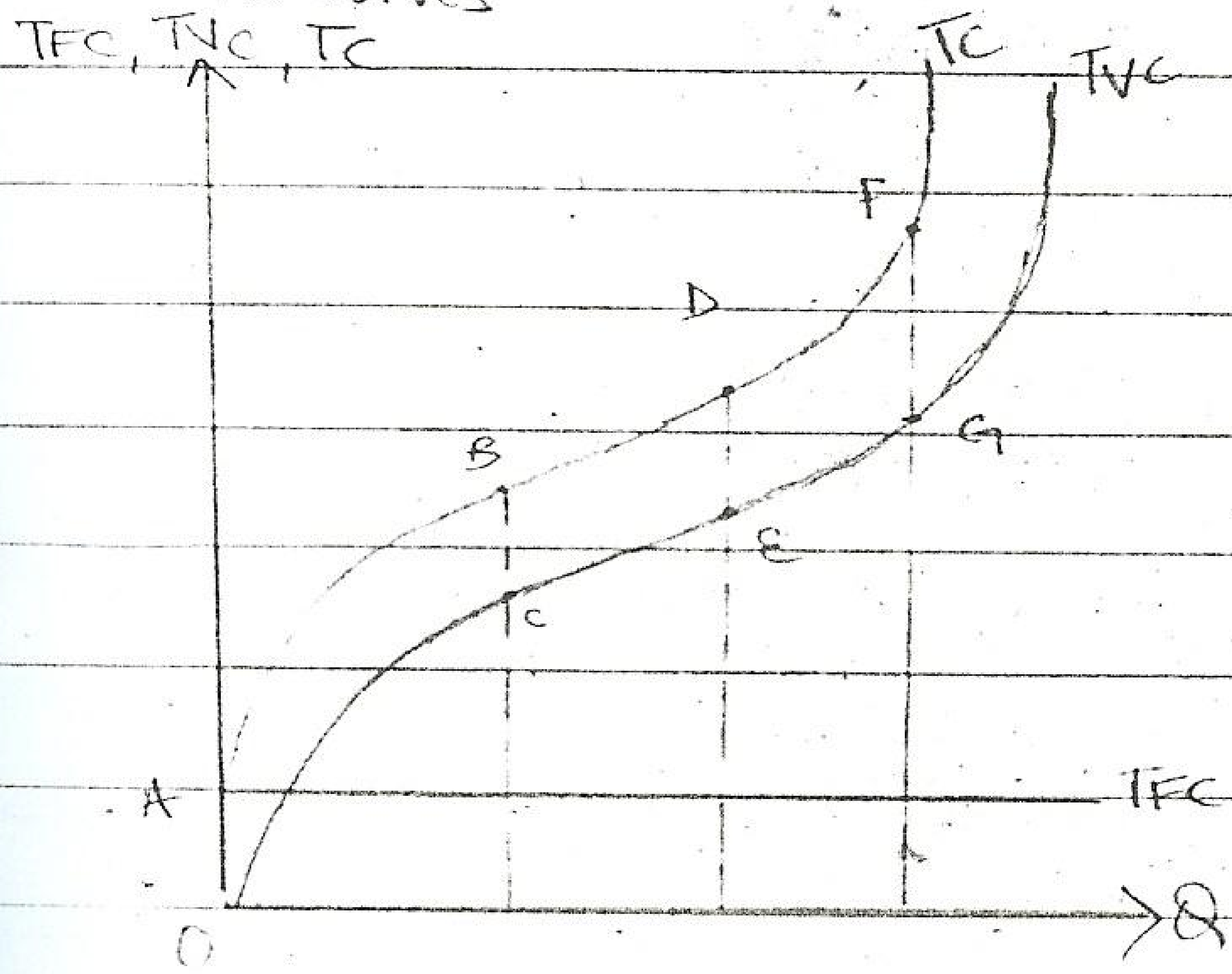
Output	TFC	TVC	TC	AFC	AVC	ATC	MC
0	120	0	120	X	0	X	X
5	120	20	140	24	4	28	4
10	120	35	155	12	3.5	15.5	3
15	120	48	168	8	3.2	11.2	2.6
20	120	70	190	6	3.5	9.5	4.4
25	120	100	220	4.8	4	8.8	6
30	120	150	270	4	5	9	10
35	120	210	330	3.43	6	9.43	12
40	120	290	410	3	7.25	10.25	16
45	120	390	510	2.67	8.67	11.33	20
50	120	500	620	2.4	10	12.4	22

Total cost curves



- slope of TC = slope of TVC
∴ TC // TVC.
- OA = BC = DE = FG = TFC
- TVC ↑ @ ↓ rate (↑ mrg rtns), then ↑ @ ↑ rate (diminishing rtns)

Analysis of AC:

Stage 1 (0–15)

AC ↓ = AFC ↓ + AVC ↓ → b/c TVC ↑ @ ↓ rate

AFC always falls b/c $\overline{TFC}$ & Q ↑

Stage 2 (15–25)

AC ↓ = AFC ↓ + AVC ↑ → b/c diminishing returns

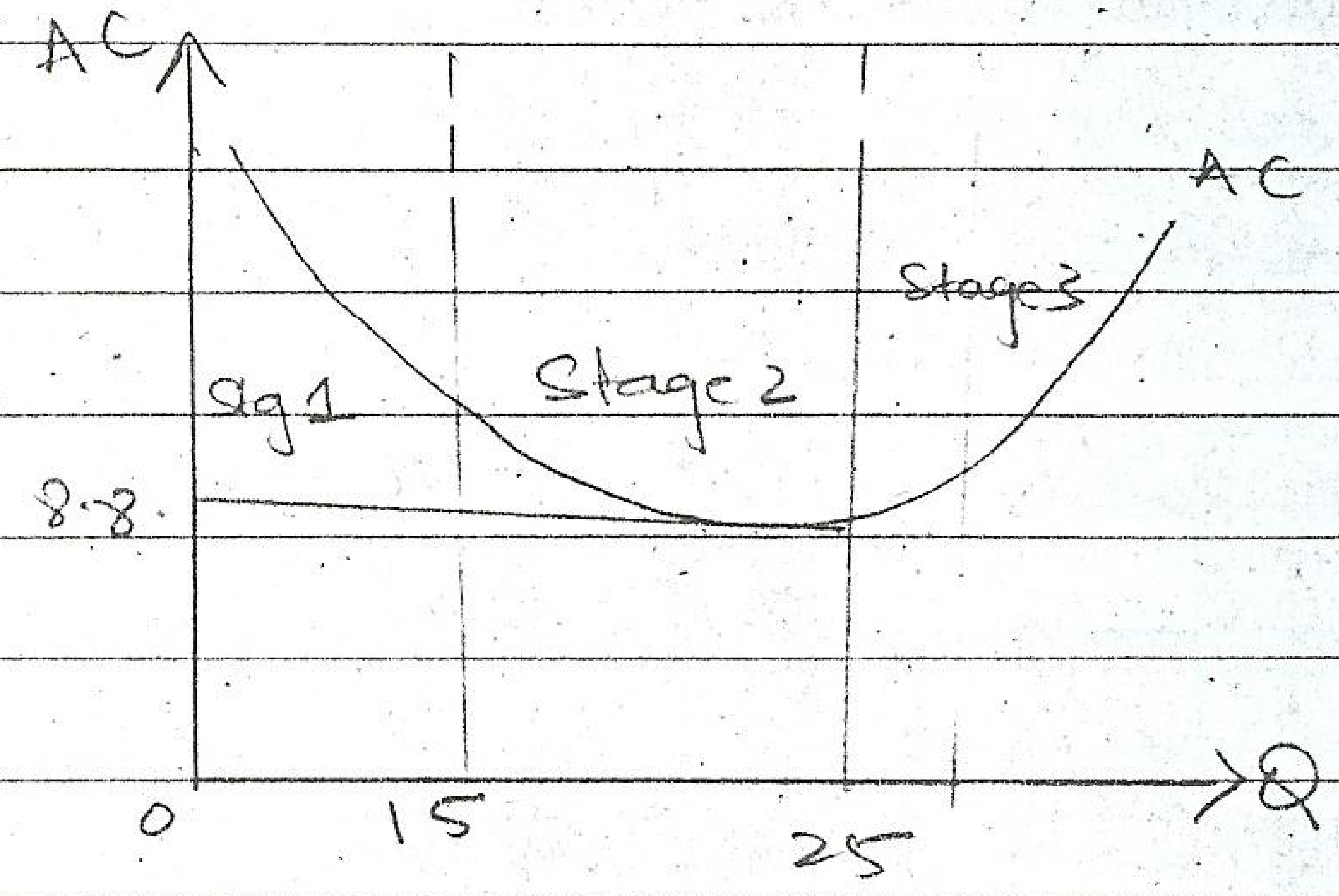
(ATC reaches its minimum here at 25)

fall in AFC > ↑ in AVC.

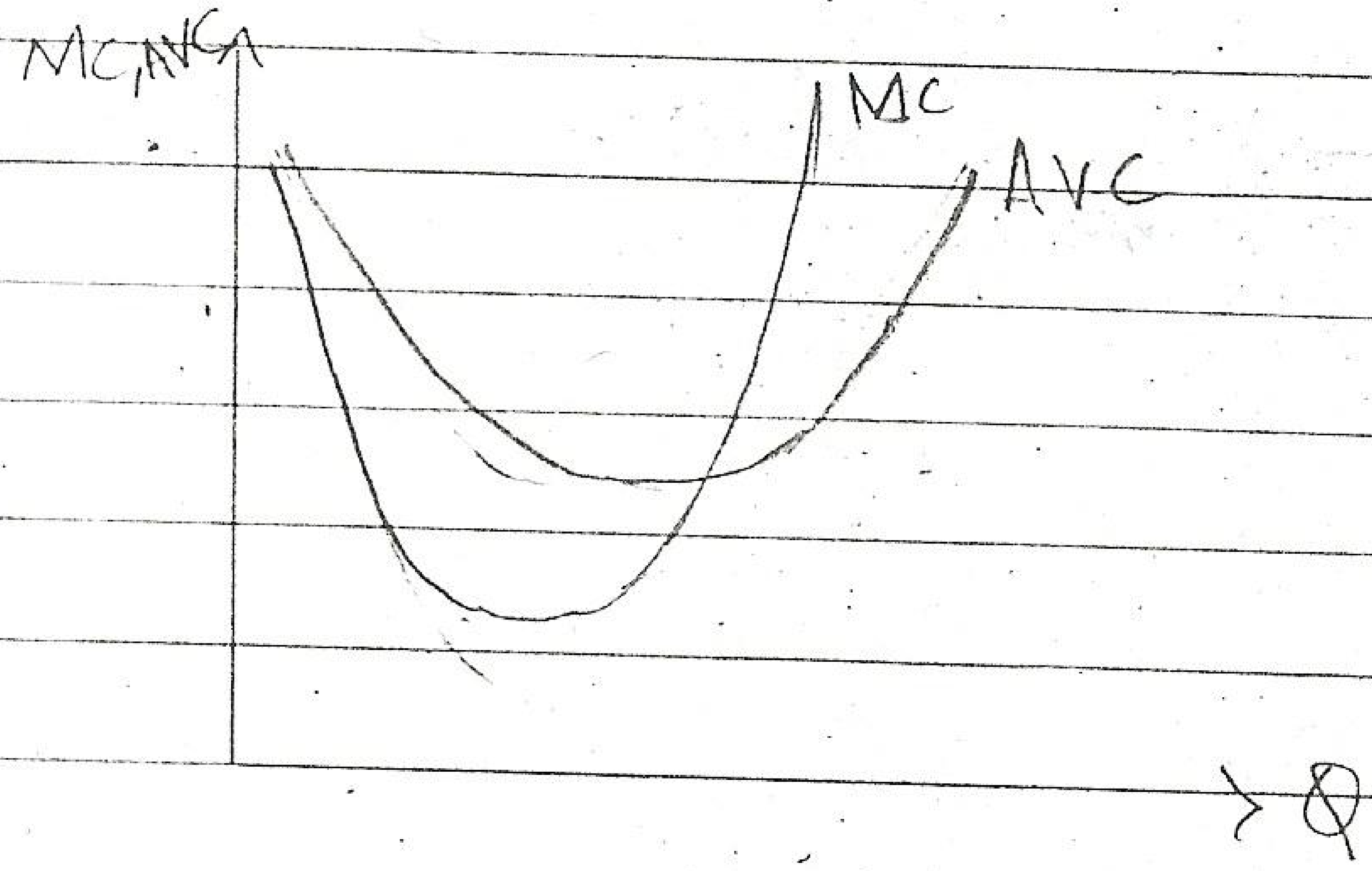
Stage 3 (25 onwards)

AC ↑ = AFC ↓ + AVC ↑ → dim returns

Fall in AFC < ↑ in AVC.

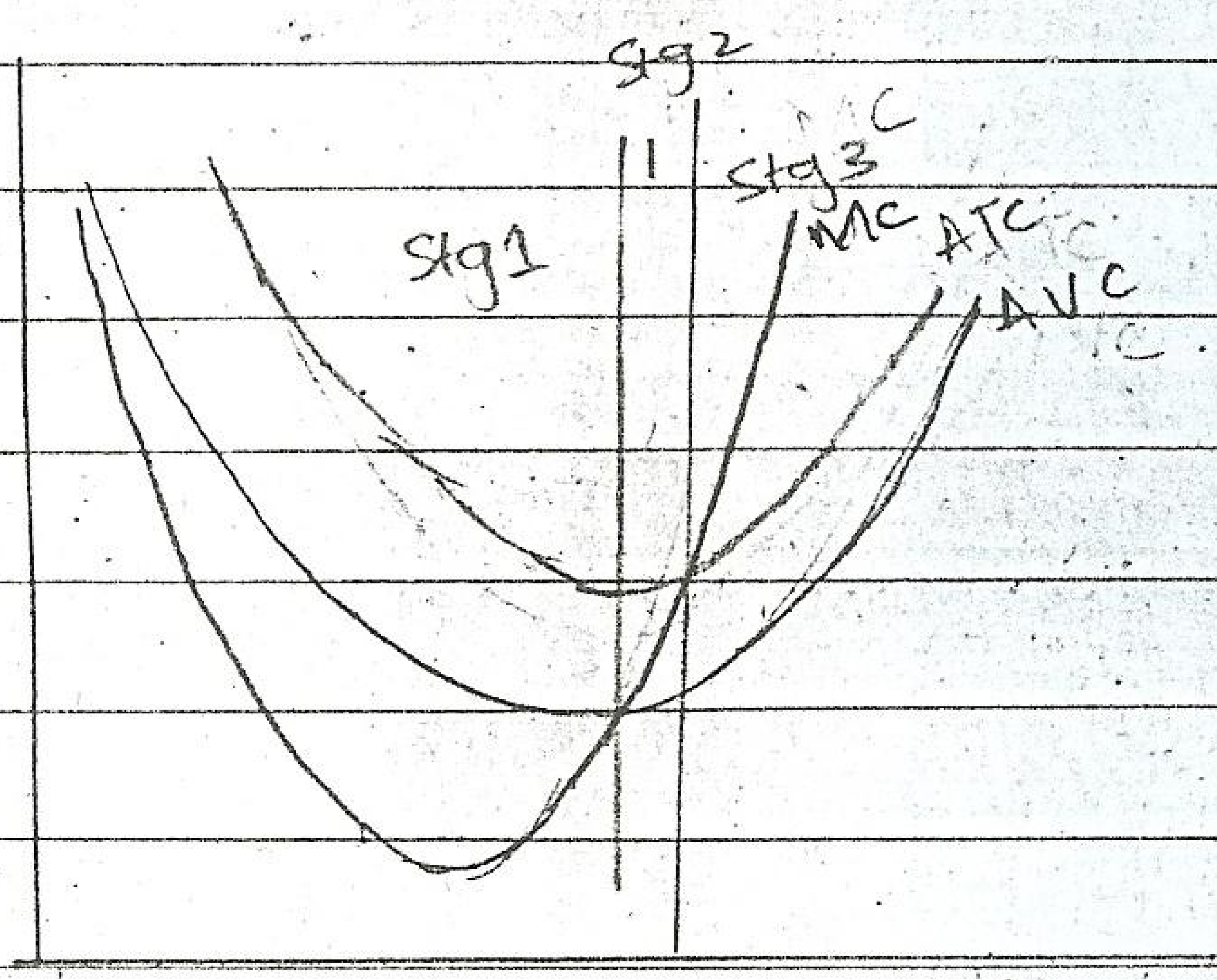


Relationship b/w MC & AVC.



Marginal Cost determines the behaviour of AVC which implies that both MC & AVC move in the same direction. However, the rate at which MC & AVC move is quite different. MC is the change in TC while AVC incorporates MC into the existing base to calculate a new average. This will make AVC respond at a much slower rate which is why when MC is falling AVC also falls but MC falls so fast that MC < AVC. Similarly when MC is rising, AVC also rises but now MC rises so fast that it becomes greater than AVC. This implies that MC will always cut AVC at its minimum.

Relationship b/w MC, AVC & ATC.



The relationship b/w MC and ATC is similar to the relationship b/w MC and AVC except that ATC will always lie above AVC b/c of AFC. Since AFC keeps decreasing with increase in output it follows that the difference b/w ATC & AVC must also diminish with increase in output. Like AVC, ATC is also intersected by MC at its minimum. However, the level of output corresponding to minimum of ATC is greater than the one that corresponds to the minimum of AVC. The output range that lies b/w these two levels becomes stage 2 where AVC after reaching its minimum has started to increase (diminishing returns setting in) but ATC continues to fall b/c fall in AFC outweighs the rise in AVC.

⟹ Integrating Cost Approach & Product Approach.

$\overline{w} = \$30$

Q of labour	Output	MP_L $\left(\frac{\Delta Q}{\Delta L}\right)$	MC $\left(\frac{\overline{w}}{MP_L}\right)$
0	0		
1	8	8	\$3.75
2	20	12	\$2.5
3	35	15	\$2
4	47	12	\$2.50
5	55	8	\$3.75
6	60	5	\$6.

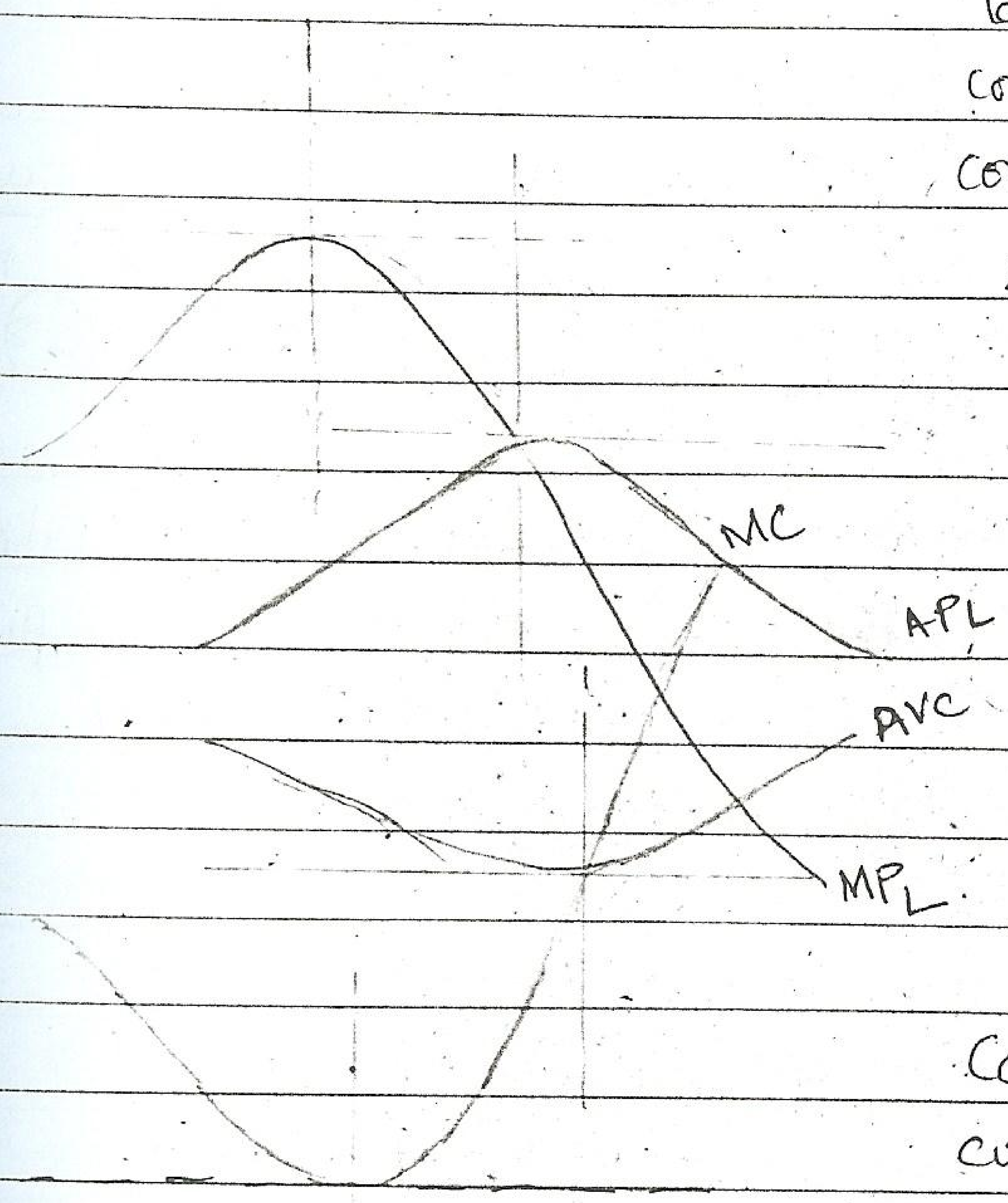
$MC = \frac{\Delta TC}{\Delta Q}$

in SR, FC ∴ $MC = \frac{\Delta VC}{\Delta Q}$

assuming ~~asking~~ $Q = f(\overline{K}, L)$ we can say that $MC = \frac{\Delta \text{ wage bill}}{MP_L}$

labor is purchased from a competitive mkt at a constant wage rate $(\overline{w})$

∴ $MC = \frac{\overline{w}}{MP_L}$.

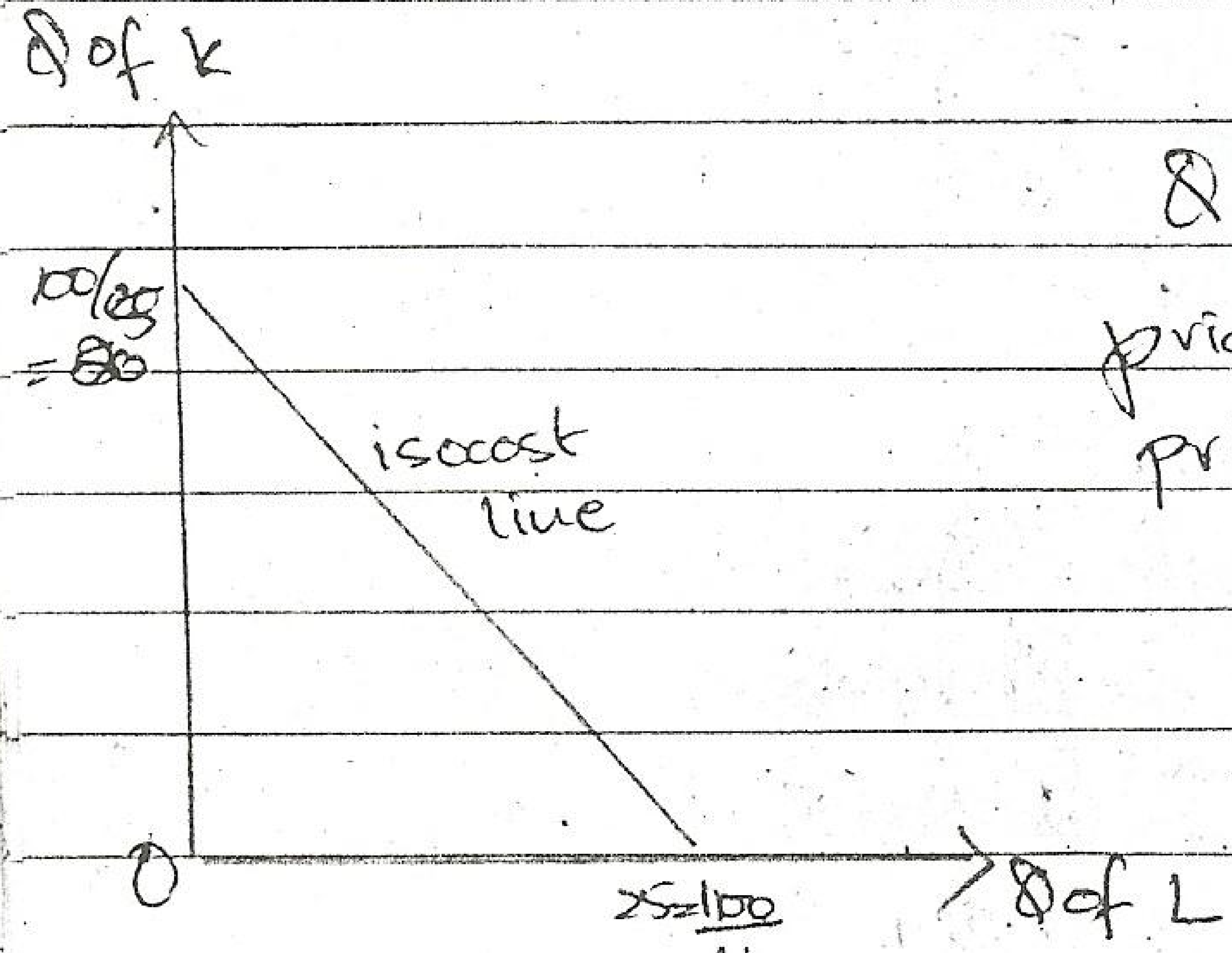


Cost and Product curves are mirror images as productivity & cost are inversely proportional

ISOCOST lines and ISOQUANTS.

→ **Isocost line**

Shows a feasible region with a different combinations of factors of production to ~~prove~~ produce a given level of output.



Example

$Q = f(K, L)$

price per unit of K = $5

price per unit of L = $4.

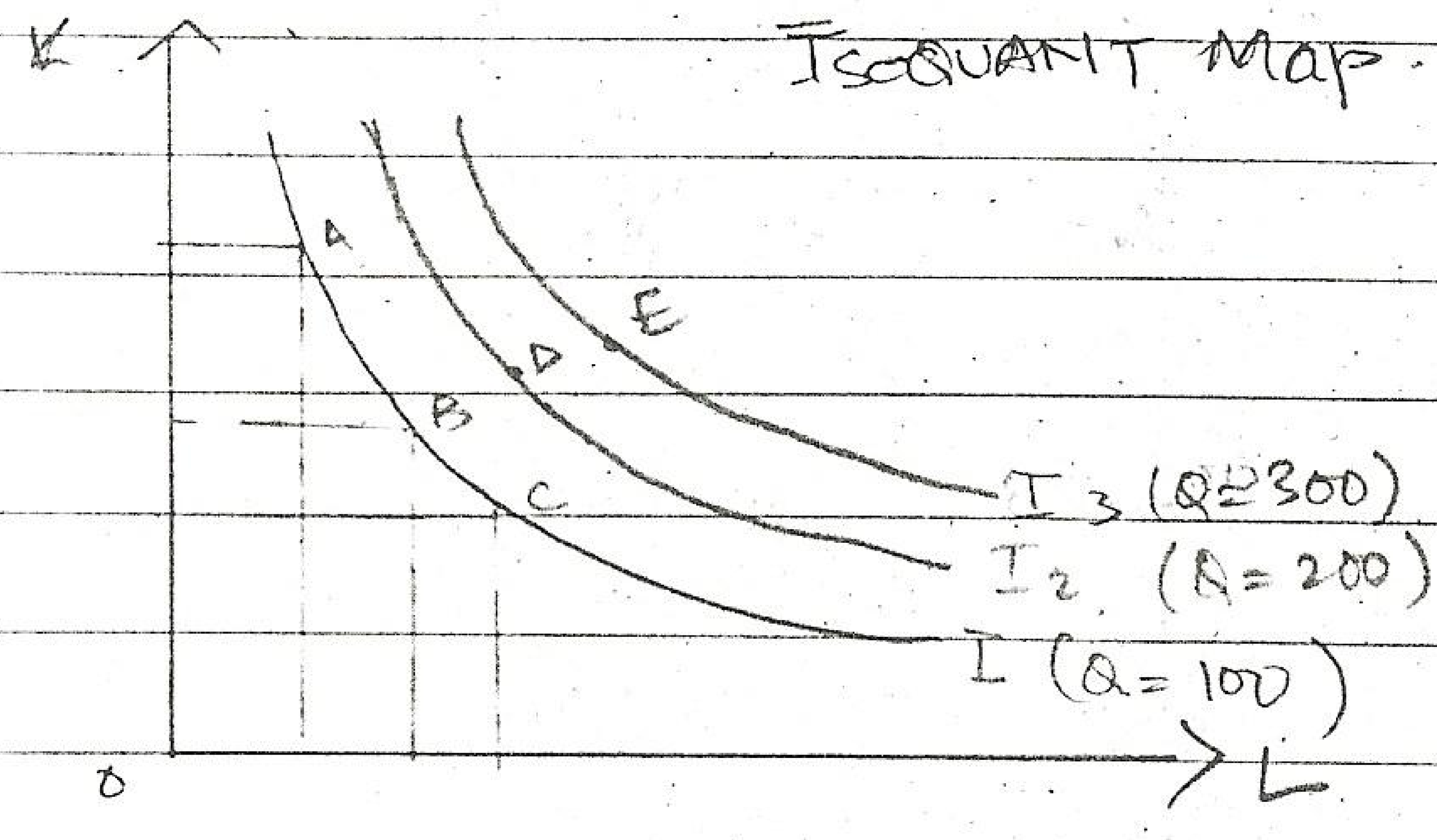
total outlay (budget) = $100.

slope of isocost line $= \frac{P_L}{P_K} = \frac{w}{r} = \frac{4}{5} = 0.8$

employing an extra unit of labour in production implies sacrificing 0.8 of capital (opp-cost).

⇒ ISOQUANTS.

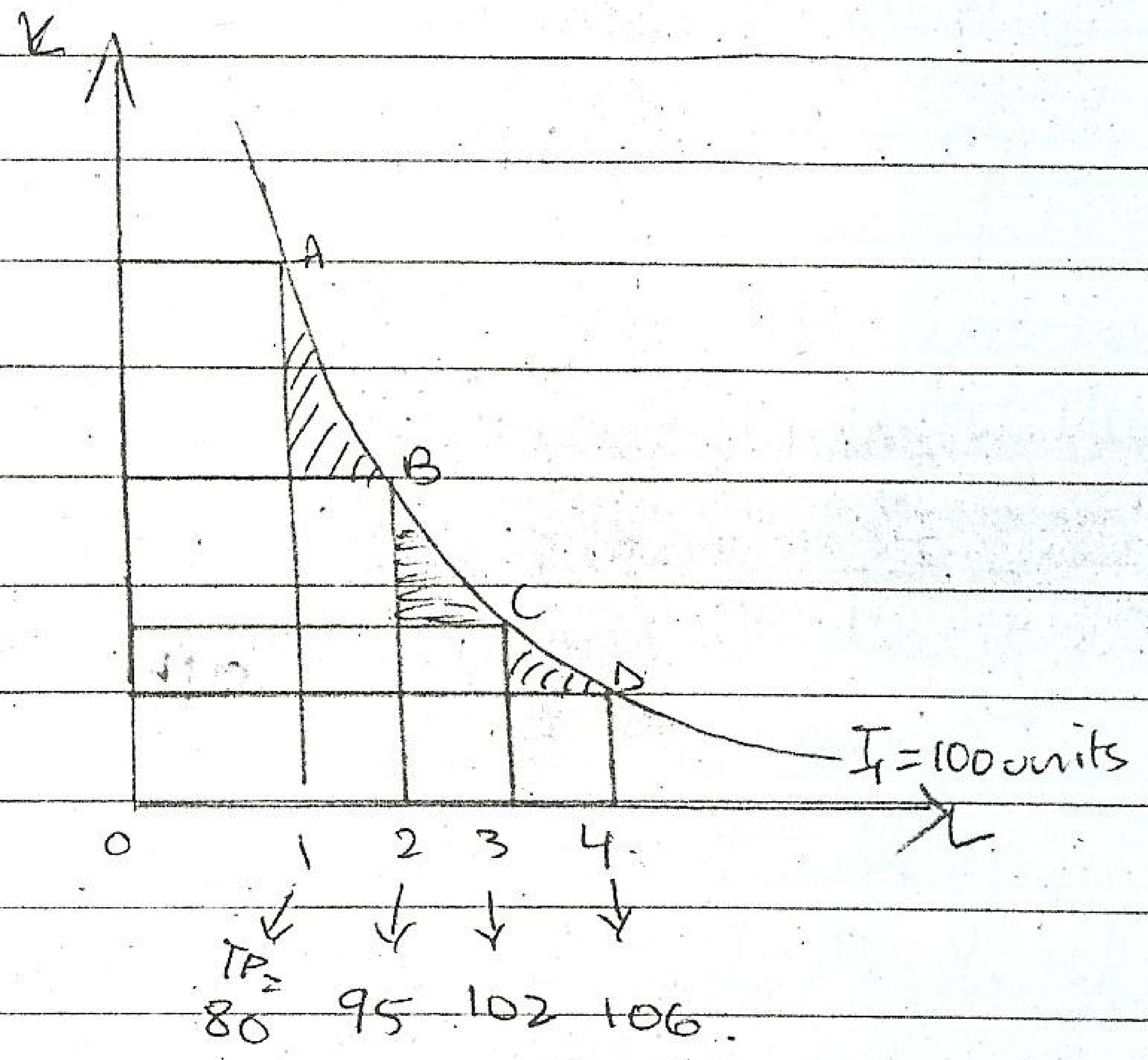
An ISOQUANT is a locus of points which show different combinations of labour & capital, yielding a given level of output. In other words as we move along an ISOQUANT the factor intensity changes, but the level of output remains the constant. So each ISOQUANT represents a given level of output and as we move onto higher ISOQUANTs, the level of output increases.



$$\left[Q_A = Q_B = Q_C = 100\right] < Q_D < Q_E$$

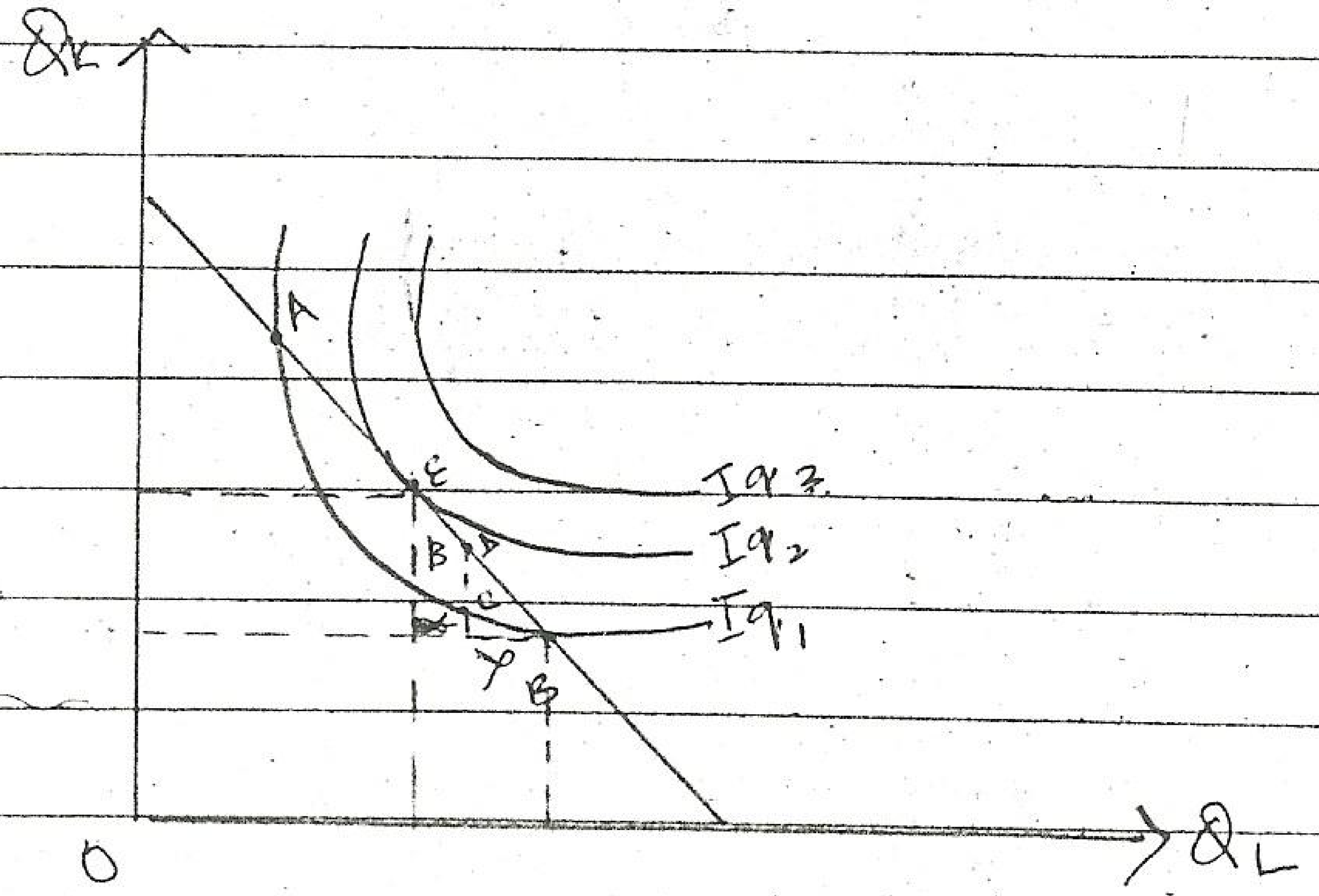
⇒ Slope of ISOQUANT:

Slope of isoquant = $\frac{MP_L}{MP_K}$. Since isoquants are convex to origin, the slope diminishes with increase in factor intensity.



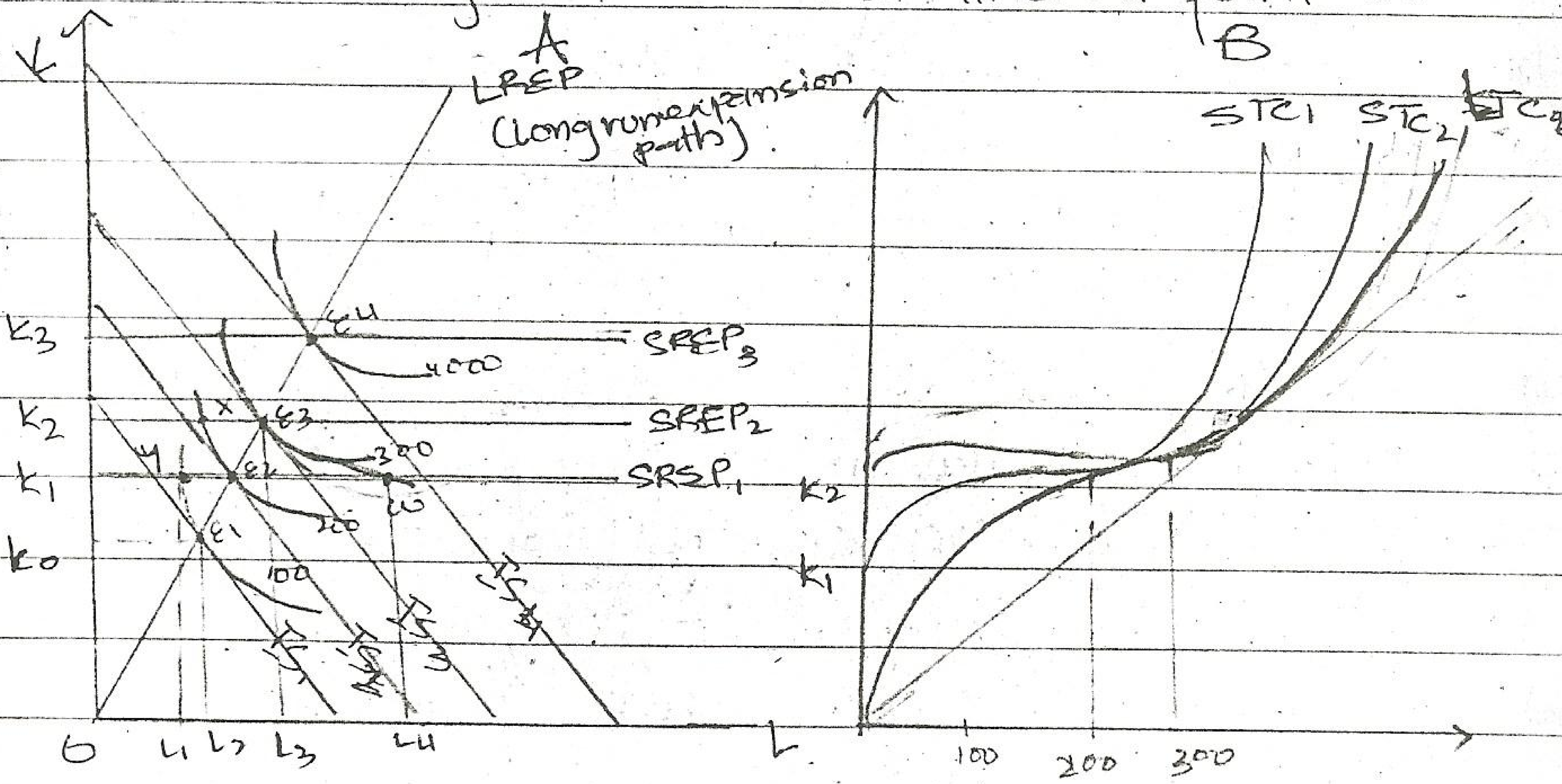
The diagram above shows an isoquant on which all combinations A, B, C and D produce a level of output equal to 100 units. As we move from left to right we increase Q of labour by 1 unit. This will add to total output and the addition most be offset by reducing the Q of capital. MP_L / MP_K shows the amount of capital that must be given up in order to offset the increase in output attained by employing an extra unit of labour. Since all factors are subject to the law of diminishing returns, the addition to total output made by each successive unit of labour will become less & less and therefore, the amount of capital that should be given up inorder to offset the increase in output will also become less. MP_L / MP_K is known as Marginal rate of technical substitution (MRTS) and since it diminishes with increase in factor intensity it is also known as diminishing MRTS

Least Cost Combination

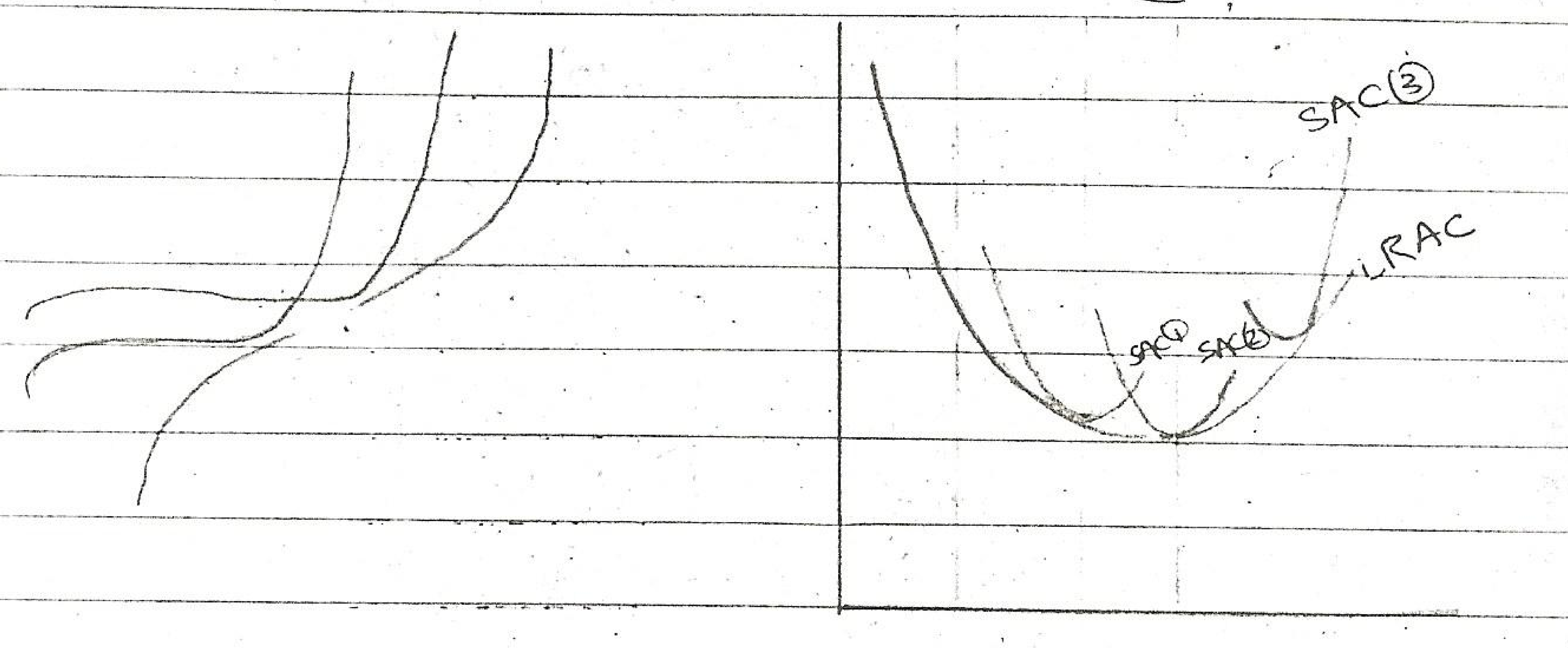


least cost combination is achieved when marginal physical Product of capital per $ spent ~~(mpk / mpl)~~ $\left(\frac{mpk}{r}\right)$ = ~~mp~~ marginal physical product of ~~mpl~~ labour per $ spent $\left(\frac{mpL}{w}\right)$. $\frac{mpk}{r}$ equals $\frac{mpl}{w}$

can be rearranged and also expressed as $\frac{mpL}{mpk} = \frac{w}{r}$. $\frac{MpL}{Mp_K}$ is the slope of an isoquant and it shows the quantity of labour that must be given up in order to offset the increase in output achieved by employing an extra unit of labour (b/c all points on an isoquant represent the same level of output. w/r is the slope of ~~budget line~~ isocost line and it shows the opportunity cost of labour in terms of the amount of capital forgone. So, in other words we are saying that 'least cost' combination is achieved when the slope of Isoquant is equated to the slope of isocost line. This occurs at point E in the diagram above. Any point which lies to the right of E such as point B shows that labour is over employed and capital is under employed. This is so b/c we can give up Y of labour and offset its effect by acquiring just x of capital which will move us from point ~~A~~ B to point C with the same level of output. However point C compared to point B lies inside the isocost line which means that we have some surplus $s left which could ~~can~~ be used to acquire extra inputs and increase output by moving to a higher isoquant b/w Iq_1 & Iq_2. The opportunity for such substitutability will remain till we have moved from point B to point E where further reduction in labour and substitution ~~to~~ with capital will not increase output level. Conversely any point to the right of E the reverse is true, i.e labour is underemployed & capital is over employed. So output can be increased by reducing capital & increasing labour till we have reached point E and isoquants have shifted out to Iq_2 which is tangent to isocost line at point E.



C



Panel A shows how different levels of output can be produced in the short run and long run. The isoquant map of Iq_1 to Iq_4 shows output increasing by constant amounts of 100 units, But if we look at the magnitude of shifts in isocost lines, we find that from IS_1 to

IS_3 the outlay increases at a decreasing rate which implies that longrun Total cost is increasing at a decreasing rate but after IS_3 the shift is isocost line becomes bigger suggesting that Longrun total cost is now increasing at an increasing rate.

Starting from short run we assume that initially the amount of capital fixed (fixed cost) is OK_1. The most optimum level of output that can be produced at this level of ~~co~~ capital is 200 units on IQ_2 where ~~shor~~ $SREP_1$ cuts LREP at point E_2 where least cost combination is achieved.

In other words, firm will produce 200 units by using that combination of labour & capital which it will choose in the long run. when all factors are variable. Any level of output less than 200 ~~st~~ such as hundred will be produced at point y on Iq_1, using K_1 of capital and L_1 of labour even though point y is not the desired point the firm can produce 100 units at point E_1 on Iq_1 with ~~ko~~ K_0 of capital and L_2 of labour. In other ~~f~~ words at point y firm is forced to overemploy capital by $OK_1 - OK_0$ and under employ labour by $OL_2 - OL_1$. Conversely, any level of output above 200 such as 300 on Iq_3 firm will be forced to remain on point w, even though cost minimising point is E_3.

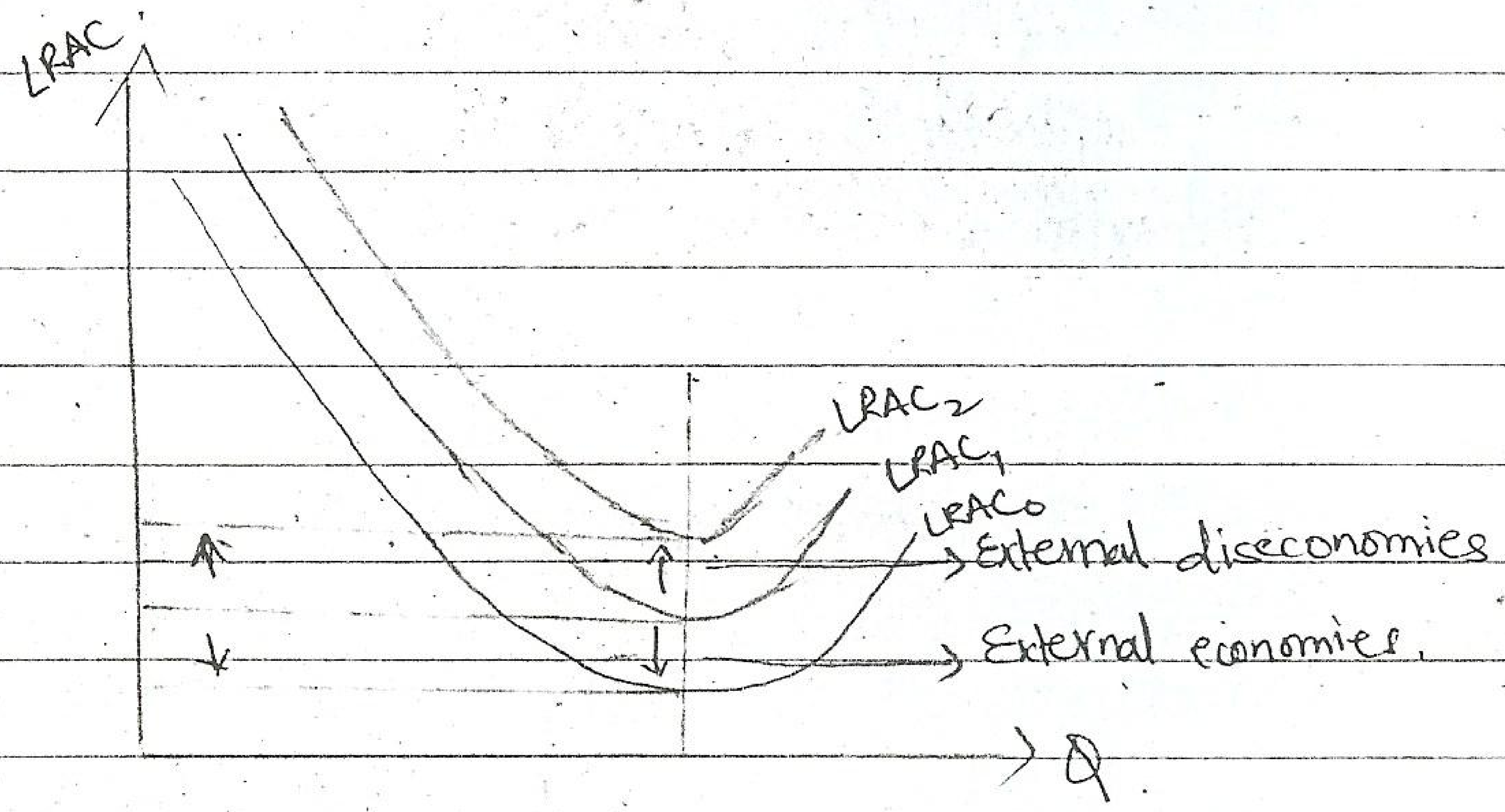
In other words at point W, firm is underemploying capital equal to $Ok_2 - Ok_1$ and overemploying labour by $OL_4 - OL_3$.
The analysis above implies that for every given level of fixed capital in production there is only one level of output where the actual combination of labour and capital will be equal to the desired combination of labour & capital. In other words the short run total cost and long run total cost will be only equal for a single level of output where short run expansion path intersects LREP. For capital stock k_1 the ideal level of output is 200 to be produced at E_2 on Iq_2. Similarly for the level of ~~stoc~~ capital stock k_2 the ideal level of output is 300 to be produced at E_3 on Iq_3 and so on so forth. At all other points the short run total cost for a given level of capital will be higher than the Long run total cost. The relationship b/w STC and LTC is shown in panel B. with different STC curves corresponding to different levels of capital stock in the short run. Panel B shows that as we increase output from 200 to 300 we are moving along the LREP by simply increasing the amount of capital in the long run from k_1 to k_2. This is why STC_1 and STC_2 are tangent to LTC. Furthermore

the movement from E_2 to E_3 on LREP also shows that Isocost lines are shifting out with a smaller magnitude which means that LTC is increasing at a decreasing rate causing Long run Avg cost to fall in panel c. However, after 300 any further expansion such as to 400 on $I_{q/4}$ will increase the magnitude of shift in Isocost line suggesting that now LTC is increasing at an increasing rate which also means that LRAC is ~~now~~ also increasing and managerial diseconomies have set in. Therefore 300 becomes the optimum level of output in the Long run. To the left of it there are economies of scale and to the right there are diseconomies. Since output level 300 corresponds to capital stock K_2 it follows that for all capital stocks below K_2 ~~SAC~~ SRAC will be tangent to LRAC at a point which lies to the left of the minimum of SAC. for example SAC, K_1. Conversely for all levels of output above 300 the SAC will be tangent to LRAC at a point which lies to the right of the min of SAC, for eg SAC, K_3. Therefore, at 300 SAC will be tangent to LRAC at its minimum point. In panel B, a ray from the origin ~~0E~~ is tangent to LTC at 300 which shows that LRAC are minimised at that point. All points to the left of this, expansion reduces Avg cost (EOS) and all pts to the right expansion increases Avg Cost (DOS)

⟹ Economies and Diseconomies of Scale

Economies of Scale is a long run phenomenon b/c. when we move along the LREP we alter the quantities of capital & labour simultaneously. As long as LREP is a ray from the origin it implies that both K & L are altered in fixed proportions. Therefore, regardless of which isoquant we are on the K:L ratio remains constant. So even in the LREP one assumption is inherent which is that relative factor prices (w/r) which is also the slope of Isocost line remains constant.

In Panel A the ~~LRE~~ LREP is a ray from the origin and as we move from E_1 to E_4 which are the least cost points, the capital labour ratio remains constant. However, b/w E_1 & E_4 the magnitude of shift in Isocost lines i.e from IS_1 to IS_4 is variable. The magnitude of shift in Iso cost lines decreases from IS_1 to IS_3 ~~and~~ which implies that total cost is increasing at a decreasing rate while from IS_3 to IS_4 its increasing at an increasing rate. Since total output is increasing at a constant rate it follows that from E_1 to E_3 (SAC_3) we have Economies of or increasing returns which will cause LRAC to fall. However after E_3 the diseconomies of scale will set in causing average cost to rise. These are most likely to be managerial diseconomies. Movement along the LRAC will always indicate internal economies or diseconomies of scale. In case there are external economies or diseconomies then the LRAC will shift. An upward shift in LRAC shows external diseconomies suggesting that each level of output is produced at a higher avg cost while a downward shift in LRAC suggests external economies where each level of output is produced at a lower Avg cost.



MARKET STRUCTURES

~~⟹ Perfect Competition~~

MKT – STRUCTURES.

- Perfect Competition
- ~~Incompete~~ Imperfect Competition
  - Monopolastic Competition
  - Oligopoly
  - monopoly
- Contestable market

⟹ Perfect Competition:

Perfect competition is a market structure with the following set of assumptions:

① There are large number of buyers & sellers, so each
② industry is made up of many firms, each having a market share which is insignificant.
② There no barriers to entry & exit. In other words if industry is making super normal profits then other firms can enter the ~~firms~~ industry easily. On the other hand if industry is making subnormal profits then firms can easily exit without ~~an~~ encurring any "sunk-costs"
③ The product produced by all firms in a perfectly competitive industry is homogenous and consumers are not able to tell b/w output of one firm & the other.
④ There is also perfect knowledge on part of both producers & consumers & therefore there is no role

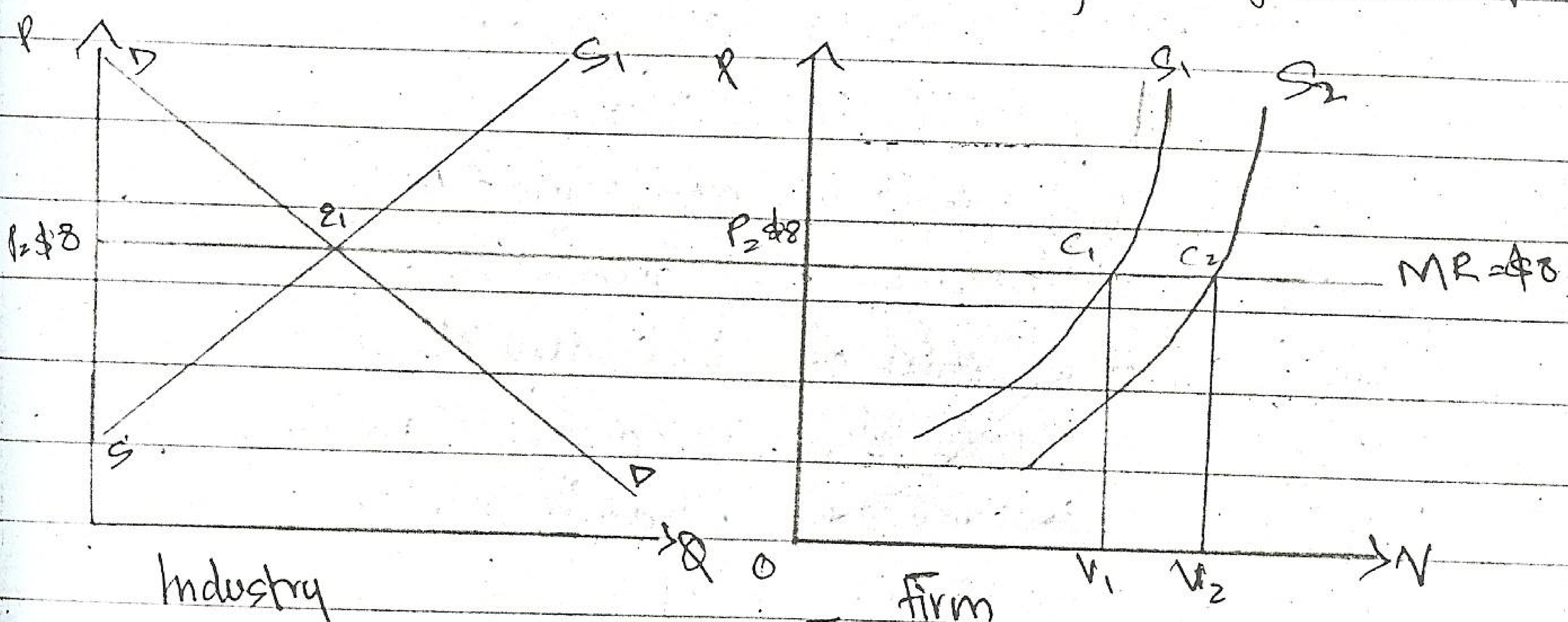
(49)

for advertising in a perfectly ~~compett~~ competitive industry.

(3) All firms in the long run break even or make normal profits. Normal profits are earned when accounting profit is equal to ~~economic~~ the implicit cost or the opportunity cost of resources employed in a ~~bu~~ business. For example MR. X leaves a job on the ~~1s~~ 1st of January 2008 to start his own business. His job paid him a net salary of $10000 a month. On 31st Dec 2008 i-e at the end of 1st accounting year MR X has earned a total revenue of $500,000 with total cost of $380,000 (FC+VC). According to the accounting point of view Mr X has earned a profit of $120,000, but from an economist's point of view Mr X has broken even b/c his accounting profit of $120,000 ($500000 - $380000) is exactly equal to what he would have earned in his previous ~~jo~~ job during the same period of 12 months ($10000 × 12). In other words the profit earned by Mr X is exactly equal to the opportunity cost of his business. So when a firm breaks even it is actually earning normal profit or profit = implicit cost from the point of view of an economist. Any profit in excess of $120000 will become supernormal profit (abnormal profit) which will induce resources in similar capacity as MR X to give up

their present use and be reallocated to what Mr X is doing. Conversely any profit less than $20000 will induce Mr X and others to revert to previous employment. The difference b/w accounting & economic profit is thus crucial in understanding the equilibrium in market for resources / factors of production.

The assumptions above suggest that a perfectly competitive firm will be too small to influence the market price for its product which is why we call it a price taker. A price taking firm faces a horizontal demand curve which implies that firm can change its own supply & alter equilibrium level of output but none of that will influence price. This is why marginal revenue and price coincide in a perfectly elastic demand curve but that is true only for perfect competition.



Industry   firm

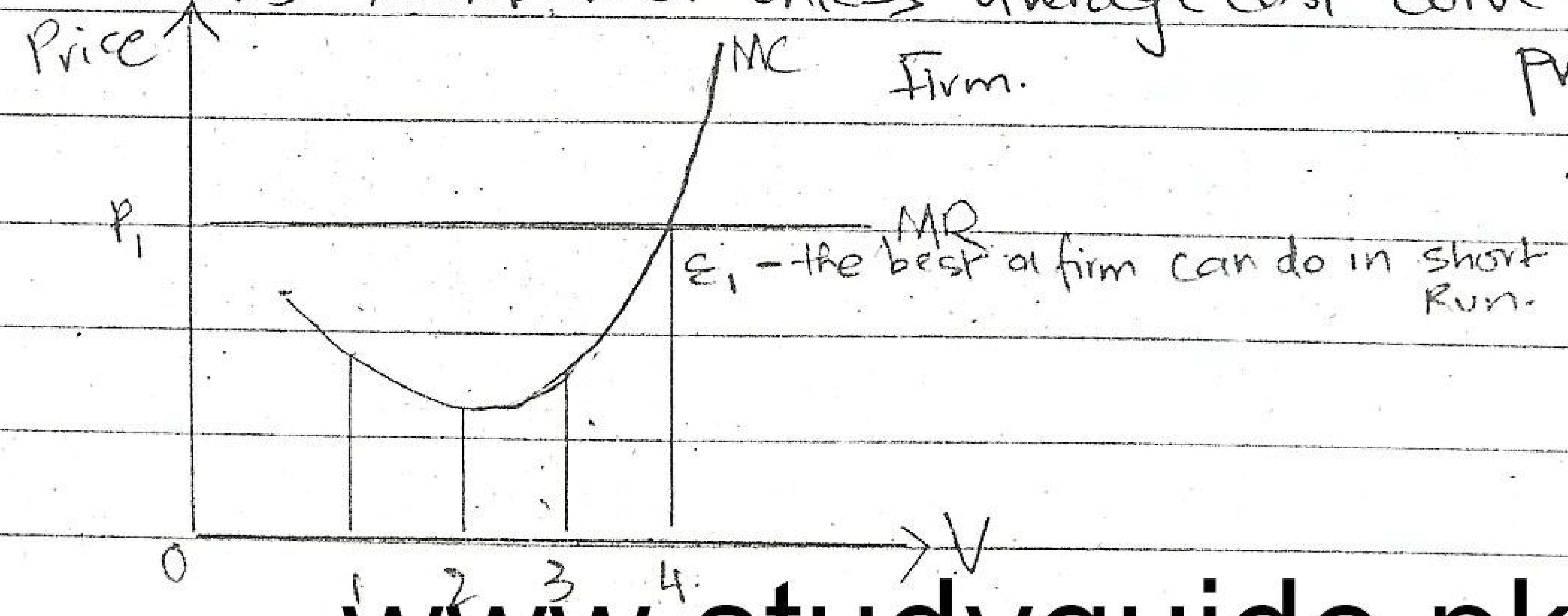
P	Q	TR	$MR = \frac{\Delta TR}{\Delta Q}$
$8	3	24	8
$8	11	88	8
$8	20	160	8
$8	42	336	8

MR = P

Only in Perfect Competition

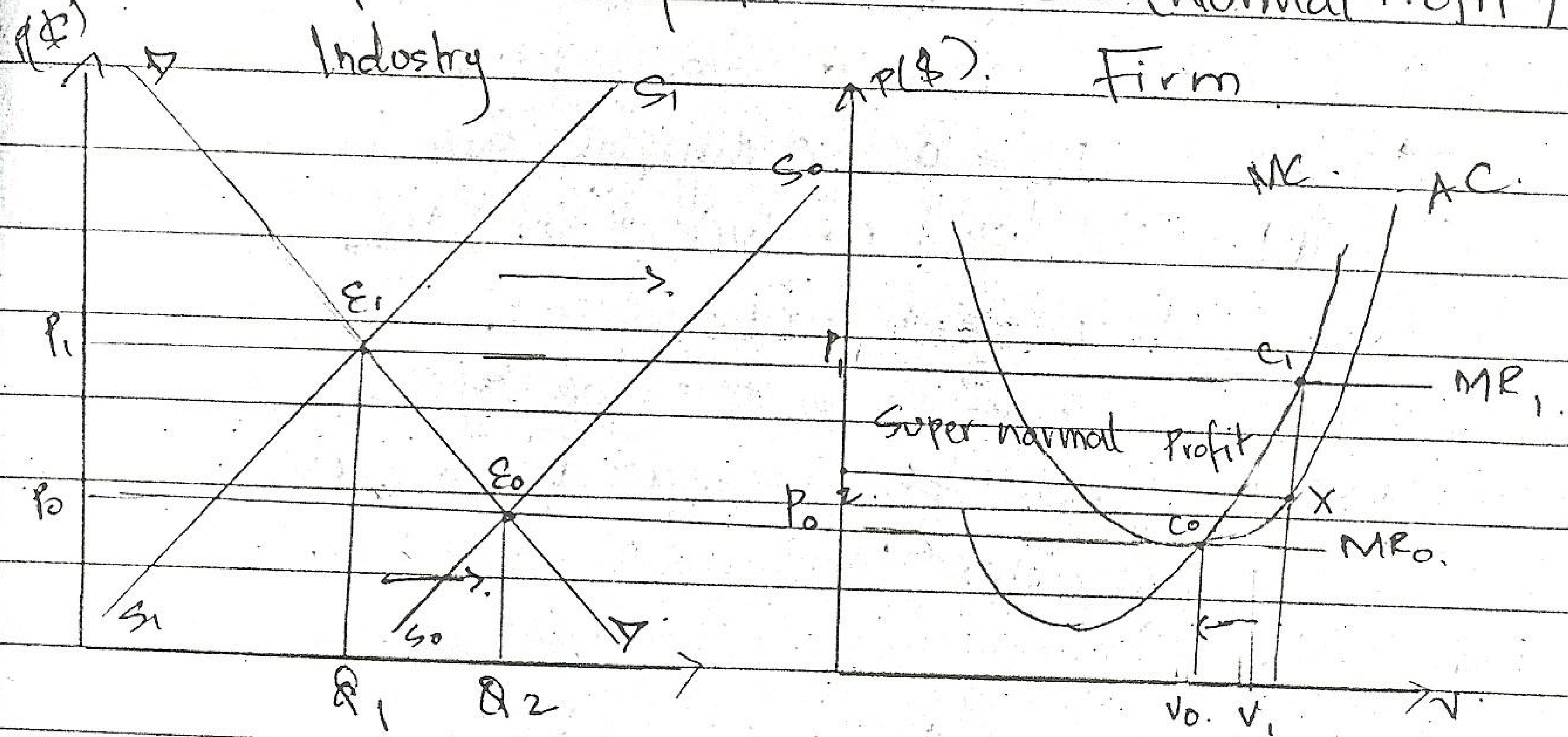
⇒ Profit maximisation under perfect competition:

Profit maximisation occurs when marginal cost is equated to marginal revenue (MC = MR). For a perfectly competitive firm this could also be stated as MC = P as price and marginal revenue are the same in perfect competition. However, by equating MC to MR or P it is not necessary that a perfectly competitive firm will always be maximising profits because it could also be a loss minimising condition depending on the level of fixed costs. Marginal Cost is defined as the cost of producing an extra unit while marginal revenue is the addition to total revenue from sale of an extra unit. As long as MR > MC, it will pay the firm to keep increasing output b/c each additional unit will either increase profit or reduce losses. In other words we can say that MC = MR is actually the best a firm can do and by looking at the intersection point of MC and MR we cannot determine whether firm is a profit maximizer or a loss minimizer unless average cost curve is also present.



Case 1:

From Super normal profits to Breakeven (Normal Profit).



The industry is in equilibrium at E_1 which is determined by the intersection of D_1 & S_1. The equilibrium price is P_1, ~~MR~~ which is transferred to a typical firm in the form of a perfectly elastic demand curve P_1, MR_1. The firm is in equilibrium at C_1 by equating MC to MR_1 and produces output level OV_1. Total revenue generated by the firm is $OP_1C_1V_1$ while total cost incurred by the firm is ~~O_2~~ O_2XV_1. Since TR > TC, the difference between them becomes supernormal profit which is represented by the rectangle P_1C_1X2. In the long run presence of supernormal profits will attract entry of new firms and as new firms enter the industry's supply curve ~~move~~ will shift rightwards causing equilibrium price to fall. This process will continue until all supernormal profits are wiped out and price has fallen, to a level where all firms are breaking even i.e earning normal profit. The final equilibrium will be E_0 where equilibrium is price is P_0 and a typical firm is in equilibrium at C_0. The output level produced is OV_0 and TR = TC. TR = TC = $OP_0C_0V_0$ (normal profits). We can see that each firm now produces less but the total industry supply has increased from Q_1 to Q_2 because the number of firms in the industry has increased.

⇒ Case 2:
From subnormal profits/losses to breakeven. (normal profits)