

## MathQuest: Differential Equations

### Nonhomogeneous Linear Systems

1. Which of the following would be an appropriate guess for the particular solution to the forced ODE  $y' = -3y + t^2$ ?

- (a)  $y_p = c_1 t^2$
- (b)  $y_p = c_1 + c_2 t + c_3 t^2$
- (c)  $y_p = c_1 e^{-3t} + c_2 t^2$
- (d)  $y_p = c_1 e^{-3t} + c_2 t^2 + c_3 t + c_4$
- (e)  $y_p = c_1 + c_2 t^2$

2. Which of the following would be an appropriate guess for the particular solution for the decoupled system  $Y' = \begin{bmatrix} -2 & 0 \\ 0 & -3 \end{bmatrix} Y + \begin{bmatrix} 2e^{4t} \\ e^t \end{bmatrix}$ ?

- (a)  $\begin{bmatrix} c_1 e^{4t} + c_2 e^t \\ c_3 e^{4t} + c_4 e^t \end{bmatrix}$
- (b)  $\begin{bmatrix} c_1 e^t \\ c_2 e^{4t} \end{bmatrix}$
- (c)  $\begin{bmatrix} c_1 e^{4t} \\ c_2 e^t \end{bmatrix}$
- (d)  $\begin{bmatrix} 2c_1 e^{4t} \\ c_2 e^t \end{bmatrix}$

3. Which of the following would be an appropriate guess for the particular solution for the system  $Y' = \begin{bmatrix} -2 & 1 \\ 2 & -3 \end{bmatrix} Y + \begin{bmatrix} e^{4t} \\ e^t \end{bmatrix}$ ?

- (a)  $\begin{bmatrix} c_1 e^{4t} + c_2 e^t \\ c_3 e^{4t} + c_4 e^t \end{bmatrix}$
- (b)  $\begin{bmatrix} c_1 e^{4t} + c_2 e^t \\ c_3 e^t \end{bmatrix}$
- (c)  $\begin{bmatrix} c_1 e^{4t} \\ c_2 e^t \end{bmatrix}$
- (d)  $\begin{bmatrix} c_1 e^{4t} \\ c_2 e^{4t} + c_3 e^t \end{bmatrix}$

4. Which of the following is a particular solution for the system  $Y' = \begin{bmatrix} -2 & 1 \\ 2 & -3 \end{bmatrix} Y + \begin{bmatrix} 6e^{4t} \\ 2e^t \end{bmatrix}$ ?

(a)  $Y_p = \begin{bmatrix} c_1e^{4t} + c_2e^t \\ c_3e^{4t} + c_4e^t \end{bmatrix}$

(b)  $Y_p = \begin{bmatrix} 2.4e^{4t} + 0.2e^t \\ 1.2e^{4t} + 0.6e^t \end{bmatrix}$

(c)  $Y_p = \begin{bmatrix} 1.05e^{4t} + 0.2e^t \\ 3e^{4t} + 0.6e^t \end{bmatrix}$

(d) More than one of the above

5. Which of the following is the general solution for the system  $Y' = \begin{bmatrix} -2 & 1 \\ 2 & -3 \end{bmatrix} Y + \begin{bmatrix} 6e^{4t} \\ 2e^t \end{bmatrix}$ ?

(a)  $Y = k_1e^{-4t} \begin{bmatrix} -1 \\ 2 \end{bmatrix} + k_2e^{-t} \begin{bmatrix} 1 \\ 1 \end{bmatrix} + \begin{bmatrix} 1.05e^{4t} + 0.2e^t \\ 3e^{4t} + 0.6e^t \end{bmatrix}$

(b)  $Y = k_1e^{-4t} + k_2e^{-t} + \begin{bmatrix} 1.05e^{4t} + 0.2e^t \\ 3e^{4t} + 0.6e^t \end{bmatrix}$

(c)  $Y = k_1e^{4t} \begin{bmatrix} -1 \\ 2 \end{bmatrix} + k_2e^t \begin{bmatrix} 1 \\ 1 \end{bmatrix} + \begin{bmatrix} 1.05e^{4t} + 0.2e^t \\ 3e^{4t} + 0.6e^t \end{bmatrix}$

(d)  $Y = k_1e^{-4t} \begin{bmatrix} 1 \\ 1 \end{bmatrix} + k_2e^{-t} \begin{bmatrix} -1 \\ 2 \end{bmatrix} + \begin{bmatrix} 1.05e^{4t} + 0.2e^t \\ 3e^{4t} + 0.6e^t \end{bmatrix}$

6. Which of the following would be an appropriate guess for the particular solution for the system  $Y' = \begin{bmatrix} -2 & 1 \\ 2 & -3 \end{bmatrix} Y + \begin{bmatrix} e^{-4t} \\ e^{-t} \end{bmatrix}$ ?

(a)  $\begin{bmatrix} c_1e^{-4t} + c_2e^{-t} \\ c_3e^{-4t} + c_4e^{-t} \end{bmatrix}$

(b)  $\begin{bmatrix} c_1e^{-4t} + c_2e^{-t} \\ c_3e^{-t} \end{bmatrix}$

(c)  $\begin{bmatrix} c_1e^{-4t} \\ c_2e^{-t} \end{bmatrix}$

(d)  $\begin{bmatrix} c_1e^{-4t} \\ c_2e^{-4t} + c_3e^{-t} \end{bmatrix}$

(e) None of the above

7. Which of the following would be an appropriate guess for the particular solution for the system  $Y' = \begin{bmatrix} -2 & 0 \\ 2 & -3 \end{bmatrix} Y + \begin{bmatrix} e^{4t} \\ e^t \end{bmatrix}$ ?

(a)  $\begin{bmatrix} c_1 e^{4t} + c_2 e^t \\ c_3 e^{4t} + c_4 e^t \end{bmatrix}$

(b)  $\begin{bmatrix} c_1 e^t \\ c_2 e^{4t} + c_3 e^t \end{bmatrix}$

(c)  $\begin{bmatrix} c_1 e^{4t} \\ c_2 e^t \end{bmatrix}$

(d)  $\begin{bmatrix} c_1 e^{4t} \\ c_2 e^{4t} + c_3 e^t \end{bmatrix}$

8. Which of the following would be an appropriate guess for the particular solution for the system  $Y' = \begin{bmatrix} -2 & 1 \\ 2 & -3 \end{bmatrix} Y + \begin{bmatrix} \sin \pi t \\ 3t \end{bmatrix}$ ?

(a)  $\begin{bmatrix} c_1 \sin \pi t + c_2 t \\ c_3 \sin \pi t + c_4 t \end{bmatrix}$

(b)  $\begin{bmatrix} c_1 \sin \pi t + c_2 \cos \pi t + c_3 t + c_4 \\ c_5 \sin \pi t + c_6 \cos \pi t + c_7 t + c_8 \end{bmatrix}$

(c)  $\begin{bmatrix} c_1 \sin \pi t + c_2 t + c_3 \\ c_4 \sin \pi t + c_5 t + c_6 \end{bmatrix}$

(d)  $\begin{bmatrix} c_1 \sin \pi t \\ c_2 t + c_3 \end{bmatrix}$