Step-1

Given matrix multiplication of A and B is

$$AB = (\text{column1})(\text{row1}) + \ldots + (\text{column } n)(\text{row } n)$$
$$= \text{sum of simple matrices}$$

We have to give a 2 by 2 example for this rule.

Step-2

Let $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and $B = \begin{pmatrix} p & q \\ r & s \end{pmatrix}$

$$A.B = \begin{pmatrix} a & b \\ c & d \end{pmatrix}.\begin{pmatrix} p & q \\ r & s \end{pmatrix}$$

$$= \begin{pmatrix} a \\ c \end{pmatrix}\begin{pmatrix} p & q \end{pmatrix} + \begin{pmatrix} b \\ d \end{pmatrix}\begin{pmatrix} r & s \end{pmatrix}$$

$$= \begin{pmatrix} a.p & a.q \\ c.p & c.q \end{pmatrix} + \begin{pmatrix} b.r & b.s \\ d.r & d.s \end{pmatrix}$$

$$= \begin{pmatrix} ap + br & aq + bs \\ cp + dr & cq + ds \end{pmatrix}$$