

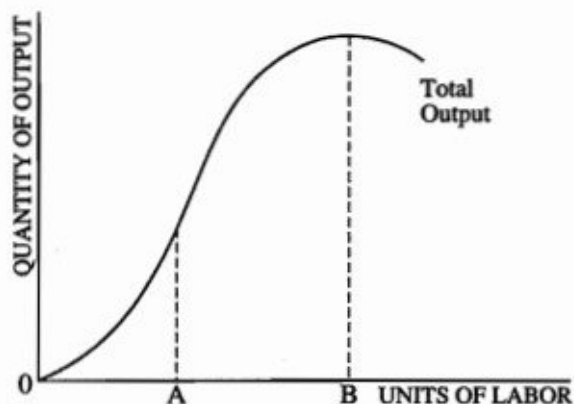
## Units 3.1-3.3 Practice AP Questions

1. A competitive firm produces a product using labor and plastic. The firm is initially in equilibrium. If the cost of plastic suddenly increases, which of the following will occur?
- (A) The demand curve for the product will shift to the left.
  - (B) The firm's demand curve for plastic will shift to the left.
  - (C) The firm will increase the number of units offered for sale.
  - (D) The firm will definitely go out of business, since competitive firms earn zero economic profits in equilibrium.
  - (E) The firm's marginal costs will increase at each level of output. ✓
2. Which of the following statements about short-run costs is always true as a firm increases its production?
- (A) Average fixed cost decreases. ✓
  - (B) Average variable cost decreases.
  - (C) Average total cost decreases.
  - (D) Marginal cost is lower than the average variable cost.
  - (E) Marginal cost is lower than the average total cost.

**Answer A**

Correct. Since average fixed cost is calculated as total fixed cost/output and total fixed cost does not change as output changes, an increase in output must decrease average fixed cost.

3.



The relationship in the graph above best illustrates the economic concept of

- (A) opportunity cost
- (B) diminishing marginal utility in consumption
- (C) diminishing marginal returns in production ✓
- (D) production possibilities
- (E) comparative advantage

## Units 3.1-3.3 Practice AP Questions

4. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

*The table below shows the total costs faced by Allura’s Little Robotics Company for different quantities of Good S sold.*

| <i>Quantity</i> | <i>Total Cost</i> |
|-----------------|-------------------|
| 0               | \$100             |
| 1               | \$136             |
| 2               | \$180             |
| 3               | \$228             |
| 4               | \$280             |
| 5               | \$336             |
| 6               | \$396             |
| 7               | \$460             |
| 8               | \$528             |
| 9               | \$600             |
| 10              | \$680             |

Allura’s Little Robotics Company sells Good S in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$62 per unit.

- Calculate the average fixed cost of producing 2 units. Show your work.
- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good S is  $-0.5$ , and the cross-price elasticity of demand for toy robots with respect to the price of Good S is  $0.8$ . Based on your answer to part (e), what will happen to the demand for toy robots? Explain.
- Now assume that the market in which Allura’s Little Robotics Company operates is in long-run equilibrium at a price of \$65 per unit.
  - Suppose shipping costs per order for Allura’s Little Robotics Company decrease. Will the profit-maximizing quantity of Good S for Allura’s Little Robotics Company increase, decrease, or stay the same in the short run? Explain.
  - Instead suppose the government imposes a price ceiling of \$60 on the market for Good S. Will total economic surplus in the market for Good S increase, decrease, or stay the same in the short run as a result of the price ceiling? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$50 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$100}{2} = \$50$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 6 units and explains that the 6th unit is the last unit where the marginal revenue (62) *is greater than the marginal cost* (60); the firm will not produce the 7th unit because the marginal cost of producing it (64) *is greater than the marginal revenue earned* (62).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as −\$24 and shows the work.

$$\text{Economic Profit} = TR - TC = 6(\$62) - \$396 = -\$24$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

### Units 3.1-3.3 Practice AP Questions

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

#### Part F

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that demand for toy robots will increase and explains that the positive cross-price elasticity of demand for toy robots with respect to the price of Good S means that the goods are substitutes; therefore, an increase in the price of Good S will lead to an increase in the demand for toy robots.

#### Part G

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good S will increase and explains that shipping costs per order are a variable cost, so a decrease in shipping costs per order will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.

- States that total economic surplus will decrease and explains that a price ceiling below the equilibrium price is binding and the quantity supplied will decrease, therefore decreasing total surplus.

5. A merger of two firms may increase economic efficiency by

(A) decreasing average total cost through an increase in economies of scale



(B) decreasing output to reduce marginal cost and equalize price

(C) increasing economic profits but decreasing consumer surplus

(D) increasing consumer surplus by decreasing economic profits

(E) increasing consumer surplus by shifting the demand curve for the product to the right

## Units 3.1-3.3 Practice AP Questions

6. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Anderson Company is a typical firm that manufactures Good G in a constant-cost, perfectly competitive market. Anderson Company is currently earning positive economic profit.

- What must be true about the relationship between accounting profit and economic profit if Anderson Company currently incurs both explicit and implicit costs in production?
- Draw correctly labeled side-by-side graphs for the market and Anderson Company and show each of the following.
  - The market equilibrium price and quantity, labeled  $P_M$  and  $Q_M$ , respectively
  - The profit-maximizing price and quantity for Anderson Company, labeled  $P_F$  and  $Q_F$ , respectively
  - The area representing Anderson Company’s positive economic profit, shaded completely
- On your graphs in part (b), show what will happen to each of the following if the market for Good G adjusts to long-run equilibrium.
  - The market equilibrium price and quantity, labeled  $P_2$  and  $Q_2$ , respectively
  - Anderson Company’s profit-maximizing price and quantity, labeled  $P^*$  and  $Q^*$ , respectively
- Assume the production of Good G creates benefits for third parties.
  - Given this situation, will the market equilibrium quantity be greater than, less than, or equal to the allocatively efficient quantity? Explain.
  - The government takes an action that corrects the externality in the market for Good G. As a result of the government’s action, does total economic surplus increase, decrease, or stay the same? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

✓

|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

- ☐ States that Anderson Company’s accounting profit must be greater than its economic profit.

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

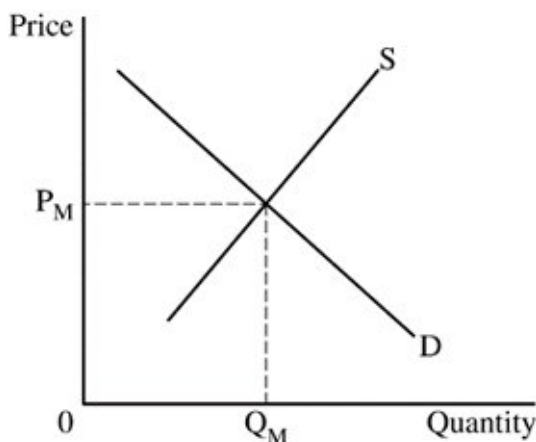
## Units 3.1-3.3 Practice AP Questions



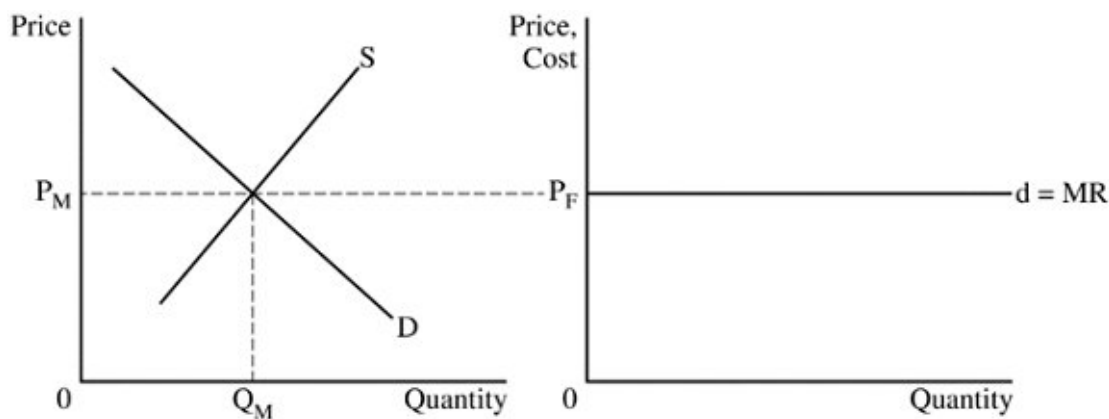
|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

The response accurately includes five of the criteria below.

Draws a correctly labeled graph of the market for Good G with a downward-sloping demand (D) curve and upward-sloping supply (S) curve and labels the market equilibrium price as  $P_M$  and the market equilibrium quantity as  $Q_M$ .



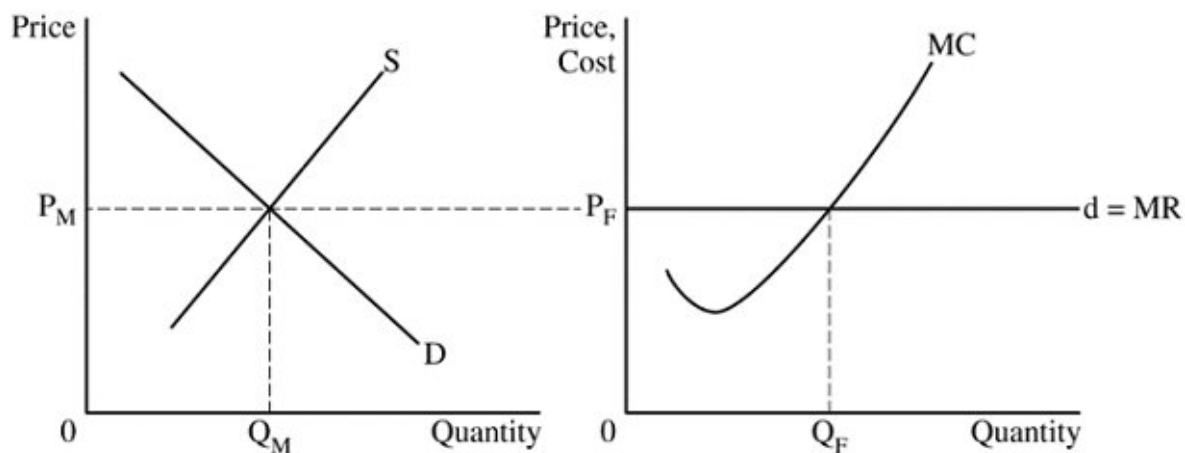
Shows the firm's horizontal demand and marginal revenue ( $d = MR$ ) curve extended from the market equilibrium price ( $P_M$ ), and labels the firm's price as  $P_F$ .



Shows a rising marginal cost (MC) curve and the profit-maximizing quantity, labeled  $Q_F$  where  $MR = MC$ .

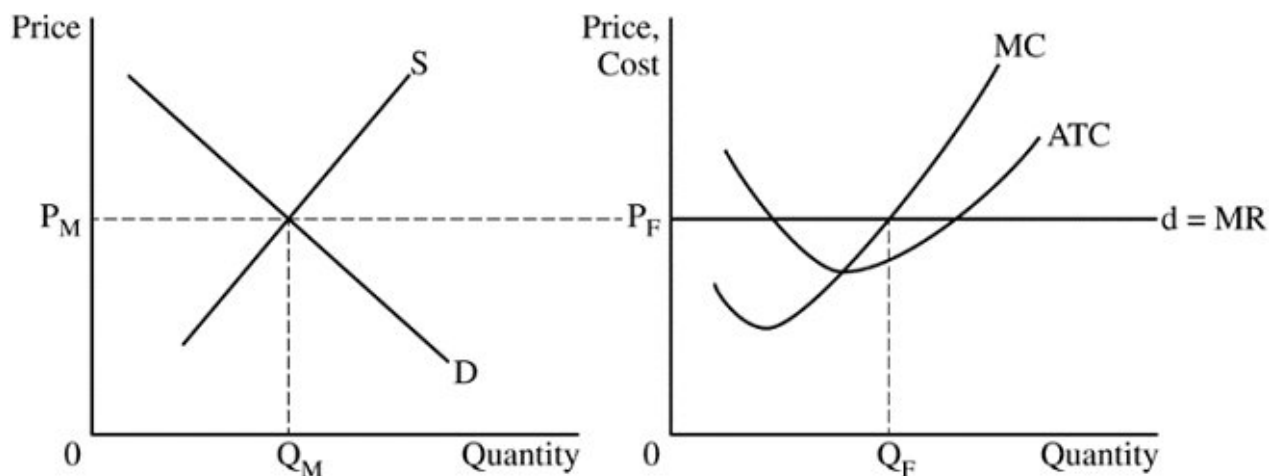


## Units 3.1-3.3 Practice AP Questions



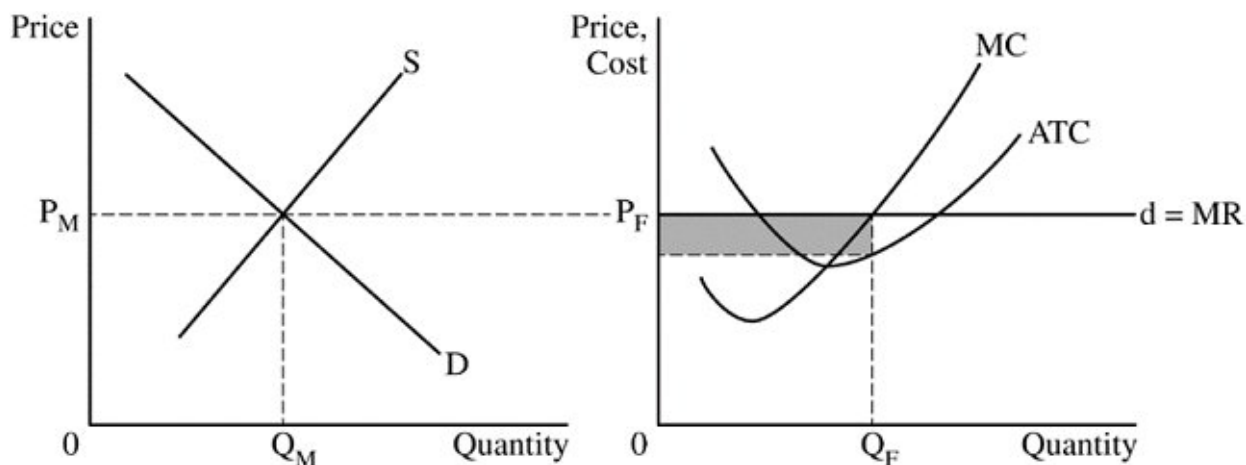
Shows the average total cost (ATC) curve below the firm's demand curve at  $Q_F$  and shows the MC curve passing through the minimum point of the ATC curve.

□



Shows the area representing positive economic profit, shaded completely.

□



## Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

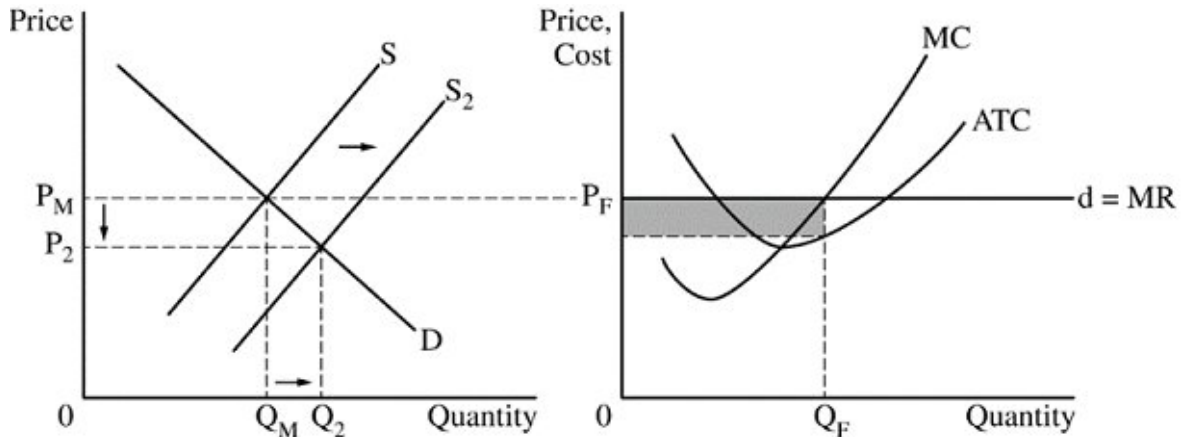
## Units 3.1-3.3 Practice AP Questions

✓

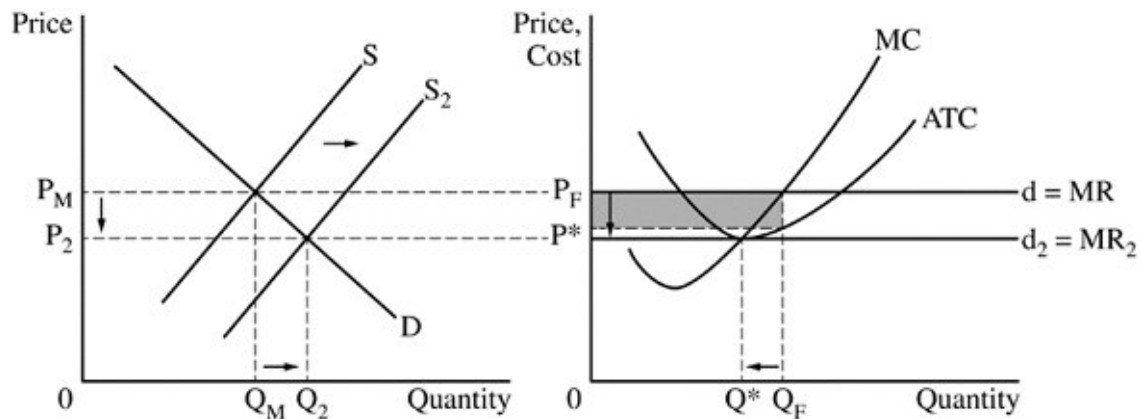
|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response accurately includes two of the criteria below.

On the market graph from part (a), shows a rightward shift in the market supply curve, resulting in a lower market equilibrium price, labeled  $P_2$ , and a greater market equilibrium quantity, labeled  $Q_2$ .

☐

Shows a lower price, labeled  $P^*$ , extended from the new market equilibrium price,  $P_2$ , and shows a lower quantity produced,  $Q^*$ , at the new intersection point of  $P^* = MR_2 = MC = \text{minimum } ATC$ .

☐

## Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

✓

|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response accurately includes two of the criteria below.

☐

States that the market equilibrium quantity will be less than the allocatively efficient quantity and explains that the positive externality in production causes the marginal social cost to be less than the

## Units 3.1-3.3 Practice AP Questions

marginal private cost ( $MSC < MPC$ ) at the market equilibrium.

States that total economic surplus will increase and explains with ONE of the following.

- ☐
  - The quantity produced will increase to the allocatively efficient quantity.
  - Deadweight loss will decrease to \$0.
  - The marginal private cost will equal the marginal social cost, causing the externality to be internalized.

7. An increase in which of the following will cause a firm's marginal cost curve to shift upward?

- (A) The price of a variable input ✓
- (B) The price of a fixed input
- (C) The level of output
- (D) Labor productivity
- (E) The demand for the firm's product

8. Assume that total fixed costs are 46, that the average product of labor is 5 units when 10 units of output are produced, and that the wage rate is 12. If labor is the only variable input, what is the average total cost of producing 10 units of output?

- (A) \$2
- (B) \$5
- (C) \$7 ✓
- (D) \$9
- (E) \$12

## Units 3.1-3.3 Practice AP Questions

9. At 100 units of a firm's output, average total cost is 10, *average variable cost is 8*, average fixed cost is 2, *and marginal cost is 12*. How will each of the following change as the firm's output further increases?

(A)

| Average Total Cost | Average Variable Cost | Average Fixed Cost |
|--------------------|-----------------------|--------------------|
| Increase           | Increase              | Increase           |

(B)

| Average Total Cost | Average Variable Cost | Average Fixed Cost | ✓ |
|--------------------|-----------------------|--------------------|---|
| Increase           | Increase              | Decrease           |   |

(C)

| Average Total Cost | Average Variable Cost | Average Fixed Cost |
|--------------------|-----------------------|--------------------|
| Increase           | Decrease              | Decrease           |

(D)

| Average Total Cost | Average Variable Cost | Average Fixed Cost |
|--------------------|-----------------------|--------------------|
| Decrease           | Increase              | Increase           |

(E)

| Average Total Cost | Average Variable Cost | Average Fixed Cost |
|--------------------|-----------------------|--------------------|
| Decrease           | Decrease              | Decrease           |

10.

| <u>Quantity</u> | <u>Marginal Cost</u> | <u>Fixed Cost</u> |
|-----------------|----------------------|-------------------|
| 0               | —                    | 20                |
| 1               | 15                   | —                 |
| 2               | 10                   | —                 |
| 3               | 15                   | —                 |

According to the table above, which shows the costs of production for a firm, the average total cost of producing 3 units of output is

- (A) 5.00  
 (B) 11.67  
 (C) 13.33  
 (D) 15.00  
 (E) 20.00



**Units 3.1-3.3 Practice AP Questions**

11. Suppose a firm's production process exhibits diseconomies of scale. How and why will costs change if the firm reduces its output?
- (A) Long-run average total cost will increase because it becomes more difficult for the firm to manage its workforce.
  - (B) Long-run average fixed costs will increase because the firm produces fewer units of output.
  - (C) Long-run average total cost will decrease because it becomes easier for the firm to manage its workforce. ✓
  - (D) Long-run average fixed costs will decrease because the firm produces fewer units of output.
  - (E) Long-run average total cost will decrease because it becomes more difficult for the firm to manage its workforce.

**Answer C**

Correct. Diseconomies of scale occur as a result of the difficulty to manage firms as their scale of production increases causing unnecessarily high costs as many layers of management try to communicate with workers and with each other, and as failures to communicate lead to disruptions in the flow of work and materials. With diseconomies of scale, the long-run average total cost curve is upward sloping or increasing. Thus, if the firm reduces its output, its long-run average total costs will decrease as it will be easier for the firm to manage its workforce.

12. What does the minimum efficient scale measure?
- (A) The smallest output level at which short-run average total cost is minimized.
  - (B) The smallest output level at which short-run total cost is minimized.
  - (C) The smallest output level at which long-run average total cost is minimized. ✓
  - (D) The largest output level at which long-run average total cost is minimized.
  - (E) The largest output level at which long-run total cost is minimized.

**Answer C**

Correct. The minimum efficient scale is the lowest quantity of output at which long-run average total cost is at its minimum.

## Units 3.1-3.3 Practice AP Questions

13.

| UNITS OF OUTPUT |   |                  |     |     |
|-----------------|---|------------------|-----|-----|
|                 |   | Units of Capital |     |     |
|                 |   | 1                | 2   | 3   |
| Units of Labor  | 1 | 100              | 140 | 160 |
|                 | 2 | 140              | 200 | 240 |
|                 | 3 | 160              | 240 | 300 |

The table above shows the various units of output that can be produced with different combinations of capital and labor. Which of the following statements is correct according to the information in the table?

- (A) In the long run, there are constant returns to scale. ✓
- (B) In the long run, there are increasing returns to scale.
- (C) In the short run, the marginal product of capital is constant.
- (D) In the short run, the marginal product of labor is constant.
- (E) In the short run, the law of diminishing marginal returns does not hold.

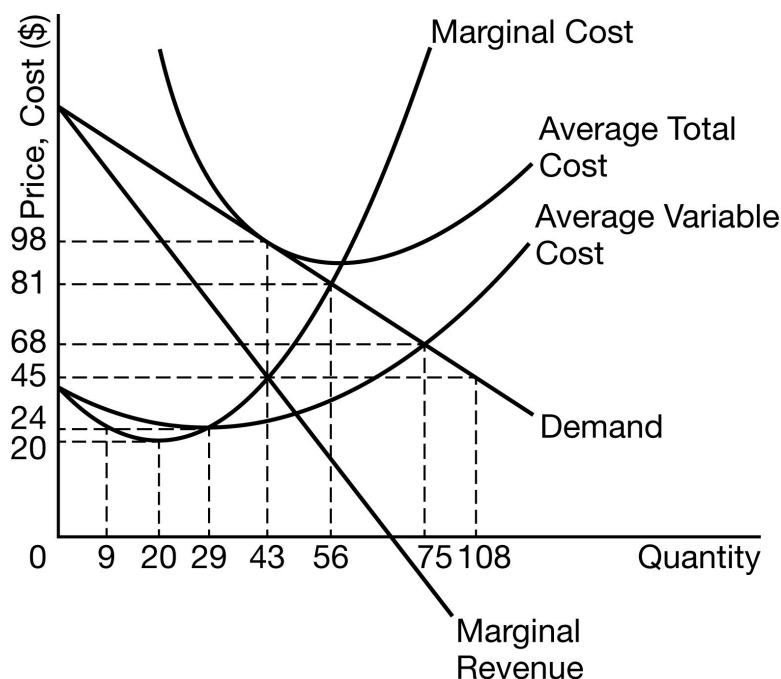
14. Which of the following is true about a firm's average variable cost?

- (A) It will rise if marginal cost is less than average variable cost.
- (B) It will never equal the firm's marginal cost.
- (C) It will decline when the firm's marginal product declines.
- (D) It will be negative if marginal revenue declines.
- (E) It will equal average total cost when fixed costs are zero. ✓

## Units 3.1-3.3 Practice AP Questions

15. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the graph provided below to answer parts (a)-(e).



BetterCook, a profit-maximizing firm, has a patent on a kitchen appliance, making it the only producer of that appliance. The graph above shows BetterCook's demand, marginal revenue, average total cost, average variable cost, and marginal cost curves.

- (a) Calculate BetterCook's total revenue if the firm produces the allocatively efficient quantity. Show your work.
- (b) Starting at a price of \$68, if BetterCook were to decrease the price by 3%, will the quantity demanded increase by more than 3%, by less than 3%, or by exactly 3%? Explain.
- (c) At a quantity of 29 units, is BetterCook's marginal product increasing, decreasing, or constant? Explain.
- (d) Identify the quantity that maximizes BetterCook's profit. Explain.
- (e) At the quantity identified in part (d), does BetterCook earn a positive economic profit, a negative economic profit, or zero economic profit? Explain.

Assume that BetterCook's patent expires. Scheff, a company with the capability to produce the same kitchen appliance as BetterCook, intends to enter the market and charge a lower price than BetterCook for the kitchen appliance. BetterCook is considering whether to maintain its price or to lower its price to match Scheff's price. Scheff is considering whether to advertise its entry into the market.

The matrix below shows the payoffs for each combination of strategies, and both players (BetterCook and Scheff) have complete information. The first entry in each cell represents BetterCook's payoff and the second entry represents Scheff's payoff. Each player independently and simultaneously chooses its strategy. Use the matrix provided below to answer parts (f)-(h).

|  |  |        |
|--|--|--------|
|  |  | Scheff |
|--|--|--------|

## Units 3.1-3.3 Practice AP Questions

|            |                |           |               |
|------------|----------------|-----------|---------------|
|            |                | Advertise | Not Advertise |
| BetterCook | Maintain Price | 400,150   | 600,250       |
|            | Lower Price    | 300,650   | 200,450       |

(f) Does Scheff have a dominant strategy? Explain using numbers from the payoff matrix.

(g) Identify the Nash equilibrium. Explain why this is a Nash equilibrium using information from the payoff matrix.

(h) Suppose Scheff makes a credible commitment to BetterCook that if BetterCook lowers its price, then Scheff will pay BetterCook \$50. Will this offer result in a Nash equilibrium with different strategies from those identified in part (g) ? Explain using numbers from the payoff matrix.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates BetterCook's total revenue at the allocatively efficient quantity as \$4,536 and shows the work.

$$\text{Total Revenue} = \text{Price} \times \text{Quantity} = \$81 \times 56 = \$4,536$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the quantity demanded will increase by less than 3% and explains that the demand is inelastic in this price range because marginal revenue is negative.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that at a quantity of 29 units BetterCook's marginal product is decreasing and explains that the marginal cost is rising.

**Units 3.1-3.3 Practice AP Questions****Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies that the firm's profit-maximizing quantity as 43 units and explains that at that quantity marginal revenue is equal to marginal cost.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm earns zero economic profit and explains that the firm's average total cost curve is tangent to the demand curve, or the firm charges a price equal to the average total cost, or  $P = ATC = \$98$ .

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that no, Scheff does not have a dominant strategy and explains that when BetterCook chooses to maintain its price, Scheff's payoff is higher when it does not advertise ( $\$250 > \$150$ ), and when BetterCook chooses to lower its price, Scheff's payoff is higher when it advertises  $\$650 > \$450$ ; therefore, Scheff does not have a dominant strategy.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

### Units 3.1-3.3 Practice AP Questions

The response identifies the Nash equilibrium as BetterCook maintains its price and Scheff does not advertise with payoffs of (\$600, \$250), and explains that if BetterCook chooses to lower its price, its payoff will decrease from 600 to 200 and if Scheff chooses to advertise, its payoff will decrease from 250 to 150; therefore, there is no incentive for either firm to change its strategy.

#### Part H

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that no, this offer will not result in a Nash equilibrium with different strategies and explains that the Nash equilibrium strategies will still be for BetterCook to maintain its price and for Scheff to not advertise with payoffs of (600,250) because if BetterCook chooses to lower its price, its payoff will decrease from 600 to 250 (200+50) and if Scheff chooses to advertise its payoff will decrease from 250 to 150; therefore, there is no incentive for either firm to change its strategy. Or explains that with the offer BetterCook's dominant strategy will continue to be to maintain the price because its payoff will always be higher (400 > 350 and 600 > 250), and since Scheff has no dominant strategy, it is better off to not advertise (250 > 150); therefore, there is no incentive for either firm to change its strategy.

16. Beyond a certain level of output, the short-run marginal cost will rise because
- (A) there is no fixed input and costs will increase
  - (B) at least one input is fixed and eventually diminishing returns will occur
  - (C) the cost of the variable input increases when marginal product increases
  - (D) the demand for the good decreases when production is limited
  - (E) input prices increase when production increases and consumption is limited



## Units 3.1-3.3 Practice AP Questions

17.

| <u>Units of Labor Input</u> | <u>Units of Output</u> |
|-----------------------------|------------------------|
| 1                           | 8                      |
| 2                           | 20                     |
| 3                           | 30                     |

The table above shows the amount of labor inputs necessary to produce given levels of output. If the cost of a unit of labor is 20 and total fixed cost is 100, the average total cost of producing 20 units of output is

- (A) \$1  
 (B) \$2  
 (C) \$7  
 (D) \$40  
 (E) \$120



## Answer C

18. The following questions are based on the table below, which gives cost information for a perfectly competitive firm.

| <u>Quantity</u> | <u>Average<br/>Fixed<br/>Costs</u> | <u>Average<br/>Variable<br/>Costs</u> | <u>Marginal<br/>Costs</u> |
|-----------------|------------------------------------|---------------------------------------|---------------------------|
| 0               |                                    |                                       |                           |
| 1               | \$100.00                           | \$55.00                               | \$55.00                   |
| 2               | 50.00                              | 45.00                                 | 35.00                     |
| 3               | 33.33                              | 50.00                                 | 60.00                     |
| 4               | 25.00                              | 55.00                                 | 70.00                     |
| 5               | 20.00                              | 60.00                                 | 80.00                     |
| 6               | 16.67                              | 65.00                                 | 90.00                     |

The average total cost to the firm of producing 2 units of output is

- (A) \$35.00  
 (B) \$85.00  
 (C) \$95.00  
 (D) \$100.00  
 (E) \$130.00



**Units 3.1-3.3 Practice AP Questions**

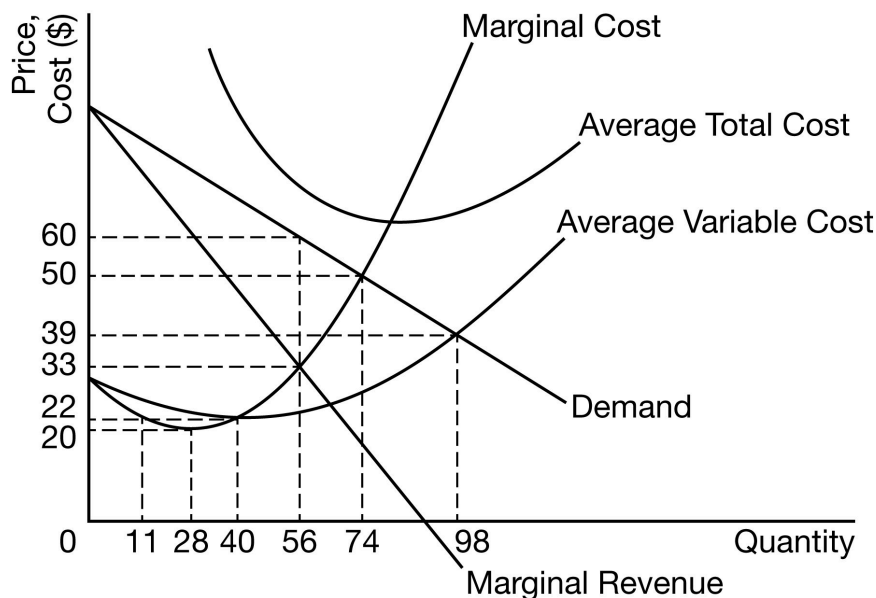
19. If labor is the only variable input and it costs \$15 per hour and if the marginal product of labor is 3 units per hour, the short-run marginal cost of 1 unit of output is approximately
- (A) \$0.20
  - (B) \$3.00
  - (C) \$5.00
  - (D) \$15.00
  - (E) \$45.00

**Answer C**

## Units 3.1-3.3 Practice AP Questions

20. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the graph provided below to answer parts (a)-(e).



CompAce, a profit-maximizing firm, has a patent on a computer accessory, making it the only producer of that computer accessory. The graph above shows CompAce's demand, marginal revenue, average total cost, average variable cost, and marginal cost curves.

- (a) Identify the quantity that maximizes CompAce's profit. Explain.
- (b) At the quantity identified in part (a), does CompAce earn a positive economic profit, a negative economic profit, or zero economic profit? Explain.
- (c) Calculate CompAce's total revenue if the firm produces the allocatively efficient quantity. Show your work.
- (d) At a price of \$60, will CompAce continue to produce or will it shut down in the short run? Explain.
- (e) Assume that at 74 units, the average total cost is 62. If the total rent paid by CompAce increases by 370, calculate the firm's new average total cost at that output. Show your work.

Assume that CompAce's patent expires. ScanzAll, a company with the capability to produce the same computer accessory as CompAce, intends to enter the market and charge a lower price than CompAce for the computer accessory. CompAce is considering whether to maintain its price or to lower its price to match ScanzAll's price. ScanzAll is considering whether or not to advertise its entry into the market.

The matrix below shows the payoffs for each combination of strategies, and both players (CompAce and ScanzAll) have complete information. The first entry in each cell represents CompAce's payoff and the second entry represents ScanzAll's payoff. Each player independently and simultaneously chooses its strategy. Use the matrix provided below to answer parts (f)-(h).

|         |              | ScanzAll      |             |
|---------|--------------|---------------|-------------|
|         |              | Not Advertise | Advertise   |
| CompAce | Lower Price  | 3,000,4,500   | 4,000,3,500 |
|         | Higher Price |               |             |

## Units 3.1-3.3 Practice AP Questions

|  |                |             |             |
|--|----------------|-------------|-------------|
|  | Maintain Price | 2,000,2,500 | 1,800,7,500 |
|--|----------------|-------------|-------------|

(f) Does CompAce have a dominant strategy? Explain using numbers from the payoff matrix.

(g) Identify the Nash equilibrium. Explain why this is a Nash equilibrium using information from the payoff matrix.

(h) Suppose ScanzAll makes a credible commitment to CompAce that if CompAce maintains its price, then ScanzAll will pay CompAce \$600. Will this offer result in a Nash equilibrium with different strategies from those identified in part (g)? Explain using numbers from the payoff matrix.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 56 units and explains that at that quantity marginal revenue is equal to marginal cost.

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm earns negative economic profit and explains that the firm's average total cost curve is above the demand curve, or the firm charges a price that is less than the average total cost, or  $ATC > P$ .

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates CompAce's total revenue at the allocatively efficient quantity as \$3,700 and shows the work.

$$\text{Total Revenue} = \text{Price} \times \text{Quantity} = \$50 \times 74 = \$3,700$$

**Part D**

### Units 3.1-3.3 Practice AP Questions

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that at that price (\$60) the firm will continue to produce and not shut down in the short run and explains that the price is above the average variable cost which means the firm generates enough revenue to pay for its variable costs and some of its fixed costs, so the firm loses less by producing, in the short run, than shutting down and losing all of its fixed costs.

#### Part E

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the new average total cost as \$67 and shows the work.

$$\begin{aligned}\text{New ATC} &= \frac{\text{Original Total Cost} + \text{Increase in Total Cost}}{\text{Quantity}} \\ &= \frac{\$62 \times 74 + \$370}{74} = \$67\end{aligned}$$

OR

$$\begin{aligned}\text{New ATC} &= \text{Original Average Total Cost} + \frac{\text{Increase in Total Cost}}{\text{Quantity}} \\ &= \$62 + \frac{\$370}{74} = \$67\end{aligned}$$

#### Part F

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that yes, CompAce has a dominant strategy and explains that CompAce's payoff is always higher when it lowers the price (\$3,000 > \$2,000 and \$4,000 > \$1,800) regardless of whether ScanzAll chooses to advertise or not advertise; or explains that when ScanzAll chooses to not advertise, CompAce's payoff is higher if it lowers its price (\$3,000 > \$2,000), and when ScanzAll chooses to advertise, CompAce's payoff is higher if it lowers the price (\$4,000 > \$1,800), which means that CompAce's dominant strategy is to lower the price.

## Units 3.1-3.3 Practice AP Questions

## Part G

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies Nash equilibrium as CompAce lowers its price and ScanzAll does not advertise (\$3,000, \$4,500), and explains that if CompAce chooses to maintain its price, its payoff will decrease from 3,000 to 2,000, and if ScanzAll chooses to advertise, its payoff will decrease from 4,500 to 3,500; therefore, there is no incentive for either firm to change its strategy.

## Part H

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that no, this offer will not result in a Nash equilibrium with different strategies and explains that the Nash equilibrium strategies will still be for CompAce to lower its price and ScanzAll to not advertise (\$3,000, \$4,500) because if CompAce chooses to maintain its price, its payoff will decrease from 3,000 to 2,600 ( $=\$2,000 + \$600$ ), and if ScanzAll chooses to advertise, its payoff will decrease from 4,500 to 3,500; therefore, there is no incentive for either firm to change its strategy. Or explains that with the offer CompAce's dominant strategy will continue to be to lower the price because its payoff will always be higher ( $\$3,000 > \$2,600$  and  $\$4,000 > \$2,400$ ) and since ScanzAll has no dominant strategy it is better off to not advertise ( $\$4,500 > \$3,500$ ); therefore, there is no incentive for either firm to change its strategy.

## Units 3.1-3.3 Practice AP Questions

21. The following questions are based on the table provided. The table provided shows a firm's average fixed cost (AFC), total variable cost (TVC), and total economic profit at different levels of output in units.

| Output | AFC  | TVC     | Profit  |
|--------|------|---------|---------|
| 50     | \$20 |         |         |
| 200    |      | \$1,600 | \$1,000 |

When the firm produces 200 units, the AFC is

- (A) \$0  
(B) \$5  
(C) \$8  
(D) \$20  
(E) \$80

**Answer B**

Correct. Since the average fixed costs (AFC)=\$20 when output equals 50 units, total fixed costs can be calculated as  $AFC \times Q = \$20 \times 50 = \$1,000$ . Thus, when output equals 200 units, AFC is  $\$1,000/200=\$5$ .

## Units 3.1-3.3 Practice AP Questions

22. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Dave’s General Store for different quantities of Good X sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$100      |
| 1        | \$110      |
| 2        | \$140      |
| 3        | \$190      |
| 4        | \$290      |
| 5        | \$440      |
| 6        | \$640      |
| 7        | \$900      |
| 8        | \$1,230    |
| 9        | \$1,640    |
| 10       | \$2,140    |

Dave’s General Store sells Good X in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$120 per unit.

- (a) Calculate the average fixed cost of producing 5 units. Show your work.
- (b) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (c) Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- (d) Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good X is 2.5, and the cross-price elasticity of demand for shoes with respect to the price of Good X is  $-0.4$ . Based on your answer to part (e), what will happen to the demand for shoes? Explain.
- (g) Now assume that the market in which Dave’s General Store operates is in long-run equilibrium.
- (i) Suppose the rent paid by Dave’s General Store decreases. Will Dave’s General Store’s profit-maximizing quantity of Good X increase, decrease, or stay the same in the short run? Explain.
- (ii) Instead suppose Dave’s General Store hires labor in a perfectly competitive market and the market wage increases. Will Dave’s General Store’s profit-maximizing quantity of Good X increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$20 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$100}{5} = \$20$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 4 units and explains that the 4<sup>th</sup> unit is the last unit where the marginal revenue (120) *is greater than the marginal cost* (100); the firm will not produce the 5<sup>th</sup> unit because the marginal cost of producing it (150) *is greater than the marginal revenue earned* (120).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$190 and shows the work.

$$\text{Economic Profit} = TR - TC = 4(\$120) - \$290 = \$190$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

### Units 3.1-3.3 Practice AP Questions

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

#### Part F

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for shoes will increase and explains that the negative cross-price elasticity of demand for shoes with respect to the price of Good X means that the goods are complements; therefore, a decrease in the price of Good X will lead to an increase in the demand for shoes.

#### Part G

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good X will stay the same in the short run and explains that a change in fixed cost does not affect the marginal cost.
- States that the profit-maximizing quantity of Good X will decrease and explains that an increase in the market wage will increase the wage the firm pays its workers because the firm is a wage-taker in a perfectly competitive market; wages are a variable cost, so an increase in the wage will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.

**Units 3.1-3.3 Practice AP Questions**

23. Over the entire range of output for which a firm's short-run average variable cost is decreasing, which of the following must be true?
- (A) Short-run marginal cost is falling.
  - (B) There are increasing returns to scale.
  - (C) There are decreasing returns to scale.
  - (D) Short-run marginal cost is less than short-run average variable cost. ✓
  - (E) Short-run marginal cost is increasing due to diminishing returns.

**Answer D**

Correct. Short-run marginal cost represents the change in total variable cost for a one unit change in output. When short-run marginal cost is less than short-run average variable costs at a given level of output, the short-run average variable cost must be falling.

24. With capital held constant, when Zane employs one additional worker, the marginal product of labor decreases by 5 units. Which economic concept best characterizes Zane's production process?
- (A) Diminishing marginal returns ✓
  - (B) Increasing marginal returns
  - (C) Constant returns to scale
  - (D) Economies of scale
  - (E) Diseconomies of scale

**Answer A**

Correct. As a firm employs more workers, each additional worker will have less capital to work with, and therefore the firm will experience diminishing marginal returns for each additional worker hired.

**Units 3.1-3.3 Practice AP Questions**

25. As a firm expands its output, it initially experiences economies of scale and then diseconomies of scale. The firm's long-run average cost curve is
- (A) horizontal and then upward sloping
  - (B) horizontal and then downward sloping
  - (C) downward sloping and then upward sloping ✓
  - (D) continuously upward sloping
  - (E) continuously downward sloping

**Answer C**

Correct. Economies of scale in production are indicated over a downward-sloping region of a long-run average total cost curve. Diseconomies of scale in production are indicated over an upward-sloping region of a long-run average total cost curve.

26. When a firm is experiencing economies of scale, an increase in the firm's output will result in which of the following?
- (A) A decrease in total cost
  - (B) A decrease in long-run average total cost ✓
  - (C) A downward shift in the long-run marginal cost curve
  - (D) An increase in long-run average variable cost
  - (E) An increase in average fixed cost

**Answer B**

Correct. Economies of scale only occur in the long run when all inputs are variable and a firm can reduce its long-run average total cost by increasing its scale of production.

**Units 3.1-3.3 Practice AP Questions**

27. If a firm experiences economies of scale over the entire range of output, the long-run average cost curve will be
- (A) U-shaped
  - (B) upward sloping
  - (C) downward sloping ✓
  - (D) horizontal
  - (E) below the marginal cost curve

**Answer C**

Correct. Economies of scale occur when the long-run average total cost of producing each individual unit declines as total output increases. This is illustrated by a downward sloping long-run average cost curve.

28. Economies of scale exist when
- (A) the doubling of all inputs doubles the output produced
  - (B) short-run average total cost decreases as output increases
  - (C) short-run average total cost remains constant as output increases
  - (D) long-run average total cost increases as output increases
  - (E) long-run average total cost decreases as output increases ✓

## Units 3.1-3.3 Practice AP Questions

29. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total variable costs faced by Emily’s Eye Care Store for different quantities of Good M sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$20                |
| 2        | \$25                |
| 3        | \$35                |
| 4        | \$50                |
| 5        | \$70                |
| 6        | \$95                |
| 7        | \$125               |
| 8        | \$160               |
| 9        | \$200               |
| 10       | \$245               |

Emily’s Eye Care Store sells Good M in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$33 per unit, and the total fixed cost is \$30.

- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- Calculate the average fixed cost of producing 6 units. Show your work.
- Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good M is 1.4, and the cross-price elasticity of demand for eyeglasses with respect to the price of Good M is  $-0.75$ . Based on your answer to part (e), what will happen to the demand for eyeglasses? Explain.
- Now assume that the market in which Emily’s Eye Care Store operates is in long-run equilibrium at a price of \$30 per unit.
  - Suppose annual property taxes for Emily’s Eye Care Store increase by \$2,000. Will the profit-maximizing quantity of Good M for Emily’s Eye Care Store increase, decrease, or stay the same in the short run? Explain.
  - Instead suppose the government imposes a price floor at \$35 on the market for Good M. Will deadweight loss in the market for Good M increase, decrease, or stay the same in the short run as a result of the price floor? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 7 units and explains that the 7th unit is the last unit where the marginal revenue (33) *is greater than the marginal cost* (30); the firm will not produce the 8th unit because the marginal cost of producing it (35) *is greater than the marginal revenue earned* (33).

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$76 and shows the work.

$$\text{Economic Profit} = TR - TC = 7(\$33) - (\$125 + \$30) = \$76$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$5 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$30}{6} = \$5$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for eyeglasses will increase and explains that the negative cross-price elasticity of demand for eyeglasses with respect to the price of Good M means that the goods are complements; therefore, a decrease in the price of Good M will lead to an increase in the demand for eyeglasses.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

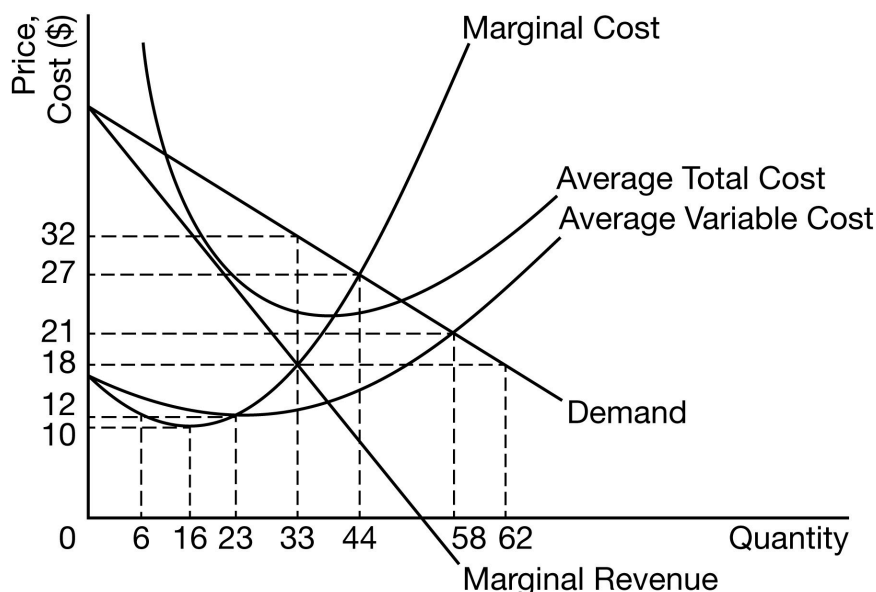
The response does both of the following:

- States that the profit-maximizing quantity of Good M will stay the same in the short run and explains that property taxes are a fixed cost and a change in fixed cost does not affect the marginal cost.
- States that deadweight loss will increase and explains that a price floor above the equilibrium price is binding and the quantity exchanged in the market will be limited by the quantity demanded, which is less than the equilibrium quantity, thus decreasing total economic surplus.

## Units 3.1-3.3 Practice AP Questions

30. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the graph provided below to answer parts (a)-(e).



EyesOn, a profit-maximizing firm, has a patent on cameras, making it the only producer of that camera. The graph above shows EyesOn's demand, marginal revenue, average total cost, average variable cost, and marginal cost curves.

- (a) Identify the quantity that maximizes EyesOn's profit. Explain.
- (b) At the quantity identified in part (a), does EyesOn earn a positive economic profit, a negative economic profit, or zero economic profit? Explain.
- (c) Calculate EyesOn's total revenue if the firm produces the allocatively efficient quantity. Show your work.
- (d) At a price of \$10, will EyesOn continue to produce or will it shut down in the short run? Explain.
- (e) Assume that at 44 units, the average total cost is 22. *If the total wages paid by EyesOn increase by 220*, calculate the firm's new average total cost at that output. Show your work.

Assume that EyesOn's patent expires. ViewTime, a company with the capability to produce the same camera as EyesOn, intends to enter the market and charge a lower price than EyesOn for the camera. EyesOn is considering whether to maintain its price or to lower its price to match ViewTime's price. ViewTime is considering whether or not to advertise its entry into the market.

The matrix below shows the payoffs for each combination of strategies, and both players (EyesOn and ViewTime) have complete information. The first entry in each cell represents EyesOn's payoff and the second entry represents ViewTime's payoff. Each player independently and simultaneously chooses its strategy. Use the matrix provided below to answer parts (f)-(h).

|        |              | ViewTime      |             |
|--------|--------------|---------------|-------------|
|        |              | Not Advertise | Advertise   |
| EyesOn | Lower Price  | 1,000,2,600   | 4,000,3,400 |
|        | Higher Price |               |             |

## Units 3.1-3.3 Practice AP Questions

|  |                |             |             |
|--|----------------|-------------|-------------|
|  | Maintain Price | 2,000,6,500 | 3,000,7,500 |
|--|----------------|-------------|-------------|

(f) Does EyesOn have a dominant strategy? Explain using numbers from the payoff matrix.

(g) Identify the Nash equilibrium. Explain why this is a Nash equilibrium using information from the payoff matrix.

(h) Suppose ViewTime makes a credible commitment to EyesOn that if EyesOn maintains the price, then ViewTime will pay EyesOn \$500. Will this offer result in a Nash equilibrium with different strategies from those identified in part (g) ? Explain using numbers from the payoff matrix.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 33 units and explains that at that quantity marginal revenue is equal to marginal cost.

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm earns positive economic profit and explains that the firm's average total cost curve is below the demand curve, or the firm charges a price above than the average total cost, or  $P > ATC$ .

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates EyesOn's total revenue at the allocatively efficient quantity as \$1,188 and shows the work.

$$\text{Total Revenue} = \text{Price} \times \text{Quantity} = \$27 \times 44 = \$1,188$$

**Part D**

### Units 3.1-3.3 Practice AP Questions

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that at that price (\$10) the firm will shut down in the short run and explains it's because the price is below the average variable cost which means the firm does not generate enough revenue to pay for its variable costs, so the firm loses more by producing, in the short run, than shutting down and just paying its fixed cost.

#### Part E

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the new average total cost as \$27 and shows the work.

$$\begin{aligned}\text{New ATC} &= \frac{\text{Original Total Cost} + \text{Increase in Total Cost}}{\text{Quantity}} \\ &= \frac{\$22 \times 44 + \$220}{44} = \$27\end{aligned}$$

OR

$$\begin{aligned}\text{New ATC} &= \text{Original Average Total Cost} + \frac{\text{Increase in Total Cost}}{\text{Quantity}} \\ &= \$22 + \frac{\$220}{44} = \$27\end{aligned}$$

#### Part F

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that no, EyesOn does not have a dominant strategy and explains that when ViewTime does not advertise, EyesOn's payoff is higher when it chooses to maintain its price (\$2,000 > \$1,000), and when ViewTime chooses to advertise, EyesOn's payoff is higher when it chooses to lower its price (\$4,000 > \$3,000); therefore, EyesOn does not have a dominant strategy.

#### Part G

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies Nash equilibrium as EyesOn lowers its price and ViewTime advertises with payoffs of (\$4,000, \$3,400), and explains that if EyesOn chooses to maintain its price, its payoff will decrease from 4,000 to 3,000, and if ViewTime chooses not to advertise, its payoff will decrease from 3,400 to 2,600; therefore, there is no incentive for either firm to change its strategy.

**Part H**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that no, this offer will not result in a Nash equilibrium with different strategies and explains that the Nash equilibrium strategies will still be for EyesOn to lower its price and ViewTime to advertise with payoffs of (\$4,000, \$3,400) because if EyesOn chooses to maintain its price, its payoff will decrease from 4,000 to 3,500 ( $=\$3,000 + \$500$ ), and if ViewTime chooses to not advertise, its payoff will decrease from 3,400 to 2,600; therefore, there is no incentive for either firm to change its strategy. Or explains that with the offer ViewTime's dominant strategy will continue to be to advertise because its payoff will always be higher ( $\$3,400 > \$2,600$  and  $\$7,000 > \$6,000$ ) and since EyesOn has no dominant strategy it is better off lowering the price ( $\$4,000 > \$3,500$ ); therefore, there is no incentive for either firm to change its strategy.

## Units 3.1-3.3 Practice AP Questions

31. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Faizah’s Manufacturing Firm for different quantities of Good G sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$64       |
| 1        | \$79       |
| 2        | \$98       |
| 3        | \$120      |
| 4        | \$145      |
| 5        | \$171      |
| 6        | \$198      |
| 7        | \$228      |
| 8        | \$262      |
| 9        | \$305      |
| 10       | \$353      |

Faizah’s Manufacturing Firm sells Good G in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$32 per unit.

- Calculate the average fixed cost of producing 8 units. Show your work.
- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good G is  $-3$ , and the cross-price elasticity of demand for gizmos with respect to the price of Good G is  $0.1$ . Based on your answer to part (e), what will happen to the demand for gizmos? Explain.
- Now assume that the market in which Faizah’s Manufacturing Firm operates is in long-run equilibrium at a price of \$35 per unit.
  - Suppose the government imposes a price floor at \$30 per unit on the market for Good G. Will consumer surplus in the market for Good G increase, decrease, or stay the same in the short run as a result of the price floor? Explain.
  - Suppose instead the cost of energy, a variable cost for Faizah’s Manufacturing Firm, decreases. Will the profit-maximizing quantity of Good G for Faizah’s Manufacturing Firm increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$8 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$64}{8} = \$8$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 7 units and explains that the 7th unit is the last unit where the marginal revenue (32) is greater than the marginal cost (30); the firm will not produce the 8th unit because the marginal cost of producing it (34) is greater than the marginal revenue earned (32).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as −\$4 and shows the work.

$$\text{Economic Profit} = TR - TC = 7(\$32) - \$228 = -\$4$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

### Units 3.1-3.3 Practice AP Questions

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

#### Part F

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that demand for gizmos will increase and explains that the positive cross-price elasticity of demand for gizmos with respect to the price of Good G means that the goods are substitutes; therefore, an increase in the price of Good G will lead to an increase in the demand for gizmos.

#### Part G

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that consumer surplus will stay the same and explains that a price floor below equilibrium is not binding and will not affect the quantity exchanged in the market.
- States that the profit-maximizing quantity of Good G will increase and explains that a decrease in variable cost will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.

32. F&D Manufacturing Company increases all its inputs by 50 percent each. If F&D's output increases by 100 percent, then F&D is experiencing

(A) increasing returns to scale

(B) constant returns to scale

(C) diseconomies of scale

(D) increasing marginal cost

(E) decreasing profits



**Units 3.1-3.3 Practice AP Questions**

33. FormalWear is a clothing factory that hires workers as a variable input and rents sewing machines as a fixed input. Which of the following will happen when the marginal product of workers decreases?
- (A) Total variable cost will decrease.
  - (B) Total fixed cost will increase.
  - (C) Short-run average total cost will decrease.
  - (D) Marginal cost will increase. ✓
  - (E) Marginal cost will equal average total cost.

**Answer D**

Correct. The marginal cost function is the “mirror image” of the marginal product of labor function; therefore, when the marginal product of workers (labor) decreases, marginal cost must increase.

34. Gale Furniture uses labor, capital, and wood as inputs in its production of office desks. When Gale Furniture doubles the quantity of labor, capital, and wood, the quantity of office desks doubles. Gale Furniture’s production process is characterized by
- (A) economies of scale
  - (B) diseconomies of scale
  - (C) constant returns to scale ✓
  - (D) decreasing returns to scale
  - (E) increasing returns to scale

**Answer C**

Correct. Constant returns to scale occur when a doubling of all the inputs used in production results in an exact doubling of output.

## Units 3.1-3.3 Practice AP Questions

35. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

The table below shows the total costs faced by Hank’s Clothing Emporium for different quantities of Good A sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$80       |
| 1        | \$130      |
| 2        | \$185      |
| 3        | \$255      |
| 4        | \$330      |
| 5        | \$410      |
| 6        | \$510      |
| 7        | \$640      |
| 8        | \$800      |
| 9        | \$995      |
| 10       | \$1,230    |

Hank’s Clothing Emporium sells Good A in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$60 per unit.

- Calculate the average fixed cost of producing 5 units. Show your work.
- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good A is  $-2$ , and the cross-price elasticity of demand for khaki pants with respect to the price of Good A is 0.8. Based on your answer to part (e), what will happen to the demand for khaki pants? Explain.
- Now assume that the market in which Hank’s Clothing Emporium operates is in long-run equilibrium.
  - Suppose the rent paid by Hank’s Clothing Emporium increases. Will Hank’s Clothing Emporium’s profit-maximizing quantity of Good A increase, decrease, or stay the same in the short run? Explain.
  - Instead suppose Hank’s Clothing Emporium hires labor in a perfectly competitive market and the market wage decreases. Will Hank’s Clothing Emporium’s profit-maximizing quantity of Good A increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$16 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$80}{5} = \$16$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 2 units and explains that the 2<sup>nd</sup> unit is the last unit where the marginal revenue (60) *is greater than the marginal cost* (55); the firm will not produce the 3<sup>rd</sup> unit because the marginal cost of producing it (70) *is greater than the marginal revenue earned* (60).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as −\$65 and shows the work.

$$\text{Economic Profit} = TR - TC = 2(\$60) - \$185 = -\$65$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for khaki pants will increase and explains that the positive cross-price elasticity of demand for khaki pants with respect to the price of Good A means that the goods are substitutes; therefore, an increase in the price of Good A will lead to an increase in the demand for khaki pants.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good A will stay the same in the short run and explains that a change in fixed cost does not affect the marginal cost.
- States that the profit-maximizing quantity of Good A will increase and explains that a decrease in the market wage will decrease the wage the firm pays its workers because the firm is a wage-taker in a perfectly competitive market; wages are a variable cost, so a decrease in the wage will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.

## Units 3.1-3.3 Practice AP Questions

36.

| Number of Cases | Total Cost (\$) |
|-----------------|-----------------|
| 0               | 15              |
| 1               | 25              |
| 2               | 45              |
| 3               | 75              |
| 4               | 115             |
| 5               | 165             |

The table provided shows the daily total cost data for Hansel's Hot Sauce. If the average fixed cost was \$5 per case, how many cases of hot sauce had Hansel's Hot Sauce produced?

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) 5

**Answer C**

Correct. Since total cost is 15 *when 0 cases are produced, total fixed cost is 15*. For average fixed cost to be \$5 per case, 3 cases must be produced (since average fixed cost is  $\frac{\$15}{3} = \$5$  only when 3 cases are produced).

## Units 3.1-3.3 Practice AP Questions

37. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Heirloom Gardens is a typical profit-maximizing firm that produces and sells tomatoes in a constant-cost, perfectly competitive market that is in long-run equilibrium.

(a) Draw correctly labeled side-by-side graphs for the tomato market and for Heirloom Gardens and show each of the following.

(i) The market equilibrium price and quantity, labeled  $P_M$  and  $Q_M$ , respectively

(ii) The profit-maximizing price and quantity for Heirloom Gardens, labeled  $P_F$  and  $Q_F$ , respectively

(iii) The average total cost curve consistent with a long-run equilibrium, labeled ATC

(b) Suppose the government imposes a binding price floor in the market for tomatoes.

(i) Will this price floor benefit all tomato farmers? Explain.

(ii) Will consumer surplus increase, decrease, or stay the same? Explain.

(c) Suppose that the government does not impose the price floor referred to in part (b) and that there is now an increase in consumers’ incomes and tomatoes are a normal good. On your graphs in part (a), show each of the following.

(i) The short-run effect of the increase in consumers’ incomes on the market equilibrium price and quantity of tomatoes, labeled  $P_2$  and  $Q_2$ , respectively

(ii) The short-run profit-maximizing quantity for Heirloom Gardens, labeled  $Q^*$

(iii) The area representing Heirloom Gardens’ economic profit, shaded completely

(d) Given the increase in consumers’ incomes in part (c), what will happen to the market equilibrium price and quantity of tomatoes in the long run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

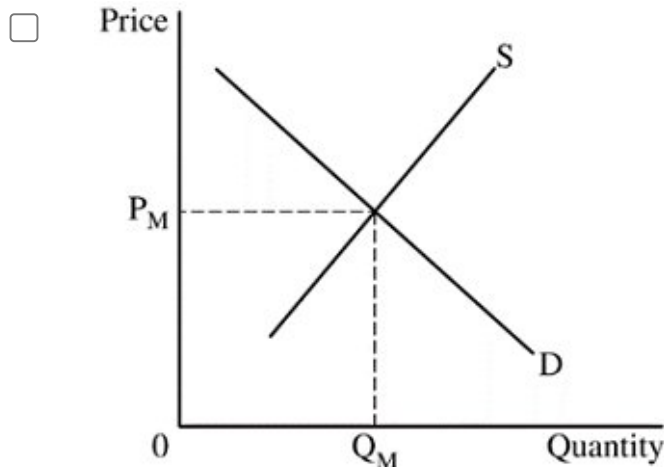


|   |   |   |   |   |
|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|

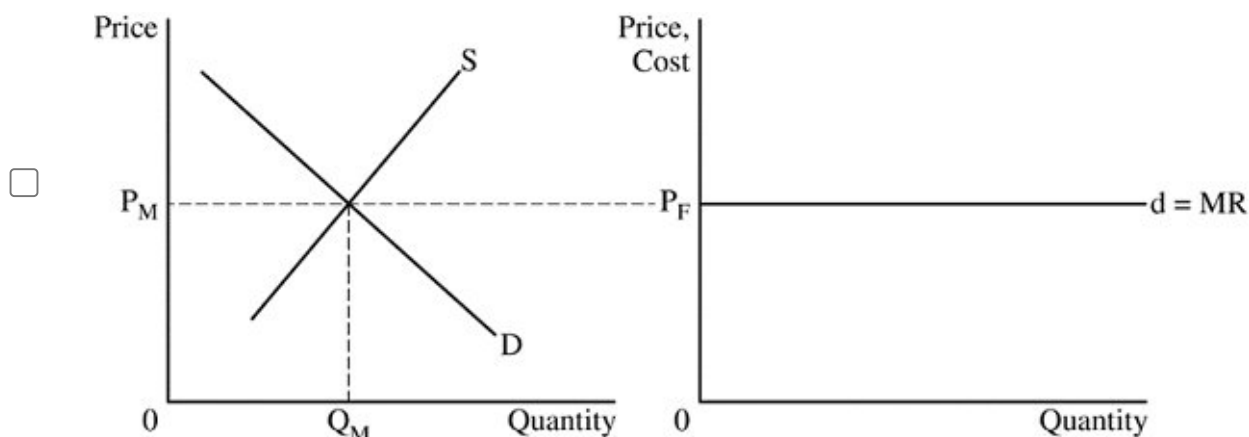
The response accurately includes four of the criteria below.

Draws a correctly labeled graph of the market for tomatoes with a downward-sloping demand (D) curve and an upward-sloping supply (S) curve and labels the market equilibrium price as  $P_M$  and the market equilibrium quantity as  $Q_M$ .

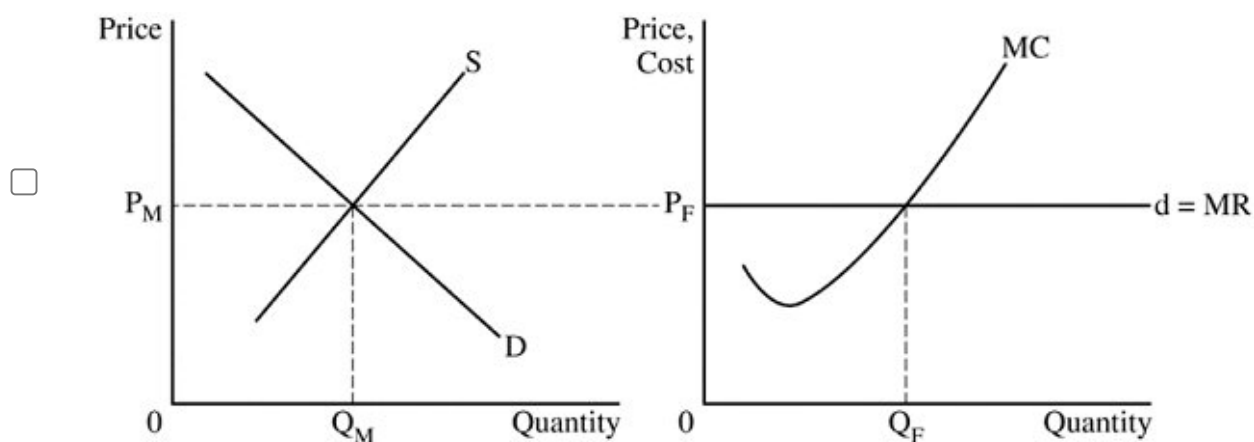
## Units 3.1-3.3 Practice AP Questions



Shows the firm's horizontal demand and marginal revenue ( $d = MR$ ) curve extended from the market equilibrium price ( $P_M$ ), and labels the firm's price as  $P_F$ .

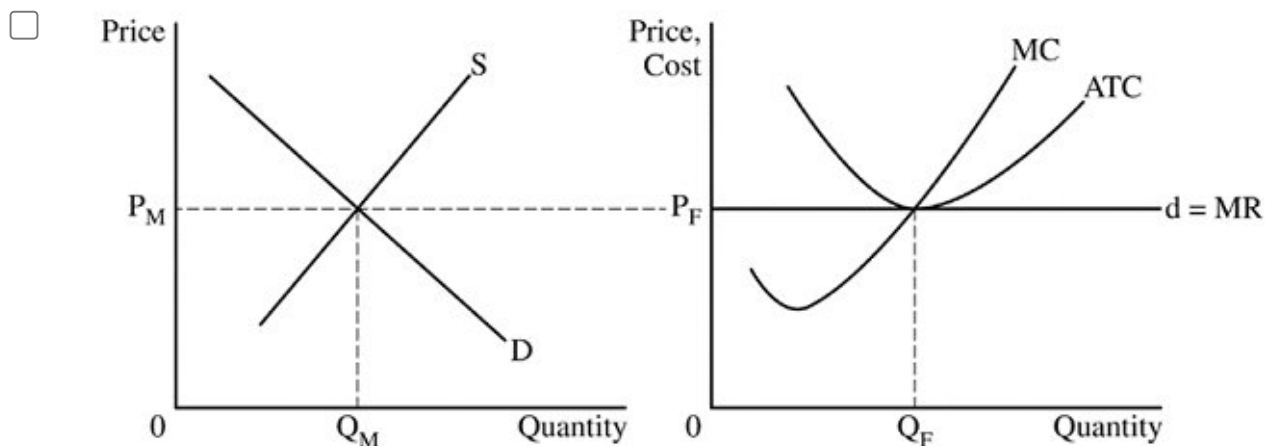


Shows a rising marginal cost ( $MC$ ) curve and the profit-maximizing quantity, labeled  $Q_F$  where  $MR = MC$ .



Shows the average total cost ( $ATC$ ) curve tangent to the firm's demand curve at  $Q_F$  and shows the  $MC$  curve passing through the minimum point of the  $ATC$  curve.

## Units 3.1-3.3 Practice AP Questions



## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response accurately includes two of the criteria below.

- ☐ States no and explains that the binding price floor will create a market surplus, and some tomato farmers will not be able to sell their tomatoes at the price floor.
- ☐ States that consumer surplus will decrease and explains that the binding price floor increases the price paid by consumers, which decreases the quantity demanded.

## Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



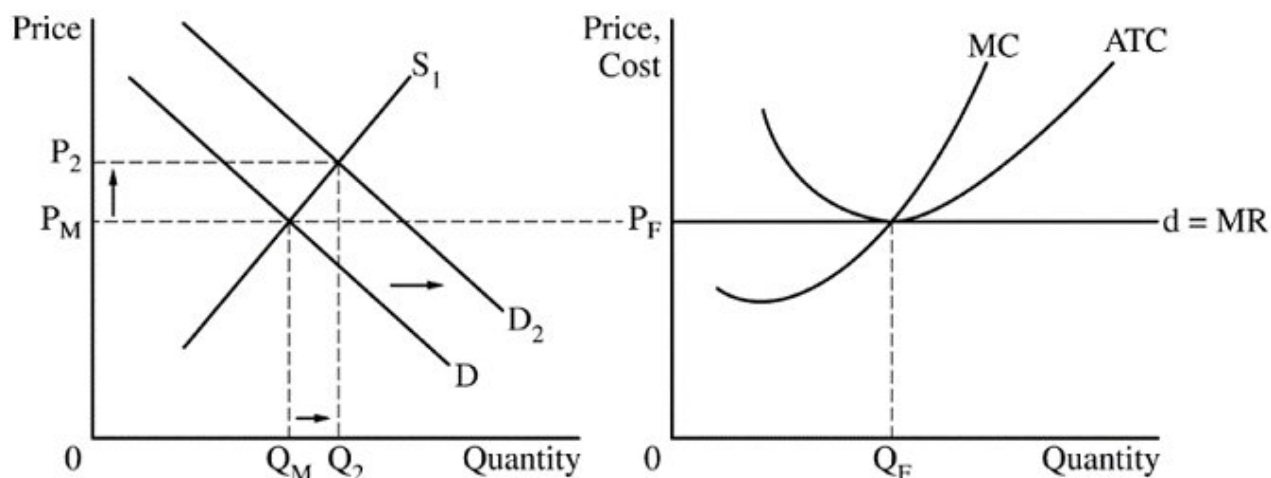
|   |   |   |   |
|---|---|---|---|
| 0 | 1 | 2 | 3 |
|---|---|---|---|

The response accurately includes three of the criteria below.

On the market graph from part (a), shows a rightward shift of the market demand curve and the new equilibrium price and quantity, labeled  $P_2$  and  $Q_2$ , respectively.

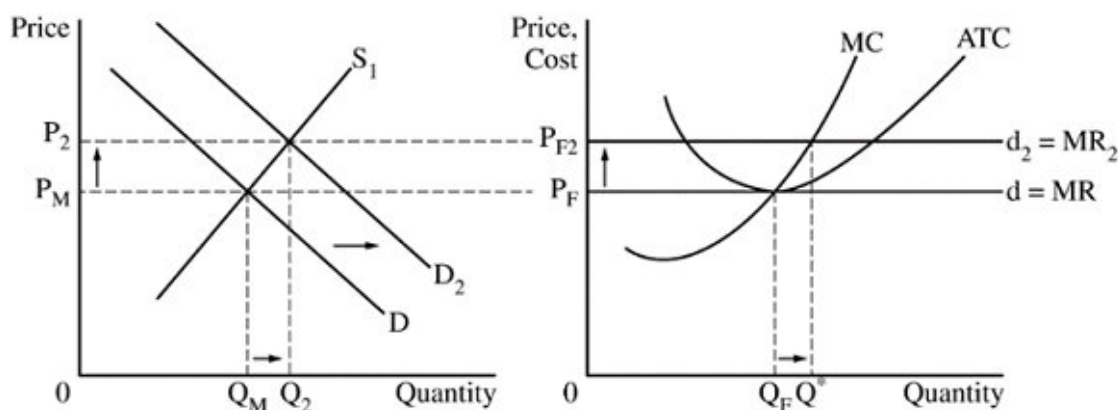


## Units 3.1-3.3 Practice AP Questions



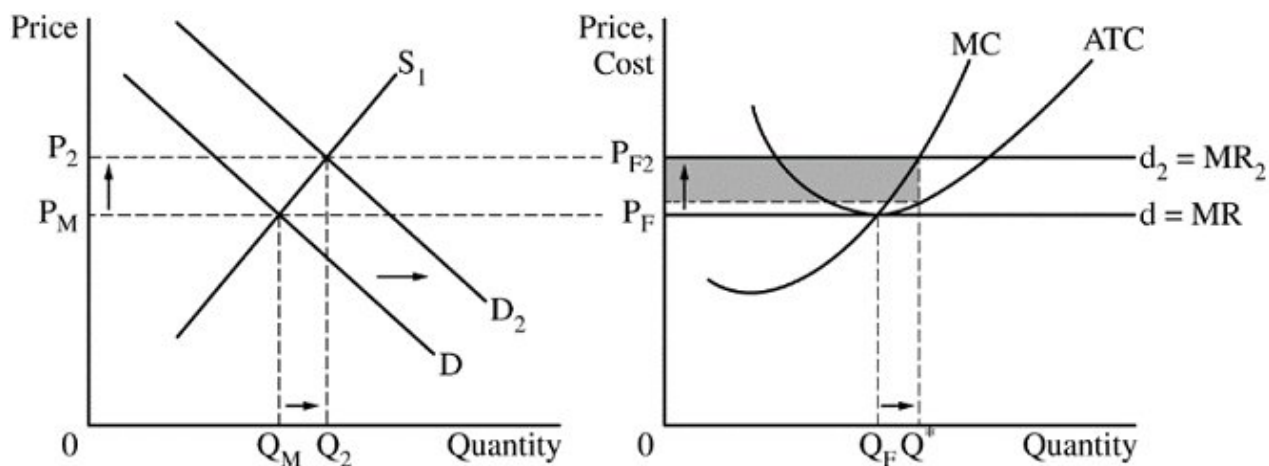
Shows an upward shift in the firm's demand curve and the new profit-maximizing quantity for Heirloom Gardens, labeled  $Q^*$ .

□



Shows a completely shaded area of Heirloom Gardens' short-run economic profit.

□



## Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



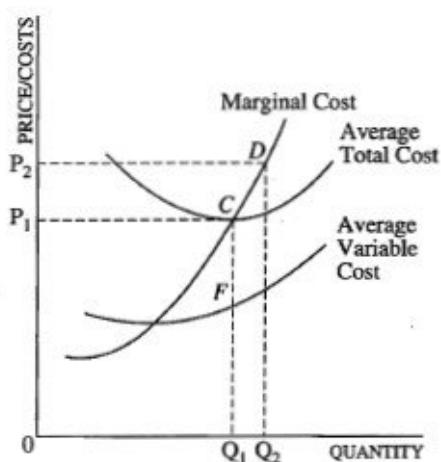
0

1

The response accurately includes the criterion below.

- ☐ States that the market price of tomatoes will decrease to  $P_M$  and the market quantity of tomatoes will increase and explains that short-run positive economic profits will lead to the entry of new firms, which shifts the market supply curve to the right.

38. The following questions refer to the graph below, which shows the cost curves for a profit maximizing, perfectly competitive firm.

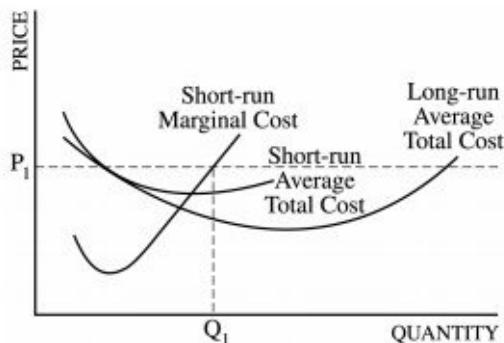


The vertical distance  $CF$  represents the

- (A) total cost of producing  $Q_1$  units of output
- (B) average total cost of producing  $Q_1$  units of output
- (C) average fixed cost of producing  $Q_1$  units of output ✓
- (D) average variable cost of producing  $Q_1$  units of output
- (E) amount of the firm's loss resulting from producing  $Q_1$  units of output
39. If a single firm can produce and supply an entire market at a lower unit cost than many small firms can, the long-run average total cost must be
- (A) increasing as firm size increases
- (B) remaining constant as firm size increases
- (C) decreasing as the firm's output increases ✓
- (D) inelastic due to specialization
- (E) constant and equal to marginal cost

## Units 3.1-3.3 Practice AP Questions

40. The following questions refer to the graph below, which shows the cost curves of a firm.



If the firm produces  $Q_1$  units of output with two inputs, the firm will be experiencing which of the following in the short run and in the long run?

|     |                              |                       |
|-----|------------------------------|-----------------------|
| (A) | <b>Short Run</b>             | <b>Long Run</b>       |
|     | Increasing marginal returns  | Economies of scale    |
| (B) | <b>Short Run</b>             | <b>Long Run</b>       |
|     | Increasing marginal returns  | Diseconomies of scale |
| (C) | <b>Short Run</b>             | <b>Long Run</b>       |
|     | Diminishing marginal returns | Economies of scale    |
| (D) | <b>Short Run</b>             | <b>Long Run</b>       |
|     | Diminishing marginal returns | Diseconomies of scale |
| (E) | <b>Short Run</b>             | <b>Long Run</b>       |
|     | Constant marginal returns    | Diseconomies of scale |

41. If the price of a firm's variable input increases, which of the following will occur?

|     |                                                                   |   |
|-----|-------------------------------------------------------------------|---|
| (A) | The firm will decrease its level of production.                   | ✓ |
| (B) | The price of the good will decrease in the short run.             |   |
| (C) | The firm's marginal costs will decrease at every level of output. |   |
| (D) | The firm's average fixed cost will decrease.                      |   |
| (E) | More firms will enter the industry in the long run.               |   |

**Units 3.1-3.3 Practice AP Questions**

42. Which of the following factors can cause a firm's cost curves to shift upward?
- (A) An increase in wages ✓
  - (B) An increase in the firm's output
  - (C) An increase in the output price
  - (D) A decrease in the firm's output
  - (E) A decrease in the price of energy
43. In microeconomics, the short run is defined as which of the following?
- (A) A period that is less than one year
  - (B) A period that is between one year and four years
  - (C) A period that is too short for a firm to be able to change its level of output
  - (D) A period during which some inputs in a firm's production process cannot be changed ✓
  - (E) A period during which a firm's fixed costs exceed its variable costs
44. In most cases the supply curve for a perfectly competitive industry can be described as which of the following?
- (A) More elastic in the short run than in the long run
  - (B) More elastic in the long run than in the short run ✓
  - (C) Downward sloping in the short run
  - (D) Perfectly inelastic in the long run
  - (E) Perfectly elastic in the short run
45. Under which of the following circumstances is a firm experiencing economics of scale?
- (A) The firm increases only its labor input, and output decreases.
  - (B) The firm doubles its inputs, and output triples. ✓
  - (C) The firm builds a new plant, and the average cost of production increases.
  - (D) The firm hires a new plant manager, and profits increase.
  - (E) The product price increases, and the firm increases its output.

**Answer B**

## Units 3.1-3.3 Practice AP Questions

46. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total variable costs faced by Julia’s Accessories Store for different quantities of Good E sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$35                |
| 2        | \$73                |
| 3        | \$113               |
| 4        | \$154               |
| 5        | \$198               |
| 6        | \$248               |
| 7        | \$303               |
| 8        | \$360               |
| 9        | \$421               |
| 10       | \$498               |

Julia’s Accessories Store sells Good E in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$62 per unit, and the total fixed cost is \$152.

- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- Calculate the average fixed cost of producing 8 units. Show your work.
- Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good E is  $-1.2$ , and the cross-price elasticity of demand for bracelets with respect to the price of Good E is  $0.6$ . Based on your answer to part (e), what will happen to the demand for bracelets? Explain.
- Now assume that the market in which Julia’s Accessories Store operates is in long-run equilibrium.
  - Suppose the market demand for Good E decreases. Will the profit-maximizing quantity of Good E for Julia’s Accessories Store increase, decrease, or stay the same in the short run? Explain.
  - Suppose instead the wages that Julia’s Accessories Store pays its workers increase. Will the profit-maximizing quantity of Good E for Julia’s Accessories Store increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 9 units and explains that the 9<sup>th</sup> unit is the last unit where the marginal revenue (62) *is greater than the marginal cost* (61); the firm will not produce the 10<sup>th</sup> unit because the marginal cost of producing it (77) *is greater than the marginal revenue earned* (62).

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as  $-\$15$  and shows the work.

$$\text{Economic Profit} = TR - TC = 9(\$62) - (\$421 + \$152) = -\$15$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as  $\$19$  and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$152}{8} = \$19$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for bracelets will increase and explains that the positive cross-price elasticity of demand for bracelets with respect to the price of Good E means that the goods are substitutes; therefore, an increase in the price of Good E will lead to an increase in the demand for bracelets.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good E will decrease and explains that the decrease in market demand will decrease the market price (the firm's marginal revenue), which will shift the marginal revenue curve downward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.
- States that the profit-maximizing quantity of Good E will decrease and explain that wages are a variable cost, so an increase in wages will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.

## Units 3.1-3.3 Practice AP Questions

47. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Kailas’s Wholesale Market for different quantities of Good Z sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$30       |
| 1        | \$55       |
| 2        | \$95       |
| 3        | \$140      |
| 4        | \$200      |
| 5        | \$280      |
| 6        | \$380      |
| 7        | \$500      |
| 8        | \$640      |
| 9        | \$800      |
| 10       | \$980      |

Kailas’s Wholesale Market sells Good Z in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$90 per unit.

- (a) Calculate the average fixed cost of producing 3 units. Show your work.
- (b) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (c) Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- (d) Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good Z is 2, and the cross-price elasticity of demand for chairs with respect to the price of Good Z is 0.4. Based on your answer to part (e), what will happen to the demand for chairs? Explain.
- (g) Now assume that the market in which Kailas’s Wholesale Market operates is in long-run equilibrium.
- (i) Suppose the rent paid by Kailas’s Wholesale Market decreases. Will Kailas’s Wholesale Market’s profit-maximizing quantity of Good Z increase, decrease, or stay the same in the short run? Explain.
- (ii) Instead suppose Kailas’s Wholesale Market hires labor in a perfectly competitive market and the market wage increases. Will Kailas’s Wholesale Market’s profit-maximizing quantity of Good Z increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$10 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$30}{3} = \$10$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 5 units and explains that the 5<sup>th</sup> unit is the last unit where the marginal revenue (90) *is greater than the marginal cost* (80); the firm will not produce the 6<sup>th</sup> unit because the marginal cost of producing it (100) *is greater than the marginal revenue earned* (90).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$170 and shows the work.

$$\text{Economic Profit} = TR - TC = 5(\$90) - \$280 = \$170$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for chairs will decrease and explains that the positive cross-price elasticity of demand for chairs with respect to the price of Good Z means that the goods are substitutes; therefore, a decrease in the price of Good Z will lead to a decrease in the demand for chairs.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good Z will stay the same in the short run and explains that a change in fixed cost does not affect the marginal cost.
- States that the profit-maximizing quantity of Good Z will decrease and explains that an increase in the market wage will increase the wage the firm pays its workers because the firm is a wage-taker in a perfectly competitive market; wages are a variable cost, so an increase in the wage will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.

## Units 3.1-3.3 Practice AP Questions

48. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total variable costs faced by Karen’s Kaleidoscope Store for different quantities of Good N sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$30                |
| 2        | \$70                |
| 3        | \$120               |
| 4        | \$180               |
| 5        | \$250               |
| 6        | \$340               |
| 7        | \$435               |
| 8        | \$535               |
| 9        | \$645               |
| 10       | \$760               |

Karen’s Kaleidoscope Store sells Good N in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$80 per unit, and the total fixed cost is \$300.

- (a) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (b) Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- (c) Calculate the average fixed cost of producing 3 units. Show your work.
- (d) Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good N is  $-1.8$ , and the cross-price elasticity of demand for kaleidoscopes with respect to the price of Good N is  $-0.5$ . Based on your answer to part (e), what will happen to the demand for kaleidoscopes? Explain.
- (g) Now assume that the market in which Karen’s Kaleidoscope Store operates is in long-run equilibrium at a price of \$85 per unit.
- (i) Suppose annual property taxes for Karen’s Kaleidoscope Store decrease by \$2,500. Will the profit-maximizing quantity of Good N for Karen’s Kaleidoscope Store increase, decrease, or stay the same in the short run? Explain.
- (ii) Instead suppose the government imposes a price floor at \$75 on the market for Good N. Will deadweight loss in the market for Good N increase, decrease, or stay the same in the short run as a result of the price floor? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 5 units and explains that the 5th unit is the last unit where the marginal revenue (80) *is greater than the marginal cost* (70); the firm will not produce the 6th unit because the marginal cost of producing it (90) *is greater than the marginal revenue earned* (80).

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as  $-\$150$  and shows the work.

$$\text{Economic Profit} = TR - TC = 5(\$80) - (\$250 + \$300) = -\$150$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as  $\$100$  and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$300}{3} = \$100$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for kaleidoscopes will decrease and explains that the negative cross-price elasticity of demand for kaleidoscopes with respect to the price of Good N means that the goods are complements; therefore, an increase in the price of Good N will lead to a decrease in the demand for kaleidoscopes.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good N will stay the same in the short run and explain that property taxes are a fixed cost and a change in fixed cost does not affect the marginal cost.
- States that the deadweight loss will stay the same and explain that a price floor below equilibrium is not binding and will not affect the quantity exchanged in the market.

## Units 3.1-3.3 Practice AP Questions

49. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Kiyoshi’s Clothing Store for different quantities of Good F sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$8        |
| 1        | \$18       |
| 2        | \$32       |
| 3        | \$48       |
| 4        | \$72       |
| 5        | \$104      |
| 6        | \$144      |
| 7        | \$192      |
| 8        | \$248      |
| 9        | \$312      |
| 10       | \$384      |

Kiyoshi’s Clothing Store sells Good F in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$60 per unit.

- (a) Calculate the average fixed cost of producing 4 units. Show your work.
- (b) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (c) Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- (d) Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good F is 3, and the cross-price elasticity of demand for gloves with respect to the price of Good F is 0.5. Based on your answer to part (e), what will happen to the demand for gloves? Explain.
- (g) Now assume that the market in which Kiyoshi’s Clothing Store operates is in long-run equilibrium at a price of \$50 per unit.
- (i) Suppose the government imposes a price floor at \$55 per unit on the market for Good F. Will consumer surplus in the market for Good F increase, decrease, or stay the same in the short run as a result of the price floor? Explain.
- (ii) Suppose instead the cost of energy, a variable cost for Kiyoshi’s Clothing Store, increases. Will the profit-maximizing quantity of Good F for Kiyoshi’s Clothing Store increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$2 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$8}{4} = \$2$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 8 units and explains that the 8<sup>th</sup> unit is the last unit where the marginal revenue (60) *is greater than the marginal cost* (56); the firm will not produce the 9<sup>th</sup> unit because the marginal cost of producing it (64) *is greater than the marginal revenue earned* (60).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$232 and shows the work.

$$\text{Economic Profit} = TR - TC = 8(\$60) - \$248 = \$232$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for gloves will decrease and explains that the positive cross-price elasticity of demand for gloves with respect to the price of Good F means that the goods are substitutes; therefore, a decrease in the price of Good F will lead to a decrease in the demand for gloves.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that consumer surplus will decrease and explains that a price floor above the equilibrium price is binding and the quantity exchanged in the market will be limited by the quantity demanded, which is less than the equilibrium quantity, thus decreasing consumer surplus.
- States that the profit-maximizing quantity of Good F will decrease and explains that an increase in variable cost will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.

## Units 3.1-3.3 Practice AP Questions

50. Locotek produces toy trains and pays each worker \$350 per week. Five workers can produce 40 trains per week and six workers can produce 45 trains per week. The marginal product per week of the sixth worker is

(A) \$70  
(B) \$350  
(C) 5 trains  
(D) 7.5 trains  
(E) 42.5 trains



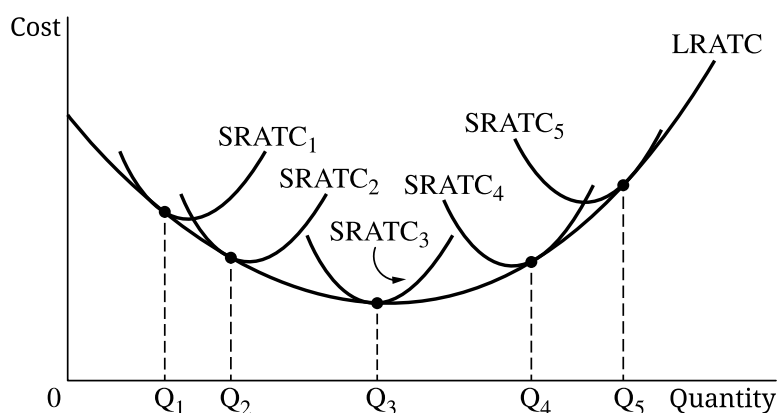
51. The long-run average cost curve will be sloping downward if a firm experiences

(A) diminishing marginal returns  
(B) decreasing returns to scale  
(C) constant returns to scale  
(D) diseconomies of scale

(E) economies of scale



52.



The graph provided shows five different short-run average total cost (SRATC) curves of a firm and its long-run average total cost (LRATC) curve. Which of the following is true if the firm is operating on its SRATC<sub>2</sub> curve and producing quantity Q<sub>2</sub>?

- (A) The firm is producing at the minimum efficient scale.  
(B) The firm must decrease its output to achieve the minimum efficient scale.  
(C) The firm must increase its output to achieve the minimum efficient scale.  
(D) The firm is producing at its productively efficient quantity of output.  
(E) The firm is experiencing diseconomies of scale.

**Answer C**

Correct. Minimum efficient scale occurs at the lowest point of the LRATC curve, which is Q<sub>3</sub>. Q<sub>2</sub> represents a point less than the level of output required to reach the minimum efficient scale on the LRATC; thus, the firm must increase output to achieve the minimum efficient scale.

## Units 3.1-3.3 Practice AP Questions

53. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Lynda’s Office Supply Store for different quantities of Good P sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$12       |
| 1        | \$22       |
| 2        | \$52       |
| 3        | \$102      |
| 4        | \$172      |
| 5        | \$252      |
| 6        | \$342      |
| 7        | \$442      |
| 8        | \$552      |
| 9        | \$672      |
| 10       | \$802      |

Lynda’s Office Supply Store sells Good P in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$45 per unit.

- Calculate the average fixed cost of producing 4 units. Show your work.
- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good P is 1.8, and the cross-price elasticity of demand for chair mats with respect to the price of Good P is 0.9. Based on your answer to part (e), what will happen to the demand for chair mats? Explain.
- Now assume that the market in which Lynda’s Office Supply Store operates is in long-run equilibrium at a price of \$40 per unit.
  - Suppose shipping costs per order for Lynda’s Office Supply Store increase. Will the profit-maximizing quantity of Good P for Lynda’s Office Supply Store increase, decrease, or stay the same in the short run? Explain.
  - Instead suppose the government imposes a price ceiling of \$50 on the market for Good P. Will total economic surplus in the market for Good P increase, decrease, or stay the same in the short run as a result of the price ceiling? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$3 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$12}{4} = \$3$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 2 units and explains that the 2<sup>nd</sup> unit is the last unit where the marginal revenue (45) is greater than the marginal cost (30); the firm will not produce the 3rd unit because the marginal cost of producing it (50) is greater than the marginal revenue earned (45).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$38 and shows the work.

$$\text{Economic Profit} = TR - TC = 2(\$45) - \$52 = \$38$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for chair mats will decrease and explains that that the positive cross-price elasticity of demand for chair mats with respect to the price of Good P means that the goods are substitutes; therefore, a decrease in the price of Good P will lead to a decrease in the demand for chair mats.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good P will decrease and explains that shipping costs per order are a variable cost, so an increase in shipping costs per order will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.
- States that total economic surplus will stay the same and explains that a price ceiling above the equilibrium price is not binding and will not affect the quantity exchanged in the market.

**Units 3.1-3.3 Practice AP Questions**

54. If the marginal product of an input is positive and increasing, total product is

- (A) decreasing at an increasing rate
- (B) increasing at an increasing rate
- (C) increasing at a decreasing rate
- (D) decreasing at a decreasing rate
- (E) increasing at a constant rate

**Answer B**

Correct. Marginal product is the change in total product as a result of increasing the quantity of an input (such as labor) by one unit. If marginal product is positive, then total product will increase by the amount of the marginal product. If marginal product is increasing, then total product will also increase at that increasing rate.

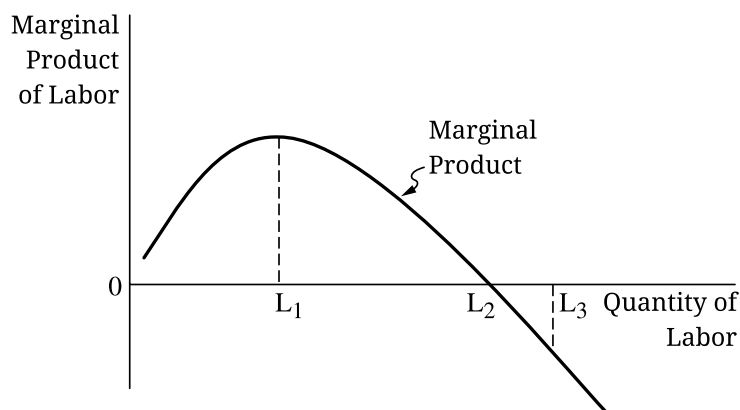
55. Marginal cost is defined as the

- (A) change in total cost resulting from producing an additional unit of output
- (B) change in total cost resulting from using an additional unit of input
- (C) difference between total cost and total variable cost
- (D) difference between total variable cost and total fixed cost
- (E) difference between average total cost and average variable cost divided by output



## Units 3.1-3.3 Practice AP Questions

56.



Which of the following will happen if the firm continues to hire additional units of labor beyond  $L_2$  in the short run?

- (A) The firm's marginal cost will decrease.
- (B) The firm will begin experiencing diminishing marginal returns.
- (C) The firm's fixed cost will increase.
- (D) The average product of labor will be equal to zero.
- (E) The total product of labor will decrease. ✓

**Answer E**

Correct. At quantities of labor hired beyond  $L_2$ , the marginal product of labor is negative. When the marginal product of labor is negative, additional labor hired will decrease total product.

57. A firm's short-run production function uses capital and labor as inputs. Assume the quantity of capital is fixed in the short run. The marginal product of labor will decrease as more labor is used in the short run because each unit of labor will have

- (A) zero units of capital to work with
- (B) fewer units of capital to work with ✓
- (C) an increase in the capital-to-labor ratio
- (D) more units of capital to work with
- (E) an infinite number of units of capital to work with

**Answer B**

Correct. In the short run, as the firm hires more labor to produce more output, each additional unit of labor will have to share the fixed capital that the firm has; therefore, there will be a decrease in the marginal product of labor. Each unit of labor will have fewer units of capital to work with.

**Units 3.1-3.3 Practice AP Questions**

**58.** Which of the following statements about cost is always true for both monopolies and perfectly competitive firms?

- (A) Average total cost equals marginal cost when average total cost is a minimum. ✓
- (B) Marginal cost decreases as production increases.
- (C) Average fixed cost is equal to marginal cost when average fixed cost is a minimum.
- (D) Average variable cost is equal to marginal cost when marginal cost is a minimum.
- (E) Average variable cost decreases as production increases.

**59.** Which of the following is true of production in the long run?

- (A) At least one factor of production is fixed.
- (B) Only one factor of production is fixed.
- (C) Some factors of production are fixed while others are variable.
- (D) All factors of production are variable. ✓
- (E) All factors of production, except technology, are fixed.

**Answer D**

Correct. In the long run, firms have complete flexibility in utilizing all factors of production. Therefore, all factors of production are variable in the long run.

## Units 3.1-3.3 Practice AP Questions

60. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

The table below shows the total variable costs faced by Raskin’s Clothing Store for different quantities of Good D sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$50                |
| 2        | \$105               |
| 3        | \$161               |
| 4        | \$218               |
| 5        | \$276               |
| 6        | \$335               |
| 7        | \$410               |
| 8        | \$540               |
| 9        | \$695               |
| 10       | \$875               |

Raskin’s Clothing Store sells Good D in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is 150 *per unit*, and the total fixed cost is 85.

- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- Calculate the average fixed cost of producing 10 units. Show your work.
- Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good D is 1.2, and the cross-price elasticity of demand for dresses with respect to the price of Good D is 0.2. Based on your answer to part (e), what will happen to the demand for dresses? Explain.
- Now assume that the market in which Raskin’s Clothing Store operates is in long-run equilibrium.
  - Suppose the market demand for Good D increases. Will the profit-maximizing quantity of Good D for Raskin’s Clothing Store increase, decrease, or stay the same in the short run? Explain.
  - Suppose instead the wages that Raskin’s Clothing Store pays its workers decrease. Will the profit-maximizing quantity of Good D for Raskin’s Clothing Store increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 8 units and explains that the 8<sup>th</sup> unit is the last unit where the marginal revenue (150) *is greater than the marginal cost* (130); the firm will not produce the 9<sup>th</sup> unit because the marginal cost of producing it (155) *is greater than the marginal revenue earned* (150).

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$575 and shows the work.

$$\text{Economic Profit} = TR - TC = 8(\$150) - (\$540 + \$85) = \$575$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost of producing 5 units as \$20 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$85}{10} = \$8.50$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for dresses will decrease and explains that the positive cross-price elasticity of demand for dresses with respect to the price of Good D means that the goods are substitutes; therefore, a decrease in the price of Good D will lead to a decrease in the demand for dresses.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good D will increase and explains that the increase in market demand will increase the market price (the firm's marginal revenue), which will shift the marginal revenue curve upward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.
- States that the profit-maximizing quantity of Good D will increase and explains that wages are a variable cost, so a decrease in wages will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.

## Units 3.1-3.3 Practice AP Questions

61. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total variable costs faced by Saif’s General Store for different quantities of Good C sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$50                |
| 2        | \$103               |
| 3        | \$165               |
| 4        | \$232               |
| 5        | \$310               |
| 6        | \$393               |
| 7        | \$481               |
| 8        | \$581               |
| 9        | \$690               |
| 10       | \$810               |

Saif’s General Store sells Good C in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$90 per unit, and the total fixed cost is \$275.

- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- Calculate the average fixed cost of producing 5 units. Show your work.
- Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good C is  $-1.5$ , and the cross-price elasticity of demand for hats with respect to the price of Good C is  $-0.6$ . Based on your answer to part (e), what will happen to the demand for hats? Explain.
- Now assume that the market in which Saif’s General Store operates is in long-run equilibrium.
  - Suppose the market demand for Good C decreases. Will the profit-maximizing quantity of Good C for Saif’s General Store increase, decrease, or stay the same in the short run? Explain.
  - Suppose instead the wages that Saif’s General Store pays its workers increase. Will the profit-maximizing quantity of Good C for Saif’s General Store increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

### Units 3.1-3.3 Practice AP Questions

The response identifies the profit-maximizing quantity as 7 units and explains that the 7<sup>th</sup> unit is the last unit where the marginal revenue (90) *is greater than the marginal cost* (88); the firm will not produce the 8<sup>th</sup> unit because the marginal cost of producing it (100) *is greater than the marginal revenue earned* (90).

#### Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as  $-\$126$  and shows the work.

$$\text{Economic Profit} = TR - TC = 7(\$90) - (\$481 + \$275) = -\$126$$

#### Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$55 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$275}{5} = \$55$$

#### Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

#### Part E

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for hats will decrease and explains that the negative cross-price elasticity of demand for hats with respect to the price of Good C means that the goods are complements; therefore, an increase in the price of Good C will lead to a decrease in the demand for hats.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good C will decrease and explains that the decrease in market demand will decrease the market price (the firm's marginal revenue), which will shift the marginal revenue curve downward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.
- States that the profit-maximizing quantity of Good C will decrease and explains that wages are a variable cost, so an increase in wages will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.

## Units 3.1-3.3 Practice AP Questions

62. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Sarah’s Tool Store for different quantities of Good J sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$110      |
| 1        | \$145      |
| 2        | \$175      |
| 3        | \$200      |
| 4        | \$220      |
| 5        | \$245      |
| 6        | \$275      |
| 7        | \$310      |
| 8        | \$350      |
| 9        | \$395      |
| 10       | \$445      |

Sarah’s Tool Store sells Good J in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$42 per unit.

- Calculate the average fixed cost of producing 5 units. Show your work.
- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good J is  $-1.4$ , and the cross-price elasticity of demand for widgets with respect to the price of Good J is  $-0.25$ . Based on your answer to part (e), what will happen to the demand for widgets? Explain.
- Now assume that the market in which Sarah’s Tool Store operates is in long-run equilibrium at a price of \$45 per unit.
  - Suppose the government imposes a price floor at \$40 per unit on the market for Good J. Will consumer surplus in the market for Good J increase, decrease, or stay the same in the short run as a result of the price floor? Explain.
  - Suppose instead the cost of energy, a variable cost for Sarah’s Tool Store, decreases. Will the profit-maximizing quantity of Good J for Sarah’s Tool Store increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$22 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$110}{5} = \$22$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 8 units and explains that the 8<sup>th</sup> unit is the last unit where the marginal revenue (42) *is greater than the marginal cost* (40); the firm will not produce the 9<sup>th</sup> unit because the marginal cost of producing it (45) *is greater than the marginal revenue earned* (42).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as −\$14 and shows the work.

$$\text{Economic Profit} = TR - TC = 8(\$42) - \$350 = -\$14$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that demand for widgets will decrease and explains the negative cross-price elasticity of demand for widgets with respect to the price of Good J means that the goods are complements; therefore, an increase in the price of Good J will lead to a decrease in the demand for widgets.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that consumer surplus will stay the same and explains that a price floor below equilibrium is not binding and will not affect the quantity exchanged in the market.
- States that the profit-maximizing quantity of Good J will increase and explains that a decrease in variable cost will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.

## Units 3.1-3.3 Practice AP Questions

63.

| Number of Workers | Number of Units of Capital | Total Product (Quantity) |
|-------------------|----------------------------|--------------------------|
| 0                 | 5                          | 0                        |
| 1                 | 5                          | 1                        |
| 2                 | 5                          | 3                        |
| 3                 | 5                          | 7                        |
| 4                 | 5                          | 10                       |
| 5                 | 5                          | 12                       |

Suppose labor and capital can be hired in a competitive market. The wage is \$15 per worker and the rental rate of capital is \$10 per unit. Based on the table, what are the average variable cost (AVC) and average total cost (ATC) of producing 10 units of output?

- (A) AVC is \$5 and ATC is \$12  
 (B) AVC is \$6 and ATC is \$11  
 (C) AVC is \$15 and ATC is \$25  
 (D) AVC is \$60 and ATC is \$110  
 (E) AVC is \$105 and ATC is \$175

**Answer B**

Correct. When the firm produces 10 units, it hires 4 workers at a wage rate of \$15. Therefore, its variable cost is \$60 ( $= 4 \times \$15$ ), and the average variable cost is  $\$6 \left( = \frac{\$60}{10} \right)$ . Total cost is the sum of variable cost and fixed cost. The firm rents capital (the fixed inputs) for \$10 per unit. Therefore, fixed cost is \$50 ( $= 5 \times \$10$ ), total cost is \$110 ( $= \$60 + \$50$ ), and average total cost is  $\$11 \left( = \frac{\$110}{10} \right)$ .

64. Which of the following best describes the relationship between the average total cost curve and the marginal cost curve in the short run?

- (A) If the average total cost curve is rising, the marginal cost curve is above the average total cost curve.  
 (B) If the average total cost curve is rising, the marginal cost curve is below the average total cost curve.  
 (C) If the average total cost curve is above the marginal cost curve, the marginal cost curve is rising.  
 (D) If the average total cost curve is below the marginal cost curve, the marginal cost curve is falling.  
 (E) If the average and marginal cost curves intersect, the marginal cost curve is at a minimum.



## Units 3.1-3.3 Practice AP Questions

65. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Sophia’s Lighting Store for different quantities of Good H sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$50       |
| 1        | \$90       |
| 2        | \$110      |
| 3        | \$115      |
| 4        | \$140      |
| 5        | \$185      |
| 6        | \$250      |
| 7        | \$335      |
| 8        | \$440      |
| 9        | \$565      |
| 10       | \$710      |

Sophia’s Lighting Store sells Good H in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$140 per unit.

- Calculate the average fixed cost of producing 2 units. Show your work.
- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good H is 1.3, and the cross-price elasticity of demand for desk lamps with respect to the price of Good H is  $-0.9$ . Based on your answer to part (e), what will happen to the demand for desk lamps? Explain.
- Now assume that the market in which Sophia’s Lighting Store operates is in long-run equilibrium at a price of \$130 per unit.
- Suppose the government imposes a price floor at \$150 per unit on the market for Good H. Will consumer surplus in the market for Good H increase, decrease, or stay the same in the short run as a result of the price floor? Explain.
- Suppose instead the cost of energy, a variable cost for Sophia’s Lighting Store, increases. Will the profit-maximizing quantity of Good H for Sophia’s Lighting Store increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$25 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$50}{2} = \$25$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 9 units and explains that the 9th unit is the last unit where the marginal revenue (140) *is greater than the marginal cost* (125); the firm will not produce the 10th unit because the marginal cost of producing it (145) *is greater than the marginal revenue earned* (140).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$695 and shows the work.

$$\text{Economic Profit} = TR - TC = 9(\$140) - \$565 = \$695$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for desk lamps will increase and explains that the negative cross-price elasticity of demand for desk lamps with respect to the price of Good H means that the goods are complements; therefore, a decrease in the price of Good H will lead to an increase in the demand for desk lamps.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that consumer surplus will decrease and explains that a price floor above the equilibrium price is binding and the quantity exchanged in the market will be limited by the quantity demanded, which is less than the equilibrium quantity, thus decreasing consumer surplus.
- States that the profit-maximizing quantity of Good H will decrease and explains that an increase in variable cost will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.

## Units 3.1-3.3 Practice AP Questions

66. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

The table below shows the total costs faced by Surisitee’s Sporting Goods Store for different quantities of Good Y sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$85       |
| 1        | \$105      |
| 2        | \$130      |
| 3        | \$165      |
| 4        | \$210      |
| 5        | \$290      |
| 6        | \$410      |
| 7        | \$580      |
| 8        | \$810      |
| 9        | \$1,110    |
| 10       | \$1,490    |

Surisitee’s Sporting Goods Store sells Good Y in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$40 per unit.

- (a) Calculate the average fixed cost of producing 2 units. Show your work.
- (b) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (c) Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- (d) Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good Y is  $-2.5$ , and the cross-price elasticity of demand for basketballs with respect to the price of Good Y is  $-0.8$ . Based on your answer to part (e), what will happen to the demand for basketballs? Explain.
- (g) Now assume that the market in which Surisitee’s Sporting Goods Store operates is in long-run equilibrium.
  - (i) Suppose the rent paid by Surisitee’s Sporting Goods Store increases. Will Surisitee’s Sporting Goods Store’s profit-maximizing quantity of Good Y increase, decrease, or stay the same in the short run? Explain.
  - (ii) Instead suppose Surisitee’s Sporting Goods Store hires labor in a perfectly competitive market and the market wage decreases. Will Surisitee’s Sporting Goods Store’s profit-maximizing quantity of Good Y increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$42.50 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$85}{2} = \$42.50$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 3 units and explains that the 3rd unit is the last unit where the marginal revenue (40) *is greater than the marginal cost* (35); the firm will not produce the 4th unit because the marginal cost of producing it (45) *is greater than the marginal revenue earned* (40).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as −\$45 and shows the work.

$$\text{Economic Profit} = TR - TC = 3(\$40) - \$165 = -\$45$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that demand for basketballs will decrease and explains that the negative cross-price elasticity of demand for basketballs with respect to the price of Good Y means that the goods are complements; therefore, an increase in the price of Good Y will lead to a decrease in the demand for basketballs.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good Y will stay the same in the short run and explains that a change in fixed cost does not affect the marginal cost.
- States that the profit-maximizing quantity of Good Y will increase and explains that a decrease in the market wage will decrease the wage the firm pays its workers because the firm is a wage-taker in a perfectly competitive market; wages are a variable cost, so a decrease in the wage will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.

## Units 3.1-3.3 Practice AP Questions

67. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total variable costs faced by Steve’s Home Appliances Store for different quantities of Good L sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$55                |
| 2        | \$105               |
| 3        | \$152               |
| 4        | \$205               |
| 5        | \$270               |
| 6        | \$345               |
| 7        | \$428               |
| 8        | \$525               |
| 9        | \$630               |
| 10       | \$745               |

Steve’s Home Appliances Store sells Good L in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$80 per unit, and the total fixed cost is \$145.

- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- Calculate the average fixed cost of producing 5 units. Show your work.
- Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good L is  $-0.8$ , and the cross-price elasticity of demand for coffee machines with respect to the price of Good L is  $0.25$ . Based on your answer to part (e), what will happen to the demand for coffee machines? Explain.
- Now assume that the market in which Steve’s Home Appliances Store operates is in long-run equilibrium at a price of \$90 per unit.
  - Suppose annual property taxes for Steve’s Home Appliances Store decrease by \$7,000. Will the profit-maximizing quantity of Good L for Steve’s Home Appliances Store increase, decrease, or stay the same in the short run? Explain.
  - Instead suppose the government imposes a price floor at \$70 on the market for Good L. Will deadweight loss in the market for Good L increase, decrease, or stay the same in the short run as a result of the price floor? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 6 units and explains that the 6th unit is the last unit where the marginal revenue (80) *is greater than the marginal cost* (75); the firm will not produce the 7th unit because the marginal cost of producing it (83) *is greater than the marginal revenue earned* (80).

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as  $-\$10$  and shows the work.

$$\text{Economic Profit} = TR - TC = 6(\$80) - (\$345 + \$145) = -\$10$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as  $\$29$  and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$145}{5} = \$29$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for coffee machines will increase and explains that the positive cross-price elasticity of demand for coffee machines with respect to the price of Good L means that the goods are substitutes; therefore, an increase in the price of Good L will lead to an increase in the demand for coffee machines.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good L will stay the same in the short run and explains that property taxes are a fixed cost and a change in fixed cost does not affect the marginal cost.
- States that deadweight loss will stay the same and explains that a price floor below equilibrium is not binding and will not affect the quantity exchanged in the market.

## Units 3.1-3.3 Practice AP Questions

68. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total costs faced by Susie’s Diner for different quantities of Good Q sold.

| Quantity | Total Cost |
|----------|------------|
| 0        | \$25       |
| 1        | \$29       |
| 2        | \$31       |
| 3        | \$34       |
| 4        | \$40       |
| 5        | \$49       |
| 6        | \$61       |
| 7        | \$76       |
| 8        | \$94       |
| 9        | \$115      |
| 10       | \$139      |

Susie’s Diner sells Good Q in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$8 per unit.

- (a) Calculate the average fixed cost of producing 2 units. Show your work.
- (b) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (c) Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- (d) Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good Q is  $-1.3$ , and the cross-price elasticity of demand for cheeseburgers with respect to the price of Good Q is  $-0.3$ . Based on your answer to part (e), what will happen to the demand for cheeseburgers? Explain.
- (g) Now assume that the market in which Susie’s Diner operates is in long-run equilibrium at a price of \$10 per unit.
  - (i) Suppose delivery costs per order for Susie’s Diner decrease. Will the profit-maximizing quantity of Good Q for Susie’s Diner increase, decrease, or stay the same in the short run? Explain.
  - (ii) Instead suppose the government imposes a price ceiling of \$6 on the market for Good Q. Will total economic surplus in the market for Good Q increase, decrease, or stay the same in the short run as a result of the price ceiling? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$12.50 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$25}{2} = \$12.50$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 4 units and explains that the 4<sup>th</sup> unit is the last unit where the marginal revenue (8) *is greater than the marginal cost* (6); the firm will not produce the 5<sup>th</sup> unit because the marginal cost of producing it (9) *is greater than the marginal revenue earned* (8).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as −\$8 and shows the work.

$$\text{Economic Profit} = TR - TC = 4(\$8) - \$40 = -\$8$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will decrease and explains that negative economic profit will cause firms to exit the industry.

**Part E**

### Units 3.1-3.3 Practice AP Questions

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will increase and explains that with the exit of firms, the market supply will decrease, causing the price to increase.

#### Part F

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that demand for cheeseburgers will decrease and explains that the negative cross-price elasticity of demand for cheeseburgers with respect to the price of Good Q means that the goods are complements; therefore, an increase in the price of Good Q will lead to a decrease in the demand for cheeseburgers.

#### Part G

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good Q will increase and explains that delivery costs per order are a variable cost, so a decrease in delivery costs per order will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity
- States that total economic surplus will decrease and explains that a price ceiling below the equilibrium price is binding and the quantity supplied will decrease, therefore decreasing total surplus.

69. Technological advances will lead to

- (A) an increase in marginal utility
- (B) a decrease in average total costs
- (C) a decrease in net exports
- (D) an increase in marginal costs
- (E) diseconomies of scale



**Units 3.1-3.3 Practice AP Questions**

70. A short-run production function shows the relationship between a firm's inputs and the output it produces when the firm
- (A) does not vary any of its inputs
  - (B) has at least one fixed input
  - (C) varies all of its inputs
  - (D) has constant marginal cost
  - (E) has no fixed costs

**Answer B**

Correct. In the short run, the firm employs fixed and variable inputs. There needs to be at least one fixed cost in the short run. The fixed input could be the number of machines or the amount of farmland.

## Units 3.1-3.3 Practice AP Questions

71. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total variable costs faced by Tom’s Toy Store for different quantities of Good B sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$3                 |
| 2        | \$8                 |
| 3        | \$14                |
| 4        | \$23                |
| 5        | \$38                |
| 6        | \$58                |
| 7        | \$83                |
| 8        | \$113               |
| 9        | \$148               |
| 10       | \$188               |

Tom’s Toy Store sells Good B in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$21 per unit, and the total fixed cost is \$50.

- Identify the profit-maximizing quantity. Explain using marginal analysis.
- Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- Calculate the average fixed cost of producing 4 units. Show your work.
- Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- The income elasticity of demand for Good B is 1.5, and the cross-price elasticity of demand for teddy bears with respect to the price of Good B is  $-0.2$ . Based on your answer to part (e), what will happen to the demand for teddy bears? Explain.
- Now assume that the market in which Tom’s Toy Store operates is in long-run equilibrium.
  - Suppose the market demand for Good B increases. Will the profit-maximizing quantity of Good B for Tom’s Toy Store increase, decrease, or stay the same in the short run? Explain.
  - Suppose instead the wages that Tom’s Toy Store pays its workers decrease. Will the profit-maximizing quantity of Good B for Tom’s Toy Store increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

### Units 3.1-3.3 Practice AP Questions

The response identifies the profit-maximizing quantity as 6 units and explains that the 6th unit is the last unit where the marginal revenue (21) *is greater than the marginal cost* (20); the firm will not produce the 7th unit because the marginal cost of producing it (25) *is greater than the marginal revenue earned* (21).

#### Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$18 and shows the work.

$$\text{Economic Profit} = TR - TC = 6(\$21) - (\$58 + \$50) = \$18$$

#### Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$12.50 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$50}{4} = \$12.50$$

#### Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

#### Part E

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for teddy bears will increase and explains that the negative cross-price elasticity of demand for teddy bears with respect to the price of Good B means that the goods are complements; therefore, a decrease in the price of Good B will lead to an increase in the demand for teddy bears.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good B will increase and explains that the increase in market demand will increase the market price (the firm's marginal revenue), which will shift the marginal revenue curve upward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.
- States that the profit-maximizing quantity of Good B will increase and explains that wages are a variable cost, so a decrease in wages will shift the marginal cost curve downward at each quantity so that marginal cost will intersect marginal revenue at a higher quantity.

## Units 3.1-3.3 Practice AP Questions

72. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the total variable costs faced by Waldo’s Electronics Store for different quantities of Good K sold.

| Quantity | Total Variable Cost |
|----------|---------------------|
| 1        | \$60                |
| 2        | \$123               |
| 3        | \$187               |
| 4        | \$254               |
| 5        | \$323               |
| 6        | \$405               |
| 7        | \$489               |
| 8        | \$579               |
| 9        | \$675               |
| 10       | \$777               |

Waldo’s Electronics Store sells Good K in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is 75 per unit, and the total fixed cost is 42.

- (a) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (b) Calculate the economic profit at the profit-maximizing quantity you identified in part (a). Show your work.
- (c) Calculate the average fixed cost of producing 7 units. Show your work.
- (d) Based on your answer to part (b), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (b), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good K is 0.5, and the cross-price elasticity of demand for televisions with respect to the price of Good K is 0.3. Based on your answer to part (e), what will happen to the demand for televisions? Explain.
- (g) Now assume that the market in which Waldo’s Electronics Store operates is in long-run equilibrium at a price of \$70 per unit.
- (i) Suppose annual property taxes for Waldo’s Electronics Store increase by \$5,000. Will the profit-maximizing quantity of Good K for Waldo’s Electronics Store increase, decrease, or stay the same in the short run? Explain.
- (ii) Instead suppose the government imposes a price floor at \$90 on the market for Good K. Will deadweight loss in the market for Good K increase, decrease, or stay the same in the short run as a result of the price floor? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 5 units and explains that the 5th unit is the last unit where the marginal revenue (75) *is greater than the marginal cost* (69); the firm will not produce the 6th unit because the marginal cost of producing it (82) *is greater than the marginal revenue earned* (75).

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$10 and shows the work.

$$\text{Economic Profit} = TR - TC = 5(\$75) - (\$323 + \$42) = \$10$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$6 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$42}{7} = \$6$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

### Units 3.1-3.3 Practice AP Questions

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

#### Part F

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for televisions will decrease and explains that the positive cross-price elasticity of demand for televisions with respect to the price of Good K means that the goods are substitutes; therefore, a decrease in the price of Good K will lead to a decrease in the demand for televisions.

#### Part G

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good K will stay the same in the short run and explains that property taxes are a fixed cost and a change in fixed cost does not affect the marginal cost.
- States that deadweight loss will increase and explains that a price floor above the equilibrium price is binding and the quantity exchanged in the market will be limited by the quantity demanded, which is less than the equilibrium quantity, thus decreasing total economic surplus.

73. When marginal product exceeds average product, which of the following must be true?

(A) Average product is increasing.

(B) Average product is decreasing.

(C) Marginal product is increasing.

(D) Total product is decreasing.

(E) Total product is at its maximum.



**Units 3.1-3.3 Practice AP Questions**

74. Which of the following best explains why the short-run average total cost curve is U-shaped?

- (A) Spreading total fixed costs over a larger output, and constant returns
- (B) Spreading total fixed costs over a larger output, and eventually diminishing returns ✓
- (C) Increasing total fixed costs and increasing returns
- (D) Increasing average variable costs and decreasing returns
- (E) Decreasing average variable costs and increasing returns

## Units 3.1-3.3 Practice AP Questions

75. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

*The table below shows the total costs faced by Yotti’s Craft Store for different quantities of Good R sold.*

| Quantity | Total Cost |
|----------|------------|
| 0        | \$3        |
| 1        | \$12       |
| 2        | \$18       |
| 3        | \$28       |
| 4        | \$42       |
| 5        | \$60       |
| 6        | \$82       |
| 7        | \$108      |
| 8        | \$138      |
| 9        | \$172      |
| 10       | \$210      |

Yotti’s Craft Store sells Good R in a perfectly competitive market with a downward-sloping demand curve and an upward-sloping supply curve. The market price is \$12 per unit.

- (a) Calculate the average fixed cost of producing 4 units. Show your work.
- (b) Identify the profit-maximizing quantity. Explain using marginal analysis.
- (c) Calculate the economic profit at the profit-maximizing quantity you identified in part (b). Show your work.
- (d) Based on your answer to part (c), will the number of firms in the industry increase, decrease, or stay the same in the long run? Explain.
- (e) Based on your answer to part (c), will the market price increase, decrease, or stay the same in the long run? Explain.
- (f) The income elasticity of demand for Good R is 0.8, and the cross-price elasticity of demand for balls of yarn with respect to the price of Good R is  $-0.1$ . Based on your answer to part (e), what will happen to the demand for balls of yarn? Explain.
- (g) Now assume that the market in which Yotti’s Craft Store operates is in long-run equilibrium at a price of \$10 per unit.
  - (i) Suppose shipping costs per order for Yotti’s Craft Store increase. Will the profit-maximizing quantity of Good R for Yotti’s Craft Store increase, decrease, or stay the same in the short run? Explain.
  - (ii) Instead suppose the government imposes a price ceiling of \$15 on the market for Good R. Will total economic surplus in the market for Good R increase, decrease, or stay the same in the short run as a result of the price ceiling? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the average fixed cost as \$0.75 and shows the work.

$$AFC = \frac{TFC}{Q} = \frac{\$3}{4} = \$0.75$$

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies the profit-maximizing quantity as 3 units and explains that the 3<sup>rd</sup> unit is the last unit where the marginal revenue (12) *is greater than the marginal cost* (10); the firm will not produce the 4th unit because the marginal cost of producing it (14) *is greater than the marginal revenue earned* (12).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the economic profit as \$8 and shows the work.

$$\text{Economic Profit} = TR - TC = 3(\$12) - \$28 = \$8$$

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the number of firms in the industry will increase and explains that positive economic profit will attract new firms to enter the industry.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the market price will decrease and explains that with the entry of firms, the market supply will increase, causing the price to decrease.

**Part F**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that that the demand for balls of yarn will increase and explains that the negative cross-price elasticity of demand for balls of yarn with respect to the price of Good R means that the goods are complements; therefore, a decrease in the price of Good R will lead to an increase in the demand for balls of yarn.

**Part G**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the profit-maximizing quantity of Good R will decrease and explains that shipping costs per order are a variable cost, so an increase in shipping costs per order will shift the marginal cost curve upward at each quantity so that marginal cost will intersect marginal revenue at a lower quantity.
- States that total economic surplus will stay the same and explains that a price ceiling above equilibrium is not binding and will not affect the number of transactions in the market.

## Units 3.1-3.3 Practice AP Questions

76. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Chukwuma's Salon.

| Number of Stylists | Total Product per Hour |
|--------------------|------------------------|
| 1                  | 6                      |
| 2                  | 13                     |
| 3                  | 21                     |
| 4                  | 30                     |
| 5                  | 40                     |
| 6                  | 47                     |
| 7                  | 50                     |
| 8                  | 51                     |

- (a) After which stylist do diminishing marginal returns begin for Chukwuma's Salon? Explain using numbers.
- (b) Assume Chukwuma's Salon sells its hair styling services in a perfectly competitive market at a price of \$6. Calculate the marginal revenue product of the third stylist. Show your work.
- (c) Chukwuma's Salon hires stylists in a perfectly competitive labor market for stylists at a wage rate of \$35 per hour, and the market price of services remains \$6. How many stylists will Chukwuma's Salon hire to maximize its profit? Explain using marginal analysis.
- (d) Assume the market price of hair styling services increases as a result of an increase in the number of customers. What will happen to each of the following?
- (i) The marginal factor cost for Chukwuma's Salon. Explain.
- (ii) The marginal revenue product curve for Chukwuma's Salon. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the fifth worker and explains that the marginal product (MP) of the sixth worker (7) was less than the MP of the fifth worker (10).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the third worker as \$48 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$6 \times 8 = \$48$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 6 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 6th worker (42) *is greater than the marginal resource cost (MRC) or wage* (35), but the MRP of the 7th worker (18) *is less than the MRC* (35).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the marginal factor cost for the firm will increase and explains that an increase in the price of hair styling services will lead to an increase in demand for workers in that market, which will increase the market wage and therefore increase the firm's marginal factor cost because the firm is a wage taker.
- States that the marginal revenue product curve for the firm will shift to the right and explains that the marginal revenue product is the price of the product times the marginal product, so an increase in the price of hair styling services will increase the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

77. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Kayla’s Construction Firm.

| Number of Construction Workers | Total Product per Hour |
|--------------------------------|------------------------|
| 1                              | 110                    |
| 2                              | 230                    |
| 3                              | 360                    |
| 4                              | 400                    |
| 5                              | 435                    |
| 6                              | 465                    |
| 7                              | 490                    |
| 8                              | 495                    |

- (a) Beginning with which construction worker do diminishing marginal returns set in for Kayla’s Construction Firm? Explain using numbers.
- (b) Assume Kayla’s Construction Firm sells its services in a perfectly competitive market at a price of \$3. Calculate the marginal revenue product of the fourth construction worker. Show your work.
- (c) Kayla’s Construction Firm hires construction workers in a perfectly competitive labor market for construction workers at a wage rate of 110 *per hour*, and the market price of services remains 3. How many construction workers will Kayla’s Construction Firm hire to maximize its profit? Explain using marginal analysis.
- (d) Assume construction workers must pay for a certification exam before they can work in this industry. If the cost of that exam increases, what will happen to each of the following in equilibrium?
- The market wage rate. Explain.
  - The number of workers hired in the labor market. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin with the fourth worker and explains that the marginal product (MP) of the fourth worker (40) is less than the MP of the third worker (130).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the fourth worker as \$120 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$3 \times 40 = \$120$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 4 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 4<sup>th</sup> worker (120) *is greater than the marginal resource cost (MRC) or wage* (110), but the MRP of the 5th worker (105) *is less than the MRC* (110).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

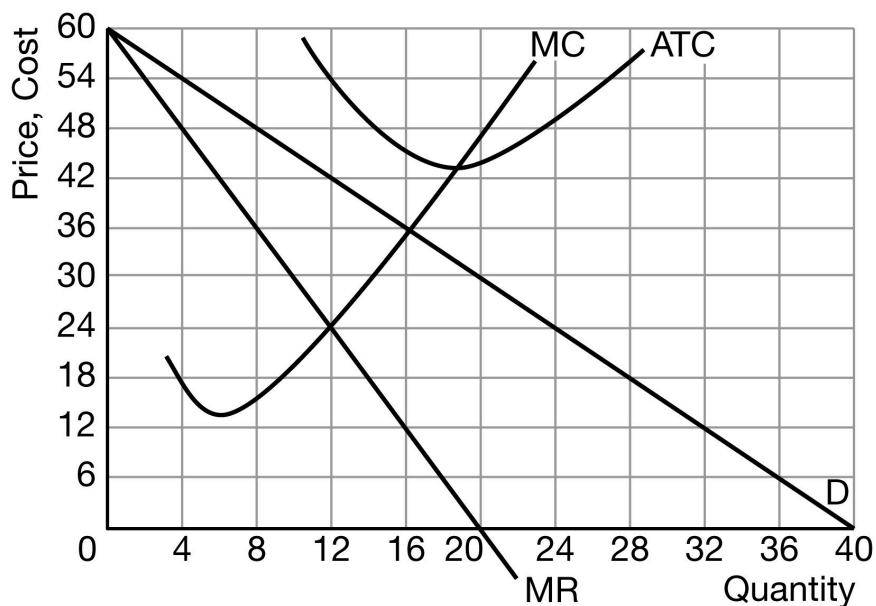
The response does both of the following:

- States that the market wage rate will increase and explains that an increase in the cost of the exam will lead to a decrease in the supply of workers in that market.
- States that the number of workers hired in the labor market will decrease and explains that the increase in the wage rate resulting from the decrease in the supply of workers in that market will lead to fewer workers hired given the downward-sloping demand curve.

## Units 3.1-3.3 Practice AP Questions

78. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Assume the firm produces 16 units. Will the firm's economic profit be positive, negative, or zero? Explain.
- If the firm charges \$36, should this firm increase its price, decrease its price, or keep the price at \$36 in order to maximize its total revenue? Explain.
- If the firm increases its price from \$36 to \$42, does the deadweight loss increase, decrease, or remain unchanged? Explain.
- Assuming the firm produces a quantity greater than zero, identify the firm's profit-maximizing quantity and price, and explain how you determined each.
- Calculate the total cost of producing the profit-maximizing quantity identified in part (c). Show your work. Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that at 16 units the firm's economic profit is negative (economic loss) and explains that the price is below the ATC.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should decrease its price and explains that when demand is elastic (the portion of the demand curve where marginal revenue is greater than zero), a lower price leads to more total revenue, or at \$30 the firm produces the quantity where marginal revenue is zero and total revenue is maximized.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that deadweight loss increases and explains that the firm produces farther away from the allocatively efficient quantity, where marginal cost equals price.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 12 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$42 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



0

1

The response calculates total cost as \$648 and shows the work.

$$\text{Total Cost} = \text{Average Total Cost} \times \text{Quantity} = \$54 \times 12 = \$648$$

## Units 3.1-3.3 Practice AP Questions

79. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Denice's Diner.

| Number of Cooks | Total Product per Hour |
|-----------------|------------------------|
| 1               | 6                      |
| 2               | 13                     |
| 3               | 22                     |
| 4               | 30                     |
| 5               | 36                     |
| 6               | 40                     |
| 7               | 42                     |
| 8               | 41                     |

- (a) Beginning with which cook do diminishing marginal returns set in for Denice's Diner? Explain using numbers.
- (b) Assume Denice's Diner sells its meals in a perfectly competitive market at a unit price of \$8. Calculate the marginal revenue product of the sixth cook. Show your work.
- (c) Denice's Diner hires cooks in a perfectly competitive labor market for cooks at a wage rate of 15 per hour, and the market price of meals remains 8. How many cooks will Denice's Diner hire to maximize its profit? Explain using marginal analysis.
- (d) Assume there is an increase in the productivity of all workers in the labor market for cooks. What will happen to each of the following in equilibrium?
- (i) The number of workers hired in the labor market for cooks. Explain.
- (ii) The wage rate Denice's Diner will pay its cooks. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin with the fourth worker and explains that the marginal product (MP) of the fourth worker (8) was less than the MP of the third worker (9).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the sixth worker as \$32 and shows the work.

$$MRP = P \times MP = \$8 \times 4 = \$32$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 7 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 7th worker (16) *is greater than the marginal resource cost (MRC) or wage* (15), but the MRP of the 8th worker (−\$8) is less than the MRC (\$15).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

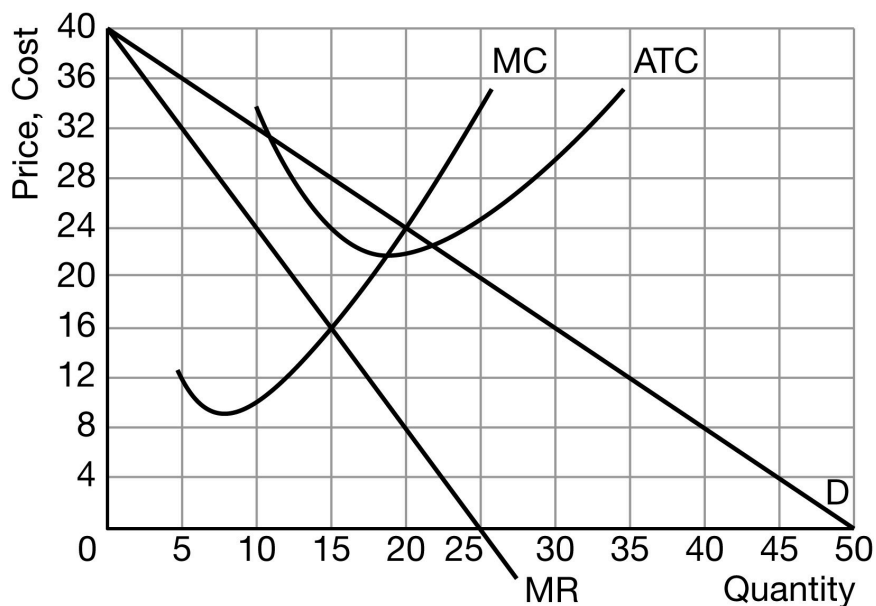
The response does both of the following:

- States that the number of workers hired in the labor market will increase and explains that an increase in the productivity of workers will increase the demand for labor in the market for cooks.
- States that the wage rate Denice's Diner will pay will increase and explains that the increase in the market demand for labor will increase the market wage, which increases the wage rate paid by the firm because the firm is a wage taker.

## Units 3.1-3.3 Practice AP Questions

80. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Assume the firm produces 20 units. Will the firm's economic profit be positive, negative, or zero? Explain.
  - If the firm charges \$12, should this firm increase its price, decrease its price, or keep the price at \$12 in order to maximize its total revenue? Explain.
  - If the firm decreases its price from \$32 to \$28, does the deadweight loss increase, decrease, or remain unchanged? Explain.
  - Identify the profit-maximizing quantity and price, and explain how you determined each.
  - Calculate the total cost of producing the profit-maximizing quantity identified in part (d). Show your work.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that at 20 units the firm's economic profit is positive and explains that the price is above the ATC.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should increase its price and explains that when demand is inelastic (the portion of the demand curve where marginal revenue is greater than zero), a higher price leads to more total revenue, or at \$20 the firm produces the quantity where marginal revenue is zero and total revenue is maximized.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that deadweight loss decreases and explains that the firm produces closer to the allocatively efficient quantity, where marginal cost equals price.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 15 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$28 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates total cost as \$360 and shows the work.

$$\text{Total Cost} = \text{Average Total Cost} \times \text{Quantity} = \$24 \times 15 = \$360$$

## Units 3.1-3.3 Practice AP Questions

81. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Esther’s Travel Agency.

| Number of Travel Agents | Total Product per Hour |
|-------------------------|------------------------|
| 1                       | 22                     |
| 2                       | 55                     |
| 3                       | 85                     |
| 4                       | 110                    |
| 5                       | 130                    |
| 6                       | 140                    |
| 7                       | 145                    |
| 8                       | 135                    |

- (a) After which travel agent do diminishing marginal returns begin for Esther’s Travel Agency? Explain using numbers.
- (b) Assume Esther’s Travel Agency sells its travel services in a perfectly competitive market at a unit price of \$5. Calculate the marginal revenue product of the fourth travel agent. Show your work.
- (c) Esther’s Travel Agency hires travel agents in a perfectly competitive labor market for travel agents at a wage rate of 26 per hour, and the market price of travel services remains 5. How many travel agents will Esther’s Travel Agency hire to maximize its profit? Explain using marginal analysis.
- (d) Assume there is a decrease in the demand for travel services in the market and Esther’s Travel Agency continues to operate. What will happen to each of the following?
- The market wage rate. Explain.
  - The marginal revenue product curve for Esther’s Travel Agency. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the second worker and explains that the marginal product (MP) of the third worker (30) is less than the MP of the second worker (33).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the fourth worker as \$125 and shows the work.

$$MRP = P \times MP = \$5 \times 25 = \$125$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 6 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 6<sup>th</sup> worker (50) *is greater than the marginal resource cost (MRC) or wage* (26), but the MRP of the 7<sup>th</sup> worker (25) *is less than the MRC* (26).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the market wage will decrease and explains that a decrease in the market demand for travel services will lead to a decrease in demand for travel agents because the demand for travel agents is dependent on (or derived from) the demand for travel services.
- States that the marginal revenue product curve for the firm will shift to the left and explains that the marginal revenue product is the price of the service times the marginal product, so a decrease in the demand for travel services will decrease the price of travel services and will therefore decrease the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

82. For each of the following statements, indicate whether it is true, false, or uncertain and explain why.
- Average total cost is always greater than average variable cost by a constant amount.
  - In the short run, a perfectly competitive firm always maximizes profit when average total cost is at minimum.
  - If a firm shuts down in the short run, its profits will equal zero.

Respond to all parts of the question.

## Part A

2 points:

- One point is earned for stating “false.”
- One point is earned for explaining that the difference between ATC and AVC is AFC, which decreases as a firm’s output increases.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

2 points:

- One point is earned for stating “false.”
- One point is earned for explaining that the difference between ATC and AVC is AFC, which decreases as a firm’s output increases.

## Part B

2 points:

- One point is earned for stating “false.”
- One point is earned for the explanation that the profit-maximizing output occurs where  $P = MC$ , which might be to the right or to the left of the lowest point on the ATC curve.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

2 points:

**Units 3.1-3.3 Practice AP Questions**

- One point is earned for stating “false.”
- One point is earned for the explanation that the profit-maximizing output occurs where  $P = MC$ , which might be to the right or to the left of the lowest point on the ATC curve.

**Part C**

2 points:

- One point is earned for stating “false.”
- One point is earned for the explanation that if the firm shuts down in the short run, its losses from operating must be larger than (or equal to) its total fixed costs OR price must be less than AVC, so it is incurring a loss.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

2 points:

- One point is earned for stating “false.”
- One point is earned for the explanation that if the firm shuts down in the short run, its losses from operating must be larger than (or equal to) its total fixed costs OR price must be less than AVC, so it is incurring a loss.

## Units 3.1-3.3 Practice AP Questions

83. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Jose's Tax Office.

| Number of Administrative Assistants | Total Product per Hour |
|-------------------------------------|------------------------|
| 1                                   | 40                     |
| 2                                   | 90                     |
| 3                                   | 150                    |
| 4                                   | 180                    |
| 5                                   | 200                    |
| 6                                   | 215                    |
| 7                                   | 225                    |
| 8                                   | 230                    |

- (a) After which administrative assistant do diminishing marginal returns begin for Jose's Tax Office? Explain using numbers.
- (b) Assume Jose's Tax Office sells its tax advisory services in a perfectly competitive market at a unit price of \$4. Calculate the marginal revenue product of the fifth administrative assistant. Show your work.
- (c) Jose's Tax Office hires administrative assistants in a perfectly competitive labor market for administrative assistants at a wage rate of 90 *per hour*, and the market price of services remains 4. How many administrative assistants will Jose's Tax Office hire to maximize its profit? Explain using marginal analysis.
- (d) Assume administrative assistants and office software are substitutes in providing tax advisory services by all tax firms in the market. If office software, a fixed input, becomes more expensive and Jose's Tax Office provides the same quantity of tax advisory services, will each of the following increase, decrease, or stay the same?
- (i) The wage rate Jose's Tax Office will pay its administrative assistants. Explain.
- (ii) The demand curve for administrative assistants for Jose's Tax Office. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the third worker and explains that the marginal product (MP) of the fourth worker (30) was less than the MP of the third worker (60).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the fifth worker as \$80 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$4 \times 20 = \$80$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 4 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 4<sup>th</sup> worker (120) *is greater than the marginal resource cost (MRC) or wage (90)*, but the MRP of the 5<sup>th</sup> worker (80) *is less than the MRC (90)*.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the wage rate the firm will pay will increase and explains that an increase in the price of office software will result in an increase in the demand for workers because office software and workers are substitutes in providing tax advisory services. An increase in the demand for workers will increase the market wage and therefore increase the wage rate paid by the firm because the firm is a wage taker.

- States that the demand curve for administrative assistants by Jose's Tax Office will stay the same in the short run and explains that the firm's demand curve for labor is the marginal revenue product of labor (MRP), which is the price of the service times the marginal product, and in the short run there is no change in the price of the service or the marginal product.

Or states that the demand curve for administrative assistants by Jose's Tax Office will increase in the long run and explains that the firm's demand curve for labor is the marginal revenue product of labor (MRP) which is the price of the product times the marginal product, and an increase in the price of an input will decrease the supply of tax advisory services in the market, which will increase the market price of services, and therefore will increase the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

84. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Josh's Consulting Firm.

| Number of Consultants | Total Product per Hour |
|-----------------------|------------------------|
| 1                     | 21                     |
| 2                     | 43                     |
| 3                     | 66                     |
| 4                     | 88                     |
| 5                     | 108                    |
| 6                     | 126                    |
| 7                     | 141                    |
| 8                     | 151                    |

- (a) After which consultant do diminishing marginal returns begin for Josh's Consulting Firm? Explain using numbers.
- (b) Assume Josh's Consulting Firm sells its consulting services in a perfectly competitive market at a unit price of \$2. Calculate the marginal revenue product of the fifth consultant. Show your work.
- (c) Josh's Consulting Firm hires consultants in a perfectly competitive labor market for consultants at a wage rate of \$41 per hour, and the market price of consulting services remains \$2. How many consultants will Josh's Consulting Firm hire to maximize its profit? Explain using marginal analysis.
- (d) Assume the market price of consulting services increases as a result of an increase in the number of consumers. What will happen to each of the following?
- The marginal factor cost for Josh's Consulting Firm. Explain.
  - The marginal revenue product curve for Josh's Consulting Firm. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the third worker and explains that the marginal product (MP) of the fourth worker (22) was less than the MP of the third worker (23).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the fifth worker as \$40 and shows the work.

$$MRP = P \times MP = \$2 \times 20 = \$40$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 4 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 4<sup>th</sup> worker (44) *is greater than the marginal resource cost (MRC) or wage* (41), but the MRP of the 5<sup>th</sup> worker (40) *is less than the MRC* (41).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the marginal factor cost for the firm will increase and explains that an increase in the price of consulting services will lead to an increase in demand for workers in that market, which will increase the market wage and therefore increase the firm's marginal factor cost because the firm is a wage taker.
- States that the marginal revenue product curve for the firm will shift to the right and explains that the marginal revenue product is the price of the product times the marginal product, so an increase in the price of consulting services will increase the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

85. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Keepdry produces and sells rain jackets in a perfectly competitive product market at the price of \$5 per jacket and hires all the workers it needs in a perfectly competitive labor market at the wage rate of \$15. Labor is the only variable input, and the firm’s production schedule is provided in the table.

| Number of Workers | Quantity of Output |
|-------------------|--------------------|
| 0                 | 0                  |
| 1                 | 9                  |
| 2                 | 20                 |
| 3                 | 27                 |
| 4                 | 32                 |
| 5                 | 34                 |
| 6                 | 35                 |

- (a) Calculate the marginal revenue product of the second worker. Show your work.
- (b) Diminishing marginal returns will begin with the hiring of which worker?
- (c) Determine the profit-maximizing number of workers the firm should hire. Explain using marginal analysis.
- (d) Assuming Keepdry’s fixed cost is \$40, calculate Keepdry’s economic profit when hiring the profit-maximizing number of workers. Show your work.
- (e) Suppose Keepdry’s fixed cost increases to \$80. Will the profit-maximizing number of workers hired in the short run increase, decrease, or stay the same? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

The response must show appropriate work in order to receive the point.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

- ☐ Calculates the marginal revenue product (MRP) of the 2nd worker as \$55 and shows the work.
- $$\text{MRP}_{(2\text{nd worker})} = (\text{Marginal Product} \times \text{Marginal Revenue})$$

$$= (20 - 9) \times \$5 = 11 \times \$5 = \$55$$

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

- ☐ States that diminishing marginal returns will begin with the hiring of the 3rd worker.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

- ☐ States that the profit-maximizing number of workers is 4 and explains that the MRP of the 4th worker (\$25) is greater than the marginal factor cost (MFC) of the 4th worker (wage = \$15), and that the hiring of the 5th worker would decrease profits because the MRP (\$10) is less than the MFC of the 5th worker (\$15).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

The response must show appropriate work in order to receive the point.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

- ☐ Calculates the economic profit as \$60 and shows the work.  

$$\text{Economic Profit} = \text{Total Revenue} - \text{Total Cost}$$

$$\text{Economic Profit} = \text{Total Revenue} - \text{Total Fixed Cost} - \text{Total Variable Cost}$$

$$\text{Economic Profit} = (\$5 \times 32) - \$40 - (\$15 \times 4) = \$160 - \$40 - \$60$$

$$= \$160 - \$100 = \$60$$

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



0

1

The response accurately includes the criterion below.

☐

States that the number of workers hired will stay the same and explains that the increase in fixed cost does not affect the marginal factor cost of producing rain jackets.

## Units 3.1-3.3 Practice AP Questions

86. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

*The table below shows the short-run production function for Lakshmi’s Law Office.*

| <i>Number of Clerks</i> | <i>Total Product per Hour</i> |
|-------------------------|-------------------------------|
| 1                       | 33                            |
| 2                       | 68                            |
| 3                       | 95                            |
| 4                       | 120                           |
| 5                       | 140                           |
| 6                       | 155                           |
| 7                       | 165                           |
| 8                       | 160                           |

- (a) Beginning with which clerk do diminishing marginal returns set in for Lakshmi’s Law Office? Explain using numbers.
- (b) Assume Lakshmi’s Law Office sells its legal services in a perfectly competitive market at a unit price of \$4. Calculate the marginal revenue product of the sixth clerk. Show your work.
- (c) Lakshmi’s Law Office hires clerks in a perfectly competitive labor market for clerks at a wage of 130 per hour, and the market price of legal services remains 4. How many clerks will Lakshmi’s Law Office hire to maximize its profit? Explain using marginal analysis.
- (d) Assume there is a decrease in the productivity of all workers in the labor market for clerks. What will happen to each of the following in equilibrium?
- (i) The number of workers hired in the labor market for clerks. Explain.
- (ii) The wage rate Lakshmi’s Law Office will pay its clerks. Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin with the third worker and explains that the marginal product (MP) of the third worker (27) is less than the MP of the second worker (35).

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the sixth worker as \$60 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$4 \times 15 = \$60$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 2 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 2<sup>nd</sup> worker (140) *is greater than the marginal resource cost (MRC) or wage* (130), but the MRP of the 3rd worker (108) *is less than the MRC* (130).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the number of workers hired in the labor market would decrease and explains that a decrease in the productivity of workers will decrease the demand for labor in the market for clerks.
- States that the wage rate Lakshmi's Law Office will pay will decrease and explains that the decrease in the market demand for labor will decrease the market wage, which decreases the wage rate paid by the firm because the firm is a wage taker.

## Units 3.1-3.3 Practice AP Questions

87. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Malikah's Fashion Clothing.

| Number of Garment Workers | Total Product per Hour |
|---------------------------|------------------------|
| 1                         | 4                      |
| 2                         | 10                     |
| 3                         | 18                     |
| 4                         | 28                     |
| 5                         | 36                     |
| 6                         | 42                     |
| 7                         | 46                     |
| 8                         | 48                     |

- (a) After which garment worker do diminishing marginal returns begin for Malikah's Fashion Clothing? Explain using numbers.
- (b) Assume Malikah's Fashion Clothing sells its clothes in a perfectly competitive market at a price of \$8. Calculate the marginal revenue product of the fifth garment worker. Show your work.
- (c) Malikah's Fashion Clothing hires garment workers in a perfectly competitive labor market for garment workers at a wage rate of 30 *per hour*, and the market price of clothes remains 8. How many garment workers will Malikah's Fashion Clothing hire to maximize its profit? Explain using marginal analysis.
- (d) Assume the market price of clothes decreases as a result of a decrease in the number of consumers and Malikah's Fashion Clothing continues to operate. What will happen to each of the following?
- (i) The marginal factor cost for Malikah's Fashion Clothing. Explain.
- (ii) The marginal revenue product curve for Malikah's Fashion Clothing. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the fourth worker and explains that the marginal product (MP) of the fifth worker (8) was less than the MP of the fourth worker (10).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the fifth worker as \$64 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$8 \times 8 = \$64$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 7 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 7<sup>th</sup> worker (32) *is greater than the marginal resource cost (MRC) or wage* (30), but the MRP of the 8<sup>th</sup> worker (16) *is less than the MRC* (30).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the marginal factor cost for the firm will decrease and explains that a decrease in the price of clothes will lead to a decrease in demand for workers in that market, which will decrease the market wage and therefore decrease the firm's marginal factor cost because the firm is a wage taker.
- States that the marginal revenue product curve for the firm will shift to the left and explains that the marginal revenue product is the price of the product times the marginal product, so a decrease in the market price of clothes will decrease the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

88. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Mateo’s Metalworks.

| Number of Welders | Total Product per Hour |
|-------------------|------------------------|
| 1                 | 5                      |
| 2                 | 11                     |
| 3                 | 16                     |
| 4                 | 20                     |
| 5                 | 23                     |
| 6                 | 25                     |
| 7                 | 26                     |
| 8                 | 25                     |

- (a) Beginning with which welder do diminishing marginal returns set in for Mateo’s Metalworks? Explain using numbers.
- (b) Assume Mateo’s Metalworks sells its welding services in a perfectly competitive market at a unit price of \$10. Calculate the marginal revenue product of the seventh welder. Show your work.
- (c) Mateo’s Metalworks hires welders in a perfectly competitive labor market for welders at a wage rate of \$35 per hour, and the market price of welding services remains \$10. How many welders will Mateo’s Metalworks hire to maximize its profit? Explain using marginal analysis.
- (d) Assume there is an increase in the productivity of all workers in the labor market for welders. What will happen to each of the following in equilibrium?
- The number of workers hired in the labor market for welders. Explain.
  - The wage rate Mateo’s Metalworks will pay its welders. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin with the third worker and explains that the marginal product (MP) of the 3<sup>rd</sup> worker (5) is less than the MP of the 2<sup>nd</sup> worker (6).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the seventh worker as \$10 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$10 \times 1 = \$10$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 4 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 4<sup>th</sup> worker (40) *is greater than the marginal resource cost (MRC) or wage* (35), but the MRP of the 5<sup>th</sup> worker (30) *is less than the MRC* (35).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

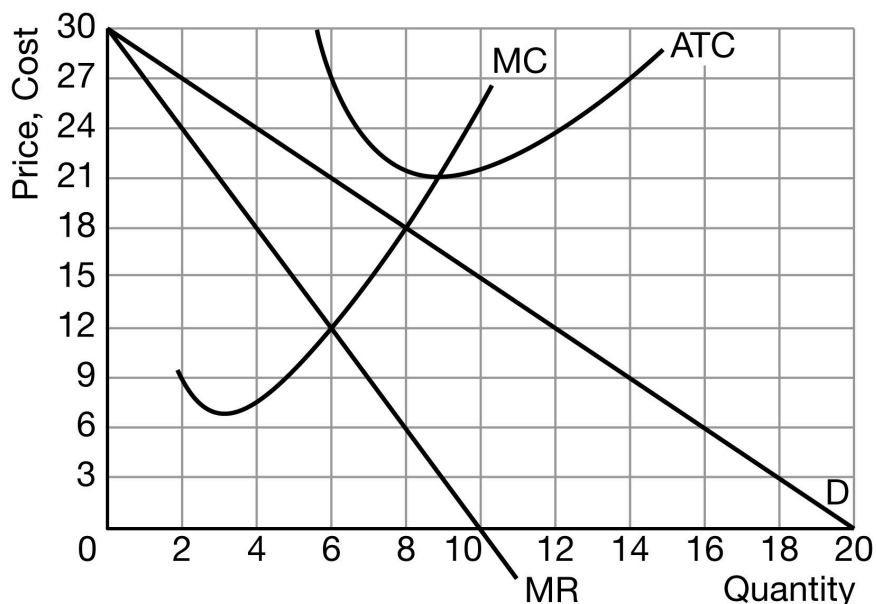
The response does both of the following:

- States that the number of workers hired in the labor market will increase and explains that an increase in the productivity of workers will increase the demand for labor in the market for welders.
- States that the wage rate Mateo's Metalworks will pay will increase and explains that the increase in the market demand for labor will increase the market wage, which increases the wage rate paid by the firm because the firm is a wage taker.

## Units 3.1-3.3 Practice AP Questions

89. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Assume the firm produces 8 units. Will the firm's economic profit be positive, negative, or zero? Explain.
  - If the firm charges \$18, should this firm increase its price, decrease its price, or keep the price at \$18 in order to maximize its total revenue? Explain.
  - If the firm increases its price from \$21 to \$24, does the deadweight loss increase, decrease, or remain unchanged? Explain.
  - Assuming the firm produces a quantity greater than zero, identify the profit-maximizing quantity and price, and explain how you determined each.
  - Calculate the total cost of producing the profit-maximizing quantity identified in part (d). Show your work.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that at 8 units the firm's economic profit is negative (economic loss) and explains that the price is below the ATC.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should decrease its price and explains that when demand is elastic (the portion of the demand curve where marginal revenue is greater than zero), a lower price leads to more total revenue, or at \$15 the firm produces the quantity where marginal revenue is zero and total revenue is maximized.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that deadweight loss increases and explains that the firm produces farther away from the allocatively efficient quantity, where marginal cost equals price.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 6 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$21 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

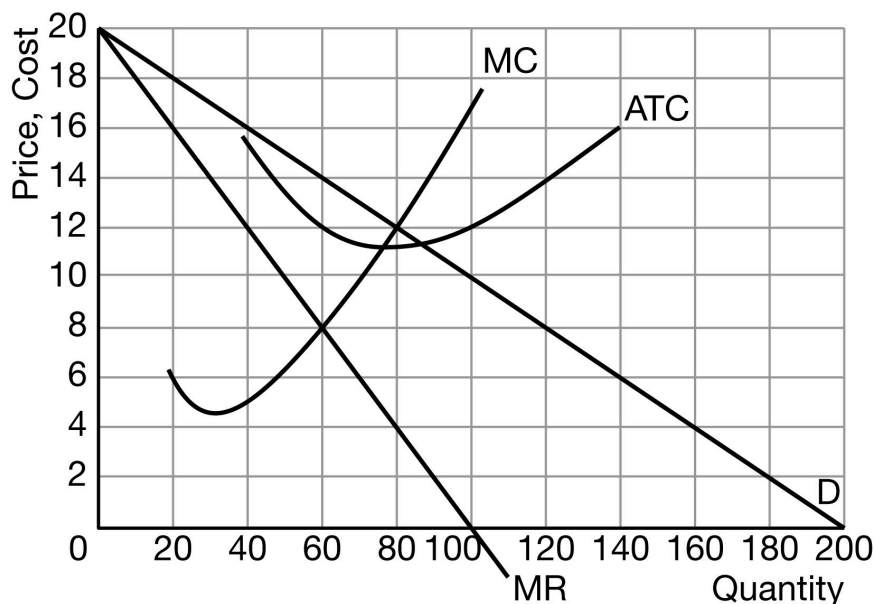
The response calculates total cost as \$162 and shows the work.

$$\text{Total Cost} = \text{Average Total Cost} \times \text{Quantity} = \$27 \times 6 = \$162$$

## Units 3.1-3.3 Practice AP Questions

90. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- For prices between \$8 and \$6, is the demand curve elastic, inelastic, or unit elastic? Explain.
- To produce the allocatively efficient quantity, how many units of output would the firm produce? Explain.
- To maximize total revenue, how many units of output would the firm produce? Explain.
- Identify the firm's profit-maximizing quantity. Explain using marginal analysis.
- Calculate the firm's economic profit at the profit-maximizing quantity identified in part (d). Show your work.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is inelastic between 8 and 6 and explains that the marginal revenue is negative; or uses numbers to explain that total revenue is falling in that price range, the percentage change in quantity is less than the percentage change in price, or the absolute value of the price elasticity of demand is less than 1.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 80 units of output at the allocatively efficient price and explains that at that quantity the marginal cost to producers equals the marginal benefit to consumers (where marginal cost crosses the demand curve).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 100 units of output to maximize total revenue and explains that at that quantity the marginal revenue is equal to zero, or uses numbers to explain that total revenue is maximized at that quantity of output.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies that the firm's profit-maximizing quantity is 60 units and explains that at that quantity marginal revenue is equal to marginal cost, or explains that when marginal revenue is higher than marginal cost the firm should increase production because each additional sale increases the firm's profit and when marginal cost is higher than marginal revenue the firm should decrease production because it costs more to produce the last unit than what the firm will earn from it.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



0

1

The response calculates the economic profit as \$120 and shows the work.

$$\text{Economic Profit} = \text{Total Revenue} - \text{Total Cost} = \$14 \times 60 - \$12 \times 60 = \$120$$

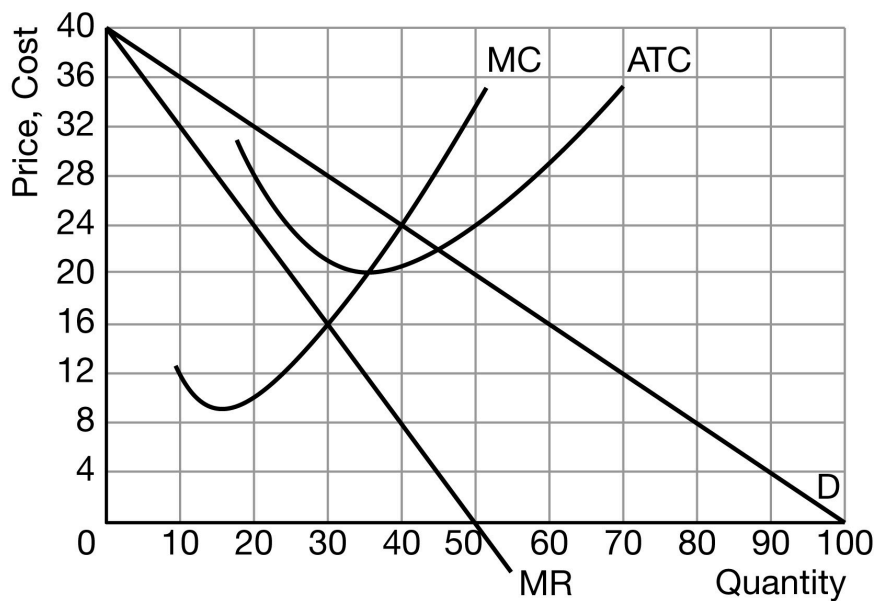
or

$$\text{Economic Profit} = (P - \text{ATC}) \times Q = (\$14 - \$12) \times 60 = \$120$$

## Units 3.1-3.3 Practice AP Questions

91. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- What will happen to total revenue if the firm raises the price from \$32 to \$36? Explain.
- At 30 units, is the firm producing at the allocatively efficient quantity? Explain.
- If the firm produces 40 units, will the firm's economic profit be positive, negative, or zero? Explain.
- Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is decreasing at 20 units.
- Calculate the consumer surplus if the firm charges the profit-maximizing price. Show your work.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that total revenue will decrease and explains that demand is price elastic in this price range; or uses numbers to explain that the percentage decrease in quantity demanded is greater than the percentage increase in price, the absolute value of the price elasticity of demand is greater than 1, or the total revenue decreases.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that no, the firm is not producing at the allocatively efficient quantity and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve (at 40 units).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that at 40 units the firm's economic profit is positive and explains that the price is above the ATC.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 20 units marginal cost is less than average total cost, which means that the cost of producing the next unit is lower than the average total cost, which pulls down the average total cost for the next unit.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

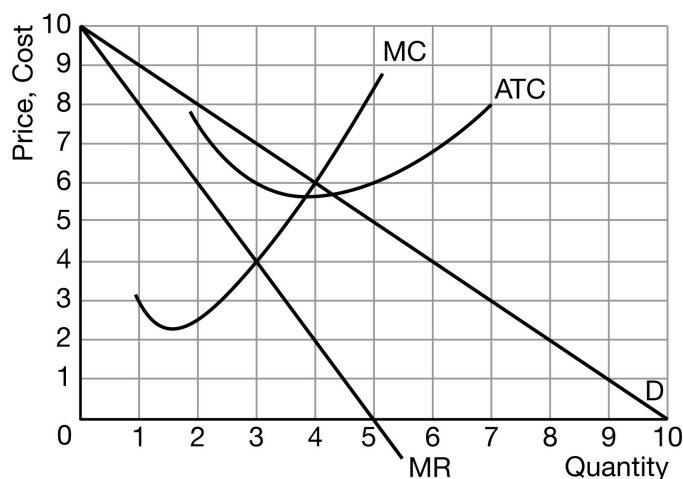
The response calculates the consumer surplus as \$180 and shows the work:

$$\text{Consumer Surplus} = \frac{1}{2}(30)(\$40 - \$28) = \$180$$

## Units 3.1-3.3 Practice AP Questions

92. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- For prices between \$3 and \$2, is the demand curve elastic, inelastic, or unit elastic? Explain.
- To produce the allocatively efficient quantity, how many units of output would the firm produce? Explain.
- To maximize total revenue, how many units of output would the firm produce? Explain.
- Identify the firm's profit-maximizing quantity. Explain using marginal analysis.
- Calculate the firm's economic profit at the profit-maximizing quantity identified in part (d). Show your work.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is inelastic between 3 and 2 and explains that the marginal revenue is negative; or uses numbers to explain that total revenue is falling in that price range, the percentage change in quantity is less than the percentage change in price, or the absolute value of the price elasticity of demand is less than 1.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 4 units of output at the allocatively efficient price and explains that at that quantity the marginal cost to producers equals the marginal benefit to consumers (where marginal cost crosses the demand curve).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 5 units of output to maximize total revenue and explains that at that quantity the marginal revenue is equal to zero, or uses numbers to explain that total revenue is maximized at that quantity of output.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies that the firm's profit-maximizing quantity is 3 units and explains that at that quantity marginal revenue is equal to marginal cost, or explains that when marginal revenue is higher than marginal cost the firm should increase production because each additional sale increases the firm's profit and when marginal cost is higher than marginal revenue the firm should decrease production because it costs more to produce the last unit than what the firm will earn from it.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



0

1

The response calculates the economic profit as \$3 and shows the work.

$$\text{Economic Profit} = \text{Total Revenue} - \text{Total Cost} = \$7 \times 3 - \$6 \times 3 = \$3$$

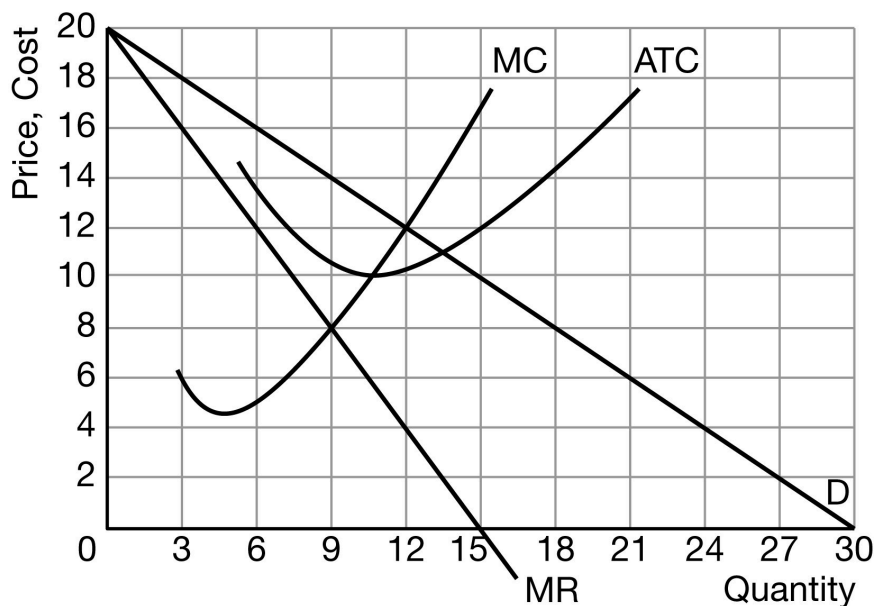
OR

$$\text{Economic Profit} = (P - \text{ATC}) \times Q = (\$7 - \$6) \times 3 = \$3$$

## Units 3.1-3.3 Practice AP Questions

93. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- At what quantity is the demand for this product unit elastic? Explain.
- Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is increasing at 12 units.
- If the firm maximizes profit, identify the profit-maximizing quantity and price, and explain how you determined each.
- Calculate the deadweight loss at the profit-maximizing quantity identified in part (c). Show your work.
- Assume fixed cost increases by \$4. Will the profit-maximizing quantity increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is unit elastic at the quantity of 15 units and explains that the marginal revenue is zero, or uses numbers to explain that total revenue is maximized at this quantity or that the absolute value of

**Units 3.1-3.3 Practice AP Questions**

the price elasticity of demand is 1.

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 12 units marginal cost exceeds average total cost, which means that the additional cost of producing the next unit is higher than the average total cost, which pulls the average total cost up for the next unit.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 9 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$14 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the deadweight loss at the profit-maximizing quantity as \$9 and shows the work.

$$\text{Deadweight Loss} = \frac{1}{2}(\$14 - \$8)(12 - 9) = \$9$$

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

**Units 3.1-3.3 Practice AP Questions**

0

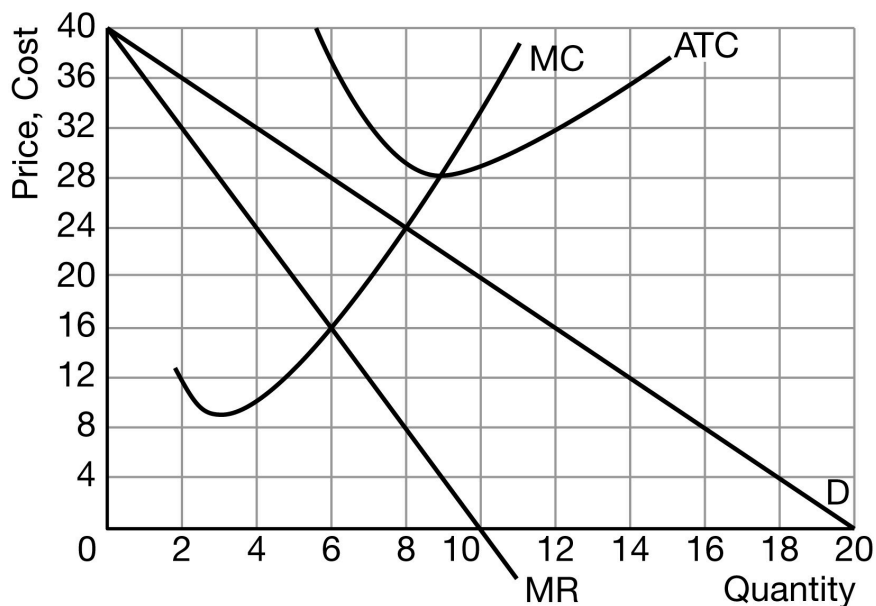
1

The response states that the profit-maximizing quantity will stay the same and explains that the increase in fixed cost does not affect marginal cost in the short run.

## Units 3.1-3.3 Practice AP Questions

94. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- What will happen to total revenue if the firm raises the price from \$12 to \$16? Explain.
  - At 10 units, is the firm producing at the allocatively efficient quantity? Explain.
  - If the firm produces 8 units, will the firm's economic profit be positive, negative, or zero? Explain.
  - Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is increasing at 10 units.
  - Calculate the consumer surplus if the firm charges the profit-maximizing price. Show your work.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that total revenue will increase and explains that demand is price inelastic in this price range; or uses numbers to explain that the percentage decrease in quantity demanded is less than the percentage increase in price, the absolute value of the price elasticity of demand is less than 1, or the total revenue increases.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that no, the firm is not producing at the allocatively efficient quantity and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve (at 8 units).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that at 8 units the firm's economic profit is negative (economic loss) and explains that the price is below the ATC.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 10 units marginal cost is greater than average total cost, which means that the cost of producing the next unit is higher than the average total cost, which pulls up the average total cost for the next unit.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the consumer surplus as \$36 and shows the work:

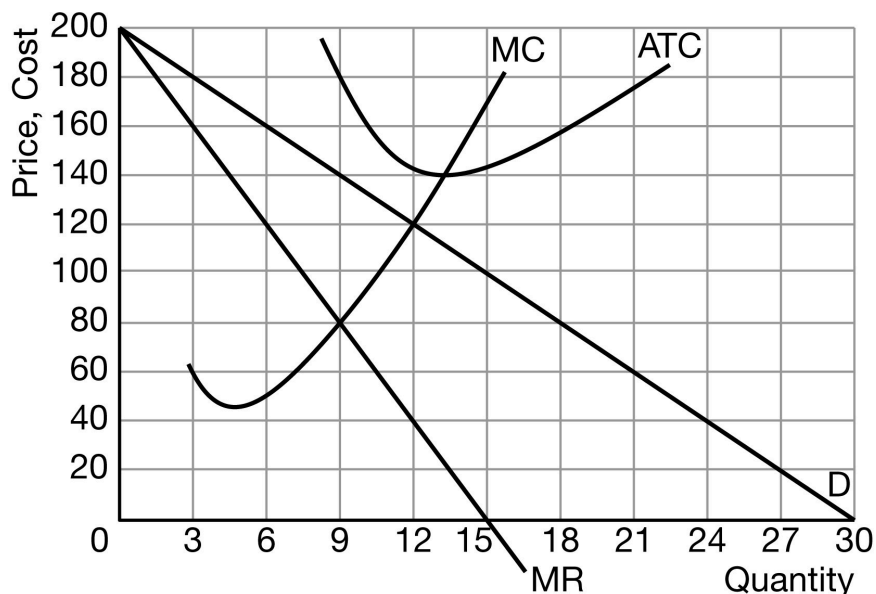
**Units 3.1-3.3 Practice AP Questions**

$$\text{Consumer Surplus} = \frac{1}{2}(6)(\$40 - \$28) = \$36$$

## Units 3.1-3.3 Practice AP Questions

95. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- For prices between \$140 and \$120, is the demand curve elastic, inelastic, or unit elastic? Explain.
- To produce the allocatively efficient quantity, how many units of output would the firm produce? Explain.
- To maximize total revenue, how many units of output would the firm produce? Explain.
- Assuming the firm produces a quantity greater than zero, identify the firm's profit-maximizing quantity. Explain using marginal analysis.
- Calculate the firm's economic profit at the profit-maximizing quantity identified in part (d). Show your work.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is elastic between 140 and 120 and explains that the marginal revenue is positive; or uses numbers to explain that total revenue is rising in that price range, the percentage change in quantity is greater than the percentage change in price, or the absolute value of the price elasticity of demand is greater than 1.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 12 units of output at the allocatively efficient price and explains that at that quantity the marginal cost to producers equals the marginal benefit to consumers (where marginal cost crosses the demand curve).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 15 units of output to maximize total revenue and explains that at that quantity the marginal revenue is equal to zero, or uses numbers to explain that total revenue is maximized at that quantity of output.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies that the firm's profit-maximizing quantity is 9 units and explains that at that quantity marginal revenue is equal to marginal cost, or explains that when marginal revenue is higher than marginal cost the firm should increase production because each additional sale increases the firm's profit and when marginal cost is higher than marginal revenue the firm should decrease production because it costs more to produce the last unit than what the firm will earn from it.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



0

1

The response calculates the economic profit(loss) as  $-\$360$  and shows the work.

$$\text{Economic Profit} = \text{Total Revenue} - \text{Total Cost} = \$140 \times 9 - \$180 \times 9 = -\$360$$

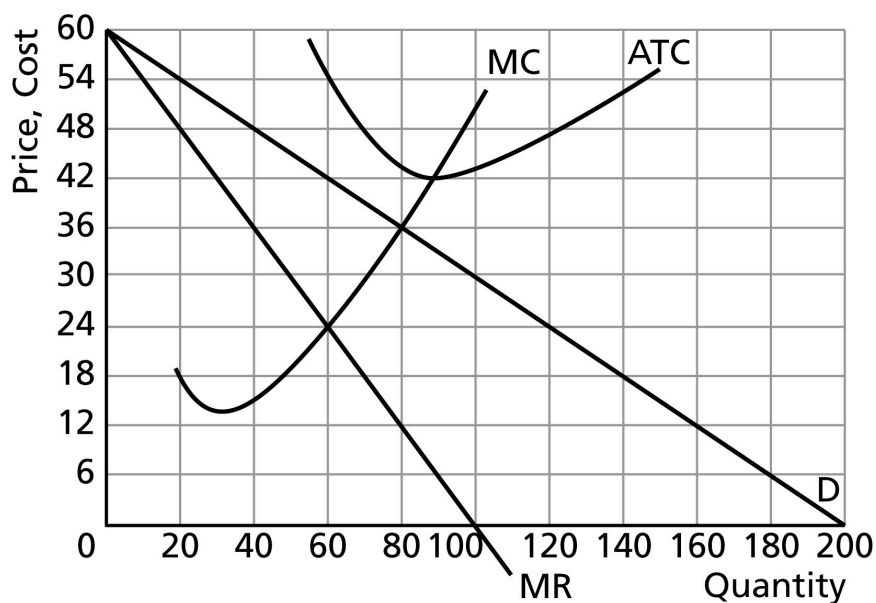
or

$$\text{Economic Profit} = (P - \text{ATC}) \times Q = (\$140 - \$180) \times 9 = -\$360$$

## Units 3.1-3.3 Practice AP Questions

96. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- At what quantity is the demand for this product unit elastic? Explain.
- Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is decreasing at 80 units.
- If the firm maximizes profit, identify the profit-maximizing quantity and price, and explain how you determined each.
- Calculate the deadweight loss at the profit-maximizing quantity identified in part (c). Show your work.
- Assume fixed cost decreases by \$12. Will the profit-maximizing quantity increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is unit elastic at the quantity of 100 units and explains that the marginal revenue is zero, or uses numbers to explain that total revenue is maximized at this quantity or that the absolute value of

**Units 3.1-3.3 Practice AP Questions**

the price elasticity of demand is 1.

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 80 units marginal cost is less than average total cost, which means that the additional cost of producing the next unit is lower than the average total cost, which pulls down the average total cost for the next unit.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 60 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$42 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the deadweight loss at the profit-maximizing quantity as \$180 and shows the work.

$$\text{Deadweight Loss} = \frac{1}{2}(\$42 - \$24)(80 - 60) = \$180$$

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

**Units 3.1-3.3 Practice AP Questions**

0

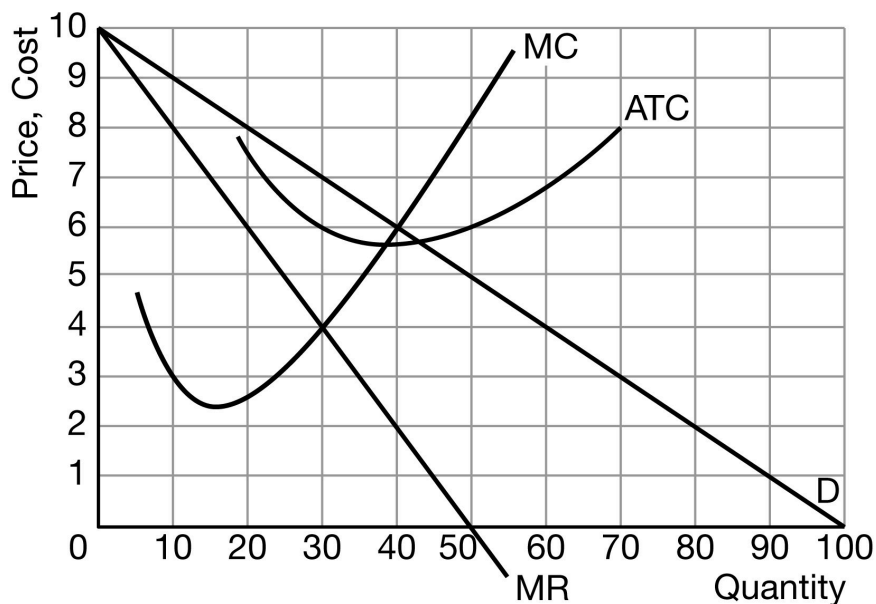
1

The response states that the profit-maximizing quantity will stay the same and explains that the decrease in fixed cost does not affect marginal cost in the short run.

## Units 3.1-3.3 Practice AP Questions

97. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Calculate the total revenue of producing 30 units. Show your work.
  - For quantities between 30 and 40 units, is the demand curve elastic, inelastic, or unit elastic? Explain.
  - Assume that this firm is currently charging a price of \$6. In order to maximize its profit, should the firm increase its price, decrease its price, or keep its price the same? Explain.
  - At a quantity of 50 units, does this firm have increasing marginal returns or diminishing marginal returns? Explain.
  - Identify the firm's allocatively efficient quantity, and explain how you determined it.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response calculates the total revenue of producing 30 units as \$210 and shows the work.

$$\text{Total Revenue} = \text{Price} \times \text{Quantity} = \$7 \times 30 = \$210$$

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the demand curve is elastic for quantities between 30 and 40 units and explains that the marginal revenue is positive; or use numbers to explain that total revenue is rising as price goes down in that quantity range, the percentage change in quantity demanded is greater than the percentage change in price, or the absolute value of the price elasticity of demand is greater than 1.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should increase its price and explains that at a price of 6, *the marginal cost is greater than the marginal revenue or explain that the profit-maximizing price is 7* (from the demand curve for the profit-maximizing quantity where marginal cost is equal to marginal revenue).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm has diminishing marginal returns and explains that marginal cost is rising at the quantity of 50 units, indicating that the marginal product is falling.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

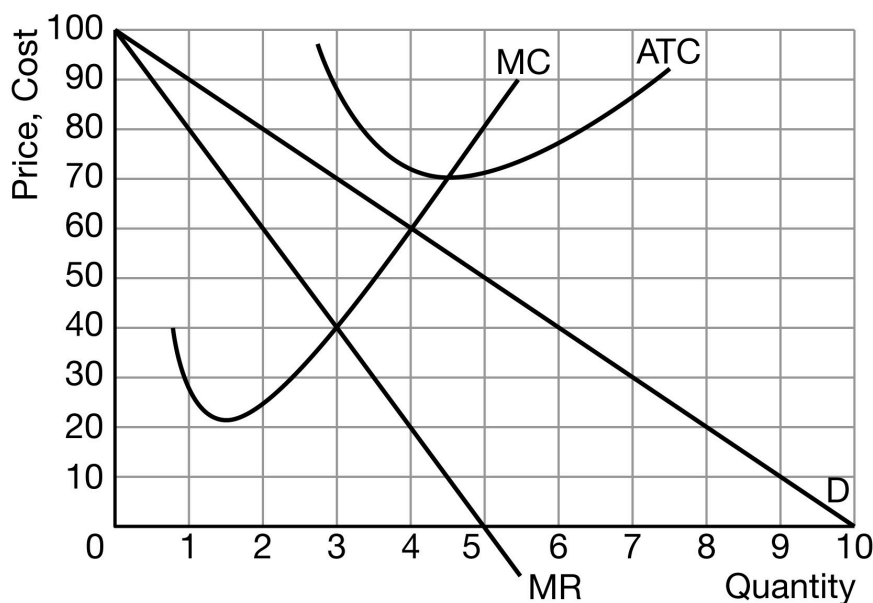
### Units 3.1-3.3 Practice AP Questions

The response identifies that the allocatively efficient quantity is 40 units and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve.

## Units 3.1-3.3 Practice AP Questions

98. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the graph provided to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Calculate the total revenue of producing 2 units. Show your work.
  - For quantities between 6 and 8 units, is the demand curve elastic, inelastic, or unit elastic? Explain.
  - Assume that this firm is currently charging a price of \$80. In order to maximize its profit, should the firm increase its price, decrease its price, or keep its price the same? Explain.
  - At a quantity of 1 unit, does this firm have increasing marginal returns or diminishing marginal returns? Explain.
  - Identify the firm's allocatively efficient quantity, and explain how you determined it.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response calculates the total revenue of producing 2 units as \$160 and shows the work.

$$\text{Total Revenue} = \text{Price} \times \text{Quantity} = \$80 \times 2 = \$160$$

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the demand curve is inelastic for quantities between 6 and 8 units and explains that the marginal revenue is negative; or uses numbers to explain that total revenue is falling as price declines in that quantity range, the percentage change in quantity demanded is less than the percentage change in price, or the absolute value of the price elasticity of demand is less than 1.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should decrease its price and explains that at a price of 80 the marginal cost is greater than the marginal revenue or explain that the profit-maximizing price is 70 (this is the price from the demand curve for the profit-maximizing quantity of 3 units where marginal cost is equal to marginal revenue).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm has increasing marginal returns and explains that marginal cost is falling at the quantity of 1 unit, indicating that the marginal product is rising.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

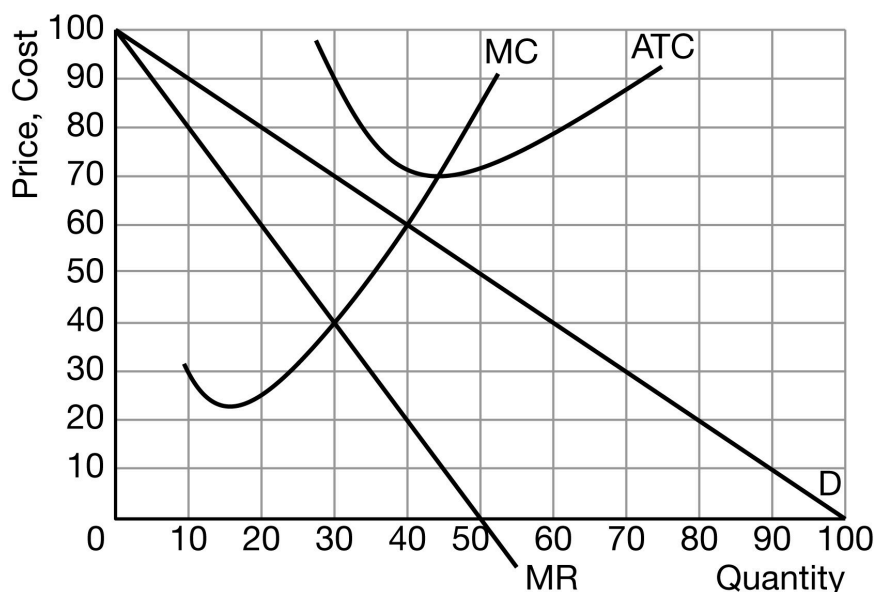
**Units 3.1-3.3 Practice AP Questions**

The response identifies that the allocatively efficient quantity is 4 units and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve.

## Units 3.1-3.3 Practice AP Questions

99. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- For prices between \$80 and \$70, is the demand curve elastic, inelastic, or unit elastic? Explain.
- To produce the allocatively efficient quantity, how many units of output would the firm produce? Explain.
- To maximize total revenue, how many units of output would the firm produce? Explain.
- Assuming the firm produces a quantity greater than zero, identify the firm's profit-maximizing quantity. Explain using marginal analysis.
- Calculate the firm's economic profit at the profit-maximizing quantity identified in part (d). Show your work.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is elastic between 80 and 70 and explains that the marginal revenue is positive; or uses numbers to explain that total revenue is rising in that price range, the percentage change in quantity is greater than the percentage change in price, or the absolute value of the price elasticity of demand is greater than 1.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 40 units of output at the allocatively efficient price and explains that at that quantity the marginal cost to producers equals the marginal benefit to consumers (where marginal cost crosses the demand curve).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm would produce 50 units of output to maximize total revenue and explains that at that quantity the marginal revenue is equal to zero, or uses numbers to explain that total revenue is maximized at that quantity of output.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies that the firm's profit-maximizing quantity is 30 units and explains that at that quantity marginal revenue is equal to marginal cost, or explains that when marginal revenue is higher than marginal cost the firm should increase production because each additional sale increases the firm's profit and when marginal cost is higher than marginal revenue the firm should decrease production because it costs more to produce the last unit than what the firm will earn from it.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



0

1

The response calculates the economic profit as  $-\$600$  and shows the work.

$$\text{Economic Profit} = \text{Total Revenue} - \text{Total Cost} = \$70 \times 30 - \$90 \times 30 = -\$600$$

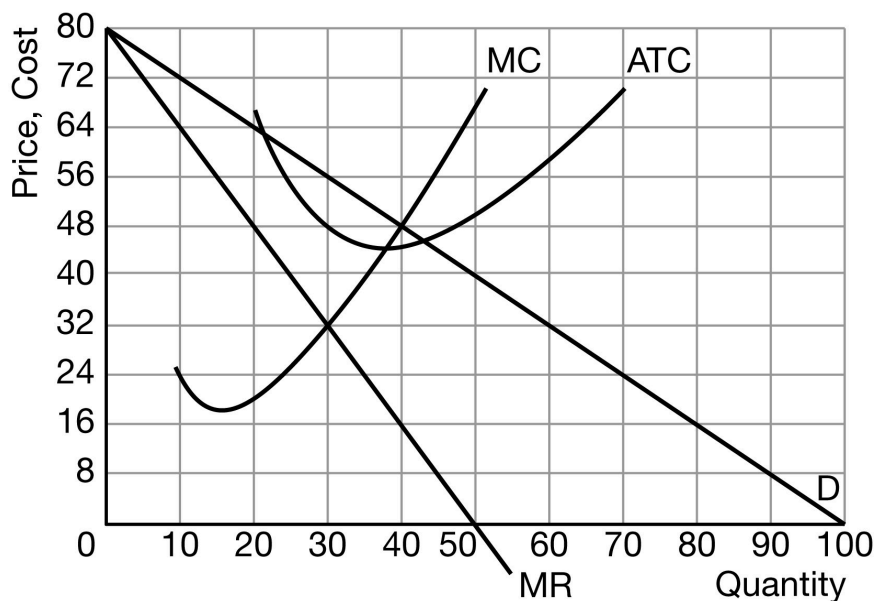
or

$$\text{Economic Profit} = (P - \text{ATC}) \times Q = (\$70 - \$90) \times 30 = -\$600$$

## Units 3.1-3.3 Practice AP Questions

100. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Assume the firm produces 40 units. Will the firm's economic profit be positive, negative, or zero? Explain.
  - If the firm charges \$32, should this firm increase its price, decrease its price, or keep the price at \$32 in order to maximize its total revenue? Explain.
  - If the firm decreases its price from \$72 to \$64, does the deadweight loss increase, decrease, or remain unchanged? Explain.
  - Identify the firm's profit-maximizing quantity and price, and explain how you determined each.
  - Calculate the total cost of producing the profit-maximizing quantity identified in part (d). Show your work.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that at 40 units the firm's economic profit is positive and explains that the price is above the ATC.

## Part B

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should increase its price and explains that when demand is inelastic (the portion of the demand curve where marginal revenue is less than zero), a higher price leads to more total revenue, or at \$40 the firm produces the quantity where marginal revenue is zero and total revenue is maximized.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that deadweight loss decreases and explains that the firm produces closer to the allocatively efficient quantity, where marginal cost equals price.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 30 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$56 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

**Units 3.1-3.3 Practice AP Questions**

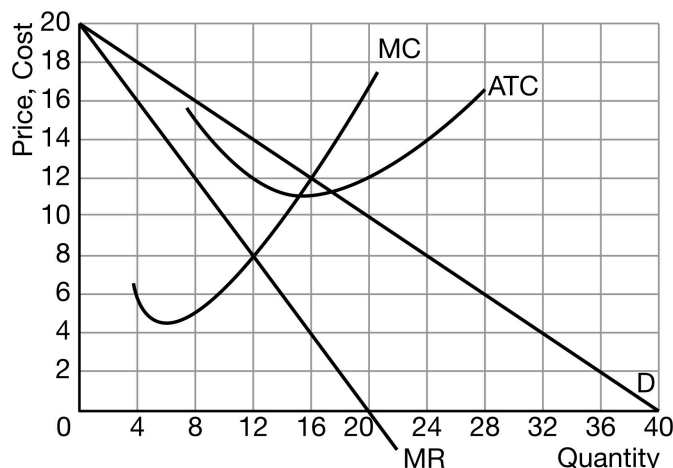
The response calculates total cost as \$1,440 and shows the work.

$$\text{Total Cost} = \text{Average Total Cost} \times \text{Quantity} = \$48 \times 30 = \$1440$$

## Units 3.1-3.3 Practice AP Questions

101. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Calculate the total revenue of producing 8 units. Show your work.
- For quantities between 8 and 12 units, is the demand curve elastic, inelastic, or unit elastic? Explain.
- Assume that this firm is currently charging a price of \$14. In order to maximize its profit, should the firm increase its price, decrease its price, or keep its price the same? Explain.
- At a quantity of 8 units, does this firm have increasing marginal returns or diminishing marginal returns? Explain.
- Identify the firm's allocatively efficient quantity, and explain how you determined it.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response calculates the total revenue of producing 8 units as \$128 and shows the work.

$$\text{Total Revenue} = \text{Price} \times \text{Quantity} = \$16 \times 8 = \$128$$

## Part B

**Units 3.1-3.3 Practice AP Questions**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the demand curve is elastic for quantities between 8 and 12 units and explains that the marginal revenue is positive; or uses numbers to explain that total revenue is rising as price declines in that quantity range, the percentage change in quantity demanded is greater than the percentage change in price, or the absolute value of the price elasticity of demand is greater than 1.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should keep its price the same and explains that at a price of \$14, the marginal cost is equal to the marginal revenue.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm has diminishing marginal returns and explains that marginal cost is rising at the quantity of 8 units, indicating that the marginal product is falling.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



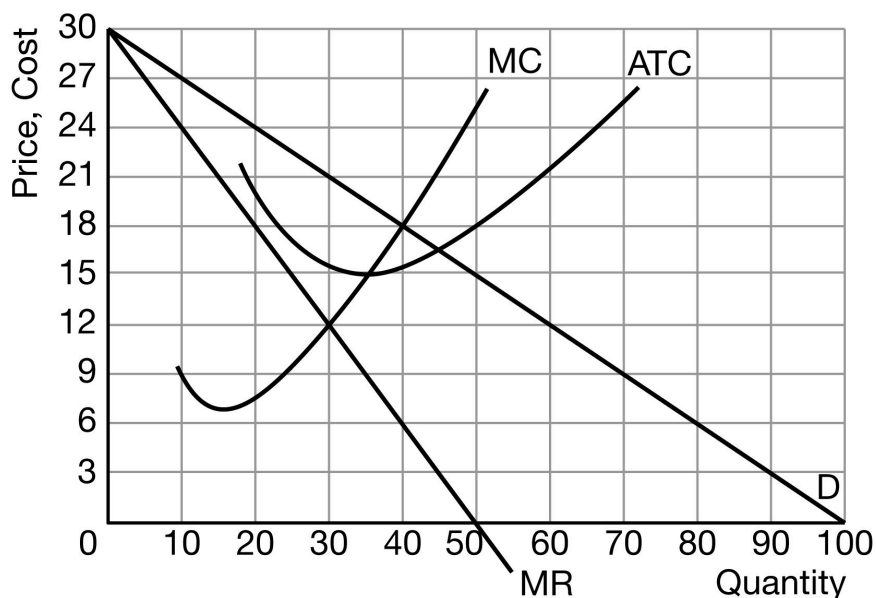
|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response identifies that the allocatively efficient quantity is 16 units and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve.

## Units 3.1-3.3 Practice AP Questions

102. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- At what quantity is the demand for this product unit elastic? Explain.
- Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is increasing at 40 units.
- If the firm maximizes profit, identify the profit-maximizing quantity and price, and explain how you determined each.
- Calculate the deadweight loss at the profit-maximizing quantity identified in part (c). Show your work.
- Assume fixed cost increases by \$6. Will the profit-maximizing quantity increase, decrease, or stay the same in the short run? Explain.

Respond to parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is unit elastic at the quantity of 50 units and explains that the marginal revenue is zero, or uses numbers to explain that total revenue is maximized at this quantity or that the absolute value of

**Units 3.1-3.3 Practice AP Questions**

the price elasticity of demand is 1.

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 40 units marginal cost exceeds average total cost, which means that the additional cost of producing the next unit is higher than the average total cost, which pulls the average total cost up for the next unit.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 30 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$21 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the deadweight loss at the profit-maximizing quantity as \$45 and shows the work.

$$\text{Deadweight Loss} = \frac{1}{2}(\$21 - \$12)(40 - 30) = \$45$$

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

**Units 3.1-3.3 Practice AP Questions**

0

1

The response states that the profit-maximizing quantity will stay the same and explains that the increase in fixed cost does not affect marginal cost in the short run.

## Units 3.1-3.3 Practice AP Questions

**103.**

| Number of Workers | Marginal Revenue Product per Day |
|-------------------|----------------------------------|
| 1                 | \$450                            |
| 2                 | \$500                            |
| 3                 | \$450                            |
| 4                 | \$400                            |
| 5                 | \$300                            |
| 6                 | \$100                            |

The table above gives the short-run marginal revenue product of labor per day for a perfectly competitive firm. The firm is currently selling its product at the market price of \$5.

- Calculate the marginal (physical) product of the third worker.
- Define the law of diminishing marginal returns and explain why it occurs.
- Diminishing marginal returns first occur with the hiring of which worker for the firm?
- What is the highest daily wage that the firm is willing to pay to hire the fifth worker?
- What will happen to the demand for labor if the market price of the product increases? Explain.

*Respond to all parts of the question.*

**Part A**

1 point:

- One point is earned for calculating the marginal product of the third worker:  $450/5$  per unit = 90 units.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for calculating the marginal product of the third worker:  $450/5$  per unit = 90 units.

**Part B**

2 points:

- One point is earned for defining the law of diminishing returns: as more and more units of a variable input are added to a fixed input, the output increases at a decreasing rate.
- One point is earned for the explanation that diminishing returns occur because of the overuse of the fixed input.

## Units 3.1-3.3 Practice AP Questions



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

2 points:

- One point is earned for defining the law of diminishing returns: as more and more units of a variable input are added to a fixed input, the output increases at a decreasing rate.
- One point is earned for the explanation that diminishing returns occur because of the overuse of the fixed input.

**Part C**

1 point:

- One point is earned for stating that diminishing marginal returns first occur with the hiring of the third worker.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for stating that diminishing marginal returns first occur with the hiring of the third worker.

**Part D**

1 point:

- One point is earned for stating \$300.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for stating \$300.

**Part E**

**Units 3.1-3.3 Practice AP Questions**

1 point:

- One point is earned for stating that the demand for labor will increase because the increase in the product price raises the marginal revenue product of labor.



0

1

Student receives 1/1 point(s)

1 point:

- One point is earned for stating that the demand for labor will increase because the increase in the product price raises the marginal revenue product of labor.

## Units 3.1-3.3 Practice AP Questions

104. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Avonni’s Painting Company.

| Number of Painters | Total Product per Hour |
|--------------------|------------------------|
| 1                  | 120                    |
| 2                  | 250                    |
| 3                  | 370                    |
| 4                  | 420                    |
| 5                  | 460                    |
| 6                  | 490                    |
| 7                  | 510                    |
| 8                  | 515                    |

- (a) Beginning with which painter do diminishing marginal returns set in for Avonni’s Painting Company? Explain using numbers.
- (b) Assume Avonni’s Painting Company sells its painting services in a perfectly competitive market at a price of \$3. Calculate the marginal revenue product of the second painter. Show your work.
- (c) Avonni’s Painting Company hires painters in a perfectly competitive labor market for painters at a wage rate of 140 *per hour*, and the market price of services remains 3. How many painters will Avonni’s Painting Company hire to maximize its profit? Explain using marginal analysis.
- (d) Assume painters must pay for a certification exam before they can work in this industry. If the cost of that exam increases, what will happen to each of the following in equilibrium?
- The market wage rate. Explain.
  - The number of workers hired in the labor market. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin with the third worker and explains that the marginal product (MP) of the third worker (120) is less than the MP of the second worker (130).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the second worker as \$390 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$3 \times 130 = \$390$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 4 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 4<sup>th</sup> worker (150) *is greater than the marginal resource cost (MRC) or wage* (140), but the MRP of the 5<sup>th</sup> worker (120) *is less than the MRC* (140).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the market wage rate will increase and explains that an increase in the cost of the exam will lead to a decrease in the supply of workers in that market.
- States that the number of workers hired in the labor market will decrease and explains that the increase in the wage rate resulting from the decrease in the supply of workers in that market will lead to fewer workers hired given the downward-sloping demand curve.

## Units 3.1-3.3 Practice AP Questions

105. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Chloe's Plumbing Services.

| Number of Plumbers | Total Product per Hour |
|--------------------|------------------------|
| 1                  | 8                      |
| 2                  | 16                     |
| 3                  | 26                     |
| 4                  | 37                     |
| 5                  | 50                     |
| 6                  | 60                     |
| 7                  | 68                     |
| 8                  | 74                     |

- (a) After which plumber do diminishing marginal returns begin for Chloe's Plumbing Services? Explain using numbers.
- (b) Assume Chloe's Plumbing Services sells its plumbing services in a perfectly competitive market at a unit price of \$15. Calculate the marginal revenue product of the third plumber. Show your work.
- (c) Chloe's Plumbing Services hires plumbers in a perfectly competitive labor market for plumbers at a wage rate of \$15 per hour, and the market price of plumbing services remains \$15. How many plumbers will Chloe's Plumbing Services hire to maximize its profit? Explain using marginal analysis.
- (d) Assume plumbers and plumbing equipment are substitutes in providing plumbing services by all plumbing firms in the market. If plumbing equipment, a fixed input, becomes less expensive and Chloe's Plumbing Services provides the same quantity of plumbing services, will each of the following increase, decrease, or stay the same?
- (i) The wage rate Chloe's Plumbing Services will pay its plumbers. Explain.
- (ii) The demand curve for plumbers for Chloe's Plumbing Services. Explain.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the fifth worker and explains that the marginal product (MP) of the sixth worker (10) was less than the MP of the fifth worker (13).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the third worker as \$150 and shows the work.

$$MRP = P \times MP = \$15 \times 10 = \$150$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 7 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 7th worker (120) *is greater than the marginal resource cost (MRC) or wage* (115), but the MRP of the 8th worker (90) *is less than the MRC* (115).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the wage rate the firm will pay will decrease and explains that a decrease in the price of plumbing equipment will result in a decrease in the demand for plumbers because plumbing equipment and workers are substitutes in providing plumbing services. A decrease in the demand for workers will decrease the market wage and therefore decrease the wage rate paid by the firm because the firm is a wage taker.
- States that the demand curve for plumbers by Chloe's Plumbing Services will stay the same in the short run and explains that the firm's demand curve for labor is the marginal revenue product of labor (MRP), which is the price of the service times the marginal product, and in the short run there is no change in the price of the service or the marginal product.

Or states that the demand curve for plumbers by Chloe's Plumbing Services will decrease in the long run and explains that the firm's demand curve for labor is the marginal revenue product of labor (MRP) which is the price of the service times the marginal product, and a decrease in the price of an input will increase the supply of plumbing services in the market, which will decrease the market price of plumbing services, and therefore will decrease the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

- 106.** The government has decided to take action to reduce the pollution caused by the chemical industry. This industry is composed of profit-maximizing, perfectly competitive firms.
- Identify one policy that the government could implement to reduce pollution.
  - Explain the effect the policy you identified in part (a) would have on each of the following for the firms in the chemical industry.
    - Marginal cost
    - Output
    - Price
  - Explain the effect of the policy you identified in part (a) on the efficiency of the allocation of society's resources.

Respond to all parts of the question.

**Part A**

1 point: government can impose a per-unit tax on pollution, sell pollution permits, restrict quantity, or require emissions reduction equipment



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point: government can impose a per-unit tax on pollution, sell pollution permits, restrict quantity, or require emissions reduction equipment

**Part B**

1 point: MC increases, since the tax increases the cost per unit of output

1 point: output will decrease

1 point: explanation that MC has shifted up and the firm will select new output level where the new MC equals P

1 point: price will increase

1 point: explanation that the supply curve will shift up by the amount of the tax, causing the price to rise



|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

Student receives 5/5 point(s)

**Units 3.1-3.3 Practice AP Questions**

1 point: MC increases, since the tax increases the cost per unit of output

1 point: output will decrease

1 point: explanation that MC has shifted up and the firm will select new output level where the new MC equals P

1 point: price will increase

1 point: explanation that the supply curve will shift up by the amount of the tax, causing the price to rise

**Part C**

1 point: efficiency will increase

1 point: explanation that the tax shifts the supply curve up to account for the social cost of pollution, and at the new equilibrium the MSC equals the MSB



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

1 point: efficiency will increase

1 point: explanation that the tax shifts the supply curve up to account for the social cost of pollution, and at the new equilibrium the MSC equals the MSB

## Units 3.1-3.3 Practice AP Questions

107. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

The table below shows the short-run production function for Raydisha’s Radiology Clinic.

| Number of Radiologists | Total Product per Hour |
|------------------------|------------------------|
| 1                      | 30                     |
| 2                      | 58                     |
| 3                      | 80                     |
| 4                      | 99                     |
| 5                      | 112                    |
| 6                      | 122                    |
| 7                      | 125                    |
| 8                      | 123                    |

- (a) After which radiologist do diminishing marginal returns begin for Raydisha’s Radiology Clinic? Explain using numbers.
- (b) Assume Raydisha’s Radiology Clinic sells its radiological services in a perfectly competitive market at a unit price of \$10. Calculate the marginal revenue product of the seventh radiologist. Show your work.
- (c) Raydisha’s Radiology Clinic hires radiologists in a perfectly competitive labor market for radiologists at a wage rate of 120 *per hour*, and *the market price of radiological services remains* 10. How many radiologists will Raydisha’s Radiology Clinic hire to maximize its profit? Explain using marginal analysis.
- (d) Assume there is a decrease in the demand for radiological services in the market and Raydisha’s Radiology Clinic continues to operate. What will happen to each of the following?
- (i) The market wage rate. Explain.
- (ii) The marginal revenue product curve for Raydisha’s Radiology Clinic. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the first worker and explains that the marginal product (MP) of the second worker (28) is less than the MP of the first worker (30).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the seventh worker as \$30 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$10 \times 3 = \$30$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 5 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 5<sup>th</sup> worker (130) *is greater than the marginal resource cost (MRC) or wage* (120), but the MRP of the 6<sup>th</sup> worker (100) *is less than the MRC* (120).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



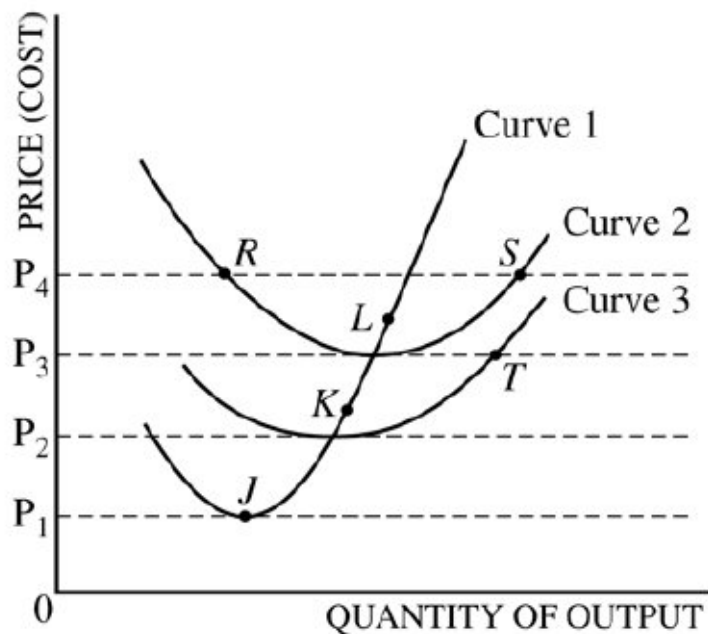
|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the market wage will decrease and explains that a decrease in the market demand for radiological services will lead to a decrease in demand for radiologists because the demand for radiologists is dependent on (or derived from) the demand for radiological services.
- States that the marginal revenue product curve for the firm will shift to the left and explains that the marginal revenue product is the price of the service times the marginal product, so a decrease in the demand for radiological services will decrease the price of radiological services and will therefore decrease the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

108.



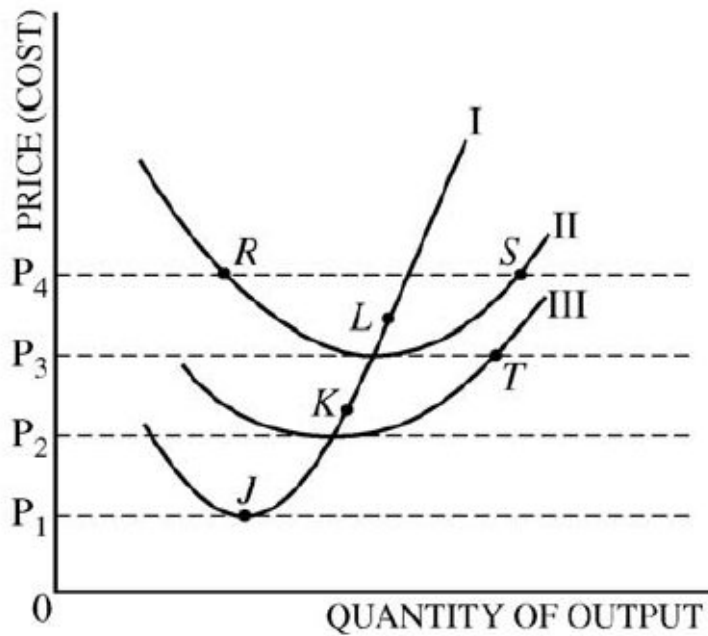
The graph above shows the short-run cost structure of a firm in a perfectly competitive industry.

- Identify the cost curves that are denoted by each of the following labels.
  - Curve 1
  - Curve 2
  - Curve 3
- Explain why curve 1 does each of the following as output increases.
  - Initially decreases
  - Finally increases
- What measure of cost is represented by the vertical distance between curve 2 and curve 3 ?
- Explain why the vertical distance between curve 2 and curve 3 decreases as output increases.
- Using the letters on the graph, identify two points on the firm's short-run supply curve.

Respond to all parts of the question.

**Part A**

## Units 3.1-3.3 Practice AP Questions



3 points:

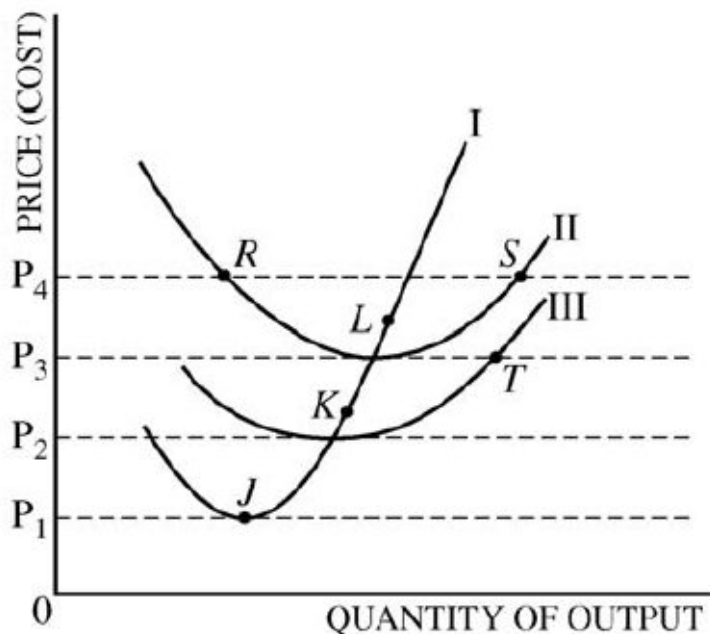
- One point is earned for identifying curve I as marginal cost (MC).
- One point is earned for identifying curve II as average total cost (ATC).
- One point is earned for identifying curve III as average variable cost (AVC).



|   |   |   |   |
|---|---|---|---|
| 0 | 1 | 2 | 3 |
|---|---|---|---|

Student receives 3/3 point(s)

## Units 3.1-3.3 Practice AP Questions



3 points:

- One point is earned for identifying curve I as marginal cost (MC).
- One point is earned for identifying curve II as average total cost (ATC).
- One point is earned for identifying curve III as average variable cost (AVC).

**Part B**

2 points:

- One point is earned for a correct explanation for (i): increasing marginal returns or increasing marginal product (productivity) or increasing returns or specialization.
- One point is earned for a correct explanation for (ii): decreasing marginal returns (productivity) or (the law of) diminishing marginal returns or sharing of fixed inputs.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

2 points:

- One point is earned for a correct explanation for (i): increasing marginal returns or increasing marginal product (productivity) or increasing returns or specialization.

**Units 3.1-3.3 Practice AP Questions**

- One point is earned for a correct explanation for (ii): decreasing marginal returns (productivity) or (the law of) diminishing marginal returns or sharing of fixed inputs.

**Part C**

1 point:

- One point is earned for identifying the average fixed cost.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for identifying the average fixed cost.

**Part D**

1 point:

- One point is earned for stating that the fixed cost is spread over larger quantity, so AFC decreases.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for stating that the fixed cost is spread over larger quantity, so AFC decreases.

**Part E**

1 point:

- One point is earned for identifying K and L.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

**Units 3.1-3.3 Practice AP Questions**

1 point:

- One point is earned for identifying K and L.

## Units 3.1-3.3 Practice AP Questions

109.

## Short-Run Total Cost Function

| Quantity Produced | Total Cost (in dollars) |
|-------------------|-------------------------|
| 0                 | 20                      |
| 1                 | 27                      |
| 2                 | 38                      |
| 3                 | 53                      |
| 4                 | 72                      |
| 5                 | 95                      |
| 6                 | 122                     |

The table above gives the short-run total cost function for a typical firm in a perfectly competitive industry.

- What is the dollar value of the firm's total fixed cost?
- Calculate the marginal cost of producing the first unit of output.
- If the price the firm receives for its product is \$20, indicate the firm's profit-maximizing quantity of output and explain how you determined your answer.
- Given your results in part (c), explain what will happen to the number of firms in the industry in the long run.
- Assume that this firm operates in a constant-cost industry and has reached long-run equilibrium. If the government imposes a per-unit tax of \$2, indicate what will happen to the firm's profit-maximizing output in the long run.

Respond to all parts of the question.

**Part A**

1 point:

- One point is earned for indicating that TFC is \$20.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for indicating that TFC is \$20.

**Part B**

**Units 3.1-3.3 Practice AP Questions**

1 point:

- One point is earned for indicating that MC of the first unit is \$7.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for indicating that MC of the first unit is \$7.

**Part C**

2 points:

- One point is earned for indicating that the profit-maximizing output=4 units (or between 4 and 5 units).
- One point is earned for explaining that  $MR > MC$  for all units until  $Q=5$  (or direct calculation of  $TR-TC$ ).



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

2 points:

- One point is earned for indicating that the profit-maximizing output=4 units (or between 4 and 5 units).
- One point is earned for explaining that  $MR > MC$  for all units until  $Q=5$  (or direct calculation of  $TR-TC$ ).

**Part D**

2 points:

- One point is earned for concluding that the number of firms will increase.
- One point is earned for explaining that profits will attract new firms to enter.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

Student receives 2/2 point(s)

**Units 3.1-3.3 Practice AP Questions**

2 points:

- One point is earned for concluding that the number of firms will increase.
- One point is earned for explaining that profits will attract new firms to enter.

**Part E**

point:

- One point is earned for stating that there is no change in the profit-maximizing output.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student receives 1/1 point(s)

1 point:

- One point is earned for stating that there is no change in the profit-maximizing output.

## Units 3.1-3.3 Practice AP Questions

110. Sparkle Car Wash is a profit-maximizing firm with the following production information.

| <u>Number of Workers</u> | <u>Number of Cars Washed per Day</u> |
|--------------------------|--------------------------------------|
| 0                        | 0                                    |
| 1                        | 15                                   |
| 2                        | 35                                   |
| 3                        | 60                                   |
| 4                        | 75                                   |
| 5                        | 85                                   |
| 6                        | 80                                   |

- With which worker is marginal product maximized?
- Identify and define the economic principle that explains why marginal product eventually decreases.
- Explain why Sparkle would never hire the sixth worker.
- If Sparkle charges \$6 for washing a car, what is the maximum daily wage that Sparkle would be willing to pay the fourth worker?

Respond to all parts of the question.

**Part A**

1 point: 3rd worker



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student earns 1/1 point(s)

1 point: 3rd worker

**Part B**

1 point: Diminishing marginal returns

1 point: Definition of diminishing marginal returns that includes both variable **and** fixed inputs



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

**Units 3.1-3.3 Practice AP Questions**

Student earns 2/2 point(s)

1 point: Diminishing marginal returns

1 point: Definition of diminishing marginal returns that includes both variable **and** fixed inputs

**Part C**

1 point: Negative marginal product for the 6th worker

Also accepted: negative returns, output falls, or  $MRP < 0$ .



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student earns 1/1 point(s)

1 point: Negative marginal product for the 6th worker

Also accepted: negative returns, output falls, or  $MRP < 0$ .

**Part D**

1 point:  $90(PxMP_{or6} \times 15 = \$90)$



|   |   |
|---|---|
| 0 | 1 |
|---|---|

Student earns 1/1 point(s)

1 point:  $90(PxMP_{or6} \times 15 = \$90)$

## Units 3.1-3.3 Practice AP Questions

111. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table provided represents the total quantity of textbooks that can be produced by a firm using different quantities of workers in a single day.

| Number of Workers | Total Quantity of Textbooks Produced per Day |
|-------------------|----------------------------------------------|
| 1                 | 10                                           |
| 2                 | 25                                           |
| 3                 | 33                                           |
| 4                 | 36                                           |
| 5                 | 37                                           |
| 6                 | 35                                           |

The workers are hired in a perfectly competitive labor market and are paid \$200 per day, and these wages are the firm’s only variable cost. The firm also has a daily fixed cost of \$500. Every textbook is sold at a unit price of \$100.

- (a) Calculate the average variable cost of producing 25 textbooks. Show your work.
- (b) With the hiring of which worker do diminishing marginal returns begin for this firm? Explain using numbers.
- (c) How many workers should this firm hire to maximize profits? Explain using marginal analysis.
- (d) Calculate the firm’s economic profit if it hires the number of workers identified in part (c). Show your work.
- (e) Assume the daily fixed cost increases to \$1,000. What will happen to the profit-maximizing quantity of labor hired?

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

The response must show appropriate work in order to receive the point.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

Calculates the average variable cost (AVC) of producing twenty-five textbooks as \$16 and shows the work.

☐ 
$$\begin{aligned} \text{AVC of 25 units} &= \frac{\text{Total Variable Cost}}{\text{Quantity}} \\ &= \frac{\text{Number of workers} \times \text{wage}}{\text{Quantity}} = \frac{2 \times \$200}{25} = \frac{\$400}{25} \\ &= \$16 \end{aligned}$$

## Units 3.1-3.3 Practice AP Questions

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

- ☐ States that diminishing marginal returns begin with the hiring of the third worker and explains that the marginal product (MP) of the third worker is 8 textbooks, which is less than the MP of the second worker ( $8 < 15$ ), and the MP of the second worker is greater than the MP of the first worker ( $15 > 10$ ).

## Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below

- ☐ States that the firm should hire 4 workers and explains that the marginal revenue product (MRP), or the value of the marginal product (VMP), of the fourth worker is greater than the marginal factor cost ( $\$300 > \$200$ ), while the MRP of the fifth worker is less than the marginal factor cost ( $\$100 < \$200$ ).

## Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

The response must show appropriate work in order to receive the point.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below.

- ☐ Calculates the firm's economic profit as \$2,300 and shows the work.
- Economic Profit = Total Revenue – Total Cost
- $$= (\text{Price} \times \text{Quantity}) - (\text{Total Variable Cost} + \text{Total Fixed Cost})$$
- $$= (\$100 \times 36) - [(\$200 \times 4) + \$500]$$
- $$= \$3,600 - (\$800 + \$500) = \$2,300$$

**Units 3.1-3.3 Practice AP Questions****Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below

- ☐ States that the profit-maximizing quantity of labor hired will not change.

## Units 3.1-3.3 Practice AP Questions

112. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The table below shows the short-run production function for Todd’s Trucking Company.

| Number of Drivers | Total Product per Hour |
|-------------------|------------------------|
| 1                 | 8                      |
| 2                 | 18                     |
| 3                 | 30                     |
| 4                 | 50                     |
| 5                 | 60                     |
| 6                 | 65                     |
| 7                 | 67                     |
| 8                 | 65                     |

- (a) Beginning with which driver do diminishing marginal returns set in for Todd’s Trucking Company? Explain using numbers.
- (b) Assume Todd’s Trucking Company sells its trucking services in a perfectly competitive market at a price of \$6. Calculate the marginal revenue product of the third driver. Show your work.
- (c) Todd’s Trucking Company hires drivers in a perfectly competitive labor market for drivers at a wage rate of 40 *per hour*, and the market price of services remains 6. How many drivers will Todd’s Trucking Company hire to maximize its profit? Explain using marginal analysis.
- (d) Assume drivers must pay for a certification exam before they can work in this industry. If the cost of that exam decreases, what will happen to each of the following in equilibrium?
- (i) The market wage rate. Explain.
- (ii) The number of workers hired in the labor market. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin with the fifth worker and explains that the marginal product (MP) of the fifth worker (10) is less than the MP of the fourth worker (20).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the third worker as \$72 and shows the work.

$$MRP = P \times MP = \$6 \times 12 = \$72$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 5 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 5<sup>th</sup> worker (60) *is greater than the marginal resource cost (MRC) or wage* (40), but the MRP of the 6<sup>th</sup> worker (30) *is less than the MRC* (40).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

The response does both of the following:

- States that the market wage rate will decrease and explains that a decrease in the cost of the exam will lead to an increase in the supply of workers in that market.
- States that the number of workers hired in the labor market will increase and explains that the decrease in the wage rate resulting from the increase in the supply of workers in that market will lead to more workers hired given the downward-sloping demand curve.

## Units 3.1-3.3 Practice AP Questions

113. *Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.*

The table below shows the short-run production function for Zhizhi’s Bakery.

| Number of Bakers | Total Product per Hour |
|------------------|------------------------|
| 1                | 9                      |
| 2                | 19                     |
| 3                | 28                     |
| 4                | 36                     |
| 5                | 43                     |
| 6                | 49                     |
| 7                | 53                     |
| 8                | 52                     |

- (a) After which baker do diminishing marginal returns begin for Zhizhi’s Bakery? Explain using numbers.
- (b) Assume Zhizhi’s Bakery sells its baked goods in a perfectly competitive market at a price of \$5 per unit. Calculate the marginal revenue product of the fifth baker. Show your work.
- (c) Zhizhi’s Bakery hires bakers in a perfectly competitive labor market for bakers at a wage rate of 36 per hour, and the market price of baked goods remains 5. How many bakers will Zhizhi’s Bakery hire to maximize its profit? Explain using marginal analysis.
- (d) Assume there is an increase in the demand for baked goods in the market. What will happen to each of the following?
- (i) The market wage rate. Explain.
- (ii) The marginal revenue product curve for Zhizhi’s Bakery. Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that diminishing marginal returns begin after the second worker and explains that the marginal product (MP) of the third worker (9) is less than the MP of the second worker (10).

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

## Units 3.1-3.3 Practice AP Questions



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the marginal revenue product of the fifth worker as \$35 and shows the work.

$$\text{MRP} = P \times \text{MP} = \$5 \times 7 = \$35$$

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that 4 workers will be hired to maximize its profit and explains that the marginal revenue product (MRP) of the 4<sup>th</sup> worker (40) *is greater than the marginal resource cost (MRC) or wage* (36), but the MRP of the 5<sup>th</sup> worker (35) *is less than the MRC* (36).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |   |
|---|---|---|
| 0 | 1 | 2 |
|---|---|---|

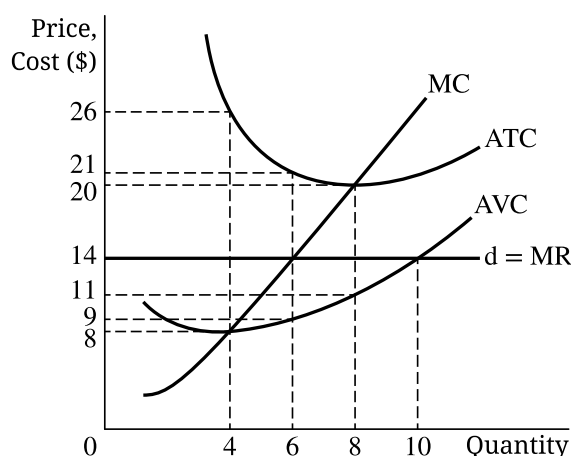
The response does both of the following:

- States that the market wage will increase and explains that an increase in the market demand for baked goods will lead to an increase in demand for bakers because the demand for bakers is dependent on (or derived from) the demand for baked goods.
- States that the marginal revenue product curve for the firm will shift to the right and explains that the marginal revenue product is the price of the product times the marginal product, so an increase in the demand for baked goods will increase the market price of baked goods and will therefore increase the marginal revenue product for every unit of labor.

## Units 3.1-3.3 Practice AP Questions

- 114.** Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

The graph provided shows the demand (d), marginal revenue (MR), average total cost (ATC), average variable cost (AVC), and marginal cost (MC) curves for Hansel Hangout, a typical profit-maximizing firm in a perfectly competitive market producing Good X.



- Calculate Hansel Hangout's total fixed cost. Show your work.
- Identify the price and Hansel Hangout's profit-maximizing quantity of Good X.
- Calculate Hansel Hangout's economic profit at the quantity identified in part (b). Show your work.
- As the market for Good X adjusts to the long-run equilibrium, what will happen to the price of Good X? Explain.
- Assume the cross-price elasticity of demand between Good X and Good C is positive. Given the change in the long-run price of Good X in part (d), will the quantity demanded of Good C increase, decrease, or remain the same? Explain.

Respond to all parts of the question.

**Part A**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

The response must show appropriate work in order to receive the point.



0

1

The response accurately includes the criterion below

Calculates the total fixed cost as \$72 and shows the work.

Total Fixed Cost = (Average Total Cost – Average Variable Cost) × Quantity

☐ Total Fixed Cost =  $(\$26 - \$8) \times 4 = (\$18 \times 4) = \$72$

OR

## Units 3.1-3.3 Practice AP Questions

$$\text{Total Fixed Cost} = (\$21 - \$9) \times 6 = (\$12 \times 6) = \$72$$

## Part B

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below

- ☐ Identifies the price as \$14 and the profit-maximizing quantity as 6 units.

## Part C

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

The response must show appropriate work in order to receive the point.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below

Calculates Hansel Hangout's economic profit at the profit-maximizing quantity as  $-\$42$  and shows the work.

$$\text{Economic Profit} = (\text{Price} - \text{Average Total Cost}) \times \text{Quantity}$$

☐  $= (\$14 - \$21) \times 6 \text{ units} = (-\$7 \times 6) = -\$42$

OR

$$\text{Economic Profit} = \text{Total Revenue} - \text{Total Cost}$$

$$= (\$14 \times 6) - (\$21 \times 6) = \$84 - \$126 = -\$42$$

## Part D

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response accurately includes the criterion below

**Units 3.1-3.3 Practice AP Questions**

- ☐ States that the market price of Good X will increase in the long run and explains that some firms will exit the market due to the negative economic profits, causing the market supply curve to shift to the left, increasing the market equilibrium price.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

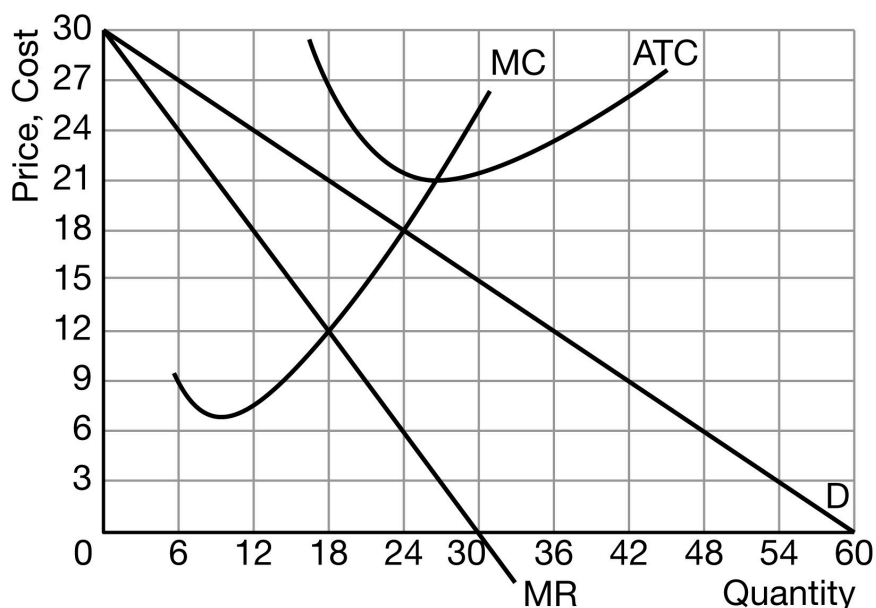
The response accurately includes the criterion below

- ☐ States that the quantity demanded of Good C will increase and explains that a positive cross-price elasticity of demand indicates that the two goods are substitutes in consumption and an increase in the price of Good X will increase the demand for Good C, causing an increase in the quantity demanded of Good C.

## Units 3.1-3.3 Practice AP Questions

115. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- At what quantity is the demand for this product unit elastic? Explain.
- Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is decreasing at 18 units.
- If the firm maximizes profit, identify the profit-maximizing quantity and price, and explain how you determined each.
- Calculate the deadweight loss at the profit-maximizing quantity identified in part (c). Show your work.
- Assume fixed cost decreases by \$9. Will the profit-maximizing quantity increase, decrease, or stay the same in the short run? Explain.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that the demand curve is unit elastic at the quantity of 30 units and explains that the marginal revenue is zero, or uses numbers to explain that total revenue is maximized at this quantity or that the absolute value of

**Units 3.1-3.3 Practice AP Questions**

the price elasticity of demand is 1.

**Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 18 units marginal cost is less than average total cost, which means that the additional cost of producing the next unit is lower than the average total cost, which pulls down the average total cost for the next unit.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response does both of the following:

- Identifies that the firm's profit-maximizing quantity is 18 units and explains that at that quantity marginal revenue is equal to marginal cost.
- Identifies that the firm's profit-maximizing price is \$21 and explains that it is the price on the demand curve at the profit-maximizing quantity (where marginal revenue is equal to marginal cost).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the deadweight loss at the profit-maximizing quantity as \$27 and shows the work.

$$\text{Deadweight Loss} = \frac{1}{2}(\$21 - \$12)(24 - 18) = \$27$$

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

**Units 3.1-3.3 Practice AP Questions**

0

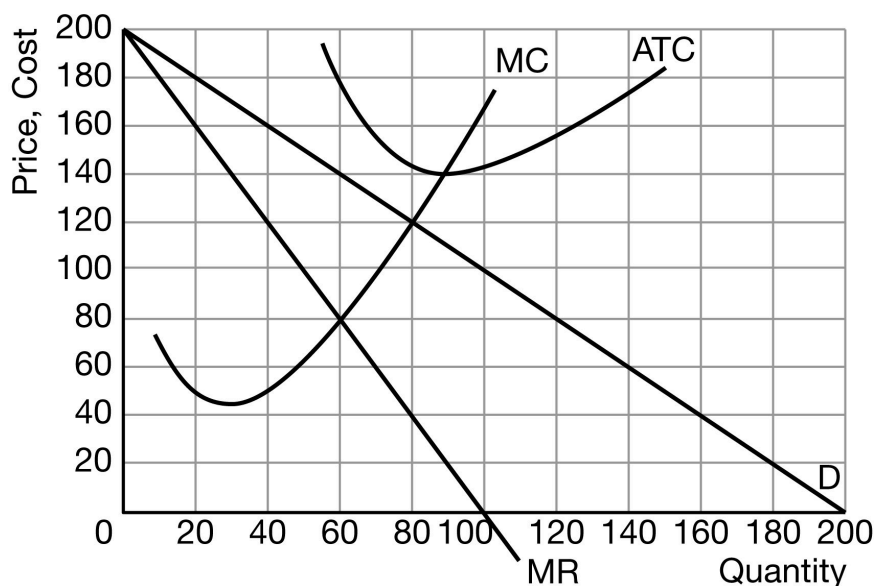
1

The response states that the profit-maximizing quantity will stay the same and explains that the decrease in fixed cost does not affect marginal cost in the short run.

## Units 3.1-3.3 Practice AP Questions

116. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- Calculate the total revenue of producing 40 units. Show your work.
- For quantities between 160 and 180 units, is the demand curve elastic, inelastic, or unit elastic? Explain.
- Assume that this firm is currently charging a price of \$100. In order to maximize its profit, should the firm increase its price, decrease its price, or keep its price the same? Explain.
- At a quantity of 20 units, does this firm have increasing marginal returns or diminishing marginal returns? Explain.
- Identify the firm's allocatively efficient quantity, and explain how you determined it.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response calculates the total revenue of producing 40 units as \$6400 and shows the work.

$$\text{Total Revenue} = \text{Price} \times \text{Quantity} = \$160 \times 40 = \$6,400$$

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the demand curve is inelastic for quantities between 160 and 180 units and explains that the marginal revenue is negative; or uses numbers to explain that total revenue is falling as the price declines in that quantity range, the percentage change in quantity demanded is less than the percentage change in price, or the absolute value of the price elasticity of demand is less than 1.

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm should increase its price and explains that at a price of 100 *the marginal cost is greater than the marginal revenue or explain that the profit – maximizing price is 140* (this is the price from the demand curve for the profit-maximizing quantity of 60 units where marginal cost is equal to marginal revenue).

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that the firm has increasing marginal returns and explains that marginal cost is falling at the quantity of 20 units, indicating that the marginal product is rising.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

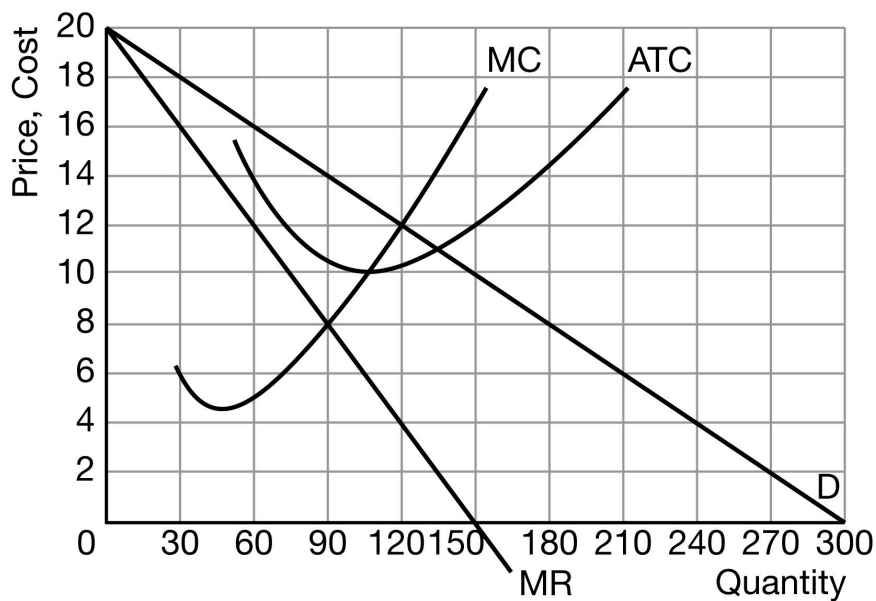
**Units 3.1-3.3 Practice AP Questions**

The response identifies that the allocatively efficient quantity is 80 units and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve.

## Units 3.1-3.3 Practice AP Questions

117. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- What will happen to total revenue if the firm raises the price from \$12 to \$16? Explain.
- At 120 units, is the firm producing at the allocatively efficient quantity? Explain.
- If the firm produces 90 units, will the firm's economic profit be positive, negative, or zero? Explain.
- Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is decreasing at 60 units.
- Calculate the consumer surplus if the firm charges the profit-maximizing price. Show your work.

Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that total revenue will decrease and explains that demand is price elastic in this price range; or uses numbers to explain that the percentage decrease in quantity demanded is greater than the percentage increase in price, the absolute value of the price elasticity of demand is greater than 1, or the total revenue decreases.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that yes, the firm is producing at the allocatively efficient quantity and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve (at 120 units).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that at 90 units the firm's economic profit is positive and explains that the price is above the ATC.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 60 units marginal cost is less than average total cost, which means that the cost of producing the next unit is lower than the average total cost, which pulls down the average total cost for the next unit.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

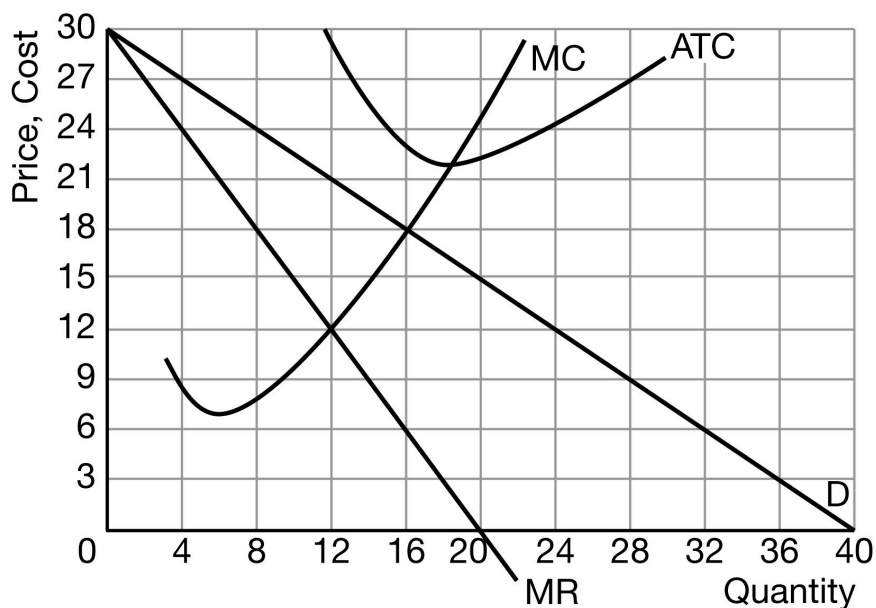
The response calculates the consumer surplus as \$270 and shows the work:

$$\text{Consumer Surplus} = \frac{1}{2}(90)(\$20 - \$14) = \$270$$

## Units 3.1-3.3 Practice AP Questions

118. Include correctly labeled diagrams, if useful or required, in explaining your answers. A correctly labeled diagram must have all axes and curves clearly labeled and must show directional changes. If the question prompts you to “Calculate,” you must show how you arrived at your final answer.

Use the following graph to answer parts (a)-(e). Prices and costs are in dollars.



The graph above shows the demand ( $D$ ), marginal revenue ( $MR$ ), marginal cost ( $MC$ ), and average total cost ( $ATC$ ) curves for one of many profit-maximizing firms operating in the short run in an industry in which there are no barriers to entry. Each firm sells a similar but not identical product.

- What will happen to total revenue if the firm raises the price from \$9 to \$12? Explain.
  - At 16 units, is the firm producing at the allocatively efficient quantity? Explain.
  - If the firm produces 12 units, will the firm's economic profit be positive, negative, or zero? Explain.
  - Use the relationship between the marginal cost curve and the average total cost curve to explain why the average total cost curve is increasing at 20 units.
  - Calculate the consumer surplus if the firm charges the profit-maximizing price. Show your work.
- Respond to all parts of the question.

## Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0

1

The response states that total revenue will increase and explains that demand is price inelastic in this price range; or uses numbers to explain that the percentage decrease in quantity demanded is less than the percentage increase in price, the absolute value of the price elasticity of demand is less than 1, or the total revenue increases.

**Units 3.1-3.3 Practice AP Questions****Part B**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that yes, the firm is producing at the allocatively efficient quantity and explains that allocative efficiency is achieved when the marginal cost to producers equals the marginal benefit to consumers, which occurs where the demand curve intersects the marginal cost curve (at 16 units).

**Part C**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response states that at 12 units the firm's economic profit is negative (or there is an economic loss) and explains that the price is below the ATC.

**Part D**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response explains that at 20 units marginal cost is greater than average total cost, which means that the cost of producing the next unit is higher than the average total cost, which pulls up the average total cost for the next unit.

**Part E**

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



|   |   |
|---|---|
| 0 | 1 |
|---|---|

The response calculates the consumer surplus as \$54 and shows the work:

**Units 3.1-3.3 Practice AP Questions**

$$\text{Consumer Surplus} = \frac{1}{2}(12)(\$30 - \$21) = \$54$$