EC 204 TEST #2 KEY

November 7, 2023 GOOD LUCK

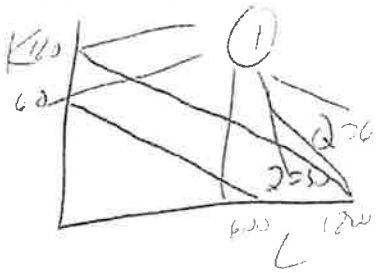

**I. Brief Response**– Please answer the following questions briefly but completely.

1. What is the difference in the short run and the long run in microeconomic theory?

7 In the ~~long~~ short run K is fixed.

2. Suppose Acme Inc. must use exactly **20 full time workers OR 2 units of capital** to produce **one rug** in their factory. DRAW representative isoquants for **Q = 30** and **Q = 60** rugs. What is the marginal rate of technical substitution everywhere in this case? EXPLAIN.

9 $MRTS = \frac{\Delta K}{\Delta L} = \frac{2}{20} = \frac{1}{10}$ (3)




3. What is the profit of a perfectly competitive firm in the long run? If a firm has a total cost curve given by **TC = 200 + 20q + 2q²**, at what price will perfectly competitive firms earn the long run profits you described? SHOW this using a diagram and EXPLAIN.

Economic profit is 0 in the LR. (3)

Any profit possible in the SR.

8


(2) $AC = MC \rightarrow P$ $MC = 20 + 4q$

$AC = \frac{200 + 20q + 2q^2}{q}$

$20 + 4q = \frac{200 + 20q + 2q^2}{q}$

$2q^2 + 4q^2 = 200 + 2q + 4q^2 \Rightarrow 2q^2 = 200$ $q^2 = 100$ $q = 10$

$P = 60$ (2)

II. **SHORT ANSWER**– Please answer the questions as carefully as you can in the time available. Carefully label your diagrams and explain your answers.

1. Please complete the blank cells in the following table. Is there evidence of diminishing returns in this production function? EXPLAIN.

| *Labor Input* | *TOTAL PRODUCT* | *MARGINAL PRODUCT* | *AVERAGE PRODUCT* |
|---|---|---|---|
| 0 | 0 | ===== | ===== |
| 1 | 70 | 70 | 70 |
| 2 | 135 | 65 | 67.5 |
| 3 | 189 | 54 | 63 |
| 4 | 240 | 51 | 60 |
| 5 | 275 | 35 | 55 |
| 6 | 300 | 25 | 50 |

12, 13

Leah

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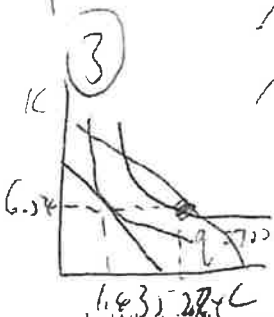
2. Suppose that a cost minimizing producer of cell phones has a production function given by $Q = 10LK^2$, where K and L are units of capital and labor inputs used to produce Q cell phones per day.

9

a. If the **price of L is $20** and the **price of K is $10** per unit, what is the cost minimizing combination of inputs for the firm if they would like to produce **700 cell phones per day**? Illustrate your answer using a diagram.




$MP_L = \frac{10K^2}{20L} = \frac{20}{10}$

$MP_K = \frac{20LK}{10}$

$K^2 = 4LK$

$4L = K$

$700 = 10L(4L)^2$

$700 = 160L^3$

$L = 1.635$ (3)

$K = 6.54$ (3)

b. What is the cost of producing 700 units? Write an equation for the firm's isocost curve at the cost required for an output of 700:

$1.635(20) + 6.54(10) = 98.1$ (5)

c. Suppose that **K is a FIXED input in the short run**. If the firm increases output to **1000 units**, CALCULATE the optimal level of L and K for the firm to use in the **short run**. SHOW this solution on your diagram above.

5

$K = 6.54$ (2)

$1000 = 10L(6.54)^2$

$L = $ [illegible]

$2.34$ (3)

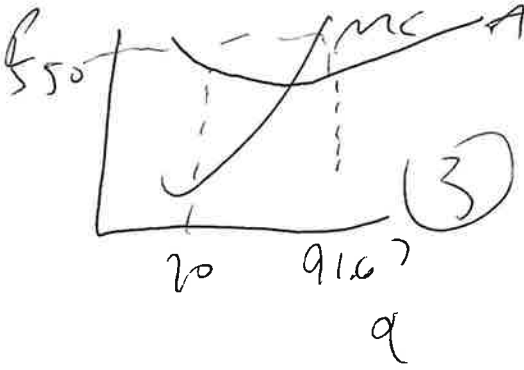
3. The short run cost function of a perfectly competitive company is given by **TC = 13,500 + 3Q²**, where TC is total cost and Q is quantity of output.

a. The company's fixed costs are 13,500. (3)

b. The average variable costs at **Q = 20** are 60. (3)

c. The marginal costs at **Q = 20** are 120. (3)

d. If the **price of the product is $550**, is the firm producing at the profit maximizing level of output with Q=20? How do you know? At the profit maximizing level of output, what is the firm's profit? Illustrate your answer using a diagram.



(3)

$MR = MC = P$

$550 = 62$

$Q = 91.67$

$\pi = 550(91.67) - 13{,}500 - 3(91.67)^2$

$= \$11{,}708$ (3)

$\pi(20) = -3{,}700$

No, it does not max profits (3)

**III. PROBLEM SOLVING**– Solve the following problem as carefully as you can. Show all your work and label your diagrams.

The market for laptop computers is highly competitive, with falling prices in recent years as a result of tremendous global competition among producers. The U.S. market demand curve is given by **P = 1000 – .8Q** and the U.S. market supply curve is given by **P = 800 + Q**, where P = price in dollars per unit sold, and Q = production and sales in the **market** in **THOUSANDS OF** units per day.

a. CALCULATE the equilibrium price of laptop computers in the U.S. and the quantity exchanged. What is the consumer surplus in this market? SHOW this solution in the market diagram on the next page.

8

$1000 - .8Q = 800 + Q$

$200 = 1.8Q$

$Q = 111{,}111$ (3)

$P = \$911.11$ (3)

$CS = \frac{1}{2}(1000 - 911.1)(111{,}111)$

$= \$4.9$ million

b. A single firm's total cost of production are given by **TC = 600 + 250q + .2q²**, where q = production and sales by a single FIRM per day. CALCULATE the optimal quantity of output for each firm in the industry. Be sure to note that little q is for the firm, and **NOT in thousands.** How many firms will compete in this market? SHOW this solution in the firm diagram on the next page.

10

$MC = P$

$MC = .4q + 250$ (2)

$.4q + 250 = 911.11$

$.4q = 661.11$

$q = 1652.775$ (3)

# of firms $= \frac{111{,}111}{1652.775}$

$\approx 67$ firms (3)

c. The firm's production function for laptop computers is given by $Q = 10L^{0.4}K^{0.6}$, where L = units of labor and K = units of capital. If **L and K both cost $20 per unit**, what is the optimal quantity of labor and capital for the FIRM to use when producing its optimal level of output (which you calculated in part b)? What will costs be? SHOW this solution using the third diagram below.

13

$$\frac{MP_L}{MP_K} = \frac{4L^{-.6}K^{.6}}{6L^{.4}K^{-.4}} = \frac{20}{20}$$

$$\frac{2K}{3L} = \frac{1}{1}$$

$2K = 3L$

$K = \frac{3}{2}L$ (2)

$1652.8 = 10L^{.4}(\frac{3}{2}L)^{.6}$

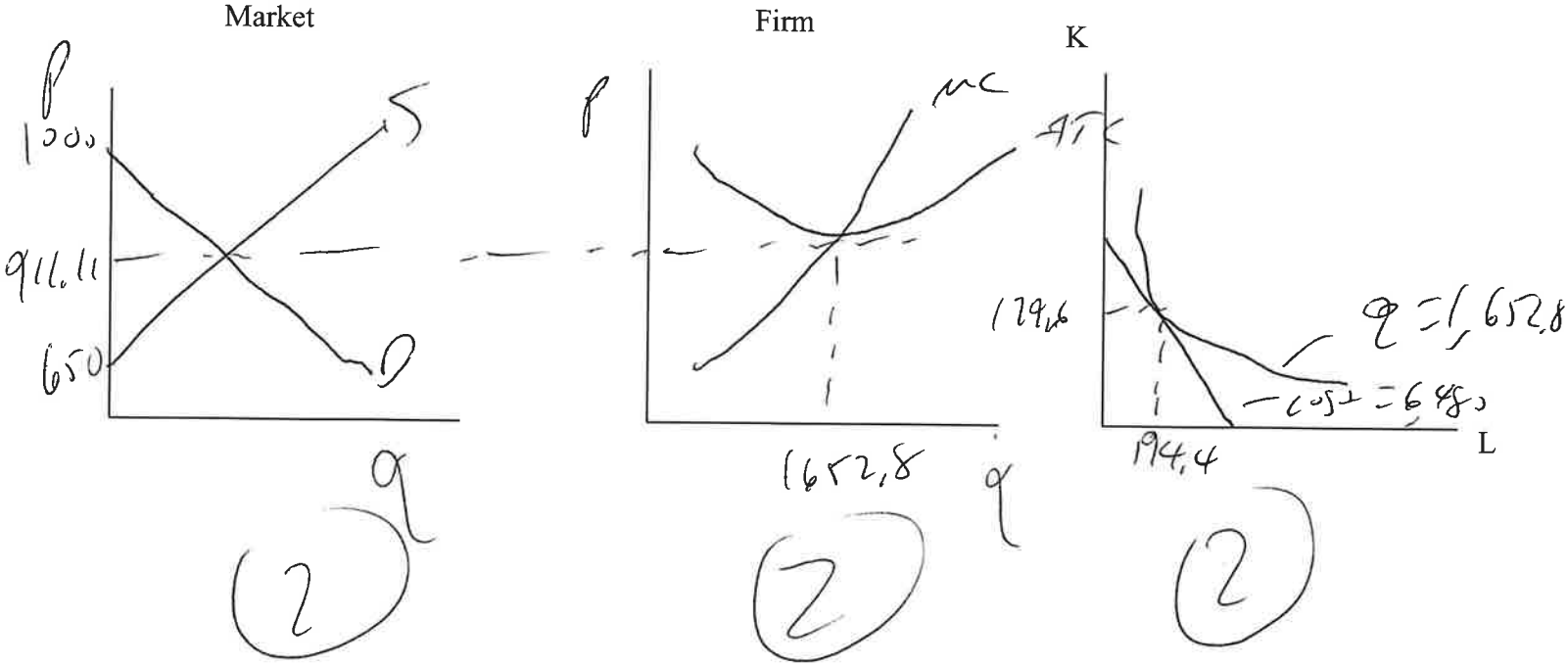
$165.28 = L(\frac{3}{2})^{.6}$

$L = 129.6$ (3)

$K = 194.4$ (3)

$Cost = 20(129.6) + 20(194.4)$

$= \$6,480$ (3)




(2) (2) (2)