

2023 MCAS Sample Student Work and Scoring Guide

Grade 10 Mathematics

Question 13: Constructed-Response

Reporting Category: Algebra and Functions

Standards: [AI.F-IF.B.4](#) - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

[MI.F-IF.B.4](#) - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

[MII.F-IF.B.4](#) - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

Item Description: Given a quadratic function that represents a context, evaluate the function for a specific input value, analyze how the function changes over different input values, and determine the maximum value of the function.

Calculator: Not allowed

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Scoring Guide

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

Score*	Description
4A	The student response demonstrates an exemplary understanding of the Functions concepts involved in interpreting key features of a function that models a relationship between two quantities. The student evaluates a quadratic function, assesses a change in its value, and determines its maximum value.
4B	
3	The student response demonstrates a good understanding of the Functions concepts involved in interpreting key features of a function that models a relationship between two quantities. 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.
2	The student response demonstrates a fair understanding of the Functions concepts involved in interpreting key features of a function that models a relationship between two quantities. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
1	The student response demonstrates a minimal understanding of the Functions concepts involved in interpreting key features of a function that models a relationship between two quantities.
0	The student response contains insufficient evidence of an understanding of the Functions concepts involved in interpreting key features of a function that models a relationship between two quantities. 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.

The price of a ticket at a theater is x dollars. The manager of the theater uses the function $t(x) = 100x - 4x^2$ to predict $t(x)$, the total ticket sales in dollars.

Part A

What are the predicted total sales, in dollars, when the price of a ticket is 10 dollars? Show or explain how you got your answer.

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

The predicted total sales when the price of a ticket is \$10 are \$600. I figured this out simply by plugging the value of 10 in for x , to get the equation $t(x) = 100(10) - 4(10^2)$. From there, I simplified to get $t(x) = 1000 - 400$, which is 600.

Part B

What is the increase or decrease in the predicted total sales, in dollars, when the price of a ticket is increased from 10 dollars to 12 dollars? Show or explain how you got your answer.

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

The increase in predicted total sales when the price of a ticket is increased from \$10 to \$12 is \$24. I got my answer by plugging 12 into the equation for x , in which I got \$624, and then subtracting \$600 from that value to get the difference, which is \$24.

Part C

What is the ticket price, in dollars, that results in the maximum value for the predicted total sales? Show or explain how you got your answer.

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

If we take the original equation and factor it to get the two x intercepts, we end up with x intercepts of 0 and 25. Because this equation is quadratic, we know that the two x intercepts divided by two will give us the x value of the vertex, which in this context would be the maximum ticket price/sales. The sum of 0 and 25 divided by two is 12.5. Therefore, the ticket price that results in maximum value for the predicted total sales would be \$12.50.

Part D

What is the maximum value, in dollars, for the predicted total sales? Show or explain how you got your answer.

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

The maximum value, in dollars, for the predicted total sales is \$625. I got this answer by plugging the ideal ticket price of \$12.50 into the original equation and getting out a value of 625.

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Score Point 4B

This question has four parts.

The price of a ticket at a theater is x dollars. The manager of the theater uses the function $t(x) = 100x - 4x^2$ to predict $t(x)$, the total ticket sales in dollars.

Part A

What are the predicted total sales, in dollars, when the price of a ticket is 10 dollars? Show or explain how you got your answer.

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

$$t(10) = 100(10) - 4(10)^2$$

$$t(10) = 1000 - 4(100)$$

$$t(10) = 1000 - 400$$

$$t(10) = 600$$

The predicted total sales, in dollars, when the price of a ticket is 10 dollars is 600 dollars.

Part B

What is the increase or decrease in the predicted total sales, in dollars, when the price of a ticket is increased from 10 dollars to 12 dollars? Show or explain how you got your answer.

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

$$t(12) = 100(12) - 4(12)^2$$

$$t(12) = 1200 - 4(144)$$

$$t(12) = 1200 - 576$$

$$t(12) = 624$$

$$624 - 600 = 24$$

The increase in predicted sales when the price of the ticket is increased to 12 dollars from 10 dollars is 24 dollars.

Part C

What is the ticket price, in dollars, that results in the maximum value for the predicted total sales? Show or explain how you got your answer.

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

$$\frac{-100}{2(-4)} = \frac{-100}{-8} = 12.5 \text{ dollars}$$

The ticket price that results in the maximum value for the predicted sales is 12.50 dollars per ticket.

Part D

What is the maximum value, in dollars, for the predicted total sales? Show or explain how you got your answer.

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

$$t(12.5) = 100(12.5) - 4(12.5)^2$$

$$t(12.5) = 1250 - 4(156.25)$$

$$t(12.5) = 1250 - 625$$

$$t(12.5) = 625$$

The maximum value for the predicted total sales is 625 dollars.

Score Point 3

This question has four parts.

The price of a ticket at a theater is x dollars. The manager of the theater uses the function $t(x) = 100x - 4x^2$ to predict $t(x)$, the total ticket sales in dollars.

Part A

What are the predicted total sales, in dollars, when the price of a ticket is 10 dollars? Show or explain how you got your answer.

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

$$(100 \times 10) - (4 \times 100) = 600$$

$t(x) = \$600$ when tickets are \$10

Part B

What is the increase or decrease in the predicted total sales, in dollars, when the price of a ticket is increased from 10 dollars to 12 dollars? Show or explain how you got your answer.

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

$$(100 \times 12) - (4 \times 144) = \$624$$

Total sales increase by \$24

Part C

What is the ticket price, in dollars, that results in the maximum value for the predicted total sales? Show or explain how you got your answer.

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

Vertex x value represents at what price sales are highest = $-\frac{b}{2a}$

$$-\frac{100}{-8} = \$12.50$$

Sales best at \$12.50 per ticket

Part D

What is the maximum value, in dollars, for the predicted total sales? Show or explain how you got your answer.

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

Plug in 12.50 back into original equation

$$(12.50 \times 10) - (4 \times 12.5^2) = 1250 - 156.25 = \$1093.75$$

Max value = \$1093.75

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Score Point 2

This question has four parts.

The price of a ticket at a theater is x dollars. The manager of the theater uses the function $t(x) = 100x - 4x^2$ to predict $t(x)$, the total ticket sales in dollars.

Part A

What are the predicted total sales, in dollars, when the price of a ticket is 10 dollars? Show or explain how you got your answer.

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

\$600 is the predicted total sales.

$$t(10) = 100(10) - 4(10^2)$$

$$t(10) = 600$$

Part B

What is the increase or decrease in the predicted total sales, in dollars, when the price of a ticket is increased from 10 dollars to 12 dollars? Show or explain how you got your answer.

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

The increase is \$24.

$$t(12) = 100(12) - 4(12^2)$$

$$t(12) = 624$$

$$624 - 600 = 24$$

Part C

What is the ticket price, in dollars, that results in the maximum value for the predicted total sales? Show or explain how you got your answer.

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

\$1

$$t(1) = 100(1) - 4(1^2)$$

$$t(1) = 96$$

Part D

What is the maximum value, in dollars, for the predicted total sales? Show or explain how you got your answer.

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

\$2,500

$$t(25) = 100(25) - 4(25^2)$$

$$t(25) = 0$$

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Score Point 1

This question has four parts.

The price of a ticket at a theater is x dollars. The manager of the theater uses the function $t(x) = 100x - 4x^2$ to predict $t(x)$, the total ticket sales in dollars.

Part A

What are the predicted total sales, in dollars, when the price of a ticket is 10 dollars? Show or explain how you got your answer.

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

600 dollars

$$t(x) = 100 \times 10 - 4 \times 10^2$$

Part B

What is the increase or decrease in the predicted total sales, in dollars, when the price of a ticket is increased from 10 dollars to 12 dollars? Show or explain how you got your answer.

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

394 i did the same as before but with 12

Part C

What is the ticket price, in dollars, that results in the maximum value for the predicted total sales? Show or explain how you got your answer.

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

12

Part D

What is the maximum value, in dollars, for the predicted total sales? Show or explain how you got your answer.

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

100

Score Point 0**This question has four parts.**

The price of a ticket at a theater is x dollars. The manager of the theater uses the function $t(x) = 100x - 4x^2$ to predict $t(x)$, the total ticket sales in dollars.

Part A

What are the predicted total sales, in dollars, when the price of a ticket is 10 dollars? Show or explain how you got your answer.

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

The predicted sale for a ticket of \$10.00 would make \$92.00 I know this by using the given fomural replacing the T with the ten and equealing it to 100 the adding the power of two to the four wich makes eight the subtracted eight from 100 and got 92.

Part B

What is the increase or decrease in the predicted total sales, in dollars, when the price of a ticket is increased from 10 dollars to 12 dollars? Show or explain how you got your answer.

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

there is no decrease or increase in sales they stayed the same I used the same steps as i did before just changing the 10 to a 12.

Part C

What is the ticket price, in dollars, that results in the maximum value for the predicted total sales? Show or explain how you got your answer.

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

The ticket price that can get the maximum vaule is \$10.00 I know this form using both 10 and 12 with the fomurla and getting the same answers for both that showed know diffrence between them.

Part D

What is the maximum value, in dollars, for the predicted total sales? Show or explain how you got your answer.

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

The maximum value in dollars for the predicted total sales is \$92.00 I know this by using the fomural to find the difference between 10 and 12 but there was none.