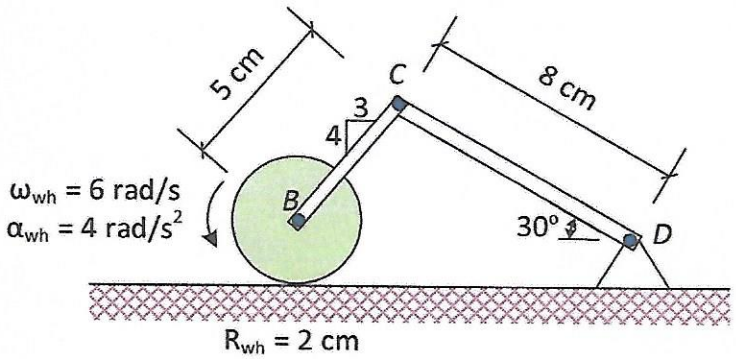
Rigid Body Kinematics II – Problem 4

The no-slip wheel at *B* has an angular velocity of 6 rad/s and an angular acceleration of 4 rad/s^2 (both CCW) as shown. Determine the angular velocity and acceleration of bars *BC* and *CD* as well as the acceleration of point *C* at this instant.



CLASSIFY MOTION

WHEEL B – GPM

BAR BC – GPM

BAR CD – RAFA

RELATIVE VELOCITY EQN:

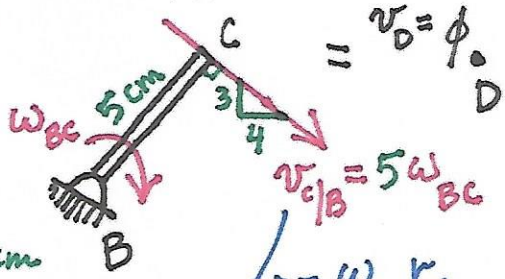
$\vec{v}_C = \vec{v}_B + \vec{v}_{C/B}$

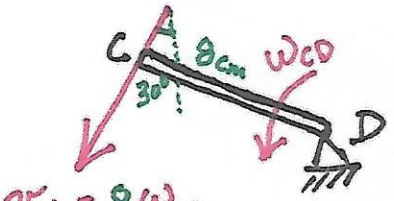
$\vec{v}_{C/B} = \vec{v}_D + \vec{v}_{C/D}$

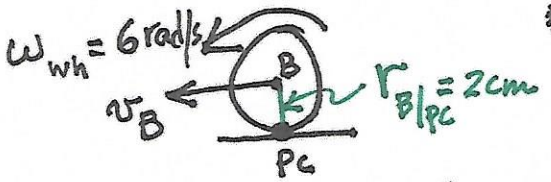
$= v_D = \phi \cdot D +$

KINEMATIC DIAGRAMS:

$v_B = 12\ \text{cm/s} \leftarrow$ B +







No Slip wheel $\Rightarrow v_B = \omega_{wh} r_{B/PC}$

$= 6\frac{\text{rad}}{\text{s}}(2\text{cm}) = 12\ \text{cm/s} \leftarrow$

$\rightarrow x$: $-12 + 5\omega_{BC}\left(\frac{4}{5}\right) = \phi - 8\omega_{CD}\sin 30$

$-12 + 4\omega_{BC} = -4\omega_{CD}$ ---- (1)

$\uparrow y$: $0 - 5\omega_{BC}\left(\frac{3}{5}\right) = \phi - 8\omega_{CD}\cos 30$

$-3\omega_{BC} = -6.9282\,\omega_{CD}$ --- (2)

2 Eqs 2 unk. ✓

Solve Eqs (1) & (2) to find ω_{BC} and ω_{CD}

$\omega_{BC} = 2.09\ \text{rad/s}\ \circlearrowleft$

$\omega_{CD} = 0.907\ \text{rad/s}\ \circlearrowright$