3. The disk rotates about a fixed axis through $O$ with an angular velocity $\omega = 5 \text{ rad/s (ccw)}$ and an angular acceleration $\alpha = 4 \text{ rad/s}^2 \text{ (cw)}$ at the instant represented. The particle $A$ moves in the circular slot with $\dot{\beta} = 2 \text{ rad/s (ccw)}$ and $\ddot{\beta} = 3 \text{ rad/s}^2 \text{ (cw)}$ when $\beta = 37^\circ$. Determine the absolute velocity and acceleration of $A$ at this instant.

Take $\cos 37 = 0.8$, $\sin 37 = 0.6$. 
4. Link 1, of the plane mechanism shown, rotates about the fixed point $O$ with a constant angular speed of 5 rad/s in the cw direction while slider $A$, at the end of link 2, moves in the circular slot of link 1. Determine the angular velocity and the angular acceleration of link 2 at the instant represented where $BO$ is perpendicular to $OA$. The radius of the slot is 10 cm.

Take $\sin 37=0.6$, $\cos 37=0.8$. 
The Geneva wheel is a mechanism for producing intermittent rotation. Pin $P$ in the integral unit of wheel $A$ and locking plate $B$ engages the radial slots in wheel $C$, thus turning wheel $C$ one-fourth of a revolution for each revolution of the pin. At the engagement position $\theta = 45^\circ$. For a constant clockwise angular velocity $\omega_1 = 2$ rad/s of wheel $A$, determine the angular acceleration $\alpha_2$ of wheel $C$ for the instant when $\theta = 20^\circ$. 
constant clockwise angular velocity \( \omega_1 = 2 \text{ rad/s} \), determine the angular acceleration \( \alpha_2 \) when \( \theta = 20^\circ \).

\[
200 / \sqrt{2} = 141.42 \text{ mm}
\]

\[
d^2 = 141.42^2 + 200^2 - 2(141.42)(200) \cos 20
\]

\[
d = 82.77 \text{ mm}
\]

**Law of sines:**

\[
\frac{82.77}{\sin 20} = \frac{141.42}{\sin \alpha} \quad \rightarrow \quad \alpha = 35.76^\circ
\]

**Velocity**

**Plate B:**

\[
\vec{v}_P = \vec{v}_{O1} + \vec{\omega}_1 \times \vec{r}_{P/O1} = -2\vec{k} \times \left(141.42 \cos \theta \vec{i} + 141.42 \sin \theta \vec{j}\right) = 96.74\vec{i} - 265.79\vec{j}
\]

**Plate C:**

\[
\vec{v}_P = \vec{v}_{O2} + \vec{\omega}_2 \times \vec{r}_{P/O2} + \vec{v}_{rel} = \omega_2 \vec{k} \times \left(-82.77 \cos \alpha \vec{i} + 82.77 \sin \alpha \vec{j}\right) + \vec{v}_{rel} \left(\cos \alpha \vec{i} - \sin \alpha \vec{j}\right)
\]

\[
\vec{v}_P = -67.17 \omega_2 \vec{j} - 48.37 \omega_2 \vec{i} + 0.811v_{rel} \vec{i} - 0.584v_{rel} \vec{j}
\]

\[
\Box 1 = \Box 2 \quad \Rightarrow \quad \omega_2 = 1.932 \text{ rad / s} \quad v_{rel} = 234.5 \text{ mm / s}
\]
\[ \ddot{a}_p = \ddot{a}_{O_1} + \omega_1 \times (\omega_1 \times \vec{r}_{P/O_1}) = -531.58 \hat{i} - 193.48 \hat{j} \]  

\[ \ddot{a}_p = 1.932 \hat{k} \times \left[ 1.932 \hat{k} \times \left( -67.17 \hat{i} + 48.37 \hat{j} \right) \right] + \alpha_2 \hat{k} \times \left( -67.17 \hat{i} + 48.37 \hat{j} \right) \]
\[ + 2 \left( 1.932 \hat{k} \right) \times \left( 234.5 \cos \alpha \hat{i} - 234.5 \sin \alpha \hat{j} \right) + a_{rel} \left( \cos \alpha \hat{i} - \sin \alpha \hat{j} \right) \]
\[ \ddot{a}_p = 250.72 \hat{i} - 180.55 \hat{j} - 67.17 \alpha_2 \hat{j} - 48.37 \alpha_2 \hat{i} + 529.52 \hat{i} + 734.16 \hat{j} + 0.811 a_{rel} \hat{i} - 0.584 a_{rel} \hat{j} \]

\[ \alpha_2 = 16.59 \text{ rad} / \text{s}^2 \quad a_{rel} = -628.1 \text{ mm} / \text{s}^2 \]
For the instant shown, particle A has a velocity of 12.5 m/s towards point C relative to the disk and this velocity is decreasing at the rate of 7.5 m/s each second. The disk rotates about B with angular velocity $\omega = 9$ rad/s and angular acceleration $\alpha = 60$ rad/s$^2$ in the directions shown in the figure. The angle $\beta$ remains constant during the motion. Telescopic link has a velocity of 5 m/s and an acceleration of $-2.5$ m/s. Determine the absolute velocity and acceleration of point A for the position shown.