Matlab and Systems of Linear Equations

- Matlab can be used to solve a system of linear equations using its “backslash” operator
- Recall that for the cubic spline example from class we had the system of linear equations

\[
\begin{align*}
M_1 &= 0 \\
4M_2 + M_3 &= 3 \\
M_2 + 4M_3 &= 2 \\
M_4 &= 0
\end{align*}
\]

- We can write this system as a coefficient matrix

\[
A = \begin{bmatrix}
1 & 0 & 0 & 0 \\
0 & 4 & 1 & 0 \\
0 & 1 & 4 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\]

where \(A(i, j)\) is the coefficient of \(M_j\) in equation \(i\), a RHS vector

\[
b = \begin{bmatrix}
0 \\
3 \\
2 \\
0
\end{bmatrix}
\]

and a vector of unknowns

\[
M = \begin{bmatrix}
M_1 \\
M_2 \\
M_2 \\
M_4
\end{bmatrix}
\]

yielding the vector equation \(AM = b\)

- After constructing \(A\) and \(b\) in Matlab, you can solve for \(M\) using the Matlab command

\[
M = A \ \backslash \ b;
\]

- For the above example we obtain

\[
M = \begin{bmatrix}
0 \\
\frac{1}{2} \\
0 \\
0
\end{bmatrix}
\]