

2024



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# AP<sup>®</sup> Microeconomics

## Sample Student Responses and Scoring Commentary Set 2

### **Inside:**

#### **Free-Response Question 2**

- Scoring Guidelines**
- Student Samples**
- Scoring Commentary**

**Question 2: Short****5 points**

- (a)** Calculate the average fixed cost of \$3 and show the work. **1 point**

$$\text{Average Fixed Cost} = \frac{\text{Total Fixed Cost}}{\text{Quantity of Output}}$$

$$\text{Average Fixed Cost} = \frac{\$90}{30} = \$3$$

- (b)** Calculate the marginal cost as \$6 and show the work. **1 point**

$$\text{Marginal Cost} = \frac{\text{Change in Total Variable Cost}}{\text{Change in Output}}$$

$$\text{Marginal Cost} = \frac{(\$108 - \$90)}{(30 - 27)} = \frac{\$18}{3} = \$6$$

OR

$$\text{Marginal Cost} = \frac{\text{Change in Total Cost}}{\text{Change in Output}}$$

$$\text{Marginal Cost} = \frac{(\$198 - \$180)}{(30 - 27)} = \frac{\$18}{3} = \$6$$

- (c)** State that diminishing marginal returns to labor begin with the hiring of the 3<sup>rd</sup> worker and explain that the marginal product of the 1<sup>st</sup> worker is 5 bags, the marginal product of the 2<sup>nd</sup> worker increases to 7 bags, and the marginal product of the 3<sup>rd</sup> worker decreases to 6 bags. **1 point**

- (d)** State that the profit-maximizing number of workers is 7 and explain that the marginal revenue product (MRP) of the 7<sup>th</sup> worker (\$20) is greater than the marginal factor cost (MFC) of the 7<sup>th</sup> worker (wage = \$18), and that the hiring of the 8<sup>th</sup> worker would decrease profits because the MRP of the 8<sup>th</sup> worker (\$10) is less than the MFC of the 8<sup>th</sup> worker (wage = \$18). **1 point**

- (e)** State that Gato Food will experience diseconomies of scale and explain that as output increases from 40 to 50 units, long-run average total cost increases from \$15 to \$18 per unit. **1 point**

**Total for question 2 5 points**

**Important:** Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1

Question 2

Question 3



Begin your response to each question at the top of a new page.

$$a) \text{ Average Fixed Cost} = \frac{\text{Fixed Cost}}{\text{Quantity}}$$

Quantity of produced when 6 workers are hired is 30 units

$$AFC = \frac{\$90}{30} = \$3$$

b) When Lowen Felix increases output from 27 to 30 units, they hire 1 additional worker, increasing the number of workers they hire to 6. Since they need to pay this worker a wage of \$18, that is the marginal resource cost. To calculate the marginal cost, we must divide this additional cost by the additional units produced. So, we get marginal cost =  $\$18 / 3 = \$6$ .

c) Diminishing Marginal Returns begin with the hiring of the third worker. This is because the third worker's marginal product =  $(18 - 12) = 6$  units which is less than the second worker's marginal product =  $(12 - 5) = 7$  units. The reason that Diminishing Marginal Returns ~~do~~ do not begin with the second worker is because the second worker's marginal product, 7 units is greater than the first worker's marginal product, 5 units.

Page 2

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● **Important:** Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1

Question 2

Question 3



Begin your response to each question at the top of a new page.

d) Lowen Feline will hire 7 workers. This is because they will hire more workers as long as the worker's marginal revenue product is greater than or equal to the wage that is paid. Since the 7th worker's marginal revenue product =  $\$10 \cdot (32 - 30) = \$20$  is greater than the wage of  $\$18$ , they will be hired. The 8th worker on the other hand will not be hired since they have a marginal revenue product =  $\$10 \cdot (33 - 32) = \$10$  which is less than the  $\$18$  wage. So, the firm will actually lose money if they hire the 8th worker.

e) ATC at 40 units =  $\$15$

ATC at 50 units =  $\$18$

Since ATC at 50 units ( $\$18$ ) is greater than ATC at 40 units ( $\$15$ ), we can conclude Gato Foods is experiencing diseconomies of scale over the 40 unit to 50 unit output range, as Average Total Costs are increasing over this interval.

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**Important:** Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1

Question 2

Question 3



Begin your response to each question at the top of a new page.

a)  $\$90/30 = \$3$

b) At 27 units of output, 5 workers are hired  $\rightarrow VC = 5 \times \$18 = \$90$

At 30 units of output, 6 workers are hired  $\rightarrow VC = 6 \times \$18 = \$108$

$\$108 - \$90 = \$18$  (the price of labor)

c) 3 workers because the marginal product is 7 bags when hiring 2 workers, and the marginal product decreases to 6 bags with the hiring of the 3<sup>rd</sup> worker, so diminishing marginal returns sets in at 3 workers.

d) Lowen Feline will hire 7 workers because 7 workers is the last quantity of workers at which  $MRP > MFC$ . With a price per unit of \$10, the MRP at 7 workers is  $MP \times P (2 \times \$10) = \$20$ . The MFC is the wage of \$18 to hire an additional worker. Hiring 8 workers decreases the MRP to \$10, while the MFC remains at \$18, so  $MFC > MRP$  at 8 workers.

Therefore, hiring 7 workers is the profit-maximizing number of workers, where  $MRP > MFC$ .

e)  $\frac{\$600}{40} = \$15$   
 $\frac{\$900}{50} = \$18$

Gato Food is experiencing diseconomies of scale because producing 40 units of output resulted in a long-run average total cost of \$15, and producing 50 units of output increased the long-run average total cost to \$18. Since the LRATC increased as output increased, Gato Food is experiencing diseconomies of scale.

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● **Important:** Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1    Question 2    Question 3

Begin your response to each question at the top of a new page.

(a) Average Fixed Cost =  $90 \div 30 = 3 \rightarrow \$3$

6 workers produce 30 bags, each worker's wage is \$18, fixed cost is \$90, each bag sells for \$10

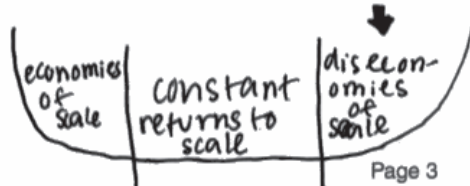
number of bags made with 6 workers

(b) Increasing output from 27 to 30 units means going from 5 to 6 workers, meaning one additional worker is being hired which costs \$18. So the marginal cost is \$18.

(c) Diminishing Marginal Returns begin with the hiring of the 9<sup>th</sup> worker. This is because with 7 workers 32 units are produced (\$320 revenue), then with another worker (number 8) 33 units are made (\$300 profit), but then once worker number 9 is hired, units produced and money made goes back down to 32 and \$320.

(d) Lowen Feline should hire 4 workers to be profit-maximizing because at this number, each worker produces a max per-unit amount of bags before it decreases from 5.75 to 5.4.

(e) Gato Food is experiencing diseconomies of scale in the long run because they are only producing 10 more units (50-40) ~~and~~ <sup>and</sup> its costing them \$300 ( $\$900 - \$600$ ) so each unit is \$30.



Page 3

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## Question 2

**Note:** Student samples are quoted verbatim and may contain spelling and grammatical errors.

### Overview

The question assessed students' understanding of how firms make decisions to maximize profits in labor markets and their understanding of how decisions are related to costs and production in the short run and the long run.

The question started with a short-run production function for Lowen Feline cat food company. Lowen Feline sells cat food at \$10 a bag and hires workers at a market wage of \$18. A table was provided showing the number of workers and the corresponding total production of cat food associated with the level of workers employed.

In part (a) students were asked to calculate the average fixed cost (AFC) given fixed costs (FC) of \$90 and six workers hired and to show their work. Students were expected to use the production function table to find the total quantity (Q) of cat food bags that six workers produced and then divide FC by Q.

In part (b) students were directed to assume that the only variable input was labor and were asked to calculate the marginal cost (MC) associated with an increase of output from 27 units to 30 units and to show their work. Students were expected to use the production function table to figure out the number of additional workers needed to produce the increase in Q and multiply the number of workers by the wage rate of \$18. This would provide them with the change in total cost (TC), associated with the change in variable cost, of adding labor which the students would then divide by the change in Q.

In part (c) students were asked to identify which hired worker was first associated with diminishing marginal returns and to explain using numbers. Students were expected to use the production function table to figure out the marginal product (MP) of each worker and then identify where MP began to decrease.

In part (d) students were asked to state the profit-maximizing number of workers Lowen Feline should hire and explain using marginal analysis. After stating the number of workers, students were expected to explain, by comparing marginal revenue product (MRP) with marginal factor cost (MFC), how Lowen Feline would determine this number of workers to maximize profits.

In part (e) students were informed that in the long run a rival firm, Gato Food, increases production from 40 to 50 units and that its total cost increases from \$600 to \$900. Students were directed to state and explain using numbers whether Gato Food was experiencing economies of scale, diseconomies, or constant returns to scale. Students were expected to divide the total cost values by output to determine that Gato Food's long-run average total cost (LRATC) increases and that it experiences diseconomies of scale.

## Question 2 (continued)

### Sample: 2A

Score: 5

Part (a): 1 point

The response earned the point in part (a) because the response correctly calculates average fixed cost as \$3 and shows the work.

Part (b): 1 point

The response earned the point in part (b) because the response correctly calculates marginal cost as \$6 and shows the work.

Part (c): 1 point

The response earned the point in part (c) because the response asserts diminishing marginal returns begins with 3rd worker and correctly explains that the marginal product of the 1st worker is 5 units, the marginal product of the 2nd worker is 7 units, and the marginal product of the 3rd worker is 6 units.

Part (d): 1 point

The response earned the point in part (d) because the response asserts 7 workers is the profit-maximizing number of workers to hire and correctly explains that the MRP (\$20) is greater than the wage (\$18), and that after the 7th worker, the MRP is less than the wage.

Part (e): 1 point

The response earned the point in part (e) because the response asserts Gato Food is experiencing diseconomies of scale and correctly explains that as output increases from 40 to 50 units, the long-run average total cost increases from \$15 to \$18.

### Sample: 2B

Score: 4

Part (a): 1 point

The response earned the point in part (a) because the response correctly calculates average fixed cost as \$3 and shows the work.



## Question 2 (continued)

Part (b): 1 point

The response did not earn the point in part (b) because the response incorrectly calculates marginal cost. The response calculates the change in variable cost but does not divide the change in variable cost by the change in quantity to find marginal cost.

Part (c): 1 point

The response earned the point in part (c) because the response asserts diminishing marginal returns begins with 3rd worker and correctly explains that the marginal product of the 2nd worker is 7 bags, and the marginal product of the 3rd worker is 6 bags.

Part (d): 1 point

The response earned the point in part (d) because the response asserts 7 workers is the profit-maximizing number of workers to hire and correctly explains that the MRP (\$20) is greater than the MFC (\$18) at the 7th worker, and that at the 8th worker, the MRP (\$18) is less than the MFC (\$10).

Part (e): 1 point

The response earned the point in part (e) because the response asserts Gato Food is experiencing diseconomies of scale and correctly explains that as output increases from 40 to 50 units, the long-run average total cost increases from \$15 to \$18.

### Sample: 2C

Score: 1

Part (a): 1 point

The response earned the point in part (a) because the response correctly calculates average fixed cost as \$3 and shows the work.

Part (b): 1 point

The response did not earn the point in part (b) because the response incorrectly calculates marginal cost as \$18.

Part (c): 1 point

The response did not earn the point in part (c) because the response incorrectly asserts diminishing marginal returns begin with 9th worker.

Part (d): 1 point

The response did not earn the point in part (d) because the response incorrectly asserts that 4 workers is the firm's profit-maximizing quantity of workers to hire.

**Question 2 (continued)**

Part (e): 1 point

The response did not earn the point in part (e) because although the response correctly asserts that Gato Food is experiencing diseconomies of scale, the response does not explain that as output increases from 40 to 50 units, the long-run average total cost increases from \$15 to \$18.