1 Read the introduction to Woodruff's monograph on *Sketching as a Tool for Numerical Linear Algebra*. Summarize the introduction in about half a page, and argue *why* sketching is useful for solving least squares problems.

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2 Woodruff's introduction proposes an argument of why ℓ^2 sketching works. In particular, this relies on the fact that if $S \in \mathbb{R}^{r \times (d+1)}$ is a matrix with entries independently distributed as $\mathcal{N}(0, 1/r)$ then $\|Sx\|_2^2 = (1 \pm \epsilon)\|x\|_2^2$ for any fixed vector x with probability at least $1 - e^{-d}$ (up to a constant). Prove this from first principles.

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