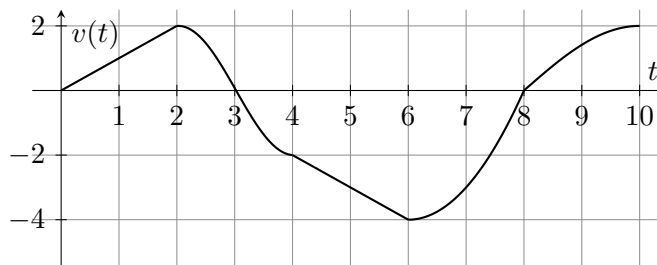


5. [9 points]

Carmen leads a team who operate a new Mars rover, named “*Determination*”. At $t = 0$, the rover starts moving, and the function $v(t)$ gives the velocity of the rover t seconds later. Assume that the rover travels on flat ground, in a straight line, and that $v(t)$ is measured in feet per second. A graph of $v(t)$, for $0 \leq t \leq 10$, is shown to the right.



- a. [2 points] Estimate the time t with $0 \leq t \leq 10$ at which the rover is furthest from its initial position.

Answer: $t =$ 8

- b. [2 points] Find an expression involving one or more integrals which gives the distance, in feet, between the rover's initial position, and its position 10 seconds later. Your answer **may** involve the letters v and t .

Answer: $-\int_0^{10} v(t) dt$

- c. [2 points] Find an expression involving one or more integrals which gives the total distance, in feet, traveled by the rover in these 10 seconds. Your answer **may** involve the letters v and t .

Answer: $\int_0^{10} |v(t)| dt$

- d. [3 points] The rate of change of the temperature of the rover m minutes after 12pm noon (Carmen's time) is given by the function $r(m)$, where $r(m)$ is measured in degrees Celsius per minute ($^{\circ}\text{C}/\text{min}$). Carmen finds left and right estimates to $\int_0^{120} r(m) dm$, and finds that $\text{LEFT}(6) = 6$ and $\text{RIGHT}(6) = 8$. Which of the following **must** be true? Circle **all** correct answers.

- i. The value $r(120)$ is larger than the value $r(0)$.
- ii. The function $r(m)$ is increasing on the entire interval $[0, 120]$.
- iii. The temperature of the rover at 2pm is at least 6°C higher than at 12pm noon.
- iv. The temperature of the rover at 2pm is no more than 8°C higher than at 12pm noon.
- v. The rate of change of the temperature of the rover at 2pm is $2^{\circ}\text{C}/\text{min}$ higher than it was at noon.
- vi. The rate of change of the temperature of the rover at 2pm is $0.1^{\circ}\text{C}/\text{min}$ higher than it was at noon.
- vii. None of the above.