

1. We are interested in solving the nonhomogeneous equation  $\mathbf{x}'(t) = \mathbf{A}\mathbf{x}(t) + \mathbf{f}(t)$  where

$$\mathbf{A} = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}, \text{ and } \mathbf{f}(t) = \begin{bmatrix} 3 + 5e^{2t} \\ -6 + 2e^{2t} \end{bmatrix}.$$

We will do so by breaking it into the following pieces.

- (a) 1 Find a general solution to the homogeneous equation  $\mathbf{x}'(t) = \mathbf{A}\mathbf{x}(t)$ .

- (b) 2 Use the Method of Undetermined Coefficients to find a particular solution to

$$\mathbf{x}'(t) = \mathbf{A}\mathbf{x}(t) + \begin{bmatrix} 3 \\ -6 \end{bmatrix}.$$

- (c) 2 Use the Method of Undetermined Coefficients to find a particular solution to

$$\mathbf{x}'(t) = \mathbf{A}\mathbf{x}(t) + \begin{bmatrix} 5e^{2t} \\ 2e^{2t} \end{bmatrix}.$$

- (d) 1 Find a general solution to  $\mathbf{x}'(t) = \mathbf{A}\mathbf{x}(t) + \mathbf{f}(t)$ .

2. 4 Find a general solution for the nonhomogeneous equation  $\mathbf{x}'(t) = \mathbf{B}\mathbf{x}(t) + \mathbf{g}(t)$  where

$$\mathbf{B} = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}, \text{ and } \mathbf{g}(t) = \begin{bmatrix} 18e^t \\ 9e^{4t} \end{bmatrix}.$$

The Method of Undetermined Coefficients is inconvenient in this case. Use Variation of Parameters to find a particular solution and then find a general solution.