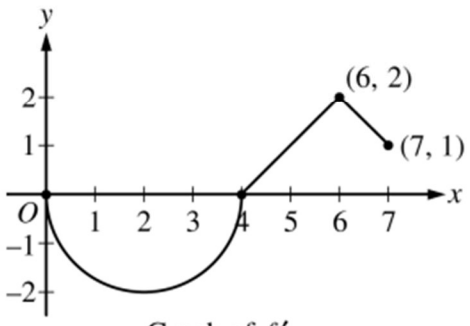
FRQ #12b (NO Calculator) – Using f' graph, f'(x) applications, net change theorem, derivative rules, evaluating integrals with geometry

AP® Calculus BC 2022 Free-Response Questions



Graph of f'

3. Let f be a differentiable function with $f(4) = 3$. On the interval $0 \le x \le 7$, the graph of f', the derivative of f, consists of a semicircle and two line segments, as shown in the figure above.

   (a) Find $f(0)$ and $f(5)$.

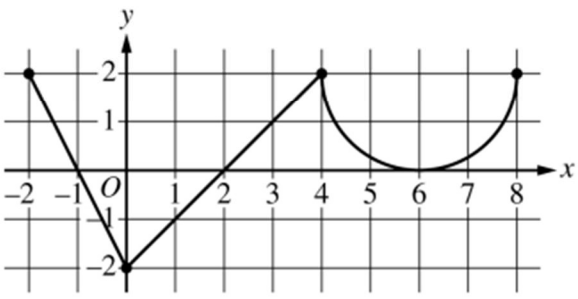
   (b) Find the x-coordinates of all points of inflection of the graph of f for $0 < x < 7$. Justify your answer.

   (c) Let g be the function defined by $g(x) = f(x) - x$. On what intervals, if any, is g decreasing for $0 \le x \le 7$? Show the analysis that leads to your answer.

   (d) For the function g defined in part (c), find the absolute minimum value on the interval $0 \le x \le 7$. Justify your answer.

FRQ #12c (NO Calculator) – Using f' graph, f'(x) applications, evaluating limits (l'Hopital's rule)

AP® Calculus BC 2023 Free-Response Questions



Graph of f'

4. The function f is defined on the closed interval $[-2, 8]$ and satisfies $f(2) = 1$. The graph of f', the derivative of f, consists of two line segments and a semicircle, as shown in the figure.

   (a) Does f have a relative minimum, a relative maximum, or neither at $x = 6$? Give a reason for your answer.

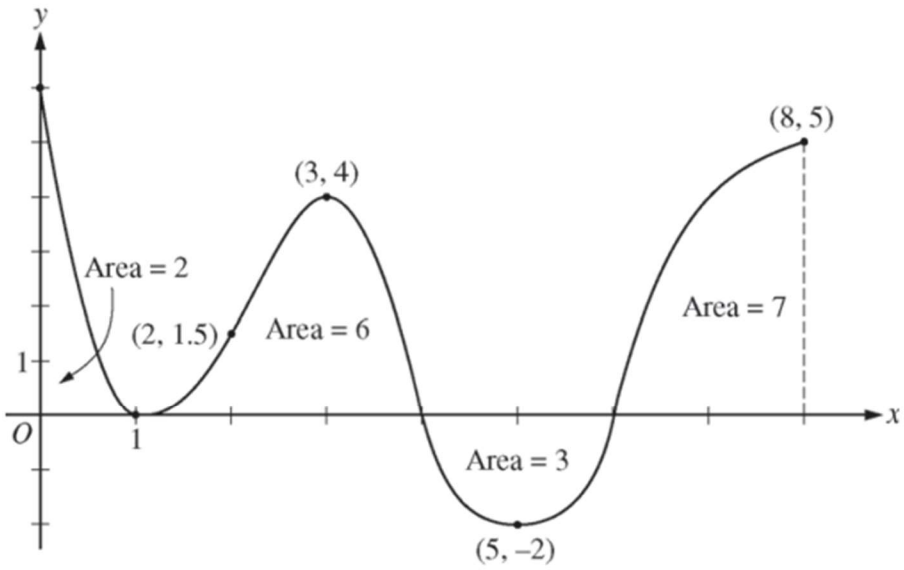
   (b) On what open intervals, if any, is the graph of f concave down? Give a reason for your answer.

   (c) Find the value of $\lim_{x \to 2} \dfrac{6f(x) - 3x}{x^2 - 5x + 6}$, or show that it does not exist. Justify your answer.

   (d) Find the absolute minimum value of f on the closed interval $[-2, 8]$. Justify your answer.

FRQ #12d (NO Calculator) – Using f' graph, f'(x) applications, derivative rules, f"(x) applications, tangent lines

2013 AP® CALCULUS BC FREE-RESPONSE QUESTIONS



Graph of f'

4. The figure above shows the graph of f', the derivative of a twice-differentiable function f, on the closed interval $0 \le x \le 8$. The graph of f' has horizontal tangent lines at $x = 1$, $x = 3$, and $x = 5$. The areas of the regions between the graph of f' and the x-axis are labeled in the figure. The function f is defined for all real numbers and satisfies $f(8) = 4$.

   (a) Find all values of x on the open interval $0 < x < 8$ for which the function f has a local minimum. Justify your answer.

   (b) Determine the absolute minimum value of f on the closed interval $0 \le x \le 8$. Justify your answer.

   (c) On what open intervals contained in $0 < x < 8$ is the graph of f both concave down and increasing? Explain your reasoning.

   (d) The function g is defined by $g(x) = (f(x))^3$. If $f(3) = -\frac{5}{2}$, find the slope of the line tangent to the graph of g at $x = 3$.