

x	0	π	2π
$f'(x)$	5	6	0

5. The function f is twice differentiable for all x with $f(0) = 0$. Values of f' , the derivative of f , are given in the table for selected values of x .

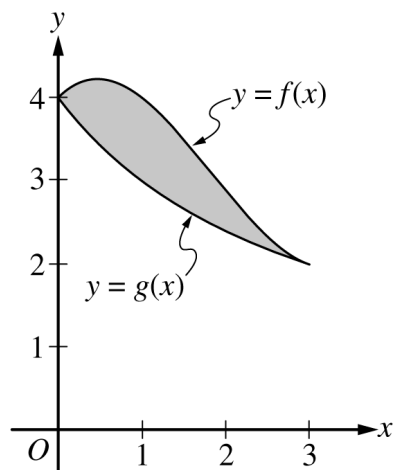
(a) For $x \geq 0$, the function h is defined by $h(x) = \int_0^x \sqrt{1 + (f'(t))^2} dt$. Find the value of $h'(\pi)$. Show the work that leads to your answer.

(b) What information does $\int_0^\pi \sqrt{1 + (f'(x))^2} dx$ provide about the graph of f ?

(c) Use Euler's method, starting at $x = 0$ with two steps of equal size, to approximate $f(2\pi)$. Show the computations that lead to your answer.

(d) Find $\int (t + 5) \cos\left(\frac{t}{4}\right) dt$. Show the work that leads to your answer.

Write your responses to this question only on the designated pages in the separate Free Response booklet. Write your solution to each part in the space provided for that part.



5. The graphs of the functions f and g are shown in the figure for $0 \leq x \leq 3$. It is known that $g(x) = \frac{12}{3+x}$ for $x \geq 0$. The twice-differentiable function f , which is not explicitly given, satisfies $f(3) = 2$ and $\int_0^3 f(x) \, dx = 10$.
- (a) Find the area of the shaded region enclosed by the graphs of f and g .
- (b) Evaluate the improper integral $\int_0^\infty (g(x))^2 \, dx$, or show that the integral diverges.
- (c) Let h be the function defined by $h(x) = x \cdot f'(x)$. Find the value of $\int_0^3 h(x) \, dx$.

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