Econ 301
Deiter
R In Class #13 (10 pts.)

Name Key!

A. Assume a production process (terms defined previously) where:

$q = K^{1/2}L^{1/2}$
$r = \$80$
$w = \$20$
$MP_L/MP_K = K/L$
LR cost minimizing $K = ¼ L$

1. What is LR optimal L* as a function of q? (Hint: plug ¼ L into production function for K.)

$\Rightarrow q = (\frac{1}{4}L)^{1/2} L^{1/2}$
$\Rightarrow q = \frac{1}{2}L \Rightarrow L^* = 2q$

2. What is LR optimal K* as a function of q? (Hint: K* = ¼ L*)

$\Rightarrow K^* = \frac{1}{4}L^* = \frac{1}{4}(2q) \Rightarrow K^* = \frac{1}{2}q$

3. What is the LR TC as a function of q?

$= rK^* + wL^* = 80(\frac{1}{2}q) + 20(2q)$
$= 40q + 40q = 80q$

4. How many units of K should be used to produce q = 200 in the LR?

plug optimal $K = \frac{1}{4}L$ into isoquant

$\Rightarrow 200 = (\frac{1}{4}L)^{1/2} L^{1/2} \Rightarrow 200 = \frac{1}{2}L \Rightarrow L^* = 400$
$\Rightarrow K^* = \frac{1}{4}L^* = \frac{1}{4}(400) = 100$

5. What is minimum LR TC of producing q = 200?

$LR\ TC = 80q = 80(200) = 16{,}000$

6. Assume the firm is using K = L = 9. If it quadruples input usage to K = L = 36, what 'returns to scale' are observed?

$K = 9 = L \Rightarrow q = (9)^{1/2}(9)^{1/2} = (3)(3) = 9$

$K = 36 = L \Rightarrow q = (36)^{1/2}(36)^{1/2} = (6)(6) = 36$

$\Rightarrow$ input quadrupled and output quadrupled

$\Rightarrow$ constant returns to scale

Refer to the information below to answer questions #7-#9.

Assume marketing specialists at Quaker Oats are deciding how to allocate monies in the company's Gatorade advertising budget (=\$1 million). Gatorade currently accounts for about 40% of company sales and earnings. Marketing researchers within the company have provided you with the following estimated relationship:

$Q = 20 + 5B - 1.25\,B^2 + 4P - .5\,P^2$, where

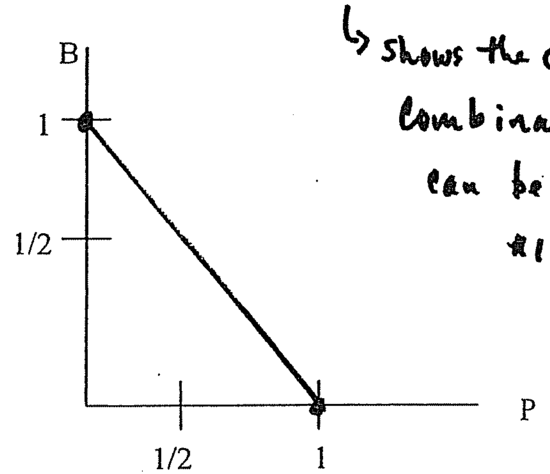
Q = gallons of Gatorade sold (millions of gallons per year)

B = millions of dollars spent on broadcast media (e.g. radio, tv) advertising

P = millions of dollars spent on print media advertising

Assume that each 'unit' of B and P costs \$1 each.

7. Draw in the graph below the company's isocost line for the given advertising budget (label axis intercepts). Explain in words what this isocost line shows.



↳ shows the different maximum combinations of B and P that can be purchased for a given \$1 million budget (cost)

8. Derive and explain what the slope of this isocost line is.

$= \frac{\Delta B}{\Delta P} = \frac{-P_P}{P_B} = \frac{-1}{1} \Rightarrow$ 1 unit of B can be exchanged for 1 unit of P holding total cost constant (at \$1 mil.)

9. In this case, it can be shown that $MP_B = 5 - 2.5B$, where MP = marginal product. Derive and explain what MP_P means.

$MP_P = \partial Q / \partial P = (1)(4)P^{1-1} - (2)(.5)P^{2} = 4 - P$

= additional Q of Gatorade sold for a 1 unit increase in P holding B constant

10. Derive and explain the slope of an isoquant in this case (in general, meaning specific P and B values are not given).

$= \frac{MP_P}{MP_B} = \frac{4-P}{5-2.5B}$