

Exam Production 2

Name _____

Group _____

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

1) Laura's Internet Services firm can design computer systems according to the function $y(K, L) = \sqrt[3]{K}\sqrt{L}$, where K is the amount of Gigabyte storage she has available and L is the amount of labor hours she employs. Currently, Laura has 125 gigabytes of storage. Sketch the change in the marginal product of labor curve for Laura's firm for values of $L= 1, 2, 3, 4,$ and $5,$ if she increases her gigabyte storage capacity to 216.

2) Complete the following table:

| Quantity Of Variable Input | Total Output | Marginal Product of Variable Input | Average Product of Variable Input |
|----------------------------|--------------|------------------------------------|-----------------------------------|
| 0 | 0 | – | – |
| 1 | | | 50 |
| 2 | | 30 | |
| 3 | 90 | | |
| 4 | | | 24 |
| 5 | | 4 | |
| 6 | 96 | | |

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

3) According to the law of diminishing returns 3) _____
 A) the total product of an input will eventually decline.
 B) the total product of an input will eventually be negative.
 C) the marginal product of an input will eventually decline.
 D) the marginal product of an input will eventually be negative.
 E) none of the above.

4) When labor usage is at 12 units, output is 36 units. From this we may infer that 4) _____
 A) the average product of labor is 3. B) the marginal product of labor is 3.
 C) the total product of labor is 1/3. D) none of the above.

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

5) A bakery operating in the shortrun has found that when the level of employment in its baking room was increased from 4 to 10, in increments of one, its corresponding levels of production of bread were 110, 115, 122, 127, 130, 132, and 133.

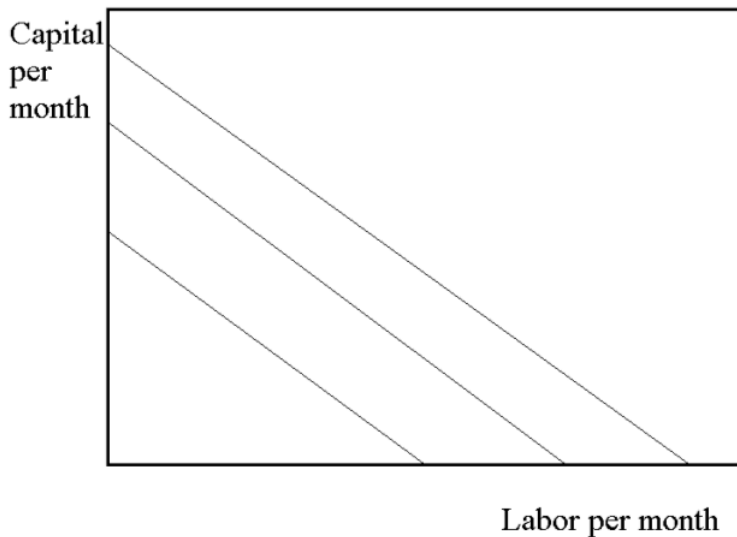
- a. Calculate the marginal product of labor.
- b. Explain whether this production function exhibits diminishing marginal productivity of labor.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 6) The law of diminishing returns refers to diminishing 6) _____
A) marginal returns. B) total returns.
C) average returns. D) all of these.

- 7) An isoquant 7) _____
A) must be linear.
B) is a curve that shows all possible output levels that can be produced at the same cost.
C) cannot have a negative slope.
D) is a curve that shows the maximum total output as a function of the level of labor input.
E) is a curve that shows all the combinations of inputs that yield the same total output.

- 8) An examination of the production isoquants in the diagram below reveals that: 8) _____



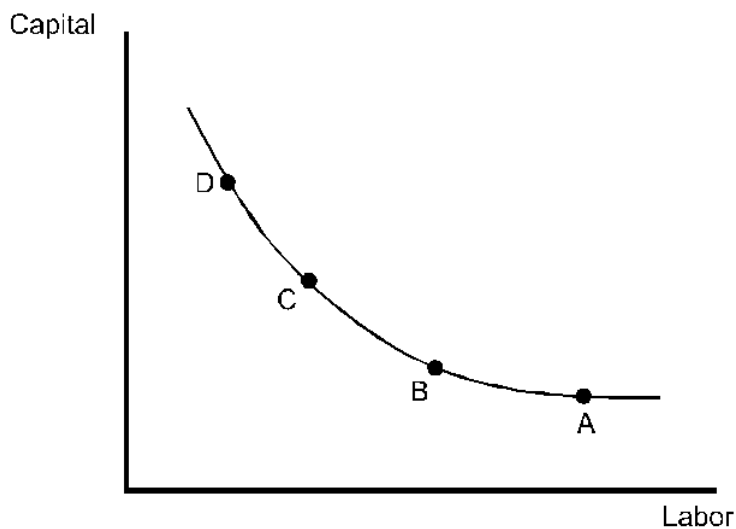
- A) capital and labor must be used in fixed proportions.
B) except at the corners of the isoquants the MRTS is constant.
C) capital and labor are perfectly substitutable.
D) both B and C are correct.
E) none of the above.
- 9) An L-shaped isoquant 9) _____
A) would indicate that the firm could switch from one output to another costlessly.
B) would indicate that the firm could not switch from one output to another.
C) would indicate that capital and labor cannot be substituted for each other in production.
D) is impossible.
E) would indicate that capital and labor are perfect substitutes in production.

10) If the isoquants are straight lines, then 10) _____
 A) there are constant returns to scale.
 B) the marginal rate of technical substitution of inputs is constant.
 C) inputs have fixed costs at all use rates.
 D) only one combination of inputs is possible.

11) If we take the production function and hold the level of output constant, allowing the amounts of capital and labor to vary, the curve that is traced out is called: 11) _____
 A) the average product.
 B) an isoquant.
 C) the total product.
 D) the marginal product.
 E) none of the above.

12) The marginal rate of technical substitution is equal to the 12) _____
 A) change in output minus the change in labor.
 B) ratio of the marginal products of the inputs.
 C) slope of the total product curve.
 D) change in output divided by the change in labor.

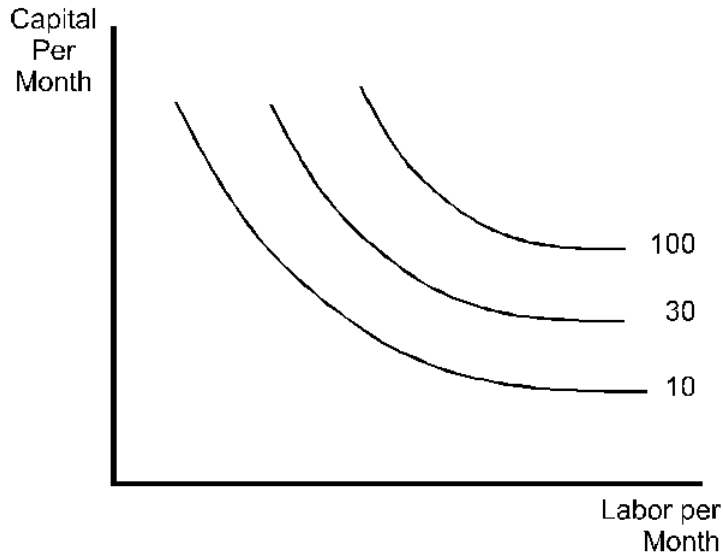
13) The diagram below shows an isoquant for the production of wheat. 13) _____



Which point has the highest marginal productivity of labor?
 A) point A. B) point B. C) point C. D) point D.

- 14) With increasing returns to scale, isoquants for unit increases in output become 14) _____
- A) the same distance apart. B) closer and closer together.
C) farther and farther apart. D) none of these.

- 15) According to the diagram below, where each isoquant's output level is marked to the right of the isoquant, production is characterized by 15) _____



- A) decreasing returns to scale.
B) increasing, constant and decreasing returns to scale.
C) increasing returns to scale.
D) constant returns to scale.

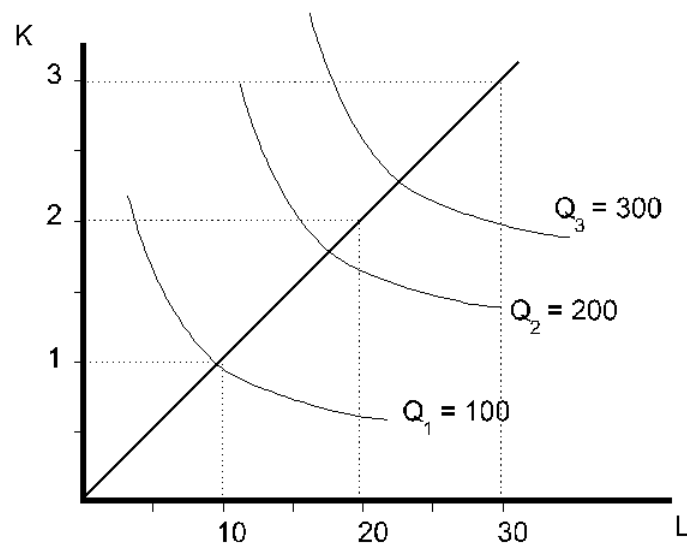


Figure 6.2

16) Refer to Figure 6.2. The situation pictured is one of

16) _____

- A) decreasing returns to scale, because the isoquants are convex.
- B) increasing returns to scale, because the isoquants are convex.
- C) constant returns to scale, because the line through the origin is linear.
- D) increasing returns to scale, because doubling inputs results in more than double the amount of output.
- E) decreasing returns to scale, because doubling inputs results in less than double the amount of output.

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

17) Leann's Telecommunication firm production function is given by $y(K, L) = 200(KL)^{2/3}$, where K is the number of internet servers and L is the number of labor hours she uses. Does this production function exhibit increasing, constant or decreasing returns to scale? Holding the number of internet servers constant at 8, is the marginal product of labor increasing, constant or decreasing as more labor is used?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

18) A farmer uses M units of machinery and L hours of labor to produce C tons of corn, with the following production function $C = L^{0.5}M^{0.75}$. This production function exhibits

18) _____

- A) constant returns to scale for all output levels
- B) decreasing returns to scale for all output levels
- C) increasing returns to scale for all output levels
- D) no clear pattern of returns to scale

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

- 19) Marge's Hair Salon production function is $y(K, L) = \sqrt{KL}$ where K is the number of hair dryers and L is the number of labor hours she employs. Does this production function exhibit increasing, decreasing, or constant returns to scale? At the moment, Marge uses 16 labor hours and 16 hair dryers. Suppose that Marge can use any amount of either input without affecting the market costs of the inputs. If Marge increased her use of labor hours and hair dryers by 10%, how much would her production increase? Increasing the use of both inputs by 10% will result in Marge's costs increasing by exactly 10%. If Marge increases her use of all inputs by 10%, what will increase more her production or her costs? Given that Marge earns \$12.50 for each unit produced, do her profits go up or down when she increases her input use by 10%?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 20) Use the following two statements to answer this question: 20) _____
- I. "Decreasing returns to scale" and "diminishing returns to a factor of production" are two phrases that mean the same thing.
- II. Diminishing returns to all factors of production implies decreasing returns to scale.
- A) I is false, and II is true. B) I is true, and II is false.
- C) Both I and II are true. D) Both I and II are false.

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

- 21) Apu's Squishy production function is $y(K, L) = K\sqrt{L}$ where K is the number of squishy machines and L is the number of labor hours he employs. Does this production function exhibit increasing, decreasing or constant returns to scale? At the moment, Apu uses 2 squishy machines and 4 labor hours. Suppose that Apu can use any amount of either input without affecting the market costs of the inputs. If Apu increased his use of labor hours and squishy machines by 100%, how much would his production increase? Increasing the use of both inputs by 100% will result in Apu's costs increasing by exactly 100%. If Apu increases his use of all inputs by 100%, what will increase more his production or his costs? Given that Apu can sell as many squishies as he produces for \$1.00, do his profits go up or down when he increases his input use by 100%?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 22) A farmer uses M units of machinery and L hours of labor to produce C tons of corn, with the following production function $C = L^{0.5} + M^{0.75}$. This production function exhibits 22) _____
- A) increasing returns to scale for all output levels
- B) no clear pattern of returns to scale
- C) constant returns to scale for all output levels
- D) decreasing returns to scale for all output levels

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

- 23) Bridget's Brewery production function is given by $y(K, L) = 2\sqrt{KL}$, where K is the number of vats she uses and L is the number of labor hours. Does this production process exhibit increasing, constant or decreasing returns to scale? Holding the number of vats constant at 4, is the marginal product of labor increasing, constant or decreasing as more labor is used?

24) Homer's boat manufacturing plant production function is $y(K, L) = \sqrt{K} \sqrt[5]{L}$ where K is the number of hydraulic lifts and L is the number of labor hours he employs. Does this production function exhibit increasing, decreasing or constant returns to scale? At the moment, Homer uses 20,000 labor hours and 50 hydraulic lifts. Suppose that Homer can use any amount of either input without affecting the market costs of the inputs. If Homer increased his use of labor hours and hydraulic lifts by 10%, how much would his production increase? Increasing the use of both inputs by 10% will result in Homer's costs increasing by exactly 10%. If Homer increases his use of all inputs by 10%, what will increase more, his production or his costs? Given that Homer can sell as many boats as he produces for \$75,000, does his profits go up by 10% with a 10% increase in input use?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

25) Consider the following statements when answering this question;

25) _____

- I. If a technology exhibits diminishing returns then it also exhibits decreasing return to scale.
- II. If a technology exhibits decreasing returns to scale then it also exhibits diminishing returns.

A) I is false, and II is true.

B) Both I and II are false.

C) Both I and II are true.

D) I is true, and II is false.

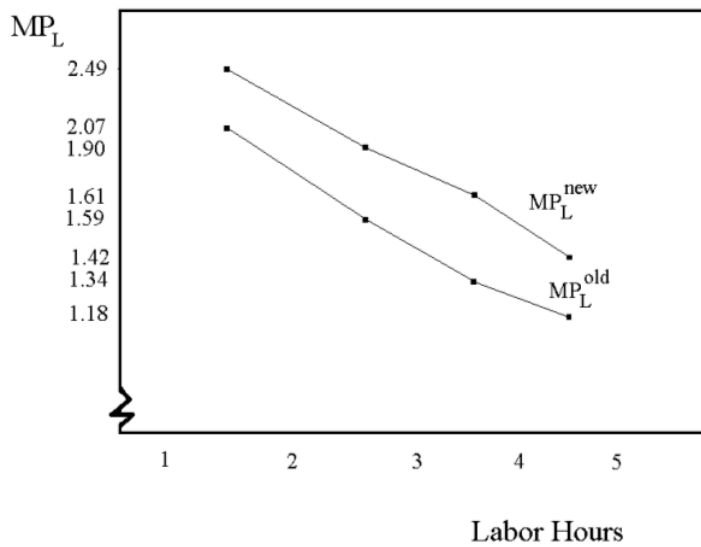
Answer Key

Testname: PRODUCTION 2

1) We can approximate the change in the marginal product of labor as indicated in the following table. The marginal product of labor has increased when Laura added additional storage capacity.

| L | $y(125, L) = 5\sqrt{L}$ | MP_L | $y(216, L) = 6\sqrt{L}$ | MP_L |
|-----|-------------------------|--------|-------------------------|--------|
| 1 | 5 | 2.07 | 6 | 2.49 |
| 2 | 7.07 | | 8.49 | |
| 3 | 8.66 | 1.59 | 10.39 | 1.90 |
| 4 | 10 | 1.34 | 12 | 1.61 |
| 5 | 11.18 | 1.18 | 13.42 | 1.42 |

A sketch of the marginal product of labor is



2)

| Quantity Of Variable Input | Total Output | Marginal Product of Variable Input | Average Product of Variable Input |
|----------------------------|--------------|------------------------------------|-----------------------------------|
| 0 | 0 | - | - |
| 1 | 50 | 50 | 50 |
| 2 | 80 | 30 | 40 |
| 3 | 90 | 10 | 30 |
| 4 | 96 | 6 | 24 |
| 5 | 100 | 4 | 20 |
| 6 | 96 | -4 | 16 |

3) C

4) A

Answer Key

Testname: PRODUCTION 2

5) a.

| L | TP | MP |
|----|-----|----|
| 4 | 110 | 5 |
| 5 | 115 | 7 |
| 6 | 122 | 5 |
| 7 | 127 | 3 |
| 8 | 130 | 2 |
| 9 | 132 | 1 |
| 10 | 133 | |

b.

This production function does exhibit diminishing returns to labor. Inputs of labor of 7 and greater units produce diminishing marginal returns, because the MP of labor is decreasing in this input range.

6) A

7) E

8) D

9) C

10) B

11) B

12) B

13) D

14) B

15) C

16) D

17) Since $y(1.1K, 1.1L) = 200[(1.1K)(1.1L)]^{2/3} = (1.1)^{4/3} \{200[KL]^{2/3}\} > 1.1y(K, L)$, we know the production process exhibits increasing returns to scale. Holding the number of internet servers constant at 8 will still result in a downward sloping marginal product of labor curve. That is, the marginal product of labor decreases as more labor is used.

18) C

19) Since $y(1.1K, 1.1L) = \sqrt{(1.1K)(1.1L)} = (1.1)(\sqrt{KL}) = 1.1y(K, L)$, we know the production process exhibits constant returns to scale. Increasing input use by 10% will result in production increasing by 10%. According to the equation above, output would increase by 10%. Since Marge can sell as many units as she likes for \$12.50, we know that Marge's revenue increase by 10%. Since costs go up by the same amount as revenue, Marge's profits go up by 10%.

$$\pi_{new} = (1.1) TR(L, K) - (1.1)TC(L, K) = (1.1)\{TR(L, K) - TC(L, K)\} = (1.1)\pi_{old}.$$

20) D

21) Since $y(2K, 2L) = (2K)\sqrt{(2L)} = (2)^{2/3}(K\sqrt{L}) > 2y(K, L)$, we know the production process exhibits increasing returns to scale. Increasing input use by 100% will result in production increasing by more than 100%. Since Apu can sell as many units as he likes for \$1.00, we know that Apu's revenue increases by more than 100%. Since costs go up by only 100%, Apu's profits go up by more than 100%. This can be shown as follows:

$$\pi_{new} = (2)^{3/2}TR(L, K) - (2)TC(L, K) > (2)\{TR(L, K) - TC(L, K)\} = (2)\pi_{old}.$$

22) D

Answer Key

Testname: PRODUCTION 2

23) Since $y(1.1K, 1.1L) = 2\sqrt{(1.1K)(1.1L)} = 1.1(2\sqrt{KL}) = 1.1y(K, L)$, we know the production process exhibits constant returns to scale. Holding the number of vats constant at 4 will still result in a downward sloping marginal product of labor curve. That is the marginal product of labor decreases as more labor is used.

24) Since $y(1.1K, 1.1L) = \sqrt{(1.1K)} \sqrt[5]{(1.1L)} = (1.1)^{7/10} \left(\sqrt{K} \sqrt[5]{L} \right) < 1.1y(K, L)$, we know the production process exhibits decreasing returns to scale. Increasing input use by 10% will result in production increasing by less than 10%. According to the equation above, output would increase by about 6.9%. Since Homer can sell as many boats as he likes for \$75,000, we know that Homer's revenue increases by 6.9%. Since costs go up by a larger amount than revenue, Homer's profits will not increase by 10%. This can be shown as follows:

$$\pi_{new} = (1.1)^{7/10} TR(L, K) - (1.1)TC(L, K) < (1.1)\{TR(L, K) - TC(L, K)\} = (1.1)\pi_{old}.$$

25) B