

ECO 401-001  
Fall 2004  
Problem Set #4

Due: Monday, October 25. Use graph paper for the diagrams in this problem set.

1. Browning and Zupan, 7.1. Fill in the Table and then graph  $TP_L$ ,  $AP_L$ , and  $MP_L$ .
2. Browning and Zupan, 7.12. Use the isoquant map in Figure 7.3 to sketch the  $TP_L$ ,  $AP_L$ , and  $MP_L$  curves when capital is fixed at  $K=3$ .
3. Crude oil is carried by pipelines from oil fields and storage areas over hundreds of miles to urban and industrial centers. The output of such pipelines is the amount of oil carried per day, and the two principal inputs are the diameter of the pipeline and the horsepower applied to the oil carried. It has been estimated that the production function for a pipeline with a 10-inch diameter is:  $Q = 286H^{.37}$ , where  $Q$  is the amount of crude oil carried per day and  $H$  is horsepower.
  - a) Derive a formula for the marginal product of horsepower.
  - b) Do increases in horsepower result in diminishing marginal returns?
  - c) How much additional oil can be transported if the horsepower is increased from 10 to 11?
4. Prunella raises peaches, which requires labor,  $L$ , and land,  $T$ . Her output of peaches, in bushels, can be represented by the production function:  $Q = L^{1/2}T^{1/2}$ .
  - a) Sketch the isoquant for 4 bushels of peaches, i.e., what are some of the different combinations of labor and land that can be combined to produce 4 bushels.
  - b) Suppose Prunella is currently using the combination  $L=4$  and  $T=4$  to produce 4 bushels of peaches. What is the marginal rate of technical substitution between  $L$  and  $T$ ? Show your answer in your isoquant diagram.
5. Now suppose that Prunella wants to expand output. She is considering doubling or even tripling her utilization of labor and land. What will happen if she does this? To answer you should draw the isoquants associated with a doubling and then a tripling of all inputs. Is peach production characterized by increasing, constant, or decreasing returns to scale?