope of Isoquant

"$\frac{P_L}{P_K}$" "MRTS at E"

$\therefore$ MRTS at E = $\frac{P_L}{P_K}$