Two Problems

Problem 1. Let $f : \mathbb{R}^3 \to \mathbb{R}^2$ be the linear function defined by the matrix

$$A = \begin{pmatrix} 1 & 13 & 0 \\ 3 & 6 & 9 \end{pmatrix}.$$

Find the coordinate functions of f; that is, find functions $f_1(x, y, z)$ and $f_2(x, y, z)$ so that

$$f(x, y, z) = (f_1(x, y, z), f_2(x, y, z)).$$

Problem 2. Let $f : \mathbb{R}^n \to \mathbb{R}^m$ be the linear function defined by the $m \times n$ matrix A. Using the definition, show that f is differentiable and that $\mathbf{D}f(\mathbf{x}) = A$ for all $\mathbf{x} \in \mathbb{R}^n$. (It might be useful to do this for the function of Problem 1 first).