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4. Additional tasks for exercise on „Introduction to Numerical Mathematics“

Problem 15:
Apply Jacobi's method and Gauss-Seidel's method to solve $Ax = b$ with

$$A = \begin{pmatrix} -4 & 1 & 0 & 1 \\ 1 & -4 & 1 & 0 \\ 0 & 1 & -4 & 0 \\ 1 & 0 & 0 & 4 \end{pmatrix}, \qquad b = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}.$$

Use $x^{(0)} = (1, 1, 1, 1)^T$ as starting vector and compute 2 steps for each method.

Problem 16:
Does the iterations in Problem 15 converge for each starting vector?

Problem 17:
Apply an a-priori estimation of the error in order to determine how many steps are necessary to reach an approximation with $\|x^* - x^{(k)}\|_2 < 10^{-5}$ in Problem 15.