$$-f(\sqrt{\rho-1-2\lambda}) \to +\infty \quad \text{as} \quad \lambda \to \frac{1}{2}\left(\rho - 1 - \left(K - \frac{1}{2}\right)^2 \pi^2\right),$$

$$-f(\sqrt{\rho-1-2\lambda}) \to 0 \quad \text{as} \quad \lambda \to \frac{1}{2}(\rho - 1 - K^2\pi^2),$$

$$-f(\sqrt{\rho-1-2\lambda}) \to -\frac{\tan\sqrt{\rho-1}}{\sqrt{\rho-1}} \quad \text{as} \quad \lambda \to 0.$$