

Week 12

AP Microeconomics

Homework bundle for this week

本周作业合集

exercises.lol

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3. Production, Cost, and the Perfect Competition Model Starter Quiz · 课前小测

AP Microeconomics

Name: _____ Score: _____

1. In the **short run**, a firm has:

- ☐ at least one fixed input
- ☐ no inputs at all
- ☐ every input variable
- ☐ no output

2. Total cost equals fixed cost plus _____ cost.

3. A firm enjoys **economies of scale** when, as it grows:

- ☐ long-run average cost falls
- ☐ long-run average cost rises
- ☐ output falls
- ☐ fixed costs rise

4. Accounting profit equals:

- ☐ total revenue — explicit costs
- ☐ total revenue — implicit costs
- ☐ total revenue — all costs
- ☐ explicit costs — implicit costs

5. A firm maximises profit by producing the quantity where:

- ☐ marginal revenue equals marginal cost
- ☐ total revenue is highest
- ☐ price equals total cost
- ☐ average cost is highest

6. In the short run, a loss-making firm should keep producing as long as:

- ☐ price is at least the average variable cost
- ☐ price is at least the average total cost
- ☐ price is above the fixed cost
- ☐ it is making any loss at all

7. Total cost is 160 at 10 units and 175 at 11 units. What is the marginal cost of the 11th unit?

8. Because the LRATC hugs the bottom of all the short-run curves, it is called their _____.

9. Economic profit is always smaller than (or equal to) accounting profit.

- ☐ True ☐ False

10. For a competitive firm, price equals average revenue and also equals _____ revenue.

1. **at least one fixed input**

The short run has at least one fixed input; the long run has none.

2. **variable**

$TC = FC + VC$. Fixed costs stay put; variable costs rise with output.

3. **long-run average cost falls**

Economies of scale = a falling LRATC as the firm gets bigger.

4. **total revenue — explicit costs**

Accountants subtract only the explicit (paid-out) costs.

5. **marginal revenue equals marginal cost**

At $MR = MC$ profit can no longer improve — the profit-maximizing rule.

6. **price is at least the average variable cost**

If $P \geq AVC$, staying open loses less than shutting down (which loses all the fixed cost).

7. **15**

$MC = \Delta TC / \Delta Q = (175 - 160) / 1 = 15$.

8. **envelope**

The LRATC envelope traces the lowest cost at each level of output.

9. **True**

Economic profit subtracts implicit costs as well, so it cannot be larger.

10. **marginal**

Because every unit sells at the same price, $P = AR = MR$.

3.1 The Production Function

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS fixed 固定 • short run 短期 • marginal product 边际产量
• production function 生产函数 • long run 长期

Objective

Build the skills to answer exam questions on **the production function**.

You must be able to:

- define the **production function** 生产函数 as the relationship between inputs and output
- distinguish the **short run** 短期 from the **long run** 长期
- calculate **total, marginal, and average product**
- explain the **law of diminishing marginal returns** 边际报酬递减

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ **Production function and time**

The production function links **inputs** to **output**. In the **short run** at least one input is **fixed**; in the **long run** all inputs are variable.

■ **Product measures**

Total product (TP) is total output; **marginal product** $MP = \frac{\Delta TP}{\Delta L}$; **average product** $AP = \frac{TP}{L}$.

■ **Diminishing marginal returns**

Adding more of a variable input to fixed inputs eventually makes **marginal product fall**.

2 Practice

2.1 State the difference between the short run and the long run. [2]

2.2 Total product rises from 20 to 26 when a fourth worker is hired. Find the marginal product of the fourth worker. [2]

2.3 State the law of diminishing marginal returns. [1]

3 Exam-style questions

3.1 In the short run, at least one input is [1]

- **A** variable
- **B** fixed
- **C** zero
- **D** free

3.2 Diminishing marginal returns means marginal product eventually [1]

- **A** rises
- **B** falls
- **C** stays constant
- **D** is always zero

3.3 A factory adds workers to a fixed set of machines. Output for 1, 2, 3, 4 workers is 10, 22, 30, 34 units.

(a) Find the marginal product of the third worker. [1]

(b) Find the marginal product of the fourth worker. [1]

(c) State whether diminishing marginal returns have set in. [1]

Solutions

2.1 in the short run at least one input is fixed; in the long run all inputs are variable.

2.2 $MP = \frac{\Delta TP}{\Delta L} = \frac{26 - 20}{1} = 6$ units.

2.3 as more of a variable input is added to fixed inputs, its marginal product eventually falls.

3.1 B.

3.2 B.

3.3 (a) $30 - 22 = 8$ units. (b) $34 - 30 = 4$ units. (c) yes — marginal product is falling.

Name:

AP Microeconomics: **2024 Set 2**

2. The table provided shows the short-run production function for Lowen Feline, a profit-maximizing firm that produces cat food.

Number of Workers	Total Quantity of Cat Food (bags)
0	0
1	5
2	12
3	18
4	23
5	27
6	30
7	32
8	33
9	32

Lowen Feline sells as many bags of cat food as it wants at a market price of \$10 per bag and hires as many workers as it wants at a market wage of \$18.

(a) Lowen Feline's fixed cost is \$90. Calculate the average fixed cost if Lowen Feline hires 6 workers. Show your work.

(b) Assume labor is the only variable input to Lowen Feline. Calculate the marginal cost if Lowen Feline increases output from 27 to 30 units. Show your work.

(c) With the hiring of which worker do diminishing marginal returns begin? Explain using numbers.

(d) Determine the profit-maximizing number of workers Lowen Feline will hire. Explain using marginal analysis.

(e) In the long run, a rival company, Gato Food, increases its production from 40 to 50 units, and its total cost increases from \$600 to \$900. Over the output range of 40 to 50 units, is Gato Food experiencing economies of scale, diseconomies of scale, or constant returns to scale? Explain using numbers.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

2. 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

2. The table below shows the output a firm produces using different amounts of capital (K) and labor (L). The markets for capital and labor are perfectly competitive. The rental rate of capital is \$75 per unit, and the wage rate is \$200 per unit. In the short run, capital is fixed and labor is variable.

Labor	Output with K=1	Output with K=2
0	0	0
1	10	20
2	25	50
3	38	75

- (a) If the firm uses one unit of capital and one unit of labor, will it be operating with constant, increasing, or decreasing returns to scale? Explain using numbers from the table.
- (b) Assume now that the firm currently has two units of capital and is using three units of labor.
- (i) Calculate the marginal product for the third unit of labor. Show your work.
- (ii) Did the firm experience diminishing marginal returns with the addition of the third unit of labor? Explain using numbers from the table.
- (iii) Calculate the firm's average total cost for its current level of production. Show your work.
- (iv) If the firm's output is sold in a competitive market, what is the lowest output price at which the third unit of labor would be hired?

3.2 Short-Run Production Costs

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS total cost 总成本 • fixed cost 固定成本 • marginal cost 边际成本
• variable cost 可变成本 • fixed 固定

Objective

Build the skills to answer exam questions on **short-run production costs**.

You must be able to:

- distinguish **fixed costs** 固定成本 from **variable costs** 可变成本
- calculate **total cost**, **average fixed cost**, **average variable cost**, and **average total cost**
- calculate **marginal cost** 边际成本 as the change in total cost per extra unit
- explain why MC cuts AVC and ATC at their minimum points

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Cost types

Fixed costs do not change with output; **variable costs** do. $TC = FC + VC$.

■ Average costs

$$AFC = \frac{FC}{Q}, AVC = \frac{VC}{Q}, ATC = \frac{TC}{Q}.$$

■ Marginal cost

$MC = \frac{\Delta TC}{\Delta Q}$. The MC curve cuts both AVC and ATC at their **minimum** points:
while MC is below an average, the average falls; above it, it rises.

2 Practice

2.1 State the difference between fixed and variable costs. [2]

2.2 At $Q = 10$, fixed cost is \$100 and variable cost is \$150. Find the average total cost.[2]

2.3 State the point on the ATC curve where the MC curve crosses it. [1]

3 Exam-style questions

3.1 Average total cost is [1]

- **A** $TC \times Q$
- **B** TC/Q
- **C** $MC \times Q$
- **D** FC/Q

3.2 The MC curve crosses the ATC curve at ATC's [1]

- **A** maximum
- **B** minimum
- **C** starting point
- **D** end point

3.3 A firm's total cost rises from \$200 (at $Q = 20$) to \$215 (at $Q = 21$).

(a) Find the marginal cost of the 21st unit. [1]

(b) Find the average total cost at $Q = 20$. [1]

(c) Since MC exceeds ATC here, state whether ATC is rising or falling. [1]

Solutions

2.1 fixed costs do not change with output; variable costs rise as output rises.

2.2 $TC = 100 + 150 = 250$; $ATC = \frac{250}{10} = \$25$.

2.3 at its minimum point.

3.1 B.

3.2 B.

3.3 (a) $MC = \frac{215 - 200}{1} = \15 . (b) $ATC = \frac{200}{20} = \$10$. (c) rising (MC is above ATC).

Name:

AP Microeconomics: 2026

2. The table shows Protecto's short-run cost schedule of producing helmets.

Quantity of Helmets	Total Cost (\$)	Marginal Cost (\$)
4	200	30
5	235	35
6	275	40
7	320	45
8	375	55
9	440	65
10	520	80

Protecto produces and sells as many helmets as it wants at a market price of \$60 each, and Protecto's fixed cost is \$80.

Part A

Identify the market structure in which Protecto sells helmets.

Part B

Calculate Protecto's average variable cost when it produces 4 helmets. Show your work.

Part C

Calculate Protecto's economic profit when it sells 5 helmets. Show your work.

Part D

Identify Protecto's profit-maximizing quantity of helmets. Explain your answer using marginal analysis and numbers.

Part E

Protecto is earning positive economic profit in the short run. As the market for helmets adjusts to long-run equilibrium, will the market price of helmets increase, decrease, or remain the same? Explain.

2. The table provided shows the short-run production function for Lowen Feline, a profit-maximizing firm that produces cat food.

Number of Workers	Total Quantity of Cat Food (bags)
0	0
1	5
2	12
3	18
4	23
5	27
6	30
7	32
8	33
9	32

Lowen Feline sells as many bags of cat food as it wants at a market price of \$10 per bag and hires as many workers as it wants at a market wage of \$18.

(a) Lowen Feline's fixed cost is \$90. Calculate the average fixed cost if Lowen Feline hires 6 workers. Show your work.

(b) Assume labor is the only variable input to Lowen Feline. Calculate the marginal cost if Lowen Feline increases output from 27 to 30 units. Show your work.

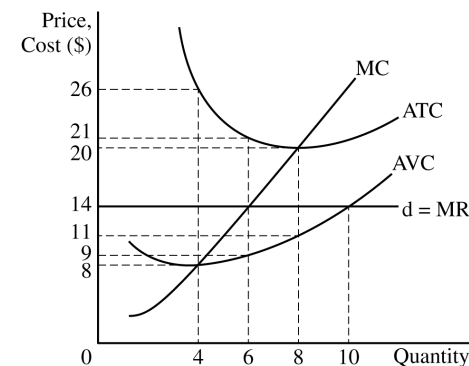
(c) With the hiring of which worker do diminishing marginal returns begin? Explain using numbers.

(d) Determine the profit-maximizing number of workers Lowen Feline will hire. Explain using marginal analysis.

(e) In the long run, a rival company, Gato Food, increases its production from 40 to 50 units, and its total cost increases from \$600 to \$900. Over the output range of 40 to 50 units, is Gato Food experiencing economies of scale, diseconomies of scale, or constant returns to scale? Explain using numbers.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

3. 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.



(a) Calculate Hansel Hangout's total fixed cost. Show your work.

(b) Identify the price and Hansel Hangout's profit-maximizing quantity of Good X.

(c) Calculate Hansel Hangout's economic profit at the quantity identified in part (b). Show your work.

(d) As the market for Good X adjusts to the long-run equilibrium, what will happen to the price of Good X? Explain.

(e) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

2. The table below shows the output a firm produces using different amounts of capital (K) and labor (L). The markets for capital and labor are perfectly competitive. The rental rate of capital is \$75 per unit, and the wage rate is \$200 per unit. In the short run, capital is fixed and labor is variable.

Labor	Output with K=1	Output with K=2
0	0	0
1	10	20
2	25	50
3	38	75

- (a) If the firm uses one unit of capital and one unit of labor, will it be operating with constant, increasing, or decreasing returns to scale? Explain using numbers from the table.
- (b) Assume now that the firm currently has two units of capital and is using three units of labor.
- (i) Calculate the marginal product for the third unit of labor. Show your work.
 - (ii) Did the firm experience diminishing marginal returns with the addition of the third unit of labor? Explain using numbers from the table.
 - (iii) Calculate the firm’s average total cost for its current level of production. Show your work.
 - (iv) If the firm’s output is sold in a competitive market, what is the lowest output price at which the third unit of labor would be hired?

3.3 Long-Run Production Costs

Name: _____ Class: _____ Date: _____ **Total: 8 marks**

KEY WORDS economies of scale 规模经济 • diseconomies of scale 规模不经济
 • minimum efficient scale 最小有效规模 • total cost 总成本 • long run 长期

Objective

Build the skills to answer exam questions on **long-run production costs**.

You must be able to:

- explain that all inputs are variable in the **long run**, so there are no fixed costs
- describe the **long-run average total cost (LRATC)** 长期平均总成本 curve
- identify **economies of scale** 规模经济, constant returns, and **diseconomies of scale** 规模不经济
- define the **minimum efficient scale** 最小有效规模

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ The long run

All inputs are variable, so there are **no fixed costs**. LRATC is the **envelope** of the short-run cost curves.

■ Returns to scale

- **Economies of scale** — LRATC **falls** as output rises.
- **Constant** returns — LRATC flat.
- **Diseconomies of scale** — LRATC **rises**.

■ Minimum efficient scale

The **lowest** output at which LRATC reaches its minimum.

2 Practice

2.1 State why there are no fixed costs in the long run. [1]

2.2 Define economies of scale. [1]

2.3 State what happens to LRATC when a firm has diseconomies of scale. [1]

3 Exam-style questions

3.1 Economies of scale occur when, as output rises, LRATC [1]

- A rises
 - B falls
 - C stays constant
 - D is zero
-

3.2 The minimum efficient scale is the lowest output at which [1]

- A ATC is maximized
 - B LRATC is minimized
 - C MC is zero
 - D profit is zero
-

3.3 A firm doubles all its inputs and finds that output **more than** doubles.

(a) Name what the firm is experiencing. [1]

(b) State what happens to LRATC. [1]

(c) State one source of economies of scale. [1]

Solutions

2.1 all inputs are variable, so none are fixed.

2.2 falling long-run average total cost as output rises.

2.3 it rises.

3.1 B.

3.2 B.

3.3 (a) economies of scale (increasing returns to scale). (b) it falls. (c) any one of: specialization of labour, bulk buying, spreading fixed costs.

1. Deskward is a typical profit-maximizing firm that produces and sells wooden desks in a constant-cost, perfectly competitive market that is in long-run equilibrium.
- A. Draw correctly labeled side-by-side graphs for the wooden desk market and for Deskward and show each of the following.
- The market equilibrium price and quantity, labeled P_M and Q_M , respectively
 - Deskward's profit-maximizing price and quantity, labeled P_F and Q_F , respectively
 - Deskward's average total cost curve consistent with long-run equilibrium, labeled ATC
- B. If the monthly rent, a fixed cost, on Deskward's factory building increases, what will happen to the firm's profit-maximizing quantity in the short run? Explain.
- C. Suppose the government is considering granting a per-unit subsidy to producers of wooden desks. On your market graph in part A, show the short-run effect of a per-unit subsidy on each of the following.
- The new market equilibrium price and quantity of wooden desks, labeled P^* and Q^* , respectively
 - The area representing the total cost of the subsidy to the government, shaded completely
- D. Instead of the per-unit subsidy, suppose the government imposes a binding price floor in the market for wooden desks. Will the price floor result in a shortage of wooden desks, a surplus of wooden desks, or neither? Explain.
- E. Deskward also produces chairs. Deskward increases its production from 500 chairs to 600 chairs, and its long-run total cost increases from \$80,000 to \$108,000.
- Calculate Deskward's long-run average total cost of producing 500 chairs. Show your work.
 - As Deskward increases production from 500 chairs to 600 chairs, is Deskward experiencing economies of scale, diseconomies of scale, or the efficient scale? Explain using numbers.

2. The table provided shows the short-run production function for Lowen Feline, a profit-maximizing firm that produces cat food.

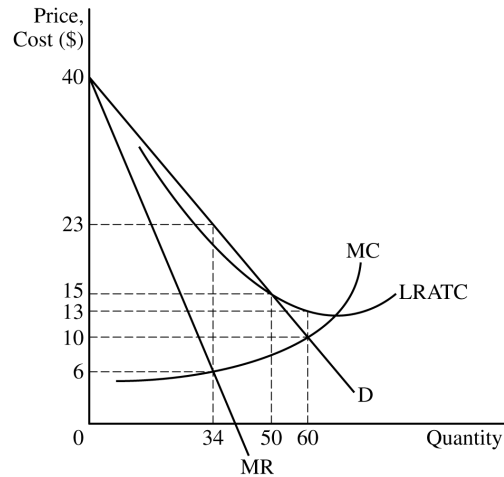
Number of Workers	Total Quantity of Cat Food (bags)
0	0
1	5
2	12
3	18
4	23
5	27
6	30
7	32
8	33
9	32

Lowen Feline sells as many bags of cat food as it wants at a market price of \$10 per bag and hires as many workers as it wants at a market wage of \$18.

- (a) Lowen Feline's fixed cost is \$90. Calculate the average fixed cost if Lowen Feline hires 6 workers. Show your work.
- (b) Assume labor is the only variable input to Lowen Feline. Calculate the marginal cost if Lowen Feline increases output from 27 to 30 units. Show your work.
- (c) With the hiring of which worker do diminishing marginal returns begin? Explain using numbers.
- (d) Determine the profit-maximizing number of workers Lowen Feline will hire. Explain using marginal analysis.
- (e) In the long run, a rival company, Gato Food, increases its production from 40 to 50 units, and its total cost increases from \$600 to \$900. Over the output range of 40 to 50 units, is Gato Food experiencing economies of scale, diseconomies of scale, or constant returns to scale? Explain using numbers.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

3. The graph provided shows the demand (D), long-run average total cost (LRATC), marginal cost (MC), and marginal revenue (MR) curves for a natural monopoly.



- (a) Over the output range of 0 to 60 units, is this firm experiencing economies of scale, diseconomies of scale, or constant returns to scale? Explain.
- (b) Using numbers from the graph, identify the price and quantity produced at which the monopolist earns zero economic profit.
- (c) Assume that regulators impose a price ceiling that results in the firm producing the socially optimal quantity in the short run.
- Calculate the total revenue at the price ceiling. Show your work.
 - Explain why the firm requires a subsidy to continue producing in the long run.
 - Calculate the lump-sum subsidy that would be required for the monopolist to produce the socially optimal quantity in the long run. Show your work.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

3. Camden's Cakery is one of many dessert cafés serving a local community. Each café produces a slightly differentiated product, there are no barriers to entry or exit, and the firm is in long-run equilibrium.
- Draw a correctly labeled graph showing Camden's demand curve, marginal revenue curve, marginal cost curve, and long-run average total cost curve. Label Camden's profit-maximizing output Q_m and its price P_m .
 - On your graph in part (a), label the output at which total revenue is maximized Q_R .
 - Do firms in this market experience economies of scale, diseconomies of scale, or neither in long-run equilibrium? Explain.

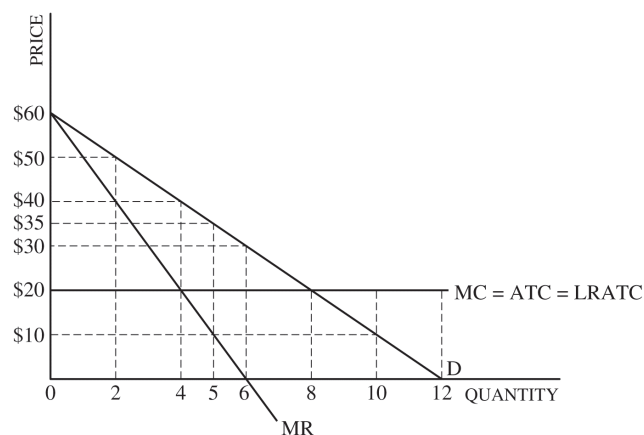
STOP

END OF EXAM

MICROECONOMICS**Section II****Planning time—10 minutes****Writing time—50 minutes**

Directions: You have 10 minutes to read all of the questions in this booklet, to sketch graphs, to make notes, and to plan your answers. You will then have 50 minutes to answer all three of the following questions. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. In answering the questions, you should emphasize the line of reasoning that generated your results; it is not enough to list the results of your analysis. 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. Use a pen with black or dark blue ink.

1. The graph below shows the demand curve (D), marginal revenue curve (MR), marginal cost curve (MC), average total cost curve (ATC), and long-run average total cost curve (LRATC) for a monopolist.



- (a) Using the numbers given in the graph, identify each of the following for the profit-maximizing monopolist.
- The quantity produced
 - The price
 - The allocatively efficient quantity
- (b) At the profit-maximizing quantity from part (a)(i), is the monopolist experiencing economies of scale? Explain.

AP MICROECONOMICS • EXERCISE SHEET**3.4 Types of Profit**Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS economic profit 经济利润 • implicit costs 隐性成本 • accounting profit 会计利润
• explicit costs 显性成本 • normal profit 正常利润

Objective

Build the skills to answer exam questions on **types of profit**.

You must be able to:

- distinguish **explicit costs** 显性成本 from **implicit costs** 隐性成本
- calculate **accounting profit** 会计利润 ($TR - \text{explicit costs}$)
- calculate **economic profit** 经济利润 ($TR - \text{explicit} - \text{implicit costs}$)
- define **normal profit** 正常利润 ($\text{economic profit} = 0$)

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ **Two kinds of profit**

- Accounting profit** = total revenue – **explicit** costs.
- Economic profit** = total revenue – explicit – **implicit** costs.

Implicit costs include the opportunity cost of the owner's own resources.

■ **Normal profit**

The level of profit where **economic profit** = 0 — the owner is doing exactly as well as in the next-best alternative. Economic profit is the correct signal for firms to **enter** or **exit** a market.

2 Practice

2.1 State the difference between accounting and economic profit. [2]

2.2 A firm has $TR = \$200k$, explicit costs = $\$120k$, and implicit costs = $\$50k$. Find its economic profit. [2]

2.3 Define normal profit. [1]

3 Exam-style questions

3.1 Economic profit equals total revenue minus [1]

- **A** explicit costs only
- **B** implicit costs only
- **C** both explicit and implicit costs
- **D** taxes only

3.2 Normal profit occurs when economic profit is [1]

- **A** positive
- **B** zero
- **C** negative
- **D** at its maximum

3.3 A firm earns $TR = \$150k$ with explicit costs $\$90k$ and implicit costs $\$60k$.

(a) Find the accounting profit. [1]

(b) Find the economic profit. [1]

(c) State whether the owner should stay in this business. [1]

Solutions

2.1 accounting profit subtracts only explicit costs; economic profit subtracts both explicit and implicit costs.

2.2 $200 - 120 - 50 = \$30k$.

2.3 the profit earned when economic profit is exactly zero.

3.1 C.

3.2 B.

3.3 (a) $150 - 90 = \$60k$. (b) $150 - 90 - 60 = \$0$. (c) yes — it earns normal profit, matching the next-best alternative.

1. Feram and Ocel are the only two steel manufacturers in the region. Feram is deciding whether to transport its steel with Truck or Rail. Ocel is deciding whether to produce its steel as Sheets or Beams. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Feram's profit, and the second entry shows Ocel's profit. Each firm independently and simultaneously chooses its strategy. Assume that Feram and Ocel know all the information in the matrix and do not cooperate.

		Ocel	
		Sheets	Beams
Feram	Truck	\$40 million, \$95 million	\$20 million, \$125 million
	Rail	\$50 million, \$75 million	\$30 million, \$25 million

Part A

What is Feram's most profitable strategy if Ocel chooses to produce Sheets?

Part B

Does Ocel have a dominant strategy? Explain using numbers from the payoff matrix.

Part C

Identify the Nash equilibrium (or equilibria) for this game, or state that none exists.

Part D

Suppose Feram incurs a \$20 million increase in the cost of Rail transport, with no change in the cost of Truck transport. Redraw the payoff matrix, including the firms, strategies, and payoffs, showing how the \$20 million increase in the cost of Rail transport affects the payoff matrix.

Part E

Suppose instead that Feram and Ocel now cooperate and merge into one new firm, Acier, which is now the only producer of steel in the region. Acier produces the profit-maximizing quantity of steel and is earning positive economic profit. Draw a correctly labeled graph for Acier, and show each of the following.

- Acier's profit-maximizing quantity, labeled Q_1
- Acier's profit-maximizing price, labeled P_1
- The average total cost curve, labeled ATC, consistent with Acier earning positive economic profit
- The area of deadweight loss, shaded completely

Part F

Government regulators impose a lump-sum tax on Acier. In the short run, will Acier's profit-maximizing price of steel increase, decrease, or remain the same as a result of the lump-sum tax? Explain.

2. The table shows Protecto's short-run cost schedule of producing helmets.

Quantity of Helmets	Total Cost (\$)	Marginal Cost (\$)
4	200	30
5	235	35
6	275	40
7	320	45
8	375	55
9	440	65
10	520	80

Protecto produces and sells as many helmets as it wants at a market price of \$60 each, and Protecto's fixed cost is \$80.

Part A

Identify the market structure in which Protecto sells helmets.

Part B

Calculate Protecto's average variable cost when it produces 4 helmets. Show your work.

Part C

Calculate Protecto's economic profit when it sells 5 helmets. Show your work.

Part D

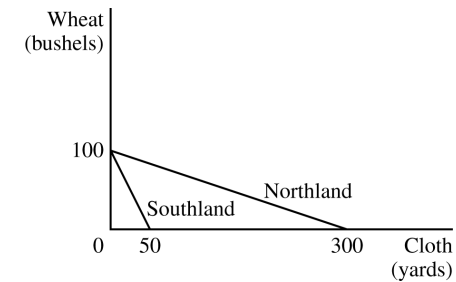
Identify Protecto's profit-maximizing quantity of helmets. Explain your answer using marginal analysis and numbers.

Part E

Protecto is earning positive economic profit in the short run. As the market for helmets adjusts to long-run equilibrium, will the market price of helmets increase, decrease, or remain the same? Explain.

1. Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.
 - A. Draw a correctly labeled graph for Voda Reservoir and show each of the following.
 - i. The profit-maximizing quantity, labeled Q_M
 - ii. The profit-maximizing price, labeled P_M
 - iii. The average total cost curve consistent with Voda Reservoir earning negative economic profit, labeled ATC
 - iv. The area of deadweight loss, shaded completely
 - B. Suppose the government requires Voda Reservoir to produce the socially optimal quantity of bottled water. On your graph in part A, show the socially optimal quantity of bottled water, labeled Q_S .
 - C. Suppose instead the government grants a per-unit subsidy to Voda Reservoir. What will happen to Voda Reservoir's profit-maximizing quantity of bottled water? Explain.
 - D. Suppose new producers have entered the bottled-water market and Voda Reservoir continues to operate in the bottled-water market. Will the demand for Voda Reservoir's bottled water become more elastic, become less elastic, or stay the same as new producers enter the market?
 - E. Voda Reservoir hires workers in a perfectly competitive labor market.
 - i. If the demand for bottled water increases, what will happen to Voda Reservoir's demand for labor? Explain.
 - ii. The government implements a new regulation that increases the minimum age required for a worker to be employed in a bottled-water factory. What will happen to the market wage in the short run? Explain.

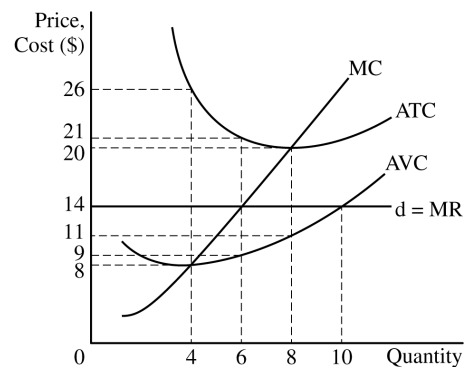
2. The graph shows the production possibilities curves for Northland and Southland.



- (a) Which country has a comparative advantage in producing wheat? Explain using numbers.
- (b) Identify a specific number of yards of cloth that could be traded for 10 bushels of wheat and would be mutually beneficial to Northland and Southland.
- (c) Southland's maximum possible output of wheat falls from 100 bushels to 75 bushels. Assuming no other changes, will Southland have a comparative advantage in producing cloth? Explain using numbers.
- (d) Turnips are produced in a perfectly competitive market in Alderia, a third country, which does not engage in international trade. Runoff from turnip fields pollutes Alderia's rivers, hurting its residents.
 - (i) Does the turnip market equilibrium result in an efficient allocation of resources? Explain using marginal analysis.
 - (ii) In an effort to reduce pollution, Alderia's government imposes a lump-sum tax on turnip production. What will be the impact on the turnip market equilibrium price and quantity in the short run?

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

3. 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.



- (a) Calculate Hansel Hangout's total fixed cost. Show your work.
- (b) Identify the price and Hansel Hangout's profit-maximizing quantity of Good X.
- (c) Calculate Hansel Hangout's economic profit at the quantity identified in part (b). Show your work.
- (d) As the market for Good X adjusts to the long-run equilibrium, what will happen to the price of Good X? Explain.
- (e) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

1. 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.
- (a) 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?
- (b) 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
- (c) 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
- (d) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. A firm has a patent on a new carbon-capture technology, making it the only producer of that device. The firm is currently earning a positive economic profit and is producing the profit-maximizing level of output.

(a) Draw a correctly labeled graph for the firm and show each of the following.

- (i) The quantity of carbon-capture devices produced by the firm, labeled Q_M
- (ii) The price charged by the firm, labeled P_M
- (iii) The area representing consumer surplus, shaded completely

(b) The government is considering different options to regulate the firm.

- (i) Suppose the government is considering taxing the firm. Could using a per-unit tax change the firm's output to the socially optimal quantity? Explain.
- (ii) Instead, suppose the government imposes a price ceiling so that the firm produces the socially optimal quantity. On your graph in part (a), label the quantity and price after the price ceiling is imposed as Q_C and P_C .
- (iii) At the price and the quantity identified in part (b)(ii), is the firm earning positive economic profit? Explain.

(c) Assume the government decides not to regulate the firm and instead the firm produces the quantity of output that maximizes total revenue.

- (i) If the firm now increases its output by one unit, would marginal revenue be positive, negative, or zero? Explain.
- (ii) Starting at the total-revenue-maximizing quantity, if the firm reduces the price by 10%, would the quantity demanded increase by less than 10%, by more than 10%, or by exactly 10%?

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.

(a) Assume Frank Sugar Co. is earning zero economic profit. Draw correctly labeled side-by-side graphs for the sugar market and Frank Sugar Co. 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 Frank Sugar Co., labeled P_F and Q_F , respectively

(b) Assume the demand for sugar increases and sugar is produced in a constant-cost industry.

- (i) On your graph in part (a), show the short-run effect of the increased demand for sugar on the market price, labeled P_2 , and the quantity sold by Frank Sugar Co., labeled Q_N .
- (ii) Compared to the equilibrium identified in part (a)(ii), what will happen to the short-run profit earned by Frank Sugar Co. as a result of the increased demand for sugar?
- (iii) When the market adjusts to long-run equilibrium, how will the market price of sugar in the long run compare to P_2 ? Explain.

(c) Instead, assume sugar consumption has a negative impact on public health over time and the negative impact of sugar on health is underestimated by consumers. Draw a correctly labeled graph of the market, with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.

- (i) The market equilibrium quantity, labeled Q_M
- (ii) The socially optimal quantity, labeled Q_S

(d) Assume the government decides to intervene in the market to affect consumers' incentives and to address the negative impact of sugar consumption on public health. Which of the following policies would best achieve that objective in the short run: a lump-sum tax, a per-unit tax, a lump-sum subsidy, or a per-unit subsidy? Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. The government of an island nation grants SkyRunner Airlines exclusive monopoly rights to serve the island. SkyRunner is earning positive economic profits.

(a) Draw a correctly labeled graph for SkyRunner, and show each of the following.

- (i) The profit-maximizing quantity of tickets, labeled Q_M
- (ii) The profit-maximizing price of a ticket, labeled P_M
- (iii) The area representing profits, shaded completely

Now the island's tourist bureau asks the government to consider the following two proposals.

- Proposal I: Set a price ceiling on tickets that eliminates all deadweight loss.
- Proposal II: Eliminate SkyRunner's monopoly rights, which will remove all barriers to entry.

(b) Suppose the government adopts proposal I. On your graph in part (a), indicate the quantity of tickets sold in the short run, labeled Q_C .

(c) Suppose instead the government adopts proposal II. How will each of the following be affected in the long run compared to the market conditions in part (a) ?

- (i) The quantity of tickets sold by SkyRunner. Explain.
- (ii) The price elasticity of demand for SkyRunner's airline service. Explain.
- (iii) SkyRunner's profits
- (iv) The deadweight loss in the market. Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

MICROECONOMICS

Section II

Total Time—1 hour

Reading Period—10 minutes

Writing Period—50 minutes

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. As the only gas station in a small town, FillUp has a local monopoly on the sale of gasoline. FillUp is currently earning positive economic profit.

(a) Draw a correctly labeled graph for FillUp and show each of the following.

- (i) FillUp's profit-maximizing quantity, labeled Q_F
- (ii) FillUp's profit-maximizing price, labeled P_F
- (iii) The deadweight loss associated with FillUp's profit-maximizing quantity, shaded completely
- (iv) The maximum quantity at which FillUp would earn zero economic profit, labeled Q_Z

(b) Assume that FillUp's fixed costs increase because of a new lease on its property and FillUp stays in business. Will each of the following increase, decrease, or remain unchanged at FillUp's profit-maximizing quantity?

- (i) The deadweight loss. Explain.
- (ii) FillUp's economic profit

(c) Assume the demand for gasoline decreases because people bike to work more often.

- (i) What must be true for FillUp to continue to operate in the short run?
- (ii) What happens to FillUp's profit-maximizing quantity and price in the short run assuming the firm continues to operate?

MICROECONOMICS**Section II****Total Time—1 hour****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. In the early twentieth century, limited transportation options and the lack of effective substitutes gave Single Cinema monopoly power in a small town. Assume that Single Cinema is a profit-maximizing firm and currently operates at a negative economic profit in the short run.
 - (a) Draw a correctly labeled graph for Single Cinema, and show each of the following.
 - (i) The profit-maximizing price and quantity of tickets, labeled as P_m and Q_m , respectively
 - (ii) The area representing the negative economic profit, shaded completely
 - (b) Explain why Single Cinema continues to operate in the short run despite earning negative economic profit in the short run.
 - (c) Would Single Cinema's total revenue increase, decrease, or stay the same if it decides to sell one fewer ticket than Q_m ? Explain.
 - (d) Single Cinema hires workers in a perfectly competitive labor market with a downward-sloping demand curve. Suppose the number of workers available in the market decreases.
 - (i) What will happen to the wage rate? Explain.
 - (ii) What will happen to the marginal revenue product of the last worker hired? Explain.

MICROECONOMICS**Section II****Total Time—60 minutes****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. Corn is used as food and as an input in the production of ethanol, an alternative fuel. Assume corn is produced in a perfectly competitive market.
 - (a) Draw correctly labeled side-by-side graphs for the corn market and a representative corn farmer. On your graphs show each of the following.
 - (i) The equilibrium price and quantity in the corn market, labeled P_M and Q_M , respectively
 - (ii) The profit-maximizing quantity of corn produced by the representative farmer earning zero economic profit, labeled Q_F
 - (b) Assume the demand for ethanol increases. On your graphs in part (a) show what will happen to each of the following in the short run.
 - (i) The market price and quantity of corn, labeled P^* and Q^*
 - (ii) The area of the profit or loss earned by the representative corn farmer, shaded completely
 - (c) Relative to your answer in part (b), state what will happen to the market equilibrium price and quantity of corn in the long run. Explain.
 - (d) Soybeans are produced in a perfectly competitive market. Assume farmers can grow either corn or soybeans on the same land. What happens to the price of soybeans in the next planting season if the price of corn increases? Explain.
 - (e) Assume instead that the government sets a binding price ceiling in the corn market. Draw a new correctly labeled graph for the corn market and show each of the following.
 - (i) The binding price ceiling, labeled P_c
 - (ii) The quantity purchased by consumers in the corn market, labeled Q_p

3.5 Profit Maximization

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS marginal revenue 边际收益 • economic profit 经济利润 • marginal cost 边际成本

Objective

Build the skills to answer exam questions on **profit maximization**.

You must be able to:

- calculate **total**, **average**, and **marginal revenue** 边际收益
- state the **profit-maximizing rule**: produce where **marginal revenue equals marginal cost**
- explain why $MR = MC$ maximizes profit or minimizes loss
- calculate economic profit at the profit-maximizing quantity using P and ATC

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ The profit-maximizing rule

Produce the quantity where $MR = MC$. Below it, an extra unit adds more revenue than cost (produce it); above it, the reverse.

■ Economic profit

$$\text{profit} = (P - ATC) \times Q.$$

A positive $(P - ATC)$ means economic profit; a negative one means a loss.

2 Practice

2.1 State the profit-maximizing rule. [1]

2.2 A firm sells at $P = \$12$ and produces $Q = 100$ where $ATC = \$9$. Find its economic profit. [2]2.3 State why producing where $MR = MC$ maximizes profit. [1]

3 Exam-style questions

3.1 A firm maximizes profit where [1]

- A $MR > MC$
- B $MR = MC$
- C $MR < MC$
- D the price is highest

3.2 Economic profit per unit is [1]

- A $P - MC$
- B $P - ATC$
- C $P - AVC$
- D $MR - AR$

3.3 A firm produces where $MR = MC$ at $Q = 50$, $P = \$20$, and $ATC = \$14$.

(a) Find the economic profit per unit. [1]

(b) Find the total economic profit. [2]

Solutions

2.1 produce the quantity where marginal revenue equals marginal cost.

2.2 $\text{profit} = (P - ATC)Q = (12 - 9)(100) = \300 .

2.3 below $MR = MC$ each extra unit adds more revenue than cost; above it the reverse, so profit peaks exactly where they are equal.

3.1 B.

3.2 B.

3.3 (a) $20 - 14 = \$6$. (b) $6 \times 50 = \$300$.

Name:

AP Microeconomics: 2026

2. The table shows Protecto's short-run cost schedule of producing helmets.

Quantity of Helmets	Total Cost (\$)	Marginal Cost (\$)
4	200	30
5	235	35
6	275	40
7	320	45
8	375	55
9	440	65
10	520	80

Protecto produces and sells as many helmets as it wants at a market price of \$60 each, and Protecto's fixed cost is \$80.

Part A

Identify the market structure in which Protecto sells helmets.

Part B

Calculate Protecto's average variable cost when it produces 4 helmets. Show your work.

Part C

Calculate Protecto's economic profit when it sells 5 helmets. Show your work.

Part D

Identify Protecto's profit-maximizing quantity of helmets. Explain your answer using marginal analysis and numbers.

Part E

Protecto is earning positive economic profit in the short run. As the market for helmets adjusts to long-run equilibrium, will the market price of helmets increase, decrease, or remain the same? Explain.

1. Voda Reservoir is a profit-maximizing firm and the only producer of bottled water in a country. Currently, Voda Reservoir is earning negative economic profit.
- A. Draw a correctly labeled graph for Voda Reservoir and show each of the following.
- The profit-maximizing quantity, labeled Q_M
 - The profit-maximizing price, labeled P_M
 - The average total cost curve consistent with Voda Reservoir earning negative economic profit, labeled ATC
 - The area of deadweight loss, shaded completely
- B. Suppose the government requires Voda Reservoir to produce the socially optimal quantity of bottled water. On your graph in part A, show the socially optimal quantity of bottled water, labeled Q_S .
- C. Suppose instead the government grants a per-unit subsidy to Voda Reservoir. What will happen to Voda Reservoir's profit-maximizing quantity of bottled water? Explain.
- D. Suppose new producers have entered the bottled-water market and Voda Reservoir continues to operate in the bottled-water market. Will the demand for Voda Reservoir's bottled water become more elastic, become less elastic, or stay the same as new producers enter the market?
- E. Voda Reservoir hires workers in a perfectly competitive labor market.
- If the demand for bottled water increases, what will happen to Voda Reservoir's demand for labor? Explain.
 - The government implements a new regulation that increases the minimum age required for a worker to be employed in a bottled-water factory. What will happen to the market wage in the short run? Explain.

1. Deskward is a typical profit-maximizing firm that produces and sells wooden desks in a constant-cost, perfectly competitive market that is in long-run equilibrium.
- A. Draw correctly labeled side-by-side graphs for the wooden desk market and for Deskward and show each of the following.
- The market equilibrium price and quantity, labeled P_M and Q_M , respectively
 - Deskward's profit-maximizing price and quantity, labeled P_F and Q_F , respectively
 - Deskward's average total cost curve consistent with long-run equilibrium, labeled ATC
- B. If the monthly rent, a fixed cost, on Deskward's factory building increases, what will happen to the firm's profit-maximizing quantity in the short run? Explain.
- C. Suppose the government is considering granting a per-unit subsidy to producers of wooden desks. On your market graph in part A, show the short-run effect of a per-unit subsidy on each of the following.
- The new market equilibrium price and quantity of wooden desks, labeled P^* and Q^* , respectively
 - The area representing the total cost of the subsidy to the government, shaded completely
- D. Instead of the per-unit subsidy, suppose the government imposes a binding price floor in the market for wooden desks. Will the price floor result in a shortage of wooden desks, a surplus of wooden desks, or neither? Explain.
- E. Deskward also produces chairs. Deskward increases its production from 500 chairs to 600 chairs, and its long-run total cost increases from \$80,000 to \$108,000.
- Calculate Deskward's long-run average total cost of producing 500 chairs. Show your work.
 - As Deskward increases production from 500 chairs to 600 chairs, is Deskward experiencing economies of scale, diseconomies of scale, or the efficient scale? Explain using numbers.

1. Soja Farm is a typical profit-maximizing firm that produces and sells soybeans in a constant-cost, perfectly competitive market that is in long-run equilibrium. The market equilibrium price of soybeans is \$14 per bushel.

(a) Draw correctly labeled side-by-side graphs for the soybean market and for Soja Farm, and show each of the following.

- (i) The market equilibrium price and quantity, labeled \$14 and Q_M , respectively
- (ii) Soja Farm's profit-maximizing price and quantity, labeled P_F and Q_F , respectively
- (iii) Soja Farm's average total cost curve consistent with a long-run equilibrium, labeled ATC

(b) If Soja Farm is the only firm in the market that chooses to increase its price of soybeans to \$15 per bushel, will Soja Farm's total revenue increase by \$1, remain the same, or decrease to \$0? Explain.

(c) Soybeans are used as an input in the production of tofu. Tofu now becomes a more popular food option among consumers. On your graphs in part (a), show the short-run effect of the increased popularity of tofu on each of the following.

- (i) The new market equilibrium price and quantity of soybeans, labeled P_2 and Q_2 , respectively
- (ii) Soja Farm's new profit-maximizing quantity, labeled Q^*

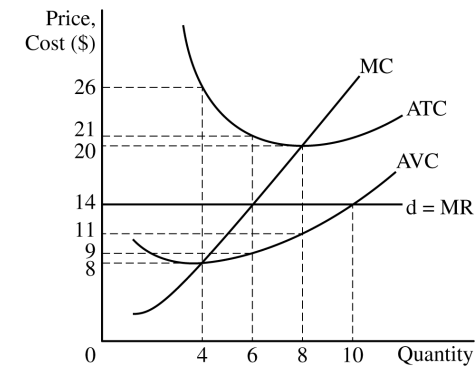
(d) Given the increase in popularity of tofu in part (c), what will happen to the number of firms in the soybean market in the long run? Explain.

(e) Suppose a 25% increase in the market price of quinoa causes a 5% decrease in the quantity demanded of quinoa and a 10% increase in the quantity demanded for tofu.

- (i) Is the demand for quinoa elastic, inelastic, or unit elastic? Explain using numbers.
- (ii) Calculate the cross-price elasticity of demand between quinoa and tofu. Show your work.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

3. 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.



(a) Calculate Hansel Hangout's total fixed cost. Show your work.

(b) Identify the price and Hansel Hangout's profit-maximizing quantity of Good X.

(c) Calculate Hansel Hangout's economic profit at the quantity identified in part (b). Show your work.

(d) As the market for Good X adjusts to the long-run equilibrium, what will happen to the price of Good X? Explain.

(e) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

1. 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.
- (a) 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?
- (b) Draw correctly labeled side-by-side graphs for the market and Anderson Company 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 Anderson Company, labeled P_F and Q_F , respectively
 - (iii) The area representing Anderson Company's positive economic profit, shaded completely
- (c) 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.
- (i) The market equilibrium price and quantity, labeled P_2 and Q_2 , respectively
 - (ii) Anderson Company's profit-maximizing price and quantity, labeled P^* and Q^* , respectively
- (d) Assume the production of Good G creates benefits for third parties.
- (i) Given this situation, will the market equilibrium quantity be greater than, less than, or equal to the allocatively efficient quantity? Explain.
 - (ii) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. A firm has a patent on a new carbon-capture technology, making it the only producer of that device. The firm is currently earning a positive economic profit and is producing the profit-maximizing level of output.
- (a) Draw a correctly labeled graph for the firm and show each of the following.
- (i) The quantity of carbon-capture devices produced by the firm, labeled Q_M
 - (ii) The price charged by the firm, labeled P_M
 - (iii) The area representing consumer surplus, shaded completely
- (b) The government is considering different options to regulate the firm.
- (i) Suppose the government is considering taxing the firm. Could using a per-unit tax change the firm's output to the socially optimal quantity? Explain.
 - (ii) Instead, suppose the government imposes a price ceiling so that the firm produces the socially optimal quantity. On your graph in part (a), label the quantity and price after the price ceiling is imposed as Q_C and P_C .
 - (iii) At the price and the quantity identified in part (b)(ii), is the firm earning positive economic profit? Explain.
- (c) Assume the government decides not to regulate the firm and instead the firm produces the quantity of output that maximizes total revenue.
- (i) If the firm now increases its output by one unit, would marginal revenue be positive, negative, or zero? Explain.
 - (ii) Starting at the total-revenue-maximizing quantity, if the firm reduces the price by 10%, would the quantity demanded increase by less than 10%, by more than 10%, or by exactly 10% ?

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.
- (a) Assume Frank Sugar Co. is earning zero economic profit. Draw correctly labeled side-by-side graphs for the sugar market and Frank Sugar Co. 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 Frank Sugar Co., labeled P_F and Q_F , respectively
- (b) Assume the demand for sugar increases and sugar is produced in a constant-cost industry.
- (i) On your graph in part (a), show the short-run effect of the increased demand for sugar on the market price, labeled P_2 , and the quantity sold by Frank Sugar Co., labeled Q_N .
 - (ii) Compared to the equilibrium identified in part (a)(ii), what will happen to the short-run profit earned by Frank Sugar Co. as a result of the increased demand for sugar?
 - (iii) When the market adjusts to long-run equilibrium, how will the market price of sugar in the long run compare to P_2 ? Explain.
- (c) Instead, assume sugar consumption has a negative impact on public health over time and the negative impact of sugar on health is underestimated by consumers. Draw a correctly labeled graph of the market, with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.
- (i) The market equilibrium quantity, labeled Q_M
 - (ii) The socially optimal quantity, labeled Q_S
- (d) Assume the government decides to intervene in the market to affect consumers' incentives and to address the negative impact of sugar consumption on public health. Which of the following policies would best achieve that objective in the short run: a lump-sum tax, a per-unit tax, a lump-sum subsidy, or a per-unit subsidy? Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

MICROECONOMICS**Section II****Total Time—1 hour****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. As the only gas station in a small town, FillUp has a local monopoly on the sale of gasoline. FillUp is currently earning positive economic profit.
- (a) Draw a correctly labeled graph for FillUp and show each of the following.
 - (i) FillUp's profit-maximizing quantity, labeled Q_F
 - (ii) FillUp's profit-maximizing price, labeled P_F
 - (iii) The deadweight loss associated with FillUp's profit-maximizing quantity, shaded completely
 - (iv) The maximum quantity at which FillUp would earn zero economic profit, labeled Q_Z
 - (b) Assume that FillUp's fixed costs increase because of a new lease on its property and FillUp stays in business. Will each of the following increase, decrease, or remain unchanged at FillUp's profit-maximizing quantity?
 - (i) The deadweight loss. Explain.
 - (ii) FillUp's economic profit
 - (c) Assume the demand for gasoline decreases because people bike to work more often.
 - (i) What must be true for FillUp to continue to operate in the short run?
 - (ii) What happens to FillUp's profit-maximizing quantity and price in the short run assuming the firm continues to operate?

MICROECONOMICS**Section II****Total Time—1 hour****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. In the early twentieth century, limited transportation options and the lack of effective substitutes gave Single Cinema monopoly power in a small town. Assume that Single Cinema is a profit-maximizing firm and currently operates at a negative economic profit in the short run.
 - (a) Draw a correctly labeled graph for Single Cinema, and show each of the following.
 - (i) The profit-maximizing price and quantity of tickets, labeled as P_m and Q_m , respectively
 - (ii) The area representing the negative economic profit, shaded completely
 - (b) Explain why Single Cinema continues to operate in the short run despite earning negative economic profit in the short run.
 - (c) Would Single Cinema's total revenue increase, decrease, or stay the same if it decides to sell one fewer ticket than Q_m ? Explain.
 - (d) Single Cinema hires workers in a perfectly competitive labor market with a downward-sloping demand curve. Suppose the number of workers available in the market decreases.
 - (i) What will happen to the wage rate? Explain.
 - (ii) What will happen to the marginal revenue product of the last worker hired? Explain.

MICROECONOMICS**Section II****Total Time—60 minutes****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. Corn is used as food and as an input in the production of ethanol, an alternative fuel. Assume corn is produced in a perfectly competitive market.
 - (a) Draw correctly labeled side-by-side graphs for the corn market and a representative corn farmer. On your graphs show each of the following.
 - (i) The equilibrium price and quantity in the corn market, labeled P_M and Q_M , respectively
 - (ii) The profit-maximizing quantity of corn produced by the representative farmer earning zero economic profit, labeled Q_F
 - (b) Assume the demand for ethanol increases. On your graphs in part (a) show what will happen to each of the following in the short run.
 - (i) The market price and quantity of corn, labeled P^* and Q^*
 - (ii) The area of the profit or loss earned by the representative corn farmer, shaded completely
 - (c) Relative to your answer in part (b), state what will happen to the market equilibrium price and quantity of corn in the long run. Explain.
 - (d) Soybeans are produced in a perfectly competitive market. Assume farmers can grow either corn or soybeans on the same land. What happens to the price of soybeans in the next planting season if the price of corn increases? Explain.
 - (e) Assume instead that the government sets a binding price ceiling in the corn market. Draw a new correctly labeled graph for the corn market and show each of the following.
 - (i) The binding price ceiling, labeled P_c
 - (ii) The quantity purchased by consumers in the corn market, labeled Q_p

3.6 Firms' Short-Run Decisions to Produce and Long-Run Decisions to Enter or Exit a Market

Name: _____ Class: _____ Date: _____ Total: 8 marks

KEY WORDS exit 退出 • entry 进入 • shut-down rule 停产法则 • economic profit 经济利润
• long run 长期

Objective

Build the skills to answer exam questions on **firms' short-run and long-run decisions**.

You must be able to:

- apply the **shut-down rule** 停产法则 in the short run
- explain why a firm operates at a loss when price exceeds **average variable cost**
- explain the long-run decision to **exit** when price is below **average total cost**
- explain how economic profits attract **entry** and losses cause **exit**

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ The shut-down rule (short run)

Keep producing if $P \geq AVC$; **shut down** if $P < AVC$. Above AVC , the firm at least covers its variable costs and part of its fixed costs.

■ The exit rule (long run)

Exit the market if $P < ATC$ (it makes a loss with no fixed costs to worry about).

■ Entry and exit

Economic **profits** attract **entry**; economic **losses** cause **exit**. A firm breaks even (normal profit) where $P = \text{minimum } ATC$.

2 Practice

2.1 State the short-run shut-down rule. [1]

2.2 State when a firm should exit a market in the long run. [1]

2.3 State what happens to a market when existing firms earn economic profits. [1]

3 Exam-style questions

3.1 A firm should shut down in the short run if price is below [1]

- **A** average total cost
- **B** average variable cost
- **C** marginal cost
- **D** average fixed cost

3.2 In the long run, economic profits attract [1]

- **A** exit
- **B** entry
- **C** shut-down
- **D** no response

3.3 A firm faces $P = \$8$, $AVC = \$6$, and $ATC = \$10$.

(a) State whether it should produce or shut down in the short run. [1]

(b) Explain why. [1]

(c) State its long-run decision. [1]

Solutions

2.1 produce if price is at least AVC ; shut down if price is below AVC .

2.2 when price is below average total cost.

2.3 new firms enter, raising supply until profits fall to normal.

3.1 B.

3.2 B.

3.3 (a) produce. (b) $P = \$8 > AVC = \6 , so it covers all variable cost plus some fixed cost, losing less than by shutting down. (c) exit — $P < ATC$, so it makes a loss in the long run.

Name:

AP Microeconomics: 2026

2. The table shows Protecto's short-run cost schedule of producing helmets.

Quantity of Helmets	Total Cost (\$)	Marginal Cost (\$)
4	200	30
5	235	35
6	275	40
7	320	45
8	375	55
9	440	65
10	520	80

Protecto produces and sells as many helmets as it wants at a market price of \$60 each, and Protecto's fixed cost is \$80.

Part A

Identify the market structure in which Protecto sells helmets.

Part B

Calculate Protecto's average variable cost when it produces 4 helmets. Show your work.

Part C

Calculate Protecto's economic profit when it sells 5 helmets. Show your work.

Part D

Identify Protecto's profit-maximizing quantity of helmets. Explain your answer using marginal analysis and numbers.

Part E

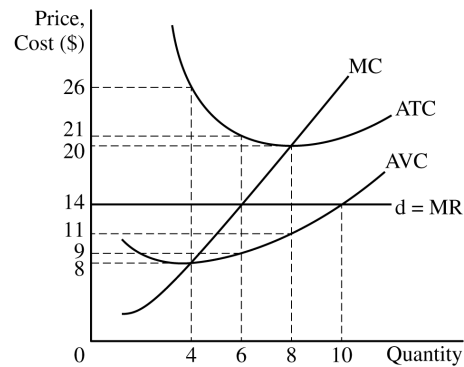
Protecto is earning positive economic profit in the short run. As the market for helmets adjusts to long-run equilibrium, will the market price of helmets increase, decrease, or remain the same? Explain.

1. Deskward is a typical profit-maximizing firm that produces and sells wooden desks in a constant-cost, perfectly competitive market that is in long-run equilibrium.
- A. Draw correctly labeled side-by-side graphs for the wooden desk market and for Deskward and show each of the following.
- The market equilibrium price and quantity, labeled P_M and Q_M , respectively
 - Deskward's profit-maximizing price and quantity, labeled P_F and Q_F , respectively
 - Deskward's average total cost curve consistent with long-run equilibrium, labeled ATC
- B. If the monthly rent, a fixed cost, on Deskward's factory building increases, what will happen to the firm's profit-maximizing quantity in the short run? Explain.
- C. Suppose the government is considering granting a per-unit subsidy to producers of wooden desks. On your market graph in part A, show the short-run effect of a per-unit subsidy on each of the following.
- The new market equilibrium price and quantity of wooden desks, labeled P^* and Q^* , respectively
 - The area representing the total cost of the subsidy to the government, shaded completely
- D. Instead of the per-unit subsidy, suppose the government imposes a binding price floor in the market for wooden desks. Will the price floor result in a shortage of wooden desks, a surplus of wooden desks, or neither? Explain.
- E. Deskward also produces chairs. Deskward increases its production from 500 chairs to 600 chairs, and its long-run total cost increases from \$80,000 to \$108,000.
- Calculate Deskward's long-run average total cost of producing 500 chairs. Show your work.
 - As Deskward increases production from 500 chairs to 600 chairs, is Deskward experiencing economies of scale, diseconomies of scale, or the efficient scale? Explain using numbers.

1. Soja Farm is a typical profit-maximizing firm that produces and sells soybeans in a constant-cost, perfectly competitive market that is in long-run equilibrium. The market equilibrium price of soybeans is \$14 per bushel.
- (a) Draw correctly labeled side-by-side graphs for the soybean market and for Soja Farm, and show each of the following.
- The market equilibrium price and quantity, labeled \$14 and Q_M , respectively
 - Soja Farm's profit-maximizing price and quantity, labeled P_F and Q_F , respectively
 - Soja Farm's average total cost curve consistent with a long-run equilibrium, labeled ATC
- (b) If Soja Farm is the only firm in the market that chooses to increase its price of soybeans to \$15 per bushel, will Soja Farm's total revenue increase by \$1, remain the same, or decrease to \$0? Explain.
- (c) Soybeans are used as an input in the production of tofu. Tofu now becomes a more popular food option among consumers. On your graphs in part (a), show the short-run effect of the increased popularity of tofu on each of the following.
- The new market equilibrium price and quantity of soybeans, labeled P_2 and Q_2 , respectively
 - Soja Farm's new profit-maximizing quantity, labeled Q^*
- (d) Given the increase in popularity of tofu in part (c), what will happen to the number of firms in the soybean market in the long run? Explain.
- (e) Suppose a 25% increase in the market price of quinoa causes a 5% decrease in the quantity demanded of quinoa and a 10% increase in the quantity demanded for tofu.
- Is the demand for quinoa elastic, inelastic, or unit elastic? Explain using numbers.
 - Calculate the cross-price elasticity of demand between quinoa and tofu. Show your work.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

3. 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.



- (a) Calculate Hansel Hangout's total fixed cost. Show your work.
- (b) Identify the price and Hansel Hangout's profit-maximizing quantity of Good X.
- (c) Calculate Hansel Hangout's economic profit at the quantity identified in part (b). Show your work.
- (d) As the market for Good X adjusts to the long-run equilibrium, what will happen to the price of Good X? Explain.
- (e) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

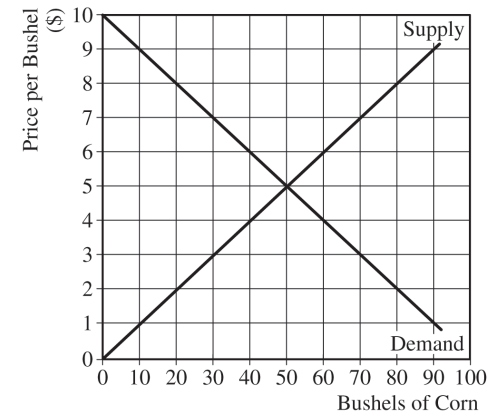
END OF EXAM

1. 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.
- (a) 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?
- (b) 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
- (c) 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
- (d) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.
- (a) Assume Frank Sugar Co. is earning zero economic profit. Draw correctly labeled side-by-side graphs for the sugar market and Frank Sugar Co. 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 Frank Sugar Co., labeled P_F and Q_F , respectively
- (b) Assume the demand for sugar increases and sugar is produced in a constant-cost industry.
- On your graph in part (a), show the short-run effect of the increased demand for sugar on the market price, labeled P_2 , and the quantity sold by Frank Sugar Co., labeled Q_N .
 - Compared to the equilibrium identified in part (a)(ii), what will happen to the short-run profit earned by Frank Sugar Co. as a result of the increased demand for sugar?
 - When the market adjusts to long-run equilibrium, how will the market price of sugar in the long run compare to P_2 ? Explain.
- (c) Instead, assume sugar consumption has a negative impact on public health over time and the negative impact of sugar on health is underestimated by consumers. Draw a correctly labeled graph of the market, with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.
- The market equilibrium quantity, labeled Q_M
 - The socially optimal quantity, labeled Q_S
- (d) Assume the government decides to intervene in the market to affect consumers' incentives and to address the negative impact of sugar consumption on public health. Which of the following policies would best achieve that objective in the short run: a lump-sum tax, a per-unit tax, a lump-sum subsidy, or a per-unit subsidy? Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.



3. The diagram above shows the market for corn in the country of Microland. Corn is produced and sold in a constant-cost, perfectly competitive market.
- (a) Calculate the total revenue earned by corn farmers at the market equilibrium price. Show your work.
- (b) In an attempt to assist corn farmers in Microland, the government sets a \$7 price floor on corn.
- How many bushels of corn will be exchanged at the price floor?
 - Calculate the deadweight loss associated with the price floor. Show your work.
 - Assume the government agrees to buy the unsold quantity at \$7. Calculate the producer surplus. Show your work.
 - Assume the price floor and the government buying program remain in effect. In addition, assume the demand for corn does not change. In the long run, will the quantity of corn purchased by the government increase, decrease, or remain the same? Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM

MICROECONOMICS**Section II****Total Time—1 hour****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. As the only gas station in a small town, FillUp has a local monopoly on the sale of gasoline. FillUp is currently earning positive economic profit.
 - (a) Draw a correctly labeled graph for FillUp and show each of the following.
 - (i) FillUp's profit-maximizing quantity, labeled Q_F
 - (ii) FillUp's profit-maximizing price, labeled P_F
 - (iii) The deadweight loss associated with FillUp's profit-maximizing quantity, shaded completely
 - (iv) The maximum quantity at which FillUp would earn zero economic profit, labeled Q_Z
 - (b) Assume that FillUp's fixed costs increase because of a new lease on its property and FillUp stays in business. Will each of the following increase, decrease, or remain unchanged at FillUp's profit-maximizing quantity?
 - (i) The deadweight loss. Explain.
 - (ii) FillUp's economic profit
 - (c) Assume the demand for gasoline decreases because people bike to work more often.
 - (i) What must be true for FillUp to continue to operate in the short run?
 - (ii) What happens to FillUp's profit-maximizing quantity and price in the short run assuming the firm continues to operate?

**MICROECONOMICS****Section II****Total Time—1 hour****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. In the early twentieth century, limited transportation options and the lack of effective substitutes gave Single Cinema monopoly power in a small town. Assume that Single Cinema is a profit-maximizing firm and currently operates at a negative economic profit in the short run.
 - (a) Draw a correctly labeled graph for Single Cinema, and show each of the following.
 - (i) The profit-maximizing price and quantity of tickets, labeled as P_m and Q_m , respectively
 - (ii) The area representing the negative economic profit, shaded completely
 - (b) Explain why Single Cinema continues to operate in the short run despite earning negative economic profit in the short run.
 - (c) Would Single Cinema's total revenue increase, decrease, or stay the same if it decides to sell one fewer ticket than Q_m ? Explain.
 - (d) Single Cinema hires workers in a perfectly competitive labor market with a downward-sloping demand curve. Suppose the number of workers available in the market decreases.
 - (i) What will happen to the wage rate? Explain.
 - (ii) What will happen to the marginal revenue product of the last worker hired? Explain.



MICROECONOMICS**Section II****Total Time—60 minutes****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. Corn is used as food and as an input in the production of ethanol, an alternative fuel. Assume corn is produced in a perfectly competitive market.
 - (a) Draw correctly labeled side-by-side graphs for the corn market and a representative corn farmer. On your graphs show each of the following.
 - (i) The equilibrium price and quantity in the corn market, labeled P_M and Q_M , respectively
 - (ii) The profit-maximizing quantity of corn produced by the representative farmer earning zero economic profit, labeled Q_F
 - (b) Assume the demand for ethanol increases. On your graphs in part (a) show what will happen to each of the following in the short run.
 - (i) The market price and quantity of corn, labeled P^* and Q^*
 - (ii) The area of the profit or loss earned by the representative corn farmer, shaded completely
 - (c) Relative to your answer in part (b), state what will happen to the market equilibrium price and quantity of corn in the long run. Explain.
 - (d) Soybeans are produced in a perfectly competitive market. Assume farmers can grow either corn or soybeans on the same land. What happens to the price of soybeans in the next planting season if the price of corn increases? Explain.
 - (e) Assume instead that the government sets a binding price ceiling in the corn market. Draw a new correctly labeled graph for the corn market and show each of the following.
 - (i) The binding price ceiling, labeled P_c
 - (ii) The quantity purchased by consumers in the corn market, labeled Q_p

MICROECONOMICS**Section II****Planning time—10 minutes****Writing time—50 minutes**

Directions: You have 10 minutes to read all of the questions in this booklet, to sketch graphs, to make notes, and to plan your answers. You will then have 50 minutes to answer all three of the following questions. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. A typical profit-maximizing firm in a perfectly competitive constant-cost industry is earning a positive economic profit.
 - (a) Is the market price greater than, less than, or equal to the firm's price? Explain.
 - (b) Draw correctly labeled side-by-side graphs for both the market and a typical firm and show each of the following.
 - (i) Market price and quantity, labeled P_m and Q_m
 - (ii) The firm's quantity, labeled Q_f
 - (iii) The firm's average revenue curve, labeled AR
 - (iv) The firm's average total cost curve, labeled ATC
 - (v) The area representing total cost, shaded completely
 - (c) If one firm in the market were to raise its price, what will happen to its total revenue? Explain.
 - (d) Now suppose the market is in long-run equilibrium. The government gives a lump-sum subsidy to each firm producing in the industry. Indicate whether each of the following will increase, decrease, or remain the same.
 - (i) The firm's quantity in the short run. Explain.
 - (ii) The market price and quantity in the long run. Explain.

3.7 Perfect Competition

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS perfectly competitive 完全竞争 • perfectly competitive market 完全竞争市场
 • price taker 价格接受者 • economic profit 经济利润 • entry 进入

Objective

Build the skills to answer exam questions on **perfect competition**.

You must be able to:

- list the characteristics of a **perfectly competitive market** 完全竞争市场
- explain why a competitive firm is a **price taker** 价格接受者 with $P = MR$
- explain how entry and exit drive long-run equilibrium to $P = MC = \min ATC$
- explain why perfect competition achieves **productive** and **allocative efficiency**

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Characteristics

Many firms, identical products, free entry and exit, and perfect information.

■ Price taker

Each firm is too small to affect the price, so it faces a **perfectly elastic (horizontal)** demand curve at the market price, with $P = MR$.

■ Long-run equilibrium

Entry and exit push the market to $P = MC = \text{minimum } ATC$, where firms earn **normal profit** — both **productively** (min ATC) and **allocatively** ($P = MC$) efficient.

2 Practice

2.1 List two characteristics of a perfectly competitive market. [2]

2.2 State why a competitive firm is a price taker. [1]

2.3 State the long-run profit level in perfect competition. [1]

3 Exam-style questions

3.1 A perfectly competitive firm's demand curve is [1]

- **A** downward-sloping
- **B** perfectly elastic (horizontal)
- **C** vertical
- **D** upward-sloping

3.2 In long-run equilibrium, a competitive firm produces where P equals [1]

- **A** $MC = \text{minimum } ATC$
- **B** a value above ATC
- **C** a value below AVC
- **D** a point where $MR > MC$

3.3 A competitive firm sells at the market price of \$10.

(a) State its marginal revenue. [1]

(b) State whether it can raise its price above \$10, and why. [1]

(c) State its long-run economic profit. [1]

Solutions

2.1 any two of: many firms, identical products, free entry and exit, perfect information.

2.2 it is too small to affect the market price, so it takes the price as given.

2.3 normal profit (zero economic profit).

3.1 B.

3.2 A.

3.3 (a) \$10 (equal to the price). (b) no — products are identical, so buyers would switch to rivals. (c) zero economic profit (normal profit).

Name:

AP Microeconomics: 2026

2. The table shows Protecto's short-run cost schedule of producing helmets.

Quantity of Helmets	Total Cost (\$)	Marginal Cost (\$)
4	200	30
5	235	35
6	275	40
7	320	45
8	375	55
9	440	65
10	520	80

Protecto produces and sells as many helmets as it wants at a market price of \$60 each, and Protecto's fixed cost is \$80.

Part A

Identify the market structure in which Protecto sells helmets.

Part B

Calculate Protecto's average variable cost when it produces 4 helmets. Show your work.

Part C

Calculate Protecto's economic profit when it sells 5 helmets. Show your work.

Part D

Identify Protecto's profit-maximizing quantity of helmets. Explain your answer using marginal analysis and numbers.

Part E

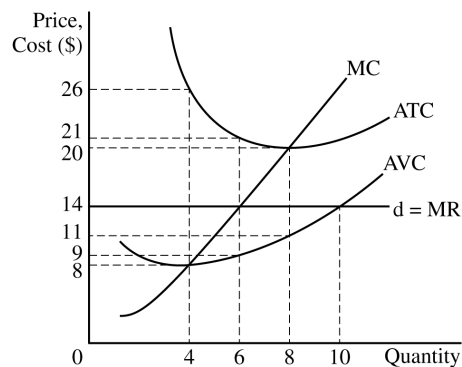
Protecto is earning positive economic profit in the short run. As the market for helmets adjusts to long-run equilibrium, will the market price of helmets increase, decrease, or remain the same? Explain.

1. Deskward is a typical profit-maximizing firm that produces and sells wooden desks in a constant-cost, perfectly competitive market that is in long-run equilibrium.
- A. Draw correctly labeled side-by-side graphs for the wooden desk market and for Deskward and show each of the following.
- The market equilibrium price and quantity, labeled P_M and Q_M , respectively
 - Deskward's profit-maximizing price and quantity, labeled P_F and Q_F , respectively
 - Deskward's average total cost curve consistent with long-run equilibrium, labeled ATC
- B. If the monthly rent, a fixed cost, on Deskward's factory building increases, what will happen to the firm's profit-maximizing quantity in the short run? Explain.
- C. Suppose the government is considering granting a per-unit subsidy to producers of wooden desks. On your market graph in part A, show the short-run effect of a per-unit subsidy on each of the following.
- The new market equilibrium price and quantity of wooden desks, labeled P^* and Q^* , respectively
 - The area representing the total cost of the subsidy to the government, shaded completely
- D. Instead of the per-unit subsidy, suppose the government imposes a binding price floor in the market for wooden desks. Will the price floor result in a shortage of wooden desks, a surplus of wooden desks, or neither? Explain.
- E. Deskward also produces chairs. Deskward increases its production from 500 chairs to 600 chairs, and its long-run total cost increases from \$80,000 to \$108,000.
- Calculate Deskward's long-run average total cost of producing 500 chairs. Show your work.
 - As Deskward increases production from 500 chairs to 600 chairs, is Deskward experiencing economies of scale, diseconomies of scale, or the efficient scale? Explain using numbers.

1. Soja Farm is a typical profit-maximizing firm that produces and sells soybeans in a constant-cost, perfectly competitive market that is in long-run equilibrium. The market equilibrium price of soybeans is \$14 per bushel.
- (a) Draw correctly labeled side-by-side graphs for the soybean market and for Soja Farm, and show each of the following.
- The market equilibrium price and quantity, labeled \$14 and Q_M , respectively
 - Soja Farm's profit-maximizing price and quantity, labeled P_F and Q_F , respectively
 - Soja Farm's average total cost curve consistent with a long-run equilibrium, labeled ATC
- (b) If Soja Farm is the only firm in the market that chooses to increase its price of soybeans to \$15 per bushel, will Soja Farm's total revenue increase by \$1, remain the same, or decrease to \$0? Explain.
- (c) Soybeans are used as an input in the production of tofu. Tofu now becomes a more popular food option among consumers. On your graphs in part (a), show the short-run effect of the increased popularity of tofu on each of the following.
- The new market equilibrium price and quantity of soybeans, labeled P_2 and Q_2 , respectively
 - Soja Farm's new profit-maximizing quantity, labeled Q^*
- (d) Given the increase in popularity of tofu in part (c), what will happen to the number of firms in the soybean market in the long run? Explain.
- (e) Suppose a 25% increase in the market price of quinoa causes a 5% decrease in the quantity demanded of quinoa and a 10% increase in the quantity demanded for tofu.
- Is the demand for quinoa elastic, inelastic, or unit elastic? Explain using numbers.
 - Calculate the cross-price elasticity of demand between quinoa and tofu. Show your work.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

3. 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.



- (a) Calculate Hansel Hangout's total fixed cost. Show your work.
- (b) Identify the price and Hansel Hangout's profit-maximizing quantity of Good X.
- (c) Calculate Hansel Hangout's economic profit at the quantity identified in part (b). Show your work.
- (d) As the market for Good X adjusts to the long-run equilibrium, what will happen to the price of Good X? Explain.
- (e) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

STOP

END OF EXAM



1. 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.
- (a) 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?
- (b) 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
- (c) 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
- (d) 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.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.



1. Sugar is produced in a perfectly competitive market using inputs from perfectly competitive factor markets. Frank Sugar Co. is a representative firm in the sugar market.
- (a) Assume Frank Sugar Co. is earning zero economic profit. Draw correctly labeled side-by-side graphs for the sugar market and Frank Sugar Co. 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 Frank Sugar Co., labeled P_F and Q_F , respectively
- (b) Assume the demand for sugar increases and sugar is produced in a constant-cost industry.
- (i) On your graph in part (a), show the short-run effect of the increased demand for sugar on the market price, labeled P_2 , and the quantity sold by Frank Sugar Co., labeled Q_N .
 - (ii) Compared to the equilibrium identified in part (a)(ii), what will happen to the short-run profit earned by Frank Sugar Co. as a result of the increased demand for sugar?
 - (iii) When the market adjusts to long-run equilibrium, how will the market price of sugar in the long run compare to P_2 ? Explain.
- (c) Instead, assume sugar consumption has a negative impact on public health over time and the negative impact of sugar on health is underestimated by consumers. Draw a correctly labeled graph of the market, with the marginal social benefit (MSB), marginal private benefit (MPB), marginal social cost (MSC), and marginal private cost (MPC) curves, and show each of the following.
- (i) The market equilibrium quantity, labeled Q_M
 - (ii) The socially optimal quantity, labeled Q_S
- (d) Assume the government decides to intervene in the market to affect consumers' incentives and to address the negative impact of sugar consumption on public health. Which of the following policies would best achieve that objective in the short run: a lump-sum tax, a per-unit tax, a lump-sum subsidy, or a per-unit subsidy? Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

1. The government of an island nation grants SkyRunner Airlines exclusive monopoly rights to serve the island. SkyRunner is earning positive economic profits.
- (a) Draw a correctly labeled graph for SkyRunner, and show each of the following.
- (i) The profit-maximizing quantity of tickets, labeled Q_M
 - (ii) The profit-maximizing price of a ticket, labeled P_M
 - (iii) The area representing profits, shaded completely
- Now the island's tourist bureau asks the government to consider the following two proposals.
- Proposal I: Set a price ceiling on tickets that eliminates all deadweight loss.
 - Proposal II: Eliminate SkyRunner's monopoly rights, which will remove all barriers to entry.
- (b) Suppose the government adopts proposal I. On your graph in part (a), indicate the quantity of tickets sold in the short run, labeled Q_C .
- (c) Suppose instead the government adopts proposal II. How will each of the following be affected in the long run compared to the market conditions in part (a)?
- (i) The quantity of tickets sold by SkyRunner. Explain.
 - (ii) The price elasticity of demand for SkyRunner's airline service. Explain.
 - (iii) SkyRunner's profits
 - (iv) The deadweight loss in the market. Explain.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

MICROECONOMICS**Section II****Total Time—60 minutes****Reading Period—10 minutes****Writing Period—50 minutes**

Directions: You are advised to spend the first 10 minutes reading all of the questions and planning your answers. You will then have 50 minutes to answer all three of the following questions. You may begin writing your responses before the reading period is over. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. Corn is used as food and as an input in the production of ethanol, an alternative fuel. Assume corn is produced in a perfectly competitive market.
 - (a) Draw correctly labeled side-by-side graphs for the corn market and a representative corn farmer. On your graphs show each of the following.
 - (i) The equilibrium price and quantity in the corn market, labeled P_M and Q_M , respectively
 - (ii) The profit-maximizing quantity of corn produced by the representative farmer earning zero economic profit, labeled Q_F
 - (b) Assume the demand for ethanol increases. On your graphs in part (a) show what will happen to each of the following in the short run.
 - (i) The market price and quantity of corn, labeled P^* and Q^*
 - (ii) The area of the profit or loss earned by the representative corn farmer, shaded completely
 - (c) Relative to your answer in part (b), state what will happen to the market equilibrium price and quantity of corn in the long run. Explain.
 - (d) Soybeans are produced in a perfectly competitive market. Assume farmers can grow either corn or soybeans on the same land. What happens to the price of soybeans in the next planting season if the price of corn increases? Explain.
 - (e) Assume instead that the government sets a binding price ceiling in the corn market. Draw a new correctly labeled graph for the corn market and show each of the following.
 - (i) The binding price ceiling, labeled P_c
 - (ii) The quantity purchased by consumers in the corn market, labeled Q_p

**MICROECONOMICS****Section II****Planning time—10 minutes****Writing time—50 minutes**

Directions: You have 10 minutes to read all of the questions in this booklet, to sketch graphs, to make notes, and to plan your answers. You will then have 50 minutes to answer all three of the following questions. It is suggested that you spend approximately half your time on the first question and divide the remaining time equally between the next two questions. 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. Use a pen with black or dark blue ink.

1. A typical profit-maximizing firm in a perfectly competitive constant-cost industry is earning a positive economic profit.
 - (a) Is the market price greater than, less than, or equal to the firm's price? Explain.
 - (b) Draw correctly labeled side-by-side graphs for both the market and a typical firm and show each of the following.
 - (i) Market price and quantity, labeled P_m and Q_m
 - (ii) The firm's quantity, labeled Q_f
 - (iii) The firm's average revenue curve, labeled AR
 - (iv) The firm's average total cost curve, labeled ATC
 - (v) The area representing total cost, shaded completely
 - (c) If one firm in the market were to raise its price, what will happen to its total revenue? Explain.
 - (d) Now suppose the market is in long-run equilibrium. The government gives a lump-sum subsidy to each firm producing in the industry. Indicate whether each of the following will increase, decrease, or remain the same.
 - (i) The firm's quantity in the short run. Explain.
 - (ii) The market price and quantity in the long run. Explain.

