Velocity

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

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

Rearranging the velocity equation:

for Δd: $v = \frac{\Delta d}{\Delta t}$

$\Delta d = v \Delta t$

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

$v \Delta t = \Delta d$

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

GRASP

G - Given

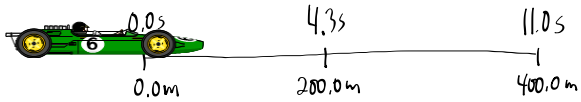
R - Required

A - Analysis

S - Solution

P - paraphrase

MP 1.2



Given

$\vec{d}_0 = 0.0\ m$

$\vec{d}_1 = 200.0m\ [E]$

$\vec{d}_2 = 400.0m\ [E]$

$t_0 = 0.0s$

$t_1 = 4.3s$

$t_2 = 11.0s$

Required

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

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

c) $\vec{V}_{ave(0\to2)} = ?$

Analysis

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

Solution

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

$= \frac{200.0m\ [E] - 0}{4.3s - 0}$

$= \frac{200.0m\ [E]}{4.3s}$

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

Paraphrase

a) The average velocity for the first 200.0m is 47 m/s [E]

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

$= \frac{400.0m\ [E] - 200.0m\ [E]}{11.0s - 4.3s}$

$= \frac{200.0m\ [E]}{6.7s}$

$= 3.0\times10^{1}\ m/s\ [E]$

The average velocity for the 2nd half of the race is 3.0×10^{1} m/s [E]

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

$= \frac{400.0m\ [E] - 0}{11.0s}$

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

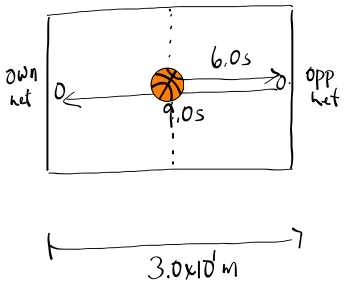
The average velocity for the whole trip is 36.4 m/s [E]

NOTE: NO! NO! NO!

$V_{ave} \neq \frac{V_1 + V_2 + V_3}{3}$

$\vec{V}_{ave} = \frac{\text{overall displacement}}{\text{overall time}}$

MP|44



Given

$\vec{d}_0 = 0.0\,m$
$\vec{d}_1 = +15\,m$ } $\Delta t_{0\to1} = 6.0\,s$
$\vec{d}_2 = -15\,m$ } $\Delta t_{1\to2} = 9.0\,s$

Required

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

Analysis

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

Solution

a) $$\vec{V}_{ave(0\to1)} = \frac{\Delta \vec{d}_{0\to1}}{\Delta t_{0\to1}}$$
$$= \frac{+15\,m - 0\,m}{6.0\,s}$$
$$= +2.5\,m/s$$
$$= 2.5\,m/s\ [\text{towards opp. net}]$$

Paraphrase

a) The average velocity is 2.5 m/s [towards opp net]

b) $$\vec{V}_{ave(1\to2)} = \frac{\Delta \vec{d}_{1\to2}}{\Delta t_{1\to2}}$$
$$= \frac{-15\,m - (+15\,m)}{9.0\,s}$$
$$= \frac{-30\,m}{9.0\,s}$$
$$= -3.3\,m/s$$
$$= 3.3\,m/s\ [\text{away from opp. net}]$$

The average velocity is 3.3 m/s [away from opp. net]

TODO

① PP|45-46
② Look over MP|55
③ FOP|6-13