

Quiz #7 Solutions

16-57. If the block at C is moving downward at 4 ft/s, determine the angular velocity of bar AB at the instant shown.

Kinematic Diagram : Since link AB is rotating about fixed point A , then v_B is always directed perpendicular to link AB and its magnitude is $v_B = \omega_{AB} r_{AB} = 2\omega_{AB}$. At the instant shown, v_B is directed towards the *negative* y axis. Also, block C is moving downward vertically due to the constraint of the guide. Then v_C is directed toward *negative* y axis.

Velocity Equation : Here, $r_{C/A} = \{3\cos 30^\circ i + 3\sin 30^\circ j\}$ ft
 $= \{2.598i + 1.50j\}$ ft. Applying Eq. 16-16, we have

$$\begin{aligned} v_C &= v_B + \omega_{BC} \times r_{C/B} \\ -4j &= -2\omega_{AB}j + (\omega_{BC}k) \times (2.598i + 1.50j) \\ -4j &= -1.50\omega_{BC}i + (2.598\omega_{BC} - 2\omega_{AB})j \end{aligned}$$

Equating i and j components gives

$$\begin{aligned} 0 &= -1.50\omega_{BC} & \omega_{BC} &= 0 \\ -4 &= 2.598(0) - 2\omega_{AB} & \omega_{AB} &= 2.00 \text{ rad/s} \end{aligned} \quad \text{Ans}$$

