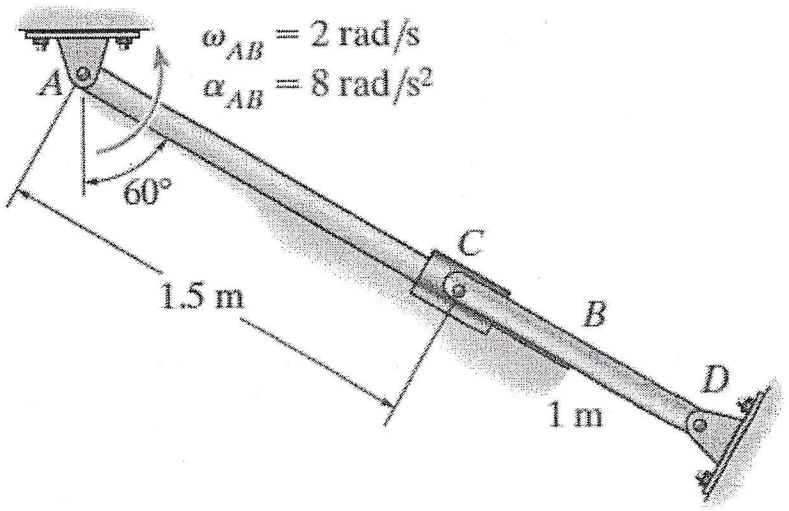
MAAE 2101 DYNAMICS – Class Quiz – 8% - L3 & L4 – Friday Nov. 24 – 2:30 to 3:30 am

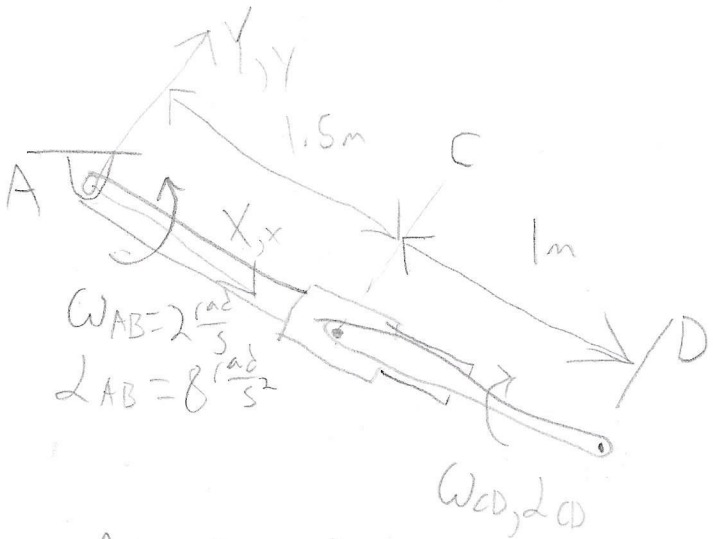
Last Name: _____ *First Name:*_____ *LAB /PA* :_____

Important: The LAB session (L1, L2, …) is required (to get the marked assignment back by your TA

The collar C is pinned to rod CD while it slides on rod AB. If rod AB has an angular velocity of 2 rad/s and an angular acceleration of 8 rad/s^2, both acting counterclockwise, determine the angular velocity and the angular acceleration of rod CD at the instant shown.



Solution



velocities

$$V_C = \omega_{CD} \times r_{DC} = (-\omega_{CD}\hat{k}) \times (-1\hat{i}) = \omega_{CD}\hat{j} \quad (1)$$

$$V_C = V_A + \omega_{AC} \times r_{AC} + (V_{C/A})_{xyz}$$

$$\omega_{CD}\hat{j} = 0 + (2\hat{k}) \times (1.5\hat{i}) + (V_{C/A})_{xyz}\hat{i} = -3\hat{j} + (V_{C/A})_{xyz}\hat{i}$$

x and y:

$$0 = (V_{C/A})_{xyz}$$

$$\omega_{CD} = +3 \text{ or } 3\frac{rad}{s}\circlearrowright$$

accelerations

$$a_C = \cancel{a_D}^{0} + \alpha_{CD} \times r_{DC} - \omega_{CD}^2 r_{DC}$$

$$= (\alpha_{CD}\hat{k}) \times (-1\hat{i}) - (-3)^2(-1\hat{i}) = +\alpha_{CD}\hat{j} + 9\hat{i} \quad (2)$$

$$a_C = \cancel{a_A}^{0} + \alpha_{AC} \times r_{AC} - \omega_{AC}^2 r_{AC} + 2\omega_{AC} \times \cancel{(V_{C/A})_{xyz}}^{0} + (a_{C/A})_{xyz}\hat{i}$$

$$9\hat{i} + \alpha_{CD}\hat{j} = (8\hat{k}) \times (1.5\hat{i}) - (2)^2(1.5\hat{i}) + 0 + (a_{C/A})_{xyz}\hat{i}$$

x and y:

$$9 = -6 + (a_{C/A})_{xyz} \rightarrow (a_{C/A})_{xyz} = 3\frac{m}{s^2}$$

$$\alpha_{CD} = 12\frac{rad}{s^2}\circlearrowright$$