$$
\begin{bmatrix}
a_1 & a_2 & a_3 & a_4 & \cdots & a_m \\
0 & a_1 & a_2 & a_3 & \cdots & a_{m-1} \\
0 & 0 & a_1 & a_2 & \cdots & \cdots \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
0 & 0 & 0 & 0 & a_1 & a_2 \\
0 & 0 & 0 & 0 & 0 & a_1
\end{bmatrix}^{n}
=
\begin{bmatrix}
a_1^n & \Delta & \Delta & \Delta & \cdots & \Delta \\
0 & a_1^n & \Delta & \Delta & \cdots & \Delta \\
0 & 0 & a_1^n & & \cdots & \cdots \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
0 & 0 & 0 & 0 & a_1^n & \Delta \\
0 & 0 & 0 & 0 & 0 & a_1^n
\end{bmatrix}
$$

$$
\Delta = \ldots \sum_{u=0} \sum_{s=0} \sum_{q=0} \sum_{p=3} \sum_{r=p+1} \sum_{t=r+1} \cdots \frac{1}{w!} \frac{1}{u!} \frac{1}{s!} \frac{1}{q!} \frac{\prod_{k=2+(pq-2q)+(rs-2s)+(ut-2u)+\ldots}^{m} (n-m+k)}{(m-1+(q-pq)+(s-rs)+(u-ut)+\ldots)!}
$$

$$
a_1^{n-m+1+(pq-2q)+\ldots} \; a_2^{m-1+(q-pq)+(s-rs)+\ldots} \; a_p^{q} \; a_r^{s} \; a_t^{u}
$$

$$
\Delta = \sum_{i=3} \sum_{s_i=0} \sum_{r_i=i+1} \frac{1}{s_i!} \frac{\prod_{k=\alpha}^{m} (n-m+k)}{(m-\beta)!} a_1^{n-m-1+\alpha} \; a_2^{m-\beta} \; a_{r_i}^{s_i}
$$

$$
\alpha = 2 + \sum_{i=3} \left(r_i s_i - 2 s_i \right)
$$

$$
\beta = 1 + \sum_{i=3} \left(r_i s_i - s_i \right)
$$