

$$\mathbf{P} \cdot \vec{\mathbf{p}} = \begin{pmatrix} P & 1 - P \\ 1 - P & P \end{pmatrix} \begin{pmatrix} p \\ 1 - p \end{pmatrix} = \begin{pmatrix} 1 - p - P + 2pP \\ p + P - 2pP \end{pmatrix}$$