1. We are interested in solving the nonhomogeneous equation $x'(t) = Ax(t) + f(t)$ where

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

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

(a) $1$ Find a general solution to the homogeneous equation $x'(t) = Ax(t)$.

(b) $2$ Use the Method of Undetermined Coefficients to find a particular solution to $x'(t) = Ax(t) + \begin{bmatrix} 3 \\ -6 \end{bmatrix}$.

(c) $2$ Use the Method of Undetermined Coefficients to find a particular solution to $x'(t) = Ax(t) + \begin{bmatrix} 5e^{2t} \\ 2e^{2t} \end{bmatrix}$.

(d) $1$ Find a general solution to $x'(t) = Ax(t) + f(t)$.
2. Find a general solution for the nonhomogeneous equation \( x'(t) = Bx(t) + g(t) \) where

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

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.