Matrix functions to compute scaled derivatives

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$$\alpha_0 e_1^T f \begin{pmatrix} \mu & 1\alpha_1/\alpha_0 & & & & \\ & \mu & 2\alpha_2/\alpha_1 & & & \\ & & \mu & 3\alpha_3/\alpha_2 & & \\ & & & \ddots & \ddots & \\ & & & & \mu & k\alpha_k/\alpha_{k-1} \\ & & & & & \mu \end{pmatrix} = \begin{pmatrix} \alpha_0 f(\mu) \\ \alpha_1 f'(\mu) \\ \alpha_2 f''(\mu) \\ \alpha_3 f^{(3)}(\mu) \\ \vdots \\ \alpha_k f^{(k)}(\mu) \end{pmatrix}^T$$