Lemma 11.33 Let $\mathbf{X}$ be a zero-mean random vector and

$$\mathbf{Y} = \mathbf{X} + \mathbf{Z}$$

where $\mathbf{Z}$ is independent of $\mathbf{X}$. Then

$$\tilde{K}_{\mathbf{Y}} = \tilde{K}_{\mathbf{X}} + \tilde{K}_{\mathbf{Z}}.$$

Remark The scalar case has been proved in the proof of Theorem 11.21.

Lemma 11.34 Let $\mathbf{Y}^* \sim \mathcal{N}(0, K)$ and $\mathbf{Y}$ be any random vector with correlation matrix K. Then

$$\int f_{\mathbf{Y}^*}(\mathbf{y}) \log f_{\mathbf{Y}^*}(\mathbf{y}) d\mathbf{y} = \int_{\mathcal{S}_{\mathbf{Y}}} f_{\mathbf{Y}}(\mathbf{y}) \log f_{\mathbf{Y}^*}(\mathbf{y}) d\mathbf{y}.$$

Remark A similar technique has been used in proving Theorems 2.50 and 10.41 (maximum entropy distributions).