3010 - Homework 2

Professor Faria

Name: _____

Instructions:

- This assignment is due at the beginning of class on Wednesday, October 25.
- Show your work where appropriate.
- Staple your assignment.
- Write legibly and in black or blue pen or pencil.
- Label your graphs.

1 The Basics

1. (2 points) Which of the following is a Cobb-Douglas production function?
   (a) $Q = f(K, L)$
   (b) $Q = 5 * K + 2.5 * L$
   (c) $Q = K^{0.50} * L^{0.75}$
   (d) $Q = \dfrac{2 * K}{3 * L}$
2. (2 points) A donut shop has a production function given by $Q = 50 * K^{1/3} * L^{1/2}$, where Q is the number of donuts produced per hour, K is the number of donut fryers (which is fixed at eight in the short run), and L is the number of employed workers. How many donuts can be produced per hour with four workers in the short run?
   (a) 200
   (b) 167
   (c) 320
   (d) 84
3. (2 points) A basic assumption of production is that the firm:
   (a) cannot borrow money to finance its input expenditures.
   (b) can buy as much labor and capital as it desires at fixed prices.
   (c) must bid up the prices of labor and capital in order to produce more output.
   (d) has a downward-sloping budget constraint.

2 Total, Average and Marginal Product

4. (2 points) The short-run production function for a firm is given by $Q = 40 * L^{2/3}$. What is the average product?

   (a) $AP_L = 16.67 * L$

   (b) $AP_L = \dfrac{40}{L}$

   (c) $AP_L = \dfrac{40}{L^{1/3}}$

   (d) $AP_L = \dfrac{1}{40 * L}$

5. (2 points) Which situation will likely give rise to diminishing marginal product of labor?

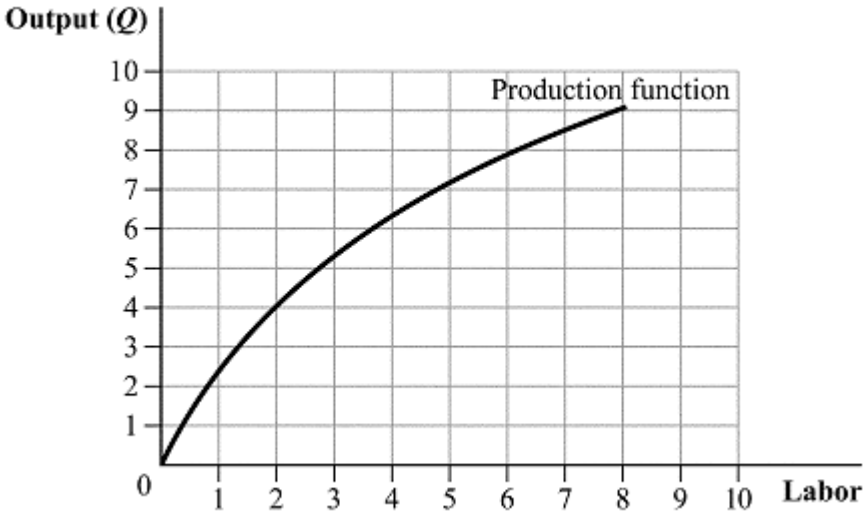
   (a) Plasma television manufacturers are going out of business because of increased competition from LCD televisions.

   (b) Hell's Kitchen, which has enough counter space for three cooks per shift, decides to hire a fourth cook per shift.

   (c) Nevaeh's Kitchen undertakes a massive expansion, doubling both the size of its kitchen and number of cooks.

   (d) A landscaping firm replaces all of its self-propelled lawnmowers with push mowers.

6. (4 points total) Refer to the graph below to answer the following two questions:



   (a) (2 points) The average product at $L = 2$ and $L = 8$ respectively are:

   (a) 2 and 1.13.

   (b) 0.5 and 0.89.

   (c) 8 and 72.

   (d) 1.5 and 0.5.

(b) (2 points) Which of the following statements is (are) TRUE?

I. At $L = 5, MPT_L > AP_L$.
II. At $L = 2, MP_L = AP_L$.
III. For this production function, MP_L is greater at $L = 2$ than at $L = 8$.
IV. For this production function, MP_L is always greater than AP_L.

(a) I and II

(b) III

(c) I and IV

(d) II

7. (8 points) Given the production function $Q = 4 * K^{1/2} * L^{1/2}$, draw the TP_L, AP_L and MP_L for the short run, where $\overline{K} = 25$. Use the table below for reference:

Hint: You can use Excel to help you plot out the coordinates

L	TP_L	AP_L	MP_L
1			
2			
3			
4			
5			
6			
7			
9			
10			

3 Isoquants, Isocost and Cost-minimizing

8. (2 points) Why are the slopes of isocost lines constant?

   (a) because firms must use capital and labor inputs in fixed proportions

   (b) because firms can hire as much of an input as they desire without changing wages or rental rates

   (c) because firms must use less labor if employing more capital

   (d) because the marginal rate of technical substitution of labor for capital is constant

9. (2 points) Katie's Pastry employs three workers who produce 6 dozen pastries per hour. After Brenda hires a fourth worker, the number of pastries produced increases to 7 dozen per hour. Because the marginal product of the fourth worker is _____ than the average product of three workers the average product must _____.

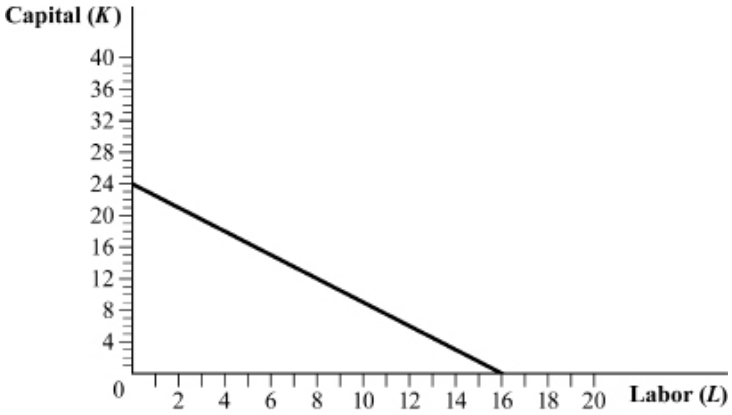
   (a) greater; fall

   (b) less; rise

   (c) greater; rise

   (d) less; fall

10. (2 points) Based on the isocost line, the ratio of the wage rate (w) to rental rate of capital (r) is:



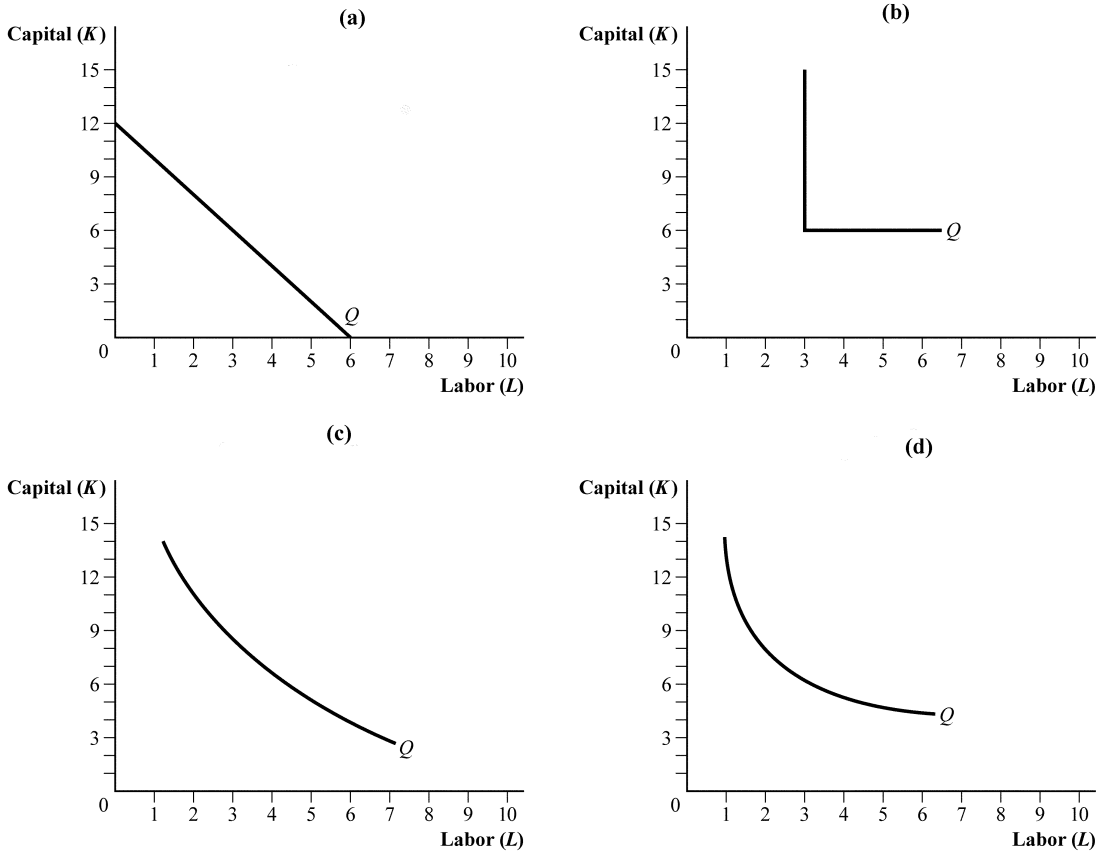
   (a) 1.5.

   (b) 4.0.

   (c) 0.67.

   (d) 0.50.

11. (2 points) Put these four panels below in order from the easiest case of input substitutability to the hardest case of input substitutability.



(a) b, a, c, d

(b) a, c, d, b

(c) d, c, a, b

(d) a, d, c, b

12. (2 points) Which of the following statements best exemplifies the firm's constrained minimization problem?

(a) The firm desires to produce a given quantity of output by choosing values of W and R that minimize $r * K + w * L$.

(b) The firm desires to produce as much output as possible subject to the constraint that $C = r * K + w * L$

(c) The firm desires to produce as much output as possible by choosing values of L and K that minimize $r * K + w * L$.

(d) The firm desires to produce a given quantity of output by choosing values of L and K that minimize $r * K + w * L$.

13. (5 points) For each of the following production functions, determine whether they exhibit constant, decreasing, or increasing returns to scale.

(a) $Q = 4 * K * L$
(b) $Q = K^{1/3} * L^{2/3}$
(c) $Q = K^{1/3} * L^{1/3}$
(d) $Q = min(K, 4L)$
(e) $Q = 6K + 3L$

(a) _____
(b) _____
(c) _____
(d) _____
(e) _____

14. (8 points) SHOW YOUR WORK Consider the production function $Q = K^{1/2} + L^{1/2}$ with a corresponding MRTS $= \dfrac{K^{1/2}}{L^{1/2}}$.

(a) Suppose the firms want to minimize the cost of producing 9 units of output. It pays a wage rate w of \$40 and capital cost r of \$10. How many units of labor and capital should the firm use? What is total cost?

(b) Suppose the firms want to minimize the cost of producing 18 units of output. It pays a wage rate w of \$40 and capital cost r of \$10. How many units of labor and capital should the firm use? What is total cost?

(c) Use the results of (a) and (b) to indicate the economies of scale.

15. (6 points) Why is a firm not optimizing when $\frac{MP_L}{w} > \frac{MP_K}{r}$?

16. (8 points) SHOW YOUR WORK A firm spends \$12,000 per day producing a good. The wage per worker is \$200 per day and rental per unit of capital is \$400 per day. The firm faces the production function $Q = 3 * K^{1/3} * L^{2/3}$ with $MP_K = \frac{L^{2/3}}{K^{2/3}}$ and $MP_L = \frac{2 * K^{1/3}}{L^{1/3}}$.

The cost-minimizing level of capital will be _____ and the cost-minimizing level of labor will be _____.

4 Cost Function Behavior in SR and LR

17. (2 points) Which of the following statements is (are) TRUE?

    I. Accounting profit equals total revenue minus accounting cost.
    II. Economic cost equals accounting cost minus opportunity cost.
    III. Economic profit equals accounting profit plus opportunity cost.
    IV. Economic profit equals total revenue minus economic cost.

    (a) I and IV
    (b) I, II, III, and IV
    (c) II and IV
    (d) I, III, and IV

18. (8 points) SHOW YOUR WORK Nick runs a coffee shop that has annual revenues of $300,000, supply costs of $60,000, and employee salaries of $60,000. He has the option of renting out the coffee shop for $80,000 per year, and he has three outside offers from competitors to work as a senior barista at Starbucks (for an annual salary of $30,000), at Simon's coffee house (for an annual salary of $40,000), and at Peet's coffee shop (for an annual salary of $60,000). He can only hold one job at a time. What should Nick do? Why?

    Hint: $\pi = TR - Costs$

19. (2 points) Which of the following factors are likely to result in fewer fixed costs?

    (a) longer time horizons
    (b) stronger labor unions
    (c) unreliable resale markets
    (d) greater capital requirements for production

20. (6 points) Explain why marginal costs increase in the short run as the marginal product of labor decreases.

21. (6 points) An Iowa City councilman argued that "We spent $30 million refurbishing the downtown: it would be silly not to build a highway now to make it easy for people to get to the downtown." Criticize.

22. (17 points total) Mr. Otto Carr, owner of Otto's Autos, sells cars. Otto buys cars for $\$c$ and has no other costs.

    (a) (1 point) What is Otto's total cost if he sells 10 cars? _____

    (b) (1 point)What is his total cost if he sells 20 cars? _____

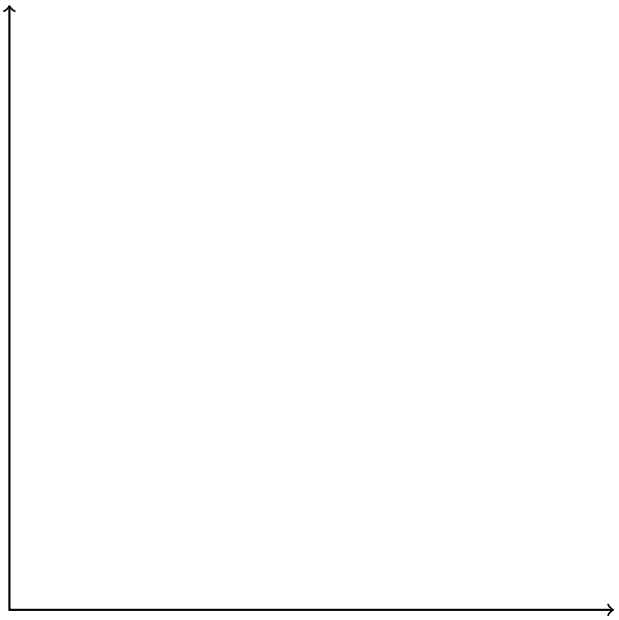
    (c) (1 point) Write the total costs equation assuming Otto sells y cars: _____

    (d) (1 point) What is Otto's average cost function? _____

    (e) (1 point) For every additional auto Otto sells, by how much do his costs increase? _____

    (f) (1 point) Write down Otto's marginal cost function: _____

(g) (5 points) On the following graph, draw Otto's average and marginal cost curves if $c = 20$.
Hint: Answer question (h) before drawing the graph



(h) (6 points total) Suppose Otto decides to pay $\$b$ a year to produce advertising for Otto's Autos.

i. (1 point) What is Otto's new total cost function? _____
ii. (1 point) What is his new average total cost function? _____
iii. (1 point) What is his new marginal cost function? _____
iv. (3 points) On the graph above, draw Otto's new average cost curve if $b = \$100$.

EXTRA CREDIT (5 points):

Who won the Nobel Prize in Economics this year? _____