Chief Reader Report on Student Responses:

2024 AP® Microeconomics Set 1

Free-Response Questions

• Number of Students Scored	103,809		
• Number of Readers	147		
• Score Distribution	Exam Score	N	%At
	5	23,816	22.9
	4	24,763	23.9
	3	21,569	20.8
	2	19,936	19.2
	1	13,725	13.2
• Global Mean	3.24		

The following comments on the 2024 free-response questions for AP® Microeconomics were written by the Chief Reader, James Leady, Teaching Professor, University of Notre Dame; Assistant Chief Reader Peter Duffer, Buffalo Grove High School; Exam Leader Lee Ann Fuller, John Carroll Catholic High School; and Question Leaders David Burgin, Science Hill High School Brian Heggood, Stanton College Preparatory School; and Mary Kohelis, Madonna High School. 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, Assert, Calculate, and Explain
Topic: Perfect Competition, Change in Demand, and Elasticity
Max Score: 10
Mean Score: 5.60

What were the responses to this question expected to demonstrate?

The question assessed students' understanding of how a firm in a perfectly competitive market would maximize profit in the long run, how the firm adjusts to the short-run equilibrium given an increase in demand, and the implication of this increase in demand on the number of firms in the market as it adjusts to a new long-run equilibrium. The question also assessed students' understanding of elasticity of demand given a percent change in market price and a percent change in quantity demanded, as well as performing a calculation of cross-price elasticity given a percent change in quantity demanded and percent change in price of a related product.

The question stated that Soja Farm was a typical profit-maximizing firm that produces and sells soybeans in a constant-cost, perfectly competitive market that is in long-run equilibrium and that the market equilibrium price of soybeans was $14.

In part (a) students were asked to draw correctly labeled side-by-side graphs for the soybean market and for Soja Farm. In part (a)(i) students were asked to show on the market graph the equilibrium price of $14 and equilibrium quantity labeled Q_M. This task included showing a downward-sloping demand curve, an upward sloping supply curve, and $14 and Q_M indicated at the intersection of the two curves. Part (a)(ii) asked students to show the firm's profit-maximizing price and quantity labeled P_F and Q_F. These parts of the question assessed students' knowledge of market conditions for perfect competition and their ability to illustrate these concepts using a graph. This task included demonstrating knowledge of a horizontal demand (d) and marginal revenue (MR) curve for the firm where d = MR at the market price, and the firm's profit–maximizing quantity where MR = Marginal Cost (MC). Students were required to show that d = MR is horizontal and extended from the market price of $14 labeled P_F, and that Q_F is the quantity where MR = MC. Part (a)(iii) asked students to draw an average total cost curve consistent with long-run equilibrium labeled ATC. This task required students to draw P_F equal to ATC at Q_F and MC passing through the minimum of the ATC curve.

In part (b) students were asked to explain if Soja Farm is the only firm in the market that chose to increase its price of soybeans to $15 per bushel, would Soja Farm's total revenue increase by $1, remain the same, or decrease to zero. This part assessed the students' knowledge that in a perfectly competitive market, firms are price-takers and if one firm raises its price, all of the firm's consumers would buy from other firms that are selling at the lower market price of $14, and therefore the total revenue for that firm would decrease to $0.

In part (c) the question stated that soybeans are an input of production for tofu and that tofu has increased in popularity. Students were asked to show the effect of the increase in popularity for tofu on the market for soybeans and for Soja Farm. In part (c)(i) students were asked to show the impact in the market. This task included drawing a rightward shift of the market demand curve and labeling the new equilibrium price as P_2 and the new equilibrium quantity as Q_2. In part (c)(ii) students were asked to show the impact of the increase in popularity of tofu on Soja Farm's graph. This task included drawing an upward shift in the firm's MR curve

at P_2 and labeling the new profit-maximizing quantity for Soja Farms as Q^* where MR_2 intersects the MC curve.

In part (d), students were asked to explain that the number of firms in the soybean market will increase in the long run as a result of the increase in popularity of tofu.

In part (e) students were informed that a 25% increase in the market price of quinoa caused a 5% decrease in quantity demanded of quinoa and a 10% increase in the quantity demanded of tofu. In part (e)(i) students were asked to explain using numbers if the demand for quinoa is elastic, inelastic, or unit elastic. This task required students to either explain that the demand is inelastic because the 25% change in price is greater than the 5% change in quantity demanded or calculate the price elasticity of demand (−5%/25% = −0.2) and explain that because the absolute value of the price elasticity of demand is less than one, the demand is inelastic. In part (e)(ii) students were asked to calculate the cross-price elasticity between quinoa and tofu and to show their work. This task required students to calculate cross price elasticity of demand as 0.4 (% change in quantity demanded of tofu/% change in price of quinoa =10%/25%=0.4).

How well did the responses address the course content related to this question? How well did the responses integrate the skill(s) required on this question?

In part (a)(i) 80% of the students correctly drew the market graph with a downward-sloping demand curve, an upward-sloping supply curve, an equilibrium price of $14, and an equilibrium quanity labeled Q_M. In part (a)(ii) 47.5% of the students correctly drew a horizontal demand curve labeled MR at the market price labeled P_F. In part (a)(iii) 69% of the students correctly identified the Soja Farm's profit-maximizing quantity where MR = MC labeled Q_F. In part (a)(iv) 69% of the students correctly showed the ATC curve tangent to the firm's demand curve, where P_F equals min ATC, with MC intersecting the ATC curve at its minimum.

In part (b) 62.5% of the students correctly asserted that the total revenue would decrease to zero and explained that if Soja Farms increased its price to $15, then all consumers would buy soybeans from other sellers who charge the market price of $14.

In part (c)(i) 76% of the students correctly showed a rightward shift of the market demand curve and identified the new equilibrium price labeled P_F and new equilibrium quantity labeled Q_F. In part (c)(ii) 61% of the students correctly showed an upward shift in the firm's MR curve and identified the new profit-maximizing quantity labeled Q^*.

In part (d) 53% of the students asserted that the number of soybean firms in the market will increase and explained that firms will enter the market because of positive economic profits being earned.

In part (e)(i) 54% of the students correctly asserted that the demand for quinoa is inelastic and explained using numbers. In part (e)(ii) 42% of the students correctly calculated the cross-price elasticity between quinoa and tofu and showed their work.

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)(i) • Labeling firm information in the market graph. • Drawing Supply or Demand curves as dashed lines. • Using hash marks on the axis instead of dotted lines to indicate equilibrium price and quantity.	• Drawing a correctly labeled market graph with downward-sloping D as a solid line, upward-sloping S as a solid line, with dotted lines extending from the D & S intersection to the price and quantity axes, indicating the equilibrium price and quantity labeled $14 and Q_M respectively.
Part (a)(ii) • Not labeling the firm's d=MR curve. • Labeling the firm's horizontal demand and MR curve as MRDARP. • Not showing a clear connection between market price and the firm's demand curve (perfectly elastic at market price). • Drawing a firm graph with market power. • Missing a MR or MC label in the firm graph.	• Correctly drawing and labeling a horizontal d=MR curve extended from the market price and labeled P_F. • Curve labels should all be distinct (MR=d=AR, not MRDARP). Price is a variable, so the P label should be on the vertical axis, not on a curve. • A dotted line connecting the market price P_M on the market graph to the firm's price P_F on the firm graph. • Correctly drawing a perfectly competitive firm with a horizontal demand curve = MR at P_F. • Correctly drawing the MC curve upward sloping. • Identifying Q_F where MR = MC.
Part (a)(iii) • Not drawing MC intersecting ATC at ATC minimum. • Drawing ATC with multiple minimums.	• Correctly drawing an ATC curve that intersects MC at ATC minimum. • Correctly drawing a U-Shaped short-run ATC curve that reaches a minimum at a single point.

Part (b)	
• Stating that "some" of the customers would choose other firms.	• Correctly explaining that if Soja Farms increases its price to $15, "all" consumers would buy soybeans from other sellers.

Part (c)(i)	
• Shifting the market supply curve instead of the market demand curve.	• Correctly graphing the shift in the market demand for soybeans when there is an increase in the popularity of tofu given that soybeans are an input of production for tofu.

Part (c)(ii)	
• Labeling a new firm price as opposed to showing an upward shift in MR.	• Correctly showing an upward shift in MR at the increased market price to indicate the new equilibrium where $MR_2 = MC$.

Part (d)	
• Not explaining that the number of firms increased because of the presence of positive economic profits (instead explaining because of "increased demand," "increased revenue" etc). • Explaining that firms enter because of profits but then exit because of losses.	• Correctly explaining that the presence of positive economic profits causes firms to want to enter the market, resulting in an increase in the number of firms. • Correctly explaining that the presence of positive economic profits incentivizes firms to enter the market in the long run. Although this process stops when profits are no longer being earned, firms do not exit the market because of positive economic profits.

Part (e)(i)	
• Stating that the demand is inelastic because the elasticity coefficient of –0.2 is negative.	• Correctly identifying that because the absolute value of –0.2 is less than 1, the demand for soybeans is inelastic.

Part (e)(ii)	
• Calculating more than one value for the cross-price elasticity between tofu and soybeans.	• Correctly calculating the cross-price elasticity between quinoa and tofu and as the % change in the quantity demanded of tofu/% change in price of quinoa = 10%/25% = 0.4.

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

The perfect competition model and its accompanying graphs are important for students to understand, as many firms operate in highly competitive markets. Students were relatively successful at drawing a market supply and demand curve and showing a demand shift in that market graph. Students were also relatively successful at indicating the profit-maximizing quantity for a firm where MR=MC as well as indicating $0 economic profits for the firm at long-run equilibrium.

Students who failed to earn the point in part (a)(ii) often did not label the firm's demand curve MR or did not make a connection between the MR curve and the market price and label that curve P_F. An understanding of the perfectly competitive firm being a price taker needs to be demonstrated in the way students draw the side-by-side graphs required in this question.

Students need to make a clear distinction when labeling curves. "MRDARP" is not a correct label. "MR=d=AR=P" is acceptable, but it is preferable to have the P label on the vertical axis.

Students were relatively successful in drawing the firm's ATC curve so that P_F equals ATC at Q_F and MC at ATC minimum in part (a)(iv). However, teachers should emphasize the relationship between MC and ATC. An ATC that has an extended minimum point is actually showing multiple minimum points. The ATC should be drawn with one clear minimum at the intersection of MC.

Students were relatively successful at graphically showing the short-run adjustment to an increase in market demand in part (c). The most common error was shifting the market supply curve to the right rather than shifting the market demand curve to the right. Once again, students needed to show that this change in market price results in an upward shift of the firm's marginal revenue curve at P_2 and a new profit-maximizing quantity for Soja Farms labeled Q* at the intersection of MR_2 and MC. A common error was to show a change in price for Soja Farms, but not a change in MR_2 which resulted in not earning the point for the firm's profit-maximizing quantity where MR_2=MC.

Teachers should provide opportunities for students to practice explaining market adjustment to long-run equilibrium, which includes all of the steps in the movement from the short run to the long run, explaining (i) how a change in the market equilibrium price affects firms' economic profits, (ii) how a change in economic profits causes firms to either enter or exit the market, (iii) how the resulting change in the number of firms affects the market supply curve, and (iv) how the change in market supply affects the market equilibrium price and quantity.

Price elasticity of demand and cross-price elasticity are concepts that are introduced in Topic 2.3 and Topic 2.5 and spiraled throughout the course. In part (b), the characteristics of a perfectly competitive firm as a price-taker with a perfectly elastic demand curve are assessed. In part (d), the students were asked to first explain using numbers whether the demand curve is elastic, inelastic, or unit elastic. Students did relatively well explaining that demand is inelastic either because the 25% change in price is greater than the 5% change in quantity demanded, or that the absolute value of the price elasticity coefficient ($-5\%/25\% = -0.2$) is less than 1. Students that did not earn the point tended to either divide the % change in price by the %

change in quantity (25%/5% = 5) or they stated, "the demand is inelastic because it is negative" (instead of "because the coefficient is less than 1").

When calculating the cross-price elasticity, the most common reason for students not earning the point was to give multiple answers or to calculate the cross-price elasticity (0.4) and then divide that by the price elasticity of the soybeans (0.2).

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

We recommend that teachers utilize the resources available in AP Classroom for the topics and skills covered in this question. The elements of perfect competition reflected in this question are covered in Topics 3.2 and 3.4–3.7. Changes in demand are covered in Topic 2.1. Price elasticity of demand is covered in Topic 2.3, and the cross-price elasticity is addressed in Topic 2.5. AP Daily videos can be assigned to students as warm-ups, lectures, or reviews. Topic Questions and past AP Exam questions from the Question Bank can be assigned to assess student understanding.

Question 2

Task: Identify, Calculate, and Explain
Topic: Externalities and the Effects of Government Intervention
Max Score: 5
Mean Score: 2.22

What were the responses to this question expected to demonstrate?
Students were provided with a graph of the market for Good X. The perfectly competitive market is experiencing a positive externality in consumption. Students were asked to recognize the inefficient market outcome from the graph provided and to evaluate the effects of government policies designed to eliminate the inefficiencies in the market.

In part (a) students were asked to identify the market equilibrium price and quantity. Students were expected to identify market equilibrium as the intersection of the marginal private cost (MPC) curve and the marginal private benefit (MPB) curve at a price of $15 and a quantity of 300 units of Good X.

In part (b) students were asked to calculate the deadweight loss at the market equilibrium. The market equilibrium quantity is not equal to the socially optimal quantity because all social benefits are not internalized. The socially optimal quantity (400 units of Good X) occurs when the marginal social benefit (MSB) is equal to the marginal social cost (MSC). Production of any non-efficient quantity results in deadweight loss. At the market equilibrium quantity, the MSB of $25 is greater than the MSC of $15. Students were expected to calculate the area of the deadweight loss using the formula DWL=½ x ($25−$15) x (400−300) = $500.

In part (c) students were asked to identify a government policy that would eliminate the deadweight loss in the market and to identify the value of the marginal external benefit. In part (c)(i) students were expected to explain the government will grant a per-unit subsidy to consumers to internalize the external benefit present in a market with a positive externality and to increase the incentive and ability of consumers to purchase the socially optimal quantity of Good X (400 units). In part (c)(ii) students were expected to identify the dollar value of the per-unit subsidy as $10, which is the vertical distance between the marginal private benefit curve ($10) and the marginal social benefit curve ($20) at the socially optimal quantity.

In part (d) students were asked to evaluate the effectiveness of a different government intervention in the market. Students were expected to explain a price ceiling established at a price of $10 would not result in the socially optimal quantity of Good X being exchanged in the market because the price ceiling would intersect the marginal social cost/marginal private cost curve at a quantity of 200 units, limiting the quantity exchanged in the market at a number less than the socially optimal quantity of 400 units.

How well did the responses address the course content related to this question? How well did the responses integrate the skill(s) required on this question?

In part (a) 68% of responses earned the point for correctly stating the market equilibrium price is $15 and the market equilibrium quantity is 300 units.

In part (b) 51% of responses earned the point for correctly calculating the deadweight loss as $500.

In part (c)(i) 36% of responses earned the point for correctly explaining a per-unit subsidy to consumers would incentivize consumers to increase consumption to the socially optimal level or that a per-unit subsidy to consumers lowers the price of Good X paid by the consumer increasing the quantity exchanged in the market to the socially optimal level. In part (c)(ii) 48% of responses earned the point for stating the value of the per-unit subsidy is $10.

In part (d) 36% of responses earned the point for stating no, the price ceiling would not achieve the socially optimal quantity of Good X and for explaining that the price ceiling would limit the quantity exchanged in the market to 200 units, which is less than the socially optimal quantity of 400 units.

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) • $20, 400 (Equilibrium at intersection of MSC/MPC=MSB). • $25, 300. • Responses choosing an incorrect intersection or no intersection.	• $15, 300 (Equilibrium at intersection of MPC=MPB).
Part (b) • ½ x ($20–$10) x (400–300). • ($25–$15) x (400–300).	• ½ x ($25–$15) x (400–300). • ½ x ($10) x (100).
Part (c)(i) • Per-unit tax on consumers to decrease consumption of Good X. • Per-unit tax on consumers to eliminate marginal external cost. • Market for Good X is experiencing a negative externality. • Per-unit subsidy to increase production. • Conflating identification of positive externality with explanation of government intervention. • Per-unit subsidies correct positive externalities (without explanation).	• Per-unit subsidy to consumers to internalize external benefits and to increase consumer willingness to consume Good X. • Per-unit subsidy to consumers to increase the quantity exchanged in the market to the socially optimal level. • Per-unit subsidy to consumers to effectively lower the price paid by consumers to encourage buying the socially optimal quantity.
Part (c)(ii) • Impose a tax or subsidy of $5. • Impose a tax or subsidy of $.05.	• Per-unit subsidy of $10.

Part (d)	
- Response focuses on price. - Response compares marginal private benefit and marginal social benefit at price ceiling. - Response compares the quantity supplied at the price ceiling with the market equilibrium price and quantity.	- Price ceiling at $10 limits the quantity exchanged in the market to 200 units, less than the socially optimal quantity of 400 units. - Socially optimal quantity is demanded at price ceiling of $10, but only 200 units are exchanged in the market. - The price ceiling at $10 creates a shortage where the socially optimal quantity is demanded but not supplied.

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

Inefficient market outcomes, externalities, and government intervention in the markets are standard topics in Unit 6 Market Failure and the Role of Government. Most student responses recognized a market inefficiency exists in the provided market graph for Good X by correctly identifying the current market equilibrium as the intersection of the marginal private benefit curve with the marginal social cost/marginal private cost curve. Teachers are encouraged to emphasize with students that market equilibrium quantity and socially optimal quantity are only equal when all social benefits, or social costs, are internalized. Students should practice analyzing models of markets experiencing market failures and compare the similarities and differences with other market models used in AP Microeconomics. Student understanding of the effects of government policies designed to correct market inefficiencies should also be addressed. In particular, responses demonstrated a basic understanding of the general market outcome that would result from a government strategy, but teachers and students have an opportunity to practice articulating how and why these strategies may or may not eliminate externalities. Teachers are encouraged to emphasize the connection between government interventions and the conditions that led to the market failure. Responses may be more effective in demonstrating understanding if students practice supporting responses with numbers from the question when appropriate. Teachers are also encouraged to introduce the concepts of marginal private benefit and marginal private cost when covering demand and supply in Unit 2. This will help to reinforce the connection between these concepts when externalities are covered in Unit 6.

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

We recommend that teachers take advantage of the resources available in AP Classroom for the topics and skills covered in this question. AP Daily Videos on Topics 6.1 Socially Efficient and Inefficient Market Outcomes, 6.2 Externalities, and 6.4 Effects of Government Intervention in Different Market Structures can be assigned to students as warm-ups, lectures, or reviews. Topic Questions can be assigned to assess student understanding. Additionally, teachers may wish to use the teaching strategies and lesson ideas presented in the curriculum module Market Failure and Deadweight Loss available in AP Classroom. The Unit 6 University Faculty Lecture video is another resource to consider employing with your students.

Question 3

Task: Assert, Explain, Identify, Interpret
Topic: Game Theory and Nash Equilibrium
Max Score: 5
Mean Score: 2.70

What were the responses to this question expected to demonstrate?

The question assessed students' ability to analyze the behavior of two firms, Nice Ride and Field Cruiser, using a payoff matrix. The concepts in the question included identifying an action to maximize a firm's profit, identifying, and explaining the conditions for a dominant strategy, determining the existence of a Nash equilibrium, calculating and identifying a combined profit, and interpreting the effect of a change in a market condition on profits at the Nash equilibrium.

The question provided a matrix with two players, who each have two strategies, and the payoffs for each combination of strategies.

In part (a) students were expected to use the payoff matrix to identify the most profitable strategy for a player (Field Cruiser) if the other player (Nice Ride) chose to improve safety. Students were required to state that "Power" is the most profitable strategy for Field Cruiser.

In part (b) students were required to determine if Nice Ride had a dominant strategy and then explain using numbers from the payoff matrix. Students needed to state that Nice Ride does not have a dominant strategy and to explain that if Field Cruiser chooses Reliability, then Nice Ride will choose Comfort, since $30 million is greater than $10 million. However, if Field Cruiser chooses Power, then Nice Ride will choose Safety, since $32 million is greater than $25 million.

In part (c) students were expected to analyze a given set of strategies and to state that the combination of Nice Ride choosing to improve Safety and Field Cruiser choosing to improve Power is a Nash equilibrium. Students then needed to explain that if Field Cruiser unilaterally chooses Reliability, its profits decrease from $35 million to $28 million, and if Nice Ride unilaterally chooses Comfort, its profits will decrease from $32 million to $25 million.

In part (d) students were required to calculate the profits of the merged firms and identify the maximum profit possible. Students needed to state that the new firm's total profit will be $70 million.

In part (e) the students needed to interpret how a change in fuel prices, reducing the profitability of choosing to improve Power by $10 million for Field Cruiser, would affect the profits of each of the firms at the Nash equilibrium. Students needed to identify each firm's profit as Nice Ride's profit will be $30 million and Field Cruiser's profit will be $40 million at the Nash equilibrium.

How well did the responses address the course content related to this question? How well did the responses integrate the skill(s) required on this question?

In part (a) 88% of students earned the point for using the payoff matrix to correctly identify that Field Cruiser's most profitable strategy is to improve Power.

In part (b) 43% of students correctly stated that there is no dominant strategy and used the correct numbers from the payoff matrix to explain that if Field Cruiser chooses Reliability, then Nice Ride will choose Comfort because $30 million is greater than $10 million, but if Field Cruiser chooses Power, then Nice Ride will choose Safety because $32 million is greater than $25 million.

In part (c) only 29% of students stated the given set of strategies is a Nash equilibrium and provided the correct numbers from the payoff matrix to explain that if Field Cruiser chooses Reliability, its profits will decrease from $35 million to $28 million, and if Nice Ride chooses Comfort, its profits will decrease from $32 million to $25 million.

In part (d) 66% of students successfully combined the firm's profits and stated that the new merged firm's total profit will be $70 million.

In part (e) 60% of students identified each firm's profit at the Nash equilibrium following the change in fuel prices as $30 million for Nice Ride'and $40 million for Field Cruiser.

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) • Asserting incorrectly the action that maximizes a firm's profit given the action of the other firm. • Choosing a strategy that has the highest payoff without regard to Nice Ride's choice of Safety (e.g. Reliability $40 million). • Asserting Field Cruiser's dominant strategy is to improve Power. • Asserting Field Cruiser chooses to improve Safety and Power.	• Stating that Field Cruiser's most profitable strategy if Nice Ride chooses to improve Safety is Power.

Part (b)	
• Asserting that Nice Ride has a dominant strategy. • Explaining why there is no dominant strategy without the use of numbers from the payoff matrix. • Identifying there is no dominant strategy but explaining the answer using incomplete comparisons from the payoff matrix (e.g. $30 million, $32 million). • Identifying there is no dominant strategy but explaining the answer using incorrect comparisons ($32 million > $10 million and $30 million > $25 million).	• Stating no, Nice Ride does not have a dominant strategy and explaining that if Field Cruiser chooses Reliability, then Nice Ride will choose Comfort because $30 million is greater than $10 million, but if Field Cruiser chooses Power, then Nice Ride will choose Safety because $32 million is greater than $25 million.
Part (c)	
• Asserting that there is no Nash equilibrium. • Asserting there is a Nash equilibrium but using incorrect comparisons from the payoff matrix (e.g. $35 million > $20 million and $32 million greater than $10 million). • Asserting there is a Nash equilibrium but only using one set of comparisons instead of two from the payoff matrix. • Asserting there is a Nash equilibrium because Nice Ride and Field Cruiser have dominant strategies. • Asserting there is no Nash equilibrium because Nice Ride and Field Cruiser have no dominant strategies. • Asserting there is a Nash equilibrium because the difference between the profits of the two firms is minimized.	• Stating yes, the combination of strategies is a Nash equilibrium and explaining 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.

Part (d)	
• Stating that the new firm's total profit will be "$70 million or $67 million." • Stating that the new firm's total profit will be $67 million which represents the total profit from the Nash equilibrium identified in part (c). • Incorrectly calculating the new firm's total profit. • Stating that the new firm's total profit is the summation of all the values in the payoff matrix. • Calculating total profit for each cell but not identifying the maximized profit.	• Stating that the new firm's total profit will be $70 million.
Part (e)	
• Stating that Nice Ride's profit will be $32 million and Field Cruiser's profit will be $35 million. • Including two sets of profits for both Nice Ride and Field Cruiser. • Incorrectly calculating the new payoff values in the payoff matrix following the change in the price of fuel. • Stating the profit values but not identifying the firms.	• Stating that Nice Ride's profit will be $30 million and Field Cruiser's profit will be $40 million.

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

When introducing the concept of game theory, teachers should emphasize the importance of being able to correctly read a payoff matrix. It is vital that students recognize that there will be players, strategies, and payoffs and that each is important in the decision-making. An effective way to introduce game theory is having the students take on the role of the decision-makers and make their best choice(s) based on the actions of the other player using the payoff matrix. Explaining the decisions then helps the students learn the concepts of dominant strategy and Nash equilibrium. Teachers are encouraged to provide students with multiple opportunities to practice game theory. Accessing questions and assigning questions from previous AP exams, available through AP Central, provides multiple opportunities for students. Using the provided student samples and commentary from previous game theory questions reinforces what is needed to successfully master the content and skills addressed in this question.

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

We recommend that teachers utilize the resources available in AP Classroom for the topics and skills covered in this question. The AP Daily video on Topic 4.5, Oligopoly and Game Theory, can be assigned to students as a warm-up, lecture, or review, and Topic Questions can be assigned to assess student understanding.