EE311: Microeconomics Theory

Supplement Slides on Production and costs in the Short run and in the long run

Figure 9.2: The Production Function

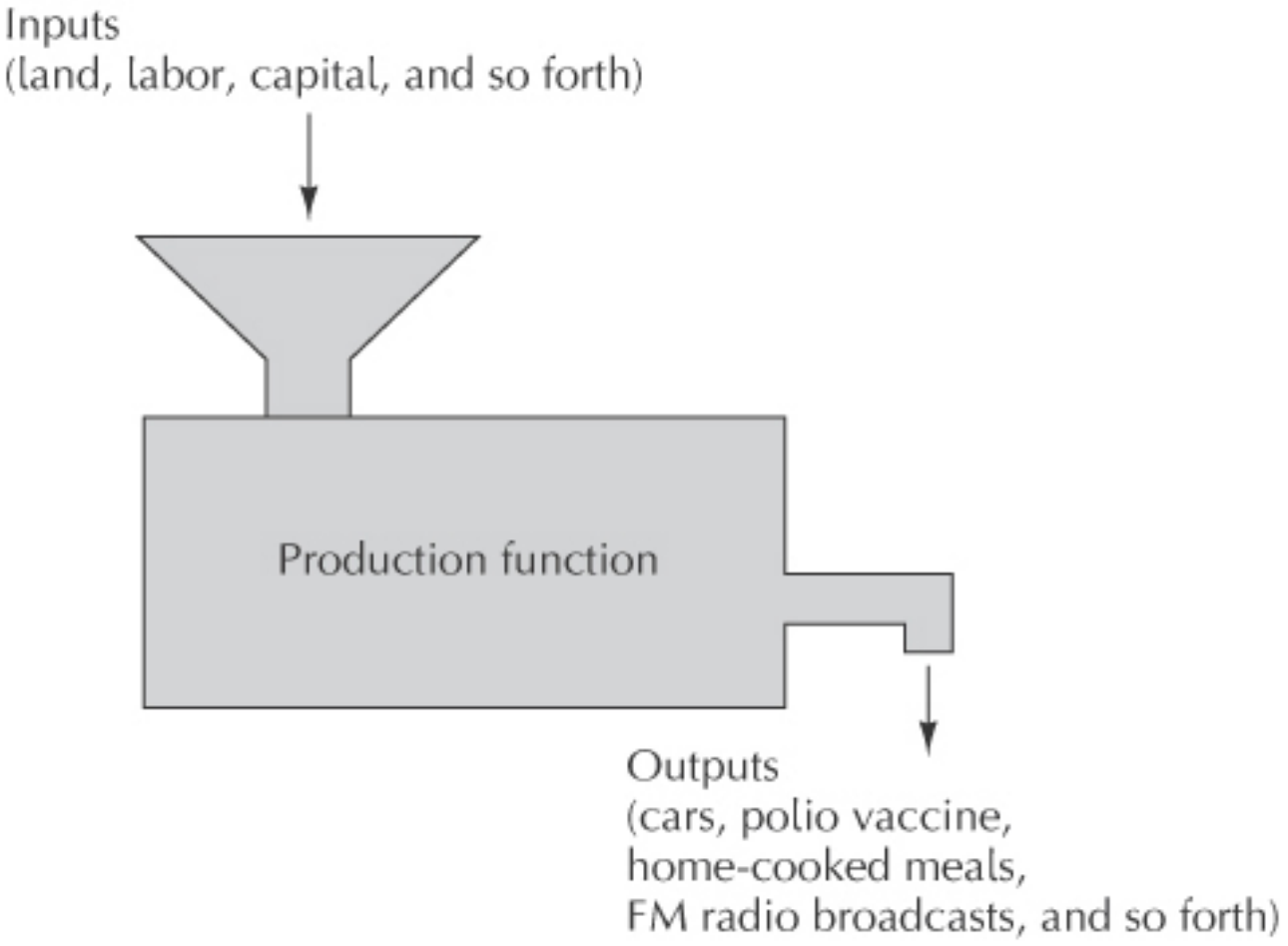


Figure 9.3: A Specific Short-Run Production Function

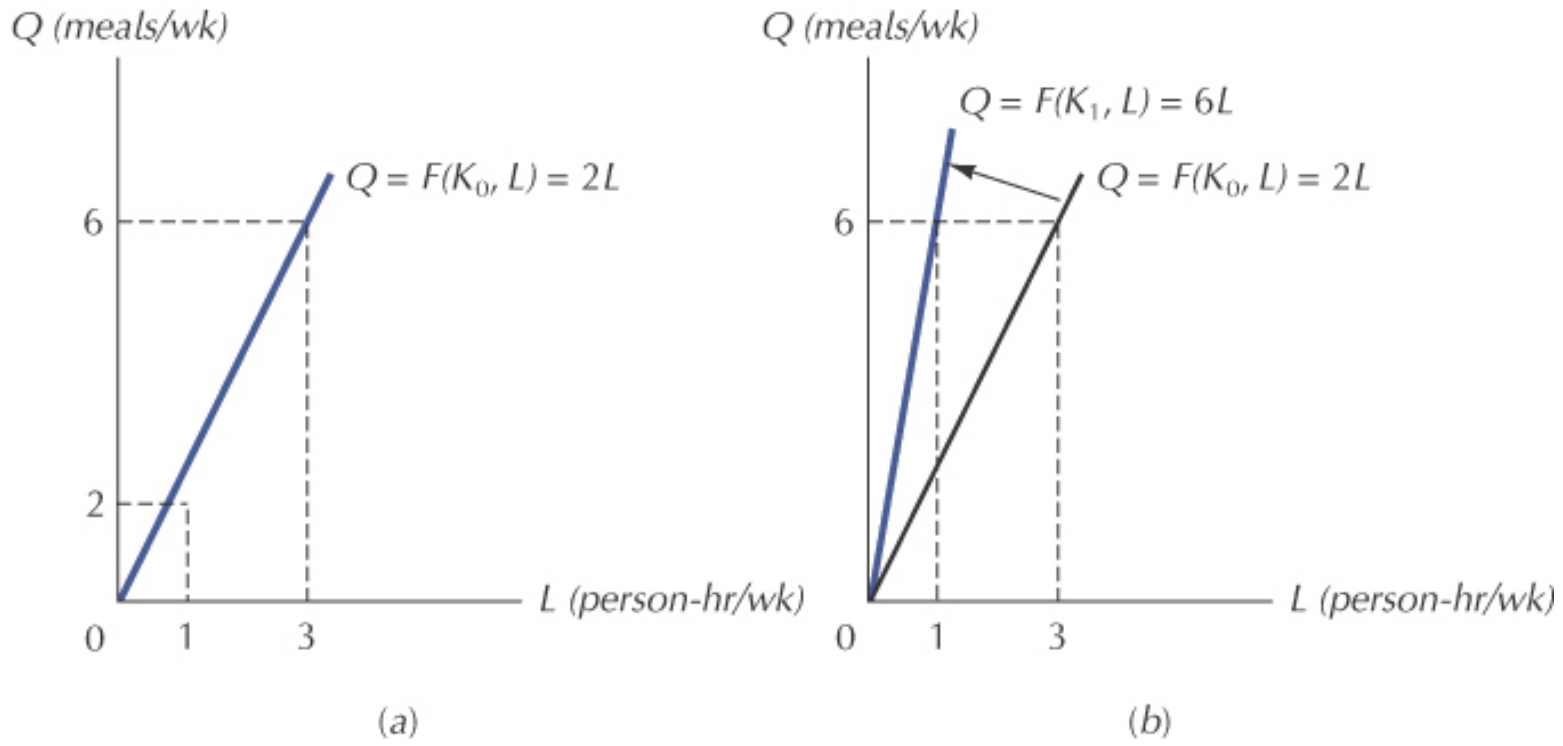
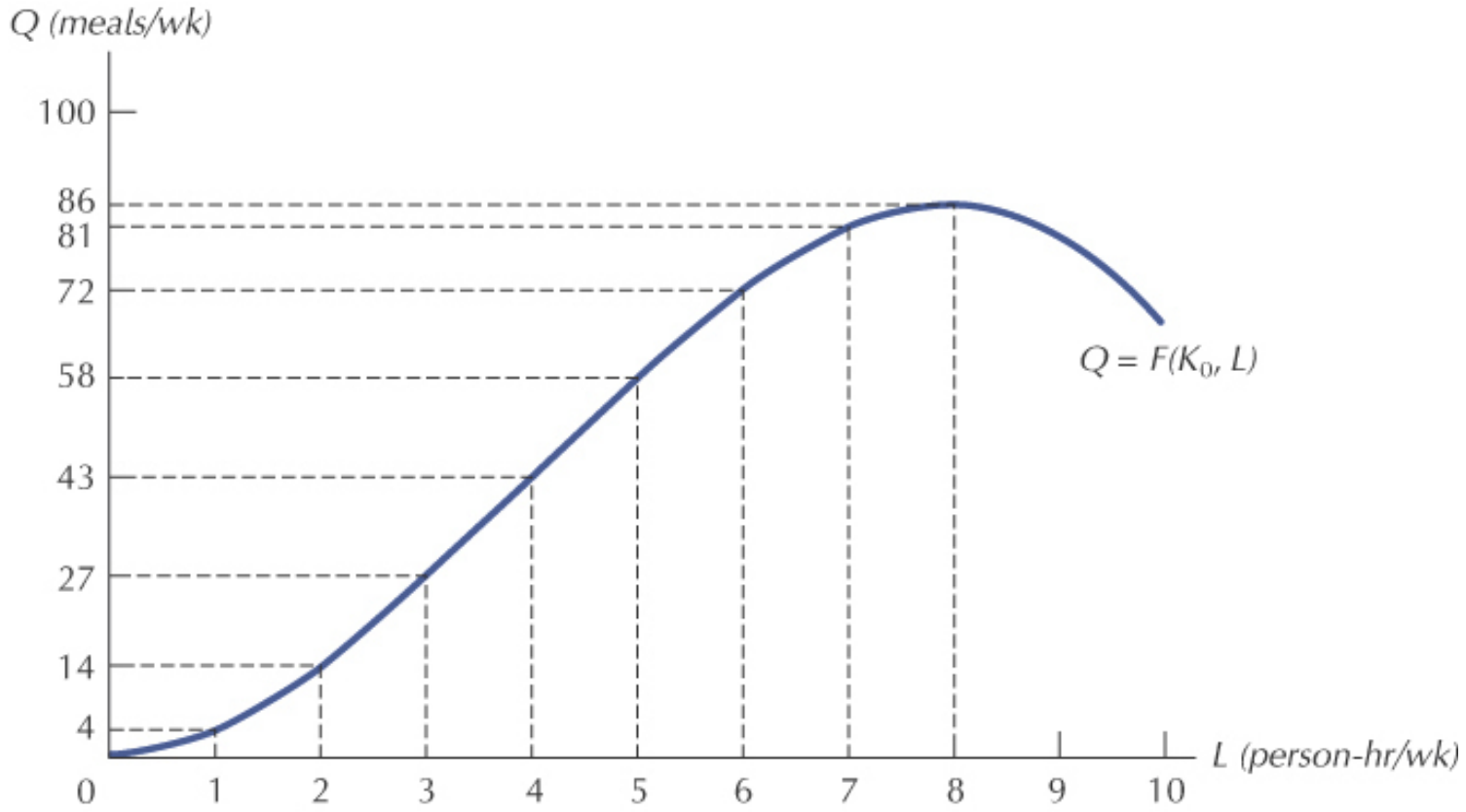


Figure 9.4: Another Short-Run Production Function



Short-run Production Function

- ***Law of diminishing returns:*** **if other inputs are fixed, the increase in output from an increase in the variable input must eventually decline.**

Why can't all the world's people be fed from the amount of grain grown in a single flowerpot?

The law of diminishing returns suggests that no matter how much labor, fertilizer, water, seed, capital equipment, and other inputs were used, only a limited amount of grain could be grown in a single flowerpot. With the land input fixed at such a low level, increases in other inputs would quickly cease to have any effect on total output.

Figure 9.6: The Marginal Product of a Variable Input

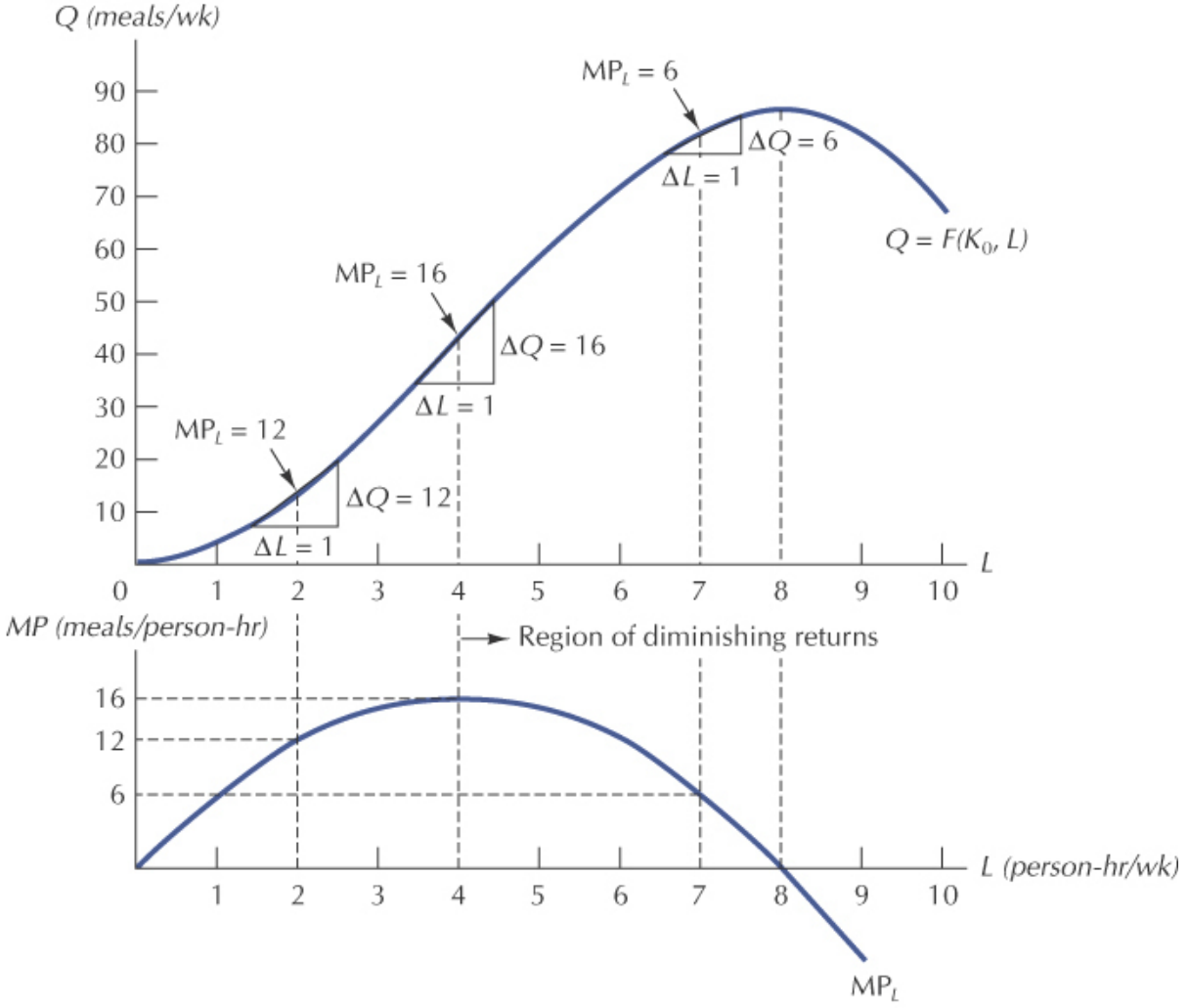


Figure 9.7: Total, Marginal, and Average Product Curves

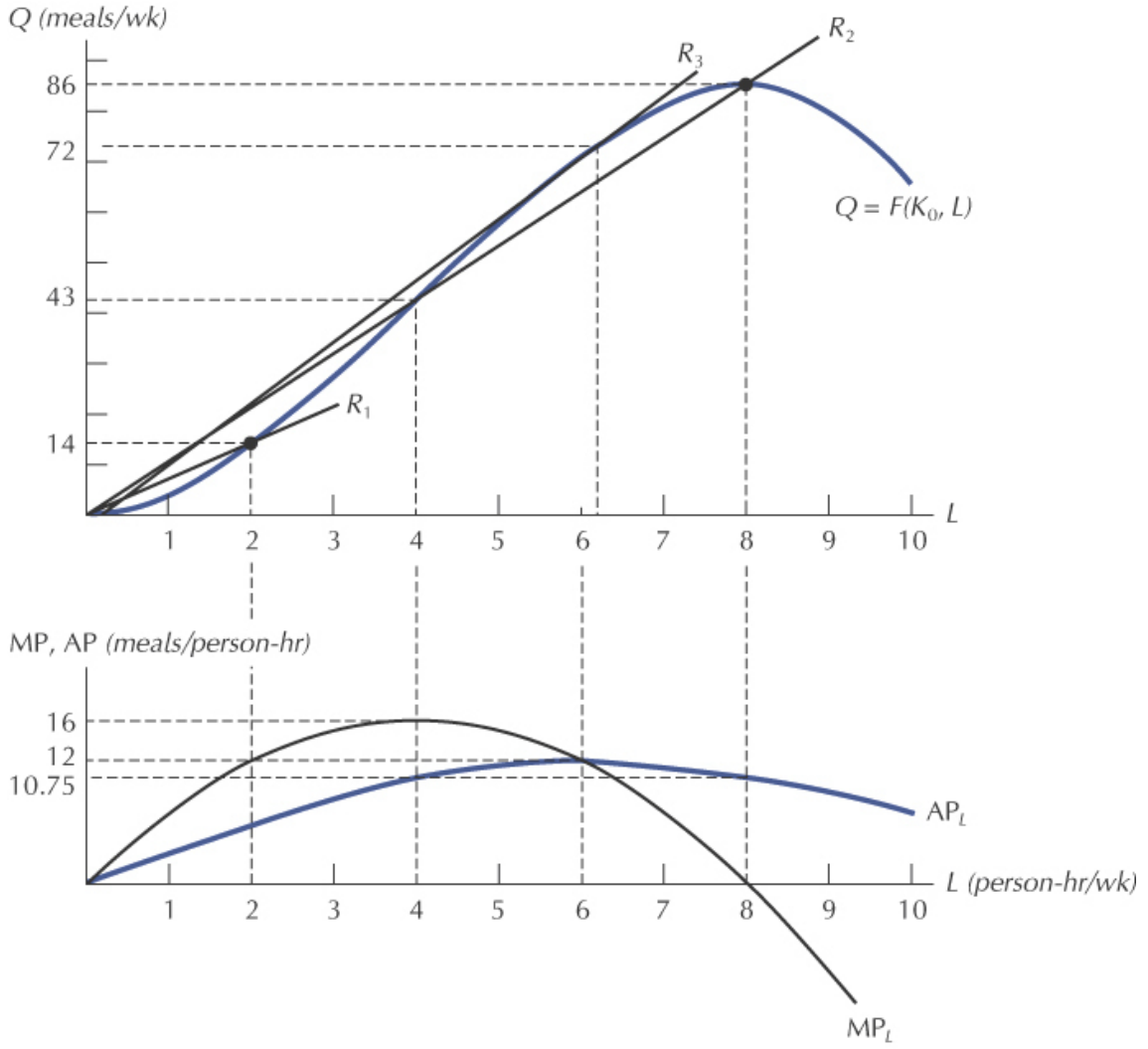
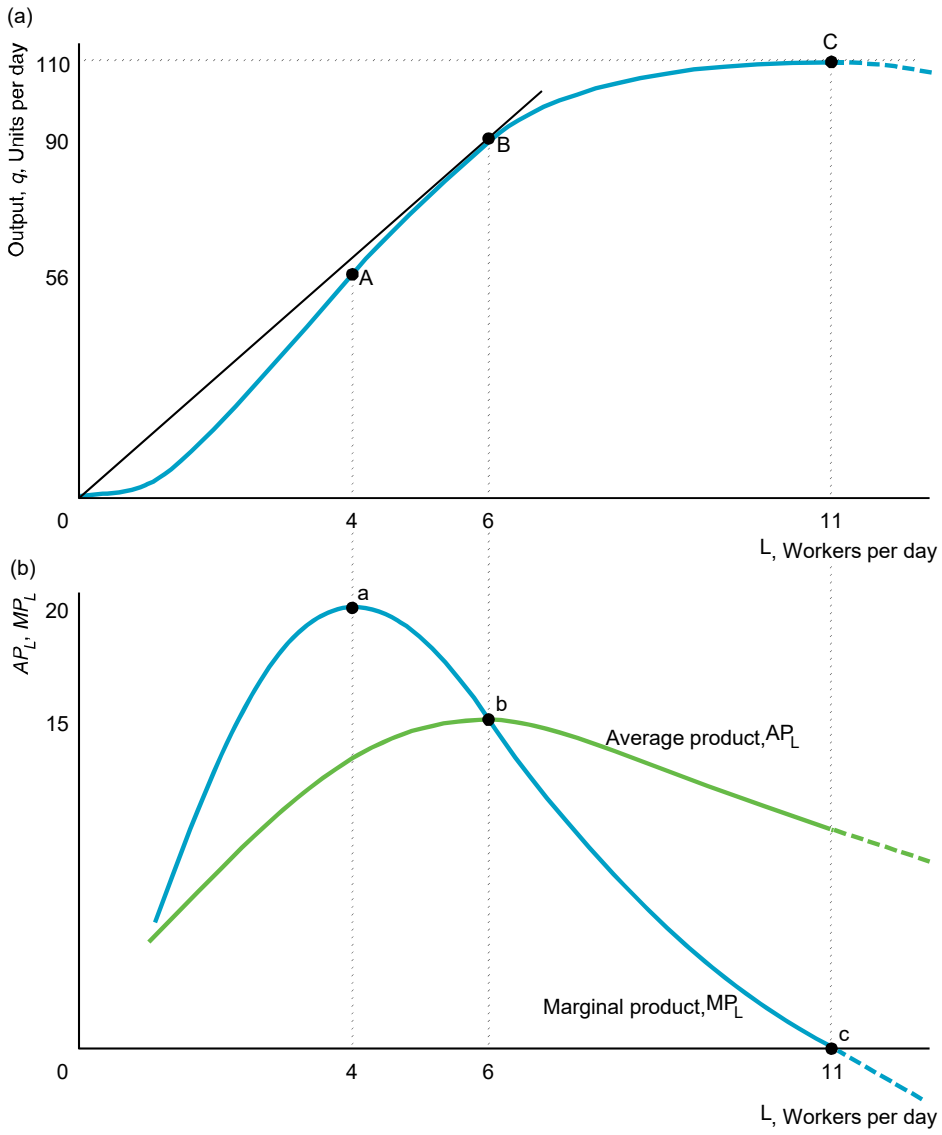


Table 6.1 Total Product, Marginal Product, and Average Product of Labor with Fixed Capital

Capital, $\bar{K}$	Labor, L	Output, Total Product of Labor, Q	Marginal Product of Labor, $MP_L = \Delta Q/\Delta L$	Average Product of Labor, $AP_L = Q/L$
8	0	0		
8	1	5	5	5
8	2	18	13	9
8	3	36	18	12
8	4	56	20	14
8	5	75	19	15
8	6	90	15	15
8	7	98	8	14
8	8	104	6	13
8	9	108	4	12
8	10	110	2	11
8	11	110	0	10
8	12	108	–2	9
8	13	104	–4	8

Figure 6.1 Production Relationships with Variable Labor



The Practical Significance Of The Average marginal Distinction

- Suppose you own a fishing fleet consisting of a given number of boats, and can send your boats in whatever numbers you wish to either of two ends of an extremely wide lake, east or west. Under your current allocation of boats, the ones fishing at the east end return daily with 100 pounds of fish each, while those in the west return daily with 120 pounds each. The fish populations at each end of the lake are completely independent, and your current yields can be sustained indefinitely.

- ***Should you alter your current allocation of boats?***

TABLE 8.2

Average Product, Total Product, and Marginal Product (lb/day) for Two Fishing Areas

Number of boats	East end			West end		
	AP	TP	MP	AP	TP	MP
0	0	0		0	0	
			100			130
1	100	100		130	130	
			100			110
2	100	200		120	240	
			100			90
3	100	300		110	330	
			100			70
4	100	400		100	400	

The average catch per boat is constant at 100 pounds per boat for boats sent to the east end of the lake. The average catch per boat is a declining function of the number of boats sent to the west end.

The Practical Significance Of The Average marginal Distinction

- *The general rule for allocating an input efficiently in such cases is to allocate the next unit of the input to the production activity where its marginal product is highest.*

Table 7.1 Variation of Short-Run Cost with Output

Output, q	Fixed Cost, FC	+	Variable Cost, VC	=	Total Cost, TC	Marginal Cost, MC	Average Fixed Cost, $AFC = F/q$	Average Variable Cost, $AVC = VC/q$	Average Cost, $AC = C/q$
0	48		0		48				
1	48		25		73	25	48	25	73
2	48		46		94	21	24	23	47
3	48		66		114	20	16	22	38
4	48		82		130	16	12	20.5	32.5
5	48		100		148	18	9.6	20	29.6
6	48		120		168	**20**	8	**20**	28
7	48		141		189	21	6.9	20.1	27
8	48		168		216	**27**	6	21	**27**
9	48		198		246	30	5.3	22	27.3
10	48		230		278	32	4.8	23	27.8
11	48		272		320	42	4.4	24.7	29.1
12	48		321		369	49	4.0	26.8	30.8

Figure 7.1 Short-Run Cost Curves

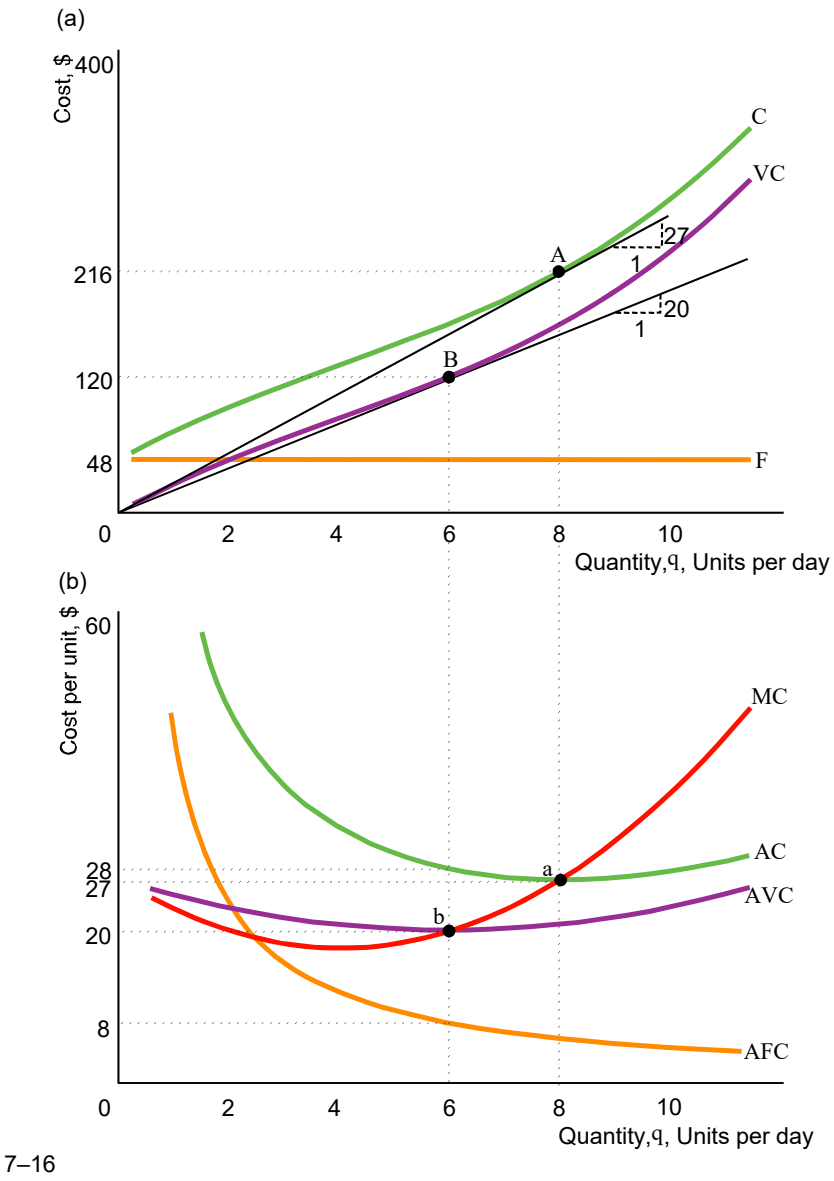


Figure 9.8: Part of an Isoquant Map for the Production Function

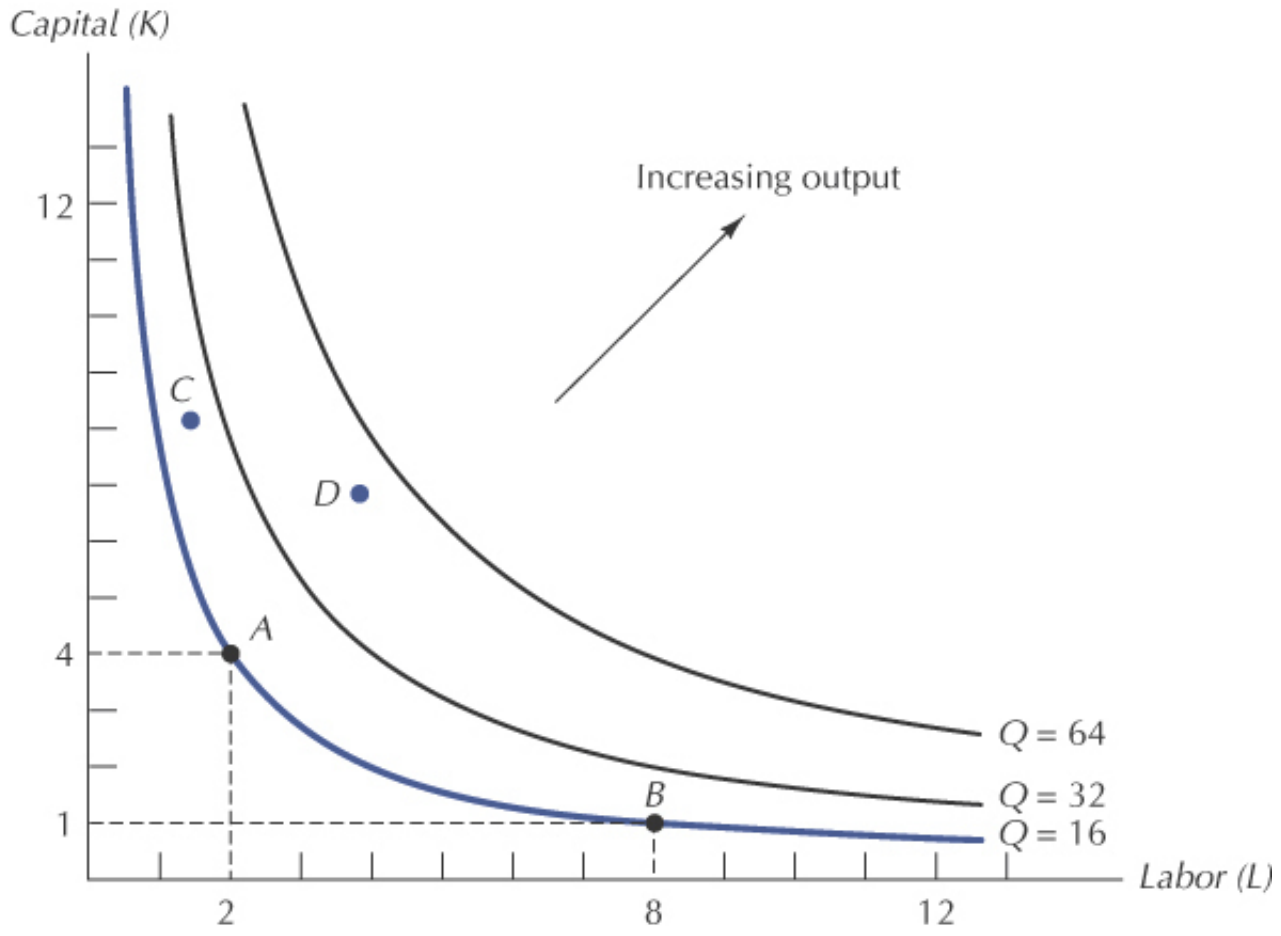


Figure 9.9: The Marginal Rate of Technical Substitution

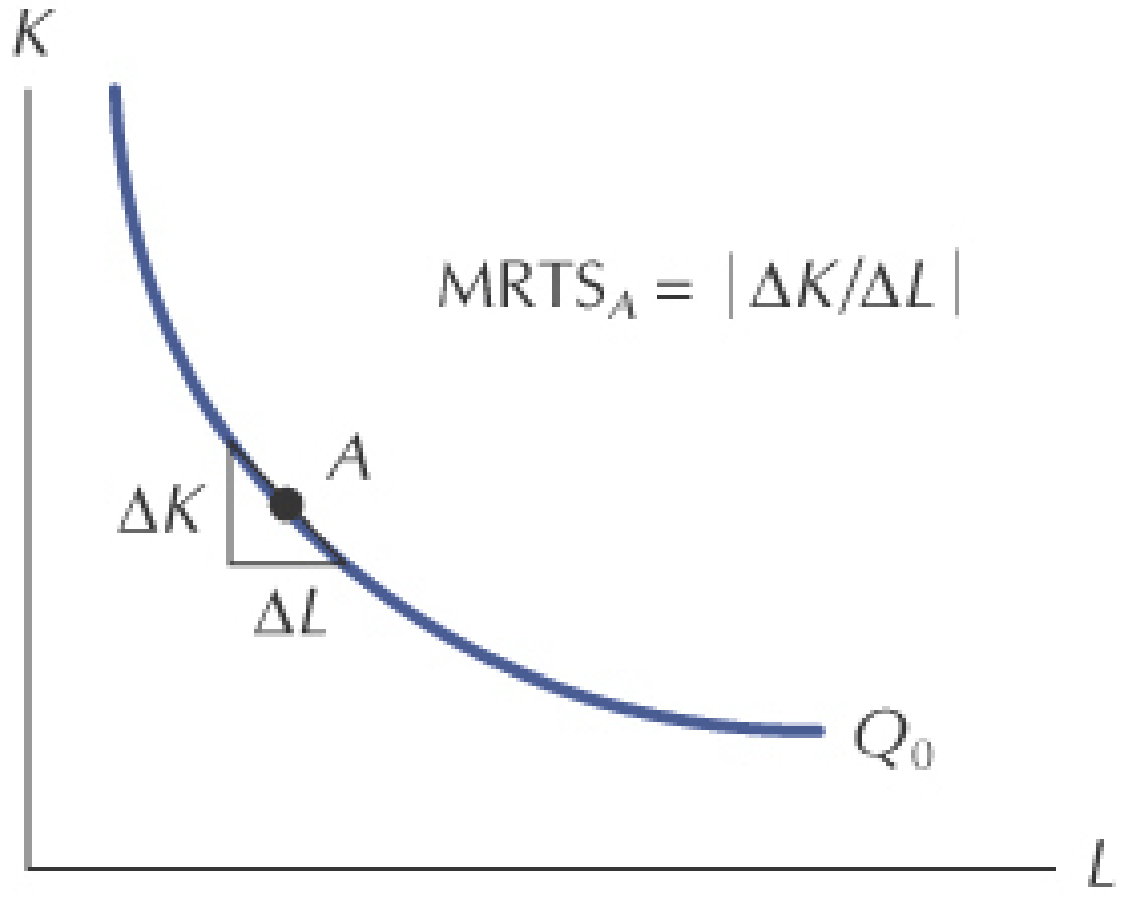
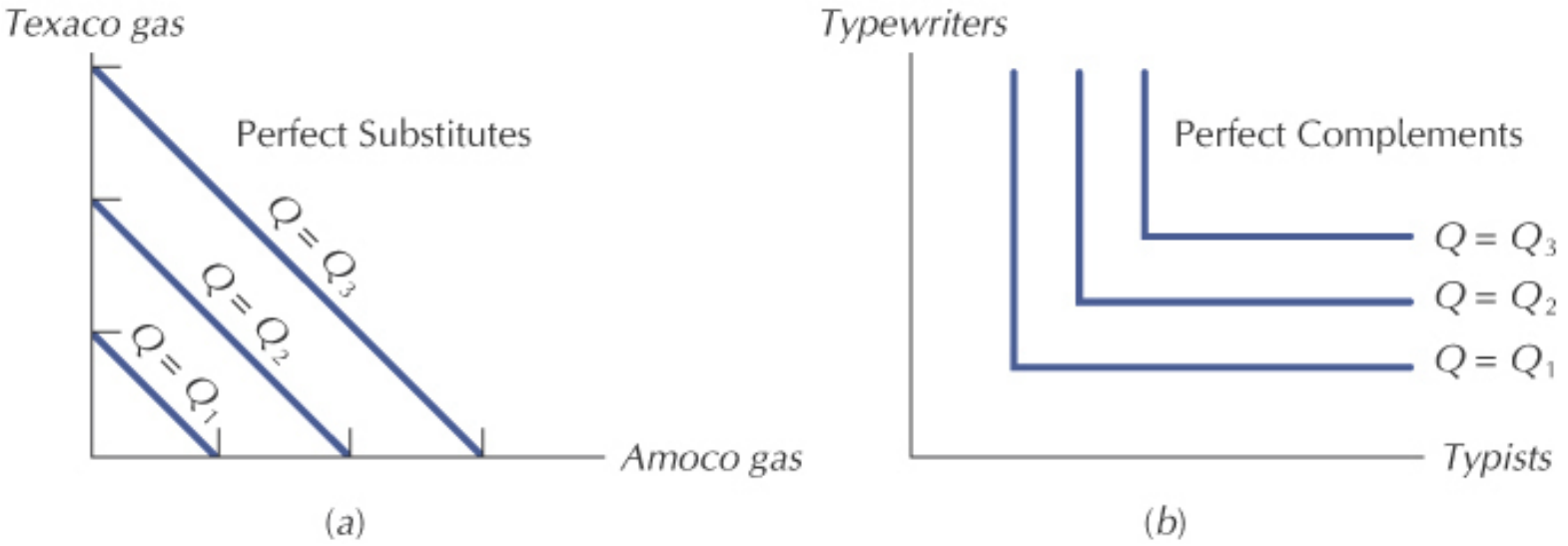


Figure 9.10: Isoquant Maps for Perfect Substitutes and Perfect Complements



Returns To Scale

- ***Increasing returns to scale:*** the property of a production process whereby a proportional increase in every input yields a more than proportional increase in output.

- ***Constant returns to scale:*** the property of a production process whereby a proportional increase in every input yields an equal proportional increase in output.

- ***Decreasing returns to scale:*** the property of a production process whereby a proportional increase in every input yields a less than proportional increase in output.

Figure 9.11: Returns to Scale Shown on the Isoquant Map

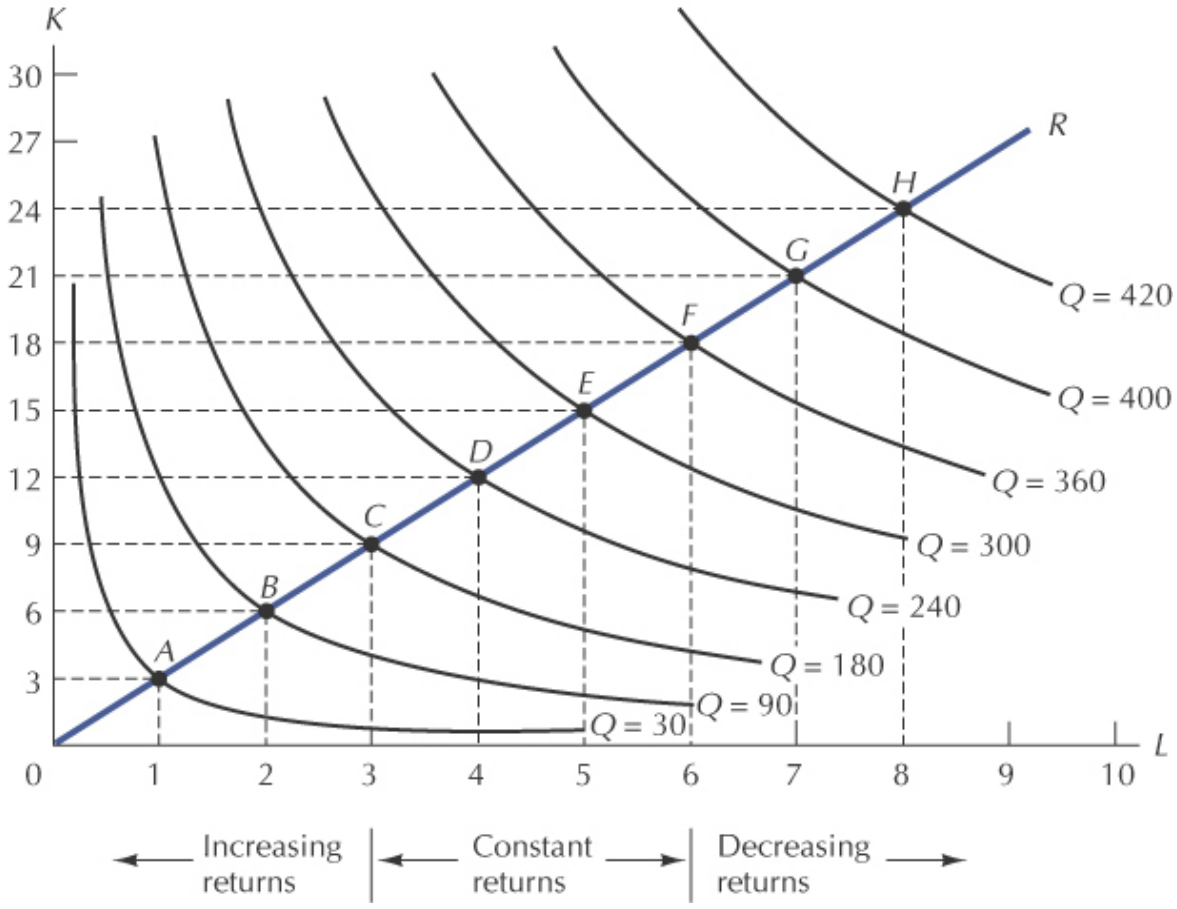


Figure A9.4: The Production Mountain

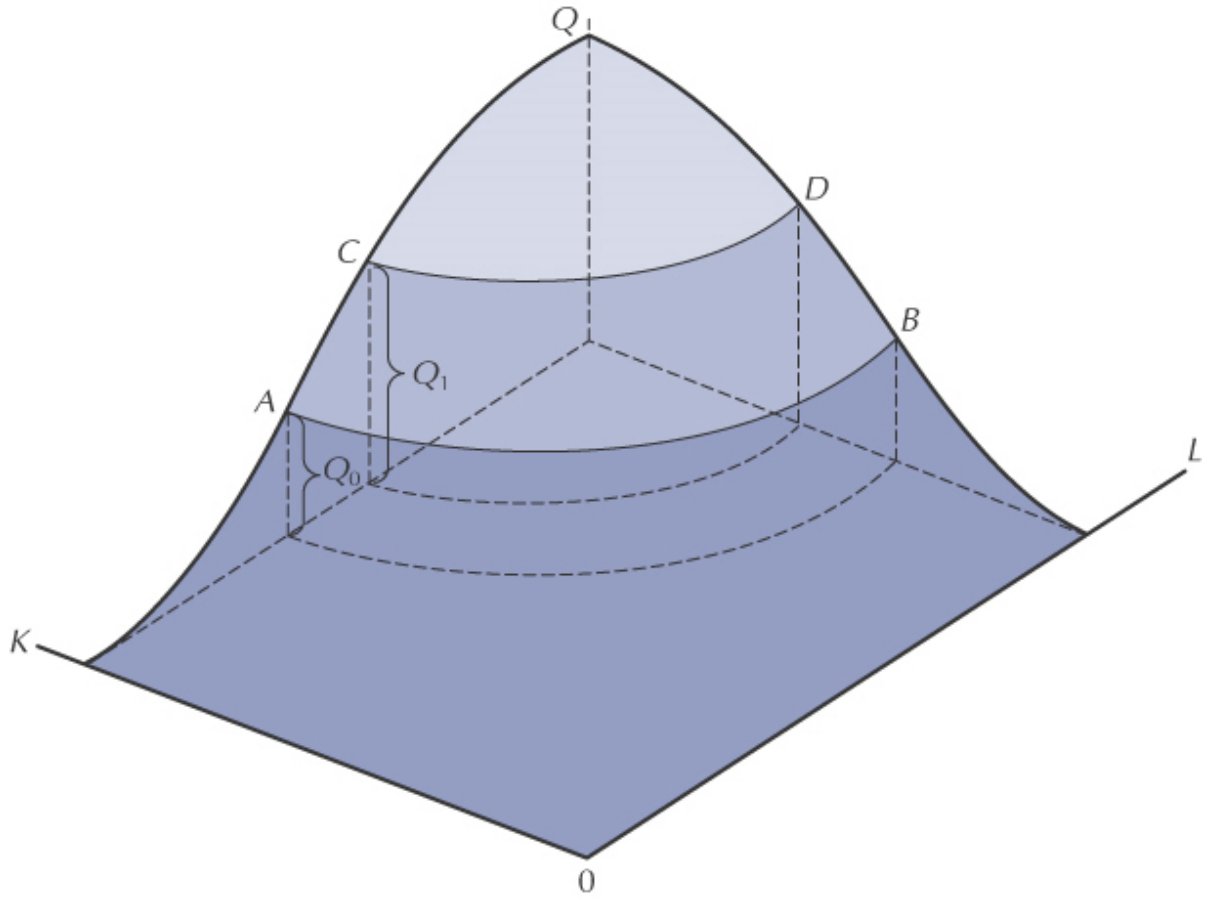


Figure A9.5: The Isoquant Map Derived from the Production Mountain

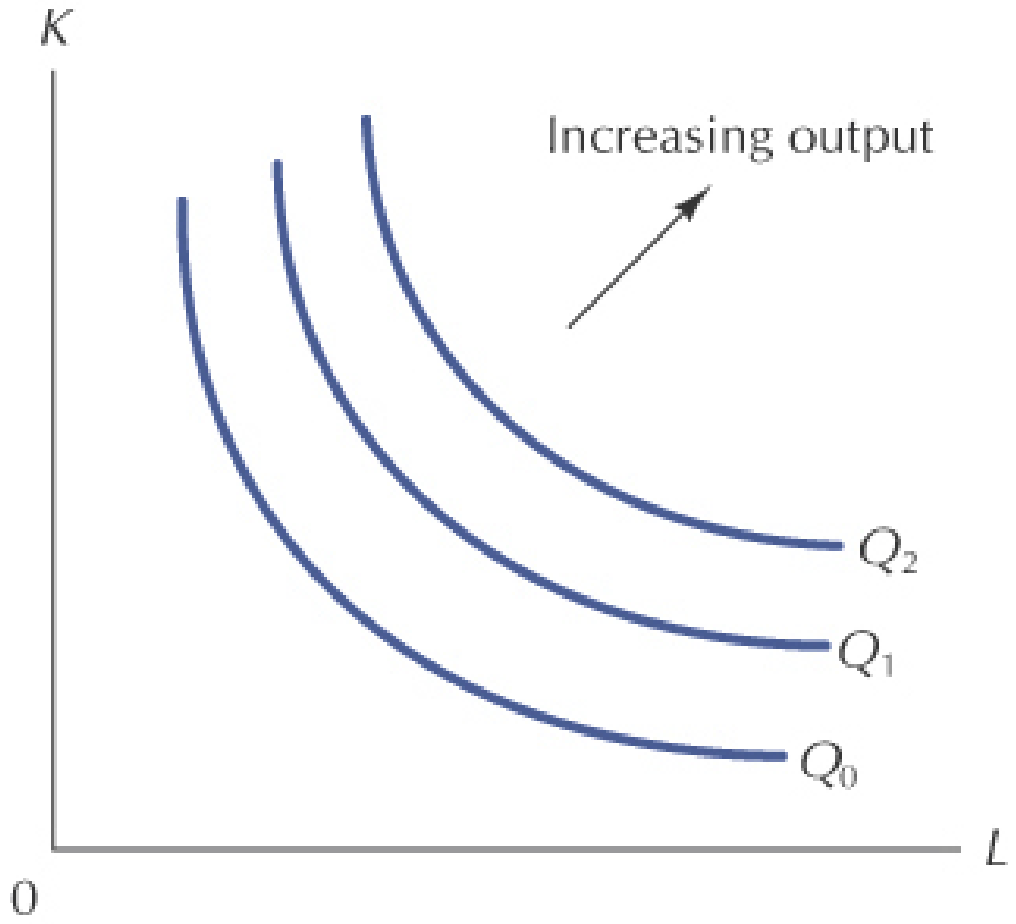


Figure A9.6: Isoquant Map for the Cobb-Douglas Production Function Q = $K^{1/2}L^{1/2}$

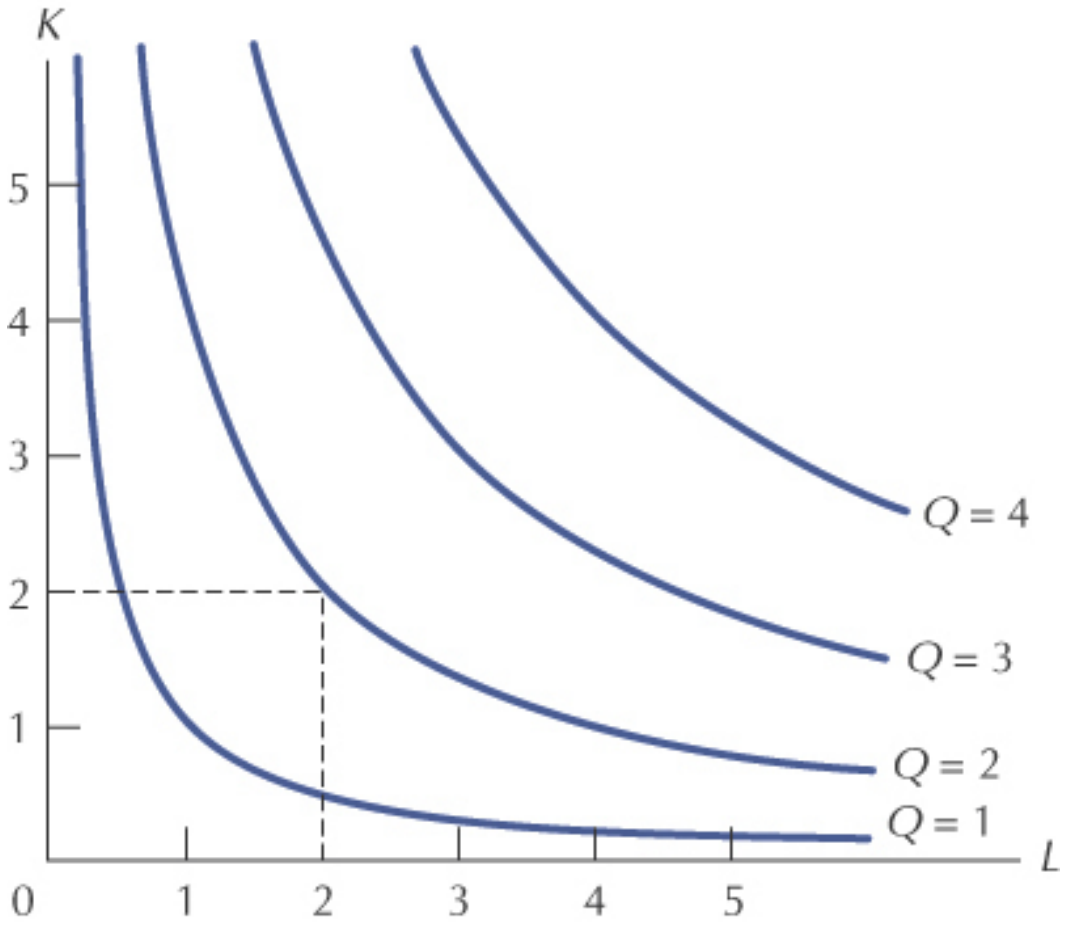


Figure A9.7: Isoquant Map for the Leontief Production Function Q = min (2*K*,3*L*)

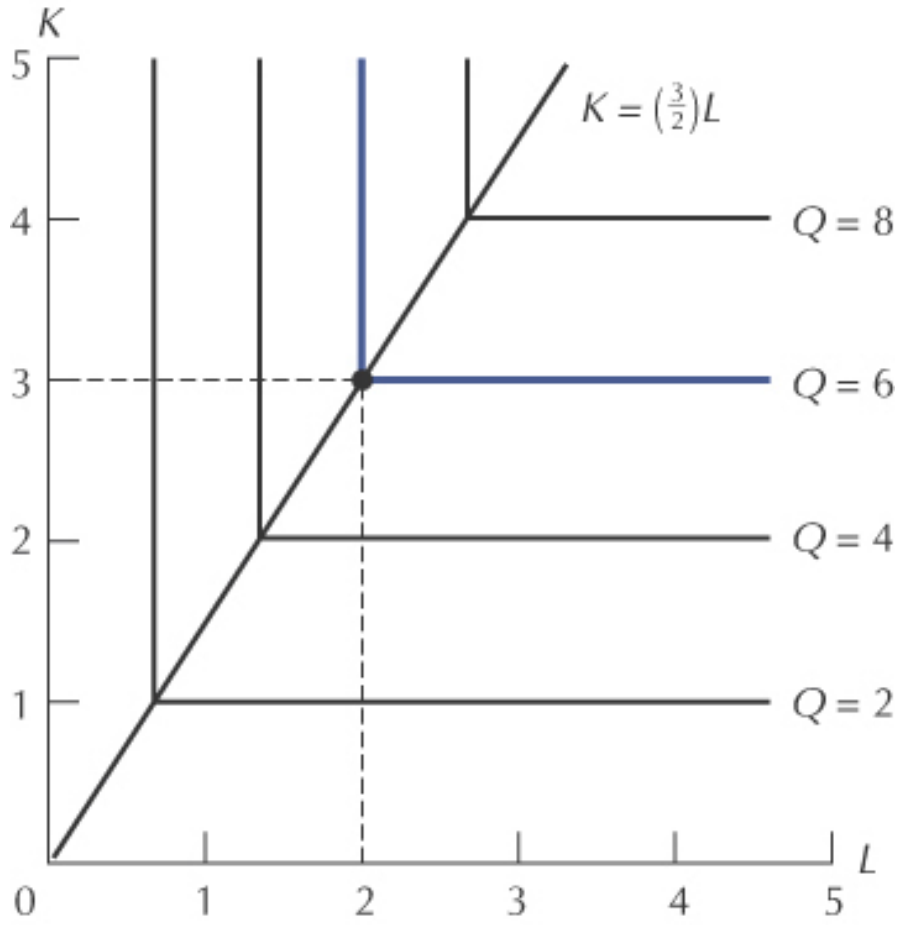


Table 7.3 Bundles of Labor and Capital That Cost the Firm $100

Bundle	Labor, L	Capital, K	Labor Cost, $wL = \$5L$	Capital Cost, $rK = \$10K$	Total Cost, $wL + rK$
a	20	0	$100	$0	$100
b	14	3	$70	$30	$100
c	10	5	$50	$50	$100
d	6	7	$30	$70	$100
e	0	10	$0	$100	$100

Figure 7.4 A Family of Isocost Lines

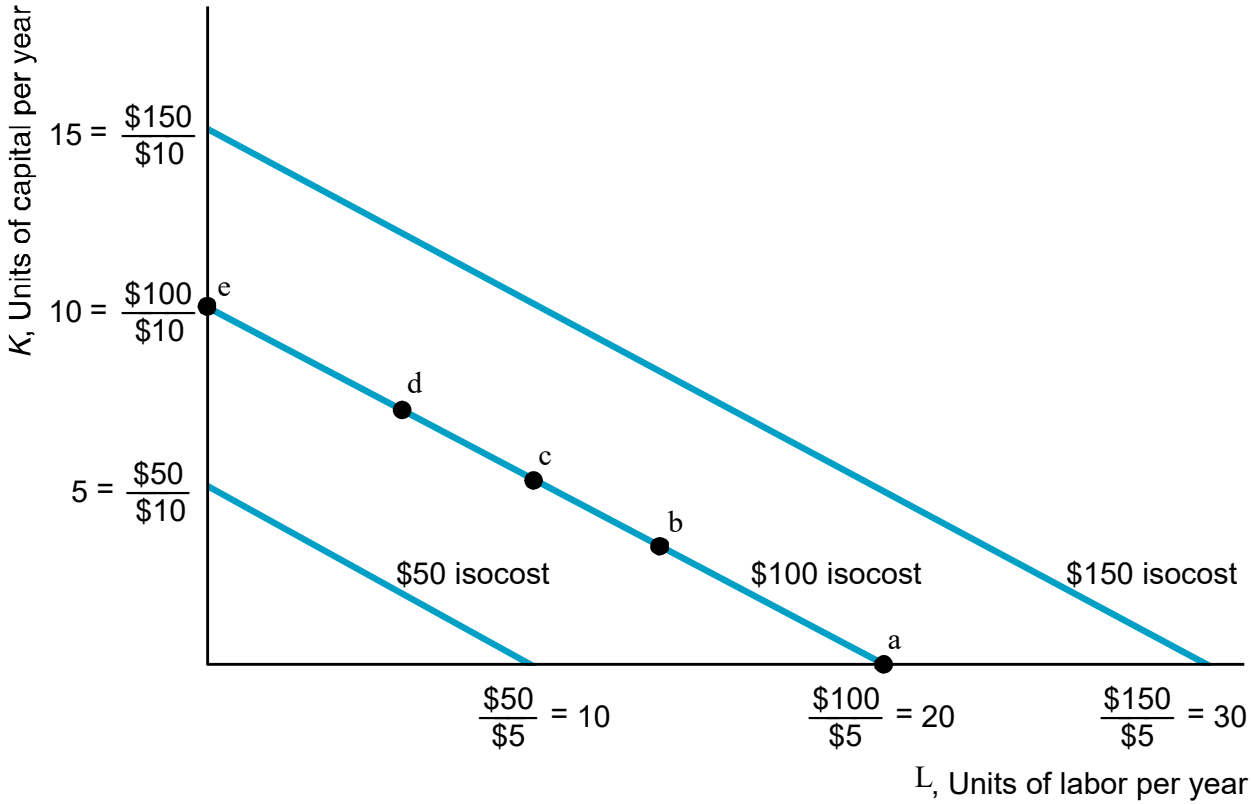


Figure 7.5 Cost Minimization

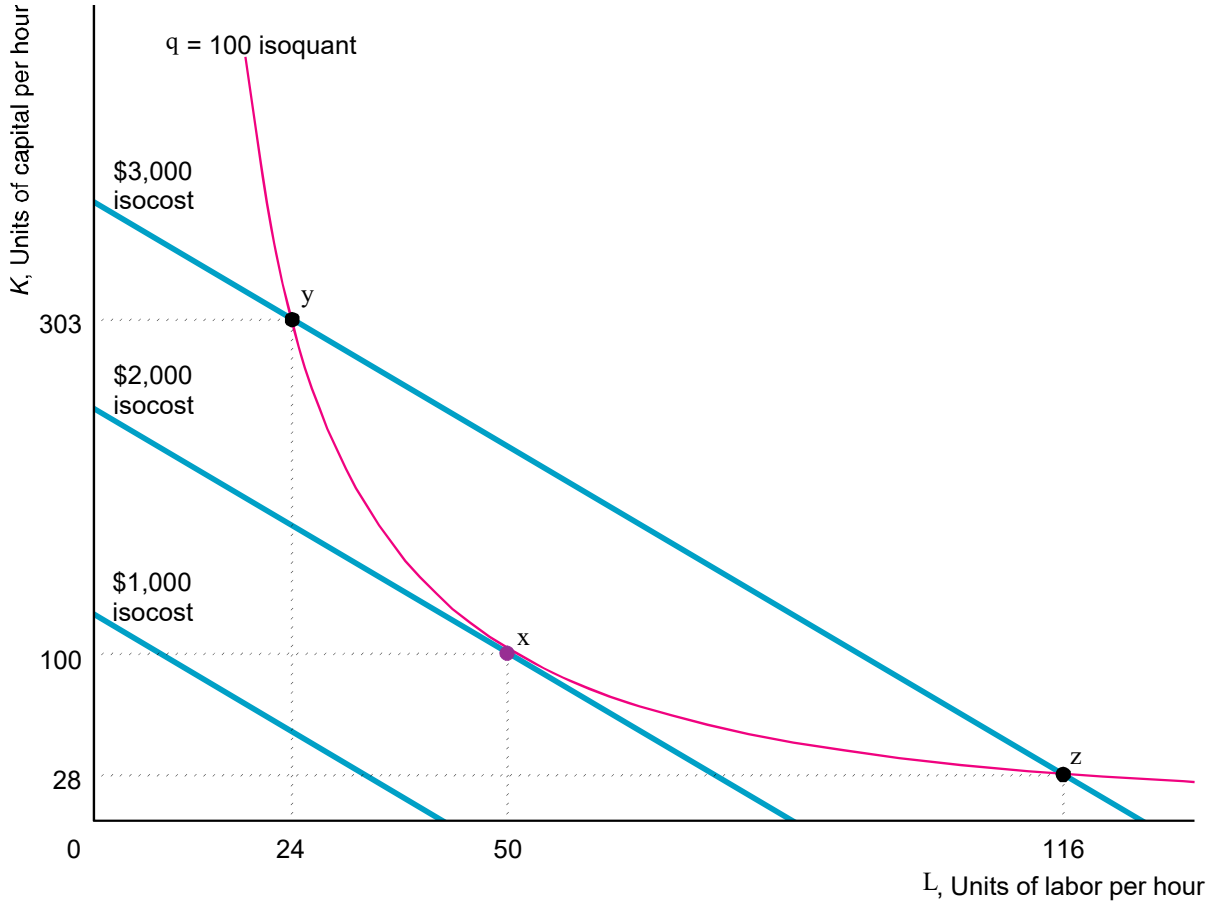


Figure 7.6 Change in Factor Price

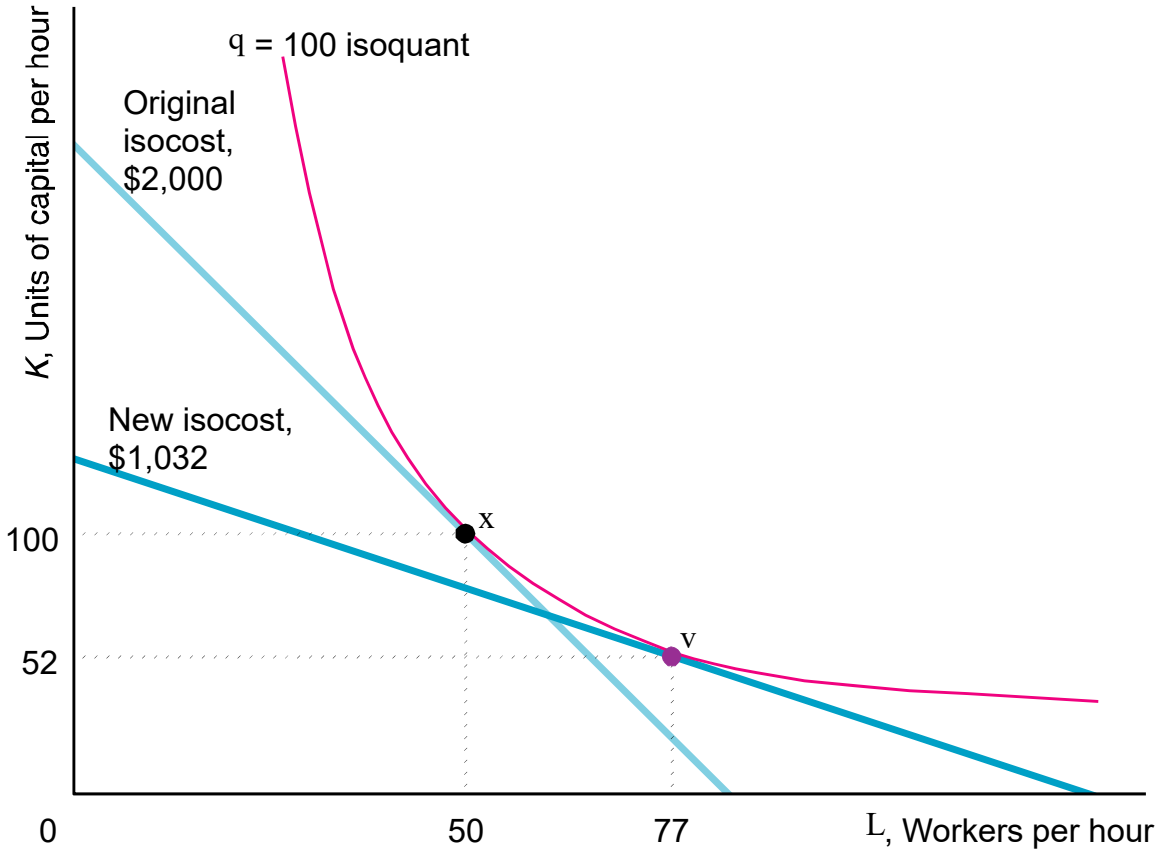


Figure 7.7 Expansion Path and Long-Run Cost Curve

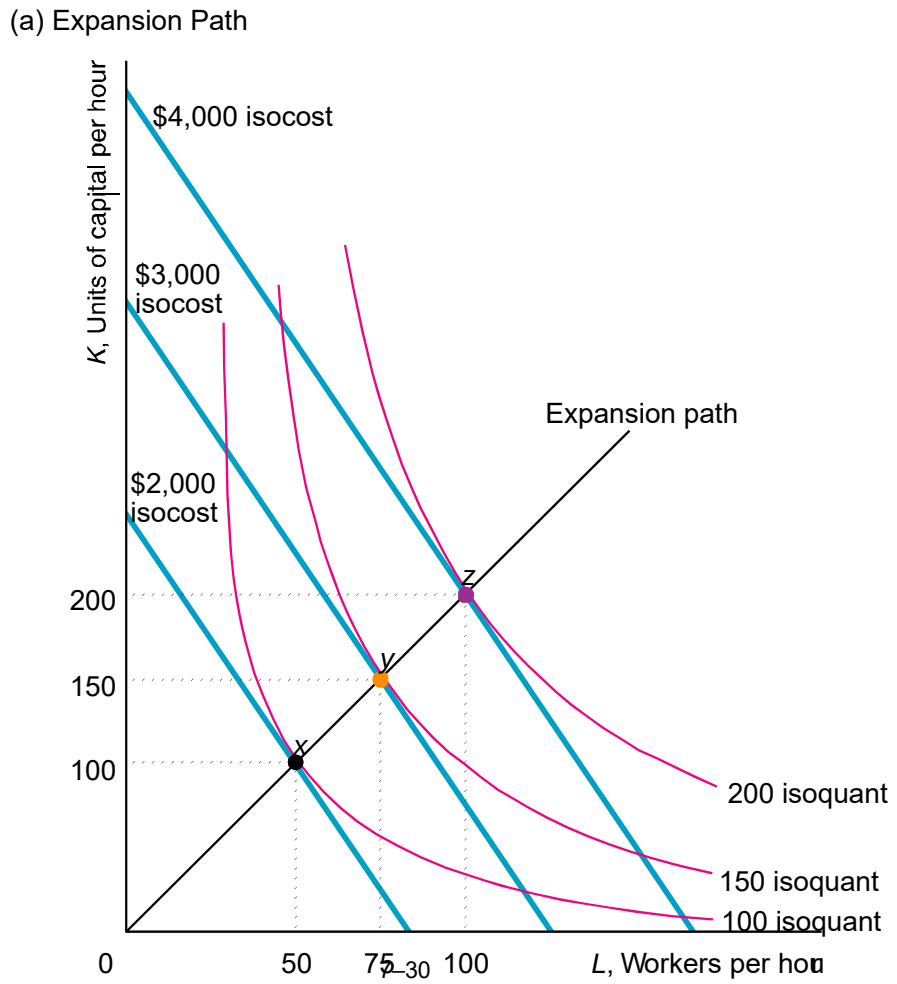


Figure 7.10 Long-Run and Short-Run Expansion Paths