

# 2023 MCAS Sample Student Work and Scoring Guide

## Grade 10 Mathematics

### Question 27: Constructed-Response

**Reporting Category:** Statistics and Probability

**Standards:** [GEO.S-CP.A.4](#) - Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

[MII.S-CP.A.4](#) - Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

**Item Description:** Complete a two-way frequency table of data, use the data in the table to compute conditional probabilities, and determine whether the variables of interest are independent.

**Calculator:** Allowed

[View item in MCAS Digital Item Library](#)

### Scoring Guide

Select a score point in the table below to view the sample student response.

Score*	Description
<a href="#">4A</a>	The student response demonstrates an exemplary understanding of the Statistics and Probability concepts involved in constructing and interpreting two-way frequency tables of data, and using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. The student completes a two-way table of data, uses the table to calculate a joint and a conditional probability, and determines whether the events represented by the data in the table are independent.
<a href="#">4B</a>	
<a href="#">3</a>	The student response demonstrates a good understanding of the Statistics and Probability concepts involved in constructing and interpreting two-way frequency tables of data, and using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result, the response merits 3 points.
<a href="#">2</a>	The student response demonstrates a fair understanding of the Statistics and Probability concepts involved in constructing and interpreting two-way frequency tables of data, and using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
<a href="#">1</a>	The student response demonstrates a minimal understanding of the Statistics and Probability concepts involved in constructing and interpreting two-way frequency tables of data, and using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.
<a href="#">0</a>	The student response contains insufficient evidence of an understanding of the Statistics and Probability concepts involved in constructing and interpreting two-way frequency tables of data, and using the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. As a result, the response does not merit any points.

\*Letters are used to distinguish between sample student responses that earned the same score (e.g., 4A and 4B).

**Score Point 4A**

This question has four parts.

A marketing researcher surveyed 1,000 shoppers about whether they had watched a television commercial about a company's shampoo and whether they had ever bought the shampoo. This table shows some of the results of the survey.

**Marketing Research**

	Bought Shampoo	Did Not Buy Shampoo	Totals
Watched Commercial	300		750
Did Not Watch Commercial	50	200	250
Totals	350	650	1,000

**Part A**

How many of the shoppers watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

450 people watched the commercial and didn't buy the shampoo. This can be found by taking the total people who watched the commercial and subtracting the number of people who bought shampoo and watched the commercial from that.

$$750 - 300 = 450$$

**Part B**

Based on the survey data, what is the probability that a randomly selected shopper watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$P(\text{watched commercial AND no shampoo}) =$

$\frac{\text{\#people watched commercial and no shampoo}}{\text{total people}} =$

$$\frac{450}{1000} = 0.45$$

**Part C**

Based on the survey data, what is the probability that a shopper bought the shampoo, given that the shopper watched the commercial? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

P (shampoo / commercial)

$$\frac{P(\text{shampoo and commercial})}{P(\text{commercial})}$$

$$\frac{300}{750} = 0.4$$

**Part D**

Based on the survey data, are watching the commercial and buying the shampoo independent events? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

To check for independence, the following must be true:

$$P(\text{shampoo/commercial}) = P(\text{shampoo})$$

$$P(\text{shampoo/commercial})=0.4$$

$$P(\text{shampoo})= \frac{350}{1000} = 0.35$$

The two probabilities are not equal, because watching the commercial increases the probability of buying the shampoo. So, watching the commercial and buying the shampoo are not independent events.

## Score Point 4B

This question has four parts.

A marketing researcher surveyed 1,000 shoppers about whether they had watched a television commercial about a company's shampoo and whether they had ever bought the shampoo. This table shows some of the results of the survey.

Marketing Research

	Bought Shampoo	Did Not Buy Shampoo	Totals
Watched Commercial	300		750
Did Not Watch Commercial	50	200	250
Totals	350	650	1,000

## Part A

How many of the shoppers watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

450 people watched the commercial and did not buy the shampoo as a total of 750 people watched the commercial and 300 bought it, so  
 $750 - 300 = 450$

## Part B

Based on the survey data, what is the probability that a randomly selected shopper watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

45% as 450 people fit into having not bought the shampoo after watching the commercial and there were 1000 people surveyed.  $\frac{450}{1000} = .45 = 45\%$

## Part C

Based on the survey data, what is the probability that a shopper bought the shampoo, given that the shopper watched the commercial? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

40% as only 750 people saw the commercial and out of that group 300 bought the shampoo.  
 $\frac{300}{750} = .4 = 40\%$

**Part D**

Based on the survey data, are watching the commercial and buying the shampoo independent events? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

No they are not as people who saw the commercial are more likely to buy the shampoo as the survey shows that more people bought the shampoo, 300 out of 750, than if they had not seen the commercial it drops to 50 out of 250 which when put in relation to 750, it would be 150 which is 50% less than 300.

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## Score Point 3

This question has four parts.

A marketing researcher surveyed 1,000 shoppers about whether they had watched a television commercial about a company's shampoo and whether they had ever bought the shampoo. This table shows some of the results of the survey.

Marketing Research

	Bought Shampoo	Did Not Buy Shampoo	Totals
Watched Commercial	300		750
Did Not Watch Commercial	50	200	250
Totals	350	650	1,000

## Part A

How many of the shoppers watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$$750 - 300 = 450$$

## Part B

Based on the survey data, what is the probability that a randomly selected shopper watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$$450 / 1000$$

$$45\%$$

## Part C

Based on the survey data, what is the probability that a shopper bought the shampoo, given that the shopper watched the commercial? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$$300 / 750$$

$$40\%$$

## Part D

Based on the survey data, are watching the commercial and buying the shampoo independent events? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

Yes, not everyone who watched the commercial bought the shampoo.

## Score Point 2

This question has four parts.

A marketing researcher surveyed 1,000 shoppers about whether they had watched a television commercial about a company's shampoo and whether they had ever bought the shampoo. This table shows some of the results of the survey.

Marketing Research

	Bought Shampoo	Did Not Buy Shampoo	Totals
Watched Commercial	300		750
Did Not Watch Commercial	50	200	250
Totals	350	650	1,000

## Part A

How many of the shoppers watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

450 shoppers watched the commercial but didn't buy the shampoo.  
 $750 - 300 = 450$

## Part B

Based on the survey data, what is the probability that a randomly selected shopper watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

45% chance that a random shopper watched the commercial but didn't buy the shampoo.  $\frac{450}{1,000} = 0.45 = 45\%$

## Part C

Based on the survey data, what is the probability that a shopper bought the shampoo, given that the shopper watched the commercial? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

30% chance that a shopper bought the shampoo and watched the commercial.  $\frac{300}{1,000} = 0.3 = 30\%$

**Part D**

Based on the survey data, are watching the commercial and buying the shampoo independent events? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

Yes because even though when people watch the commercial there are still more people who don't buy the shampoo. 65% don't buy the shampoo while 35% do.

$$\frac{650}{1000} = 65\%$$

$$\frac{350}{1000} = 35\%$$

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## Score Point 1

This question has four parts.

A marketing researcher surveyed 1,000 shoppers about whether they had watched a television commercial about a company's shampoo and whether they had ever bought the shampoo. This table shows some of the results of the survey.

Marketing Research

	Bought Shampoo	Did Not Buy Shampoo	Totals
Watched Commercial	300		750
Did Not Watch Commercial	50	200	250
Totals	350	650	1,000

## Part A

How many of the shoppers watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$750 - 300 = 450$  people watched the commercial but did not buy the shampoo

## Part B

Based on the survey data, what is the probability that a randomly selected shopper watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

about a 65 to 35, 65 % they wont buy it 35% they will

## Part C

Based on the survey data, what is the probability that a shopper bought the shampoo, given that the shopper watched the commercial? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$$\frac{750}{300} = 2.5$$

## Part D

Based on the survey data, are watching the commercial and buying the shampoo independent events? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

$\frac{50}{250}$  bought it but did not watch, and then 450 watched but did not buy ,this adds up to  $\frac{500}{1000}$  in total so  $\frac{1}{2}$  the time they independent events.

## Score Point 0

This question has four parts.

A marketing researcher surveyed 1,000 shoppers about whether they had watched a television commercial about a company's shampoo and whether they had ever bought the shampoo. This table shows some of the results of the survey.

Marketing Research

	Bought Shampoo	Did Not Buy Shampoo	Totals
Watched Commercial	300		750
Did Not Watch Commercial	50	200	250
Totals	350	650	1,000

## Part A

How many of the shoppers watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

My answer is 500 because there were 300 people who watched the commercial and 200 people who didn't buy the shampoo, to get my answer i added,  $300 + 200 = 500$

## Part B

Based on the survey data, what is the probability that a randomly selected shopper watched the commercial but did **not** buy the shampoo? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

The probability would be very high because 350 out of 500 is a lot lower. The 350 is the amount of people who watched the commercial and did buy the shampoo.

## Part C

Based on the survey data, what is the probability that a shopper bought the shampoo, given that the shopper watched the commercial? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

There is a very low probability because the amount of people who bought the shampoo compared to the ones who didn't is lower.

## Part D

Based on the survey data, are watching the commercial and buying the shampoo independent events? Show or explain how you got your answer.

Enter your answer and your work or explanation in the space provided.

Yes they are independent events because it is based on that persons opinion on the shampoo, if the person didn't agree or like the commercial they wouldn't buy the shampoo, and others would if they did like it or agree.