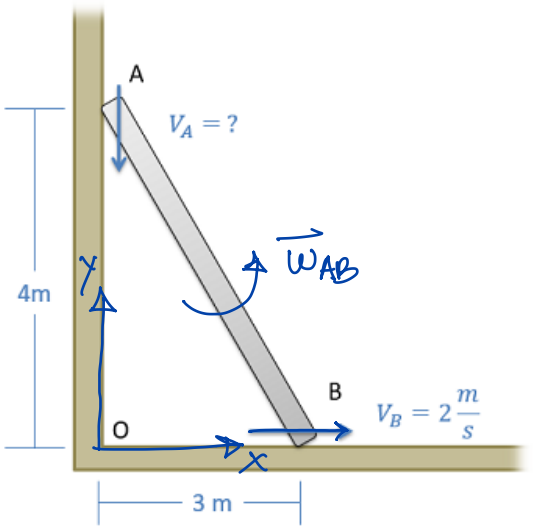
A ladder is propped up against a wall as shown below. If the base of the ladder is sliding out at a speed of 2 m/s, what is the velocity of the top of the ladder?



Find $\vec{v}_A$?

Known: $\vec{v}_B = 2\ m/s\ \hat{i}$

$\vec{v}_A = -v_A\ \hat{j}$

$\vec{r}_{A/B} = (-3\hat{i} + 4\hat{j})\ m$

Assume: $\vec{\omega}_{AB} = \omega_{AB}\ \hat{k}$

$$\vec{v}_A = \vec{v}_B + \vec{\omega}_{AB} \times \vec{r}_{A/B}$$

$$-v_A\hat{j} = 2\hat{i}\ m/s + \omega_{AB}\hat{k} \times (-3\hat{i} + 4\hat{j})\ m$$

$$-v_A\hat{j} = 2\ m/s\,\hat{i} - 3\omega_{AB}\hat{j} - 4\omega_{AB}\hat{i}$$

Components:

$\hat{i}$: $0 = 2\ m/s - 4\omega_{AB} \Rightarrow \omega_{AB} = 0.5\ rad/s$

$\hat{j}$: $-v_A = -3\omega_{AB} \Rightarrow v_A = 1.5\ m/s$

$$\boxed{\vec{v}_A = -1.5\ m/s\ \hat{j}}$$