$$c_2' = a_3' b_1' - a_1' b_3' = a_2 b_1 \sin\theta + a_3 b_1 \cos\theta - a_1 b_2 \sin\theta - a_1 b_3 \cos\theta$$

$$= (a_2 b_1 - a_1 b_2)\sin\theta + (a_3 b_1 - a_1 b_3)\cos\theta = c_2\cos\theta - c_3\sin\theta$$

Similarly we can get

$$c_3' = c_2 \sin\theta + c_3\cos\theta$$

$$c_1' = c_1$$

$$(R_{ij})(c_j) = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{pmatrix}\begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix} = \begin{pmatrix} c_1 \\ c_2\cos\theta - c_3\sin\theta \\ c_2\sin\theta + c_3\cos\theta \end{pmatrix}$$

$$= \begin{pmatrix} c_1' \\ c_2' \\ c_3' \end{pmatrix}$$

$$\det(R) = \cos^2\theta + \sin^2\theta = 1$$

$$\therefore \quad c_i' = (\det R)\sum_j R_{ij} c_j$$

(d) rotation about $x_2$ axis

$$(R_{ij}) = \begin{pmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{pmatrix}$$