MAT 2384-Practice Problems on Systems of Differential Equations

In each case, solve the Systems of Differential Equations $\vec{Y}' = A\vec{Y} + \vec{F}(x)$ for the given matrix A and the vector $\vec{F}(x)$. If an initial condition is given, solve the corresponding IVP.

1. $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} 2e^{x} \\ 3e^{-2x} \end{bmatrix}$

2. $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} 4e^{-x} \\ e^{-2x} \end{bmatrix}$, $\vec{Y}(0) = \begin{bmatrix} \frac{5}{7} \\ -\frac{5}{4} \end{bmatrix}$

3. $A = \begin{bmatrix} -1 & 1 \\ -1 & -1 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} 2e^{x} \\ 3x \end{bmatrix}$

4. $A = \begin{bmatrix} 4 & -1 \\ 1 & 2 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} 3x^2 + 2x + 1 \\ x + 2 \end{bmatrix}$

5. $A = \begin{bmatrix} 3 & 1 \\ 7 & -3 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} -3\sin(3x) \\ 9\cos(3x) - 16\sin(3x) \end{bmatrix}$

6. $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} -5x^2 + 6x + \frac{1}{3} \\ -x^2 + 2x + \frac{4}{3} \end{bmatrix}$, $\vec{Y}(0) = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

7. $A = \begin{bmatrix} 0 & 1 \\ -4 & 0 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} -5\sin x \\ 17\cos x \end{bmatrix}$, $\vec{Y}(0) = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$

8. $A = \begin{bmatrix} 1 & 4 \\ 1 & 1 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} -x^2 + 6x \\ -x^2 + x - 1 \end{bmatrix}$, $\vec{Y}(0) = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$

9. $A = \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} x \\ -x \end{bmatrix}$

10. $A = \begin{bmatrix} -2 & 1 \\ -1 & 0 \end{bmatrix}$, $\vec{F}(x) = \begin{bmatrix} 0 \\ e^{x} \end{bmatrix}$