4. [9 points] The city of Rainneapolis has a strange weather pattern. It is always sunny, except for February 2nd, when it rains substantially all day. This year, Amin prepared for the stormy day by building a machine which continuously removes rainwater from his backyard.

- Let $T(h)$ be the total amount of rainwater in Amin’s backyard, in cubic feet, $h$ hours after 12:00am on February 2nd.
- Let $A(h)$ be the rate at which the rain adds water to Amin’s backyard, in cubic feet per hour, $h$ hours after 12:00am on February 2nd.
- Let $M(h)$ be the rate at which Amin’s machine removes rainwater from his backyard, in cubic feet per hour, $h$ hours after 12:00am on February 2nd.

The functions $T(h)$, $A(h)$, and $M(h)$ are all differentiable. Assume that there is no rainwater in Amin’s backyard before it starts raining at 12:00am on February 2nd.

a. [3 points] Which of the following gives a correct interpretation of $\int_{4}^{10} M(h) \, dh = 8000$? Circle all correct answers.

(i) The total amount of rainwater in Amin’s backyard decreases by 8000 cubic feet from 4:00am to 10:00am on February 2nd.

(ii) Between 4:00am and 10:00am on February 2nd, Amin’s machine removes a total of 8000 cubic feet of rainwater from his backyard.

(iii) The rate at which Amin’s machine removes rainwater from his backyard between 4:00am and 10:00am on February 2nd is 8000 cubic feet per hour.

(iv) At 10:00am on February 2nd, Amin’s machine removes rainwater from his backyard at a rate of 8000 cubic feet per hour faster than at 4:00am.

(v) NONE OF THESE

b. [3 points] Which of the following expressions gives the total amount of rainwater, in cubic feet, in Amin’s backyard at 7:00am? Circle all correct answers.

(i) $\int_{0}^{7} T'(h) \, dh$

(ii) $\int_{0}^{7} T(h) \, dh$

(iii) $\int_{0}^{7} (A(h) + M(h)) \, dh$

(iv) $\int_{0}^{7} A(h) \, dh - \int_{0}^{7} M(h) \, dh$

(v) NONE OF THESE

c. [3 points] Which of the following expressions gives the average amount of rainwater, in cubic feet, in Amin’s backyard between 6:00am and 9:00am? Circle all correct answers.

(i) $\frac{1}{9 - 6} \int_{6}^{9} T'(h) \, dh$

(ii) $\frac{1}{9 - 6} \int_{6}^{9} T(h) \, dh$

(iii) $\frac{T(9) - T(6)}{9 - 6}$

(iv) $\frac{1}{3} \int_{0}^{9} T(h) \, dh + \frac{1}{3} \int_{6}^{9} T(h) \, dh$

(v) NONE OF THESE