Day 7 HW Relative Velocity – Part I – p1, 5, 7, 8 pg 48

1/2

P1] T- teens, B- boat, W- water

a) $\vec{V}_{BW} = 2.8\,m/s\ [F]$

$\vec{V}_{TB} = 1.1\,m/s\ [F]$

$\vec{V}_{TW} = ?$ let [F]+

$\vec{V}_{TW} = \vec{V}_{TB} + \vec{V}_{BW}$

$= 1.1\,m/s + 2.8\,m/s$

$= 3.9\,m/s\ [F]$

b) $\vec{V}_{TB} = 1.1\,m/s\ [B]$

$\vec{V}_{TW} = ?$

$\vec{V}_{TW} = \vec{V}_{TB} + \vec{V}_{BW}$

$= -1.1\,m/s + 2.8\,m/s$

$= 1.7\,m/s\ [F]$

5] B- boat C- child E- Earth

a) $\vec{V}_{BE} = 4.0\,m/s\ [N]$

$\vec{V}_{CB} = 3.0\,m/s\ [N]$

$\vec{V}_{CE} = ?$

$\vec{V}_{CE} = \vec{V}_{CB} + \vec{V}_{BE}$

$= 7.0\,m/s\ [N]$

b) $\vec{V}_{CB} = 3.0\,m/s\ [S]$

let N+

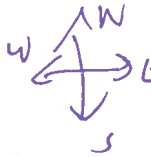
$\vec{V}_{CE} = \vec{V}_{CB} + \vec{V}_{BE}$

$= -3.0\,m/s + 4.0\,m/s$

$= 1.0\,m/s\ [N]$

c) $\vec{V}_{CB} = 3.0\,m/s\ [E]$

$\vec{V}_{CE} = \vec{V}_{CB} + \vec{V}_{BE}$



$V_{CE} = \sqrt{4.0^2 + 3.0^2} = 5.0\,m/s$

$\theta = \tan^{-1}\left(\frac{4.0}{3.0}\right) = 53.1°$

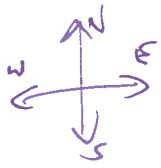
$\therefore \vec{V}_{CE} = 5.0\,m/s\ [E\ 53°N]$

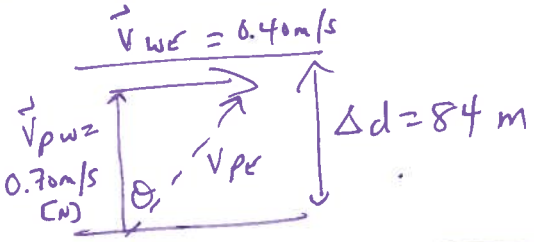
7] p-person, w-water, E-Earth

a) $\vec{V}_{WE} = 0.40\text{ m/s [E]}$

$\vec{V}_{pw} = 0.70\text{ m/s [N]}$

$\vec{V}_{pE} = ?$





Analysis: $\vec{V}_{pE} = \vec{V}_{pw} + \vec{V}_{WE}$

$V_{pE} = \sqrt{0.70^2 + 0.40^2} = 0.8062 \approx 0.81$

$\theta = \tan^{-1}\left(\frac{0.40}{0.70}\right) = 29.7°$

$\therefore \boxed{\vec{V}_{pE} = 0.81\text{ m/s [N 30° E]}}$.

b) $\Delta t = ?$ $\Delta t = \frac{\Delta \vec{d}}{\vec{V}_{pw}} = \frac{84\text{ m [N]}}{0.70\text{ m/s [N]}} = 120.\text{ s}$

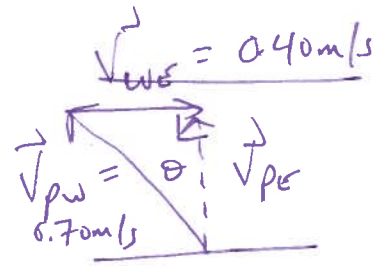
c) $\Delta d_{E\text{-}w} = ?$ $\Delta d_{E\text{-}w} = (\vec{V}_{WE})(\Delta t) = 0.40\text{ m/s} \times 120.\text{ s}$

$= 48\text{ m}$

d) $\vec{V}_{WE} = 0.40\text{ m/s [E]}$

$\vec{V}_{pw} = 0.70\text{ m/s [?]}$

$\vec{V}_{pE} = ?\text{ [N]}$



$\therefore \theta = \sin^{-1}\left(\frac{0.40\text{ m/s}}{0.70\text{ m/s}}\right) = 34.8°$

$\therefore$ she should swim [N 35° W].

8] a) C-canoeist, w-water, E-Earth

$V_{CW} = ?$

$V_{WE} = ?$

$V_{CE_1} = 2.9\text{ m/s}$ (person, paddles downstream (with current))

$V_{CE_2} = -1.2\text{ m/s}$ (person & paddles upstream (against current))

Let downstream direction be +

$V_{CE_1} = V_{CW} + V_{WE}$

$2.9 = V_{CW} + V_{WE}$

$V_{CE_2} = -V_{CW} + V_{WE}$

$-1.2 = -V_{CW} + V_{WE}$

Adding the equations:

$1.7 = 2V_{WE}$

$\therefore V_{WE} = \frac{1.7}{2} = 0.85\text{ m/s}$

Solving for V_{CW}:

$V_{CW} = 2.9 - V_{WE}$

$= 2.9 - 0.85$

$= 2.05\text{ m/s}$