

AP MICROECONOMICS**UNIT 4**

Imperfect Competition



15–22%
AP EXAM WEIGHTING



~8–10
CLASS PERIODS



Remember to go to [AP Classroom](#) to assign students the online **Personal Progress Check** for this unit.

Whether assigned as homework or completed in class, the **Personal Progress Check** provides each student with immediate feedback related to this unit's topics and skills.

Personal Progress Check 4

Multiple-choice: ~15 questions

Free-response: 2 questions

- Short
- Long

Imperfect Competition



Developing Understanding

BIG IDEA 3

Production Choices and Behavior **PRD**

- What drives producers' decision making?
- How are imperfectly competitive markets inefficient?

In the real world, firms rarely operate in perfectly competitive markets. In this unit, students will encounter the ways in which imperfectly competitive markets depart from the model of perfect competition introduced in Unit 3. Students will continue to build on their understanding of what it means for a market to be efficient or inefficient as they consider the welfare implications of imperfect markets. In the context of learning about oligopoly behavior, students will be introduced to the field of game theory as an approach to studying strategic decision making.

Building Course Skills

1.D 2.C 4.B 4.C

In this unit, students should be able to describe the similarities and differences between market structures. To help students develop this skill, consider first approaching the topic by using real-world examples and having students describe distinguishing characteristics of those examples. Using graphic organizers such as Venn diagrams might also be helpful to keep track of similarities and differences.

Graphing continues to be essential in this unit, and graphing each market structure can be difficult for some students. Be deliberate in modeling the differences between a license/patent monopoly and a natural monopoly, as well as a monopolistically competitive firm both in the short-run (with profits or losses) and at long-run equilibrium. While it is critical that students understand the differences between the graphs in

each of these models, it is also important to stress the similarities. For example, a common characteristic of all imperfect product market graphs is that the marginal revenue curve lies below the demand curve. Regardless of the market structure, students should practice neatly drawing each graph and labeling it appropriately until they can do so flawlessly.

Preparing for the AP Exam

Game theory is an important concept in the field of economics and is a challenge for some students on both the multiple-choice and free-response sections of the AP Exam. Students should have sufficient opportunities for guided practice interpreting payoff matrices, identifying dominant strategies and Nash equilibria, and redrawing payoff matrices after given changes. Answering past free-response questions on the topic (e.g., **2013 AP Exam Question #2**) is a good way to practice.

UNIT AT A GLANCE

Enduring Understanding	Topic	Suggested Skills	Class Periods
			~8–10 CLASS PERIODS
PRD-3	4.1 Introduction to Imperfectly Competitive Markets	1.D Describe the similarities, differences, and limitations of economic concepts, principles, or models.	1
	4.2 Monopoly	4.B Demonstrate your understanding of a specific economic situation on an accurately labeled graph or visual.	2
	4.3 Price Discrimination	4.C Demonstrate the effect of a change in an economic situation on an accurately labeled graph or visual.	1
	4.4 Monopolistic Competition	4.B Demonstrate your understanding of a specific economic situation on an accurately labeled graph or visual.	2
	4.5 Oligopoly and Game Theory	2.C Interpret a specific economic outcome using quantitative data or calculations.	2
 Go to AP Classroom to assign the Personal Progress Check for Unit 4. Review the results in class to identify and address any student misunderstandings.			

SAMPLE INSTRUCTIONAL ACTIVITIES

The sample activities on this page are optional and are offered to provide possible ways to incorporate various instructional approaches into the classroom. Teachers do not need to use these activities or instructional approaches and are free to alter or edit them. The examples below were developed in partnership with teachers from the AP community to share ways that they approach teaching some of the topics in this unit. Please refer to the Instructional Approaches section beginning on p. 105 for more examples of activities and strategies.

Activity	Topic	Sample Activity
1	4.1	Response Groups Divide students into four groups representing a monopoly, an oligopoly, monopolistic competition, and perfect competition. Each group should come up with real-world examples that represent its assigned market and use those examples to describe the distinguishing characteristics of its market type. After working in small groups, a presenter will share each group’s findings with the class.
2	4.2	Socratic Seminar Following instruction on the characteristics of a monopoly, provide students with several articles containing varied analysis of an antitrust case. Ask students to discuss and evaluate whether the situation meets the criteria of a monopoly, using economic vocabulary and referencing the articles.
3	4.5	Systematic and Explicit Instruction Demonstrate to students how to identify a dominant strategy and Nash equilibrium in a 2×2 payoff matrix. Then provide students with sample problems to work through on their own.



Unit Planning Notes

Use the space below to plan your approach to the unit. Consider how you want to pace your course and methods of instruction and assessment.

1. Copyright

The government protection of someone's intellectual property from being taken or sold by another. Serves as a barrier to entry of new firms, giving the owner of the copyright monopoly power.

2. Geographic Monopoly

A market condition in which a firm faces no competition in a certain geographic area.

3. Government Monopoly

A market condition in which government provides a good or service and prevents the private sector from competing in the market. Related to the idea of public goods.

4. Natural Monopoly

A market condition in which a firm is able to prevent competition because its economy of scale allows it to produce at a lower average total cost than any smaller competitor could.

5. Patent

A government-granted license to be the sole producer of a new good or service. Similar in function to a copyright because it is a source of monopoly power for the sole legal producer.

6. Perfect Price Discrimination

The ability of a monopolist to charge each individual consumer the highest price the consumer would willingly pay for a good or service. Because each buyer pays his or her reservation price, there is no consumer surplus if a firm perfectly price discriminates.

7. Price Discrimination

The ability of some producers to charge consumers different prices for the same good or service. When firms price discriminate they sell some units at high prices and other units at lower prices, usually on the basis of different customers' willingness to pay.

8. Technological Monopoly

A market condition in which the firm's possession of either a patent or copyright prevents other firms from legally competing in the market for a good or service.

1. Excess Capacity

The difference in the long run between the quantity that a perfectly competitive market produces and the quantity produced by monopolistically competitive firms. Underutilization of the factories or productive capabilities of each firm; amount by which a firm would increase production in order to be productively efficient.

2. Monopolistic Competition

A relatively competitive market structure in which many firms compete, each having a limited ability to set prices and earn economic profits because of product differentiation.

3. Product Differentiation

The efforts by firms to make their products appear different from those of their competitors. Also known as non-price competition, this involves firms making all sorts of claims about the relative quality of their product or service. Location, reliability, friendly employees, community tradition, social responsibility, popularity with the masses, and an air of exclusivity related to the product are all types of claims firms make to differentiate their products.

1. Cartel

A group of producers in an industry who collude in order to form a functional monopoly. Cartels are illegal in many countries and tend to be rare and unstable due to the incentives their member firms often have to cheat on agreed prices and/or quantities.

2. Collusion

Agreement by producers in an industry to cooperate and set prices instead of competing with one another. Considered an unethical or illegal practice, collusion makes oligopolies function more like monopolies.

3. Dominant Strategy

In game theory, a strategy in which a player always chooses independent of the other player's choice. For a choice to be a dominant strategy, it must be the best response a player could choose from all of the choices available to the other player.

4. Game Theory

The study of strategic decision-making used in economics and many other disciplines in which analysis of interdependent choices is performed. To an economist, a game is a situation in which a discrete number of players can be identified, each has specific strategies or choices, and the payoffs to each player can be quantified (or approximated) for strategic analysis.

5. Interdependence

The condition in which the decisions of producers are based on the possible decisions of other producers. Oligopolies feature interdependence because firms must take into consideration the actions of other firms when determining their optimal price and quantity.

6. Nash Equilibrium

In game theory, it is the condition where a player has no incentive to change their strategy after considering the other player's choices. It is possible to have no, one, or multiple Nash equilibria in a payoff matrix.

7. Oligopoly

A market structure in which a few firms dominate and behave interdependently. Entry of new firms is often quite difficult, usually because of the size of existing firms.

8. Payoff Matrix

SUGGESTED SKILL

 *Principles and Models*

1.D

Describe the similarities, differences, and limitations of economic concepts, principles, or models.

TOPIC 4.1

Introduction to Imperfectly Competitive Markets

Required Course Content

ENDURING UNDERSTANDING

PRD-3

Even with a common goal of profit-maximization, market structure constrains and influences prices, output, and efficiency.

LEARNING OBJECTIVE

PRD-3.B

- a. Define (using graphs where appropriate) the characteristics of imperfectly competitive markets and inefficiency.

ESSENTIAL KNOWLEDGE

PRD-3.B.1

Imperfectly competitive markets include monopoly, oligopoly, and monopolistic competition in product markets and monopsony in factor markets.

PRD-3.B.2

In imperfectly competitive output markets and assuming all else is constant, a firm must lower price to sell additional units.

PRD-3.B.3

In imperfectly competitive markets, consumers and producers respond to prices that are above the marginal costs of production and/or marginal benefits of consumption (i.e., price is greater than marginal cost in an inefficient market).

PRD-3.B.4

Incentives to enter an industry may be mitigated by barriers to entry. Barriers to entry—such as high fixed/start-up costs, legal barriers to entry, and exclusive ownership of key resources—can sustain imperfectly competitive market structures.

- A. A market is imperfect when one of the conditions for perfect competition is not met. For example, if instead of many sellers, a market has just a few or one, then the market behaves differently and is considered imperfect.
- B. In the product market, imperfect competition includes: monopoly, oligopoly, and monopolistic competition. In the factor market imperfect competition includes monopsony.
- C. Imperfectly competitive product markets can be described by how many sellers exist in the market and by how much control individual firms have over the price of goods in the market.
- D. Unlike perfect competition, imperfectly competitive firms have a degree of power to change the price.
 - 1. This pricing power is offset by the fact that in order to sell more of their good, they must still lower the price.
 - 2. The ability to control prices leads to a condition in the market where the price does not necessarily reflect the marginal cost of production
- E. Another difference between perfectly competitive and imperfectly competitive markets is the presence of barriers to entry.
 - 1. High startup costs, government regulations, and control over certain factors of production, are examples of barriers which limit the ability of new firms to enter into imperfectly competitive markets.

1. Define the following:
 - monopoly
 - monopolistic competition
 - monopsony
 - oligopoly
2. In order for firms to sell more of their output in imperfectly competitive markets, they must do what with the price of the good or service they are selling?
3. Imperfectly competitive markets are not allocatively efficient because...
4. Explain how barriers to entry prevent or reduce competition in some industries.
5. Imperfectly competitive markets are not productively efficient because they do not produce output at
 - a. Minimum marginal cost
 - b. Minimum fixed cost
 - c. Minimum average variable cost
 - d. Minimum average total cost
 - e. Maximum total revenue

1. Define the following:

monopoly

An industry with only one producer

monopolistic competition

An industry with many producers who differentiate their output from that of their competitors giving them limited pricing power

monopsony

An industry with only one consumer

oligopoly

2. In order for firms to sell more of their output in imperfectly competitive markets, they must do what with the price of the good or service they are selling?

Lower their price

3. Imperfectly competitive markets are not allocatively efficient because...

Price > marginal cost

4. Explain how barriers to entry prevent or reduce competition in some industries.

Barriers to entry prevent competition because existing firms may have economies of scale, government

5. Imperfectly competitive markets are not productively efficient because they do not produce output at

~~a. Minimum marginal cost~~

~~b. Minimum fixed cost~~

~~c. Minimum average variable cost~~

~~d. Minimum average total cost~~

~~e. Maximum total revenue~~

11. Which of the following is more likely to occur when there are high barriers to entry in an industry?
- (A) The firm(s) in the industry earn economic profits in the long run.
 - (B) The industry will be characterized by diseconomies of scale.
 - (C) The firm(s) in the industry are price takers.
 - (D) The firm(s) in the industry will charge a price equal to average total cost.
 - (E) The firm(s) will charge a price on the inelastic portion of the demand curve.

TOPIC 4.2

Monopoly

SUGGESTED SKILL

 *Graphing and Visuals*

4.B

Demonstrate your understanding of a specific economic situation on an accurately labeled graph or visual.

Required Course Content

ENDURING UNDERSTANDING

PRD-3

Even with a common goal of profit-maximization, market structure constrains and influences prices, output, and efficiency.

LEARNING OBJECTIVE

PRD-3.B

- b. Explain (using graphs where appropriate) equilibrium, firm decision making, consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets and why prices in imperfectly competitive markets cannot be relied on to coordinate the actions of all possible market participants and can lead to inefficient outputs.
- c. Calculate (using data from a graph or table as appropriate) areas of consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets.

ESSENTIAL KNOWLEDGE

PRD-3.B.5

A monopoly exists because of barriers to entry.

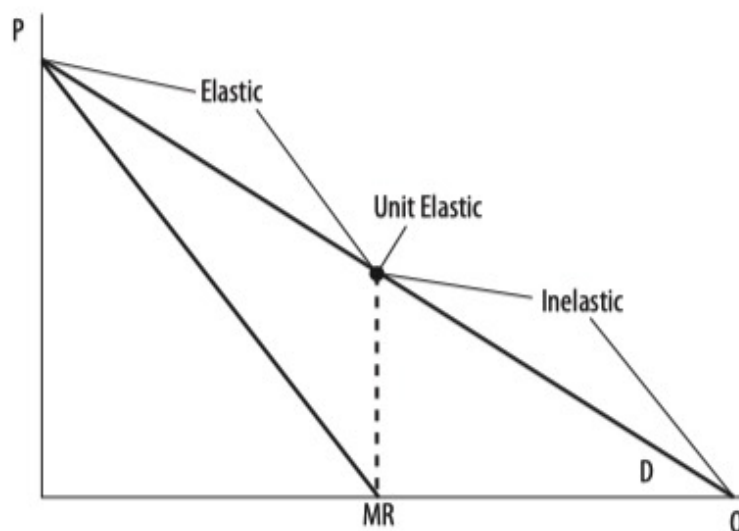
PRD-3.B.6

In a monopoly, equilibrium (profit-maximizing) quantity is determined by equating marginal revenue (MR) to marginal cost (MC). The price charged is greater than the marginal cost.

PRD-3.B.7

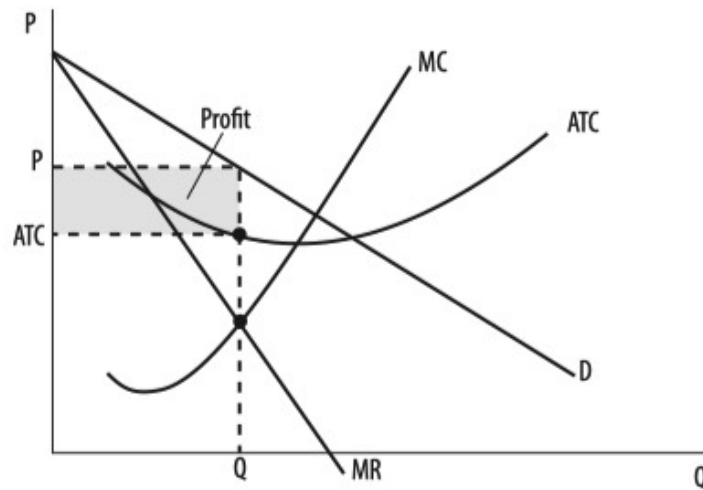
In a natural monopoly, long-run economies of scale for a single firm exist throughout the entire effective demand of its product.

- A. A monopoly is when there is only one firm supplying the market with a unique good or service.
- B. Monopoly markets have barriers to entry which keep new firms from entering the monopolized market and competing.
- C. Because they don't face competition from other firms, monopolists have a lot of power over price and quantity in their particular market limited only by consumers' demand. This makes monopolies very different from firms in perfect competition that have no control over the price at which their goods can be sold.
- D. Monopolies lie at the extreme opposite end of the market structure spectrum from perfect competition.
- E. A geographic monopoly exists when a business has no competition in a certain geographic area.
- F. A government monopoly exists when only the government provides a certain good or service.
- G. A natural monopoly exists when the industry features such extreme economies of scale that one firm can serve the market more cheaply than any combination of smaller firms.
- H. A technological monopoly exists when the government grants a patent or copyright to an individual or firm.
 - 1. A patent protects an individual's/firm's invention or process from being legally copied by another person or firm for a fixed period of time. Patents encourage innovation and invention by giving the inventor an opportunity to earn monopoly profits while the patent is in effect.
 - 2. A copyright gives an author or artist the monopoly over their intellectual property for at least their lifetime.
- I. Because the monopolist is the only firm in its particular market, it faces the entire down-sloping market demand curve where it only produces in the elastic (upper-half) region of the demand curve to maximize profits.
- J. The graph shows the demand and marginal revenue curves a monopolist faces. Why is marginal revenue below the demand curve? As the monopolist tries to sell more output, it must lower its price on each additional unit and also on each previous unit. For example, if a monopolist wants to go from selling 300 units to selling 301 units, then it must lower its price on all of its output. This means that the additional revenue generated decreases at an ever-faster rate as the monopolist lowers its price to meet consumer demand.



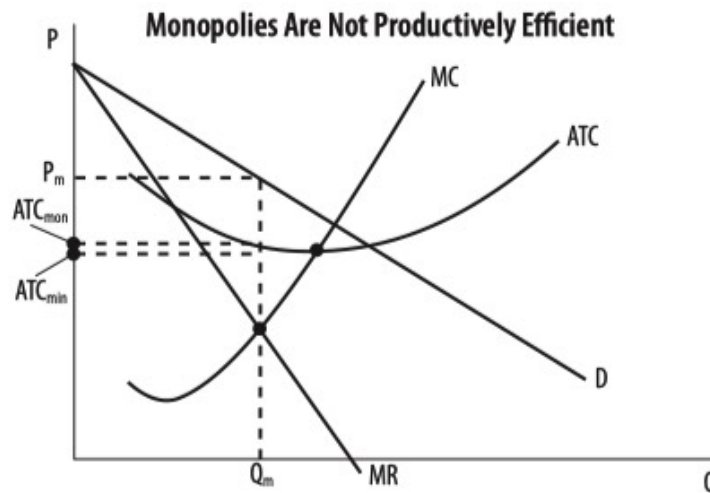
K. The Profit Maximization Rule

1. Like perfectly competitive firms, monopolists maximize profits by producing up to the point where the marginal revenue of production equals the marginal cost of production.
2. Note that after they determine the quantity (Q , below where $MC = MR$) they seek or search to find the price at which that quantity is demanded.



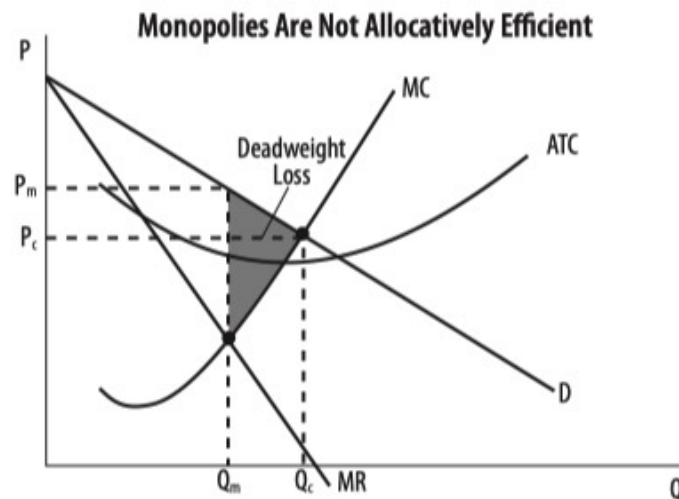
L. Productive Inefficiency.

A monopoly is not productively efficient because it does not produce at the lowest average total cost.

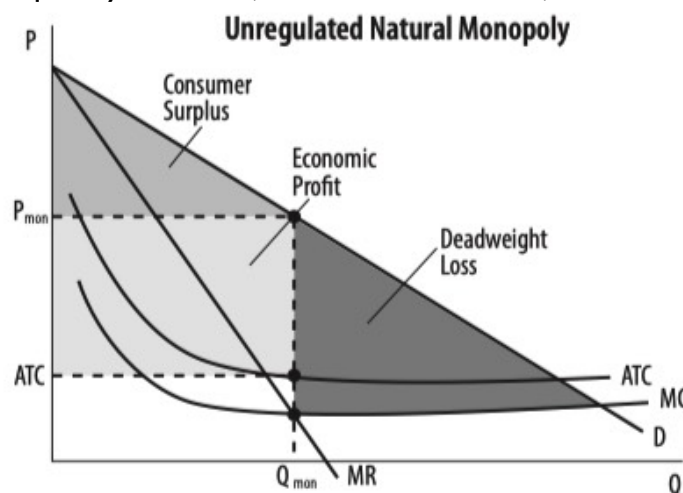


M. Allocative Inefficiency

1. A monopoly is not allocatively efficient because the monopoly price is greater than the marginal cost of production. The gap between Q_m , the monopolist's output, and Q_c , the allocatively efficient output that would be achieved if the industry had many producers, shows the under-allocation that resulted from this market having only one seller.
2. The graph below illustrates the deadweight loss created by the monopoly not being allocatively efficient. P_m refers to the monopoly price while P_c refers to the competitive price. Notice that P_c equals marginal cost (MC), while P_m is greater than MC at Q_m . Deadweight loss resulting from underproduction will always be found below the demand curve, above marginal cost, and to the right of quantity produced.



- A. Natural monopolies (typically utilities) have economies of scale so their large size effectively prevents competition from smaller (and thus higher ATC) firms, serving as a barrier to entry into the market.
- B. ATC is always decreasing as quantity increases (because MC is below it).



- C. The natural monopoly creates a large area of deadweight loss. However, unlike other monopolies which can be broken into parts, natural monopolies would not be good choices for this strategy since any combination of smaller

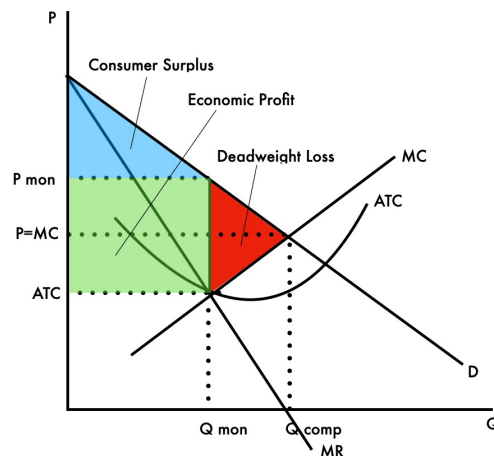
1. Why do monopolies exist?
2. Monopolists maximize profits by producing output at the point where...
3. Draw a graph for a single-price monopolist with increasing marginal cost and earning economic profit
4. Using the graph from 3, identify the profit maximizing price and quantity, allocatively efficient price and quantity, area of consumer surplus, area of economic profit, and deadweight loss.
5. Draw a graph of a single-price natural monopoly earning economic profit. Identify the profit maximizing price and quantity, allocatively efficient price and quantity, area of consumer surplus, area of economic profit, and deadweight loss.

1. Why do monopolies exist? *Barriers to entry created by economies of scale, geography,*

2. Monopolists maximize profits by producing output at the point where...

$$MR = MC$$

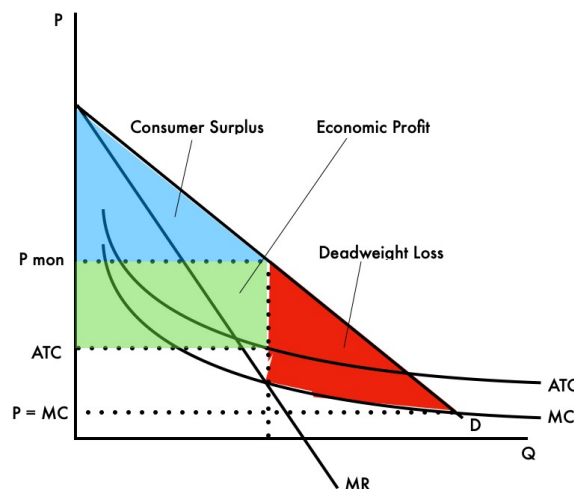
3. Draw a graph for a single-price monopolist with increasing marginal cost and earning economic profit

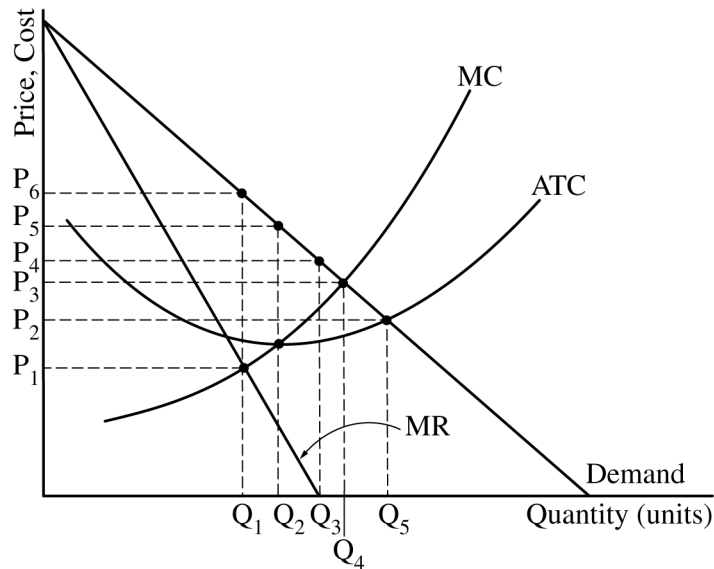


4. Using the graph from 3, identify the profit maximizing price and quantity, allocatively efficient price and quantity, area of consumer surplus, area of economic profit, and deadweight loss.

see graph above... P_{mon} & Q_{mon} are profit maximizing

5. Draw a graph of a single-price natural monopoly earning economic profit. Identify the profit maximizing price and quantity, allocatively efficient price and quantity, area of consumer surplus, area of economic profit, and deadweight loss.





12. What are the profit- and revenue-maximizing quantities for the monopolist whose revenue and cost conditions are described by the graph above?

(A)	Profit-Maximizing	Revenue-Maximizing
	Q_5	Q_2
(B)	Profit-Maximizing	Revenue-Maximizing
	Q_4	Q_3
(C)	Profit-Maximizing	Revenue-Maximizing
	Q_3	Q_3
(D)	Profit-Maximizing	Revenue-Maximizing
	Q_1	Q_4
(E)	Profit-Maximizing	Revenue-Maximizing
	Q_1	Q_3

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) ?

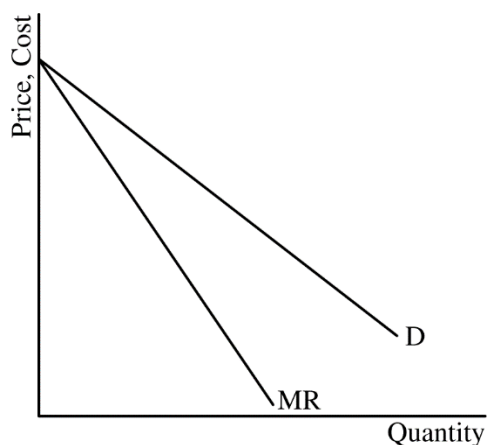
- (i) The quantity of tickets sold by SkyRunner. Explain.
- (ii) The price elasticity of demand for SkyRunner's airline service. Explain.
- (iii) SkyRunner's profits
- (iv) The deadweight loss in the market. Explain.

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.

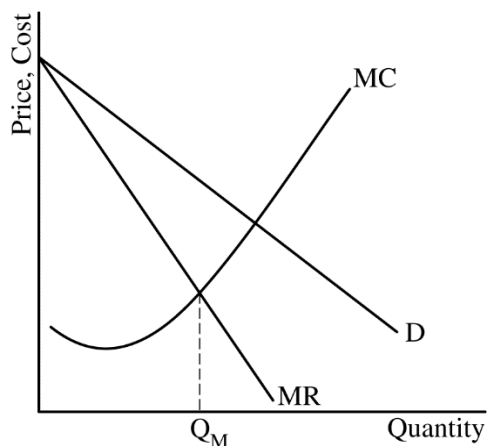
Question 1: Long

10 points

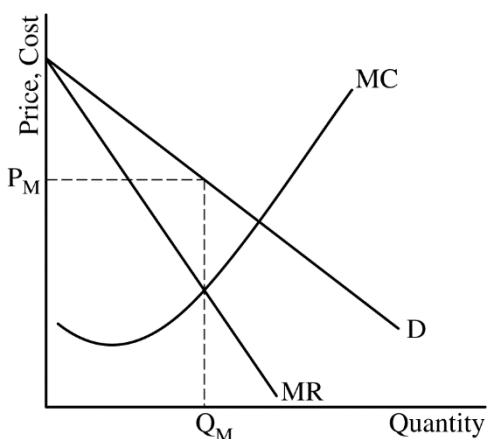
- (a) Draw a correctly labeled graph for SkyRunner Airlines showing downward sloping demand (D) and marginal revenue (MR) curves with the MR curve below the demand curve. **1 point**



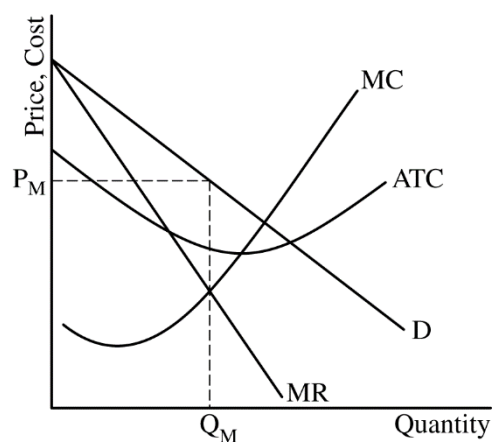
- For the second point, the graph must show the marginal cost (MC) curve and the profit-maximizing quantity, labeled Q_M , where $MR=MC$. **1 point**



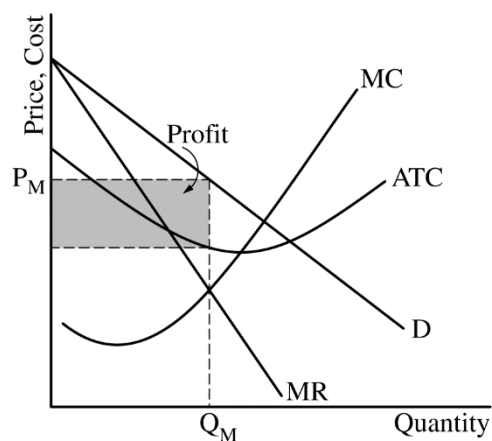
- For the third point, the graph must show the profit-maximizing price, labeled P_M , from the demand curve at Q_M . **1 point**



For the fourth point, the graph must show the ATC curve below the demand curve at Q_M with the MC curve rising and intersecting the ATC at its minimum point.

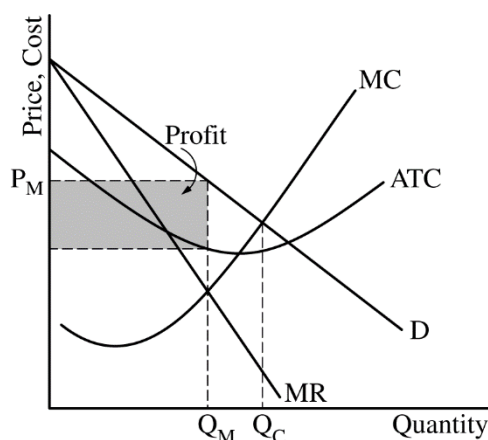
1 point

For the fifth point, the graph must show a completely shaded area of profit representing $(P_M - \text{ATC at } Q_M) \times Q_M$.

1 point**Total for part (a) 5 points**

- (b) On your graph from part (a), show the quantity that is consistent with the goal of eliminating all deadweight loss as Q_C .

1 point



- (c) (i) State that the number of tickets SkyRunner sells will decrease and explain that the entry of new firms will reduce the demand for SkyRunner's service.

1 point

- (ii) State that the price elasticity of demand for SkyRunner Airlines' service will increase and explain that the entry of new firms will increase the number of substitutes available to consumers.

1 point

- (iii) State that SkyRunner Airlines' profit will be zero or decrease toward zero.

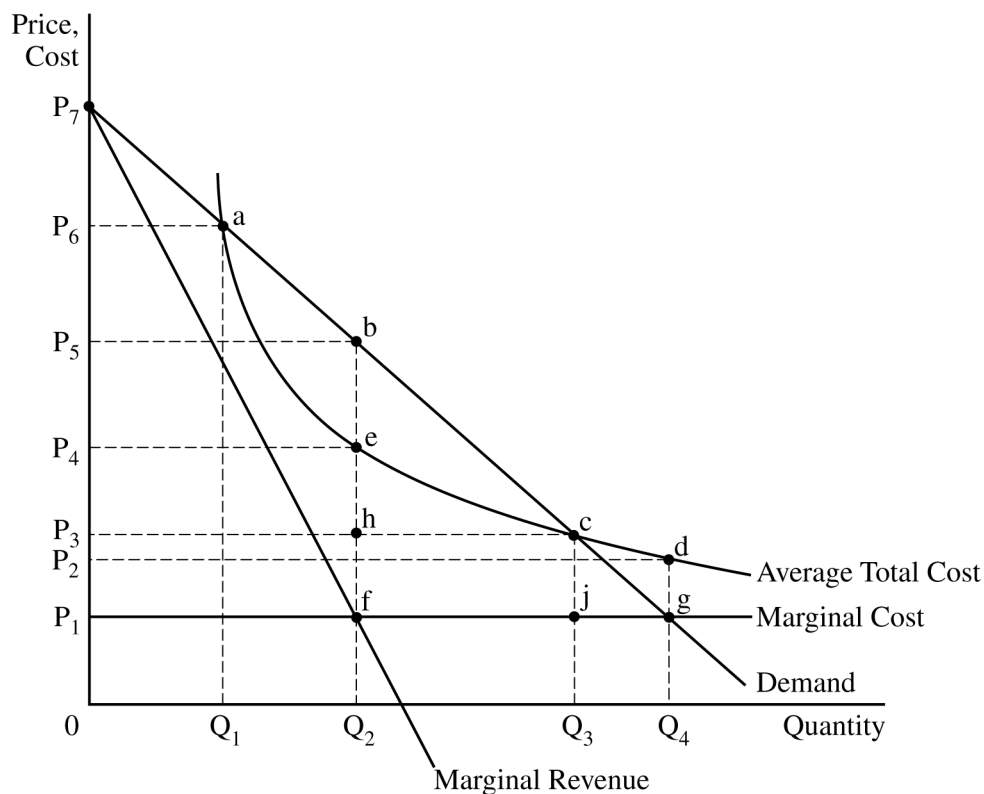
1 point

- (iv) State that the deadweight loss will decrease and explain that the entry of new firms increases the total market output (services provided) and moves the output closer to the socially optimal output.

1 point

Total for part (c) 4 points

Total for question 1 10 points



3. The graph shows the cost and revenue curves for an unregulated, profit-maximizing monopoly.
- (a) Is the firm shown in this graph a natural monopoly? Explain.
- (b) Using the labeling from the graph, identify the area representing the deadweight loss for this profit-maximizing monopoly.

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.

Question 3: Short**5 points**

-
- (a) State yes and explain that this firm is a natural monopoly because it experiences decreasing average total costs over the entire effective demand for its product. **1 point**
-
- (b) State the area of deadweight loss is equal to **ONE** of the following areas: **1 point**
- bfg
 - $\frac{1}{2} \times (P_5 - P_1) \times (Q_4 - Q_2)$
-

SUGGESTED SKILL

 *Graphing and Visuals*

4.C

Demonstrate the effect of a change in an economic situation on an accurately labeled graph or visual.

TOPIC 4.3

Price Discrimination

Required Course Content

ENDURING UNDERSTANDING

PRD-3

Even with a common goal of profit-maximization, market structure constrains and influences prices, output, and efficiency.

LEARNING OBJECTIVE

PRD-3.B

- b. Explain (using graphs where appropriate) equilibrium, firm decision making, consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets and why prices in imperfectly competitive markets cannot be relied on to coordinate the actions of all possible market participants and can lead to inefficient outputs.
- c. Calculate (using data from a graph or table as appropriate) areas of consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets.

ESSENTIAL KNOWLEDGE

PRD-3.B.8

A firm with market power can engage in price discrimination to increase its profits or capture additional consumer surplus under certain conditions.

PRD-3.B.9

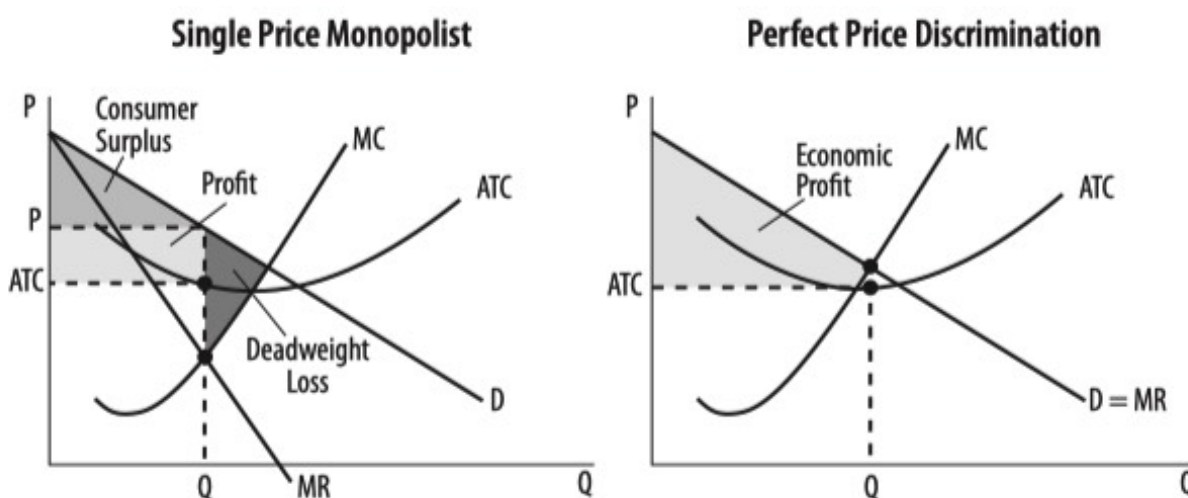
With perfect price discrimination, a monopolist produces the quantity where price equals marginal cost (just as a competitive market would) but extracts all economic surplus associated with its product and eliminates all deadweight loss.

A. Price discrimination is the ability of some monopolists to charge consumers different prices for the same good or service.

1. Several conditions must be true for price discrimination to occur.

- i. The firm must have some ability to set the price. For example, monopolists have pricing power because they don't face competition from other firms.
- ii. The firm must be able to prevent customers from reselling the firm's products or services to other consumers. For example, airlines print customers' names on tickets to prevent other consumers from using them.
- iii. The firm must be able to differentiate customers either individually or by groups so that it can charge them different amounts. Your local movie theater probably charges students a lower price than they charge teachers to see the same movie. The firm is separating people into groups based on willingness to pay, or elasticity. In the extreme, if a firm can charge each individual a different price for the same good or service, then perfect price discrimination exists.

iv. The following graphs (Figure 7.5) illustrate a single price monopolist and a monopolist that practices perfect-price discrimination. Notice that demand equals marginal revenue for the firm able to perfectly discriminate. Also, notice how consumer surplus and deadweight loss vanish when the firm can perfectly price discriminate.



1. Define the following:
 - perfect price discrimination
 - price discrimination

2. How do monopolists with the power to perfectly price discriminate eliminate consumer surplus?

3. Draw a graph for a monopolist with increasing marginal cost and the ability to perfectly price discriminate

4. Using the graph from 3, identify the profit maximizing quantity, allocatively efficient price, area of consumer surplus, area of economic profit, and deadweight loss.

1. Define the following:

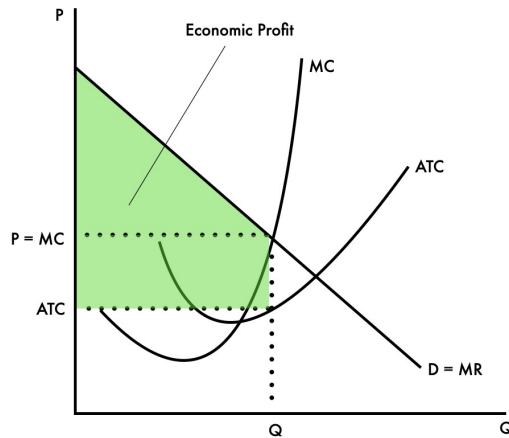
perfect price discrimination *the ability to charge each consumer the maximum price they are willing to pay for a good or service*

price discrimination *the ability to charge different groups of consumers different prices for the same good or service*

2. How do monopolists with the power to perfectly price discriminate eliminate consumer surplus?

Consumer surplus is the difference between the market price and the maximum price consumers are willing to pay, so by eliminating a single market price and charging each consumer according to their maximum willingness and ability to pay, all consumer surplus is eliminated.

3. Draw a graph for a monopolist with increasing marginal cost and the ability to perfectly price discriminate



4. Using the graph from 3, identify the profit maximizing quantity, allocatively efficient price, area of consumer surplus, area of economic profit, and deadweight loss.

note: perfect price discrimination eliminates all consumer surplus and deadweight loss

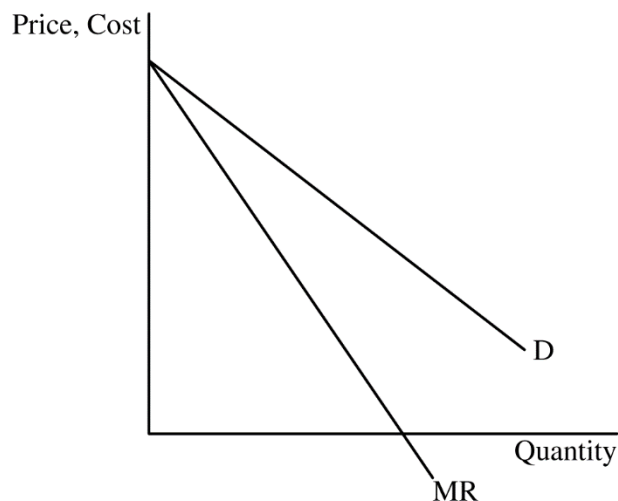
1. Arzeeye Pharma has a patent, a legal barrier to entry, on its newly developed eye treatment that cures common eye problems. Arzeeye Pharma is currently earning positive economic profit and is producing the profit-maximizing quantity of eye treatments.
- (a) Draw a correctly labeled graph for Arzeeye Pharma and show each of the following.
- (i) The profit-maximizing quantity of eye treatments, labeled Q^*
 - (ii) The profit-maximizing price, labeled P^*
 - (iii) The average total cost curve consistent with positive economic profit, labeled ATC
 - (iv) The area representing consumer surplus, shaded completely
- (b) Suppose Arzeeye Pharma wants to charge a price that maximizes its total revenue rather than its profit.
- (i) On your graph in part (a), show the revenue-maximizing quantity, labeled Q_R .
 - (ii) At quantity Q_R identified in part (b)(i), is the demand for eye treatments elastic, inelastic, or unit elastic?
- (c) Suppose now that Arzeeye Pharma engages in perfect price discrimination.
- (i) On your graph in part (a), show the lowest price that Arzeeye Pharma would charge, labeled P_2 .
 - (ii) What would happen to consumer surplus? Explain.
- (d) Suppose instead that Arzeeye Pharma's patent expires. Will the demand for Arzeeye Pharma's treatment become more elastic, become less elastic, or not change? 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.

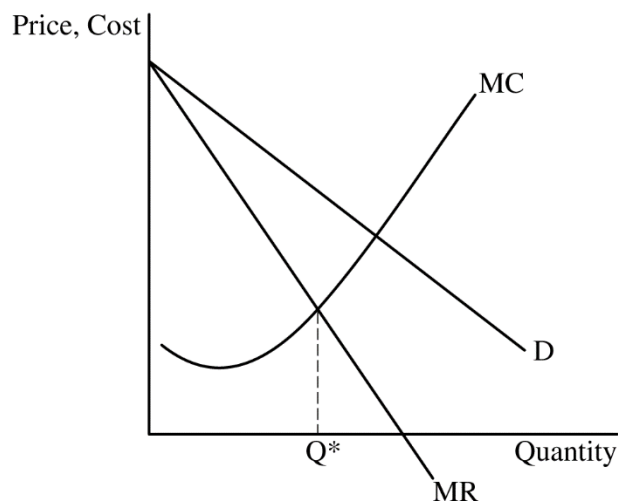
Question 1: Long

10 points

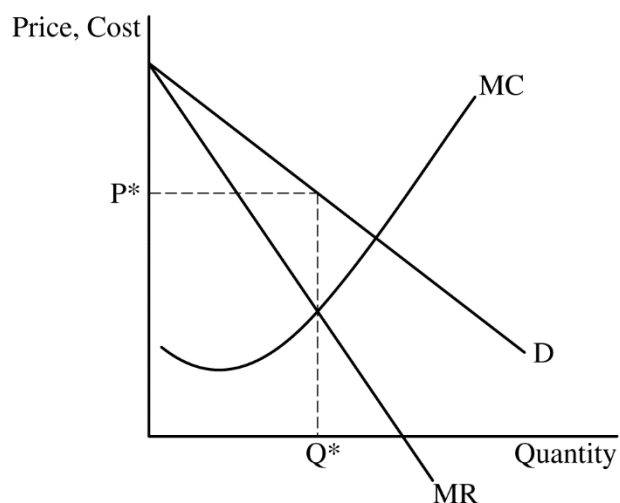
- (a) Draw a correctly labeled graph of Arzeye Pharma with a downward-sloping demand (D) curve and a downward-sloping marginal revenue (MR) curve with the MR curve below the D curve. **1 point**



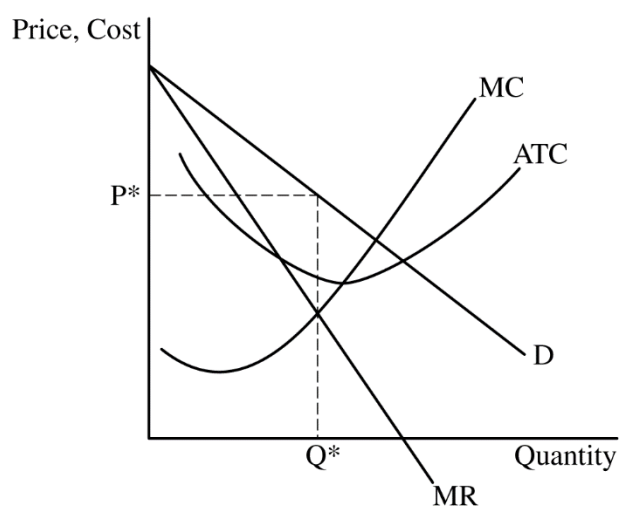
- For the second point, the graph must show a rising marginal cost (MC) curve and the profit-maximizing quantity, labeled Q^* , where $MR = MC$. **1 point**



For the third point, the graph must show the profit-maximizing price, labeled P^* , from the downward-sloping demand curve at Q^* .

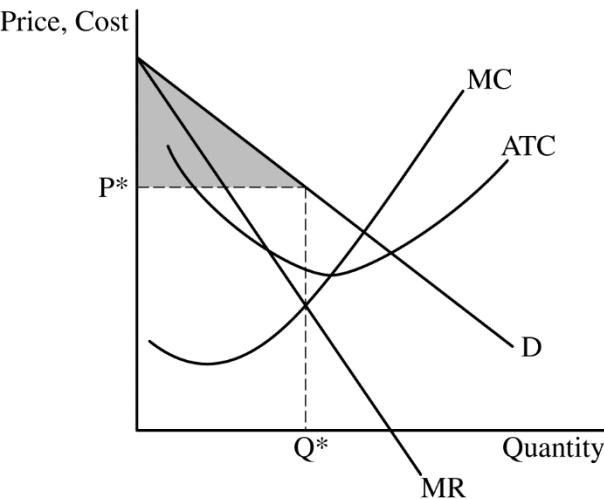
1 point

For the fourth point, the graph must show the average total cost (ATC) curve below P^* at Q^* and the marginal cost curve passing through the minimum point of the ATC curve.

1 point

For the fifth point, the graph must show the area of consumer surplus, shaded completely.

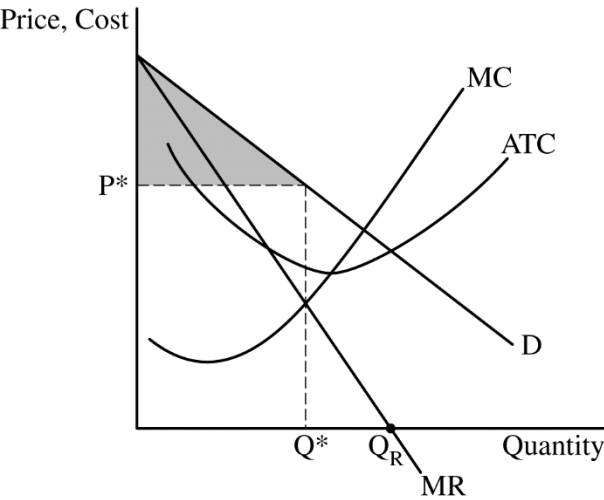
1 point



Total for part (a) 5 points

(b) (i) The graph from part (a) must show the quantity that maximizes total revenue, labeled Q_R , where marginal revenue equals 0.

1 point

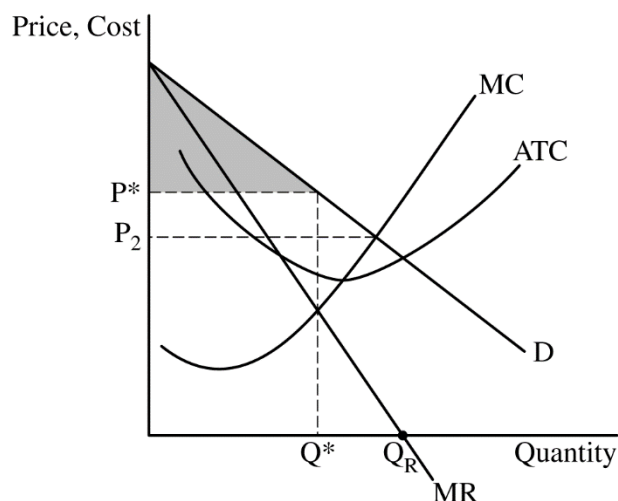


(ii) State that demand is unit elastic.

1 point

Total for part (b) 2 points

- (c) (i) The graph from part (a) must show the lowest price that Arzeye Pharma would charge if it engaged in perfect price discrimination, labeled P_2 , from the intersection of the demand and marginal cost curves. **1 point**



- (ii) State that consumer surplus would decrease to \$0 and explain that Arzeye is able to charge the maximum price each consumer is willing to pay. **1 point**

Total for part (c) 2 points

- (d) State that Arzeye Pharma's demand will become more elastic and explain that as the patent expires more firms will enter the market which increases the number and availability of substitutes, causing consumers to be more responsive to changes in the price of eye treatments. **1 point**

Total for question 1 10 points

TOPIC 4.4

Monopolistic Competition

SUGGESTED SKILL

 *Graphing and Visuals*

4.B

Demonstrate your understanding of a specific economic situation on an accurately labeled graph or visual.

Required Course Content

ENDURING UNDERSTANDING

PRD-3

Even with a common goal of profit-maximization, market structure constrains and influences prices, output, and efficiency.

LEARNING OBJECTIVE

PRD-3.B

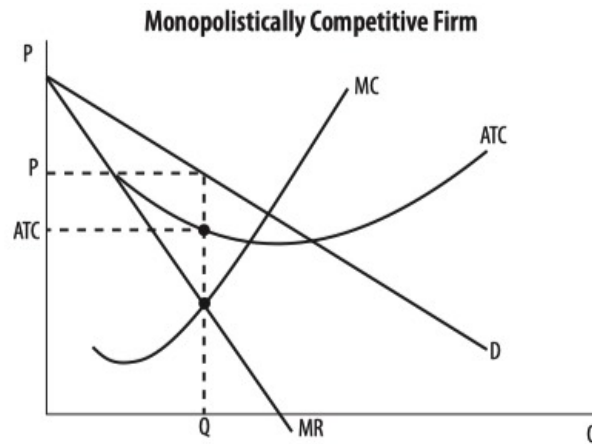
- b. Explain (using graphs where appropriate) equilibrium, firm decision making, consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets and why prices in imperfectly competitive markets cannot be relied on to coordinate the actions of all possible market participants and can lead to inefficient outputs.
- c. Calculate (using data from a graph or table as appropriate) areas of consumer surplus, producer surplus, profit (loss), and deadweight loss in imperfectly competitive markets.

ESSENTIAL KNOWLEDGE

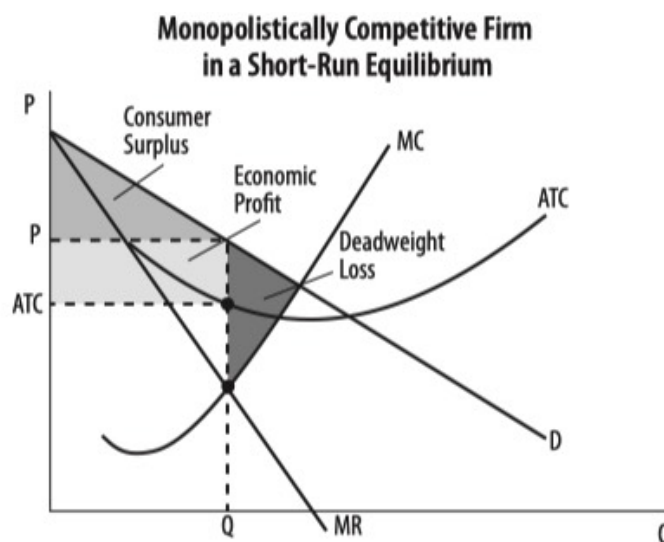
PRD-3.B.10

In a market with monopolistic competition, firms producing differentiated products may earn positive, negative, or zero economic profit in the short run. Firms typically use advertising as a means of differentiating their product. Free entry and exit drive profits to zero in the long run. The output level, however, is smaller than the output level needed to minimize average total costs, creating excess capacity. The price is greater than marginal cost, creating allocative inefficiency.

- A. Monopolistic competition is a market structure that has similarities with both perfect competition and monopoly. In addition, it has its own unique features. An example of a monopolistically-competitive industry that will help your understanding of the concept is the fast-food industry.
1. Monopolistic competition's similarities with perfect competition:
 - i. There are many firms competing against each other. For example, there are hundreds, if not thousands, of firms in the fast-food industry.
 - ii. The barriers to entry are very low, so it's relatively easy for new firms to enter into monopolistically-competitive markets.
 - iii. In the short run, it's possible to earn economic profit, but in the long run, economic profits attract competition and disappear.
 2. Monopolistic competition's similarities with monopoly:
 - i. Monopolistically-competitive firms have the ability to set a price for their product, though they have a narrower range of prices they can choose, so changing prices affects quantity sold proportionally more than for a monopolist.
 - ii. They face a downward-sloping demand curve for their product because of their pricing power, but the demand curve is flatter than a monopolist's—they usually face a more elastic demand curve than do monopolists.
 - iii. Because they face a downward-sloping demand curve, the marginal revenue is less than demand.
 3. Features unique to monopolistic competition:
 - i. So that they can earn an economic profit, monopolistically competitive firms make products that are different (or are presented as being different) than their competitors' products. Efforts on behalf of a firm to distinguish its products from potential competitors' output are called product differentiation. Firms do this to make other goods seem less substitutable for their own, allowing them to charge higher prices and not lose as much market share.
 - ii. Monopolistically-competitive firms spend some of their scarce resources on advertising their products. This means that they must sacrifice production in order to spend money on advertising. They do this to attract new consumers and to create brand loyalty for their existing customers. Firms use advertising to point out the real and/or perceived differences between their products and those of the competition, reinforcing the goal of product differentiation.

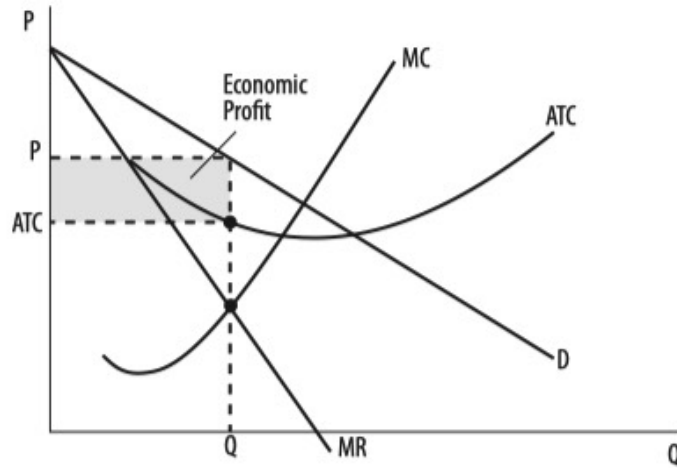


- B. Product differentiation allows, but does not guarantee, that monopolistically-competitive firms will earn economic profits in the short run.
- C. Product differentiation results in a market for the firm's particular output, so the firm's demand and marginal revenue are downward sloping.
- D. The monopolistically-competitive firm, along with perfectly competitive firms and monopolists, maximizes profits by producing the quantity associated with marginal revenue equaling marginal cost.
- E. Monopolistically-competitive firms are inefficient in the short run.
 - 1. They are productively inefficient because they don't produce a quantity of output associated with average total cost (ATC) being at its lowest point.
 - 2. They are allocatively inefficient because the price earned by the firm is not equal to its marginal cost of production.
 - 3. Because they are not allocatively efficient, monopolistic competition results in deadweight loss.

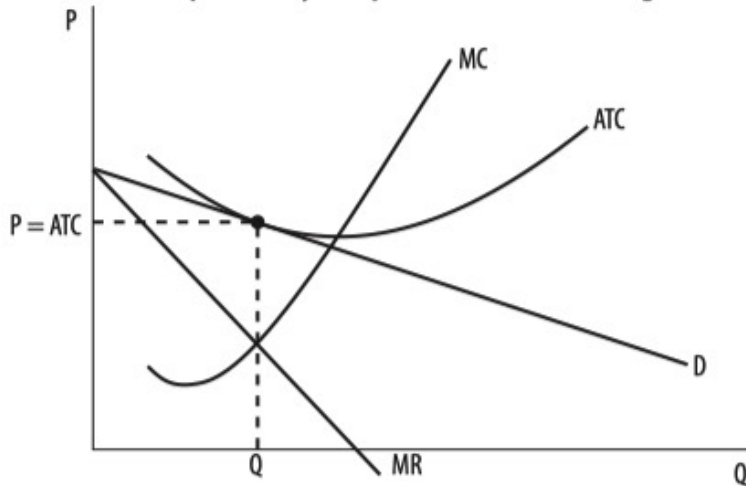


F. In the long run, economic profits encourages competition from firms selling similar goods or services which reduces demand for the monopolistically competitive firms' output and ultimately eliminates any economic profit firms in the industry were earning before. Unlike perfect competition, the long-run equilibrium is neither productively nor allocatively efficient.

Monopolistically Competitive Firm in the Short-Run

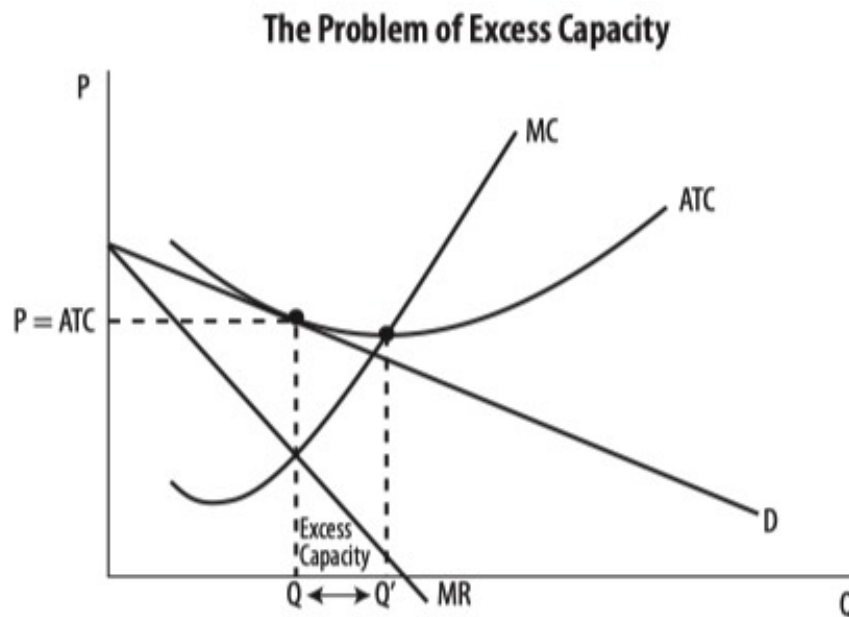


Monopolistically Competitive Firm in the Long-Run



G. Monopolistically-competitive firms do not produce enough output to achieve the lowest ATC possible.

1. When compared to perfectly-competitive firms, monopolistically-competitive firms of similar size and with similar costs produce less output in the long run.
2. This problem is called excess capacity.
3. In the graph below, Q' is the quantity perfectly-competitive firms would produce in the long run which is at the lowest ATC. Q is the quantity produced by a monopolistically competitive firm. The difference between them is excess capacity. Excess capacity is evidence that the firm is not productively efficient. Q' represents the optimal use of this factory size. Because the firm is producing at less than the optimal level for its scale of plant, it experiences a higher ATC than minimum.



1. Define the following:
 - excess capacity
 - product differentiation

2. Why do firms in industries with monopolistic competition face downward sloping demand curves rather than just being price-takers?

3. Draw a graph for a firm in a monopolistically competitive industry earning an economic profit. Identify areas of consumer surplus, deadweight loss, and economic profit.

4. Draw a graph for a firm in a monopolistically competitive industry in a long-run equilibrium. Identify areas of consumer surplus, deadweight loss, and economic profit. Also identify excess capacity.

5. Explain why excess capacity exists in monopolistic competition.

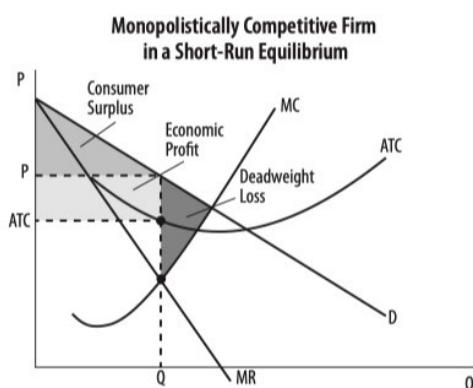
1. Define the following:
 excess capacity
 product differentiation

The difference between the quantity Mon.Comp. firms produce and the quantity associated with minimum ATC

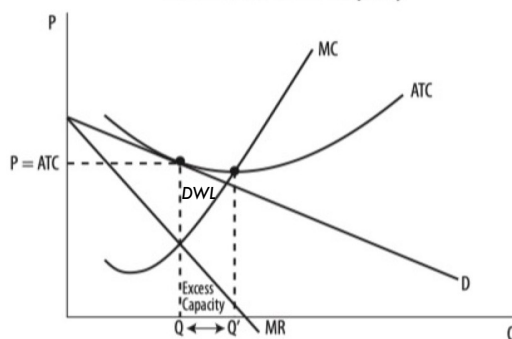
2. Why do firms in industries with monopolistic competition face downward sloping demand curves rather than just being price-takers?

Successful product differentiation creates demand for each firm's individual products

3. Draw a graph for a firm in a monopolistically competitive industry earning an economic profit. Identify areas of consumer surplus, deadweight loss, and economic profit.



4. Draw a graph for a firm in a monopolistically competitive industry in a long-run equilibrium. Identify areas of consumer surplus, deadweight loss, and economic profit. Also identify excess capacity.



5. Explain why excess capacity exists in monopolistic competition.

firms in monopolistic competition do not produce at minimum ATC because they face additional costs associated with product differentiation like advertising and marketing instead of producing more output

13. In long-run equilibrium, at which of the following output levels will a monopolistically competitive firm operate?
- (A) Where long-run average total cost is at a minimum
 - (B) Where price equals marginal revenue
 - (C) Where price equals average total cost
 - (D) Where marginal revenue equals average total cost
 - (E) Where marginal revenue equals average revenue

SUGGESTED SKILL

 Interpretation

Interpret a specific economic outcome using quantitative data or calculations.



AVAILABLE RESOURCES

- Classroom Resources >
 - ♦ **Mastering Economic Thinking Skills—Focusing on Marginal Thinking and Game Theory in Microeconomics**
 - ♦ **Mastering Economic Thinking Skills—Teaching About Game Theory**

TOPIC 4.5

Oligopoly and Game Theory

Required Course Content

ENDURING UNDERSTANDING

PRD-3

Even with a common goal of profit-maximization, market structure constrains and influences prices, output, and efficiency.

LEARNING OBJECTIVE

PRD-3.C

- a. Define (using tables as appropriate) key terms, strategies, and concepts relating to oligopolies and simple games.
- b. Explain (using tables as appropriate) strategies and equilibria in simple games and the connections to theoretical behaviors in various oligopoly market and non-market settings.
- c. Calculate (using tables as appropriate) the incentive sufficient to alter a player's dominant strategy.

ESSENTIAL KNOWLEDGE

PRD-3.C.1

An oligopoly is an inefficient market structure with high barriers to entry, where there are few firms acting interdependently.

PRD-3.C.2

Firms in an oligopoly have an incentive to collude and form cartels.

PRD-3.C.3

A game is a situation in which a number of individuals take actions, and the payoff for each individual depends directly on both the individual's own choice and the choices of others.

PRD-3.C.4

A strategy is a complete plan of actions for playing a game; the normal form model of a game shows the payoffs that result from each collection of strategies (one for each player).

PRD-3.C.5

A player has a dominant strategy when the payoff to a particular action is always higher independent of the action taken by the other player.

continued on next page

LEARNING OBJECTIVE

PRD-3.C

- Define (using tables as appropriate) key terms, strategies, and concepts relating to oligopolies and simple games.
- Explain (using tables as appropriate) strategies and equilibria in simple games and the connections to theoretical behaviors in various oligopoly market and non-market settings.
- Calculate (using tables as appropriate) the incentive sufficient to alter a player's dominant strategy.

ESSENTIAL KNOWLEDGE

PRD-3.C.6

A Nash equilibrium is a condition describing the set of actions in which no player can increase his or her payoff by unilaterally taking another action, given the other players' actions.

X Exclusion:

Dominant strategies and Nash equilibrium with more than two players or more than two actions per player, mixed-strategy equilibria, extensive form games, and normal form games with more than two players or more than two actions per player are beyond the scope of the course and the AP Exam.

PRD-3.C.7

Oligopolists have difficulty achieving the monopoly outcome for reasons similar to those that prevent players from achieving a cooperative outcome in the Prisoner's Dilemma; nevertheless, prices are generally higher and quantities lower with oligopoly (or duopoly) than with perfect competition.

-
- A. Oligopoly is a market structure in which just a few firms dominate the market. Examples of oligopolistic markets include the breakfast-cereal industry, automobile industry, airline industry, and cellular-phone industry.
- B. In oligopoly, it is difficult for new firms to enter into the market and compete because there are barriers to entry.
1. Economies of scale give existing firms a low-cost advantage over newer, smaller entrants into the market.
 2. Existing firms may cooperate to prevent new firms from entering the market.
 3. Existing firms enjoy huge name recognition due to their size and prominence.
- C. Firms act interdependently. This means that the firms' best choices are influenced by one another's decisions, an aspect that introduces an element of strategy into the way firms behave.
1. Because there are so few competitors in oligopoly, firms have to be strategic in their production and pricing decisions. This means they carefully consider the possible decisions and reactions of other firms when deciding how much to produce or at what price to offer their output for sale.
 2. Often this dependence is two-way, as in the case of Coke and Pepsi, when deciding how many units to produce or what price to charge.
 3. In some oligopolies, because firms are of unequal size, one firm is recognized as the price leader, and other firms set their prices in response to the leading firm. The ketchup market is probably a good example of the price-leadership type of oligopoly, with Heinz acting as the dominant firm.
- D. Oligopolistic firms can either produce similar or differentiated products depending on the industry in which they compete.
- E. Oligopolistic firms have an incentive to collude, or illegally cooperate, to set prices and production.
- F. Left unregulated, collusion among firms may result in them forming a cartel, which is a formal agreement to not compete, but instead behave as a monopoly by collectively determining quantity and price rather than doing so separately.
1. Collusion, price-fixing, and other behaviors indicative of formation of cartels are highly regulated in the United States and many other countries. An example of a cartel is the Organization of Petroleum Exporting Countries (OPEC). OPEC colludes to limit oil production and thus set the price of oil higher than it otherwise would be if member nations each acted to maximize profits.
- G. This tendency toward cartel formation also faces a natural limitation: firms often have an incentive to "cheat" on the quantity and price decisions that were collectively reached. This incentive to cheat can be illustrated and analyzed using certain types of games, and this is why much of the study of oligopoly involves game theory.

A. Unlike other market structures that are modeled graphically, oligopoly can be modeled using a tool from game theory called a payoff matrix.

1. Game theory is the study of strategic decision-making. Games in this context refers to strategic situations in which a discrete number of players face choices that result in quantifiable benefits to each.
2. A payoff matrix is a grid that shows the possible combinations of outcomes (benefits) when two people or firms make decisions in such a game.

B. Look at the following payoff matrix and determine the possible daily profit two firms could earn given their choice to set a high price or a low price. Assume the firms both try to maximize their profit and know all of the information in the payoff matrix.

	Firm A High Price	Firm A Low Price
Firm B High Price:	A: \$1000 B: \$1000	A: \$1200 B: \$ 500
Firm B Low Price:	A: \$ 500 B: \$1200	A: \$ 750 B: \$ 750

C. What can you learn about a firm's incentives by studying a payoff matrix?

1. If the firms compete, then they would both charge a low price and earn a daily profit of \$750. Why?
 - i. Because the low-price strategy is a dominant strategy in this situation.
 - ii. A dominant strategy is the one a profit-maximizing firm pursues independent of the other firm's strategy.

For example, Firm A is always better off choosing a low-price strategy. If firm B sets a high price, then firm A makes a bigger profit choosing low (\$1200) than it would by setting a high price (\$1000). Also, if firm B sets a low price, then firm A still makes a bigger profit choosing low (\$750) than it would by setting a high price (\$500). For firm A, the low price strategy dominates the high-price strategy because it is the best response no matter what the opposing firm chooses.

- iii. Repeat this analysis to find that choosing a low price is also a dominant strategy for firm B. In this case, the result is the same, but on some problems one firm (or even both) may not have a dominant strategy.
- iv. When one strategy is always inferior to the other, as in this case, choosing a high price is the dominant strategy.
- v. The dominant strategy for each firm choosing a low price, also happens to be an example of the Prisoner's Dilemma in this particular payoff matrix. If given the opportunity to work together, both firm A and B would likely agree to each set a high price and earn higher daily profits of \$1000 rather than \$750. But, because they are unable to collude, then they each must assume that the other player will choose the low-price strategy.
- vi. A Nash Equilibrium exists when no player can increase their payoff in the game by individually choosing a different strategy. Looking back at the payoff matrix, you can see that neither player has an incentive to switch from their low-price strategy. Depending on the payoff matrix, it is possible to have none, one, or multiple Nash Equilibria in a game.

1. Define the following:
 - cartel
 - collusion
 - dominant strategy
 - duopoly
 - game
 - game theory
 - interdependence
 - Nash Equilibrium
 - payoff matrix
 - prisoners dilemma

2. Why is it difficult for competitors in an oligopoly to cooperate and act as a monopoly?

Two competing firms, Blue's and Red's, own the only ice cream stores on a remote island. Each firm is aware of the payoffs in the payoff matrix and neither firm is willing to cooperate with the other. The two firms choose between setting a high price or a low price for their ice cream cones. The payoff matrix shows the daily profit each firm can make. Blue's profit always appears first and Red's always appears second in the payoff matrix.

	Red's sets a high price	Red's sets a low price
Blue's sets a high price	\$1000, \$10000	\$500, \$1500
Blue's sets a low price	\$2000, \$500	\$450, \$450

Refer to the payoff matrix above to answer the following questions

3. Explain why setting a low price is not a dominant strategy for Blue's?
4. Explain which set of payoffs represents a Nash Equilibrium
5. Assume, Red's receives a daily subsidy of \$500 from the island's government for setting a low price. Redraw the payoff matrix to reflect the effect of the subsidy.
6. As a result of the subsidy, will Blue's now have a dominant strategy? Explain.

1. Define the following:

cartel ... *firms which work together rather than compete*

collusion ... *illegal agreement to form a cartel*

dominant strategy ... *strategy a player will always choose independent of the other player's strategy*

duopoly ... *industry with only two firms*

game ... A game is a situation in which a number of individuals take actions, and the payoff for each individual depends directly on both the individual's own choice and the choices of others.

game theory ... *study of strategic, interdependent behavior*

interdependence ... *when the behavior of people or firms is dependent on each other*

Nash Equilibrium... *situation in a game where neither player has an incentive to change their strategy given the other player's strategy*

payoff matrix ... *a grid or table which shows the various payoffs in a game*

prisoners dilemma... *situation where each player's dominant strategy results in lower utility than if they had cooperated*

2. Why is it difficult for competitors in an oligopoly to cooperate and act as a monopoly?

Each has a strong incentive to cheat on the cartel in order to increase their individual profit

Two competing firms, Blue's and Red's, own the only ice cream stores on a remote island. Each firm is aware of the payoffs in the payoff matrix and neither firm is willing to cooperate with the other. The two firms choose between setting a high price or a low price for their ice cream cones. The payoff matrix shows the daily profit each firm can make. Blue's profit always appears first and Red's always appears second in the payoff matrix.

	Red's sets a high price	Red's sets a low price
Blue's sets a high price	\$1000, \$10000	\$500, \$1500
Blue's sets a low price	\$2000, \$500	\$450, \$450

Refer to the payoff matrix above to answer the following questions

3. Explain why setting a low price is not a dominant strategy for Blue's?

Because if Red sets a low price, then Blue is better off setting a high price

4. Explain which set of payoffs represents a Nash Equilibrium

Blue low, red high

5. Assume, Red's receives a daily subsidy of \$500 from the island's government for setting a low price. Redraw the payoff matrix to reflect the effect of the subsidy.

]

	Red's sets a high price	Red's sets a low price
Blue's sets a high price	\$1000, \$10000	\$500, \$2000
Blue's sets a low price	\$2000, \$500	\$450, \$950

6. As a result of the subsidy, will Blue's now have a dominant strategy? Explain.

No, Blue's strategy still depends on Red's strategy

2. Two discount stores, Discount Delight and Bargain Floor, sell a popular brand of athletic shoes. They are considering including these shoes in their upcoming sale. The relevant payoff matrix appears below, with the first entry in each cell indicating Discount Delight's profit from shoe sales and the second entry in each cell indicating Bargain Floor's profit. The two firms know all the information in the payoff matrix and do not cooperate.

		Bargain Floor	
		Includes	Does Not Include
Discount Delight	Includes	\$150, \$180	\$200, \$100
	Does Not Include	\$100, \$250	\$240, \$220

- If Discount Delight does not include the shoes in its sale but Bargain Floor includes them, what will Bargain Floor's profit be?
- Does either player have a dominant strategy? If so, identify the player and the strategy.
- Using numbers from the table, explain why both stores choosing not to include the shoes in their respective sales does **not** correspond to a Nash equilibrium.
- Identify the Nash equilibrium strategy for each store.
- If the two stores could cooperate in choosing their strategies, would the outcome change? Explain.

Scoring Guidelines for Question 2: Short

5 points

Learning Objectives: PRD-3.C

- | | | |
|-----|--|--|
| (a) | State that Bargain Floor's profit will be \$250.
<i>Task type: Perform numerical analysis</i> | 1 point
1.C |
| (b) | State yes and identify that including the shoes in its sale is the dominant strategy for Bargain Floor.
<i>Task type: Perform numerical analysis</i> | 1 point
1.C |
| (c) | Explain that it is not a Nash equilibrium because Bargain Floor has an incentive to move to including the shoes in its sale, earning \$30 more (\$250 > \$220).
<i>Task type: Explain</i> | 1 point
2.C |
| (d) | Identify the Nash equilibrium strategy for each store as choosing to include the shoes in the sale.
<i>Task type: Perform numerical analysis</i> | 1 point
2.C |
| (e) | State yes and explain that by both agreeing to not include the shoes in their sales, they would both increase their profits.
<i>Task type: Explain</i> | 1 point
3.C |

Total for question 2 5 points

1. NCHart is a corporation that has developed and patented a new drug to treat heart disease. There are no substitutes for this drug, giving NCHart a monopoly.
- (a) Draw a correctly labeled graph of NCHart making a positive economic profit, and show each of the following.
- (i) The profit-maximizing quantity, labeled Q_m
 - (ii) The profit-maximizing price, labeled P_m
- (b) At Q_m from part (a)(i), is demand elastic, unit elastic, or inelastic? Explain using information from the graph.
- (c) Instead of maximizing profit, suppose NCHart considers providing the new drug to as many patients as possible as long as it can generate enough revenue to cover its total costs.
- (i) On your graph from part (a), show the quantity that is consistent with this goal, labeled Q_z .
 - (ii) At Q_z from part (c)(i), is there a deadweight loss? Explain.
- (d) NCHart's patent expires next year, and a new firm, TXDrug, is considering whether to Enter this market or Stay Out. NCHart can either produce Q_m or Q_z . The firms independently and simultaneously choose their actions. The first entry in the payoff matrix represents NCHart's payoff and the second entry represents TXDrug's payoff. Both firms have complete information. Use the payoff matrix below to answer the following questions.

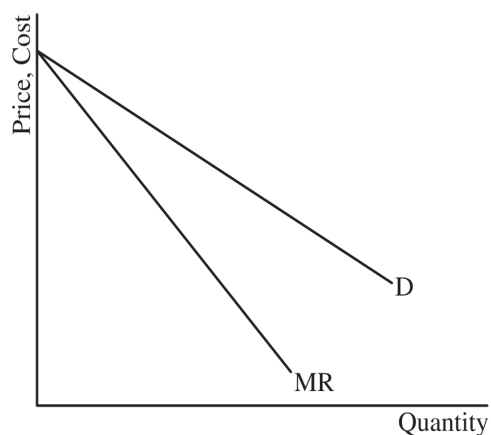
		TXDrug	
		Stay Out	Enter
NCHart	Q_m	\$10, \$0	\$4, \$1
	Q_z	\$0, \$0	−\$2, −\$1

- (i) Does TXDrug have a dominant strategy? Explain using strategies and payoffs from the payoff matrix.
- (ii) What is the best response for NCHart if TXDrug chooses to Stay Out?
- (iii) Identify the Nash equilibrium.

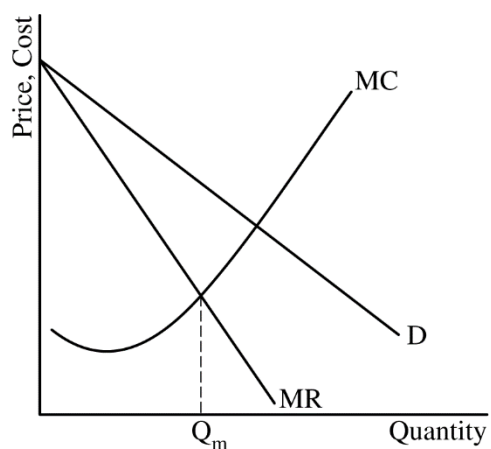
Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

Question 1: Long**10 points**

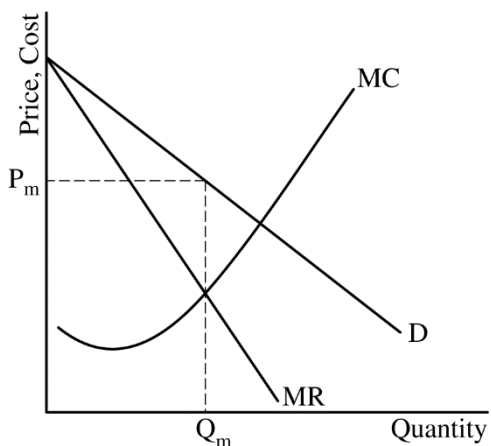
- (a) Draw a correctly labeled graph for NCHart showing downward-sloping demand (D) and marginal revenue (MR) curves with the marginal revenue curve below the demand curve. **1 point**



- For the second point, the graph must show the marginal cost (MC) curve and the profit-maximizing quantity, labeled Q_m , where $MR=MC$. **1 point**

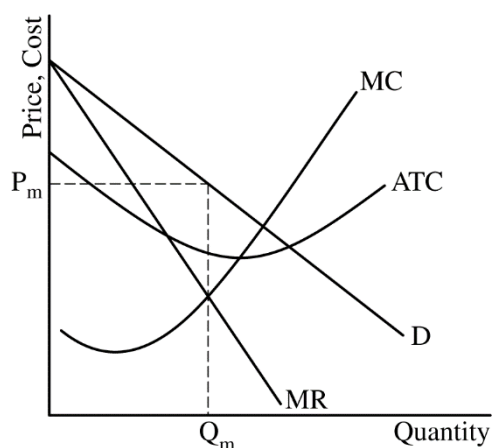


- For the third point, the graph must show the profit-maximizing price, labeled P_m , above Q_m from the demand curve. **1 point**



For the fourth point, the graph must show the ATC below the demand curve at Q_m with the MC curve rising and intersecting the ATC curve at its minimum.

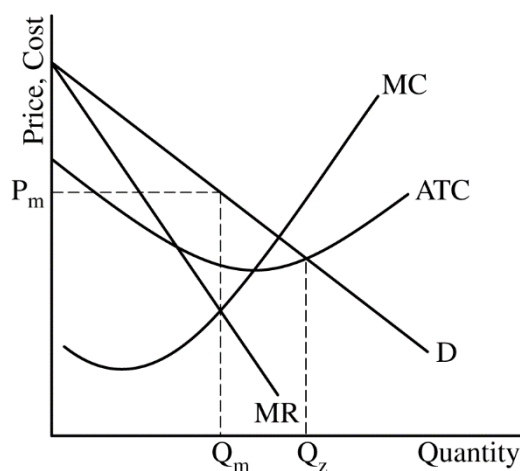
1 point



Total for part (a) 4 points

- (b) State that demand is elastic and explain that MR is positive at Q_m or that Q_m is less than the quantity at which marginal revenue equals zero. 1 point

- (c) (i) On your graph from part (a), show the quantity that is consistent with the goal of NChart generating enough revenue to cover its total costs labeled as Q_z . 1 point



- (ii) State there is a deadweight loss at Q_z and explain that P (or D) < MC , as shown. 1 point

Note: Deadweight loss will exist at Q_z if the demand is drawn such that the quantity at which $D=ATC$ is less than the quantity at which $D=MC$, because P (or D) > MC .

Note: Deadweight loss will NOT exist at Q_z if the demand is drawn such that the quantity at which $D=ATC$ is equal to the quantity at which $D=MC$, because P (or D) = MC .

Total for part (c) 2 points

(d) (i)	State that no, TXDrug does not have a dominant strategy, and explain that if NCHart chooses Q_m , then TXDrug's best response is to Enter because $\$1 > \$0$, but if NCHart chooses Q_z , then TXDrug's best response is to Stay Out because $\$0 > -\$1$.	1 point
(ii)	State that the best response for NCHart is to produce Q_m .	1 point
(iii)	Identify the Nash equilibrium as NCHart produces Q_m and TXDrug chooses to Enter.	1 point
		Total for part (d) 3 points
		Total for question 1 10 points

		Field Cruiser	
		Reliability	Power
Nice Ride	Safety	\$10 million, \$28 million	\$32 million, \$35 million
	Comfort	\$30 million, \$40 million	\$25 million, \$20 million

3. Nice Ride and Field Cruiser are the only two producers of vehicles. Nice Ride is deciding whether to improve Safety or Comfort. Field Cruiser is deciding whether to improve Reliability or Power. The payoff matrix shows the payoffs for each combination of strategies. The first entry in each cell shows Nice Ride's profit, and the second entry shows Field Cruiser's profit. Each firm independently and simultaneously chooses its strategy. Assume the two firms know all the information in the matrix and do not cooperate.
- (a) What is Field Cruiser's most profitable strategy if Nice Ride chooses to improve Safety?
- (b) Does Nice Ride have a dominant strategy? Explain using numbers from the payoff matrix.
- (c) Is Nice Ride choosing to improve Safety and Field Cruiser choosing to improve Power a Nash equilibrium? Explain using numbers from the payoff matrix.
- (d) Suppose Nice Ride and Field Cruiser decide to merge to maximize combined profits and choose to keep producing both Nice Ride and Field Cruiser vehicles. Assuming the values in the payoff matrix do not change, what would be the new firm's total profit?
- (e) Suppose instead that a change in fuel prices reduces the profitability of choosing to improve Power by \$10 million for Field Cruiser. Identify each firm's profit at the Nash equilibrium.

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.

Question 3: Short**5 points**

(a)	State that Field Cruiser’s most profitable strategy is to improve Power.	1 point
(b)	State no, Nice Ride does not have a dominant strategy and explain that if Field Cruiser chooses Reliability, then Nice Ride will choose Comfort since \$30 million is greater than \$10 million, and if Field Cruiser chooses Power, then Nice Ride will choose Safety since \$32 million is greater than \$25 million.	1 point
(c)	State yes, the combination of strategies is a Nash Equilibrium and explain that if Field Cruiser unilaterally chooses Reliability, its profits will decrease from \$35 million to \$28 million and if Nice Ride unilaterally chooses Comfort, its profits will decrease from \$32 million to \$25 million.	1 point
(d)	State that the new firm’s total profit will be \$70 million.	1 point
(e)	State that Nice Ride’s profit will be \$30 million and Field Cruiser’s profit will be \$40 million at the Nash equilibrium.	1 point
Total for question 3		5 points

Different Types of Market Structures

After you have learned about the four types of market structures, complete Figure 24.1.



Figure 24.1

Market Structures

Characteristics

Market Structure	Number of Firms	Differentiated or Homogeneous Product	Ease of Entry
Perfect Competition			
Monopolistic Competition			
Oligopoly			
Monopoly			

Results

Market Structure	Price-Setting Power	Nonprice Competition	Allocative and Productive Efficiency	Long-Run Profits	Examples
Perfect Competition					
Monopolistic Competition					
Oligopoly					
Monopoly					