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

$$\Delta = \dots \sum_{u=0} \sum_{s=0} \sum_{q=0} \sum_{p=3} \sum_{r=p+1} \sum_{t=r+1} \dots \dots \frac{1}{w!}\frac{1}{u!}\frac{1}{s!}\frac{1}{q!} \frac{\prod_{k=2+(pq-2q)+(rs-2s)+(ut-2u)+\dots}^{m}(n-m+k)}{(m-1+(q-pq)+(s-rs)+(u-ut)+\dots)!} a_1^{n-m+1+(pq-2q)+\dots} a_2^{m-1+(q-pq)+(s-rs)+\dots} a_p^q \, a_r^s \, a_t^u \dots$$

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

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

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