



Homework — Numerical Linear Algebra

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1. To find a polynomial of degree 1, let

$$A = \begin{pmatrix} x_1^0 & x_1^1 \\ x_2^0 & x_2^1 \\ \vdots & \vdots \\ x_n^0 & x_n^1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 1 & 1 \\ 1 & 3 \\ 1 & 5 \\ 1 & 7 \\ 1 & 9 \\ 1 & 12 \end{pmatrix}, \quad b = \begin{pmatrix} 10 \\ 12 \\ 18 \\ 15 \\ 20 \\ 25 \\ 36 \end{pmatrix}.$$

$$Q = \begin{pmatrix} 1/\sqrt{7} & -37/49\sqrt{122} \\ 1/\sqrt{7} & -30/49\sqrt{122} \\ 1/\sqrt{7} & -26/49\sqrt{122} \\ 1/\sqrt{7} & -2/49\sqrt{122} \\ 1/\sqrt{7} & 12/49\sqrt{122} \\ 1/\sqrt{7} & 26/49\sqrt{122} \\ 1/\sqrt{7} & 47/49\sqrt{122} \end{pmatrix}, \quad R = \begin{pmatrix} \sqrt{7} & 37/\sqrt{7} \\ 0 & 7\sqrt{122} \end{pmatrix}, \quad R^{-1} = \frac{1}{7\sqrt{854}} \begin{pmatrix} -\sqrt{7} & 0 \\ 37/\sqrt{7} & -7\sqrt{122} \end{pmatrix}$$

$$R^{-1}Q^T = \begin{pmatrix} -1 & -1 & -1 & -1 & -1 & -1 & -1 \\ 74/7 & 67/7 & 63/7 & 39/7 & 25/7 & 26/7 & 4/7 \end{pmatrix}$$

$$x = A^\dagger b = R^{-1}Q^T b = \begin{pmatrix} -136 \\ 651 \end{pmatrix}$$