The pinion $A$ of the hoist motor drives gear $B$, which is attached to the hoisting drum. The load $L$ is lifted from its rest position and acquires an upward velocity of 2 m/s in a vertical raise of 0.8 m with constant acceleration. As the load passes this position, compute (a) the acceleration of point $C$ on the cable in contact with the drum and (b) the angular velocity and angular acceleration of the pinion $A$. 

![Diagram of a hoist motor and gear system]
The angular velocity of a gear is controlled according to \( \omega = 12 - 3t \) where \( \omega \), in radians per second, is positive in the clockwise sense and where \( t \) is the time in seconds. Find the net angular displacement \( \Delta \theta \) from the time \( t = 0 \) to \( t = 3s \). Also find the total number of revolutions \( N \) through which the gear turns during the 3 seconds.
The circular disk rotates about its $z$-axis with an angular velocity in the direction shown. At a certain instant the magnitude of the velocity of point $A$ is 3 m/s and is decreasing at the rate 7.2 m/s$^2$. Write the vector expressions for the angular acceleration $\alpha$ of the disk and the total acceleration of point $B$ at the instant.
A wheel of radius \( r \) rolls on a flat surface without slipping. Determine the angular motion of the wheel in terms of the linear motion of its center \( O \). Also determine the acceleration of a point on the rim of the wheel as the point comes into contact with the surface on which the wheel rolls.
The slotted arm $OA$ rotates with a constant angular velocity $\omega = \dot{\theta}$ during a limited interval of its motion and moves the pivoted slider block along the horizontal slot. Write the expressions for the velocity $v_B$ and acceleration $a_B$ of the pin $B$ in the slider block in terms of $\theta$. 

![Diagram of the slotted arm and slider block](image-url)
At the instant represented, $a = 150$ mm and $b = 125$ mm, and the distance $a + b$ between $A$ and $C$ is decreasing at the rate of 0.2 m/s. Determine the common velocity $v$ of points $B$ and $D$ for this instant.
Link $OA$ revolves counterclockwise with a constant angular velocity of $3 \text{ rad/s}$. Link $AB$ slides through the pivoted collar at $C$. Determine the angular velocity $\omega$ of $AB$ when $\theta = 40^\circ$. 

![Diagram of the mechanism with link $OA$ revolving and link $AB$ sliding through a collar at $C$. The diagram shows the dimensions and the direction of motion.]
The wheel of radius $r = 300$ mm rolls to the right without slipping and its center $O$ has a velocity $v_0 = 3$ m/s. Calculate the velocity of point $A$ on the wheel for the instant represented.
Each of the sliding bars \( A \) and \( B \) engages its respective rim of the two riveted wheels without slipping. Determine the magnitude of the velocity of point \( P \) for the position shown.
End $A$ of the link has a downward velocity $v_A$ of 2 m/s during an interval of its motion. For the position where $\theta = 30^\circ$ determine the angular velocity $\omega$ of $AB$ and the velocity $v_G$ of the midpoint $G$ of the link.
If the link $OB$ and the connecting rod $AB$ have lengths of $r = 0.3$ m and $l = 0.8$ m, respectively. The link $OB$ rotates with the angular velocity of 2000 rpm. At the instant of $\theta = 40^\circ$ determine the angular velocity of the rod $AB$ and the velocities of the slider $A$ and of the connecting rod’s C.G.
The power screw turns at a speed which gives the threaded collar $C$ a velocity of 0.25 m/s vertically down. Determine the angular velocity of the slotted arm when $\theta = 30^\circ$. 
If the wheel rolls on the circular surface without slipping, obtain an expression for the acceleration of point $C$ on the wheel momentarily in contact with the circular surface in the bottom position. The wheel has an angular velocity $\omega$ and an angular acceleration $\alpha$ at this position.
The crank $CB$ has a constant counterclockwise angular velocity of 2 rad/s in the position shown during a short interval of its motion. Determine the angular acceleration of links $AB$ and $OA$ for this position.
Elements of the switching device are shown here. If the velocity $v$ of the control rod is 0.9 m/s and is decreasing at the rate of 6 m/s$^2$ when $\theta = 60^\circ$, determine the magnitude of the acceleration of $C$. 
The crank $OA$ revolves clockwise with a constant angular velocity of 10 rad/s within a limited arc of its motion. For the position $\theta = 30^\circ$, determine the angular velocity of the slotted link $CB$ and the acceleration of $A$ as measured relative to the slot in $CB$. 

![Diagram of a crank OA with a slotted link CB and point A]
Each of the two cars $A$ and $B$ is traveling with a constant speed of 72 km/h. Determine the velocity and acceleration of car $A$ as seen by an observer moving and rotating with car $B$ when the cars are in the position shown. The $x$-$y$ axes are attached to car $B$. Sketch both relative-motion vectors.
At the instant represented, the disk with the radial a lot is rotating about $O$ with a counterclockwise angular velocity of 4 rad/s which is decreasing at the rate of 10 rad/s$^2$. The motion of slider $A$ is separately controlled, and at this instant, $r = 150$ mm, $\dot{r} = 125$ mm/s, and $\ddot{r} = 2025$ mm/s$^2$. Determine the absolute velocity and acceleration of $A$ for this position.