Numerical Simulation

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Exercise Sheet 1.

Due date: **Tuesday, 22 April**.

Exercise 1. (multi-dimensional derivatives)

Given $f, g : \mathbb{R}^d \to \mathbb{R}$ and $w : \mathbb{R}^d \to \mathbb{R}^d$ and $\partial_i f(x) := \lim\limits_{h \to 0} \frac{f(x + e_i h) - f(x)}{h}$, show

$$\text{a)} \qquad \nabla_x \left(\tfrac{1}{2} \|x\|^2 \right) = x,$$

$$\text{b)} \qquad \partial_i \left(f \circ w \right)(x) = f'(w(x)) \, \partial_i w(x),$$

$$\text{c)} \qquad \partial_i \left(f \, g \right)(x) = \partial_i f(x) \, g(x) + f(x) \, \partial_i g(x).$$

(6 points)