4. RELATIVE MOTION

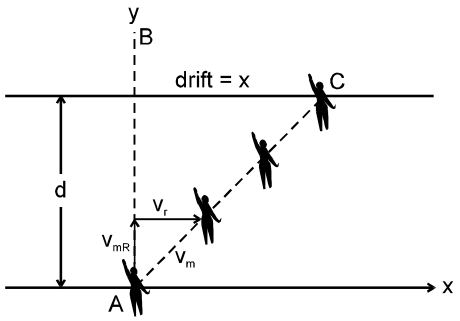
v_{AB} (velocity of A with respect to B) $= v_A - v_B$

a_{AB} (acceleration of A with respect to B) $= a_A - a_B$

Relative motion along straight line - $x_{AB} = x_B - x_A$

CROSSING RIVER

A boat or man in a river always moves in the direction of resultant velocity of velocity of boat (or man) and velocity of river flow.



1. Shortest Time :

Velocity along the river, $v_x = v_R$.

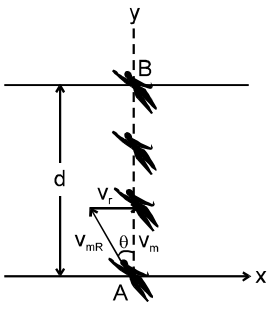
Velocity perpendicular to the river, $v_y = v_{mR}$

The net speed is given by $v_m = \sqrt{v_{mR}^2 + v_R^2}$

2. Shortest Path :

velocity along the river, $v_x = 0$

and velocity perpendicular to river $v_y = \sqrt{v_{mR}^2 - v_R^2}$



The net speed is given by $v_m = \sqrt{v_{mR}^2 - v_R^2}$

at an angle of 90° with the river direction.

velocity v_y is used only to cross the river,

therefore time to cross the river, $t = \frac{d}{v_y} = \frac{d}{\sqrt{v_{mR}^2 - v_R^2}}$

and velocity v_x is zero, therefore, in this case the drift should be zero.

$v_R - v_{mR} \sin\theta = 0$ or $v_R = v_{mR} \sin\theta$

or $\theta = \sin^{-1} \frac{v_R}{v_{mR}}$

RAIN PROBLEMS

$\vec{v}_{Rm} = \vec{v}_R - \vec{v}_m$ or $v_{Rm} = \sqrt{v_R^2 + v_m^2}$