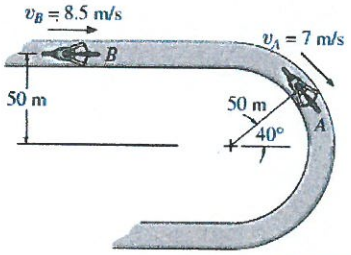
Problem 4: Particle Kinematics II

At the instant shown, the bicyclist at ***A*** is traveling at 7 m/s around the curve on the race track while increasing his speed at 0.5 m/s^2. The bicyclist at ***B*** is traveling at 8.5 m/s along the straight-a-way and increasing his speed at 0.7 m/s^2. Determine the relative velocity and relative acceleration of ***A*** with respect to ***B*** at this instant.



$$\vec{V}_A = \vec{V}_B + \vec{V}_{A/B}$$

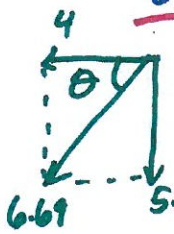
$X \rightarrow \quad 7\sin 40 = 8.5 + (V_{A/B})_x$

$$(V_{A/B})_x = -4 = 4 \text{ m/s} \leftarrow$$

$y \uparrow \quad -7\cos 40 = 0 + (V_{A/B})_y$

$$(V_{A/B})_y = -5.36 = 5.36 \text{ m/s} \downarrow$$

$$|\vec{V}_{A/B}| = \sqrt{4^2 + 5.36^2} = 6.69 \text{ m/s}$$



$$\theta = \tan^{-1}\frac{5.36}{6.69}$$

$$\theta = 53.3°$$

$$\vec{a}_A = \vec{a}_B + \vec{a}_{A/B}$$

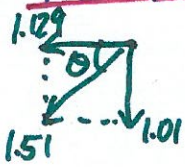
$X \rightarrow \quad -0.98\sin 50 + 0.5\sin 40 = 0.7 + (a_{A/B})_x$

$$(a_{A/B})_x = -1.129 = 1.129 \text{ m/s}^2 \leftarrow$$

$y \uparrow \quad -.98\cos 50 - 0.5\cos 40 = 0 + (a_{A/B})_y$

$$(a_{A/B})_y = -1.01 = 1.01 \text{ m/s}^2 \downarrow$$

$$|\vec{a}_{A/B}| = \sqrt{1.129^2 + 1.01^2} = 1.51 \text{ m/s}^2$$



$$\theta = \tan^{-1}\frac{1.01}{1.129}$$

$$\theta = 41.9°$$