1 Derivatives

Let $A \in \mathbb{R}^{n\times n}$ be a symmetric matrix and $b \in \mathbb{R}^n$ a vector . Show that the function

$$f : \mathbb{R}^n \to \mathbb{R}, x \mapsto \frac{1}{2}x^T Ax - b^T x$$

is Frechét differentiable and determine the gradient $\nabla f(x)$ of f at a point $x \in \mathbb{R}^n$.

Hint: Compute the directional (Gâteau) derivative and use the resulting expression as a candidate for the Fréchet derivative.

Solution: