

Directions: Complete each Free Response Question on the FRQ Planning/Solution Template.

1)

Let  $f$  be a function defined by  $f(x) = \begin{cases} 1 - 2\sin x & \text{for } x \leq 0 \\ e^{-4x} & \text{for } x > 0. \end{cases}$

- (a) Show that  $f$  is continuous at  $x = 0$ .
- (b) For  $x \neq 0$ , express  $f'(x)$  as a piecewise-defined function. Find the value of  $x$  for which  $f'(x) = -3$ .
- (c) Find the average value of  $f$  on the interval  $[-1, 1]$ .

2)

$x$	2	3	5	8	13
$f(x)$	1	4	-2	3	6

Let  $f$  be a function that is twice differentiable for all real numbers. The table above gives values of  $f$  for selected points in the closed interval  $2 \leq x \leq 13$ .

- (a) Estimate  $f'(4)$ . Show the work that leads to your answer.
- (b) Evaluate  $\int_2^{13} (3 - 5f'(x)) dx$ . Show the work that leads to your answer.
- (c) Use a left Riemann sum with subintervals indicated by the data in the table to approximate  $\int_2^{13} f(x) dx$ .  
Show the work that leads to your answer.
- (d) Suppose  $f'(5) = 3$  and  $f''(x) < 0$  for all  $x$  in the closed interval  $5 \leq x \leq 8$ . Use the line tangent to the graph of  $f$  at  $x = 5$  to show that  $f(7) \leq 4$ . Use the secant line for the graph of  $f$  on  $5 \leq x \leq 8$  to show that  $f(7) \geq \frac{4}{3}$ .