Engineering Dynamics
Homework 5

1.
A flywheel has its angular speed increased uniformly from 15 rad/s to 60 rad/s in 90 s. If the diameter of the wheel is 1 ft, determine the magnitudes of the normal and tangential components of acceleration of a point on the rim of the wheel when $t = 90$ s, and the total distance the point travels during the time period.

$a_n =$_____ ft/s^2

$a_t =$_____ ft/s^2

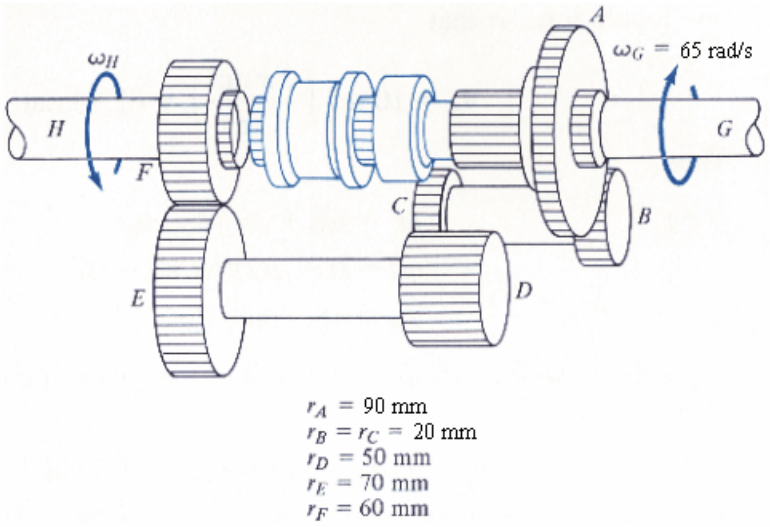
$s_{\Delta t=80} =$_____ ft

2.
The tub of a washing machine is rotating at 54 rad/s when the power is turned off. If it takes 12 s for the tub to come to rest, determine (a) the constant angular deceleration α, and (b) the total number of revolutions n the tub makes.

$|\alpha| =$_____ rad/s^2

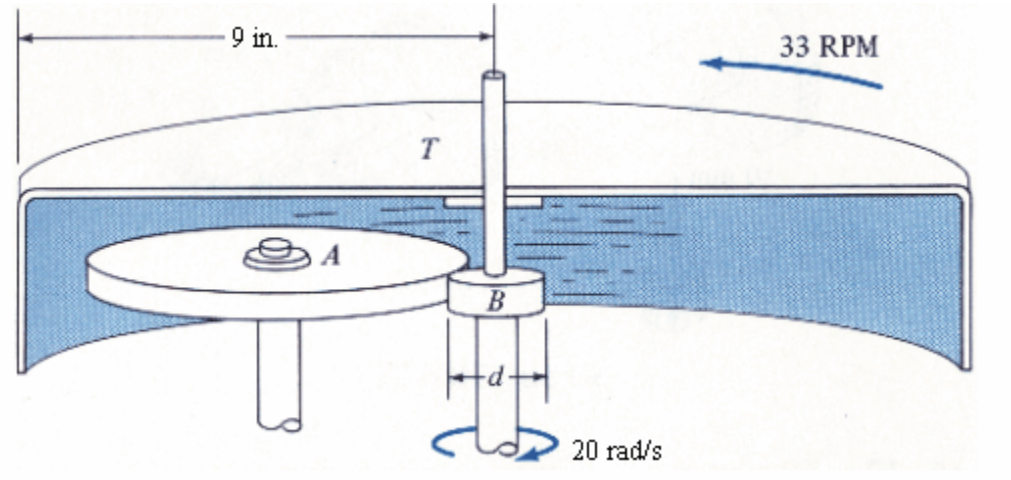
$n =$_____ revolutions

3.
The operation of "reverse" for a three-speed automotive transmission is illustrated schematically in the figure. If the crank shaft G is turning with an angular speed of 65 rad/s, determine the angular speed of the drive shaft H . Each of the gears rotates about a fixed axis. Note that gears A and B, C and D, E and F are in mesh. The radius of each of these gears is reported in the figure.



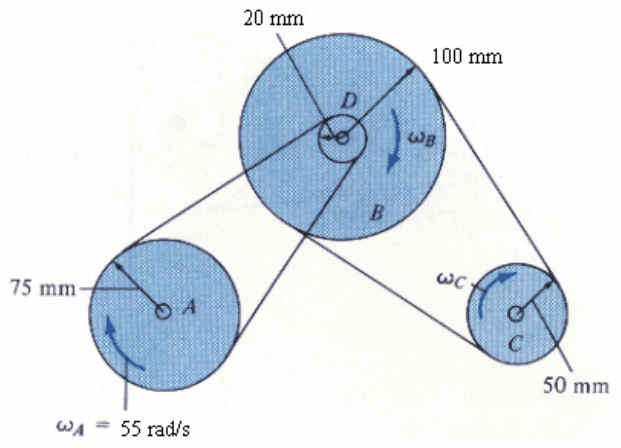
ω_H = _____ rad/s

4.
The phonograph turntable *T* is driven by the frictional idler wheel *A* which simultaneously bears against the inner rim of the turntable and the motor-shaft spindle *B*. Determine the required diameter *d* of the spindle if the motor turns it at 20 rad/s and it is required that the turntable rotate at 33 revolutions per minute.



d = _____ in.

5.
The power of a bus engine is transmitted using the belt-and-pulley arrangement shown. If the engine turns pulley *A* and 55 rad/s, compute the angular velocities of the generator pulley *B* and the air-conditioning pulley *C*. The hub at *D* is rigidly connected to *B* and turns with it.

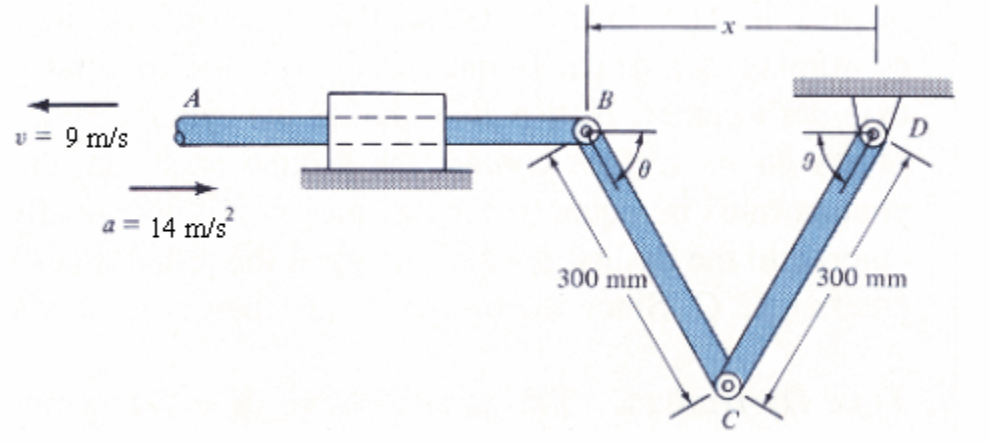


$|\omega_B|$ = _____ rad/s

$|\omega_C|$ = _____ rad/s

6.

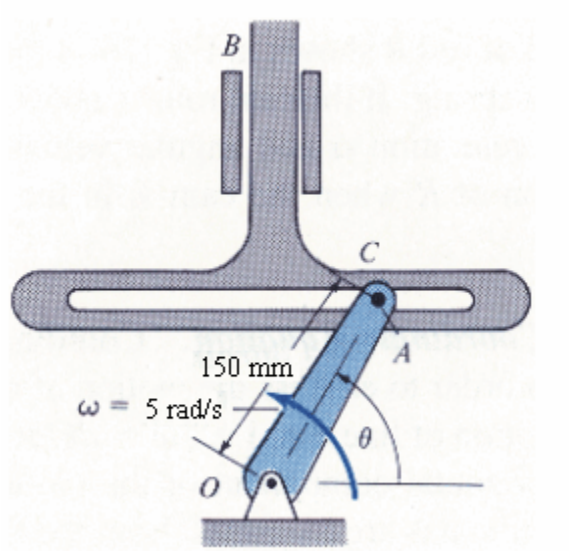
At the instant shown, $\theta = 60°$ and rod AB is subjected to a deceleration of 14 m/s^2 when the velocity is 9 m/s. Determine the angular velocity and angular acceleration of link CD at this instant.



$|\omega_{CD}|$ = _____ rad/s

$|\alpha_{CD}|$ = _____ rad/s^2

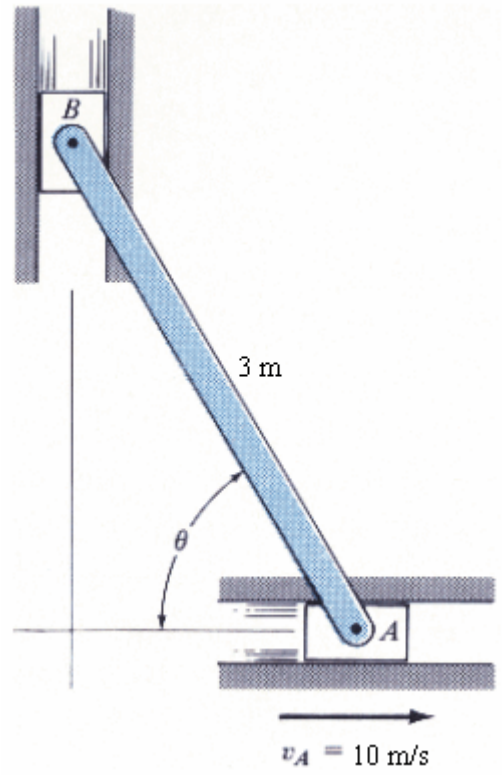
7.
The Scotch yoke is used to convert the constant circular motion of crank *OA* into translating motion of rod *BC*. If *OA* is rotating with a constant angular velocity ω=5 rad/s, determine the velocity and acceleration of *BC* for any angle θ of the crank.



v = _____ m/s

a = _____ m/s^2

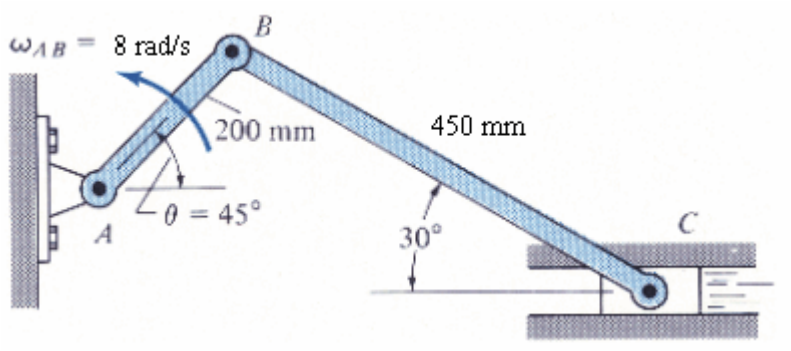
8.
The 2-m-long bar is confined to move in the horizontal and vertical slots *A* and *B*. If the velocity of the slider block at *A* is 10 m/s, determine the bar's angular velocity and the velocity of block *B* at the instant θ=55º.



$|\omega_{AB}|$ = _____ rad/s

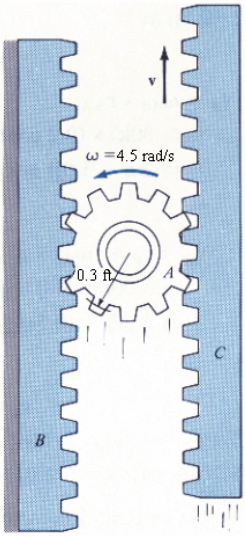
$|v_B|$ = _____ m/s

9.
If bar AB has an angular velocity ω_{AB} = 8 rad/s, determine the velocity of the slider block C at the instant shown.



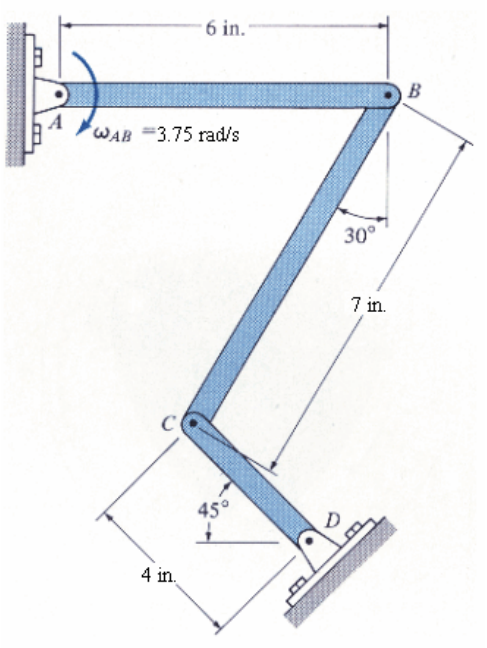
$|v_C|$ = _____m/s

10.
The pinion gear A rolls on the fixed gear rack B with an angular velocity ω=4.5 rad/s. Determine the velocity of the gear rack C.



$|v_C|$ = _____ ft/s

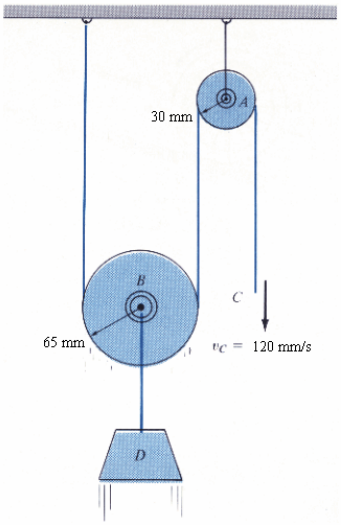
11.
If link *AB* is rotating at 3.75 rad/s, determine the angular velocities of links *BC* and *CD* at the instant shown.



$|\omega_{BC}|$ = _____ rad/s

$|\omega_{CD}|$ = _____ rad/s

12.
If the end of the cord is pulled downward with a speed v_C = 120 mm/s, determine the angular velocities of pulleys *A* and *B* and the speed of block *D*. Assume that the cord does not slip on the pulleys.

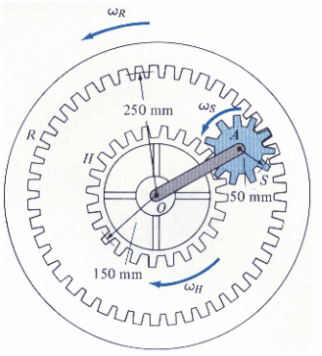


$|\omega_A|$ = _____ rad/s

$|\omega_B|$ = _____ rad/s

$|v_D|$ = _____ mm/s

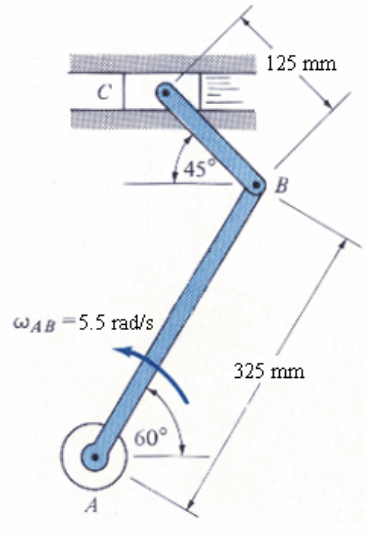
13.
If the hub gear *H* and ring gear *R* have angular velocities ω_H = 3.5 rad/s and ω_R = 20 rad/s, respectively, determine the angular velocity ω_S of the spur gear *S* and the angular velocity of its attached arm *OA*.



$|\omega_S|$ = _____

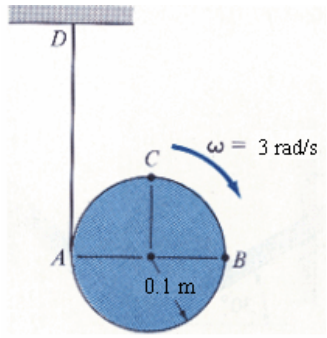
$|\omega_{OA}|$ = _____

14.
The shaper mechanism is designed to give a slow cutting stroke and a quick return to a blade attached to the slider at *C*. Determine the velocity of the slider at *C* at the instant shown, if the link *AB* is rotating at 5.5 rad/s.



$|v_C|$ = _____ m/s

15.
At the instant shown, the disk is rotating at ω=3 rad/s. If the end of the cord wrapped around the disk is fixed at *D*, determine the velocities of points A, *B*, and *C*.



$|v_A|$ = _____ m/s

$|v_B|$ = _____ m/s

$|v_C|$ = _____ m/s