

$$1. \begin{pmatrix} 3 & -3 \\ 2 & 0 \\ 1 & 4 \end{pmatrix} \begin{pmatrix} 2 & -1 & 5 \\ 0 & 3 & -2 \end{pmatrix} = \begin{pmatrix} 6 & -12 & 21 \\ 4 & -2 & 10 \\ 2 & 11 & -3 \end{pmatrix}$$

$$2. \begin{pmatrix} 2 & -1 \\ 3 & 5 \end{pmatrix} \begin{pmatrix} 5 & -3 \\ -1 & 0 \end{pmatrix} = \begin{pmatrix} 11 & -6 \\ 10 & -9 \end{pmatrix}$$

$$3. \begin{pmatrix} 2 & 3 & -1 \end{pmatrix} \begin{pmatrix} -1 \\ 0 \\ 5 \end{pmatrix} = (-7) \\ PQ = (-7)$$

$$\begin{pmatrix} -1 \\ 0 \\ 5 \end{pmatrix} \begin{pmatrix} 2 & 3 & -1 \end{pmatrix} = \begin{pmatrix} -2 & -3 & 1 \\ 0 & 0 & 0 \\ 10 & 15 & -5 \end{pmatrix} \\ QP = \begin{pmatrix} -2 & -3 & 1 \\ 0 & 0 & 0 \\ 10 & 15 & -5 \end{pmatrix}$$

4 BA because the width of B is the same as the length of A.

1. No because there is:

$$A = \begin{pmatrix} 2 & 3 \\ 2 & 3 \end{pmatrix} \quad B = \begin{pmatrix} 3 & 4 \\ 8 & 2 \end{pmatrix} \quad AB = \begin{pmatrix} 30 & 14 \\ 30 & 14 \end{pmatrix} \quad BA = \begin{pmatrix} 14 & 21 \\ 20 & 30 \end{pmatrix}$$

2. No because there is $\begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix} \begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$

$$3. M^{2023} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$M = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

$$M^2 = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$M^3 = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$$

$$M^4 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

⋮

$$M^{2023} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$4. P = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

$$\text{Every } PX = 0 \quad \forall P \geq 0$$

$$PX = XP$$