

Rigid Body Kinematics III – Problem 1

In the position shown, bar AB has a constant angular velocity of 4 rad/sec counterclockwise. Determine the angular acceleration of bar CD.  $\omega_{BC} = 5 \text{ rps} \swarrow$   
 $\omega_{CD} = 3 \text{ rps} \nwarrow$

CLASSIFY MOTION

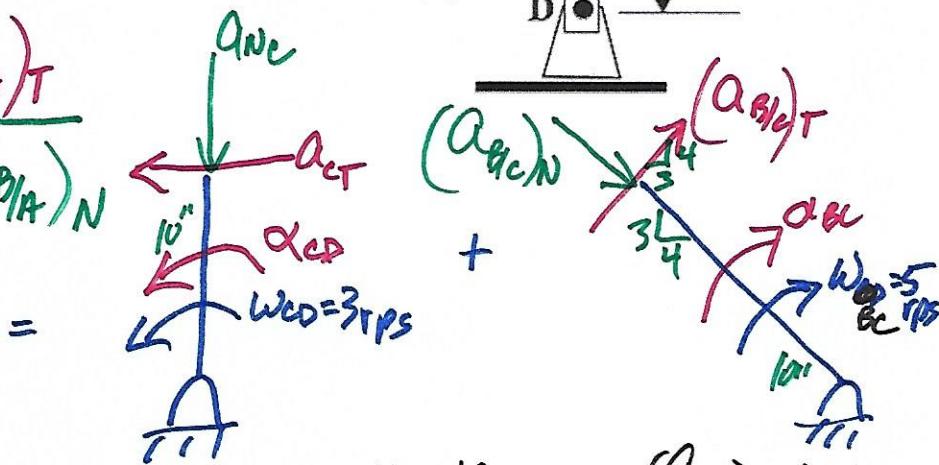
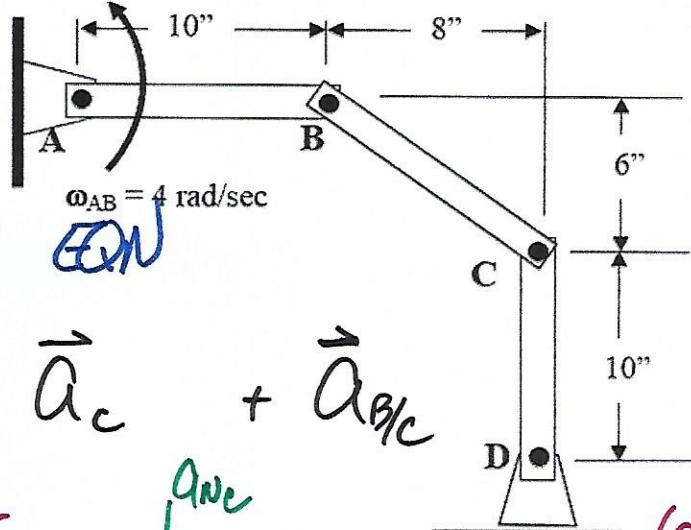
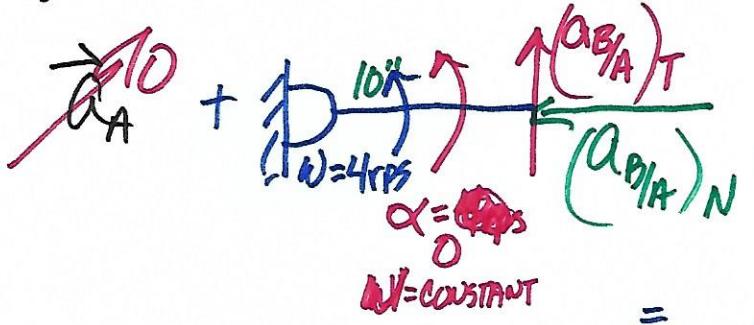
AB RAFA

BC GPM

CD RAFA

RELATIVE ACCELERATION

$$\vec{\alpha}_B = \vec{\alpha}_A + \vec{\alpha}_{B/A} = \vec{\alpha}_C + \vec{\alpha}_{B/C}$$



SCALAR EQNS

$$(a_{B/A})_T = \alpha r_{AB} = 0$$

$$(a_{B/A})_N = \omega^2 r_{AB} = (4)^2 (10) = 160$$

$$a_C = \alpha r_{CD} \quad \ddot{r}_{CD} = 10\alpha_{CD}$$

$$a_{CD} = \omega^2 r_{CD} = 5^2 (10) = 250$$

$$(a_{B/C})_T = \alpha r_{BC}$$

$$(a_{B/C})_N = \omega^2 r_{BC} = (5)^2 (10) = 250$$

$$\rightarrow 0 - 160 = -10\alpha_{CD} + \frac{3}{5}(10\alpha_{BC}) + \frac{4}{5}(250)$$

$$\uparrow 0 + 0 = -90 + \frac{4}{5}(10\alpha_{BC}) - \frac{3}{5}(250)$$

$$\alpha_{BC} = 30 \text{ rps}^2 \swarrow$$

$$\underline{\alpha_{CD} = 54 \text{ rps}^2 \nwarrow}$$