

$$x^\lambda \cdot \hat{f}'(x) + \hat{f}(x) = \lambda x^{\lambda+1} \cdot \sum_{m \geq 0} a_m x^m + x^{\lambda+1} \sum_{m \geq 0} m a_m x^m$$

$$+ x^\lambda \cdot \sum_{m \geq 0} a_m x^m.$$

$$= \sum_{m \geq 0} a_m x^m \cdot \left(\lambda x^{\lambda+1} + x^\lambda \right) + x^{\lambda+1} \sum_{m \geq 0} m a_m x^m$$