Differentiating Matrix Expressions

In Part IIA Paper 6 Lectures, some matrix differentiation occurs, even though you have not been taught how to do this. There are four basic results you need, listed below. My only way of proving them requires something called suffix notation, which is definitely not part of the Economics Tripos, and not a topic you ought to be taking on unless you have very good reason.

If $\underline{y} = A\underline{x}$ then $\dfrac{d\underline{y}}{d\underline{x}} = A^T$.

If $\underline{y} = \underline{x}^T A$ then $\dfrac{d\underline{y}}{d\underline{x}} = A$.

If $\underline{y} = \underline{x}^T \underline{x}$ then $\dfrac{d\underline{y}}{d\underline{x}} = 2\underline{x}$.

If $\underline{y} = \underline{x}^T A\underline{x}$ then $\dfrac{d\underline{y}}{d\underline{x}} = A\underline{x} + A^T \underline{x}$.

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