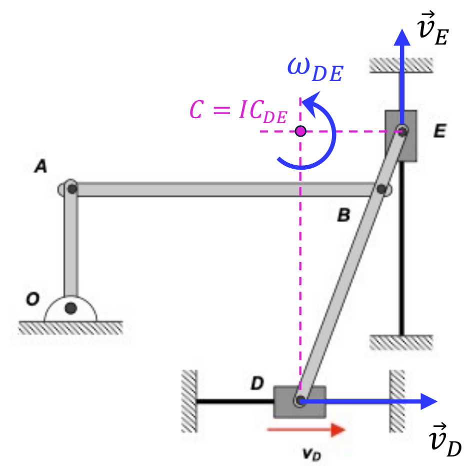
ME 274 – Spring 2025
Quiz04 – 1:30 section

SOLUTION

Question Q1

Block D moves to the right with a speed of v_D.

Part A – Show the location of the instant center for link DE in the figure to the right. The figure is drawn to scale.



Part B – If $\vec{\omega}_{DE}$ represents the angular velocity of link DE, then:

a) $\vec{\omega}_{DE} =$ CCW
b) $\vec{\omega}_{DE} = 0$
c) $\vec{\omega}_{DE} =$ CW

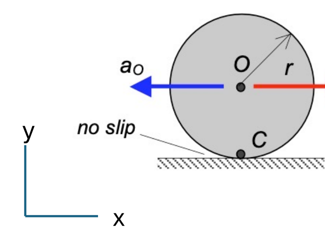
Part C – If v_E represents the speed of E in position shown, then:

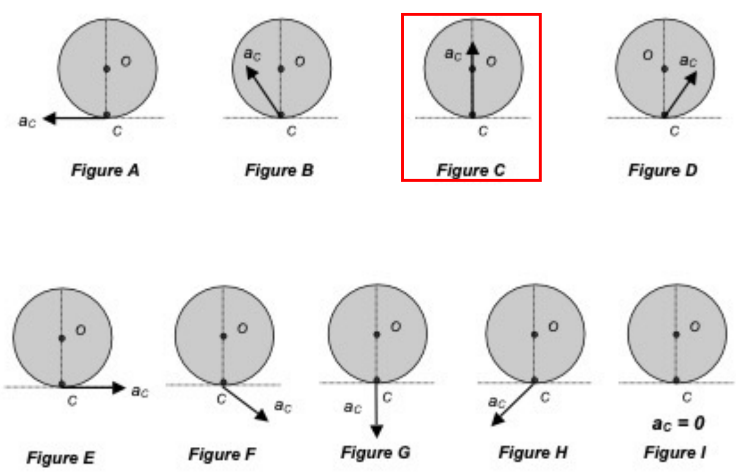
a) $v_D > v_E$
b) $v_D = v_E$
c) $v_D < v_E$

$$v_D = |\vec{r}_{D/C}|\omega_{DE}$$
$$v_E = |\vec{r}_{E/C}|\omega_{DE}$$
$$|\vec{r}_{D/C}| > |\vec{r}_{D/C}| \Rightarrow v_D > v_E$$

Question Q2

A disk rolls to the right with its center O having a speed of v_O and $\dot{v}_O < 0$. Circle the figure below that most accurately represents the direction of the acceleration of the no-slip contact point C.





Since C is no-slip point on a fixed surface aligned with the x-axis, we know that $a_{Cx} = 0$. Also, O moves on a straight path aligned with the x-axis.

$$\vec{a}_C = \vec{a}_O + \vec{\alpha} \times \vec{r}_{C/O} - \omega^2 \vec{r}_{C/O}$$
$$a_{Cy}\hat{j} = -a_O\hat{\imath} + (\alpha\hat{k}) \times (-r\hat{j}) - \omega^2(-r\hat{j})$$
$$= (-a_O + r\alpha)\hat{\imath} + r\omega^2\hat{j}$$

Balancing the y-components shows that $a_{Cy} = r\omega^2 > 0$.