Rigid Body Kinematics II – Problem 2 ALTERNATE SOLUTION

At the instant shown the angular velocity of BC is 2 rad/second clockwise. Wheel A is a rolling no-slip wheel. Classify the motion of each rigid body in the figure, and determine the angular velocity of Wheel A. The radius of Wheel A is 1".
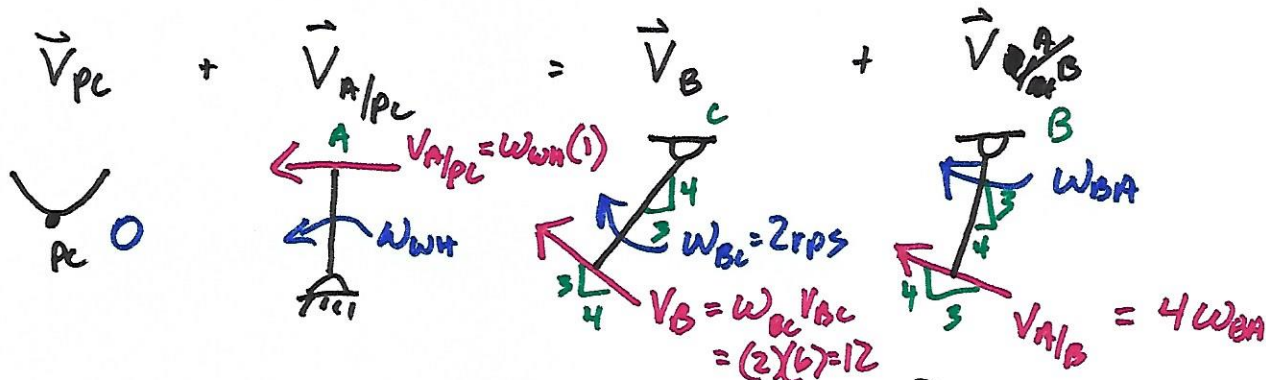
CLASSIFY MOTION

BC – RAFA
AB – GPM
WHEEL A – GPM

VELOCITY EQNS   CHOOSE PT "A"

$$\vec{V}_A = \vec{V}_{PC} + \vec{V}_{A/PC}$$
$$\vec{V}_A = \vec{V}_B + \vec{V}_{A/B}$$

COMBINING

$$\vec{V}_{PC} + \vec{V}_{A/PC} = \vec{V}_B + \vec{V}_{A/B}$$

$V_{A/PC} = \omega_{WH}(1)$

ω_{WH}

$\omega_{BC} = 2\,rps$

$V_B = \omega_{BC} V_{BC} = (2)(6) = 12$

ω_{BA}

$V_{A/B} = 4\omega_{BA}$

$$\leftarrow \Sigma X \quad 0 + V_{A/PC} = \tfrac{4}{5}V_B + \tfrac{3}{5}V_{A/B}$$
$$\omega_{WH}(1) = \tfrac{4}{5}(12) + \tfrac{3}{5}(4\omega_{BA})$$

$$\uparrow \Sigma Y \quad 0 + 0 = \tfrac{3}{5}(12) + \tfrac{4}{5}(4\omega_{BA})$$

$$\omega_{BA} = -2.25 = 2.25\,rps \;\circlearrowright$$

$$\underline{\omega_{WH} = 4.2\,rps} \;\circlearrowleft$$

$$\underline{V_A = \omega_{WH}(1) = 4.2(1) = 4.2\,in/s} \;\leftarrow$$