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2021

AP CollegeBoard

# AP® Microeconomics

## Sample Student Responses and Scoring Commentary Set 2

**Inside:**

**Free Response Question 1**

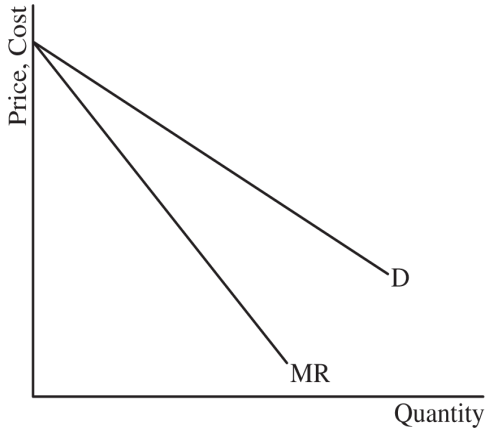
- ☑ **Scoring Guideline**
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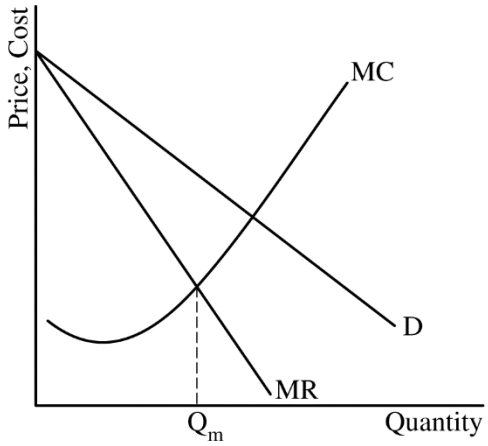
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## Question 1: Long — 10 points

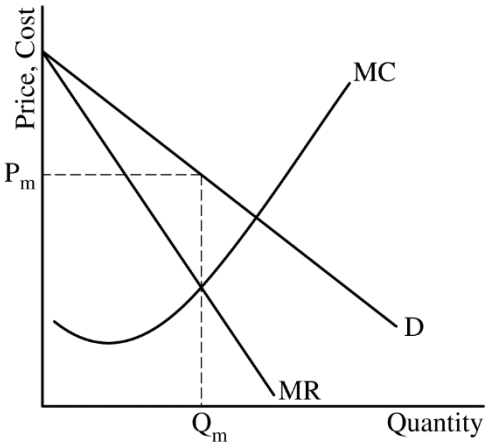
**(a)** Draw a correctly labeled graph for NCHart showing downward-sloping demand (D) and marginal revenue (MR) curves with the marginal revenue curve below the demand curve. **1 point**




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**

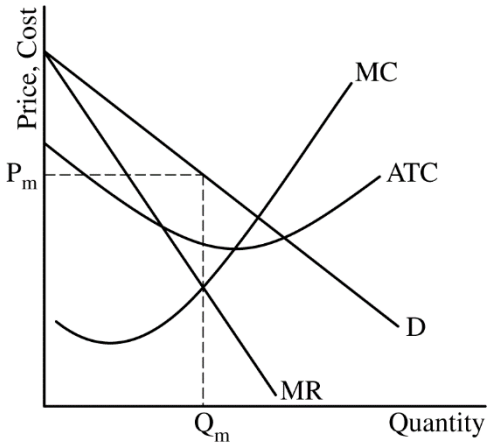



For the third point, the graph must show the profit-maximizing price, labeled $P_m$, above $Q_m$ from the demand curve. **1 point**




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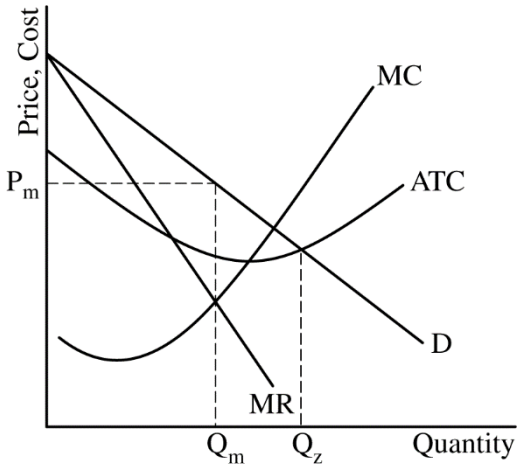
For the fourth point, the graph must show the ATC below the demand curve at $Q_m$ with the MC curve rising and intersecting the ATC curve at its minimum. **1 point**




**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**

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| | | |
|---|---|---|
| **(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** |

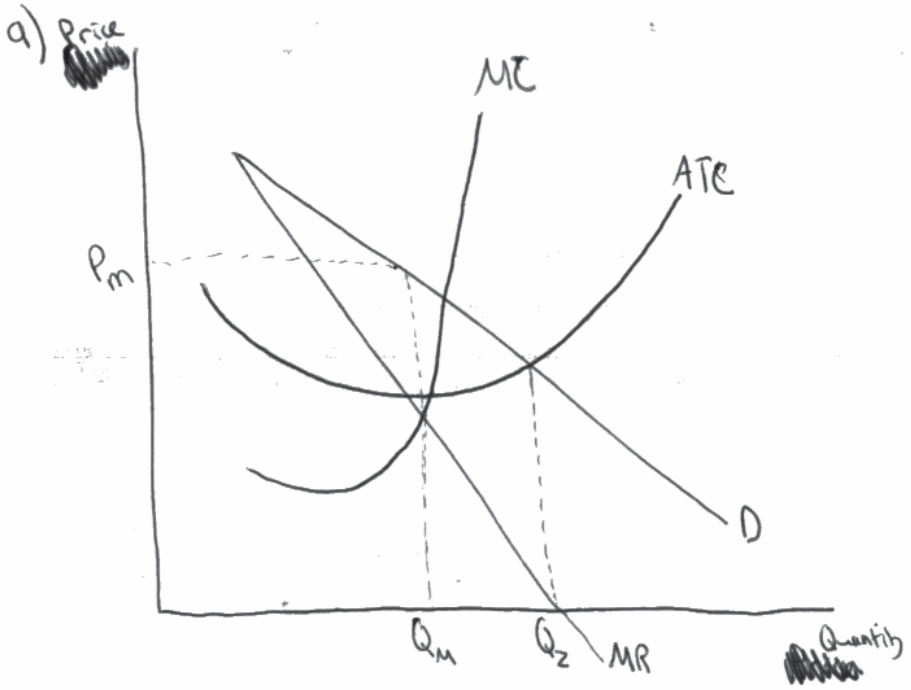
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# Q1 Sample A Page 1 of 2

Question 1 ● Question 2 ○ Question 3 ○

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

a)




b) At $Q_m$, demand is elastic because Marginal revenue is positive. This is confirmed by the total revenue test in that as price decreases, total revenue increases, showing it is demand elastic.

c) i) On graph

ii) Yes, there is deadweight loss because it is not at the socially optimal quantity. The socially optimal quantity is where $MC = D$, but $Q_2$ is located where Demand/price = ATC. Thus, there is

Question 1 ● Question 2 ○ Question 3 ○

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

deadweight loss.

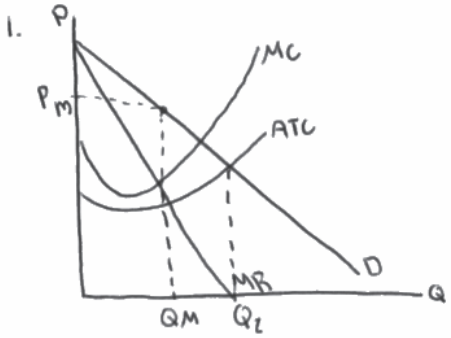
d) i) TXDrug has no dominant strategy. If NCHart produces at $Q_m$, TXDrug should enter for a $1 instead of 0 staying out. If NCHart produces at $Q_z$, TXDrug should stay out for 0 instead of entering to lose one dollar.

ii) NCHart should produce at $Q_m$

iii) The Nash equilibrium is for NCHart to produce at $Q_m$ and for TXDrug to enter. NCHart will get a $4 payoff and TXDrug will get a $1 payoff.

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

1.




b) Demand is relatively elastic at $Q_m$ as a demand curve is more elastic at the top (where $Q_m$ is) compared to the bottom of the curve which is more inelastic.

c) There is no deadweight loss because NCHart is producing where demand equals ATC, meaning there is zero economic profit.

d(i) TXDrug doesn't have a dominant strategy because if NCHart produces at $Q_m$, TXDrug should ~~pick~~ enter, but if NCHart produces at $Q_2$, TXDrug should stay out. Thus, it doesn't have a dominant strategy.

(ii) If TXDrug chooses to stay out, NCHart should produce at $Q_m$ as \$10 is greater than the \$0 at $Q_2$.

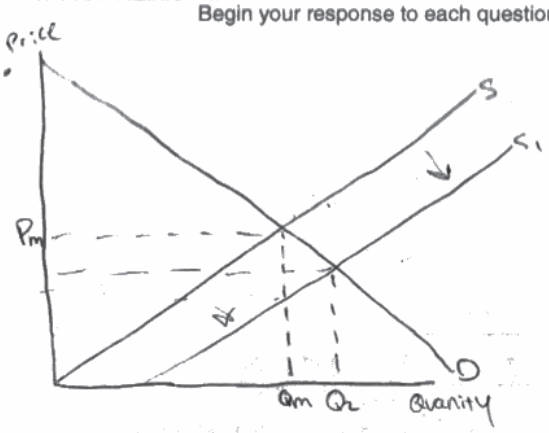
(iii) The nash equilibrium would be for NCHart to produce at $Q_m$ and TXDrug to enter the market.

# Q1 Sample C Page 1 of 1

Question 1 | Question 2 | Question 3

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

a). I.




b). Demand is unit elastic because Based on the Quanity Produced Demand can change as long as supply doesn't

C). II. yes there is a dead Wieght loss because the Quanity and Price From equilibrium have changed and are now having a dead Wieght loss

D). I. No they dont because TXDrug would not want to take the chance if they did it would be to stay out because then they dont gain or lose anything

II. NCHarts best responce for TXDrug staying out would be for them to also Qm cause then its an increase of 10 dollars

III. Nash equilibrium would be NCHart to $Q_2$ and TXDrug to stay out because then they both dont gain nor lose anything in the Process

# Question 1

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

**Overview**

The question assessed students' understanding of how a monopoly would maximize profit in the short run, where the firm would operate if they were to offer the product at an output that still allowed the firm to break even, and whether this output was allocatively efficient. Students were also expected to use game theory to identify the presence, or absence, of a dominant strategy and a Nash equilibrium between two rivals.

The question stated that 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. In part (a) students were asked to draw a correctly labeled graph for a monopoly. Part (a)(i) and (a)(ii) asked students to show the profit-maximizing quantity and price, labeled as $Q_m$ and $P_m$ respectively. These parts of the question tested students' knowledge of market conditions for a monopoly and their ability to illustrate these concepts using a graph. This task included demonstrating knowledge of revenue and cost conditions by drawing a downward-sloping demand curve (D) and a downward-sloping marginal revenue curve (MR) that lies below the demand curve and both the marginal cost (MC) and average total cost (ATC) curves. Students were asked to show that the profit-maximizing quantity ($Q_m$) occurs where MR equals MC and that the profit-maximizing price ($P_m$) is determined by identifying the price that corresponds to this quantity from the demand curve. These tasks required students to demonstrate marginal analysis in a graphical format. Students also had to draw an ATC curve consistent with the given positive economic profit condition by having the ATC curve below the demand curve at the profit-maximizing quantity and having ATC's minimum where the rising MC curve and ATC curve intersected.

Part (b) of this question asked students whether demand was elastic, inelastic, or unit elastic at the profit-maximizing quantity. The students' explanation required the use of information from the graph. This part required students to demonstrate knowledge that the monopolist's profit-maximizing output was in the elastic range of demand because marginal revenue is positive at that quantity.

Part (c) of this question introduced an alternative level of production to the profit-maximizing decision. Specifically, this asked students to consider the possibility that NCHart would provide the new drug to as many patients as possible as long as it could generate enough revenue to cover its total costs. Part (c)(i) asked students to show, in the graph from part (a), the quantity ($Q_z$) that is consistent with this goal. This part required students to demonstrate knowledge that the firm would break even if output were set where price equals average total cost (P=ATC). Part (c)(ii) asked the students whether deadweight loss existed at the quantity identified in (c)(i). Students needed to explain that deadweight loss exists when $P \neq MC$ and apply that condition to the quantity, $Q_z$, shown in the graph.

Part (d) of this question introduced the possible entry of a rival firm, TXDrug, when the patent held by NCHart expired. Students were told that these two firms independently and simultaneously choose their actions. NCHart can choose between $Q_m$ or $Q_z$, while TXDrug can choose between entry into the market or staying out. The payoff matrix was provided for the students.

Part (d)(i) of the question asked whether TXDrug has a dominant strategy. Students were instructed to explain their answer using strategies and payoffs from the payoff matrix. This part required students to demonstrate knowledge of how to determine whether a dominant strategy exists and how to read the payoff matrix. Students needed to state that there was not a dominant strategy for TXDrug. The explanation required students to analyze the best response for TXDrug, given each possible action by NCHart, and to compare the payoffs for TXDrug under both scenarios. If NCHart chooses $Q_m$, TXDrug would enter because earning \$1 is better than earning \$0. If NCHart chooses $Q_z$, TXDrug would stay out because earning \$0 is better than losing \$1.

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## Question 1 (continued)

Part (d)(ii) of the question asked students to state the best response for NCHart if TXDrug chose to stay out of the market. This part required students to demonstrate that they could read the payoff matrix and determine that NCHart would choose output $Q_m$ if TXDrug stayed out of the market.

Part (d)(iii) of the question asked students to identify the Nash equilibrium of this game. This part required students to understand what the Nash equilibrium is, and how to locate it in the payoff matrix. Students needed to state that NCHart would produce $Q_m$, and TXDrug would enter the market.

**Sample: 1A**
**Score: 10**

Part (a): 4 points

- The response earned the first point in part (a) because the response shows downward-sloping demand (D) and marginal revenue (MR) curves with the marginal revenue curve below the demand curve.
- The response earned the second point in part (a) because the response shows $Q_m$ where MR=MC.
- The response earned the third point in part (a) because the response shows $P_m$ above $Q_m$ from the demand curve.
- The response earned the fourth point in part (a) because the response shows ATC below the demand curve at $Q_m$ with MC curve rising and intersecting ATC at its minimum.

Part (b): 1 point

- The response earned the point in part (b) because the response states that demand is elastic at $Q_m$ because marginal revenue is positive.

Part (c): 2 points

- The response earned the point in part (c)(i) because the response shows $Q_z$ at D=ATC.
- The response earned the point in part (c)(ii) because the response correctly explains that deadweight loss occurs because price does not equal marginal cost.

Part (d): 3 points

- The response earned the point in part (d)(i) because the response correctly states that there is no dominant strategy for TXDrug and explains with the correct strategies and payoffs.
- The response earned the point in part (d)(ii) because the response states that the best response is $Q_m$.
- The response earned the point in part (d)(iii) because the response correctly identifies the Nash equilibrium.

**Sample: 1B**
**Score: 6**

Part (a): 4 points

- The response earned the first point in part (a) because the response shows downward-sloping demand (D) and marginal revenue (MR) curves with the marginal revenue curve below the demand curve.
- The response earned the second point in part (a) because the response shows $Q_m$ where MR=MC.
- The response earned the third point in part (a) because the response shows $P_m$ above $Q_m$ from the demand curve.
- The response did not earn the fourth point in part (a) because the response does not show the correct relationship between MC and ATC.

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## Question 1 (continued)

Part (b): 1 point

- The response did not earn the point in part (b) because the response does not sufficiently explain that demand is elastic at $Q_m$ because the point is above the midpoint of demand where MR=0.

Part (c): 2 points

- The response earned the point in part (c)(i) because the response shows $Q_z$ at D=ATC.
- The response did not earn the point in part (c)(ii) because the response incorrectly states that there is no deadweight loss.

Part (d): 3 points

- The response did not earn the point in part (d)(i) because the response correctly states that there is no dominant strategy for TXDrug but does not explain with the correct strategies and payoffs.
- The response earned the point in part (d)(ii) because the response states the best response is $Q_m$.
- The response earned the point in part (d)(iii) because the response correctly identifies the Nash equilibrium.

**Sample: 1C**
**Score: 2**

Part (a): 4 points

- The response did not earn the first point in part (a) because the response does not show downward-sloping demand (D) and marginal revenue (MR) curves with the marginal revenue curve below the demand curve.
- The response did not earn the second point in part (a) because the response does not show $Q_m$ where MR=MC.
- The response earned the third point in part (a) because the response shows $P_m$ from the demand curve above $Q_m$.
- The response did not earn the fourth point in part (a) because the response does not show ATC below demand.

Part (b): 1 point

- The response did not earn the point in part (b) because the response states that demand is unit elastic.

Part (c): 2 points

- The response did not earn the point in part (c)(i) because the response does not show $Q_z$ at D=ATC.
- The response did not earn the point in part (c)(ii) because the response does not include a comparison of price and marginal cost.

Part (d): 3 points

- The response did not earn the point in part (d)(i) because the response correctly states that there is no dominant strategy for TXDrug but does not explain with the correct strategies and payoffs.
- The response earned the point in part (d)(ii) because the response states that the best response is $Q_m$.
- The response did not earn the point in part (d)(iii) because the response does not identify the Nash equilibrium.

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