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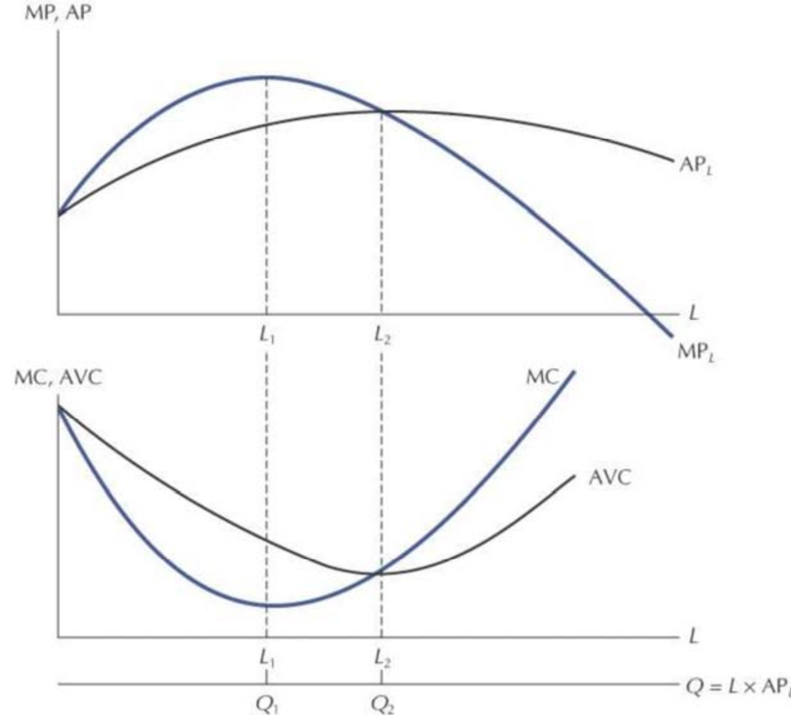
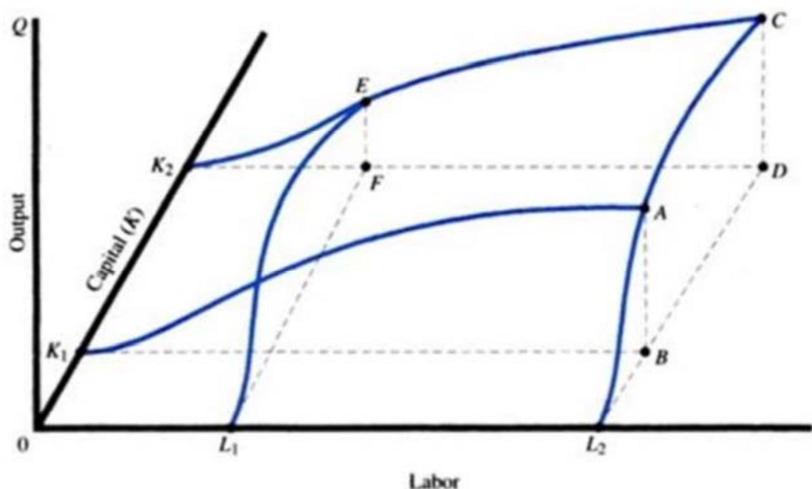
Figure 10.9: The Relationship Between MP, AP, MC, and AVC



Continuous Production Surface



Production Function With Two Inputs

$Q = f(L, K)$

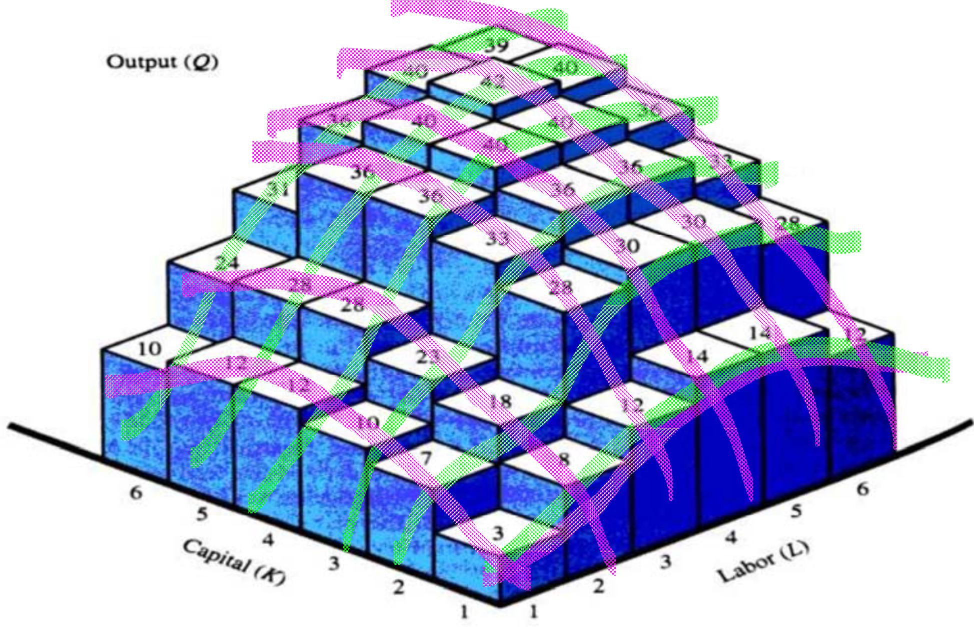
K							Q
6	10	24	31	36	40	39	
5	12	28	36	40	42	40	
4	12	28	36	40	40	36	
3	10	23	33	36	36	33	
2	7	18	28	30	30	28	
1	3	8	12	14	14	12	
	1	2	3	4	5	6	L

PRODUCTION IN THE LONG RUN

- NOW, NO FIXED INPUTS
  ALL INPUTS BECOME VARIABLE.

Production Function With Two Inputs

Discrete Production Surface



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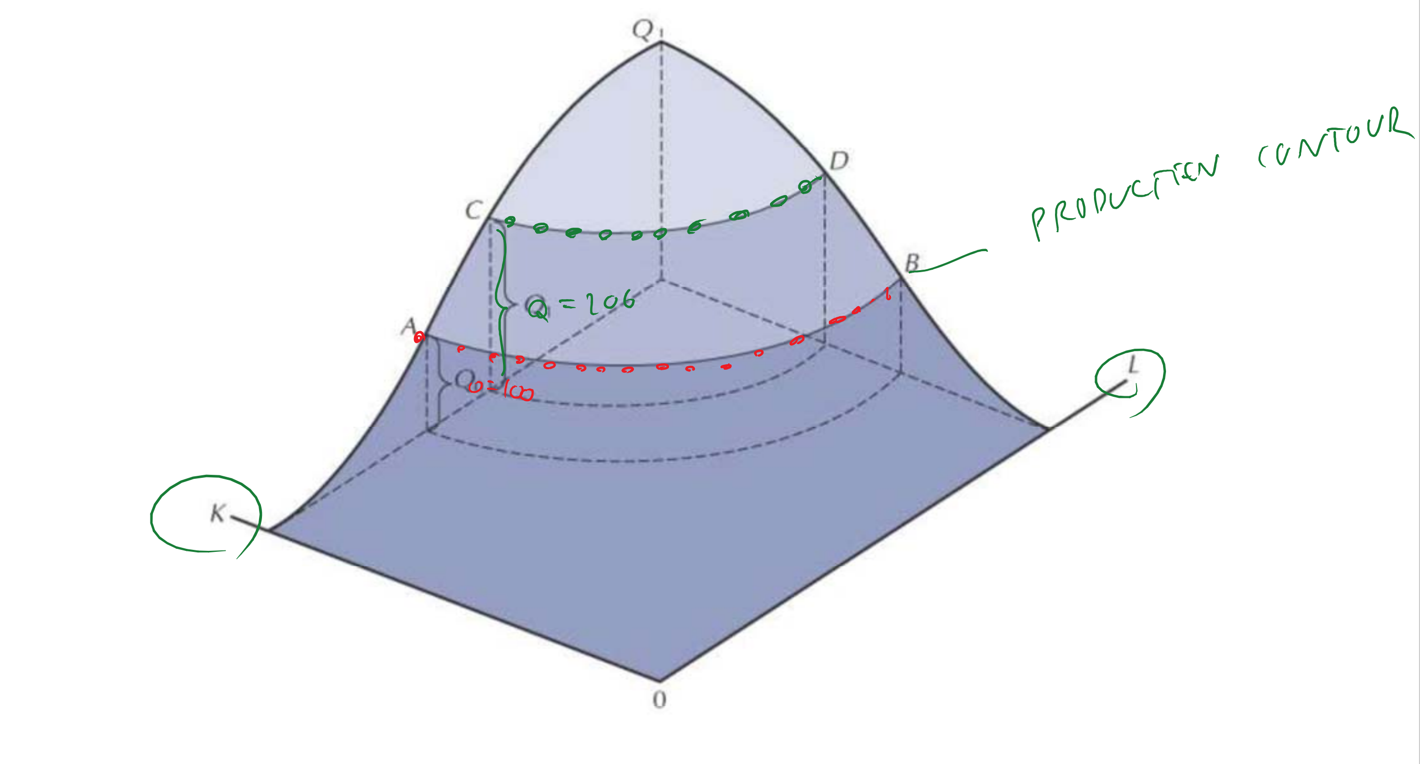

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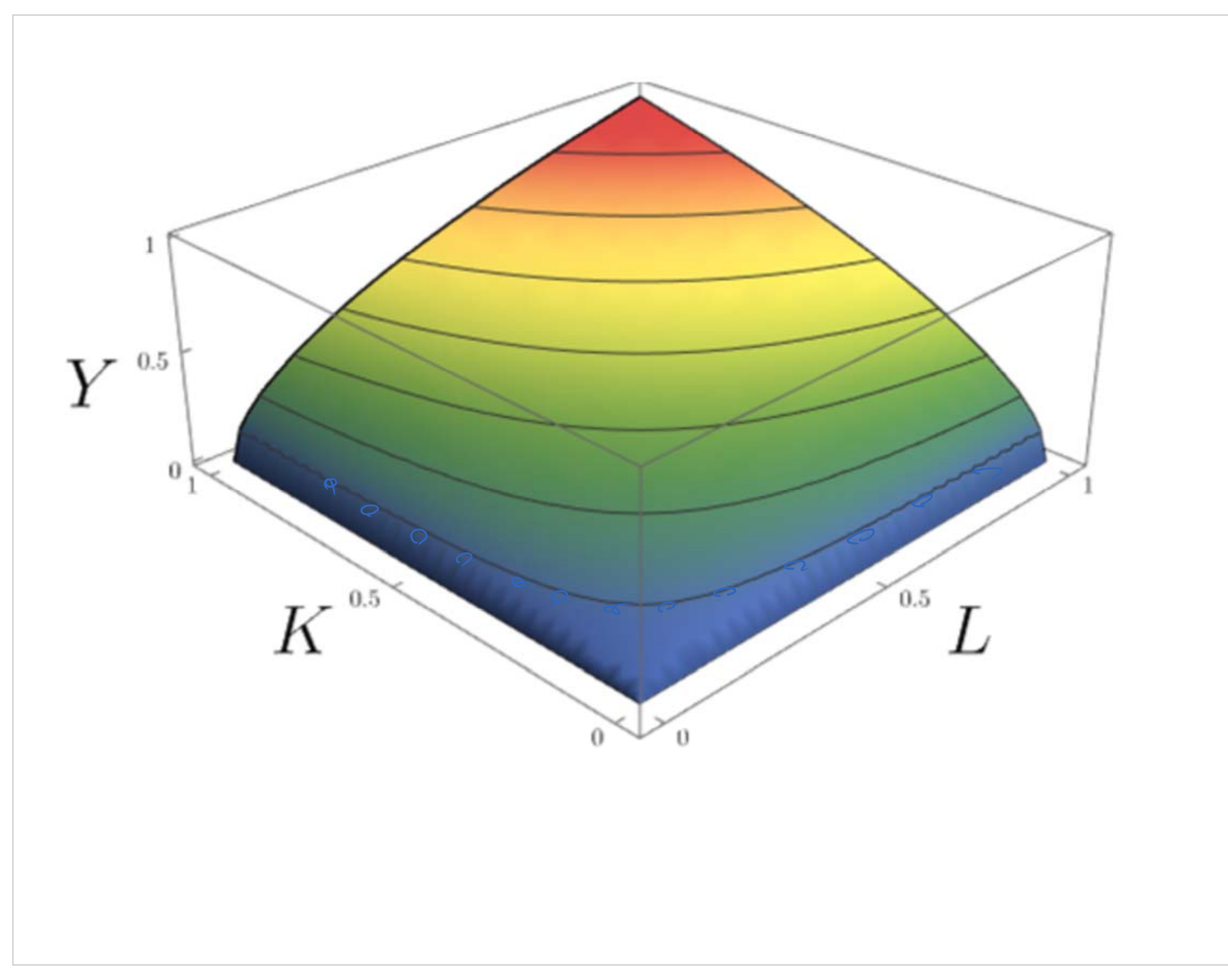

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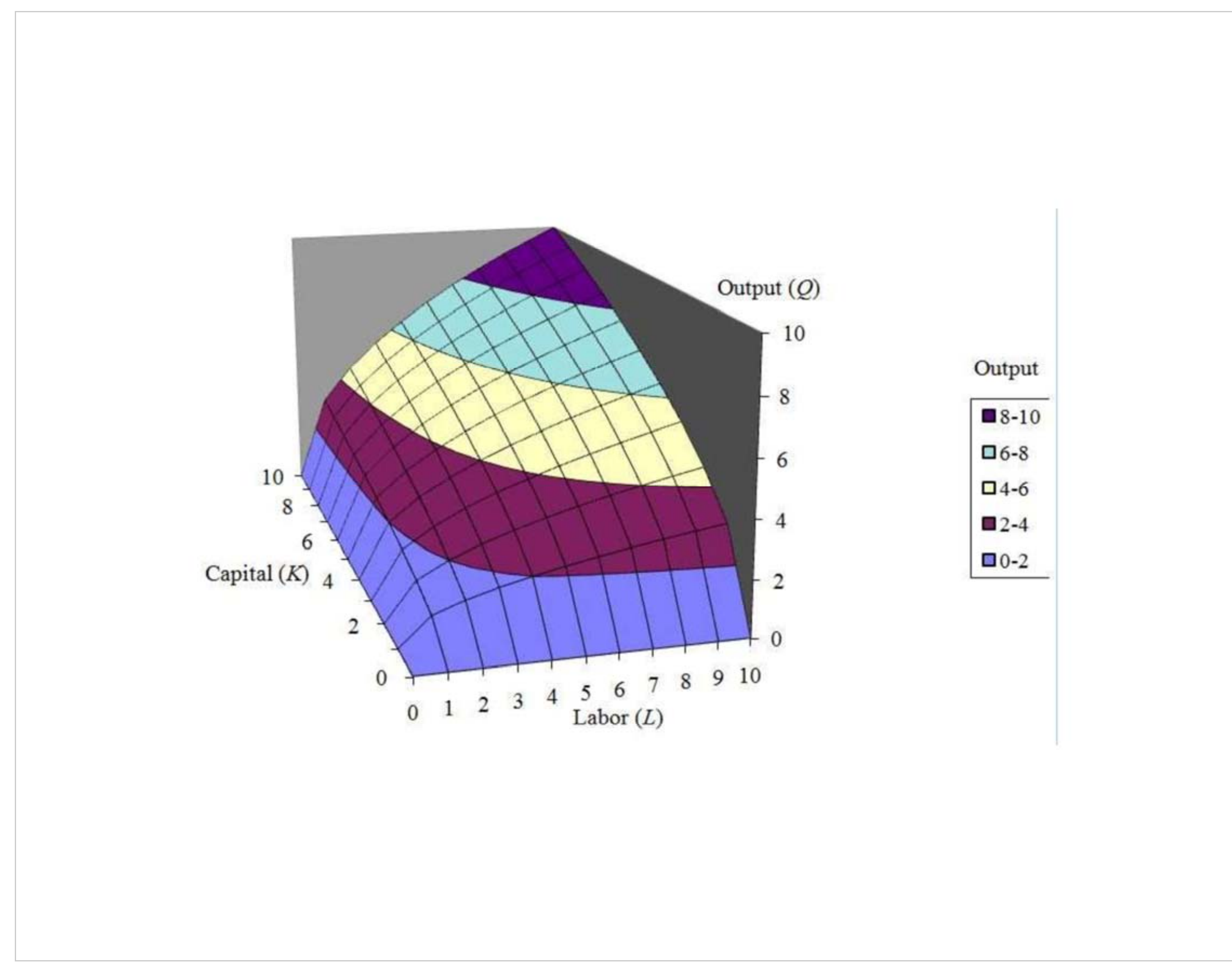

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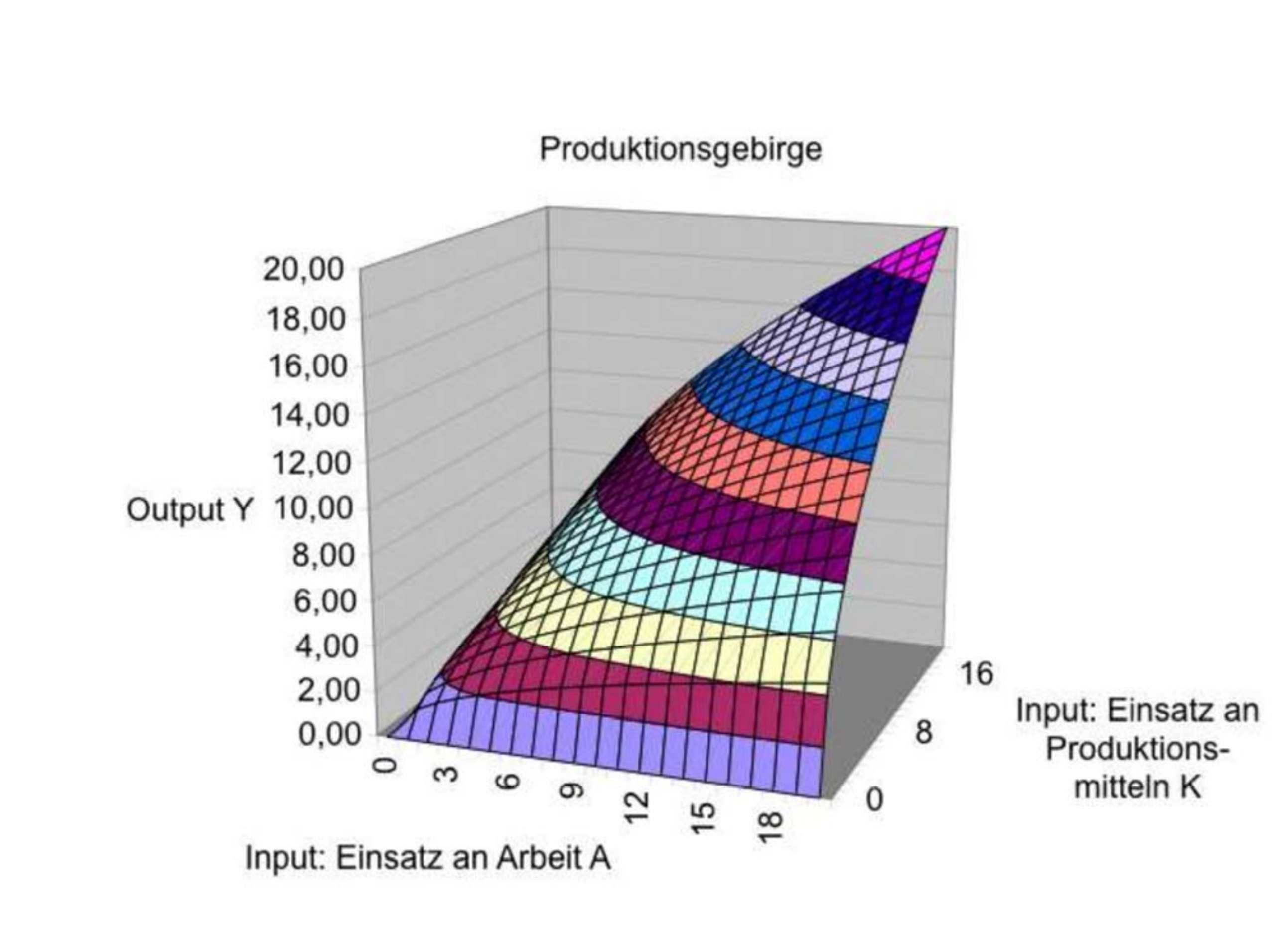

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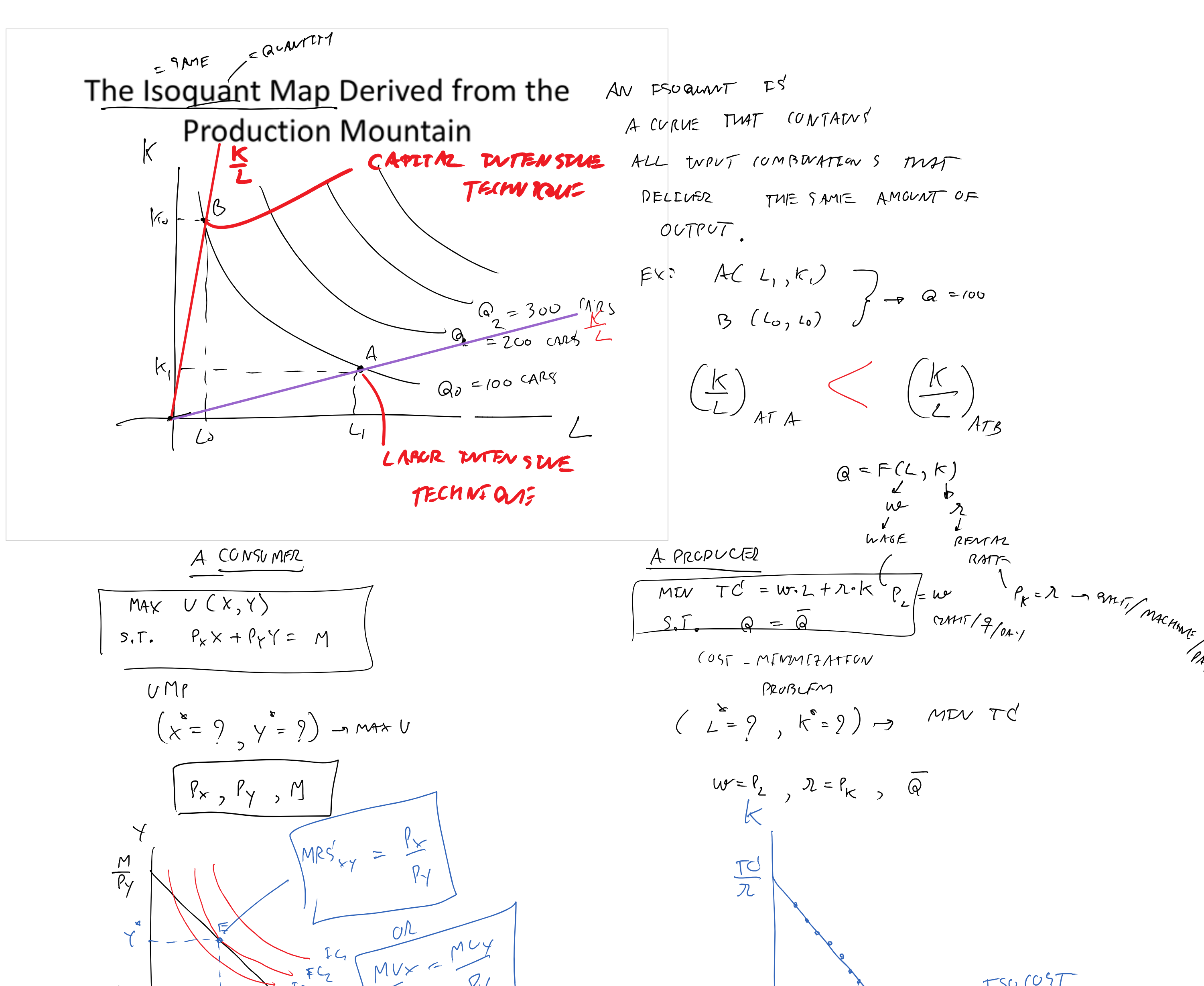

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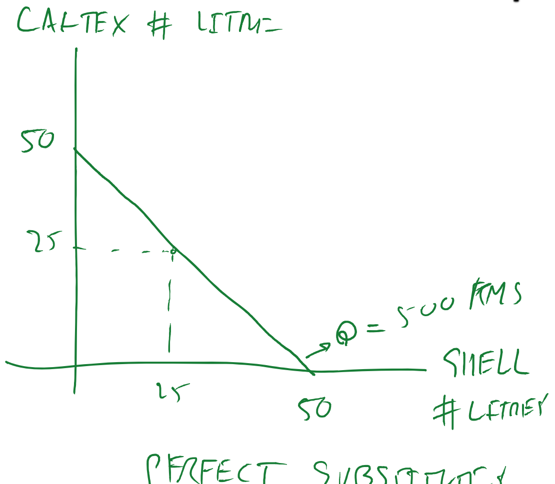
Isoquant Maps for Perfect Substitutes and Perfect Complements



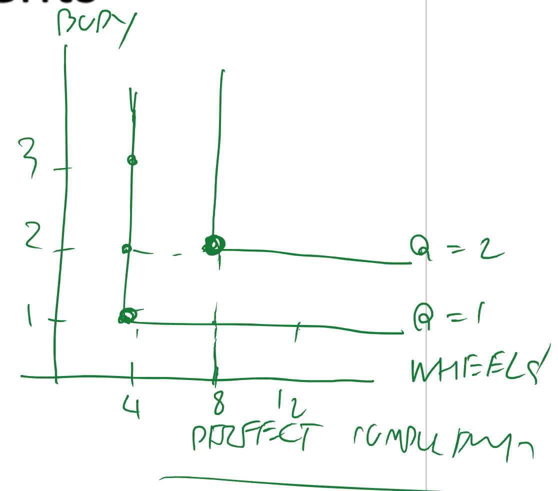
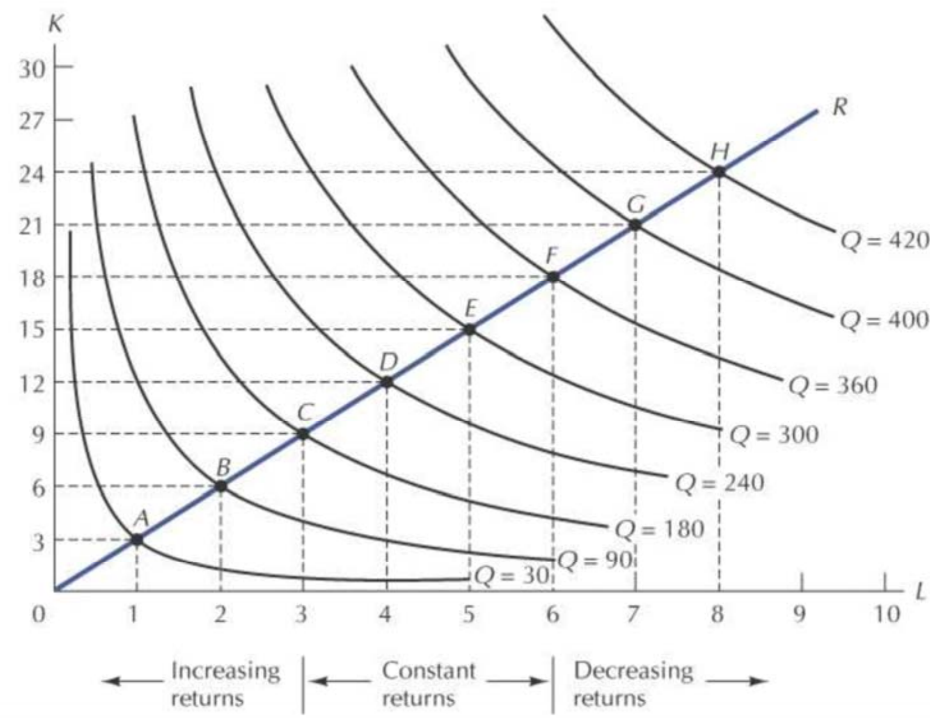


Figure 9-11: Returns to Scale Shown on the Isoquant Map



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Point	L	% change	K	% change	Q	% change	RTS
A	1	-	3	-	30	-	
B	2	100.0%	6	100.0%	90	200%	IRS
C	3	50.0%	9	50.0%	180	100%	IRS
D	4	33.3%	12	33.3%	240	33%	CRS
E	5	25.0%	15	25.0%	300	25%	CRS
F	6	20.0%	18	20.0%	360	20%	CRS
G	7	16.7%	21	16.7%	400	11%	DRS
H	8	14.3%	24	14.3%	420	5%	DRS

Note: Calculated from Figure 9-11: Returns to Scale Shown on the Isoquant Map, Frank (2006).

7.4

The Inflexibility of Short-Run Production

Figure 7.7

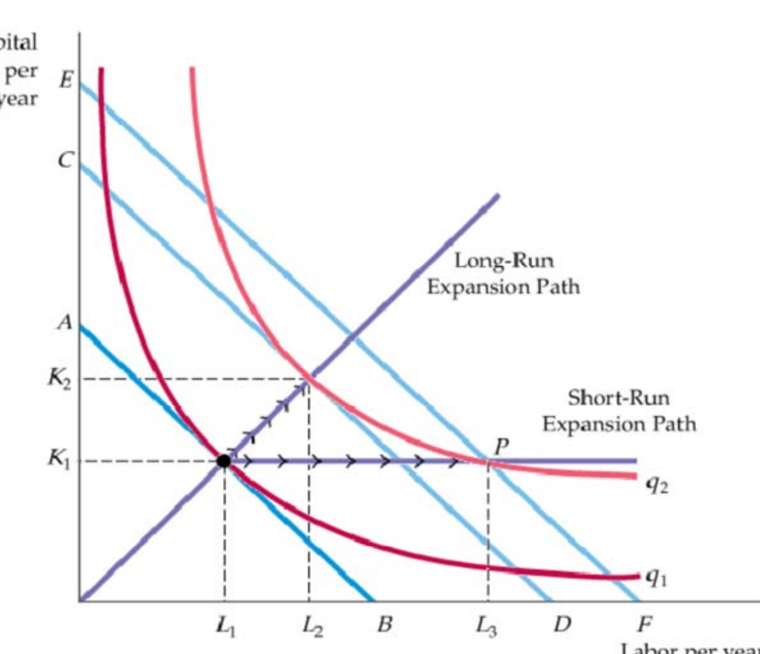
The Inflexibility of Short-Run Production

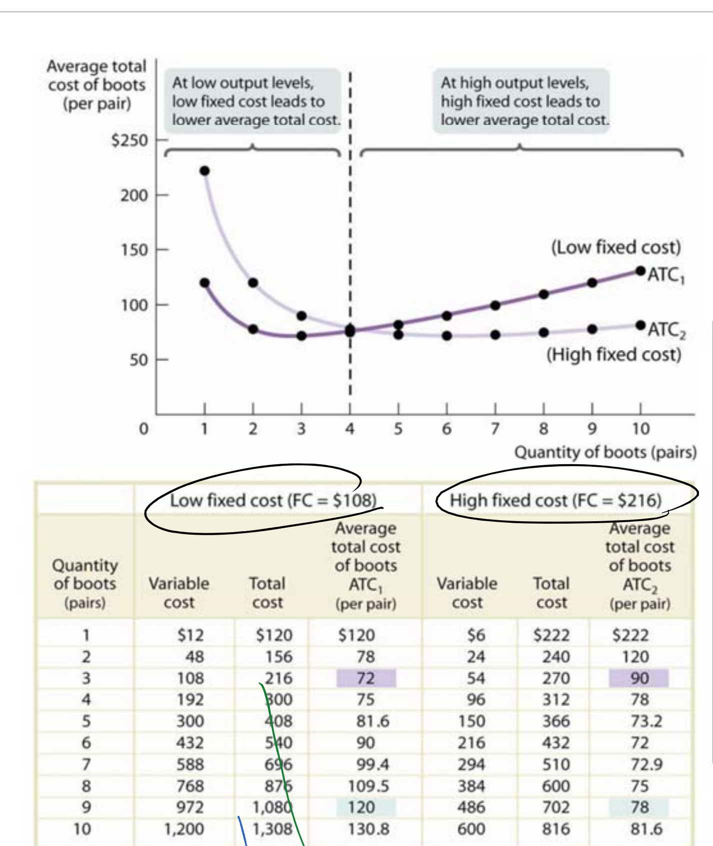
When a firm operates in the short run, its cost of production may not be minimized because of inflexibility in the use of capital inputs.

Output is initially at level q_1.

In the short run, output q_2 can be produced only by increasing labor from L_1 to L_3 because capital is fixed at K_1.

In the long run, the same output can be produced more cheaply by increasing labor from L_1 to L_2 and capital from K_1 to K_2.





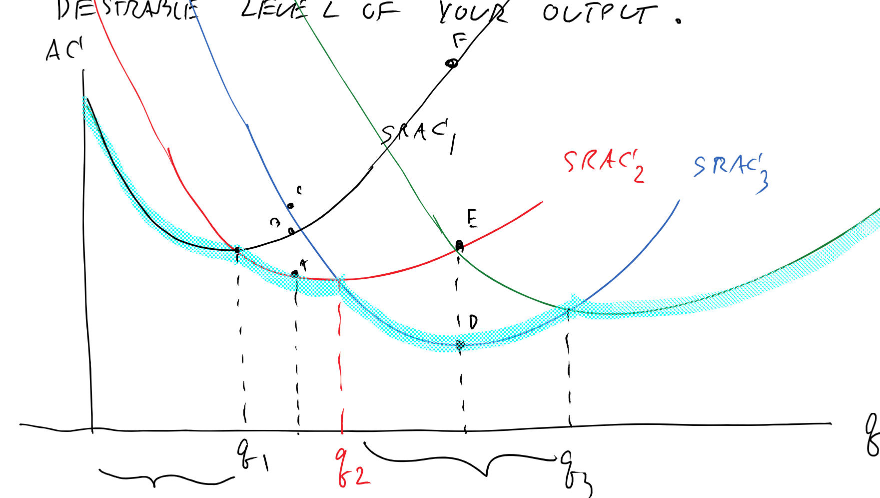
Quantity of boots (pairs)	Low fixed cost (FC = $108)			High fixed cost (FC = $216)		
	Variable cost	Total cost	Average total cost of boots ATC_1 (per pair)	Variable cost	Total cost	Average total cost of boots ATC_2 (per pair)
1	$12	$120	$120	$6	$222	$222
2	48	156	78	24	240	120
3	108	216	72	54	270	90
4	192	300	75	96	312	78
5	300	408	81.6	150	366	73.2
6	432	540	90	216	432	72
7	588	696	99.4	294	510	72.9
8	768	876	109.5	384	600	75
9	972	1,080	120	486	702	78
10	1,200	1,308	130.8	600	816	81.6

Choosing the Level of Fixed Cost for Ben's Boots

There is a trade-off between higher fixed cost and lower variable cost for any given output level, and vice versa.
But as output goes up, average total cost is lower with the higher amount of fixed cost.

14

NOW, WE ARE IN LONG-RUN PRODUCTION. ALL INPUTS CAN BE VARIED, AMOUNT OF CAPITAL (K) CAN BE CHOSEN TO MATCH W/ YOUR DESIRABLE LEVEL OF YOUR OUTPUT.



LRAC (LONG-RUN AVERAGE COST) REPRESENT THE LOWEST AVERAGE COST OF PRODUCTION IN THE LONG RUN WHEN A MANAGER IS FREE TO CHOOSE AN APPROPRIATE LEVEL OF K TO MINIMIZE HIS AVERAGE COST OR UNIT COST.

i.e., IF $q \leq 1$, FACTORY W/ 1 MACHINE MINIMIZES YOUR AC.

i.e., IF $q \leq 1$, FACTORY W/ 1 MACHINE MINIMIZES YOUR AC.

IF $q_1 < q \leq 2$, " 2 MACHINES "

IF $q_2 < q \leq q_3$, " 3 MACHINES "

IF $q > q_3$, " 4 MACHINES "

LRAC IS AN ENVELOP CURVE OF MANY SRACs.

(ห่อหุ้ม)

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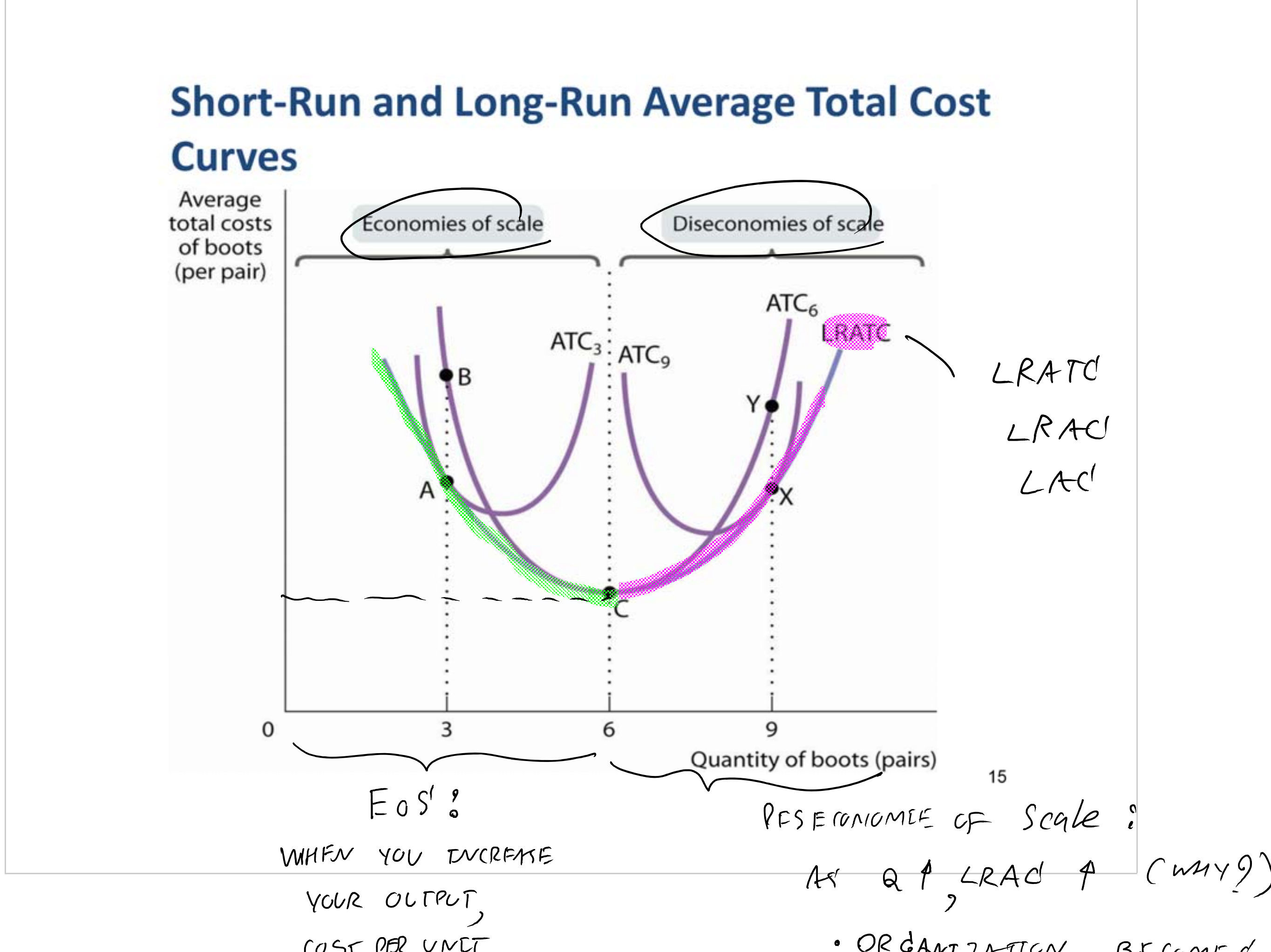

YOUR OUTPUT, COST PER UNIT FALLS

- SPECIALIZATION
- BETTER PRICE FOR BUYING RAW MATERIALS FROM SUPPLIERS

- ORGANIZATION OR FIRM BECOMES TOO BIG TO MANAGE
- MISCOMMUNICATION AMONG SEVERAL DEPARTMENTS IN THE FIRM.

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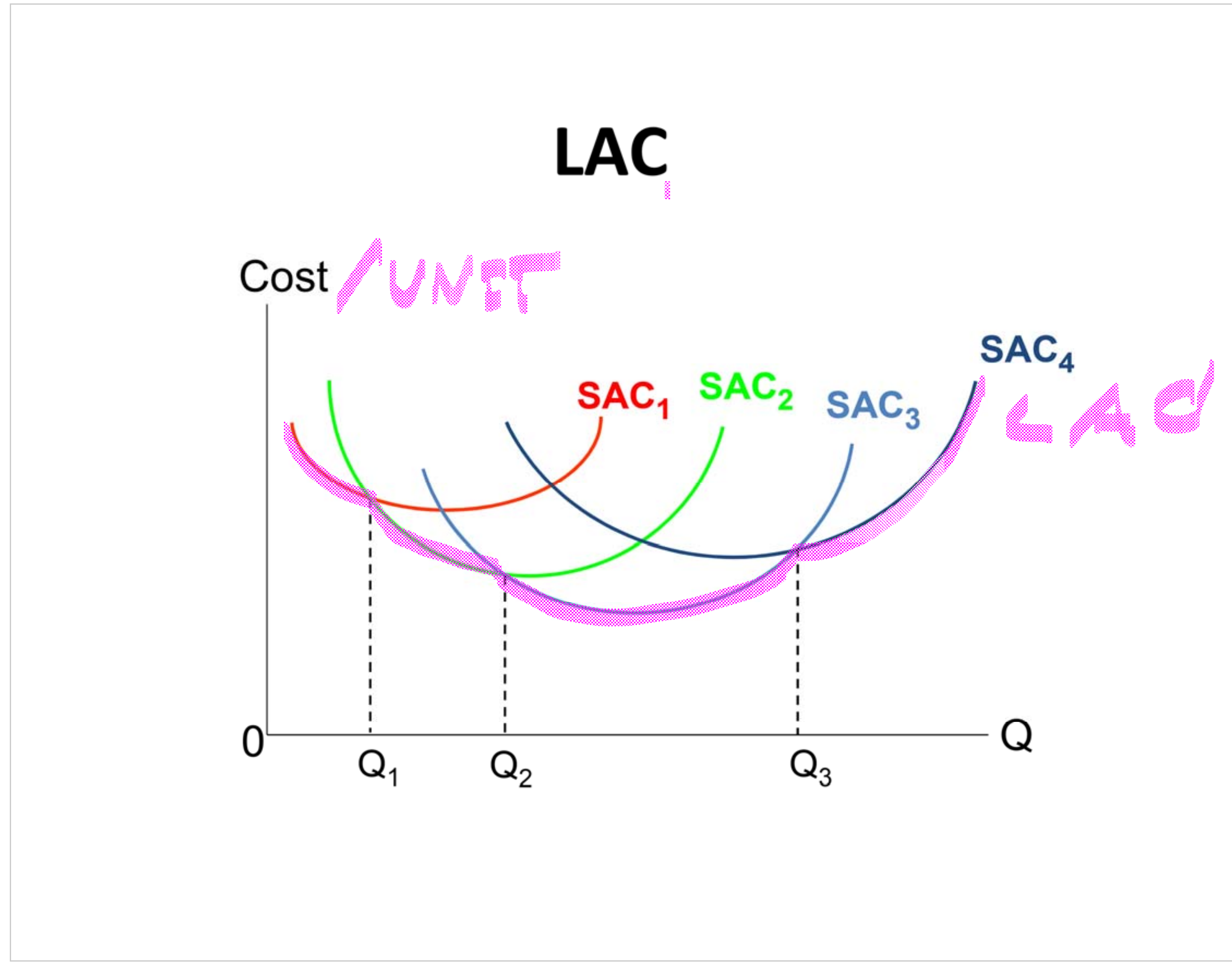

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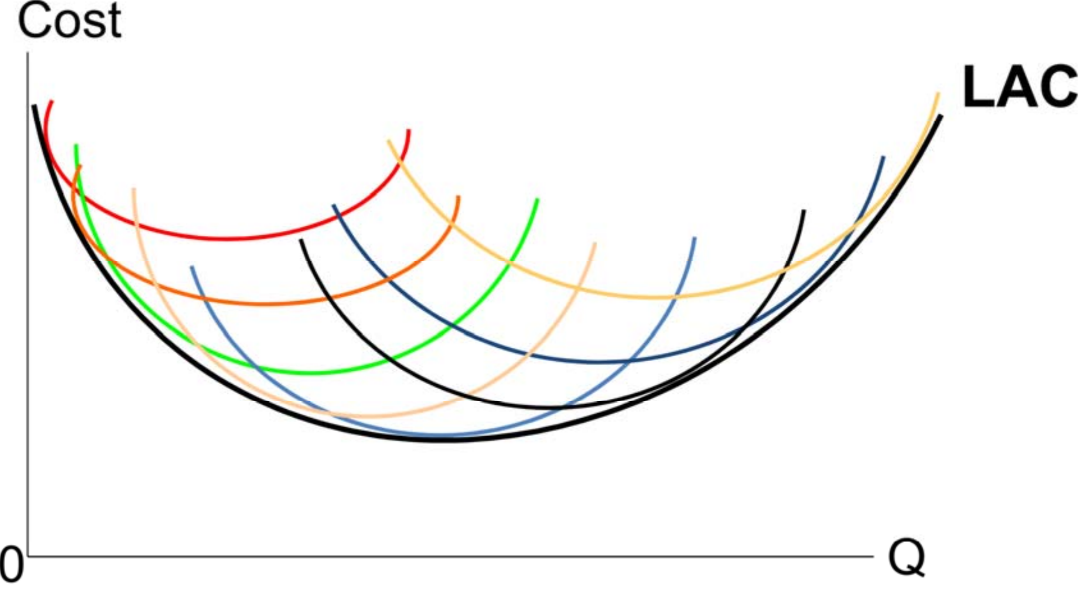

Why would a bathroom equipment manufacturer bake the image of a housefly onto the center of its ceramic urinals?

This example is base on Stefan Verhagen, “Fly in the Pot,” Cornell Business, April 21, 1992.