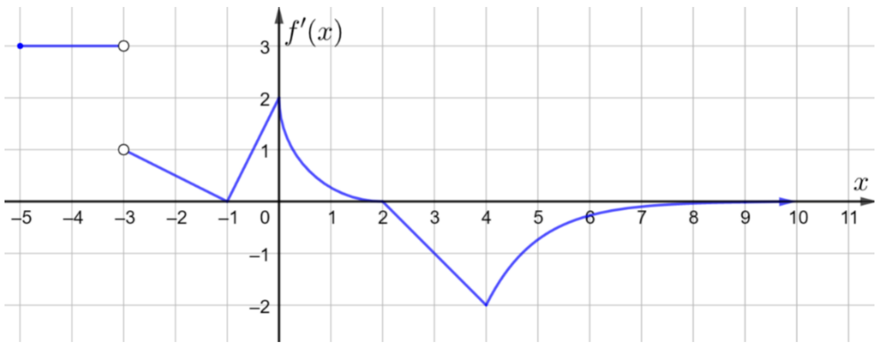
AP CALCULUS BC	YouTube Live Virtual Lessons	Mr. Bryan Passwater Mr. Anthony Record
Topic: All Units	**Free Response Question Stem Types** **Graphical**	**Date:** April 28, 2020

Free Response Questions Stem Types: Graphical

2020 FRQ Practice Problem BC1



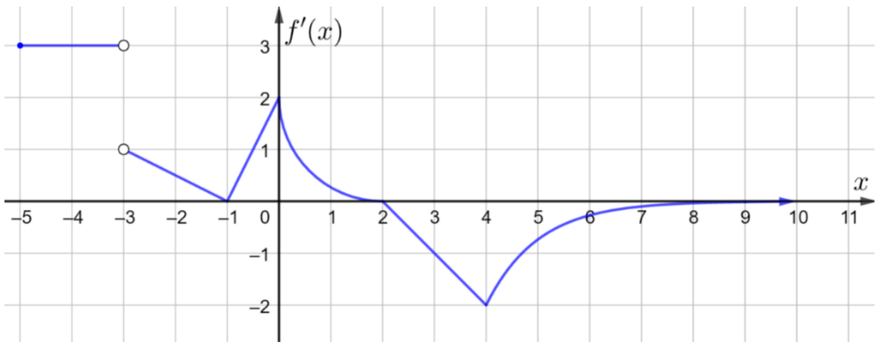
BC1: The graph of f', the derivative of the continuous function f, is given above. For $-5 \leq x < 4$, the graph of f' consists of four linear pieces and a quarter circle centered at $(2,2)$. For $x \geq 4$, $f'(x) = -2e^{4-x}$. It is known that $f(0) = 6$

(**a**) Find $f(4)$.

(**b**) Write, but do not evaluate, an integral expression that gives the arc length of the graph of f from $x = 4$ to $x = 10$.

(**c**) Find $\sum_{n=2}^{\infty} a_n$ where $a_n = f'(n)$.

The problem has been restated.



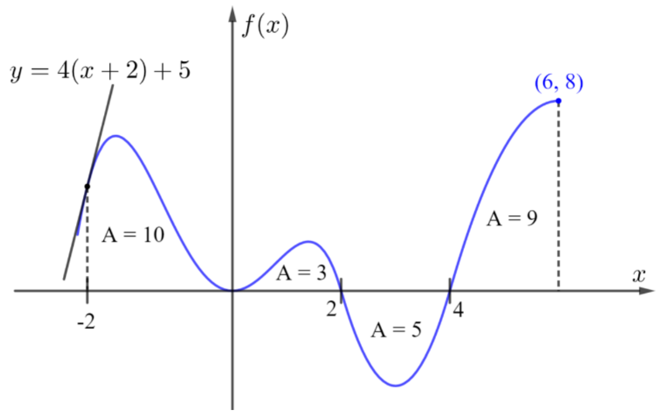
BC1: The graph of f', the derivative of the continuous function f, is given above.
For $-5 \leq x < 4$, the graph of f' consists of four linear pieces and a quarter circle centered at $(2,2)$. For $x \geq 4$, $f'(x) = -2e^{4-x}$. It is known that $f(0) = 6$

For parts (d) and (e), let $g(x) = 3 - \int_{-1}^{x} [2f'(2t) + 1]dt$.

(**d**) Write an expression for $g'(x)$ and $g''(x)$.

(**e**) Does the graph of g have a point of inflection at $x = 2$? Give a reason for your answer.

Free Response Questions Stem Types: Graphical
2020 FRQ Practice Problem BC2



BC2: A portion of the graph of the twice differentiable function f is shown in the figure above. The areas of the regions bounded by the graph of f and the x axis for $[-2, 6]$ are shown above. At $x = -2$, the line tangent to the graph of f is shown along with its equation.

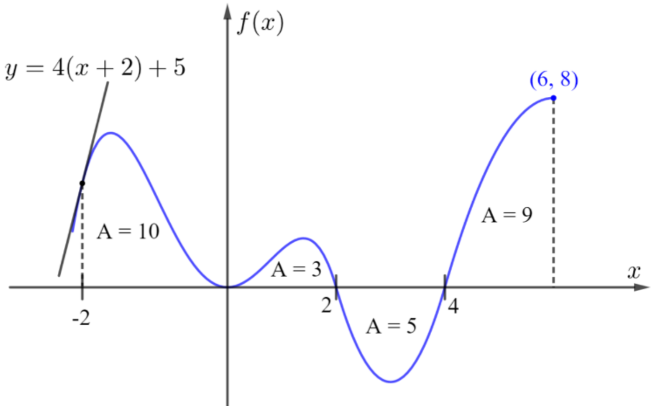
The function H is defined by $H(x) = \int_0^x f(t)dt$.

(**a**) Evaluate $\int_{-1}^{2} f(4 - 2x)dx$.

(**b**) Find $\lim_{x \to 2} \frac{H(3x) - 7}{\sin(\pi x)}$.

(**c**) Find any x value(s) where $H(x)$ has a relative maximum. Give a reason for your answer.

The problem has been restated.



BC2: A portion of the graph of the twice differentiable function f is shown in the figure above. The areas of the regions bounded by the graph of f and the x axis for $[-2, 6]$ are shown above. At $x = -2$, the line tangent to the graph of f is shown along with its equation. The function H is defined by $H(x) = \int_0^x f(t)dt$.

(**d**) Find the second degree Taylor polynomial to $H(x)$ centered at $x = -2$.

(**e**) Consider the curve $y^2 + 2xy - x = H(x)$. Find the slope of the line tangent to the curve at the point $(6,1)$.

For values of x greater than or equal to 6 , the function H can also be modeled by the function:

$$H(x) = 64 - \frac{128}{\sqrt{x-2}}.$$

(**f**) Find $\int_6^\infty f(t)dt$.

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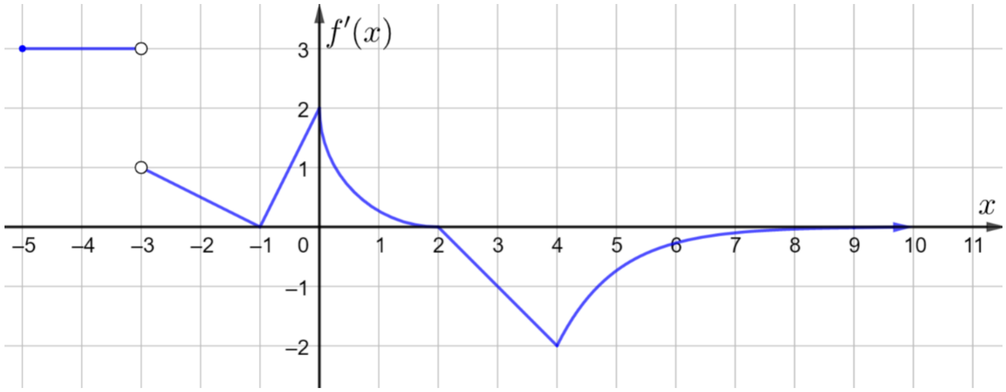
2020 FRQ Practice Problem BC3



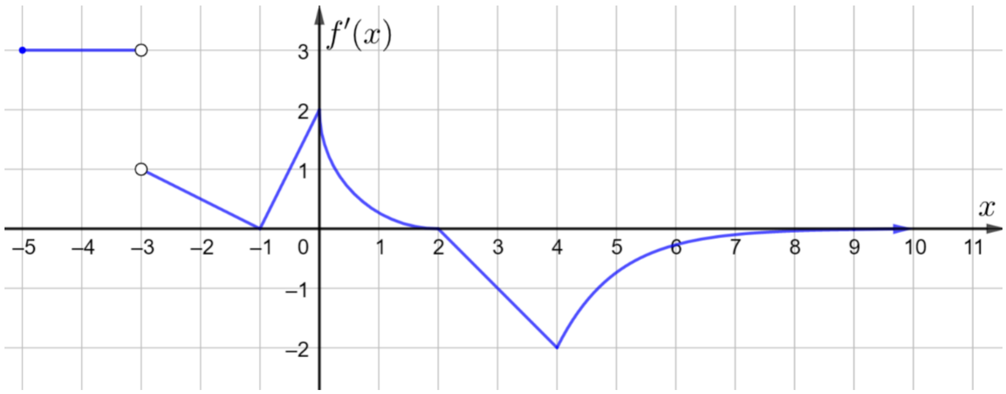
BC3: The graph of f', the derivative of the continuous function f, is given above. For $-5 \leq x < 4$, the graph of f' consists of four linear pieces and a quarter circle centered at $(2,2)$. For $x \geq 4$, $f'(x) = -2e^{4-x}$. It is known that $f(0) = 6$

(**a**) Find any x value(s) where the graph of f has a point of inflection. Explain your reasoning.

(**b**) Find the maximum value of f on the closed interval $[-1, 4]$. Justify your answer.

(**c**) Find $\lim\limits_{x \to \infty} f(x)$.

The problem has been restated.



BC3: The graph of f', the derivative of the continuous function f, is given above.
For $-5 \leq x < 4$, the graph of f' consists of four linear pieces and a quarter circle centered at $(2,2)$. For $x \geq 4$, $f'(x) = -2e^{4-x}$. It is known that $f(0) = 6$

For parts (d) and (e), let $g(x) = 3 - \int_{-1}^{x} [2f'(2t) + 1]dt$.

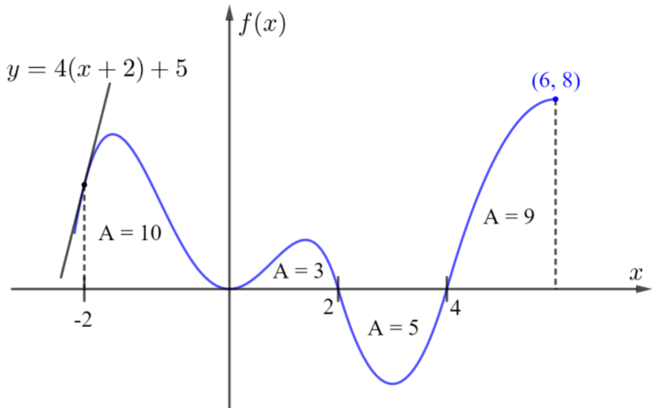
(**d**) Does the graph of g have a local minimum, local maximum, or neither at $x = 2$?

Give a reason for your answer.

(**e**) Find $P_2(x)$, the second degree Taylor polynomial to $g(x)$ centered at $x = -1$.

Free Response Questions Stem Types: Graphical

2020 FRQ Practice Problem BC4



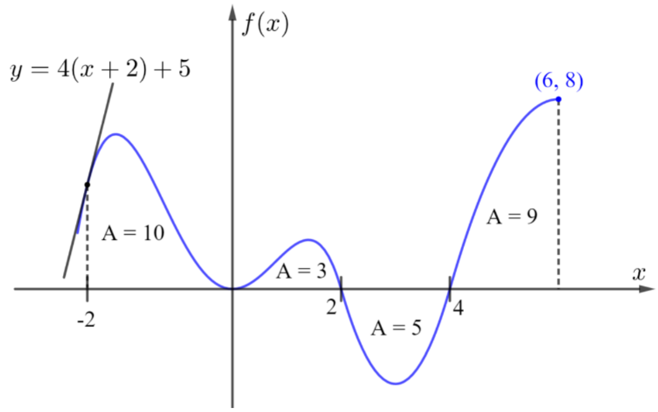
BC4: A portion of the graph of the twice differentiable function f is shown in the figure above. The areas of the regions bounded by the graph of f and the x axis for $[-2, 6]$ are shown above. At $x = -2$, the line tangent to the graph of f is shown along with its equation.

The function H is defined by $H(x) = \int_0^x f(t)dt$.

(**a**) Evaluate $\int_0^4 H(x)f(x)dx$

(**b**) Let $k(x) = H(x)e^{2x}$. Find $k'(6)$.

The problem has been restated.



BC4: A portion of the graph of the twice differentiable function f is shown in the figure above. The areas of the regions bounded by the graph of f and the x axis for $[-2, 6]$ are shown above. At $x = -2$, the line tangent to the graph of f is shown along with its equation.

The function H is defined by $H(x) = \int_0^x f(t)dt$.

For values of x greater than or equal to 6 , the function H can also be modeled by the function:

$$H(x) = 64 - \frac{128}{\sqrt{x-2}}.$$

(**c**) Consider the series $\sum_{n=6}^{\infty} a_n$ where $a_n = H'(x)$. Determine if $\sum_{n=6}^{\infty} a_n$ converges or diverges.

(**d**) Write, but do not evaluate, an expression with one or more integrals in terms of x and $f(x)$ that gives the length of the curve $H(x)$ from $x = 0$ to $x = 10$.