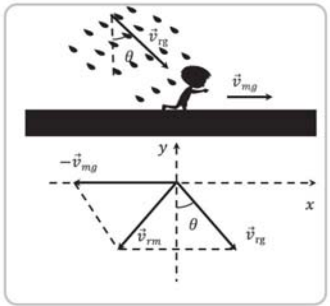
RAIN-MAN PROBLEM AND ITS APPLICATIONS

Rain Man Problem

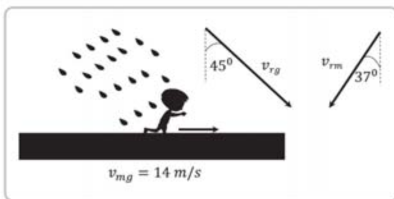


Using Parallelogram law,

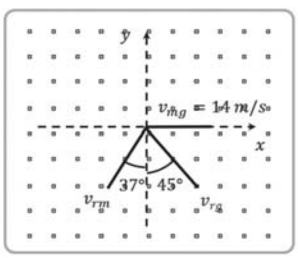
$$\vec{v}_{rm} = \vec{v}_{rg} + [-\vec{v}_{mg}]$$

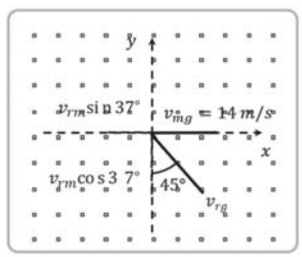
The orientation of the umbrella is always against vḥrm, in order to avoid getting drenched.

Ex. A boy is running on a horizontal road with speed 14 $m/$. Rain is falling at an angle of 45∘ with the vertical. For the boy, rain appears at an angle of 37 S ∘ with the vertical as shown. Find the actual velocity of rain.



Sol. Adding the vectors using resolution technique





$$\vec{v}_{rg} = \vec{v}_{rm} + \vec{v}_{mg}$$

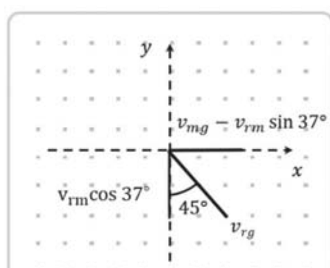
Representing, $\vec{v}_{rg} = \vec{v}_{rm} + \vec{v}_{mg}$ in figure:

Let $v_{rm} = x$

$$\tan\ 45° = \left|\frac{(v_{rg})_x}{(v_{rg})_y}\right|$$

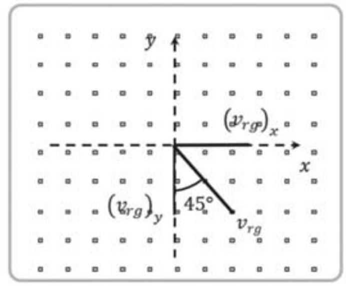
$$\frac{14 - \frac{3x}{5}}{4x/5} = 1$$

$$x = v_{\text{rm}} = 10\ \text{m/s}$$



Representing, $\vec{v}_{rg} = \vec{v}_{rm} + \vec{v}_{mg}$ in figure:

$$(v_{rg})_x = 8\ m/s$$
$$(v_{rg})_y = 8\ m/s$$
$$v_{rg} = \sqrt{8^2 + 8^2}$$
$$v_{rg} = 8\sqrt{2}\ m/s$$



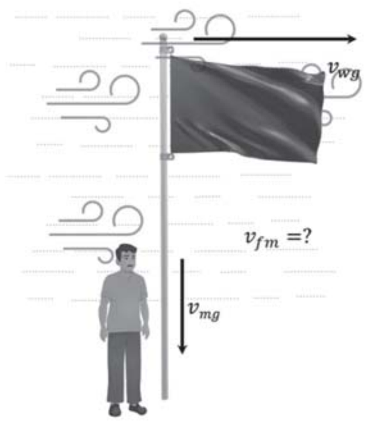
Rain- Lorry Problems (Fluttering of Flag)

Let,

Velocity of the wind w.r.t. ground be $\vec{v}_{wg}$

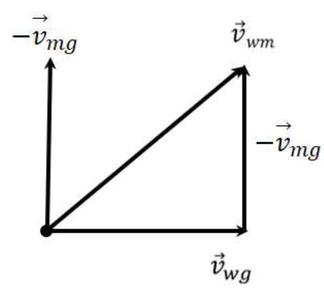
Velocity of the flag w.r.t. man be $\vec{v}_{fm}$

Velocity of the man w.r.t. ground be $\vec{v}_{mg}$



When the man is at rest, the velocity of the flag is same as the velocity of the wind, i.e. $\vec{v}_{fg} = \vec{v}_{wg}$

Velocity of wind w.r.t. man



$$\vec{v}_{wm} = \vec{v}_{wg} + (-\vec{v}_{mg}) = \vec{v}_{wg} - \vec{v}_{mg}$$

Note: Flag flutters in the direction of $\vec{v}_{wm}$