

Tensor Calculus I

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$$

The choice of subscripts for the two matrices, A and B, determine the calculation. We have three options.

$$A_{ij}B_{ij}$$

Both indices, i and j, are involved in the summation. Each component of A will pair with each of the four components of B for a multiplication resulting in 16 terms that will sum to a single component--a scalar.

$$\begin{aligned} &1(2) + 1(3) + 1(4) + 1(5) + \\ &2(2) + 2(3) + 2(4) + 2(5) + \\ &3(2) + 3(3) + 3(4) + 3(5) + \\ &4(2) + 4(3) + 4(4) + 4(5) \end{aligned}$$

$$= 140$$