Answer Sheet
Test 3
ECN150
Spring 2011
Wake Forest University
Instructor: McFall

Name Key

1. Lucky's Diner has the best breakfast in town. However, Lucky knows a lot more about hash browns than economics. He's been trying to monitor his diner's production function and needs some help. Fill in the missing entries in the table below:

# of Workers	Total Product	Average Product of Labor	Marginal Product of Labor
0	0	N/A	N/A
1	12	12/1 = 12	12
2	2·17 = 34	17	22
3	51	17	17
4	64	64/4 = 16	13
5	70	70/5 = 14	6

Lucky wants to know why marginal product of labor increases, reaches a maximum, and then declines. Explain briefly.

At low levels of labor hired, the firm benefits from division of labor. However, as more workers are employed, the firm will have to provide capital constraints, and these constraints will cause worker productivity to fall with every unit of labor hired.

2. Currently, Lucky can only hire labor if he wants to increase output. Suppose that a unit of capital costs 40 and a unit of labor costs 10. If Lucky's production function is $Q = K^{.5}L^{.5}$ and Lucky's employs 16 units of capital, then how many units of labor does he need to hire in order to fill 40 orders in a shift? What does it cost in order for Lucky to fill these 40 orders?

$r = 40 \quad w = 10 \quad \bar{K} = 16$

$Q = K^{1/2}L^{1/2} = 16^{1/2}L^{1/2} = 40$

$\Rightarrow \quad 4L^{1/2} = 40$

$L^{1/2} = 10$

$L = 100$

$C = rK + wL = 40K + 10L$

$= 40(16) + 10(100)$

$= 1640$

3. Suppose Lucky can change the amount of capital that he employs at his diner and faces the same prices for capital and labor as described above. How many more orders can Lucky fill if his costs remain unchanged from the short run answer you found in question 2? Explain briefly.

Lucky can possibly reduce costs by reducing capital or increasing capital. Remember, he wants to find the amount of capital and labor that equates the marginal rate of technical substitution to the factor price ratio.

We can find the optimal K & L by solving the following:

$$\mathcal{L} = \max K^{1/2}L^{1/2} + \lambda(1640 - 40K - 10L)$$

$$\text{FOC 1: } \frac{\partial \mathcal{L}}{\partial L} = \tfrac{1}{2}K^{1/2}L^{-1/2} - \lambda 10 = 0$$

$$\text{FOC 2: } \frac{\partial \mathcal{L}}{\partial K} = \tfrac{1}{2}K^{-1/2}L^{1/2} - 40\lambda = 0$$

Together, we can use FOC 1 & FOC 2 to obtain $\frac{K}{L} = \frac{1}{4} \Rightarrow K^* = \frac{1}{4}L$.

Using the cost constraint and solving for K^* gives $1640 = 40(\frac{1}{4}L) + 10L = 20L$

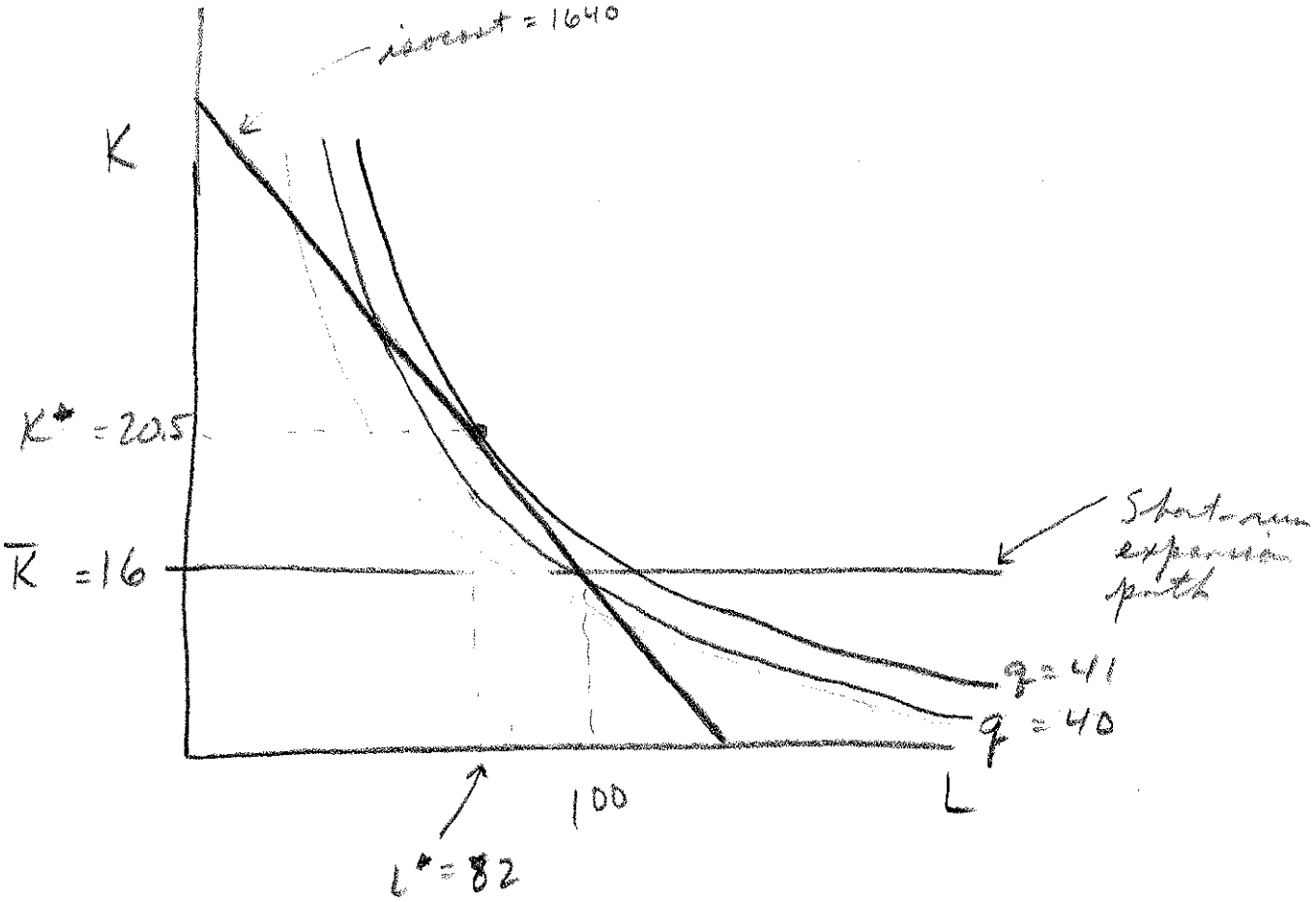
$\Rightarrow L^* = 82$ & $K^* = 20.5$.

With K^* & L^*, Lucky's can produce

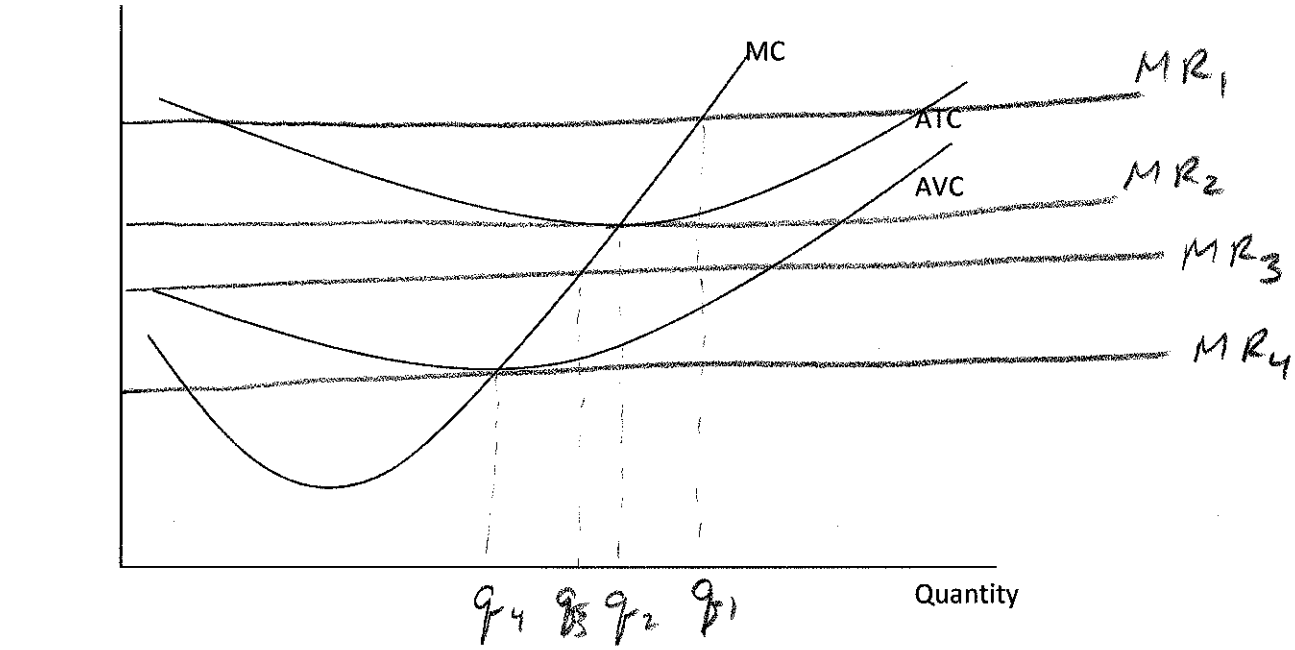
$Q = (20.5 \cdot 82)^{1/2} = 41$ orders,

which is one more order than he could produce when $K = 16$ & $L = 100$.

4. Show the outcomes from question 3 and 4 on a <u>single</u> graph, with isoquant and isocost lines.



5. Pictured below is a graph of the costs of production incurred by a firm in a competitive market. On the graph, draw four marginal revenue curves, one in which the firm earns profits greater than zero, one in which the firm earns zero economic profits, one in which the firm produces with a loss and one in which the firm shuts down. Label these curves MR1-MR4, respectively.



① If $\pi > 0$, then $MR_1 > ATC \Rightarrow q_1$

② If $\pi = 0$, then $MR_2 = \min ATC \Rightarrow q_2$.

③ If produce with loss, then $MR_3 < ATC$ & $MR_3 > AVC \Rightarrow q_3$.

④ If shut down, the firm will pay only costs (FC) and avoid making situation worse by producing. This implies $MR < AVC \Rightarrow q_4$.

6. What could Lucky do in order to decrease the cost per unit he incurs for making breakfasts? How might this alter his production function that is described in question 2?

a) Better managerial practices

b) Increase capital so that firm utilizes economies of scale.

c) Invest in better technology.

7. Paulie's Pizza exists in the perfectly competitive pizza market. The price of pizza is 4.4/slice. Paulie's cost function is $C = 200 + 0.4q + 0.01q^2$.
   a) What is Paulie's marginal cost function?
   b) At what output level does the marginal cost curve intersect the average variable cost curve? Average total curve?
   c) How much pizza will Paulie produce? What are Paulie's profits for producing the amount of pizza you specify?
   d) Since Paulie's is a representative firm in the competitive pizza market, what can we expect with regard to entry into or exit from this market in the next time period? Explain.
   e) At what price would Paulie be indifferent to shutting down and producing with a loss? Explain.

a) $MC = \frac{dC}{dq} = 0.4 + 0.02q$ (Tells us how cost changes as output changes.)

b) $AVC = \frac{C - FC}{q} = 0.4 + 0.01q$

Set equal to MC and solve for q gives $q = 0$.

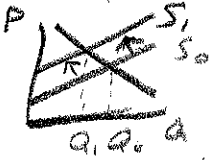
$ATC = \frac{C}{q} = \frac{200}{q} + 0.4 + 0.01q$

Set equal to MC gives $q = 141$.

c) $MR = 4.4$. Find q that equates MC to MR.

$\Rightarrow q^* = 200$ $\quad \pi = Rev - TC = 880 - 680 = 200$

d) Because Paulie is earning $\pi > 0$, he can expect competitors to enter the market, drive down price, and decrease the profit he earns.



e) Paulie will shut down and have $\pi = -FC$ if $P < \min AVC$. So, if $P < .4$/unit, Paulie will go fishing.

8. With firm's long run decision-making in mind, comment on one of the following statements:

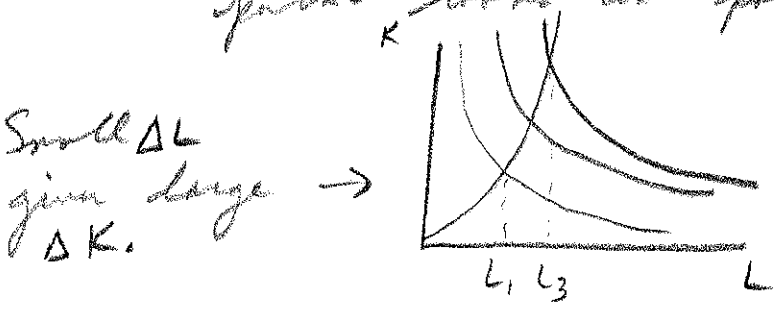
c) "Our county [Starke Co., Indiana] is very high in the state as far as the unemployment rate goes, because so few of the eligible workers are actually tied to agriculture. They're still looking at manufacturing jobs, and that has no direct relationship to the agricultural economy in our area."

-Farmer Virgil Brown
"US Farmers Flourish as Grain Prices Soar"
Financial Times, March 30, 2011

d) "as a firm gets larger, there may be decreasing returns to the entrepreneur function, that is, the costs of organizing additional transactions within the firm may rise. Naturally, a point must be reached where the costs of organizing an extra transaction within the firm are equal to the costs involved in carrying out the transaction in the open market, or, to the costs of organizing by another entrepreneur."

-Sir Ronald Coase
"The Nature of the Firm"
Economica, November 1937

a) Farming is capital intensive. Expansion path looks as follows:



Small ΔL give large ΔK.

Few workers need to be hired to increase output, given a K increase.

b) A firm will expand so long as the benefit of doing so outweighs the costs. It is possible that a firm will hire just to contract out for certain needs b/c it is more efficient to do so. Therefore, firm's size is affected b/c of these transaction costs.