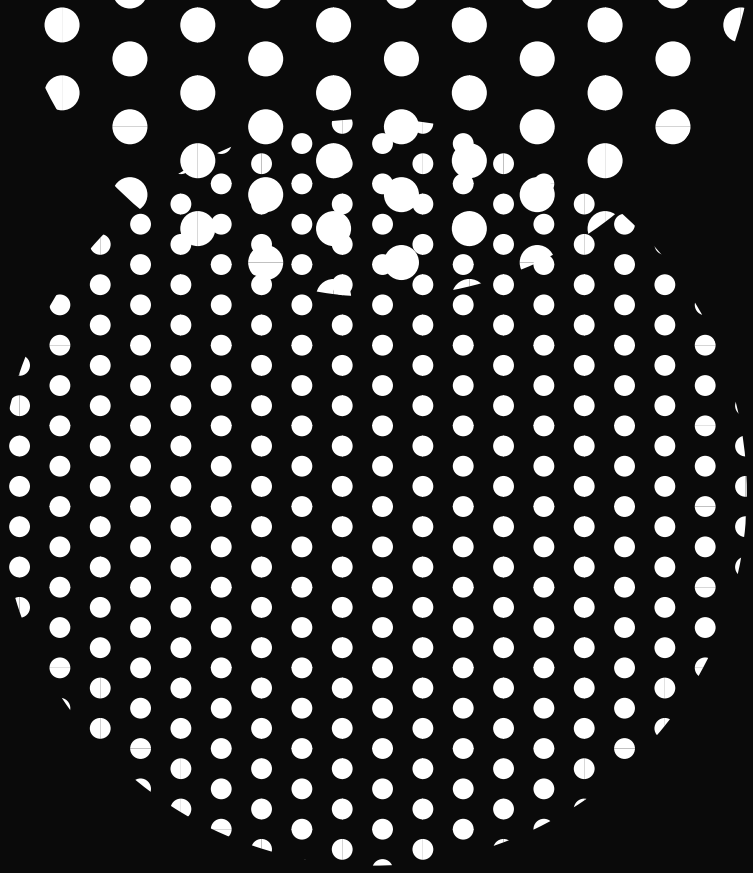

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} e & h \\ f & g \end{bmatrix}$$

$$= e\begin{bmatrix} a \\ c \end{bmatrix} + f\begin{bmatrix} b \\ d \end{bmatrix} = \begin{bmatrix} ea+fb & ha+gb \\ ec+fd & hc+gd \end{bmatrix}$$

$$\begin{bmatrix} -4 & 0 & -2 \\ 0 & 1 & 0 \\ 5 & 1 & 3 \end{bmatrix}$$

$$\begin{bmatrix} -4-\lambda & 0 & -2 \\ 0 & 1-\lambda & 0 \\ 5 & 1 & 3-\lambda \end{bmatrix}$$

$$-4-\lambda \begin{vmatrix} 1-\lambda & 0 \\ 1 & 3-\lambda \end{vmatrix} - 2 \begin{vmatrix} 0 & 1-\lambda \\ 5 & 1 \end{vmatrix}$$

$$(-4-\lambda)(1-\lambda)(3-\lambda) + 2(5-5\lambda)$$

$$(-4-\lambda+4+\lambda^2)(3-\lambda)$$

$$= (-\lambda+\lambda^2)(3-\lambda)$$

$$= (-3\lambda+3\lambda^2+\lambda^2-\lambda^3) + 10 - 10\lambda$$

$$= -\lambda^3+4\lambda^2-13\lambda+10$$