CHAP#3 Theory of Production & cost

Definitions of Production :-

(i) Production is Process of converting Raw materials into finished goods.

(ii) Production is, Transformation of inputs into Output.

(iii) Value addition

(iv) According to Prof Marshall, "Production is creation / addition of utility"!

(v) Any Economic Activity, including charitable Services.

Factors of Production

(Input, means, sources, Resources)

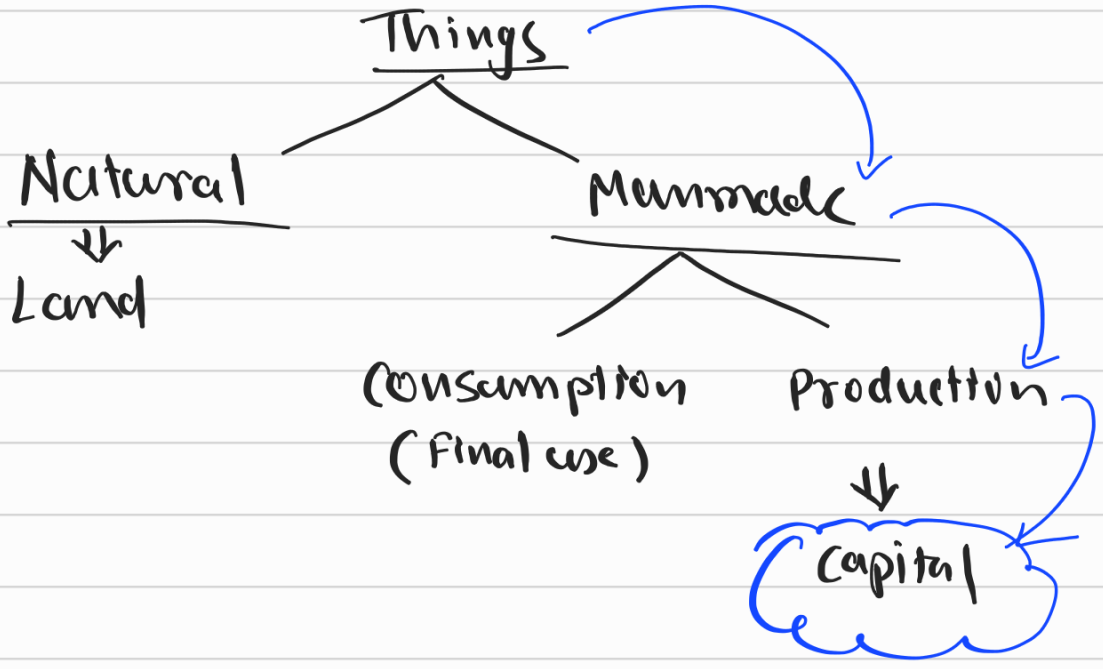
(i) Land :- All Natural resources

Reward :- Rent

(ii) Labour :- Any Exertion (effort, मेहनत) of mind or body for rewards.

- All Human efforts
- reward = wages.

(iii) Capital :-



Capital	Wealth
X	Gold, Jewel, Diamonds
X	Cars, gadget, plane, bldg. (Res.)
✓	factories, machines, stock

- Capital is man made factor used for further production
- it is productive wealth

(iv) Entrepreneur :- (Businessman)

- Organiser [Arranging + managing]
- Risk & uncertainty bearer [F.H. Knight]
- innovator [Joseph Schumpeter]

Production function

$Q = f(L, K)$
or
$Q = f(a, b, c, d \ldots n)$

(i) Production function is a functional relationship between inputs & output.

(ii) It is quantity of input needed to get given level of output.

(iii) It is Maximum resulting output, from given level of input.

(iv) It is technical Relationship between physical input & physical output.

Features of Production Function

(i) Quantitative concept = Not a Qualitative

concept.

(ii) Physical concept :- Not a monetary concept.

(iii) Flow concept :-

Flow — stock

measured for

Period of time — Point of time

(iv) Two Attributes of Inputs (Labour & capital)

(a) Complementary to each other
(b) Substitutes of each other.

e.g output = shirt

Inputs	1	100	change	Types	1000	10000
Cloth (mtr)	3	300	✓	V1	✓	✓
Labour (Hrs)	2	200	✓	V1	✓	✓
Electri (units)	5	500	✓	V1	✓	✓
Machine	1	1	×	F1	10✓	✓
Table	1	1	×	F1	10✓	✓
Land (sqft)	500	500	×	F1	500 ×	✓
	SHORT RUN.					LONG RUN

(a) Fixed input :- input whose quantity doesnot change with output leve.

(b) Variable input :- input whose quantity

changes along with output quantity.

(vi) Two Types of Production Functions :-

(a) Short Run :-

- which includes some fixed & some variable inputs
- Production increases due to increase in variable inputs only
- It exists as long as at least one input is fixed.

(b) Long Run :-

- when all inputs are variable.
- Production increases due to increase in fixed as well as variable inputs (All inputs)

LAW OF VARIABLE PROPORTION

- Related to short Run
- AKA Law of Diminishing Returns & Law of Returns to factor.
- Assumptions :-

(i) Technology is constant / same
(ii) There are some fixed & some variable inputs.
(iii) Labour is only variable input.
(iv) ALL Labours are Homogeneous.

— **Statement** :- "other things being constant, when variable input such as labour is increased one by one, initially output increases at increasing rate (TP↑, MP↑), after some time output increases at diminishing rate (TP↑, MP↓) & finally output falls (TP↓, MP -ve).

— **Simple words** :- Under certain conditions MP decreases, eventually.

Stages	QFI	QV (lab)	TP	AP	MP	Law of
I st = ends AP=MP or AP is Highest	4	1	20	20	20	Increasing Return (MP↑) (upto 3rd unit)
	4	2	50	25	30	
	4	3	90	30	40	
	4	4	120	30	30	Dimishing
II nd - ends when MP=0 or TP is Highest	4	5	140	28	20	Returns (MP↓) (From 4th - 7th unit)
	4	6	150	25	10	
	4	7	150	21.4	0	
III rd	4	8	148	18.5	-2	Negative Returns (MP -ve)
—	4	9	143	15.8	-5	

Explanation :-

— **During 1st stage**

- TP↑, initially at ↑ rate then at ↓ rate
- AP↑
- MP↑&↓

- During II[nd] stage
  - TP ↑ at ↓ rate
  - AP ↓ & MP ↓

- During III[rd] stage
  - TP ↓
  - AP ↓ but remain +ve
  - MP becomes -ve

Reasons :-

- Law of Increasing Return

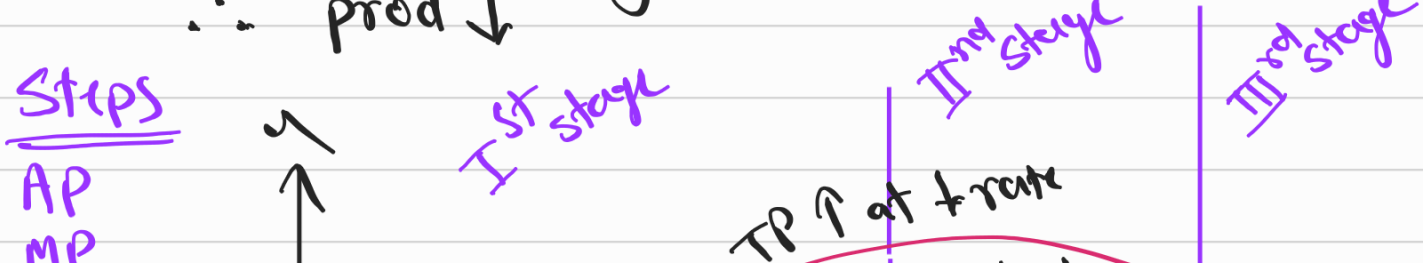
- FI are efficient & indivisible
- VI are proportionately less
- FI are underutilised.
- ∴ with ↑ in VI, FI are better exploited
  Hence prodⁿ ↑ at ↑ rate

Law of Diminishing Return

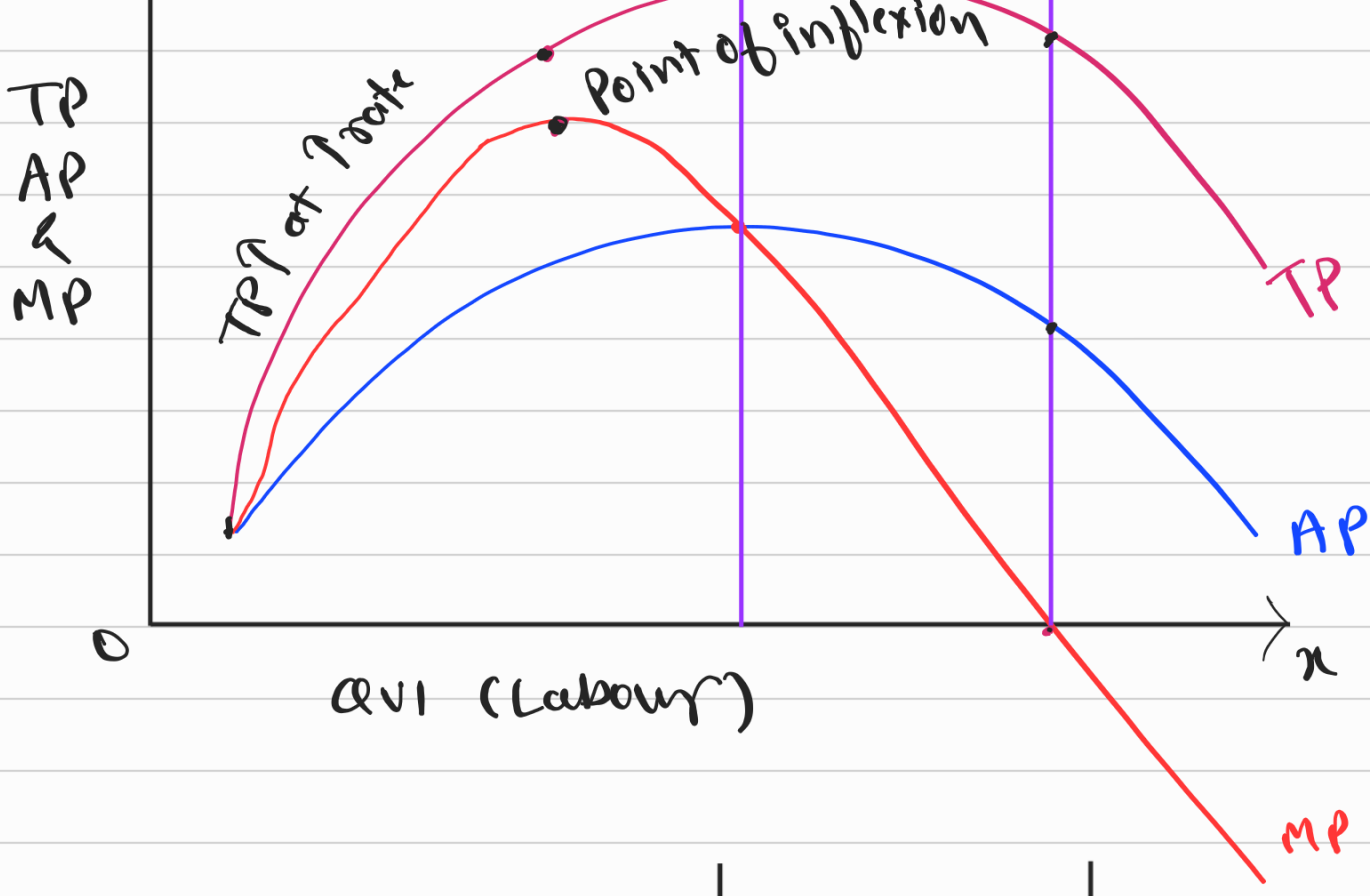
- Efficiency of FI is declining.
- Labour is not perfect substitute of Machine
- ∴ prod ↑ at ↓ rate

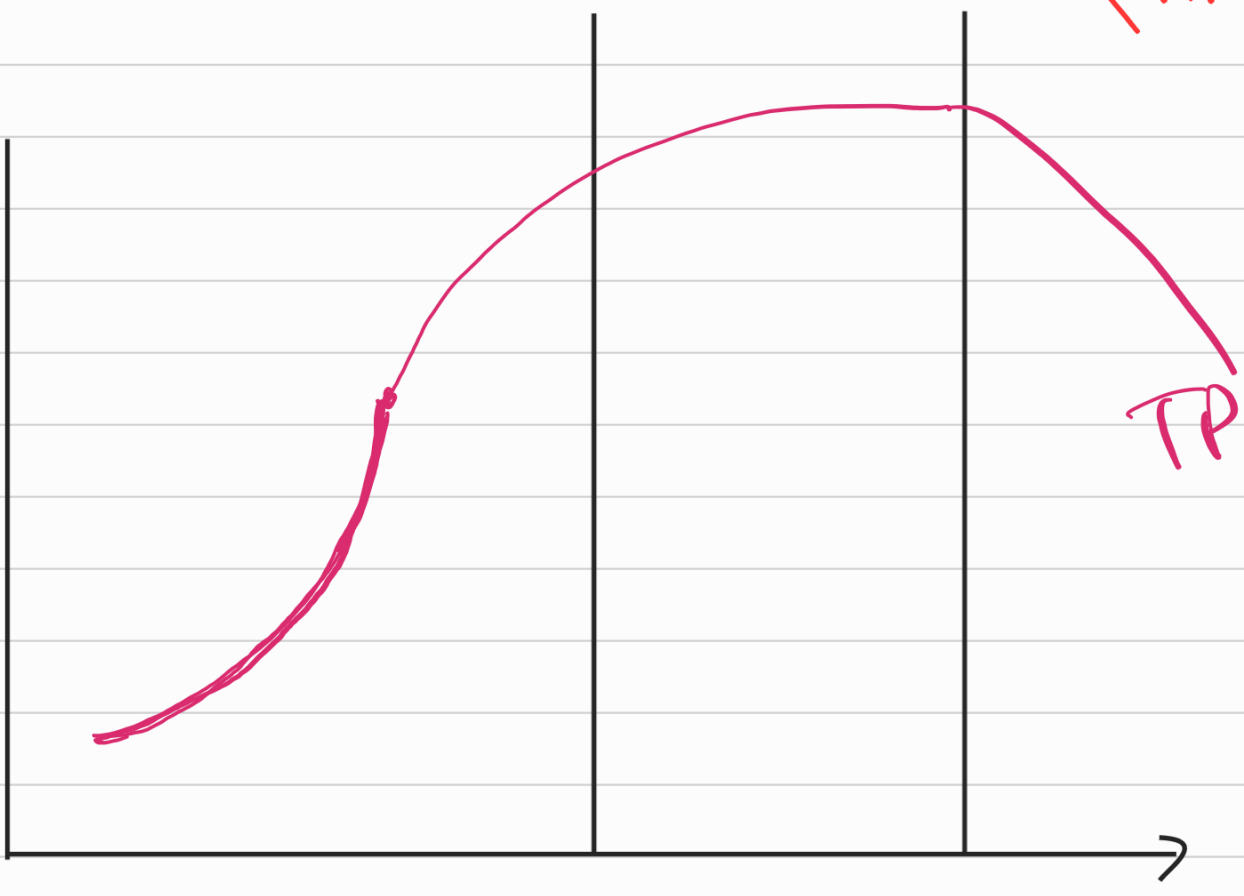
Law of Negative Return

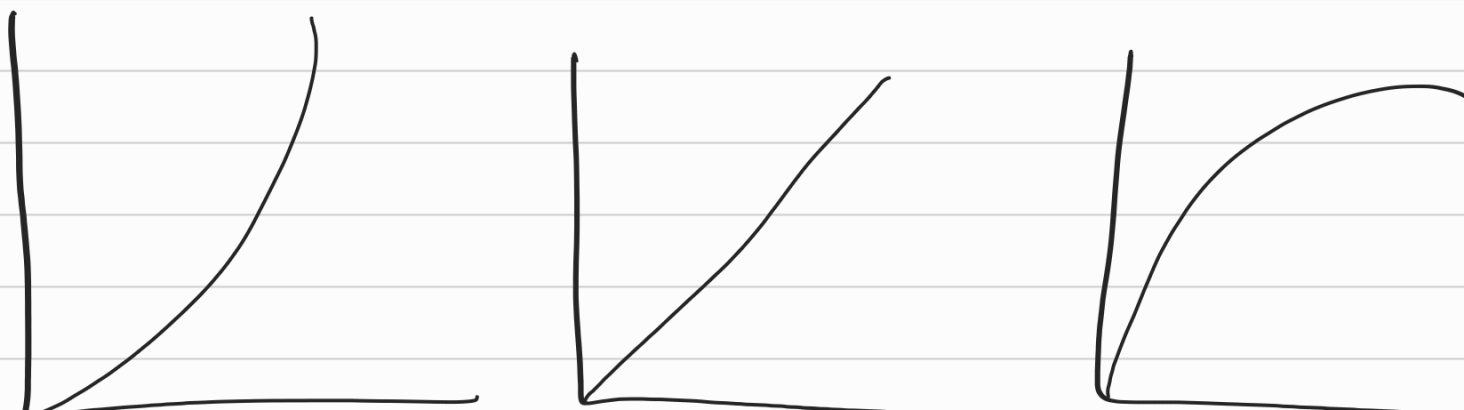
- Efficiency of FI is very Low
- Overcrowdening of VI
  ∴ prod ↓



Stages TP







↑ at ↑ rate

	MP
10	10
22	12
36	14

↑ at ↓ rate

	MP
10	10
20	10
30	10
40	10

↑ at ↓ rate

Explanation :-

When TP ↑, (upto 11nd stage)

- AP & MP ↑ & ↓
- MP is +ive

when TP is Highest

- MP is zero
- AP ↓, but +ve

when TP ↓

- MP is Negative
- AP ↓ but +ve

At "point of inflexion"

AKA "inevitable point"

- MP is Highest
- TP is ↑
- AP is ↑

Before inflexion point

- MP ↑, AP ↑, TP ↑ at ↑ rate.

when AP ↑

- MP is above AP
- MP ↑ & ↓
- MP > AP

when AP is Highest

- AP = MP

when AP ↓

- MP is below AP
- AP > MP
- MP is also ↓
- MP is +ve, 0 & -ve

Economies & Diseconomies of Scale

2001 → 2023

1000 units → 100000 units

Large Scale / Long Run

Advantages → Economies of Scale

- Internal
  - Due to growth of Firm → exclusive
- External
  - Due to growth of industry → common

Dis-advantages → Dis-economies of Scale

- internal
  - Due to growth of Firm → Exclusive
- External
  - Due to growth of industry → common

(I) Internal Economies :- with ↑ in qty = cost per unit ↓

(i) Labour economies (due to specialisation & Division of work)

(ii) Purchase side economies

(iii) Sales side economies

(iv) Managerial economies

(v) Technical economies

(vi) Financial economies

(vii) Risk-bearing economies through diversification.

(II) Internal Diseconomies

- Beyond efficient level (when AC is minimum) with ↑ in quantity, cost per unit ↑ it's called 'internal' Dis-economies.

- All internal economies turn into diseconomies.

(III) External economics :-
common advantages to entire industry.

(i) Technical innovations
(ii) cheap materials & equipments
(iii) Availability of skilled workers
(iv) Growth of ancilliary units (Supporting industries)
(v) Economies of information
(vi) Better transport, storages & marketing facilities

(IV) External Dis-economies

(i) Shortage of Raw materials
(ii) ↑ in price of Raw materials
(iii) Natural calamities

LAW OF RETURNS TO SCALE

- Related to Long Run

- " Other things being constant, when All inputs are increased in same proportion

initially output increases at higher proportion then output increases at equal proportion & finally output increases at lower proportion.

$I\uparrow$ (10%) $<$ $Q\uparrow$ Increasing Returns to scale (IRS)

$I\uparrow$ (10%) $=$ $Q\uparrow$ constant returns to scale (CRS)

$I\uparrow$ (10%) $>$ $Q\uparrow$ Diminishing Return to scale (DRS)

Reasons

IRS = Economies ($\Delta Q > \Delta I$)

CRS = eco = Diseco ($\Delta Q = \Delta I$)

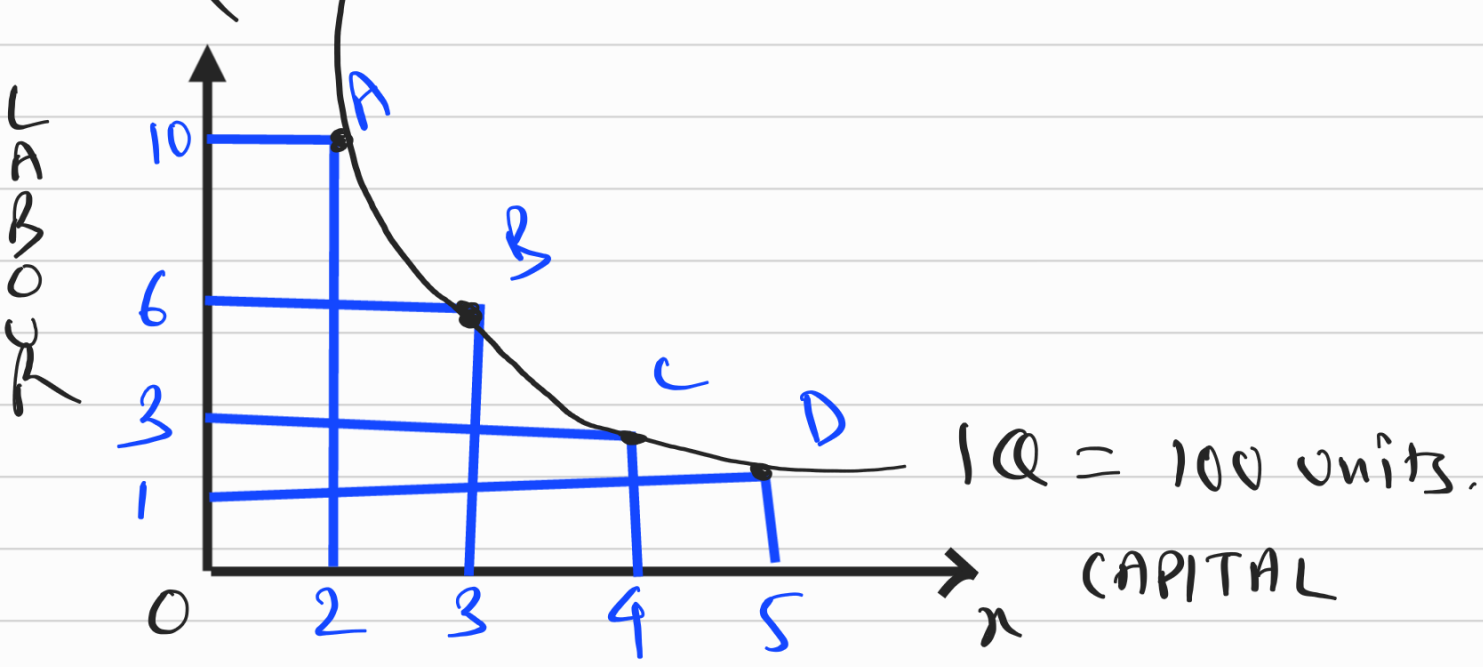
DRS = Diseconomies ($\Delta Q < \Delta I$)

Iso-Quant Curve

Same qty Production Curve.

IQ refers to a Locus of different combinations of 2 factors, which gives equal level of production.

Set	Labour	capital	Output
A	10	2	100 units
B	6	3	100 units
C	3	4	100 units
D	1	5	100 units

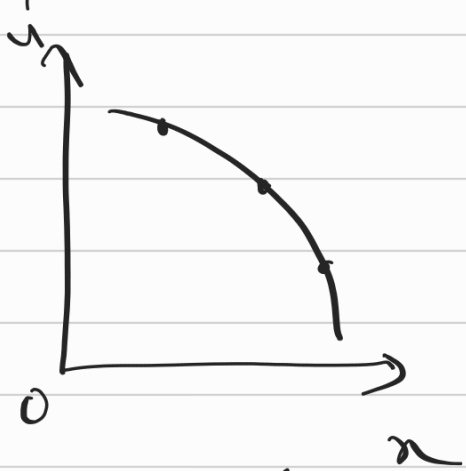


Properties of iso-Quants

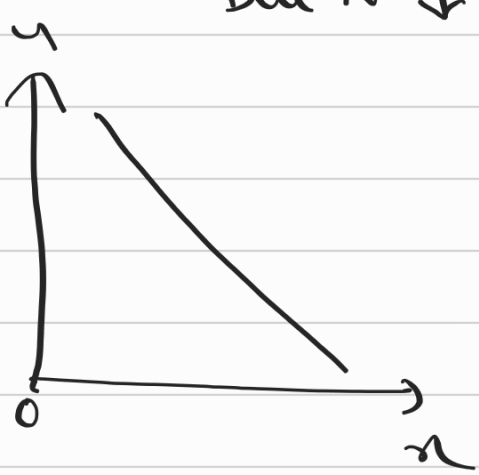
(i) IQ is always **Downward** sloping

(ii) IQ is always **convex** to origin

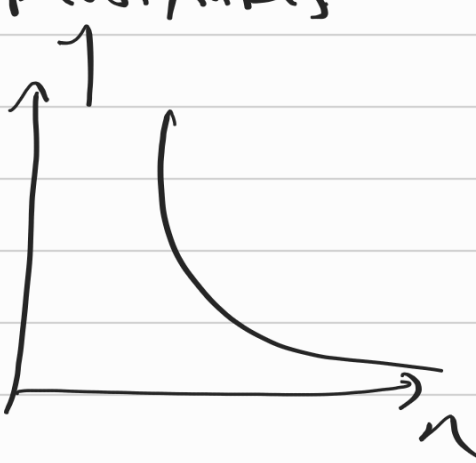
Due to ↓ opp cost/MRTS



Concave / Bowed out / Curvature



Straight line / Linear



convex / Rectangular Hyperbola.

Opportunity cost / Marginal Rate of Technical Substitution (MRTS)

↓ Increasing

↓ constant

↓ Decreasing

Set	Lab	Cap	Opp. cost	MRTS
A	10	2	—	—
B	6 ↓	3 ↑	4L	4L : 1K = 4 : 1 = 4/1 = 4
C	3 ↓	4 ↑	3L	3L : 1K = 3 : 1 = 3/1 = 3
D	1 ↓	5 ↑	2L ↓	2L : 1K = 2 : 1 = 2/1 = 2 ↓

If 2 factors are perfect

Substitutes

⇓

Straight line IQ

⇓

constant MRTS / opp. cost

complementary

⇓

"L" shaped IQ

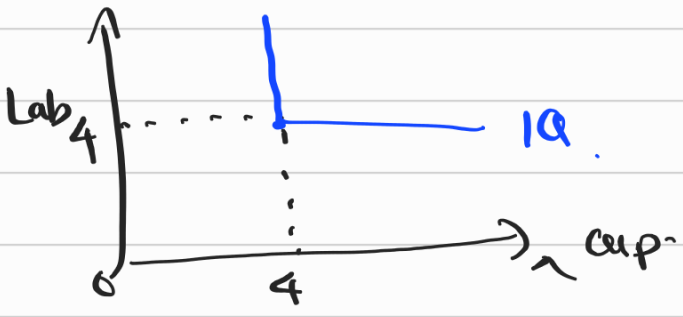
⇓

Same production is not possible by any other combination of inputs.

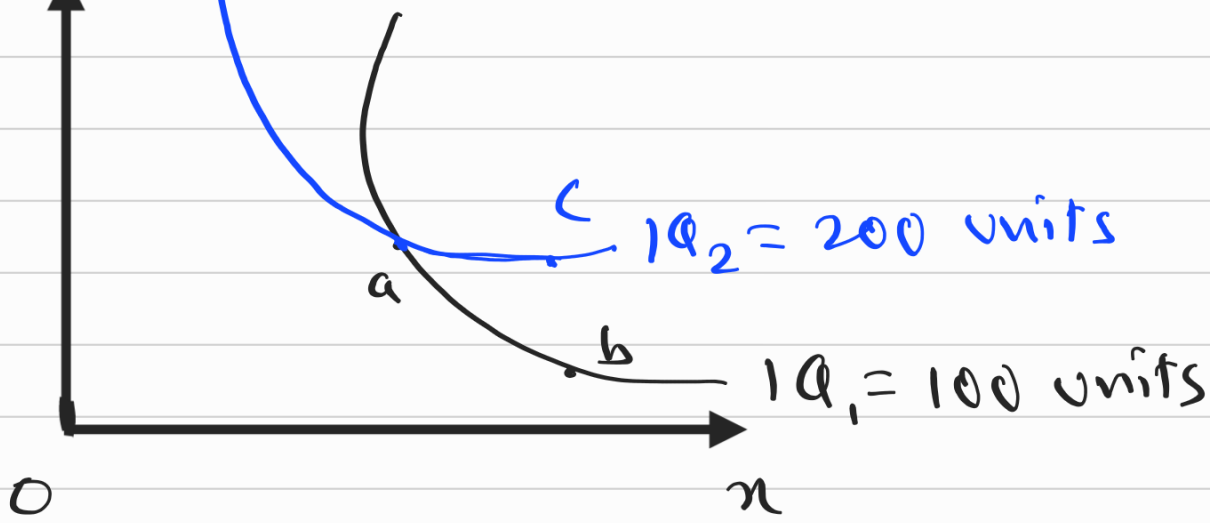
e.g $4L + 4K = 100$ units

$10L + 10K \neq 100$ units

$2L + 2K \neq 100$ units.

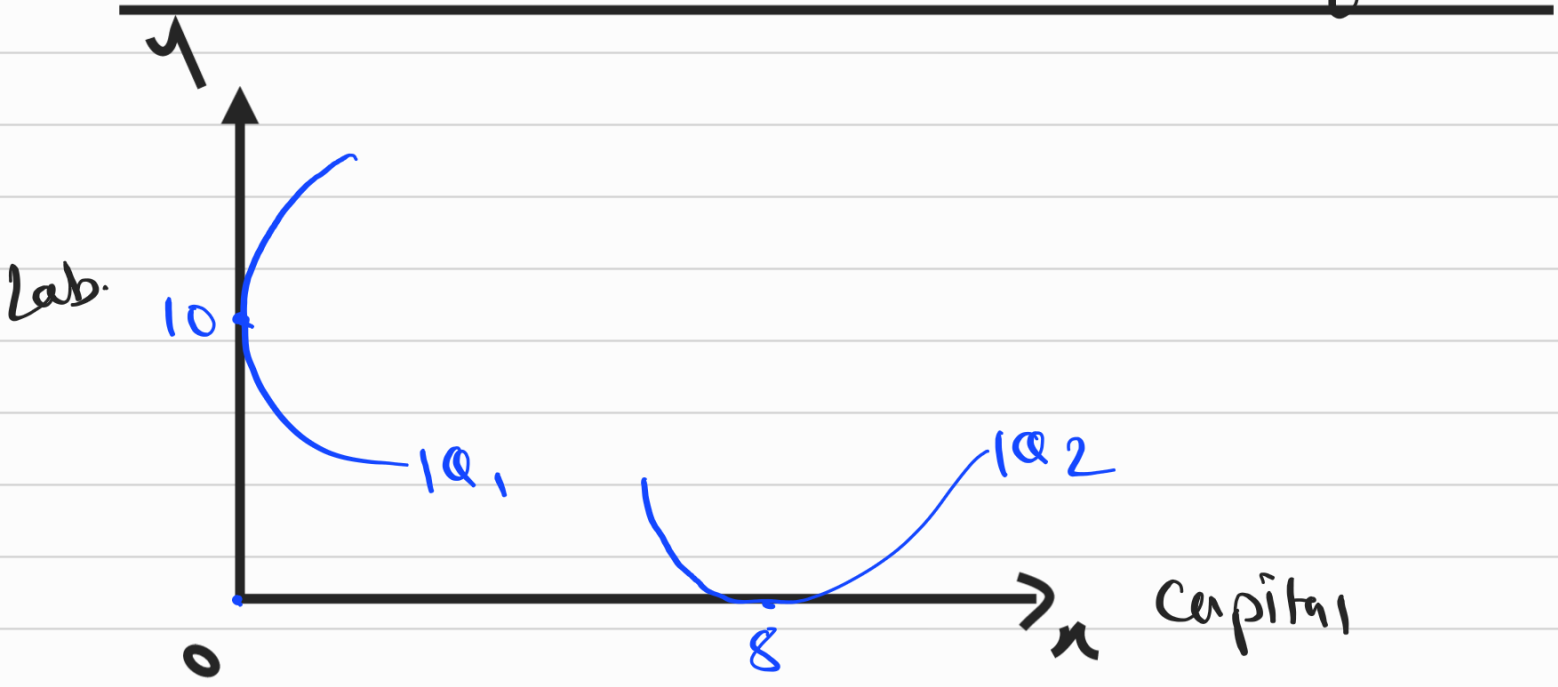


(iii) IQ's can never intersect each other



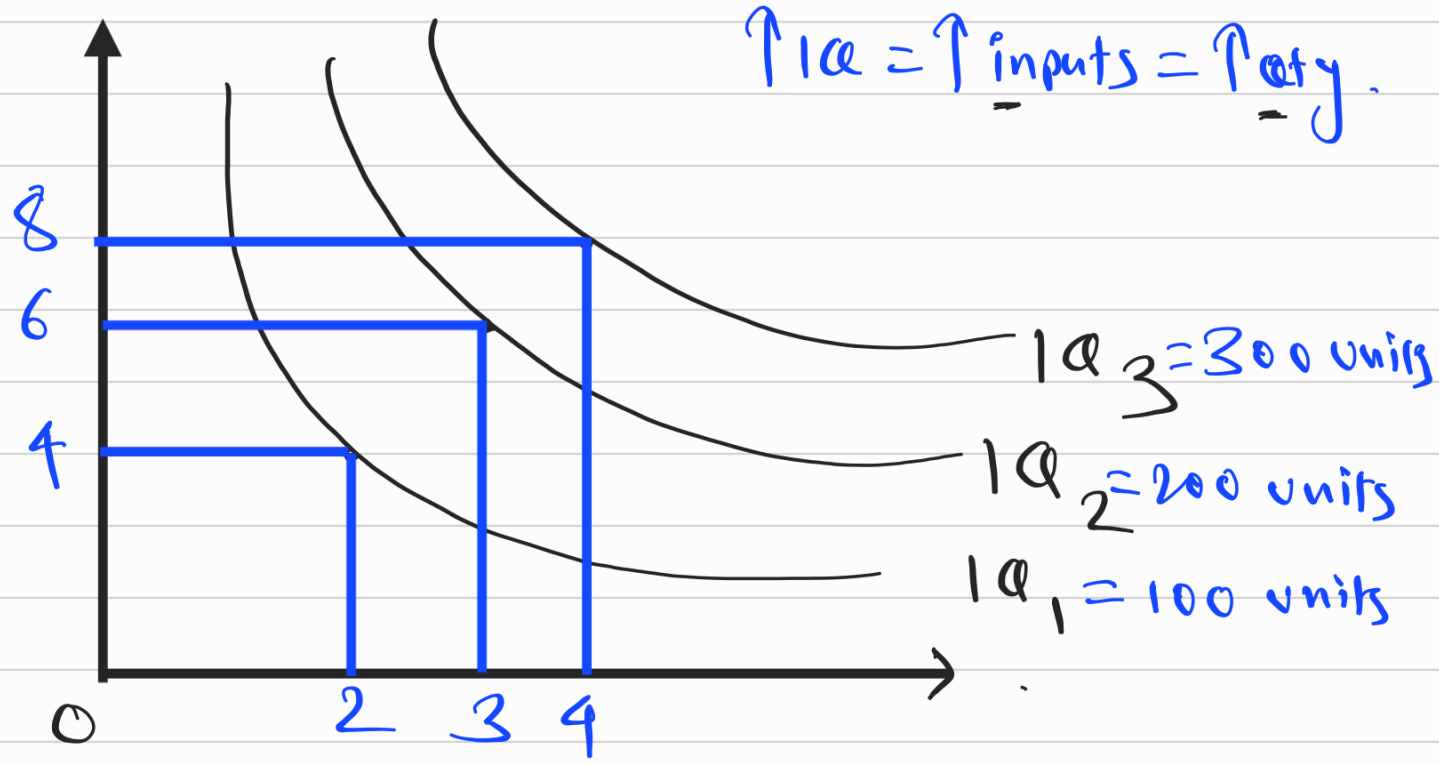
Since a=b & a=C then b=C
but here = b= 100 units C = 200 units
∴ this diagram is not possible

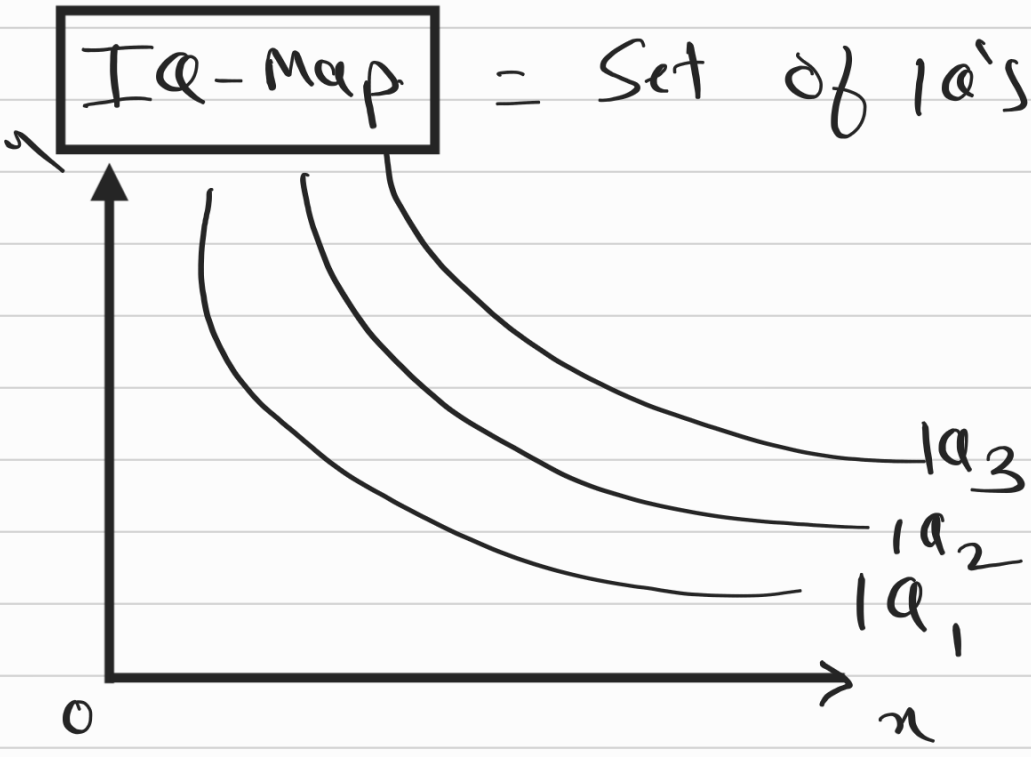
(iv) IQ's can never touch either of Axes.



IQ_1 = 10 Lab + 0 cap
IQ_2 = 0 Lab + 8 cap
} prod^n is not possible

(v) Higher the IQ, represents higher level of production





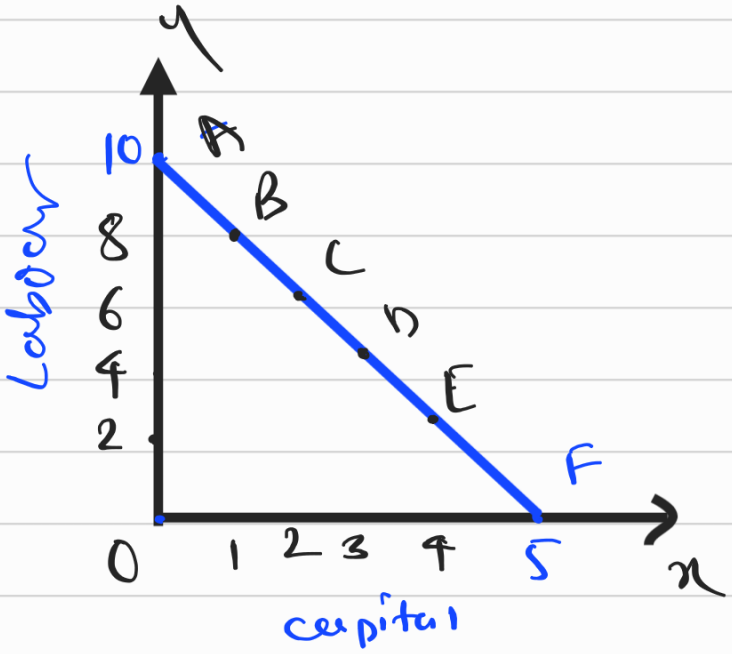
Budget-line = It refers to a locus of different combinations of 2 factors which can be bought with available resources.

- It shows available resources of producers.
- AKA iso-cost line & price-line.

e.g Available resources = ₹100/-
Price of Labour = ₹10 each

Capital = ₹ 20 each

Set	Lab	Cap.
A	10	0
B	8	1
C	6	2
D	4	3
E	2	4
F	0	5



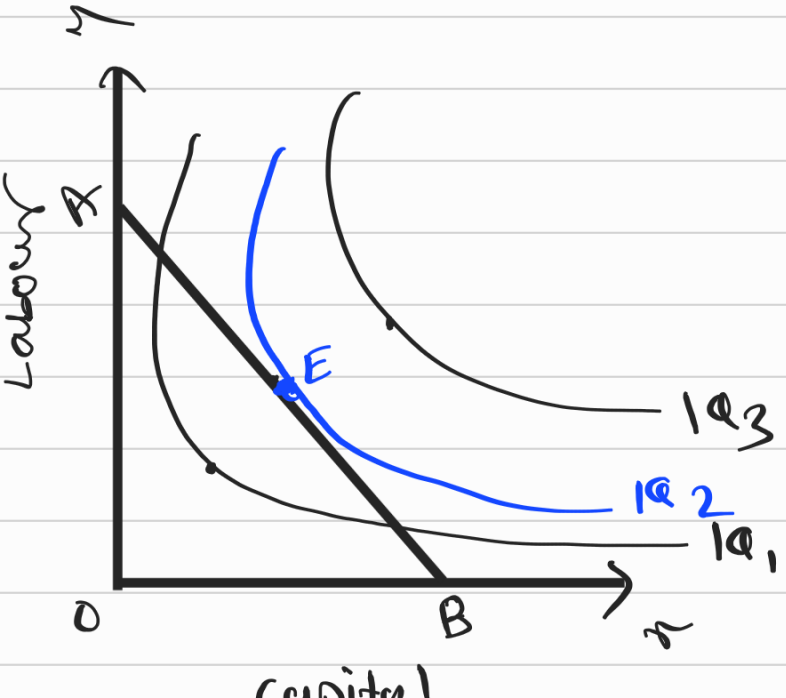
Producer's Equilibrium point

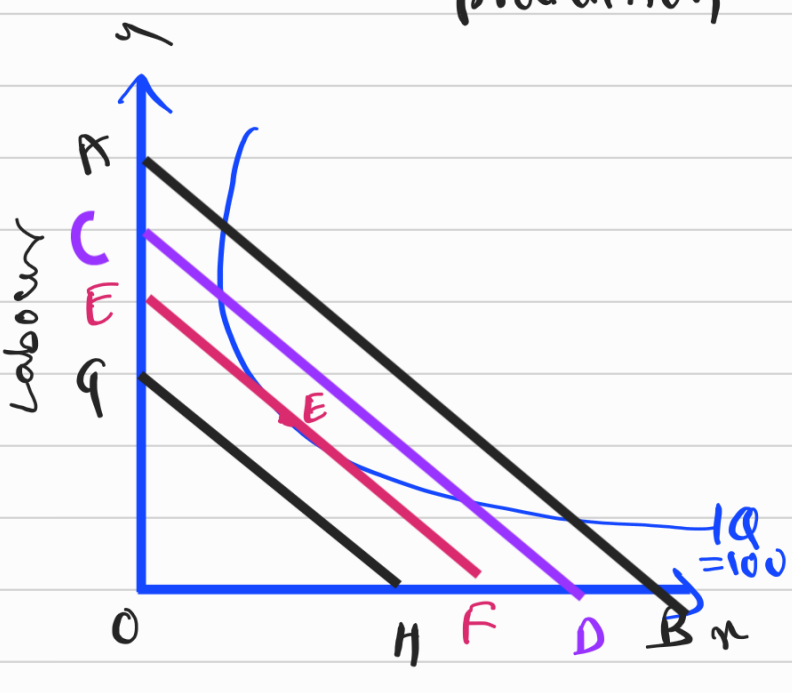
- It is achieved at a point where IQ is tangent to budget-line.
-

Two meanings

Maximum production with available resources

Least cost for given level of production





capital

Theory of cost

Types of cost :-

① Real cost :- cost in terms of other than money.

② Money cost :-
- AKA outlay cost
- cost in terms of money.

③ Traceable cost :- AKA Direct cost
- can be easily traced
- e.g factory exp. [Trading A/c - Dr side]

④ Non-Traceable cost :- AKA Indirect cost.
- can not be traced easily.
- e.g office exp [P&L A/c - Dr side]

⑤ Historical cost :- cost of Acquisition of Asset (Purchase price)

⑥ Incremental cost :-
Additional cost incurred on repairs, maintainance etc

⑦ Replacement cost :- cost of replacing Asset

⑧ Sunk cost :- cost which is irrecoverable.

e.g Advertisement, specific equipment, some fixed cost like Rent etc.

(9) Fixed cost (TFC) :-
- which does not change with output qty.
- when unit = 0, TFC ≠ 0

(10) Variable cost (TVC) :-
- which changes along with output qty.
- when unit = 0, TVC = 0

(11) Semi-variable cost
- combination of fixed & variable cost.
- e.g Salesman's Salary, post-paid mobile bill.

(12) Total cost (TC) = TFC + TVC

(13) Marginal cost = Additional expenses incurred for one additional unit.

(14) Prime cost = Factory exp.
= Direct material + Direct labours + Direct exp.

(15) Stair-case cost = which behaves like stair-case
AKA step-ladder cost

(16) Private cost = cost borne by parties internal

(17) External cost = cost borne by parties external.
e.g pollution etc.

(18) Social cost = Private cost + External cost

(19) Explicit cost = Money payment for Hiring/purchasing inputs
AKA Accounting cost.

(20) Implicit cost =
- Not a money payment
- Sacrificed income due to use of owned input into self owned business.
- AKA opportunity cost.

(21) Economic cost = Explicit cost + Implicit cost

Practical Sums

Record = Bus. expense
* = implicit cost
ignore = BS items

Q1. Mr A. started a business with an investment of ₹ 10,00,000/- out of which ₹ 700000 he borrowed from bank at 10% p.a & remaing Amount he arranged from his own saving [7% p.a]*. Total expenses of business is ₹ 600,000 & Total revenue is ₹ 1400000; he was earlier working in another firm for salary of ₹ 169000 p.a*.
Calculate economic cost & economic profit.

Soln

Total Revenue	—	1400,000
(-) Explicit cost		
• int on Bank loan (7L x 10%)		70000
Business expenses		600000 (670,000)

. Business Expenses 600,000 (600,000)

Accounting Profit (TR - Acc. cost) ₹30,000

(-) Implicit cost

. Sacrificed interest (3L x 7%) 21000

. Sacrificed Salary 169000 (190,000)

Economic Profit (TR - economic cost) 5,40,000

Economic cost = Explicit + implicit

860,000 = 670000 + 190,000

Q.2. Mr B, a Driver, getting Salary of ₹ 180,000 p.a, left the job to start his own business. He borrowed ₹ 900,000 from bank at 12% p.a & invested his own 400,000 (8% p.a). He charges ₹ 2785 from each passenger & spends ₹ 1750 each passenger on fuel, Dep^n, maint. etc. Total no. of passengers are 230. Calculate economic cost & economic profit

TR (2785 x 230) — 640550

(-) Exp cost

. int on BK loan (9L x 12%) 108000

. exp (1750 x 230) 402500 (510500)

Accounting profit 130050

(-) implicit cost

. Sacrificed Salary 180,000

. —11— int 4L x 8% 32,000 (212,000)

Eco. loss 81950

Eco cost = 510500 + 212000

= 722500

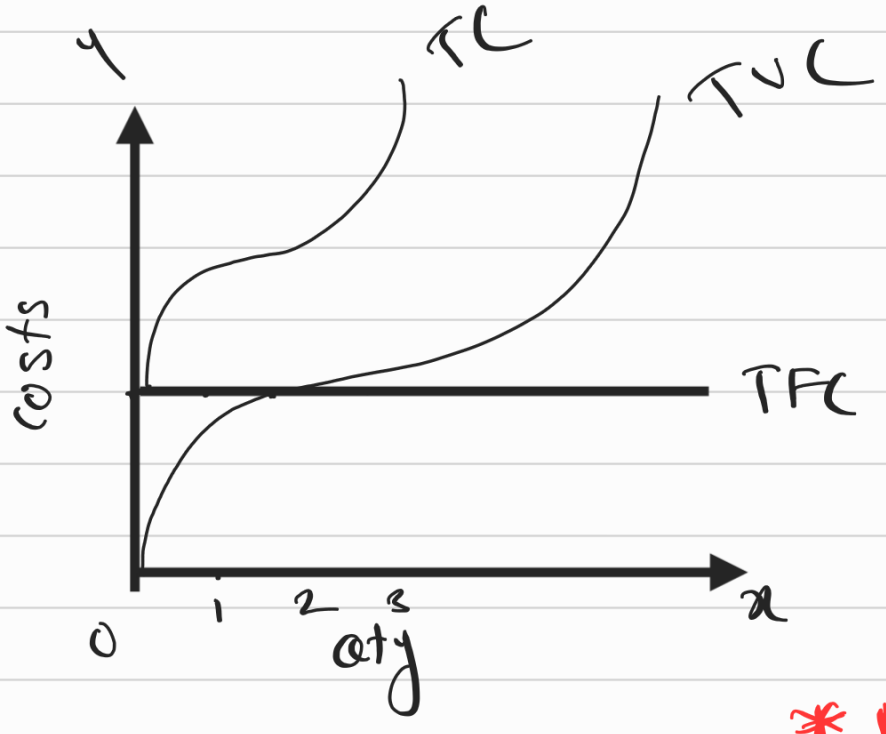
Q.3 Mr C, a Trainer, getting salary of ₹ 340,000 Pa, started his own Gym with an investment of ₹ 1500,000/- out of which ₹ 400,000 he borrowed from Father in law at 6% P.a, ₹ 300000 from mother-in-law at 12% P.a, ₹ 200000 from wife at 24% P.a & remaining amount from his own Saving (7% P.a). Total members = 320 Membership fees = ₹ 8000 P.a p.m. total exp = 500,000 Calculate economic cost & economic profit

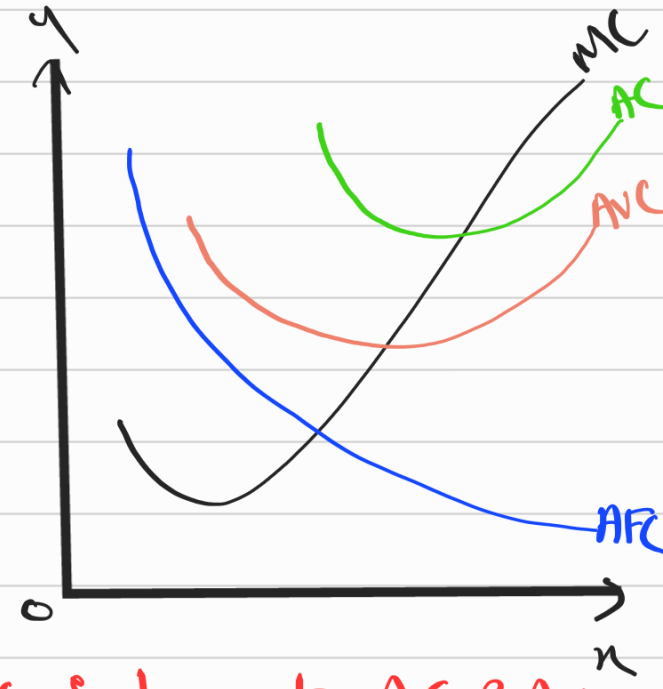
TR	320 X 8000	2560000
(-) Exp cost		
Int on FIL	4L X 6%	24000
MIL	3L X 12%	36000
wife	2L X 24%	48000
Exp	500,000	(608000)
A.P		1952000
(-) imp. cost		
Sam salary	340,000	
Int (8L X 7%)	42000	(382000)
Eco. profit		1570,000

Eco. cost 608000 + 382000 = 990,000

Behaviour of short Run costs

units	TFC	TVC	TC	MC	AFC	AVC	ATC/AC
0	100	0	100	—	—	—	—
1	100	20	120	20	100	20	120
2	100	30	130	10	50	15	65
3	100	60	160	30	33.33	20	53.33
4	100	120	220	60	25	30	55
5	100	210	310	90	20	42	62
6	100	350	450	140	16.67	58.3	75



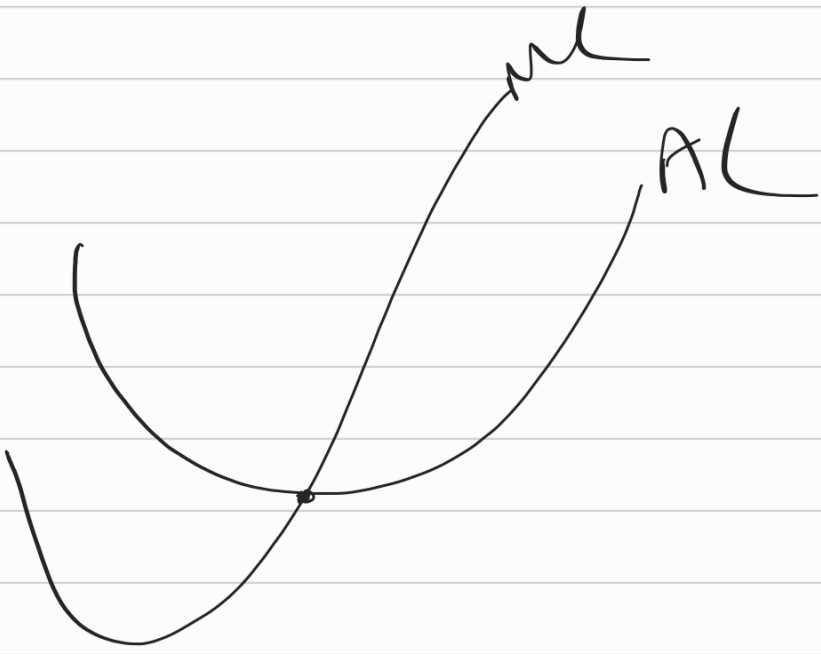


* MC intersects AC & AVC at their respective minima's (min. points)

As Output increases

↑	TC, TVC
↓	AFC
C	TFC

MC, AVC, AC



when AC is ↓

- MC = ↑ & ↓
- AC > MC
- AC is above MC

when AC is minimum

- MC = AC
- Most efficient point

when AC is ↑

MC is also ↑

MC > AC

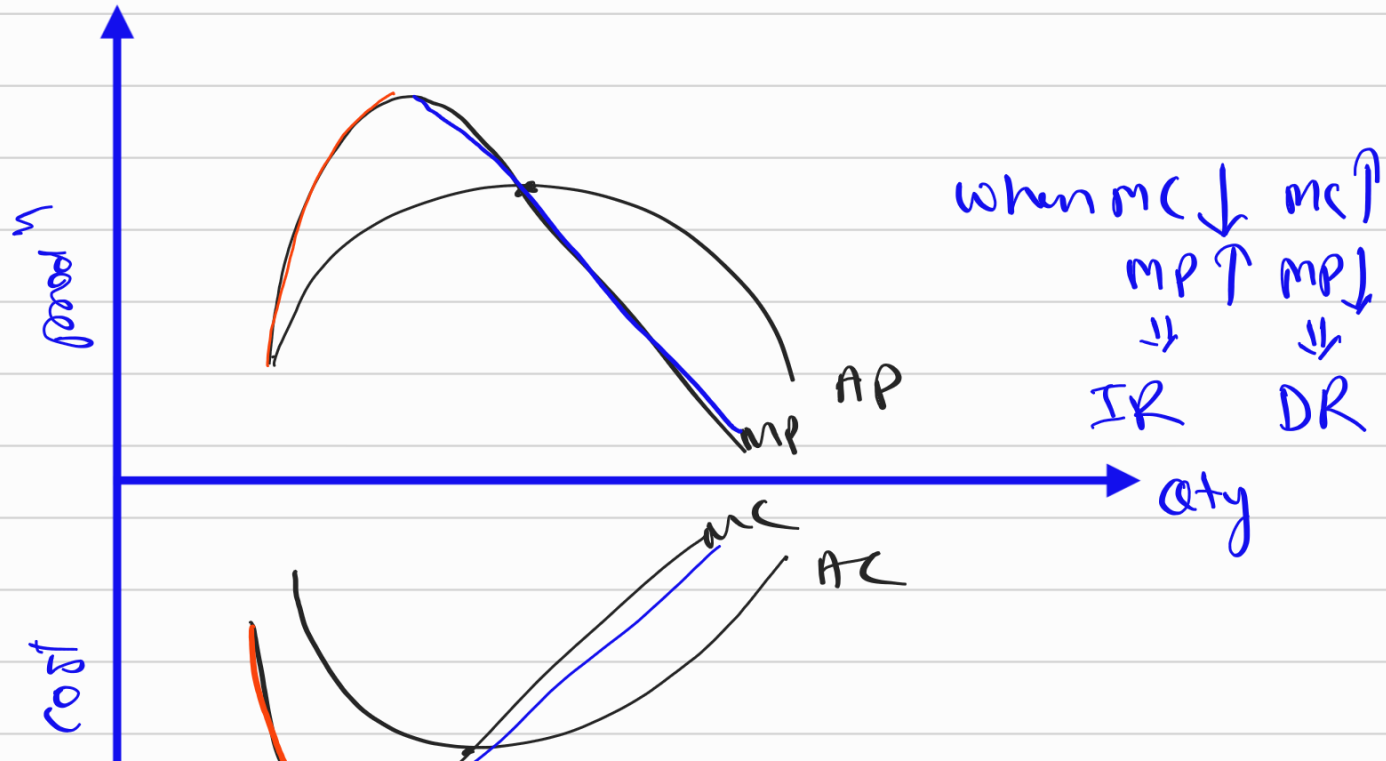
MC is above AC

Short Run

Production — cost

TP↑ = MP↑ = Increasing Ret. = TC↑ = MC↓

TP↑ = MP↓ = Diminishing Ret = TC↑ = MC↑



when MC↓ MC↑

MP↑ MP↓

⇓ ⇓

IR DR

Formulas

$TC = TFC + TVC$
$TFC = TC - TVC$
$TVC = TC - TFC$

$TC = AC \times Q$
$TFC = AFC \times Q$
$TVC = AVC \times Q$

$AC = AFC + AVC$
$AFC = AC - AVC$
$AVC = AC - AFC$

$AC = TC \div Q$
$AFC = TFC \div Q$
$AVC = TVC \div Q$

$MC = TC_n - TC_{n-1}$
$TVC_n - TVC_{n-1}$

Q	TC	MC
25	1000	–
26	1300	300

$MC = \frac{\Delta TC}{\Delta Q} = \frac{800}{8} = 100$
$= \Delta TVC / \Delta Q$

Q	TC	MC
30	4000	—
38	4800	100

Q	0	1	2	3	4
TC	50	70	80	120	200

① Format
② copy Q
③ start with

Q	0	1	2	3	4	5	6
TC	100	115	120	150	210	300	420

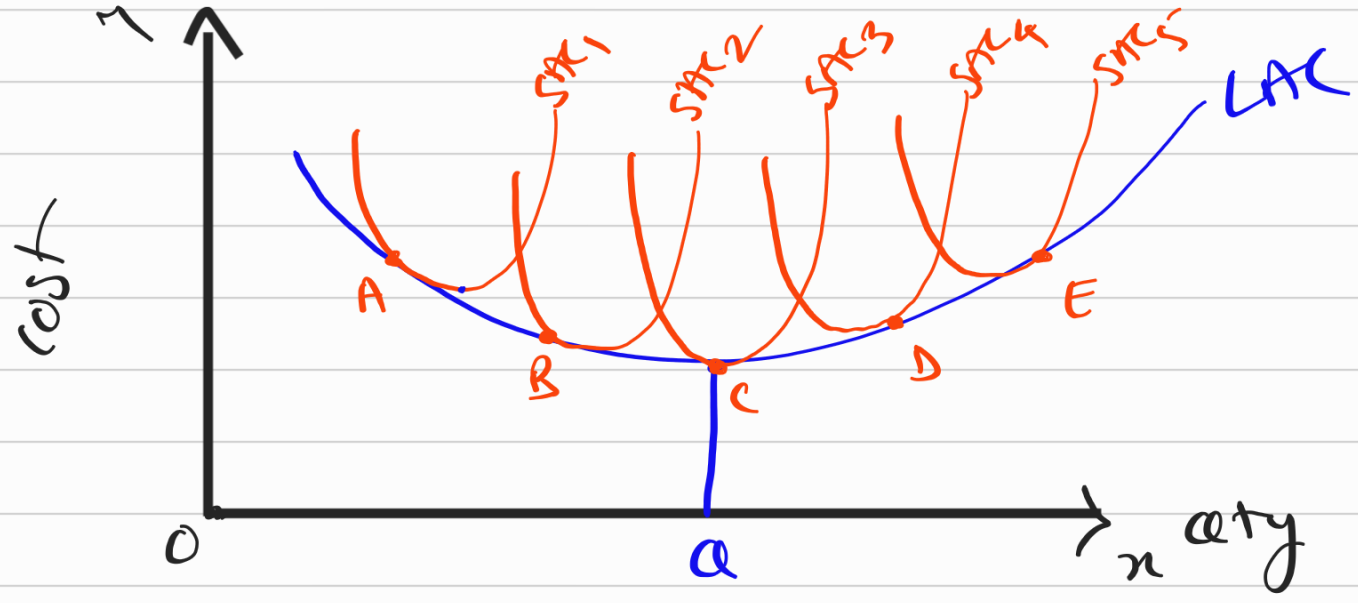
Q	1	2	3	4	5	6
MC	20	5	42	58	65	80
TFC	120					

Q	TFC	TVC	TC	MC	AFC	AVC	AC
0				-	-	-	-
1							
2							
3							
4							
5							
6							

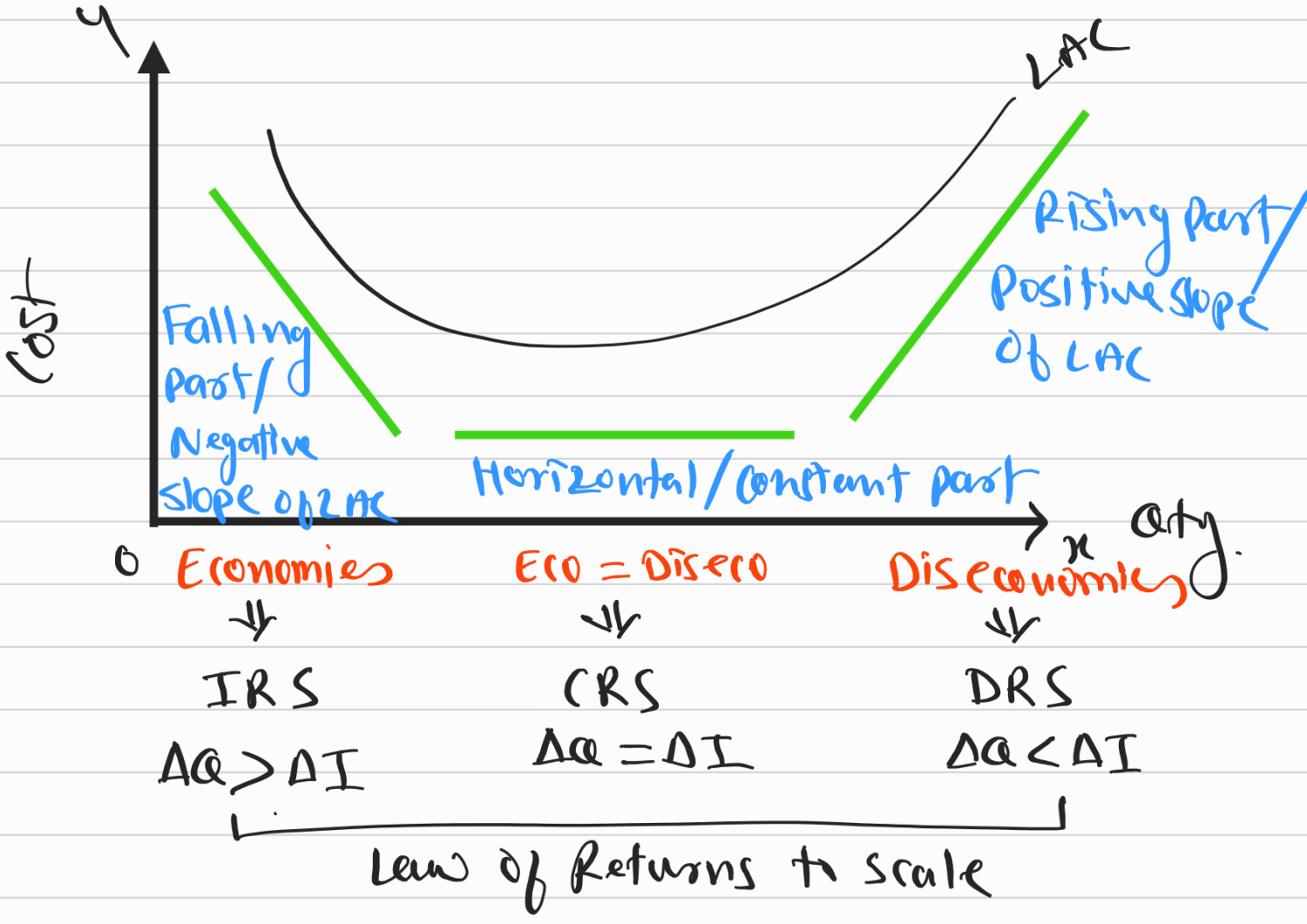
Q	1	2	3	4	5	6
TVC	30	40	60	100	160	240
TFC	180					

LONG RUN AVG COST CURVE (LAC)

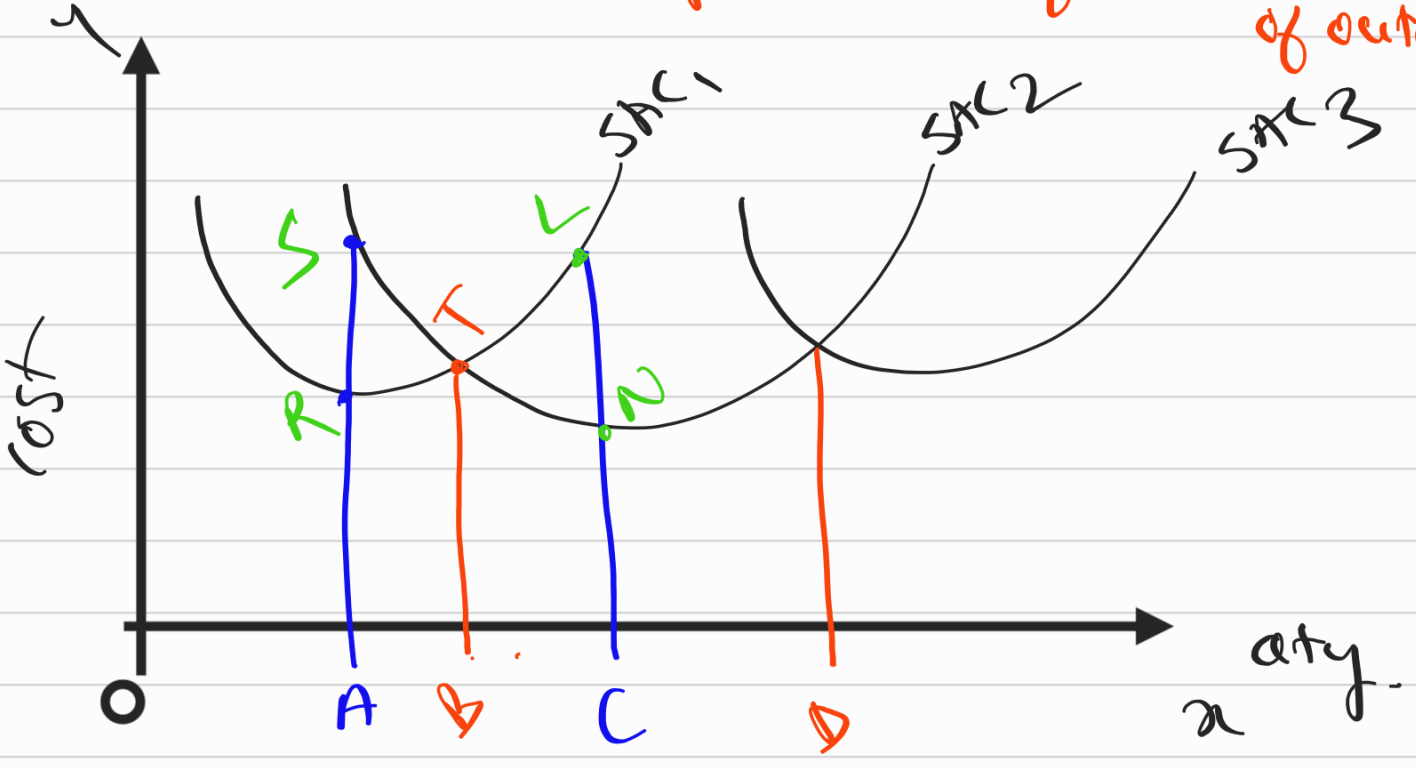
(i) LAC is derived from series of SAC's



(ii) LAC is 'U' shaped curve



(iii) LAC is AKA Envelope curve & planning curve. (Bcz we can plan least cost plant size for each level of output)



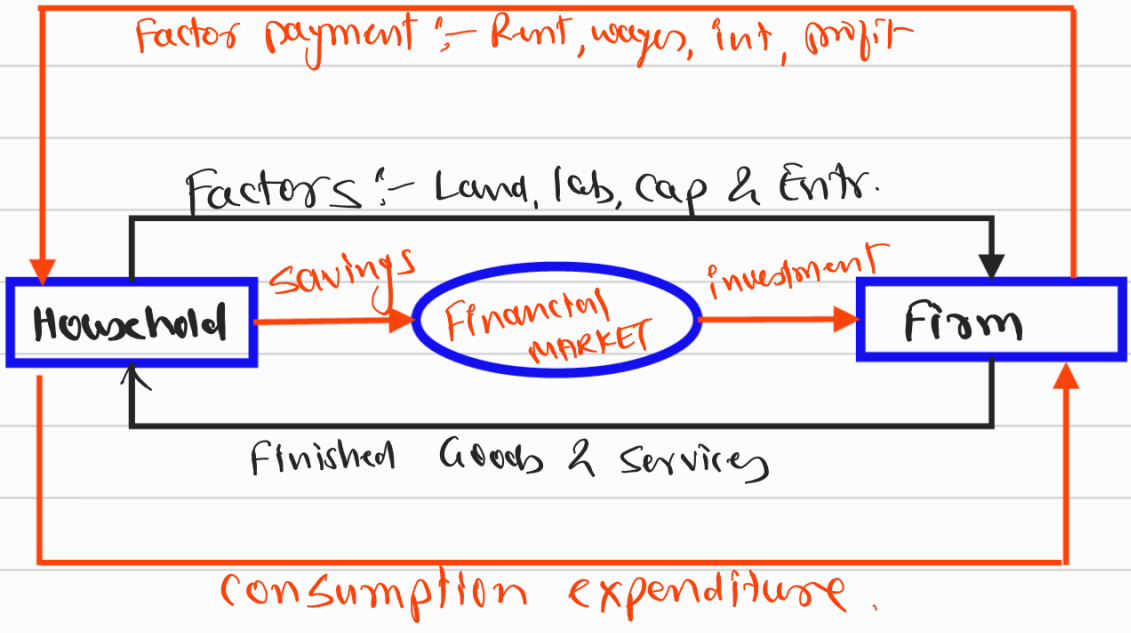
Qty	SAC	Cost	Choice	Reason
OA	1	RA	SAC_1	Least cost
OA	2	SA		RA < SA
OC	1	LC	SAC_2	Least cost
OC	2	NC		NC < LC
OB	1	TB	SAC_2	More Quantities
	2	TB		

④ LAC is NOT Always tanget to Minimum points of SAC's

initially it is tangent to falling part of SAC (e.g point A & B)
then at min point (point C)
& finally at rising part of SAC (point D & E)

Capital Formation / Capital accumulation

- Converting savings into investment
- 3 stages - (i) Savings (ii) Mobilisation of saving (iii) investment
- Affected by various factors like income, taxation, monetary policy etc.



Cobb-Douglas Production Function

$$Q = f(K \cdot L^{a} C^{1-a})$$

where Q = Output qty
K = constant Number
L = Labour
C = Capital
a = prop^{n} of Labor i.e $\frac{3}{4}$
$1-a$ or b = proportion of capital $\frac{1}{4}$

$a+b = 1$ CRS
$a+b > 1$ IRS
$a+b < 1$ DRS

Acc. to Cobb-douglas prod^{n} is "CRS" i.e "Linear Homogeneous func^{n}"

Features of Land

(i) Natural Factor
(ii) Mobility — immobile

Geographically - immobile
Occupationally (Usc) = mobile

(iii) Supply :- Perfectly inelastic, fixed, limited

(iv) Heterogeneous :- Differs from place to place (Fertility)

(v) Passive factor :- productivity land Depends upon Labour

(vi) Permanent factor :- Indestructible

Features of Labour

(i) Human factor
(ii) Bargaining power of Labour = Weak
" " of Trade Union = Strong
(iii) Labourer sells his labour only
(iv) Heterogeneous factor
(v) Supply < Firms = Elastic
economy / country = inelastic
(vi) Active factor
(vii) Perishable factor = can not be stored.
(viii) Mobility = Least mobile factor

Features of Capital

(i)

(i) Man made factor

(ii) Productive factor = it ↑ productivity of Land & Labour

(iii) Produced means of production

(iv) Durable = Not perishable like labour

(vi) Passive factor

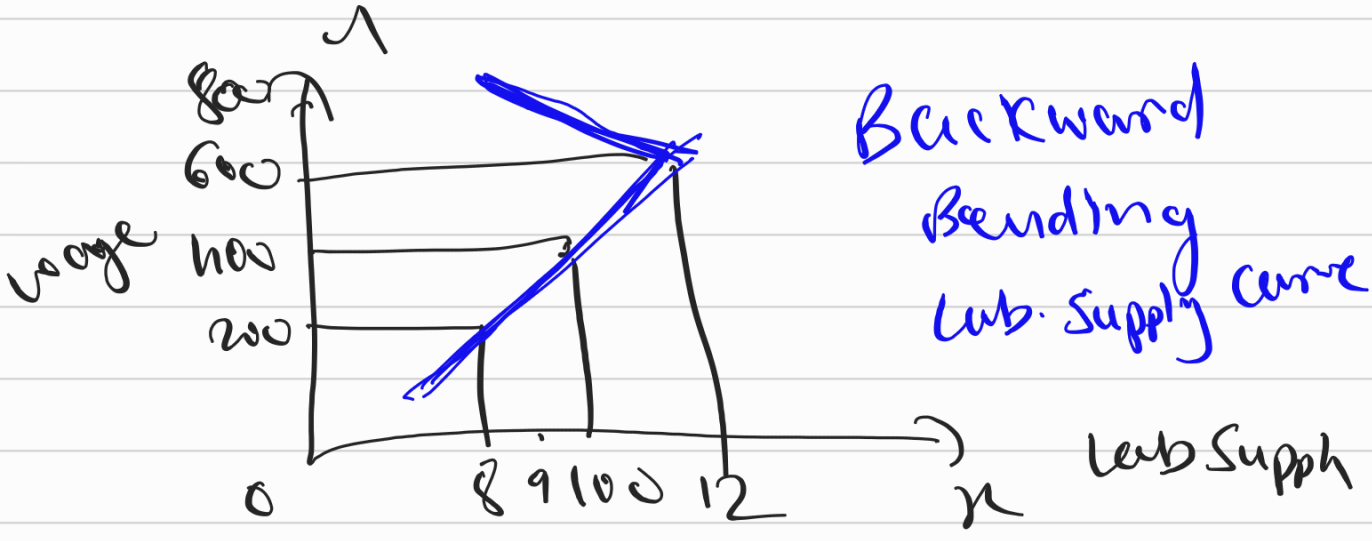
(vii) Supply < Short Run = inelastic
Long Run = elastic ✓

(viii) Mobile = Most mobile

MCQ's = Pg NO: 138

Q = 13

	Wage Rate	Labour Supply
↑	200 p/hr	8 hrs ↑
	400 p/hr	10 hrs
↑	600 per/hr	12 hrs. ↑
↑	800 pas/hr	9 hrs ↓



Backward Bending Lab. Supply Curve

Types of Capital

(i) Money capital :- money invested into business
(ii) Real capital :- physical Assets
(iii) Sunk capital :- specific use
(iv) Floating capital :- multiple use.
(v) Fixed capital :- purchase once & use again & again
(vi) working / variable capital = can not be used again & Again.
(vii) Human capital = Human skills etc
(viii) Tangible capital
(ix) Intangible capital = Trade Marks, patents etc
(x) Private capital = Personal Assets
(xi) Social capital = collective ownership.

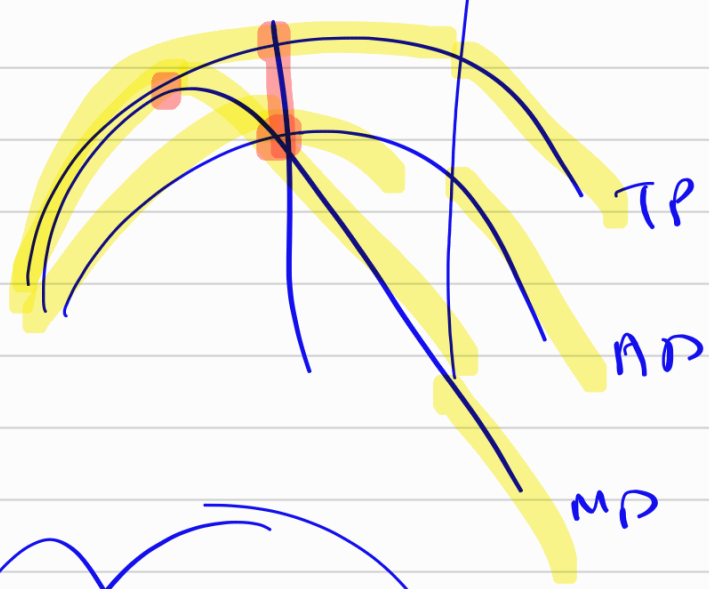
Q58

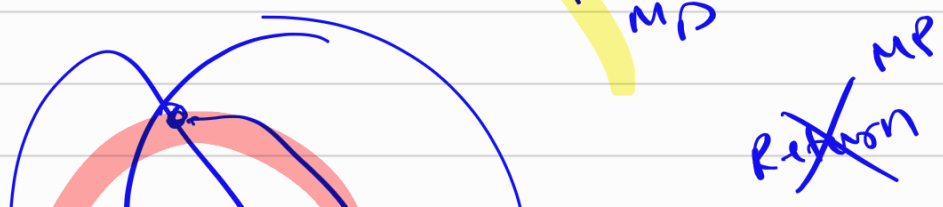
$$MC_6 = TC_6 - TC_5 \qquad \frac{\Delta TC}{\Delta Q}$$

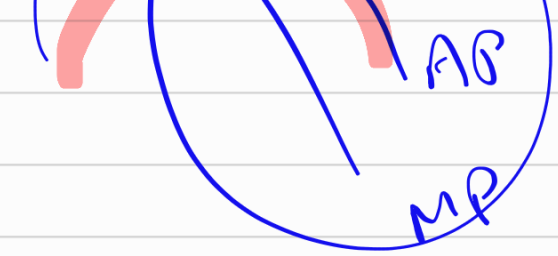
$$= (ATC \times 6) - (ATC \times 5)$$

$$= (320 \times 6) - 300 \times 5$$

$$420 = 1920 - 1500$$







Nos of labs	Total output	Marginal output
0	–	–
1	100	100
2	180	80
3	240	60

	Option	Cost Affected
A	prod func^n 10L+2K, 2L+10K	✓
B	wages ↑↓	✓
C	Tax ↑↓	✓
D	price ↑↓	✗

Q.15 opt D

NP is Implicit cost

TC = Explicit + implicit + NP ← if used for self consumption

13000 = 8000 + 2000 + 3000

Sold = 15000

TC = 10000

Profit = 5000

3000 NP, 2000 SNP

Q. = TC = 125000

Implicit cost = 35000

NP = 25000

Explic cost = ?

TC = Explicit + implicit + NP

125000 = (65000) + 35000 + 25000

Q.99

ATC = 150

AFC | AVC

350/7 = 50 | 100

(100)

ATC × Q = TC

150 × 7 = 1050

↳ TFC (350)

TVC 700

∴ AVC = 700/7 = 100

$AFC_4 = \frac{TFC}{Q} = \frac{120}{4} = 30$

TFC = AFC × Q

120 = 20 × 6

Q	TFC	AFC
4	120	(30)
6	120	20

$$AFC = \frac{TFC}{Q} = \frac{240}{2} = 120$$

(when unit = 0, TC = TFC)

$\downarrow MP = \uparrow MC$

Q	0	1	2	3	4	5	6
TC	240	330	410	480	540	610	690
MC	—	90	80	70	60	70	80

$MC\downarrow = MP\uparrow$ — Increasing Return

$MC\uparrow = MP\downarrow$ — Diminishing Return