Chief Reader Report on Student Responses:

2018 AP® Microeconomics Free-Response Questions

- Number of Students Scored 90,032
- Number of Readers 91
- Score Distribution

Exam Score	N	%At
5	18,827	20.9
4	25,070	27.8
3	17,238	19.1
2	13,823	15.4
1	15,074	16.7

- Global Mean 3.21

The following comments on the 2018 free-response questions for AP® Microeconomics were written by Chief Reader Pamela Schmitt of the United States Naval Academy, and Operational Question Leaders Dee Mecham, Peter Duffer, and Walentyna Karcz. They give an overview of each free-response question and of how students performed on the question, including typical student errors. General comments regarding the skills and content that students frequently have the most problems with are included. Some suggestions for improving student preparation in these areas are also provided. Teachers are encouraged to attend a College Board workshop to learn strategies for improving student performance in specific areas.

Question #1	**Task:** Graph and explain	**Topic:** Monopoly Behavior and Labor Market
	Max. Points: 9	**Mean Score:** 4.24

What were the responses to this question expected to demonstrate?

The question assessed students' understanding of the market conditions for monopoly, how a monopoly would operate under those conditions, how a change in behavior would affect the outcome for the monopoly, and how changes in the labor market would affect wages. Students were expected to draw and label a graph for a monopoly earning negative economic profit, to analyze and explain the behavior of the firm, and to explain how a change in the labor market affected wages and the conditions for hiring labor.

The question states that Single Cinema has monopoly power and is a profit-maximizing firm currently operating with a negative economic profit in the short run. In part (a) students were asked to draw a correctly labeled graph for a monopoly. Part (a)(i) asked students to show the profit-maximizing price and quantity for the monopoly, and part (a)(ii) asked students to shade the area representing the negative economic profit. This part of the question tests students' knowledge of the market conditions for a monopoly and their ability to illustrate these concepts using graphs. This task includes showing revenue and cost conditions, a downward-sloping demand curve and a marginal revenue (MR) curve below the demand curve, and a marginal cost (MC) curve rising and crossing a U-shaped average total cost (ATC) curve at the minimum of that ATC curve. With those conditions students were asked to show that the profit-maximizing quantity is determined by equating marginal revenue and marginal cost and that the profit-maximizing price is determined by going up to the demand curve at the profit-maximizing quantity. This part of the question also asked students to shade the area of the negative economic profit, with ATC above the price at the profit-maximizing quantity and with the ATC curve drawn above the demand curve for all quantities.

Part (b) asked the students to explain why Single Cinema would continue to operate in the short run despite earning negative economic profit. This tested students' understanding of the shutdown condition, price (P)> average variable cost (AVC) or total revenue (TR) > total variable cost (TVC), for a firm earning negative economic profit and that the economic loss would be greater than fixed costs if the firm shuts down.

Part (c) asked the students to explain how selling a smaller quantity than Q_m would affect Single Cinema's total revenue. This part tested students' understanding of how total revenue varies at different quantities along a downward-sloping demand curve. Students were expected to describe a decrease in total revenue because the positive marginal revenue of the one unit no longer sold would not be included in the total revenue, or describe a decrease in total revenue as a result of the increase in price having a smaller relative effect on total revenue than the decrease in the quantity or referring to the change in quantity occurring in the elastic range of the demand curve.

Part (d) states that the number of workers available has decreased in the perfectly competitive labor market from which Single Cinema hires workers. Given the situation, students were asked to explain what happened to the wage rate and the marginal revenue product (MRP) of the last worker hired. In part (d)(i) students were expected to conclude that the decrease in the supply of labor resulted in an increase in the wage rate. Part (d)(ii) tested students' ability to explain the effect of the resulting increase in the wage rate on the firm's decision on hiring workers. The firm will hire fewer workers where the MRP of the last worker hired was equal to the increased wage rate because each worker no longer hired by Single Cinema had a lower marginal product of labor than the last worker hired (diminishing marginal product).

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
Part (a) • Drawing a horizontal demand curve, confusing perfect competition and monopoly. • Identifying the MR curve as the same as the demand curve for monopoly.	• Drawing a downward-sloping demand curve for monopoly. • Drawing a marginal revenue curve, starting at the same point as demand on the price axis, that is downward-sloping but with a steeper slope so that it is below demand.
• Drawing the MC curve without intersecting the ATC curve, or intersecting the ATC curve at a point that is clearly not the minimum of the ATC curve.	• Drawing a marginal cost curve that initially falls then rises, rising up through the minimum of a U-shaped ATC curve.
• Identifying the profit-maximizing quantity (Q_m) at the intersection of the MC curve and the demand curve, which indicates the allocatively efficient quantity, or at the minimum of the ATC curve, which indicates the productively efficient quantity.	• Showing Q_m labeled on the quantity axis, marked with a dashed line down from the intersection of the MR and MC curves. Profit is maximized at the quantity where MR=MC.
• Identifying the profit-maximizing price (P_m) directly across from the intersection of the MR and MC curves.	• Marking a dashed line up from the intersection of the MR and MC curves to the demand curve, and then marking a dashed line across to the price axis to label P_m.
• Having the ATC curve below the demand curve over a range of quantities.	• Having the ATC curve above demand for all quantities, so that there is no quantity for which positive or zero economic profit is possible since the firm is earning negative economic profit when it maximizes profit.
• Shading the area of total revenue instead of the area of economic profit. • Shading a shape other than a rectangle for negative economic profit.	• Shading the area of economic profit to illustrate that economic profit is total revenue minus total cost. • Shading the rectangle from P_m over to demand at Q_m then up to ATC and back to the price axis.
Part (b) • Referencing accounting profit to justify staying open instead of the shutdown rule. The difference in economic profit and accounting profit are the implicit costs, but the shutdown rule requires a comparison between revenue and variable costs, whether explicit or implicit.	• Explaining that the firm will continue to operate when total revenue is greater than total variable cost (TR>TVC) or price (average revenue) is greater than average variable cost so that the economic loss is less than it would be if the firm were to shut down and incur an economic loss equal to total fixed cost.

• Misunderstanding the short run nature of shutdown and stating that in the long run profits will eventually be positive which, even if some other change could happen to make that true, is not relevant to the question of shutdown in the short run. • Not making a direct comparison between the revenue and cost measures relevant to shutdown, referencing variable costs without being specific about the revenue (they are covering variable costs).	• Explaining that the firm will continue to operate when total revenue is greater than total variable cost (TR>TVC) or price (average revenue) is greater than average variable cost so that the economic loss is less than it would be if the firm were to shut down and incur an economic loss equal to total fixed cost. • Explaining that the firm will continue to operate when total revenue is greater than total variable cost (TR>TVC) or price (average revenue) is greater than average variable cost so that the economic loss is less than it would be if the firm were to shut down and incur an economic loss equal to total fixed cost.
Part (c) • Explaining why profit, not total revenue, would decrease with one fewer ticket sold. • Not recognizing that price changes when there is a change in quantity on a downward-sloping demand curve, and only considering the quantity effect on total revenue. • Identifying the change in price associated with the change in quantity but not comparing the relative effects of each on total revenue. • Incorrectly describing demand as inelastic in the range of demand between Q_m and Q_m-1.	• Stating that Single Cinema's total revenue will decrease because the decrease in quantity would result in an increase in price but that the quantity effect would be greater than the price effect. • Stating that Single Cinema's total revenue will decrease and providing an explanation that recognizes that the change in price would have an opposite, but not greater, effect on total revenue than the effect of the decrease in quantity. • Explaining that the quantity effect (% change in quantity) was greater than the price effect (% change in price) so that the net effect of the quantity change and price change was a decrease in total revenue. • Explaining the magnitudes of the quantity effect and price effect by correctly describing the demand as elastic in the range of demand between Q_m and Q_m-1.
Part (d)(i) • Repeating the given information or using imprecise terms instead of using the correct economic terminology to describe the impact of the changes in the labor market. • Explaining that there was no change in the wage rate because Single Cinema had to take the market wage rate as given without recognizing that the given change would have increased the market wage rate.	• Explaining the increase in the wage rate resulting from a decrease in supply (a leftward shift of the supply curve). • Explaining that the given change in the labor market caused a leftward shift in the market supply that resulted in a higher market wage rate or a higher wage rate for Single Cinema, which takes the market wage as given.

• Explaining with the assertion that Single Cinema would have to raise its wages to attract workers without identifying that as a response to the increase in wage in the labor market.	• Explaining that the given change in the labor market caused a leftward shift in the market supply that resulted in a higher market wage rate or a higher wage rate for Single Cinema, which takes the market wage as given.
Part (d)(ii) • Explaining diminishing marginal product with an increase in labor, or just saying diminishing marginal product with no indication of direction.	• Explaining that the higher wage rate would result in fewer workers being hired, and that marginal product diminishes with more workers and it will increase with fewer workers as in this case.
• Not recognizing the difference between the marginal revenue product curve, which would not change, and the marginal revenue product of the last worker hired, which would change as the number of workers hired changes.	• Explaining that the higher wage rate would result in fewer workers being hired, because marginal factor cost (wage) increases and the firm would hire the number of workers where MRP=MFC, and so the last worker hired will have a higher MRP (a movement along the MRP curve) with the higher MFC.

Based on your experience at the AP® Reading with student responses, what advice would you offer to teachers to help them improve the student performance on the exam?

The graph of a monopoly is a very important analytical model in microeconomics and frequently appears on the exam. Most students (78.4%) correctly drew the monopoly's downward-sloping demand with a corresponding MR curve, but a smaller majority (59.6%) were as careful about drawing the MC curve rising and crossing through the minimum of a U-shaped ATC curve. Many students who missed the point for the MC and ATC curves still had MC rising with a U-shaped ATC curve, but did not have MC crossing the minimum of the ATC curve. Only 44% of students received both points for the correct set-up of the correct demand and marginal revenue curves and the correct relationship between the marginal cost and average total cost curves. Of the students who started with the correct set-up, 85.5% earned all 5 points for the graph in part (a). Of those students with the correct set-up, 92.4% earned the point for labeling the profit-maximizing quantity, Q_m, where MR=MC. Those that did not get the point for Q_m after a correct set-up often missed the point for not making an explicit connection between the intersection of MR and MC, a dashed line from that intersection to the Q_m label on the horizontal quantity axis. Of those students with the correct set-up, 90.8% earned the point for labeling the profit-maximizing price, P_m, by making an explicit extension of the dashed line from Q_m up to the demand curve and then a dashed line across to the P_m label on the vertical price axis. The small percentage that received the point for Q_m and not for P_m usually went across to the vertical price axis from the intersection of MR and MC and did not go up to demand curve to set the monopoly price. The most significant improvements can be made by emphasizing the correct set-up, and reinforcing that by having students practice drawing the monopoly model.

In part (a), students were asked to shade the area representing negative economic profit, the rectangle from P_m over to demand at Q_m, then up to ATC and back to the price axis. The percentage of students who earned this point (51.3%) was not indicative of students not being able to shade the rectangle as described, because many students had an ATC that crossed below demand at another quantity. Having ATC above demand for all quantities is a condition for correctly setting up the graph for a profit-maximizing firm that is earning negative economic profits. Of the students with the correct set-up of the correct demand and marginal revenue curves and the correct relationship between the marginal cost and average total cost curves, 73.3% earned the point for shading the negative economic profit. After emphasizing the

correct set-up for a monopoly, students need to practice drawing those curves to illustrate each of the possible outcomes for economic profit should yield performance improvements. Students are frequently asked to shade areas that represent total values (TR, TC, TVC, TFC, profit) for the firm, and in each case it involves finding a rectangle with the average of the total value at a given quantity. Teachers should continue to help students develop the skill of shading the total measures on graphs with average measures.

For part (b), 34.8% of the students correctly explained why Single Cinema would continue to operate despite earning negative economic profit. Many students interpreted the question to be asking about economic profits versus accounting profits, a comparison that distinguishes between explicit and implicit costs, instead of addressing the condition for shutdown where the distinction between variable cost and fixed cost is what is relevant. Others simply asserted that economic profit would eventually be positive in the long run, which does not address whether to continue to operate and that seems to suggest that there is some confusion about the temporary nature of shut down in the short run versus exit in the long run. Some students may need more instruction on what it means to shut down and when that would minimize the firm's economic loss. Many students, though, interpreted the question correctly and appeared to understand the shutdown rule, but stated that the firm covered variable costs without specifically addressing the revenue side of the shutdown rule. Teachers should emphasize that a firm's revenue needs to be greater than its total variable costs if it is going to continue operating with negative economic profit, that means price covers average variable cost or total revenue covers total variable costs and not just that variable costs are covered.

For part (c), the decrease in total revenue was identified by most students but only included that identification with a complete explanation in 26.2% of the responses. Many students explained how profit would change, not total revenue. Others only explained the quantity effect without comparing it to the price effect. Teachers should emphasize the relationship between total revenue, marginal revenue and the ranges of elasticity along a downward-sloping demand curve, and should also be clear about the distinction between profit-maximization and revenue-maximization.

The increase in wage for part (d)(i) was also identified by most students, but the point was awarded 57% of the time when the explanation specifically described or showed a decrease in the supply of labor. Many students stated that there was an increase in wage and justified that by repeating the information in the question without using precise economic terminology to describe the adjustment that would occur in the market. Teachers can help students perform better on this type of question by emphasizing the correct use of economic terms.

In part (d)(ii), 21.5% of students earned the point for explaining the increase in the marginal revenue product of the last worker hired. Many students seemed to find it difficult to explain diminishing marginal product when the number of workers hired was decreasing instead of increasing. Some did not recognize that the increase in the wage rate would cause Single Cinema to hire fewer workers. Other students appeared to confuse marginal revenue product of the last worker hired with the marginal revenue product of labor curve. Although a graph was not required, students who drew a graph for themselves tended to be more precise in the words they used in their explanations. Teachers should encourage students to use graphs to better understand a situation they are trying to describe in words.

Question #2	**Task:** Analyze and interpret a graph	**Topic:** Market Failure
	Max. Points: 6	**Mean Score:** 2.40

What were the responses to this question expected to demonstrate?

This question assessed students' ability to identify and analyze market failure from a given graph. The concepts in the question included an analysis of market failure, identifying the private market equilibrium price and quantity, identifying the area of deadweight loss, calculating the per-unit subsidy, understanding the effects of a price floor, and understanding how the price floor addresses the market failure.

The question included a graph where the marginal social benefit is greater than the marginal private benefit. In part (a) students were asked to identify the type of market failure. Students were expected to recognize and explain the positive externality because the marginal social benefit (MSB) is greater than the marginal private benefit (MPB) or that the equilibrium quantity is less than the socially optimal quantity.

In part (b) students were expected to identify the private market equilibrium price of $6 and the market equilibrium quantity of 16 units.

Part (c) required students to use the labeling on the graph to identify the area of DEF as the deadweight loss at the quantity identified in part (b). The students could have also calculated the area of deadweight loss and shown their work for the point.

In part (d) students were expected to identify the per-unit subsidy of $4, which is the vertical difference between MSB and MPB at all quantities.

Part (e)(i) required students to analyze the effects of a price floor instead of a subsidy to correct the market failure. Students were expected to recognize that the quantity exchanged would be 8 units. In part (e)(ii) the students were asked to demonstrate that the price floor did not correct the market failure and to explain that the quantity exchanged will be less than the socially optimal quantity or that the marginal social benefit is greater than the marginal social cost at 8 units.

How well did the response address the course content related to this question? How well did the responses integrate the skills required on this question?

In part (a), 30% of students properly identified the market failure as a positive externality and stated that either the marginal social benefit was greater than the marginal private benefit or stated that the equilibrium quantity was less than the socially optimal quantity. Many students identified that the equilibrium quantity was less than socially optimal but did not state that the failure was a positive externality.

In part (b), 60% of students properly identified the equilibrium price and quantity as $6 and 16 units respectively. Many students that did not receive credit chose the socially optimal price and quantity or a price and quantity that was not in equilibrium.

In part (c), 42% of students correctly identified the area of deadweight loss as DEF.

In part (d), 35% of the students identified the per-unit subsidy of $4. The question required students to understand the difference between social benefits and private benefits on a graph and to know that at all quantities the difference between social benefits and private benefits was $4 per unit.

In part (e)(i), 34% of students recognized that only 8 units would be exchanged. Most students knew that the price floor would create a surplus but many did not correctly identify that only 8 would be exchanged because many consumers were not willing or able to pay more than $6 leaving a quantity exchanged of only 8.

For the last point, part (e)(ii) required students to explain whether the price floor corrected the market failure. Students were expected to reason that the floor makes the deadweight loss larger because even fewer transactions would be made or to explain that the marginal social benefit is still larger than the marginal social cost (instead of equal to) at the quantity of 8. At 28% correct, this last point was the lowest scoring point in question number 2.

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
Part (a) • The market is in equilibrium so there is no market failure. • The MSB is equal to the MSC. • It is a positive externality because society wants more.	• The market has a positive externality because the marginal social benefit is greater than the marginal private benefit. • The market has a positive externality because the socially optimal quantity is greater than the equilibrium quantity.
Part (b) • Price is $10 and quantity is 16 units. • Price is $8 and quantity is 24 units.	• Price is $6 and quantity is 16 units.
Part (c) • FEG • BFE • Point C • $32	• DEF • The calculated area of the triangle DEF ½ of ($10-$6) *(24-16) = $16

Part (d) • $2 • $0.25	• $4
Part (e)(i) • 8 and 24 • 16 • 32	• 8 units
Part (e)(ii) • The price floor corrects the market failure because it eliminates the deadweight loss. • The price floor produces the socially optimal level of output. • The floor does not correct the market failure because it is set below the equilibrium price.	• No, the price does not correct the market failure because only 8 units are exchanged between consumers and producers, which is less than the socially optimal quantity of 24. • No, because at 8 units the MSB>MSC. • No, because the deadweight loss increased after the price floor.

Based on your experience at the AP® Reading with student responses, what advice would you offer to teachers to help them improve the student performance on the exam?

One key point to emphasize with students is to make sure they answer the question that is asked. In part (a), the question asks the students to identify market failure illustrated by the graph. Many students did not mention any market failure. One tip to offer students, and one that can be seen by readers, is to suggest students check off, underline and/or circle the parts of the question they have answered in the test booklet.

Another common strategy is to give many formative FRQs for practice in class. The FRQs allow the students to use their analytical skills in a different way. Students can practice drawing a positive externality and also analyze a graph of a positive externality, as well.

Understanding how to read the graph and numbers vertically from the x-axis is helpful. Even if the students were not sure of the relevant intersections, they can look at the two curves and from any given quantity and calculate the difference between the MSB and MPB.

Lastly, emphasizing analytical skills and problem solving over memorization is helpful. In part (e), students seemed tricked by the fact that a price floor was offered as a correction for a positive externality. Many students had properly memorized that a price floor creates a surplus but they did not answer the question. Students did not analyze how a price floor would impact this market failure. The price floor made the situation worse and increased the deadweight loss.

Question #3	**Task:** Analyze and interpret a table	**Topic:** Opportunity Cost and Marginal Analysis
	Max. Points: 5	**Mean Score:** 3.33

What were the responses to this question expected to demonstrate?

This question assessed students' ability to apply the concept of opportunity cost of allocating a fixed amount of study time between two activities. Students were provided with production possibilities data and were asked to differentiate between marginal benefit and the opportunity cost, demonstrate how to calculate opportunity cost applying marginal analysis, understand and recognize increasing opportunity cost, as well as how to allocate resources to maximize the outcome.

In this question, the concept of opportunity cost is tested using two tables showing the time (resource) and expected exam scores (outcome) in two courses: microeconomics and history. The expected score depends on the number of hours spent studying. More time spent studying for one exam causes an increase in the score of this exam at a decreasing rate, and a decrease of time available to study for the other exam causes the score for the other exam to decrease at an increasing rate.

In part (a) students were expected to use the table with the data for the history exam and calculate the marginal benefit (gain) by taking the difference between the original total benefit (the expected score after one hour of studying) and the total benefit after the second hour of studying history. The expected marginal benefit from the second hour spent studying history is 20 (60 points minus 40 points).

In part (b) using data in the table, students were expected to calculate the opportunity cost of the second hour studying history by recognizing it as the loss of the alternative, which is the expected score on the microeconomics exam (6 points; a decrease from 96 to 90). Increasing an exam score (outcome) of one course will cause a decrease of the score on the other exam when the time (resource) is limited.

Part (c) required students to recognize the opportunity cost of studying history increases because the expected score on microeconomics decreases at an increasing rate with each additional hour spent studying history. Students were expected to demonstrate an understanding of increasing opportunity cost which happens when the increase in production of one good causes a decrease in the production of the other good at **an increasing rate**, assuming fixed resources.

Part (d) tested whether students understand that in order to maximize the output (exam scores) they need to allocate the limited resources (time) by looking at the combination that provides the largest total outcome (exam score). Finally, in part (e), students were expected to demonstrate how to allocate an additional hour of study in order to maximize the outcome (exam score). Students needed to use marginal analysis and demonstrate the understanding that the additional resource should be allocated to the activity that brings the largest **marginal benefit.**

How well did the response address the course content related to this question? How well did the responses integrate the skills required on this question?

A majority of students were able to calculate the marginal benefit (gain) from adding an extra unit of a resource (time) – 91.41% – as well as to calculate the opportunity cost of shifting some resources (time) to production (studying) of the alternative (history) – 71.71%. Most of the students were able to recognize that the opportunity cost of studying history is an increasing opportunity cost, however only 32.39% were able to give a correct explanation by stating that when more time is allocated to studying history, the expected score on microeconomics decreases at an increasing rate with each additional hour spent studying history. A large number of responses, 90.54%, were correct in allocating resources (time) to maximize the output (the sum of her test scores). The students also performed well on part (e). Again, a majority of students, 74.73%, recognized

that the extra hour should be spent on studying microeconomics because the marginal benefit is greater than the marginal benefit of spending an extra hour studying history.

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
Part (a) • Unable to calculate the opportunity cost using data provided in a table.	• Opportunity cost represents an alternative given up. (60 points – 40 points = 20 points)
Part (b) • Confusing an opportunity cost of the 2nd hour with 2 hours.	• Nirali's opportunity cost of spending the second hour studying history is 6 points on her Microeconomics exam (96 -90).
Part (c) • Unable to explain an increasing opportunity cost using marginal analysis.	• If Nirali spends a third hour studying for history she loses 8 points on her microeconomics exam. If she spends a fourth hour studying for history, she loses 22 points on her microeconomics exam.
Part (d) • Unable to allocate resources to maximize an outcome.	• She should spend 2 hours to study Microeconomics and 3 hours to study history, because 82+72 = 154 points, which is the highest possible combined score in total if she can only spend 5 hours studying.
Part (e) • Confusing marginal benefit with total benefit while allocating an extra resource	• She will allocate her extra hour to Microeconomics because she can gain 8 more points with an additional hour compared to studying history and gaining 5 more points with an additional hour.

Based on your experience at the AP® Reading with student responses, what advice would you offer to teachers to help them improve the student performance on the exam?

The concept of an opportunity cost is one of the fundamental concepts of economics. It is not a difficult concept and students can easily relate to it in their daily lives; it is the value of the next best alternative or option, and it can be measured in time, satisfaction, money etc. However, in order to correctly apply it to economic problems, teachers need to

spend time practicing how to calculate an opportunity cost using a data table, as well as recognizing an increasing, constant, and decreasing opportunity cost.

Part (c) of the question was the most challenging and it asked about the increasing opportunity cost. It is imperative to emphasize the use of marginal analysis in calculating an opportunity cost. Also, an opportunity cost is not a difference between a sacrifice minus a gain. Marginal benefits should also be used when deciding where to allocate an extra resource in order to maximize the outcome. A common misconception is that we have unlimited resources, so teachers, while teaching/practicing the concept of an opportunity cost, should always emphasize the amount of resource(s) available in the particular problem. A common mistake is confusing an opportunity cost of the second hour with 2 hours; the marginal value versus total value. This difference should be emphasized as well while teaching the concept of opportunity cost.

Many practice questions and examples with data tables should be used to prepare students for the exam. While reviewing for the AP exam, teachers should remind students to put the answer first so it stands out, and support afterwards.