

Due: Wednesday, March 2, 2011

You own and operate a lawn-care service in Lexington. Your company supplies lawn care to up-scale homeowners whose yards are typically one acre in size. You use labor and capital in the production process. Your production function is given by the formula $Q = L^{.5}K^{.5}$, where L represents worker days and K represents machine days. The number of yards that you can mow and trim in a day thus is given in the following table.

		Labor Input									
		1	2	3	4	5	6	7	8	9	10
Capital Input	1	1.00	1.41	1.73	2.00	2.24	2.45	2.65	2.83	3.00	3.16
	2	1.41	2.00	2.45	2.83	3.16	3.46	3.74	4.00	4.24	4.47
	3	1.73	2.45	3.00	3.46	3.87	4.24	4.58	4.90	5.20	5.48
	4	2.00	2.83	3.46	4.00	4.47	4.90	5.29	5.66	6.00	6.32
	5	2.24	3.16	3.87	4.47	5.00	5.48	5.92	6.32	6.71	7.07
	6	2.45	3.46	4.24	4.90	5.48	6.00	6.48	6.93	7.35	7.75
	7	2.65	3.74	4.58	5.29	5.92	6.48	7.00	7.48	7.94	8.37
	8	2.83	4.00	4.90	5.66	6.32	6.93	7.48	8.00	8.49	8.94
	9	3.00	4.24	5.20	6.00	6.71	7.35	7.94	8.49	9.00	9.49
	10	3.16	4.47	5.48	6.32	7.07	7.75	8.37	8.94	9.49	10.00

1. Write an expression for your short-run production function when capital is fixed at $K=4$. Now write an expression for the marginal product of labor when $K=4$. Plot the total product of labor curve for $K=4$. Does your production function exhibit diminishing returns?
2. Suppose that you contract with seven workers to work the entire summer for your company. You rent your equipment by the day, so capital is variable on a day-to-day basis. Are diminishing returns still an issue? Explain, using a diagram illustrating the marginal product and average product of capital curves.
3. Now consider your long-range planning horizon (i.e. next summer) when both labor and capital are variable. Sketch four or five of the isoquants associated with your production function, based on the information in the table above.
4. Choose one of the isoquants that you have sketched and verify that it exhibits a diminishing marginal rate of technical substitution. Show what you are talking about in your diagram.
5. Does your production process exhibit increasing, constant, or decreasing returns to scale? Explain your answer.