Step-1

Let a projection matrix have n rows and n columns. Consider a matrix A, which too has n rows and n columns.

Let the projection matrix be denoted by P_{ij}. This means, in the i^{th} row of the same, we have $\cos\theta$ and $-\sin\theta$ in the i^{th} column and j^{th} column respectively. Also, the matrix has $\sin\theta$ and $\cos\theta$ in the j^{th} row in the i^{th} column and j^{th} column respectively.

Step-2

Consider the matrix $P_{ij}A$.

It is clear that all the entries in this matrix will be same as that of A, except in the i^{th} and j^{th} rows.

Thus, if b_{kl} denotes the entry in the k^{th} row and l^{th} column of the matrix $P_{ij}A$, and if a_{kl} denotes the entry in the k^{th} row and l^{th} column of the matrix A, then we get the following:

$b_{kl} = a_{kl}$ when $k \neq i$ and $k \neq j$

Step-3

Let the inverse projection matrix be denoted by P_{ij}^{-1}. This means, in the i^{th} row of the same, we have $\cos\theta$ and $\sin\theta$ in the i^{th} column and j^{th} column respectively. Also, the matrix has $-\sin\theta$ and $\cos\theta$ in the j^{th} row in the i^{th} column and j^{th} column respectively.

Consider the matrix $P_{ij}AP_{ij}^{-1}$.

It is clear that all the entries in this matrix will be same as that of $P_{ij}A$, except in the i^{th} and j^{th} columns.

Thus, if b_{kl} denotes the entry in the k^{th} row and l^{th} column of the matrix $P_{ij}AP_{ij}^{-1}$, and if a_{kl} denotes the entry in the k^{th} row and l^{th} column of the matrix $P_{ij}A$, then we get the following:

$b_{kl} = a_{kl}$ when $l \neq i$ and $l \neq j$