ECO 610-401
Fall 2002
Problem Set \#3
Due: Monday, October 21, 2002

1. 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: $\mathrm{Q}=$ $286 \mathrm{H}^{37}$, 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) Derive a formula for the average product of horsepower.
d) If the marginal revenue from an extra unit of crude oil carried per day is $\$ 2$, what is the marginal revenue product of horsepower?
e) If an oil pipeline firm can add all of the horsepower it wants at a price of $\$ 30$ per unit of horsepower, how much horsepower should be used?
2. You own and operate an Arby's restaurant. Your production function is given by $\mathrm{Q}=10 \mathrm{~K}^{.5} \mathrm{~L}^{.5}$, where Q represents the number of meals per hour produced in your restaurant and K and L refer to inputs of capital and labor per hour.
a) Derive expressions for the marginal product of capital and the marginal product of labor.
b) If capital is fixed at $K=8$ in the short run, how much labor must you use if you want to produce 120 meals per hour?
c) Suppose the prices per unit of labor and capital are $w=\$ 6 /$ hour and $v=\$ 6 /$ hour. Does the combination that you are using in part (b) minimize the cost of producing 120 meals per hour? In your answer you should use the marginal product expressions that you derived in part (a), and illustrate with an isoquant-isocost diagram.
3. On one side of your professor's family tree, brother-in-law Bubba owns a restaurant/bar in Fort Walton Beach, Florida. On a recent visit Bubba shared the following information:

Income Statement for Bubba's Bar

| Costs |  | Revenues | Sales of food and drinks |
| :--- | :--- | :--- | :--- |$\$ 130,000$

Bubba has $\$ 50,000$ of his own money invested in the bar. He anticipates that business will continue like this for the foreseeable future. Bubba also has a standing offer of \$30,000 to manage another bar in Fort Walton Beach. Suppose a national restaurant/bar chain offers Bubba \$150,000 to sell his bar, which would enable him to pay back the $\$ 100,000$ bank loan and recoup his own $\$ 50,000$. Should he take the offer? (Hint: what are Bubba's economic profits?)
4. A couple of questions from C. Horngren, Cost Accounting: A Managerial Emphasis, 5th ed.:
a) A bakery distributed its products through route salesmen, each of whom loaded a truck with an assortment of products in the morning and spent the day calling on customers in an assigned territory. Believing that some items were more profitable than others, management asked for an analysis of product costs and sales. The accountants to whom the task was assigned allocated all manufacturing and marketing costs to products to obtain a net profit for each product. The resulting figures indicated that some of the products were being sold at a
loss, and management discontinued these products. However, when this change was put into effect, the company's overall profit declined. Analyze and advise.
b) Your company owns a machine, which cost $\$ 120,000$ and is two-thirds depreciated on a straight-line basis, with a book value (original cost less accumulated depreciation) of \$40,000 and with a remaining useful life of four years. The old machine has a $\$ 4,000$ disposal value now; in four years, its disposal value will be zero. A new machine is available that will dramatically reduce operating costs. Annual revenue of $\$ 100,000$ will not change regardless of the decision. The new machine will cost $\$ 60,000$ and have zero disposal value at the end of its four-year life. The new machine promises to slash variable operating costs from $\$ 80,000$ to $\$ 56,000$ per year. Analyze and advise.

