Solving Velocity Problems

Recall: $\vec{v} = \frac{\Delta \vec{d}}{\Delta t}$ ← displacement

(velocity)

$v = \frac{\Delta d}{\Delta t}$ ← distance.

(speed)

GRASP

G - given

R - required

A - analysis

S - solution

P - paraphrase

$v = \frac{\Delta d}{\Delta t}$

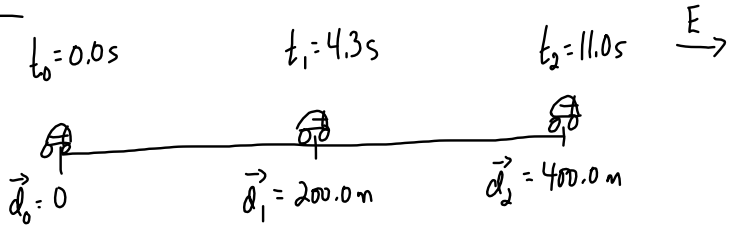
$v\Delta t = \Delta d$ ← solve for Δd

$\Delta t = \frac{\Delta d}{v}$ ← solve for Δt

DO NOT MEMORIZE!

KNOW HOW TO REARRANGE.

MP 1.2



Given

$t_0 = 0.0s$
$t_1 = 4.3s$
$t_2 = 11.0s$
$\vec{d}_0 = 0.0m$
$\vec{d}_1 = 200.0m\ [E]$
$\vec{d}_2 = 400.0m\ [E]$

Required

a) $\vec{V}_{ave(0\to1)} = ?$
b) $\vec{V}_{ave(1\to2)} = ?$
c) $\vec{V}_{ave(0\to2)} = ?$

Analysis

$\vec{V}_{ave} = \frac{\Delta \vec{d}}{\Delta t}$

Solution

a) $\vec{V}_{ave(0\to1)} = \frac{\Delta \vec{d}}{\Delta t}$

$\vec{V}_{ave(0\to1)} = \frac{200.0m\ [E] - 0}{4.3s - 0}$

$\vec{V}_{ave(0\to1)} = \frac{200.0m\ [E]}{4.3s}$

$\vec{V}_{ave(0\to1)} = 47m/s\ [E]$

b) $\vec{V}_{ave(1\to2)} = \frac{\Delta \vec{d}}{\Delta t}$

$\vec{V}_{ave(1\to2)} = \frac{400.0m\ [E] - 200.0m\ [E]}{11.0s - 4.3s}$

$\vec{V}_{ave(1\to2)} = \frac{200.0m\ [E]}{6.7s}$

$\vec{V}_{ave(1\to2)} = 3.0 \times 10^{1} m/s\ [E]$

c) $\vec{V}_{ave(0\to2)} = \frac{\Delta \vec{d}}{\Delta t}$

$\vec{V}_{ave(0\to2)} = \frac{400.0m\ [E] - 0}{11.0s - 0}$

$\vec{V}_{ave(0\to2)} = \frac{400.0m\ [E]}{11.0s}$

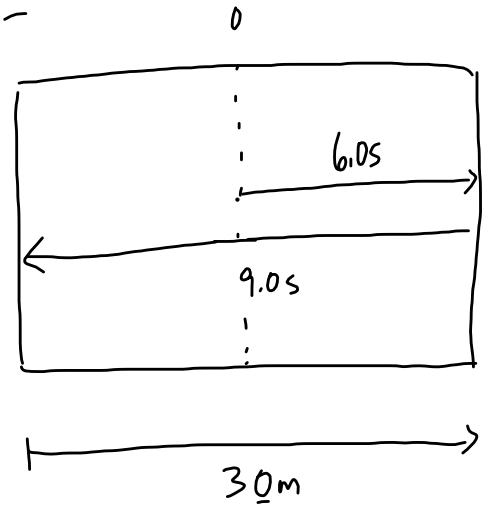
$\vec{V}_{ave(0\to2)} = 36.4m/s\ [E]$

* NOTE that average velocity is NOT the same as $\frac{V_1 + V_2 + V_3 + \ldots V_n}{n}$

Paraphrase

The average velocity for the first 200.0m was 47m/s [E]
The average velocity for the second 200.0m was 3.0×10^{1} m/s [E]
The average velocity for the whole trip was 36.4m/s [E]

MP|44



Given

$\vec{d}_0 = 0\ m$

$\vec{d}_1 = +15m$ } $\Delta t = 6.0s$

$\vec{d}_2 = -15m$ } $\Delta t = 9.0s$

Required

a) $\vec{V}_{ave(0\to1)} = ?$

b) $\vec{V}_{ave(1\to2)} = ?$

Analysis

$\vec{V}_{ave} = \frac{\Delta \vec{d}}{\Delta t}$

Solution

a) $\vec{V}_{ave(0\to1)} = \frac{+15m - 0}{6.0s}$

$\vec{V}_{ave(0\to1)} = +2.5m/s$

towards your net.

b) $\vec{V}_{ave(1\to2)} = \frac{-15_m - (+15m}{9.0s}$

$\vec{V}_{ave(1\to2)} = \frac{-30m}{9.0s}$

$\vec{V}_{ave(1\to2)} = -3.3m/s$

away from your net.

Paraphrase

The average velocity in the first 6.0s was 2.5m/s [towards your net]

The average velocity in the last 9.0s was 3.3m/s [away from your net]

TO DO: PP|45-46

Look over MP|55