

$$7. \frac{d^4 w}{dt^2} + w = t^2$$

$$x_1 = w, \quad x_2 = w', \quad x_3 = w'', \quad x_4 = w^{(3)}$$

$$\Rightarrow x_1' = x_2$$

$$x_2' = x_3$$

$$x_3' = x_4$$

$$x_4' = w^{(4)} = -w + t^2 = -x_1 + t^2$$

$$\vec{x}' = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -1 & 0 & 0 & 0 \end{bmatrix} \vec{x} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ t^2 \end{bmatrix}$$

19. No

$$\left(\begin{array}{l} \textcircled{\ominus} \vec{x}_2 = e^{2t} \begin{bmatrix} -2 \\ 4 \end{bmatrix} \\ = -2e^{2t} \begin{bmatrix} 1 \\ -2 \end{bmatrix} \\ = -2\vec{x}_1 \\ \therefore \vec{x}_1 \text{ \& } \vec{x}_2 \text{ are lin. dep.} \end{array} \right)$$