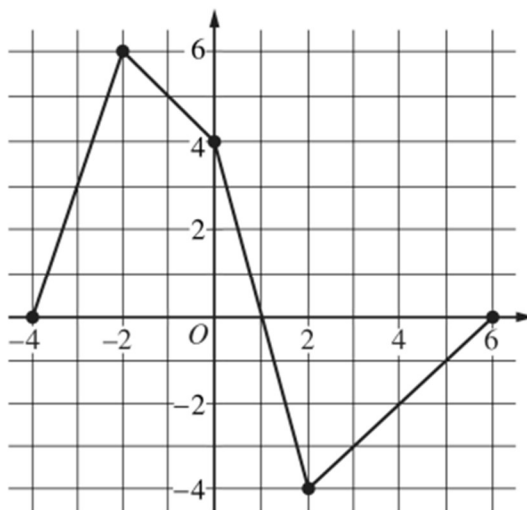


FRQ #4 (NO Calculator) – Using graph of f , evaluate integrals with Fundamental Theorem of Calculus, Evaluating Limits/L'Hopital's Rule, Mean/Intermediate Value Theorems, evaluating integrals using geometry, derivative rules, $f'(x)$ applications, $f''(x)$ application, average vs instantaneous rates of change, net change theorem

AP[®] Calculus BC 2021 Free-Response Questions



Graph of f

4. Let f be a continuous function defined on the closed interval $-4 \leq x \leq 6$. The graph of f , consisting of four line segments, is shown above. Let G be the function defined by $G(x) = \int_0^x f(t) dt$.
- On what open intervals is the graph of G concave up? Give a reason for your answer.
 - Let P be the function defined by $P(x) = G(x) \cdot f(x)$. Find $P'(3)$.
 - Find $\lim_{x \rightarrow 2} \frac{G(x)}{x^2 - 2x}$.
 - Find the average rate of change of G on the interval $[-4, 2]$. Does the Mean Value Theorem guarantee a value c , $-4 < c < 2$, for which $G'(c)$ is equal to this average rate of change? Justify your answer.