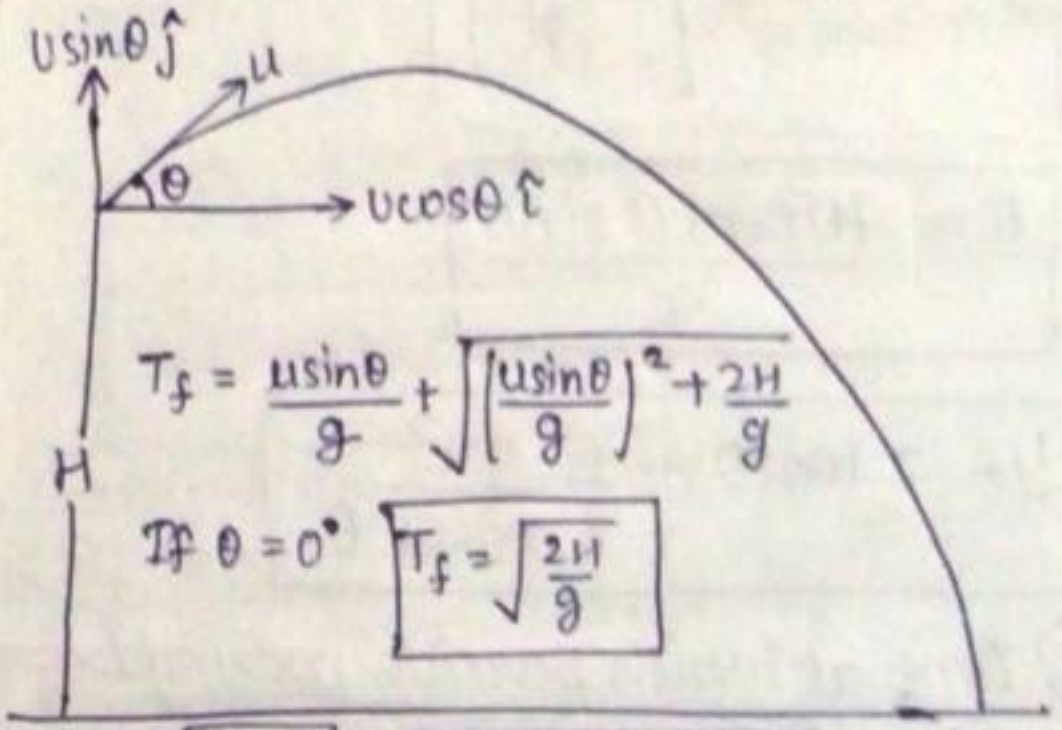
(17) Projectile Motion from some Height at angle θ



$$T_f = \frac{u\sin\theta}{g} + \sqrt{\left(\frac{u\sin\theta}{g}\right)^2 + \frac{2H}{g}}$$

If $\theta = 0°$ $\quad \boxed{T_f = \sqrt{\frac{2H}{g}}}$

If $\boxed{H=0}$ $\quad \boxed{T_f = \frac{2u\sin\theta}{g}}$

(18) Relative Motion in a plane

$$\boxed{\vec{V}_{AB} = \vec{V}_A - \vec{V}_B}$$

- If angle b/w V_A and V_B is θ then ⇝

$$|\vec{V}_{AB}| = \sqrt{V_A^2 + V_B^2 - 2V_AV_B\cos\theta}$$

- Relation b/w V_A and V_B so that A always moving along y-axis

$$\boxed{V_A\cos\theta = V_B}$$

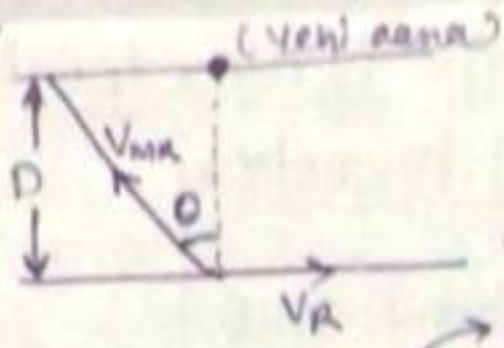
(19) River Man Problem

V_{MR} = Velocity of man wrt River
= Velocity of man wrt still water
= Velocity by which man can swim

River apne dam pe cross kiya jata h.
→ Ramlal puri jan apne jan ki traf lagayega river minimum time me cross karne ke liye (Man will swim ⊥ to flow of river)

$$\boxed{t_{min} = \frac{D}{V_{MR}}}$$

$$\boxed{\text{Drift along river} = V_R \times \frac{D}{V_{MR}}}$$



$$\boxed{\sin\theta = \frac{V_r}{V_M}}$$

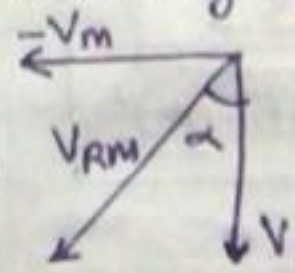
→ For shortest path

$$\boxed{V_{MR}\sin\theta = V_R}$$

$$\boxed{t = \frac{D}{V_{MR}\cos\theta} = \frac{D}{\sqrt{V_M^2 - V_R^2}}}$$

(20) Rain Man Problem
↳ Admi x me chalega.

Case 1 Rain is falling vertically with $\vec{V}_R$ and Man is running horizontally with $\vec{V}_M$ then velocity of rain relative to man



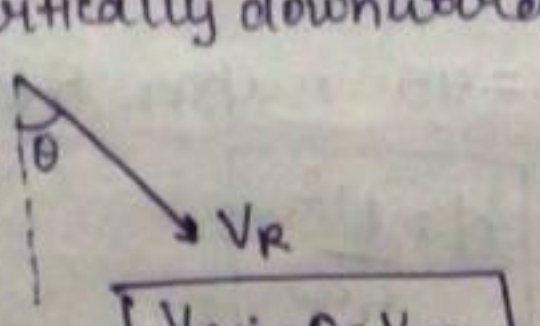
$$\vec{V}_{RM} = \vec{V}_R - \vec{V}_M$$

$$\boxed{|V_{RM}| = \sqrt{V_R^2 + V_M^2}}$$

$$\boxed{\tan\alpha = \frac{V_M}{V_R}}$$

$$\boxed{\text{umbrella} \rightarrow \text{opp dirn to } \vec{V}_{RM}}$$

Case 2 Rain is falling vertically at an angle θ then find velocity of man so that rain appears to fall vertically downward.



$$\boxed{V_R\sin\theta = V_M}$$

Condition of collision :-
Position of A and B are $\vec{r}_A$ and $\vec{r}_B$ moving with velocity $\vec{V}_A$ and $\vec{V}_B$ then find condition of collision.

$$\boxed{\frac{\vec{r}_A - \vec{r}_B}{|\vec{r}_A - \vec{r}_B|} = -\frac{\vec{V}_A - \vec{V}_B}{|\vec{V}_A - \vec{V}_B|}} \Longrightarrow$$

$$\boxed{\hat{r}_{AB} = -\hat{V}_{AB}}$$

@TEAMKOTA