

1.  $y_c(x) = C, y_p(x) = \frac{x^3}{3}$
2.  $y_p(x) = \frac{2}{7}e^{4x}$
3.  $y(x) = c_1e^{-x} + c_2xe^{-x} + c_3x^2e^{-x} + c_4\cos(x) + c_5\sin(x) + c_6x\cos(x) + c_7x\sin(x)$
4.  $D - 3$
5.  $y(x) = c_1e^{3x} + c_2\cos(2x) + c_3\sin(2x)$
6.  $G(s) = 3\frac{2}{s^3} - 5\frac{s-4}{(s-4)^2+3^2}$
7. proof in book
8.  $g(t) = u(t-3)(t-3)^2; G(s) = e^{-3s}\frac{2}{s^3}$
9.  $y(t) = 3e^{-5t}$
10.  $Y(s) = \frac{1}{s^2-3s+1}(\frac{3s}{s^2+16} + 2s - 6)$
11.  $f(t) = 3e^{-t}\cos(6t) - \frac{4}{3}e^{-t}\sin(6t)$
12.  $y_p(t) = At\cos(2t) + Bt\sin(2t)$
13.  $y' = v, v' = 2y - v; \vec{x}' = \begin{pmatrix} 0 & 1 \\ 2 & -1 \end{pmatrix} \vec{x}, \text{ where } \vec{x} = \begin{pmatrix} y \\ v \end{pmatrix}.$
14. Yes. (plug and check)
15. Other eigenvalue and eigenvector: 2 and  $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ . Solution:  $\vec{x}(t) = c_1e^{-3t} \begin{pmatrix} 4 \\ 1 \end{pmatrix} + c_2e^{2t} \begin{pmatrix} 1 \\ -1 \end{pmatrix}$   
(or equivalent)
16. (a)  $(0, 0)$  and  $(0, 1)$ .  
(b)  $< -\frac{1}{2}, -2 >$
17. (Extra Credit)  $\vec{x}(t) = c_1e^{2t} \begin{pmatrix} \cos(4t) \\ \sin(4t) \end{pmatrix} + c_2e^{2t} \begin{pmatrix} \sin(4t) \\ -\cos(4t) \end{pmatrix}$