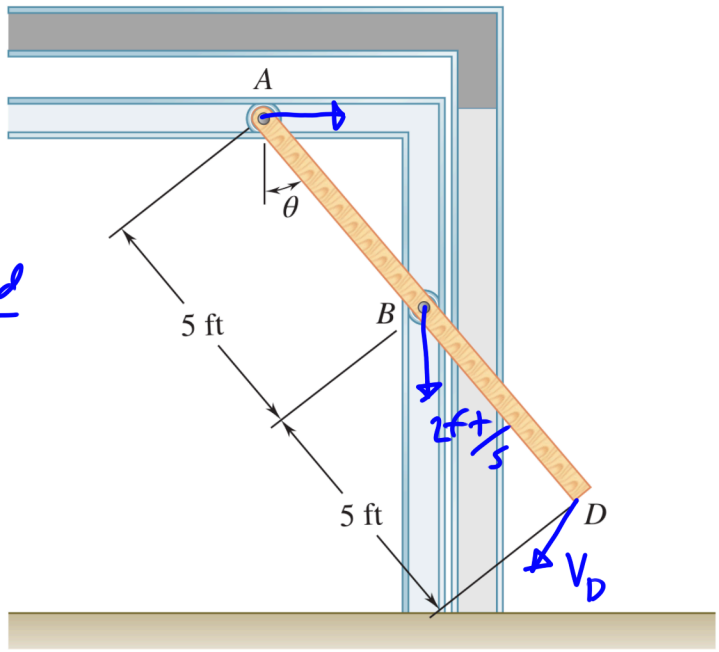
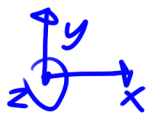
An overhead door is guided by wheels at A and B that roll in horizontal and vertical tracks. Knowing that when $\theta = 30°$ the velocity of wheel B is 2 ft/s downward, determine (a) the angular velocity of the door, (b) the velocity of end D of the door.

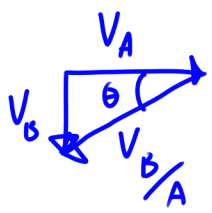


$$\omega = \frac{|\vec{V}_{B/A}|}{\ell}$$

$$= \frac{4\ ft/s}{5\ ft} = 0.8\ \frac{rad}{s}$$

$$\vec{\omega} = -0.8k\ \frac{rad}{s}$$





$$\frac{|\vec{V}_B|}{|\vec{V}_{B/A}|} = \sin\theta$$

$$\frac{|\vec{V}_B|}{\sin\theta} = |\vec{V}_{B/A}|$$

$$\frac{2\ ft/s}{\sin 30} = \frac{2\ ft/s}{0.5} = 4\ ft/s$$

$$\vec{V}_D = \vec{V}_B + \vec{\omega} \times \vec{r}_{D/B}$$

$$= -2j\ ft/s - 0.8k\ rad/s \times 5\ ft \sin 30\, i - 5\ ft \cos 30\, j$$

$$= -2j - (0.8k \times 2.5i - 4.33j)$$

$$= -2j - \begin{vmatrix} i & j & k \\ 0 & 0 & 0.8 \\ 2.5 & -4.33 & 0 \end{vmatrix} \begin{matrix} i & j \\ 0 & 0 \\ 2.5 & -4.33 \end{matrix}$$

$$= -2j - (0.8 \cdot 2.5j + 0.8 \cdot 4.33i) = \boxed{-3.46i - 4.24j\ ft/s}$$