ME 481 - H04 **Name** ________________________

1) A trunnion mount hydraulic cylinder actuates the arm of a skid steer loader as shown below.

Write a geometric equation to determine lift angle θ when given cylinder/rod length e.

Compute lift angle θ for e = 40 inches. θ _______________

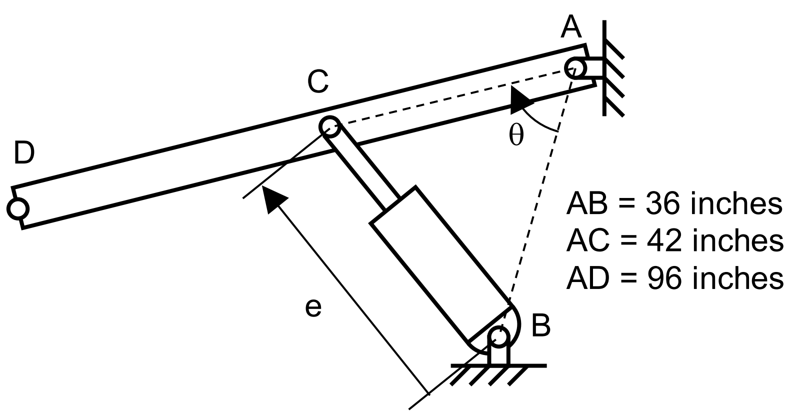
Write a geometric equation to determine lift speed $\dot{\theta}$ when given cylinder rod velocity $\dot{e}$.

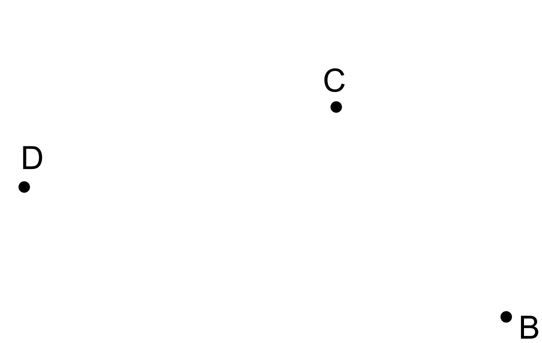
Compute lift speed $\dot{\theta}$ when the cylinder rod is retracting at 12 inches per second at this position.

$\dot{\theta}$ _______________

Use the dots to the right of the picture to draw and label complex number vectors that model this mechanism. Write a position loop equation to analyze this mechanism.

For each vector in your loop equation, complete the table describing if the length and angle of each vector are constant, variable, constrained or driver information.





Vector #	Length	Angle

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2) Program the two variable Newton-Raphson algorithm for position analysis of a four bar mechanism as shown in Notes_03_02 and Notes_03_03. Complete the table shown below. Provide hard copy of your code.

Given: r_1 = 90 cm, r_2 = 30 cm, r_3 = 60 cm, r_4 = 45 cm, $\theta_1 = 0°$, $\theta_2 = 10°$

k	$\{q\} = \begin{Bmatrix} \theta_3 \\ \theta_4 \end{Bmatrix}$ [deg]	$\{\Phi\} = \begin{Bmatrix} f_H \\ f_V \end{Bmatrix}$ [cm]	$[\partial\Phi / \partial q]$ [cm/rad]	$[\partial\Phi / \partial q]^{-1}\{\Phi\}$ [rad]	$[\partial\Phi / \partial q]^{-1}\{\Phi\}$ [deg]
1	0 90				
2					
3					
4					
5			$\det[\Phi_q]$=		

Check your solution by another method. Show your work. θ_3 ____________ θ_4 ____________

3) Use your Newton-Raphson code to find θ_3 and θ_4 for the four bar portion of the sewing machine on page 5 of Notes_03_04 when the crank is straight down. Do not analyze the offset slider crank portion.

Given: r_1 = 4.07 cm, r_2 = 1.60 cm, r_3 = 3.57 cm, r_4 = 2.24 cm, $\theta_1 = 110.4°$, $\theta_2 = 270°$

θ_3 ____________ θ_4 ____________

EXTRA CREDIT

Modify your Newton-Raphson algorithm to find θ_2 and θ_4 when $\theta_3 = 0°$ for the four bar in part 2) above. Provide hardcopy of your code.

θ_2 ____________ θ_4 ____________