

Group # _____

Calculus I

Lab Project: Area Navigation

Introduction. Suppose that $v(t)$ is the *eastward* velocity (in feet per second) at time t (in seconds) of an object moving along an east-west axis. The graph of v is given below in Figure 1.

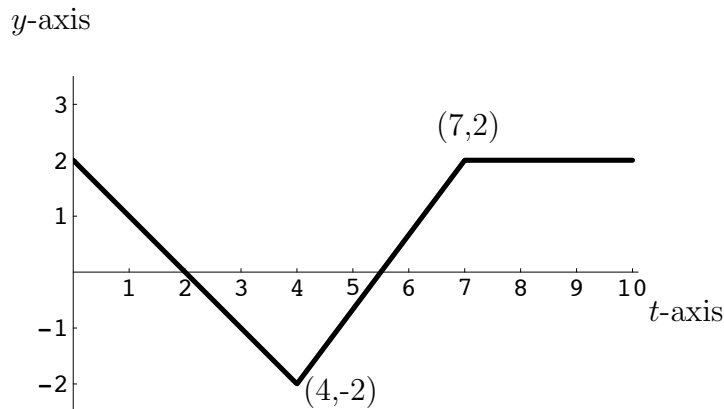


Figure 1: Velocity curve: $y = v(t)$

1. Use the graph of v and simple geometry to solve the following problems:

(a) Find the signed area of the region bounded by the graph of v and the t -axis from $t = 0$ to $t = 10$. Then find the net distance and the total distance traveled by the object over the interval $[0, 10]$.

(b) Find the *average velocity* of the object over $[0, 10]$. (i.e. Find the *average value* of v over $[0, 10]$.)

(c) Find the *average acceleration* of the object over $[0, 10]$. (i.e. Find the *average rate of change* of v over $[0, 10]$.)

(d) Find the *average speed* of the object over $[0, 10]$.

2. Find a piecewise-defined algebraic formula for the velocity function v as represented in Figure 1. .
3. Let $p(x)$ = “the position (in feet) of the object at time x (in seconds) relative to the origin,” for $0 \leq x \leq 10$, and assume $p(0) = 3$.
- (a) Express $p(x) - p(0)$ as a *definite integral involving v* .
- (b) Use the results from problems #2 and #3 (a) to find a piecewise-defined algebraic formula for the position function p .
- (c) Find the average rate of change of p over the interval $[0,10]$. How does this compare with the average velocity found in problem #1 (b)?

4. Provide a graph of p below. Identify the critical numbers of p and the global maximum and minimum values of p .

5. Write out a set of “step-by-step” instructions that can be used to match the motion of the object with velocity v as represented in Figure 1.