

20-P-KM-AF-030

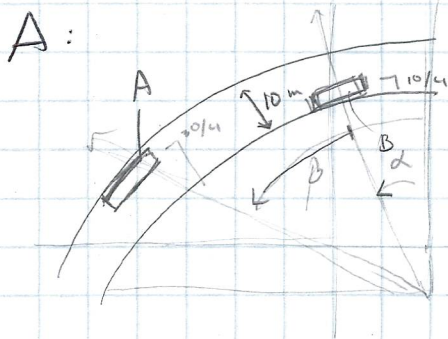
Relative Motion : Advanced

$$w/ \text{ eqn } x^2 + y^2 = c.$$

Q: Race tracks are ovals however the curves can be described as a section of a circle. Car A and B are speeding around the curve with A m/s and B m/s respectively. Car B accelerates at 0 m/s^2 and A de-accelerates at $F \text{ m/s}^2$.

Determine relative velocity and acceleration.

$$\alpha = G^\circ, \quad \beta = H^\circ$$

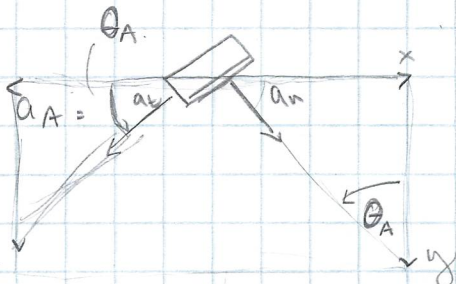


$$\begin{aligned} r_A &= \sqrt{C} + 30/4 \\ r_B &= \sqrt{C} + 10/4 \\ \theta_A &= G + H \\ \theta_B &= H \end{aligned}$$

$$V_A = V_B + V_{A/B} \Rightarrow [-A \sin(\theta_A) i + A \cos(\theta_A) j] = [B \sin(\theta_B) + B \cos(\theta_B) + V_{A/B}]$$

$$a_A = a_B + a_{A/B}$$

$$V_{A/B} = [-A \sin(\theta_A) + B \sin(\theta_B)] i + [A \cos(\theta_A) - B \cos(\theta_B)] j$$

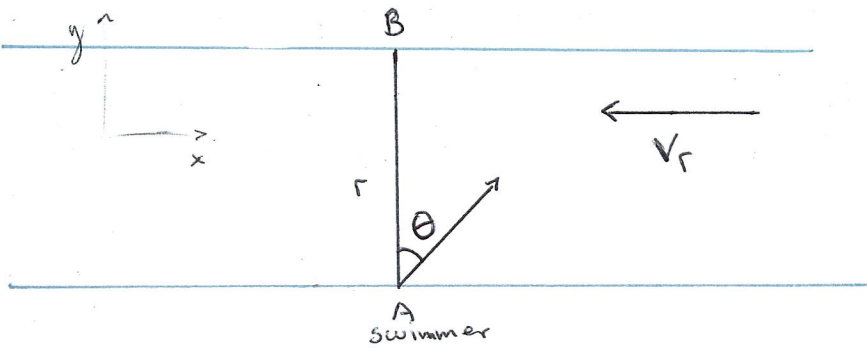


$$\begin{aligned} a_A &= -a_t \sin(\theta_A) j + a_n \cos(\theta_A) i - a_n \sin(90 - \theta_A) j \\ &\quad - a_n \cos(90 - \theta_A) i \end{aligned}$$

$$\begin{aligned} a_B &= -a_t \sin(\theta_B) j + a_n \cos(\theta_B) - a_n \sin(90 - \theta_B) j \\ &\quad - a_n \cos(90 - \theta_A) i \end{aligned}$$

(summate it)

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