Dr. Bob

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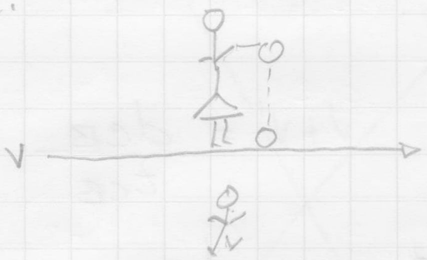
1, A reference frame is made up of an origin an three axes.
In this book we will only deal with motion in a plane. Most often we will use the orthogonal x-y plane.

2.



a. This oberver will see the ball drop straight down.

b. The ground observer sees the ball fall in a parabola.
1) The ball keeps moving forward @ a constant velocity.
2) The ball falls downward accelerated by gravity. 1) & 2) together make a parabola.

3.

a. The ground observer see the person to stay in the same place, 'Walking in place.' So, $v=0$.

b. The ground observer see the ball fall straight down.

P. 154 $\qquad$ Positive x-direction $\longrightarrow x$ $\qquad$ Dr. Bob

4.

$V_s = V_{swimmer} = V$

$V_c = V_{current} = -V' \quad (V' > 0)$

$t_{BC} = 18\,\text{min} = 1080\,\text{s}$

$d_{AB} = 800\,\text{m} = -d_{BA}$

$d_{BC} = -d_{CB}$

$t = 0$ when swimmer reaches log @ B.

$t_{tot} = ?$ when swimmer & log reach A.

<u>Log floating with current</u>

$$t_{tot} = \frac{d_{BA}}{V_c} = \frac{-d_{AB}}{-V'} = \frac{d_{AB}}{V'} \quad ; \quad t_{tot} = \frac{d_{AB}}{V'}$$

<u>Swimmer</u>

<u>$B \to C$</u> $\quad t_{BC} = \dfrac{d_{BC}}{V - V'} \qquad d_{BC} = (V - V')\,t_{BC}$

<u>$C \to B$</u> $\quad t_{CB} = \dfrac{d_{CB}}{-(V+V')} = \dfrac{-d_{BC}}{-(V+V')} = \dfrac{d_{BC}}{V+V'}$

It is $-(V+V')$ because velocity is to the left, negative direction

<u>$B \to A$</u> $\quad t_{BA} = \dfrac{d_{BA}}{-(V+V')} = \dfrac{-d_{AB}}{-(V+V')} = \dfrac{d_{AB}}{V+V'}$

Total time $\qquad t_{tot} = t_{CB} + t_{BC} + t_{BA}$

$$\frac{d_{AB}}{V'} = t_{BC} + \frac{d_{BC}}{V+V'} + \frac{d_{AB}}{V+V'}$$

Substitute $d_{BC} = (V - V')\,t_{BC}$

Move $\dfrac{d_{AB}}{V+V'}$ over

$$\frac{d_{AB}}{V'} - \frac{d_{AB}}{V+V'} = t_{BC} + \frac{(V-V')}{V+V'}\,t_{BC}$$

$$d_{AB}\left(\frac{1}{V'} - \frac{1}{V+V'}\right) = \left(1 + \frac{V-V'}{V+V'}\,t_{BC}\right)$$

Common denominator
$$d_{AB}\left(\frac{V+V'}{V'(V+V')}-\frac{V'}{V'(V+V')}\right)=\left(\frac{V+V'}{V+V'}+\frac{V-V'}{V+V'}\right)t_{BC}$$

$$d_{AB}\left(\frac{V+\cancel{V'}-\cancel{V'}}{V'(V+V')}\right)=\left(\frac{V+\cancel{V'}+V-\cancel{V'}}{V+V'}\right)t_{BC}$$

$$d_{AB}\left(\frac{\cancel{V}}{V'(\cancel{V+V'})}\right)=\frac{2\cancel{V}}{(\cancel{V+V'})}t_{BC}$$ cancel V & $(V+V')$

$$\frac{d_{AB}}{V'}=2t_{BC}$$

$$V'=\frac{d_{AB}}{2t_{BC}}=\frac{800\,m}{2(1080\,s)}=0{,}37\,m/s$$

$$V_c=-V'=-0{,}37\,m/s$$

$$\boxed{V_c=-0{,}37\,m/s}$$

The negative sign means velocity flows to the left, towards negative direction.