(1) Give an ϵ-δ proof of the theorem mentioned in class:
Let $f\colon R^n \to R^m$ and $g\colon R^n \to R$ satisfy

$$\lim_{x\to a} f(x) = 0 \text{ and } g(x) \text{ is bounded on } B(a,\delta) \text{ for some } \delta > 0$$

then $\lim_{x\to a} g(x)f(x) = 0$

(2) Let $f\colon R^n \to R^m$ satisfy $\lim_{x\to 0} f(x) = L$ prove that for any line passing through the origin the limit of $f(x)$ as $x \to 0$ along this line exists and is equal to L. More precisely. For any vector $x \in R^n$, $x \neq 0$ consider the line $t \cdot x$ where $t \in R$. Prove that

$$\lim_{t\to 0} f(tx) = L$$

Extra Credit Problem (to be written up and submitted separately)
Give an example of a function $f\colon R^2 \to R$ such that $\frac{\partial f}{\partial x}(x,y)$ and $\frac{\partial f}{\partial y}(x,y)$ exist everywhere but $f(x,y)$ is not differentiable at $(0,0)$.