

$$\begin{aligned} \frac{\partial}{\partial \theta} \mathbb{E}_{a \sim P_\theta} [g_\theta(a)] &= \sum_a g_\theta(a) \frac{\partial}{\partial \theta} P_\theta(a) \\ &+ \sum_a P_\theta(a) \frac{\partial}{\partial \theta} g_\theta(a) \end{aligned}$$