$$\mathbf{MT} = \begin{pmatrix} \cos(\theta) & \cos(\alpha)\,(-\sin(\theta)) & \sin(\alpha)\sin(\theta) & a\cos(\theta) \\ \sin(\theta) & \cos(\alpha)\cos(\theta) & \sin(\alpha)\,(-\cos(\theta)) & a\sin(\theta) \\ 0 & \sin(\alpha) & \cos(\alpha) & d \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Out[16]= $\begin{pmatrix} \cos(\theta) & -\cos(\alpha)\sin(\theta) & \sin(\alpha)\sin(\theta) & a\cos(\theta) \\ \sin(\theta) & \cos(\alpha)\cos(\theta) & -\cos(\theta)\sin(\alpha) & a\sin(\theta) \\ 0 & \sin(\alpha) & \cos(\alpha) & d \\ 0 & 0 & 0 & 1 \end{pmatrix}$

MT01 = MT /. $\{\theta \to \theta1,\ d \to 0,\ \alpha \to 0,\ a \to l1\}$

Out[17]= $\begin{pmatrix} \cos(\theta1) & -\sin(\theta1) & 0 & l1\cos(\theta1) \\ \sin(\theta1) & \cos(\theta1) & 0 & l1\sin(\theta1) \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

MT12 = MT /. $\{\theta \to \theta2,\ d \to 0,\ \alpha \to 0,\ a \to l2\}$

Out[18]= $\begin{pmatrix} \cos(\theta2) & -\sin(\theta2) & 0 & l2\cos(\theta2) \\ \sin(\theta2) & \cos(\theta2) & 0 & l2\sin(\theta2) \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

MT23 = MT /. $\{\theta \to -\theta3,\ d \to 0,\ \alpha \to 0,\ a \to l3\}$

Out[19]= $\begin{pmatrix} \cos(\theta3) & \sin(\theta3) & 0 & l3\cos(\theta3) \\ -\sin(\theta3) & \cos(\theta3) & 0 & -l3\sin(\theta3) \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

MT02 = FullSimplify[MT01.MT12]
⌊simplifica completamente

Out[20]= $\begin{pmatrix} \cos(\theta1+\theta2) & -\sin(\theta1+\theta2) & 0 & l1\cos(\theta1)+l2\cos(\theta1+\theta2) \\ \sin(\theta1+\theta2) & \cos(\theta1+\theta2) & 0 & l1\sin(\theta1)+l2\sin(\theta1+\theta2) \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

MT03 = FullSimplify[MT01.MT12.MT23]
⌊simplifica completamente

Out[21]= $\begin{pmatrix} \cos(\theta1+\theta2-\theta3) & -\sin(\theta1+\theta2-\theta3) & 0 & l1\cos(\theta1)+l2\cos(\theta1+\theta2)+l3\cos(\theta1+\theta2-\theta3) \\ \sin(\theta1+\theta2-\theta3) & \cos(\theta1+\theta2-\theta3) & 0 & l1\sin(\theta1)+l2\sin(\theta1+\theta2)+l3\sin(\theta1+\theta2-\theta3) \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

$$\mathbf{Ori} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

Out[22]= $\begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$

$$P1 = \begin{pmatrix} x1 \\ y1 \\ 0 \\ 1 \end{pmatrix}$$

Out[23]= $\begin{pmatrix} x1 \\ y1 \\ 0 \\ 1 \end{pmatrix}$

MT01

Out[24]= $\begin{pmatrix} \cos(\theta1) & -\sin(\theta1) & 0 & l1\cos(\theta1) \\ \sin(\theta1) & \cos(\theta1) & 0 & l1\sin(\theta1) \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

MT01.Ori

Out[25]= $\begin{pmatrix} l1\cos(\theta1) \\ l1\sin(\theta1) \\ 0 \\ 1 \end{pmatrix}$

MT02.Ori

Out[26]= $\begin{pmatrix} l1\cos(\theta1) + l2\cos(\theta1+\theta2) \\ l1\sin(\theta1) + l2\sin(\theta1+\theta2) \\ 0 \\ 1 \end{pmatrix}$

MT03.Ori

Out[27]= $\begin{pmatrix} l1\cos(\theta1) + l2\cos(\theta1+\theta2) + l3\cos(\theta1+\theta2-\theta3) \\ l1\sin(\theta1) + l2\sin(\theta1+\theta2) + l3\sin(\theta1+\theta2-\theta3) \\ 0 \\ 1 \end{pmatrix}$

MT02.Ori /. $\left\{\theta1 \to \dfrac{\pi}{2}, \theta2 \to \dfrac{\pi}{2}, l1 \to 150, l2 \to 80\right\}$

Out[28]= $\begin{pmatrix} -80 \\ 150 \\ 0 \\ 1 \end{pmatrix}$