1. [15 points] Consider the differentiable function $f(x)$ defined for $x \geq 0$ by

$$f(x) = 2\ln(4x + e).$$

a. [3 points] Which of the following functions are antiderivatives of $f(x)$? Circle **all** that apply.

i. $\dfrac{1}{2}(\ln(4x+e))^2$ iii. $\displaystyle\int_0^1 2\ln(4x+e)\,dx$ v. $\dfrac{1}{2}\displaystyle\int_1^{4x+e} \ln(s)\,ds$

ii. $\dfrac{1}{2}(4x+e)\ln(4x+e) - 2x$ iv. $1 + \displaystyle\int_0^x 2\ln(4t+e)\,dt$ vi. None of these

b. [2 points] Suppose that $F(x)$ is an antiderivative of $f(x)$. Which of the following quantities **must** be equal to the average value of the function $f(x)$ on the interval $[2, 10]$? Circle **all** that apply.

i. $\dfrac{F(10) - F(2)}{8}$ ii. $\dfrac{1}{8}\displaystyle\int_2^{10} f(x)\,dx$ iii. $\dfrac{1}{8}\displaystyle\int_2^{10} f'(x)\,dx$ iv. $\dfrac{f(10) - f(2)}{8}$

c. [4 points] Set up, but do not evaluate, a definite integral that represents the arclength of the curve $f(x)$ between $x = 0$ and $x = 8$. Your answer should **not** involve the letter f.

Answer: _____

d. [3 points] Approximate the integral $\displaystyle\int_0^8 f(x)\,dx$ using MID(4). Write out all the terms in your sum. You do not need to simplify, but your final answer should **not** involve the letter f.

Answer: _____

e. [3 points] Is your answer to part **d**. an overestimate or underestimate to $\displaystyle\int_0^8 f(x)\,dx$? Briefly explain your reasoning.