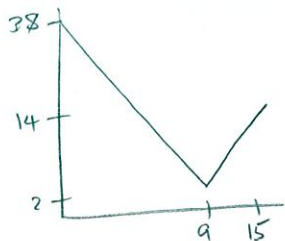


A person's velocity (in meters per second) at time t (in seconds) is given by $v(t) = \begin{cases} 38 - 4t, & 0 \leq t \leq 9 \\ 2t - 16, & 9 \leq t \leq 15 \end{cases}$

SCORE: ____ / 5 PTS

- [a] Find the exact distance the person travelled from time $t = 0$ seconds to $t = 15$ seconds.

NOTE: You must show the arithmetic expression that you used to get your answer.



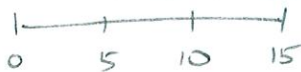
$$\frac{1}{2}(9)(38+2) + \frac{1}{2}(6)(2+14)$$

$$= 180 + 48 = 228 \text{ m}$$

- [b] Estimate the distance the person travelled from time $t = 0$ seconds to $t = 15$ seconds using three subintervals and left endpoints.

NOTE: You must show the arithmetic expression that you used to get your answer.

$$\Delta x = \frac{15-0}{3} = 5$$



$$f(0)\Delta x + f(5)\Delta x + f(10)\Delta x = 38 \cdot 5 + 18 \cdot 5 + 4 \cdot 5 = 300 \text{ m}$$

The graph of function f is shown on the right.

The graph consists of two diagonal lines, an arc of a circle, then an additional diagonal line.

SCORE: ____ / 4 PTS

[a] Evaluate $\int_{-10}^{10} f(x) dx$.

NOTE: You must show the arithmetic expression that you used to get your answer.

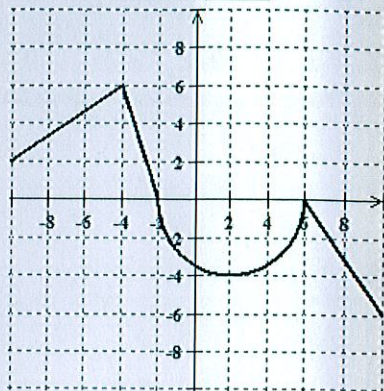
$$\begin{aligned} & \frac{1}{2}(6)(2+6) + \frac{1}{2}(2)(6) - \frac{1}{2}\pi(4)^2 - \frac{1}{2}(4)(6) \\ &= 24 + 6 - 8\pi - 12 \\ &= \underline{18 - 8\pi} \end{aligned}$$

① POINT EACH
EXCEPT AS NOTED

[b] Evaluate $\int_2^{-10} f(x) dx$.

$$= - \int_{-10}^2 f(x) dx = - \left[24 + 6 - \frac{1}{4}\pi(4)^2 \right] = \underline{4\pi - 30}$$

①



Using the limit definition of the definite integral, and right endpoints, find $\int_{-3}^1 (3x^2 + 9x) dx$.

SCORE: ____ / 10 PTS

NOTE: Solutions using any other method will earn 0 points.

$$\Delta x = \frac{1 - (-3)}{n} = \frac{4}{n}$$

$$\begin{aligned} & \textcircled{1} \lim_{n \rightarrow \infty} \sum_{i=1}^n \left(3 \left(-3 + \frac{4i}{n} \right)^2 + 9 \left(-3 + \frac{4i}{n} \right) \right) \frac{4}{n} \textcircled{1} \\ &= \lim_{n \rightarrow \infty} \frac{4}{n} \sum_{i=1}^n \left(3 \left(9 - \frac{24}{n}i + \frac{16}{n^2}i^2 \right) - 27 + \frac{36}{n}i \right) \\ &= \lim_{n \rightarrow \infty} \frac{4}{n} \sum_{i=1}^n \left(-\frac{36}{n}i + \frac{48}{n^2}i^2 \right) \textcircled{2} \\ &= \lim_{n \rightarrow \infty} \frac{4}{n} \left(-\frac{36}{n} \sum_{i=1}^n i + \frac{48}{n^2} \sum_{i=1}^n i^2 \right) \\ &= \lim_{n \rightarrow \infty} \frac{4}{n} \left(-\frac{36}{n} \frac{n(n+1)}{2} + \frac{48}{n^2} \frac{n(n+1)(2n+1)}{6} \right) \\ &= 4(-18+16) \textcircled{1} \textcircled{1} \\ &= -8 \textcircled{1} \end{aligned}$$

+ $\textcircled{1}$ POINT IF YOU WRITE $\lim_{n \rightarrow \infty}$
ON EVERY LINE THAT
CONTAINS "n"

Evaluate $\int_{-8}^0 (2\sqrt{64-x^2} - |x+6|) dx$ using the properties of definite integrals and interpreting in terms of area. SCORE: ____ / 5 PTS

NOTE: You must show the proper use of the properties of the definite integral, NOT just the arithmetic.

$$\textcircled{2} \quad 2 \int_{-8}^0 \sqrt{64-x^2} dx - \int_{-8}^0 |x+6| dx = \underbrace{2 \cdot \frac{1}{4} \pi (8)^2}_{\textcircled{1}} - \underbrace{\left[\frac{1}{2} \cdot 2 \cdot 2 + \frac{1}{2} \cdot 6 \cdot 6 \right]}_{\textcircled{1}}$$
$$= \underbrace{32\pi - 20}_{\textcircled{1}}$$

