

Unit 2 Progress Check: FRQ Part A

1. A GRAPHING CALCULATOR IS REQUIRED FOR THIS QUESTION.

You are permitted to use your calculator to solve an equation, find the derivative of a function at a point, or calculate the value of a definite integral. However, you must clearly indicate the setup of your question, namely the equation, function, or integral you are using. If you use other built-in features or programs, you must show the mathematical steps necessary to produce your results. Your work must be expressed in standard mathematical notation rather than calculator syntax.

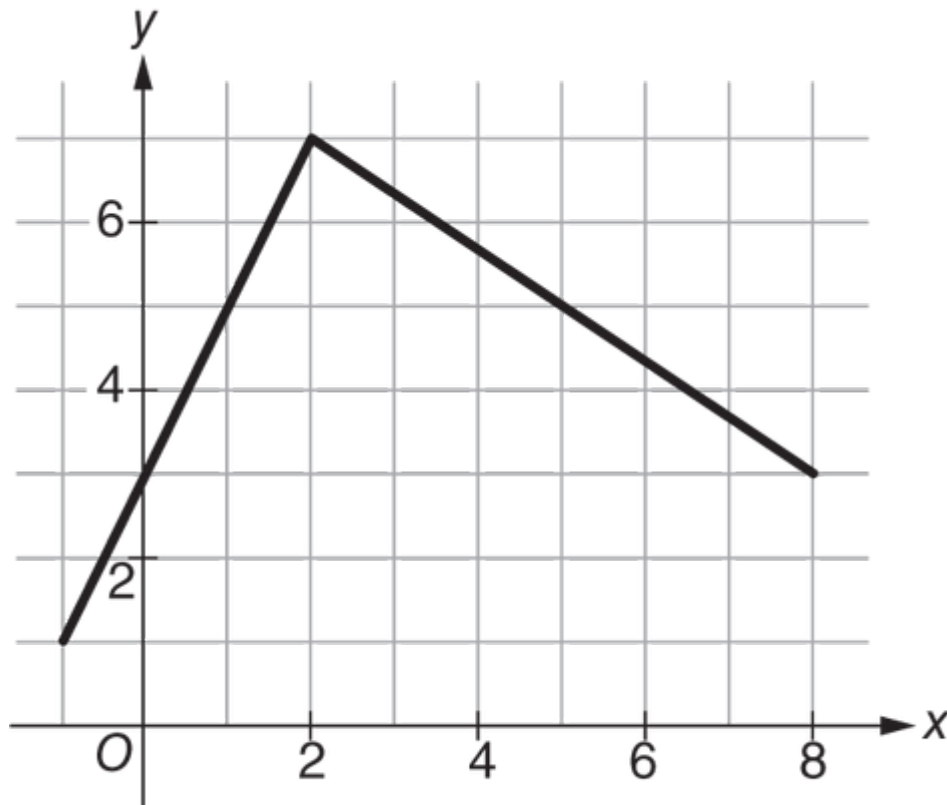
Show all of your work, even though the question may not explicitly remind you to do so. Clearly label any functions, graphs, tables, or other objects that you use. Justifications require that you give mathematical reasons, and that you verify the needed conditions under which relevant theorems, properties, definitions, or tests are applied. Your work will be scored on the correctness and completeness of your methods as well as your answers. Answers without supporting work will usually not receive credit.

Unless otherwise specified, answers (numeric or algebraic) need not be simplified. If your answer is given as a decimal approximation, it should be correct to three places after the decimal point.

Unless otherwise specified, the domain of a function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number.



Unit 2 Progress Check: FRQ Part A



Graph of f

Let f be the continuous function defined on $[-1, 8]$ whose graph, consisting of two line segments, is shown above. Let g and h be the functions defined by $g(x) = \sqrt{x^2 - x + 3}$ and $h(x) = 5e^x - 9 \sin x$.

- (a) The function k is defined by $k(x) = f(x)g(x)$. Find $k'(0)$.



Please respond on separate paper, following directions from your teacher.

- (b) The function m is defined by $m(x) = \frac{f(x)}{2g(x)}$. Find $m'(5)$.



Please respond on separate paper, following directions from your teacher.

- (c) Find the value of x for $-1 < x < 2$ such that $f'(x) = h'(x)$.



Unit 2 Progress Check: FRQ Part A



Please respond on separate paper, following directions from your teacher.

Part A

The third point is earned for a correct product rule expression that substitutes all 4 correct numerical values. The expression does not need to be simplified. The third point can also be earned if a student imports an incorrect value for either $f'(0)$ or $g'(0)$.

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1	2	3 
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The student response accurately includes all three of the criteria below.

- $f'(0)$
- $g'(0)$
- $k'(0)$

Solution:

$$k'(x) = f'(x) \cdot g(x) + f(x) \cdot g'(x)$$

$$f'(0) = 2 \text{ from the graph.}$$

$$g'(0) = -0.288675$$

$$\begin{aligned} k'(0) &= f'(0) \cdot g(0) + f(0) \cdot g'(0) \\ &= 2 \cdot \sqrt{3} + 3 \cdot (-0.288675) = 2.598 \end{aligned}$$

Part B

The third point is earned for a correct quotient rule expression that substitutes all 4 correct numerical values. The expression does not need to be simplified.



Unit 2 Progress Check: FRQ Part A

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0	1	2	3
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The student response accurately includes all three of the criteria below.

- $f'(5)$
- $g'(5)$
- $m'(5)$

Solution:

$$m'(x) = \frac{f'(x) \cdot 2g(x) - f(x) \cdot 2g'(x)}{(2g(x))^2}$$

$$f'(5) = -\frac{2}{3} \text{ from the graph.}$$

$$g'(5) = 0.938315$$

$$\begin{aligned} m'(5) &= \frac{f'(5) \cdot 2g(5) - f(5) \cdot 2g'(5)}{(2g(5))^2} \\ &= \frac{\left(-\frac{2}{3}\right) \cdot 2\sqrt{23} - 5 \cdot 2 \cdot 0.938315}{(2\sqrt{23})^2} = -0.171 \end{aligned}$$

Part C

If $h'(x)$ has a maximum of one sign error with either term, the response is eligible for the second point based on a correct evaluation with the presented $h'(x)$

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.



0	1	2
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Unit 2 Progress Check: FRQ Part A

The student response accurately includes both of the criteria below.

- $h'(x)$
- answer

Solution:

$$f'(x) = 2 \text{ for } -1 < x < 2$$

$$h'(x) = 5e^x - 9 \cos x$$


$$h'(x) = 2 \Rightarrow x = 0.622$$

Part C

If $h'(x)$ has a maximum of one sign error with either term, the response is eligible for the second point based on a correct evaluation with the presented $h'(x)$

Select a point value to view scoring criteria, solutions, and/or examples and to score the response.

0	1	2
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The student response accurately includes both of the criteria below.

- $h'(x)$
- answer

Solution:

$$f'(x) = 2 \text{ for } -1 < x < 2$$

$$h'(x) = 5e^x - 9 \cos x$$

$$h'(x) = 2 \Rightarrow x = 0.622$$