$\vec{a} = (a_0 \dots a_{n-1})$

7 e) (i) Ω_k = kth root of $p(x)$ $\quad (\mathrm{cond}(\Omega_k))(\vec{a}) = \sum_{l=0}^{n-1} \Gamma_{kl} \vec{a}$

~~→ Now if shift jth root, ...~~

→ Now if shift jth coefficient, will also shift all Ω

by some δ ie $P_{a_j \to a_j + \delta_{a_j}}(\Omega_k + \delta\Omega_k) = 0$ ↳ shifted kth root due to change in a_j δ_{a_j}

define this as $\equiv$

$$P_{\delta a_j}(\Omega_k + \delta\Omega_k) = \sum_{l=0} a_l(\Omega_k + \delta\Omega_k)^l = 0$$

$$= a_0 + a_1(\Omega_k + \delta\Omega_k) + \dots (a_j + \delta a_j)(\Omega_k + \delta\Omega_k)^j + (\Omega_k + \delta\Omega_k)^n$$

$$= a_0 + a_1(\Omega_k + \delta\Omega_k) + a_2(\Omega_k^2 + 2\Omega_k\delta\Omega_k) \dots$$

$$+ a_n(\Omega_k^n + n\Omega_k^{n-1}\delta\Omega_k) + (a_j + \delta a_j)(\Omega_k^j + j\Omega_k^{j-1}\delta\Omega_k)$$

→ now $p'(\Omega_k) = \dfrac{p(\Omega_k + \delta\Omega_k) - p(\Omega_k)}{\delta\Omega_k}$ = $\sum$ terms in front of $\delta\Omega_k$

and we have $P_{\delta a_j}(\Omega_k + \delta\Omega_k) = 0$

so subtracting $p(\Omega_k)$ we have only order lead terms remaining

↳ ie $\delta a_j \Omega_k^j + p'(\Omega_k)\delta\Omega_k = 0$

$$\frac{\delta\Omega_k}{\delta a_j} = \frac{-\Omega_k^j}{p'(\Omega_k)} \Rightarrow \boxed{\frac{\partial\Omega_k}{\partial a_j} = -\frac{\Omega_k^j}{p'(\Omega_k)}}$$

→ from here we have $\mathrm{cond}(\Omega_k)\vec{a} = \sum_j |\mathrm{cond}(\Omega_k) a_j|$

$$\rightarrow \left|(\mathrm{cond}(\Omega_k))(a_j)\right| = \left|\frac{a_j \frac{\partial\Omega_k}{\partial a_j}}{\Omega_k}\right| = \left|\frac{a_j\Omega_k^j}{\Omega_k p'(\Omega_k)}\right|$$ → now just sum

and thus $\boxed{(\mathrm{cond}(\Omega_k))(\vec{a}) = \frac{1}{|\Omega_k p'(\Omega_k)|}\sum_j |a_j\Omega_k^j|}$ as required