

$$\ln \hat{\phi}_1 = \int_0^P (\bar{Z}_1 - 1) \frac{dP}{P} = \int_0^P \left[ (1 - y_2^2) B_{11} - y_2^2 B_{22} + 2y_2^2 B_{12} \right] \frac{P}{RT} \frac{dP}{P}$$

$$= \left[ (1 - y_2^2) B_{11} - y_2^2 B_{22} + 2y_2^2 B_{12} \right] \frac{1}{RT} \int_0^P dP$$

$$\ln \hat{\phi}_1 = \left[ (1 - y_2^2) B_{11} - y_2^2 B_{22} + 2y_2^2 B_{12} \right] \frac{P}{RT}$$

$$\ln \hat{\phi}_2 = \left[ (1 - y_1^2) B_{22} - y_1^2 B_{11} + 2y_1^2 B_{12} \right] \frac{P}{RT}$$