Step-1

$$\begin{pmatrix} 4 & 0 & 1 \\ 0 & 1 & 0 \\ 4 & 0 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 4 \\ 5 \end{pmatrix} = \begin{pmatrix} 4.3+0.4+1.5 \\ 0.3+1.4+0.5 \\ 4.3+0.4+1.5 \end{pmatrix}$$

$$= \begin{pmatrix} 17 \\ 4 \\ 17 \end{pmatrix}$$

In the resultant matrix the entry 17 is $4(3)+0(4)+1(5)$,

The entry 4 is $0(3)+1(4)+0(5)$ and

The entry 17 is $4(3)+0(4)+1(5)$

That means row times column is the resultant matrix.

Step-2

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}\begin{pmatrix} 5 \\ -2 \\ 3 \end{pmatrix} = \begin{pmatrix} 1.5+0.-2+0.3 \\ 0.5+1.-2+0.3 \\ 0.5+0.-2+1.3 \end{pmatrix}$$

$$= \begin{pmatrix} 5 \\ -2 \\ 3 \end{pmatrix}$$

In the resultant matrix the entry 5 is $1(5)+0(-2)+0(3)$,

The entry -2 is $0(5)+1(-2)+0(3)$ and

The entry 3 is $0(5)+0(-2)+1(3)$

That means row times column is the resultant matrix.

Step-3

To compute $\begin{pmatrix} 2 & 0 \\ 1 & 3 \end{pmatrix}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ draw the column vectors $(2,1)$ and $(0,3)$

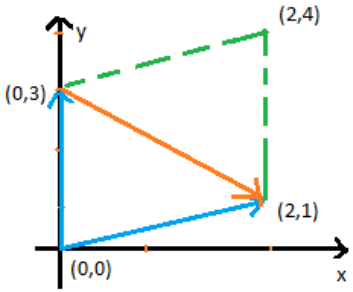
Multiplying by $(1,1)$ to get $(2.1,1.1)=(2,1)$ and

$(0.1,3.1)=(0,3)$

Now by adding these two we get $(2,1)+(0,3)=(2,4)$

Step-4

This is shown graphically below.



Step-5

With sides $(2,1)$ and $(0,3)$, the parallelogram goes to $(2,4)$.