



## **Student Performance Q&A:**

### **2016 AP<sup>®</sup> Microeconomics Free-Response Questions**

The following comments on the 2016 free-response questions for AP<sup>®</sup> Microeconomics were written by the Chief Reader, Pamela Schmitt of the United States Naval Academy and Question Leaders Woodrow Hughes, Gregory Wassall, 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 performance 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**

##### *What was the intent of this question?*

This question assessed the students' ability to interpret and apply the supply and demand model to analyze the impact of changes in several economic variables on market equilibrium. Part (a) assessed the students' ability to determine the effect of a price floor in a market; to calculate the price elasticity of supply; and to explain if supply is elastic, inelastic, or unit elastic. Part (b) tested the students' ability to display graphically the market for a good, determining the equilibrium price and quantity, showing the effect on the market price and quantity when the price of an input rises, as well as the change in consumer surplus as a result of the higher input cost. In part (c) students were given information regarding the equilibrium price and quantity of coffee and a negative cross-price elasticity coefficient between coffee and muffins. Students were asked whether the goods are normal, inferior, complementary, or substitute goods. Students were also asked to draw a diagram illustrating the market for coffee when market supply is perfectly elastic, the equilibrium price and quantity of coffee, and the effect of an increase in the price of the complementary good to coffee. Lastly students were asked to show the calculation for the new equilibrium quantity of coffee, given the cross-price elasticity of demand.

##### *How well did students perform on this question?*

The mean score was 5.43, which is approximately 54 percentage of the maximum possible score of 10 points. The standard deviation was a 2.90. Students did especially well answering part b (i) where they were asked to draw and correctly label the equilibrium price and quantity in the muffin market. Nearly 90 percent of the students earned this point. Students also did quite well showing that an increase in the cost of making muffins would shift the supply curve to the left, increasing the equilibrium price and reducing the equilibrium quantity. Nearly three out of four students earned this point. Students also did quite well recognizing that coffee and muffins are complementary goods. Seventy-nine percent of the students earned this point.

### *What were common student errors or omissions?*

The lowest-scoring part of this question was part (c) (iii), which required students to apply the concept of cross-price elasticity of demand. Approximately 36 percent of the students correctly answered this part. Many students applied the formula correctly except for the negative sign on the coefficient. This resulted in students correctly calculating the magnitude of the change in quantity (20), but moving the quantity in the opposite direction, to 120 cups of coffee. This was true even for some who graphically showed a decrease in the equilibrium quantity in part (c) (ii). Another common mistake was that students used the percentage change in price of 10 percent to calculate the new equilibrium quantity. The 10 percent change in price should be multiplied by the cross-price elasticity of -2 to determine a -20 percent change in quantity.

Part (a) (ii) asked students to calculate the elasticity of supply. Approximately 40 percent of the students answered this correctly. Common errors included using the reciprocal of the formula and comparing the change in quantity to the change in price, not the percentage changes. In part (a) (iii) students were asked to explain why supply was elastic or inelastic. Many students correctly answered elastic, but did not earn the point because the explanation either did not refer to the numerical answer in part (a) (ii) or the explanation did not discuss the percentage changes in quantity supplied and price.

In part (b) (iii) common errors were incorrectly shading the change in consumer surplus or shading only the new consumer surplus. Approximately 55 percent of the students earned this point. Slightly more than half, 57.2 percent, of the students also correctly answered part (a) (i). Most students correctly answered surplus, but did not earn the point because the explanation was inadequate. A common, though incorrect, statement was that the surplus resulted because supply was greater than demand. A surplus occurs when the **“quantity supplied”** is greater than the **“quantity demanded”** at a given price. Students often omitted the quantity supplied/quantity demanded terminology, causing them to lose the point.

Part (c) (ii) was answered correctly by about 60 percent of the students. Common mistakes were that the supply curve was drawn either as an upward sloping or downward sloping curve, demand was upward sloping, or the labels on the supply and demand curves were reversed. Another common error was that the new equilibrium quantity was not labeled as such following the shift in demand.

### *Based on your experience of student responses at the AP<sup>®</sup> Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?*

In part (a) of this question, the student is given information regarding the market for bananas and is asked if a price floor of \$1.20 will result in a surplus, shortage or neither and to explain. On first appearance, this seems to be straight-forward, but only 57 percent of the students answered this question correctly. The biggest issue was the explanation for the surplus. Many students said a surplus resulted because supply was greater than demand. While it is common to define a surplus using this terminology, in the technical language of economics a surplus occurs when the “quantity supplied” is greater than the “quantity demanded” at a given price. Teachers of economics need to emphasize to their students the technical language of the field, and this distinction between supply and quantity supplied and between demand and quantity demanded is important.

The two lowest scored points both relate to elasticity formulas and applications of the formulas. Part (a) (ii), answered correctly by 40 percent of the students, asks students to calculate the price elasticity of supply and show their work. To earn this point, students needed to use a formula for elasticity and substitute the correct numbers into the formula. One of the more common errors on this question was that students used the reciprocal of the formula. Teachers need to emphasize that a change in quantity results from a change in price. This means the percentage change in quantity is in the numerator of the formula and the percentage change in price is in the denominator.

Another common error was calculating the change in quantity divided by the change in price, omitting the percentage aspect of the formula. Part (c) (iii), answered correctly by 36 percent of the students, asks students to apply a negative cross-price elasticity of demand. Many students made the calculation correctly in absolute value terms, but did not recognize the importance or the economic significance of the negative sign. Unlike the elasticity of demand which generally ignores the negative sign, a negative sign on the cross-price elasticity has a very important meaning. This point should be emphasized to students.

Another point of emphasis regarding part (c) (iii) is for students to recognize the connection between the elasticity coefficient, the shift of the demand curve in the graph, and the calculation of the new equilibrium quantity. A number of students correctly answered that the goods were complements in part (c) (i) and correctly shifted the demand curve to the left in the graph of part (c) (ii), but lost this last point because they did not account for the negative sign. The leftward shift of the demand curve in (c) (ii) should be an indication that the answer in part (c) (iii) must be less than the original equilibrium quantity of 100, yet many students responded by stating that the equilibrium quantity had increased. There were also a number of students who incorrectly answered part (c) (i) by describing the goods as substitutes, but then correctly calculated the new equilibrium of 80 for part c (iii). Here again the economic connection between these two answers should indicate that something is amiss. Teachers should help students to see and make these types of connections of economic concepts.

One common error seen in various parts of this question, as well as other questions, deals with drawing and labeling graphs. Related to this idea is the type of graph to draw. The question stated that each market was perfectly competitive. Students were asked to draw a graph representing the market for each good. In some cases, students would draw a graph of the perfectly competitive firm, but not the market, thus losing points. Emphasizing the difference between the perfectly competitive market and perfectly competitive firm would reduce these errors. Further, students continue to lose points because they have failed to label the graphs properly. Some points are lost because the axes are not labeled or because a supply or demand curve is not labeled. Some points are lost because students fail to show the direction that a curve moves or that a curve has moved at all. Other points are lost because students fail to trace or connect equilibrium points to the appropriate axis. Using a dashed or dotted line from the equilibrium shown in the graph to the axis clearly indicates the price or quantity at the equilibrium. Students need to practice drawing, labeling, and connecting points to the correct axis until this becomes second nature.

## **Question 2**

### *What was the intent of this question?*

This question assessed the students' ability to interpret and apply several economic concepts of consumer behavior, which includes the utility-maximization principle, marginal vs. total benefit, and consumer surplus. Students were presented with a table of hypothetical data on total benefits that Martha received for consuming up to five units of each of two goods, X and Y. Part (a) required students to calculate the marginal benefit from consuming a fifth unit of good X. Part (b) required students to calculate the consumer surplus from consuming five units of good X. Part (c) presented a possible consumption choice and required students to explain, using marginal analysis, why this choice was not optimal. Part (d) required students to determine Martha's optimal combination of X and Y, given her budget. Part (e) required students to determine how three separate changes in income and prices would affect her consumption of good Y.

### *How well did students perform on this question?*

The mean score was 4.63, which was 66 percent of the maximum possible score of 7 points. The standard deviation was 1.71. Students performed well identifying the marginal benefit from consuming an additional unit of a good. They also were generally able to correctly identify the optimal combination of X and Y that

Martha should choose. Last, they were able to identify the effects of changes in prices and income on the amount consumed of one of the goods.

### ***What were common student errors or omissions?***

The lowest-scoring part of this question was (c), which asked students to explain, using marginal analysis, why consuming 4 units of X and 2 units of Y is not optimal. To answer this part correctly, students had to explain that the marginal benefit per dollar spent on good X was less than that spent on good Y; thus Martha could maximize her total benefit by consuming more Y and less X. Alternatively, students could state that the ratios of marginal benefit to price were not equal for goods X and Y, but had to show the correct numerical values of these ratios. Common errors included comparing marginal benefits only, and comparing total benefits and/or total outlays rather than marginal benefit per dollar.

The second lowest-scoring part was (b). The most common mistake in (b) was failing to subtract price from marginal benefit at each quantity when calculating consumer surplus. Some students mistakenly stated that consumer surplus was 0 because Martha spent her entire budget, or that consumer surplus was calculated as price multiplied by quantity. Others tried to find consumer surplus by drawing the demand curve implied by the numbers in the table, which invariably led to an incorrect answer.

### ***Based on your experience of student responses at the AP<sup>®</sup> Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?***

Students performed worst in those parts of the question that required them to perform calculations to show that they had mastered the relevant consumer theory. Most students seemed to grasp the concept of consumer optimization, but many were uncertain how to apply it using numbers. Some, who had apparently learned optimization using terms such as marginal and total utility, had difficulty applying it when asked to show benefits in dollars. In addition, although most students seemed familiar with consumer surplus, and could probably identify it if shown a market diagram, many had difficulty calculating it from consumption data.

After discussing the relevant consumer theory and the logic underlying it, teachers should help students master these concepts by using numerical examples and exercises as a means to reinforce what they have just learned. Also, students should be trained to perform such calculations using either utility or monetary units as measures of benefits.

## **Question 3**

### ***What was the intent of this question?***

This question assessed students' ability to analyze a firm in a monopolistically competitive market in long-run equilibrium, as well as the concept of economies and diseconomies of scale. Although students were not asked to identify in which market the firm operates, recognizing that it was a monopolistically competitive market was necessary for drawing the correct graph of a monopolistically competitive firm in part (a). Students were asked to draw a correctly labeled graph showing a demand curve, marginal revenue curve, marginal cost curve, and a long-run average total cost curve, as well as the profit-maximizing output and price. Items required in part (a) tested for understanding: 1) that the typical monopolistically competitive firm has a downward sloping demand curve with the marginal revenue curve below the demand curve; 2) that the long-run average total cost curve is tangent to the demand curve at the profit-maximizing quantity in long-run equilibrium; and 3) how the typical monopolistically competitive firm determines its profit-maximizing output and price. In part (b) students used the graph they drew in part (a) to identify the output at which total revenue was maximized. In part (c) students were asked if firms in that market experience economies of scale, diseconomies of scale, or neither in long-run equilibrium and then explain their answer. Part (c) tested whether students understand what happens to the firm's average total costs in the long run.

### ***How well did students perform on this question?***

The mean score was 2.8, which is approximately 47 percent of the maximum possible score of 6 points. The standard deviation was 1.72. Students performed well on graphing the downward sloping demand curve with marginal revenue curve below the demand curve, as well as graphing the firm's profit-maximizing output and its price.

### ***What were common student errors or omissions?***

Incorrectly answering part (c) was by far the most common mistake on this question. The question asked students to identify and explain whether firms in this market experience economies of scale, diseconomies of scale, or neither in long-run equilibrium. About one-tenth of the students correctly stated that firms experience economies of scale in long-run equilibrium because long-run average total cost is decreasing at the profit-maximizing level of output. The rest of the students either stated that the firms experienced diseconomies of scale, neither, or correctly responded that firms operated in economies of scale but gave wrong explanations.

Another common error was in part (b) which asked students to label the output at which total revenue is maximized. About one-fourth of the students correctly showed the output where the marginal revenue equals zero. Many students incorrectly showed that output at the intersection point of marginal cost curve and the demand curve. A third common error was in part (a) which asked students to show a long-run average total cost curve. Many students failed to show that the long-run average total cost curve in a monopolistically competitive market should be tangent to the demand curve at the profit-maximizing output. Also, they did not follow instructions to label long-run average total cost curve (LRATC). Instead, they labeled it as average total cost (ATC).

### ***Based on your experience of student responses at the AP<sup>®</sup> Reading, what message would you like to send to teachers that might help them to improve the performance of their students on the exam?***

Most of the points in this question were linked to a graph of a typical firm in a monopolistically competitive market. Teachers need to ensure that students practice drawing graphs of firms in different markets and proper placement of curves, as well as carefully following instructions in regards to labeling; many students lost points for incorrectly drawing the demand curve as a horizontal line. Teachers should keep reminding students to add lines from the intersecting points to the price and quantity axes. Equilibrium price and quantity should be clearly labeled on the axes and show a clear connection between the axes and points on the graph.

Part (a) asked students to draw a firm's demand curve, marginal revenue curve, marginal cost curve, and long-run average total cost curve. Although most students correctly drew the demand curve, marginal revenue curve, and marginal cost curve, many incorrectly placed the long-run average total cost curve. Teachers should emphasize that when a firm is in a long-run equilibrium, the LRATC is tangent to the demand curve at the profit maximizing output. Teachers should continue to emphasize that the marginal cost curve must intersect the average total cost curve at the lowest point of the ATC. One way that may make it easier to do this is to draw the marginal cost curve first, then fit the average total cost curve around the marginal cost curve.

Part (b) asked students to label the output at which total revenue was maximized. Many students incorrectly showed that output at the intersection of the marginal cost curve and the demand curve. It should be emphasized to students that total revenue is maximized when marginal revenue equals zero. Teachers need to ensure that students are able to find that output on the graph at a point where a downward sloping marginal revenue curve intersects the X-axis.

The last part of the question, part (c), asked students to identify if firms in this market experience economies of scale, diseconomies of scale or neither in long-run equilibrium, and asked for an explanation. In general, students are taught about economies and diseconomies of scale; however, it needs to be emphasized that in the long run, firms in monopolistic competition experience economies of scale because their profit-maximizing output is produced where average total costs decrease; quantity is to the left of the minimum point of the long-run average total cost curve.