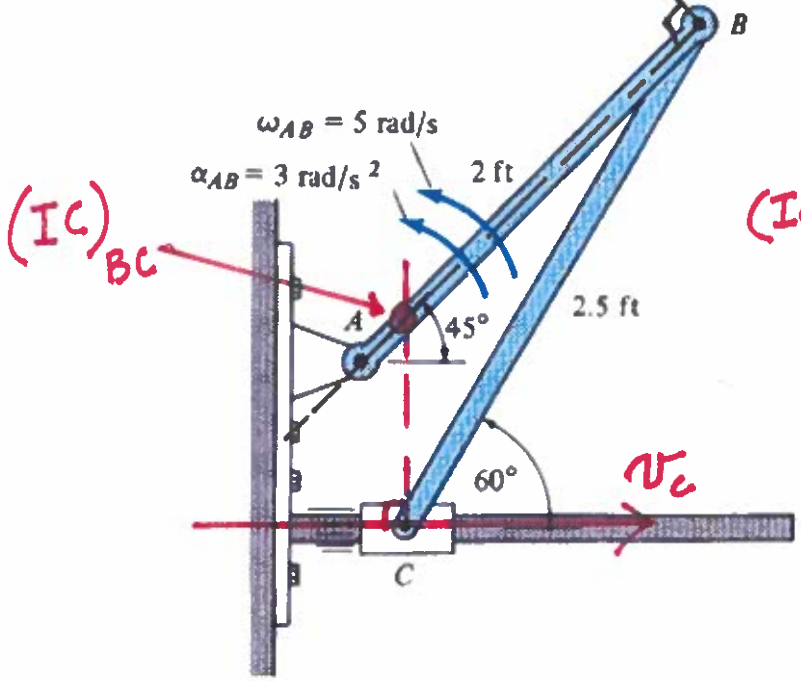
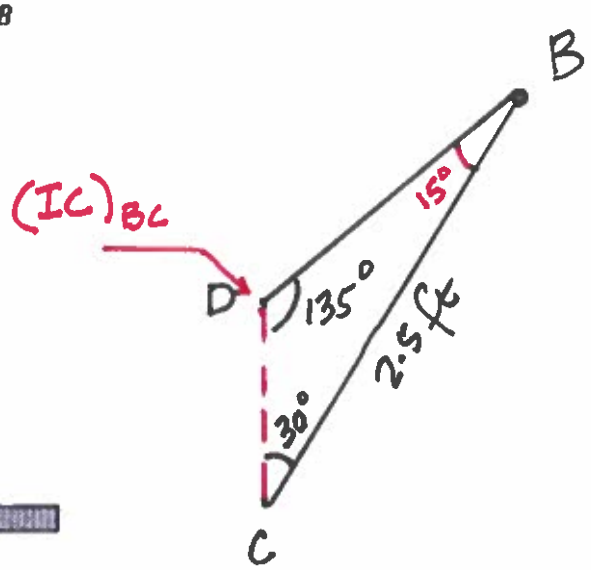
Name: _____ EGM 3240C – Fall 2023

Self-Graded Problem 1

$v_B = 5(2) = 10$ ft/s

Determine the acceleration of point *C* at the instant shown if rod *AB* has the angular motion as shown in the figure. You should show the appropriate kinematic diagrams for the system.





Note: To find the acceleration, we need to know the angular velocity ω_{AB} & ω_{BC} ⇒ Therefore solve first for ω_{BC} using either the ICZV or the relative velocity equation

Δ BCD $\quad \frac{\overline{DC}}{\sin 15^\circ} = \frac{\overline{BD}}{\sin 30} = \frac{2.5\text{ ft}}{\sin 135^\circ}$

$\overline{DC} = 0.91506$ ft , $\overline{BD} = 1.76777$ ft

Rod BC $\quad v_B = \omega_{BC}\,\overline{BD}$

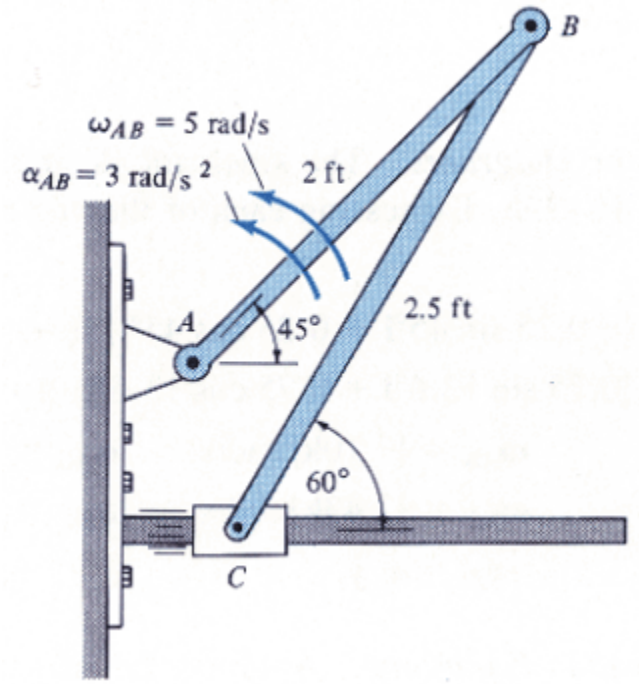
$10\text{ ft/s} = \omega_{BC} \times 1.76777\text{ ft}$

$\omega_{BC} = 5.657$ rad/s

Note: Although not needed, we can find v_C since $v_C = \omega_{BC}\,\overline{DC}$

$v_C = 5.657 \times 0.91506 = 5.18$ ft/s →

Problem 6. Determine the acceleration of point *C* at the instant shown if rod *AB* has the angular motion as shown in the figure. You should show the appropriate kinematic diagrams for the system.

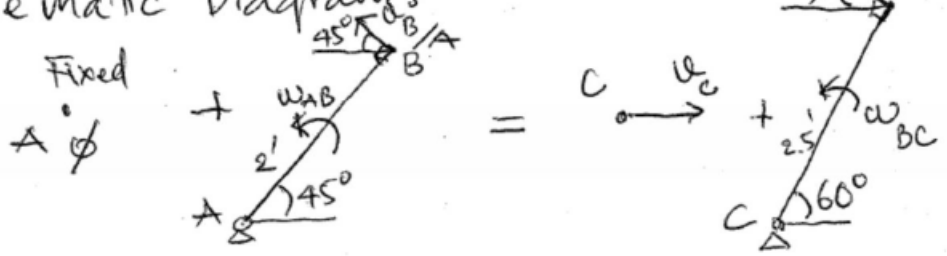


Classify motion:
AB: RAFA
BC: GPM

Relative Velocity Equation:

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

Kinematic Diagrams



Answer: $a_C = 66.4$ ft/s^2 →

Problem 6 Continued

Equations to Solve:

$\uparrow F_y: \quad 0 + v_{B/A}\sin 45^\circ = 0 + v_{B/C}\sin 30^\circ$

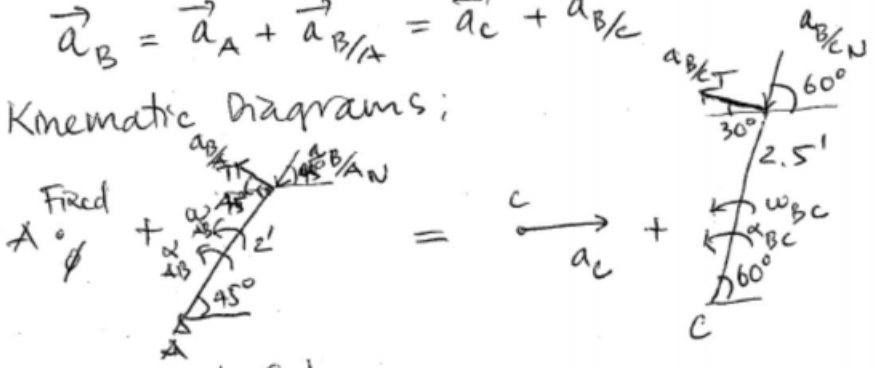
$5 \times 2 \times \sin 45^\circ = \omega_{BC} \times 2.5 \times \sin 30^\circ$

$\Rightarrow \omega_{BC} = 5.657 \text{ rad/s} \quad \text{c.c.w.}$

Relative acceleration Equation:

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

Kinematic Diagrams:



Equations to Solve:

$\uparrow \Sigma F_y: \quad a_{B/A_T}\sin 45^\circ - a_{B/A_N}\sin 45^\circ = 0 + a_{B/C_T}\sin 30^\circ - a_{B/C_N}\sin 60^\circ$

$3 \times 2 \times \sin 45^\circ - 5^2 \times 2 \times \sin 45^\circ = \alpha_{BC} \times 2.5 \times \sin 30^\circ - 5.657^2 \times 2.5 \times \sin 60^\circ$

$\Rightarrow \alpha_{BC} = 30.5 \text{ rad/s}^2 \quad \text{c.c.w.}$

$\rightarrow \Sigma F_x: \quad 0 - a_{B/A_T}\cos 45^\circ - a_{B/A_N}\cos 45^\circ = a_C - a_{B/C_T}\cos 30^\circ - a_{B/C_N}\cos 60^\circ$

$-3 \times 2 \times \cos 45^\circ - 5^2 \times 2 \times \cos 45^\circ = a_C - 30.5 \times 2.5 \times \cos 30^\circ - 5.657^2 \times 2.5 \times \cos 60^\circ$

$\Rightarrow a_C = \underline{66.4 \text{ ft/s}^2} \rightarrow C$