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 $\mathbb{E} /: \text{Zip}_{\mathcal{L}S\_List} @ \mathbb{E} [Q_, P_] := (* \mathbb{E} [Q, P] \text{ means } e^{QP} *)$ 
Module [ { $\mathcal{L}$ ,  $z$ ,  $zs$ ,  $c$ ,  $ys$ ,  $\eta s$ ,  $qt$ ,  $zrule$ ,  $Q1$ ,  $Q2$ },
   $zs = \text{Table} [\mathcal{L}^*, \{\mathcal{L}, \mathcal{L}S\}];$ 
   $c = Q /. \text{Alternatives} @@ (\mathcal{L}S \cup zs) \rightarrow \theta;$ 
   $ys = \text{Table} [\partial_{\mathcal{L}} (Q /. \text{Alternatives} @@ zs \rightarrow \theta), \{\mathcal{L}, \mathcal{L}S\}];$ 
   $\eta s = \text{Table} [\partial_z (Q /. \text{Alternatives} @@ \mathcal{L}S \rightarrow \theta), \{z, zs\}];$ 
   $qt = \text{Inverse} @ \text{Table} [K \delta_{z, \mathcal{L}^*} - \partial_{z, \mathcal{L}} Q, \{\mathcal{L}, \mathcal{L}S\}, \{z, zs\}];$ 
   $zrule = \text{Thread} [zs \rightarrow qt. (zs + ys)];$ 
   $Q1 = c + \eta s.zs /. zrule; Q2 = Q1 /. \text{Alternatives} @@ zs \rightarrow \theta;$ 
   $\text{Simplify} /@ \mathbb{E} [Q2, \text{Det} [qt] e^{-Q2} \text{Zip}_{\mathcal{L}S} [e^{Q1} (P /. zrule)]]];$ 

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