9.7.8

Prove $\nabla(fg) = f\nabla g + g\nabla f$

$$\nabla(fg) = \begin{bmatrix} \partial_1 fg & \partial_2 fg & \cdots & \partial_n fg \end{bmatrix}^T$$

$$= \begin{bmatrix} f\partial_1 g + g\partial_1 f & \cdots & f\partial_n g + g\partial_n f \end{bmatrix}^T$$

$$= \begin{bmatrix} f\partial_1 g & \cdots & f\partial_n g \end{bmatrix}^T \begin{bmatrix} g\partial_1 f & \cdots & g\partial_n f \end{bmatrix}$$

$$= f\nabla g + g\nabla f$$