Step-1

We need to choose the value of *, so that* $(2,1)$ *entry in the matrix* $R = P\frac{1}{3}A$ *will be 0. We will consider only* PA.

Consider

$$PA = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -1 & 2 & 2 \\ 2 & -1 & 2 \\ 2 & 2 & -1 \end{bmatrix}$$
$$= \begin{bmatrix} -\cos\theta - 2\sin\theta & 2\cos\theta + \sin\theta & 2\cos\theta - 2\sin\theta \\ -\sin\theta + 2\cos\theta & 2\sin\theta - \cos\theta & 2\sin\theta + 2\cos\theta \\ 2 & 2 & -1 \end{bmatrix}$$

Step-2

The $(2,1)$ *entry corresponds to the element in the 2nd row and 1st column of the product. Since, this has to be zero, we want* $-\sin\theta + 2\cos\theta = 0$.

Consider

$$\begin{aligned} -\sin\theta + 2\cos\theta &= 0 \\ 2\cos\theta &= \sin\theta \\ 2 &= \tan\theta \\ \theta &= \tan^{-1}(2) \end{aligned}$$

Therefore, $\theta = 63.43°$.