# 20-R-KM-DK-18 Beginner Rotating Frame

Inspiration: 16-131 Hibbeler

On a televised show, contestants run through an obstacle course. One obstacle is a turning platform which rotates at a constant **omega = 4 rad/s** clockwise. A contestant has successfully jumped onto one end and runs at a constant speed of **v = 6.5 m/s** relative to the platform. What is the magnitude of her velocity and acceleration when she reaches the other end of the platform? The platform has a length **l = 2 m**.
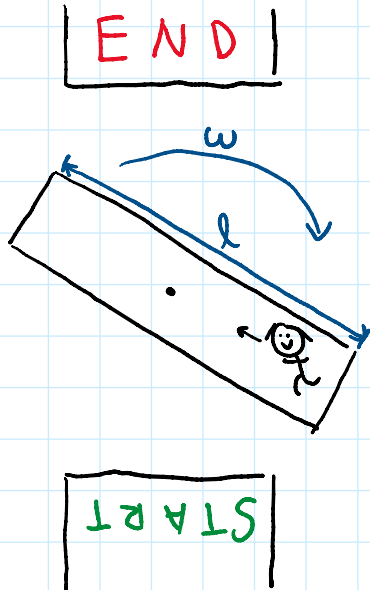
$$\vec{V}_A = \vec{V}_0 + \vec{\Omega} \times \vec{V}_{A/O} + (V_{A/O})_{xyz}$$

$$= 0 + (-4\hat{k}) \times 1\hat{j} + 6.5\hat{j} = 4\hat{i} + 6.5\hat{j}$$

$$\|\vec{V}_A\| = V_A = \sqrt{4^2 + 6.5^2} = \boxed{7.6321 \text{ m/s}}$$

$$\vec{a}_A = \vec{a}_0 + \dot{\vec{\Omega}} \times \vec{r}_{A/O} + \vec{\Omega} \times (\vec{\Omega} \times \vec{r}_{A/O}) + 2\vec{\Omega} \times (V_{A/O})_{xyz} + (a_{A/O})_{xyz}$$

$$= 0 + 0 + (-4\hat{k} \times (-4\hat{k} \times 1\hat{j})) + (-8\hat{k}) \times 6.5\hat{j} + 0$$

$$= -16\hat{j} + 52\hat{i}$$

$$\|\vec{a}_A\| = a_A = \sqrt{52^2 + (-16)^2} = 4\sqrt{195} \qquad \boxed{a_A = 54.410588 \text{ m/s}^2}$$