

## Step-1

Given that  $A$  is  $m$  by  $n$ , we have found the number of separate multiplications are involved in each case.

## Step-2

(a)  $A$  multiplies a vector  $x$  with  $n$  components.

In the product of  $Ax$  every entry involves  $mn$  separate multiplications.

## Step-3

(b)  $A$  multiplies an  $n$  by  $p$  matrix  $B$  and then  $AB$  is  $m$  by  $p$ .

Since  $A$  is  $m$  by  $n$  and  $B$  is  $n$  by  $p$  and  $AB$  is of order  $m$  by  $p$ . So in the product  $AB$  every entry involves  $mnp$  separate multiplications.

## Step-4

(c)  $A$  multiplies itself to produce  $A^2$  and here  $m = n$ .

Since  $m = n$ , the product  $A^2$  involves  $n^3$  separate products and these are  $n^2$  dot products.