$$\mathbf{p} = \begin{bmatrix} p_k \end{bmatrix} = \begin{bmatrix} \mathbf{A} \\ \mathbf{B} \\ \mathbf{C} \end{bmatrix} = \mathrm{vec}(\mathbf{P}^\top)$$

rows of P as
column vectors,
one vbelow the other (12x1)