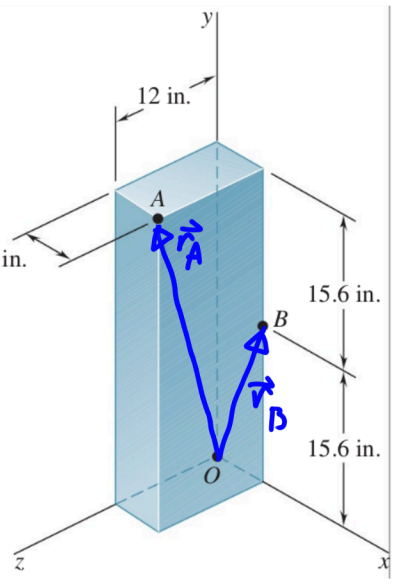
The rectangular block shown rotates about the diagonal OA with a constant angular velocity of 6.76 rad/s. Knowing that the rotation is counterclockwise as viewed from A, determine the velocity and acceleration of point B at the instant shown.



$\vec{r}_A = 5i + 31.2j + 12k$ in

$\vec{r}_B = 5i + 15.6j$ in

$|\vec{r}_A| = \sqrt{5^2 + 31.2^2 + 12^2}$

$= 33.8$ in

$\lambda_A = \dfrac{\vec{r}_A}{|\vec{r}_A|}$

$= \dfrac{5i + 31.2j + 12k \text{ in}}{33.8 \text{ in}} = 0.15i + 0.92j + 0.36k$

$\vec{\omega} = \omega \lambda_A = 6.76 \dfrac{\text{rad}}{\text{s}} (0.15i + 0.92j + 0.36k)$

$= 1i + 6.24j + 2.4k \ \text{rad/s}$

$\vec{V}_B = \vec{\omega} \times \vec{r}_B$

$= \begin{vmatrix} i & j & k \\ 1 & 6.24 & 2.4 \\ 5 & 15.6 & 0 \end{vmatrix} \begin{matrix} i & j \\ 1 & 6.24 \\ 5 & 15.6 \end{matrix}$

$= 624.0i + 2.4 \cdot 5j + 1 \cdot 15.6k - 6.24 \cdot 5k - 2.4 \cdot 15.6i - 1.0j$

$\boxed{= -37.4i + 12j - 15.6k \ \text{in/s}}$

$\vec{a} = \cancel{\vec{\alpha} \times \vec{r}_B} + \vec{\omega} \times (\vec{\omega} \times \vec{r}_B) = \vec{\omega} \times \vec{V}_B$

$= \begin{vmatrix} i & j & k \\ 1 & 6.24 & 2.4 \\ -37.4 & 12 & -15.6 \end{vmatrix} \begin{matrix} i & j \\ 1 & 6.24 \\ -37.4 & 12 \end{matrix}$

$= 6.24(-15.6)i + 2.4(-37.4)j + 1 \cdot 12k$

$-6.24(-37.4)k - 2.4 \cdot 12i - 1(-15.6)j$

$\boxed{= -126.3i - 37.36j + 245.6k \ \text{in/s}^2}$