QUESTION 1 (2018 Supp Final Exam)

The two-link mechanism serves to amplify angular motion. Link *AB* has a pin at *B* which is confined to move within the slot of link *CD*. At the instant shown in Figure Q1, link *AB* (input) has a clockwise angular velocity of ω_{AB} = 2.5 rad/s and a counter-clockwise angular acceleration α_{AB} = 5 rad/s^2, determine:

(a) The angular velocity (magnitude and direction) of link *CD*.
(b) The velocity (magnitude and direction) of pin *B* relative to link *CD*.
(c) The angular acceleration (magnitude and direction) of link *CD*.
(d) The acceleration (magnitude and direction) of pin *B* relative to link *CD*.

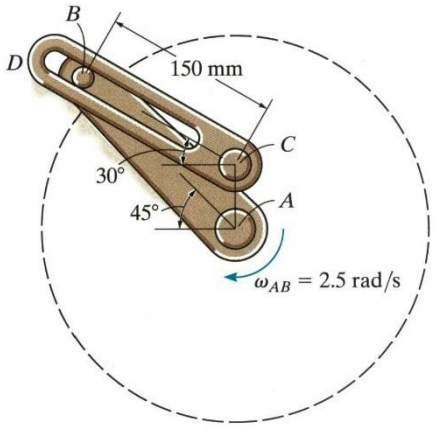

Figure Q1

[Answers: ω_{CD} = 2.962 rad/s CW; $v_{B/B'}$ = 0.119 m/s along link *CD* towards point *C*; α_{CD} = 3.20 rad/s^2 CCW; a_{rel} = 0.444 m/s^2 along link *CD* towards point *D*]

QUESTION 2 (2018 Final Exam)

The 5-kg disk rotates about a fixed axis through point *O* with a clockwise angular velocity ω_0 = 20 rad/s and a counter-clockwise angular acceleration α_0 = 5 rad/s^2 at the instant shown in Figure Q2. Pin *A* is fixed to the disk but slides freely within the slotted member *BC* with a mass of 2 kg. Determine:

(a) the angular velocity (magnitude and direction) of BC,
(b) the velocity (magnitude and direction) of pin A relative to slotted member BC,
(c) the acceleration (magnitude and direction) of pin A relative to slotted member BC, and
(d) the reaction force exerted on the disk at point A at the instant shown.

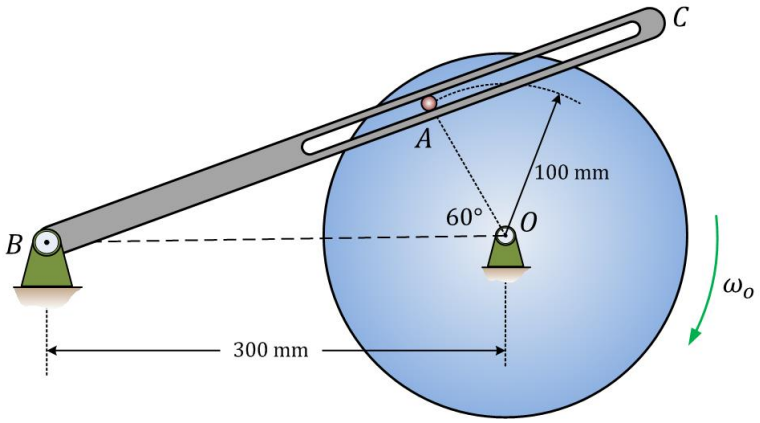

Figure Q2

[Answers: ω_{BC} = 1.43 rad/s CCW; $v_{A/A'}$ = 1.964 m/s along link *BC* towards point *C*; a_{rel} = 7.609 m/s^2 along link *BC* towards point *C*; F_A = 6.596 N]

Also, see the full solution in Test 2 Questions & Solution under Week 10 in Moodle (Note ω_0 is different)

QUESTION 3 (2018 Supplementary Exam)

A 4-kg disk is driven by a constant moment M = 15 Nm and is connected to a 3-kg piston by a 2-kg connecting rod AB. The spring constant is k = 500 N/m and its mass is neglectable. The system is at rest at the position shown in Figure Q3. After the disk rotates one-fourth of a revolution, determine:

(a) The angular velocity (magnitude and direction) of the disk.
(b) The velocity (magnitude and direction) of the piston.

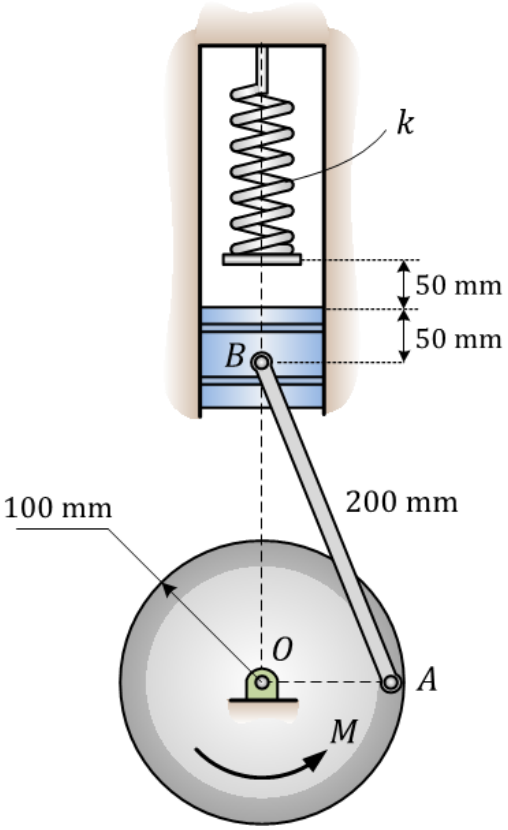

Figure Q3

[Answers: ω_{disk} = 34.813 rad/s CCW; v_P = 0 m/s]