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

Thus when we want to find out the matrix product PA, in order to obtain its i^{th} row, we have to carry out $2n$ products. Similarly, in order to obtain the j^{th} row of PA, we again have to carry out $2n$ products.

Note that the remaining elements of the matrix of P are either 0 or 1.

Thus, total number of products is equal to $2n + 2n = \boxed{4}n$.