4. Derive:

$$\Psi(\lambda) = \Phi + R_\emptyset(\lambda V_c - E(\lambda))\Psi(\lambda)$$

---

start by operating on $H(\lambda)\Psi(\lambda) = E(\lambda)\Psi(\lambda)$ with $R_\emptyset$:

$$R_\emptyset H(\lambda)\Psi(\lambda) = R_\emptyset E(\lambda)\Psi(\lambda)$$

$$R_\emptyset (H_\emptyset + \lambda V_c)\Psi(\lambda) = R_\emptyset E(\lambda)\Psi(\lambda)$$

o.s. $\equiv$ orthogonal space

$$R_\emptyset H_\emptyset \Psi(\lambda) + R_\emptyset \lambda V_c \Psi(\lambda) = R_\emptyset E(\lambda)\Psi(\lambda)$$

$$-Q\Psi(\lambda) + R_\emptyset \lambda V_c \Psi(\lambda) = R_\emptyset E(\lambda)\Psi(\lambda)$$

$R_\emptyset = -H_\emptyset^{-1}\big|_{o.s.}$

$$-(\Psi(\lambda) - \Phi) + R_\emptyset \lambda V_c \Psi(\lambda) = R_\emptyset E(\lambda)\Psi(\lambda)$$

$Q\Psi = \Psi - \Phi$

$$\Phi - \Psi(\lambda) + R_\emptyset \lambda V_c \Psi(\lambda) = R_\emptyset E(\lambda)\Psi(\lambda)$$

$$\Phi + R_\emptyset \lambda V_c \Psi(\lambda) - R_\emptyset E(\lambda)\Psi(\lambda) = \Psi(\lambda)$$

$$\Rightarrow \Psi(\lambda) = \Phi + R_\emptyset(\lambda V_c)\Psi(\lambda) - R_\emptyset(E(\lambda))\Psi(\lambda)$$

$$\Psi(\lambda) = \Phi + R_\emptyset(\lambda V_c - E(\lambda))\Psi(\lambda)$$

QED