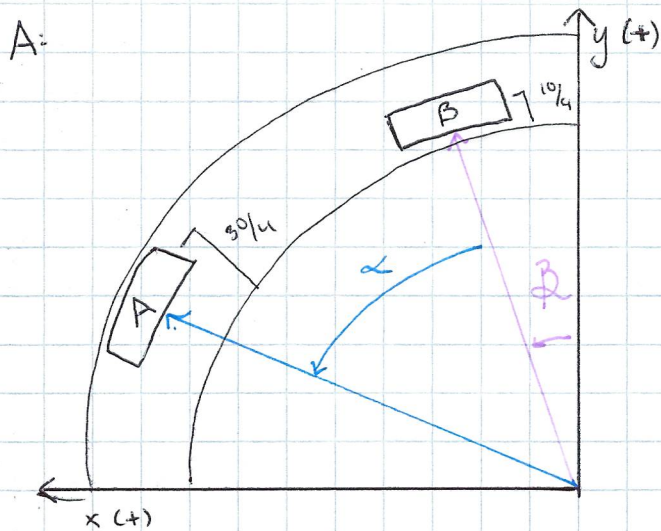


20-P-KM-AF-030

Relative Motion: Advanced

Q: Race tracks ovals, however the curves can be described as a section of a circle with the equation $x^2 + y^2 = C$. Car A and B are speeding around the curve with A m/s and B m/s respectively. Car B accelerates at D m/s² in the same direction of the velocity, Car A accelerates in the opposite direction with F m/s².



$$\alpha = G^\circ, \beta = H^\circ, r = C$$

$$r_A = \sqrt{C} + 30/4$$

$$r_B = \sqrt{C} + 10/4$$

$$\theta_A = H + G$$

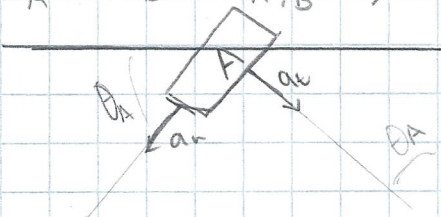
$$\theta_B = H$$

$$V_A = V_B + V_{A/B}$$

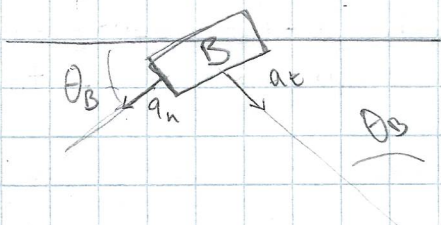
$$\Rightarrow [-A \sin(\theta_A) i + A \cos(\theta_A) j] = [-B \sin(\theta_B) i + B \cos(\theta_B) j] + V_{A/B}$$

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

$$a_A = a_B + a_{A/B}, a_{tA} = -F, a_{tB} = D, a_{nA} = v_A^2 / r_A, a_{nB} = v_B^2 / r_B$$



$$a_A = [a_t \cos(\theta_A) - a_n \cos(90 - \theta_A)] i + [-a_t \sin(\theta_A) - a_n \sin(90 - \theta_A)] j$$



$$a_B = [a_t \cos(\theta_B) - a_n \cos(90 - \theta_B)] i + [-a_t \sin(\theta_B) - a_n \sin(90 - \theta_B)] j$$

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