$$\nabla_\theta L \qquad \nabla\ell \qquad Dg_k \qquad Dg_{k-1} \qquad Dg_2 \qquad Dg_1$$

$$1 \times p \quad = \quad 1 \times d_k \qquad d_k \times d_{k-1} \qquad d_{k-1} \times d_{k-2} \quad \cdots \quad d_2 \times d_1 \qquad d_1 \times p$$

$$1 \times p \quad = \quad 1 \times d_k \qquad d_k \times d_{k-1} \qquad d_{k-1} \times p \quad \xleftarrow{\mathcal{O}(kp)} \quad \text{Forward}$$

$$1 \times p \quad = \quad \text{Backward} \quad \xrightarrow{\mathcal{O}(k+p)} \quad 1 \times d_2 \qquad d_2 \times d_1 \qquad d_1 \times p$$